Technical Publication

Ultrasound System

Common Service Information
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Rev. 5

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GE Medical Systems
www.gehealthcare.com

Revision History

Reason for Change

REVISION	DATE (YYYY/MM/DD)	REASON FOR CHANGE
1	2012/01/30	Initial Release
2	2013/12/16	Updated according to feedback.
3	2014/11/04	Adding New Products
4	2016/01/29	Updated according to feedback.
5	2018/08/21	Updated according to feedback.

List of Effective Pages (LOEP)

PAGE NUMBER	REVISION NUMBER	PAGE NUMBER	REVISION NUMBER
Title Page	Rev. 5	Table of Contents	Rev. 5
Revision History	Rev. 5	Chapters 1 through 4	Rev. 5
Important precautions	Rev. 5	Index	Rev. 5

Please verify that you are using the latest revision of this document. Information pertaining to this document is maintained on ePDM (GE Healthcare electronic Product Data Management). If you need to know the latest revision, contact your distributor, local GE Sales Representative, or in the USA call the GE Ultrasound Clinical Answer Center at 1 800 682 5327 or 1 262 524 5698. Note: Testing requirements and descriptions of the safety equipment in this Common Service Information (CSI) Manual supersedes the product's Service Manual if that manual's publication date precedes the date of this CSI manual.

Important precautions

Translation policy

WARNING

English (EN)

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

Français (FR)

Ce manuel de maintenance est disponible en anglais uniquement.

- Si un client de la personne responsable de la maintenance demande une langue autre que l'anglais, il est de la responsabilité du client de fournir les services de traduction.
- N'essayez pas d'effectuer vous-même la maintenance de l'équipement avant d'avoir préalablement lu et compris le manuel de maintenance.
- Le non-respect cet avertissement peut entraîner des blessures dues à un choc électrique, une défaillance mécanique ou à d'autres éléments dangereux chez la personne en charge de la maintenance, l'opérateur ou le patient.

ADVERTENCIA

Español (ES)

Este Manual de servicio está disponible en idioma inglés únicamente.

- Si un proveedor de servicio del cliente requiere un idioma distinto, es responsabilidad del cliente ofrecer servicios de traducción.
- No intente reparar el equipo a menos que haya consultado y comprendido este Manual de servicio.
- Si no presta atención a esta Advertencia, se pueden ocasionar lesiones al proveedor de servicio, al operador o al paciente por descarga eléctrica, por riesgos mecánicos o de otra índole.

WARNUNG

Deutsch (DE)

Dieses Wartungshandbuch ist nur auf Englisch verfügbar.

- Wenn der Kundendiensttechniker eines Kunden eine andere Sprache als Englisch benötigt, unterliegt es der Verantwortung des Kunden eine Übersetzung anfertigen zu lassen.
- Warten Sie das Gerät nur, wenn Sie dieses Wartungshandbuch gelesen und verstanden haben.
- Die Nichtbeachtung dieses Warnhinweises kann zu Verletzungen des Kundendiensttechnikers, Anwenders oder Patienten durch Stromschläge, mechanische oder andere Gefahren führen.

WAARSCHUWING

Nederlands (NL)

Deze servicehandleiding is alleen beschikbaar in het Engels.

- Als de serviceleverancier van een klant vraagt om een andere taal dan Engels, is het de verantwoordelijkheid van de klant om een vertaalde versie te bieden.
- Probeer geen onderhoud aan de apparatuur uit te voeren tenzij deze servicehandleiding is geraadpleegd en begrepen.
- Het niet opvolgen van deze waarschuwing kan bij de serviceleverancier, de operator of de patiënt leiden tot letsel door elektrische schokken, mechanische of andere gevaren.

HOIATUS!

Eesti (ET)

Service Manual (Hooldusjuhend) on saadaval ainult ingliskeelsena.

- Kui kliendi teenusepakkuja nõue on, et juhend oleks mõnes muus keeles, korraldab juhendi tõlkimise klient.
- Tutvuge enne seadme hooldustööde tegemist kindlasti juhendiga Service Manual (Hooldusjuhend).
- Selle nõude eiramise korral võib teenindaja, kasutaja või patsient saada elektrilöögi, samuti võivad kaasneda muud ohud.

OPOZORILO

Slovenščina (SL)

Ta servisni priročnik je na voljo samo v angleščini.

- Če ponudnik servisnih storitev za stranko potrebuje navodila v drugem jeziku, mora stranka sama poskrbeti za prevajanje.
- Ne poskušajte servisirati opreme, ne da bi prej prebrali in razumeli servisni priročnik.
- Če tega opozorila ne upoštevate, obstaja nevarnost električnega udara, mehanskih ali drugih nevarnosti in posledičnih poškodb ponudnika servisnih storitev, uporabnika opreme ali pacienta.

警告

日本語 (JA)

このサービスマニュアルは英語版のみ提供されています。

- お客様の保守担当者が英語以外のマニュアルを必要とされる場合は、お客様の負担にて翻訳サービスをご利用ください。
- 装置の保守を行う前に、必ずサービスマニュアルを読み、内容を理解してください。
- この警告に注意を払わない場合、保守担当者やオペレータ、患者に対して、電気ショック、機械またはその他の危険による傷害が発生する恐れがあります。

警告

简体中文 (ZH-CN)

本维修手册仅提供英文版。

- 如果客户需要其它语种版本，请自行翻译。
- 在维修机器前，请务必阅读并完全理解本维修手册。
- 若违反本警告，有可能会给维修提供商、操作员或患者带来电击伤害、机械损伤或其它危害。

VARNING

Svenska (SV)

Den här servicehandboken finns endast på engelska.

- Om en kunds servicetekniker kräver ett annat språk än engelska är det kundens ansvar att tillhandahålla en översatt version.
- Försök inte att utföra service på utrustningen om du inte har läst igenom och förstått den här servicehandboken.
- Om du inte tar hänsyn till den här varningen kan serviceteknikern, operatören eller patienten utsättas för elektriska stötar eller mekaniska eller andra faror, vilket kan leda till personskador.

警告

繁體中文 (ZH-TW)

此服務手冊僅推出英文版。

- 若客戶的維修人員需要英文以外的其他語言版本，客戶需自行負責提供翻譯服務。
- 在詳閱此服務手冊並充分理解其內容之前，請勿試圖開始維修設備。
- 若忽視此警告，可能導致維修人員、操作人員或病患因為觸電、機械問題或其他危險而受傷。

경고

한국어 (KO)

이 서비스 설명서는 영어로만 제공됩니다.

- 고객의 서비스 공급자가 영어 이외의 언어를 요구하는 경우 번역 서비스를 제공할 책임은 고객에게 있습니다.
- 이 서비스 설명서를 참조 및 이해하지 못한 경우 장비를 만지지 마십시오.
- 이 경고를 무시한 경우 서비스 공급자, 오퍼레이터 또는 환자가 감전, 기계적 위험 또는 기타 위험으로 인한 부상을 입을 수 있습니다.

ПРЕДУПРЕЖДЕНИЕ

На русском языке (RU)

Данное руководство по обслуживанию доступно только на английском языке.

- Если специалисту по техническому обслуживанию клиента требуется документация на каком-либо другом языке, ответственность за выполнение перевода возлагается на клиента.
- Приступайте к обслуживанию оборудования только после того, как изучите данное руководство по обслуживанию и полностью поймете его содержание.
- Несоблюдение данного требования может привести к травмированию специалиста по техническому обслуживанию, пользователя или пациента вследствие поражения электрическим током, механических и прочих повреждений.

OSTRZEŻENIE

Polski (PL)

Niniejszy podręcznik serwisowy jest dostępny wyłącznie w języku angielskim.

- Jeżeli dostawca usług klienta posługuje się językiem innym niż angielski, za zapewnienie usług tłumaczeniowych odpowiada klient.
- Przed przystąpieniem do czynności serwisowych należy zapoznać się z informacjami zawartymi w niniejszym podręczniku serwisowym i je zrozumieć.
- W przeciwnym wypadku dostawca usług, operator lub pacjent mogą odnieść obrażenia spowodowane porażeniem prądem elektrycznym, działaniem elementów mechanicznych lub innymi zagrożeniami.

ΠΡΟΕΙΔΟΠΟΙΗΣΗ

Ελληνικά (EL)

Το παρόν Εγχειρίδιο σέρβις διατίθεται μόνο στα Αγγλικά.

- Εάν ο πάροχος σέρβις του πελάτη απαιτεί γλώσσα εκτός των Αγγλικών, η παροχή μεταφραστικών υπηρεσιών αποτελεί ευθύνη του πελάτη.
- Μην επιχειρήσετε να επισκευάσετε τον εξοπλισμό εάν πρώτα δεν συμβουλευτείτε και κατανοήσετε το παρόν Εγχειρίδιο σέρβις.
- Σε περίπτωση μη τήρησης της παρούσας προειδοποίησης, ενδέχεται να προκληθεί τραυματισμός στον πάροχο σέρβις, το χειριστή ή τον ασθενή εξαιτίας ηλεκτροπληξίας καθώς και μηχανικών ή άλλων κινδύνων.

FIGYELMEZTETÉS

Magyar (HU)

A szervizkézikönyv kizárólag angol nyelven érhető el.

- Amennyiben az ügyfél szolgáltatójának nem felel meg az angol nyelvű dokumentáció, úgy a fordításról az ügyfélnek kell gondoskodnia.
- Kizárólag úgy lásson hozzá a berendezés karbantartásához, hogy elolvasta és megértette a szervizkézikönyvben foglaltakat.
- Ezen figyelmeztetés figyelmen kívül hagyása esetén a szolgáltató, a kezelő vagy a páciens áramütést, mechanikus sérülést vagy más veszély által okozott személyi sérülést szenvedhet.

VAROVANIE

Slovenčina (SK)

Táto servisná príručka je dostupná iba v anglickom jazyku.

- Ak poskytovateľ služieb zákazníkom vyžaduje iný jazyk ako anglický jazyk, jeho povinnosťou je zabezpečiť prekladateľské služby.
- Zariadenie nepoužívajte bez prečítania a porozumenia tejto servisnej príručky.
- Nedodržanie tejto výstrahy môže viesť k zraneniu poskytovateľa služieb, operátora alebo pacienta spôsobeného elektrickým šokom, mechanickým alebo iným nebezpečenstvom.

VÝSTRAHA

česky (CZ)

Tato servisní příručka je k dispozici pouze v angličtině.

- Pokud poskytovatel služby zákazníkovi požaduje jiný jazyk než angličtinu, je odpovědností zákazníka poskytnout služby překladu.
- Nepokoušejte se provádět servis zařízení, dokud si neprostudujete a neporozumíte servisní příručce.
- Nevěnování pozornosti této výstraze může způsobit poskytovateli služeb, obsluze nebo pacientovi úraz elektrickým proudem, mechanická nebo jiná nebezpečí.

UYARI

Türkçe (TK)

Servis Kılavuzu yalnızca İngilizce olarak mevcuttur.

- Müşterinin servis sağlayıcısı için kılavuzun İngilizce dışında başka bir dile çevrilmesi gerekiyorsa çeviri hizmeti sağlamak müşterinin sorumluluğudur.
- Bu Servis Kılavuzu'na bakıp talimatları anlamadan ekipmanı kullanmaya çalışmayın.
- Bu Uyarının göz ardı edilmesi servis sağlayıcısının, operatörün veya hastanın, elektrik çarpması, mekanik arıza ya da diğer tehlikeler nedeniyle yaralanmasına neden olabilir.

ADVARSEL

Dansk (DA)

Denne servicemanual fås kun på engelsk.

- Hvis en kundes tjenesteudbyder kræver et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelsesydelserne.
- Forsøg ikke at udføre service på udstyret, medmindre denne servicemanual er læst og forstået.
- Manglende overholdelse af denne advarsel kan medføre skade på serviceudbyderen, operatøren eller patienten som følge af elektrisk stød, mekaniske eller andre farer.

ADVARSEL

Norsk (NO)

Denne servicehåndboken er bare tilgjengelig på engelsk.

- Hvis en kundes tjenestetilbyder krever et annet språk enn engelsk, er det kundens ansvar å tilby oversettelsestjenester.
- Ikke forsøk å utføre service på utstyret før denne servicehåndboken er lest og forstått.
- Dersom det ikke tas hensyn til denne advarselen, kan det føre til skader på tjenestetilbyderen, operatøren eller pasienten fra elektrisk støt, mekaniske eller andre farer.

VAKAVA VAROITUS

Suomi (FI)

Tämä huolto-opas on saatavana vain englanniksi.

- Jos asiakkaan palveluntarjoaja tarvitsee oppaan jollain muulla kielellä, käännöspalveluiden hankkiminen on asiakkaan vastuulla.
- Laitetta ei saa huoltaa ellei huolto-oppaaseen ole sitä ennen tutustuttu huolellisesti.
- Jos tätä varoitusta ei noudateta, palveluntarjoaja, käyttäjä tai potilas saattaa saada sähköiskun, ja saattaa aiheutua mekaanisia tai muita vaurioita.

ПРЕДУПРЕЖДЕНИЕ

Български (BG)

Настоящото Сервизно ръководство се предлага само на английски език.

- Ако доставчикът на сервизни услуги на клиента изисква ръководство на език, който се различава от английския, клиентът има отговорност да осигури адекватен превод.
- Не правете опити за сервиз на оборудването, без да проверите и да разберете съветите в Сервизното ръководство.
- Неспазването на това предупреждение може да доведе до нараняване на доставчика на сервизни услуги, оператора или пациента вследствие на токов удар, механична или други опасности.

AVERTISMENT

Română (RO)

Acest manual de service este disponibil doar în engleză.

- Dacă furnizorul de servicii al unui client solicită altă limbă decât engleza, este responsabilitatea clientului să ofere servicii de traducere.
- Nu încercaţi să efectuaţi lucrări de service asupra echipamentului, în afară de cazul când aţi consultat acest manual de service şi l-aţi înţeles.
- Nerespectarea acestui avertisment poate avea ca rezultat rănirea furnizorului de servicii, a operatorului sau a pacientului ca urmare a electrocutării, pericolelor mecanice sau a altor pericole.

UPOZORENJE

Hrvatski (HR)

Ovaj servisni priručnik dostupan je samo na engleskom jeziku.

- Ako klijentov serviser zahtijeva jezik koji nije engleski, odgovornost klijenta je pružiti usluge prijevoda.
- Nemojte pokušavati servisirati opremu ako niste pročitali i razumjeli servisni priručnik.
- Ako ne poštujete ovo upozorenje, može doći do ozljede servisera, operatera ili pacijenta prouzročene strujnim udarom, mehaničkim i drugim opasnostima.

ĮSPĖJIMAS

Lietuvių k. (LT)

Šis priežiūros vadovas galimas tik anglų kalba.

- Jei kliento paslaugų teikėjas reikalauja kitos kalbos nei anglų, klientas atsako už vertimo paslaugos teikimą.
- Atlikite įrangos priežiūrą tik gerai susipažinę su priežiūros vadovu ir jį supratę.
- Nesilaikant šio įspėjimo galimas paslaugos teikėjo, operatoriaus ar paciento sužeidimas dėl elektros šoko, mechaninio ar kito pavojaus.

BRĪDINĀJUMS

Latviski (LV)

Šī apkalpes rokasgrāmata ir pieejama tikai angļu valodā.

- Ja klienta pakalpojumu sniedzējam ir nepieciešama cita valoda, kas nav angļu valoda, klienta pienākums ir nodrošināt tulkojumu.
- Nemēģiniet apkalpot aprīkojumu, ja apkalpes rokasgrāmata nav izlasīta un izprasta.
- Ja šis brīdinājums netiek ievērots, pakalpojumu sniedzējs, operators vai pacients var gūt traumas no elektrošoka vai var rasties mehānisks vai cita veida apdraudējums.

UPOZORENJE

Srpski (SR)

Ovaj priručnik za servisiranje dostupan je samo na engleskom jeziku.

- Ako klijentov serviser zahteva jezik koji nije engleski, odgovornost je na klijentu da pruži usluge prevođenja.
- Nemojte da pokušavate da servisirate opremu ako prethodno niste pročitali i razumeli ovaj priručnik.
- Ako ne poštujete ovo upozorenje, može doći do povređivanja servisera, operatera ili pacijenta uzrokovanog električnim udarom, mehaničkim i drugim opasnostima.

AVISO

Português (Portugal) (PT-PT)

Este manual de assistência está disponível apenas em inglês.

- Se o prestador de serviços de assistência do cliente necessitar do manual noutro idioma, a disponibilização dos serviços de tradução é da responsabilidade do cliente.
- Não tente reparar o equipamento se não tiver consultado e compreendido este manual de assistência.
- O não cumprimento das instruções constantes neste aviso pode resultar em ferimentos no prestador de serviços de assistência, no operador ou no paciente devido a choques eléctricos, perigos mecânicos ou outros problemas.

ПОПЕРЕДЖЕННЯ

Українська (UK)

Цей посібник із технічного обслуговування доступний лише англійською мовою.

- Якщо постачальнику послуг із технічного обслуговування потрібна інформація мовою, відмінною від англійської, відповідальність за надання послуг перекладу несе користувач.
- Технічне обслуговування обладнання можна виконувати лише після ознайомлення з посібником із технічного обслуговування та усвідомлення його змісту.
- Недотримання цього попередження може призвести до травм постачальника послуг, оператора або пацієнта, спричинених дією електричного струму, механічних або інших пошкоджень.

PERINGATAN

Bahasa Indonesia (ID)

Panduan Servis ini hanya tersedia dalam Bahasa Inggris.

- Jika penyedia layanan pelanggan memerlukan bahasa di luar Bahasa Inggris, maka pelanggan bertanggung jawab untuk memberikan layanan tersebut.
- Jangan mencoba menyervis peralatan ini, kecuali Panduan Servis ini telah dijadikan rujukan dan dipahami dengan baik.
- Kelalaian memperhatikan Peringatan ini dapat menyebabkan cedera terhadap penyedia layanan, operator, atau pasien akibat bahaya kejutan listrik, mekanik, dan bahaya lainnya.

คำเตือน

ไทย (TH)

คู่มือซ่อมบำรุงนี้มีเฉพาะภาษาอังกฤษเท่านั้น

- หากผู้ให้บริการของลูกค้าต้องการฉบับภาษาอื่นนอกเหนือจากภาษาอังกฤษ ลูกค้าต้องเป็นผู้รับผิดชอบในการจัดเตรียมคู่มือซ่อมบำรุงฉบับแปล
- โปรดอย่าซ่อมบำรุงอุปกรณ์โดยไม่ศึกษา และทำความเข้าใจคู่มือซ่อมบำรุงนี้
- หากไม่ปฏิบัติตามคำเตือนนี้อาจส่งผลให้ผู้ให้บริการ ผู้ใช้งานอุปกรณ์ หรือผู้ป่วยได้รับบาดเจ็บจากไฟฟ้าช็อต อันตรายจากกลไกของอุปกรณ์ หรืออันตรายอื่น ๆ

CẢNH BÁO

Tiếng Việt (VI)

Hướng dẫn sử dụng dịch vụ này chỉ sẵn dùng bằng tiếng Anh.

- Nếu nhà cung cấp dịch vụ của khách hàng yêu cầu ngôn ngữ khác ngoài tiếng Anh, thì khách hàng phải có trách nhiệm cung cấp các dịch vụ dịch thuật.
- Không được tìm cách sửa chữa thiết bị trừ khi đã tham khảo và hiểu rõ Hướng dẫn sử dụng dịch vụ này.
- Bỏ qua lời cảnh báo này có thể gây thương tích cho nhà cung cấp dịch vụ, nhân viên vận hành hoặc bệnh nhân do sốc điện, những nguy hiểm về máy móc hoặc yếu tố khác.

ЕСКЕРТУ

Қазақ тілінде (KK)

Осы қызмет көрсету нұсқаулығы тек ағылшын тілінде қолжетімді.

- Егер тұтынушылардың қызметтер жеткізушісі ағылшын тілінен басқа тілді талап етсе, аудару қызметтерімен қамтамасыз ету тұтынушының жауапкершілігіне кіреді.
- Осы қызмет көрсету нұсқаулығын түсініп, ол туралы кеңес алмайынша жабдыққа қызмет көрсетуге тырыспаңыз.
- Осы ескертуді орындамау электр тогының соғуы, механикалық немесе басқа да қауіптер салдарынан қызметтер жеткізушісінің, оператордың немесе емделушінің жарақаттануына алып келуі мүмкін.

BABALA

Tagalog (TL)

Available lamang sa Ingles ang Manwal ng Serbisyong ito.

- Kung ang kailangan lamang ng tagabigay ng serbisyo ng kustomer ng wika maliban sa Ingles , responsibilidad ng kustomer na magbigay ng serbisyo sa pagsasalin wika nito.
- Huwag subukan na iserbisyo ang mga kasangkapan maliban kung nakonsulta ang nauunawaan itong Manwal ng Serbisyo.
- Ang pagkabigong maunawaan ang Babalang ito ay maaring maging resulta ng pinsala sa tagabigay ng serbisyo, nagpapagana o pasyente mula sa pagkakakoryente, mekanikal o iba pang peligro.

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 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 field engineers, personnel of third-party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

Omission and errors

If there are any omissions, errors or suggestions for improving this documentation, contact the GE Ultrasound Global Documentation Group with specific information listing the system type, manual title, part number or direction number, revision number, page number and suggestion details.

Mail the information to:

GE
Service Documentation
9900 Innovation Drive (RP-2156)
WAUWATOSA, WI 53226
USA

GE employees should use Post-Market Quality Management (PQM) to report service documentation issues.

Service Safety Considerations

DANGER

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

WARNING

Use all Personal Protection Equipment (PPE) such as gloves, safety shoes, safety glasses, and kneeling pads, to reduce the risk of injury.

For a complete review of all safety requirements, see: ‘Safety Information’ on *page 2-1*.

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Table of Contents

Chapter 1

Overview

This Service Manual includes common service information for GE's Ultrasound systems. The manual provides Installation, Safety, and Maintenance information.

Content in this manual

The following topics are covered in this manual:

- Products covered in this manual. See Chapter 1 (this chapter).
- Safety Information. See Chapter 2.
- Site Preparations. See Chapter 3.
- Care and Maintenance. See Chapter 4.

Product description

Overview of the Ultrasound System

This Ultrasound System is a high performance digital ultrasound imaging system with total data management.

The fully digital architecture of the Ultrasound System allows optimal usage of all scanning modes and probe types throughout the full spectrum of operating frequencies.

Signal flows from the Probe Connector Panel through the Ultrasound system and finally to the monitor and peripherals.

System configuration is stored on the hard drive.

All necessary software is loaded from the hard drive on power up.

Products Covered in this Manual

This Common Service Information (CSI) Manual is effective for the products listed in Table 1-1.

Testing requirements and descriptions of the safety equipment in this Common Service Information (CSI) Manual supersedes the product's Service Manual if that manual's publication date is earlier than the date of this CSI manual.

Table 1-1: Products Covered in this Manua

U/S Product	U/S Product	U/S Product	U/S Product	U/S Product
Invenia ABUS	Vivid 3	Voluson E6	LOGIQ P9/P7	LOGIQ V3
EchoPac Workstation	Vivid 3*n*	Voluson S10	LOGIQ S7	LOGIQ i
Vivid 7, Vivid E9, and Vivid E7	Vivid P3	Voluson S8	LOGIQ 7	LOGIQ e
Vivid E80/E90/E95	Vivid i	Voluson S6	LOGIQ S6	LOGIQ Book
Vivid S60/S70	Vivid i*n*	Voluson P8	LOGIQ 5	LOGIQ Book XP
Vivid S60N/S70N	Vivid e	Voluson P6	LOGIQ P6	LOGIC C2/3/5 Series
Vivid T8 and Vivid T8 Pro	Vivid iq	Voluson i	LOGIQ P5/A5	LOGIQ e Vet
Vivid S6	Vivid q	Voluson e	LOGIQ 3	LOGIQ F Series
Vivid-S6 N	Vivid q N	LOGIQ E10	LOGIQ P3	LOGIQ C9 Series
Vivid S5	Voluson 730	LOGIQ E9	LOGIC C3	LOGIQworks Workstation
Vivid S5 N	Voluson E10	LOGIQ 9	LOGIC C5	LOGIQ V2/V1
Vivid 4	Voluson E8	LOGIQ S8, LOGIQ E8	LOGIC V5	Venue & Venue 40/50
Docking and Isolation Carts: Voluson Station/Voluson Dock Cart, LOGIQ e/LOGIQ e Vet/ LOGIQ i/ Vivid e/ Vivid iq / LOGIQbook XP/ LOGIQ e/LOGIQ i/ LOGIQ e Vet/ Vivid e/ Venue				

Chapter 2

Safety Information

This chapter describes important issues related to safely servicing the Ultrasound System. The service provider must read and understand all the information presented here before installing or servicing the Ultrasound System.

Overview

Contents in this chapter

Important conventions

Conventions used in book

Important conventions, used in this document, are described below.

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.

Important conventions (continued)

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 to personnel are labeled in one of three ways:

- DANGER
- WARNING
- CAUTION

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. Equipment damage possible.

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

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

Standard hazard icons

Important information will always be preceded by either the exclamation point (!) contained within a triangle, or the symbols for “Danger”, “Warning” or “Caution”, as seen throughout this chapter and manual. 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.

NOTE: Refer to the User Manual for a complete list of icons used on the Ultrasound System; not all icons may be listed in the table below.

Table 2-1: Common hazard icons

	ELECTRICAL
	MECHANICAL
	RADIATION
	LASER
	HEAT
	PINCH

Standard Icons that indicate that a special procedure is to be used

Other icons make you aware of specific procedures that should be followed.

Table 2-2: Standard Icons that indicates that a special procedure is to be used

Avoid Static Electricity	Tag and Lock Out	Wear Eye Protection
		
Hand Protection	**Foot Protection**	**Wear Eye Protection**
		

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

Product Icons

Label Icon Description

Refer to the User's Manual for a description and location of Ultrasound System icons.

How to lock the Operator Panel prior to transport

Refer to the User Manual for the Ultrasound console for instructions.

Safety considerations

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.

Human Safety

- Operating personnel must not remove the Ultrasound system covers.
- Servicing should be performed by authorized personnel only.

  Only personnel who have participated in a Ultrasound System Training Seminar are authorized to service the equipment.

NOTE: *Local laws may restrict this device for sale or use by or on the order of a physician.*

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

WARNING If the covers are removed from an operating Ultrasound System, some metal surfaces may be warm enough to pose a potential heat hazard if touched, even while in shutdown mode.

Human Safety (continued)

WARNING

Because of the limited access to cabinets and equipment in the field, placing people in awkward positions, GE has 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

For Console Ultrasound systems and for Ultrasound systems mounted on a Docking/Isolation Cart, have two people available to deliver and unpack the Ultrasound System.

Attempts to move the Ultrasound system considerable distances or on an incline by one person could result in injury or damage or both.

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, ONLY install GE approved parts. DO NOT perform any unauthorized modification of the equipment.

WARNING

For Console Ultrasound systems and for Ultrasound systems mounted on a Cart, when the top console is in its locked position, the gas shock is compressed and stores mechanical energy. During normal operation the top console, the weight of the monitor and the mechanical force of the gas shock are in balance. Take care if/when you activate this gas shock. Personal injury can occur after the panel is removed and the shock pressure is released. Take care when you repair the elevation assembly.

Human Safety (continued)


WARNING

Risk of electrical shock, Ultrasound system must be turned off and disconnected from power source. Cord must be controlled at all times.

Wait for at least 30 seconds for capacitors to discharge as there are no test points to verify isolation. The light on the OP panel on/off button will turn off.

Ultrasound System components may be energized. Always refer to the Ultrasound system's Service Manual for LOTO warnings and cautions.

Capacitors on Ultrasound Systems with the Shearwave Option can take up to 5 minutes to discharge.


WARNING

For Console Ultrasound systems and for Ultrasound systems mounted on a Cart, use extreme caution as long as the Ultrasound System is un-stable, not resting on all four casters.


WARNING

For Console Ultrasound systems and for Ultrasound systems mounted on a Cart, tilting the console requires two people in order to avoid injury to service personnel and damage to the equipment.


WARNING

Use all Personal Protection Equipment (PPE) such as gloves, safety shoes, safety glasses, and kneeling pads, to reduce the risk of injury.


WARNING

Beware of possible sharp edges on all mechanical parts. If sharp edges are encountered, the appropriate PPE should be used to reduce the risk of injury.


WARNING

Wear all PPE including gloves as indicated in the chemical MSDS.

Mechanical safety

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.

WARNING

While the software install procedure is designed to preserve data, you should save any patient data, images, system setups to removable media or hardcopy before doing a software upgrade.

Mechanical safety (continued)

CAUTION

Ultrasound System weights can be significant, plus the weight of installed peripherals, 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.

- Use the handle to move the Ultrasound system.
- Be sure the pathway is clear. Limit movement to a slow careful walk.
- Do not let the Ultrasound system strike walls or door frame.
- Use two people when moving on inclines or lifting more than 16 kg (35 lbs).

CAUTION

Use protective glasses during drilling, filing smooth surfaces, and during all other work where eyes need protection.

CAUTION

Use protective gloves when working with sharp edges or when directed to wear PPE during a removal/replacement procedure.

Mechanical safety (continued)

CAUTION

Use safety shoes when doing work where there is any chance of foot injury.

CAUTION

Be careful not to pinch any of the cables.

Console Ultrasound System

Prior to elevating Ultrasound system:

- verify that the floating Operating Panel is locked in its lowest, parking position.
- verify that the front brake is locked and the Ultrasound system is unable to swivel.
- verify that the rear brakes are in the locked position.

When the Ultrasound system is raised for a repair or moved along any incline, use extreme caution since it may become unstable and tip over.

The Ultrasound system should not be moved with the Operator I/O Panel extended. Move the operator i/o panel to its centered and locked position. Lower the Operator I/O Panel as much as possible before moving the Ultrasound system.

Remember: If the front caster swivel lock is engaged for transportation, pressing the release pedal once disengages the swivel lock. You must depress the release pedal a second time to engage the brake.

NOTE: Refer to the Ultrasound Basic User Manual for the product for brake and swivel control instructions.

Console Ultrasound System (continued)


CAUTION

Before you move or transport the Ultrasound system, make sure to lock the LCD monitor arm firmly and flip down the monitor to prevent damage to the Ultrasound system.


CAUTION

Always lock the Top Console (Operating Panel) in its parking (locked) position before moving the Ultrasound system around.


CAUTION

To avoid injury when you move the LCD monitor and the monitor arm, do not put your finger, hand, or object on the joint of the monitor or the monitor arm.


CAUTION

Ensure that nobody touches the console arm/frogleg when moving the Operating Panel.


CAUTION

Do not move the Ultrasound system if the Operating Panel is in unlocked position.


CAUTION

Do not transport Ultrasound System in a vehicle without locking the casters (wheels) and securing it.


CAUTION

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

Mechanical safety (continued)

NOTE: Special care should be taken when transporting the Ultrasound system in a vehicle:

- Before transporting, place the Ultrasound system in its special storage case.
- Ensure that the Ultrasound system is firmly secured while inside the vehicle.
- Secure Ultrasound system with straps or as directed otherwise to prevent motion during transport.
- Prevent vibration damage by driving cautiously. Avoid unpaved roads, excessive speeds, and erratic stops or starts.

Electrical safety

Safe practices

Follow these guidelines to minimize shock hazards whenever you are using the Ultrasound System:

- To minimize shock hazard, the equipment chassis must be connected to an electrical ground.
- The Ultrasound System 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 Ultrasound System power cable and the power connector must meet international electrical standards


WARNING

Connecting a Ultrasound System to the wrong voltage level will most likely destroy it.

Probes

Follow these guidelines before connecting a probe to the Ultrasound system:

- Inspect the probe prior to each use for damage or degradation to the:
  - housing
  - cable strain relief
  - lens
  - seal
  - connector pins
  - locking mechanism
- Do not use a damaged or defective probe.
- Never immerse the probe connector or adapter into any liquid.
- The Ultrasound System has more than one type of probe port. Use the appropriate probe port designed for the probe you are connecting.

Peripherals

Refer to the Patient Safety Environment section of the User's Manual for peripheral isolation information.

Label locations

Product Labels

It is important to refer to the current revision of the Ultrasound System's User Manual for a full list of product labels prior to servicing the Ultrasound System.

Dangerous procedure warnings

Warnings

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

DANGER

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

WARNING

If the covers are removed from an operating Ultrasound System, some metal surfaces may be warm enough to pose a potential heat hazard if touched, even while in shutdown mode.

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, ONLY install GE approved parts. DO NOT perform any unauthorized modification of the equipment.

Lockout/Tagout (LOTO)

LOTO Requirements

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

To apply Lockout/Tagout (LOTO):

1. Plan and prepare for shutdown.
2. Shutdown the equipment.
3. Isolate the equipment.
4. Remove/disconnect the battery, if present.
5. Apply Lockout/Tagout Devices.
6. Control all stored and residual energy.
7. Verify isolation.

All potentially hazardous stored or residual energy is relieved.

WARNING

Energy Control and Power Lockout for Ultrasound System.

When servicing parts of the Ultrasound system where there is exposure to voltage greater than 30 volts:

1. Follow LOCK OUT/TAG OUT procedures.
2. Turn off the breaker.
3. Unplug the Ultrasound system from the wall outlet, then from the Ultrasound System.
4. Maintain exclusive control of the Ultrasound system power cable.
5. Wait at least 30 seconds for capacitors to discharge as there are no test points to verify isolation.
6. Remove/disconnect the battery if present.

Ultrasound System components may be energized.

Capacitors on Ultrasound Systems with the Shearwave Option can take up to 5 minutes to discharge.

Returning probes and repair parts

Requirements for Returning Parts

Equipment being returned must be clean and free of blood and other infectious substances. GE policy states that body fluids must be properly removed from any part or equipment prior to shipment. GE 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.

NOTE: The USER/SERVICE staff should dispose of all the waste properly, per federal, state, and local waste disposal regulations.

User Responsibility

The Ultrasound System is not meant to be used for long-term storage of patient data or images. The user is responsible for the data on the Ultrasound System and a regular backup is highly recommended.
If the Ultrasound System is sent for repair, please ensure that any patient information is backed up and erased from the Ultrasound System before shipping. It is always possible during system failure and repair to lose patient data. GE is not responsible for the loss of this data.
If PHI (Patient Healthcare Information) data needs to be sent to GE employees for service purposes, GE will ascertain agreement from the customer. Patient information shall only be transferred by approved service processes, tools and devices restricting access, protecting or encrypting data where required, and providing traceability in the form of paper or electronic documents at each stage of the procedure while maintaining compliance with cross-border restrictions of patient information transfers.

GE employees:
Please refer to DOC1487129, GEHC Global Service Privacy and Security Standards.
It is available in MyWorkshop.

Electromagnetic compatibility (EMC)

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 to 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.

Compliance

Ultrasound System 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.

For applicable standards, refer to the Safety Chapter of the Ultrasound system's User's Manual.

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.

Electrostatic discharge (ESD) prevention

WARNING

DO NOT touch any boards with integrated circuits prior to taking the necessary ESD precautions.

Always connect yourself, via an arm-wrist strap, to the advised ESD connection point located on the rear of the Ultrasound system (near the power connector).

Follow general guidelines for handling of electrostatic sensitive equipment.

WARNING

Risk of electrical shock, Ultrasound system must be turned off. Avoid all contact with electrical contacts, conductors and components. Always use non-conductive handles designed for the removal and replacement of ESD sensitive parts. All parts that have the potential for storing energy must be discharged or isolated before making contact.

WARNING

If the covers are removed from an operating Ultrasound System, some metal surfaces may be warm enough to pose a potential heat hazard if touched, even while in shutdown mode.

Chapter 3

Site Preparations

This chapter provides the information required to plan and prepare for the setup of an Ultrasound system. Included are descriptions of the facility and electrical needs to be met by the purchaser of the Ultrasound system.

Overview

Contents in this chapter

General Ultrasound system requirements

Contents in this section

Ultrasound system environmental requirements

If the Ultrasound system is very cold or hot

When unpacking the Ultrasound system, allow the temperature of the Ultrasound system to stabilize before powering up. The following table describes guidelines for reaching operational temperatures from storage or transport temperatures.

CAUTION

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

Table 3-1: Ultrasound system acclimate time

°C	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
°F	-40	-31	-22	-13	-4	5	14	23	32	41	50	59	68	77	86	95	104	113	122	131	140	149	158
Hrs	20	18	16	14	12	10	8	6	4	2	0	0	0	0	0	0	0	2	4	6	8	10	12

Environmental specifications for Ultrasound System system

Refer to the User Manual/ Basic User Manual for the product.

Cooling

The cooling requirement for a console Ultrasound system with monitor and on board peripherals, is up to 3800 BTU/h. This figure does not include cooling needed for lights, people, or other equipment in the room.

NOTE: Each person in the room places an additional 300 BTU/h demand on the cooling system.

Lighting

Bright light is needed for Ultrasound 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.

Electrical requirements

General requirements

NOTE: GE 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 Ultrasound system.

The Ultrasound System will function on voltages from 100-240 Volts and 50 or 60 Hz. However, if using 220 volt power in North America, then a center tapped power source is required.

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.

NOTE: 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 system is only a conduit.

Electrical requirements for the Ultrasound System

The electrical requirements vary depending on the mains voltage and the equipment in use.

Contents:

Electrical requirements for Console Ultrasound Systems

Contents:

Table 3-2: Electrical Requirements - Invenia ABUS

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
Invenia ABUS Scan Station	100 - 240 VAC	±10%	10 A	50/60 Hz

Table 3-3: Electrical requirements - LOGIQ Consoles

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
LOGIQ E10	100-240 VAC	±10%	0.9kVA	50/60Hz (±2Hz)
LOGIQ E9	100-240 VAC		1100 W (valid through R5) 1.0kVA (effective from R6)	
LOGIQ P5 LOGIQ A5	100-120 VAC 200-240 VAC		750 VA	
LOGIQ E8 LOGIQ S8 LOGIQ S7	100-120 VAC 200-240 VAC		900 VA	
LOGIQ P3	100-120 VAC 200-240 VAC		425 VA	
LOGIQ P6	100-120 VAC 200-240 VAC		950 VA	
LOGIQ P9/P7	100-120 VAC 200-240 VAC		500 VA	
LOGIQ 9	100-120 VAC		9.5 A	
	200-240 VAC		4.75 A	
LOGIQ 7	100 VAC		MAX. 1200 VA	
	115 VAC			
	220 VAC			
LOGIQ 5	100 VAC		MAX. 1250 VA	
	115 VAC			
	230 VAC			
LOGIQ 3	100 VAC		MAX. 860VA	
	115 VAC			
	230 VAC			
LOGIQ F Series	100-240 VAC	±10%	MAX. 400 VA	50/60Hz (±2Hz)
LOGIQ C9 Series	220-240 VAC		MAX. 950 VA	
LOGIQ V3/LOGIQ V5/LOGIQ V5 Expert	100-240 VAC		MAX. 300 VA	

Electrical requirements for Console Ultrasound Systems (continued)

The following power line parameters should be monitored for one week before installation. We recommend that you use an analyzer Dranetz Model 606-3 or Dranetz Model 626:

Table 3-4: Electrical Specifications for LOGIQ C Series and LOGIQ C3/C5 Premium

Parameter	Area	Limits
Voltage Range	100-120V~	500VA
	220-240V~	500VA
Power	All applications	MAX. 750 VA
Line Frequency	All applications	50/60Hz (±2Hz)
Power Transients	All applications	Less than 25% of nominal peak voltage for less than 1 millisecond for any type of transient, including line frequency, synchronous, asynchronous, or aperiodic transients.
Decaying Oscillation	All applications	Less than 15% of peak voltage for less than 1 millisecond.

Electrical requirements for Console Ultrasound Systems (continued)

Table 3-5: Electrical Requirements - Vivid Consoles

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
Vivid E7/E9	100-230 VAC	±10%	1100 W	50/60 Hz
Vivid 7	230 VAC		5 A	
Vivid 7	100-120 VAC		10 A	
Vivid S5/S5N Vivid S6/S6N	100-240 VAC		0.5 to 1A	
Vivid 4	100 VAC		8 A	
	120 VAC		8 A	
	220-240 VAC		4 A	
Vivid 3	100 VAC		8 A	
	120 VAC		8 A	
	230 VAC		4 A	
Vivid P3	100-120 VAC 220-240 VAC		425 VA	
Vivid E95 Vivid E90 Vivid E80	100-240 VAC		700 W / 770 VA	
Vivid S60/S70/ S60N/S70N	100-240 VAC		500VA	
Vivid T8/Vivid T8 Pro	100-240 VAC		400VA	
Vivid iq	100-240 VAC		Max. 150VA	

Electrical requirements for Console Ultrasound Systems (continued)

Table 3-6: Electrical Requirements - Voluson Consoles

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
Voluson® 730	100 VAC	±10%	10.1 A	50, 60 Hz (±2Hz)
	110 VAC		9.2 A	
	115 VAC		8.8 A	
	130 VAC		7.8 A	
	230 VAC		4.4 A	
	240 VAC		4.2 A	
Voluson E6 / Voluson E8 model-type <=BT13	100 - 130 VAC		10.3 - 7.7 A	
	220 - 240 VAC		4.5 - 4.2 A	
Voluson E6 / Voluson E8 model-type >BT13 Voluson E10, >BT15	100-240 VAC		800 VA	
Voluson P6 / Voluson P8	100-240 VAC		900 VA	
Voluson S6 / Voluson S8	100-130 VAC 200-240 VAC		900 VA	
Voluson S10	100-120 VAC 220-240 VAC		900 VA	

Electrical requirements for Laptop Ultrasound Systems

Contents:

Table 3-7: Electrical Requirements - LOGIQ Laptops

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
LBAC-66 adapter for LOGIQ Book	100-240 VAC	±10%	120 VA 1.2-0.5 A	50-60 Hz
GE-90W adapter for LOGIQ Book			108 VA 1.08-0.45 A	
ADM-9020M-GE for LOGIQ Book XP Series				
Adapter for LOGIQ e and LOGIQ e Vet R7.x.x and below.			130 VA max. 1.3 A (max.)	50/60 Hz
Adapter for LOGIQ i				
Adapter for LOGIQ e R8.x.x, R9.x.x			160 VA max. 1.6 A (max.)	
AC Adapter for LOGIQ V2/V1			2 A	50-60 Hz

Electrical requirements for Laptop Ultrasound Systems (continued)

Table 3-8: Electrical Requirements - Vivid Laptops

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
AC/DC Converter for Vivid i/Vivid iN and Vivid q/ Vivid qN	100 - 240 VAC	±10%	0.5 to 1.0 A	50-60 Hz
Adapter for Vivid e	100 - 240 VAC	±10%	130 VA max. 1.3 A (max.)	50/60 Hz

Table 3-9: Electrical Requirements - Voluson Laptops

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
Voluson i/e	100 - 240 VAC	±10%	120 VA	50, 60 Hz (±2%)
Voluson Station / Voluson Dock Cart	100-130 VAC 220-240 VAC		320 VA	

Electrical Requirements for Docking Carts

Table 3-10: Docking Cart for LOGIQ e/LOGIQ e Vet/LOGIQ i/Vivid| e/Vivid iq Power Requirements

PARAMETER	AREA	LIMITS	FREQUENCY
Voltage Range (Docking Cart used for LOGIQ e/ LOGIQ e Vet R7.x.x and below, LOGIQ i and Vivid e)	100-120V~ 220-240V~	500VA 500VA	50/60 Hz
Voltage Range (Docking Cart used for LOGIQ e R8.x.x or higher)	100-240V~	350 VA	
Vivid iq Docking Cart	100-240V~	190VA ~ 350 VA	
Power	All applications	More than or equal to 750 VA	
Line Frequency	All applications	50/60Hz (±2Hz)	
Power Transients	All applications	Less than 25% of nominal peak voltage for less than 1 millisecond for any type of transient, including line frequency, synchronous, asynchronous, or aperiodic transients.	
Decaying Oscillation	All applications	Less than 15% of peak voltage for less than 1 millisecond.	

Electrical Requirements for Isolation Cart

Table 3-11: Isolation Cart for LOGIQBook XP Series/LOGIQ e/LOGIQ e Vet/LOGIQ i/ Vivid e

Input	Output
100-120V~, 50/60Hz, 500VA	100-120V~, 50/60Hz, 250VA
220-240V~, 50/60Hz, 500VA	220--240V~, 50/60Hz, 250VA

Table 3-12: E-Isolation Cart for LOGIQ e

Input	Output
100-120V~, 60Hz, 400VA	100-120V~, 60Hz, 350VA
220-240V~, 50Hz, 400VA	220--240V~, 50Hz, 350VA

Table 3-13: Advanced Isolation Cart

Input	Output
100-120V~, 60Hz, 400VA	100-120V~, 60Hz, 350VA
220-240V~, 50Hz, 400VA	220--240V~, 50Hz, 350VA

Electrical requirements for the Handheld Ultrasound Systems

Contents:

Table 3-14: Electrical Requirements - Venue Series

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
Venue	100-240 VAC	±10%	500 VA	50 / 60 Hz
Venue 40/50			180 VA max.	
Docking Station for the Venue Series			180 VA max.	
Docking Cart for the Venue Series			380 VA max	

Electrical requirements for the Ultrasound workstations

Contents:

Table 3-15: Electrical Requirements - EchoPAC PC Turnkey Workstations

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
All models	100 VAC	±10%	8 A	50-60 Hz
	110 VAC		8 A	
	230 VAC		4 A	

Table 3-16: Electrical Requirements - LOGIQworks Workstations

Product	Voltage	Tolerance	Current or Power Consumption	Frequency
All models	110 - 230 VAC	±10%	310 to 543 W (depending on workstation model)	50-60 Hz

Site circuit breaker

Power outage may occur. The Ultrasound System 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.

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

Site power outlets

A dedicated AC power outlet must be within reach of the Ultrasound system without extension cords. Other outlets adequate for the external peripherals, medical and test equipment needed to support this Ultrasound system must also be present within 1 m (3.2 ft.) of the Ultrasound system. Electrical installation must meet all current local, state, and national electrical codes.

Power cable

If the Ultrasound system arrives without a power cable, or with the wrong cable, you must contact your GE dealer or the installation engineer must supply what is locally required.

EMI limitations

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

Possible EMI sources should be identified before the Ultrasound system is installed.

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

- medical lasers
- scanners
- cauterizing guns
- computers
- monitors
- fans
- gel warmers
- microwave ovens
- light dimmers
- mobile phones
- in-house wireless phones (DECT phones)
- wireless computer keyboard and mouse
- air conditioning system
- High Frequency (HF) surgery equipment
- general AC/DC adapters

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

See: ‘EMI prevention/abatement’ on *page 3-19* for EMI prevention tips.

EMI prevention/abatement

Prevention/abatement details are provided below:

Table 3-17: EMI prevention/abatement

EMI RULE	DETAILS
Be aware of Radio Frequency sources	• Keep the Ultrasound system at least 5 meters (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 Ultrasound system	Poor grounding is the most likely reason an Ultrasound system will have noisy images. Check grounding of the power cord and power outlet.
Replace all screws, Radio Frequency gaskets, covers, cores	• After you finish repairing or updating the Ultrasound system, replace all covers and tighten all screws. • Any cable with an external connection requires a magnet wrap at each end. • Install all covers. Loose or missing covers or Radio Frequency gaskets allow radio frequencies to interfere with the ultrasound signals.
Replace broken Radio Frequency gaskets	If more than 20% or a pair of the fingers on a Radio Frequency gasket are broken, replace the gasket. Do not turn on the Ultrasound system until any loose metallic part is removed.
Do not place labels where Radio Frequency gaskets touch metal	Where applicable, never place a label where Radio Frequency gaskets meet the Ultrasound system. Otherwise, the gap created will permit Radio Frequency 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 route peripheral cables	Where applicable, do not allow cables to lie across the top of the Card Rack 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.

Probes environmental requirements

Operation and storage temperatures for probes

For probe operation and storage temperature information, refer the the Ultrasound System or Probe User Manual.

Time and manpower requirements

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

WARNING

For Console Ultrasound systems and for Ultrasound systems mounted on a Docking/Isolation Cart, have two people available to deliver and unpack the Ultrasound System.

Attempts to move the Ultrasound system considerable distances or on an incline by one person could result in injury or damage or both.

Facility needs

Contents in this section

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. 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

Purchaser responsibilities (continued)

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 Ultrasound 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 Ultrasound system. 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 Ultrasound system reliability.

Required facility needs

NOTE: *GE 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 Ultrasound system.*

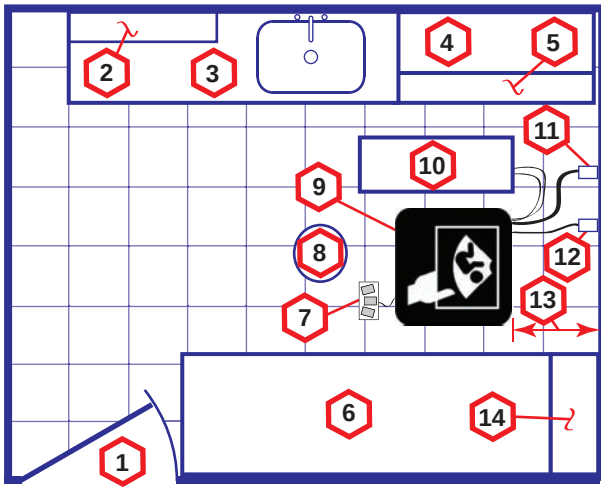
The Ultrasound system will function on voltages from 100-240 Volts and 50 or 60 Hz. However, if using 220-volt power in North America, then a center tapped power source is required.

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.

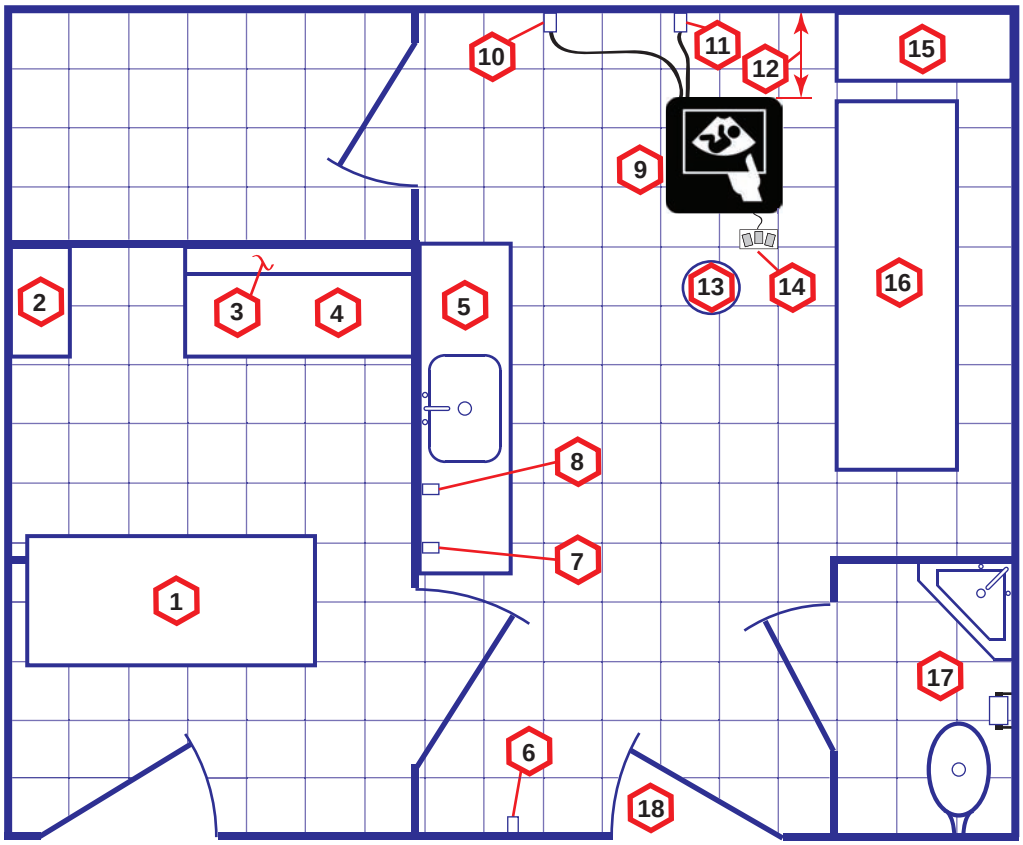


Scale:
Each square equals one square foot (app. 31 x 31 cm)

1. Door – at least 762 mm (30 inches)
2. Film Viewer
3. Counter Top, Sink with hot and cold water and Supplies Storage
4. Linen Supply
5. Probes/Supplies
6. Examination Table – 1930 x 610 mm (76 x 24 inches)
7. Footswitch
8. Stool
9. Ultrasound system
10. External Peripherals
11. Dedicated Power Outlet - Circuit Breaker protected and easily accessible
12. Network Interface
13. 457 mm (18 inches) distance of Ultrasound system from wall or objects
14. GE Cabinet for Software and Manuals

Figure 3-1. Minimal floor plan, 2.5 m x 3 m (8 by 10 foot)

Required facility needs (continued)



Scale: Each square equal one square foot (app. 31 x 31 cm)

1. Secretaries or Doctors Desk
2. File Cabinet
3. Film Viewer
4. Counter Top
5. Counter Top and Sink with hot and cold water
6. Overhead Lights Dimmer - Dual Level Lighting (bright and dim)
7. Emergency Oxygen
8. Suction Line
9. Ultrasound system
10. Dedicated Power Outlet - Circuit Breaker protected and easily accessible
11. Network Interface
12. 457 mm (18 inches) distance of Ultrasound system from wall or objects
13. Stool
14. Footswitch
15. Storage for Linens and Equipment
16. Examination Table – 1930 x 610 mm (76 x 24 inches)
17. Lavatory and Dressing Room
18. Door – at least 762 mm (30 inches)

Figure 3-2. Recommended floor plan, 4.27 x 5.18 m (14 x 17 foot)

Required facility needs (continued)

- Dedicated single branch power outlet of adequate amperage, meeting all local and national codes, which is located less than 2.5 m (8 ft.) from the Ultrasound system's proposed location
- Door opening is at least 76 cm (30 in) wide
- Proposed location for Ultrasound system is at least 0.5 m (1.5 ft.) from the wall for cooling
- Power outlet and place for any external peripheral are within 2 m (6.5 ft.) of each other with peripheral within 1 m of the Ultrasound system to connect cables.
- Power outlets for other medical equipment
- Power outlets for test equipment within 1 m (3.2 ft.) of Ultrasound system
- Clean and protected space to store probes (in their cases or on a rack)
- Material to safely clean probes (done with a plastic container, never metal)

For the amperage requirements, see: 'Electrical requirements' on *page 3-5*.

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

Chapter 4

Care and Maintenance

*This chapter describes **Care and Maintenance** on the Ultrasound system and peripherals. These procedures are intended to **maintain the quality** of the Ultrasound **system's performance**. Read this chapter completely and familiarize yourself with the procedures before performing a task.*

Overview

Care and Maintenance

Normal Care and Maintenance is mandatory; it is the responsibility of the customer and includes the following:

- Quality Assurance Program to perform routine quality control testing.

NOTE: Some customers' Quality Assurance Programs may require additional tasks and or inspections at a different frequency than listed in this manual.

- System Maintenance and Checks (Preliminary System, Functional Checks, Peripheral, Cable, Physical Inspection).
- Probe Maintenance
- System Cleaning, including Air Filter Cleaning
- Electrical Safety Testing

*NOTE: It has been determined by engineering that your Ultrasound System **DOES NOT** have any high wear components that fail with use. Therefore, **Periodic Maintenance inspections are not mandatory for any Ultrasound system**. Only normal Care and Maintenance is recommended.*

Contents in this chapter

Warnings

Warnings


DANGER

WHERE APPLICABLE, THERE ARE SEVERAL PLACES ON THE BACKPLANE, THE AC DISTRIBUTION, AND DC DISTRIBUTION THAT ARE DANGEROUS. BE SURE TO DISCONNECT THE ULTRASOUND 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

Practice good ESD prevention. Wear an anti–static strap when handling electronic parts and even when disconnecting/ connecting cables.


CAUTION

Do not pull out or insert circuit boards while power is on.


CAUTION

Do not operate this Ultrasound system unless all board covers and frame panels are securely in place. System performance and cooling require this.


CAUTION

To ensure the mutual protection and safety of GE service personnel and our customers, all equipment and work areas must be clean and free of any hazardous contaminants before a Service Engineer starts a repair. This includes, but is not limited to, decontamination and/or sterilization, depending on the application or use of the medical device.

Why do maintenance

Keeping records

It is good business practice that ultrasound facilities maintain records of all corrective maintenance and care and maintenance on Ultrasound systems where it is applicable. The Ultrasound Equipment Quality Check form provides the customer with documentation that the Ultrasound system is maintained regularly.

A copy of the *Ultrasound Equipment Quality Check* form should be kept in the same room or near the Ultrasound system.

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 Ultrasound system. 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. Contact GE for coverage and/or price for service.

Maintenance task schedule

How often should maintenance tasks be performed?

The Customer Care Schedule specifies how often your Ultrasound System should be serviced and outlines items requiring special attention.

NOTE: It is the customer's responsibility to ensure the Ultrasound System care and 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 Ultrasound System and can best provide competent, efficient service. Contact GE for coverage information and/or price for service.

The service procedures and recommended intervals shown in the Customer Care Schedule assumes that you use your Ultrasound System for an average patient load (10-12 per day) and not use it as a primary mobile Ultrasound system which is transported between diagnostic facilities.

NOTE: If conditions exist which exceed typical usage and patient load, then it is recommended to increase the maintenance frequencies.

Please refer to the Customer Care Schedule in the service manual for the Ultrasound System unit for the correct maintenance care schedule.

System maintenance

Preliminary checks

The preliminary checks take about 15 minutes to perform. Refer to the Ultrasound system user documentation whenever necessary.

Table 4-1: Ultrasound system preliminary checks

Step	Item	Description
1.	Ask and Listen	Ask the customer if they have any problems or questions about the equipment.
2.	Paperwork	Fill in the top of the EQC inspection form. Record all probes and Ultrasound system options.
3.	Power up	• Turn the Ultrasound 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. • Where applicable, confirm that the battery is charged. If no AC Input present, use the internal battery.
4.	Probes	Verify that the Ultrasound system properly recognizes all probes.
5.	Displays	Verify proper display on the monitor and touch panel (where present).
6.	InSite	Where applicable, for Warranty and Contract Customers only: • Verify that InSite is functioning properly. • Ensure two-way remote communications.
7.	Review Error Logs	Where applicable, Error Logs can be reviewed via system diagnostics.
8.	Diagnostics	Optional.
9.	Presets	Backup all Customer Presets to an appropriate media.
10.	Image Archive	Back up the Image Archive onto appropriate media.

Functional checks

The functional checks take about 60 minutes to perform. Refer to the Ultrasound system user documentation whenever necessary.

System checks

Table 4-2: Ultrasound system functional checks

Step	Item	Description
1.	B-Mode	Verify basic B-Mode (2D) operation. Check the basic Ultrasound system controls that affect this mode of operation.
2.	CF-Mode	Verify basic CF-Mode (Color Flow Mode) operation. Check the basic Ultrasound system controls that affect this mode of operation.
3.	Doppler Modes	Where applicable, verify basic Doppler operation (PW and CW if available). Check the basic Ultrasound system controls that affect this mode of operation.
4.	M-Mode	Verify basic M-Mode operation. Check the basic Ultrasound system controls that affect this mode of operation.
5.	3D Mode	Where applicable, verify basic 3D Mode operation. Check the basic system controls that affect this mode of operation.
6.	RealTime 4D Mode	Where applicable, verify basic RealTime 4D Mode operation. Check the basic system controls that affect this mode of operation.
7.	Basic Measurements	Check Distance and Tissue Depth Measurement.
8.	Probe Elements	Perform an Element Test on each probe to verify that all the probe elements and Ultrasound system channels are functional, where applicable.
9.	Applicable Software Options	Verify the basic operation of all optional modes. Check the basic system controls that affect each options operation.
10.	System Diagnostic	Perform the Automatic Tests, where applicable.
11.	Transmit/Receive	Verify that all system XMIT/RECV channels are functional, where applicable.
12.	Operating Panel test	Perform the Operating Panel Test Procedure.
13.	Keyboard	Do the interactive keyboard test.
14.	Touch Panel	Where applicable, verify basic Touch Panel display functions.
15.	Monitor	Verify basic monitor display functions.
16.	Peripherals	See: ‘Peripheral/option checks’ on *page 4-8*.

Peripheral/option checks

If any peripherals or options are not part of the Ultrasound system configuration, the check can be omitted.

Table 4-3: GE approved peripheral/hardware option functional checks

Step	Item	Description
1.	Media	Verify media drive(s) read/write properly. Clean 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.	DICOM	Verify that DICOM is functioning properly. Send an image to a DICOM device.
5.	ECG	Verify basic operation with customer
6.	Footswitch	Verify that the footswitch is functioning as programed. Clean as necessary.

Mains cable inspection

Table 4-4: Mains Cable Inspection, As Appropriate

Step	Item	Description
1.	Unplug Cord	Disconnect the mains cable from the wall and Ultrasound 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.

Optional diagnostic checks

To complete the Ultrasound System checks, view the error logs and run desired diagnostics.

View the logs

1. Review the Ultrasound system error log for any problems.
2. Check the temperature log to see if there are any trends that could cause problems in the future.

Physical inspection

NOTE: These features may not be present on all Ultrasound systems.

Table 4-5: Physical checks

Step	Item	Description
1.	Labeling	Verify that all Ultrasound system labeling is present and in readable condition.
2.	Scratches & Dents	Inspect the exterior for dents, scratches or cracks.
3.	Covers	Where applicable, verify all covers are secured in place and are properly aligned with other covers. Replace any covers that are damaged.
4.	Operating Panel	Inspect alphanumeric keyboard and operator panel (operator control panel). Record any damaged or missing items.
5.	Operating Panel Movement	• Where applicable, verify ease of operating panel (operator control panel) movement in all acceptable directions. • Where applicable, ensure that it latches in position as required.
6.	Operating Panel Lights	Check for proper operation of all operating panel and TGC lights.
7.	LCD	Inspect the LCD Display for scratches and bad pixels. Verify proper operation of Contrast and Brightness controls. Where applicable, confirm that the LCD arm allows: • swivelling the screen to the left and to the right • folding the screen to the locked position • release and adjustment backwards and forwards • can be adjusted in the up/down positions. *Note: LCD Arm movement may vary and is not applicable to all Ultrasound systems.*
8.	Monitor Light	Check for proper operation of any monitor lights, if available.
9.	Input Power	Refer to: ‘Mains cable inspection’ on *page 4-8*.
10.	External I/O	Check all connectors for damage and verify that the labeling is good.

Table 4-5: Physical checks (Continued)

Step	Item	Description
11.	Wheels and Brakes	• Where applicable, check all wheels and casters for wear and verify operation of foot brake, to stop the Ultrasound system from moving, and release mechanism. • Where applicable, check all wheel locks and wheel swivel locks for proper operation.
12.	Cables and 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.
13.	Shielding and 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.
14.	Control Panel	Inspect alphanumeric keyboard and Operating Panel. Record any damaged or missing items.
15.	Probe Holders	Where applicable, inspect the Probe Holders for cracks or damage.
16.	Power and System Status Indicators	Check for proper operation of all Power and System Status Indicators.
17.	Battery	Where applicable, check that the battery is not damaged, does not leak, does not emit an odor, and is not deformed or discolored. Observe all warnings and cautions for battery handling, recharging, storing, and/or disposal,
18.	External Microphone	Where applicable, check for proper operation of any external microphones by recording an audio test.

Cleaning

Refer to the User Manual for the Ultrasound console for instructions.

Air filter cleaning

Refer to the User Manual for the Ultrasound console for instructions.

Probe maintenance

Refer to the Ultrasound System User Manual, the probe's User Manual/Probe Care Card, or Probe Addendum (p/n 5661328) for probe maintenance, checks, cleaning, and disinfecting instructions.

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.

CAUTION

Transesophageal and intraoperative probes require a special handling. Refer to the user documentation enclosed with these probes.

NOTE: *GE does not substantiate the effectiveness of recommended disinfectant products. Questions regarding efficacy, instructions for use, and proper handling should be directed to the disinfectant manufacturer. GE publishes a list of material-compatible disinfectants (see below and also refer to the GE website at http://www3.gehealthcare.com/en/Products/Categories/Ultrasound/Ultrasound_Probes. DO NOT use non-GE-approved disinfectants or products that have not been evaluated by GE for material compatibility. Damages linked to the use of disapproved chemicals are not covered under product warranty or service contract.)*

Using a Phantom

Phantoms

The use of a Phantom is not required during Care and Maintenance, except for the Invenia ABUS Scan Station. Customer may use it as part of their Quality Assurance Program tests.

Electrical safety tests

Content in this section

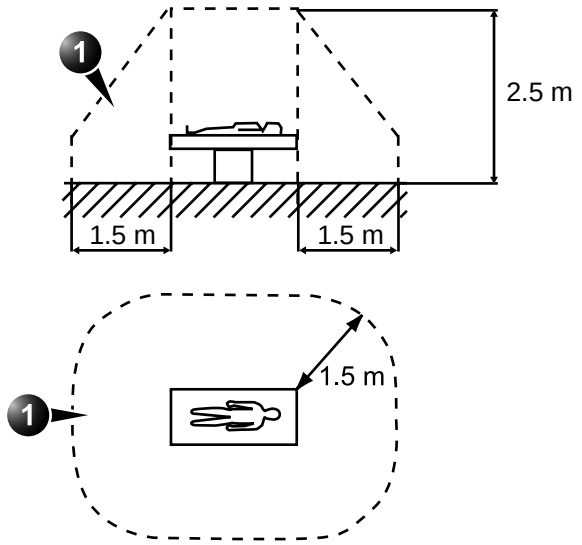
The following topics and measurements are covered in this section:

Uninterrupted Power Supply (UPS)

NOTE: For all instructions in the "Electrical safety tests" section in case of using a UPS (uninterrupted power supply) the terms outlet, wall outlet, AC wall outlet and power outlet refer to the AC power outlet of the UPS. In case of further available AC (or DC) power outlets at the same used UPS, these must remain unused i.e. not connected to any other devices.

CAUTION

Please observe that some Uninterruptible Power Supplies (UPS) may not be medical devices! If the UPS is not a medical device, it has to be located outside of the patient environment (according to IEC 60601-1 / UL 60601-1).



1. Patient environment

Safety test overview

WARNING

Energy Control and Power Lockout for Ultrasound System.

When servicing parts of the Ultrasound system where there is exposure to voltage greater than 30 volts:

1. Follow LOCK OUT/TAG OUT procedures.
2. Turn off the breaker.
3. Unplug the Ultrasound system from the wall outlet, then from the Ultrasound System.
4. Maintain exclusive control of the Ultrasound system power cable.
5. Wait at least 30 seconds for capacitors to discharge as there are no test points to verify isolation.
6. Remove/disconnect the battery if present.

Ultrasound System components may be energized.

Capacitors on Ultrasound Systems with the Shearwave Option can take up to 5 minutes to discharge.

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.

The electrical safety tests in this section are based on IEC60601 standard including national deviations for Health Care Facilities and IEC 62353 Medical electrical equipment – Recurrent test and test after repair of medical electrical equipment. These standards provide guidance on evaluating electrical safety of medical devices which are placed into service and are intended for use in normal Care and Maintenance or testing following service or repair activities. They differ somewhat from the standards that are used for design verification and manufacturing tests (e.g., IEC 60601-1 including national deviations) which require a controlled test environment and can place unnecessary stress on the Ultrasound system.

These tests may refer to specific safety analyzer equipment as an example. Always refer to the safety analyzer's user manual that will be used to perform the tests.

Safety test overview (continued)

Prior to initiating any electrical test, the Ultrasound system must be visually inspected. Perform the following visual checks:

- Check for missing or loose enclosure covers that could allow access to internal live parts.
- Examine the mains cord, mains plug and appliance inlet for damaged insulation and adequacy of strain relief and cable clamps.
- Locate and examine all associated probes. Inspect the cables and strain relief at each end. Inspect the transducer enclosure and lens for cracks, holes and similar defects.


CAUTION

For all instructions in this section in case of using a UPS (Uninterrupted Power Supply) the terms outlet, wall outlet, AC wall outlet and power outlet refer to the AC power outlet of the UPS. In case of further available AC (or DC) power outlets at the same used UPS, these must remain unused i.e. not connected to any other devices.

Safety test overview (continued)

WARNING

Users must ensure that safety inspections are performed whenever damage is suspected and on a regular basis in accordance with local authorities and facility procedures. DO NOT use the Ultrasound system or individual probes which fail any portion of the safety test.

WARNING

To minimize the risk and avoid an electric shock, only trained persons are allowed to perform the electrical safety inspections and tests.

CAUTION

Compare all safety-test results with safety-test results of previously performed safety tests (e.g. last year etc). In case of unexplainable abrupt changes of safety-test results consult experienced authorized service personnel or GE for further analysis.

CAUTION

To avoid electrical shock, the Ultrasound system under test **MUST NOT** be connected to other electrical equipment. Remove all interconnecting cables and wires. The Ultrasound system under test must not be contacted by users or patients while performing these tests.

Leakage current limits

WARNING

Energy Control and Power Lockout for Ultrasound System.

When servicing parts of the Ultrasound system where there is exposure to voltage greater than 30 volts:

1. Follow LOCK OUT/TAG OUT procedures.
2. Turn off the breaker.
3. Unplug the Ultrasound system from the wall outlet, then from the Ultrasound System.
4. Maintain exclusive control of the Ultrasound system power cable.
5. Wait at least 30 seconds for capacitors to discharge as there are no test points to verify isolation.
6. Remove/disconnect the battery if present.

Ultrasound System components may be energized.

Capacitors on Ultrasound Systems with the Shearwave Option can take up to 5 minutes to discharge.

The following acceptance limits and test conditions are summarized from IEC 60601-1/A1:2012 (ed.3.1) including national deviations and IEC 62353:2014 (ed.2) and in some cases are lower than that specified by the standards.

Because the main source of leakage current is the mains supply, there are different acceptance limits depending on the configuration of the mains (100-130 Volt, 220-240 Volt, or 230-240 Volt mains).

LOGIQ/Vivid/Voluson Ultrasound System Leakage Current Limits

Leakage current limits for LOGIQ, Vivid and VOLUSON Ultrasound Systems are shown below for 100-130 Volt and 220-240 Volt mains.

Table 4-6: Leakage current limits for Ultrasound system operation on 100-130 Volt mains (US/Canada/Japan)

Leakage Current Test	System Power	Grounding/ PE Conductor	Limit in mA	Limit in µA
Earth Leakage	On and Off	N/A	0.3 (1)	300 (1)
Chassis/Enclosure Leakage	On and Off	Closed Open	0.1 0.3 (1)	100 300 (1)
Type BF Applied Parts	On (transmit)	Closed Open	0.1 0.5	100 500
Type CF Applied Parts	On (transmit)	Closed Open	0.01 0.05	10 50
Type BF Applied Parts (sink leakage, mains voltage on applied part)	On and Off	Closed	5	5000
Type CF Applied Parts (sink leakage)	On and Off	Closed	0.05	50
(1) UL 60601-1 standard				

NOTE: Open Grounding is also known as “Lift Ground”.

LOGIQ/Vivid/Voluson Ultrasound System Leakage Current Limits (continued)

Table 4-7: Leakage current limits for Ultrasound system operation on 220-240 Volt mains

Leakage Current Test	System Power	Grounding/ PE Conductor	Limit in mA	Limit in µA
Earth Leakage	On and Off	N/A	0.5	500
Chassis/Enclosure Leakage	On and Off	Closed Open	0.1 0.5	100 500
Type BF Applied Parts	On (transmit)	Closed Open	0.1 0.5	100 500
Type CF Applied Parts	On (transmit)	Closed Open	0.01 0.05	10 50
Type BF Applied Parts (sink leakage, mains voltage on applied part)	On and Off	Closed	5	5000
Type CF Applied Parts (sink leakage, mains voltage on applied part)	On and Off	Closed	0.05	50
Values based on IEC60601				

Table 4-8: ISO and Mains Applied Limits*

Probe Type	Measurement
BF	5.0 mA (5000 µA)
CF	0.05 mA (50 µA)

*ISO and Mains Applied refers to the sink leakage test where mains (supply) voltage is applied to the applied part to determine the amount of current that will pass (or sink) to ground if a patient is in contact with mains voltage.

LOGIQ/Vivid/Voluson Ultrasound System Leakage Current Limits (continued)

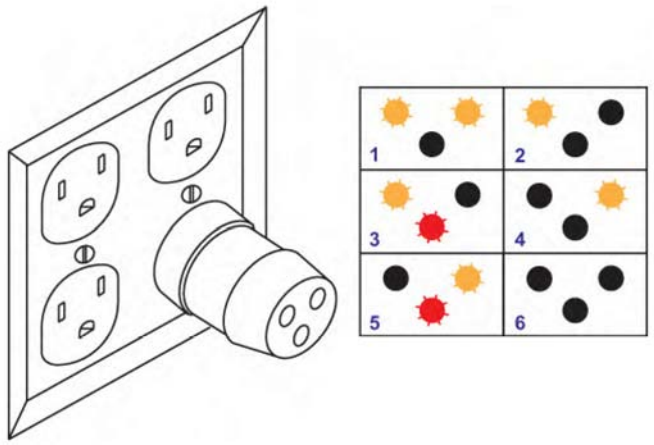
NOTE: Electrical leakage testing may be accomplished with any calibrated Electrical Safety Analyzer tool compliant with AAMI/ESI 1993 or IEC 60601 or AS/NZS 3551 or IEC62353 or other relevant national regulation.

Table 4-9: Equipment Type and Test Definitions

Applied Parts (AP)	Parts or accessories that contact the patient to perform their function. For ultrasound equipment, this includes transducers, ECG leads and e-TRAX Needle Sensor.	
Type BF	Type BF Applied Part (man in the box) symbol is in accordance with IEC 60417-5333, e.g. ultrasound probes which are marked with the 'man in box' BF symbol.	
Type BF Defib.-Proof	Type BF defibrillation proof Applied Part (man in the box with paddle) symbol is in accordance with IEC 60417-5334, e.g. ECG electrodes which are marked with the 'man in box with paddle' BF symbol.	
Type CF	Type CF Applied Part (heart in the box) symbol is in accordance with IEC 60417-5335, e.g. intraoperative probes for direct cardiac contact, isolated ECG connections and e-TRAX Needle Sensor, so marked with the 'heart in box' CF symbol.	
Type CF Defib.-Proof	Type CF defibrillation proof Applied Part (heart in the box with paddle) symbol is in accordance with IEC 60417-5336, e.g. intraoperative probes for direct cardiac contact, isolated ECG connections and e-TRAX Needle Sensor, so marked with the 'heart in box with paddle' CF symbol.	
Sink Leakage	The current resulting from the application of mains voltage to the applied part. This test is required for Type BF and CF applied parts.	

Outlet test - wiring arrangement - USA and 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.



1. Correct Wiring
2. Open Ground Wire
3. Reversed Polarity
4. Open Neutral Wire
5. Hot and Ground Reversed
6. Open Hot Wire

Figure 4-1. Typical alternate outlet tester

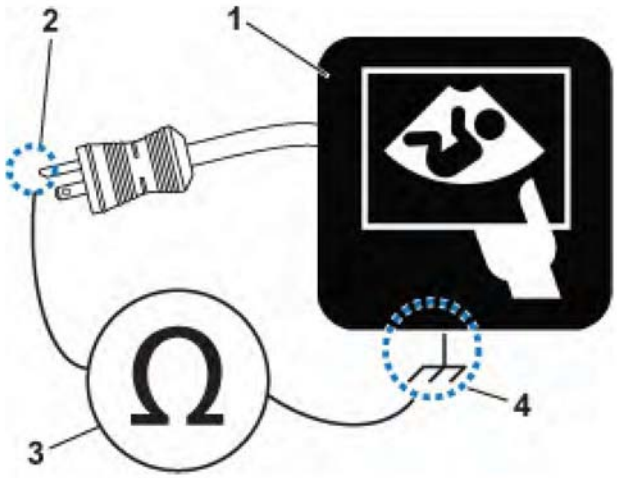
NOTE: No outlet tester can detect the condition where the Neutral (grounded supply) conductor and the Grounding (protective earth) conductor are reversed. If later tests indicate high leakage currents, this should be suspected as a possible cause and the outlet wiring should be visually inspected.

Grounding continuity

DANGER

Electric Shock Hazard!
The patient or operator MUST NOT come into contact with 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 IEC60601-1-1 and/or IEC62353.



1. Ultrasound System
2. Ground Pin
3. Ohmmeter or Electrical Safety Analyzer
4. Accessible Metal Part such as:
   - Potential equilibrium connector
   - Monitor housing
   - Probe connector

Figure 4-2. Ground continuity test

CAUTION

Lacquer is an isolation barrier! Measure only on blank accessible metal parts.

Chassis leakage current test

DANGER

Electric Shock Hazard.
When the Electrical Safety Analyzer's ground switch is OPEN, DO NOT touch the Ultrasound system!

CAUTION

Equipment damage possibility.

Never switch the Polarity and the status of Neutral when the Ultrasound system is powered ON.

Power off the Ultrasound system, allow the stored energy to bleed down, and turn the circuit breaker off BEFORE switching the "POLARITY" switch and/or the "NEUTRAL" switch on the Electrical Safety Analyzer to avoid possible power supply damage.

Definition

This test, also known as Enclosure Leakage current test, measures the current that would flow through a grounded person who touches the accessible conductive parts of the equipment during normal and fault conditions.

The test verifies the isolation of the power line from the chassis.

The testing Electrical Safety Analyzer is connected to parts of the equipment, easily contacted by the user or patient.

Record the highest reading.

Generic procedure

The test verifies the isolation of the power line from the chassis. The testing Electrical Safety Analyzer is connected from accessible metal parts of the case to ground. Measurements should be made under the test conditions specified in:

- Table 4-6 *on page 4-20*, or
- Table 4-7 *on page 4-21*, as applicable.

Record the highest reading of current.

1. Connect the Safety analyzer to wall AC wall outlet.
2. Plug the equipment under test into the receptacle on the panel of the Electrical Safety Analyzer.
3. Connect the Electrical Safety Analyzer to an accessible metal surface of the Ultrasound system using the cable provided with the Electrical Safety Analyzer.
4. Select the “Chassis” or “Enclosure Leakage” function on the Electrical Safety Analyzer.
5. Test opening and closing the ground with the Ultrasound system on and off as indicated in Table 4-6 *on page 4-20* or Table 4-7 *on page 4-21* as applicable.

NOTE: For more information, refer to the safety analyzer’s user manual that will be used to perform the tests.

The maximum allowable limit for chassis source leakage is shown in:

- Table 4-6 *on page 4-20*, or
- Table 4-7 *on page 4-21*, as Chassis/Enclosure Leakage.

Data sheet for enclosure/chassis leakage current

Table 4-10 shows a typical format for recording the enclosure/chassis leakage current. Measurements should be recorded from multiple locations for each set of test conditions. The actual location of the test probe may vary by Ultrasound system.

Record all data in the Electrical safety tests log.

NOTE: Not all test procedures are applicable to all areas of the world. Reversed Polarity testing content satisfies regions following IEC 62353:2007 and IEC 60601-1:2005.

Table 4-10: Typical data format for recording enclosure/chassis leakage

Unit under test_____ **Date of test:**_____					
Test Conditions		**Measurement/Test Point Location**			
System Power	**Grounding/ PE**	***Potential equilibrium connectorl***	***Lower Frame***	***Probe Connector***	***Main Handle***
off	closed				
off	open				
on	closed				
on	open				

NOTE: Values in italics font are given as examples only.

Table 4-11: Typical data format for recording enclosure/chassis leakage

Unit under test_____ **Date of test:**_____						
Test Conditions			**Measurement/Test Point Location**			
System Power	**Grounding/ PE**	**Limit µA**	***Potential equilibrium connector***	***Monitor housing***	***Probe connector***	
off	closed	100				
off	open	500				
on	closed	100				
on	open	500				
off	closed (reversed polarity)	100				

Table 4-11: Typical data format for recording enclosure/chassis leakage (Continued)

Unit under test_____			**Date of test:**_____			
Test Conditions			**Measurement/Test Point Location**			
System Power	**Grounding/ PE**	**Limit µA**	***Potential equilibrium connector***	***Monitor housing***	***Probe connector***	
off	open (reversed polarity)	500				
on	closed (reversed polarity)	100				
on	open (reversed polarity)	500				

Isolated patient lead (source) leakage–lead to ground

Equipment damage possibility.

Never switch the Polarity and the status of Neutral when the Ultrasound system is powered ON.

Power off the Ultrasound system, allow the stored energy to bleed down, and turn the circuit breaker off BEFORE switching the "POLARITY" switch and/or the "NEUTRAL" switch on the Electrical Safety Analyzer to avoid possible power supply damage.

Definition

This test measures the current which would flow to ground from any of the isolated ECG leads. The Electrical Safety Analyzer 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 system on and off (per IEC 62353).

For each combination the operating controls, such as the lead switch, should be operated to find the worst case condition.

Generic procedure

1. Connect the Safety analyzer to wall AC power outlet.
2. Plug the equipment under test power cable into the receptacle on the panel of the Electrical Safety Analyzer.
3. Connect the ECG cable to the Ultrasound system and the patient leads to the analyzer.
4. Select the “Patient Lead Leakage” function on the Electrical Safety Analyzer.
5. Test opening and closing the ground with the Ultrasound system on and off.

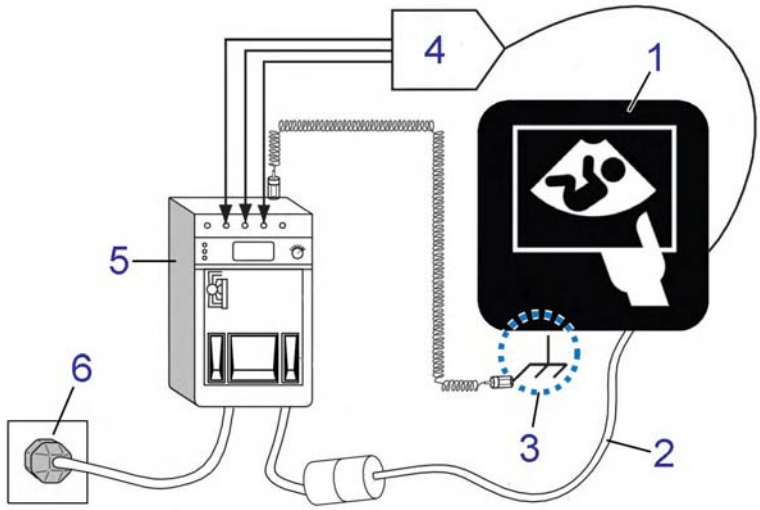
NOTE: For more information, refer to the safety analyzer's user manual.

Measurements should be made under the test conditions specified in:

- Table 4-6 *on page 4-20*, or
- Table 4-7 *on page 4-21*, as applicable.

For each combination, the operating controls, such as the lead switch, should be operated to find the worst case condition.

Record all data and keep the record of the results with other hard copies of maintenance data.



1. Ultrasound system
2. Mains power cable
3. Accessible Metal Parts (chassis - non-earth ground, unprotected surface)
4. ECG patient cable
5. Electrical safety analyzer
6. AC wall outlet

Figure 4-3. Set Up for test of Earth Leakage Current, UL60601-1/IEC60601-1

Isolated patient lead (source) leakage–lead to lead

Select and test each of the ECG lead positions (except ALL) on the LEAD selector, testing each to the power and ground condition combinations found in:

- Table 4-6 *on page 4-20*, or:
- Table 4-7 *on page 4-21*, as applicable.

Record the highest leakage current measured.

NOTE: This test is also known as the Patient Auxililary Current test.

Lead to lead leakage test record

Table 4-12 *on page 4-32* shows a typical format for recording the patient lead to lead leakage current.

Measurements should be recorded from each lead combination under each set of test conditions specified in:

- Table 4-6 *on page 4-20*, or
- Table 4-7 *on page 4-21*, as applicable.

Record all data and keep the record of the results with other hard copies of maintenance data.

1. Connect the Safety analyzer to a wall AC power outlet.
2. Plug the equipment under test into the receptacle on the Electrical Safety Analyzer's panel.
3. Connect the ECG cable to the Ultrasound system and the patient leads to the analyzer.
4. Select the “Patient Lead Leakage” function on the Electrical Safety Analyzer.
5. Test opening and closing the ground with the Ultrasound system on and off.

NOTE: Refer to the safety analyzer’s user manual that will be used to perform the tests.

Keep a record of the results with other hard copies of maintenance data usingTable 4-12.

Lead to lead leakage test record (continued)

NOTE: Not all test procedures are applicable to all areas of the world. Reversed Polarity testing content satisfies regions following IEC 62353:2007 and IEC 60601-1:2005.

Table 4-12: Typical data format for recording patient lead to lead leakage

Unit under test_____		**Date of test:**_____		
Test Conditions		**Patient Lead or Combination Measured**		
System Power	**Grounding/PE**	***RA to LA***	***LA to LL***	***LL to RA***
Off	closed			
Off	open			
On (Transmit)	closed			
On (Transmit)	open			

NOTE: Values in italics font are given as examples only.

Table 4-13: Typical data format for recording patient lead to lead leakage

Unit under test_____			**Date of test:**_____			
Test Conditions			**Patient Lead or Combination Measured**			
System Power	**Grounding/PE**	**Limit µA**	***RA to LA***	***LA to LL***	***LL to RA***	***(RA+LA+ LL) to GRND***
off	closed	10				
off	open	50				
on	closed	10				
on	open	50				
off	closed (reversed polarity)	10				
off	open (reversed polarity)	50				
on	closed (reversed polarity)	10				
on	open (reversed polarity)	50				

Isolated patient lead (sink) leakage-isolation test

Select the Individual Leads as well as All Lead position since the test is performed with mains applied to all ECG leads at the same time.

Line voltage is applied to the ECG leads during this test. To avoid possible electric shock hazard, the Ultrasound system being tested must not be touched by patients, users or anyone while the ISO TEST switch is depressed.

Isolated lead (sink) leakage test record

Table 4-14 shows a typical format for recording the isolated patient lead sink leakage current.

Measurements should be recorded for full lead combination under each set of test conditions specified in:

- Table 4-8 *on page 4-21*

Record all data and keep the record of the results with other hard copies of maintenance data.

1. Connect the Safety analyzer to a wall AC power outlet.
2. Plug the equipment under test into the receptacle on the panel of the Electrical Safety Analyzer.
3. Connect the ECG cable to the Ultrasound system and the patient leads to the analyzer.
4. Select the “Patient Lead Leakage” function on the Electrical Safety Analyzer.
5. Test with closed ground with the Ultrasound system on and off.

NOTE: Refer to the electrical safety analyzer’s user manual that will be used to perform the tests.

Isolated lead (sink) leakage test record (continued)

Keep a record of the results with other hard copies of maintenance data using Table 4-14.

NOTE: Not all test procedures are applicable to all areas of the world. Reversed Polarity testing content satisfies regions following IEC 62353:2007 and IEC 60601-1:2005.

Table 4-14: Typical data format for recording isolated patient lead (sink) leakage

Unit under test_____		**Date of test:**_____
Test Conditions		**Patient Lead**
System Power	**Grounding/PE**	***RA+LA+LL***
on	*closed*	
off	*closed*	

NOTE: Values in italics font are given as examples only.

Table 4-15: Typical data format for recording isolated patient lead (sink) leakage

Unit under test_____			**Date of test:**_____
Test Conditions			**Patient Lead**
System Power	**Grounding/PE**	**Limit µA**	***RA+LA+LL***
off	closed	50	
on	closed	50	
off	closed (reversed polarity)	50	
on	closed (reversed polarity)	50	

Probe (Source) leakage current test

WARNING

Do not use the probe if the insulating material has been punctured or otherwise compromised. Integrity of the insulation material and patient safety can be verified by safety testing according to IEC60601-1.

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.

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. It is abnormal if no leakage current is measured. If no leakage current is detected, check the configuration of the test equipment.

Generic procedure on probe leakage current

The most common method of measuring probe leakage is to partly immerse the probe into a saline bath while the probe is connected to the Ultrasound system and active. This method measures the actual leakage current resulting from the probe RF drive.

Measurements should be made under the test conditions specified in:

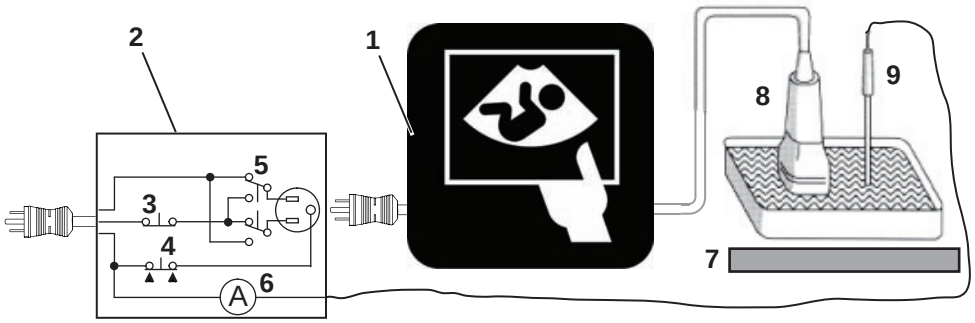
- Table 4-6 *on page 4-20*, or
- Table 4-7 *on page 4-21*, as applicable for every probe.

For each combination, the probe must be active to find the worst case condition.

Record all data and keep the record of the results with other hard copies of maintenance data.

NOTE: Saline water pod should be insulated from floor and earth ground.

NOTE: The Saline solution is a mixture of water and salt. The salt adds free ions to the water, making it conductive. Normal saline solution is 0.9% salt and 99.1% water. If ready-mixed saline solution is not available, a mixture of 1 quart or 1 liter water with 9 or more grams of table salt, mixed thoroughly, will substitute.



1. Ultrasound System
2. Electrical Safety Analyzer
3. Neutral Switch
4. Ground Switch
5. Polarity Reversing Switch
6. Meter
7. Isolator
8. Ultrasound Probe
9. Saline Probe

Figure 4-4. Set up for probe leakage current

Generic procedure on probe leakage current (continued)

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. It is abnormal if no leakage current is measured. If no leakage current is detected, check the configuration of the test equipment.

The ultrasound probes imaging area is immersed in the Saline solution along with a grounding probe from the Electrical Safety Analyzer to complete the current path.

This test is also known as Patient Leakage Current.

1. Turn the Ultrasound system **OFF**
2. Connect the Safety analyzer to AC wall outlet.
3. Set the Safety analyzer's function switch to “Chassis” or “Enclosure Leakage”.
4. Plug the Ultrasound system’s power cord into the Electrical Safety Analyzer.
5. Plug the Chassis Ground Probe (saline probe) into the Electrical Safety Analyzer's “CHASSIS” connector.
6. Connect the Ultrasound Probe to the Ultrasound system.
7. Immerse the Saline Probe in the saline solution.
8. Immerse the Ultrasound probe’s face (imaging area of the probe) into the saline solution.

CAUTION

To avoid probe damage and possible electric shock, do not immerse probes into any liquid beyond the level indicated in the probe users manual.

Do not touch the probe, conductive liquid or any part of the Ultrasound system under test while doing the test.

CAUTION

Equipment damage possibility.

Never switch the Polarity and the status of Neutral when the Ultrasound system is powered ON.

Power off the Ultrasound system, allow the stored energy to bleed down, and turn the circuit breaker off BEFORE switching the "POLARITY" switch and/or the "NEUTRAL" switch on the Electrical Safety Analyzer to avoid possible power supply damage.

Generic procedure on probe leakage current (continued)

9. Test opening and closing the ground with the Ultrasound system on and off.
   a. Power ON the Ultrasound system.
   b. After the Ultrasound system has completed the boot process, select the probe to be tested so it is the active probe.
   c. Depress the “LIFT GROUND” rocker switch and record the highest current reading.
   d. Follow the test conditions and test limits described in:
   - Table 4-6 *on page 4-20*, or:
   - Table 4-7 *on page 4-21*, as applicable for every probe.
10. Record the highest current reading.

The test passes when all readings measure less than the stated limits.

The actual location of the test probe may vary by Ultrasound system. Measurements should be recorded for each probe under the set of test conditions.

Record all data and keep the record of the results with other hard copies of maintenance data.

Generic procedure on probe leakage current (continued)

NOTE: Not all test procedures are applicable to all areas of the world. Reversed Polarity testing content satisfies regions following IEC 62353:2007 and IEC 60601-1:2005.

Table 4-16: Typical data format for recording probe (source) leakage current

Unit under test_____		**Date of test:**_____			
Test Conditions		**Probe as measured in saline bath**			
System Power	**Grounding /PE**	***4C***	***i12L***	***TS***	***E8C***
off	closed				
off	open				
on	closed				
on	open				

NOTE: Values in italics font are given as examples only.

Table 4-17: Typical data format for recording probe (source) leakage current

Unit under test_____			**Date of test:**_____			
Test Conditions			**Probe as measured in saline bath**			
System Power	**Grounding/ PE**	**Limit µA**	***4C***	***i12L***	***TS***	***E8C***
off	closed	100				
off	open	500				
on	closed	100				
on	open	500				
off	closed (reversed polarity)	100				
off	open (reversed polarity)	500				
on	closed (reversed polarity)	100				
on	open (reversed polarity)	500				

Isolated Probe (Sink) Leakage-Isolation Test

WARNING

Do not use the probe if the insulating material has been punctured or otherwise compromised. Integrity of the insulation material and patient safety can be verified by safety testing according to IEC60601-1.

CAUTION

Line voltage is applied to the ultrasound probe 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.

Measurements should be recorded for probes and transducers under each set of test conditions specified in:

- Table 4-8 *on page 4-21*

Record all data and keep the record of the results with other hard copies of maintenance data.

1. Connect the Safety analyzer to an AC wall outlet.
2. Plug the equipment under test into the receptacle on the panel of the Electrical Safety Analyzer.
3. Connect the Ultrasound probe to be tested to the Ultrasound system.
4. Immerse the saline probe in the saline solution.
5. Immerse the Ultrasound probe’s face (imaging area of the probe) into the saline solution.
6. Select the “Patient Lead Leakage” function on the Electrical Safety Analyzer.
7. Test with closed ground with the Ultrasound system on and off.

NOTE: For more information, refer to the safety analyzer's user manual.

Isolated Probe (Sink) Leakage-Isolation Test (continued)

Record all data and keep the record of the result with other hard copies of maintenance data.

NOTE: Not all test procedures are applicable to all areas of the world. Reversed Polarity testing content satisfies regions following IEC 62353:2007 and IEC 60601-1:2005.

Table 4-18: Typical data format for recording Isolated Probe (sink) leakage

Unit under test_____ **Date of test:**_____					
Test Conditions		**Probe as measured in saline bath**			
System Power	**Grounding /PE**	***4C***	***i12L***	***TS***	***E8C***
off	closed				
on	closed				

NOTE: Probe names in italics font are given as examples only.

Table 4-19: Typical data format for recording Isolated Probe (sink) leakage

Unit under test_____ **Date of test:**_____						
Test Conditions			**Probe as measured in saline bath**			
System Power	**Grounding/ PE**	**Limit µA**	***4C***	***i12L***	***TS***	***E8C***
off	closed	5000				
on	closed	5000				
off	closed (reversed polarity)	5000				
on	closed (reversed polarity)	5000				

Mains on applied part

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.

Mains on applied part is one of the described leakage current tests applicable for probes (Ref: IEC60601-1). This is to be performed with the probe disconnected from the Ultrasound system. Apply mains voltage over the insulation barrier. (Between protective earth on the probe connector, and an electrical anode in saline solution. The patient applied part of the probe is immersed into the saline solution.) Measure current flowing in the circuit = leakage current.

As a minimum, tests according to IEC60601-1 must be performed once a year. The requirements for Body Floating (BF) have to be applied for TEE and Trans thorax probes bearing the symbol for safety class BF.

The symbol for BF is indicated on the probe connector label below:

Figure 4-5. GE Probe Connector Label example

Mains on applied part (continued)

A typical test setup for TEE probes could be as indicated below:

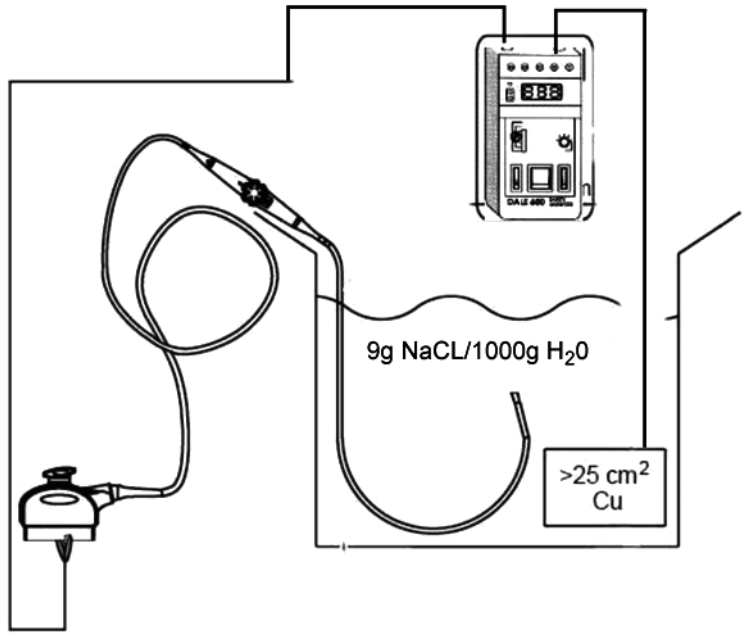


Figure 4-6. TEE probe leakage isolation (sink) current test

WARNING

The handle of the TEE probes must not be immersed.

For immersion levels, please refer to the User Manual.

NOTE: *Where applicable, a typical test setup of non-TEE Probes can be as illustrated in: Figure 4-4 on page 4-36.*

The test passes when the reading measure less than the values in:

- Table 4-8 *on page 4-21*.

When there's too much leakage current …

AC/DC Fails

Where applicable, check the AC/DC adapter and its cable. Replace a new one if any portion is defective.

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.

Where applicable, 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. If reversed wiring is observed, it is the customers responsibility to have the condition corrected by qualified personnel.

Probe Fails

Test the probe in another connector to isolate if the fault lies with the probe or the Ultrasound system.

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 Ultrasound 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.

Where applicable, in the case of using a UPS (uninterruptible power supply), perform the tests in the “Electrical Safety tests” section without using the UPS (i.e. directly connect the Ultrasound system to the AC wall outlet). If this leads to a pass result, the specific UPS must no longer be used.

New Ultrasound system

If the leakage current measurement tests fail on a new Ultrasound system and if situation can not be corrected, submit a Safety Failure Report to document the Ultrasound system problem. Remove Ultrasound system from operation.

ECG Fails

Inspect cables for damage or poor connections.

Ultrasound Equipment Quality Check (EQC and IQC)

Quality Checks

Contact your GE Service Representative to perform Equipment and Image Quality Checks.

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