Voluson E-Series BT13.5

Service Manual

English (English)

- Voluson E6 / Voluson E8 / Voluson E8 Expert with Software version EC250, 14.x.x (BT13.5)

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Chapter 1

Introduction

This chapter describes important issues related to safely servicing the Voluson E-Series (Voluson E6, Voluson E8 and/or Voluson E8 Expert) ultrasound system. The service provider must read and understand all the information presented in this manual before installing or servicing this system.

Content in this chapter

Note

Under consideration of general maintenance requirements a minimum lifetime of 7 years for the equipment and 5 years for the probes may be expected. To maintain the safety and performance of the ultrasound system, a regular check (once per year) by authorized personnel is recommended.

1.1 Important Precautions

Translation Policy

English (EN)

WARNING

This Service Manual is available in English only.

- If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services.
- Do not attempt to service the equipment unless this Service Manual has been consulted and is understood.
- Failure to heed this Warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.

Français (FR)

AVERTISSEMENT

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.

Español (ES)

ADVERTENCIA

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.

Deutsch (DE)

WARNUNG

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.

italiano (IT)

AVVERTENZA

Il presente Manuale di assistenza è disponibile solo in inglese.

- Se il fornitore di servizi di un cliente ne richiede una copia in una lingua diversa dall'inglese, è responsabilità del cliente fornire il servizio di traduzione.
- Non tentare di riparare l'apparecchio se questo Manuale di assistenza non è stato letto e compreso.
- Il mancato rispetto di questa avvertenza può comportare il rischio di lesioni al fornitore di servizi, all'operatore o al paziente causate da scosse elettriche o da pericoli di origine meccanica o di altro tipo.

Nederlands (NL)

WAARSCHUWING

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.

Português (PT-BR)

ADVERTÊNCIA

Este Manual de Manutenção está disponível apenas em Inglês.

- Caso um prestador de serviços do cliente solicite o manual em idioma diferente do inglês, é de responsabilidade do cliente o fornecimento de serviços de tradução.
- Não tente realizar a manutenção do equipamento antes de ler e compreender este Manual de manutenção.
- O não cumprimento desta advertência pode resultar em danos por choque elétrico e riscos mecânicos para o prestador de serviços, operador ou paciente.

Eesti (ET)

HOIATUS!

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.

Slovenščina (SL)

OPOZORILO

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.

日本語 (JA)

警告

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。

简体中文 (ZH-CN)

警告

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。

Svenska (SV)

VARNING

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.

繁體中文 (ZH-TW)

警告

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。

한국어 (KO)

경고

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.

На русском языке (RU)

ПРЕДУПРЕЖДЕНИЕ

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.

Polski (PL)

OSTRZEŻENIE

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.

Ελληνικά (EL)

ΠΡΟΕΙΔΟΠΟΙΗΣΗ

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.

Magyar (HU)

FIGYELMEZTETÉS

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.

Slovenčina (SK)

VAROVANIE

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.

česky (CZ)

VÝSTRAHA

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.

Türkçe (TK)

UYARI

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.

Dansk (DA)

ADVARSEL

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.

Norsk (NO)

ADVARSEL

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.

Suomi (FI)

VAKAVA VAROITUS

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.

Български (BG)

ПРЕДУПРЕЖДЕНИЕ

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.

Română (RO)

AVERTISMENT

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.

Hrvatski (HR)

UPOZORENJE

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.

Lietuvių k. (LT)

ĮSPĖJIMAS

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.

Português (Portugal)
(PT-PT)

AVISO

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.

Українська
(UK)

ПОПЕРЕДЖЕННЯ

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.

Bahasa Indonesia
(ID)

PERINGATAN

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.

ไทย
(TH)

คำเตือน

คู่มือซ่อมบำรุงนี้มีเฉพาะภาษาอังกฤษเท่านั้น

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

Latviski (LV)

BRĪDINĀJUMS

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.

Srpski (SR)

UPOZORENJE

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.

Tiếng Việt (VI)

CẢNH BÁO

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.

Қазақ тілінде (KK)

ЕСКЕРТУ

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.

Tagalog (TL)

BABALA

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

Omissions & errors

If there are any omissions, errors or suggestions for improving this documentation, please contact the GE Healthcare Austria GmbH & Co OG Service Documentation group with specific information listing the system type, manual title, part number, revision number, page number and suggestion details.

Mail the information to:	GE Healthcare Austria GmbH & Co OG Tiefenbach 15 A-4871 Zipf Austria - Europe Attn.: " Service Documentation"

GE employees should use TrackWise to report service documentation issues. These issues will then be in the internal problem reporting tool and communicated to the writer.

Service safety considerations

Danger
Dangerous voltages, capable of causing death are present in this system. Use extreme caution when handling, testing and adjusting.

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

1.2 Legal Notes

The contents of this publication may not be copied or duplicated in any form, in whole or in part, without prior written permission of General Electric.

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Trademarks

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Copyrights

1.3 Purpose of this Service Manual

This Service Manual is valid for Voluson E-Series (Voluson E6, Voluson E8 and/or Voluson E8 Expert) ultrasound systems.

Note *The Voluson E6 is a “feature-reduced” version of the Voluson E8 ultrasound system. That means not all options are available on the Voluson E6 (marked with an asterisk * in sections of this manual).*

Note *The Voluson E8 Expert offers full functionality and performance of “standard” Voluson E8 platform by providing the new feature “'Wide Sector” (extended field of view of curved array probes by means of beam steering) on all probes capable of this feature. Secondly the function of Matrix Volume Probes and the high resolution transvaginal probe RIC6-12 is enabled.*

The Voluson E8 Expert system is only distinguished by the Permanent activated “Expert option” (refer to: Figure 8-2 "System Setup - Administration - Options page " on page 8-5) and the “Expert" label on the User Interface (see: Figure 1-1 on page 1-14); it has NO own serial number!

For the sake of simplicity, descriptions in this manual will be briefly denoted with "Voluson E8", if no special differentiation is required.

The service manual is divided into 10 chapters. In the beginning of the manual, before chapter 1, you will find the revision overview and the Table of Contents (TOC).

The language policy for GE’s service documentation, the omission & errors and the legal information are included in the beginning of this chapter (chapter 1).

Table 1-1 Contents in this service manual

Chapter Number and Title	Description
Chapter 1 – Introduction	Contains a content summary and warnings.
Chapter 2 – Site Preparation	Contains pre-installation requirements.
Chapter 3 – Setup Instructions	Contains setup and installation procedures.
Chapter 4 – Functional Checks	Contains functional checks that are recommended as part of the installation, or as required during servicing and periodic maintenance.
Chapter 5 – Components and Functions (Theory)	Contains block diagrams and functional explanations of the electronics.
Chapter 6 – Service Adjustments	Contains instructions on how to make available adjustments.
Chapter 7 – Diagnostics/Troubleshooting	Provides procedures for running diagnostic or related routines.
Chapter 8 – Replacement Procedures	Provides disassembly procedures and reassembly procedures for all Field Replaceable Units (FRU) and Customer Replaceable Units (CRU).
Chapter 9 – Renewal Parts	Contains a complete list of field replaceable parts.
Chapter 10 – Care and Maintenance	Provides periodic maintenance procedures.

1.3.1 Typical Users of the "Basic" Service Manual

- GE service personnel (setup, maintenance, etc.)
- Hospital's service personnel
- Architectural planners/installation planners (Some parts of Chapter 2 - Site Preparation)

1.3.2 Models covered by this Manual

Table 1-2 Voluson E6 - model designations

Part Number	Description	BT version
H48681XB	Voluson E6	BT13.5
H48691JU	Upgrade Voluson E6 BT13.5 to Voluson E8 BT13.5	BT13.5

Table 1-3 Voluson E8 - model designations

Part Number	Description	BT version
H48681XC	Voluson E8	BT13.5
H48691JT	Upgrade Voluson E8 BT13.5 to Voluson E8 Expert BT13.5	BT13.5

Table 1-4 Voluson E8 Expert - model designations

Part Number	Description	BT version
H48681XD	Voluson E8 Expert	BT13.5

Table 1-5 Voluson E8 Expert Limited Edition - model designations

Part Number	Description	BT version
H48681XE	Voluson E8 Expert Limited Edition	BT13.5

1.3.3 System History - Hardware and Software Versions

This manual applies to:

- Voluson E6 systems with Serial Number D62001 - (BT13.5)
- Voluson E6 systems with Software version EC250, Ext.x, 14.x.x (BT13.5)
- Voluson E8 / Voluson E8 Expert systems with Serial Number D22001 - (BT13.5)
- Voluson E8 / Voluson E8 Expert systems with Software version EC250, Ext.x, 14.x.x (BT13.5)
- Voluson E8 Expert Limited Edition systems with Serial Number D82001 - (BT13.5)
- Voluson E8 Expert Limited Edition systems with Software version EC250, Ext.x, 14.x.x (BT13.5)

1.3.3.1 How to identify the Systems

Housing, Console and Monitor are the same, but labels and logos have different colors:

- Voluson E8 = blue
- Voluson E8 Expert = blue + additional Expert label
- Voluson E6 = silver

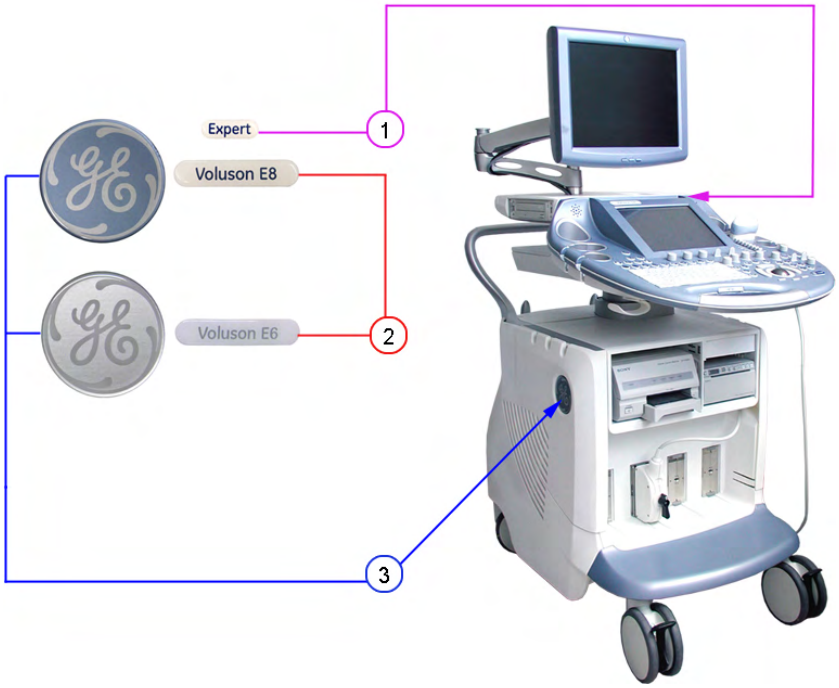


Figure 1-1 labels and logos have different colors

1	**Expert** label right above the Touch panel
2	**Voluson E*** label left above the Touch panel
3	**GE** logo on the left and right side panel

1.3.4 Purpose of Operator Manual(s)

The operator manuals should be fully read and understood before operating the Voluson E-Series system and also kept near the system for quick reference.

The online versions of the operator manual is available via the Help function (**F1** key) on Voluson E-Series control console.

The translated online user manuals are available on a CD ROM delivered with the system. They are also available on OnBase and/or the Common Documentation Library (CDL) for downloading.

1.4 Important Conventions

1.4.1 Conventions used in this Manual

MODEL DESIGNATIONS

This manual covers the Voluson E-Series ultrasound systems listed in *Models covered by this Manual*.

ICONS

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

SAFETY PRECAUTION MESSAGES

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

- **Danger**
- **Warning**
- Caution

1.4.2 Standard Hazard Icons

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

	**Danger** **Indicates the presence of a hazard that will cause severe personal injury or death if the instructions are ignored.**
	**Warning** Indicates the presence of a hazard that can cause severe personal injury and property damage if instructions are ignored.
	Caution Indicates the presence of a hazard that will or can cause minor personal injury and property damage if instructions are ignored. Equipment damage possible.
	Electric Hazard Indicates the risk of injury from electric hazards.
	Bio Hazard Indicates the risk of disease transmission or infections.
	Explosion Hazard Indicates the risk of injury from explosion hazards.
	Moving Hazard Indicates the risk of injury from moving or tipping hazards.
	Mechanical Hazard Indicates the risk of injury from mechanical/pinch hazards.
	Acoustic Output Hazard Indicates the risk of injury from acoustic output hazards.

	Laser Radiation Hazard Indicates the risk of injury from laser radiation.
	Non-ionizing Hazard Indicates the risk of injury from non-ionizing radiation.
	Operating LED Indicates the risk of injury from light beams entering the eye. Do not stare into the light beam of the LED.
	Electrostatic Discharge (ESD) Hazard Describes precautions necessary to avoid static electricity that will or can damage integrated circuits.
	This icon is used when options or features are specific for BT-Software versions.
	This icon is used for special hints, or tips that may facilitate servicing a Voluson E-Series system.

Note *Notes are used to provide important information about an item or a procedure.*
Be sure to read the notes; the Information contained in a note can often save you time or effort.

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 1-6 Standard icons that indicates that a special procedure is to be used

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

1.4.3 Product Labels and Icons

The following table describes the purpose and location of labels, safety icons and other important information provided on the equipment.

Note *For description of all symbols and labels used in combination with this Voluson E-Series ultrasound system, refer to Chapter 2 in the Basic User Manual.*

Table 1-7 Product Labels and Icons

LABEL/SYMBOL	PURPOSE/MEANING	LOCATION
Identification and Rating Plate	Manufacturer's name and address Model and Serial numbers Electrical ratings	rear side of the system on plug of each probe
	Manufacturer's name and address	Identification and Rating Plate (rear side of the system / on plug of each probe)
	Date of manufacture	Identification and Rating Plate (rear side of the system / on plug of each probe)

LABEL/SYMBOL	PURPOSE/MEANING	LOCATION
SN	Serial number	Identification and Rating Plate (rear side of the system / on plug of each probe)
REF	Catalog or model number	Identification and Rating Plate (rear side of the system / on plug of each probe)
Device Listing / Certification Labels	Laboratory logo or labels denoting conformance with industry safety standards such as UL or IEC.	rear side of the system
CE 0123	CE Conformity mark according to Medical Device Directive 93/42/EEC. **0123**: Identification number of notified body TÜV Süd Product Service.	Identification and Rating Plate (rear side of the system / on plug of each probe)
TÜV SÜD NRTL C US	“Tested and production monitored by TÜV Product Service NRTL with respect to ELECTRICAL SHOCK, FIRE and MECHANICAL HAZARDS only in accordance with UL2601-1 and CAN/CSA C22.2 NO.601.1.”	Identification and Rating Plate (rear side of the system)
Type/Class Label	Used to indicate the degree of safety or protection.	
IP Code (IPX 0) IP Code (IPX 1) IP Code (IPX 7)	degree of protection provided by enclosure per IEC 60529: IPX 0 - no protection against ingress of water IPX 1 - protected against dripping water IPX 7 - protected against the effects of immersion	various
	Equipment Type BF (man in box, symbol IEC 60417-5333) indicates B Type equipment having even more electrical isolation than standard Type B equipment because it is intended for intimate patient contact.	Identification and Rating Plate (rear side of the system / on plug of each probe)
	Defibrillator-proof Type CF equipment (heart in box with paddle, symbol IEC 60417-5336) identifies a defibrillation-proof type CF applied part complying with IEC 60601-1.	front side of the ECG-preamplifier
"DANGER - Risk of explosion used in ..."	The system is not designed for use with flammable anesthetic gases.	Indicated in the Service Manual.
	This precaution is intended to prevent injury that may result if one person attempt to move the system considerable distances or on an incline due to the weight of the system.	Used in the Service and User Manual which should be adjacent to equipment at all times for quick reference.
	Pushing prohibited. Do not lean on the system. Tipping danger. Take special care when moving the system.	various
	Loading prohibited. Do not put any items on this shelf. Danger of breaking. Also items might be crushed when lowering the user interface.	at top cover of the system
	“ATTENTION” - Read and understand all instructions for use” This symbol advises the reader to consult the accompanying documents (operator manual or other instructions).	rear side of the system
Rx only	This symbol indicates that in the United States of America, federal law restricts this device to sale by or on the order of a physician.	Identification and Rating Plate (rear side of the system)
	Waste Electrical and Electronic Equipment (WEEE) Disposal. This symbol indicates that waste electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.	Identification and Rating Plate (rear side of the system / on plug of each probe)

LABEL/SYMBOL	PURPOSE/MEANING	LOCATION
	This product consists of devices that may contain mercury, which must be recycled or disposed of in accordance with local, state, or country laws. (Within this system, the backlight lamps in the monitor and the Touch Panel display, contain mercury.)	Identification and Rating Plate (rear side of the system) not visible: - below the cover on read side of Monitor - on rear side of the Touch Panel
ME20 or	GOST-R label (Russia Regulatory Country Clearance)	Identification and Rating Plate (rear side of the system)
	"CAUTION - Consult accompanying documents" This symbol is used to advise the reader to consult the accompanying documents for important safety-related information such as warnings and pre-cautions that cannot be presented on the device itself.	various
	"CAUTION - Dangerous electric voltage" (lightning flash with arrowhead) is used to indicate electric shock hazards. Unplug the main plug before opening the system!	various
	"Mains OFF" Indicates the power off position of the mains power switch.	rear of system at mains switch (on power supply RSP)
	"On/Off" or "Standby" **CAUTION: System shutdown using this button DOES NOT disconnect the Voluson E-Series from mains voltage!**	**ON/OFF** Standby button on control console
	"Mains ON" Indicates the power on position of the mains power switch.	rear of system at mains switch (on power supply RSP)
	"Protective Earth" Indicates the protective earth (grounding) terminal.	rear of system at mains switch (on power supply RSP)
	"Equipotential" Indicates the terminal to be used for connecting equipotential conductors when interconnecting (grounding) with other equipment.	rear of system at mains switch (on power supply RSP)
	This symbol indicates that the device is equipped with hardware for using Continuous Wave Doppler.	rear side of the system
	These symbols indicate that at least one of the six hazardous substances of the China RoHS Labeling Standard is above the RoHS limitation. The number inside the circle is referred to as the Environmental Friendly Use Period (EFUP). It indicates the number of years that the product, under normal use, will remain harmless to health of humans or the environment. EFUP = 10 for Short Use Products EFUP = 20 for Medium Use Products	rear side of the system on the plug of each probe

1.5 Safety Considerations

1.5.1 Introduction

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

1.5.2 Human Safety

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

Only personnel who have participated a Voluson E-Series training are authorized to service the equipment.

Danger
Dangerous voltages, capable of causing death are present in this system. Use extreme caution when handling, testing and adjusting.

Warning
Do not operate the system in an explosive atmosphere. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

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

Warning
Do not substitute parts or modify the system. Because of the danger of introducing additional hazards, ONLY install GE Healthcare Austria GmbH & Co OG approved parts. DO NOT perform any unauthorized modification of the system.

Warning: Risk of electrical shock

Beware that the main power supply, extended power shutdown and BackEnd processor may be energized even if the power is turned off when the cord is still plugged into the AC outlet.

- Ensure that the system is turned off and disconnected from power source.
- Wait for at least 20 seconds for capacitors to discharge as there are no test points to verify isolation. The amber light on the control console **ON/OFF** button will turn off.

Warning
Use extreme caution as long as the Voluson E-Series is un-stable, not resting on all four caster wheels.

Warning
Use all Personal Protection Equipment (PPE) such as gloves, safety shoes, safety glasses, and kneeling pad, 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 Material Safety Data Sheet (MSDS).

1.5.3 Mechanical Safety

Moving the system on plains	Moving the system on inclines
	

Caution

The Voluson E-Series systems weighs 130 kg or more, depending on installed peripherals, (300 lbs., or more) when ready for use.

Be careful when moving the system. Two people are required when moving the Voluson E-Series on inclines or lifting more than 16 kg (35 lbs).

- Always lower and center the control console (UI) to its minimum height and lock it in its parking (locked) position.
- Secure the monitor for transport: Lock the monitor arm and flap down the LCD monitor.
- Use the rear handle to move the system.
- Remove all obstacles.
- Move the system slowly and carefully.
- Avoid collisions with walls or door frames.
- Always place the system on horizontal ground and engage the caster brakes.
- Do not move the system when the brakes are engaged.
- Move the system forward or backward when going up or down inclines. Do not move the system sideways or diagonally.

Failure to follow the precautions could result in injury, uncontrolled motion and costly damage.

Warning

Ultrasound systems and probes are highly sensitive medical instruments that can easily be damaged by improper handling. Use care when handling and protect from damage also when not in use. Do not use a damaged or defective ultrasound system or probe. Failure to follow these precautions can result in serious injury and system damage.

Warning

Never use a probe that has fallen to the floor. Even if it looks OK, it may be damaged.

Note

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

- *Eject any DVD/CD from the drive.*
- *Place the probes in their carrying cases.*
- *DO NOT use the control console as an anchor point.*
- *Secure the system with straps in an upright position and lock the caster wheels (brake).*
- *Ensure that the Voluson E-Series system is firmly secured while inside the vehicle.*
- *Drive cautiously to prevent vibration damage.*

1.5.4 Electrical Safety

1.5.4.1 Safe Practices

Follow these guidelines to minimize electrical shock hazards whenever using the system:

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

Warning
Connecting a Voluson E-Series system to the wrong voltage level will most likely destroy it.

1.5.4.2 Probes

All probes for Voluson E-Series systems are designed and manufactured to provide trouble-free, reliable service. To ensure this, correct handling of probes is important and the following points should be noted:

- Do not drop a probe or strike it against a hard surface, as this may damage the probe elements, acoustic lens, or housing.
- Inspect the probe prior to each use for damage or degradation to the housing, cable strain relief, lens, seal, connector pins and locking mechanism.
- Do not use a cracked or damaged probe. In this event, call your field service representative immediately to obtain a replacement.
- Avoid pulling, pinching or kinking the probe cable, since a damaged cable may compromise the electrical safety of the probe.
- Never immerse the probe connector or adapter into any liquid.
- The system has more than one type of probe port. Use the appropriate probe port designed for the probe you are connecting.

Note *For detailed information on handling probes, refer to the Voluson E-Series Basic User Manual and the care card supplied with the probe.*

1.5.5 Auxiliary Devices Safety

Caution
Power supplies for additional equipment MUST comply with IEC 60601-1.

Caution
Do not attempt to use different peripherals and accessories (brand and model; connected via USB port) other than approved and provided by GE Healthcare Austria GmbH & Co OG! The Voluson E-Series ultrasound system is an extremely sensitive and complex medical system. Any unauthorized peripherals may cause system failure or damage.

Voluson E-Series systems are equipped with an isolation transformer to provide the required separation from AC mains for both, the system and the auxiliary devices. One AC mains power outlet is located at the power supply. It is used for connecting the threefold/fourfold splitter whose outlets are led to the shelves, intend for auxiliary devices (e.g., printers).

The IEC60601 standard provides a guideline for safely interconnecting medical devices in systems. “Equipment connected to the analog or digital interface must comply with the respective IEC/UL standards (e.g. IEC60950 / UL 60950 for data processing equipment and IEC60601-1 / UL60601-1 for medical equipment).

Everybody who connects additional equipment to the signal input portion or signal output portion configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC60601.

1. The medical device may be connected to a single IEC XXX device (protection class I) placed in a room which is not medically used.
2. If the device is to be connected in a medically-used room the following rule applies:

- IEC XXX compliant devices (protection class I) may be connected with an additional safety measure.
- IEC 60601 compliant devices may be connected as such.

For all situations 1 and 2, the additional device shall be installed outside the typical patient environment.

Possible additional safety measures are additional protective earth connection between the 2 devices, or a safety isolation mains transformer for the other device.

Special care has to be taken, if the device is connected to computer network (e.g., Ethernet), because other devices could be connected without any control. There could be a potential difference between the protective earth and any line of the computer network including the shield.

In this case the only way to operate the system safely is to use an isolated signal link with minimum air clearance and creepage distance of the isolation device in agreement with IEC60601 incl. national deviations. For computer networks there are media converters available which convert the electrical to optical signals. Please consider that this converter has to comply with IEC xxx standards* and is battery operated or connected to the isolation mains output of the Voluson E-Series ultrasound system.

* IEC xxx stands for standards such as:

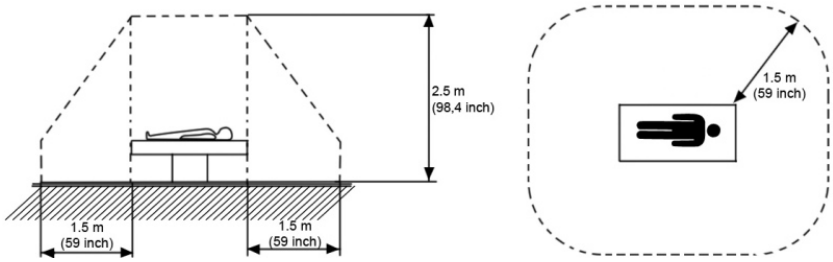
- IEC60601 for medical devices
- IEC60950 for information technology equipment etc.

Note *The system integrator (any person connecting the medical device to other devices) **is responsible that connections are safe.** If in doubt, consult the technical service department or your local representative.*

Caution
The leakage current of the entire system including any / all auxiliary equipment must not exceed the limit values as per EN60601-1-1 (IEC60601-1-1) respectively other valid national or international standards. All equipment must comply with UL, CSA, IEC or other relevant requirements.

Caution

Please observe that some printers may not be medical devices! If Bluetooth-, Line- or Laser Printers are no medical devices, they have to be located outside of the typical patient environment. Examples for typical patient environments can be found in standard IEC 60601 (see illustrations below).



Caution
Auxiliary equipment must only be connected with the special main outlet provided for the electrical safety of the system.

Caution
Auxiliary equipment with direct main connection requires galvanic separation of the signal and/or control leads.

Note *Always observe the instructions given in the manual of the peripheral/auxiliary device.*

For hardware installation procedures see: *Chapter 3 – Setup Instructions*

Warning
After each installation, the leakage currents have to be measured according to IEC 60601-1, UL 60601-1, IEC 62353 or other relevant standard.

Note *All peripherals mounted on the Voluson E-Series system chassis must be firmly secured in position.*

1.5.6 Labels Locations

The Voluson E-Series ultrasound system comes equipped with product labels and icons. These labels and icons represent pertinent information regarding the operation of the system.

Note *For description of all symbols and labels used in combination with this Voluson E-Series ultrasound system, refer to Section 1.4.3 on page 1-16 and Chapter 2 in the Basic User Manual of your system.*

1.5.6.1 Identification and Rating Plate

The Identification and Rating Plate is located on the rear of the Voluson E-Series system.

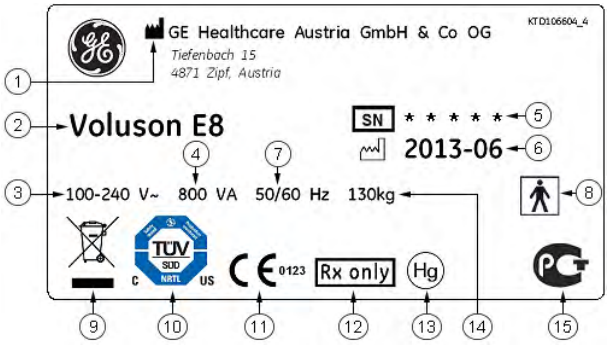


Figure 1-2 Identification and Rating Plate: Examples

1	Manufacturer	6	Manufacturing date	11	CE Conformity mark
2	Model Type	7	Frequency	12	FDA Guidance
3	System Voltage range	8	Safety type: Type BF	13	Hg label
4	Power Consumption nominal	9	WEEE Disposal Icon	14	approx. weight of the system
5	System Serial Number	10	TUEV NRTL Certification mark	15	GOST-R label

1.5.7 Dangerous Procedure Warnings

Warnings, such as the examples 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 system. Use extreme caution when handling, testing and adjusting.

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

Warning
Do not operate the system 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 the system. Because of the danger of introducing additional hazards, ONLY install GE Healthcare Austria GmbH & Co OG approved parts. DO NOT perform any unauthorized modification of the system.

1.5.8 Lockout/Tagout (LOTO) Requirements

Follow OSHA Lockout/Tagout requirements (USA) or local 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. Apply Lockout/Tagout Devices.
5. Control all stored and residual energy.
6. Verify isolation.

All potentially hazardous stored or residual energy is relieved.

Warning

Energy Control and Power Lockout for Voluson E-Series:

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

1. Follow LOTO (Lockout/Tagout) procedures.
2. Turn off the breaker.
3. Unplug the Voluson E-Series system.
4. Maintain control of the Voluson E-Series system power plug.
5. Wait for at least 30 seconds for capacitors to discharge as there are no test points to verify isolation.

Ultrasound system components may be energized.

1.5.9 Returning/Shipping System, Probes and Repair Parts

When returning or shipping the Voluson E-Series system in the original packaging:

- system must be lowered to its minimum height with monitor flapped down
- the control console has to be centered and locked in “unextended” position

Note *For control console positioning see Section 6.3 on page 6-5 .*

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 and 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 what 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 purpose 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.*

The Voluson E-Series 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 system and a regular backup is highly recommended.

If the system is sent for repair, please ensure that any patient information is backed up and erased from the 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.

1.6 EMC, EMI and ESD

1.6.1 What is EMC?

Electromagnetic compatibility describes a level of performance of a device within its electromagnetic environment. This environment consists of the device itself and its surroundings including other equipment, power sources and persons with which the device must interface. Inadequate compatibility results when a susceptible device fails to perform as intended due interference from its environment or when the device produces unacceptable levels of emission to its environment. This interference is often referred to as radio–frequency or electromagnetic interference (RFI/EMI) and can be radiated through space or conducted over interconnecting power of signal cables. In addition to electromagnetic energy, EMC also includes possible effects from electrical fields, magnetic fields, electrostatic discharge and disturbances in the electrical power supply.

For applicable standards please refer to Chapter 2 in the Basic User Manual of the Voluson E-Series ultrasound system.

1.6.2 Compliance

The Voluson E-Series 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 as mentioned in IEC60601-1-2.

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

1.6.3 Electrostatic Discharge (ESD) Prevention

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

1. When installing boards, ESD may cause damage to a board. ALWAYS connect yourself, via an arm-wrist strap, to the advised ESD connection point located on the rear of the system (to the right of the power connector).
2. Follow general guidelines for handling of electrostatic sensitive equipment.

Warning: Risk of electrical shock! 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.

1.7 Customer Assistance

1.7.1 Contact Information

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

Note *Prepare vital system information (see: Section 7.1 on page 7-2) before you call:*

- System Type
- System Serial number (also visible on label on back of the system)
- Application Software version
- Backup version
- additional information about installed software

LOCATION	PHONE NUMBER	
USA GE Healthcare Ultrasound Service Engineering 9900 Innovation Drive (RP-2123) Wauwatosa, WI 53226, USA	**USCAN** Service: On-site: Service Parts: OLC: Application Support:	 1-800-437-1171 1-800-558-2040 1-800-321-7937 or 1-262 524-5300 1-800-682-5327 or 1-262-524-5698
Canada	**OLC - USCAN**	1-800-321-7937 1-800-668-0732
Latin America	**LATAM** Service: Application Support:	 +1-262-524-5300 +1-262-524-5698
EUROPE Ultrasound Europe GE Ultraschall Deutschland GmbH Beethovenstraße 239 Postfach 11 05 60, D-42655 Solingen Germany	**OLC - EUROPE** Support Phone: English/German, all segments Support Fax:	 +49 (0) 212 2802 652 +33 1 3083 1300 +49 (0) 212 2802 431
EAGM	**OLC - EAGM** Phone: Egypt Service center: UAE Service center:	 +49 (0) 212-2802-652 00202 2322 1252 00971 8003646
APAC	**Online Services Ultrasound Asia** ANZ - Service Support: Australia: Japan Support Center: Korea: Singapore:	 1800 647 855 +(61) 1-800-659-465 +(81) 42-648-2940 (Phone) +(81)-42-648-2905 (Fax) +(82) 2-1544-6119 +(65) 6291-8528 (Phone) +(65) 6291-7006 (Fax)
China	Phone:	+(86) 800-810 8188 +(86) 400-812 8188 +(86) 10-6788 2652
India Wipro GE Healthcare Pvt. Ltd. 4, Kadugodi Industrial Area, Bangalore - 560 067 India	Phone:	 +(91) 1-800-425-8025 +(91) 1-800-425-7255 +(91) 1-800-102-7750

Figure 1-3 phone numbers for customer assistance

1.7.2 System Manufacturer

Table 1-8 system manufacturer

Manufacturer	Telephone	FAX
GE Healthcare Austria GmbH & Co OG Austria GmbH & Co OG Tiefenbach 15 A-4871 Zipf Austria - Europe	+43 (0) 7682-3800-0	+43 (0) 7682-3800-47

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Chapter 2

Site Preparation

This chapter provides the information required to plan and prepare for the installation of a Voluson E-Series system. Included are descriptions of the facility and electrical needs to be met by the purchaser.

Content in this chapter

2.1 General Requirements

2.1.1 Environmental requirements

Table 2-1 environmental requirements

Operating Temperature	Operating Humidity	Heat Dissipation	Storage Temperature	Storage Humidity
10 to 30°C (50 to 86°F)	30 to 80% rH non-condensing	2730 BTU/hour	-10 to 40°C (14 to 104°F)	< 90% rH non-condensing

Caution
If the system has been in storage, has been transported or is very cold or hot, do not turn on its power until it has had a chance to acclimate to its operating environment. (see: *Section 3.1.2 "Installation Warnings" on page 3-2*).

2.1.1.1 Cooling

The cooling requirement for a Voluson E-Series system is 2730 BTU/hour. 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/hr demand on the cooling system.*

2.1.1.2 Lighting

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

2.1.2 Electrical Requirements

Note *GE Healthcare Austria GmbH & Co OG requires a dedicated power and ground for the proper operation of its Ultrasound equipment. This dedicated power shall originate at the last distribution panel before the system.*

The Ultrasound 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.*

2.1.2.1 Voluson Power Requirements Voluson E-Series

Table 2-2 electrical specifications for Voluson E-Series

Voltage	Tolerances	Power Consumption	Frequency
100 - 240 VAC	±10%	800 VA	50, 60 Hz (±2%)

AC mains power outlets (AUX) for auxiliary devices and peripherals are co-switched by the systems mains switch. Output voltage for AUX: 115V

Caution
The maximum power consumption of equipment (inclusive color LCD monitor) connected to these outlets must not exceed 200VA!

2.1.2.2 Inrush Current

Inrush current is not a factor to consider due to the inrush current limiting properties of the power supplies.

2.1.2.3 Site Circuit Breaker

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

Caution: Power outage may occur.

Voluson E-Series requires a dedicated single branch circuit. To avoid circuit overload and possible loss of critical care equipment, make sure you DO NOT have any other equipment operating on the same circuit.

2.1.2.4 Site Power Outlets

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

2.1.2.5 System Power Plug

If the Voluson E-Series arrives without a power plug, or with the wrong plug, you must contact your GE dealer or the installation engineer must supply what is locally required.

2.1.3 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 Voluson E-Series system complies with limits as stated on the EMC label. However, there is no guarantee that interference will not occur in a particular installation.

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

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

- medical lasers
- scanners
- cauterizing guns
- computers
- monitors
- fans
- gel warmers
- microwave oven
- 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.

Table 2-3 EMI prevention/abatement

EMI Rule	Details
Be aware of Radio Frequency sources.	Keep the 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 system.	Poor grounding is the most likely reason a system will have noisy images. Check grounding of the power cord and power outlet.
Replace all screws, Radio Frequency gaskets, covers and cores.	After you finish repairing or updating the system, replace all covers and tighten all screws. Any cable with an external connection requires a magnet wrap at each end. Install 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 an Radio Frequency gasket are broken, replace the gasket. Do not turn ON the system until any loose metallic part is removed.
Do not place labels where Radio Frequency gaskets touch metal.	Never place a label where Radio Frequency gaskets meet the system. Otherwise, the gap created will permit Radio Frequency leakage. In case a label has been found in such a position, move it.
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 causes image artifacts.
Properly route peripheral cables.	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.

2.1.4 Environmental Requirements for Probes

Probes can be used in clinical environment.

Ensure that the probe face temperature does not exceed the normal operation temperature range.

Probes must be operated, stored, or transported within the parameters outlined below.

	Operational	Storage	Transport
Temperature	+18º to +30º C (+64.4°F to +86°F)	-10º to +50º C (+14°F to +122°F)	-10º to +50º C (+14°F to +122°F)
Humidity	30% to 75% RH non-condensing	10% to 85% RH non-condensing	10% to 85% RH non-condensing
Pressure	700hPa (3000m) to 1060hPa	700hPa (3000m) to 1060hPa	700hPa (3000m) to 1060hPa

2.1.5 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

Have two people available to deliver and unpack the Voluson E-Series ultrasound system.

Attempts to move the system considerable distances (or on an incline) by one person alone, could result in personal injury and/or damage to the system.

2.1.6 System Specifications

2.1.6.1 Physical Dimensions of Voluson E-Series

Physical dimensions and weight (without peripherals) of the Voluson E-Series system are summarized in *Table 2-4*.

Note *Physical dimensions (especially height and depth) depend on control console and monitor positioning.*

For more details see *Section 5.10.3 "Control Console Positioning" on page 5-37* .

Table 2-4 physical dimensions and weight (without monitor and peripherals)

Height	Width	Depth	Weight
1520 mm / 59.9 inch * 1320 mm / 52.0 inch ** 1120 mm / 44.1 inch ***	580 mm / 22.8 inch	1160 mm / 45.6 inch * 960 mm / 37.8 inch **	130 kg / 286.6 lbs.

* maximum at “normal” monitor position (control console is lifted and moved forwards to the maximum)

** minimum at “normal” monitor position (no control console lifted or forwards movement)

*** absolute minimum (monitor flapped down)

2.1.6.2 Acoustic Noise Output

max. 60 dB(A)

2.1.6.3 Electrical Specifications

Refer to: *Section 2.1.2.1 "Voluson Power Requirements Voluson E-Series" on page 2-2* .

2.2 Facility Needs

2.2.1 Purchaser Responsibilities

The work and materials needed to prepare the site is the responsibility of the purchaser. Delay, confusion, and waste of manpower can be avoided by completing pre-installation work before delivery.

Use the Pre-installation checklist (provided in *Table 2-5*) to verify that all needed steps have been taken.

Table 2-5 Voluson E-Series pre-installation checklist

Action	Yes	No
Schedule at least 3 hours for installation of the system.		
Notify installation team of the existence of any variances from the basic installation.		
Make sure system and probes have been subject to acclimation period.		
Environmental cooling is sufficient.		
Lighting is adjustable to adapt to varying operational conditions of the system.		
Electrical facilities meet system requirements.		
EMI precautions have been taken and all possible sources of interference have been removed.		
Mandatory site requirements have been met.		
If a network is used, IP address has been set for the system and a dedicated network outlet is available.		

Purchaser responsibility includes:

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

Note *All electrical installations that are preliminary to the positioning of the equipment at the site prepared for the equipment must be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations, and testing must also be performed by qualified personnel. The products involved (and the accompanying electrical installations) are highly sophisticated and special engineering competence is required. All electrical work on these products must comply with the requirements of applicable electrical codes. The purchaser of GE equipment must only utilize qualified personnel to perform electrical servicing on the equipment.*

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

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

2.2.2 Required Facility Needs

- dedicated single branch power outlet of adequate amperage (see: *Table 2-2 on page 2-2*), meeting all local and national codes, which is located less than 2.5 m (8 ft.) from the system's proposed location.; see *Section 2.1.2 "Electrical Requirements" on page 2-2* .
- door opening is at least 76 cm (30 in) wide
- proposed location for the system is at least 0.5 m (1.6 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 system to connect cables.
- power outlets for other medical equipment
- power outlets for test equipment within 1 m (3.2 ft.) of 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)

Note *The Voluson E-Series has four outlets inside. One for the monitor and three for on board peripherals.*

In case of network option:

- An active network outlet in the vicinity of the ultrasound system.
- A network cable of appropriate length (regular Pin-to-Pin network cable).
- An IT administrator who will assist in configuring the system to work with your local network. A fixed IP address is required. Refer to the form provided in *Figure 3-81* for network details that are required.

Note *All relevant preliminary network port installations at the prepared site must be performed by authorized contractors. The purchaser of GE equipment must utilize only qualified personnel to perform servicing on the equipment.*

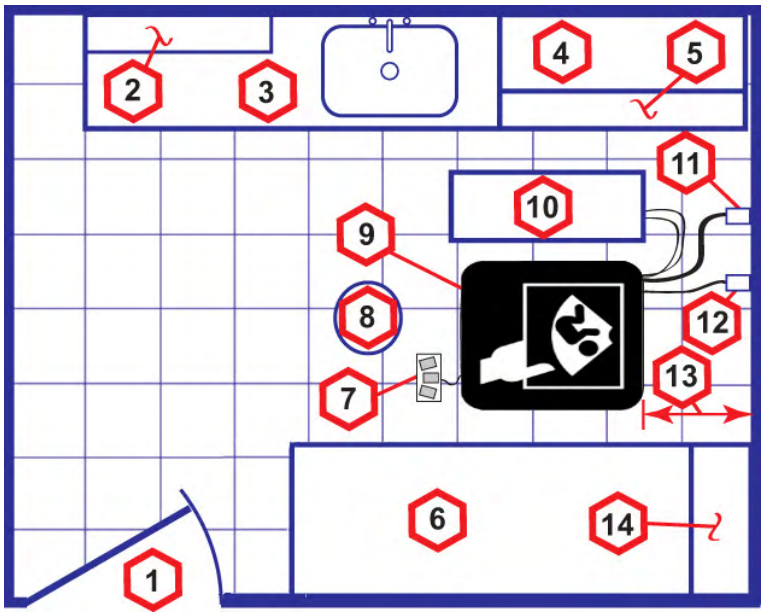


Figure 2-1 recommended Floor Plan 4.3 m x 5.2 m (14 by 17 foot)

1	door – at least 76 cm (30 inches)	8	stool
2	film viewer	9	ultrasound system
3	counter top, sink with hot and cold water, supplies storage	10	external peripherals
4	linen supply	11	dedicated power outlet - circuit breaker protected and easily accessible
5	probes/supplies	12	network interface
6	examination table	13	distance from wall or objects
7	footswitch	14	cabinet for software and manuals

2.2.3 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 for software and manuals

2.2.4 Network Setup Requirements

2.2.4.1 Stand-alone System (without Network Connection)

None

2.2.4.2 System connected to Hospital's Network

Supported networks:

- Ethernet network connection
- Wireless LAN (option)

2.2.4.3 Purpose of the DICOM Network Function

DICOM® [1] (**D**igital **I**maging and **Co**mmunications in **M**edicine) services provide the operator with clinically useful features for moving images and patient information over a hospital network. Examples of DICOM services include the transfer of images to workstations for viewing or transferring images to remote printers. As an added benefit, transferring images in this manner frees up the on-board monitor and peripherals, enabling viewing to be done while scanning continues. With DICOM, images can be archived, stored, and retrieved faster, easier, and at a lower cost.

2.2.4.4 DICOM Option Pre-installation Requirements

To configure the Voluson E-Series ultrasound system to work with other network connections, the network administrator must provide some necessary information.

Use the *Figure 3-80 on page 3-80* to record required information that must include:

- Voluson E-Series Details: DICOM network details for the Voluson E-Series system, including the host name, local port, IP address, AE title and net mask.
- Routing Information: IP addresses for default gateway and other routers in use at site.
- DICOM Application Information: Details of DICOM devices in use at the site, including the DICOM host name, AE title, DICOM port number and IP addresses.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

1 DICOM is the registered trademark of the National Electrical Manufacturers Association for its standards publications relating to digital communications of medical information.

Chapter 3

Setup Instructions

This chapter contains information needed to setup the Voluson E-Series ultrasound system. Included are procedures to receive, unpack and configure the equipment. A worksheet is provided (see: Section 3.14 on page 3-80) to help ensure that all the required information is available, prior to setup the system.

Content in this chapter

3.1 Setup Reminders

3.1.1 Average Installation Time

Once the site has been prepared, the average installation time required is shown in Table 3-1 below.

Table 3-1 average installation time

Description	Average Installation Time	Comments
Unpacking the system	0.5 hours	
Installing the system / options / printers	0.5 to 1.5 hours	depends on required configuration
DICOM Option (connectivity)	0.5 to 1.5 hours	depends on configuration amount
Install InSite	0.5 hours	

3.1.2 Installation Warnings

Caution
Since the Voluson E-Series weighs approximately 130 kg (286.6 lbs.) without peripherals, two people are required to unpack it.

Warning
There are no operator serviceable components. To prevent shock, do not remove any covers or panels. Should problems or malfunctions occur, unplug the power cord.

Only qualified service personnel should carry out servicing and troubleshooting.

3.1.2.1 Moving/Lifting the System

Note *For important safety considerations see Section 1.5.3 "Mechanical Safety" on page 1-20 .*

Figure 3-1 lifting the system

How to lift the system:

1 Preparation
- Disconnect all probes and transport them separately.
- Disconnect the ECG cable (if applicable) and transport it separately.
- Ensure all peripheral devices (printer, ...) are firmly fixed within the system.

2 Remove the footrest cover on the front side of the system: Turn the 2 quick release devices below the footrest 90° (see: *Figure 8-21 on page 8-17*).

3 Pass a strap through the openings in the metal sheet.

4 Lift the system by the straps and the rear handle.

Caution
- Do not pull or lift the system with the front handle of the user interface (control console).
- Always use a strap to lift the system. Do not grasp the metal sheet with your hands.
- Move the system forward or backward when going up or down inclines. Do not move the system sideways or diagonally.

3.1.2.2 System Acclimation Time

After being transported, the Voluson E-Series system may be very cold or hot. It requires one hour for each 2.5°C increment if it's temperature is below 10°C or above 40°C.

Caution
Equipment damage possibility. Turning the system on without acclimation after arriving at site may cause the system to be damaged.

Table 3-2 Acclimation Time

°C	60	55	50	45	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
°F	140	131	122	113	104	96	86	77	68	59	50	41	32	23	14	5	-4	-13	-22	-31	-40
hrs	8	6	4	2	0	0	0	0	0	0	0	2	4	6	8	10	12	14	16	18	20

3.1.2.3 Control Console Positioning

If weight is placed on the control console (UI) in it's extended position the system could tip over.

Caution
The system should not be moved with the control console (UI) extended. Move the control console to it's centered and locked position for transport.

Caution
Monitor mounting mechanism may break if not properly supported (e.g., with packing foam) during transportation.

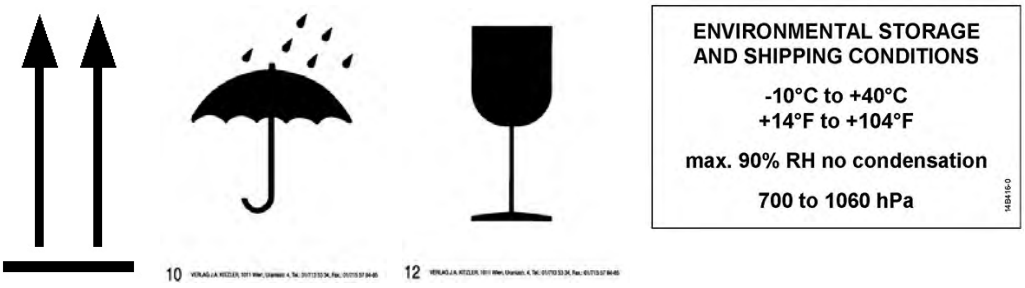
3.1.2.4 Brake Pedal Operation

Caution
If the wheel brakes are engaged, release brake pedals (brakes on wheels under the foot rest) to disengage the lock, for transportation.

3.1.3 Safety Reminders

	**Danger** **When using any test instrument that is capable of opening the AC ground line (i.e., meter's ground switch is OPEN), DO NOT touch the system!**
	Caution To prevent electrical shock, connect the system to a properly grounded power outlet. DO NOT use a three to two prong adapter. This defeats safety grounding.
	Caution When connecting the optional PE (potential equalization) and/or the optional additional GND (ground cable) it is mandatory to also use the Power Filter (H48701EL).
	Caution: The Voluson E-Series requires all covers! Do not operate this system unless all board covers and frame panels are securely in place, to ensure optimal system performance and cooling. (When covers are removed, EMI may be present).
	Caution Two people should unpack the system because of its weight. Two people are required whenever a part weighing 16kg (35 lb.) or more must be lifted.
	Caution: Do not wear the ESD wrist strap when you work on live circuits and more than 30 V peak is present.
	Caution If the system is very cold or hot, do NOT turn on its power until it has had sufficient time to acclimate to its operating environment.
	Caution: Operator Manual(s) The User Manual(s) should be fully read and understood before operating the Voluson E-Series. Keep manuals near the system for reference.
	Caution: Acoustic Output hazard Although the ultrasound energy transmitted from the Voluson E-Series ultrasound system is within FDA limitations, avoid unnecessary exposure. Ultrasound energy can produce heat and mechanical damage.

Table 3-3 Environmental Labels



3.2 Receiving and Unpacking the System

Note *Please read this section carefully before unpacking the Voluson E-Series ultrasound system and its (optional) peripherals.*

The Voluson E-Series ultrasound system, together with peripherals, probes and accessories are shipped from the factory in a single durable shipping cardboard which is mounted on a raised wooden platform base.

Caution
Transport only with forklift or stacker truck. During transport pay attention to the point of gravity ("tilt and drop" indicator)!

Warning
Have two people available to deliver and unpack the Voluson E-Series ultrasound system.

Attempts to move the system considerable distances (or on an incline) by one person alone, could result in personal injury and/or damage to the system.

Table 3-4 shipping cardboard -dimensions and weight

Description	Height	Width	Depth	Weight*
Voluson E-Series incl. peripherals and accessories	1500 mm / 59 inch	800 mm / 31.5 inch	1150 mm / 45.3 inch	170 kg / 375 lbs.

* Weight is approximate and will vary depending upon the supplied peripherals

Before unpacking the system

- Inspect the cardboard for visible damage.
- Inspect the drop and tilt indicator **(1)** for evidence of accidental shock or tilting during transit.
  The tilt indicator must not turn *red*.
- Verify delivery address and remove the packing slip and invoice from the envelope **(2)** that is located on the front panel of the cardboard.
- Remove the unpacking instruction **(3)** that is located on the side panel of the cardboard.

Figure 3-2 shipping cardboard

Note *The device must only be transported in the original packaging cardboard!*

It is recommended to keep and store the shipping cardboard and all other packing materials (including the support foams, anti-static plastic cover, etc.), in case the system has to be moved to a different location. Unpack the system such a way that packaging can be reused. For warranty purposes, storage of the above is required for one year from date of purchase.

Note *If the shipping cardboard is damaged, please inform the GE Healthcare Austria GmbH & Co OG sales representative immediately.*

Unpacking procedure

Unpack the Voluson E-Series ultrasound system and its (optional) peripherals and accessories according to the provided unpacking instruction.

3.3 Preparing for Setup

3.3.1 Verify Customer Order

1. After unpacking, it is important to verify that all items ordered by the customer have been received. Compare all items listed on the packing slip (delivery note) with those received.

Note *It is recommended to keep and store the shipping cardboard and all other packing materials (including the support foams, anti-static plastic cover, etc.), in case the system has to be moved to a different location. Unpack the system such a way that packaging can be reused. For warranty purposes, storage of the above is required for one year from date of purchase.*

2. Visually inspect the system components using the following checklist.

Table 3-5 Damage Inspection Checklist - Voluson E-Series system

✓	Step	Item	Recommended Procedure
	1	Rating Plate	Enter Serial Number: _____ (printed on rating plate, see: *Figure 1-2 on page 1-23*)
	2	System	Verify that the Voluson E-Series system is switched OFF and unplugged. Clean the system.
	3	Control Console	Physically inspect the control console for missing or damaged items. After switching on the system, verify the proper illumination of all the control console buttons.
	4	Probes	Check all probes for wear and tear on the lens, cable, and connector. Look for bent or damaged pins on the connector and in the connector socket on the system. Verify that the EMI fingers around the probe connector socket housing are intact. Check the probe locking mechanism and probe switch.
	5	LCD Display	Clean the LCD display by gently wiping with a dry, soft, lint-free non-abrasive folded cloth. Inspect the monitor for scratches and raster burn.
	6	Fans	Verify that the system's cooling fans and peripheral fans are operating.
	7	Rear Panel	Check the rear panel connectors for bent pins, loose connections and loose or missing hardware. Screw all the cable connectors tightly to the connector sockets on the panel. Verify that the labeling is in good condition.
	8	Covers	Check that all screws are tightly secured in place, that there are no dents or scratches and that no internal parts are exposed.
	9	Peripherals	Check and clean the peripherals in accordance with the manufacturer's directions. To prevent EMI or system overheating, dress the peripheral cables inside the peripheral cover.
	10	Power Cord	Check the power cord for cuts, loose hardware, tire marks, exposed insulation, or any deterioration. Verify continuity. Replace the power cord, as required.

Note *Report any items that are missing, back-ordered, or damaged, to your GE Healthcare Austria GmbH & Co OG sales representative. The contact address is shown in "Contact Information" on page 1-26 .*

3.3.2 EMI Protection

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

Ensure that the system is protected from electromagnetic interference (EMI), as follows:

- Operate the system at least 15 feet away from equipment that emits strong electromagnetic radiation.
- Operate the system in an area enclosed by walls, floors and ceilings comprised of wood, plaster or concrete, which help prevent EMI.
- Shield the system when operating it in the vicinity of radio broadcast equipment, if necessary.
- Do not operate mobile phones or other EMI emitting devices in the ultrasound room.
- Verify that all EMI rules listed are followed.

The Voluson E-Series system is approved for use in hospitals, clinics and other environmentally qualified facilities, in terms of the prevention of radio wave interference. Operation of the ultrasound system in an inappropriate environment can cause electronic interference to radios and television sets situated near the medical equipment.

For further details and EMI Prevention/Abatement refer to *Section 2.1.3 "EMI Limitations" on page 2-3* .

3.4 Connection of Auxiliary Devices

Content in this section

Note *Always observe the instructions given in the manual of the peripheral/auxiliary device.*

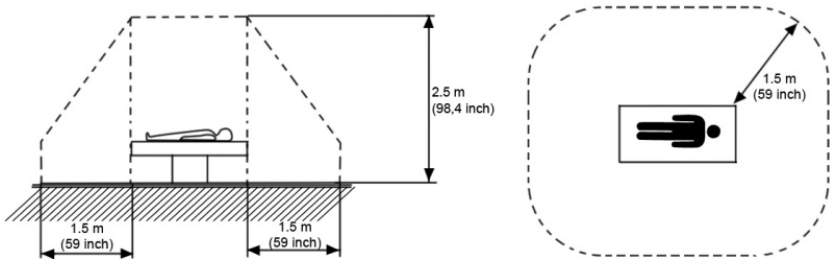
Note *It is impossible to attach a Black&White printer, a Color printer and a DVD/USB video recorder within the system at the same time, as there is not enough space for them all. At the left shelf you can place either a Color printer or a DVD/USB video recorder.*

Note *Only one recording device can be connected at a time to the Voluson E-Series system!*

Warning
After each installation, the leakage currents have to be measured according to IEC 60601-1, UL 60601-1, IEC 62353 or other relevant standard.

Caution

Please observe that some printers may not be medical devices! If Bluetooth-, Line- or Laser Printers are no medical devices, they have to be located outside of the typical patient environment. Examples for typical patient environments can be found in standard IEC 60601 (see illustrations below).



Note *For more detailed Safety Considerations when connecting auxiliary devices to the Voluson E-Series system, please review: Section 1.5.5 "Auxiliary Devices Safety" on page 1-21 .*

3.4.1 Connecting the LCD Monitor

Note *The LCD Monitor comes pre-installed with the system.*

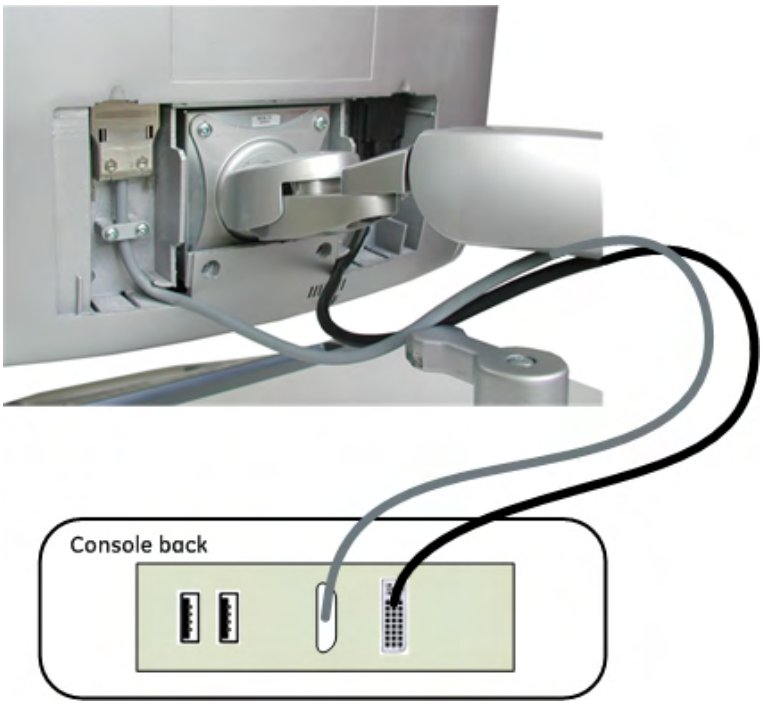


Figure 3-3 Connection Scheme - LCD Monitor

3.4.2 Connecting the Black & White Printer

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .
2. If your printer is **UP-D898MD**:[2]

   a. Connect your printer to any power source.

      Note: If you connect the printer directly to an AC mains power outlet for auxiliary devices (provided by the Voluson E-Series system), DO NOT yet connect the USB cable!

   b. Press the Power ON button **(1)** on the printer.
   c. Enter the Menu by pushing the **Joystick** key **(2)**.
   d. Display "*Digital*" by shifting the **Joystick** key up or down.
   e. Push the **Joystick** key to enter the sub menu.
   f. Display "*Driver*" by shifting up or down.
   g. Push the **Joystick** key to enter the sub menu.
   h. Display "*DRV:897*" by shifting up or down.
   i. Push the **Joystick** key again to confirm selection. The printer is now set-up with the driver of UP-D897.
   j. Proceed installation procedure as described below.
3. Connect the Black & White printer according to connection scheme, see: *Figure 3-4 on page 3-12* .
4. When all cables are connected, press the Power ON button on the printer.
5. Power ON/Boot up the Voluson E-Series system as described in *Section 3.5.1 on page 3-39* .

   All software drivers are pre-installed for the designated printer only.
6. After physical connection to the Voluson E-Series system, assign the printer to a remote key (**P1**, **P2**, **P3** and/or **P4**) as described in *Section 3.6.7 "Remote Control Selection" on page 3-57* .
7. Verify correct printer settings; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .

Note *The B&W printer should be connected to the **USB3** port of the Voluson E-Series´s PC-part. Location of the USB3 port depends on the installed PC-Motherboard. If in doubt, refer to Section 5.4 on page 5-24 for detailed internal In/Out cable routing.*

If the printer driver is not pre-installed, install it manually by means of the “Found New Hardware Wizard” and the printer driver disk which is included with this new printer.

Warning
After each installation, the leakage currents have to be measured according to IEC 60601-1, UL 60601-1, IEC 62353 or other relevant standard.

2 The UP-D898MD features a legacy mode driver mode. In this mode the printer identifies itself as UP-D897 via the USB interface. This enables the use of the printer with the driver of UP-D897. Through this feature the new medical printer UP-D898MD can be used to easily replace an existing UP-D897 unit in the field.

3.4.2.1 Connection Scheme: B&W Printer

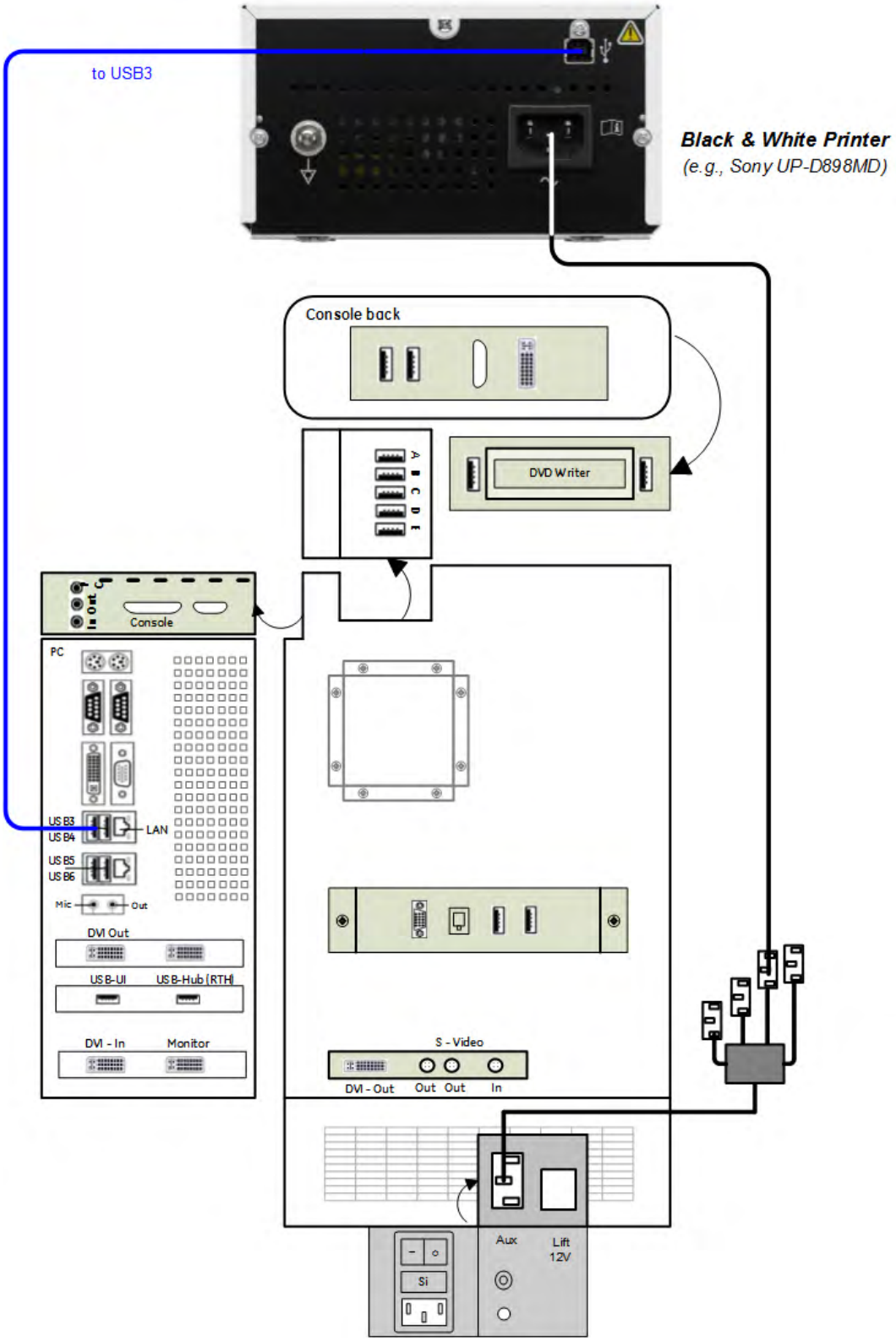


Figure 3-4 Connection Scheme - B&W Printer

3.4.3 Connecting the Color Printer

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .
2. Connect the Color printer according to connection scheme, see: *Figure 3-5 on page 3-14* .
3. When all cables are connected, press the Power ON button on the printer.
4. Power ON/Boot up the Voluson E-Series system as described in *Section 3.5.1 on page 3-39* .

   All software drivers are pre-installed for the designated printer only.
5. After physical connection to the Voluson E-Series system, assign the printer to a remote key (**P1**, **P2**, **P3** and/or **P4**) as described in *Section 3.6.7 "Remote Control Selection" on page 3-57* .
6. Verify correct printer settings; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .

Note *The Color printer should be connected to the **USB4** port of the Voluson E-Series´s PC-part. Location of the USB4 port depends on the installed PC-Motherboard. If in doubt, refer to Section 5.4 on page 5-24 for detailed internal In/Out cable routing.*

If the printer driver is not pre-installed, install it manually by means of the “Found New Hardware Wizard” and the printer driver disk which is included with this new printer.

Warning
After each installation, the leakage currents have to be measured according to IEC 60601-1, UL 60601-1, IEC 62353 or other relevant standard.

3.4.3.1 Connection Scheme: Color Printer

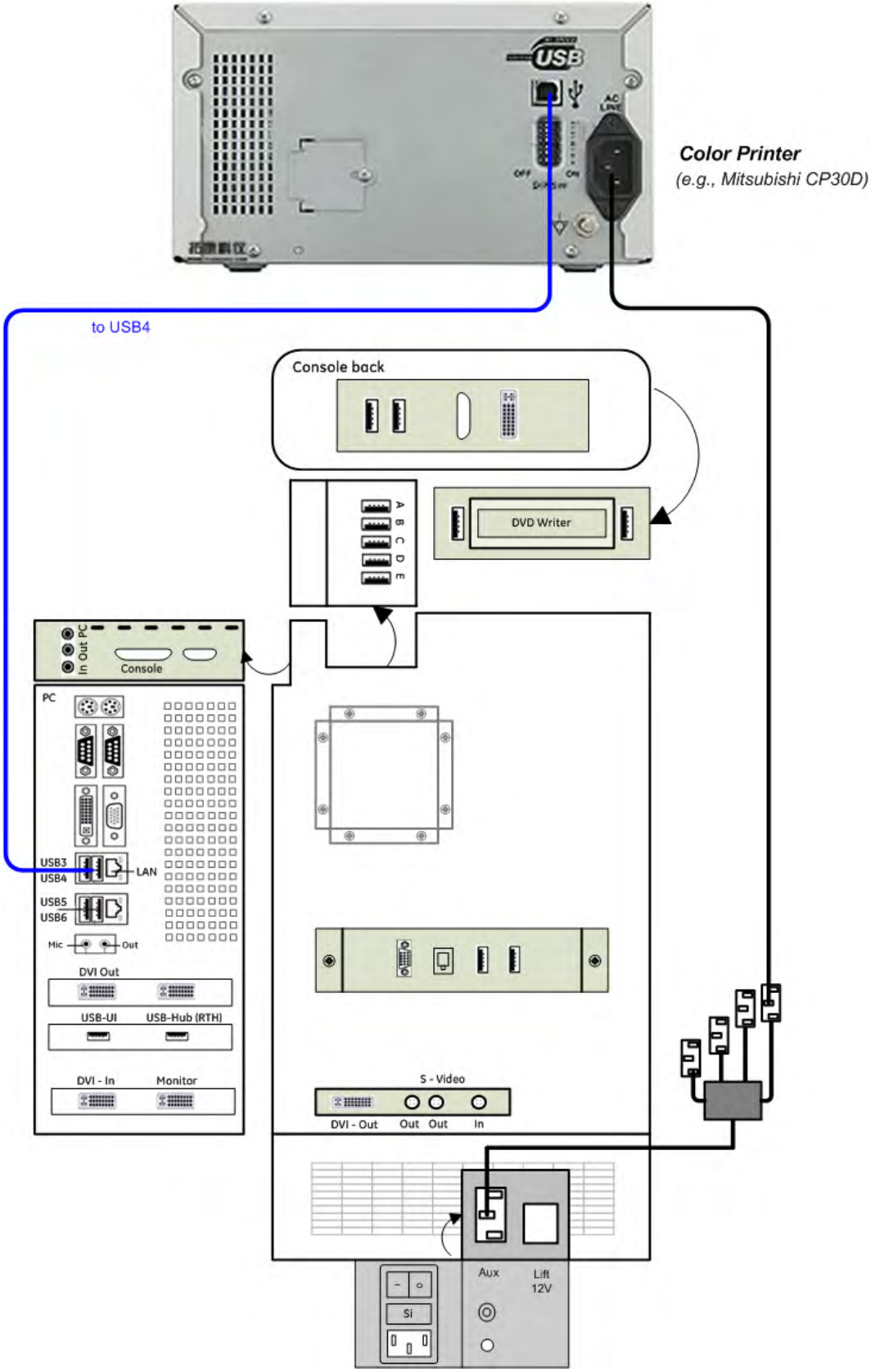


Figure 3-5 Connection Scheme - Color Printer

3.4.4 Connecting the DeskJet Color Printer

Caution
Please observe that the complete Printer Assembly has to be located outside of the patient environment (according to IEC 60601-1 / UL 60601-1).

Caution
The printer being used may not be a medical device. The (Bluetooth) Printer Set and the Power Supply is also not a medical device. The equipment meets the requirements of the EN 60950 Standard.

Connection via Bluetooth Adapter

The DeskJet Color Printer can be connected to an external, non-isolated power source. The Bluetooth Adapter should be directly connected to the indicated **USB port E** on the RTB Distribution Board Bottom.

Note *Please use the proper Bluetooth Printer Connection set; see: Section 9.10.2 "Printers" on page 9-34 .*

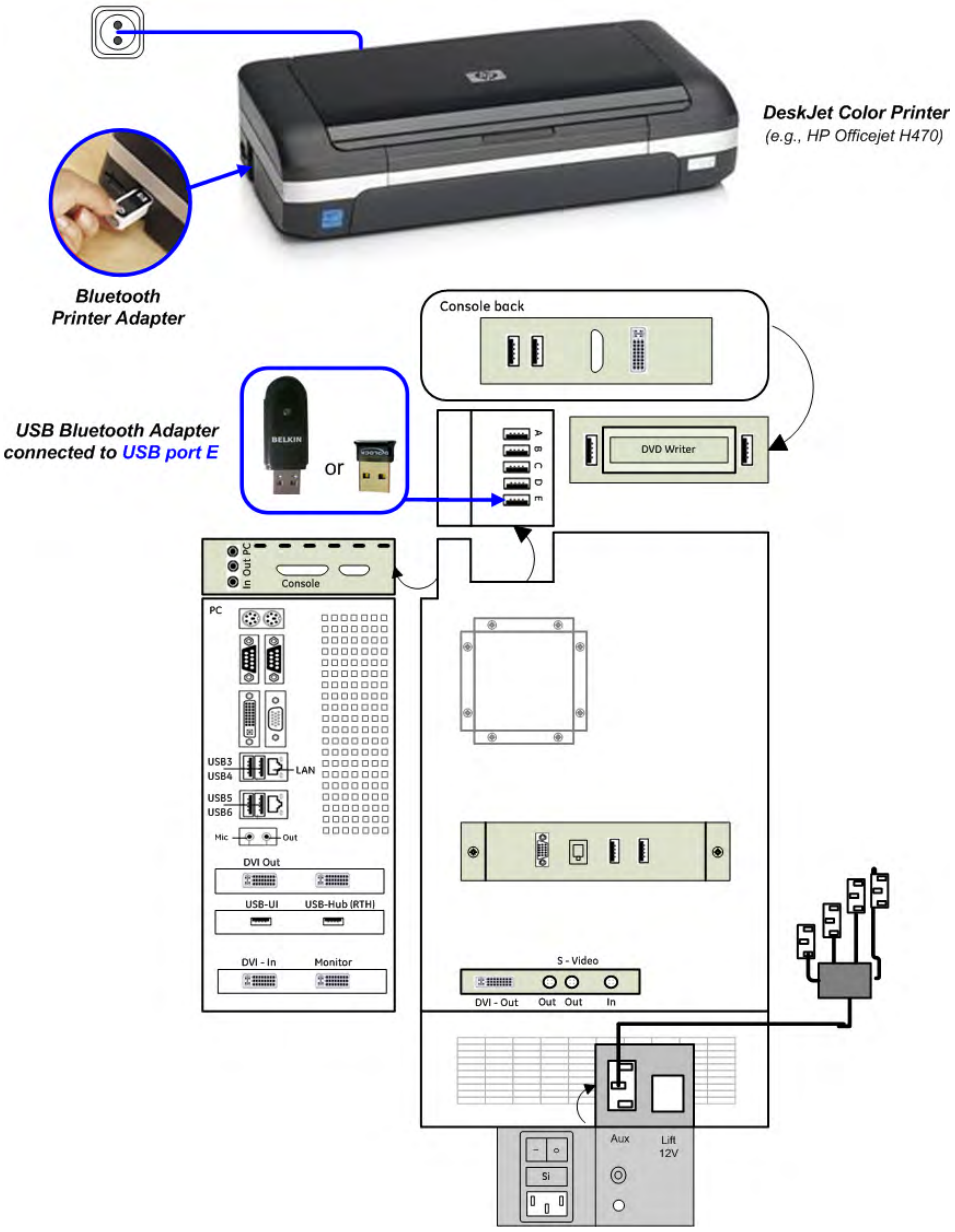


Figure 3-6 Connection Scheme - DeskJet Color Printer (via Bluetooth Adapter)

Connection directly to the Voluson E-Series

The DeskJet Color Printer can be directly connected to any accessible USB port or the indicated USB port E on the RTB Distribution Board Bottom via an USB cable.

Note *If a DeskJet printer (e.g., HP Officejet 100) is connected directly via an USB-cable, use the AC mains power outlet provided by the Voluson E-Series system (auxiliary output). This ensures medical grade separation from AC mains.*

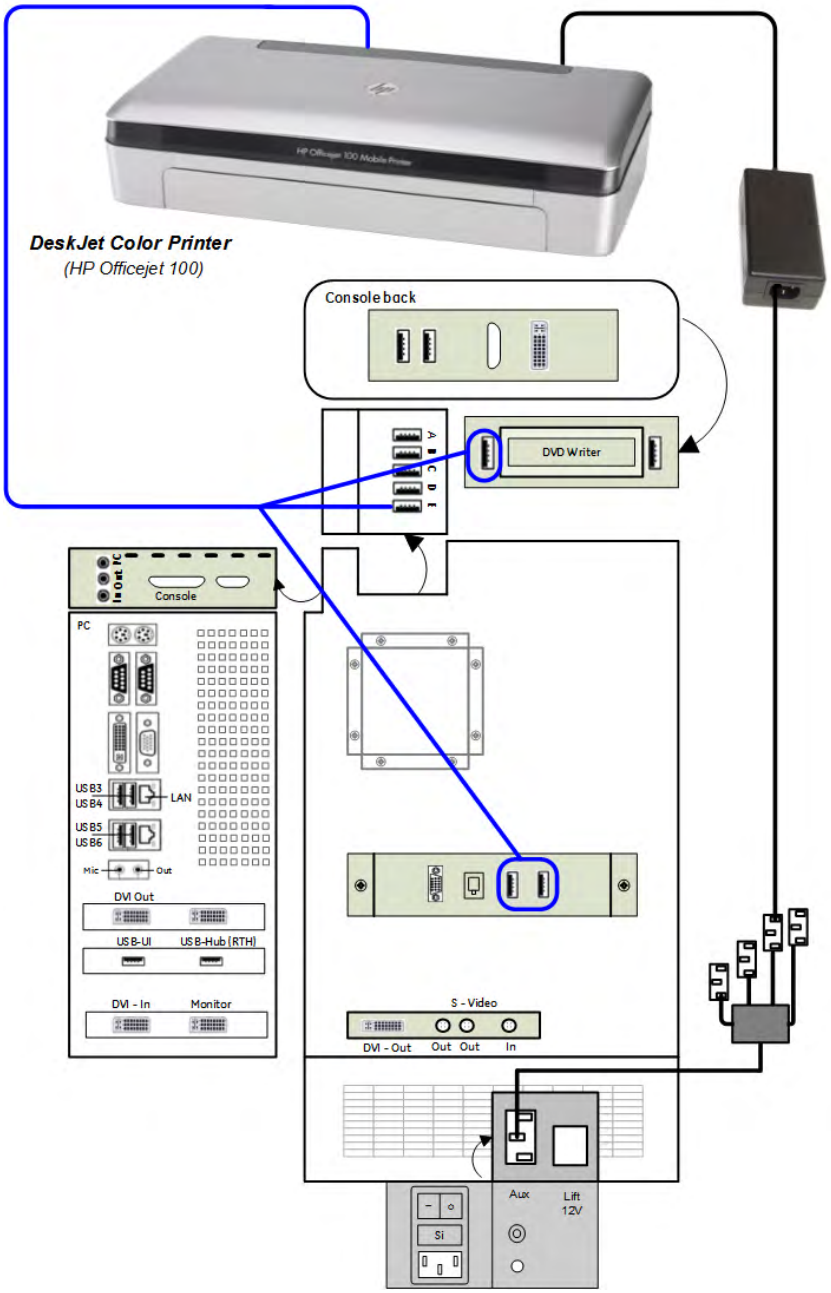


Figure 3-7 Connection Scheme - DeskJet Color Printer (directly via USB cable)

3.4.5 Connecting the Network Color Laser Printer

Caution
Please observe that the complete Printer Assembly has to be located outside of the patient environment (according to IEC 60601-1 / UL 60601-1).

Caution
The printer being used may not be a medical device. The (Bluetooth) Printer Set and the Power Supply is also not a medical device. The equipment meets the requirements of the EN 60950 Standard.

Note *It does not matter, whether an Ethernet crossover cable or a patch cable (straight through cable) is used. The Network Color Laser Printer HP451 automatically reconfigures signals to yield expected results.*

Connection directly to the Voluson E-Series

Physical connection:

1. Connect the Color Laser Printer.
   - Connect the network cable to the Ethernet **LAN** connector on the Voluson E-Series system. The other end connect to the Ethernet connector of the Color Laser Printer.
   - Connect the power cable of the printer to an external, non-isolated power source.
2. Install the Color Laser Printer as described in *Section 3.6.4 on page 3-45* .

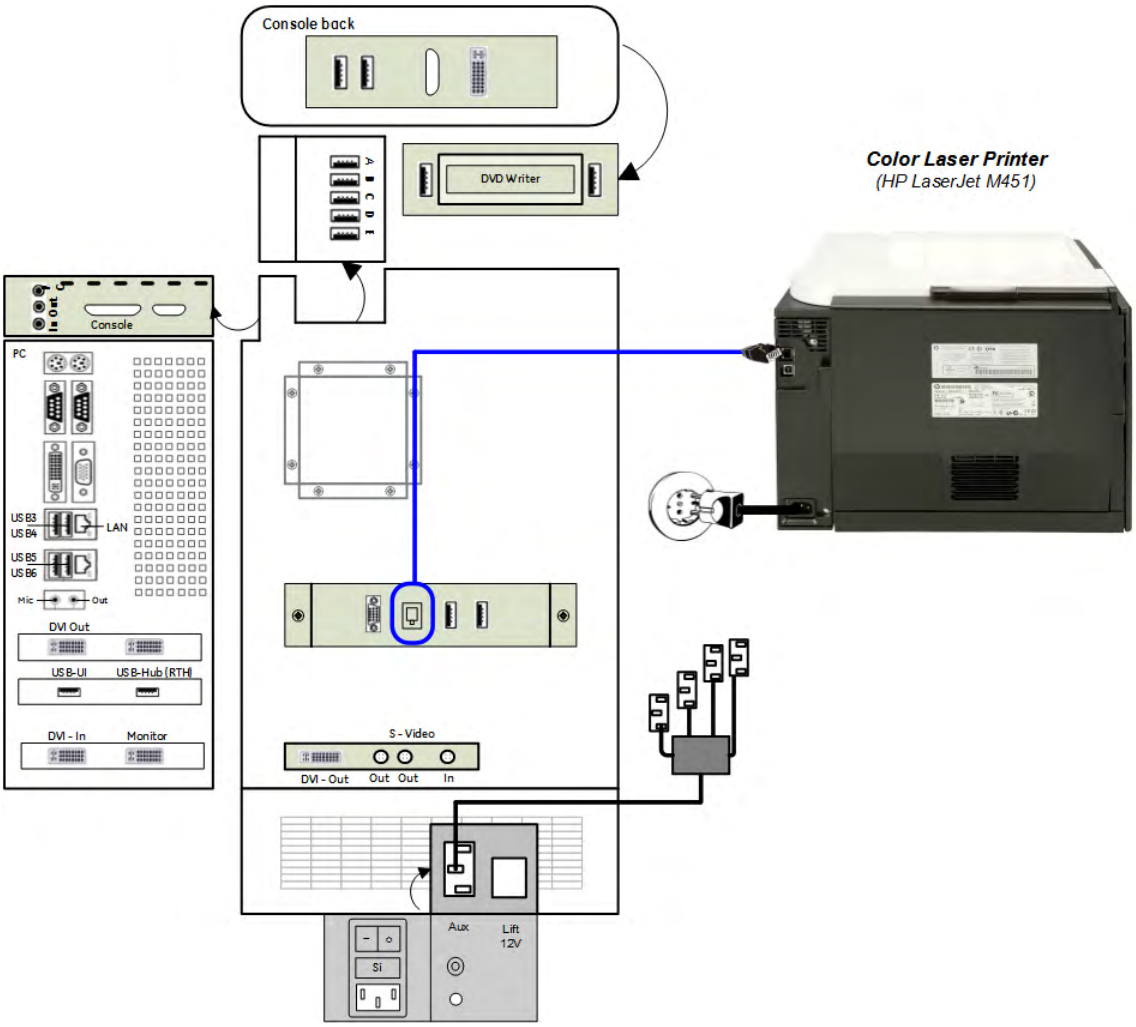


Figure 3-8 Connection Scheme - Color Laser Printer (directly via network cable)

Connection to work within the Network Environment

The Color Laser Printer can be connected to work within the network environment. Usually this will be the hospital network.

Physical connection:

Two network cables are needed.

1. Connect the Color Laser Printer.
   - Connect the first network cable to the Ethernet **LAN** connector on the Voluson E-Series system. The other end connect to a hospital network wall outlet.
   - Connect the second network cable to the Ethernet connector of the Color Laser Printer. The other end connect to a hospital network wall outlet.
   - Connect the power cable of the printer to an external, non-isolated power source.
2. Install the Color Laser Printer as described in *Section 3.6.4 on page 3-45* .

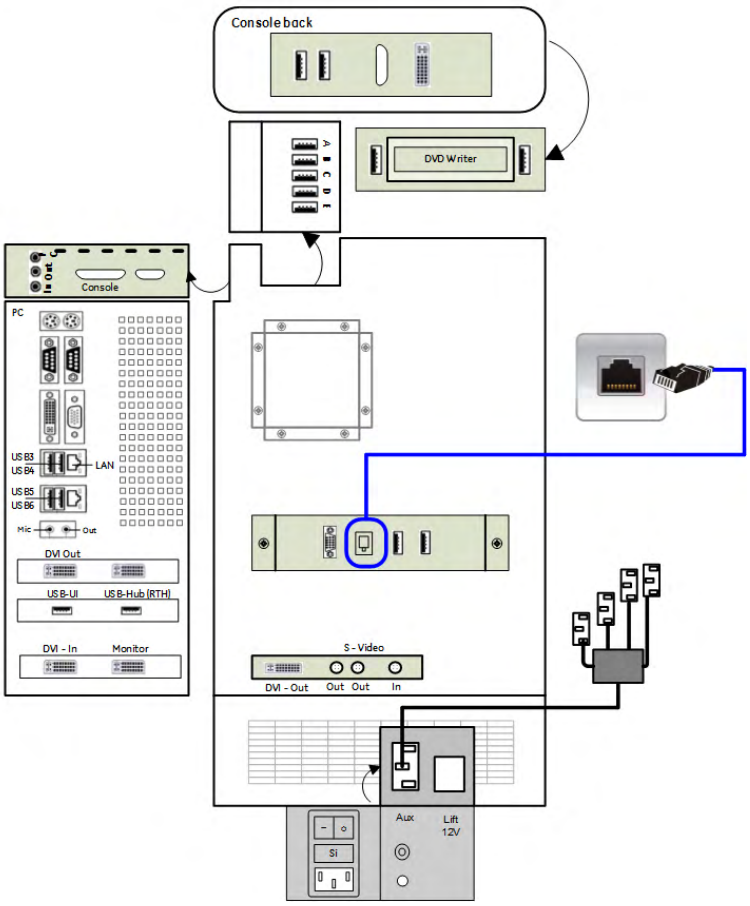


Figure 3-9 Connection Scheme - Color Laser Printer (directly via network cable)

3.4.6 Connecting the DVD Recorder

Note *The Sony DVO-1000MD DVD recorder is only able to read and write on DVD+RW (ReWriteable) media! Please check on your DVD case before using.*

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .
2. Connect the DVD Recorder according to connection scheme, see:
   - *Figure 3-10 "DVD Recorder connection - ADVANTECH PC-Motherboard" on page 3-20*
   - *Figure 3-11 "DVD Recorder connection - DFI PC-Motherboard" on page 3-21*
3. When all power and signal cables are connected to the system and recorder, proceed as follows:
   a. Press the power ON button on the recorder.
   b. Power On/Boot Up the system as described in *Section 4.2.1 on page 4-3* .
4. After physical connection to the Voluson E-Series system:
   a. Adjust the DVD Recorder settings as described in *Section 3.4.6.2 on page 3-22* .
   b. Check and if necessary change the Video Norm, see: *Section 3.7.1.6 on page 3-60* .
   c. Check and if necessary change the Recorder Type, see: *Section 3.7.1.8 on page 3-60* .
   d. Assign the recorder control to a remote key (**P1**, **P2**, **P3** and/or **P4**) as described in *Section 3.6.7 "Remote Control Selection" on page 3-57* .

Warning
After each installation, the leakage currents have to be measured according to IEC 60601-1, UL 60601-1, IEC 62353 or other relevant standard.

3.4.6.1 Connection Scheme: DVD Recorder

DVD Recorder Connection at ADVANTECH Micro ATX PC-Motherboard

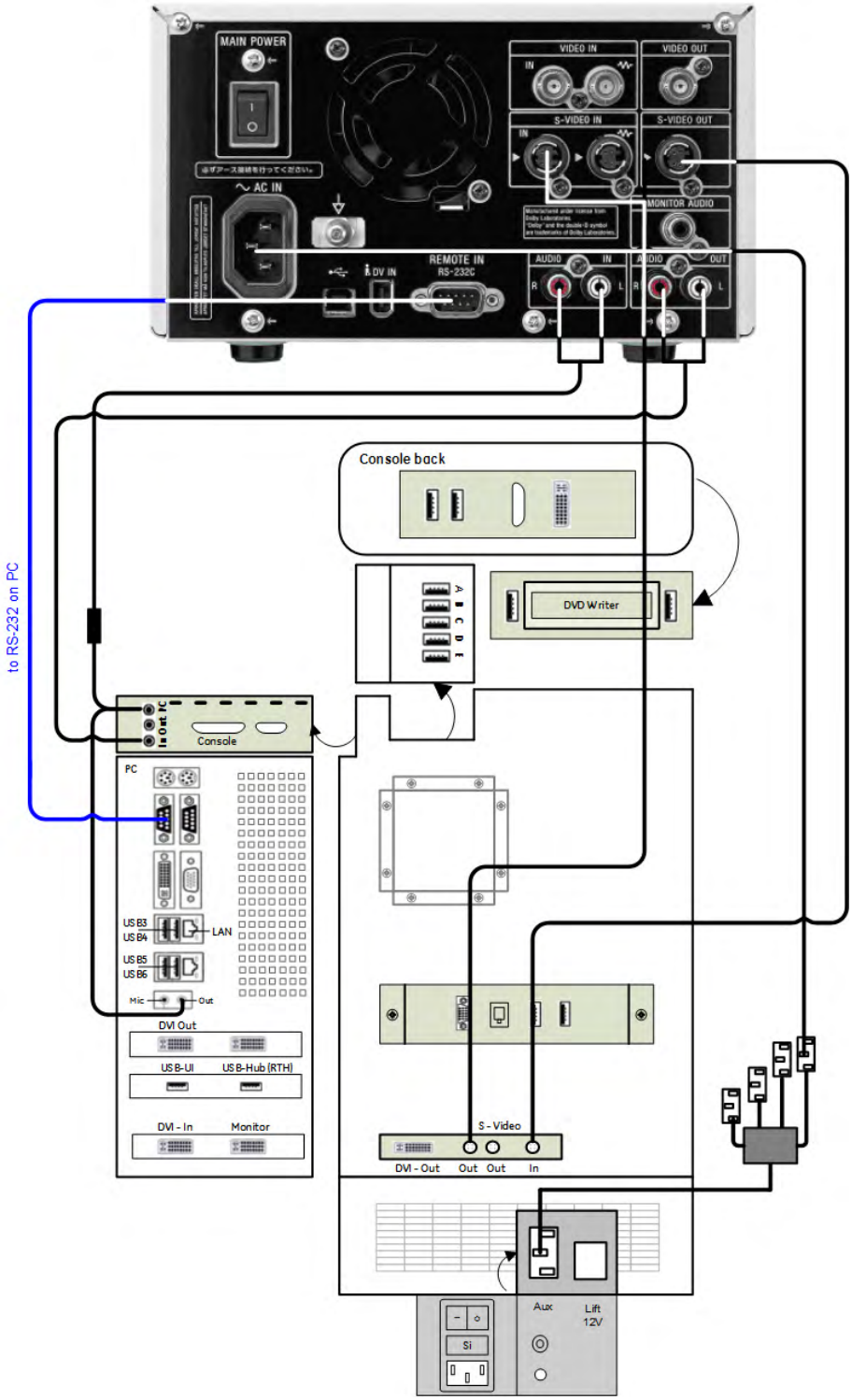


Figure 3-10 DVD Recorder connection - ADVANTECH PC-Motherboard

DVD Recorder Connection at DFI Micro ATX PC-Motherboard

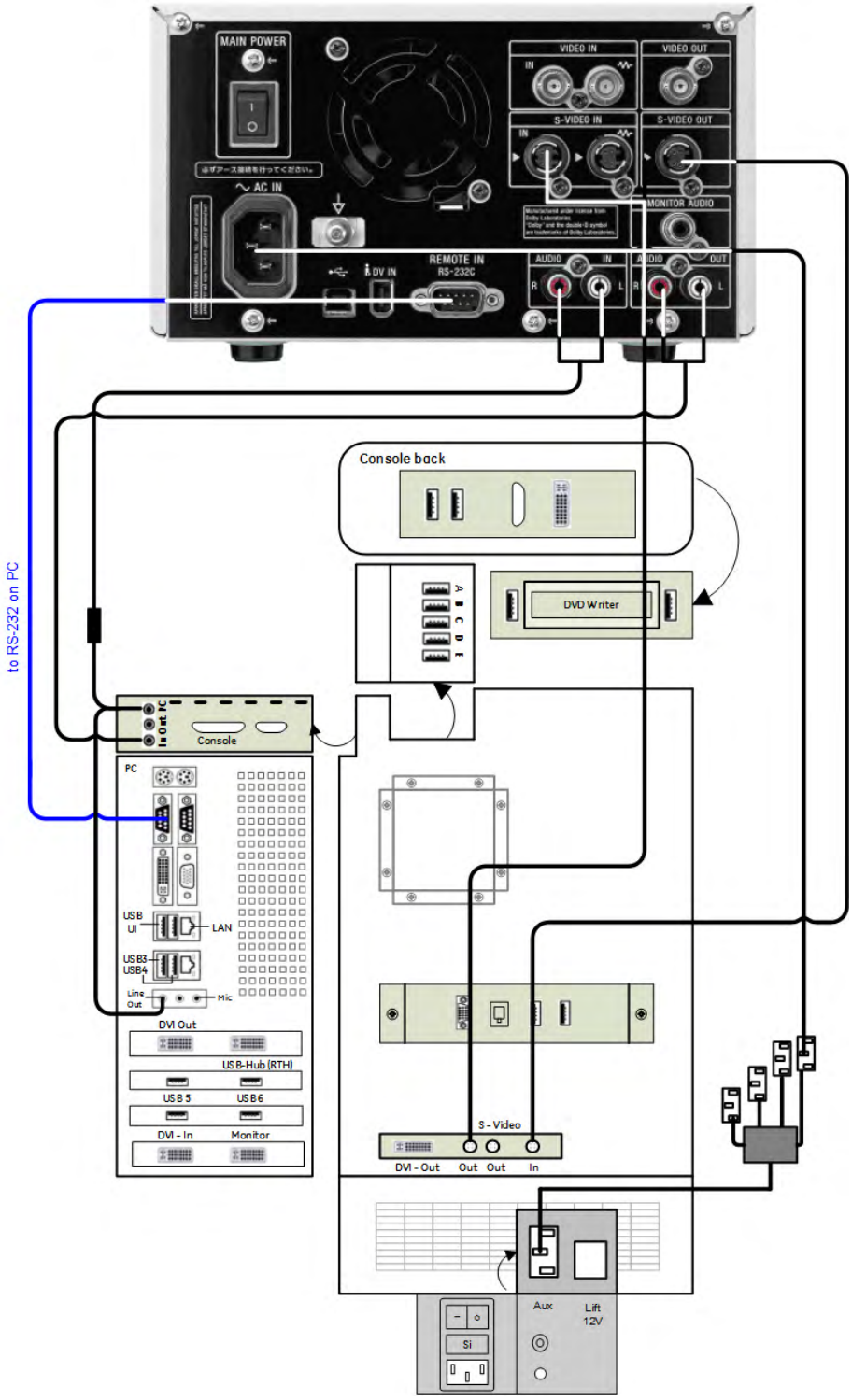


Figure 3-11 DVD Recorder connection - DFI PC-Motherboard

3.4.6.2 Adjustment of the DVD Recorder Settings

If you press the **Utilities** key on the Voluson E-Series control console and then ***Ext.Video***, you will see the actual screens (as shown here in this manual). You can use the on-screen programming menu's instead of the LCD to setup the DVD recorder. This ensures that all cables have been properly connected first!

Changing the Remote Interface to RS232

1. If not already done, switch on the Sony DVO-1000MD DVD recorder.
2. Press the **MENU** button **(A)** located on the front of the DVD recorder.

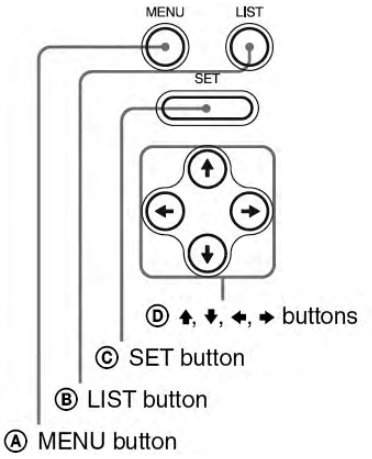


Figure 3-12 keys on the front of the recorder

3. The “Main Menu” appears on the LCD screen of the DVD recorder.

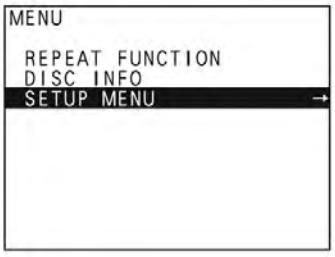


Figure 3-13 “Main Menu” - [SETUP MENU] highlighted

4. Press the **[↓]** button on the front of the recorder repeatedly until the [SETUP MENU] item is highlighted.
5. Press the **[→]** button. The “Setup Menu” appears.
6. Press the **[↓]** button on the front of the recorder repeatedly until [REMOTE I/F] is highlighted.

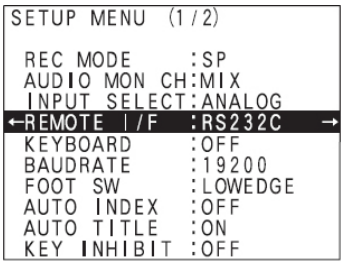


Figure 3-14 “Main Menu” - [REMOTE I/F] highlighted

7. Press the **[→]** button to enter the REMOTE I/F menu.
8. Press the **[→]** button until you see **RS232C** on the screen.
9. Press the **SET** button **(C)** on the front of the DVD recorder.

Your DVD recorder is now using RS232 remote interface.

Changing TV System (Video Format)

Note *To check Video format needed, see: Table 3-6 on page 3-24 .*

1. If not already done, switch on the Sony DVO-1000MD DVD recorder.
2. Press the **MENU** button **(A)** located on the front of the DVD recorder, see: *Figure 3-12 "keys on the front of the recorder" on page 3-22* .
3. The “Main Menu” appears on the LCD screen of the DVD recorder.

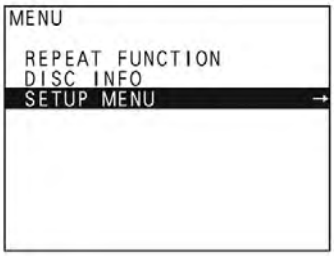


Figure 3-15 “Main Menu” - [SETUP MENU] highlighted

4. Press the **[↓]** button on the front of the recorder repeatedly until the [SETUP MENU] item is highlighted.
5. Press the **[→]** button. The “Setup Menu” appears.
6. Press the **[↓]** button repeatedly, until [MENU GRADE] is highlighted.

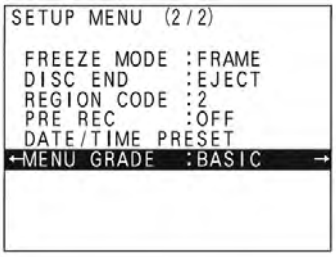


Figure 3-16 “Setup Menu” - [MENU GRADE] highlighted

7. Press the **[→]** button and select [ENHANCED].
8. Press the**[←]** button to exit the “Menu Grade” menu.

Note *Now additional items are displayed in the “Setup Menu”.*

9. Press the **[↓]** button repeatedly, until [TV SYSTEM] is highlighted.

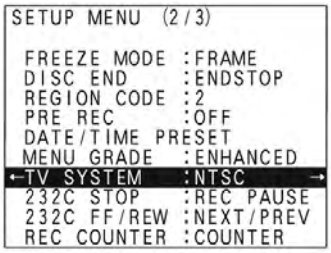


Figure 3-17 “Setup Menu” - [TV SYSTEM] highlighted

10. Press the **[→]** button. The “TV System” Sub menu appears.
11. Select the appropriate video signal by pressing the **[↑]** or **[↓]** button respectively. To check the video signal, see: *Table 3-6 on page 3-24* .
12. Press the **SET** button **(C)**. The message “Now loading...” appears and the system starts to save the settings.
13. When “Power off” appears on the display, press the **Power** switch on the front of the DVD recorder to turn power off.
14. Press the **Power** switch again to turn power on.

Change the Region Code

Note *To specify the correct region code, see: Table 3-6 on page 3-24 .*

1. If not already done, switch on the Sony DVO-1000MD DVD recorder.
2. Press the **MENU** button **(A)** located on the front of the DVD recorder, see: *Figure 3-12 "keys on the front of the recorder" on page 3-22* .
3. The “Main Menu” appears on the LCD screen of the DVD recorder.

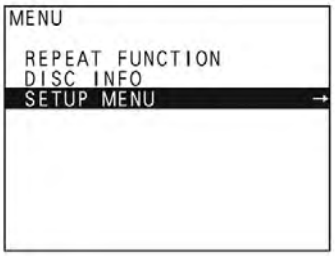


Figure 3-18 “Main Menu” - [SETUP MENU] highlighted

4. Press the **[↓]** button on the front of the recorder repeatedly until the [SETUP MENU] item is highlighted.
5. Press the **[→]** button. The “Setup Menu” appears.
6. Press the **[↓]** button repeatedly, until [REGION CODE] is highlighted.
7. Press the **[→]** button. The “Region Code Menu” appears.
8. Select the appropriate region code by pressing the **[↑]** or **[↓]** button respectively. To check the region code, see: *Table 3-6 on page 3-24* .
9. Press the **SET** button **(C)**. The message “Now loading...” appears and the system starts to save the settings.
10. When “Power off” appears on the display, press the **Power** switch on the front of the DVD recorder to turn power off.
11. Press the **Power** switch again to turn power on.

Table 3-6 TV System and Region Code

Country	Region Code	TV System
USA and Canada	1	NTSC
Western Europe, Middle East, South Africa	2	PAL
Japan	2	NTSC
Southeast Asia, incl. Hong Kong	3	PAL/NTSC
Central and South America, Australia	4	PAL
Africa	5	NTSC
Eastern Europe, Russia, Central Asia incl. India	5	PAL
China	6	PAL

3.4.7 Connecting the USB Video Recorder

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .
2. Connect the USB Video Recorder according to connection scheme, see: *Figure 3-19 on page 3-26* . .
3. When all power and signal cables are connected to the system and recorder, proceed as follows:
   a. Press the power ON switch on the USB Video recorder.
   b. Turn ON the power of the Voluson E-Series system.
4. After physical connection to the Voluson E-Series system:
   a. Check and if necessary change Ext. Monitor setting to ***DVI***, see: *Section 3.7.1.7 on page 3-60* .
   b. Adjust the USB Video Recorder settings as described in *Section 3.4.7.2 on page 3-27* .

Warning
After each installation, the leakage currents have to be measured according to IEC 60601-1, UL 60601-1, IEC 62353 or other relevant standard.

3.4.7.1 Connection Scheme: USB Video Recorder

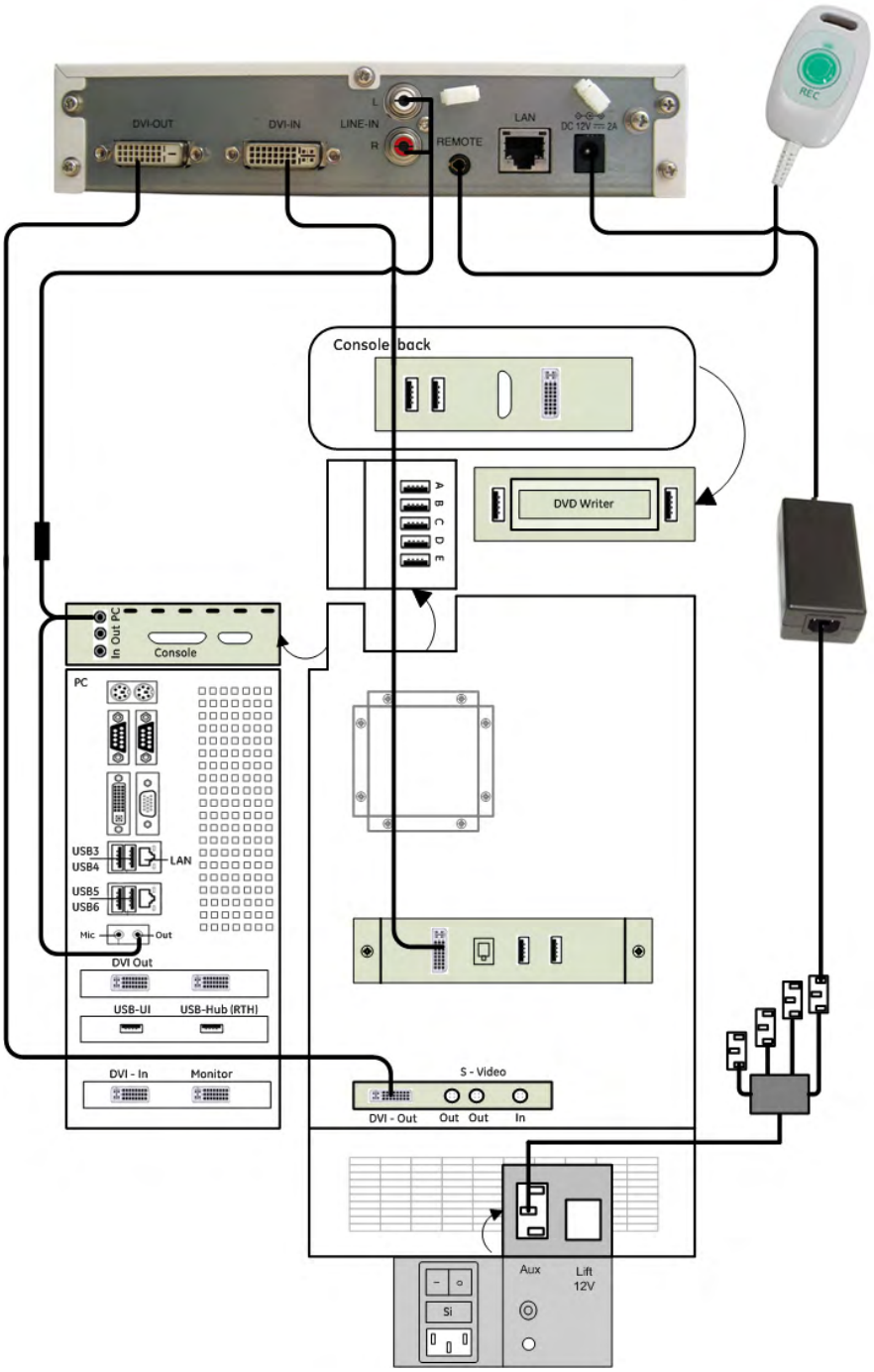


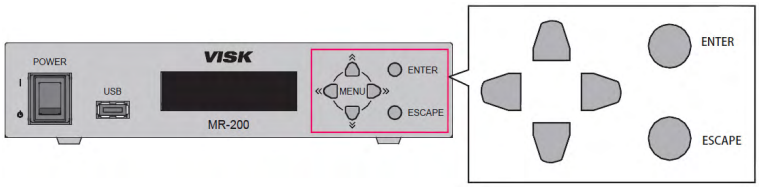
Figure 3-19 USB Video Recorder connection

3.4.7.2 Adjustment of the USB Video Recorder Settings

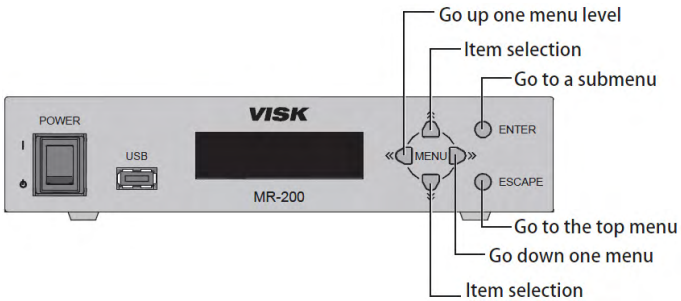
Note *Make sure that the Ext. Monitor video signal is set to **DVI**; see Section 3.7.1.7 on page 3-60 .*

Basic Functions of Setting Buttons

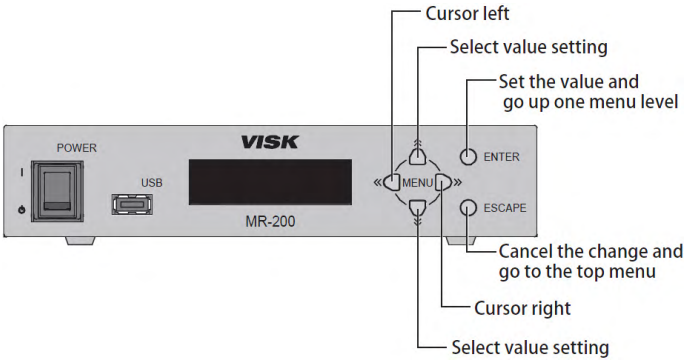
Parameters can be set using the display and buttons at the front of the USB video recorder.



Menu selection



When changing a parameter setting



Check and match Default Settings

- TOP MENU - MEDIA FORMAT: FAT32
  1. Press the **O Enter** button on the front of the USB video recorder for min. 4 seconds.
  2. Press the **[↑]** or **[↓]** button to select [MEDIA FORMAT] and then press **O Enter**.
  3. Press the **[↑]** or **[↓]** button to select [FAT32] and then press **O Enter**.
- TOP MENU - SETTING - 01 REC SETTING - 11 INPUT: DVI -SXGA
  1. Press the **O Enter** button on the front of the USB video recorder for min. 4 seconds.
  2. Press the **[↑]** or **[↓]** button to select [SETTING] and then press **O Enter**.
  3. Press the **[↑]** or **[↓]** button to select [REC SETTING] and then press **O Enter**.
  4. Press the **[↑]** or **[↓]** button to select [INPUT] and then press **O Enter**.
  5. Press the **[↑]** or **[↓]** button to select [DVI - SXGA] and then press **O Enter**.
- TOP MENU - SETTING - 01 REC SETTING - 12 MODE: High - FAT32
  1. Press the **O Enter** button on the front of the USB video recorder for min. 4 seconds.
  2. Press the **[↑]** or **[↓]** button to select [SETTINGS] and then press **O Enter**.
  3. Press the **[↑]** or **[↓]** button to select [REC SETTING] and then press **O Enter**.
  4. Press the **[↑]** or **[↓]** button to select [MODE] and then press **O Enter**.
  5. Press the **[↑]** or **[↓]** button to select [High - FAT32] and then press **O Enter**.

- TOP MENU - SETTING - 02 REC OPTION - 21 BUZZER: ON

Note *During recording to media, a continuous beep tone is audible. This tone can be turned ON/OFF.*

1. Press the **O Enter** button on the front of the USB video recorder for min. 4 seconds.
2. Press the **[↑]** or **[↓]** button to select [SETTING] and then press **O Enter**.
3. Press the **[↑]** or **[↓]** button to select [REC OPTION] and then press **O Enter**.
4. Press the **[↑]** or **[↓]** button to select [BUZZER] and then press **O Enter**.
5. Press the **[↑]** or **[↓]** button to select [ON] and then press **O Enter**.

- TOP MENU - SETTING - 02 REC OPTION - 22 OVER WRITE: OFF

1. Press the **O Enter** button on the front of the USB video recorder for min. 4 seconds.
2. Press the **[↑]** or **[↓]** button to select [SETTING] and then press **O Enter**.
3. Press the **[↑]** or **[↓]** button to select [REC OPTION] and then press **O Enter**.
4. Press the **[↑]** or **[↓]** button to select [OVER WRITE] and then press **O Enter**.
5. Press the **[↑]** or **[↓]** button to select [OFF] and then press **O Enter**.

- TOP MENU - SETTING - 02 REC OPTION - 23 REMOTE: Start / Stop

1. Press the **O Enter** button on the front of the USB video recorder for min. 4 seconds.
2. Press the **[↑]** or **[↓]** button to select [SETTING] and then press **O Enter**.
3. Press the **[↑]** or **[↓]** button to select [REC OPTION] and then press **O Enter**.
4. Press the **[↑]** or **[↓]** button to select [REMOTE] and then press **O Enter**.
5. Press the **[↑]** or **[↓]** button to select [Start / Stop] and then press **O Enter**.

3.4.8 Connecting the Wireless Network Adapter

1. Turn ON the power of the system and wait till the system has booted.
2. Plug the Wireless Network adapter into an accessible USB port of the Voluson E-Series. All software drivers are pre-installed for the designated Wireless Network adapter only.

The Wireless Network Adapter can be connected to any accessible USB port of the Voluson E-Series.

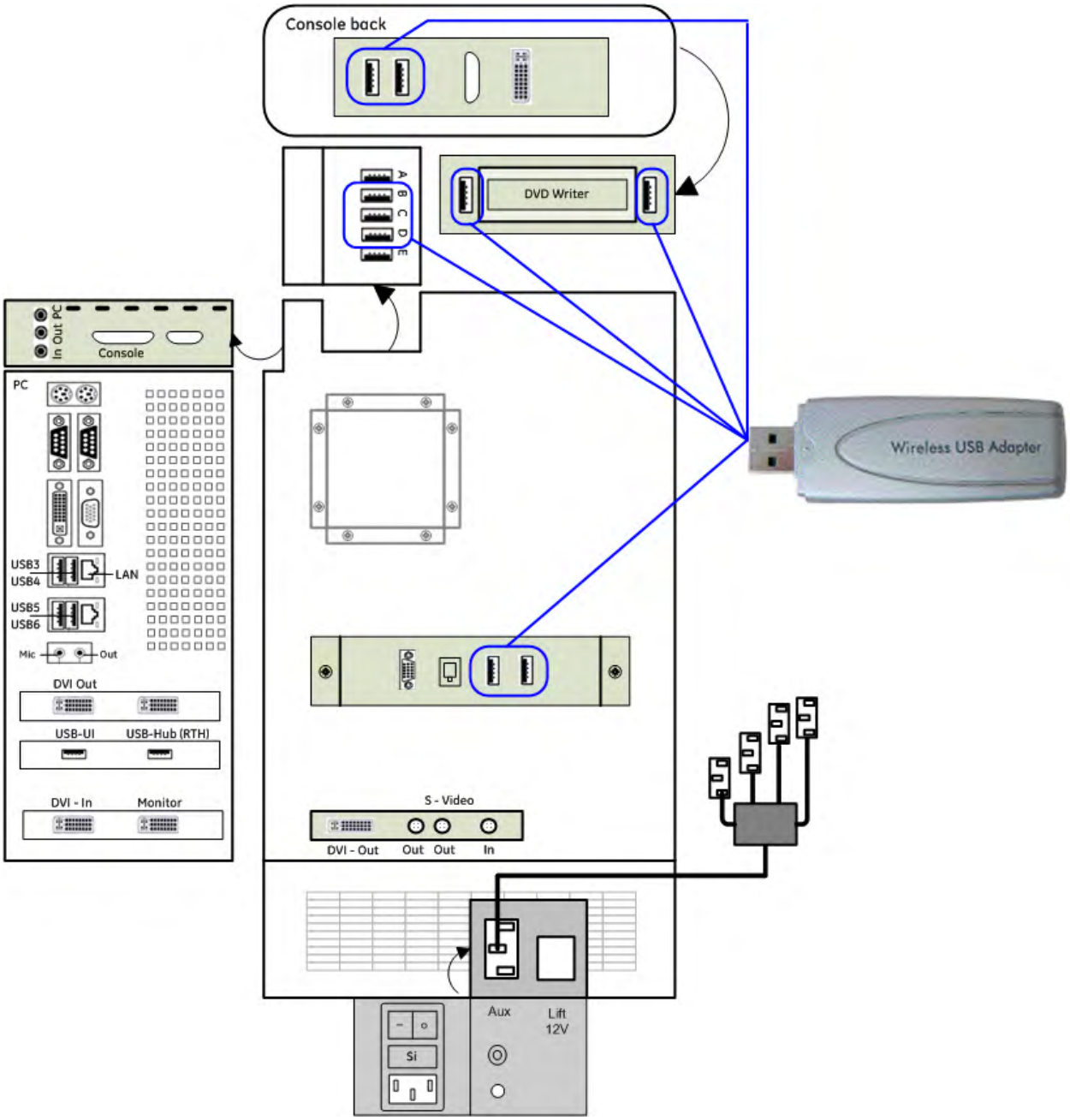


Figure 3-20 Connection Scheme - Wireless (USB) Network Adapter

Note *Connection is always the same (no differences between PC-Motherboard version of the Voluson E-Series system).*

Note *After physical connection of the WLAN adapter to the Voluson E-Series system, follow the procedure described in* *Section 3.13.2 "Wireless Network Configuration" on page 3-71 .*

3.4.9 Connecting the VGA Image (Video) Resizer

Note *For more detailed description see Section 8.17 "Replacing optional Peripherals / How to mount Peripherals at a later date" on page 8-26 .*

Note *The VGA Image (Video) Resizer is required whenever the used Secondary "Patient" Monitor has a different screen resolution than the Voluson E-Series system!*

Caution
A Secondary "Patient" Monitor **MUST NEVER** be connected to the Voluson E-Series systems mains supply directly! Always connect it to an appropriate Isolation Transformer (see *Section 9.10.4 on page 9-37*).

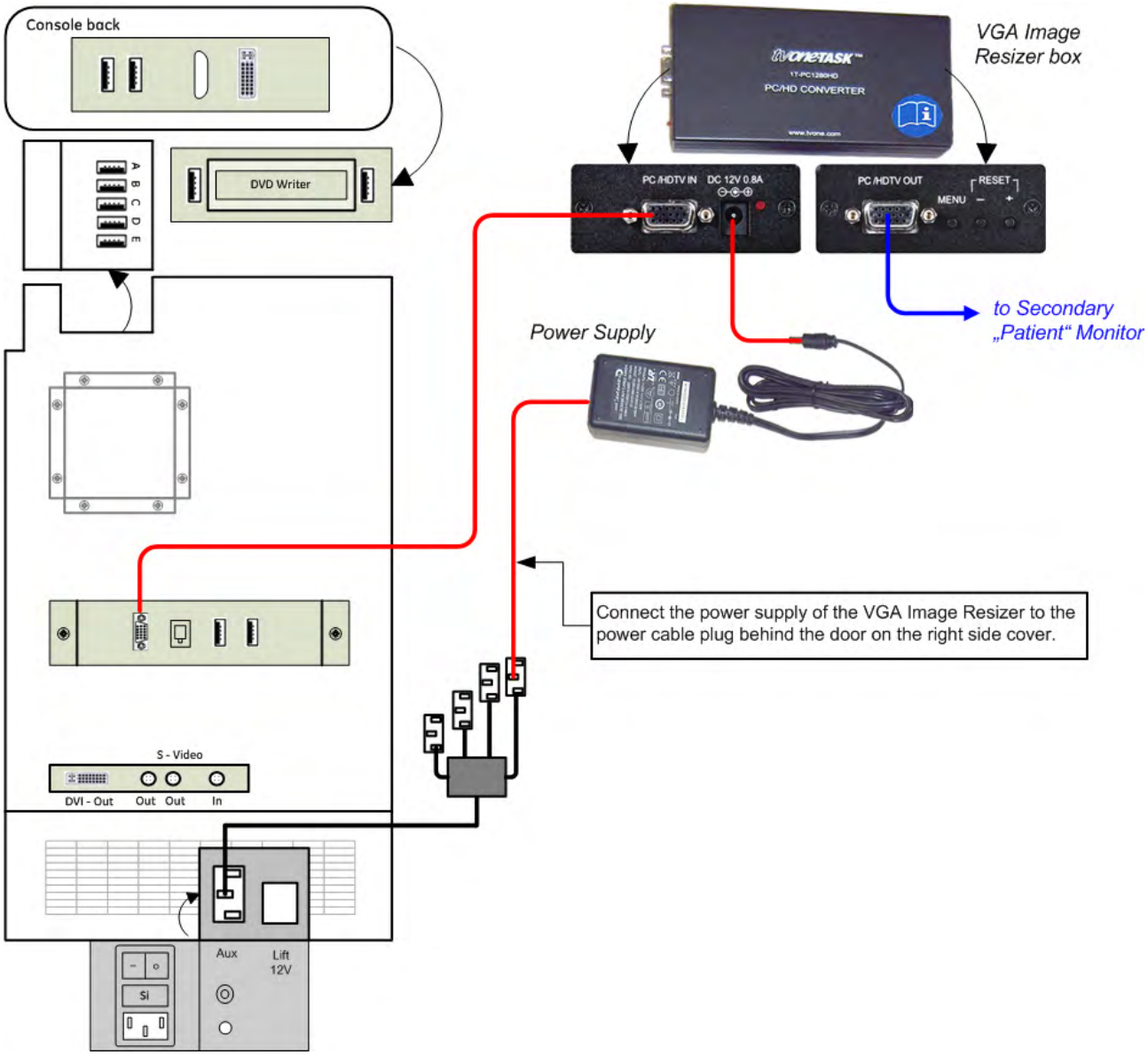


Figure 3-21 Connection Scheme - VGA Image Resizer

Note *After physical connection of the VGA Image Resizer to the Voluson E-Series system, follow the procedure described in Section 3.4.9.1 "Adjustment of the VGA Image Resizer Settings" on page 3-31 .*

3.4.9.1 Adjustment of the VGA Image Resizer Settings

To get the best results in image quality out of this Resizer Box you should make the following settings.

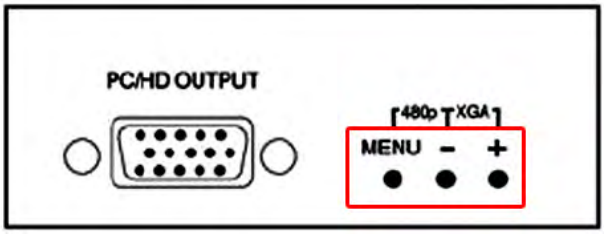


Figure 3-22 keys on Image Resizer

1. Set the output resolution of the Image Resizer to the native resolution of the monitor:
   a. Press the **Menu** key at the Image Resizer and use **+** (plus) and **-** (minus) key to navigate to ***Output Setup*** using the On Screen Menu.
   b. Press the **Menu** key to enter the sub menu output setup, press the menu key again to highlight the ***Mode Setting***.
   c. Choose mode with **+** and **-** key. When correct mode is displayed press **Menu** key to activate the setting.
   d. Navigate to menu item ***Exit*** and press **Menu** key to leave the On Screen Menu.

Note *Changes get effective immediately. If monitor is not showing anything after a change, your setting might be wrong. To reset the Image Resizer in case that anything went wrong, press either the **Menu** and **-** key or the **+** and **-** key until the image reappears. Try other settings that are supported by your monitor.*

2. Use high quality Video cables especially for longer distances. High quality cables improve overall image quality due to lower sensitivity on electromagnetic interferences.
3. Set Brightness & Contrast for best and detailed image display.
   a. Press the **Menu** key, select ***Picture Adj.*** using the On Screen Menu.
   b. Select first item ***Cont.*** (means contrast) by pressing the **Menu** key and adjust it (using **+** and **-** key) until you think you get the best result on your monitor and then press the menu key.
   c. Navigate to ***Bright.*** (means brightness) and press **Menu** key again to highlight item.
   d. Set brightness to any value you think it results in the best quality image for your monitor and then press the **Menu** key.

Note *You may change the **Color** setting in the same way if you think adjustment is necessary.*

   e. When everything is done, navigate to ***Exit*** and press **Menu** key to leave the On Screen Menu.

3.4.10 Connecting a Secondary "Patient" Monitor

Caution
A Secondary "Patient" Monitor **MUST NEVER** be connected to the Voluson E-Series systems mains supply directly! Always connect it to an appropriate Isolation Transformer (see *Section 9.10.4 on page 9-37*).

Caution
The secondary monitor is the only item to be connected to the isolation transformer.

Note *A Secondary Monitor is **NOT intended for diagnostic use**. It is an additional device used to allow the patient to watch the proceedings.*

Note *Take your time to think about the best position of the monitor in your facilities. Patients should be able to view the monitor easily and without having to bend or turn around.*

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4*.
2. Connect the Secondary Monitor according to connection scheme, see: *Figure 3-23 on page 3-33*.
3. After physical connection to the Voluson E-Series system check, and if necessary change the Ext. Monitor setting, see: *Section 3.7.1.7 on page 3-60*.

Note *Connection is always the same (no differences between PC-Motherboard version of the Voluson E-Series system).*

3.4.10.1 Connection Scheme: Secondary "Patient" Monitor

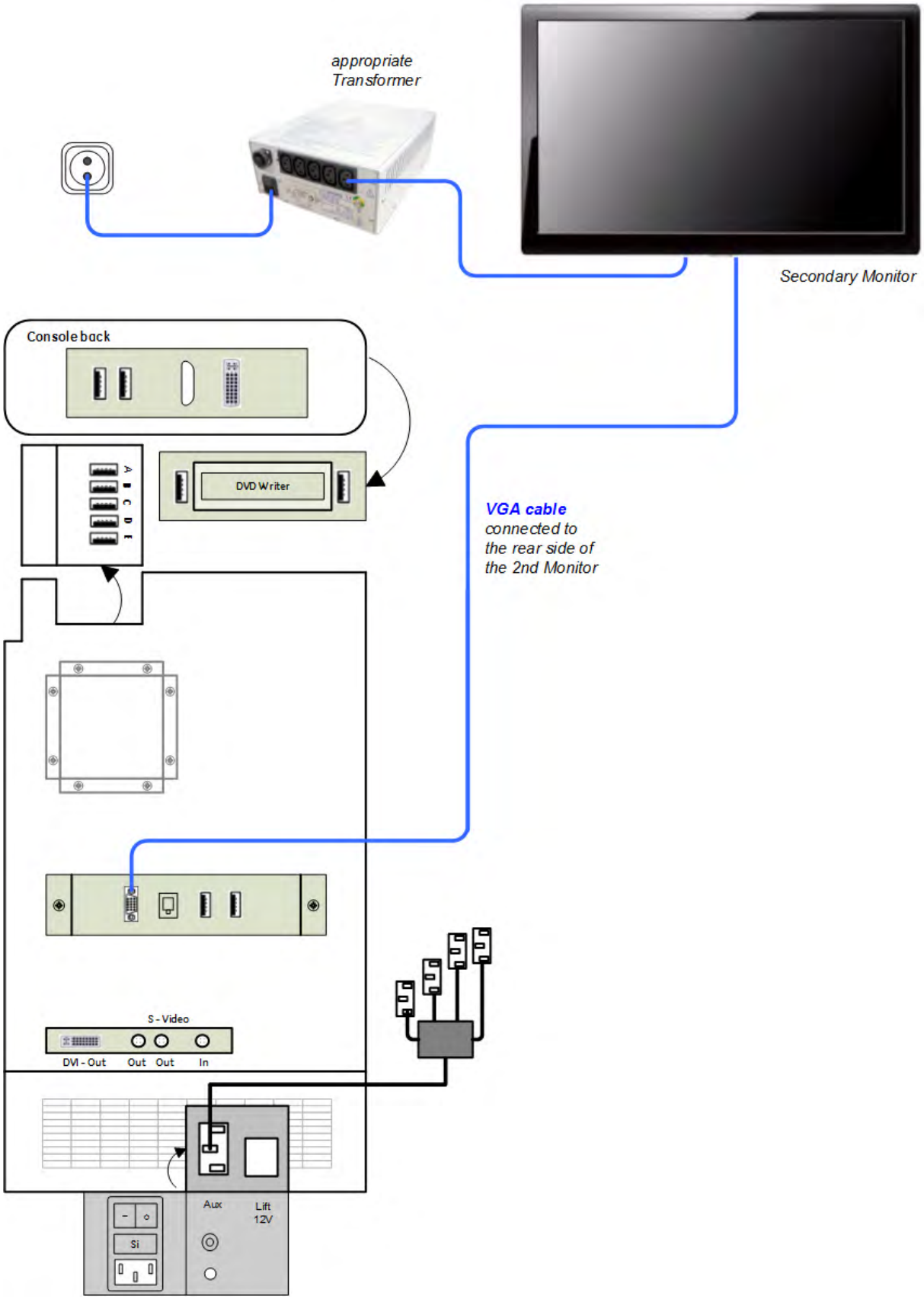


Figure 3-23 Connection Scheme - Secondary Monitor

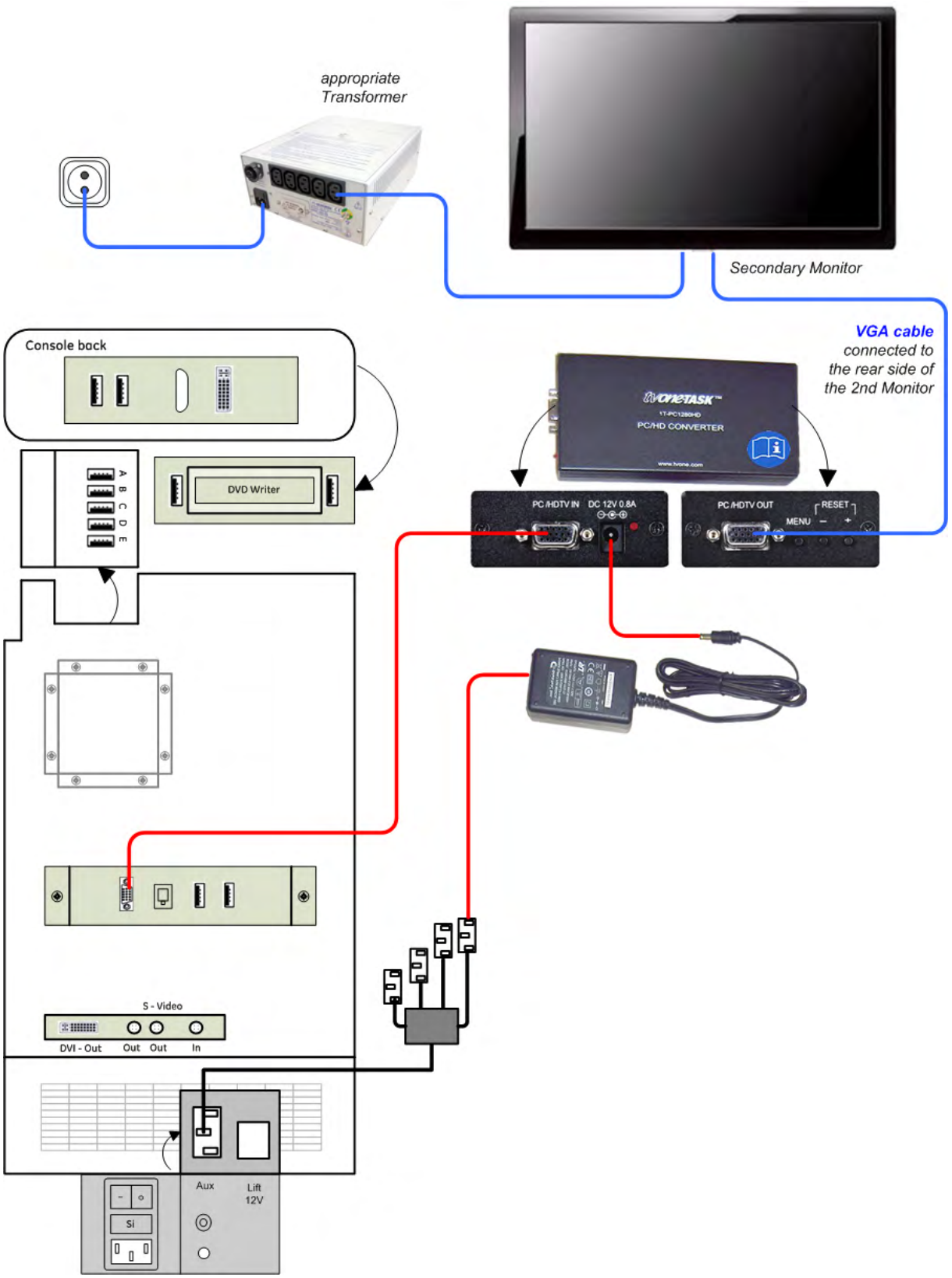


Figure 3-24 Secondary Monitor connection - via VGA Image Resizer

3.4.11 Connecting the Footswitch

The Footswitch should be directly connected to any accessible USB-port on the Voluson E-Series (e.g., on rear of the system).

Note *Connection is always the same (no differences between PC-Motherboard version of the Voluson E-Series system).*

After physical connection, adjust the Footswitch as described in *Section 3.7.1.9 on page 3-60* .

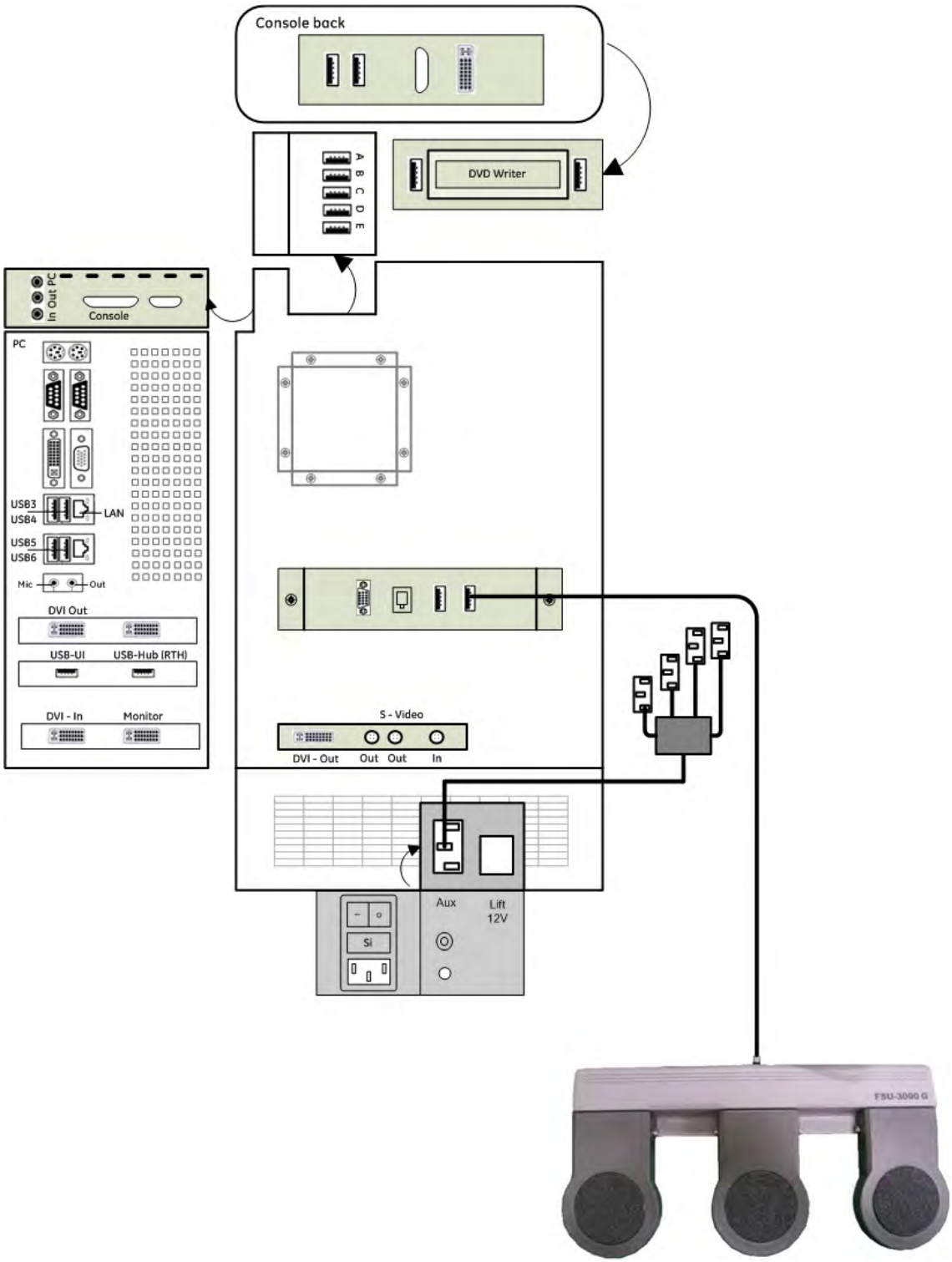


Figure 3-25 Connection Scheme - Footswitch

3.4.12 Connecting the ECG-preamplifier

Note *Connection is always the same (no differences between PC-Motherboard version of the Voluson E-Series system).*

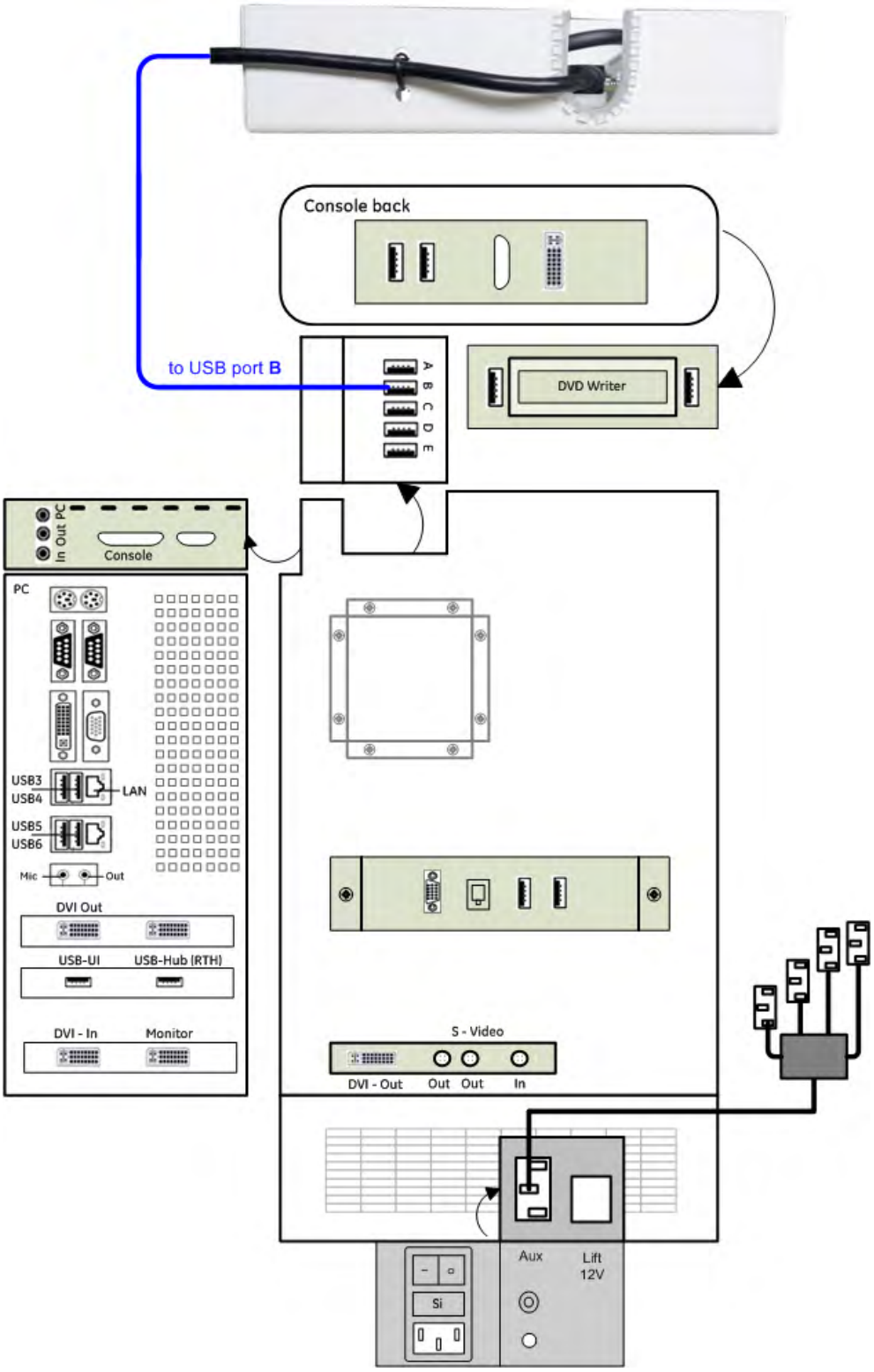


Figure 3-26 Connection Scheme - ECG-preamplifier

3.4.13 Connecting an USB Flash Memory Stick

Note *Before connecting an USB device, please read Section 3.4.15 "General Remarks and Hints when using external USB-Devices" on page 3-38 .*

An USB Flash Memory Stick may be connected to an accessible USB port of the Voluson E-Series system (e.g., on back of control console).

An external USB Flash Memory Stick can be connected once the system is powered ON, or after shutdown. The Voluson E-Series, Windows detects the device and automatically installs a driver. During this process several dialogs may pop up, starting with the „Found New Hardware” dialog.

Note *Memory drives or sticks may be sensitive to EMC interference. This may affect system performance and/or image quality.*

Note *Before disconnecting an external USB-device (e.g., USB Stick), the system has to be informed about the removal of the device! For this purpose press the **USB** key on the keyboard.*

For further details see Section 3.4.15.2 "External USB-Devices - Disconnection" on page 3-38 .

3.4.14 Connecting an external USB Hard disk

Note *Before connecting an USB device, please read Section 3.4.15 "General Remarks and Hints when using external USB-Devices" on page 3-38 .*

An external HDD may be connected to an accessible USB port of the Voluson E-Series system (e.g., on back of control console).

An external USB Hard Disk Drive can be connected once the system is powered ON, or after shutdown. The Voluson E-Series, Windows detects the device and automatically installs a driver. During this process several dialogs may pop up, starting with the „Found New Hardware” dialog.

Note *Memory drives or sticks may be sensitive to EMC interference. This may affect system performance and/or image quality.*

Note *Before disconnecting an external USB-device (e.g., USB Stick), the system has to be informed about the removal of the device! For this purpose press the **USB** key on the keyboard.*

For further details see Section 3.4.15.2 "External USB-Devices - Disconnection" on page 3-38 .

3.4.15 General Remarks and Hints when using external USB-Devices

Caution
Do not connect or disconnect any external USB-devices to or from the system while scanning a patient! The appearing dialogs could distract you from the scan!

3.4.15.1 External USB-Devices - Connection

When an external USB-storage device (such as an USB-memory stick or an external hard disk) is connected to the Voluson E-Series, Windows detects the device and automatically installs a driver. During this process, several dialogs may pop up, starting with the “Found New Hardware“ dialog.

The device is then accessible using the drive letter the system assigned to it.

Note *If an external drive was not recognized automatically after connecting it, click **Rescan Drive**.*

Note *When connecting external USB devices, be sure to execute Safety Directions found in the Voluson E-Series Basic User Manual.*

3.4.15.2 External USB-Devices - Disconnection

Before an external USB-device (e.g., USB-memory stick) can be disconnected, the system has to be informed about the removal of the device! For this purpose press the **USB** key on the keyboard.

Caution
Unplugging or ejecting USB devices without first stopping them can cause the system to crash and possibly result in loss of valuable data.

By pressing the **USB** key on the keyboard, a dialog window (see: *Figure 3-27 below*) is displayed. The “Connect USB and Network Drives” window shows all USB and Network drives connected to the system. Using this dialog, the USB-devices can be stopped before they are physically disconnected.

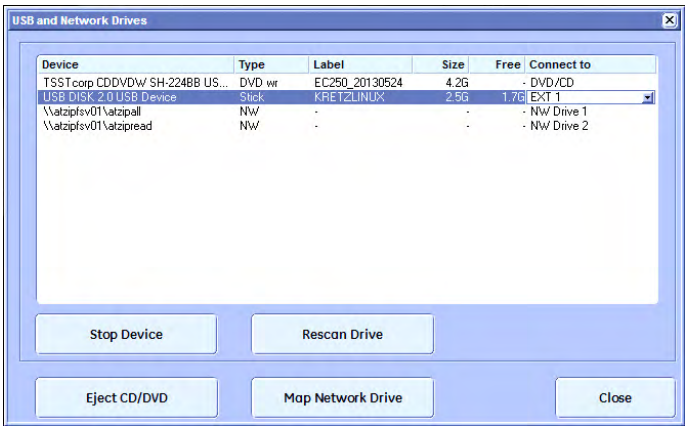


Figure 3-27 Connect USB and Network Drives

To stop the external device, select it and then click the ***Stop Device*** button.

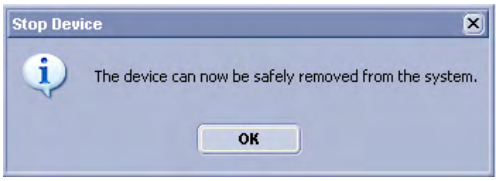


Figure 3-28 Device can now be safely removed

Confirm the "‘Stop Device" dialog with ***OK*** and ***Close*** the "Connect USB and Network Drives" window.

3.5 Completing the Setup

Connecting the System to a Power Source

Caution
Prior to connect the Voluson E-Series system to a power source, verify compliance with all electrical and safety requirements. Check the power cord to verify that it is intact and of hospital-grade. Products equipped with a power source (wall outlet) plug should be connected to the fixed power socket that has a protective grounding conductor. Never use an adapter or converter to connect with a power source plug (for example, a three-prong to two-prong converter).

Warning
The system's power must be supplied from a separate, properly rated outlet to avoid risk of fire. Refer to *Section 2.1.2.1 "Voluson Power Requirements Voluson E-Series" on page 2-2* for rating information. The power cord should not, under any circumstances, be altered to a configuration rated less than that specified for the current.

Note *Use only the power cords, cables and plugs provided by or designated by GE Healthcare Austria GmbH & Co OG to connect the system to the power source.*

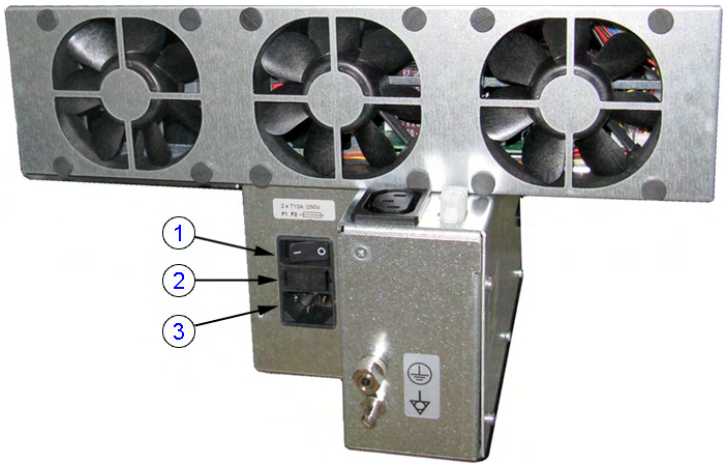
Caution
Whenever disconnecting the Voluson E-Series system from the electrical outlet, always observe the safety precautions. First unplug the main power cable from the wall outlet socket, then from the system itself. Remove by pulling on the cable connector - Do not pull on the cable.

Caution: The Voluson E-Series requires all covers!
Do not operate this system unless all board covers and frame panels are securely in place, to ensure optimal system performance and cooling. (When covers are removed, EMI may be present).

3.5.1 Power On / Boot Up

System Power On / BackEnd Processor Boot Up

1. Connect the main power cable to the back of the system.
2. If not already done, screw on the pull-out protection of the mains power cable with the 2 screws.
3. Connect the main power cable to a hospital grade power outlet with the proper rated voltage. Never use an adapter that would defeat the safety ground.
4. Switch ON the circuit breaker at the rear of the system.



1 circuit breaker
2 fuses (2x T10A H/250V)
3 connector for main power cable

Figure 3-29 Circuit Breaker at rear of system

Note *When AC power is applied to the system, the **ON/OFF** standby button on the control console illuminates amber, indicating that the system (including the Back-end Processor) is in standby mode.*

5. Hold down the **ON/OFF** standby button (see: *Figure 3-30 below*) on the control console for ~3 seconds.

Note *The mains outlet of the system for peripheral auxiliary equipment are commonly switched with the **ON/OFF** standby button. The power switch of any attached printer(s) needs to be in ON position before starting the system. However, be aware some auxiliary equipment may switch itself to standby mode (e.g., Color video printer) and must therefore be switched on separately.*

When the **ON/OFF** standby button on the control console is pressed, the system (including the Back-end Processor) starts and the operating system is loaded which then leads to activate the application software.
The system automatically performs an initialization sequence which includes the following:

- Loading the operating system.
- Running a quick diagnostic check of the system.
- Detecting connected probes

Figure 3-30 ON/OFF standby button

As soon as the software has been loaded, the system enters 2D-Mode with the probe and application that were used before the system shutdown.

Note *Total time used for start-up is about 2 minutes.*

6. Adjust height and position of the control console as described in *Section 6.3 "Control Console Positioning" on page 6-5* .

3.5.1.1 During a normal boot, you may observe

1. Power is distributed to peripherals, control console, monitor, FrontEnd and BackEnd processor.
2. The BackEnd processor and rest of the system starts with the sequence listed in following steps:
   a. First of all, the BIOS version is shown on the monitor.
   b. Afterward the “Boot Screen” is displayed. (**Voluson** is highlighted).

Figure 3-31 Boot screen

3. BackEnd processor is turned ON and starts to load the software.
4. The start screen is displayed on the monitor.
5. Start-up progress bars indicating software loading procedures, are displayed on the monitor.

Figure 3-32 start-up screen

6. The software initiates and sets up the FrontEnd electronics and the rest of the system (incl. clicking sound of relays on RTF board).
7. The keyboard backlight is lit.
8. As soon as the software has been loaded, the 2D screen is displayed on the monitor.

3.5.2 Power Off / Shutdown

Note *After turning off a system, wait at least 10 seconds before turning it on again. The system may not be able to boot if power is recycled too quickly.*

1. If not already in read mode, freeze the image.
2. Press the **ON/OFF** Standby button on the control console. Following dialog appears.

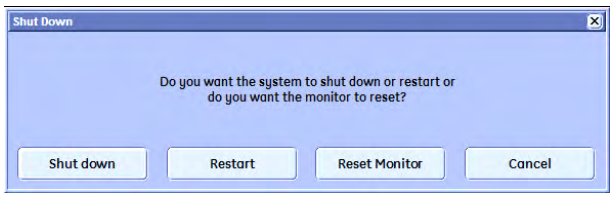


Figure 3-33 Shutdown dialog

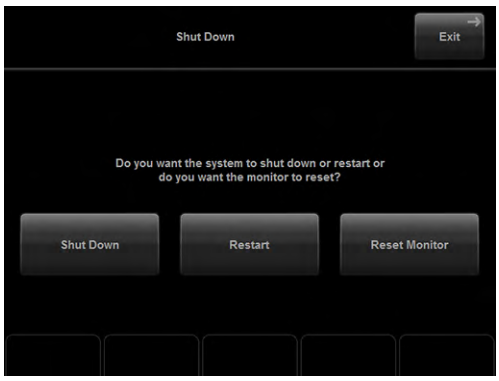


Figure 3-33 Shutdown dialog

3. Select ***Shutdown***. The system performs an automatic full shutdown sequence.
4. Switch OFF the circuit breaker at the rear of the system.

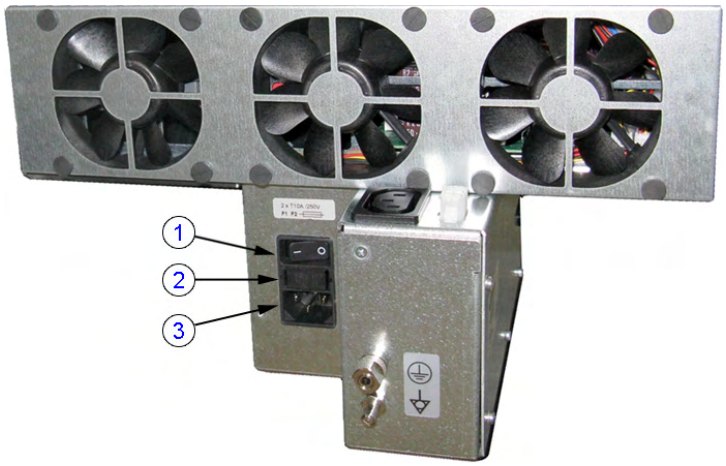
Note *A full shutdown is also performed when pressing the **ON/OFF** standby button on the control console twice.*

Note *The mains outlet of the system for peripheral auxiliary equipment are commonly switched with the **ON/OFF** standby button. So the auxiliary equipment need not to be switched ON/OFF separately.*

Warning

Disconnection of the main power cable is necessary!

5. After complete power down, unscrew the 2 screws and remove the pull-out protection to disconnect the main power cable from the system or unplug it from the AC wall outlet socket.



1 circuit breaker
2 fuses (2x T10A H/250V)
3 connector for main power cable

Figure 3-34 Circuit Breaker at rear of system

6. Press on the brakes to block the front caster wheels.
7. Disconnect probes. (Turn the probe locking handle counterclockwise and then pull the connector straight out of the probe port.)

Caution

Do not disconnect a probe while running (Live Scan “Write” mode)! A software error may occur. In this case switch the system OFF (perform a reset).

3.5.3 Probe Connection

Note *When the probe is connected, it is automatically activated. Once connected, probes can be selected for different applications.*

Connect a probe to one of the three rightmost probe receptacle as follows:

1. Inspect the probe and probe socket to verify that it is free of debris.
2. Ensure that the probe locking lever is at horizontal position.
3. Insert the connector on the receptacle guide pin until it touches the receptacle mating surface.
4. Twist the probe locking lever clockwise (to vertical position) to lock it in place.
5. Open the side door, lay the cable into the intended cable holder and close the door.
6. Carefully position the probe cord so that it is free to move and is not resting on the floor.

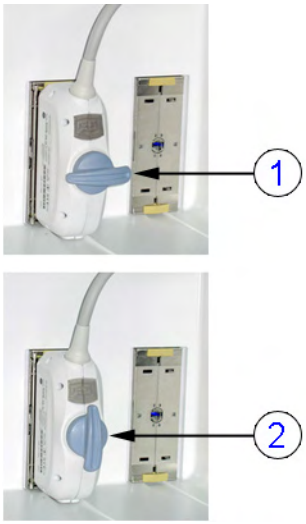


Figure 3-35 probe connection

1	probe **unlocked** (locking lever is in horizontal position)
2	probe **locked** (locking lever is in vertical position)

Caution

- Do not bend the probe cable acutely. **Fault conditions can result in electric shock hazard.**
- Do not touch the surface of probe connectors which are exposed when the probe is removed.
- Do not touch the patient when connecting or disconnecting a probe.

Note *Prior to connecting or disconnecting a probe, freeze the image. It is not necessary to turn OFF power to connect or disconnect a probe.*

3.6 Printer Installation

Note *For connection schemes see Section 3.4 "Connection of Auxiliary Devices" on page 3-9 .*

Content in this section

Note *The Bluetooth printer connection set MUST NOT be installed by the user! For Bluetooth installation please contact your local distributor or GE service representative.*

If a DeskJet printer (e.g., HP Officejet 100) is connected directly via an USB-cable, use the AC mains power outlet provided by the Voluson E-Series system (auxiliary output). This ensures medical grade separation from AC mains.

Warning
After each installation, the leakage currents have to be measured according to IEC 60601-1, UL 60601-1, IEC 62353 or other relevant standard.

3.6.1 Installing the Digital Black & White Printer

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .
2. Connect and install the printer as described in *Section 3.4.2 on page 3-11* .
3. Verify correct printer settings; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .
4. Assign the printer to the remote keys **P1**, **P2**, **P3** and/or **P4**; see *Section 3.6.7 "Remote Control Selection" on page 3-57* .

3.6.2 Installing the Digital Color Printer

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .
2. Connect and install the printer as described in *Section 3.4.3 on page 3-13* .
3. Verify correct printer settings; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .
4. Assign the printer to the remote keys **P1**, **P2**, **P3** and/or **P4**; see *Section 3.6.7 "Remote Control Selection" on page 3-57* .

3.6.3 Installing the DeskJet Color Printer directly via an USB-cable

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .
2. Connect the printer according to connection scheme *Figure 3-7 on page 3-16* .
3. When all cables are connected, press the Power ON button on the printer.
4. Power ON/Boot up the Voluson E-Series system as described in *Section 3.5.1 on page 3-39* .

   All software drivers are pre-installed for the designated printer only.
5. After physical connection to the Voluson E-Series system, assign the printer to a remote key (**P1**, **P2**, **P3** and/or **P4**) as described in *Section 3.6.7 "Remote Control Selection" on page 3-57* .
6. Verify correct printer settings; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .
7. Assign the printer as Report Printer, see *Section 3.6.7.1 "Report Printer Selection" on page 3-57* .

3.6.4 Installing the Network Color Laser Printer

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .
2. Connect the printer as described in *Section 3.4.5 on page 3-17* .
3. Power On/Boot Up the system as described in *Section 4.2.1 on page 4-3* .
4. Press the **Power ON** button on the printer.
5. Install ink tanks and load paper.
6. Wait until the printer displays ***Ready*** .

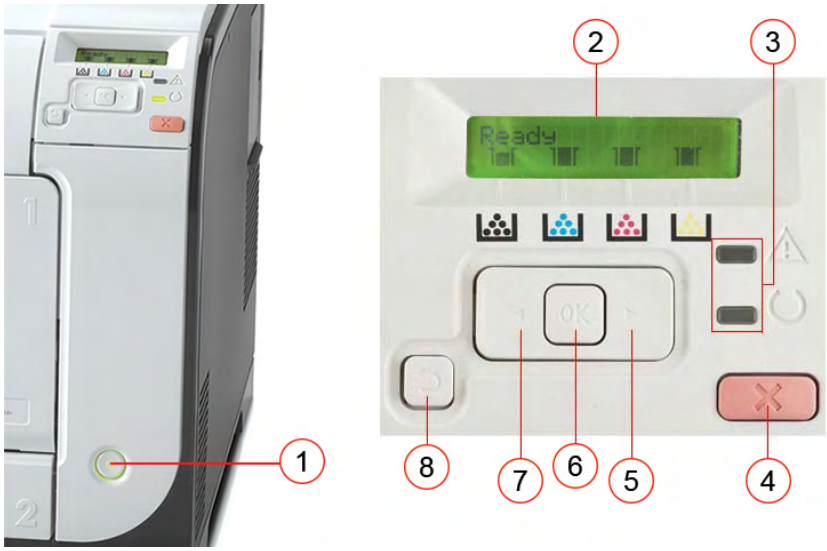


Figure 3-36 printer controls

1	Power ON	5	Right >
2	Display	6	OK
3	Status Indicators	7	Left <
4	Cancel	8	Back

7. By means of the Printer Controls **Left <** , **Right >** and **OK** set the TCP/IP address to ***Automatic*** .

Figure 3-37 TCP/IP Config - Automatic

8. Press the **Back** button until the Printer displays ***Ready*** again.
9. By means of the Printer Controls **Left <** , **Right >** and **OK** print out the ***Config Report*** .

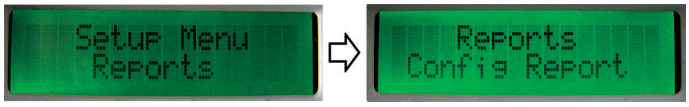
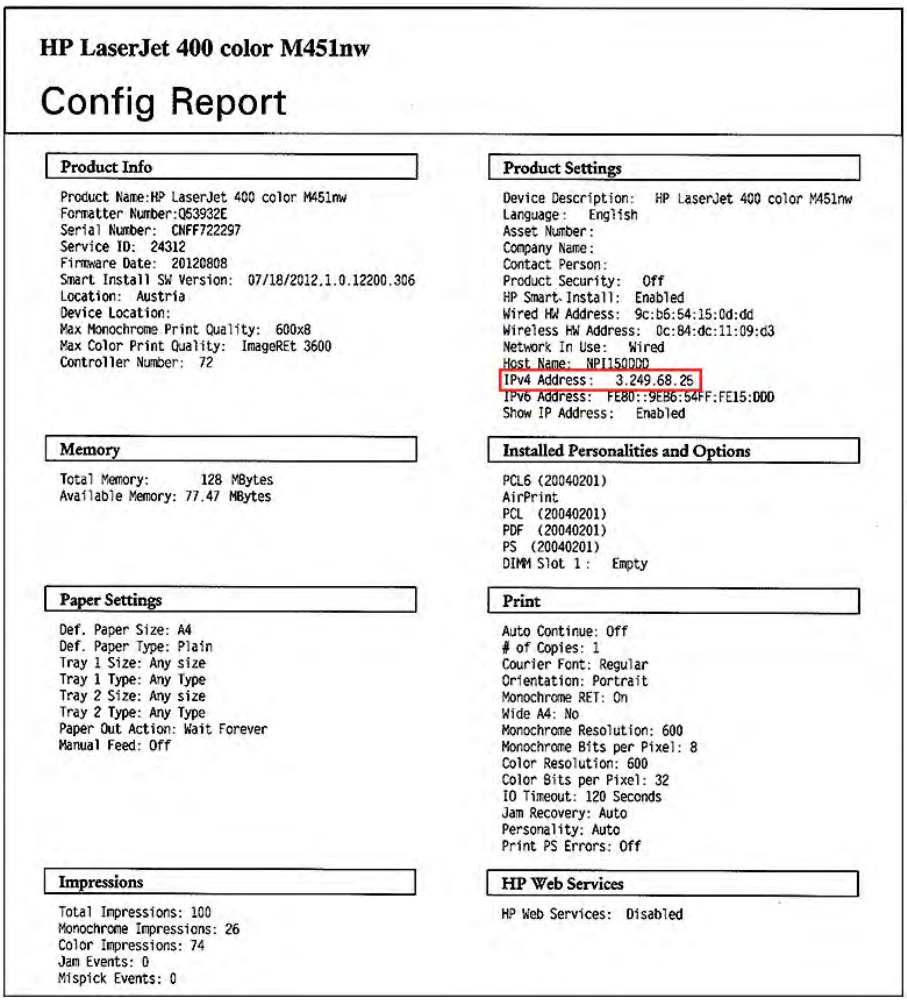


Figure 3-38 Reports -> Config Report



HP LaserJet 400 color M451nw

Config Report

Product Info

Product Name:HP LaserJet 400 color M451nw
Formatter Number:Q53932E
Serial Number: CNFF722297
Service ID: 24312
Firmware Date: 20120808
Smart Install SW Version: 07/18/2012.1.0.12200.306
Location: Austria
Device Location:
Max Monochrome Print Quality: 600x8
Max Color Print Quality: ImageREt 3600
Controller Number: 72

Product Settings

Device Description: HP LaserJet 400 color M451nw
Language: English
Asset Number:
Company Name:
Contact Person:
Product Security: Off
HP Smart Install: Enabled
Wired HW Address: 9c:b6:54:15:0d:dd
Wireless HW Address: 0c:84:dc:11:09:d3
Network In Use: Wired
Host Name: NPI150DDD
IPv4 Address: 3.249.68.25
IPv6 Address: FE80::9EB6:54FF:FE15:DDD
Show IP Address: Enabled

Memory

Total Memory: 128 MBytes
Available Memory: 77.47 MBytes

Installed Personalities and Options

PCL6 (20040201)
AirPrint
PCL (20040201)
PDF (20040201)
PS (20040201)
DIMM Slot 1: Empty

Paper Settings

Def. Paper Size: A4
Def. Paper Type: Plain
Tray 1 Size: Any size
Tray 1 Type: Any Type
Tray 2 Size: Any size
Tray 2 Type: Any Type
Paper Out Action: Wait Forever
Manual Feed: Off

Print

Auto Continue: Off
# of Copies: 1
Courier Font: Regular
Orientation: Portrait
Monochrome RET: On
Wide A4: No
Monochrome Resolution: 600
Monochrome Bits per Pixel: 8
Color Resolution: 600
Color Bits per Pixel: 32
IO Timeout: 120 Seconds
Jam Recovery: Auto
Personality: Auto
Print PS Errors: Off

Impressions

Total Impressions: 100
Monochrome Impressions: 26
Color Impressions: 74
Jam Events: 0
Mispick Events: 0

HP Web Services

HP Web Services: Disabled

Figure 3-39 Config Report -> IPv4 Address

10. Below ***Product Settings*** you can find the printers IP Address (e.g., IPv4 Address: *3.249.68.25*).

Note *Keep in mind this unique printer IP Address (IPv4 Address). It has to be entered during Printer Installation procedure.*

11. Download the appropriate printer driver from GE folders http://libraries.ge.com/foldersIndex.do?entity_id=52794606101&sid=101&SF=1 and extract files to CD or USB disk.
12. Connect the USB stick to the Voluson E-Series system or insert the CD into the drive.
13. Press the **Utilities** key on the control console.
14. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
15. On the left side of the screen select ***Connectivity*** and then click the ***Peripherals*** tab.
16. Click the ***Add Printer*** button.

    Please read the displayed message carefully and click ***Yes*** if you have skills to do this.

17. In the displayed window click on ***Add a network, wireless or Bluetooth printer***.

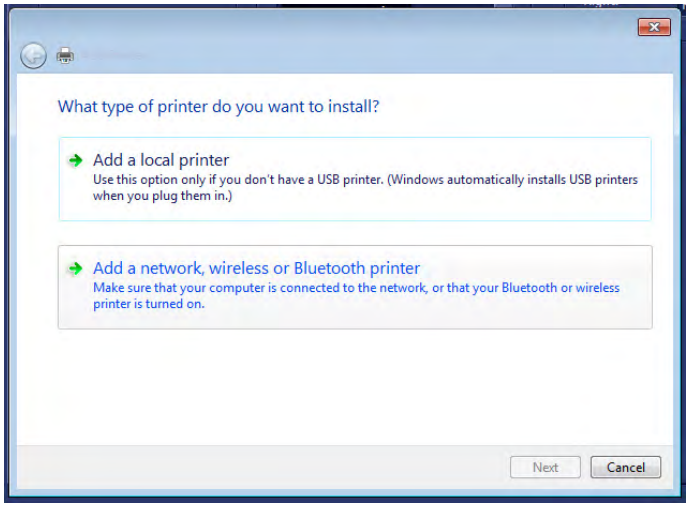


Figure 3-40 add printer

18. In the displayed window click on ***The printer that I want isn't listed*** and then click ***Next***.

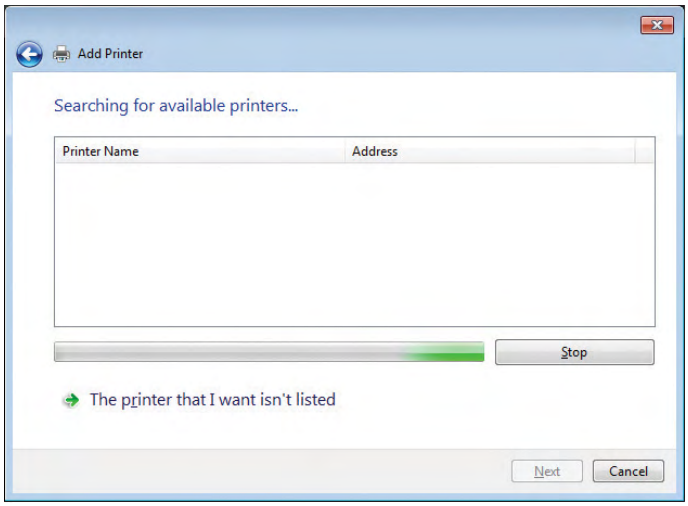


Figure 3-41 the printer isn´t listed

19. Check mark ***Connect to this printer***.
20. Enter **http://.....** followed by the previously print out printer IPv4 Address (e.g., *3.249.68.25*; see: *Figure 3-39 on page 3-46*) and then click ***Next***.

Note *This example shows fictional numbers!*

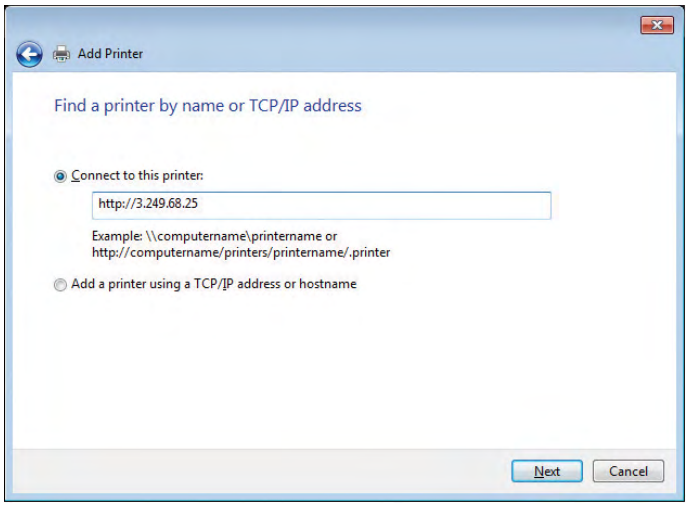


Figure 3-42 enter printers IP Address

21. Click on ***Have Disk*** and browse for E:\ (where E: stands for the USB stick resp. the CD drive), search for the printer driver folder and open the file *hpcu175u.inf*. Finally click ***OK***.

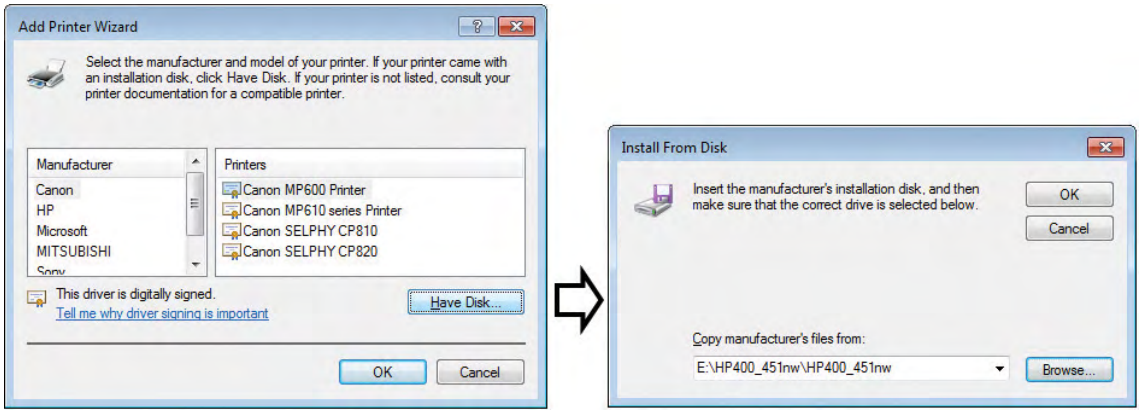


Figure 3-43 search for printer driver

22. Select ***HP Universal Printing PCL6*** and then click ***OK*** to start the installation.

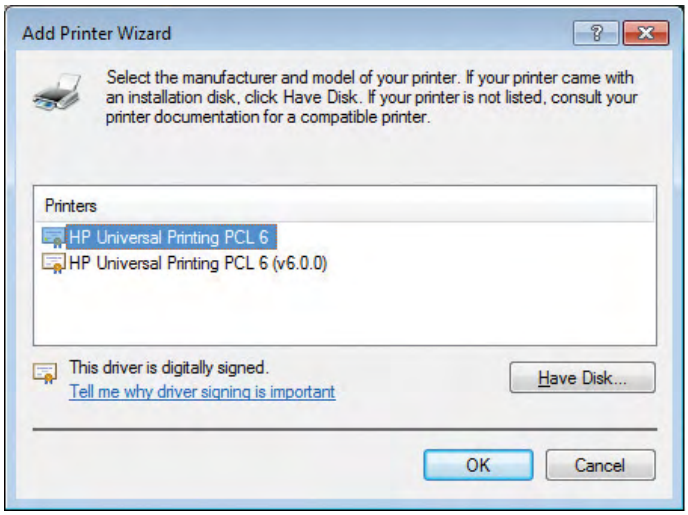


Figure 3-44 select proper printer

23. Confirm the following screen with ***Next***.
24. Remove the check mark at ***Set as the default printer*** and then click on ***Print a test page***.

Note *Please, **DO NOT yet** click on Finish!!!*

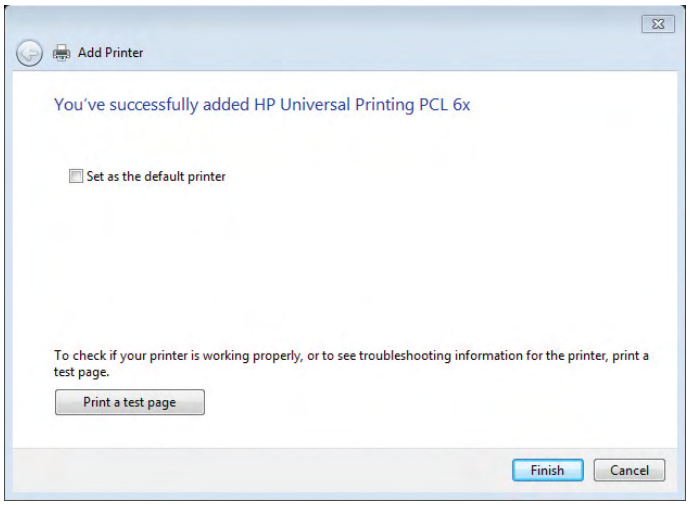


Figure 3-45 installation successful

25. In the following window check mark ***No, do not send this info to HP and do not ask me again*** and then click ***OK***.

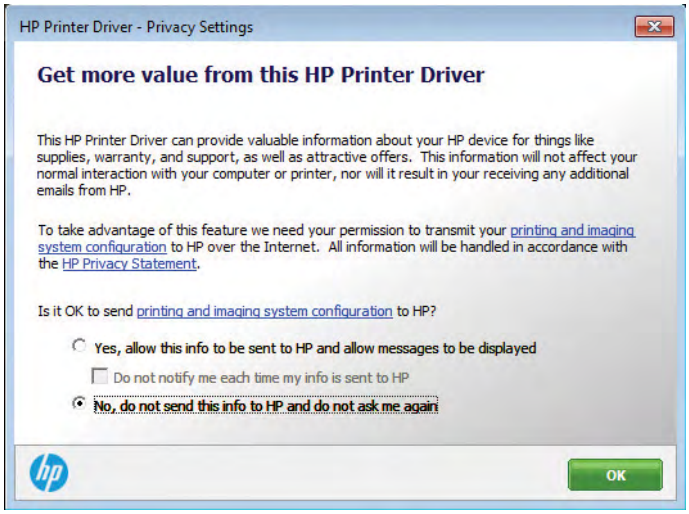


Figure 3-46 No, do not send info the HP

26. In the following screen click on ***Settings***.

Figure 3-47 click Settings

27. Remove all check marks to avoid further setup notifications and then click ***OK***.

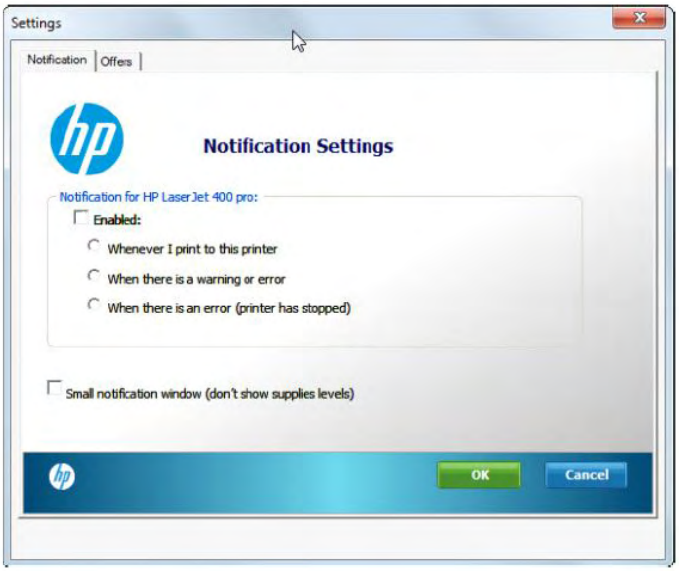


Figure 3-48 remove all check marks

28. Finally click on Finish (see: *Figure 3-45 on page 3-48*).
29. Assign the printer to the remote keys **P1**, **P2**, **P3** and/or **P4**; see *Section 3.6.7 "Remote Control Selection" on page 3-57* .
30. Assign the printer as Report Printer, see *Section 3.6.7.1 "Report Printer Selection" on page 3-57* .
31. Close all open windows, select ***Save & Exit*** and restart the system (turn off and on the system).

3.6.5 Printer Installation manually

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Connectivity*** and then click the ***Peripherals*** tab.

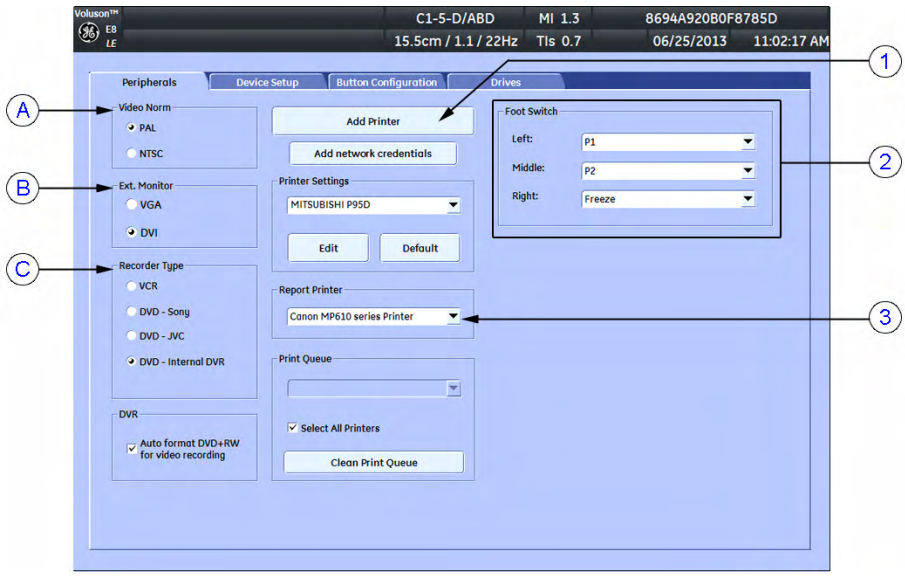


Figure 3-49 System Setup - Connectivity - PERIPHERALS page

A	Video Norm selection	1	Add Printer button
B	External Monitor selection	2	Footswitch Remote Control
C	Recorder Type selection	3	Report Printer selection

4. Click the ***Add Printer*** button.
   Please read the displayed message carefully and click ***Yes*** if you have skills to do this.
5. Click the ***Next*** button to start the Add Printer Wizard.
6. After installation, close all open windows, select ***Save & Exit*** and restart the system (turn off and on the system).
7. Verify correct printer settings; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .
8. Assign the printer to the remote keys **P1**, **P2**, **P3** and/or **P4**; see *Section 3.6.7 "Remote Control Selection" on page 3-57* .

3.6.6 Adjustment of Printer Settings

After system restart:

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Connectivity*** and then click the ***Peripherals*** tab.
4. Select the desired printer from the Printer Settings pull-down menu and click the ***Edit*** button.

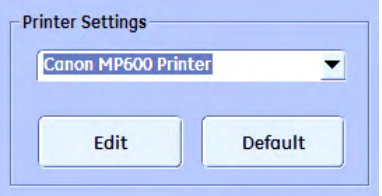


Figure 3-50 select desired printer

- *"UP-D897 / UP-D898MD Printer - Settings" on page 3-51*
- *"P95D Printer - Settings" on page 3-52*
- *"CP30D Printer - Settings" on page 3-53*
- *"UP-D25MD Printer - Settings" on page 3-54*
- *"UP-D23MD Printer - Settings" on page 3-56*

Warning
After each installation, the leakage currents have to be measured according to IEC 60601-1, UL 60601-1, IEC 62353 or other relevant standard.

3.6.6.1 UP-D897 / UP-D898MD Printer - Settings

1. Call up the "Printer Preferences"; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .
2. Select the ***Layout*** page and select:
   - Paper: **960x1280**
   - Orientation: **Portrait**
   - Interpolation Method: **Bilinear**

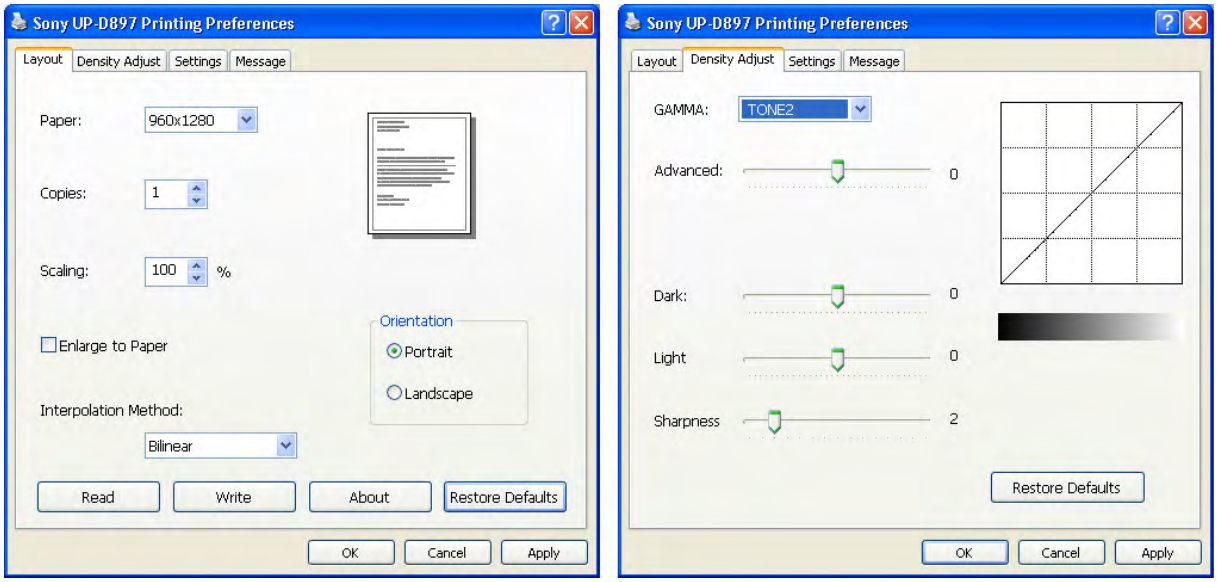


Figure 3-51 Layout / Density Adjust page

3. Select the ***Density Adjust*** page and select:
   - Gamma: **TONE2**
   - Advanced = **0**, Dark = **0**, Light = **0**, Sharpness = **2**
4. Save the adjusted printer settings with ***Apply*** and ***OK***. Close window and exit System Setup.
5. Assign the printer to the remote keys **P1**, **P2**, **P3** and/or **P4**; see *Section 3.6.7 "Remote Control Selection" on page 3-57* .

3.6.6.2 P95D Printer - Settings

1. Printer Settings directly on the B&W printer:
   a. Press the **BRT** button on the printer and adjust Brightness to **0** by using the turning knob.
   b. Press the **CONT** button on the printer and adjust Contrast to **0** by using the turning knob.
   c. Press the **SHARP** button on the printer and adjust Sharpness to **3** by using the turning knob.
   d. Press the **FUNC** button on the printer and adjust Gamma to **r5** by using the turning knob.
   e. Press the **BRT** button twice to save and exit.

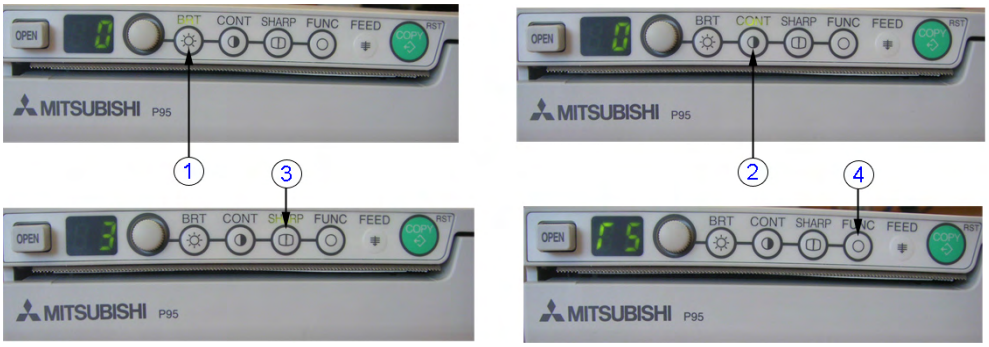


Figure 3-52 P95D - Printer settings

1	Brightness = **0**	2	Contrast = **0**
3	Sharpness = **3**	4	Gamma = **r5**

2. Assign the printer to the remote keys **P1**, **P2**, **P3** and/or **P4**; see *Section 3.6.7 "Remote Control Selection" on page 3-57* .
3. Activate USB serial number:
   a. Turn the printer OFF and wait 5 seconds.
   b. Press and hold the buttons **COPY** + **CONT** and power on the printer. When the Display changes to **S1** the buttons can be released.
   c. Press the **FUNC** button -> the display changes to **U0**.
   d. Adjust the value to **U2** via turning knob.
   e. Press the **FUNC** button again -> the display changes to another value (normally **F0**).
   f. Power OFF the printer.

3.6.6.3 CP30D Printer - Settings

1. Set Dip-switches on rear of the printer. **1 and 2 to ON**. 3, 4, 5, 6, 7 and 8 to OFF.

2. Call up the "Printer Preferences"; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .
3. Select the ***Paper*** page and select:
   - Paper Size: **L (large)**
   - Orientation: **Landscape** (recommended when using large paper size)

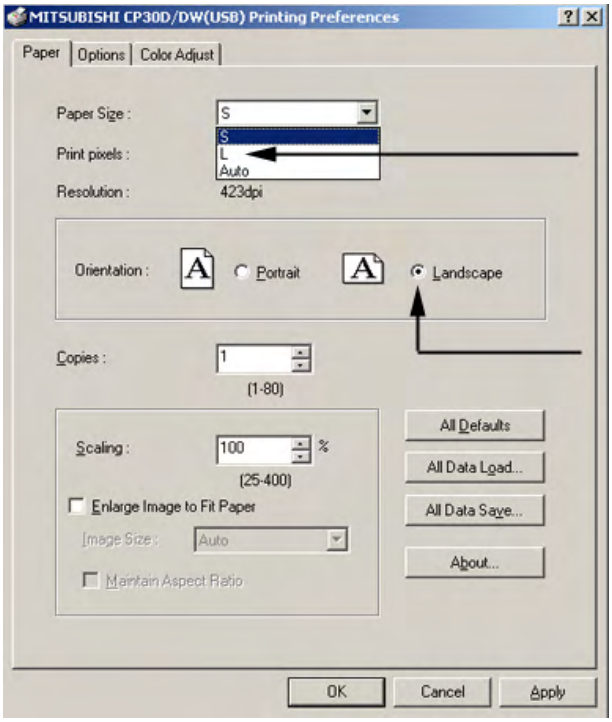


Figure 3-53 Paper page

4. Save the adjusted printer settings with ***Apply*** and ***OK***. Close window and exit System Setup.
5. Assign the printer to the remote keys **P1**, **P2**, **P3** and/or **P4**; see *Section 3.6.7 "Remote Control Selection" on page 3-57* .

3.6.6.4 UP-D25MD Printer - Settings

1. Call up the "Printer Preferences"; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .
2. Select the ***Paper*** page and select:
   - Paper: **UPC-...L** (large) / UPC-...S (small)
   - Orientation: **Landscape** (recommended when using large paper size)
   - **High Speed** (check mark on)

Note *Settings for paper size **must** match with the used paper (large/small) and also the right color ink cartridge has to be used. Otherwise you will get an error message at printing.*

3. Select the ***Graphics*** page. From the "Color Adjust" pull-down menu select:
4. ***Color Balance***: Cyan = **0**, Magenta = **0**, Yellow = **0**

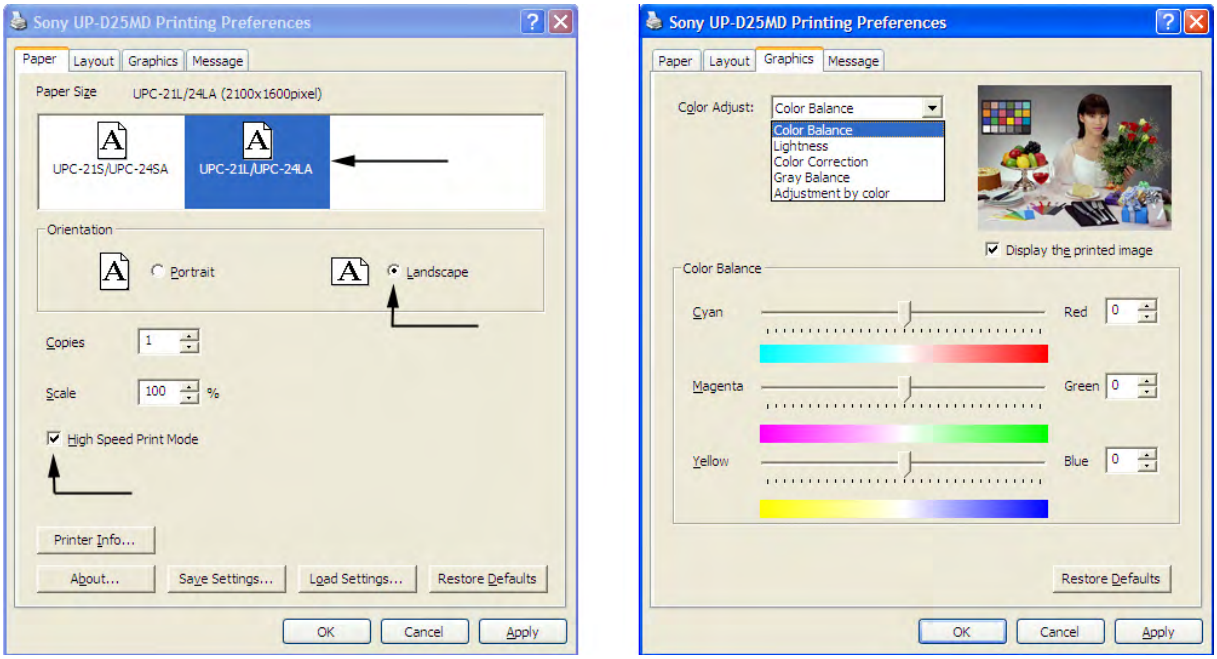


Figure 3-54 Paper / Graphics page

5. *Lightness*: Sharpness = **7**, Dark = **0**, Gamma = **-6**, Light = **2**, Gamma Curve = **Curve 1**
6. *Color Correction*: check mark **Printer Hardware Color Correction**

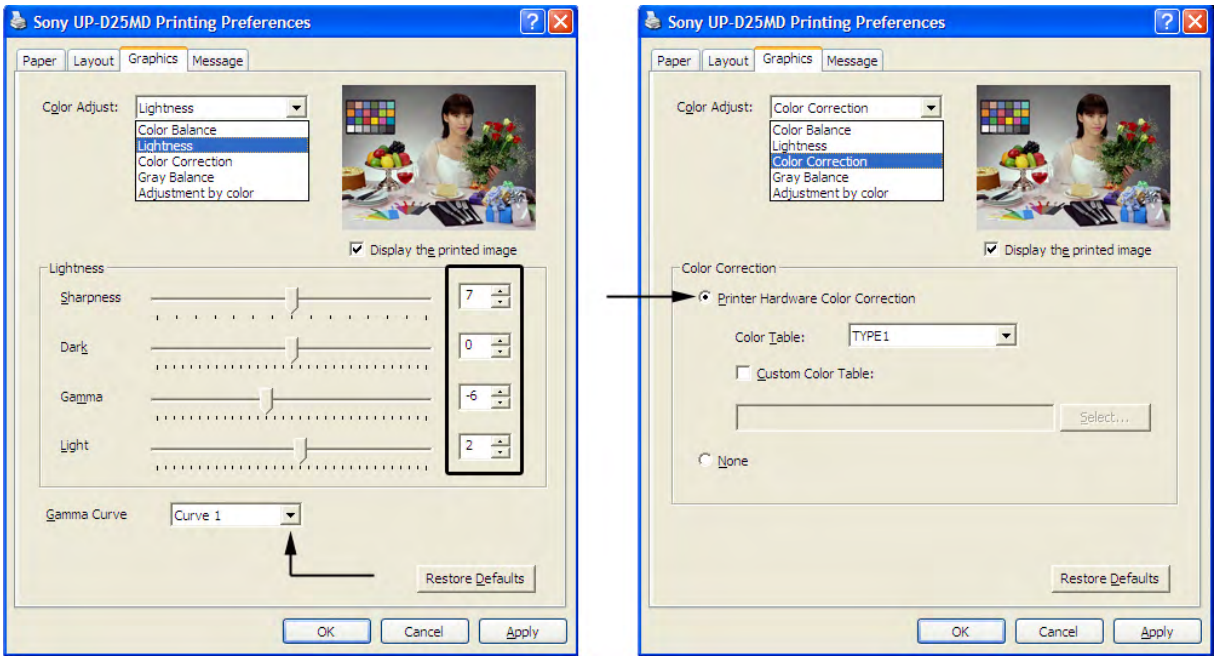


Figure 3-55 Graphic page (Lightness / Color Correction)

7. *Gray Balance*: X = **50**, Y = **50**
8. *Adjustment by Color*: Color (region) = **Magenta Red**

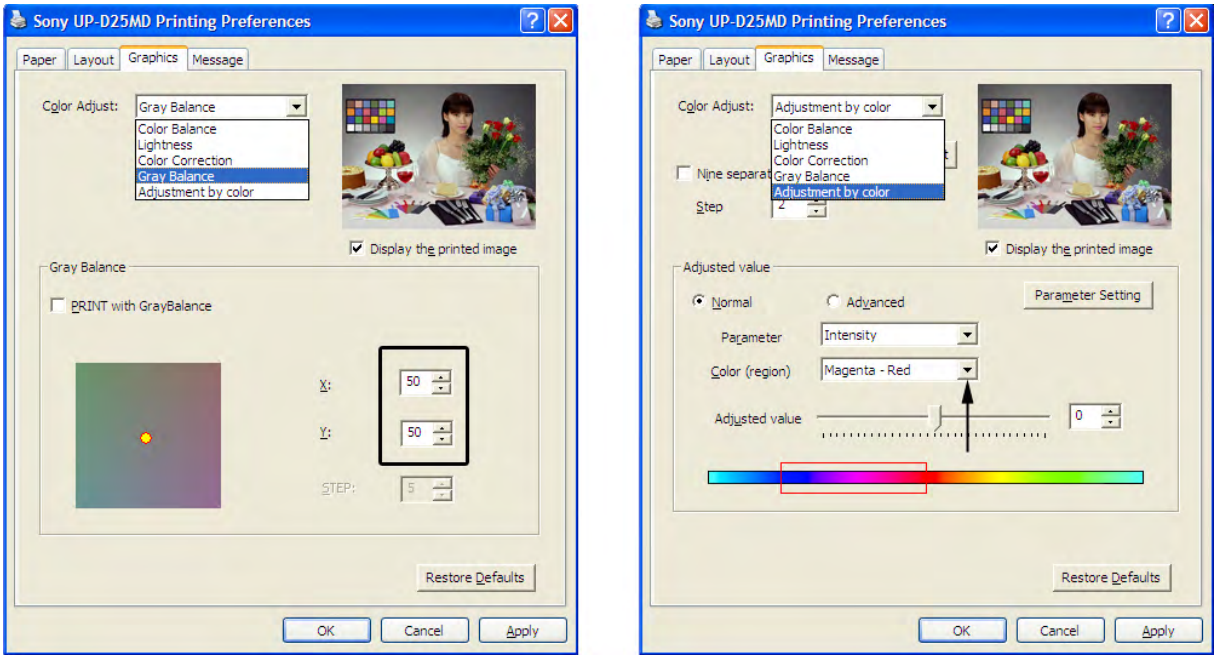


Figure 3-56 Graphic page (Gray Balance / Adjustment by Color)

9. Save the adjusted printer settings with *Apply* and *OK*. Close window and exit System Setup.
10. Assign the printer to the remote keys **P1**, **P2**, **P3** and/or **P4**; see *Section 3.6.7 "Remote Control Selection" on page 3-57*.

3.6.6.5 UP-D23MD Printer - Settings

1. Call up the "Printer Preferences"; see *Section 3.6.6 "Adjustment of Printer Settings" on page 3-51* .
2. Select the ***Paper*** page and set settings as shown in the left image at *Figure 3-54 on page 3-54* .
3. Select the ***Graphics*** page. From the "Color Adjust" pull-down menu select:
   - Color Balance: Cyan = **0**, Magenta = **0**, Yellow = **0**
   - Gamma Select: **Gamma 1**

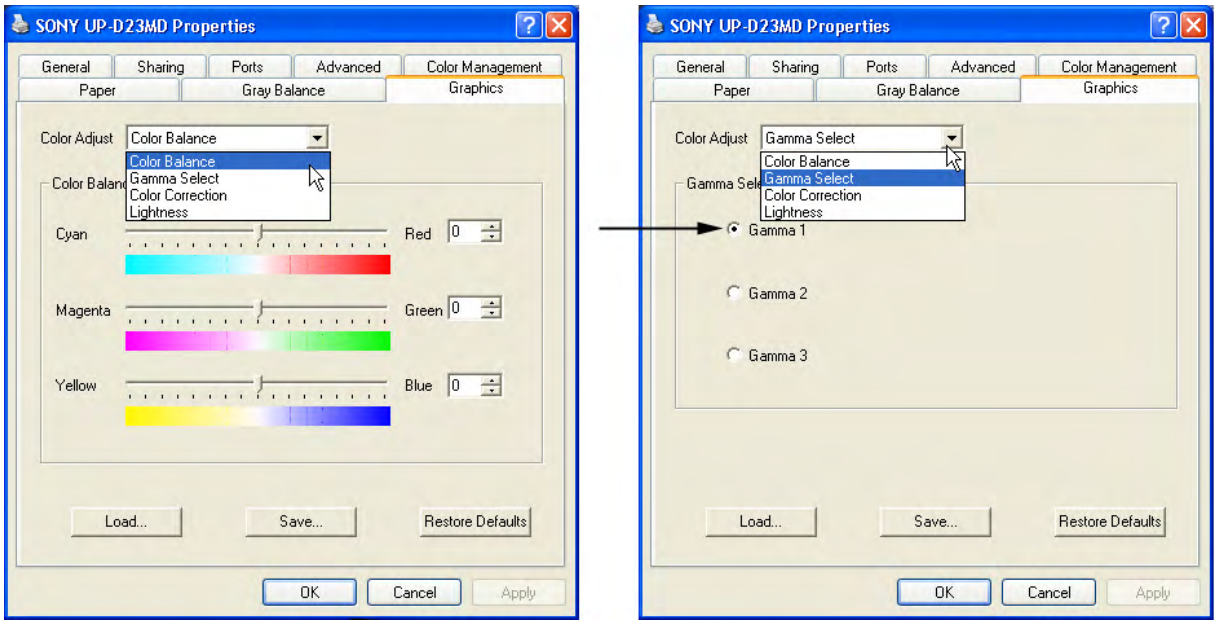


Figure 3-57 Graphics page (Color Balance + Gamma Select)

   - Color Correction: set **Printer Hardware Color Correction**
   - Lightness: Sharpness = **7** or **8**, Dark = **0**, Gamma = **-12**, Light = **8**

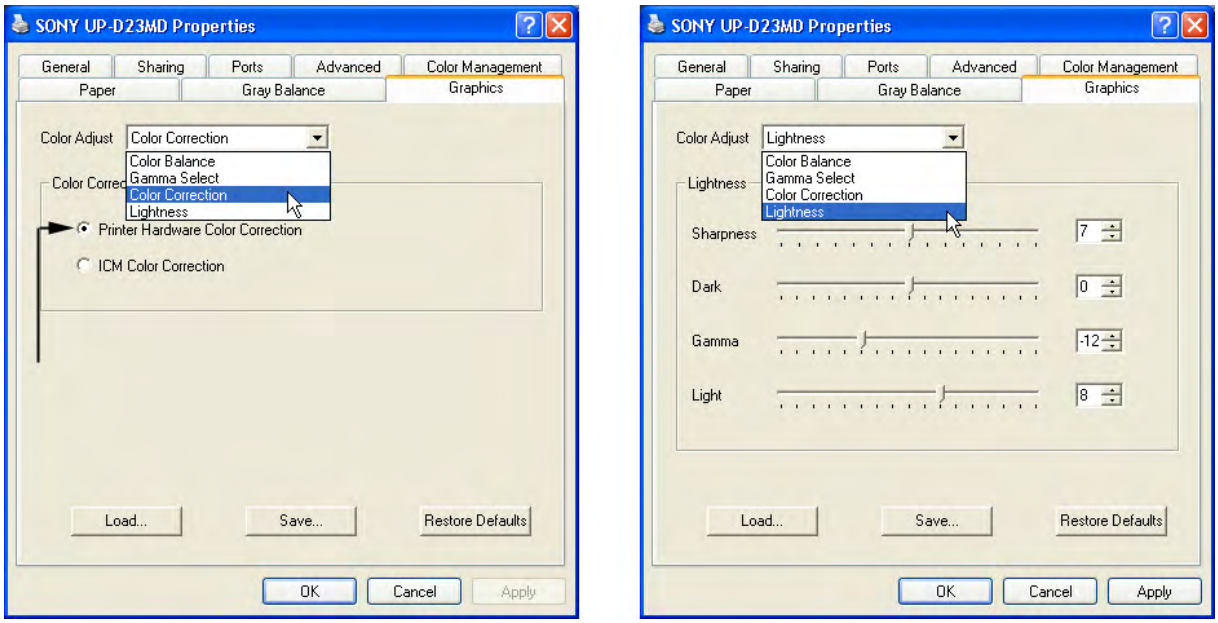


Figure 3-58 Graphic page (Color Correction / Lightness)

4. Save the adjusted printer settings with ***Apply*** and ***OK***. Close window and exit System Setup.
5. Assign the printer to the remote keys **P1**, **P2**, **P3** and/or **P4**; see *Section 3.6.7 "Remote Control Selection" on page 3-57* .

3.6.7 Remote Control Selection

To assign an auxiliary device (e.g., printer) to the remote keys **P1**, **P2**, **P3** and/or **P4**:

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Connectivity*** and then click the ***Button Configuration*** tab.

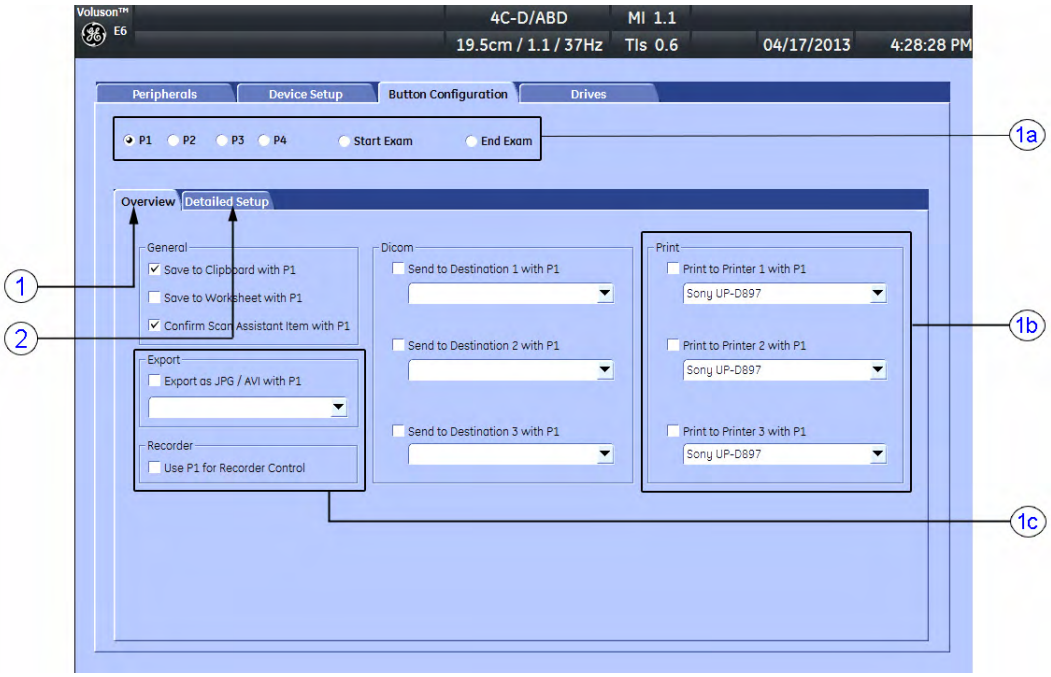


Figure 3-59 System Setup - Connectivity - BUTTON CONFIGURATION page (Overview)

1	Overview	2	Detailed Setup
1a	Configure buttons		
1b	Select Printer		
1c	Recorder Control		

1. **Overview** tab:
   a. Configure “Remote” Buttons: Select the desired remote control button.
   b. Select Printer: Check mark and select the desired Printer for the remote control button.
   c. Recorder Control: Check mark this item to use the selected **P?** key for Recorder Control.

Note *Optionally the Printer Remote Control can be done by the Foot switch; see* *Figure 3-49 on page 3-50* *.*

2. **Detailed Setup** tab:
   a. If it is desired, check mark "Use Report Printer for Reports"

3.6.7.1 Report Printer Selection

1. Click on the ***Peripherals*** tab; see *Figure 3-49 on page 3-50* .
2. Select the desired Report Printer from the pull-down menu.

Note *The selected Report Printer is usually used for printing reports and images from the Archive.*

3.7 System Configuration

3.7.1 System Setup

Modifications of system parameters and settings are supported by 4 major groups. Each major group contains diverse dialog pages and sub windows.

- **General Settings:** Date, Time, Clinic Name, (EUM) Language, Screen saver, etc.
- **Details:** Doppler 2D Refresh, Zoom options, Annotation presets, Menu Brightness, Trackball Speed, etc.
- **Presets:** to save User programs/presets and 3D/4D programs/presets, Logo display, etc.
- **Clipboard:** adjustment of Clipboard display and functions
- **Patient Info Display:** Drop Down Management, Title Bar Settings, Capitalize Letter in Patient Names, etc.
- **Scan Assistant:** Scan Assistant List/Item Settings, etc.

- **Service:** enter the password to get access to the Service Tools functions
- **System Info:** shows which Software/Hardware version is installed in the system
- **Options:** shows which options are installed in the system. For information on configuring software options refer to: *Section 8.7 on page 8-15* .

- **Peripherals:** Video Norm selection, Foot switch assignment, Add Printer, Edit Printer settings, etc.
- **Device Setup:** to set up all DICOM, Archive and Network configuration nodes
- **Button Configuration:** adjust assignment of Remote keys **P1**, **P2**, **P3**, ... (e.g, Printer selection)
- **Drives:** USB and Network drives: stop devices, map network drive, erase CD

- **System Configuration:** Save/Load Scan Settings (Small Backup), Save/Load/Delete Full System Configuration
- **Image Archive:** Save/Load Image Archive

Note *For further details refer to the Voluson E-Series Basic User Manual.*

3.7.1.1 How to invoke Setup Procedure

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. Select the corresponding major group from the left side of the screen and then click the desired tab.

Note *In general operations are done with the trackball and the trackball keys (mouse emulation).*

Trackball (mouse position):
positions the pointing device (arrow) on the desktop

left trackball key (left mouse button):
sets, fixates markers and activates pages/buttons etc. marked by the pointing device

upper trackball key (right mouse button):
no function in system desktop

right trackball key (left mouse button):
sets, fixates markers and activates pages/buttons etc. marked by the pointing device

3.7.1.2 How to enter Date and Time

1. Invoke System Setup as described in *Section 3.7.1.1 on page 3-58* .
2. On the left side of the screen select ***General*** and then click the ***General Settings*** tab.

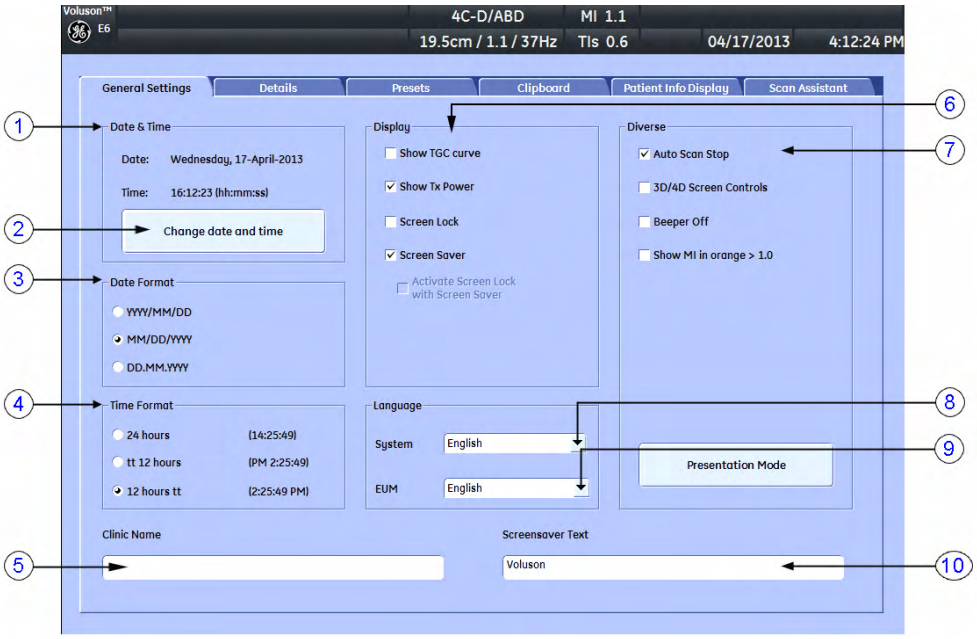


Figure 3-60 System Setup - General- GENERAL SETTINGS page

1	Date and Time	6	Display options
2	change date and time	7	Diverse options
3	Date Format	8	change System Language
4	Time Format	9	change EUM Language
5	Clinic Name	10	Screensaver Text

3. Click the ***Change date and time*** button to activate a sub dialog window to enter date, time and time zone.
4. Select the “Date Format” (only one can be active).
5. Select the “Time Format” (only one can be active).
6. Close the Service page with ***Save&Exit***.

3.7.1.3 How to enter Clinic Name

1. Invoke System Setup as described in *Section 3.7.1.1 on page 3-58* .
2. On the left side of the screen select ***General*** and then click the ***General Settings*** tab.
3. Select the text box to enter a new "Clinic Name" with the keyboard.
4. Close the Service page with ***Save&Exit***.

The clinic name will be copied into the Clinic Name (ID) field of the information header.

3.7.1.4 How to change Language and/or EUM Language

1. Invoke System Setup as described in *Section 3.7.1.1 on page 3-58* .
2. On the left side of the screen select ***General*** and then click the ***General Settings*** tab.
3. Select the desired language from the pull-down menu.
4. Close the Service page with ***Save&Exit*** and restart the system.

Note *After changing the language the Voluson E-Series has to reboot.*

3.7.1.5 How to activate Screen Lock

1. Invoke System Setup as described in *Section 3.7.1.1 on page 3-58* .
2. On the left side of the screen select ***General*** and then click the ***General Settings*** tab.
3. Check mark "Screen Lock".
   a. If no password previously entered, following dialog appears.

Figure 3-61 change password

   b. Enter "New Password".
   c. "Retype new Password" and then click ***Save&Exit*** to save new screen lock password.
4. Close the Service page with ***Save&Exit*** and restart the system.

Note *A new screen lock password must be at least 6 characters long and has a maximum length of 80 characters. The password must contain at least 2 non-letter characters, 0...9 or !@#$%^*().*

Note *If screen is locked you have to enter the password to get full system control. If password is unknown click **Emergency**. This enables standard - but limited - operation.*

Note *The Screen Lock password cannot be reset by the user! Please contact your GE service representative.*

3.7.1.6 How to change Video Norm

1. Invoke System Setup as described in *Section 3.7.1.1 on page 3-58* .
2. On the left side of the screen select ***Connectivity*** and then click the ***Peripherals*** tab.
3. Click the proper field: PAL (50Hz) or NTSC (60Hz); see *Figure 3-49 on page 3-50* .
4. Close the Service page with ***Save&Exit*** and restart the system.

3.7.1.7 How to change Ext. Monitor Video Signal

1. Invoke System Setup as described in *Section 3.7.1.1 on page 3-58* .
2. On the left side of the screen select ***Connectivity*** and then click the ***Peripherals*** tab.
3. If not currently selected, click the proper field; see *Figure 3-49 on page 3-50* .
4. Close the Service page with ***Save&Exit*** and restart the system.

3.7.1.8 How to change Recorder Type

1. Invoke System Setup as described in *Section 3.7.1.1 on page 3-58* .
2. On the left side of the screen select ***Connectivity*** and then click the ***Peripherals*** tab.
3. Depending on the used Recorder type, click the proper field. Refer to *Figure 3-49 on page 3-50* .
4. Close the Service page with ***Save&Exit*** and restart the system.

3.7.1.9 How to adjust function of the Footswitch

1. Invoke System Setup as described in *Section 3.7.1.1 on page 3-58* .
2. On the left side of the screen select ***Connectivity*** and then click the ***Peripherals*** tab.
3. Select desired function of the Footswitch. Refer to *Figure 3-49 on page 3-50* .
4. Close the Service page with ***Save&Exit*** and restart the system.

3.7.1.10 How to change the Keyboard Layout

see *Section 6.4 "Modification of Keyboard Layout" on page 6-7*

3.7.1.11 How to configure InSite ExC

see *Section 3.13.4 "InSite ExC Configuration" on page 3-77*

3.7.2 Measure Setup

Modifications of system parameters and settings are supported by diverse dialog pages and windows on the measure setup desktop:

Note *Parameters and possible adjustments mostly depend on the selected application!*

Measure & Calc	shows all settings, which are used for generic measurements as well as calculations in different applications
Application Parameters	to adjust: status on freeze for different modes, Manual Trace method, Calculation Ratio, etc.
Global Parameters	to select: if the measurement results should be deleted (= Yes), or kept on screen (= No) as soon as cine mode is activated, cursor type and size, Font size and color of measure results, position of measure results for different modes, etc.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

3.7.2.1 How to invoke Setup Procedure

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***Measure Setup*** button to invoke the setup desktop on the screen.

Note *In general operations are done with the trackball and the trackball keys (mouse emulation).*

Trackball (mouse position):
positions the pointing device (arrow) on the desktop

left trackball key (left mouse button):
sets, fixates markers and activates pages/buttons etc. marked by the pointing device

upper trackball key (right mouse button):
no function in system desktop

right trackball key (left mouse button):
sets, fixates markers and activates pages/buttons etc. marked by the pointing device

3.8 On-board optional Peripherals

AC mains power outlets (AUX) for auxiliary devices and peripherals are co-switched by the systems mains switch. Output voltage for AUX: 115V

Caution
The maximum power consumption of equipment (inclusive color LCD monitor) connected to these outlets must not exceed 200VA!

Table 3-7 Approved Peripherals

Device	Manufacturer	Model	Connection	Comment
Digital B/W Video Printer	SONY	UP-D897	USB-Port	*Table 9-11*
		UP-D898MD		
	Mitsubishi	P95D		
Digital Color Printer	SONY	UP-D25MD	USB-Port	*Table 9-11*
	Mitsubishi	CP30D		
Color Deskjet Printer	Hewlett Packard (HP)	HP Officejet H470	USB-Port or	*Table 9-11*
		HP Officejet 100	Bluetooth	
Color Laser Printer	Hewlett Packard (HP)	HP LaserJet M451	USB-Port	*Table 9-11*
Bluetooth Adapter	Delock	Delock	USB-Port	*Table 9-11*
	Belkin	Belkin		
DVD Recorder	SONY	DVO-1000MD (PAL / NTSC)	PAL / NTSC	*Table 9-10*
USB Video Recorder	VISK	MR-200	USB-Port	*Table 9-10*
ECG Preamplifier	NORAV	MAN10	USB-Port	*Table 9-12*
		MAN30		
USB Flash Memory device	SanDisk	Cruzer Micro	USB-Port	*Table 9-12*
USB external Hard Disk Drive	Fujitsu	"Handydrive"	USB-Port	*Table 9-12*
Wireless Adapter (WLAN)	Netgear	WG111v3	USB-Port	*Table 9-12*
Footswitch	Steute	GP26	USB-Port	*Table 9-13*
	Whanam	FSU3000G		
VGA Image Resizer	TV One	1T-PC1280HD	VGA	*Table 9-13*
Isolation Transformer	Noratel	IMED, 300WR 3rd Edition		*Table 9-13*
UPS (Uninterruptible Power Supply)	Tripp Lite	SMART1200XLHG[3]		*Table 9-13*
		SMX1200XLHG[4]		
Power Filter	TNC	-	-	*Table 9-13*
32" Secondary Patient Monitor (US version	SONY	KDL-32EX523	HDMI / VGA	-
40" Secondary Patient Monitor (European version)	SONY	FWD-40W600P	HDMI / VGA	-

3 for 100-130V AC countries

4 for 220-240V AC countries

It might be possible that some probes, options or features are NOT available

- in some countries.
- at the time of release of this Service Manual.

3.9 External I/O Connectors

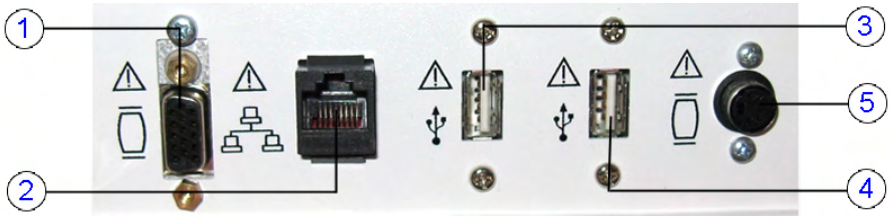


Figure 3-62 External I/O connectors - on rear of system (GES)

Item	Connector Name	Table Number	Description
1	DVI / VGA OUT	*Table 3-13* *Table 3-8*	Connector for external monitor
2	Network	*Table 3-9*	DICOM input/output, twisted pair RJ-45 10/100 megabit/s
3	USB	*Table 3-10*	USB 2.0 port
4			
5	S-Video OUT	*Table 3-11*	S-Video OUT connector

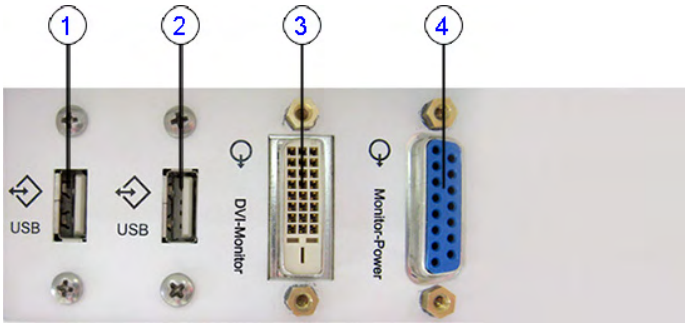


Figure 3-63 External I/O connectors - on back of console

Item	Connector Name	Table Number	Description
1	USB	*Table 3-10*	USB 2.0 port
2			
3	DVI Monitor	*Table 3-13*	Monitor DVI (Digital Visual Interface)
4	Monitor Power	*Table 3-12*	Monitor Power

Figure 3-64 External I/O connectors - next to DVD or DVR drive

Item	Connector Name	Table Number	Description
1	USB[5]	*Table 3-10*	USB 2.0 port
2			

5 If the USB cables need to be replaced, use **Item 722** in *Section 9.9 "Miscellaneous Cables" on page 9-26* . Remove USB connectors from metal bracket and use here.

3.9.1 External I/O Pin Outs

Table 3-8 VGA OUT connector, Sub-D (15 pin)

Pin No	Output Signal	Description
1	VGA OUT1 R	Red
2	VGA OUT1 G	Green
3	VGA OUT1 B	Blue
4, 9, 11, 12, 15	N/C	N/C
5, 6, 7, 8, 10	GND	GND
13	VGA OUT1 HS	H Sync
14	VGA OUT1 VS	V Sync

Table 3-9 Network connector, RJ45 Modular (8 pin)

Pin No	Output Signal	Description
1	ETHER TD	Ethernet RD +
2	ETHER TD	Ethernet RD -
3	ETHER RD	Ethernet TD +
6	ETHER RD	Ethernet TD -
others	NC	no connection

Table 3-10 USB 2.0 connectors

Pin No	Output Signal	Description
1	VCC	USB Power Supply
2	- Data	USB Data (-)
3	+ Data	USB Data (+)
4	GND	USB Power Ground

Table 3-11 S-Video OUT connector (4 pin)

Pin No	Output Signal	Description
1	SVIDEO OUT/IN YG	Y (Luma) GND
2	SVIDEO OUT/IN CG	C (Chroma) GND
3	SVIDEO OUT/IN Y	Y (Luma) Signal
4	SVIDEO OUT/IN C	C (Chroma) Signal

Table 3-12 Monitor Power connector (16 pin)

Pin No	Description
2, 3, 7, 10, 15	12V
1, 5, 8, 9, 11, 16	GND
6 / 14	USB 1- / USB 1+
4, 12, 13	NC (no connection)

Table 3-13 DVI OUT connector

Pin No	Description	Pin No	Description
1	TDMS data 2-	13	TDMS data 3+
2	TDMS data 2+	14	+5 Volt
3	TDMS data 2, 4 shielding	15	ground for +5 Volt
4	TDMS data 4-	16	Hotplug-Detect
5	TDMS data 4+	17	TDMS data 0-
6	DDC clock	18	TDMS data 0+
7	DDC data	19	TDMS data 0, 5 shielding
8	Analog: V-Sync	20	TDMS data 5-
9	TDMS data 1-	21	TDMS data 5+
10	TDMS data 1+	22	TDMS meter shielding
11	TMDS data 1, 3 shielding	23	TDMS clock +
12	TDMS data 3-	24	TDMS clock -

3.9.2 Video Specification

Video specifications may be needed to be able to connect laser cameras or other devices to the Voluson E-Series system.

DVI-D/VGA-connector:

- visible resolution ... 1280 x 1024
- screen refresh rate ... 60Hz

S-Video connector:

- Type: separate Video (Y/C)
- Video modes: PAL (50Hz), NTSC (60Hz)

3.9.3 External Cables - Maximum Lengths

Table below shows maximum permitted cable length of external cables, according to IEC60601-1-2.

Table 3-14 maximum cable lengths

Description	Maximum Cable Length	Type
Probe cable	2.5 m	shielded
USB cable (port 2.0)	5 m	shielded; USB2.0 or higher
USB cable (port 3.0)	2m	shielded; USB3.0 or higher
LAN cable	80 m	shielded; Cat5e or higher
VGA cable	15 m	shielded
S-Video cable	5 m	shielded
ECG cable	4 m	shielded
Power cable	4 m	unshielded
PE cable	10 m	unshielded

3.10 Available Probes

See *Section 9.12 "Probes" on page 9-41* , for part numbers to be used when ordering new or replacement service probes.

3.11 Software/Option Configuration

For description refer to:

- *Section 3.7.1 "System Setup" on page 3-58*
- *Section 3.7.2 "Measure Setup" on page 3-61*

Note *For further details refer to the Voluson E-Series Basic User Manual.*

3.12 Connectivity Setup

The Voluson E-Series ultrasound system can be connected to various connectivity devices. The following sections describe how to connect the system to a remote archive/work station or a DICOM service, using a TCP/IP connection.

3.12.1 Connectivity Introduction

This section describes communication and connection options between the Voluson E-Series ultrasound system and other devices in the hospital information system.

The following scenarios are covered:

- stand-alone Voluson E-Series system; see *Section 3.12.1.3 on page 3-69* .
- Voluson E-Series and one or several PC workstations - with Software 4D View installed - within a “Sneaker Net” environment. (“Sneaker Net” means that you use a DVD/CD to move data because no network is available); see *Section 3.12.1.4 on page 3-69* .
- Voluson E-Series and DICOM server in a network; see *Section 3.12.1.5 on page 3-69* .

3.12.1.1 Dataflow Concept

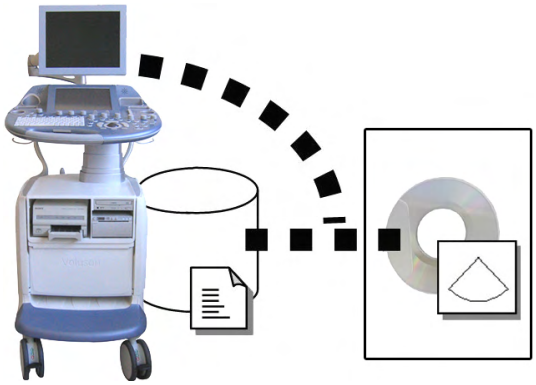
Communication between the Voluson E-Series ultrasound system and other information providers on the network takes the form of data flows. Each dataflow defines the transfer of patient information from either an input source to the system, or from the system to an output source (see examples in *Section 3.12.1.2 on page 3-68*).

Patient information can include demographic data and images, as well as reports and Measurement and Analysis (M&A) data. A dataflow is a set of pre-configured services. Selecting a dataflow will automatically customize the ultrasound system to work according to the services associated with this dataflow.

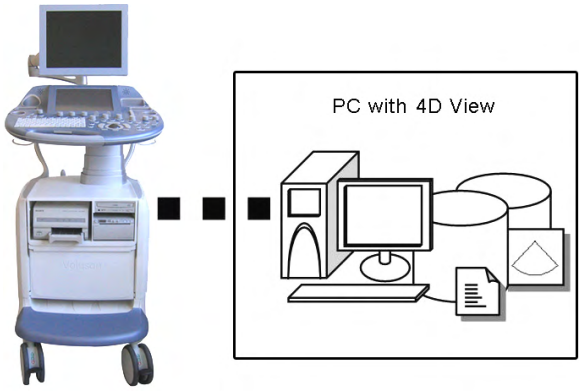
By utilizing data flows, the user can configure the Voluson E-Series ultrasound system to optimally meet the needs of the facility, while keeping the user interface unchanged. Once the dataflow is selected, the actual location of the database is entirely transparent.

3.12.1.2 Dataflow Examples

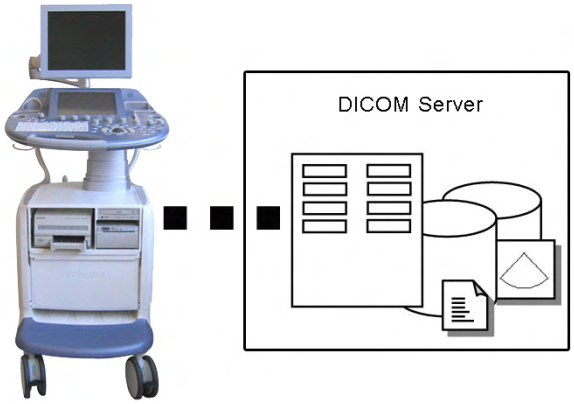
The local database is used for patient archiving. Images are stored to internal hard drive.



The local database is used for patient archiving. Afterwards images are stored to a DVD/CD or external USB device, etc.



A remote database is used for patient archiving. Images are also stored to a remote archive.



Search in the DICOM Modality Worklist, the patient found is copied into local database. The patient information and the examination results are stored to the local database. Images are stored to a DICOM server and to an image network volume on the local hard drive.

3.12.1.3 Stand-alone Voluson E-Series

If digital images or 3D/4D data sets are stored, they should be saved in the Archive (Image Management System software).

Note *For further details refer to the Voluson E-Series Basic User Manual.*

Note *To avoid loss of essential data, it is highly recommended to* ***export/backup patient data*** *as well as measurements* ***at least once a month****.*

Physical Connection:

No network connection needed.

3.12.1.4 Voluson E-Series + PC (with 4D View Software) within a "Sneaker Net"

A PC (one or several with 4D View software installed) is used for review and work on studies acquired on one or more Voluson E-Series system without being connected in a network.

The images are first stored on the Voluson E-Series system's hard drive (Archive) and then exported from the system's hard drive to a sneaker device (e.g., DVD/CD), and finally imported from the sneaker device to the “4D View” PC's internal hard drive.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

Note *To avoid loss of essential data, it is highly recommended to* ***export/backup patient data*** *as well as measurements* ***at least once a month****.*

Physical Connection:

No network connection needed.

3.12.1.5 Connection between Voluson E-Series and DICOM Server

In this configuration, the Voluson E-Series is configured to work with a DICOM server in a network environment. Usually, this will be the hospital network. Images are first saved on the local image buffer on the system. At the end of the examination, the images are sent to the DICOM server via a DICOM spooler. This scenario requires that the system is configured to be connected to the DICOM server.

Physical Connection:

You will need one network cable.

1. Connect one end of the cable to the Ethernet connector on the Voluson E-Series.
2. Connect the other end of the cable to the wall outlet.

Note *If a Peer-to-Peer Network is connected to the hospital's network, you may connect the Voluson E-Series to the Peer-to-Peer Network.*

Note *For further details refer to the Voluson E-Series Basic User Manual.*

3.13 Network Configuration

Content in this section

3.13.1 TCP/IP Configuration

Note *Following information must be provided by the customer or hospital engineer before you can start: Station name, AE Title, IP address and Port Number for the Voluson E-Series. The IP addresses for the default gateway and other routers at the site for ROUTING INFORMATION. Only if necessary (e.g. for Internet access).*

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
4. Click the ***TCP/IP Configuration*** button, read the message and confirm with ***Yes***.

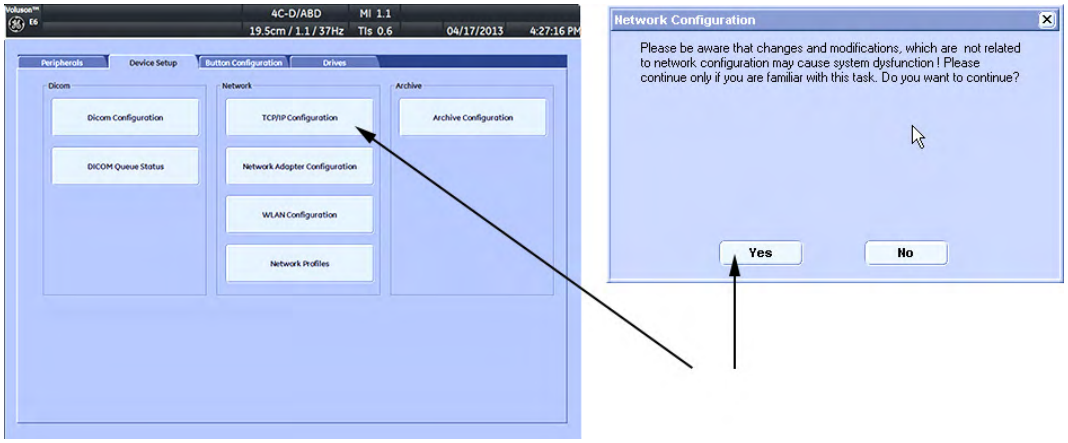


Figure 3-65 TCP/IP Configuration

5. The "Internet Protocol (TCP/IP) Properties" dialog page appears.

Note *This example shows fictional numbers!*

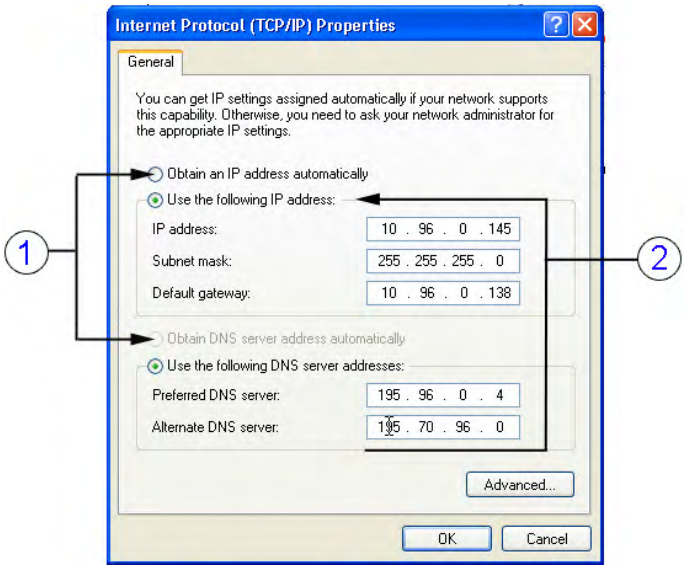


Figure 3-66 Internet Protocol (TCP/IP)

1 You can get IP and DNS settings assigned automatically, if your network supports this capability.

2 If fixed IP address is required, ask your network administrator for the appropriate settings.

Type in:

- IP address
- Subnet mask
- Default gateway
- DNS server

Note *For further details refer to the Voluson E-Series Basic User Manual.*

3.13.2 Wireless Network Configuration

Note *To configure the Voluson E-Series system to work with WLAN, the **hospital's network administrator has to provide the required information**.*

Content in this section

3.13.2.1 Connecting to the WLAN

1. Connect the Wireless Network adapter as described in *Section 3.4.8 on page 3-29* .
2. Press the **Utilities** key on the control console.
3. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
4. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
5. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
6. The Wireless Network Configuration tool with available Wireless Networks appear.

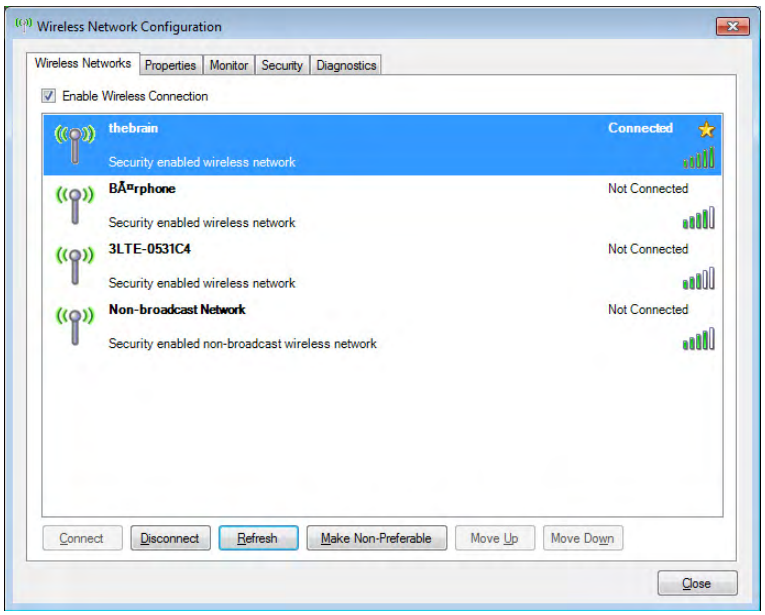


Figure 3-67 Wireless Networks - Connect

7. Check box "Enable Wireless Connection".
8. Highlight the wireless network you want to use and then click ***Connect***.

Note *If the WLAN fails to connect, review and/or recreate the Wireless connection in the **Security** tab.*

3.13.2.2 Disconnecting from the WLAN

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Select the WLAN you are connected to and then click ***Disconnect***.

3.13.2.3 Adding a WLAN Profile

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Select the ***Security*** tab and then click ***Add***.

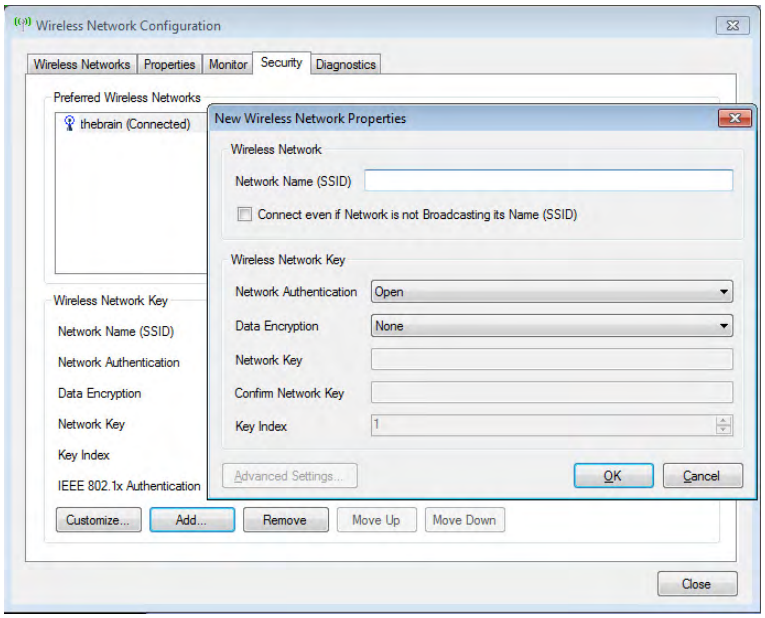


Figure 3-68 Security - Add

6. Add the following information to the Wireless Network Properties page:
   - Network Name (SSID)
   - Check box "Connect even if Network is not Broadcasting its Name (SSID)"
   - Network Authentication (Open, Shared Key, WPA PSK or WPA2 PSK)
   - Data Encryption
   - Network Key
   - Key Index
7. After you have filled in all the required information, click ***OK***.

3.13.2.4 Refreshing a WLAN Network

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Click ***Refresh***.

3.13.2.5 Setting a WLAN Network as Non-Preferable

When you make a WLAN non-preferable, you disconnect the network from the system and delete all connection settings from the system. Afterwards the system WILL NOT try to reconnect to this WLAN automatically. And if you want to reconnect, you will need to re-add this WLAN.

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Highlight the wireless network you want to set as non-preferred.
6. Click ***Make Non-Preferable*** and confirm the message box.

3.13.2.6 Removing a WLAN Profile

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Select the ***Security*** tab and then click ***Remove***.

3.13.2.7 Customizing an existing WLAN Profile

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Select the ***Security*** tab and then click ***Customize***.

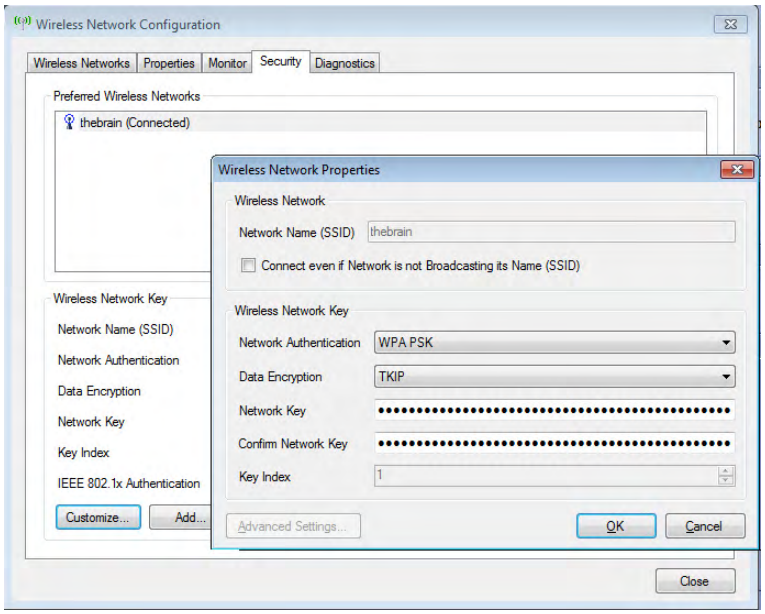


Figure 3-69 Security - Customize

6. Customize the following information:
   - Network Name (SSID)
   - Check box "Connect even if Network is not Broadcasting its Name (SSID)"
   - Network Authentication (Open, Shared Key, WPA PSK or WPA2 PSK)
   - Data Encryption
   - Network Key
   - Key Index
7. After you have filled in all the required information, click ***OK***.

3.13.2.8 Available WLAN Channels

The available WLAN channels show availability of wireless connect point that the system can talk to. Each channel supports a finite number of users and has limited signal strength. This may effect the ability to connect, the throughput and the connection dropping out.

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Select the ***Properties*** tab.

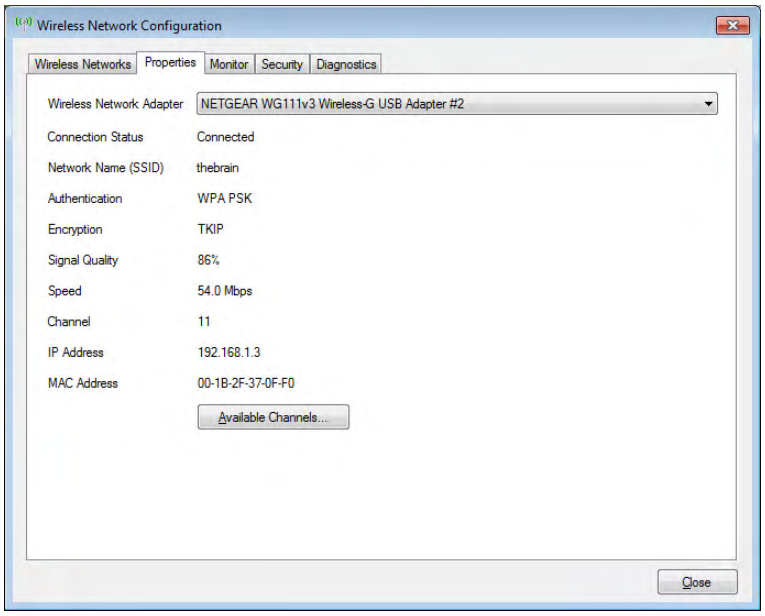


Figure 3-70 Properties

6. Click ***Available Channels***.

3.13.2.9 Monitoring the WLAN

If there are wireless network communication issues, you can monitor the wireless connection to see if it is dropping out and recovering periodically. This can effect throughput.

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Select the ***Monitor*** tab.

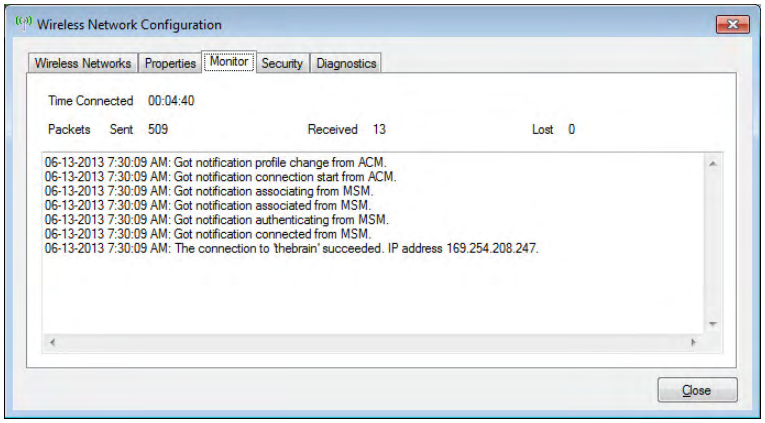


Figure 3-71 Monitor

3.13.2.10 WLAN Diagnostic

Running diagnostics is good if you think the adapter might be bad. Diagnostics also tell you if the connection is behaving properly. Sometimes the system connects by accident to the DVR or another internal device which uses the TCP/IP protocol. The diagnostics would show if there are errors when performing the full two-way communication. For example, if the IP address starts with 197 or 169 (loopback addresses), then something is wrong.

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Select the ***Diagnostics*** tab and then click ***Run Diagnostics***.

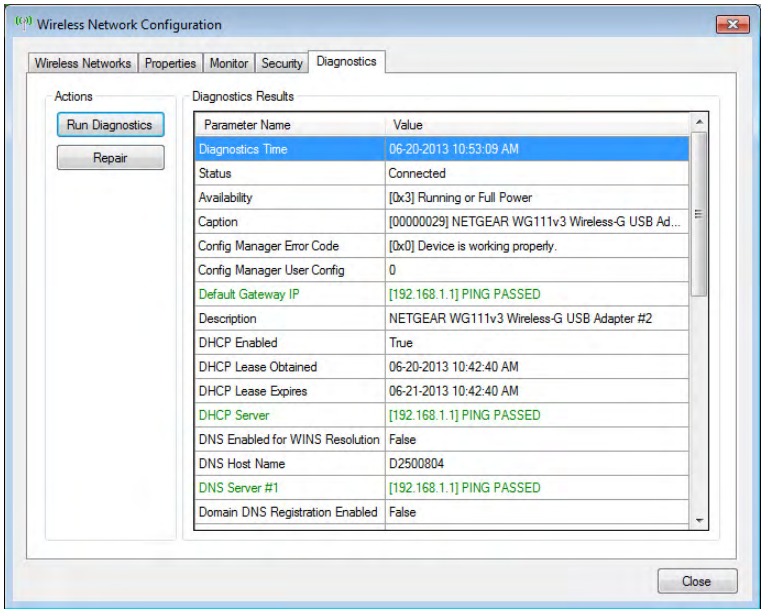


Figure 3-72 Run Diagnostics

3.13.2.11 Repairing the WLAN

Occasionally you may need to repair a WLAN that has lost its connection to the Voluson E-Series.

1. Press the **Utilities** key on the control console.
2. On the left side of the screen select ***Connectivity*** and then click the ***Device Setup*** tab.
3. Click the ***WLAN Configuration*** button; see *Figure 3-65 on page 3-70* .
4. The Wireless Network Configuration tool with available Wireless Networks appear.
5. Select the ***Diagnostics*** tab and then click ***Repair***.

Note *DO NOT cancel the Repair operation after you have selected to repair the Wireless LAN connection.*

3.13.3 Map Network Drive

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Connectivity*** and then click the ***Drives*** tab.

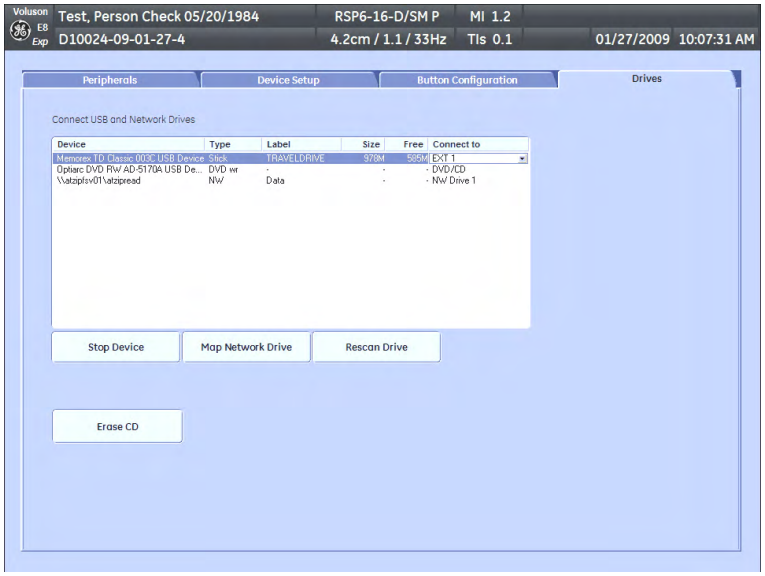


Figure 3-73 System Setup - Connectivity - DRIVES page

4. Click the ***Map Network Drive*** button to open a dialog where the system can be connected to a shared network drive of another server.

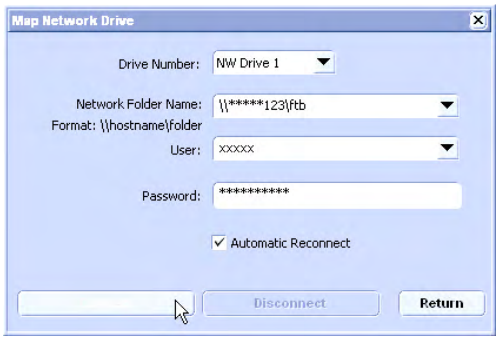


Figure 3-74 Map Network Drive

5. Enter the name of the shared network folder in the „Network Folder Name” field.
6. Supply a valid user name and a password for this folder.

Note *If you check the „Automatic Reconnect“ box, the system tries to establish the connection again when starting up. Otherwise, the connection must be re-established manually after a shutdown or reboot.*

7. Select the ***Connect*** button to establish the connection to the remote system. If successful, the ***Disconnect*** button becomes active.

Note *The **Map Network Drive** button is also accessible in the “Connect USB and Network Drives” dialog window that appears when pressing the **USB** key on the alphanumeric keyboard.*

Note *If there is an error during the connection, a warning message appears inside the dialog. In this case, please verify the data in the dialog.*

Note *If there already is a connection to the remote server, the **Connect** button is grayed. To change the existing connection, first click on **Disconnect** and then enter the new settings.*

Warning
Please make sure that the server you are connecting to is trustworthy and reliable. For details, contact your local system administrator.

If you backup archive data to this server, all the patients demographic data will be copied to this server!

3.13.4 InSite ExC Configuration

Prerequisites for InSite Setup

If not already available, collect the following information from the hospital network administrator:

1. Proxy Server, if necessary
   _____ / _____ / _____ / _____ and Port _____
2. Proxy Authentication, if necessary
   User _____ and Password
   _____

Configuration Steps

1. Enter the Common Service Desktop (CSD).

Note *There are different possibilities to access the Common Service Desktop and its available features; see* *Section 5.12.2 "Access / Security" on page 5-39* *.*

2. Select the ***Configuration*** page, then double-click ***InSite ExC Agent Configuration*** (A).

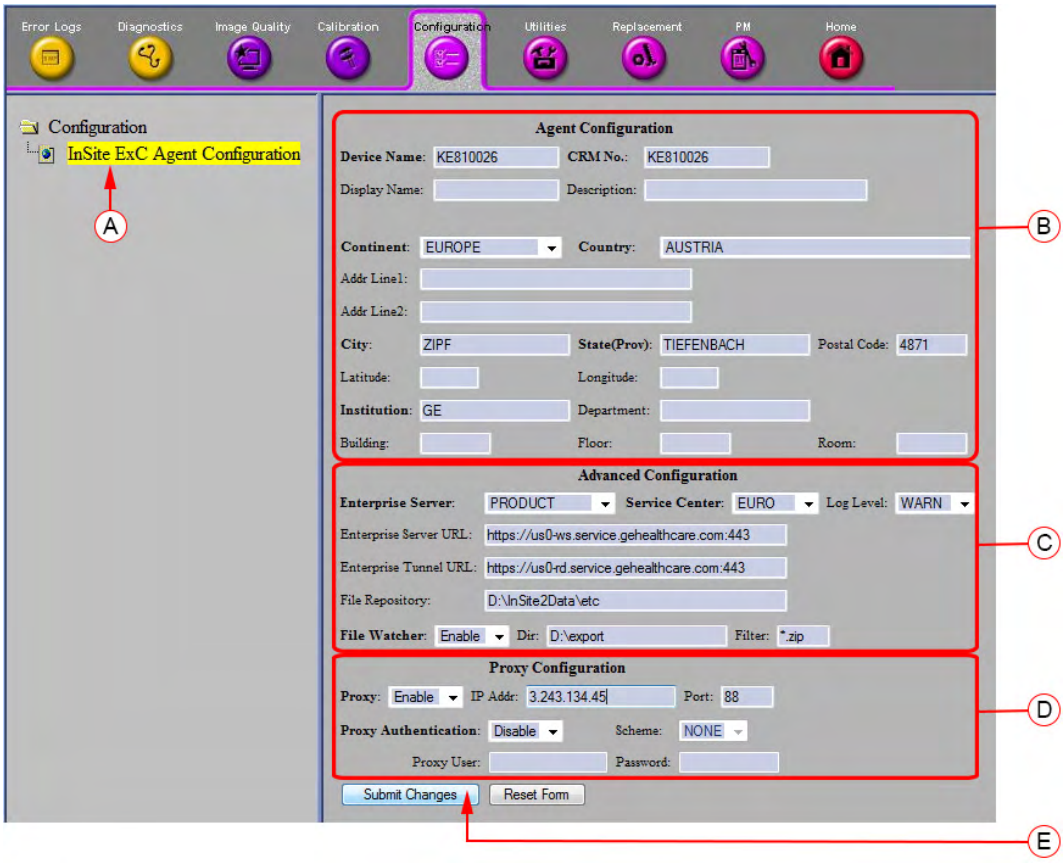


Figure 3-75 Common Service Desktop - Configuration

Note *This example shows fictional numbers!*

3. Fill out **at least all bold** stated <u>mandatory</u> fields in the Agent Configuration section **(B)**.
   - The *Device Name* (pre-populated) and the *CRM* field have to be prefix KE6 or KE8 + systems serial number without prefix letter; e.g. **KE810026**.
   - Select *Continent* and *Country* from the pull-down menu.
   - Enter *City*, *State*, *Postal Code* and *Institution* where the system resides.
4. Check settings in the Advanced Configuration section **(C)**.
   - *Enterprise Server* - PRODUCT
   - *Service Center* - EURO
   - *Log Level* - WARN

Further fields should be pre-populated and should not be modified. However, please ensure correct setting.

- *Enterprise Server URL* - pre-populated URL
- *Enterprise Tunnel URL* - pre-populated URL
- *File Repository* - This path is set by engineering and must not be changed!
- *File Watcher* - Should always be Enabled!
- *Dir* - D:\export
- *Filter* - ensure that this field has the entry "*.zip"

5. Enter Proxy Configuration **(D)**.
   a. If the customer site does not require a Proxy server, select Disable from the Proxy pull-down menu and continue with step 7.
   b. If a Proxy server is available, select Enable from the Proxy pull-down menu, enter a valid Proxy IP Address and Port number.

Note *The **information MUST be properly entered, otherwise remote control does not work**. There is no possibility to detect proxy server information automatically.*

6. Click the ***Submit Changes*** button **(E)** and then close the page.
7. Reboot.
8. Reenter the Common Service Desktop (CSD).
9. Confirm that Service Connectivity is "Configured" and "Checked Out" in the ***Home*** page.

   If the system indicates "Checked Out" you can be confident that the system has registered correctly. If required, verify further connectivity (e.g., remote connectivity using your account) .
10. Close the page and check/create InSite permanent user setting; see *Section 3.13.4.1 on page 3-78* .

3.13.4.1 How to create an InSite permanent User

An InSite permanent user is required for automatic system error reporting to the digital service network.

1. 

   Move the cursor to the InSite ExC link (GE icon) at the right bottom of the display screen and press the left trackball key (= left-click). The “Contact GE” form is displayed.
2. Ensure that Connection is "Checked Out" **(1)**.

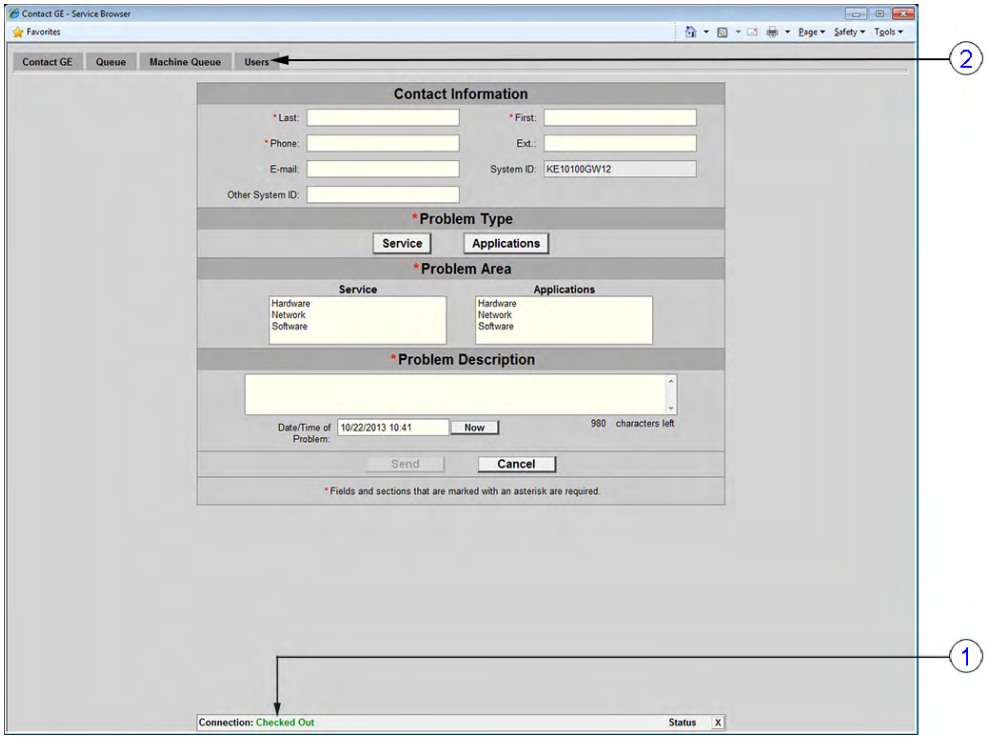


Figure 3-76 Contact GE

3. Select ***Users*** on the top menu **(2)**.

4. In the next screen click ***Add User*** **(3)**.

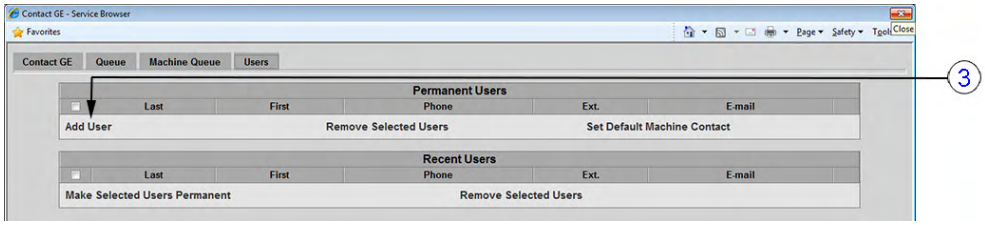


Figure 3-77 Add User

5. Fill in the required information and confirm with ***Add User*** **(4)**.

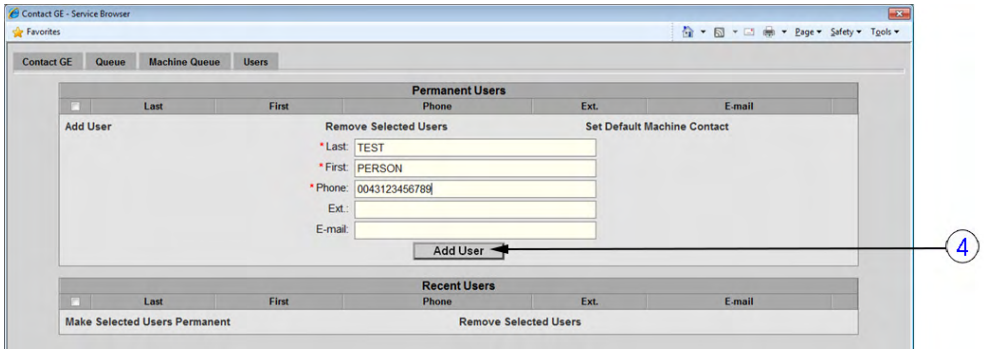


Figure 3-78 confirm with Add User

6. Check mark the appropriate user and then click ***Set Default Machine Contact*** **(5)**.

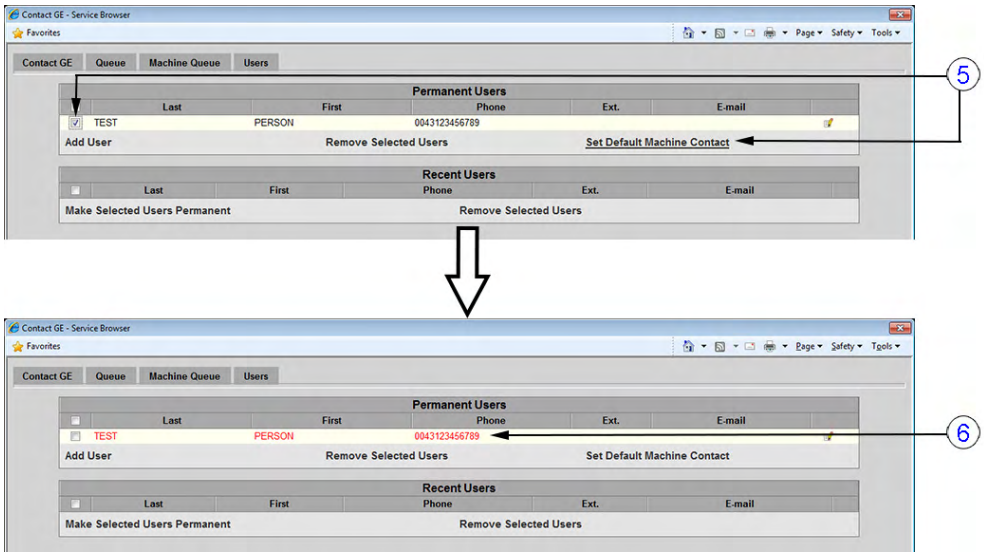


Figure 3-79 set User as Default

Color of the selected user turns from BLACK to RED **(6)**. The permanent user is created.

7. Close the window.

3.14 Connectivity Setup Worksheet

Site System Information

Site:

Dept:

Voluson E_ Type:

Floor:

Room:

REV:

Comments:

CONTACT INFORMATION

Name	Title	Phone	E-Mail Address

TCP/IP Settings

System IP Settings

Name - AE Title:

IP Address:

Subnet Mask:

Default Gateway:

Remote Archive Setup

Name - AE Title:

IP Address:

Subnet Mask:

Default Gateway:

Server Name:

Remote DB User Name:

Services (Destination Devices)

	Device Type	Manufacturer	Name	IP Address	Port	AE Title
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Figure 3-80 Site System Information

Voluson E __

Host Name _____ Local Port _____ IP Address ___ . ___ . ___ . ___

AE Title _____ Net Mask ___ . ___ . ___ . ___

ROUTING INFORMATION

	Destination IP Addresses	GATEWAY IP Addresses
		Default ___ . ___ . ___ . ___
ROUTER1	___ . ___ . ___ . ___	___ . ___ . ___ . ___
ROUTER2	___ . ___ . ___ . ___	___ . ___ . ___ . ___
ROUTER3	___ . ___ . ___ . ___	___ . ___ . ___ . ___

DICOM APPLICATION INFORMATION

	NAME	MAKE/REVISION	AE TITLE	IP ADDRESSES	PORT
Store 1				___ . ___ . ___ . ___	___
Store 2				___ . ___ . ___ . ___	___
Store 3D_1				___ . ___ . ___ . ___	___
Store 3D_2				___ . ___ . ___ . ___	___
Print				___ . ___ . ___ . ___	___
Worklist				___ . ___ . ___ . ___	___
Structured Reporting				___ . ___ . ___ . ___	___
Storage Commit				___ . ___ . ___ . ___	___
MPPS				___ . ___ . ___ . ___	___

Figure 3-81 Worksheet for DICOM Network Information

3.15 Paperwork

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

3.15.1 Product Locater Installation Card

Note *The provided Product Locater Installation Card may not be the same as shown in the Figure below.*

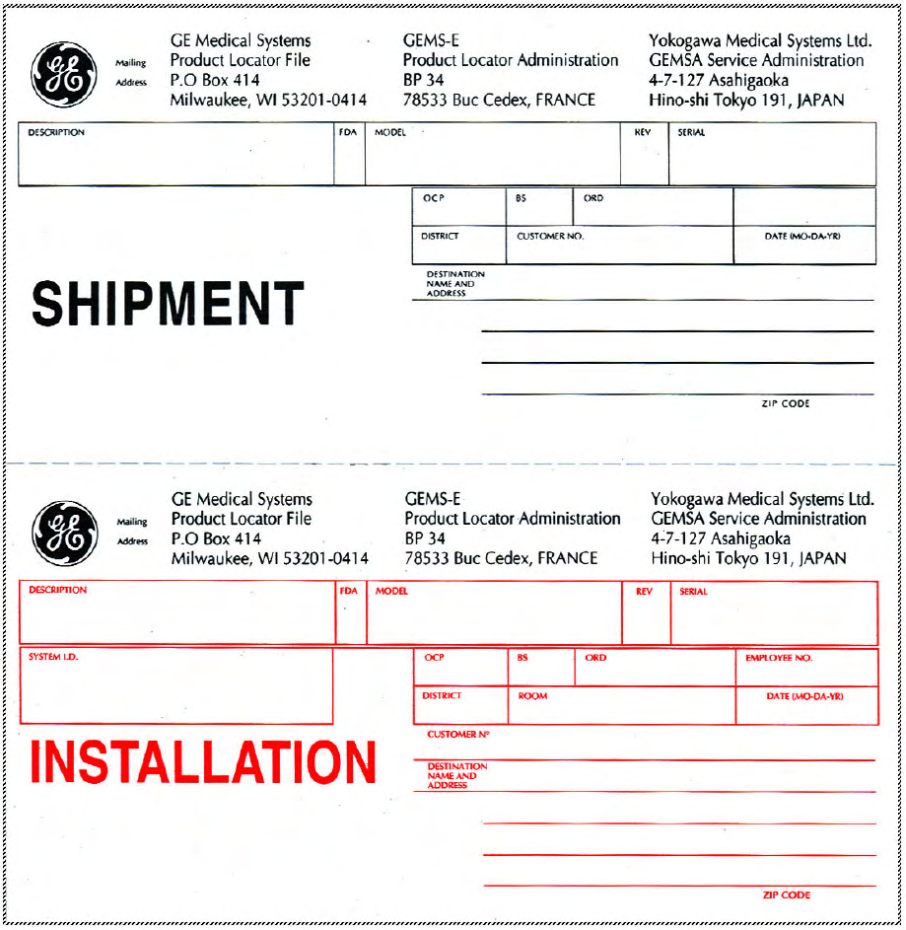


Figure 3-82 Product Locater Installation Card

3.15.2 User Manual(s)

Check that the correct User Manual(s) for the system and software revision, is included with the installation. Specific language versions of the User Manual may also be available. Check with your GE Sales Representative for availability.

Chapter 4

Functional Checks

This chapter provides procedures for quickly checking major functions of Voluson E-Series system diagnostics by using the built-in service software, and power supply adjustments.

Content in this chapter

Note

Most of the information pertaining to this Functional Checks chapter is found in the Voluson E-Series Basic User Manual; see: Section 9.11 "System Manuals" on page 9-40 .

4.1 Required Equipments

- An empty (blank) DVD/CD+R/RW and/or external USB device (stick or hard disk drive).
- At least one probe; see *Section 9.12 "Probes" on page 9-41* for an overview. Usually you should check all the probes used on the system

4.2 General Procedure

Caution

The system requires all covers. Do not operate the Voluson E-Series system unless all board covers and frame panels are securely in place. The covers are required for safe operation, good system performance and cooling purposes. When covers are removed, EMI may be present.

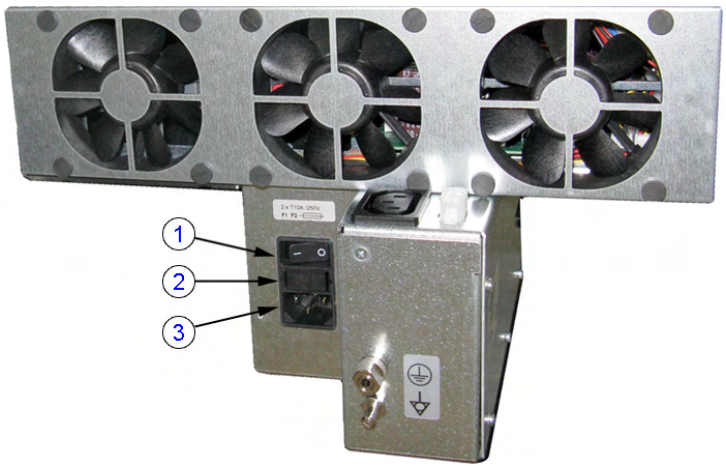
Lockout/Tagout Requirements (For USA only).

Follow OSHA Lockout/Tagout requirements by ensuring you are in total control of the Power Cable on the system.

4.2.1 Power On / Boot Up

Note *After turning off a system, wait at least 10 seconds before turning it on again. The system may not be able to boot if power is recycled too quickly.*

1. Connect the main power cable to the back of the system.
2. If not already done, screw on the pull-out protection of the mains power cable with the 2 screws.
3. Connect the main power cable to a hospital grade power outlet with the proper rated voltage. Never use an adapter that would defeat the safety ground.
4. Switch ON the circuit breaker at the rear of the system.



1 circuit breaker
2 fuses (2x T10A H/250V)
3 connector for main power cable

Figure 4-1 Circuit Breaker at rear of system

Note *When AC power is applied to the system, the **ON/OFF** standby button on the control console illuminates amber, indicating that the system (including the Back-end Processor) is in standby mode.*

5. Hold down the **ON/OFF** standby button (see: *Figure 4-2 below*) on the control console for ~3 seconds.

Note *The mains outlet of the system for peripheral auxiliary equipment are commonly switched with the **ON/OFF** standby button. The power switch of any attached printer(s) needs to be in ON position before starting the system. However, be aware some auxiliary equipment may switch itself to standby mode (e.g., Color video printer) and must therefore be switched on separately.*

Figure 4-2 ON/OFF standby button

As soon as the software has been loaded, the system enters 2D-Mode with the probe and application that were used before the system shutdown. Total time used for start-up is about 2 minutes.

Note *The mains outlet of the system for peripheral auxiliary equipment are commonly switched with the **ON/OFF** standby button. So the auxiliary equipment need not to be switched ON/OFF separately.*

4.2.2 Power Off / Shutdown

Note *After turning off a system, wait at least 10 seconds before turning it on again. The system may not be able to boot if power is recycled too quickly.*

1. If not already in read mode, freeze the image.
2. Press the **ON/OFF** Standby button on the control console. Following dialog appears.

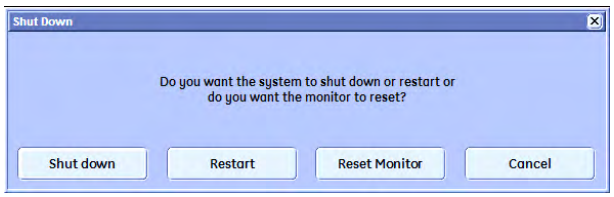


Figure 4-3 Shutdown dialog

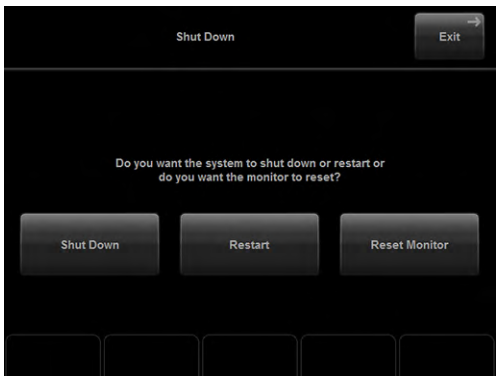


Figure 4-3 Shutdown dialog

3. Select ***Shutdown***. The system performs an automatic full shutdown sequence.
4. Switch OFF the circuit breaker at the rear of the system.

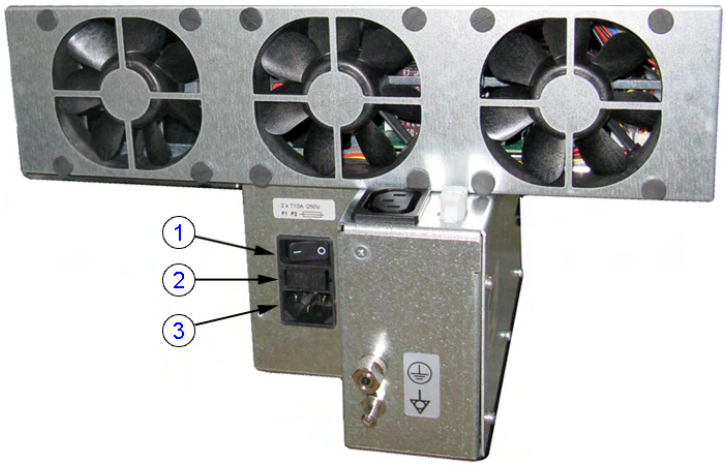
Note *A full shutdown is also performed when pressing the **ON/OFF** standby button on the control console twice.*

Note *The mains outlet of the system for peripheral auxiliary equipment are commonly switched with the **ON/OFF** standby button. So the auxiliary equipment need not to be switched ON/OFF separately.*

Warning

Disconnection of the main power cable is necessary!

5. After complete power down, unscrew the 2 screws and remove the pull-out protection to disconnect the main power cable from the system or unplug it from the AC wall outlet socket.



1 circuit breaker
2 fuses (2x T10A H/250V)
3 connector for main power cable

Figure 4-4 Circuit Breaker at rear of system

6. Press on the brakes to block the front caster wheels.
7. Disconnect probes. (Turn the probe locking handle counterclockwise and then pull the connector straight out of the probe port.)

Caution

Do not disconnect a probe while running (Live Scan “Write” mode)! A software error may occur. In this case switch the system OFF (perform a reset).

4.2.3 System Features

4.2.3.1 Control Console

Figure 4-5 Control Console Tour

1	Touch Panel screen	9	Trackball and Trackball keys
2	Touch Panel rotary & toggle switch controls	10	button for control console rotation
3	TGC-Slider controls	11	Mode keys, rotary controls used in 3D/4D Mode
4	screen format keys	12	keyboard and F1 key (to invoke EUM)
5	3D and 4D Volume Mode keys	13	additional Mode keys
6	HR-Zoom/Pan-Zoom rotary control (toggle)	14	DVD/VCR key
7	Remote control keys (programmable)	15	button for control console height adjustment
8	Freeze / Run key	16	ON/OFF Standby power button

4.2.3.2 Touch Panel

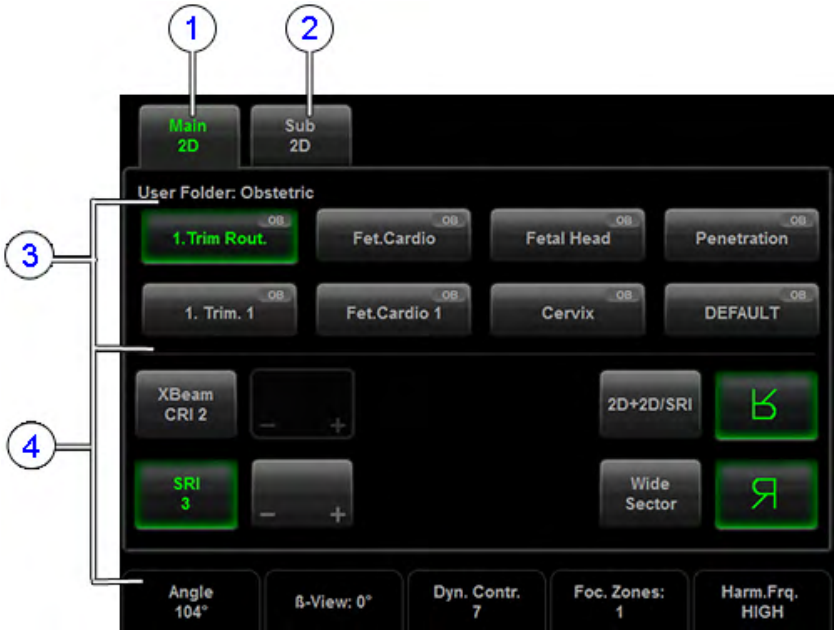


Figure 4-6 Touch Panel - Main Menu

1	Main menu key: to change from “Sub menu” back to appendant “Main” mode menu
2	Sub menu key: the “Sub menu” (to adjust settings of the selected “Main” mode) is displayed
3	Setting window: shows all settings for the active application; the active one is highlighted
4	Additional functions which are supported by the selected Mode

Note *Different menus are displayed depending on which Touch Panel Menu and which Mode is selected.*

At the bottom of the Touch Panel, there are combination rotary dial/push buttons and flip switch controls. The functionality of these controls changes, depending upon the currently displayed menu.

4.2.3.3 Monitor Display

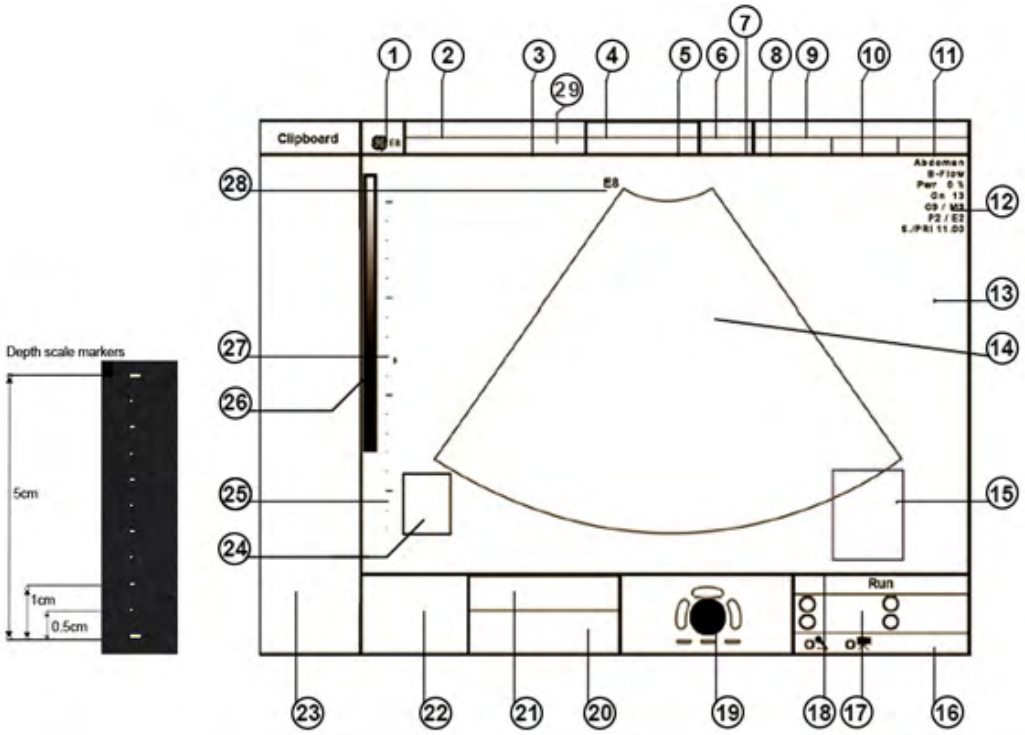


Figure 4-7 Monitor Display Tour

1.)	Logo	16.)	Status bar area
2.)	Patient Name (Last-, First-, Middle Name)	17.)	P Buttons
3.)	Patient ID-number; GA (Gestational Age)	18.)	Run/Freeze/Cine
4.)	Probe / Application	19.)	Trackball
5.)	Depth / Frame rate	20.)	-
6.)	Mechanical Index	21.)	Message Area
7.)	Thermal Index	22.)	Clipboard History
8.)	Sonographers Name	23.)	Current Clipboard
9.)	Hospital Name (Identification)	24.)	Bodymarks
10.)	Date	25.)	Depth scale markers
11.)	Time	26.)	Gray scale wedge
12.)	Image Info	27.)	Focal zones marker
13.)	TGC curve	28.)	Orientation marker.
14.)	Image area	29.)	Second patient ID
15.)	Measurement results		

4.3 Functional Checks

For a basic functional check of Voluson E-Series different modes, following pages will familiarize you with image optimization for:

- *"2D Mode (B-Mode)" on page 4-9*
- *"Additional (optional) Operating Modes" on page 4-11*
  - *"B-Flow" on page 4-11*
  - *"XTD-View" on page 4-12*
  - *"Coded Contrast Imaging" on page 4-12*
- *"M-Mode" on page 4-13*
  - *"MCFM-Mode" on page 4-14*
- *"Spectral Doppler Mode" on page 4-14*
  - PW - Pulsed Wave Doppler
  - CW- Continuous Wave Doppler
- *"Color Doppler Mode" on page 4-15*
  - CFM - Color Flow Mode
  - PD - Power Doppler
  - TD - Tissue Doppler
  - HD-Flow - Bi-Directional Angio
- *"Volume Mode" on page 4-17*
  - 3D Static
  - 4D Real Time
  - 4D Biopsy
  - VCI - Volume Contrast Imaging (A-Plane, C-Plane and VCI Static)
  - STIC (Spatio-Temporal Image Correlation)
  - T.U.I. (Tomographic Ultrasound Imaging)
  - VOCAL II

It might be possible that some probes, options or features are NOT available

- in some countries.
- at the time of release of this Service Manual.

Note *Some software may be considered standard depending upon system configuration. If any Modes or Options are not part of the system configuration, the check can be omitted.*

Note *Different menus are displayed depending on which Touch Panel Menu and which Mode is selected.*

Note *Some function keys only appear on the Touch Panel if they are available for the selected probe.*

4.3.1 2D Mode (B-Mode)

Figure 4-8 2D Main and 2D Sub Menu

Table 4-1 2D Mode Functions

Step	Task	Expected Results
1	2D Mode Gain	Rotate the **2D Mode** key to adjust the sensitivity (brightness) of the entire image.
2	Transmit Power & Acoustic Output of speakers 	Transmit Power: Optimizes image quality and allows user to reduce beam intensity. push/dial Toggle control Acoustic Output: Adjustment of the Audio level of the speakers.
3	Focus Depth 	To select the depth position of the actual focus zone(s). Arrows at the left edge of the 2D-Image mark the active focal zone(s) by their depth position.
4	Depth 	Adjusts the penetration depth range of the ultrasound image for the region of interest. The number of image lines and the frame rate are automatically optimized.
5	Screen Format (Dual, Quad) 	Press this keys to change the display Mode from Single to **Dual** or **Quad** display mode. Press the **Single** format key or the **2D Mode** key to change from Dual or Quad to Single display.
6	2D Automatic Optimization 	Pressing the **Auto** key causes automatic optimization of the gray scale to enhance the contrast resolution. Pressing again: optimization will be updated and remain active. Press the **Auto** key twice to switch off the Automatic Optimization in 2D.
7	Harmonic Imaging 	Press the **HI** key on the control console to switch on/off the Coded Harmonic Imaging function in 2D Mode provided the active probe allows this function.
8	Elastography 	Press the **Elasto** key on the control console to switch on/off the Elastography function in 2D Mode provided the active probe allows this function.

Step	Task	Expected Results
9	HR Zoom & Image Magnification 	HR Zoom: Image magnification of selected image area. push/dial Toggle control Image Magnification: Image magnification of complete image in read and write mode.
10	*FFC* (Focus and Frequency Composite)	FFC combines a low frequency to increase the penetration and higher frequency to keep a high resolution. It reduces speckle and artifacts in the 2D image.
11	*XBeam CRI* (CrossBeam Compound Resolution Imaging)	Pulses are transmitted not only perpendicularly to the acoustic window, but also in oblique directions. The advantages of XBeam CRI are enhanced contrast resolution with better tissue differentiation and clear organ borders.
12	*CE* (Coded Excitation)	Coded Excitation improves image resolution and penetration in the far field. This allows to use a higher frequency on technically difficult patients.
13	*SRI* (Speckle Reduction Imaging)	Speckle Reduction Imaging is a smoothing type filter to reduce speckle in the ultrasound image.
14	*2D+2D/SRI*	Changes the Single image display to two simultaneous half images. The left frame shows only the 2D Mode image. The right frame shows the 2D Mode image with *SRI* information.
15	*2D+2D/SRI CRI*	Changes the Single image display to two simultaneous half images. The left frame shows only the 2D Mode image. The right frame shows the 2D Mode image with *SRI* and *XBeam CRI* information.
16	*Wide Sector*	Extends the field of view of curved array probes by means of beam steering.
17	*Trapez*	Advantage of the Trapezoid Mode (button is highlighted): The scan area is very increased in relation to the linear display by steering the ultrasound lines in the border of the probe.
18	Image Orientation	Use the *left/right* respectively the *up/down* keys on the Touch panel to alternate the image orientation.
19	**Angle**	Use this control to select a part of interest of the 2D image. The advantage of the decreased field-of-view is an increased 2D frame rate due to the smaller sector width.
20	**ß-View**	This function allows the adjustment of the Volume O-Axis position of 3D probes in 2D Mode. The green line in the displayed symbol indicates the position of the acoustic block.
21	**Dyn.Contr.**	Dynamic Range controls how echo intensities are converted to shades of gray, thereby increasing the adjustable range of contrast.
22	**Foc.Zones**	Increases the number of transmit focal zone, so that you can tighten up the beam for a specific area.
23	**Frequency** resp. **Harm.Frequ.**	To adjust the range of the receive frequency. high resolution / lower penetration, mid resolution / mid penetration, or lower resolution / high penetration
24	**OTI** (Optimized Tissue Imaging)	OTI allows to “fine tune” the system for scanning different kinds of tissue.
25	*Gray Map*	A gray map determines the displayed Brightness of an echo in relationship to its amplitude.
26	*Tint Map*	A Tint map determines the Chroma value (color tone and saturation) of an echo in relationship to its amplitude.
27	*Persist.*	Persistence is a temporal filter that averages frames together. This has the effect of presenting a smoother, softer image. This function is only available if *XBeam CRI* is switched off.
28	*CRI Filter*	If this filter is set to “high”, the XBeam CRI-image is smoothed. CRI Filter setting “off” leads to a sharper impression of the XBeam CRI-image. This function is only available if *XBeam CRI* is switched off.

Step	Task	Expected Results
29	*Line Filter*	The signals of the neighboring pulses are less weighted for the display of the actual pulse which considerably improves the detail lateral resolution and signal-to-noise ratio. This function is only available if *XBeam CRI* is switched off.
30	*Line Density*	Control to improve the resolution by reducing the frame rate. Respectively reducing the resolution by increasing the image frame rate.
31	*Enhance*	Edge Enhance brings out subtle tissue differences and boundaries by enhancing the gray scale differences corresponding to the edges of structures.
32	*Reject*	Selects a level below which echoes will not be amplified (an echo must have a certain minimum amplitude before it will be processed).

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.2 Additional (optional) Operating Modes

4.3.2.1 B-Flow

B-Flow On/Off switch

Press the **BF** key to activate/deactivate the B-Flow mode.

Figure 4-9 B-Flow Main and B-Flow Sub Menu

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.2.2 XTD-View

XTD-View On/Off switch

Press the **XTD** key to activate/deactivate the XTD-View mode. A blue box is displayed at the border of the 2D image. Start and Stop the XTD-image acquisition with the **right trackball key**.

Figure 4-10 XTD-View Main Menu

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.2.3 Coded Contrast Imaging

Coded Contrast Imaging On/Off switch

Press the **Contrast** key to activate/deactivate the Coded Contrast Imaging mode.

Figure 4-11 Contrast Main and Contrast Sub Menu

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.3 M-Mode

Note *The **AMM** button is only displayed if the Anatomical M-Mode option is installed.*

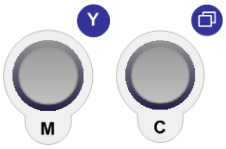
Figure 4-12 M Main and M Sub Menu

Table 4-2 M-Mode Functions

Step	Task	Expected Results
1	Cursor Position	Adjust the M Cursor position with the **Trackball** in the 2D Single image.
2	Activation of M-Mode	Press the **right or left trackball key** to activate both Modes (2D/M).
3	M-Mode Gain	Rotate the **M Mode** key to adjust the sensitivity (brightness) of the entire M image.
4	M Mode Depth	Common with Depth.
5	***AMM*** (optional)	Anatomical M-Mode displays a distance/time plot from a cursor line.
6	Display Format	e.g., In the Dual format, two defined distances can be displayed at the same time.
7	***Speed***	By touching up or down, four different sweep speeds can be selected.
8	***Invert***	Invert of the M Mode image. (Function is only available with endovaginal probes.)
9	**Frequency** resp. **Harm.Frequ.**	Common with Frequency.
10	***Display Format***	For selection of different rations of display format.
11	***Reject***	It determines the amplitude-level below which echoes are suppressed (rejected).
12	***Dyn.Contr.***	Dynamic Range enhances a part of the grayscale to make it easier to display pathology.
13	***Enhance***	Due to this function a finer, sharper impression of the image is produced.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.3.1 MCFM-Mode



By pressing the **M** control and the **C** control, the MCFM mode is switched on in the preparation mode. The M-cursor with M-Color window appears on the active 2D image.

Figure 4-13 MCFM Main and MCFM Sub Menu

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.4 Spectral Doppler Mode

Note *Different menus are displayed depending on which Spectral Doppler Mode is selected.*

Note *The Continuous Wave Doppler Mode is an Option. The **CW** key is only illuminated if the option is installed and the selected probe is capable for the Continuous Wave Doppler Mode.*

Figure 4-14 PW Main and PW Sub Menu

Table 4-3 Spectral Doppler Mode (PW, CW) Functions

Step	Task	Expected Results
1	Gate Position and Gate Size	Adjust the Gate- Position resp. Size with the **trackball** in the 2D Single image. The **upper trackball key** changes from Gate position to Gate size.
2	Activation of Doppler-Mode	Press the **right trackball key** to activate the motion display. Press the **left trackball key** to activate both Modes (B/D).
3	Doppler Gain	Rotate the **PW Mode** key to adjust the amplification of the entire spectrum.
4	***Steering***	The steering function is only available with linear probes.

Step	Task	Expected Results
5	*Speed*	By touching up or down, four different sweep speeds can be selected.
6	*RT Trace* (Real Time Auto-Trace)	The envelope curve of the Doppler spectrum (maximum velocities) and the corresponding evaluations are automatically displayed on the monitor.
7	Display Format	Doppler spectrum is displayed below the B mode image or on its right side.
8	*Invert*	To invert the Doppler spectrum display in relation to the direction of the flow.
9	**Angle**	The angle cursor can be turned in both directions without stop. By pressing the angle knob repeatedly the angle correction switches from +60° to 0° and to -60°.
10	**Baseline**	Adjusting the baseline is possible in read- and write Mode (up/down in 8 steps).
11	**WMF** (Wall Motion Filter)	Used to eliminate Doppler “noise” that is caused by vessel wall motion.
12	**PRF**	The Velocity Range display is governed by the pulse repetition frequency (PRF) Exceeding the maximum PRF, the HPRF-Mode is automatically switched on.
13	*Dyn.Contr.*	Dynamic Range adjusts the display cutoff of the Doppler analysis waveform.
14	*Center Freqeuency*	It serves for selection of the required transmit frequency.
15	*Scale Unit*	To select the displayed measuring system (in relation to the zero-line).
16	*Display Format*	For selection of different rations of display format.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.5 Color Doppler Mode

Note *Different menus are displayed depending on which Color Doppler Mode is selected.*

Note *After pressing the **PD** key on the control console, the **HD-Flow** key (to activate the Bi-Directional Angio Mode) can be seen.*

Figure 4-15 CFM Main and CFM Sub Menu

Table 4-4 Color Doppler Mode (CFM, PD, HD-Flow, TD) Functions

Step	Task	Expected Results
1	Color Box Position and Color Box Size	Adjust the Box- Position resp. Size with the **trackball** in the 2D Single image. The **upper trackball key** changes from Box position to Box size.
2	CFM Gain PD Gain HD-Flow Gain TD Gain	Rotate the **C Mode** key to ensure that continuous flow is displayed, where appropriate. Rotate the **PD Mode** key to adjust the Power Doppler Gain. Rotate the **PD Mode** key to adjust the Bi-Directional Angio Gain. Rotate the **C Mode** key to adjust the Tissue Doppler Gain.
3	*Steering*	Beam Steering is only possible with linear probes in CFM, PD and HD-Flow Mode..

Step	Task	Expected Results
4	*2D+2D/C* (PD, HD-Flow or TD)	Changes the Single image display to two simultaneous half images. The left frame shows only the 2D Mode image. The right frame shows the 2D Mode image with color information.
5	*Invert*	The color of the color wedge inverts around the baseline. (impossible in PD Mode)
6	Zoom	Image magnification (PAN-Zoom) in read- and write mode.
7	Quality	Improves the Color Resolution by reducing the image frame rate, respectively vice versa.
8	WMF (Wall Motion Filter)	Used to eliminate Doppler “noise” that is caused by vessel wall or cardiac wall motion. (CFM,PD, HD-Flow)
9	PRF	By touching toward up the PRF increases. By touching toward the PRF decreases.
10	Threshold	After Freeze you can adjust the Color Threshold. It eliminates small color noise or motion artifact signals in the color image. (small number cuts off less signals than a higher setting)
11	*Displ.Mode*	To select the CFM- Display Mode (V; V-T; V-Pow; Pow-T; or T).
12	*Smooth*	To select different filter periods for rising velocity and falling velocity. *Rise* Filtering of the rise velocity leads to noise suppression. *Fall* This filter leads for “prolongation” of the display flow.
13	*Frequ.*	It serves for selection of the Transmit Frequency which also depends on the Color Box position.
14	*Ensemble*	Controls the number of pulses to constitute one Color-, Power-Doppler or HD-Flow line in the display.
15	*Flow Res.*	This function controls the axial resolution of color in the display. It adjusts the axial sample depth of color pixels.
16	*Line Dens.*	Determines the line density within the Color-Box. The lower the line density, the larger the line distance and the size of the color pixels.
17	*Scale* (CFM, HD-Flow, TD)	The maximum velocities are displayed above and under the color scale in kHz, cm/s or m/s.
18	*CFM Map* (PD, HD-Flow, TD)	To select the color coding for an optimization of the display of blood flow (similar to the post-processing curves with grayscale 2D scans). After a selection has been made, the color bar displays the resultant map.
19	*Gently Color*	Gently means the transition between color and gray scale information. The embedding of the color into 2D Mode is performed smoothly with less colored splashes. To activate the “Gently Color” function, touch the *CFM Map* (PD, HD-Flow, TD) key in the Sub menu.
20	*Balance*	The Balance controls the amount of Color display over bright echoes and helps to confine color within the vessel walls.
21	*Artifact* (on/off)	Switch on/off the artifact suppression.
22	*Baseline*	The baseline shift can be used to prevent aliasing in one flow direction similar to the Doppler baseline shift. (Impossible in PD Mode.)
23	*Line F.*	With “Line Filter” the signals of the neighboring pulses are less weighted for the display of the actual pulse which considerably improves the detail lateral resolution and signal-to-noise ratio.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.6 Volume Mode

Note *4D Real Time 4D, RT_4D_Biopsy, VOCAL II, etc. are Options. If options are not part of the system configuration, checks can be omitted.*

Note *Different menus are displayed depending on which Touch Panel menu and which Volume Mode is selected.*

Note *Some function keys only appear on the Touch Panel if they are available for the selected probe.*

4.3.6.1 Pre-Volume Mode Functions

1. Press the **3D** or **4D** key to select the desired Volume Mode.

The Volume Mode function is switched on, the “3D Pre” respectively “4D Pre” menu appears on the screen (write mode) and the volume box appears on the Image area.

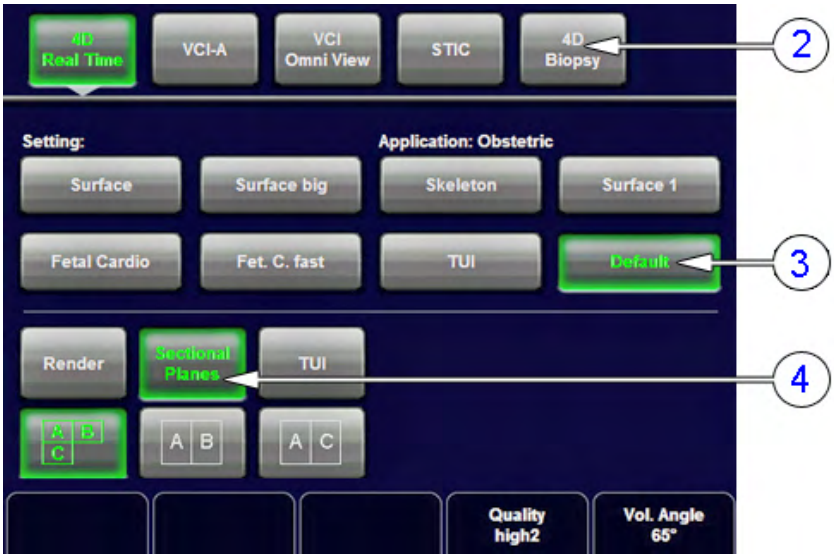


Figure 4-16 Pre-Volume Mode menu (e.g., 4D Real Time)

2. Select the Acquisition Mode **(2)**.
3. Select an User Setting **(3)**.
4. Select the desired Visualization Mode **(4)**.
5. Start the Volume Acquisition with the **Freeze** key resp. the **right trackball key**.

Table 4-5 Pre-Volume Mode Functions

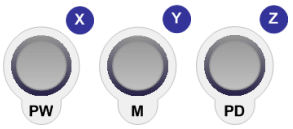
Step	Task	Expected Results
1	ACQUISITION:	
	3D Static	3D Volume Mode - Static volume acquisition (also in combination with PD, HD-Flow or CFM)
	4D Real Time	Real Time 4D - continuous volume acquisition and parallel calculation of 3D rendered images
	VCI A	Volume Contrast Imaging - improves the contrast resolution and the signal / noise ratio and therefore facilitates finding of diffuse lesions in organs
	VCI Omni View	Volume Contrast Imaging Omni View (any plane) - improves the contrast resolution and the signal / noise ratio and therefore facilitates finding of diffuse lesions in organs. Volumes can be edited in all other Visualization Modes.
	STIC	The fetal heart or an artery can be visualized in 4D (also in combination with PD, HD-Flow or CFM)

Step	Task	Expected Results
	4D Biopsy	Real Time 4D Biopsy - continuous volume acquisition + parallel calculation of 3D rendered images
2	**Quality**	Changes the line density against the acquisition speed (low, mid1, mid2, high1, high2).
3	**Vol.Angle**	To select the Volume Sweep Angle.
4	Screen Format 	- Quarter size display of Sectional planes - Quarter size display of Sectional planes + rendered 3D image Note: The display depends on selected Acquisition- and Visualization Mode!
5		Dual size display of Sectional planes + rendered 3D image Note: The display depends on selected Acquisition- and Visualization Mode! Note: This format is not possible for Static 3D Acquisition.
6		- Full size display of a reference image **or** - Full size display of the rendered 3D image Note: The display depends on selected Acquisition- and Visualization Mode!
7	Volume Box Position and Volume Box Size	Adjust the Volume Box (ROI) Position resp. Size with the **Trackball** in the 2D Single image. The **upper trackball key** to change the Trackball function from Box Position to Box Size.
8	Start Acquisition	Press the **Freeze** key resp. the **right trackball key** to start the Volume acquisition.
9	**VISUALIZATION:**	After resp. during Volume Mode Acquisition:
	Render	After the 3D acquisition the system switches automatically to the read menu. The selected format will be present on the monitor (e.g., 3D ROI Mode: sectional planes A, B, C + rendered 3D image).
	Sectional Planes	After the 3D Sectional Planes acquisition the system switches automatically to the read menu. The selected format will be present on the monitor (e.g., A,B,C - Sectional Plane mode).
	TUI	This method of visualization is consistent with the way other medical systems such as CT or MRI, present the data to the user (slices through the data set, which are parallel to each other).
	Volume Analysis	The basic idea behind “VOCAL” is the combination of 3D ultrasound tissue (presented as voxels) and the geometric information of surfaces in a 3D data set. After definition of contour in 3D space (semi-automatically, manually or spherical) a wide range of functionality is given.
	SonoVCAD Heart	Technology that automatically generates a number of views of the fetal heart. At this time it can help to find the right and left outflow tract of the heart and the fetal stomach.
	SonoVCAD labor	Allows to measure fetal progression during the second stage of labor – fetal head progression, rotation and direction. Visual evidence and objective data of the labor process are provided.
	SonoAVC General	This Feature can automatically detect low echogenic objects (e.g., follicles) in a volume of an organ (e.g., ovary) and analyze their shape and volume.
	Niche	Parts of the orthogonal sections A, B and C are compiled to a 3D-section aspect. The name “Niche” has been chosen because the aspect shows a quasi spatial cut into the reference image.

4.3.6.2 Functions after the Acquisition

Figure 4-17 Sectional Planes and Image Rendering

Table 4-6 Functions after the 3D Acquisition

Step	Task	Expected Results
1		**PW Mode** rotary control: Rotation about X-axis of the reference image. **M Mode** rotary control: Rotation about the Y-axis of the reference image. **PD Mode** rotary control: Rotation about the Z-axis of the reference image.
2		**C Mode** rotary control: Movement along Z-axis of the reference image. **Trackball**: Movement along X- and Y-axis of the reference image.
3	*Niche*	Parts of the orthogonal sections A, B and C are compiled to a 3D-section aspect. The aspect shows a quasi spatial cut into the reference image.
4	*Ref. Image*	To select the Reference image among A, B, C or 3D.
5	*Init*	Resets rotations and translations of a volume section to the initial (start) position.
6	*3D Init*	Resets the 3D image to the initial (start) position.
7	*SRI / SRI 3D*	Speckle Reduction Imaging (SRI) to reduce speckle which interferes with the sectional planes or rendered 3D image. ***SRI*** information.
8	*3D Orientation*	To change the image orientation of the 3D image..
9	**Zoom**	The 3D image as well as the sectional planes can be varied by their aspect ratio.
10	**Mix**	To adjust the mix ratio between two calculated modes.
11	**TH. low**	All color values below the level will be disregarded for calculation of the surface.
12	*Magi Cut*	Ability to electronically manipulate the images and cut way “3D artifacts”.
13	*Render Mode*	To select the Render Mode (Image Type and Render Algorithm)

4.3.6.3 3D/4D Sub Menu

Figure 4-18 3D/4D Sub Menu

Table 4-7 Sub Menus

Step	Task	Expected Results
1	*Probe Orientation*	Adjust and activate the display of direction markers at border of the image.
2	*Gray/Tint Maps*	Depending on individual requirements a “harder” or “softer” image can be obtained.
3	*Render View Direction*	To select the desired Render View Direction. The green line symbolizes the direction of the view. Note: The Render View Direction keys are not available in Static 3D Sectional Planes.
4	*3D/4D Info*	On/Off switch to show full or reduced Image Info parameter on screen.
5	*3D Color Off*	On/Off switch to show an acquired 3D+CFM, 3D+PD or 3D+HD-Flow image with or without the color information.
6	Gray 3D	Adjusts the contrast and brightness of the rendered 3D image.
7	Background	Adjusts the contrast of the screen background from dark to bright. Note: This key is not available in Static 3D Sectional Planes mode.
8	Balance	Note: Only available if a 3D+CFM, a 3D+PD or a 3D+HD-Flow image is acquired.
9	Power Tresh.	This function eliminates low color noise of motion artifact signals in the sectional slices as well as in the rendered 3D image. Note: Only available if a 3D+CFM, a 3D+PD or a 3D+HD-Flow image is acquired.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.7 Using Cine

4.3.7.1 Activating Cine

Press **Freeze**, then roll the **Trackball** to display the images of the stored sequence one by one.

4.3.7.2 Cine-Split Function (Multiple Format)

After **Freeze** of a sequence in 2D Mode, two or four different images of the sequence can be displayed simultaneously in Dual respectively Quad display mode.

Move the **Trackball** to display the images of the stored sequence. Use the **Format** keys to change to the next (part of) frozen 2D image sequence to play back the cine memory.

Note *The Cine-Split function (multiple format) is also possible in 2D Auto Cine mode.*

4.3.7.3 Activating 2D Auto Cine

1. After Freeze touch the *2D Cine* key on the Touch Panel.
2. Select the **Start Image** of the sequence. The selected image is simultaneously displayed.
3. Turn the **End Image** digipot to the end of the sequence. The selected image is displayed.
4. Select the review **Speed** and the read **Zoom** factor.
5. Select the Cine Mode review direction.
6. To start/stop the Cine Loop playback touch *2D Cine Start/Stop*.

After stopping the sequence, move the **Trackball** to display the images one by one.

4.3.7.4 Spectral Doppler- or M-Cine Loop

Press **Freeze**, then roll the **Trackball** to display the Cine / Loop one by one.

The **upper Trackball key** changes from 2D Cine to D Loop (respectively M Loop).

Note *The active Cine is displayed on the monitor screen: **2D**/D(M)-image or 2D/**D(M)-image**.*

4.3.7.5 Activating 3D Rotation Cine

1. After 3D Volume acquisition touch the *3D Rot. Cine* key on the Touch Panel.
2. Select the rotation angle with the touch keys or select it manually by means of the **Start Image** and **End Image** rotation controls.
3. Select the Step angle and the Rotation axis.
4. Touch the *Calculate Cine Sequence* key to start the calculation.
5. To start/stop the 3D Rotation Cine sequence touch *Start/Stop*.

4.3.7.6 Activating Volume Cine

After Real Time 4D acquisition move the **Trackball** horizontally to display the Volumes of the stored sequence one by one. (Alternative use the **Vol Cine #** control to select the desired volume.)

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.7.7 Activating Auto Cine

1. After Real Time 4D acquisition touch the *Auto Cine* key on the Touch Panel.
2. Select the **Start Volume** and the **End Volume** of the sequence with the rotary controls.
3. Select the Cine Mode direction and the review **Speed**.
4. To start/stop the Cine sequence touch the *Start/Stop* key.

Note *After stopping a sequence, move the **Trackball** to display the images / volumes one by one.*

4.3.7.8 Activating Cine Calc

1. After 3D Volume or Real Time 4D acquisition touch the *Cine Calc* key on the Touch Panel.
2. Choose desired Cine Calc display mode.
3. Select Step Size and Reference image.
4. Select the **Start Image** and the **End Image** of the sequence with the rotary controls.
5. Touch the *Calculate Cine Sequence* key to start the calculation.
6. To start/stop the Cine sequence touch the *Start/Stop* key.

4.3.8 Generic Measurements

Different menus are displayed depending on:

- the currently selected Application,
- the selected Display Mode,
- the selected “Study”,
- and the settings in the Measure Setup - ***Measure & Calc*** page.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

General remarks to perform Generic Measurements:

- By pressing the **Caliper** key on the control console the Generic Measurement function is switched on.
- Positioning of measurement marks is done with the **Trackball**.
- Entering and storage of measuring marks is done with **Set** (right or left trackball key).
- To change measuring marks before completion press **Change** (upper trackball key).
- Depending on the setting in the Measure Setup, also the **Freeze** key can be used for confirming the last measuring mark of the currently performed measurement.
- The status bar area shows the current function of the trackball.
- To cancel the measurement of the currently selected item, touch ***Cancel*** on the Touch Panel.
- To delete all measurement results of the selected “Study” from the monitor as well as from the corresponding Worksheet, touch the ***Clear Study*** key on the Touch Panel.
- All measurement results will be automatically included in the “Generic” patient worksheet.
- To erase measurement results from the screen, press the **Clear** key on the control panel or press the **Del** key on the keyboard.
- To exit from Generic measurements touch the Exit key on the Touch Panel, press the **Caliper** key or the **Exit** key on the control console.

Note *The following instructions assume that you first scan the patient and then press **Freeze**.*

4.3.8.1 Distance and Tissue Depth Measurements (2D and M-Mode)

1. Press the **Caliper** key and then touch ***Generic Dist.*** on the Touch Panel.
2. Touch the appropriate item on the Touch Panel. An active cursor appears.
3. To position the active cursor at the start point (distance) or the most anterior point (tissue depth), move the **Trackball**.
4. To fix the start point, press **Set** (the right or left trackball key). The system fixes the first cursor and displays a second active caliper.
5. To position the second active caliper at the end point (distance) or the most posterior point (tissue depth), move the **Trackball**.
6. To complete the measurement, press **Set**. The system displays the distance or tissue depth value in the measurement results window.

Before you complete a measurement:

- To toggle between active calipers, or to re-adjust the traced line, press the upper trackball key.
- To erase results, touch the ***Delete*** key on the Touch Panel, press the **Clear all** key on the control console or the **Delete Meas.** key on the keyboard.

Note *To alternate the control from one cursor to the other, press **Change** (the upper trackball key).*

*To re-adjust a traced line, press **Undo** (the upper trackball key) repeatedly.*

Note *To exit Generic measurements, touch the **Exit** key on the Touch Panel, press the **Caliper** key or the **Exit** key on the control console.*

4.3.8.2 Circumference/Area Measurements

1. Press the **Caliper** key and then touch ***Generic Area*** on the Touch Panel.
2. Touch the appropriate item on the Touch Panel. An active cursor appears.
3. To position the active cursor, move the **Trackball**.
4. To fix the start point, press **Set** (the right or left trackball key). The system fixes the first cursor and displays a second active caliper.
5. To position the second caliper, move the Trackball and press **Set** (right/left trackball key).

Note *If you have selected a "trace" item, the measurement is finished and the area and circumference results appear on the screen.*

6. An ellipse appears the axis of which is defined by these two points. To adjust the width of the ellipse, move the **Trackball**
7. To toggle between calipers, or to readjust a traced line, press the upper trackball key.
8. To complete the measurement, press **Set** (right or left trackball key). The system displays the circumference and area in the measurement results area.

Before you complete a measurement:

- To erase the ellipse resp. trace and the current data measured, touch ***Delete*** once. The original caliper is displayed to restart the measurement.
- To exit the measurement function without completing the measurement, touch ***Exit*** on the Touch Panel, press the **Caliper** key again or press **Exit** on the control console.

4.3.8.3 Volume Measurements

1. Press the **Caliper** key and then touch ***Generic Volume*** on the Touch Panel.
2. Touch the appropriate item.
3. Perform the measurement(s) using the **Trackball** and **Set** (right or left trackball key).

   For further details see: *"Distance and Tissue Depth Measurements (2D and M-Mode)" on page 4-22* and *"Circumference/Area Measurements" on page 4-23* .

4.3.8.3.1 Multiplane Measurements

Note *This volume measurement is only possible in 3D Mode.*

1. Select the reference image in which the measurement is to be performed (A, B or C).
2. Press the **Caliper** key and then touch ***Multiplane*** on the Touch Panel.
3. Select the first section through the body by rotating the **Ref.Slice** digipot below the Touch Panel or by rotating the ***C Mode*** digipot. (first section should be set at the edge of the object).
4. Position the start dot of the area which should be surrounded and store it with **Set**.
5. Surround the area with the trackball, then press **Set** (right or left trackball key). The area is calculated and displayed. It may even be "zero". Press the **Set** key twice.
6. Select the next parallel section with the **Ref.Slice** digipot or the **C Mode** digipot, and measure the area.
7. Repeat 5. and 6. until the edge of the measured object is reached.

Note *The contour of the measured area is not erased if a new section is adjusted. To call back the measured areas touch the **Prev.** respectively the **Next** key on the Touch Panel.*

Note *To erase the results, touch the **Init** key on the Touch Panel.*

4.3.8.4 Measurements in Spectral Doppler Mode

Note *The Spectral Doppler image is displayed based on time (X-axis) and velocity (Y-axis).*

4.3.8.4.1 Auto Trace

1. Press the **Caliper** key.
2. Touch ***Auto Trace*** on the Touch Panel. It traces the Spectral Doppler image automatically and displays the results (according to the Measure Setup).
3. Select the **Sensitivity** of the envelope curve (to eliminate artifacts).
4. Select the **Trace Mode** channel of the envelope curve (upper, both, lower).
5. If necessary, select the Angle and the Baseline.
6. Press **Set** (right/left trackball key) to finish the measurement.

Before you complete a measurement:

- To readjust the start cycle (vertical yellow line), press **Change** (upper trackball key). Press **Set** (right/left trackball key) to fix the line.
- Press the **Change** key again to readjust the end cycle (vertical green line). Press **Set** to fix the line.

Caution
The determination of the envelope curve requires a clear and low-noise record of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!

4.3.8.4.2 Manual Trace

1. Press the **Caliper** key.
2. Touch ***Manual Trace*** on the Touch Panel. A cursor appears on the screen.
3. Move the cursor with the **Trackball** to the start point of the measurement and press **Set** (right or left trackball key) to fix the marker.
4. Trace to the end of the period and press the **Set** key again to fix the mark. The measurement results appear on the screen.

Before you complete a measurement:

- To readjust the traced line, press **Undo** (upper trackball key) repeatedly.

4.3.8.4.3 Heart Rate

1. Press the **Caliper** key.
2. Touch ***HR*** on the Touch Panel. A line appears on the screen.
3. Move the line with the **Trackball** to the start point of the period and press **Set** (right/left trackball key). A second line appears.
4. Move the second line to the end point of the period.
5. Select the number of “HR cycles” for the measurement with the digipot below the Touch Panel.
6. Press **Set** (right/left trackball key) again to fix the line. The heart rate is displayed.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

4.3.9 Calculations

The Voluson E-Series system supports calculation packages and application-oriented patient Worksheets (Reports) for following applications:

- Abdomen Calculations
- Small Parts Calculations
- Obstetric Calculations
- Cardiology Calculations
- Urology Calculations
- Vascular Calculations
- Gynecology Calculations
- Pediatric Calculations
- Neurology Calculations
- Orthopedics Calculations

Note *Confirm that the patient information is correct and the probe and application are selected properly.*

Different menus are displayed depending on:

• the currently selected Application,

• the selected Display Mode,

• the selected “Study”,

• and the settings in the Measure Setup - ***Measure & Calc*** page.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

General remarks to perform Calculations:

- By pressing the **Calc** key on the control console the Calculation function is switched on.
- Positioning of measurement marks is done with the **Trackball**.
- Entering and storage of measuring marks is done with **Set** (right or left trackball key).
- To change measuring marks before completion press **Change** (upper trackball key).
- Depending on the setting in the Measure Setup, also the **Freeze** key can be used for confirming the last measuring mark of the currently performed measurement.
- The status bar area shows the current function of the trackball.
- To cancel the measurement of the currently selected item, touch ***Cancel*** on the Touch Panel.
- To delete the results of the last measured item, touch ***Delete Last*** on the Touch Panel.
- To delete all measurement results of the selected “Study” from the monitor as well as from the corresponding Worksheet, touch the ***Clear Study*** key on the Touch Panel.
- All measurement results will be automatically included in the corresponding patient worksheet.
- To erase measurement results from the screen, press the **Clear** key on the control console or press the **Del** key on the keyboard.
- To exit from Calculations touch the Exit key on the Touch Panel, press the **Calc** key or the **Exit** key on the control console.

4.3.9.1 Worksheet (Report) Pages

Press the **Report** key on the control console to view the “application dependent” patient worksheet pages that contain the results of calculations and measurements. Any stored patient worksheet can be edited, printed, transferred, saved in the Archive or sent to DICOM server.

4.3.10 Probe/Connectors Usage

4.3.10.1 Connecting a probe

1. Place the probe's carrying case on a stable surface and open the case.
2. Carefully remove the probe and unwrap the probe cable.
3. DO NOT allow the probe head to hang free. Impact to the probe head could result in irreparable damage.
4. Turn the connector locking handle counterclockwise.
5. Align the connector with the probe port and carefully push into place.
6. Turn the connector locking handle clockwise to secure the probe connector.
7. Open the side door, lay the cable into the intended cable holders and close the door. So it is free to move, but not resting on the floor.

4.3.10.2 Activating a probe

1. Press the **Probe** key to activate the “Probe Select” menu.
2. Select the appropriate probe by touching the corresponding key.
3. Upon selection of an “Application”, the programmed user presets appear.
4. Touching a “Setting” key causes loading of the preset.

The probe is initialized, the Touch Panel shows the main menu (2D mode) and the ultrasound image appears on the monitor in write mode (real time display).

4.3.10.3 Deactivating a probe

When deactivating the probe, the probe is automatically placed in standby mode (read mode).

1. Press the **Freeze** key.
2. Gently wipe the excess gel from the face of the probe. (Refer to the Basic User Manual of Voluson E-Series for complete cleaning instructions.)
3. Carefully slide the probe around the side of the keyboard, toward the probe holder. Ensure that the probe is placed gently in the probe holder.

4.3.10.4 Disconnecting a probe

Prior to disconnect a probe freeze the image. It is not necessary to switch the system off.

1. Press the **Freeze** key.
2. Gently wipe the excess gel from the face of the probe. (Refer to the Basic User Manual of Voluson E-Series for complete cleaning instructions.)
3. Carefully slide the probe around the side of the keyboard, toward the probe holder. Ensure that the probe is placed gently in the probe holder.

4.3.11 Patient Archive (Image Management)

The Voluson E-Series provides an Patient/Image Management System that allows fast and extremely easy patient, exam and image management.

Current Patient:

The entered patient data will be used in calculations, patient worksheets, DICOM settings and is displayed on the screen to identify images.

Archive:

The patient archive database is used for searching a particular exam and/or patient. Via the ***Data Transfer*** button, it is possible to send images over the DICOM network, print exams/images, export exams/images, import exams/images, etc.

Image History:

Image History gives you access to all the US pictures and exams of a particular patient.

Exam Review:

Exam Review allows you to view all exams of a particular patient. Additionally it is possible to view image properties, input comments and voice annotations, etc.

Note *For further details refer to the Voluson E-Series Basic User Manual.*

Note *Images can also be backed up and restored by means of the* ***Image Archive*** *function in the System Setup. Operation see* *Section 4.4.6 on page 4-39* .

4.3.12 Erasing DVD/CD

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Connectivity*** and then click the ***Drives*** tab.

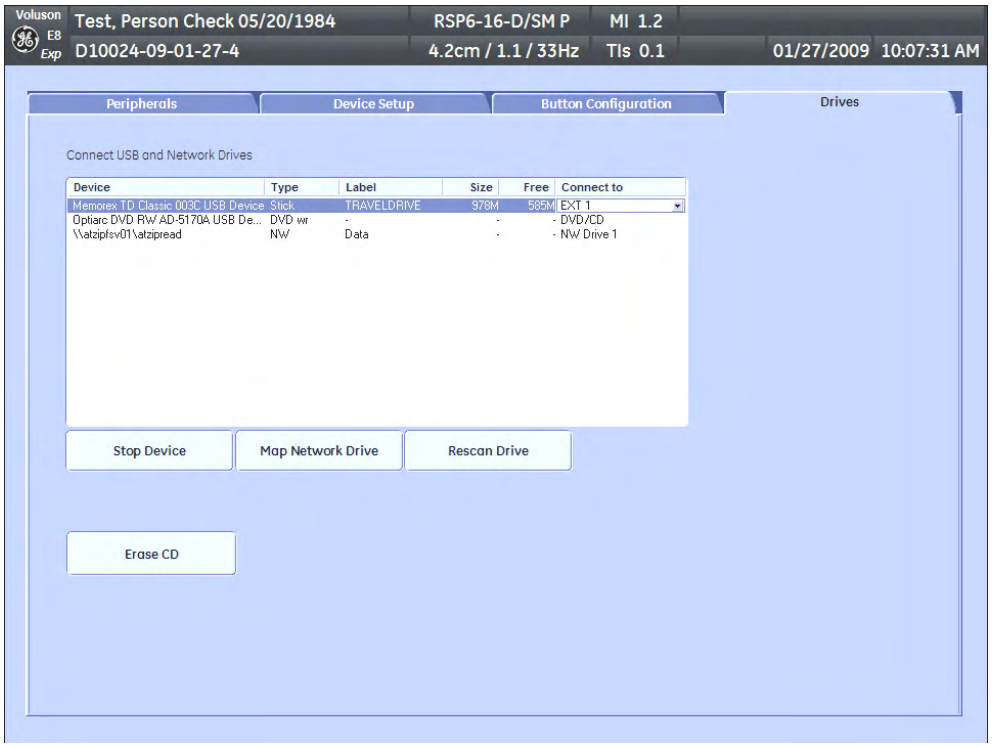


Figure 4-19 System Setup - Connectivity - DRIVES page

4. Click the ***Erase CD*** button to displays the “Erase DVD/CD” window.

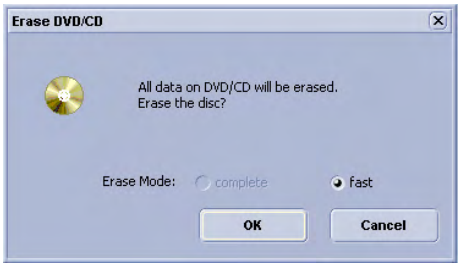


Figure 4-20 Erase DVD/CD Window

5. Select the “Erase Mode”.

Note *It is highly recommended to use the complete erase mode, to avoid problems with the CD+(R)W! When using a DVD+R/RW, the complete erase mode is not possible.*

6. Click the ***OK*** button to start the process.
7. When erasing is finished, select ***Exit*** to return to scan mode.

4.4 Backup and Restore Database, Preset Configurations and Images

Note *It is highly recommended to Backup the Full System Configuration (Section 4.4.3 on page 4-34) and the Image Archive (Section 4.4.6 on page 4-39) once a week.*

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Backup*** and then click the ***System Configuration*** tab.

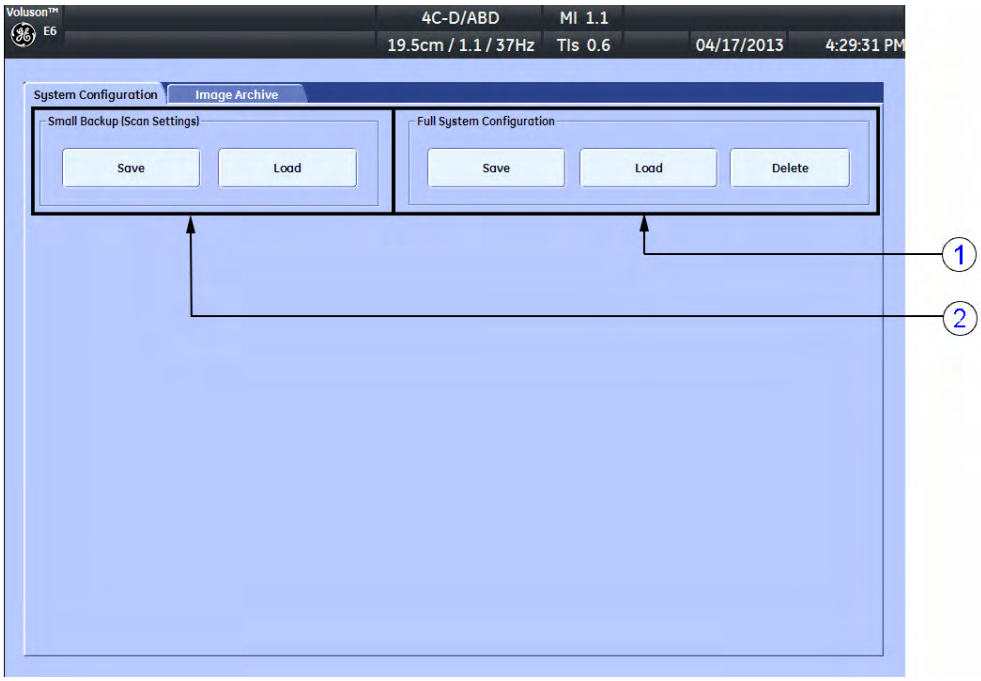


Figure 4-21 System Setup - Backup - SYSTEM CONFIGURATION page

1	Full System Configuration
2	Small Backup (Scan Settings)

The System Configuration page is subdivided in 2 main groups:

1. **Small Backup (Scan Settings)**
   - *"Save Small Backup (Scan Settings)" on page 4-30*
   - *"Load Small Backup (Scan Settings)" on page 4-31*
2. **Full System Configuration**
   - *"Save Full System Configuration (Full Backup)" on page 4-34*
   - *"Load Full System Configuration (Full Backup)" on page 4-36*
   - *"Delete Full System Configuration (Full Backup)" on page 4-38*

Settings and/or Full System Configuration can be saved to the following destinations:

- D: partition of internal hard disk
- DVD/CD+R/RW
- Mapped Network Drive, see: *Section 3.13.3 on page 3-76* .
- Any other drive connected to the system (e.g.; USB-Stick or external hard disk drive)

  Note: This function is only available in the Full Backup utility. For further details review: *Section 3.4.15 "General Remarks and Hints when using external USB-Devices" on page 3-38* .

4.4.1 Save Small Backup (Scan Settings)

The Image/Scan Settings contain:

- Application Settings
- 2D Factory and 2D User Presets
- 3D/4D Factory and 3D/4D User Presets
- Annotation Presets
- Scan Assistant Configuration
- Measure Configuration
- Biopsy Lines

1. Insert a DVD/CD+R/RW into the drive or connect an external USB device.
2. Press the **Utilities** key on the control console.
3. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
4. On the left side of the screen select ***Backup*** and then click the ***System Configuration*** tab.
5. Click the ***Save*** button **(1)** of the "Small Backup (Scan Settings)" group.

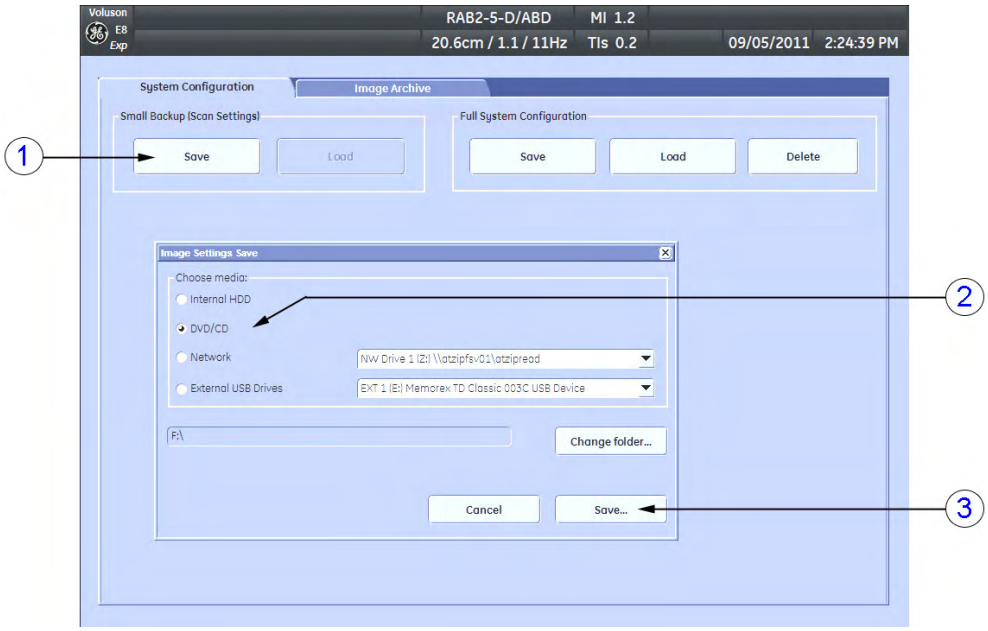


Figure 4-22 Save window

6. Choose the media **(2)** and click the ***Save*** button **(3)**.
7. Select the ***New File...*** key and enter a file name (without extension).
8. Click the ***OK*** key to start the process. When the saving has been completed, click ***OK***.

4.4.2 Load Small Backup (Scan Settings)

The loading procedure overwrites existing image/scan settings on the local hard drive.

Make sure to insert the correct System DVD. Additionally you can load the image settings from “D:\UserSettings\FactoryDefault\V830”.

4.4.2.1 Preparations

1. Insert a DVD/CD+R/RW into the drive or connect an external USB device.
2. Press the **Utilities** key on the control console.
3. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
4. On the left side of the screen select ***Backup*** and then click the ***System Configuration*** tab.
5. Click the ***Load*** button **(1)** of the "Small Backup (Scan Settings)" group.

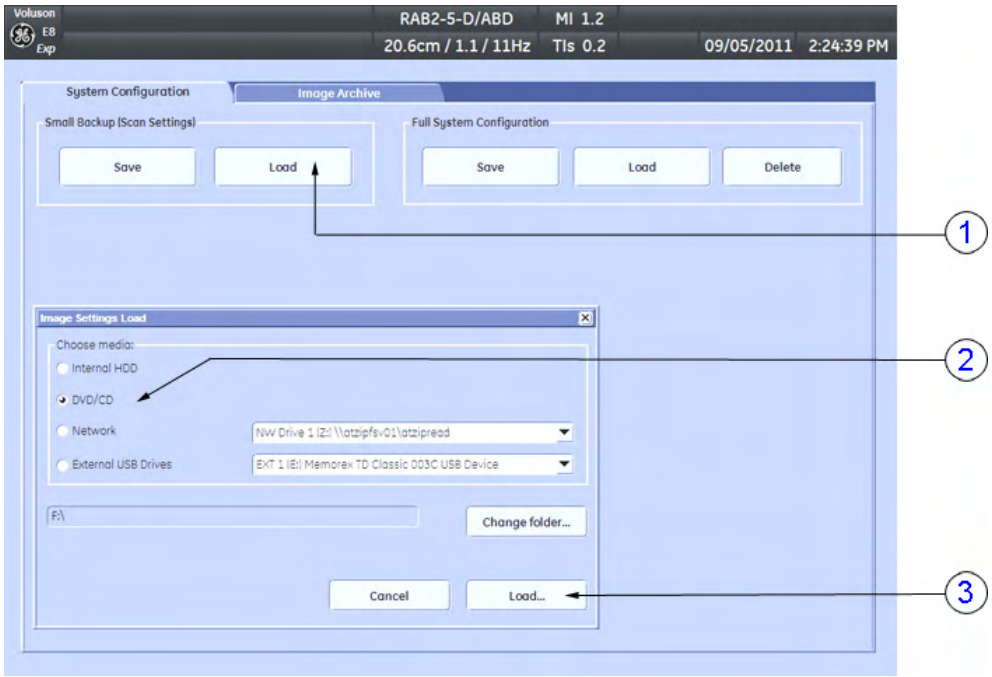


Figure 4-23 Load window

6. Choose the media **(2)** and click the ***Load*** button **(3)**.

Note *If it is desired to load settings from media Internal HDD, click on the **Change folder** button, browse for the folder on “D:\usersettings\FactoryDefault\V830” and then click the **Load** button.*

Two settings are available which slightly differ:

- **General** = for rest of the world
- **USA** = for United States (e.g., image orientation UP/DOWN inverted at transvaginal probes)

7. Select the appropriate file and click ***OK***.
8. Select the desired loading procedure:
   - *"Load "Complete Backup"" on page 4-32*
   - *"Load only parts of the "Complete Backup"" on page 4-33*

4.4.2.2 Load "Complete Backup"

Note *The "Complete Backup" contains factory default settings that are adapted for the installed Application Software version.*

1. Perform *"Preparations" on page 4-31* .
2. Select the "Complete Backup" **(1)** (marked blue; see figure below) and click the ***[>>]*** button **(2)** to copy it into the Load Data field.

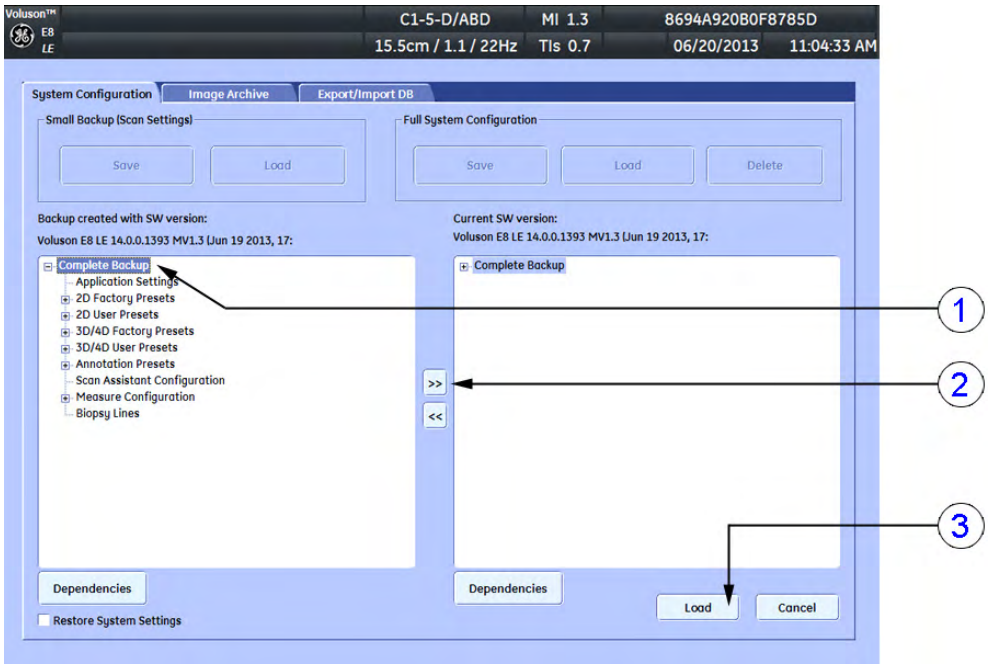


Figure 4-24 Load Backup Data

3. Click the ***Load*** button **(3)** to start the loading procedure of the complete backup into the system.

The US Application Software restarts.

4.4.2.3 Load only parts of the "Complete Backup"

Note *Following procedure should be used, if the user has saved own 2D/3D/4D Presets or Annotation entries, but new settings (presets) have to be added to match the installed Application Software version (e.g., 2D/3D/4D Factory Presets for new probe, etc.).*

1. Perform *"Preparations" on page 4-31* .
2. Click the ***[+]*** sign next to “Complete Backup” **(1)** to open the content tree.

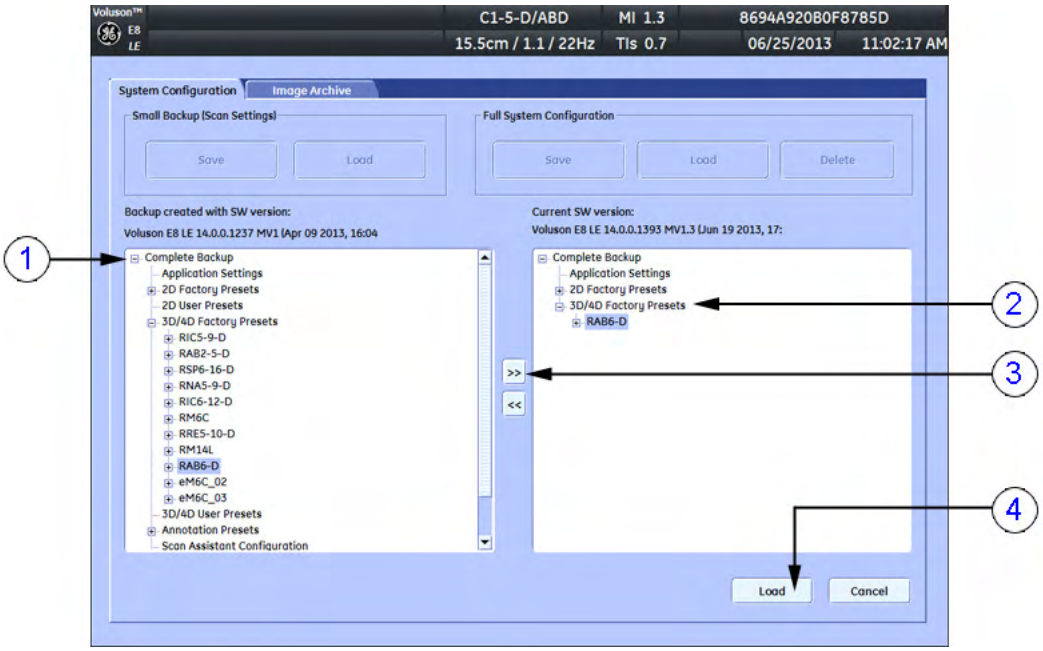


Figure 4-25 Load settings

3. <u>For example:</u> Click the ***[+]*** sign and copy the desired content by clicking the ***[>>]*** button; and so on ....

Note *To return selected items from the “Load Data” field to “Backup Data” field select the **[<<]** button.*

4. Confirm selection with the ***Load*** button **(3)**.

Settings will be loaded and the US Application Software restarts.

4.4.3 Save Full System Configuration (Full Backup)

A backup of the Full System Configuration always contains the following data

- User Settings (databases and files containing User Programs, 2D/3D/4D Presets, gray curves and complete system settings such as language, time/date format, button configuration, etc.)
- Measure Configuration (user specific measure setup settings)
- Patient Archive (database containing patient demographic exam data and measurements) - **no images**
- Options (Permanent Key that is specific for enabled software options and Demo Key)
- Image Transfer Configuration (DICOM configuration e.g., DICOM servers, AE Title, Station Name, etc.)
- Network Configuration (Network settings: IP address, Network Profiles, e-mail configuration, network printer, network drives, computer name)
- Service Platform (state of the Service Software)

Note *It is recommended to "Full Backup" system configuration data before upgrading the software and/or image settings (presets). This ensures that if settings need to be reloaded, will be the same ones the customer was using prior to service.*

1. Press the **Utilities** key on the control console.
2. In the "Utilities" menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Backup*** and then click the ***System Configuration*** tab.
4. Click the ***Save*** button of the "Full System Configuration" group.
5. Choose the destination **(1)**.

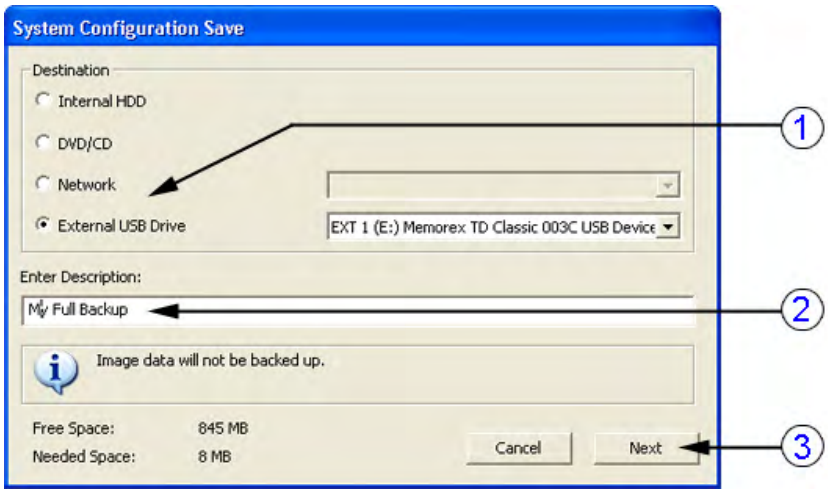


Figure 4-26 System Configuration Save

6. Enter the description of the Full Backup **(2)**.

Note *Image data will not be backed up! To backup the Image Archive, refer to* *Section 4.4.6 on page 4-39* *.*

7. Click the ***Next*** button **(3)**.
8. To start the backup process click ***Yes***.

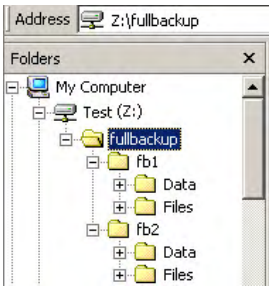
After copying the data, the Voluson E-Series reboots and the application starts again.

When the "Full Backup" is saved on a network drive it may be desirable to move the data (e.g., for backup or maintenance). To map a network drive see *Section 3.13.3 on page 3-76* .

The backups reside in sub folders of the main *"fullbackup"* -folder found at the root of the drive.

For Example: Backups on the mapped **Network Drive** are below path **Z:\fullbackup**.

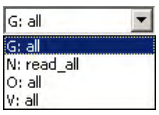
The directory structure of the full backup data is as follows:



The sub folders have the names fb**X** where **X** is a number (e.g., Z:\fullbackup\fb1).

The data resides within a directory structure within these sub folders. It is possible to move the fb**X** sub folders, even leaving gaps in the numeration sequence.

However, **NO** change **MUST** be made to the contents of the fb**X** folders itself, otherwise the backup data cannot be restored!



If the destination „Other drive“ is selected, the available drives (e.g., external USB-memory stick) can be chosen from the pull-down menu.

Note *When the backup is saved to an external USB-device, the system has to be informed about the removal of the hardware. For this purpose every last dialog of "Full Backup Save" and "Full Backup Delete" has a **Stop USB Devices** button.*

Figure 4-27 Please stop USB Devices before unplugging!

For further details see *Section 3.4.15 "General Remarks and Hints when using external USB-Devices" on page 3-38* .

4.4.4 Load Full System Configuration (Full Backup)

Caution
It is recommended to backup data before an upgrade; see *Section 4.4.3 on page 4-34* .

The “Full Backup” loading procedure replaces (overwrites) **ALL** existing data (except Application Settings adapted for the used system software version) on the local hard drive of the Voluson E-Series system!

Note *It is neither required nor advisable to reload a previously stored “Full Backup” after a software upgrade that was performed by means of the FMI from DVD button!*

Note *There are circumstances where it is not possible to load (restore) all the data. The following rules specify these restrictions:*

1. Generally, **only** restoring data from an older to a newer software version is possible. Loading a backup into a system that has a lower software version than the system the backup was created on is prohibited.
2. Options can **only** be restored on the same Voluson E-Series system within the same major software version.
3. When loading a backup into a system with a software version that has a higher major number (13.x.x -> 15.x.x), the following items will not be restored:
   - Options
   - State of the Service Platform
4. The **user is only** allowed to restore data to a different system if and only if the software version on this system is the same as in the backup.
5. The **user is not** allowed to restore the following items to a different system:
   - Windows Network Settings
   - Options
   - DICOM AE Title and DICOM Station Name
   - State of the Service Platform

Operation

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Backup*** and then click the ***System Configuration*** tab.
4. Click the ***Load*** button of the "Full System Configuration" group.
5. Choose the destination **(1)**.

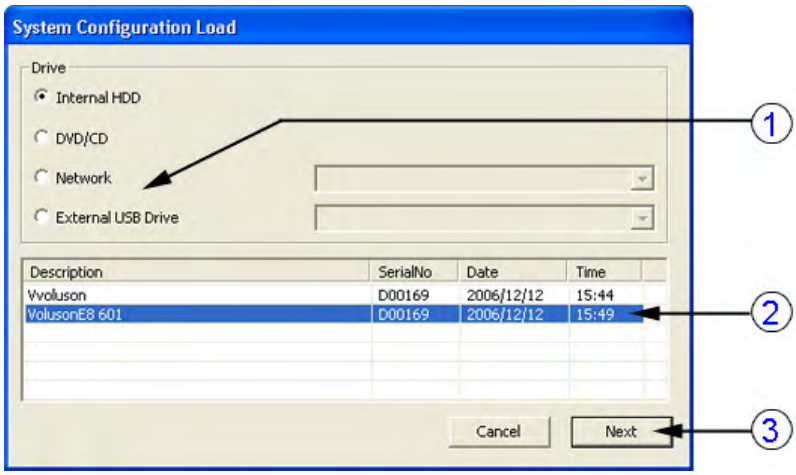


Figure 4-28 System Configuration Load

6. Click on the backup to be restored **(2)**. Additional information is displayed in the table.
7. Select the ***Next*** button **(3)**.

   The following window will be displayed.

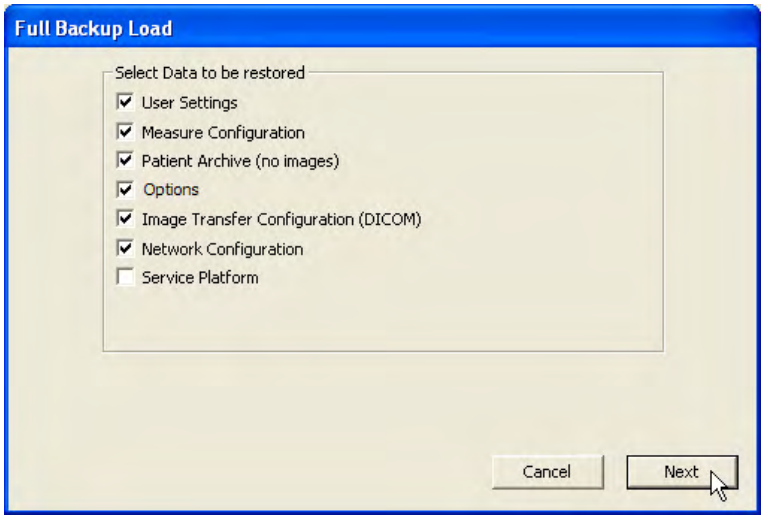


Figure 4-29 Select data to be restored

8. Select the data to be restored to the Voluson E-Series system.

Note *For description of the check box names see* *Section 4.4.3 on page 4-34* .

9. Click the ***Next*** button and then select ***Yes*** to start, or ***No*** to cancel the restore procedure.

Caution
When clicking ***Yes***, the current data on the system will be permanently replaced by the data of the backup and can not be restored!

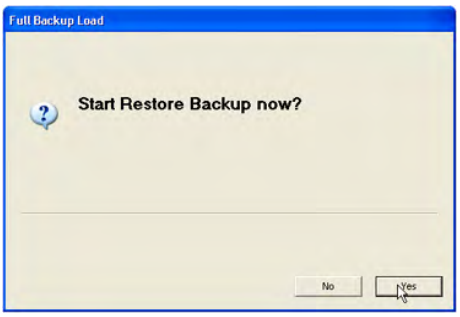


Figure 4-30 Start Restore Backup now?

After restoring the data, the Voluson E-Series reboots and the application starts again.

10. Confirm that the date and time are set correctly.

4.4.5 Delete Full System Configuration (Full Backup)

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Backup*** and then click the ***System Configuration*** tab.
4. Click the ***Delete*** button of the "Full System Configuration" group.
5. Choose the destination **(1)**.

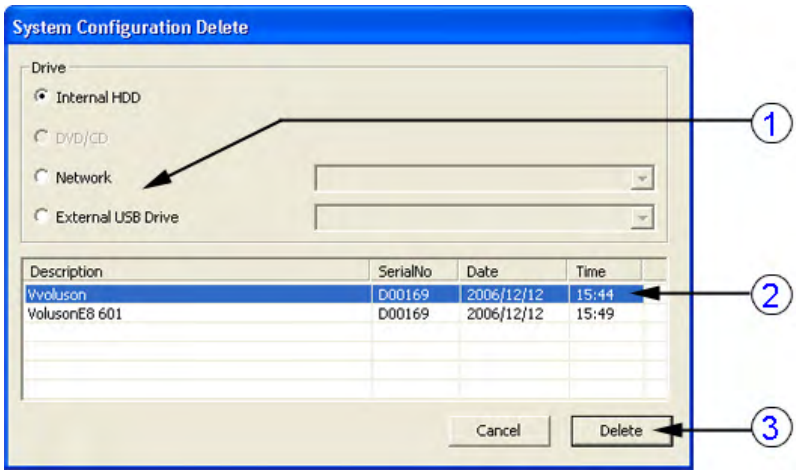


Figure 4-31 System Configuration Delete

6. Click on the backup to be deleted **(2)**. Additional information is displayed in the table.
7. Select the ***Delete*** button **(3)**.

Caution
There is **no "Undo"** function for this action!!!

4.4.6 Archiving Images

Note *It is highly recommended to Backup the Full System Configuration (Section 4.4.3 on page 4-34) and the Image Archive (Section 4.4.6 on page 4-39) once a week.*

4.4.6.1 Save Image Archive

Note *A backup of the Image Archive always contains the Patient Archive (database containing patient demographic data and measurements)* ***+ images*** *of the selected exams.*

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Backup*** and then click the ***Image Archive*** tab.

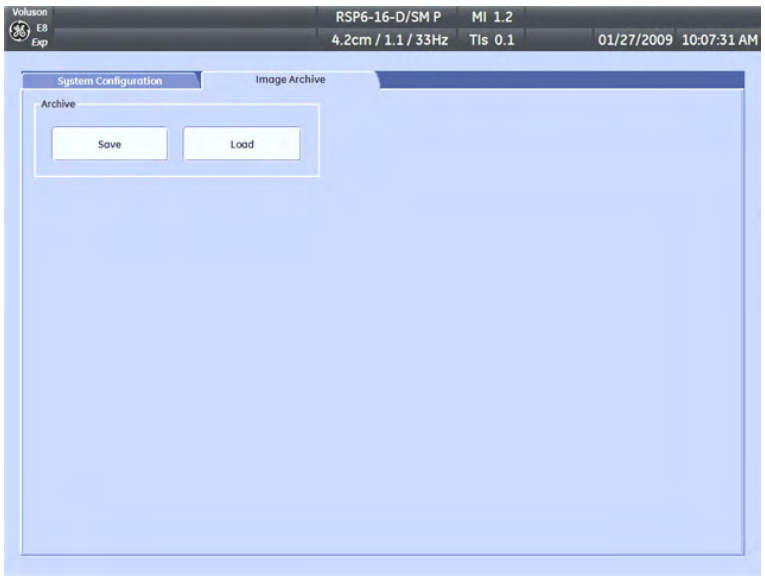


Figure 4-32 System Setup - Backup - IMAGE ARCHIVE page

4. Click the ***Save*** button **(2)**.

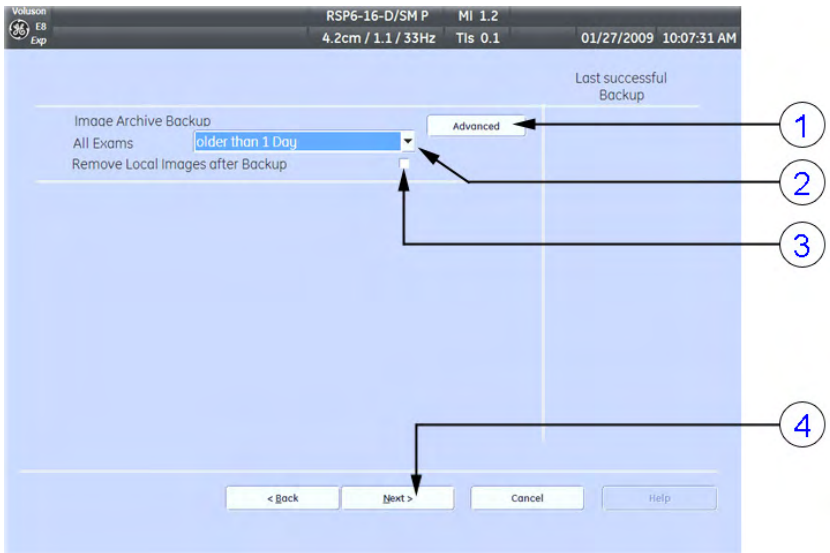


Figure 4-33 Image Archive Save - preparations

5. Choose archiving span time from the pull-down menu **(2)**.

Note *If for example “All images older than”* ***1 Day*** *is chosen (see: Figure 4-33 on page 4-39), images of the current day will not be archived! However, if you click the [Advanced] button you can put this right.*

6. If desired, check mark “Remove Local Images after Backup” **(3)**.
7. Click the ***Advanced*** button **(1)** if it is desired to adapt archive data.

8. Select the ***Next*** button **(4)**.

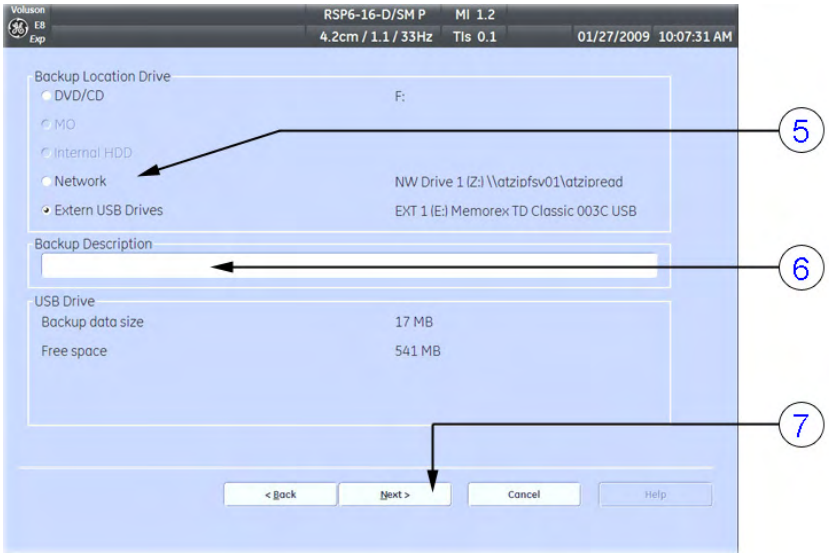


Figure 4-34 Image Archive Save - choose destination

9. Choose the destination **(5)**.
10. Enter the description of the backup **(6)**.

Note *Voluson E-Series presets, configurations and image settings will not be backed up! To Backup the Full System Configuration see* *Section 4.4.3 on page 4-34* .

11. Select the ***Next*** button **(7)**.
12. To start the backup process click ***Yes***.

4.4.6.2 Load Image Archive

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Backup*** and then click the ***Image Archive*** tab.
4. Click the ***Load*** button.

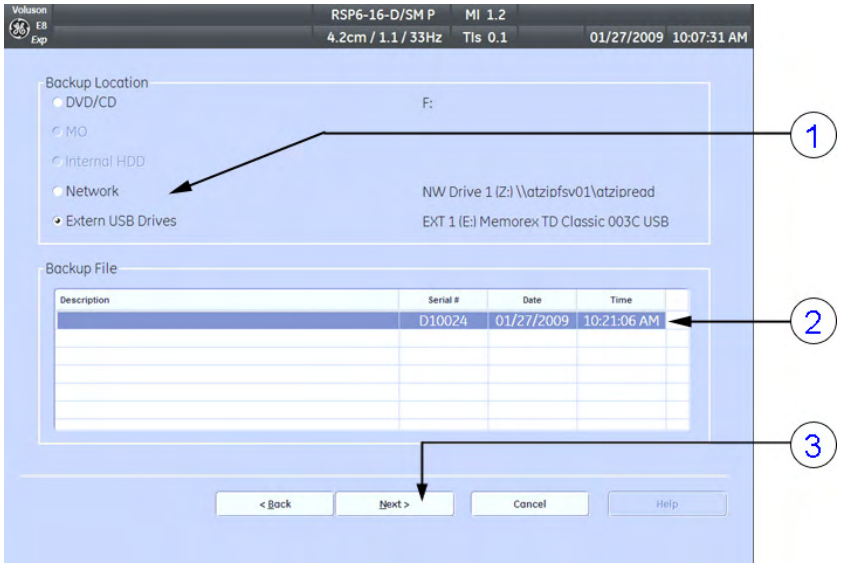


Figure 4-35 Image Archive Load - choose destination

5. Choose the destination **(1)**.
6. Click on the backup to be restored **(2)**. Additional information is displayed in the table.
7. Select the ***Next*** button **(3)**. The following window will be displayed.

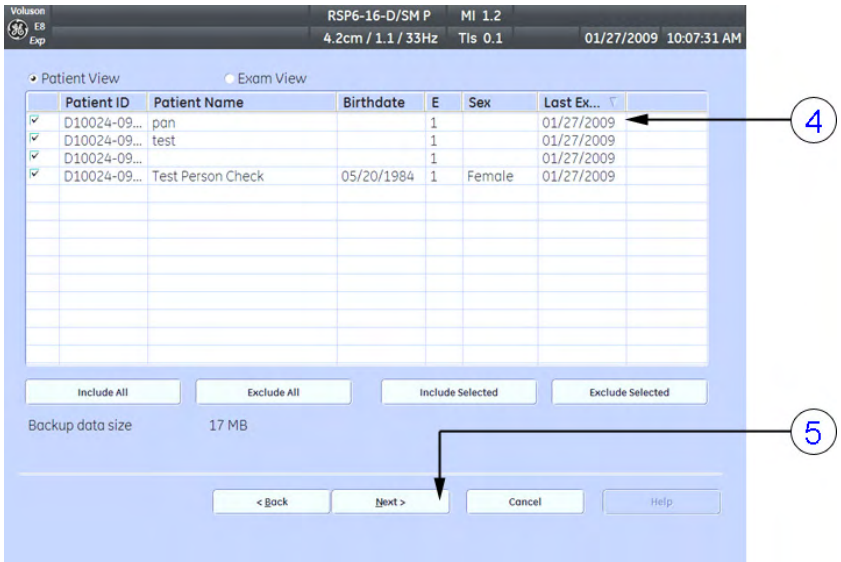


Figure 4-36 select image archive data to be restored

8. Select (check mark) the image archive data to be restored to the Voluson E-Series system **(4)**.
9. Select the ***Next*** button **(5)** and then select ***Yes*** to start, or ***No*** to cancel the restore procedure.

4.5 Software Configuration Checks

4.5.1 System Setup

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select the desired major group.

Each major group contains different pages to check:

Table 4-8 System Setup Checks - GENERAL

Step	Page + Task	Expected Result(s)
1	General: Check Date and Time setting	Date and Time are correct
2	General: Check that Clinic Name is correct	Clinic Name (location) is correct
3	General: Check Language settings	desired Language is displayed
4	General: Check EUM Language settings	desired EUM Language is displayed
5	User Setting: Check all the User Settings	settings assigned as desired by the customer
6	Patient Info Display: Check all settings	settings assigned as desired by the customer
7	Scan Assistant: Check settings	settings assigned as desired by the customer

Table 4-9 System Setup Checks - ADMINISTRATION

Step	Page + Task	Expected Result(s)
1	Options: Check that all options are set up correct	D = Demo , I = Inactive , P = Permanent

Table 4-10 System Setup Checks - CONNECTIVITY

Step	Page + Task	Expected Result(s)
1	Peripherals: Check the Video Norm standard as described in *Section 3.7.1.6 on page 3-60* .	settings assigned as required for the country
2	Peripherals: Check assignment of Report Printer	printer assigned as desired by the customer
3	Peripherals: Check assignment of Footswitch	Footswitch buttons assigned as desired by the customer
4	Device Setup: Check DICOM, Network and Archive configuration	setting assigned as desired and required by the customer
5	Button Configuration: Check assignment of remote keys **P1**, **P2**, **P3** and **P4**.	remote keys are assigned as desired by the customer
6	Button Configuration: Check assignment of ***Start exam*** and ***End exam***	buttons are assigned as desired by the customer

4.5.2 Measure Setup

1. Press the **Utilities** key on the control console.
2. In the"Utilities" menu touch the ***Measure Setup*** button.

The Measure Setup desktop offers 3 different pages to check:

Table 4-11 Measurement Setup Checks

Step	Page + Task	Expected Result(s)
1	Measure & Calc: Check all settings for all applications	setting assigned as desired by the customer
2	Application Parameters: Check all settings for all applications	setting assigned as desired by the customer
3	Global Parameters: Check all settings	setting assigned as desired by the customer

4.6 Peripheral Checks

Check that peripherals work as described below:

Table 4-12 Peripheral Checks

Step	Page + Task	Expected Result(s)
1	Press the **Freeze** key.	Stop image acquisition.
2	Press the remote key (**P1**, **P2**, **P3** or **P4**), which is assigned to the BW printer.	The image displayed on the screen is printed on the Black & White printer.
3	Press the remote key (**P1**, **P2**, **P3** or **P4**), which is assigned to the color printer.	The image displayed on the screen is printed on the Color printer.
4	Press the remote key (**P1**, **P2**, **P3** or **P4**), which is assigned to recorder control.	Recording starts/stops.

Verify basic operations of further auxiliary devices.

4.6.1 ECG Check Out

Connect the ECG preamplifier and check:

Table 4-13 Peripheral Checks

Step	Page + Task	Expected Result(s)
1	Press the **Utilities** key on the control console and then touch the ***ECG*** button to display the “ECG” menu.	It will display a curve along the bottom edge of the image sector.

4.7 Mechanical Function Checks

4.7.1 Control Console Positioning

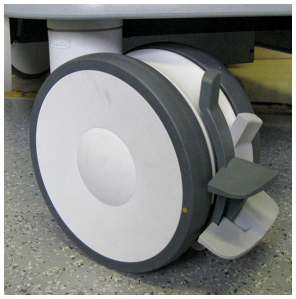
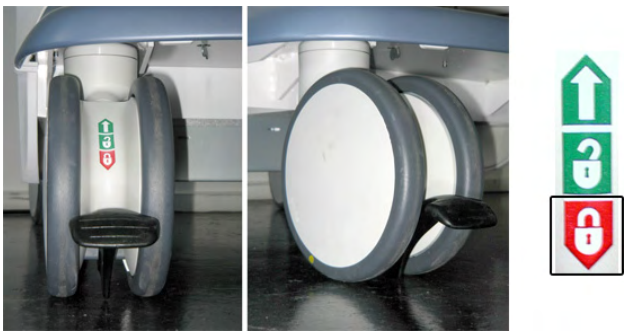
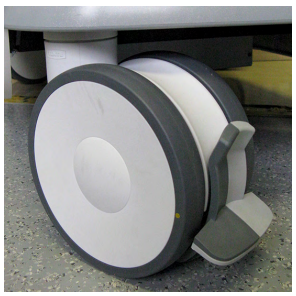
The control console can be rotated, translated and adjusted in height (**electronically** only).

Note *For further details refer to Section 5.10.3 on page 5-37 and/or Section 6.3 on page 6-5 .*

4.7.2 Brakes and Direction (Swivel) Locks

Check the brakes and swivel locks function as described below.

Table 4-14 Brakes and Direction (Swivel) Lock

Step	Task		Expected Result(s)
	Caster "Steinco"	Caster universal "Tente"	
1			swivel lock engaged
2			brakes and swivel lock released
3			brakes and swivel lock engaged (=full lock)

4.8 Site Log

Table 4-15 Voluson E-Series - Site Log (Paper Documentation)

Date	Service Person	Problem	Comments

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Chapter 5

Components and Functions (Theory)

This chapter explains Voluson E-Series system concepts, component arrangement, and subsystem function. It also describes the Power Distribution System (PDS) and probes.

Content in this chapter

5.1 General information

Voluson E-Series is a digital beamforming curved-, linear- and phased array ultrasound imaging system. It has provisions for analog input sources like ECG and Phono. A CW-Doppler probe may also be connected and used.

The system can be used for:

- 2D Mode Imaging and additional Operating Modes (B-Flow, XTD-View, Contrast Imaging, etc.)
- Color Doppler Imaging (CFM, PD, TD and HD-Flow)
- M Mode + MCFM Imaging
- Doppler (PW, CW)
- 3D Mode and Real Time 4D Imaging
- Different combinations of the above modes

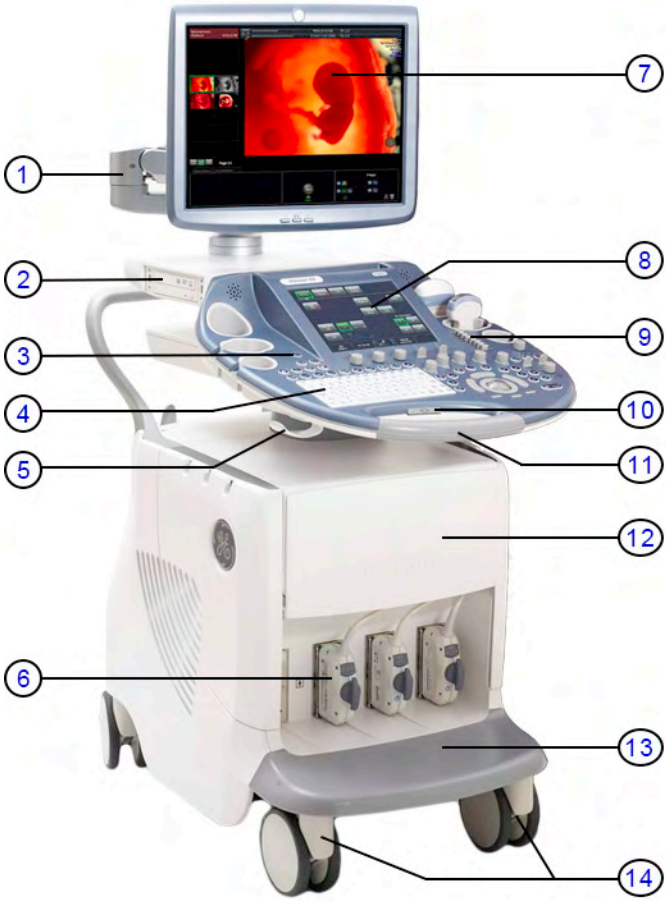


Figure 5-1 Voluson E-Series - Major Components

1	Monitor arm (fully adjustable)	8	Touch Panel display
2	DVD drive	9	TGC - slider controls
3	ON/OFF Standby button	10	button to rotate Control Console
4	Control Console	11	Front handle
5	Probe cable holder	12	Place for peripherals (e.g., ECG, printer,...)
6	Probe connectors incl. CW and probe storage connector (left - not active for scanning)	13	Footrest
7	Monitor 19"	14	Brakes to block front wheels

Among other significant features of the Voluson E-Series ultrasound system are the following:

- Integrated FrontEnd (uses advanced ASIC and FGPA technologies)
- Open connectivity using USB ports
- Bluetooth - wireless connectivity
- high performance 19" LCD color monitor
- Low profile, backlit Keyboard

Voluson E-Series has a digital beam forming system (incorporated in the FrontEnd) which can handle up to 256 element probes by use of multiplexing.

Signal flow from the Probe Connector Panel, to the FrontEnd (FE) Electronics, to the BackEnd Processor (BEP), and finally is displayed on the LCD monitor and peripherals.

Voluson E-Series internal electronics are divided into three:

- FrontEnd (FE)
- BackEnd Processor (BEP)
- Power Supply Unit

Interconnecting signals from FrontEnd, BackEnd, keyboard, monitor, and power distribution sub-systems are routed internally.

Major System Components

- FrontEnd processor: *Section 5.2 on page 5-20*
- BackEnd processor: *Section 5.3 on page 5-22*
- Control Console (User interface); System I/O with hard keys, Touch Panel and EL-Display: *Section 5.5 on page 5-27*
- Monitor: *Section 5.6 on page 5-31*
- External I/O: *Section 5.7 on page 5-32*
- Peripherals: *Section 5.8 on page 5-33*
- Power supply and Isolation transformer for the peripherals, *Section 5.9 on page 5-35*
- System mechanical chassis: trolley to keep all major components, *Section 5.10 on page 5-36*

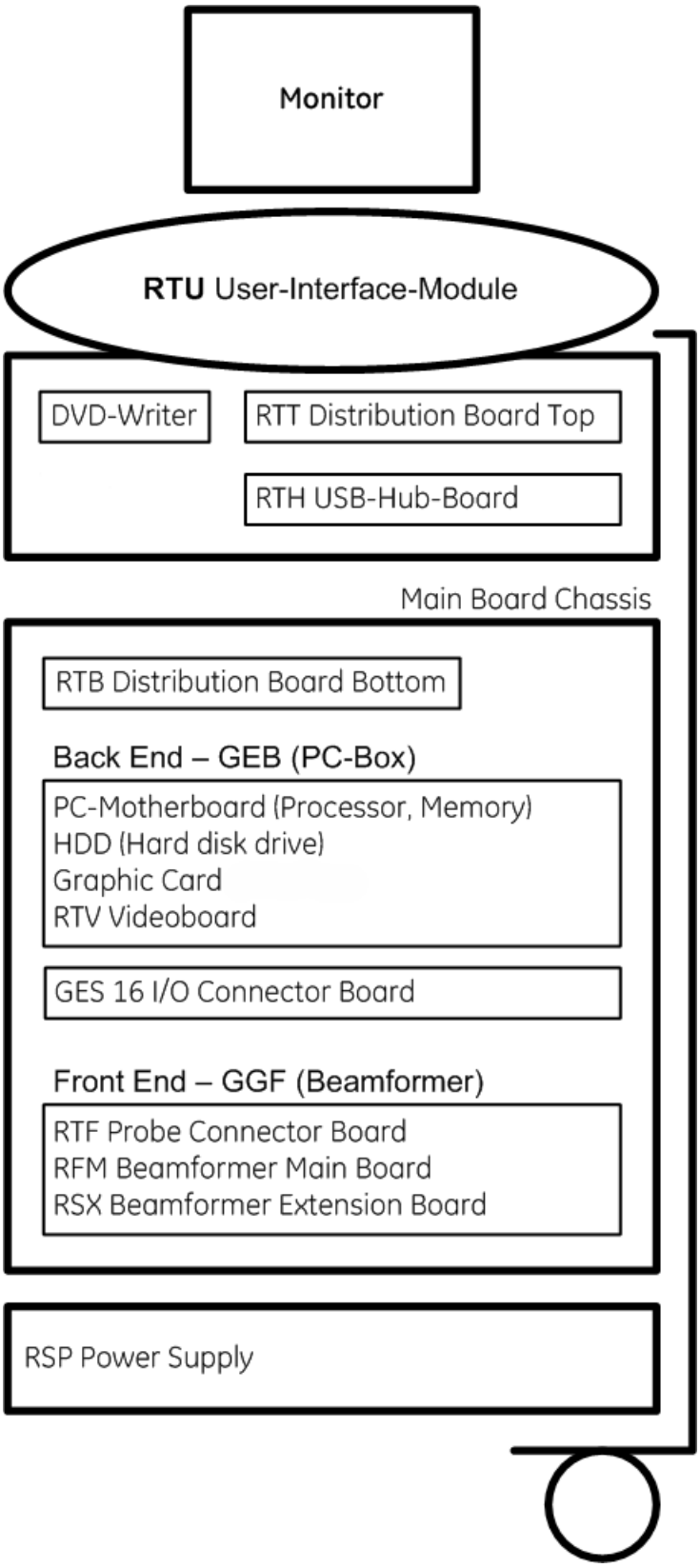


Figure 5-2 Basic Block diagram of Voluson E-Series

The Voluson E-Series used digital beamforming technology which provides high resolution and high penetration performance. It is a general purpose, mobile, software controlled diagnostic ultrasound system. Its function is to acquire ultrasound data and to display the data of different modes gives the operator the ability to measure anatomical structures and offers analysis packages that provide information that is used to make a diagnosis by competent health care professionals.

The Calculation and Report function supports following application packages:

- Abdomen (ABD)
- Obstetrics (OB)
- Gynecology (GYN)
- Cardiology (CARD)
- Urology (URO)
- Vascular (VAS)
- Neurology (NEURO)
- Small Parts (SM P)
- Pediatrics (PED)
- Orthopedics (ORTHO)

The Voluson E-Series supports a variety of linear-, curved-, phased array and pencil CW probes for various clinical applications. Any 3 probes may be connected at the same time (+ 1 pencil CW probe).

Medical application fields include:

- Obstetrics
- Gynecology and Fertility
- Radiology
- Internal Medicine
- Neurology
- Cardiology
- Oncology
- Urology
- Orthopedics
- Pediatrics

The system is designed for follow-up expansion.

In addition to the initial operational settings for each probe preprogrammed in the system, user-customized parameter settings for each probe may be inserted by the operator and stored for recall as needed via the system control console. System configuration is stored on the hard drive and all necessary software is loaded from the hard drive on power up.

Biopsy guidelines are provided on screen to assist in the collection of tissue samples, using biopsy guide adapters offered as an optional accessory.

The system provides the ability to perform remote viewing of images without compression, via DICOM 3.0 compatible output. Management of patient history is possible by image-filing function. High-resolution images are provided by utilizing a technology called digital dynamic receive focusing.

For more detailed explanations of functions and controls refer to the Voluson E-Series Basic User Manual.

5.1.1 Description of Operating Modes

5.1.1.1 B-Mode or 2D-Mode

B-Mode or 2D-mode is a two-dimensional image of the amplitude of the echo signal. It is used for location and measurement of anatomical structures and for spatial orientation during operation of other modes. In 2D-mode, a two-dimensional cross-section of a three-dimensional soft tissue structure such as the heart is displayed in real time. Ultrasound echoes of different intensities are mapped to different gray scale or color values in the display. The outline of the 2D cross-section may be a rectangle, parallelogram, sector or 360-degree circle, depending on the transducer used. 2D-mode can be used in combination with any other mode.

5.1.1.1.1 Coded Harmonic Imaging (HI)

In Harmonic Imaging, acoustic aberrations due to tissue are minimized by receiving and processing the second harmonic signal that is generated within the insonified tissue. Voluson E-Series high performance HI provides superb detail resolution and penetration, outstanding contrast resolution, excellent acoustic clutter rejection and an easy to operate user interface. Coded Harmonics enhances near field resolution for improved small parts imaging as well as far field penetration. It diminishes low frequency amplitude noise and improves imaging technically difficult patients. It may be especially beneficial when imaging isoechoic lesions in shallow-depth anatomy in the breast, liver and hard-to-visualize fetal anatomy. Coded Harmonics may improve the B-Mode image quality without introducing a contrast agent.

5.1.1.1.2 XTD-View

XTD-View (Extended View) provides the ability to construct and view a static 2D image which is wider than the field of view of a given probe. This feature allows viewing and measurement of anatomy that is larger than what would fit in a single image. XTD-View constructs the extended image from individual image frames as the operator slides the probe along the surface of the skin in direction of the scan plane. Examples include scanning of vascular structures and connective tissues in the arms and legs.

5.1.1.1.3 B-Flow

For details see: *Section 5.1.4.6 "B-Flow" on page 5-14* .

5.1.1.1.4 Coded Contrast Imaging (optional)

For details see: *Section 5.1.4.7 "Coded Contrast Imaging" on page 5-14* .

5.1.1.1.5 Elastography (optional)

For details see: *Section 5.1.4.16 "Elastography" on page 5-17* .

5.1.1.2 M-Mode

In M-mode, soft tissue structure is presented as scrolling display, with depth on the Y-axis and time on the X-axis. It is used primarily for cardiac measurements such as value timing on septal wall thickness when accurate timing information is required. M-mode is also known as T-M mode or time-motion mode. Ultrasound echoes of different intensities are mapped to different gray scale values in the display. M-mode displays time motion information of the ultrasound data derived from a stationary beam. Depth is arranged along the vertical axis with time along the horizontal axis. M-mode is normally used in conjunction with a 2D image for spatial reference. The 2D image has a graphical line (M-line) superimposed on the 2D image indicating where the M-mode beam is located.

5.1.1.2.1 MCFM Mode (M Mode + Color Flow Mode)

Color Flow Mode and Color M Mode are Doppler modes intended to add color-coded qualitative information concerning the relative velocity and direction of fluid motion within the 2D mode or M mode image. Color Flow overlays color on the M mode trace using velocity and variance color maps. The Color Flow wedge overlays the 2D mode image and M mode timeline.

5.1.1.3 Color Doppler Modes

Color Doppler is used to detect motion presented as a two-dimensional display. There are following applications of this technique:

- Color Flow Mode (C) - used to visualize blood flow velocity and direction
- Power Doppler (PD) - used to visualize the spatial distribution of blood
- Bi-Directional Angio (HD-Flow) - used to visualize flow direction with spatial resolution and low artifact visibility
- Tissue Doppler (TD) - used to visualize tissue motion direction and velocity

5.1.1.3.1 Color Flow Mode

A real-time two-dimensional cross-section image of blood flow is displayed. The 2D cross-section is presented as a full color display, with various colors being used to represent blood flow (velocity, variance, power and/or direction). Often, to provide spatial orientation, the full color blood flow cross-section is overlaid on top of the grayscale cross-section of soft tissue structure (2D echo). For each pixel in the overlay, the decision of whether to display color (Doppler), gray scale (echo) information or a blended combination is based on the relative strength of return echoes from the soft tissue structures and from the red blood cells. Blood velocity is the primary parameter used to determine the display colors, but power and variance may also used. A high pass filter (wall filter) is used to remove the signals from stationary or slowly moving structures. Tissue motion is discriminated from blood flow by assuming that blood is moving faster than the surrounding tissue, although additional parameters may also be used to enhance the discrimination. Color flow can be used in combination with 2D and Spectral Doppler modes as well as with 3D mode.

5.1.1.3.2 Power Doppler

A real-time two dimensional cross-section of blood flow is displayed. The 2D cross-section is presented as a full color display, with various colors being used to represent the power in blood flow echoes. Often, to provide spatial orientation, the full color blood flow cross-section is overlaid on top of the gray scale cross-section of soft tissue structure (2D echo). For each pixel in the overlay, the decision of whether to display color (Doppler power), gray scale (echo) information or a blended combination is based on the relative strength of return echoes from the soft-tissue structures and from the red blood cells. A high pass filter (wall filter) is used to remove the signals from stationary or slowly moving structures. Tissue motion is discriminated from blood flow by assuming that blood is moving faster than the surrounding tissue, although additional parameters may also be used to enhance the discrimination. The power in the remaining signal after wall filtering is then averaged over time (persistence) to present a steady state image of blood flow distribution. Power Doppler can be used in combination with 2D and Spectral Doppler modes as well as with 3D mode.

5.1.1.3.3 Bi-Directional Angio (HD-Flow Mode)

Directional Power Doppler is a Power Doppler mode incorporating the flow direction (much like Color Doppler) into the displayed image. The focus of the settings for Directional Power Doppler is for high spatial resolution and low artifact visibility, allowing vessels to be seen with less blooming and finer detail.

5.1.1.3.4 Tissue Doppler

The Tissue Color Doppler Imaging is used for color encoded evaluation of heart movements. The TD image provides information about tissue motion direction and velocity.

5.1.1.4 Pulsed (PW) Doppler

PW Doppler processing is one of two spectral Doppler modalities, the other being CW Doppler. In spectral Doppler, blood flow is presented as a scrolling display, with flow velocity on the Y-axis and time on the X-axis. The presence of spectral broadening indicates turbulent flow, while the absence of spectral broadening indicates laminar flow. PW Doppler provides real time spectral analysis of pulsed Doppler signals. This information describes the Doppler shifted signal from the moving reflectors in the sample volume. PW Doppler can be used alone but is normally used in conjunction with a 2D image with an M-line and sample volume marker superimposed on the 2-D image indicating the position of the Doppler sample volume. The sample volume size and location are specified by the operator. Sample volume can be overlaid by a flow direction cursor which is aligned, by the operator, with the direction of flow in the vessel, thus determining the Doppler angle. This allows the spectral display to be calibrated in flow velocity (m/sec.) as well as frequency (Hz). PW Doppler also provides the capability of performing spectral analysis at a selectable depth and sample volume size. PW Doppler can be used in combination with 2D and Color Flow modes.

5.1.1.5 3D Imaging

The Voluson E-Series Ultrasound System will be used to acquire multiple, sequential 2D images which can be combined to reconstruct a three dimensional image. These 3D images are useful in visualizing three-dimensional structures, and in understanding the spatial or temporal relationships between the images in the 2D sequence. The 3D image is presented using standard visualization techniques, such as surface or volume rendering.

5.1.1.6 3D Data Collection and Reconstruction

2D gray scale images including Color Flow or Power Doppler information may be reconstructed. The acquisition of volume data sets is performed by sweeping 2D-scans with special transducers (called 3D-transducers) designed for the 2D-scans and the 3D-sweep.

2D ultrasound imaging modes are used to view a two dimensional cross-sections of parts of the body. For example in 2D gray scale imaging, a 2 dimensional cross-section of a 3-dimensional soft-tissue structure such as the heart is displayed in real time. Typically, the user of an ultrasound machine manipulates the position and orientation of this 2D cross-section in real time during an ultrasound exam.

By changing the position of the cross-section, a variety of views of the underlying structure are obtained, and these views can be used to understand a 3-dimensional structure in the body.

To complete survey a 3-dimensional structure in the body, it is necessary to collect 2D images which span a volume containing the structure. One way is to sweep the imaging cross-section by translating it in a direction perpendicular to the cross-section. Another example method is to rotate the cross section about a line contained in the cross section. The Voluson E-Series Ultrasound System uses the automated so called C-Scan for the motion perpendicular to automated B-scan. Once a representative set of 2D cross-sections are obtained, standard reconstruction techniques can be used to construct other 2D cross-sections, or to view the collection of the cross-sections as a 3D images.

5.1.1.7 3D Image Presentation

Several techniques can be used to aid the human observer in understanding the resulting 2D image as a representation of a three-dimensional object. One is to rotate the volume of data, and present the resulting sequence of 2D projections to the observer. The changing direction of observation helps the observer to separate the features in the volume according to their distance from the observer.

5.1.1.8 3D Rendering

The 3D (volume) rendering is a calculation process to visualize certain 3D-structures of a scanned volume by means of a 2D-image. The gray value for each pixel of the 2D-image is calculated from the voxels along the corresponding projection path (analyzing beam) through the volume. The render (calculation) algorithm, surface or transparent mode, determines how 3D-structures are visualized.

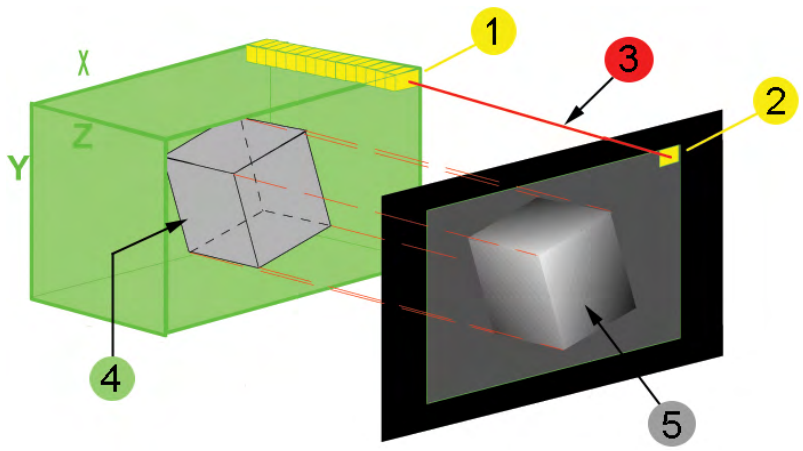


Figure 5-3 Principle: Volume Rendering

1	Voxel	3	Projection Way	5	2D - Display
2	Pixel	4	Volume - Block		

5.1.2 Block diagram Voluson E-Series

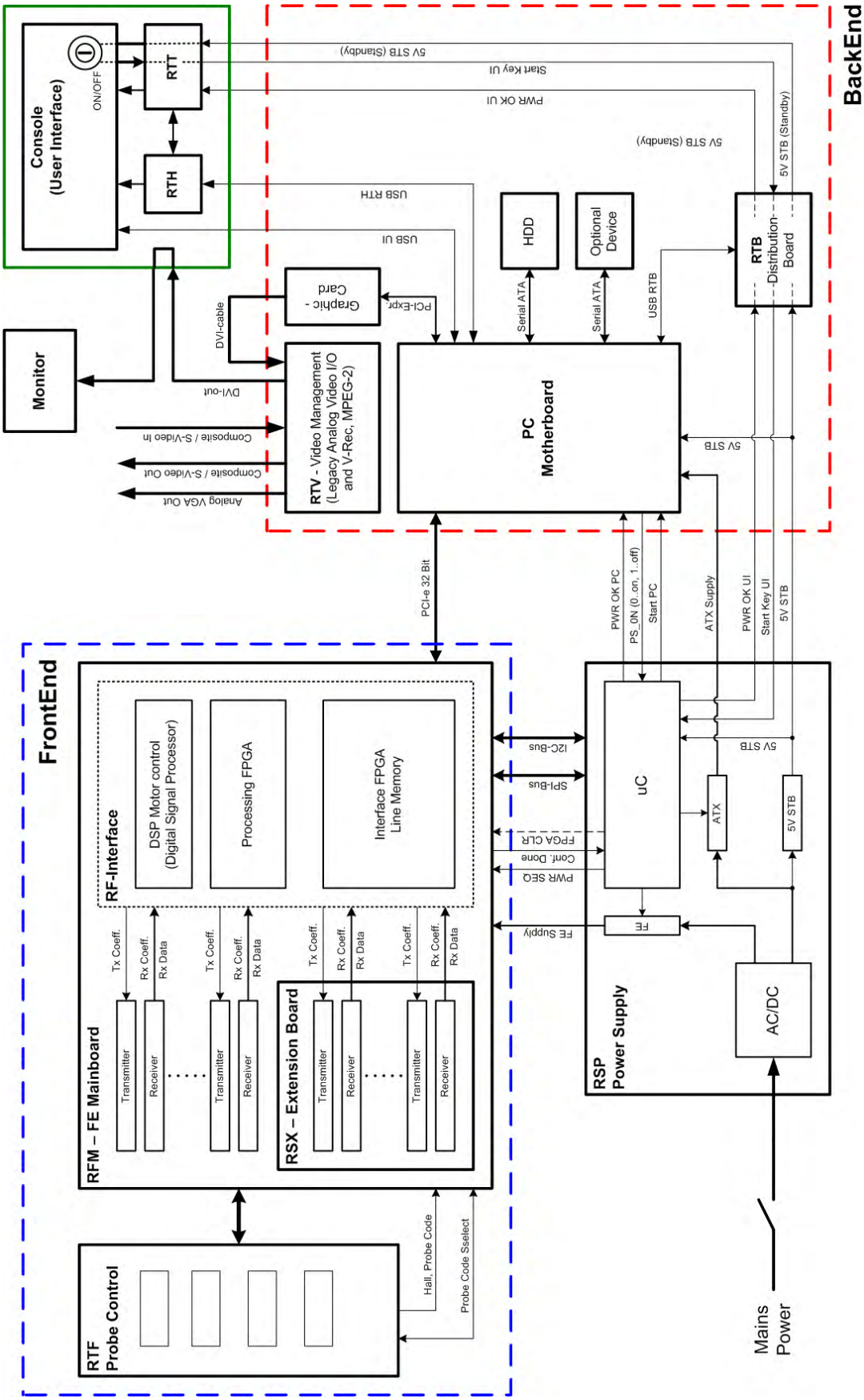


Figure 5-4 Voluson E-Series - Block diagram

5.1.3 Data Flow Control Description

This section describes the functions of the boards vs. different operation modes.

- RFM - (RF-Interface & Beamformer) FE Mainboard
- RSX - (Beamformer Receiver/Transmitter) Extension Board
- RTV - Video Management Board

5.1.3.1 B-Mode

1. IF-FPGA

   The RFM contains the Clock-Management and PRF-Generator. It generates (drives) Shot-Trigger for the BF-FPGAs. Configures the BF-FPGAs of RFM and RSX with Tx-Frequ, Tx-Focus, Rx-Focus, LineNo (lateral Position), Tx- Apodisation, RX-Apodisation, Multibeam, etc.

   Furthermore it contains Multibeam-DeInterleave, Subtraction Filter (for HI-Mode, see *Section 5.1.3.1.1 "Special B-Mode Techniques" on page 5-10* , DigitalTGC, DC-Canceler, Mixer (Part of Demodulator), LowPassFilter and Decimation (Pixel rate Conversion).

   After DC-cancelling the signal is mixed with RX-Frequency and brought to LF-Spectrum, where the LowPassFilter cuts HF. Mixer and Magnitude-Calculator arrange Complex Demodulation, and Logarithmic Amplifier arrange the conversion from High-Dynamic LinearSignal to the Low-Dynamik(e.g. 8Bit) Log-Signal. Several postprocessing steps (LineFilter, FrameFilter, ReSample, Edge Enhance) enable smooth image quality while keeping contrast high.

   a. Direct Memory Access (DMA) section

      B-mode data from RFM is written via Signal Processor (SP) Channel 0 into SDRAM Fifo Buffer memory. DMA Controller 0 transfers the data into PC main memory where scan conversion is performed per software. Cine Mode: Reserved area in PC main memory is used.

2. BF-FPGAs

   Each BF-FPGA handles Rx/Tx of 64 channels. It controls 16 Tx-pulsers and 8 AFE ICs (i.e.: 32 Tx-pulsers and 16 AFE ICs each on RFM <u>and</u> RSX board).

   The AFE consists of Low Noise Amplifier (LNA), Rx-TGC-Amplifier, Signal-ADC. Each pulser can support 4 Tx-channels, each AFE can support 8 Rx-channels.

   - Tx-channel: The BF-FPGA generates Tx-Freq through dividing 200MHz by 2,3,4,5,... and Tx-Focus.
   - Rx-channel: The clock distribution generates Sample-Clocks for the ADC (50 MHz). The BF-FPGA manages Rx-Focus (Delay and Chain-Adder) and Apodization.

3. RTV - Video section

   Video Information is provided by the PC on the DVI (Digital Visual Interface) output connector. The signal is connected to RTV, where the analog VGA signals for the monitor and standard video timing outputs are generated.

5.1.3.1.1 Special B-Mode Techniques

1. HI (Coded Harmonic Imaging): In one method of HI the RX-Frequency is doubled, so that the radial resolution is increased due to the higher RX-Frequency. The second method of HI is pulse-inversion, that is handled by software: 2 TX-Beams are shot to the same Tissue-location, one with positive, one with negative polarity. The subtraction of both shots (Subtraction Filter) brings to bear the nonlinear-echo-reflection-properties of the tissue (especially in usage of Contrast-medias), which is very useful with extremely difficult-to-image patients.
2. *FFC* (Frequency and Focus Composite): 2 or more TX-Beams are shot to the same Tissue-location. The Beams have different TX-foci. By means of Blending (adaption of Brightnesses) they are composed to one whole RX-Line.
3. *XBeam CRI* (CrossBeam - Compound Resolution Imaging): Does not need any special functions of RFM. Image is composed of more than one different-direction-steered images. PC-calculated.
4. *VCI* (Volume Contrast Imaging): Does not need any special functions of RFM. Image is composed of more than 2 small angle neighbored images. PC-calculated. (Only possible with 4D-Probes).

5.1.3.2 M-Mode

1. IF-FPGA

   see: *Section 5.1.3.1 "B-Mode" on page 5-10*
2. RTV - Video section

   see: *Section 5.1.3.1 "B-Mode" on page 5-10*

5.1.3.3 D-Mode (Pulsed Wave- and Continuous Wave Doppler)

1. IF-FPGA
   - PRF-generator; see: *Section 5.1.3.1 "B-Mode" on page 5-10*
   - After DC-cancelling the signal is mixed with RX-Frequency and brought to LF-Spectrum, where the LowPassFilter cuts HF. Mixer and Magnitude-Calculator arrange Complex Demodulation.

   a. DMA section

      I/Q-Data is transferred to the PC where FFT and scan conversion is performed per software, i.e. the sweep image is generated (scaling and interpolation between lines).
2. RTV - Video section

   see: *Section 5.1.3.1 "B-Mode" on page 5-10*

5.1.3.4 CFM-Mode (Color Flow Mode)

1. IF-FPGA
   - PRF-generator; see: *Section 5.1.3.1 "B-Mode" on page 5-10*
   - After DC-cancelling the signal is mixed with RX-Frequency and brought to LF-Spectrum, where the LowPassFilter cuts HF. Mixer and Magnitude-Calculator arrange Complex Demodulation.
2. RTV - Video section

   see: *Section 5.1.3.1 "B-Mode" on page 5-10*

5.1.3.5 3D-Mode (Freezes after 1 volume sweep)

see: *Section 5.1.3.1 "B-Mode" on page 5-10*

5.1.3.6 Real Time 4D-Mode (nonstop volume rendering)

see: *Section 5.1.3.1 "B-Mode" on page 5-10*

5.1.3.7 XBeam CRI-Mode (CrossBeam Compound Resolution Imaging)

see: *Section 5.1.3.1 "B-Mode" on page 5-10*

5.1.3.8 VCI-Mode (Volume Contrast Imaging)

see: *Section 5.1.3.1 "B-Mode" on page 5-10*

5.1.3.9 Extern-Video-Mode (display Video from V-Rec)

1. IF-FPGA

   Not used for Signal-Processing
2. RTV - Video section

   Analog input from an external video source (YC or CVBS) is converted to a digital RGB data stream by a video decoder. It is mixed with the DVI video output from PC in an overlay unit (Chroma keying mechanism). Generation of analog VGA signals for the monitor and standard video timing outputs follows this block.

5.1.4 Description of Software Options

To activate the software options:

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***Options*** tab.

It might be possible that some probes, options or features are NOT available

- in some countries.
- at the time of release of this Service Manual.

Table 5-1 Software Options

Software Option	Description	VE6	VE8	VE8 Exp	VE8 Exp LE
Advanced 4D (incl. Real time 4D HD*Live*, RT-4D Biopsy, VCI "Basic" and TUI)	*Advanced 4D*	X	X	X	X
HD*Live*	*HDlive*	1)	S	S	S
DICOM	*DICOM*	X	X	X	X
VOCAL II	*VOCAL II - Virtual Organ Computer-aided Analysis*	1)	1)	1)	1)
Advanced VCI (VCI OmniView)	*Advanced VCI*	2)	2)	2)	2)
B-Flow	*B-Flow*	S	S	S	S
Contrast	*Coded Contrast Imaging*	X	X	X	X
Sono VCAD Heart	*SonoVCAD heart - Computer Assisted Heart Diagnosis Package*	1)	-	-	-
SonoAVC	*SonoAVC - Sono Automated Volume Count*	1)	1)	1)	1)
SonoVCAD labor	*SonoVCAD labor*	1)	1)	1)	1)
Anatomical M-Mode	*Anatomical M-Mode (AMM)*	X	X	X	X
Advanced STIC (incl. Basic STIC, STIC M-Mode and STIC Flow) + SonoVCAD Heart	*Advanced STIC (Spatio-Temporal Image Correlation)*	-	2)	2)	2)
STIC "Basic"	*STIC “Basic” (Spatio-Temporal Image Correlation)*	2)	-	-	-
SonoNT	*SonoNT*	S	S	S	S
SonoIT	*SonoIT*	**)	**)	**)	**)
SonoBiometry	*SonoBiometry*	S	S	S	S
Elastography (incl. Elastography Analysis)	*Elastography*	X	X	X	X
SRI Advanced	*SRI Advanced - Speckle Reduction Imaging*	S	S	S	S
V-SRI	*V-SRI Advanced - Speckle Reduction Imaging*	-	-	3)	3)
CW	*CW - Continuous Wave Doppler*	X	X	X	X
Expert	*Expert (= Upgrade “Option“ Voluson E8 -> Voluson E8 Expert)*	-	X	S	S

Legend:

X Optional Feature (separately purchasable)

\- not available

S Standard Feature

1) this 3D/4D option can be used in 3D-Mode, but **for 4D-Modes the option “Advanced 4D” has to be active** as well

2) this 4D option is **only available if the option “Advanced” 4D is active** as well

3) only with probe RM6C, RIC5-9-D, RIC6-12-D

**) not yet released in all countries

5.1.4.1 Advanced 4D

5.1.4.1.1 Real Time 4D

Real Time 4D mode is obtained through continuous volume acquisition and parallel calculation of 3D rendered images. In Real Time 4D mode the volume acquisition box is at the same time the render box. All information in the volume box is used for the render process. In Real Time 4D mode a “frame rate” of up 40 volumes/second is possible. By freezing the acquired volumes, size can be adjusted, manipulated manually as known from the Voluson 3D Mode.

5.1.4.1.2 Real Time 4D Biopsy

For minimal invasive procedures like biopsies, ultrasound is a widely used method to visualize and guide the needle during puncture. The advantage in comparison with other imaging methods is the real-time display, quick availability and easy access to any desired region of the patient. 4D biopsy allows for real time control of the biopsy needle in 3D multi-planar display during the puncture. The user is able to see the region of interest in three perpendicular planes (longitudinal, transversal and frontal section) and can guide the biopsy needle accurately into the center of the lesion.

5.1.4.1.3 VCI - Volume Contrast Imaging

Volume Contrast Imaging utilizes 4D transducers to automatically scan multiple adjacent slices and delivers a real-time display of the ROI. This image results from a special rendering mode consisting of texture and transparency information. VCI improves the contrast resolution and therefore facilitates finding of diffuse lesions in organs. VCI has more information (from multiple slices) and is of advantage in gaining contrast due to improved signal/noise ratio.

Static VCI is a part of the VCI option, which allow to apply the contrast enhancing VCI method to 3D data sets after the acquisition.

5.1.4.1.4 T.U.I. - Tomographic Ultrasound Imaging

TUI is a new visualization mode for 3D and 4D data sets. The data is presented as slices through the data set which are parallel to each other. An overview image, which is orthogonal to the parallel slices, shows which parts of the volume are displayed in the parallel planes. This method of visualization is consistent with the way other medical systems such as CT or MRI, present the data to the user. The distance between the different planes can be adjusted to the requirements of the given data set. In addition it is possible to set the number of planes. The planes and the overview image can also be printed to a DICOM printer, for easier comparison of the ultrasound data with CT and/or MRI data.

5.1.4.2 HDlive

Most current surface reconstructions use an illumination frontal to the rendered object. This can cause the image to look flat. HD*live* Rendering uses an illumination source that can be positioned by the user around the rendered 3D object on a spherical surface. By highlighting structures from the side, the three-dimensional impression is improved considerably.

Note *"HDlive" is part of the “Advanced 4D” option for Voluson E8 systems. At Voluson E6 systems it is optional (separately purchasable)..*

5.1.4.3 DICOM

Software package providing following DICOM functionality:

- Storage Service Class
- Print Management Service Class
- Structured Reporting Service Class
- Storage Commit Service Class
- Modality Performed Procedure Step Service Class

Sending of reports - Additionally all OB/Gyn measurements can be sent to a PC (without using structured reporting). Receiving of these reports is supported by ViewPoint workstation “PIA” only. All other workstations can be adapted individually.

5.1.4.4 VOCAL II - Virtual Organ Computer-aided Analysis

Diagnosis and therapy of cancer is one of the most important issues in medical care. The VOCAL II - Imaging program allows completely new possibilities in cancer diagnosis, therapy planning and follow-up therapy control.

VOCAL II offers additional functions:

- Manual or Semi automatic Contour detection of structures (such as tumor lesion, cyst, prostate, etc.) and subsequent volume calculation. The accuracy of the process can be visually controlled by the examiner in multi-planar display.
- Construction of a virtual shell around the contour of the lesion. The wall thickness of the shell can be defined. The shell can be imagined as a layer of tissue around the lesion, where the tumor vascularization takes place.
- Automatic calculation of the vascularization within the shell by 3D color histogram by comparing the number of color voxels to the number of grayscale voxels.

5.1.4.5 Advanced VCI

5.1.4.5.1 VCI Omni View - Volume Contrast Imaging (any plane)

More flexibility with Any Plane, VCI plane is freely selectable. Any shape can be drawn. Volumes from older BT’s can be loaded and edited with VCI Omni View without any limitations.

- Volumes can be edited in all other Visualization Modes.
- Dual Format is now also possible in Render Mode and Sectional Planes Mode.
- VCI slice thickness can be set to zero.

5.1.4.6 B-Flow

B-Flow is especially intuitive when viewing blood flow, for acute thrombosis, parenchymal flow and jets. It helps to visualize complex hemodynamics and highlights moving blood in tissue. B-Flow is less angle dependent, no velocity aliasing artifacts, displays a full field of view and provides better resolution when compared with Color-Doppler Mode. It is therefore a more realistic (intuitive) representation of flow information, allowing to view both high and low velocity flow at the same time.

5.1.4.7 Coded Contrast Imaging

Injected contrast agents re-emit incident acoustic energy at a harmonic frequency much more efficiently than the surrounding tissue. Blood containing the contrast agent stands out brightly against a dark background of normal tissue. Possible clinical uses are to detect and characterize tumors of the liver, kidney and pancreas and to enhance flow signals in the determination of stenosis or thrombus.

5.1.4.8 SonoVCAD heart - Computer Assisted Heart Diagnosis Package

VCAD is a technology that automatically generates a number of views of the fetal heart to make diagnosis easier. At this time it can help to find the right and left outflow tract of the heart and the fetal stomach.

Note *"SonoVCAD heart" is part of the "Advanced STIC" option for Voluson E8. At Voluson E6 systems it is optional (separately purchasable).*

5.1.4.9 SonoAVC - Sono Automated Volume Count

This feature can automatically detect low echogenic objects (e.g., follicles) in a volume of an organ (e.g., ovary) and analyze their shape and volume. From the calculated volume an average diameter can be calculated. It also lists the objects according to their size.

- Each object can be calculated automatically.
- A description name can be defined for each object up to 10 descriptions. With the "Add to Report" button all values of the measured objects can be sent to the worksheet. Also the description name will be sent.
- The description name can be edited in the worksheet.
- If the number button is activated, all objects are assigned a number inside the displayed object according to the measurement index.
- Group function: All objects will be added to one volume. The color of all objects will be changed to red and the measurement will show only one result.

5.1.4.10 SonoVCAD labor

Allows the user to measure fetal progression during the second stage of labor – fetal head progression, rotation and direction. Visual evidence and objective data of the labor process are provided.

All SonoVCAD *labor* measurements (Head direction, Midline Angle, Progression Distance, Progression Angle and associated acquisition time) are automatically added to the worksheet, as soon as they are performed. Only one measurement result is available for each measurement type. If the measurement is repeated, the old result is replaced by the new result.

If a volume is deleted, the according measurements are not deleted from the worksheet.

SonoVCAD *labor* measurement data can be transferred via DICOM SR.

5.1.4.11 Anatomical M-Mode (AMM)

Anatomical M-Mode displays a distance/time plot from a cursor line, which can be defined freely. The M-Mode display changes according to the motion of the M cursor. In the Dual format, two defined distances can be displayed at the same time.

AMM is available in grayscale and color modes (CF, HD Flow, TD)

- simultaneous Display of 2 M-Mode Cursors in 2D Mode
- each Cursor is freely rotatable
- can be done after Freeze and on reloaded Cine

5.1.4.12 Advanced STIC (Spatio-Temporal Image Correlation)

Note *The option "Advanced STIC" is **NOT** available for Voluson E6 systems.*

5.1.4.12.1 STIC "Basic" (Spatio-Temporal Image Correlation)

With this acquisition method the fetal heart or an artery can be visualized in 4D. It is not a Real Time 4D technique, but a post processed 3D acquisition.

In order to archive a good result, try to adjust the size of the volume box and the sweep angle to be as small as possible. The longer the acquisition time, the better the spatial resolution will be. A good STIC, STIC CFM (2D+CFM), STIC PD (2D+PD) or STIC HD (2D+HD-Flow) data set shows a regular and synchronous pumping of the fetal heart or of an artery.

The user must be sure that there is minimal movement of the participating persons (e.g., mother and fetus), and that the probe is held absolutely still throughout the acquisition period. Movement will cause a failure of the acquisition. The acquired images are post processed to calculate a 4D Volume Cine sequence. Please make sure that the borders of the fetal heart or the artery are smooth and there are no sudden discontinuities. If the user (trained operator) clearly recognizes a disturbance during the acquisition period, the acquisition has to be cancelled.

- STIC - Fetal Cardio is only available on RAB & RIC probes in the OB/GYN application.
- STIC - Vascular is only available on the RSP probe in the Peripheral Vascular application.

Note *"STIC" is part of the "Advanced STIC" option for Voluson E8. At Voluson E6 systems it is optional (separately purchasable).*

5.1.4.12.2 STIC M-Mode

Creates a M-spectrum from a STIC acquisition (capture of a full fetal heart cycle in real-time saved as a volume for later analysis). After activating STIC M-Mode the STIC cine is running and the STIC M-spectrum will be shown. In STIC-M all M-Measurements are possible. Furthermore the M-cursor is available as a freeform line type.

- can be done in A, B or C Plane and can be done postprocessing
- possibility to perform measurements for evaluation of ventricle contraction
- possibility to easily detect End Systole and End Diastole for ventricular measurements

5.1.4.12.3 STIC flow

Clinical application and advantage:

The STIC function, that is generally used to display high flow velocities at the heart, is now used to represent slow flow (tumor blood circulation) of vessels over the time. One of the objectives is, to display ovarian tumors (which are frequently found in GYN applications), to observe them over the time and consequently visualize them in 4D and/or evaluate them via histogram.

Function:

Similar to STIC Cardio-acquisitions, a volume sweep is made of the lesion. Afterwards the computer displays the heart rate and vessels in multiplanar view and/or visualizes it in 4D

5.1.4.13 SonoNT

SonoNT is an additional function for manual NT (Nuchal Translucency) measurement. This function supports the user to find the correct position for the NT measurement. The user can switch between NT Method "Manual" and "Sono NT" (semi-automatic).

A Box has to be placed for the NT-ROI. Then the NT-distance is calculated automatically, a graphic (yellow head-image) and the NT-result are displayed.

If no result is found a temporary warning "No valid NT-distance found!" is displayed.

5.1.4.14 SonoIT

SonoIT = **Sono**graphy based **I**ntracranial **T**ranslucency measurement

SonoIT is a Semi-automatic measurement for the Intracranial Transluceny. The IT-button can be found in the "Early Gestation" section beside the NT-button.

The workflow of this measurement is identical to the SonoNT measurement.

5.1.4.15 SonoBiometry

SonoBiometry is an alternative to the common fetal biometry measurements. It provides system suggested measurements for BPD, HC, AC and FL which need to be confirmed by the user or can be changed manually.

The following automated fetal biometry measurements are available:

- BPD (o-o) – Biparietal diameter type: outside-outside
- BPD (o-i) - Biparietal diameter type: outside-inner
- HC – Head circumference
- AC – Abdomen circumference
- FL – Femur length
- BPD + HC: combined measurement

The measurement mode can be changed from automatic to manual. Available measurement methods depend on this selection and on the measurement item itself.

It is not necessary to select a region where the measurement should be performed

5.1.4.16 Elastography

Elastography refers to the measurement of elastic properties of tissues, based on the well-established principle that malignant tissue is harder than benign tissue.

Elastography shows the spatial distribution of tissue elasticity properties in a region of interest by estimating the strain before and after tissue distortion caused by external or internal forces. The strain estimation is filtered and scaled to provide a smooth presentation when displayed.

During scanning in the elastography mode, the examiner manually slightly compresses the tissue using the ultrasound probe. A strain correlation (strain is the deformation of the tissue by compression) is continuously performed for visual perception on the monitor.

5.1.4.16.1 Elastography Analysis

A selectable sequence of Elastography images are analyzed within a ROI (range of interest). The Strain % or the Elasticity Index is displayed as curves over the time.

The mean value of the Strain % is measured within 1 or more ROI's and Ratios are calculated. "Generic Elasto" measurements are located in the generic measurement menu and are only available if "Elastography" is activated.

5.1.4.17 SRI Advanced - Speckle Reduction Imaging

A type of image noise or interference is generally considered undesirable and can obscure the quality or interpretation of B-mode images. Although somewhat associated with the underlying echogenicity of tissue scatters, image speckle characteristics such as brightness, density or size have no apparent value in determining tissue structure or related properties. The elimination of or significant reduction in speckle improves the quality or diagnostic potential of the image. The method applied in the subject modification utilizes a nonlinear diffusion filtering technique that permits effective speckle reduction in real time. The speckle reduction filter is available to the user in all B-mode imaging, independent of the used probe.

5.1.4.18 V-SRI Advanced - Speckle Reduction Imaging

V-SRI is an enhancement of the existing SRI algorithms and improves specially the C-plane image. This new algorithm (from Context Vision) is used in the A-, B-, C-planes and rendered images instead of the conventional SRI.

Note *The "V-SRI" option is only available at Voluson E8 Expert systems with probe RM6C, RIC5-9-D and RIC6-12-D.*

5.1.4.19 CW - Continuous Wave Doppler

For details see: *Section 5.1.5.1 "CW - Continuous Wave Doppler" on page 5-18* .

Note *Additional hardware required!*

5.1.4.20 Expert (= Upgrade “Option“ Voluson E8 -> Voluson E8 Expert)

- enables the full functionality and performance of “standard” Voluson E8 platform by providing the new feature “'Wide Sector” (extending the field of view of curved array probes by the means of beam steering) on all probes capable of this feature
- secondly this function is needed to enable the function of the Matrix Volume probes RM14-L and RM6C and the high resolution transvaginal probe RIC6-12

5.1.5 Description of Hardware Options

Table 5-2 Hardware Options

	HW-Options	Description
1	CW-Doppler	*CW - Continuous Wave Doppler*
2	ECG Digital Module	*ECG Preamplifier*
3	WLAN Network Adapter	*Wireless Network Adapter (WLAN - Wireless Local Area Network)*
4	Scan/Freeze Footswitch	*Scan/Freeze Footswitch*

5.1.5.1 CW - Continuous Wave Doppler

CW Doppler mode provides real time spectral analysis of CW Doppler signals. This information describes the Doppler shifted signal from the moving reflectors in the CW Doppler beam. CW Doppler can be referenced through a small pencil probe or phased array scan head, but it can also be used in conjunction with a 2D image which has an M-line superimposed on the 2D image indicating the position of the Doppler sample volume. For through-the-beamformer CW, this beam is steerable by the operator, and is done by adjusting the location of the M-line. The CW Doppler beam, or M-mode line, can be steered allowing interrogation along an operator-selected line within the image.

5.1.5.2 ECG Preamplifier

MAN (internal, digital version)

For details see *Section 5.8.4 "ECG-preamplifier (MAN - optional)" on page 5-33* .

5.1.5.3 Wireless Network Adapter (WLAN - Wireless Local Area Network)

For details see *Section 5.8.5 "Wireless Network Adapter" on page 5-34* .

5.1.5.4 Scan/Freeze Footswitch

For details see *Section 5.8.6 "Footswitch" on page 5-34* .

5.1.6 Data Location

The Voluson E-Series Hard disk drive (HDD) is divided into 4 partitions:

C: System partition:

- Operating System (Windows 7) including all Windows settings (IP-address, Network Name, etc.)
- US-Application Software (UISAPP)
- Global Service Platform Software
- Software Options

D: User partition:

- User Presets (Backup) database
- Images (Archive), Patient-ID´s and Reports database
- Service database
- System settings database

R: Rescue partition:

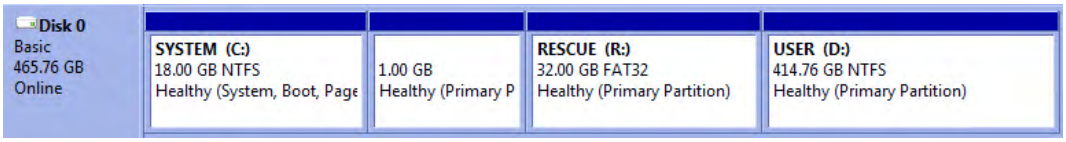
- Factory Images of C: Partition for System recovery after HDD (Windows) crash
- Printer Drivers

LINUX partition: (not visible in Windows)

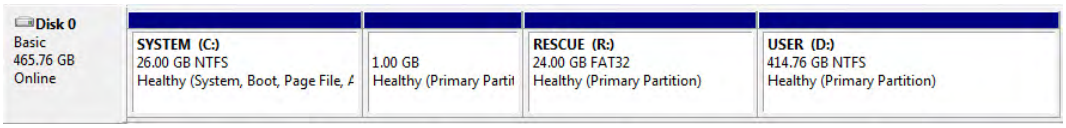
- Linux operating system for rescue functionality

Distribution of partitions at 500 Gbyte HDD

Ext.1 - Ext.7:



Ext.8 onwards:



5.2 FrontEnd Processor

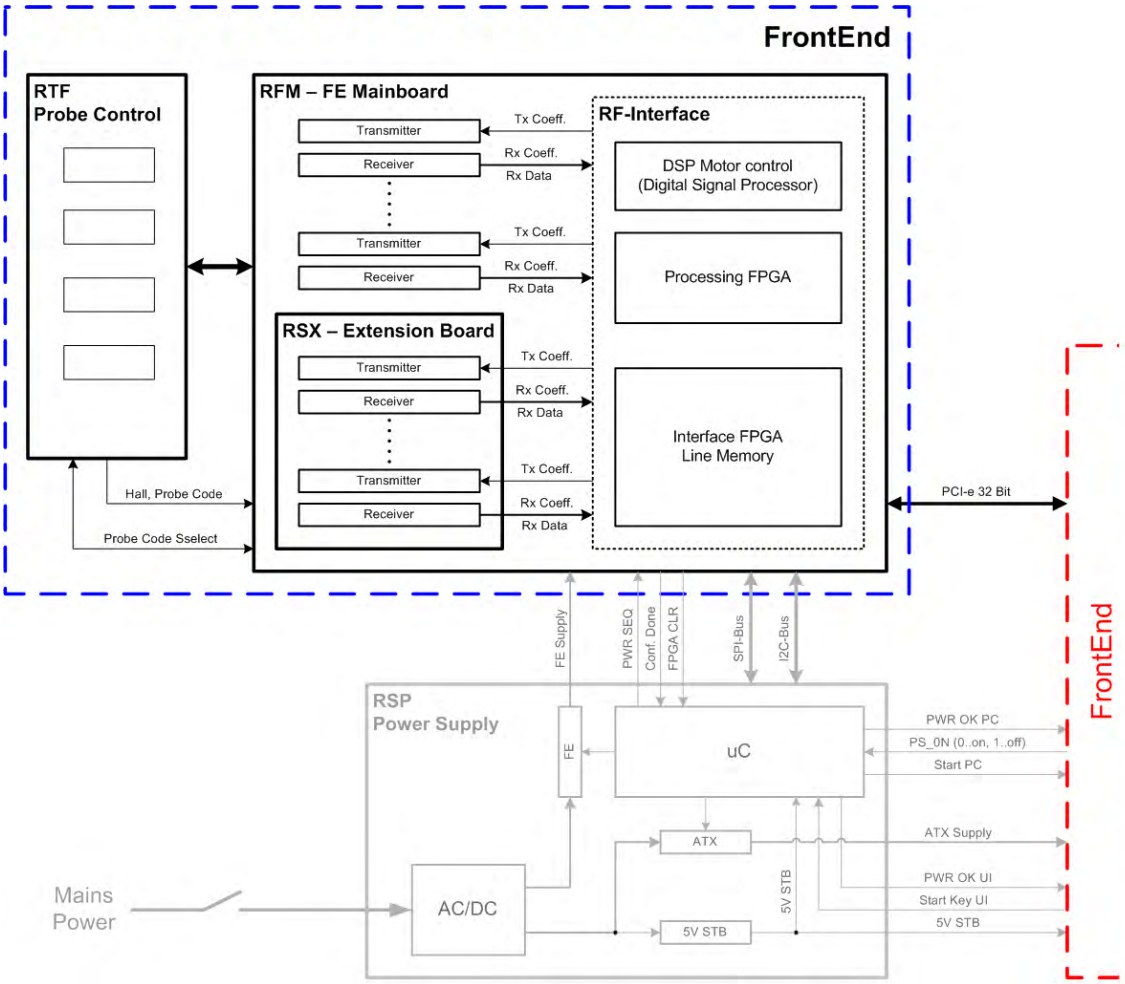


Figure 5-5 FrontEnd - Block diagram

Content in this section

5.2.1 RTF - Probe Control Board

Switches the Probe Connectors (3 DLP-Connectors, 1 CW-Connector) and recognizes Probes

- 1 CW-Probe Connector
- 3 Probe-Connectors 408pin
- 1 Dummy-Probe Connector 408pin
- Probe Select Relays
- Probe Recognition

5.2.2 RSE - Pencil Probe Board (optional)

Adapter board for connection of CW pencil probes.

Note *The RSE board is required for CW-Option.*

5.2.3 RFM - (RF-Interface & Beamformer) FE Mainboard

The FrontEnd Mainboard supports Tx/Rx for 128 channels only. To extend to 192 or 256 channels, the *RSX - (Beamformer Receiver/Transmitter) Extension* board is required.

5.2.3.1 RFM Board - Interface FPGA

1. DMA logic
2. Beamformer Interface
3. RTF Control Interface
4. RTF FPGA Control Interface

5.2.3.2 RFM Board - Processing FPGA

1. Ultrasound Data Pre-Processing
2. System Control
3. Motor Control

5.2.4 RSX - (Beamformer Receiver/Transmitter) Extension Board

Subset (for RFM) that is required to extend to 192 or 256 channels.

Note *All components of RSX board are also present on RFM - (RF-Interface & Beamformer) FE Mainboard.*

5.3 BackEnd Processor

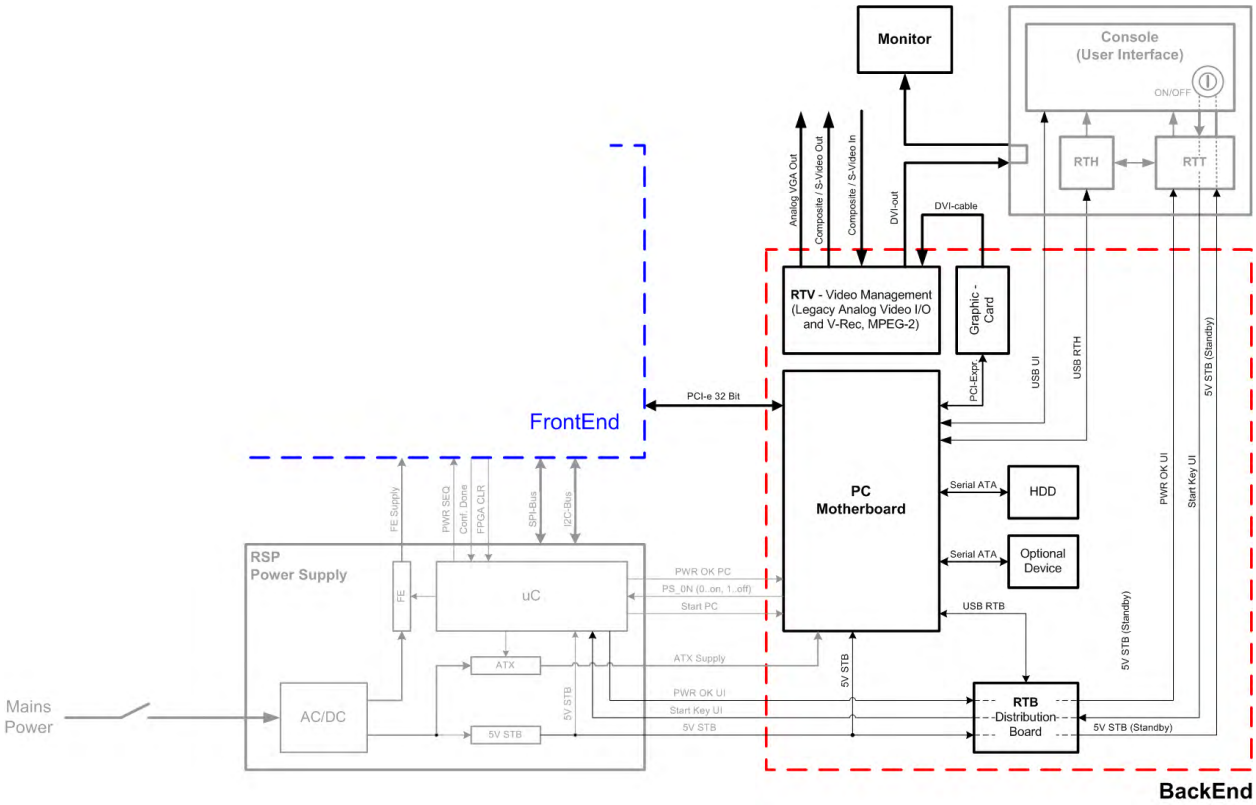


Figure 5-6 BackEnd - Block diagram

Content in this section

5.3.1 PC-Motherboard

Built in or external Components:

- On Board VGA
- LAN
- USB 2.0
- Sound
- CPU: 3.1 GHz at 4 cores

Major Tasks:

- System Control
- 2D- / 3D- / 4D- Image processing and Rendering
- Control DVD drive (USB)
- Control User Interface (USB)

5.3.2 Hard Disk Drive (HDD)

The Hard Disk is the main storage device of the Voluson E-Series ultrasound system.

The Voluson E-Series hard disk drive is divided into 4 partitions.

For further details see *Section 5.1.6 "Data Location" on page 5-19*

5.3.3 Graphic Card

Graphic Card which supplies RTV (Video manager) board with DVI Video. It offers dynamic contrast enhancement and color stretch video processing optimized on a scene by scene basis for spectacular picture clarity.

5.3.4 RTV - Video Management Board

Distributes DVI-D-information coming from the Graphic Cardto the DVI-D (digital) and DVI-I (integrated) connectors. Converts DVI-D-inputs to S-Video output(s). Displays external playback video and adds overlay graphics to it.

- DVI-D output for the System Main Monitor
- DVI-I output for external device (only RGB signals used)
- S-Video output (2 channels)
- S-Video input for external devices
- USB connector for board configuration

5.3.5 RTB - Distribution Board Bottom

Function of the Distribution Board Bottom (RTB):

- USB2.0 Interface, Board is connected to PC via USB cable
- 5 port USB2.0 Hub for connecting peripherals (e.g., optional ECG)
- Feed through DC-Power and Signals for the console (12V_ATX, 5V_ATX, 5VSB, PWR_On, Start_Key, Loud speaker)
- Connector for ECG–preamplifier (not used)
- Multiplexer and Amplifier for PC-Sound, Doppler Audio and VCR/DVD-Recorder

5.4 Internal I/O

Internal In/Out depends on the currently installed PC Motherboard.

Note *The "Mainboard type" can be read out in the System Setup - Administration - SYSTEM INFO page (see Figure 7-1 on page 7-3).*

Content in this section

5.4.1 Internal I/O Voluson E-Series: ADVANTECH Micro ATX

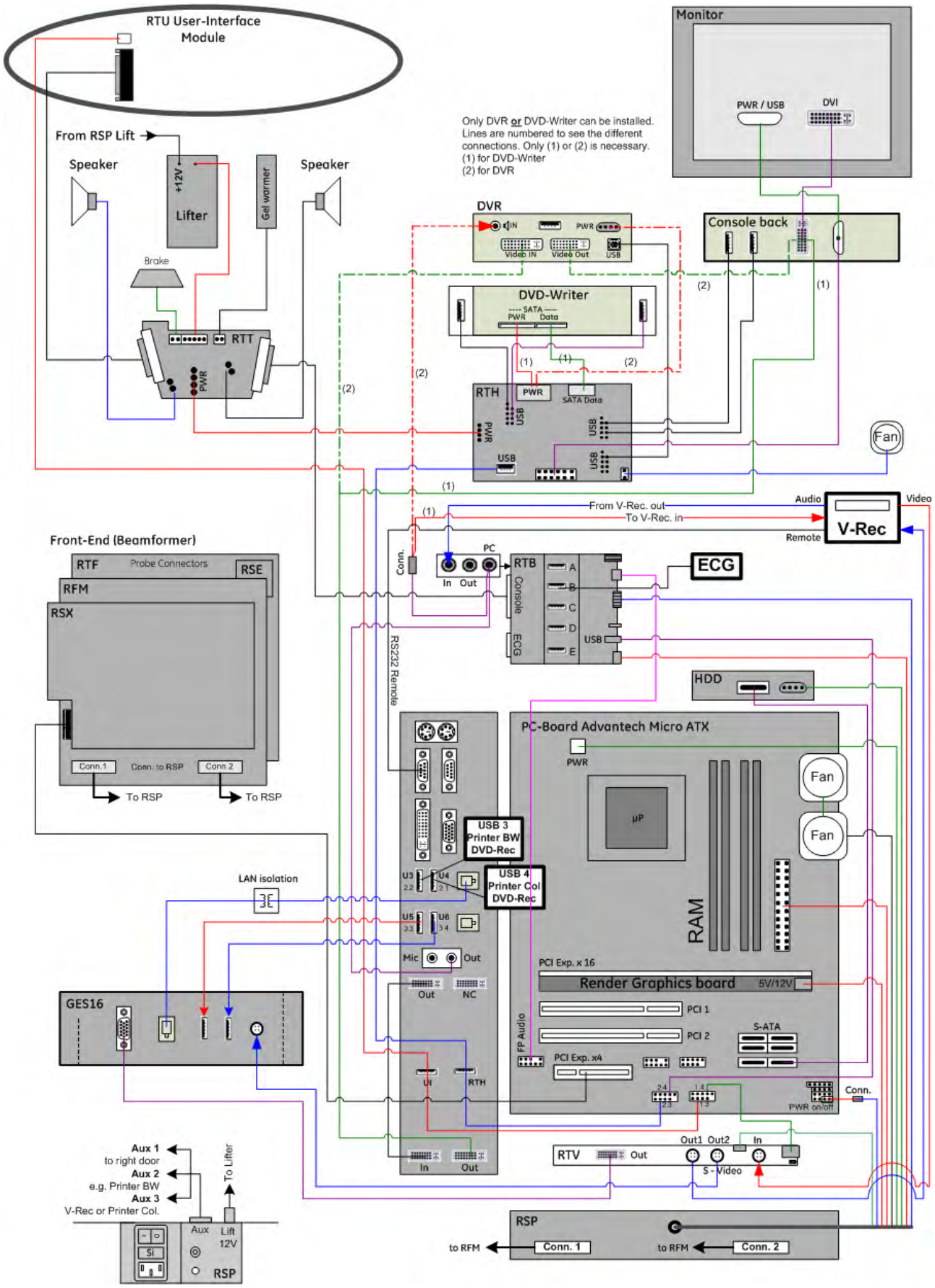


Figure 5-7 Internal I/O Voluson E-Series: ADVANTECH Micro ATX PC-Motherboard installed

5.4.2 Internal I/O Voluson E-Series: DFI Micro ATX

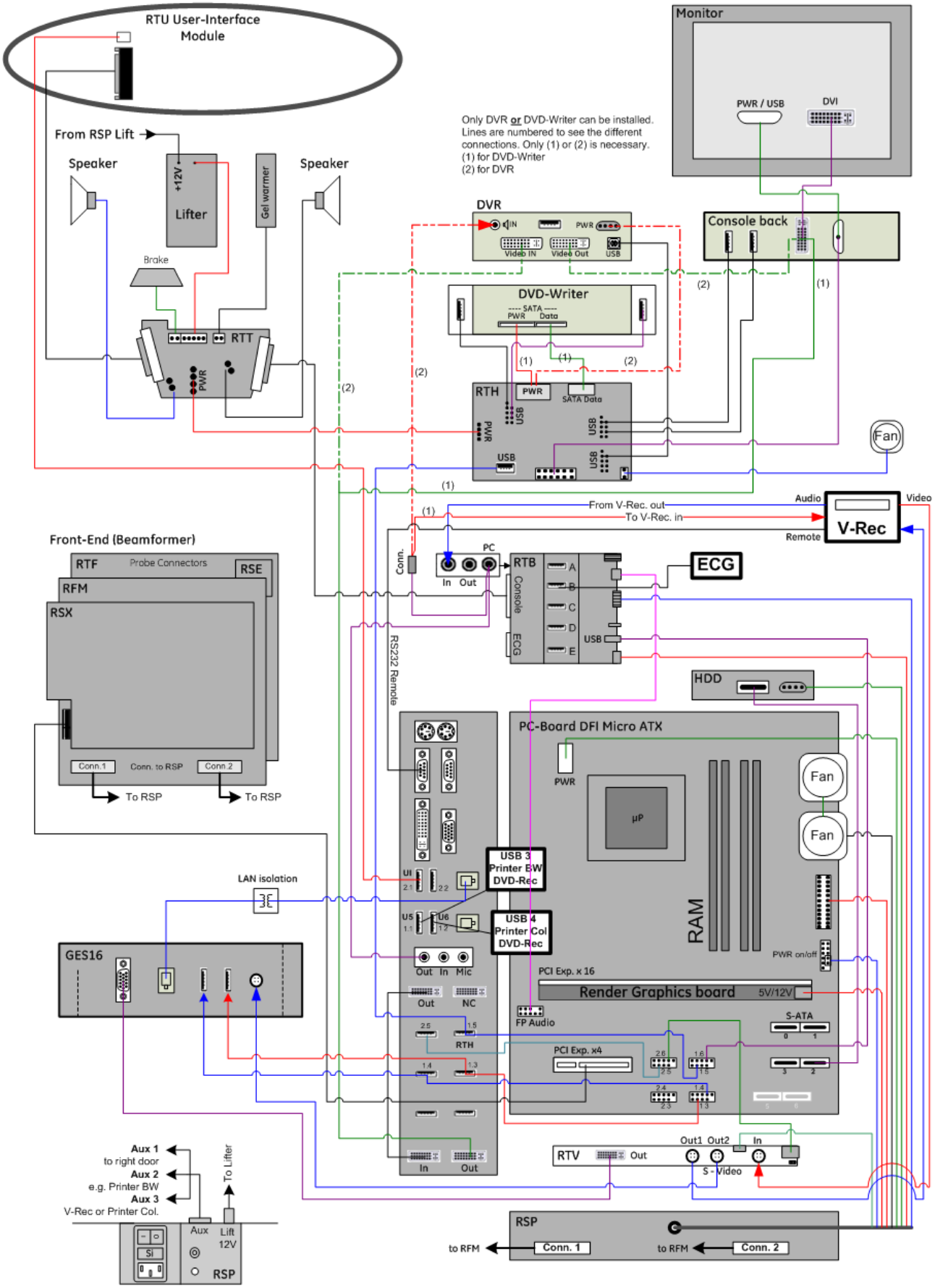


Figure 5-8 Internal I/O Voluson E-Series: DFI Micro ATX PC-Motherboard installed

5.5 Control Console (User Interface)

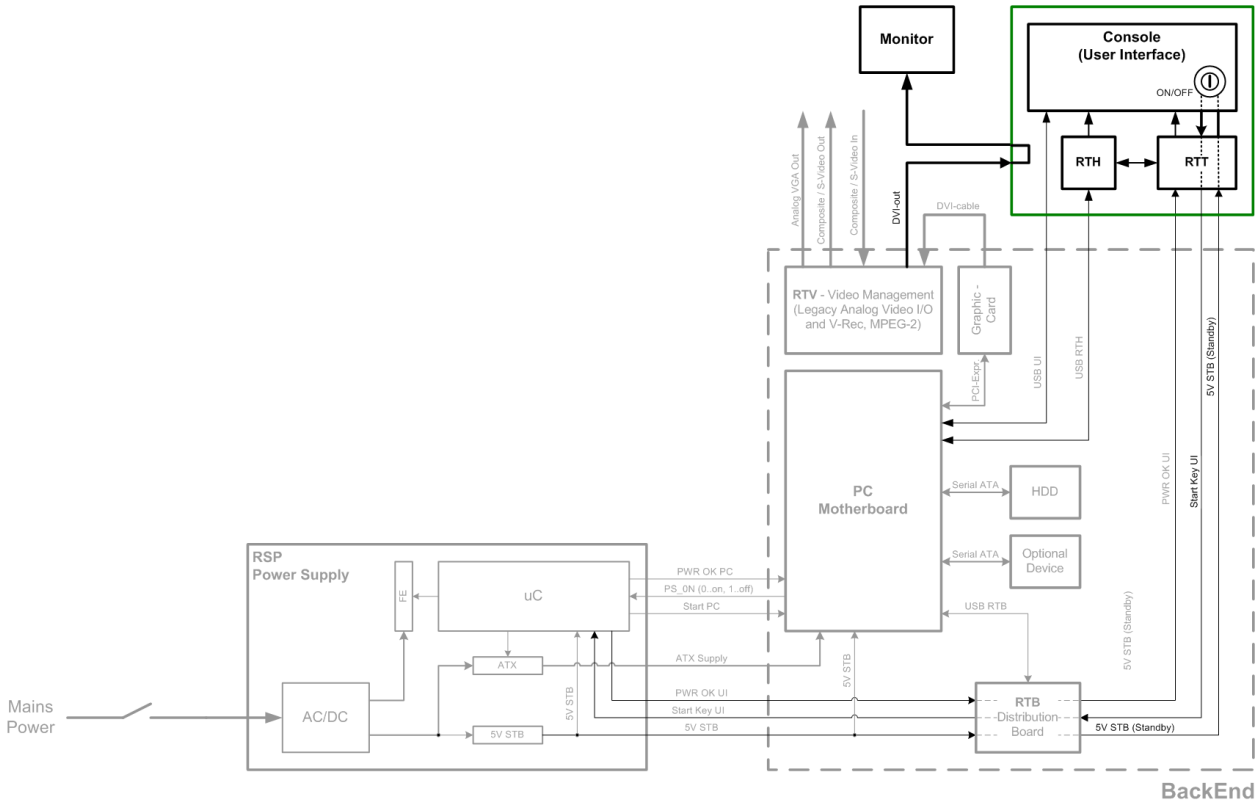


Figure 5-9 Control Console (User Interface) - Block diagram

The Voluson E-Series control console (User Interface) consists of the following electronic sub-assemblies and/or functional components:

- Display/Touch screen module:
  - VGA display – 640x480 pixels
  - Integrated USB to VGA converter with USB2.0 High Speed Interface
  - Resistive 5 wire analog touch screen
- Console module:
  - Micro controller C8032
  - 4 port USB 2.0 Hub controller
  - Slide pots TGC with zero raster position
  - Rotary controls (Encoders) with integrated push function
  - USB Trackball (2”) with dedicated buttons to emulate standard three button mouse
  - USB standard alphanumeric keyboard
  - USB extended keyboard with controller
  - LED Indicators with wide range dimming
- DC/DC Converter:
  - Converts 12VDC input voltage to 5VDC and 3.3VDC output voltage for supplying User Interface components

5.5.1 RTH - Distribution Board USB-Hub

Function of the Distribution Board Hub (RTH):

- USB2.0 Interface, Board is connected to PC via USB cable
- 7 port USB2.0 Hub
- 4 USB Ports for external use
- 1 USB to SATA Converter for DVD Drive
- 2 USB Ports not used
- Power distribution for Monitor
- Feed through for DC-Power for the DVD Drive and Fan

5.5.2 RTT - Distribution Board Top

Function of the Distribution Board Top RTT:

- Feed through for DC-Power (12V_ATX, 5V_ATX, 5VSB) and Signals (PWR_On, Start_Key, Speaker, Lifter control, UI_Brake)
- Power distribution for Monitor
- Power for RTH (Distribution Board Hub)
- Power for DVD-Drive
- Signal switching for UI Brake, Lift and Gel warmer[6]

6 reserved for the future

5.5.3 Control Console (UI)

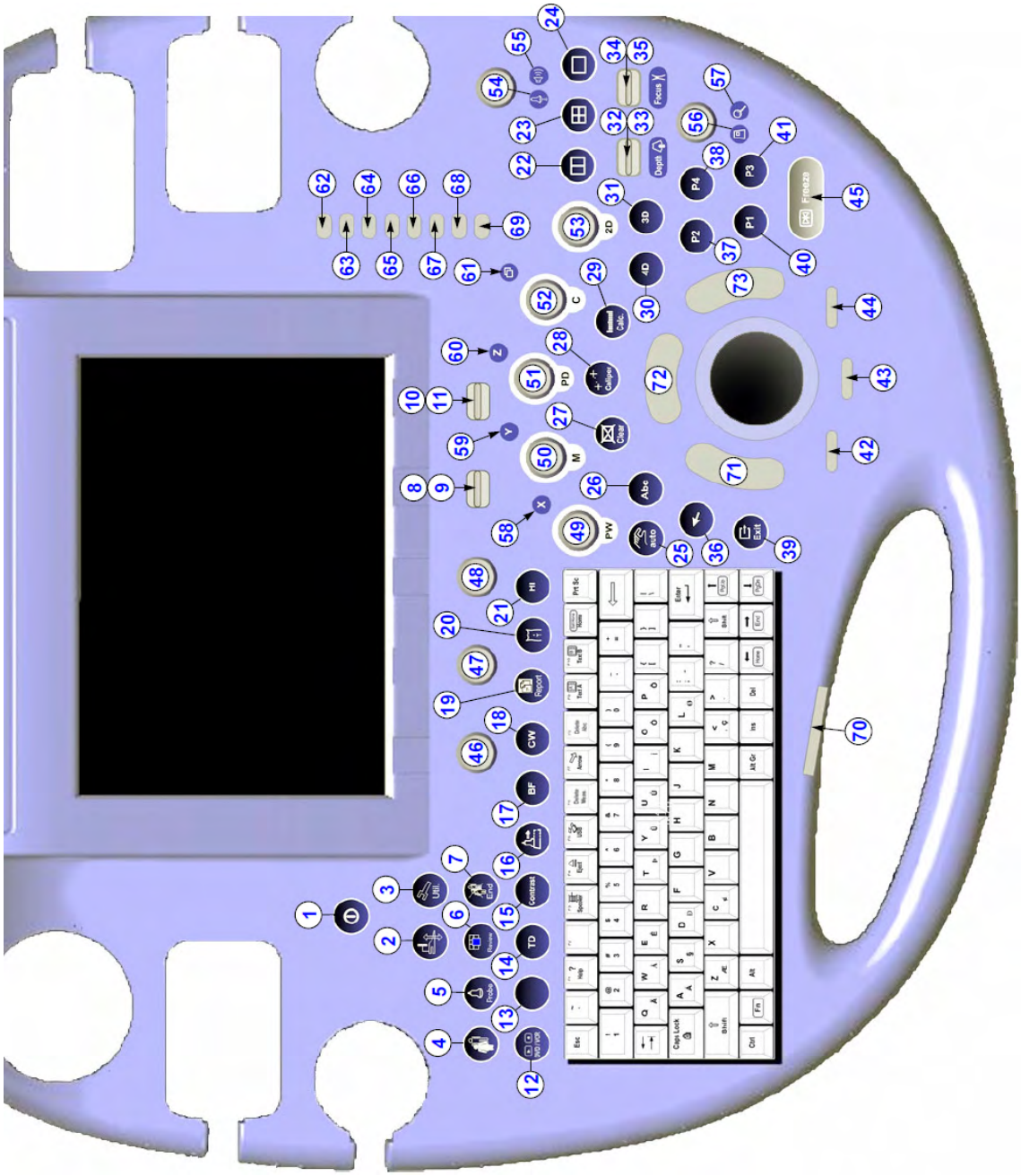


Figure 5-10 Voluson E-Series - Control Console

Table 5-3 Voluson E-Series - key codes

key code	Description	Functionality
1	Power/Standby ON/OFF	ON/OFF Standby button of the system
2	UI Level Adjustment	Height Adjustment (Elevation) of the Control Console (User Interface)
3	Utilities	call-up of the utilities menu
4	Patient Data (PID)	call-up of the patient data entry menu and/or patient archive
5	Probe	call-up of the probe program menu
6	Review	call-up of exam review mode and/or patient archive
7	End Exam	Patient and measurement data are stored in the “Data manager”
8	Paddle (Toggle) switch	UP - Toggle switch (function depends on currently selected mode)

key code	Description	Functionality
9	Paddle (Toggle) switch	DOWN - Toggle switch (function depends on currently selected mode)
10	Paddle (Toggle) switch	UP - Toggle switch (function depends on currently selected mode)
11	Paddle (Toggle) switch	DOWN - Toggle switch (function depends on currently selected mode)
12	DVD / VCR	also used to lower control console (in combination with 2 other keys)
13	Elasto	invokes Elastography function
14	Acquisition Mode TD	invokes TD-Mode (Tissue Doppler Mode)
15	Acquisition Mode Contrast	invokes Contrast Imaging function
16	Acquisition Mode XTD	invokes XTD-View (Extended View) function
17	Acquisition Mode BF	invokes B-Flow function
18	Acquisition Mode CW	invokes CW-Mode (Continuous Wave Doppler)
19	Report	call-up of the Patient report page
20	Bodymark	Bodymark display - to enter Bodymark symbols
21	HI	(Coded) Harmonic Imaging
22	Dual Format (V)	Dual-Screen format (vertical distribution)
23	Quad Format	Quad-Screen format
24	Single Format	Single-Screen format
25	Auto (OTO)	Automatic Optimization
26	ABC (Text)	Image Annotation - to write onto the screen
27	Clear	to clear graphics, measurements and annotations on the screen
28	Caliper	Generic Measurements
29	Calc	Calculation (tables)
30	Acquisition Mode 4D	invokes Real Time 4D Mode (continuous volume sweep)
31	Acquisition Mode 3D	invokes 3D Volume Mode
32	Depth (Toggle) switch	Penetration Depth UP - Toggle switch function
33	Depth (Toggle) switch	Penetration Depth DOWN - Toggle switch function
34	Focus Depth (Toggle) switch	Focus Depth UP - Toggle switch function
35	Focus Depth (Toggle) switch	Focus Depth DOWN - Toggle switch function
36	Trackball pointer	displays a pointer (arrow or hand shaped cursor)
37	P2	programmable key
38	P4	programmable key
39	Exit	Exit current menu
40	P1	programmable key
41	P3	programmable key
42	Trackball Mode switch	function depends on currently selected mode
43	Trackball Mode switch	function depends on currently selected mode
44	Trackball Mode switch	function depends on currently selected mode
45	Freeze	Read/Write (Freeze/Run)
46	Encoder 1	function depends on currently selected mode
47	Encoder 2	function depends on currently selected mode
48	Encoder 3	function depends on currently selected mode

key code	Description	Functionality
49	Encoder PW-Mode	PW-Mode (Pulsed Wave Doppler)
50	Encoder M-Mode	M-Mode (Motion Mode)
51	Encoder PD-Mode	PD-Mode (Power Doppler) and HD-Mode (Bi-Directional Angio)
52	Encoder C-Mode	C-Mode (Color Flow Mode)
53	Encoder 2D-Mode	2D-Mode (B-Mode)
54	label illuminated: Power (Probe)	Acoustic Output (Ultrasound emission of a probe)
55	label illuminated: Power (Speaker)	Acoustic Output (Speakers)
56	label illuminated: HR-Zoom	image magnification of selected image area
57	label illuminated: Pan Zoom	image magnification of complete image
58	label illuminated: X	Volume Mode icon (rotation about X-axis)
59	label illuminated: Y	Volume Mode icon (rotation about Y-axis)
60	label illuminated: Z	Volume Mode icon (rotation about Z-axis)
61	label illuminated:	Volume Mode icon (movement along Z-axis)
62	Slider 1	TGC Slider Control
63	Slider 2	TGC Slider Control
64	Slider 3	TGC Slider Control
65	Slider 4	TGC Slider Control
66	Slider 5	TGC Slider Control
67	Slider 6	TGC Slider Control
68	Slider 7	TGC Slider Control
69	Slider 8	TGC Slider Control
70	UI Brake	Rotation/Translation of the Control Console (User Interface)
71	Trackball button	left trackball key
72	Trackball button	upper trackball key
73	Trackball button	right trackball key

5.6 Monitor

For further details see *Section 6.2.2 "Load Default Monitor Settings" on page 6-3*

5.7 External I/O

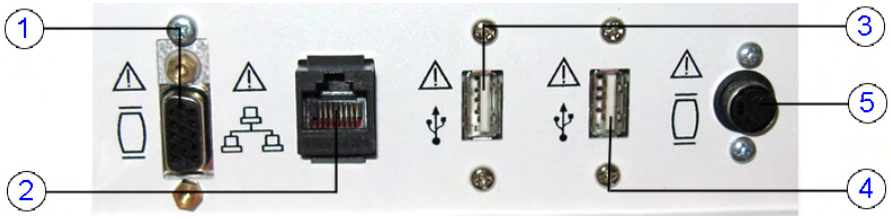


Figure 5-11 External I/O connectors - on rear of system (GES)

Item	Connector Name	Description
1	VGA OUT	Connector for external monitor
2	Network	DICOM input/output, twisted pair RJ-45 10/100 megabit/s
3	USB	USB 2.0 port
4		
5	S-Video OUT	S-Video OUT connector

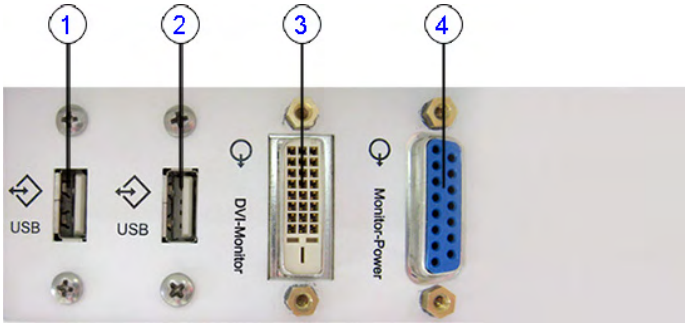


Figure 5-12 External I/O connectors - on back of console

Item	Connector Name	Description
1	USB	USB 2.0 port
2		
3	DVI Monitor	Monitor DVI (Digital Visual Interface)
4	Monitor Power	Monitor Power

Figure 5-13 External I/O connectors - next to DVD or DVR drive

Item	Connector Name	Description
1	USB	USB 2.0 port
2		

Note *For further description of I/O connectors refer to Section 3.9 "External I/O Connectors" on page 3-64 .*

5.8 Peripherals

5.8.1 Recording Tools

DVD Recorder

The DVD recorder is controlled from the systems front panel. Operation is completely independent of the Voluson E-Series system. One must set the appropriate Recorder Type, Video Norm (PAL or NTSC) and Region Code in accordance with the regional standards.

USB Recorder

The optional USB recorder is controlled via included remote control "Rec" switch. Operation is completely independent of the Voluson E-Series system. For video recording use an USB stick FAT32 or USB-HDD that is powered from an external source. The movies recorded can not be replayed on the Voluson E-Series system! For recommended players see user manual of the USB video recorder.

5.8.2 Printers

Black & White Digital Printer

The B&W Digital Printer receives image data via the USB port. The print command is controlled by the keys **P1**, **P2**, **P3** and/or **P4** on the Voluson E-Series control console (depending on system configuration).

Color Digital Printer

The Color Digital Printer receives image data via the USB port. The print command is controlled by the keys **P1**, **P2**, **P3** and/or **P4** on the Voluson E-Series control console (depending on system configuration).

Color Deskjet Printer

A Color Deskjet Printer is used to print out reports and exams, but in some cases also ultrasound images. Usually it is controlled via Bluetooth Adapter.

Network Color Laser Printer

The Network Color Laser Printer is used to print out reports and exams, but in some cases also ultrasound images. The printer can either be connected directly to the Voluson E-Series system, or to work within the network environment (usually the hospital network).

5.8.3 DVD Drive

Caution

Laser radiation: Avoid exposure to the beam Class 3B laser product.

Class 3B laser radiation: When open avoid exposure to the beam.

DVD Drive

The DVD Drive (Writer) is used to backup images and reports. In addition, it is used as the main source of software upgrades and other service utility operations. It is controlled by the BEP via USB port.

5.8.4 ECG-preamplifier (MAN - optional)

The ECG-preamplifier is used for acquiring an ECG-signal to be displayed with the ultrasound image. This optional peripheral serves for gaining an ECG-signal to mark the systolic and end diastolic moments in M-Mode and Doppler evaluations.

The ECG-preamplifier must not be used for ECG-diagnostics. It is not intended for use as a cardiac monitor and must not be used for an intra-operative application on the heart.

5.8.5 Wireless Network Adapter

The Voluson E-Series supports a Wireless Network USB Adapter based on industry standards to provide easy-to-use and compatible high-speed wireless connectivity. For details regarding type and installation, see *Section 3.4.8 "Connecting the Wireless Network Adapter" on page 3-29* .

The Wireless Network USB Adapter provides a mobile network connection to the local area network.

5.8.6 Footswitch

The Footswitch is used for comfortable system control when no hand is free. To adjust function of the Footswitch (Left/Middle/Right) see *Section 3.7.1.9 on page 3-60* .

5.9 Power Distribution

5.9.1 RSP - Power Supply Module

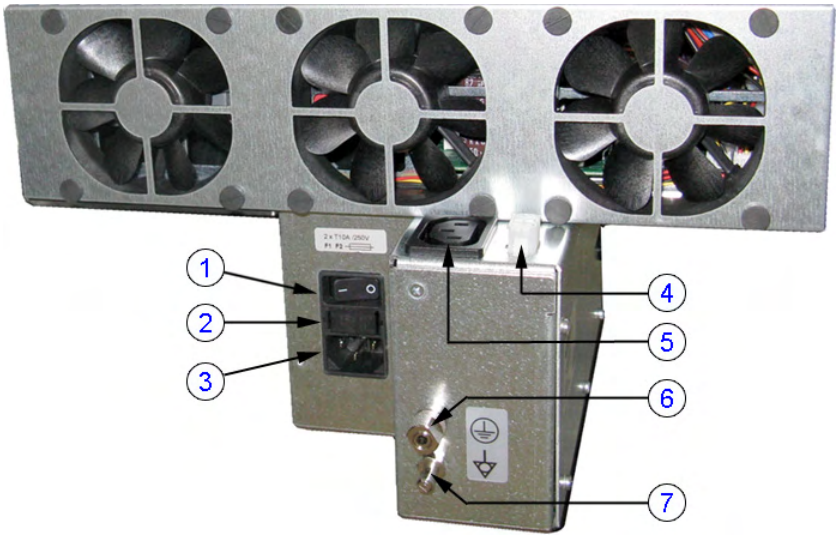


Figure 5-14 Power Supply Module - RSP

1	Circuit Breaker	5	Auxiliary Output
2	Fuses (2x T10A H/250V)	6	Protective Earth connection
3	connector for Main Power Cable	7	Equipotential connection
4	Lift system (12VDC)		

5.9.1.1 Mechanical Concept and Overview

The AC Power's main tasks are to supply the various internal subsystems with AC power and to galvanically isolate the system from the on site Mains Power System. To reduce inrush current, an inrush current limiter is implemented.

From the input voltage from the Power Supply (RSP) the AC/DC device generates all system supply voltages, which are:

- FrontEnd voltages
- Standby voltages
- ATX motherboard supply
- Tx voltages

In addition the AC/DC device contains the digital motor amplifier.

5.9.1.2 Input Voltage Range

input voltage range: 100 - 240VAC; 50/60Hz

5.9.1.3 Auxiliary Output Voltage

nominal 115VAC

All DC-supply voltages for built-in peripherals are generated in the RSP- Power Supply Module.

5.10 Mechanical Descriptions

5.10.1 Physical Dimensions

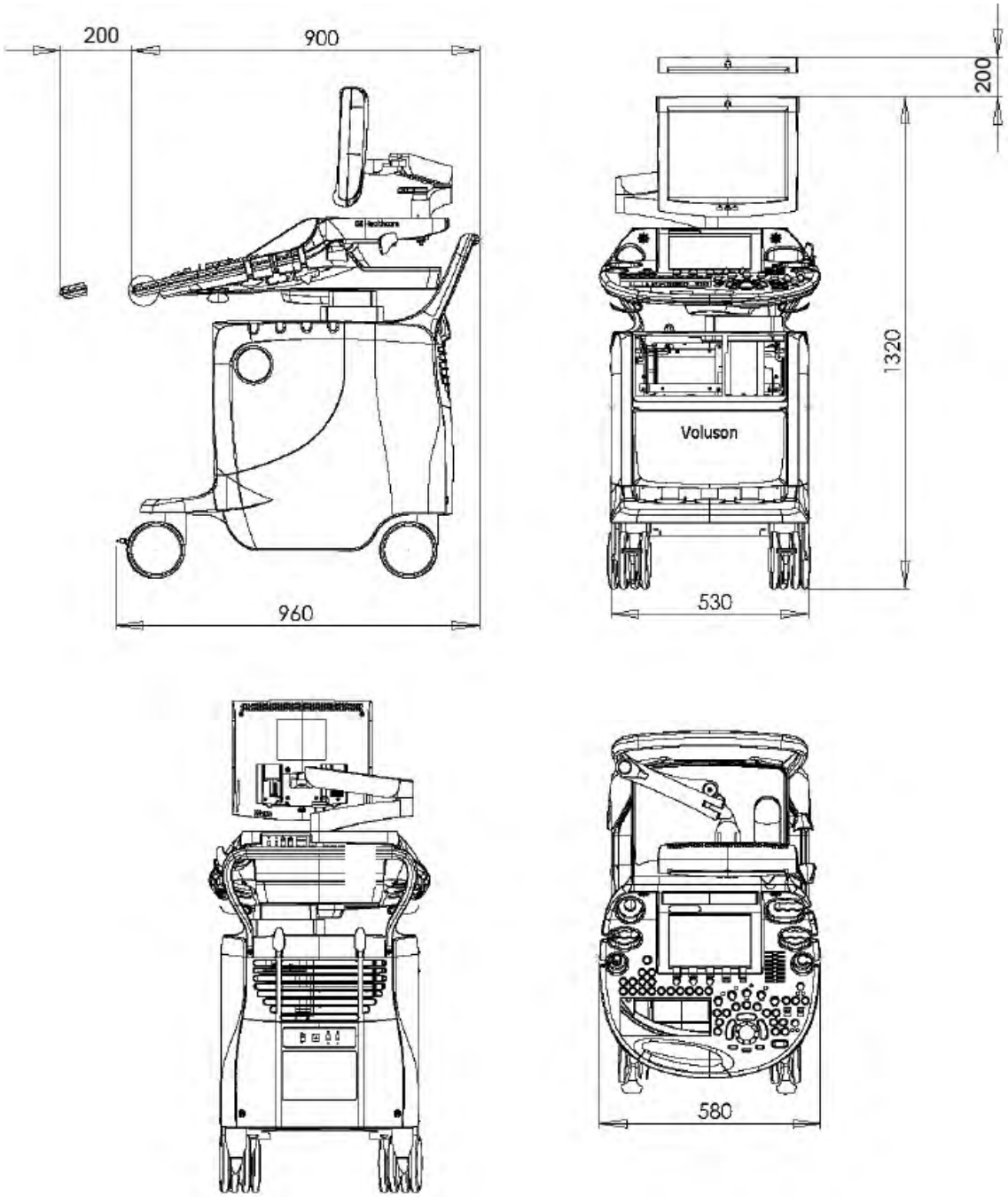


Figure 5-15 Physical Dimensions

5.10.2 LCD Monitor

The Voluson E-Series system has a free adjustable LCD monitor in relation to the user interface.

- position up/down: +/- 5 cm
- position left/right: +/- 20 cm
- rotation up/down: 30°/10°
- rotation left/right: +/- 45°

5.10.3 Control Console Positioning

The control console can be rotated, translated and adjusted in height.

- height adjustment: 20 cm (7.9 inch)
- translation adjustment: 20 cm (7.9 inch)
- rotation adjustment: +/- 40°

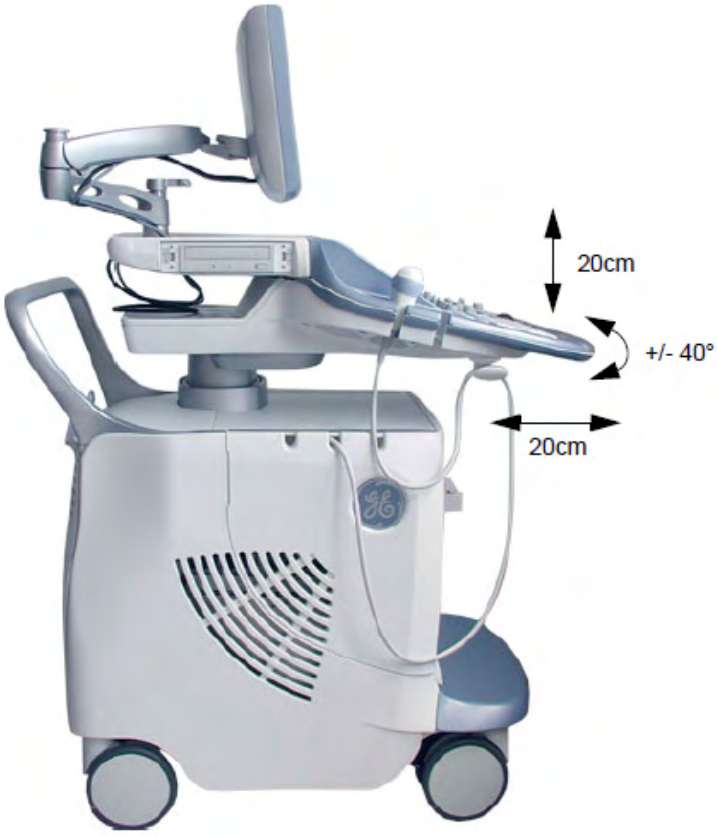


Figure 5-16 adjustable control console

5.10.3.1 Rotation/Translation of the Control Console

Press the **Brake** button inside of the handlebar opening to rotate/translate the console to the desired position. Press the **Brake** button again in order to secure the console against uncontrolled movement.

5.10.3.2 Height Adjustment (Elevation) of the Control Console

Height adjustment is done with the **Lift** key on the control console. As long as this key is pressed, the control console can be lifted / lowered by means of the ***up*** and ***down*** button displayed on the Touch Panel.

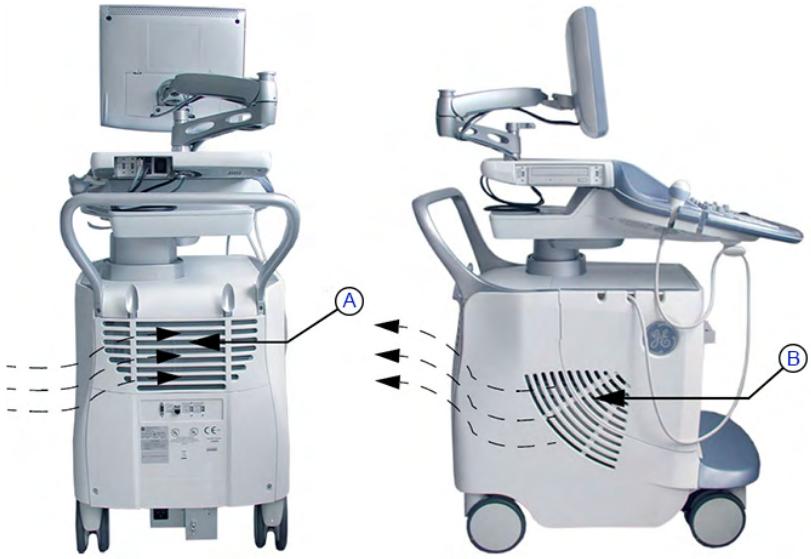
5.11 Air Flow Control

5.11.1 Air Flow Distribution

Through the filter grid on the back of the system (Main Air Inlet), air flow into the Voluson E-Series system.

- Air holes in the RSP power supply allow the air to pass through; the 3 fans inside the RSP suck in the air and spread it through the beamformer.
- By means of the 2 Backend fans, air is blown through the GEB-box (along its internal components and the PC- Motherboard).

The warm air exits the system through holes in the left side panel (Main Air Outlet).



A Main Air Inlet (filter grid)

B Main Air Outlet

Figure 5-17 Main Air Inlet/Outlet at Voluson E-Series

5.12 Service Platform

5.12.1 Introduction

InSite ExC (InSite with Express Connect) is the connectivity to the Voluson E-Series system that allows GE to deliver remote diagnostics capability. InSite is your direct link with a GE Online Service Engineer or Applications Support Engineer, or a Request for Service via the InSite ExC link (*GE* icon) at the right bottom of the display screen.

The GE icon in the status bar change symbol and color depending on ongoing activity; see *Table 7-2 on page 7-12* .

5.12.2 Access / Security

The Service Platform has different access and security user levels. Each user is only granted access to the tools that are authorized for their use.

There are different possibilities to access the Common Service Desktop and its available features:

- *Local Access* : via System Setup - Administration - ***Service*** page
- *Remote Access*: This offers GE technicians the possibility to view the entire customer's desktop and operation system. Remote access to the Voluson E-Series system requires permission and customer input to run diagnostics.

5.12.2.1 Local Access

1. If not already in read mode, **Freeze** the image.
2. Press the **Utilities** key on the control console.
3. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
4. On the left side of the screen select ***Administration*** and then click the ***Service*** tab.
5. Enter the password <SHE> and click the ***Accept*** button to display the Service Tools page (see *Figure 5-20 on page 5-42*).
6. Click the ***CSD*** button.
7. As soon as the GEHC Service Home Page appears, select “Operator” from the pull-down menu, enter the password <uls> and then click ***Okay***.

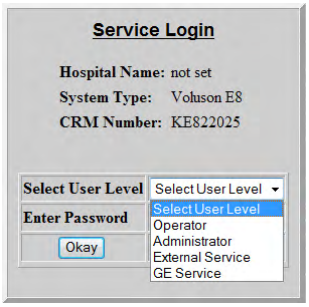


Figure 5-18 Service Login

The Common Service Desktop (CSD) is started and the Home page - containing basic System Information - appears. The navigation bar at the top of the screen allows to select different tools.

For more detailed information see *Section 7.6 "Common Service Desktop (CSD)" on page 7-13* .

5.12.2.2 Remote Access

Note *Remote access is ONLY possible if the Service Platform is properly configured (either by the user or a GE technician at site). Operation see Section 3.13.4 "InSite ExC Configuration" on page 3-77 .*

This allows GE technicians to view the entire customer´s desktop and operation system. Using VCO (**V**irtual **C**onsole **O**bservation) a service technician or the OLC (**O**n**L**ine **C**enter) can access and modify all settings and programs or run diagnostics on the customer's Voluson E-Series system.

Remote access to the Voluson E-Series system requires permission and customer input before a GE service technician or OLC can access the customer's system remotely.

Disruptive Mode can be selected by the customer directly on the Voluson E-Series (see *Section 7.5.2 on page 7-12*), or requested remotely by the service technician or OLC .

5.13 Common Service Desktop (CSD)

The Service Platform contains a set of software modules that are common to all ultrasound and cardiology systems. The Service Platform will increase service productivity and reduce training and service costs.

Internationalization

The user interface provided by the service platform is designed for GE personnel and as such is in English only. There is no multi-lingual capability built into the Service Interface.

There are different possibilities to access the Common Service Desktop and its available features:

- *Local Access* : via System Setup - Administration - ***Service*** page
- *Remote Access*: This offers GE technicians the possibility to view the entire customer's desktop and operation system. Remote access to the Voluson E-Series system requires permission and customer input to run diagnostics.

As soon as the Common Service Desktop (CSD) is started, the Service ***Home*** Page appears.

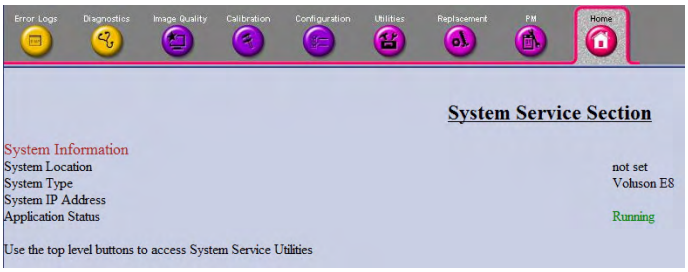


Figure 5-19 Common Service Desktop - Home

The navigation bar at the top of the screen allows to select from different tools for troubleshooting/ adjustment. For detailed description see *Section 7.6 "Common Service Desktop (CSD)" on page 7-13* .

5.14 Service Page

5.14.1 Introduction

The Service Page contains specific software/hardware test modules, system setup,update, etc. for Voluson E-Series systems only.

5.14.2 Access / Security

The service page has different access and security user levels. Each user is only granted access to the tools that are authorized for their use.

5.14.3 Service Login

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***Service*** tab.
4. Enter the password <SHE> and click the ***Accept*** button to display the Service Tools page (see *Figure 5-20 on page 5-42*).

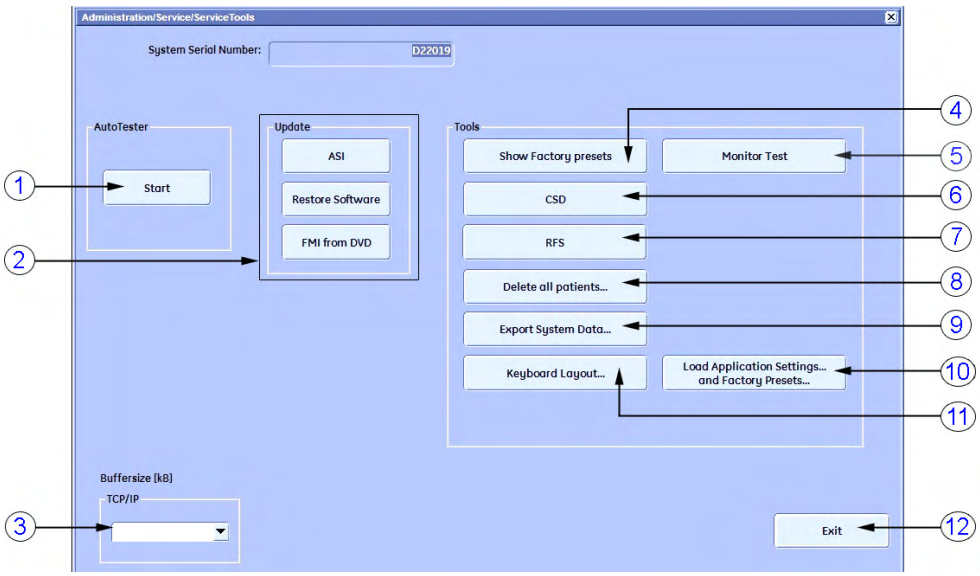


Figure 5-20 Service Tools page

1	Auto Tester	5	Monitor Test	9	Export System Data
2	Update	6	Common Service Desktop	10	Load Application Settings and Factory Presets
3	TCP/IP Buffersize	7	Request for Service	11	Keyboard Layout
4	Show Factory Presets	8	Delete all Patients	12	Exit

5.14.3.1 Auto Tester

Autotester is a log function of customer activities. It records all user actions (scanning, Touch Panel entries, performing Calculations, review of Patient Reports, etc.…). It is possible to safe (record) as file on HDD. But also export to DVD/CD can be done to allow replay of the records on other units.

Note *For intermittent problems this file can be requested from the Service Engineer or customer. It is possible to burn this file on DVD/CD+R/RW.*

Operation see *Section 7.7 "How to use the Auto Tester program" on page 7-17* .

5.14.3.2 Update

5.14.3.2.1 FMI from DVD

By means of the ***FMI from DVD*** button, the Systems C:\ image is partly or completely updated. The System Software parts to be upgraded depend on contents of the used System DVD.

The first “Boot Device” in BIOS has to be Hard Disk Drive.

Note *During “FMI from DVD” the used system configuration (incl. Full Backup) will be stored on R:\. If required, the previously used System configuration (before FMI from DVD was performed) can be restored by activating the “Rollback” function. Operation see: Section 5.15.1.3 on page 5-45 .*

5.14.3.2.2 ASI - Additional Software Installation

Click the ***ASI*** button to install additional software. The Software parts to be installed depend on the contents of the System DVD that is used.

5.14.3.2.3 Restore Software

Click the ***Restore software*** button to perform an automatic restore of the system software from your hard disk. The installation procedure starts with saving and recording the settings present on the system (silent “Full Backup" and "Rollback”). During the software restore the system will restart several times.

Note *Please make sure that **ONLY the DVD writer is connected** on the USB ports. Disconnect all other external USB devices (such as printers, hubs, bluetooth, memory devices) as this might interfere with the recovery/ installation procedure.*

Note *Existing User Programs, 3D/4D Programs and Auto Text remain unaffected! Therefore it is not necessary to perform any readout preparations.*

5.14.3.3 TCP/IP Buffersize

The TCP/IP Buffersize selects the amount of buffer memory used for DICOM transfers (both directions).

5.14.3.4 Common Service Desktop (CSD)

Access to the Common Service Desktop (CSD) by entering security level and password. Each user is only granted access to the tools that are authorized for their use.

5.14.3.5 Request for Service (RFS)

Fill out the “Request For Service” form and then send the problem description to GE Service/Application representatives. Operation see *Section 7.2 "Request for Service (RFS)" on page 7-5* .

5.14.3.6 Delete all Patients

1. Click the ***Delete all Patients...*** button.

   Following WARNING message appears on the screen.

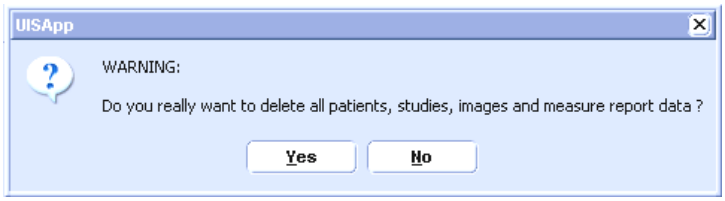


Figure 5-21 Warning message

Warning

If you select the ***YES*** button, all patients data, studies, images and measure report data will be deleted permanently from the hard disk and **cannot be recovered**!

5.14.3.7 Export System Data

Select the Export System Data button on the “Service Tools” page to Full Backup the System State. This includes dump-files and text files, the full Service Database informations about probes, boards, Software, Options and the Event Log File. Operation see *Section 7.4.2.2 on page 7-10* .

5.14.3.8 Keyboard Layout

To change the keyboard layout to different languages. Operation see: *Section 6.4 "Modification of Keyboard Layout" on page 6-7* .

Note *Reconfigure the layout of the keyboard is only useful by changing the concerned keys also; see:* *Section 8.13 "Replacement of Key Caps (by special native language keys)" on page 8-22* .

5.14.3.9 Monitor Test

Select the ***Monitor Test*** button to perform color calibration. Operation see: *Section 6.2 "LCD Monitor Adjustment" on page 6-2* .

5.14.3.10 Load Application Settings and Factory Presets

If the Tune version of the Application presets does not match the Application Software version, it is probably that there are adverse affects on image quality (e.g., after reloading an old “Full Backup”).

Note *When reloading these Application Settings, any existing User Programs, 3D/4D Programs and Auto Text* ***remain unaffected****!*

1. Click the ***Load Application Settings and Factory Presets*** button on the “Service Tools” page (see *Figure 5-20 on page 5-42*).
2. Choose the media and then click ***Load***.

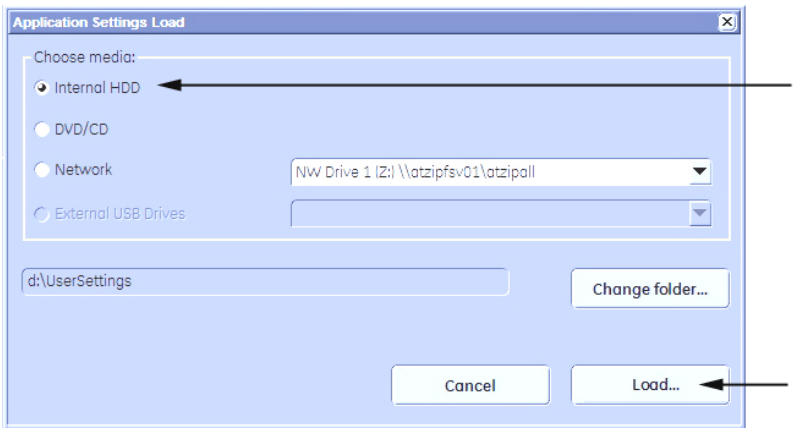
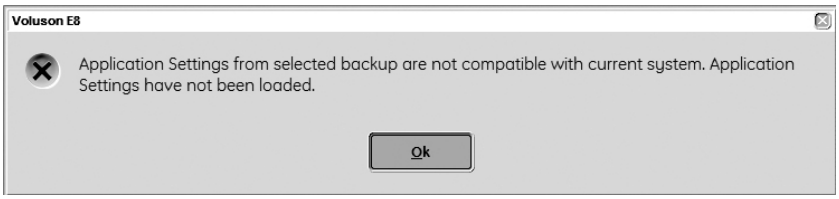


Figure 5-22 Application Settings Load

3. Select the desired file and then click ***Ok***.

   Load procedure starts immediately including a reboot of the system.

Note *If the ID of the Application Setting is not valid for the currently installed Application Software version, a warning message appears during boot up sequence.*



4. If warning message is displayed, confirm it with ***OK*** and then load appropriate Application Settings (perform loading procedure as described in steps above).

5.15 Boot Screen Functions

5.15.1 Overview

Following LINUX supported functions are available as soon as the “Boot Screen” appears:

Voluson
GE-Service
Rollback
Memtest (Memory Check)

Figure 5-23 Boot screen

After 3 sec. without pressing any key, the system will boot-up in windows (= **Voluson** item). If you missed selection, retry again with **Ctrl** + **Alt** + **Del**.

5.15.1.1 Voluson

The System will boot-up in windows. The Ultrasound Application is started. For details see *Section 3.5.1.1 "During a normal boot, you may observe" on page 3-41* .

5.15.1.2 GE-Service

This function MUST NOT be used by the customer!

5.15.1.3 Rollback

This function offers the possibility to simply restore the previously used system configuration (rollback), which was stored on R:\ during “FMI from DVD”.

1. Turn system OFF and then back ON.
2. As soon as the “Boot Screen” appears (see: *Figure 5-23 on page 5-45*), press the **[PgDn]** (Arrow down) key on the keyboard until the **Rollback** item is highlighted, then press **Enter**.
3. When the following WARNING message appears, press the **[<-]** (Arrow left) button to highlight ***OK*** and then press **Enter**.

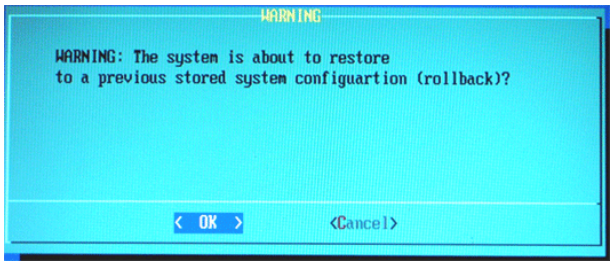


Figure 5-24 Warning message

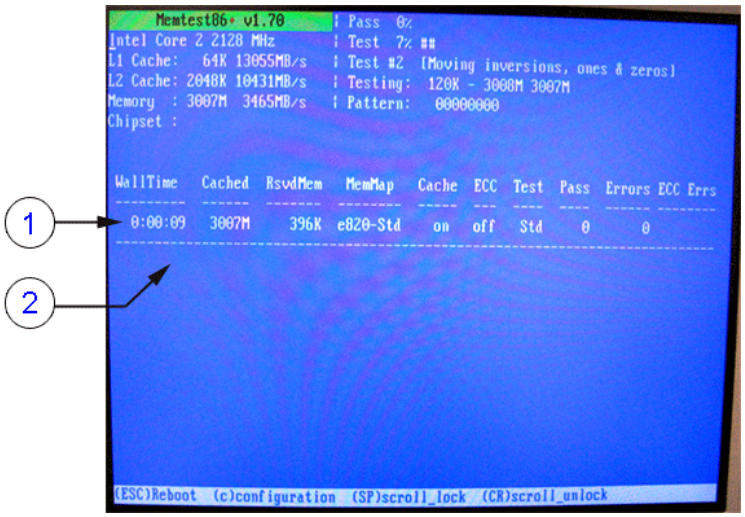
After performing the rollback, the system reboots. The Ultrasound Application is started and finally the 2D screen is displayed on the monitor.

5.15.1.4 Memtest (Memory Check)

1. Turn system OFF and then back ON.
2. As soon as the “Boot Screen” appears (see: *Figure 5-23 on page 5-45*), press the **[PgDn]** (Arrow down) key on the keyboard until the **Memtest** item is highlighted, then press **Enter**.

After 3 sec. without pressing any key, the system will boot-up in windows (= **Voluson** item). If you missed selection, retry again with **Ctrl** + **Alt** + **Del**.

The PC Memory Test will start automatically and will take about 2.5 hours. If there are errors they will be listed.



1 elapsed test time

2 list of errors

Figure 5-25 Memory check in LINUX

Note *After one cycle (~ 2.5 hours) the memory check starts again. To interrupt the test, press the **Esc** key. If you don't interrupt the memory test , it will perform never ending cycles of memory checks.*

Note *If after one cycle (about 2.5 hours), no error messages are listed, it can be assumed that the Back End Processor including power supply is working properly.*

Chapter 6

Service Adjustments

This chapter describes how to test and adjust the mechanical capabilities of a system that may be out of specification. Although some tests may be optional they should only be performed by qualified personnel.

Content in this chapter

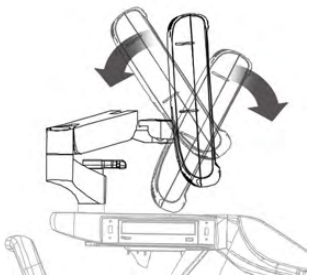
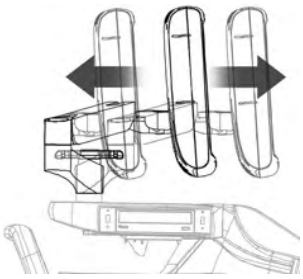
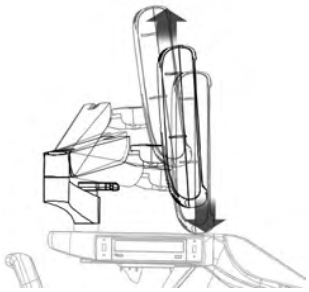
6.1 Regulatory

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

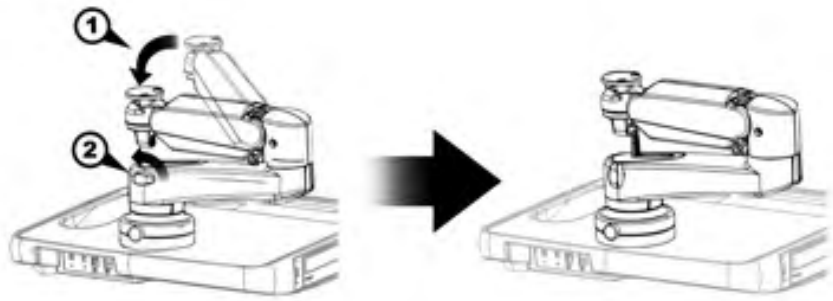
6.2 LCD Monitor Adjustment

The Voluson E-Series system has a free adjustable LCD monitor in relation to the user interface.

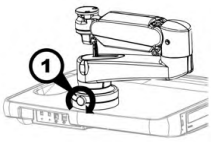
- position up/down: +/- 5 cm
- position left/right: +/- 20 cm
- rotation up/down: 30°/10°
- rotation left/right: +/- 45°

Incline the monitor	Move back and forth	Move up and down
		

Lock Height Adjustment

Move the upper monitor arm parallel to the lower arm and push it down (1), then lock it by turning the knob (2) counterclockwise. Release by turning the knob clockwise.


Lock Arm Rotation

Rotate the arm to center position and turn the knob (1) clockwise till the rotation is locked. Release by turning the knob counterclockwise.


6.2.1 Preparing for Transport

To ensure that no part of the monitor can be damaged when transporting or moving the system, the monitor has to be in a secure position.

1. Lock all monitor parts.
2. Incline the monitor to horizontal position.

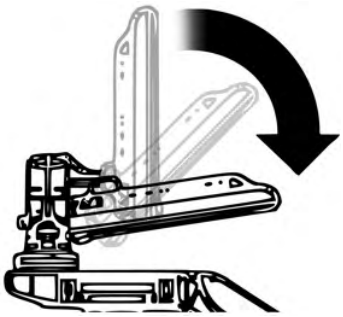


Figure 6-1 incline the monitor

The system can now be safely transported. Nevertheless be careful when transporting or moving the device.

6.2.2 Load Default Monitor Settings

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***Monitor*** button to display the "Monitor Menu".

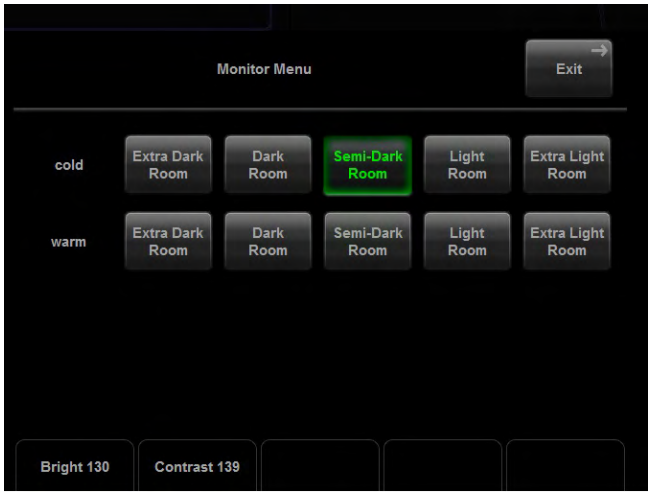


Figure 6-2 Monitor Menu

3. Touch the ***Semi-Dark Room*** button to load default monitor settings for your system.

Table 6-1 Default Monitor Settings

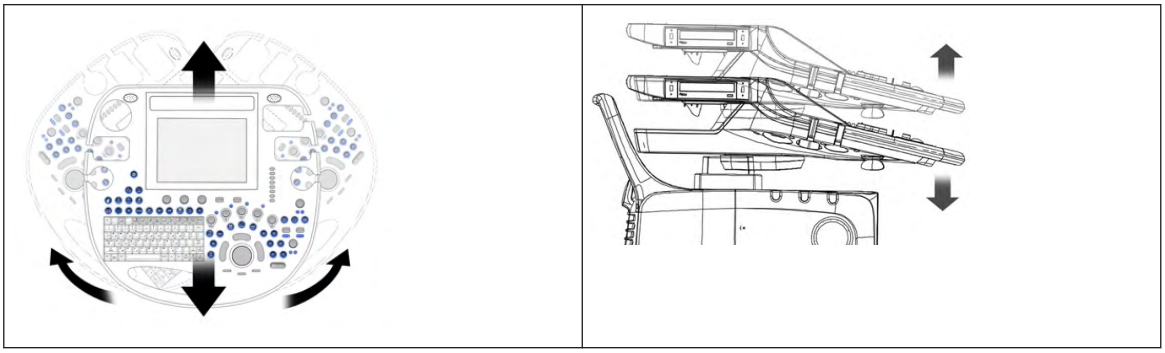
	Extra Dark Room		Dark Room		Semi-Dark Room		Light Room		Extra Light Room	
	cold	warm	cold	warm	cold	warm	cold	warm	cold	warm
Brightness	124	122	128	126	130	129	132	132	137	144
Contrast	128	120	132	124	139	130	144	134	150	149
Backlight Brightness	144	134	160	148	176	159	192	176	200	192
Sharpness	0	0	0	0	0	0	0	0	0	0
Red	170	182	170	182	170	182	170	182	170	182
Green	202	209	202	209	202	209	202	209	202	209
Blue	255	255	255	255	255	255	255	255	255	255

6.2.3 Monitor Test

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***Service*** tab.
4. Enter the password <SHE> and click the ***Accept*** button to display the Service Tools page (see *Figure 5-20 on page 5-42*).
5. Select the ***Monitor Test*** button in the “Service Tools” menu.
6. The screen becomes white.
   - WHITE is displayed without any tint (discolor) or colored pixels.
7. Press the **right/left trackball** key repeatedly to step through RED, GREEN, BLUE, BLACK and GRAYSCALE.
   - Each color is displayed correctly (without any tint or discolored pixels).
8. To exit the Monitor Test program, press **ESC**.

6.3 Control Console Positioning

The control console can be rotated, moved forward and backward and adjusted in height.



6.3.1 Translation/Rotation Adjustment

Press the **Brake** button inside of the handlebar opening to rotate/translate the console to the desired position. Press the **Brake** button again in order to secure the console against uncontrolled movement.

Figure 6-3 Buttons for Control Console Adjustment

1	**Lift** button for height adjustment of the control console
2	**Brake** button for locking and unlocking the control console

Caution

The system should not be moved with the control console (UI) extended. Do not put your hand between the control console and the main unit when moving the control console to its centered and locked position: Danger of injuries!

6.3.2 Height Adjustment (Elevation)

Height adjustment is done with the **Lift** key on the control console. As long as the **Lift** key is pressed, the control console can be lifted / lowered by means of the ***up*** or ***down*** button displayed on the Touch Panel (soft keys for safety reason).

Caution

Make sure that nothing would be jammed while moving!

6.3.2.1 Moving down (lower) the Console - without booting up the System

If it is impossible to boot up the system, the user interface can be moved downwards by pressing 3 keys on the control console.

1. Connect the main power cable to the back of the system.
2. Connect the main power cable to a hospital grade power outlet with the proper rated voltage.
3. Press 3 keys (see *Figure 6-4 below*) on the control console simultaneously to move it downwards.

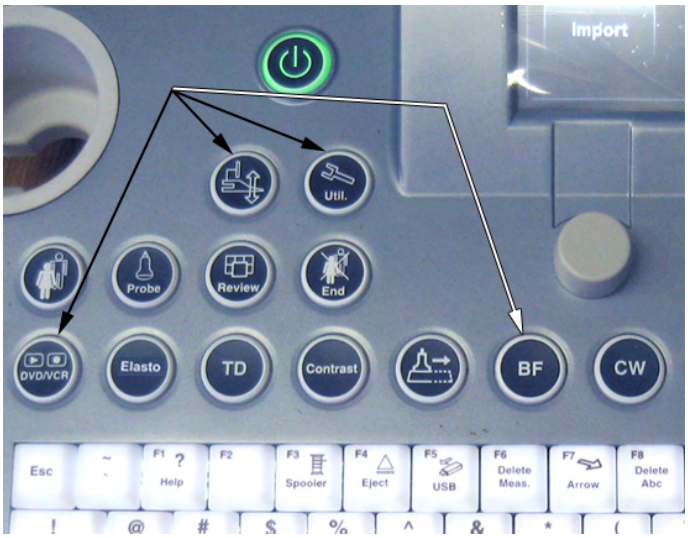


Figure 6-4 keys to lower/lift the control console

Note *Shipping the Voluson E-Series ultrasound system in its original packaging is only possible when control console is centered and locked in position, the system is lowered to its minimum height and the monitor is flapped down and locked (see Figure 6-1 on page 6-3).*

6.3.2.2 Moving up (lift) the Console - without booting up the System

Note ***Whanam console only:*** *If it is impossible to boot up the system, the user interface can be moved upwards (lifted) by pressing 4 keys on the control console.*

1. Connect the main power cable to the back of the system.
2. Connect the main power cable to a hospital grade power outlet with the proper rated voltage.
3. Press 3 keys + **BF** (see *Figure 6-4 above*) on the control console simultaneously to move it upwards.

6.4 Modification of Keyboard Layout

Note *Configuring the layout of the keyboard is only useful by changing the concerned keys also; see Section 8.13 "Replacement of Key Caps (by special native language keys)" on page 8-22 .*

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***Service*** tab.
4. Enter the password <SHE> and click the ***Accept*** button to display the Service Tools page (see *Figure 5-20 on page 5-42*).
5. Click on the ***Keyboard Layout*** button.
6. Select the input language from the pull-down menu.

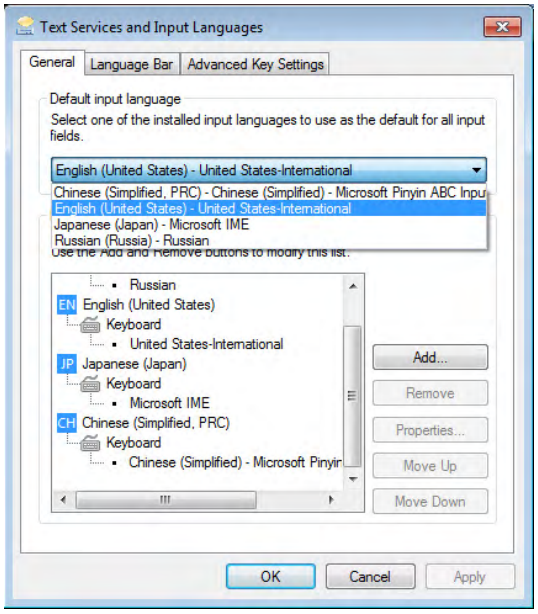


Figure 6-5 input language

Note *If the desired language is not listed, click the **Add** button, choose the desired input language from the pull-down menu, as shown in Figure 6-6 below, and then confirm with **OK**.*

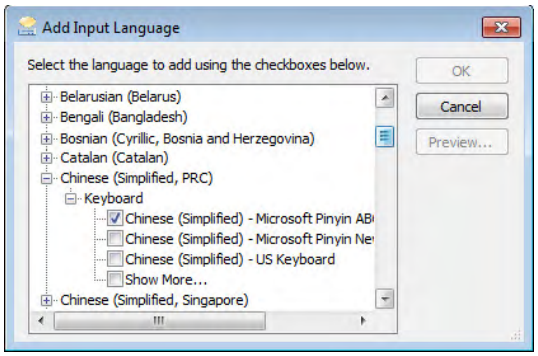


Figure 6-6 add input language

7. If not already done, select the default input language from the pull-down menu. The corresponding keyboard layout is changed accordingly.
8. Click on ***Apply*** and then close the window with ***OK***.
9. Close the Service page with ***Save&Exit*** and restart the system.
10. Reenter “Keyboard Layout” by repeating step 1.) to step 8.). This time ***Remove*** unused language(s).
11. Test the Keyboard function:
    - Press the **ABC** key on the control console.
    - Press some keys on the keyboard and verify the entered text.

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Chapter 7

Diagnostics/Troubleshooting

This chapter describes how to setup and run the tools and software that help maintain image quality and system operation. Basic host, system, and board level diagnostics are run whenever power is applied. Some Service Tools may be run at the application level.

Content in this chapter

7.1 Collect vital System Information

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***System Info*** tab.

The following information is necessary in order to properly analyze data or images being reported as a malfunction or being returned to the manufacturer:

- **System Type**
- **System Serial number** (also visible on label on back of the system)
- **Application Software version**
- **Backup version** (File name, Date of Factory Settings, Tune version, etc.)
- **additional information** (e.g., Hardware ID, “Mainboard Type”, HW configuration, etc.)

Note *All the above information can be found in the "System Info" page; see: Figure 7-1 on page 7-3 .*

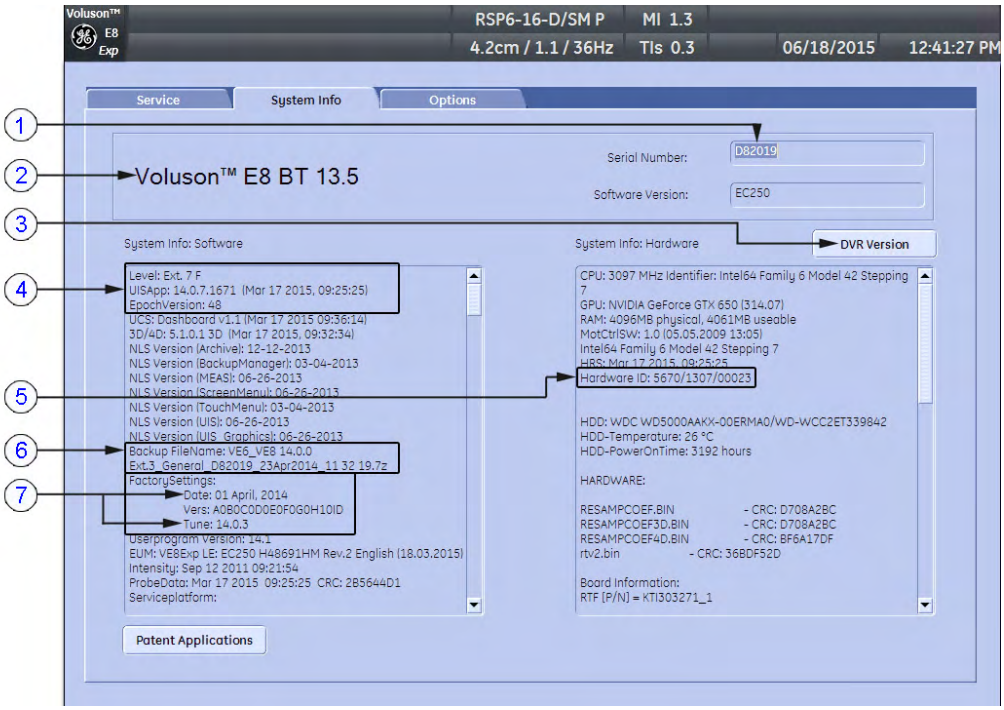


Figure 7-1 System Setup - Administration - SYSTEM INFO page

Note *Move the scroll bars downwards to view additional information about the installed software/hardware.*

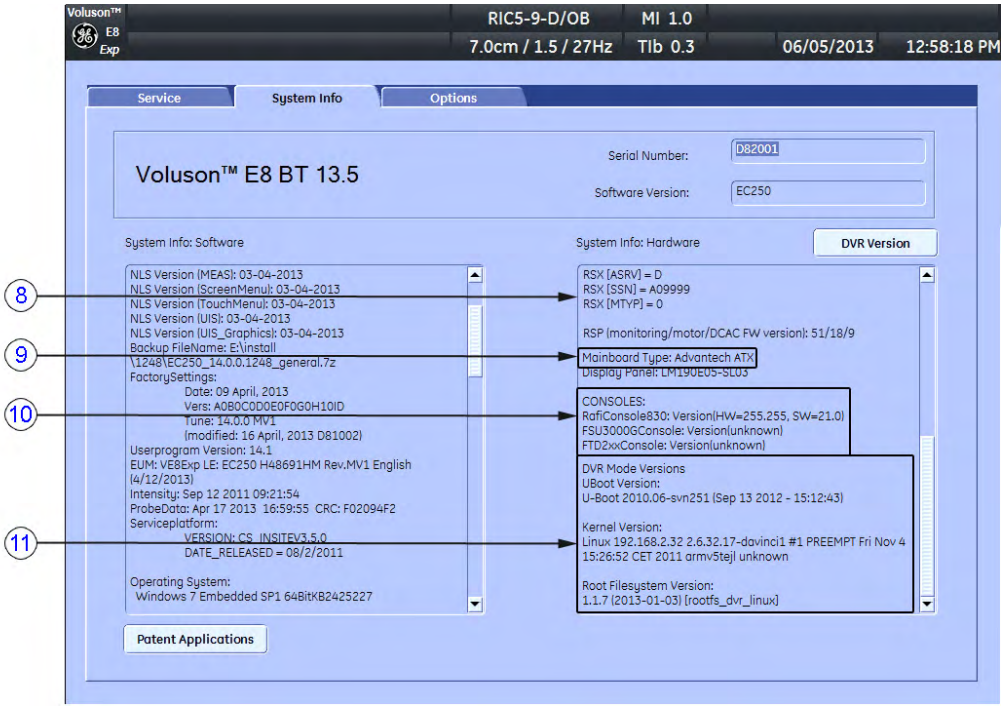


Figure 7-1 System Setup - Administration - SYSTEM INFO page

1	Serial Number	7	Factory Settings: Date & Tune version
2	System Type	8	Hardware configuration (board versions)
3	show DVR version	9	Mainboard Type (e.g. ADVANTECH ATX)
4	Application Software	10	Console version (e.g. RAFI)
5	Hardware ID	11	DVR version
6	Backup File Name		

7.1.1 Shortcuts List

Press the **Ctrl** + **H** key simultaneous to display the shortcuts list and a description of what they do.

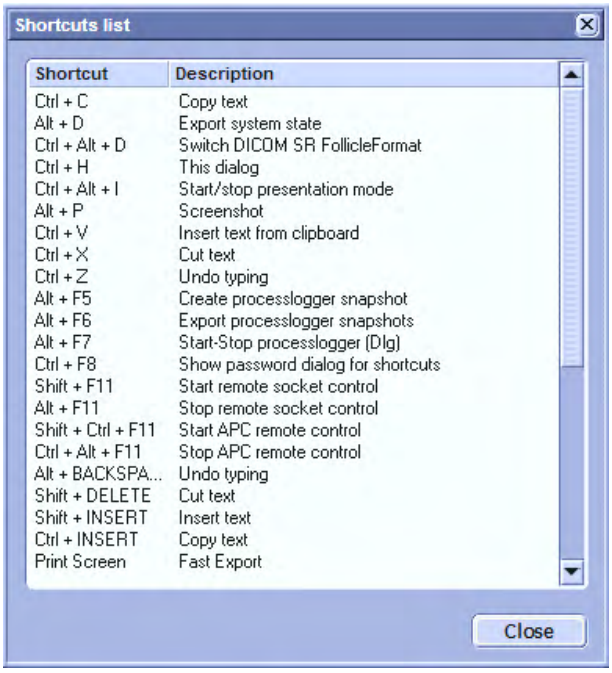


Figure 7-2 Shortcuts list (Ctrl + H)

Table 7-1 list of shortcuts + description of what they do

Shortcut	Description	Shortcut	Description
Ctrl + C	copy text	Alt + F7	start/stop process logger
Alt + D	export system state (Full Backup and Dump files) to D:\export	Ctrl + F8	Factory use ONLY! This function is not intended for the user.
Ctrl+ Alt + D	Factory use ONLY! This function is not intended for the user.	Shift + F11	start remote socket control
Ctrl + H	shortcuts list (see: *Figure 7-2 above*)	Alt + F11	stop remote socket control
Ctrl + Alt + I	start/stop presentation mode	Shift + Ctrl + F11	Factory use ONLY! This function is not intended for the user.
Alt + P	stores screenshot on D:\export	Crtl + Alt + F11	Factory use ONLY! This function is not intended for the user.
Ctrl + V	paste, insert text from clipboard	Alt + Backspace	undo typing
Ctrl + X	cut text	Shift + Delete	cut text
Ctrl + Z	undo typing	Shift + Insert	insert text (paste)
Alt + F5	create process logger snapshot	Ctrl + Insert	copy text
Alt + F6	export process logger snapshots (to USB Drive, CD or network share)	Print Screen	fast export

7.2 Request for Service (RFS)

Note *Service Connectivity has to be checked out once before you can request for service. i.e., Service Platform has to be configured properly; see Section 3.13.4 "InSite ExC Configuration" on page 3-77 .*

There are 2 possibilities to contact GE:

- by means of the GE “Remote Status Icon” that is displayed on the bottom of the screen

Move the cursor to the InSite ExC link (GE icon) at the right bottom of the display screen and press the left trackball key (= left-click). The “Contact GE” form (see *Figure 7-3 below*) is displayed.

- via the System Setup "Service" page

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***Service*** tab.
4. Enter the password <SHE> and click the ***Accept*** button to display the Service Tools page (see *Figure 5-20 on page 5-42*).
5. Click the ***RFS*** button and fill out the displayed form. (Enter detailed problem description.)

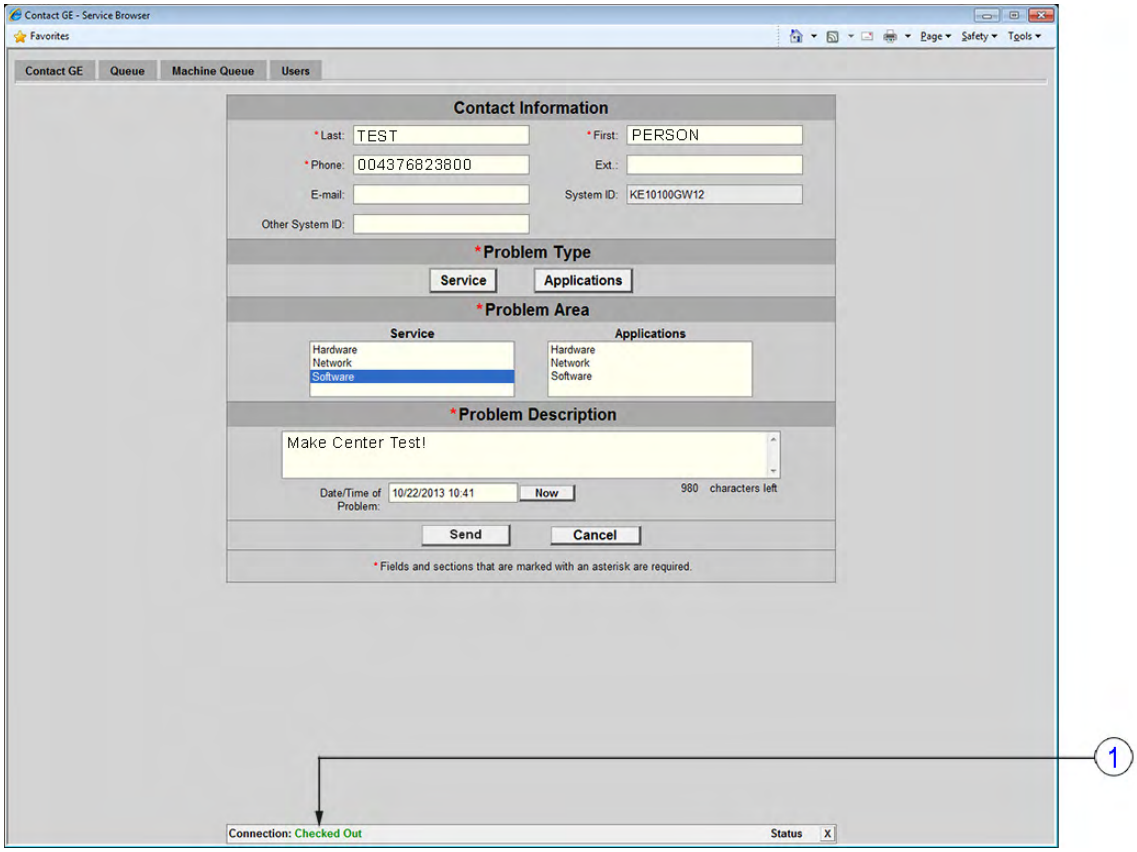


Figure 7-3 Contact GE - Request for Service

Note *Connection must be checked out! **(1)***

6. Click the ***Send*** button to send the problem description to GE Service/Application representatives.

A request confirmation screen is displayed.

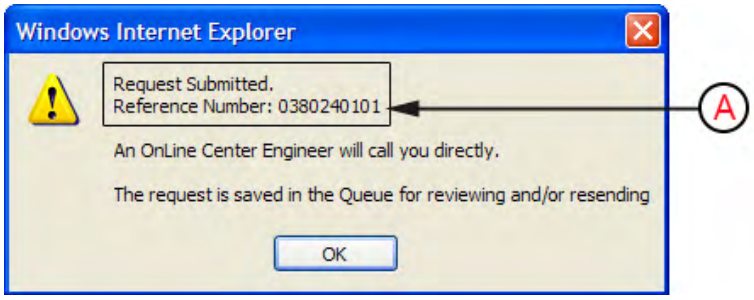


Figure 7-4 Request submitted

7. Write down and keep the Reference Number **(A)** for follow up procedures, then click ***OK***.
   The request is saved in QUEUE for reviewing and/or resending.

Note *If the service platform is not configured an Error message is displayed. The request is NOT sent!*

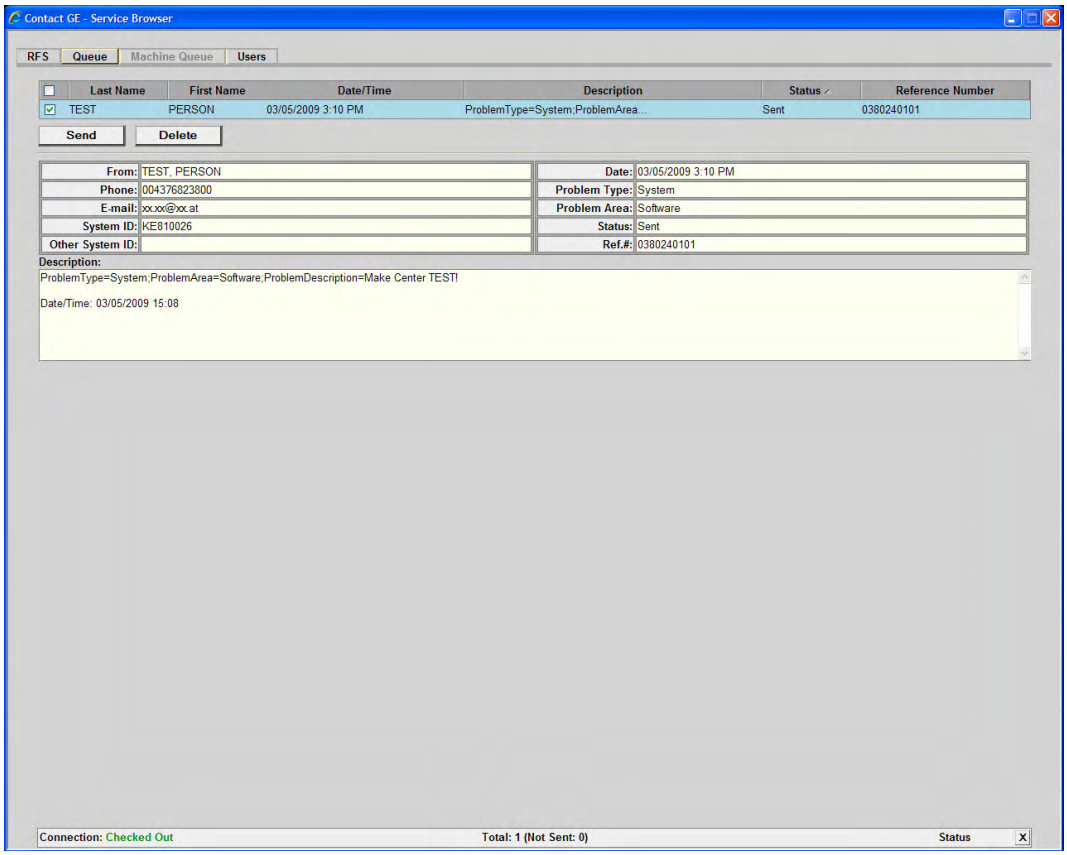


Figure 7-5 Contact GE - Queue

7.3 Check Point Voltages

7.3.1 User Interface - Status LEDs

The LED within the start key (**ON/OFF** button) on the User Interface is used to signal the status of the Voluson E-Series system.

The following states are implemented:

	Orange	System in standby mode.
	Green	System in normal operation mode.
	blinking **Orange <=> Green**	FPGA_CONF_DONE = low IF-FPGA not initialized -> probably FrontEnd (RFM board) or Power Supply (RSP) issue
	NO light	System is switched OFF (circuit breaker)
	NO light	probably Power Supply (RSP) defect

7.3.2 Power Supply (RSP) - Status LEDs

On the backside of the ATX board near the fans 3 green status LEDs are mounted. These LEDs are used for signaling the status of the Power Supply (RSP).

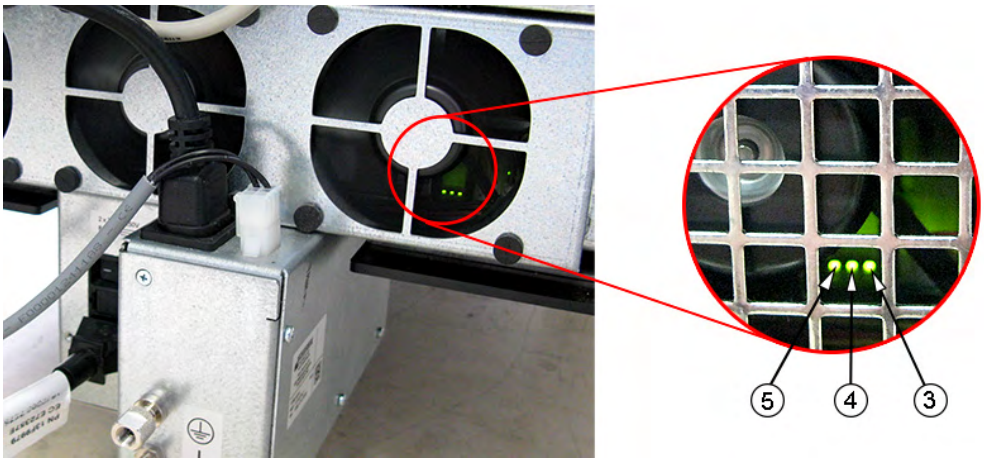


Figure 7-6 check green LEDs inside RSP

LED 3	Off: 12V_FE off On: 12V_FE on
LED 4	Off: FPGA_CONF_DONE = low On: FPGA_CONF_DONE = high
LED 5	Off: ATX supply off On: ATX supply on

7.4 Screen Captures and Logs

There may be times when the customer or field engineer will want to capture a presentation on the screen so it may be recovered by the OnLine Center. This is accomplished by saving the image(s):

1. to archive and export them (as jpg, bmp or tiff) to DVD or external USB drive
2. as jpg and bmp to D:\export by pressing the **Alt** + **P** key on the alphanumeric keyboard

   Note: Successive **Alt** + **P** keystrokes (max. 20) overwrite existing snapshots at destination HDD!
3. creates one snapshot (Alt-D.bmp) + “Full Backup” of the System state (fullbackup -> fb1) saved on D:\export by pressing the **Alt** + **D** key on the alpha-numeric keyboard

7.4.1 Capturing a Screen

The following is the generic process to capture any screen from the Voluson E-Series system.

1. Navigate to, and display the image/screen/volume to be captured.
2. Press the **P1**, **P2**, **P3** or **P4** key (depending on system configuration) on the control console and store the image onto the clipboard (frame on left side of the screen).

Note *A short summary of **P1**, **P2**, **P3** or **P4** keys configuration is shown in the status area on the screen.*

Figure 7-7 summary of keys configuration

3. Select the stored image(s) and export them to DVD drive, an external USB drive (optional) or mapped Network drive (jpg, bmp, tiff or Volume file).

7.4.2 Export Log's and System Data

There are two possibilities to export system data (and log´s):

1. by pressing the **Alt** + **D** key to save a snapshot and “Full Backup” of the System state; see *Section 7.4.2.1 on page 7-9*
2. via the ***Export System Data*** button in the System Setup - Administration - Service page; see *Section 7.4.2.2 on page 7-10*

7.4.2.1 Export System Data (by pressing the ALT + D key)

Alt + **D** uses “Full Backup” to gather data from the system. In addition it creates one screen shot (Alt-D.bmp) of the point in time when **Alt** + **D** was pressed. The main use is when R&D or OLC need detailed information about the system (e.g., when experiencing strange behaviour or when the problem should be investigated by R&D). It is not intended to replace or enhance the existing Full Backup functionality.

The Full Backup created by **Alt** + **D** is protected by a password that can be customized. Whenever transmitting system state to R&D, do not forget to inform them about any password change.

Data can be stored on the hard disk (D:\export\fullbackup\fb1), or you can export them to DVD/CD, etc. Including the D:\export folder, which contains dump files (for details see *Section 7.4.2.2.1 on page 7-10*), Autotester script files, SMART logs, sniffer logs and screen shots (**Alt** + **P**).

Note *Successive **Alt** + **D** keystrokes overwrite existing snapshots at destination (Internal) HDD.*

1. Press the **Alt** + **D** key on the keyboard simultaneously.

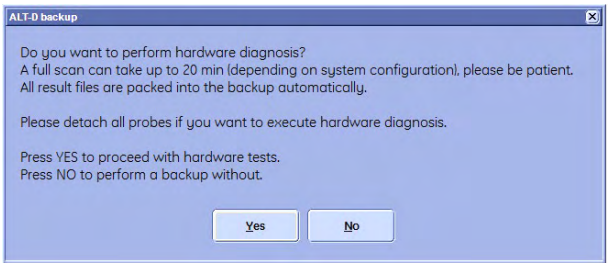


Figure 7-8 "Alt-D" backup

2. Select whether you want to backup data with our without hardware diagnosis tests.

Please detach all probes if you want to execute hardware diagnosis, then click ***Yes***.

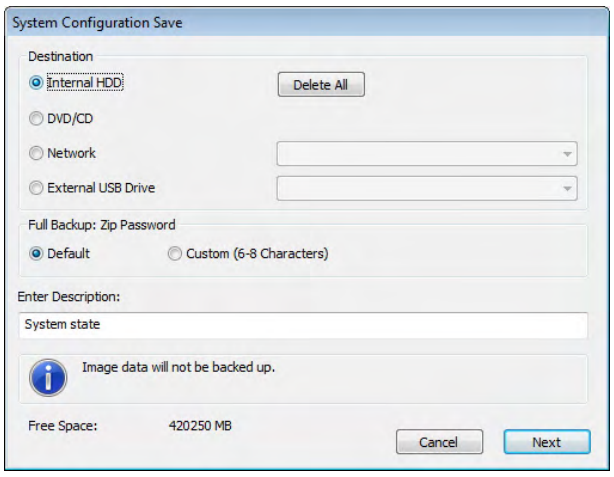


Figure 7-9 System Configuration Save

3. Select the destination of the “System state” backup.
4. Select the ***Next*** button to start the backup process.

After saving the data, the Voluson E-Series reboots and the application starts again.

7.4.2.2 Export Log's and System Data (via Service Page)

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***Service*** tab.
4. Enter the password <SHE> and click the ***Accept*** button to display the Service Tools page (see *Figure 5-20 on page 5-42*).
5. Click on the ***Export System Data*** button to Full Backup the System state. This includes dump files and text files, full Service Database informations about probes, boards, Software, Options and the Event Log File.

7.4.2.2.1 Dump file

Every time an error message is produced, a dump file and a text file containing the error dump and the error message are created in D:\export. Up to 20 dump files are stored there.

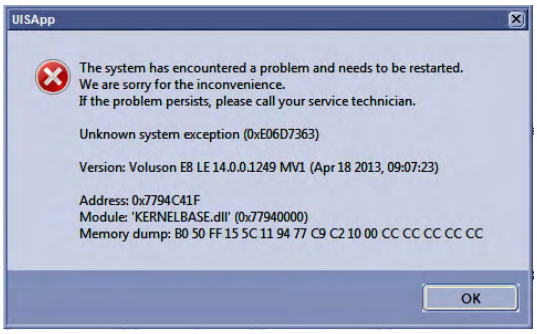


Figure 7-10 system has encountered a problem

After clicking on ***OK*** the system reboots automatically.

7.5 Remote Access to the Service Platform

Content in this section

7.5.1 General

This allows GE technicians to view the entire customer´s desktop and operation system. Using VCO (**V**irtual **C**onsole **O**bservation) a service technician or the OLC (**O**n**L**ine **C**enter) can access and modify all settings and programs or run diagnostics on the customer's Voluson E-Series system.

Note *Remote access is ONLY possible if the Service Platform is properly configured (either by the user or a GE technician at site). Operation see Section 3.13.4 "InSite ExC Configuration" on page 3-77 .*

Remote access to the Voluson E-Series system requires permission and customer input before a GE service technician or OLC can access the customer's system remotely.

Disruptive Mode can be selected by the customer directly on the Voluson E-Series (see *Section 7.5.2 on page 7-12*), or requested remotely by the service technician or OLC .

7.5.2 How the Customer enables/disables Disruptive Mode and VCO

1. If not already in read mode, **Freeze** the image.
2. Move the cursor to the InSite ExC link (*GE* icon at the right bottom of the display screen) and press the **right trackball key** (= right-click).
3. Select *Connect Clinical Lifeline* (see: *Figure 7-11 below*). This activates “Disruptive Mode” and “VCO” for the application OLC to quickly assist the customer.

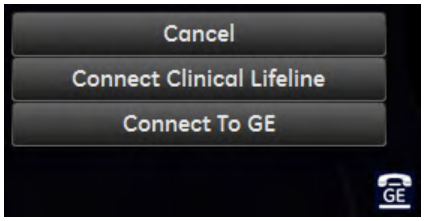


Figure 7-11 Connect Clinical Lifeline

4. If you select *Cancel*, “Disruptive Mode” and “VCO” is turned OFF.

Note *Visual information about GE remote service status is shown in the status area on the right bottom of the screen.*

 	**Gray** = Idle State	Remote access is inactive.
	**Yellow** = Access pending	Remote Access connection is active, but Disruptive Mode and Virtual Console Observation (VCO) is not yet enabled.
	**Red** = Disrupted State	Remote Access is active. All processes [UL_VNC and UL_CSD] are active. In this state the Voluson E-Series system should NOT be used clinically.
	**Gray** + envelope	New Software Update Package is available for download and installation. Operation see *Section 8.2.3 "Software Update Package - Download/ Installation Procedure" on page 8-9* .

If a GE Service Technician requests Remote Access Permission

If a GE Service technician requests remote access to your Voluson E-Series system, following message appears on the screen.

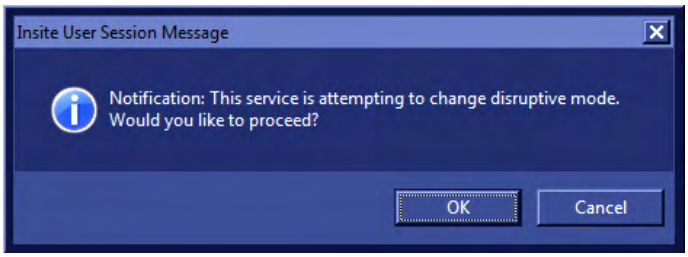


Figure 7-12 Insite User Session Message

To enable Disruptive Mode click *OK*.

Note *If the customer does not wish to have diagnostics running at the time of the request, select **Cancel**. A message is sent back to the OLC or FE that permission to change Disruptive Status is denied.*

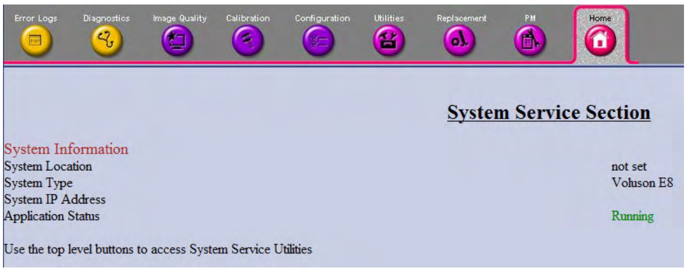
7.6 Common Service Desktop (CSD)

There are different possibilities to access the Common Service Desktop and its available features:

- *Local Access* : via System Setup - Administration - ***Service*** page
- *Remote Access*: This offers GE technicians the possibility to view the entire customer's desktop and operation system. Remote access to the Voluson E-Series system requires permission and customer input to run diagnostics.

Whenever any hardware diagnostic tests have to be executed on site, the CSD **must be accessed** via the - *All Programs - Voluson - GE Field Engineer - Common Service Desktop*.

The navigation bar at the top of the screen shows the top level menu choices.



System Service Section

System Information

System Location	not set
System Type	Voluson E8
System IP Address	
Application Status	Running

Use the top level buttons to access System Service Utilities

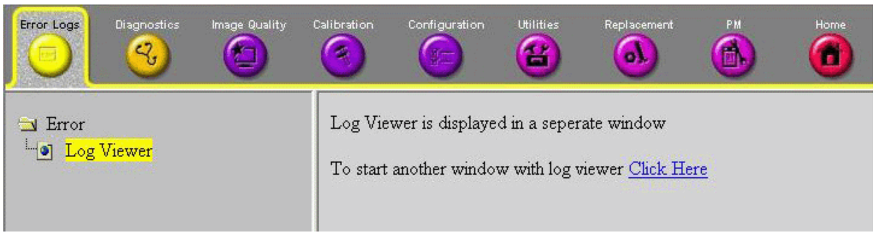
Figure 7-13 Common Service Desktop - Home

Note *As described in Section 5.13 on page 5-41 , the service platform uses a web-based user interface to provide access to common service components. The Service platform is designed for GE personnel and as such is in English only. There is no multi-lingual capability.*

Content in this section

7.6.1 Error Logs

When the ***Error Logs*** page is selected, different log viewing options are available.



Log Viewer is displayed in a seperate window

To start another window with log viewer Click Here

Figure 7-14 Common Service Desktop - Error Logs

Select the Log Viewer option in the left pane of the Error Logs page. Available logs are displayed in a separate window.

7.6.2 Diagnostics

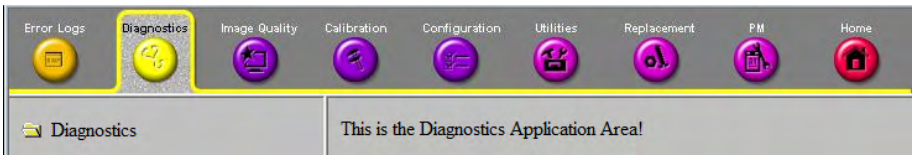


Figure 7-15 Common Service Desktop - Diagnostics

Note *This page is not populated in this version.*

7.6.3 Image Quality

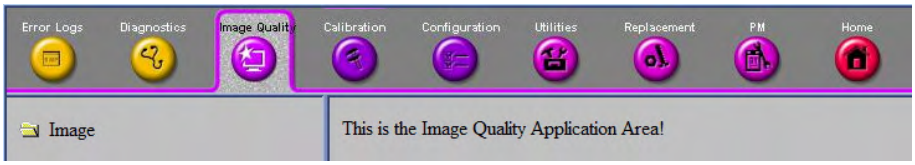


Figure 7-16 Common Service Desktop - Image Quality

Note *This page is not populated in this version.*

7.6.4 Calibration

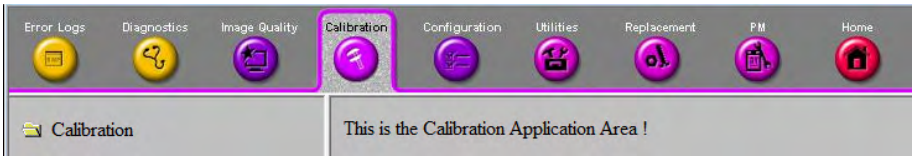


Figure 7-17 Common Service Desktop - Calibration

Note *This page is not populated in this version.*

7.6.5 Configuration

In the ***Configuration*** page, you can view and modify different device informations and configurations in the “InsiteExC Agent Configuration” option field.

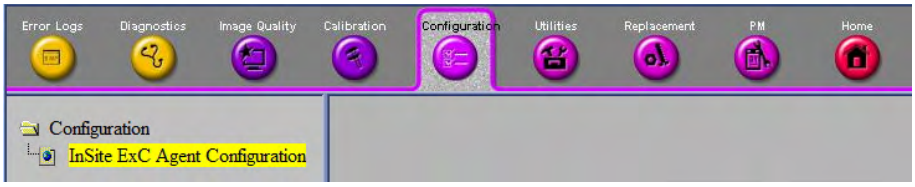


Figure 7-18 Common Service Desktop - Configuration

Note *Remote access is ONLY possible if the Service Platform is properly configured (either by the user or a GE technician at site). Operation see* *Section 3.13.4 "InSite ExC Configuration" on page 3-77* .

7.6.6 Utilities

The *Utilities* page contains a variety of Windows utility tools to indicate the status of the system, in addition to various other tools.

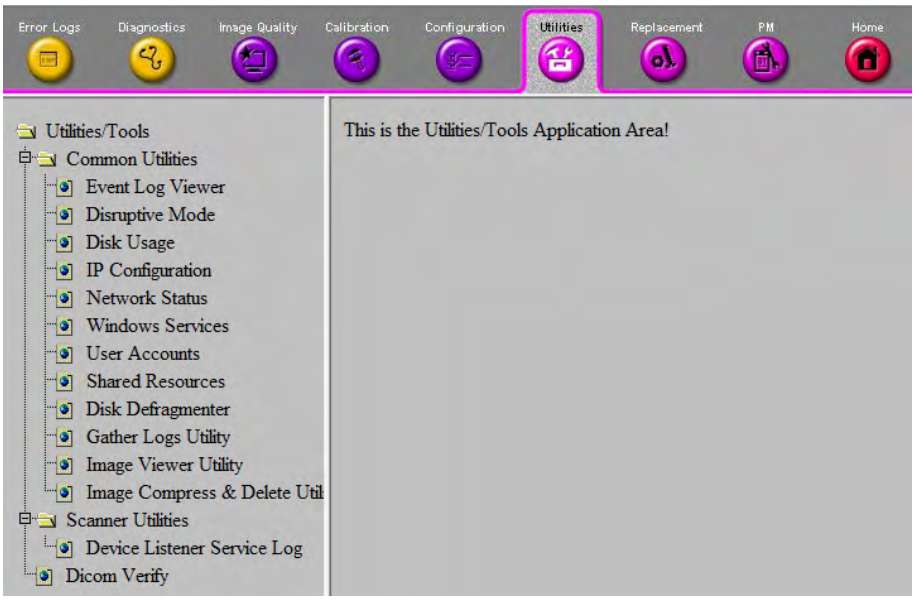


Figure 7-19 Common Service Desktop - Utilities

Content in this section

7.6.6.1 Common Utilities

Event Log Viewer

Select the log you wish to view:

- Application link = an event log relative to application events
- System link = an event log relative to system events
- Log Name = enter the Log Name you want to view and click the *View* button

Disruptive Mode

Allows to enable or disable disruptive mode.

Disk Usage

All drives (real & virtual) mounted on the system will be shown in the right frame. Each drive will display the total size in bytes and the total number of free bytes.

IP Configuration

Windows IP Configuration: The TCP/IP information for the device + all real and virtual networking interfaces are displayed.

Network Status

All ports (listening & established) are displayed along with any external/foreign address that might be connected to the device.

Windows Services

The currently active windows services (applications) are displayed.

User Accounts

Shows the internal account information that was provided and set up on the system by the OLC.

Shared Resources

Indicates the resources being shared by the system.

Disk Defragmenter

Shows how to execute a Disk Defragmentation.

Gather Logs Utility

This will gather up logs and presets. Logs are zipped up and located in (D:\export\Logs_xxxx.zip) for retrieval by the OnLine Center.

Image Viewer Utility

A list of all images stored in D:\export is displayed. It is possible to display the Images.

Image Compress & Delete Utility

A list of all images stored in D:\export is displayed. It is possible to compress or delete the select the images. The compressed files are added to (D:\export\xxxx.zip).

7.6.6.2 Scanner Utilities

Device Listener Service

This will analyze the USB connect/disconnect logs from the Device Listener Server. The output is displayed on the screen.

Dicom Verify

This enables to verify DICOM devices.

7.6.7 Replacement

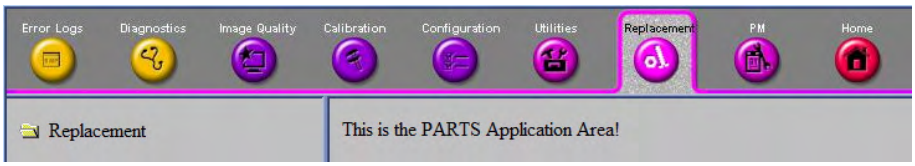


Figure 7-20 Common Service Desktop - Replacement

Note *This page is not populated in this version.*

7.6.8 PM

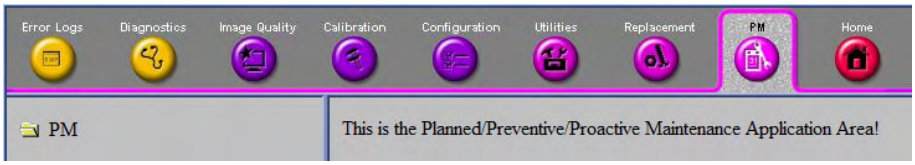


Figure 7-21 Common Service Desktop - PM

Note *This page is not populated in this version.*

7.7 How to use the Auto Tester program

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***Service*** tab.
4. Enter the password <SHE> and click the ***Accept*** button to display the Service Tools page (see *Figure 5-20 on page 5-42*).
5. Activate the “Auto Tester” program by clicking ***Start***. The following message box appears.

Figure 7-22 Autotester activation

6. Click ***OK***.
7. Press the **Alt Gr** key on the alphanumeric keyboard.
8. Activate the “Auto Tester” program by clicking the *“Record”* icon on the displayed screen.

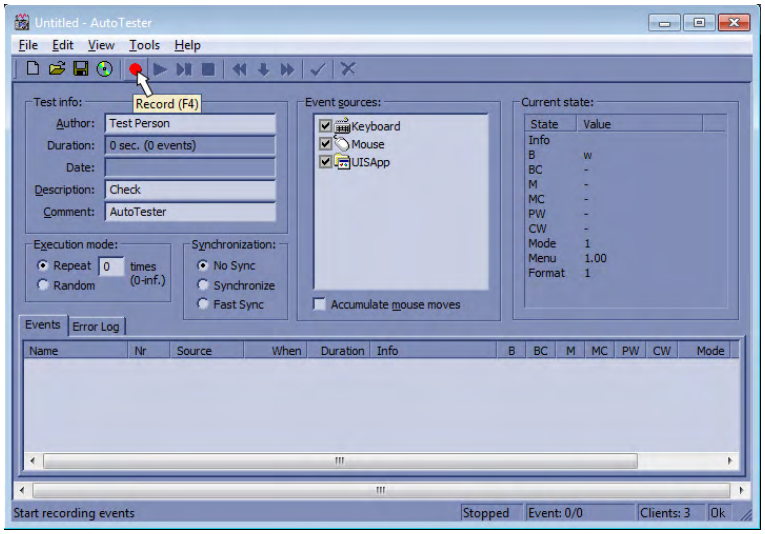
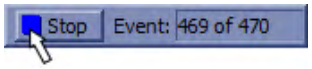


Figure 7-23 Autotester record

9. Start scanning. You can scan normally and everything will be recorded to the program (up to several hours).

Note *It is important that you are recording the processes where the errors normally occur.*



Stop the program by clicking on [Stop] shown on the screen, or by pressing the **Alt Gr** key on the alphanumeric keyboard.

The following screen appears.

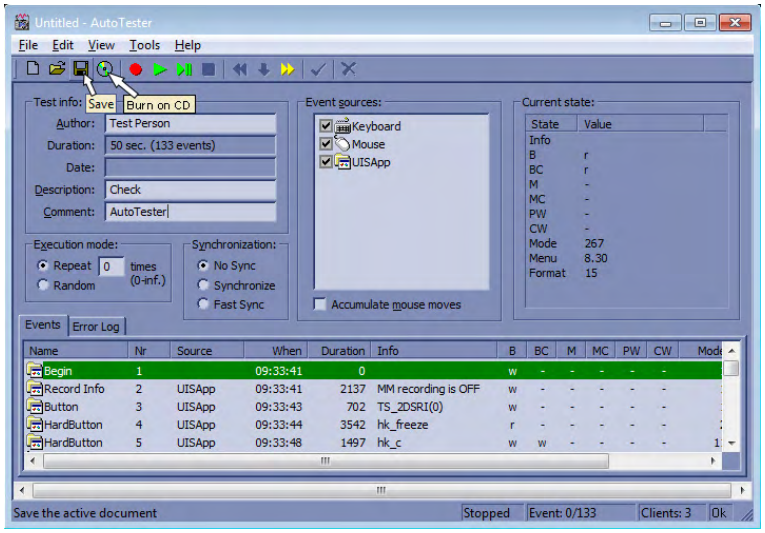


Figure 7-24 Autotester finished

10. Select the *"Save"* icon. The file will be saved in D:\Export\AutotesterScripts*.*.
11. Press **Alt** + **D** to export system data and the needed logs. Operation see *Section 7.4.2.1 "Export System Data (by pressing the ALT + D key)" on page 7-9* .

Note *The standalone recorded "Auto Tester" file makes only sense with the **Alt** + **D** log! To analyze the workflow the exact date and time of occurrence needs to be documented!*

12. If desired, save the script file also on DVD/CD. Therefore:
    - Insert an empty DVD/CD+R/RW in the Drive and select the *"Burn on CD"* icon.
    - Enter a Filename.
    - After the DVD/CD write is finished click the ***OK*** button.
13. Close the "Auto Tester" program.

7.7.1 Limitation of the Auto Tester

The following information will not be recorded. Depending on the moment the Auto Tester is activated, this must be provided by the customer or the field engineer.

- Which probe is in use and which probes are connected?
- Which Mode is activated?
- Which peripherals are connected (Dicom, Printer, etc..)?

Collected information from all steps above + exported system data and needed logs (**Alt** + **D**) can be sent to the Make Center. With this information the Make Center can see how the customer is using the system and reproduce potential failures.

Note *Providing all information at once will help the Make Center find the root cause and speeds up finding a solution for the customer.*

7.8 Minimum Configuration to Boot/Scan

7.8.1 Minimum Configuration to Scan

1. Connect the minimum configuration of cables as shown in figures below:
   a. Console (RTU)
   b. USB UI (User Interface) and USB Hub Top
   c. DVI Cable (Digital Visual Interface) from Graphic Card DVI Out to RTV DVI In
   d. Monitor
2. Connect the mains power cable and mount the pull-out protection, see: *Figure 4-1 on page 4-3* .
3. Connect the mains power cable to an appropriate mains power outlet and switch ON the circuit breaker.
4. Press the **ON/OFF** Standby button on the control console to boot up the system.
5. Connect a probe and start an User Program.

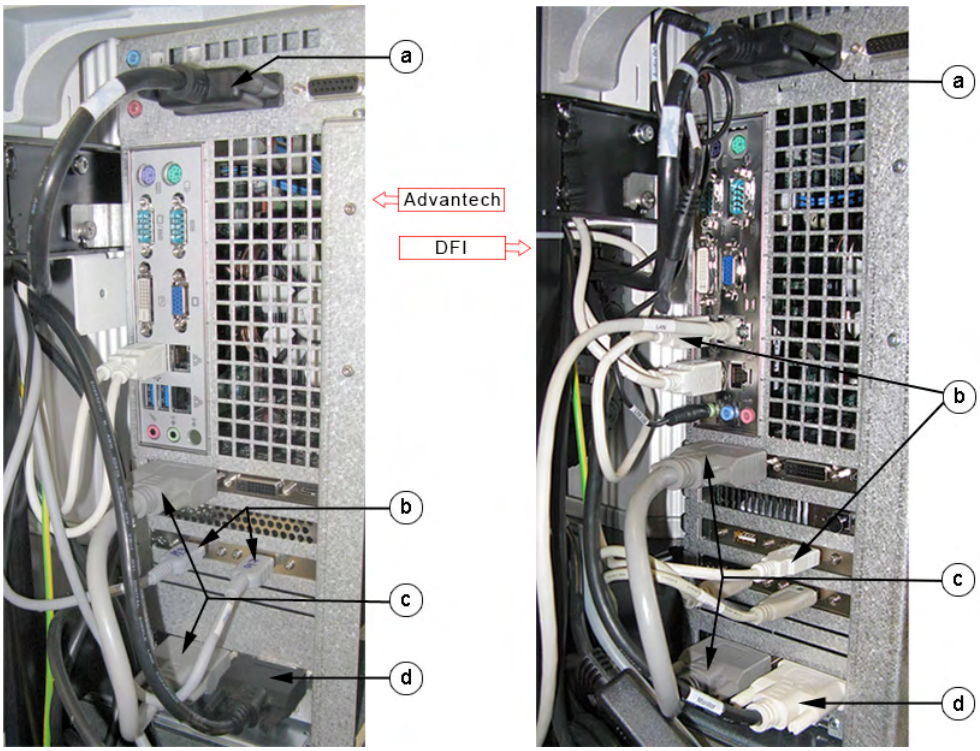


Figure 7-25 cable minimum configuration (BT13.5)

7.9 Troubleshooting Trees, Instructions and Tech Tips

Content in this section

7.9.1 System does not boot up

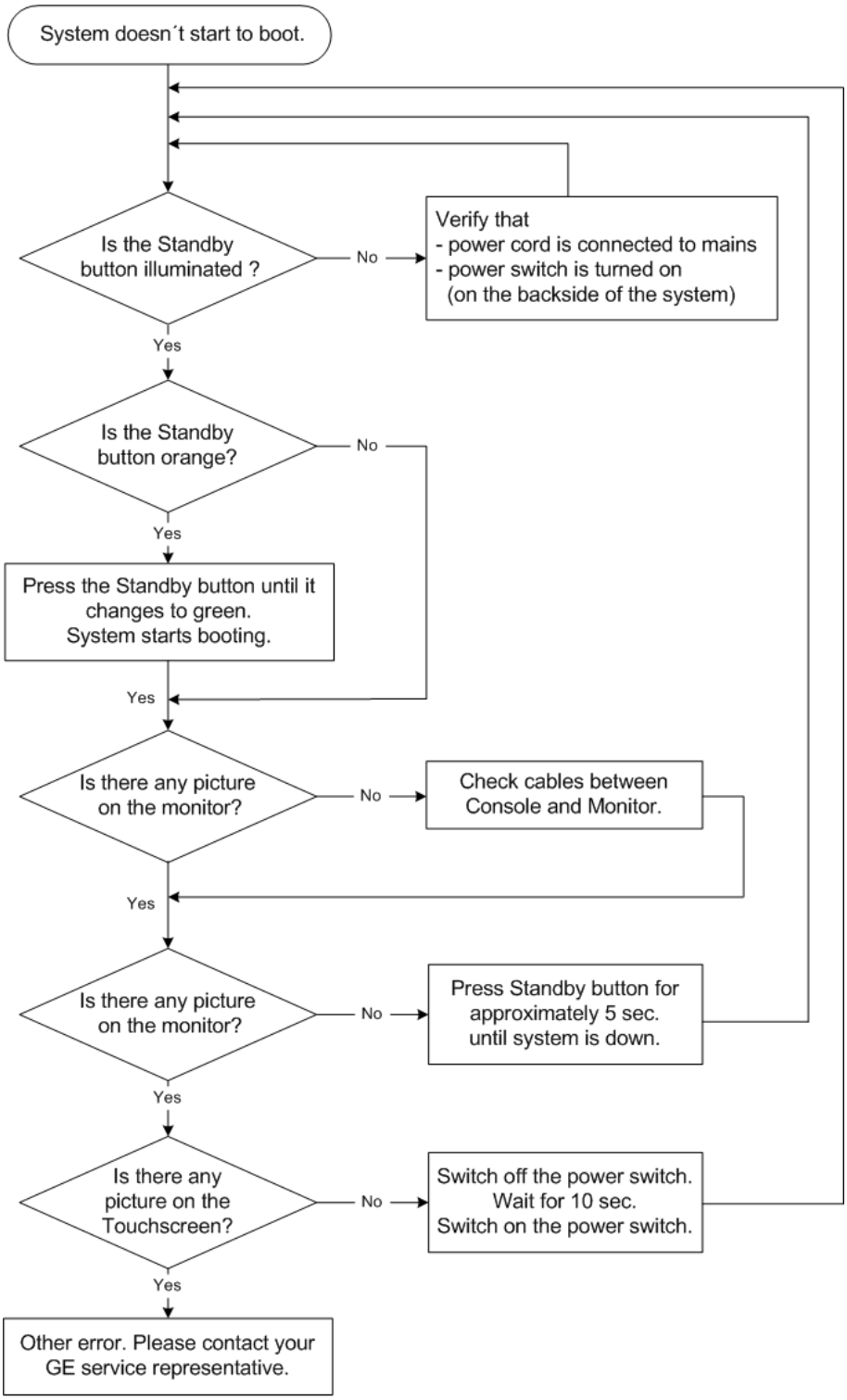


Figure 7-26 System does not start to boot up - Troubleshooting

7.9.2 Noise disturbs the Image

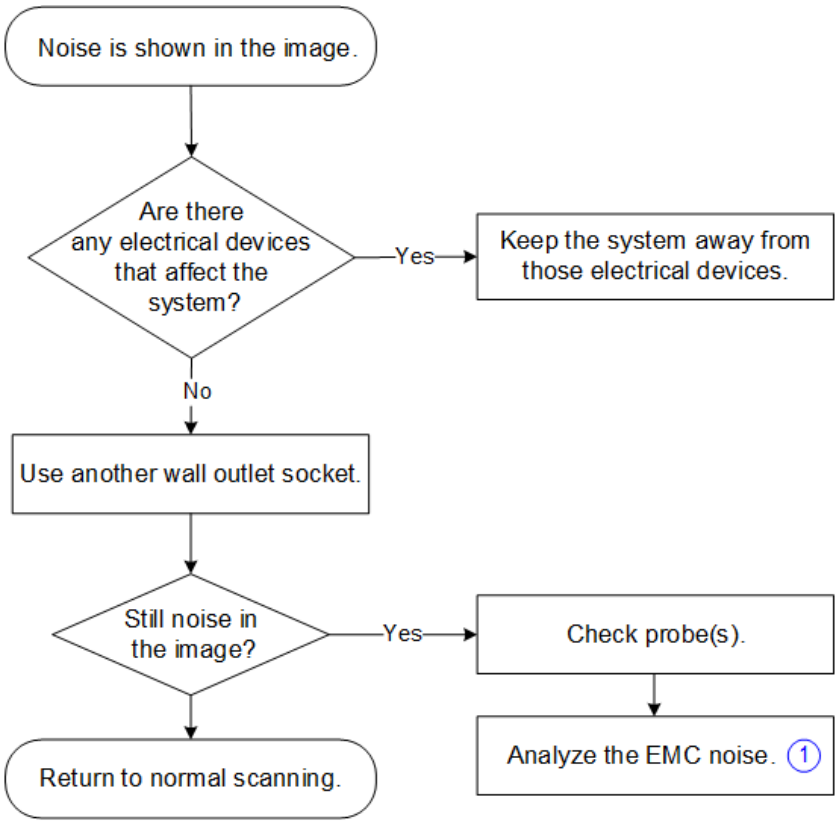


Figure 7-27 Noise disturbs the Image - Troubleshooting

1	*Section 7.9.2.1 "How to analyze the EMC noise" on page 7-23*

7.9.2.1 How to analyze the EMC noise

1. Switch on the Voluson E-Series system and choose settings which show EMC noise in the ultrasound image.Typically the ultrasound probe must be contacted (hold in hand/apply to body) to observe EMC noise.
2. Disconnect one by one all cords that are connected to the Voluson E-Series system like LAN/Ethernet, VGA, DVI, S-Video, USB, ... on the ultrasound system-side and observe the EMC noise.
3. If EMC noise is still present after disconnecting all cables, then use the stand-alone Power Filter (H48701EL) to power the Voluson E-Series system. Connect the Power Filter between AC mains and the Voluson E-Series system.

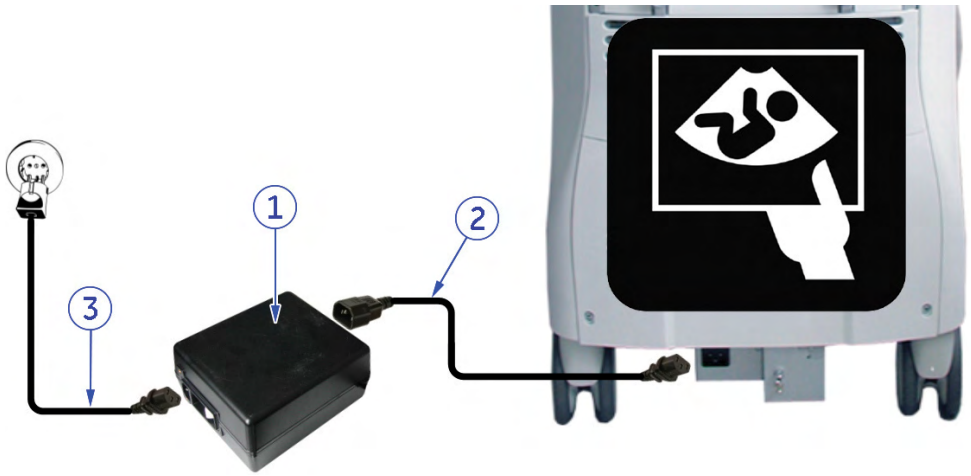


Figure 7-28 Power Filter - Connection Scheme

Note

Make sure, that:

- *the Power Filter **(1)** is located behind (not under) the Voluson E-Series system.*
- *the Power Filter **(1)** is not close to any metallic devices.*
- *the AC mains power cable **(3)** is not located near/under the Voluson E-Series system.*
- *the AC mains power cable **(3)** is not located close to the short 1m Power Extension cord **(2)**.*

4. Switch on the Voluson E-Series system.
5. Activate the ultrasound probe and choose settings which show EMC noise in the ultrasound image to check for EMC noise (EMC noise should be absent). If EMC noise is still present – then check again for any other conducting connections to the Voluson E-Series; perform step 2.) again.
6. Connect one by one other cords to the Voluson E-Series system like LAN/Ethernet, VGA, DVI, S-Video, USB, ... and check for EMC noise.

If a stand-alone UPS (Uninterruptible Power Supply) is available to power the Voluson E-Series

Connect the UPS between AC mains and the Voluson E-Series system in the same manner as shown in *Figure 7-28*; - instead of the stand-alone Power Filter.

1. Switch on the Voluson E-Series system.
2. Activate the ultrasound probe and choose settings which show EMC noise in the ultrasound image to check for EMC noise (EMC noise should be visible).
3. Disconnect one by one all cords that are connected to the Voluson E-Series system like LAN/Ethernet, VGA, DVI, S-Video, USB, ... on the ultrasound system-side and observe the EMC noise.
4. If EMC noise is still present after disconnecting all cables, then disconnect the AC mains power cord that supplies the UPS from the wall outlet socket.

   If EMC noise is absent, then it is confirmed that the EMC noise source is in the power line of the wall outlet socket.
5. If EMC noise is still present – then check again for any other conducting connections to the Voluson E-Series; perform step 3.) again.
6. Connect one by one other cords to the Voluson E-Series system like LAN/Ethernet, VGA, DVI, S-Video, USB, ... and check for EMC noise.

For reducing EMC noise consider following options

- use WLAN instead of LAN-cable
- use wireless video transmitter instead of VGA-cable, DVI-cable, S-Video-cable, ...

If EMC noise does not depend on whether the ultrasound probe is contacted

When the EMC noise does not depend on whether the ultrasound probe is contacted (hold in hand/apply to body), then do the following:

1. Hold the ultrasound probe only at the cable and change the orientation of the ultrasound probe.
2. If the EMC noise changes by changing the orientation of the ultrasound probe then the EMC noise is caused by a magnetic field in the room/building.

In such situations the Power Filter (H48701EL) cannot reduce the EMC noise.

7.9.3 Trackball - Malfunction

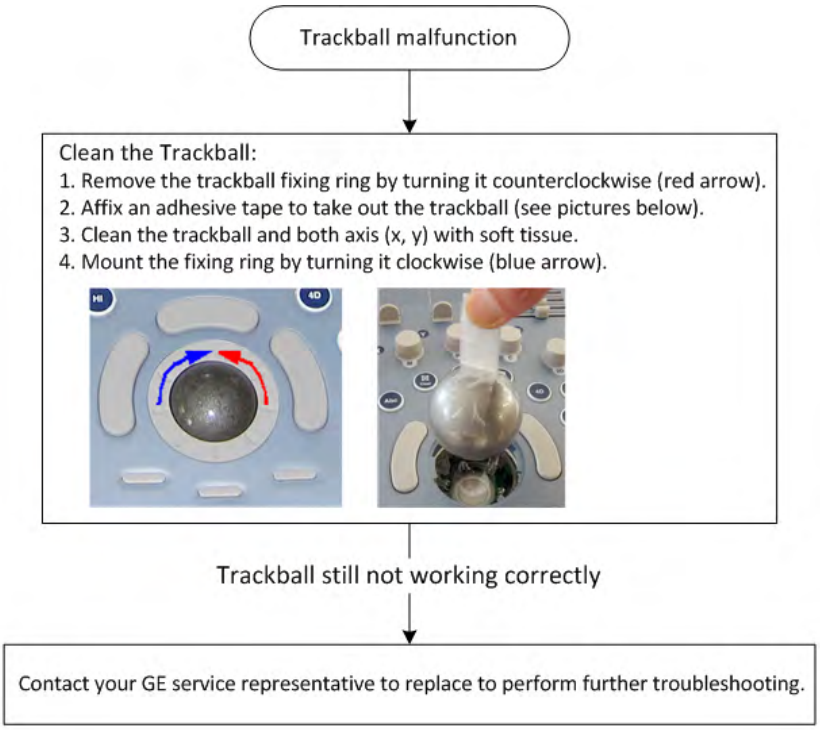


Figure 7-29 Trackball - Malfunction

Connect an USB-Mouse to one of the USB-Connectors of the Voluson E-Series system (the USB connectors beside the DVD-Drive are recommended). So the system remains operable until the trackball problems are solved.

7.9.4 Printer Malfunction

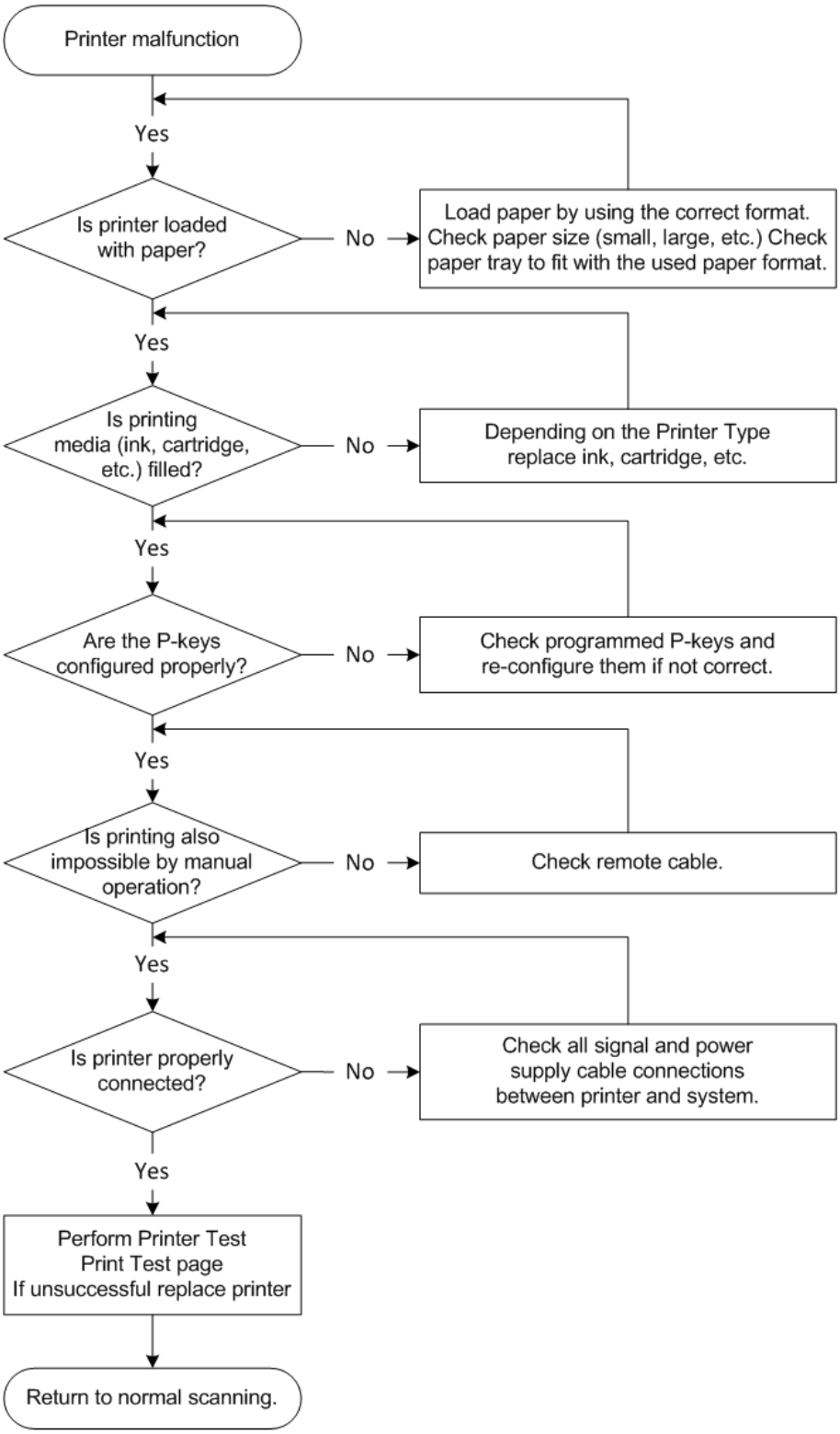


Figure 7-30 Printer Malfunction

7.9.5 Monitor Troubleshooting

Fault symptom	Check these items
No image	Check the power cord is properly connected.
	Check the video cable is properly connected.
	Check no pins of the video cable are bent.
	Check if video is present on backplane.
Blank screen after boot up	Press the **ON/OFF** standby button. The shutdown screen appears on the touch panel, see *Figure 4-3 on page 4-4* . Select the ***Reset Monitor*** button (if available) that is displayed on the touch panel. This initiates a reset of the monitor controller (settings remain unchanged).
Picture is fuzzy	Adjust the picture contrast and picture brightness. Some SVGA cards having an excessive video output level will cause a fuzzy picture at the maximum contrast level.
Video test patterns are not clear, bright, parallel or square	Replace the monitor.

Note *For further details see Section 6.2 "LCD Monitor Adjustment" on page 6-2 .*

7.9.6 DVD/CD-Drive Tests

Content in this section

7.9.6.1 Export images from "Local Archive" to DVD/CD+R/RW

1. Insert an empty, formatted DVD/CD+R/RW disc into the drive. At a DVR-Drive use a DVD**+RW** only!
2. Enter “Patient Archive” by pressing the **Patient ID** key on the control console.

Figure 7-31 Patient Archive - ARCHIVE

3. On the left side of the screen select ***Archive (1)***.
4. If not already selected, choose “Local Archive” from the *“Source”* pull-down menu **(2)**.
5. Select an exam with images **(3)**.

6. Export images of the selected exam to DVD/CD+R/RW

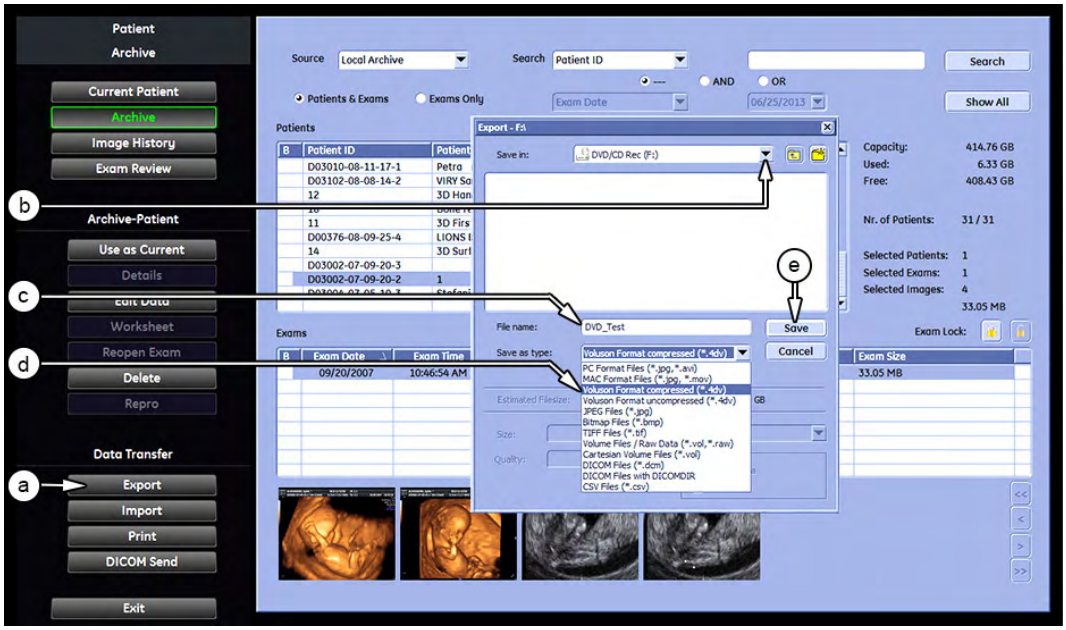


*Figure 7-32 Export images to DVD/CD - *.4dv format*

a. Click on ***Export***.
b. If not already selected, choose “DVD/CD” resp. "DVD Rec" from the pull-down menu.
c. Enter "File name".
d. Select any Voluson Format (*.**4dv**) from the pull-down menu.
e. Click the ***Save*** button.

After successful export, perform an import of images

1. On the left side of the screen select ***Import***.
2. Choose “DVD/CD” resp. "DVD Rec" from the *“Source”* pull-down menu.
3. Select the folder where the file was stored and the file name.
4. Click ***Open*** to display the images.

Limits: All images, which have been exported to DVD/CD+R/RW are visible.

Press the **Eject** key on the alphanumeric keyboard and remove the media from the drive.

7.9.7 Network Troubleshooting

7.9.7.1 No Connection to the Network at all

	**Gray** = Cable disconnected or no network signal on a connected cable.
	**Green** = Cable connected to a network. **Does not imply** proper network settings.

1. Check that the network cable between the Voluson E-Series system and the wall network is connected and well seated in both ends. (Use a network cable that is known to be OK.)
2. Connect a network cable between the system and a PC by either using a hub or a cross-over cable. Try to ping from system to IP address on PC. If OK, hardware connection inside the system is OK.

7.9.7.2 GE remote service connection

Note *Visual information about GE remote service status is shown in the status area on the right bottom of the screen.*

 	**Gray** = Idle State	Remote access is inactive.
	**Yellow** = Access pending	Remote Access connection is active, but Disruptive Mode and Virtual Console Observation (VCO) is not yet enabled.
	**Red** = Disrupted State	Remote Access is active. All processes [UL_VNC and UL_CSD] are active. In this state the Voluson E-Series system should NOT be used clinically.
	**Gray** + envelope	New Software Update Package is available for download and installation. Operation see *Section 8.2.3 "Software Update Package - Download/ Installation Procedure" on page 8-9* .

7.9.8 Tech Tips

Content in this section

7.9.8.1 Storing SonoView images to Voluson E-Series systems

Issue: Storing SonoView images from Voluson 730/Expert/Pro/ProV to Voluson E-Series systems.

Cause: Archive is different (no SonoView on Voluson E-Series systems).

Solution:
1. Perform SonoView backup on Voluson 730/Expert/Pro/ProV to external hard disk (USB) or DVD.
2. Import file "V730.mdb" from external hard disk (USB) or DVD to your Voluson E-Series system.

Procedure

1. Connect the external hard disk (USB) or insert the DVD with the SonoView backup to the Voluson E-Series system.
2. Enter “Patient Archive” by pressing the **Patient ID** key on the control console.

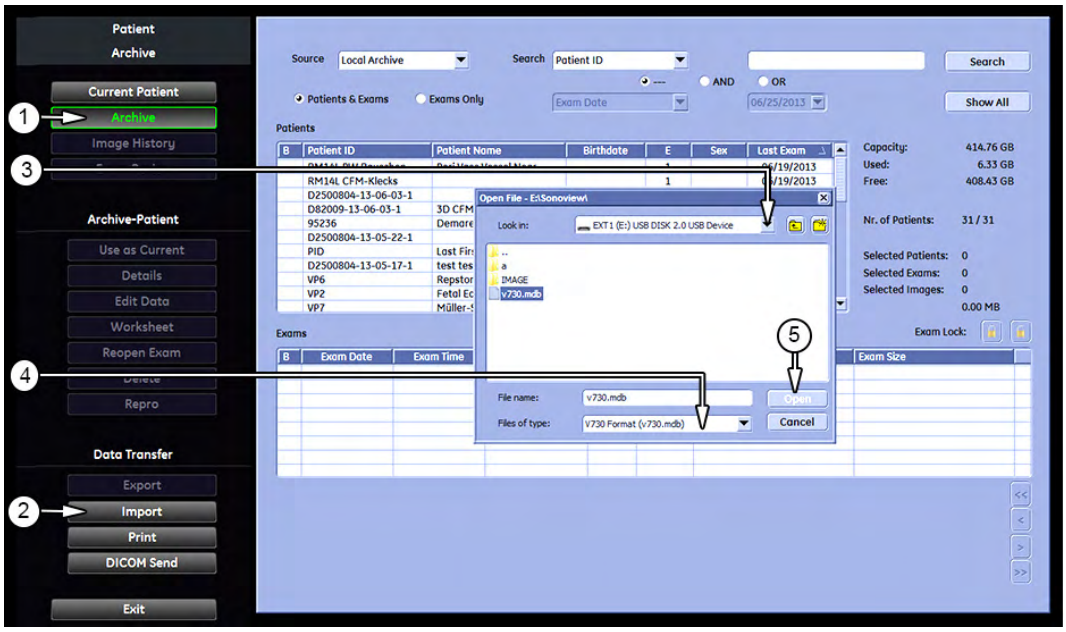


Figure 7-33 Patient Archive -ARCHIVE

3. On the left side of the screen select ***Archive (1)***.
4. Click on ***Import (2)***. The "Open File" window appears.
5. If not already selected, choose the proper drive from the *“Look In”* pull-down menu **(3)**.
6. Change the *“File of type”* field to **V730Format (v730.mdb) (4)**.
7. Browse for the folder where the SonoView Backup was stored.
8. Select the file **v730.mdb** and then click on ***Open*** **(5)**.

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Chapter 8

Replacement Procedures

This chapter contains replacement procedures for different modules and their subsystems.

Note *The Manpower, time and **Tools** indicated in the Sub-sections include all requirements from **Preparations** to **Installation Procedures**.*

Note *Please observe that some FRU parts depend on Console (RTU). The Console version (**R**afi or **W**hanam) is shown in the System Info page (see: Figure 7-1 on page 7-3).*

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

1. When installing boards, ESD may cause damage to a board. ALWAYS connect yourself, via an arm-wrist strap, to the advised ESD connection point located on the rear of the system (to the right of the power connector).
2. Follow general guidelines for handling of electrostatic sensitive equipment.

Warning
No covers or panels should be removed from the system (high-voltage risk). Service and repairs must only be performed by authorized personal. Attempting do-it-yourself repairs invalidate warranty and are an infringement to regulations and are inadmissible acc. to IEC 60601-1.

The Waste of Electrical and Electronic Equipment (WEEE) **must not be disposed as unsorted municipal waste** and must be collected separately. Please contact the manufacturer or other authorized disposal company for information concerning the decommission of your equipment.

Content in this chapter

8.1 Returning/Shipping System, Probes and Repair Parts

When returning or shipping the Voluson E-Series system in the original packaging:

- system must be lowered to its minimum height with monitor flapped down
- the control console has to be centered and locked in “unextended” position

Note *For control console positioning see Section 6.3 on page 6-5 .*

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 and 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 what 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 purpose 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.*

The Voluson E-Series 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 system and a regular backup is highly recommended.

If the system is sent for repair, please ensure that any patient information is backed up and erased from the 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.

8.2 System software - Installation/Upgrade procedure

Introduction

There are two possibilities to update the system software:

1. via the *FMI from DVD* button in the System Setup ***Service*** page
   - Software parts to be upgraded (e.g., Ultrasound Application Software, Service Software, EUM, MS patches, etc.) and installation time depend on contents of the used System DVD.
   - If the currently installed software has to be upgraded to a newer version, a new software specific "Permanent key" is required. Please contact your local distributor or GE service representative.
2. by downloading and installing a *Software Update Package* via active InSite connection
   - Software parts to be upgraded (e.g., Ultrasound Application Software, Service Software, EUM, MS patches, etc.) and installation time depend on contents of the SW update package.
   - PRECONDITION: InSite connection has to be configured and checked out. Operation see: *Section 3.13.4 "InSite ExC Configuration" on page 3-77* .

Caution
Disconnecting ALL external USB devices (except DVD drive) is NECESSARY. **Re-installation of any previously attached printer has to be done after the upgrade procedure**.

Note *Installing the Bluetooth Printer and its connection set is NOT possible by the user.*

Manpower

One person ~ 1 hour (depends on contents of System DVD resp. SW update package, peripherals, etc.)

Tools

System DVD

8.2.1 Before the Installation/Upgrade Procedure

Before performing the Software Upgrade:

- perform an initial verification of the system and its functions
- check the current Application Software version and the installed Options as described in *Section 8.2.1.1 on page 8-4*
- if the currently installed software has to be upgraded by a newer version, calculate new software specific “Permanent key” in OKOS. Please contact your local distributor or GE service representative to get the necessary key.

Note *It is **NOT necessary** to save Full System Configuration (Full Backup) prior to the upgrade. All existing User Programs, 3D/4D Programs and Auto Text settings remain untouched!*

8.2.1.1 Check vital System Setup data

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***System Info*** tab.
4. Check the currently installed Software/Hardware version of the Voluson E-Series system.

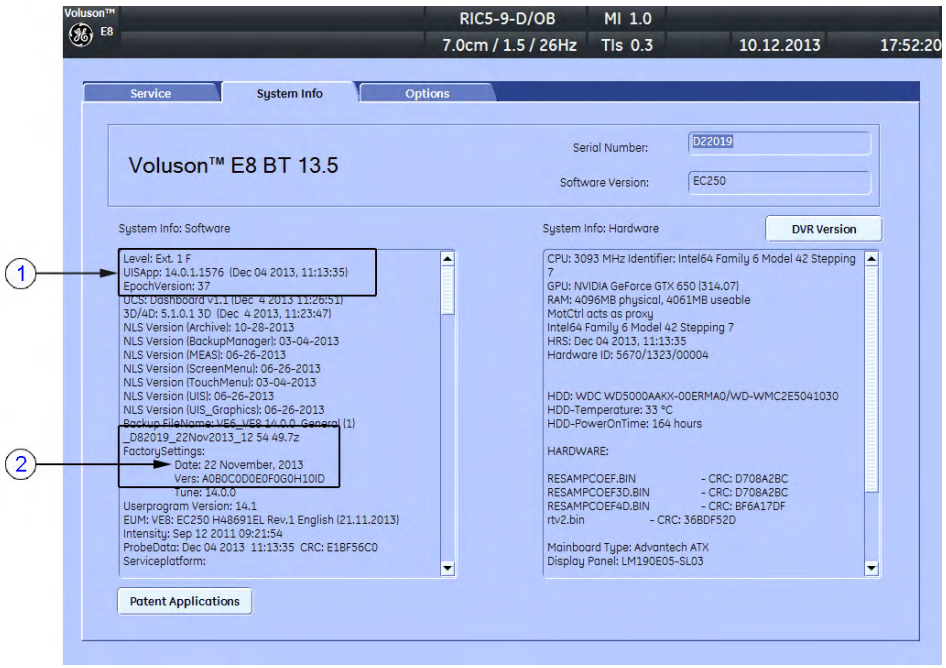


Figure 8-1 Version check: System Setup - Administration - System Info page

1	currently installed Ultrasound **Application Software version**
2	Date of Factory Settings

5. Select the ***Option*** tab to see which options (and Application Packages) are currently installed. Please print out the options page or write down down the state of the options (P = permanent, I = inactive).

Note *It is not necessary to note the Permanent Key; it is the state of the option that matters.*

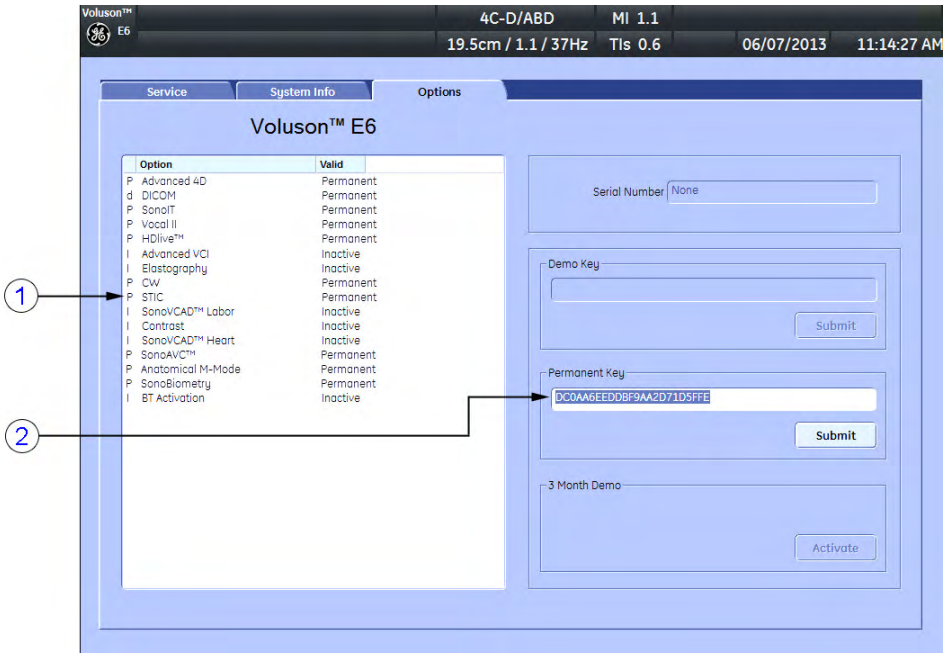


Figure 8-2 System Setup - Administration - Options page

1 **D = Demo** (Option is activated for demo and expires at date shown in the "Valid" column)

I = Inactive (Option is not activated)

P = Permanent (Option is permanently activated, i.e.purchased)

d = deactivated (Option is inactive)

2 Permanent Key

Note *If the currently installed software has to be upgraded to a newer version, and the system is updated via the **FMI from DVD** button, a new software specific "Permanent key" is required. Please contact your local distributor or GE service representative.*

8.2.2 System Software - Installation Procedure (FMI from DVD)

The system software installation procedure starts with saving and recording the settings present on the system (silent “Rollback”). Then the new software is written to the hard disk using the System DVD. Application Settings are automatically updated, to match with new Software version.

Existing User Programs, 3D/4D Programs and Auto Text remain unaffected! Afterwards the new software is configured such that it is integrated again in its environment.

Note *For more detailed information, see Section 5.14.3.2.1 "FMI from DVD" on page 5-43 .*

1. Perform Preparations as described in *Section 8.2.1 on page 8-4* .
2. If not already done, disconnect all external USB devices (except DVD drive).
3. Insert the System DVD into the drive.
4. **Restart** the system. (Turn system OFF and then back ON.)

Note *If the system boots into LINUX, the “Boot priority order” in BIOS is incorrect. In this case, cancel the software installation procedure (select Exit/Reboot by means of the [Arrow] keys (right, left, up, down) and the [Enter] key on the keyboard) and then contact your service representative.*

5. Press the **Utilities** key on the control console.
6. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
7. On the left side of the screen select ***Administration*** and then click the ***Service*** tab.
8. Type in the password **SHE** and click ***Accept***.

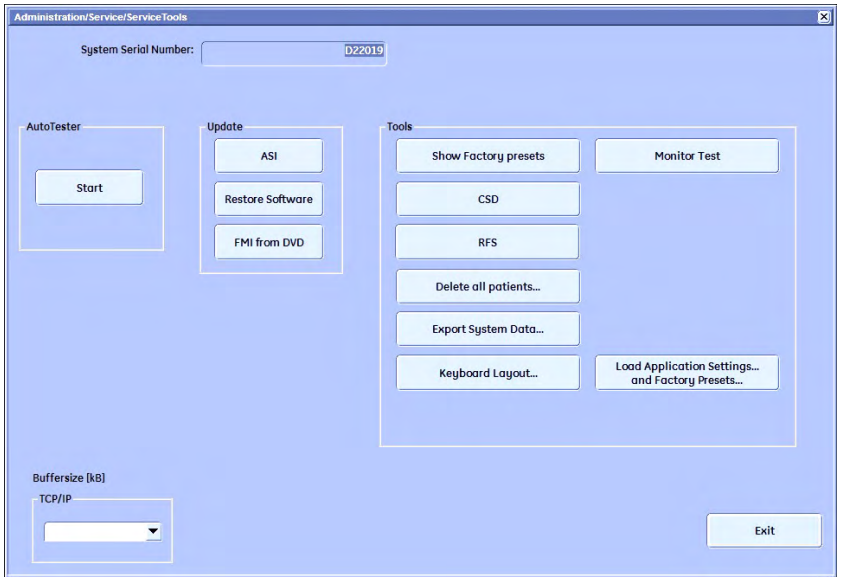


Figure 8-3 Service Tools

9. Click the ***FMI from DVD*** button for updating the System Software.
10. Verify that only the DVD drive is connected to the system, then click ***OK***.

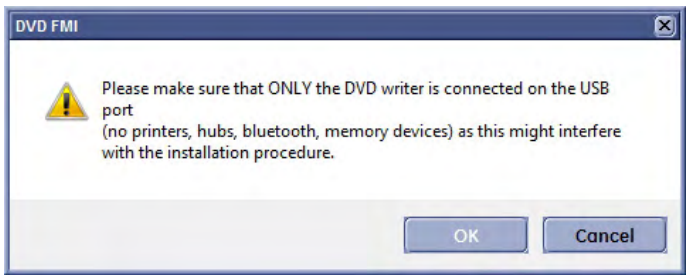


Figure 8-4 Verify that USB devices are disconnected, then click OK

11. To start update procedure click ***Yes***.

    The system saves Full Backup in silent mode on R:, then it reboots into LINUX. A silent “Rollback” image from C:\ is stored on R:\. After executing all LINUX commands, the system reboots again.

Note *If the currently installed software has to be upgraded to a newer version, a new software specific “Permanent key is required.*

12. Enter the appropriate “Permanent Key” (calculated in OKOS; http://3.187.187.9/OKOS), select ***OK*** and confirm with **Enter**.

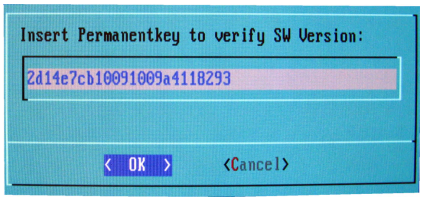


Figure 8-5 enter Permanent key

If the entered Permanent key is correct, following window appears, confirm with **Enter**.

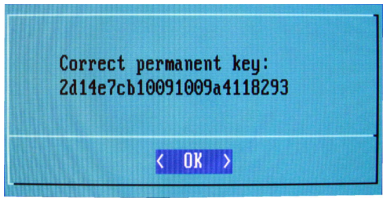


Figure 8-6 confirm key

13. Check disk is performed automatically - restart.

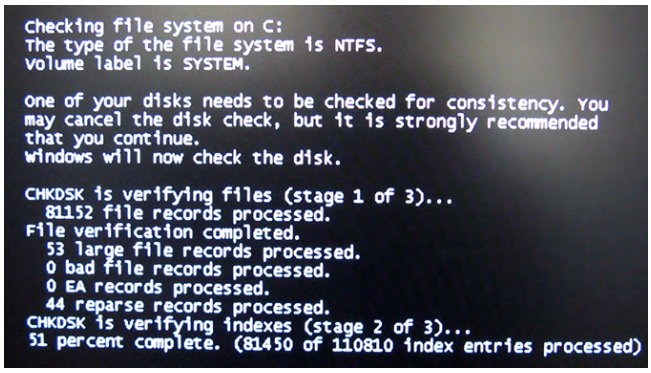


Figure 8-7 Check disk is performed automatically

14. 3 dots (one after the other) appear on the screen.
15. Booting **auto** ....

Figure 8-8 Boot screen - auto

16. Updating will take some time ....

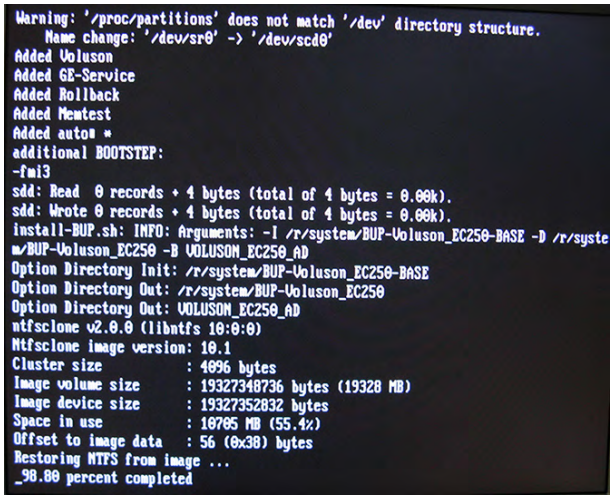


Figure 8-9 Please wait ...

17. Please wait until all processes are finished (100 percent completed).
18. The system is rebooting into windows (Boot screen - **Voluson**).

Note *An automated process was developed to install the required software parts, perform check disk, remap drive letters and match settings.* ***During this process the system might reboot several times!***

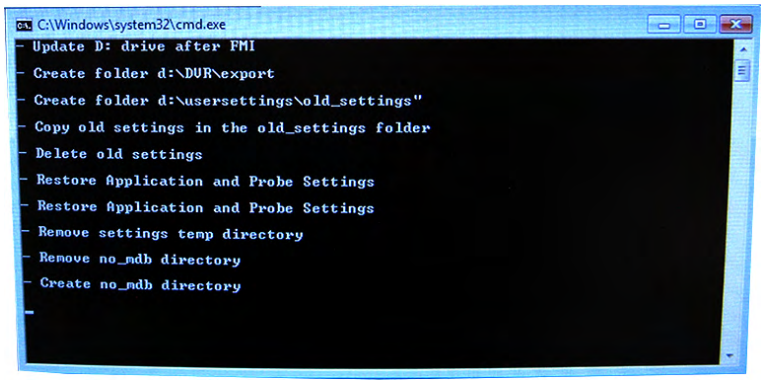


Figure 8-10 automatic processes are running

19. Please wait until all processes are finished. Finally the 2D screen is displayed on the monitor.
20. Remove the System DVD from the DVD/CD+R/RW Drive drive.
21. If the Touch panel is not working after first boot up, please **shutdown** the system; then boot up again.

Note *After turning off a system, wait at least 10 seconds before turning it on again. The system may not be able to boot if power is recycled too quickly.*

22. Reconnect the external devices, install all the printers and adjust the printer settings as described in *Section 3.6 "Printer Installation" on page 3-44* .
23. Check and match Printer Remote Control selection in the *System Setup - Connectivity - Button Configuration* page.
24. Confirm date and time setting in the *System Setup - General - General Settings* page.
25. Perform Software and Functional checks as described in *Section 8.3 on page 8-13* .

8.2.3 Software Update Package - Download/Installation Procedure

Overview

This icon (at right bottom of the screen) indicates that a new Software Update Package is available for download and installation.

An **InSite permanent user is required** for automatic system error reporting to the digital service network; see *Section 3.13.4.1 "How to create an InSite permanent User" on page 3-78* .

The system software installation procedure starts with saving and recording the settings present on the system (silent “Full Backup" and "Rollback”). Then the new software is written to the hard disk. Application Settings are automatically updated, to match with new Software version.

Existing User Programs, 3D/4D Programs and Auto Text remain unaffected! Afterwards the new software is configured such that it is integrated again in its environment.

Update Procedure

1. Remove any CD/DVD from the DVD drive.
2. Perform Preparations as described in *Section 8.2.1 on page 8-4* .
3. If not already done, disconnect all external USB devices (except DVD drive).
4. Press the **ON/OFF** Standby button on the control console.
5. In the displayed screen click ***Download***.

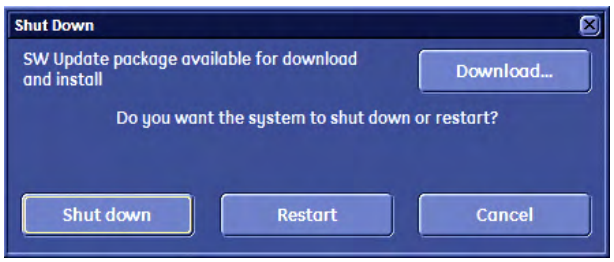


Figure 8-11 download SW update package

6. Download takes some time; please wait. (Download my be paused by means of the ***Pause*** button.)
7. When download is finished, click ***Install***.

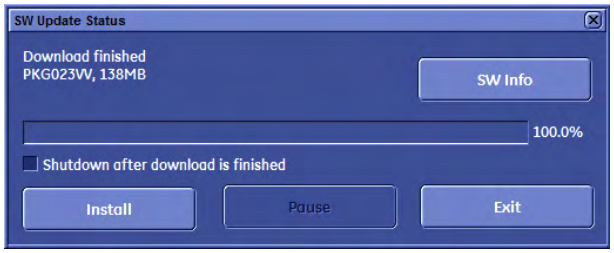
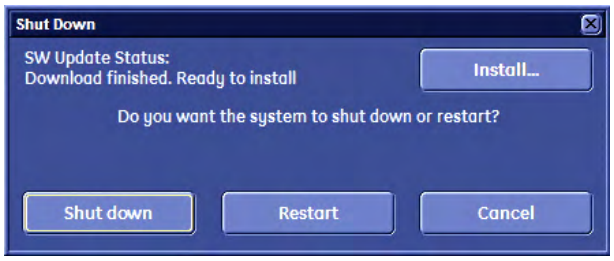


Figure 8-12 download finished - click Install

Note *Installation may take up to one hour. DO NOT interrupt the installation!*

*If you want to install the new software later, click **Exit**. Installation can be resumed by clicking **Install** (in the Shutdown window).*



8. After clicking ***Install***, the SW update procedure starts.
   The system saves Full Backup in silent mode on R:, then it reboots into LINUX.

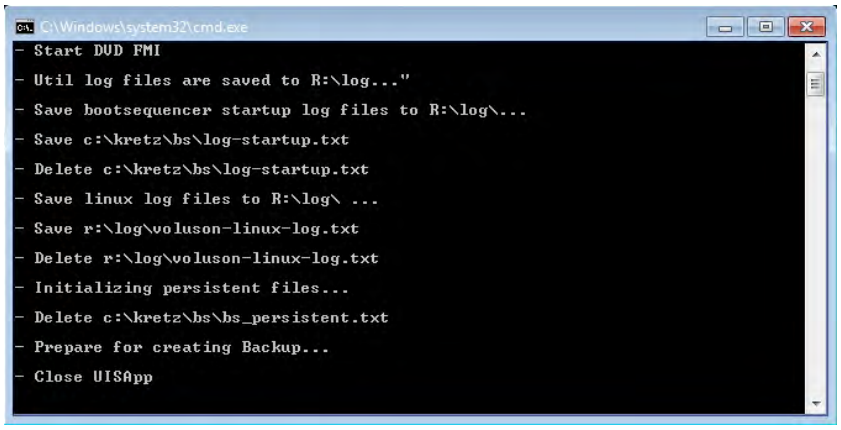


Figure 8-13 installation in progress

9. Check disk is performed automatically - restart.

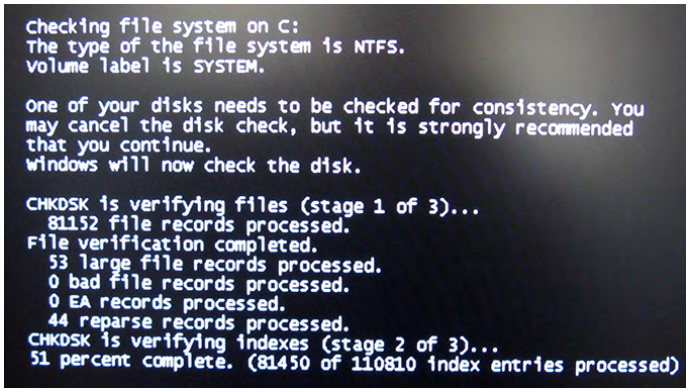


Figure 8-14 Check disk is performed automatically

A silent “Rollback” image from C:\ is stored on R:\. After executing all LINUX commands, the system reboots again.

10. 3 dots (one after the other) appear on the screen.
11. Booting **auto** ....

Figure 8-15 Boot screen - auto

12. Updating will take some time ....

    First the image is saved to R:\ (*Saving NTSF to image ....*); then the image is restored from R:\ (*Restoring NTFS from image ....*).

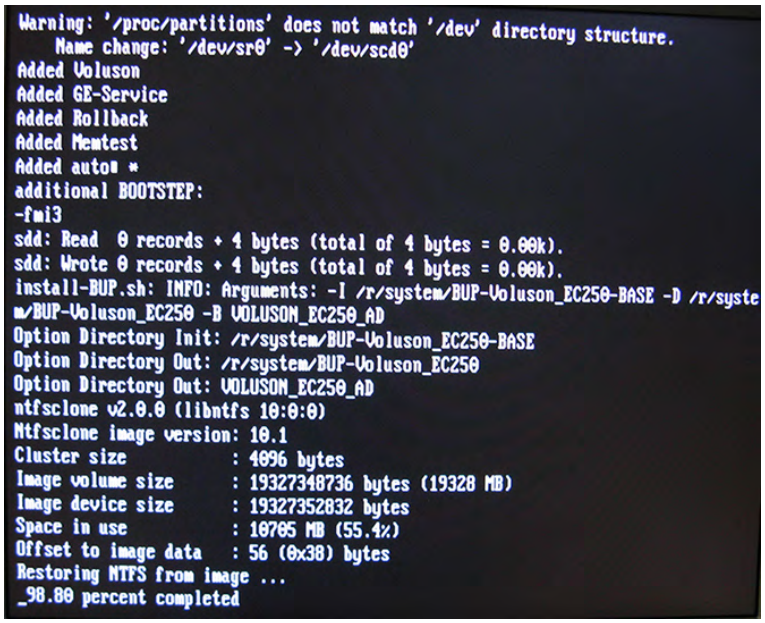


Figure 8-16 Please wait ...

13. Please wait until all processes are finished (100 percent completed).
14. The system is rebooting into windows (Boot screen - **Voluson**).

Note *An automated process was developed to install the required software parts, perform check disk, remap drive letters and match settings.* ***During this process the system might reboot several times!***

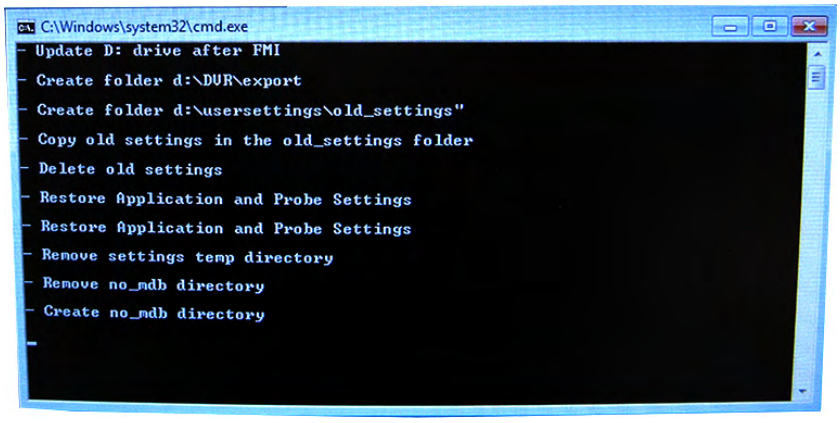


Figure 8-17 automatic processes are running

15. Please wait until all processes are finished.

Finally the 2D screen with the "New Software Verification" report is displayed on the monitor.

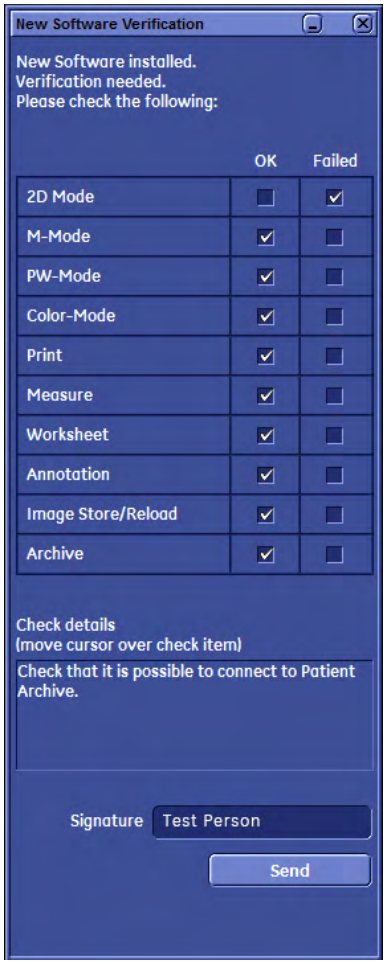


Figure 8-18 New Software Verification

16. Reconnect the external devices, install all the printers and adjust the printer settings as described in *Section 3.6 "Printer Installation" on page 3-44* .
17. Check and match Printer Remote Control selection in the *System Setup - Connectivity - Button Configuration* page.
18. Confirm date and time setting in the *System Setup - General - General Settings* page.
19. Perform a check of all modes and features listed. (Move the cursor over the feature name to get information how to check.)
20. When all features are ***OK*** enter your signature and then click ***Send***; see: *Figure 8-18 above*.

Note *If one feature gets "Failed", rollback the installation (restore the previously used system configuration). For more detailed information, see Section 5.15.1.3 on page 5-45 .*

8.3 Software and Functional Checks after Installation/Upgrade procedure

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***Options*** tab.
4. Verify the correct settings of the *Options* page; see: *Figure 8-2 on page 8-5* . If necessary, customize the settings according to the printout.
5. Click the ***System Info*** tab.

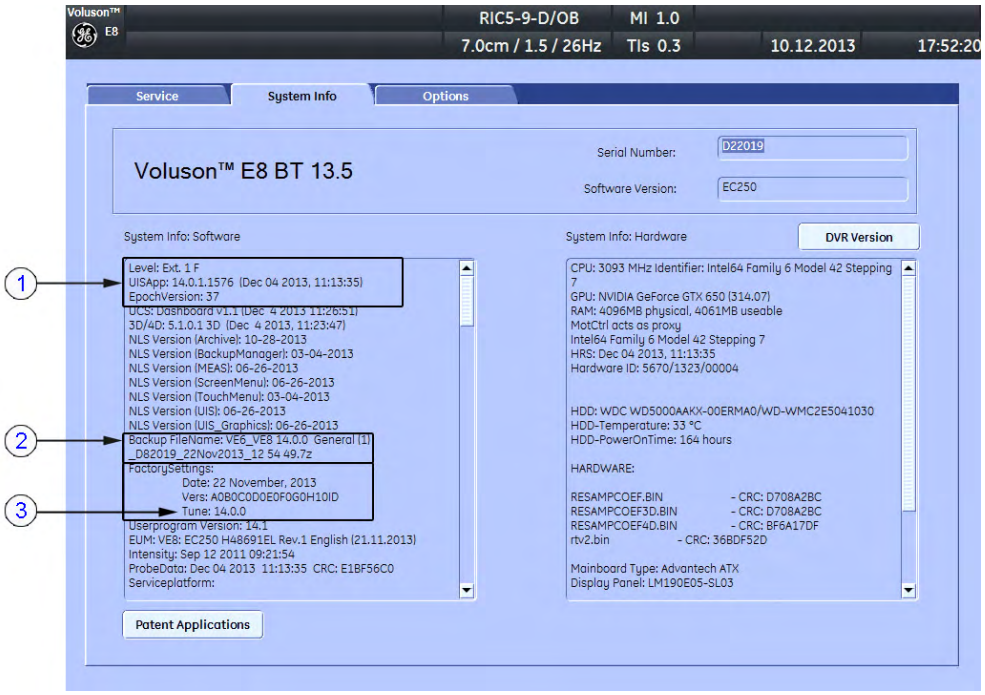


Figure 8-19 System Setup - Administration - System Info page

1	Ultrasound **Application Software version**	3	**Tune version** of Application presets
2	Backup File Name		

6. Check the Application Software version.
7. Check that the Tune version of the Application presets match the Application Software version.

Note *It is neither required nor advisable to reload a previously stored “Full Backup” after a software upgrade that was performed by means of the **FMI from DVD** button! If the Tune version does not match the Application Software version, a warning message appears whenever booting up the system. In this case, it is essential to load the **proper Application Settings** (image presets), adapted for the installed software version. Refer to: Section 5.14.3.10 "Load Application Settings and Factory Presets" on page 5-44 .*

8. Perform basic functional checks to ensure system is functioning normally.
9. Check Service Connectivity; if required, perform InSite Checkout. i.e., Service platform has to be configured properly; see *Section 7.6.5 "Configuration" on page 7-14* .

8.4 Image Settings Only - Loading Procedure

Introduction

The image settings contain:

- Application Settings
- 2D Factory and 2D User Presets
- 3D/4D Factory and 3D/4D User Presets
- Annotation Presets
- Scan Assistant Configuration
- Measure Configuration
- Biopsy Lines

Loading Procedure

see: *Section 4.4.2 "Load Small Backup (Scan Settings)" on page 4-31*

8.5 Full Backup (Full System Configuration) - Loading Procedure

Introduction

The Full Backup contains following data:

- User Settings (databases and files containing User Programs, 2D/3D/4D Programs, Auto Text entries, gray curves and complete System settings such as language, time/date format, etc.)
- Measure Configuration (user specific measure setup settings)
- Patient Archive (database containing patient demographic data and measurements) - **no images**
- Options (Permanent Key that is specific for enabled software options and Demo Key)
- Image Transfer Configuration (DICOM settings e.g., DICOM servers, AE Title, Station Name, etc.)
- Network Configuration (network settings including the computer name)
- Service Platform (state of the Service Software)

Loading Procedure

see: *Section 4.4.4 "Load Full System Configuration (Full Backup)" on page 4-36*

8.6 Image Archive - Loading Procedure

Introduction

A backup of the Image Archive contains the Patient Archive (database containing patient demographic data and measurements) **+ images**.

Loading Procedure

see: *Section 4.4.6.2 "Load Image Archive" on page 4-41*

8.7 Replacement or Activation of Options

Following SW Options are available:

Voluson E6 EC250 (BT13.5) systems	Voluson E8 EC250 (BT13.5) systems
Advanced 4D	Advanced 4D
DICOM	DICOM
SonoIT	SonoIT
VOCAL II	VOCAL II
HD*Live*	Advanced VCI (Volume Contrast Imaging)
Advanced VCI (Volume Contrast Imaging)	Elastography (incl. Elastography Analysis)
Elastography (incl. Elastography Analysis)	V-SRI (Voluson E8 Expert only)
CW (Continuous Wave Doppler)	CW (Continuous Wave Doppler)
STIC (Spatio-Temporal Image Correlation)	Advanced STIC (Spatio-Temporal Image Correlation)
SonoVCAD Labor	SonoVCAD Labor
Contrast (Coded Contrast Imaging)	Contrast (Coded Contrast Imaging)
SonoVCAD Heart	SonoAVC (Sono Automated Volume Count)
SonoAVC (Sono Automated Volume Count)	Expert (= Upgrade Voluson E8 -> Voluson E8 Expert)
Anatomical M-Mode	Anatomical M-Mode

Note *Additional options are not yet implemented in the Voluson E-Series system. For more details, see: Section 5.1.4 "Description of Software Options" on page 5-12*

It might be possible that some probes, options or features are NOT available

- in some countries.
- at the time of release of this Service Manual.

8.7.1 How to activate Options by means of a "Demo Key" or a "Permanent Key"

1. Press the **Utilities** key on the control console.
2. In the “Utilities” menu touch the ***System Setup*** button to invoke the setup desktop on the screen.
3. On the left side of the screen select ***Administration*** and then click the ***Option*** tab.

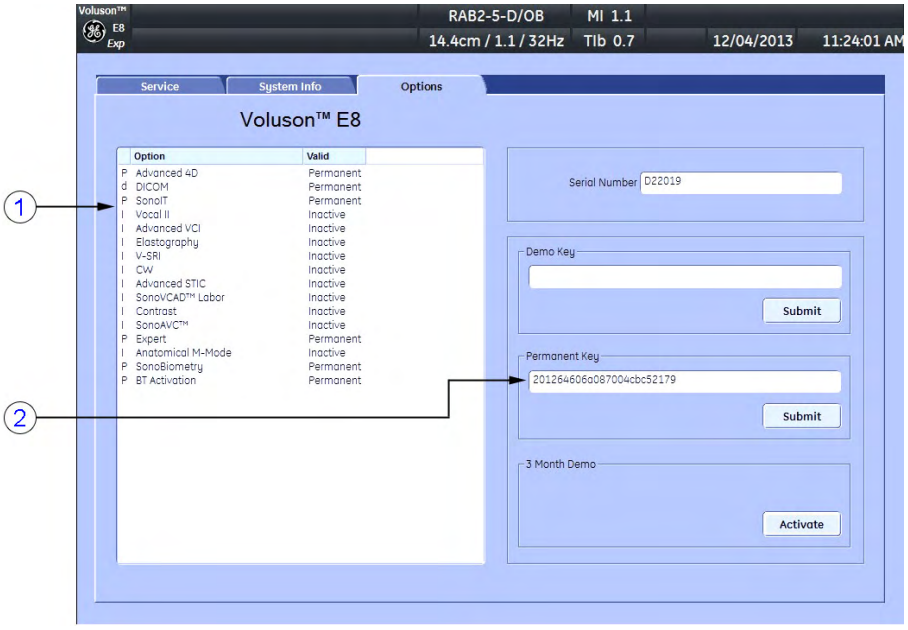


Figure 8-20 System Setup - Administration - Options page (e.g., Voluson E8 Expert)

1 **D = Demo** (Option is activated for demo and expires at date shown in the "Valid" column)
I = Inactive (Option is not activated)
P = Permanent (Option is permanently activated, i.e.purchased)
d = deactivated (Option is inactive)

2 Permanent Key

4. Position the cursor inside the input field desired and press the **right/left trackball** key.
5. If one exists, clear/edit the current Permanent Key.
6. Enter the encrypted Permanent Key with the keyboard and click on ***Submit***. (Code will be checked.)
7. Click the ***Save&Exit*** button.

Note *After activating a Permanent Key, restart (turn off and on) the Voluson E-Series system.*

8.8 Replacement of Covers

Content in this section

8.8.1 Replacement of the Footrest Cover

Manpower

One person, 1 minute

Tools

none

Preparations

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .

8.8.1.1 Footrest Cover - Removal Procedure

1. For unlocking, turn the 2 quick release devices below the footrest 90°.

Figure 8-21 turn quick release devices 90° and remove the footrest cover

2. Remove the Footrest Cover.

8.8.1.2 Footrest Cover - Installation Procedure

1. Place the (new) Footrest Cover on the original position.
2. For locking, turn the 2 quick release devices below the footrest 90°.

8.8.2 Replacement of the Voluson Cover

Manpower

One person, 1 minute

Tools

none

Preparations

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .

8.8.2.1 Voluson Cover - Removal Procedure

Note *The Voluson Cover is fixed by magnets only.*

1. Gently flap the Voluson Cover upwards ant then pull it away.

Figure 8-22 remove Voluson cover

8.8.2.2 Voluson Cover - Installation Procedure

1. Place the Voluson Cover on its original position.

8.9 Replacement of the Cable Holder

Manpower

One person, 3 minutes

Tools

Phillips screwdriver PH1 and PH2

8.9.1 Cable Holder - Removal Procedure

1. Loosen 2 screws below the control console and then remove the Cable Holder.

Figure 8-23 loosen 2 screws and remove cable holder

8.9.2 Cable Holder - Installation Procedure

1. Place the new Cable Holder at its original position and fasten it with 2 screws.

8.10 Replacement of the Probe Holder (Kit)

Manpower

One person, 1 minute

Tools

none

8.10.1 Probe Holder (Kit) - Removal Procedure

1. Pull out the elastic Probe Holder to be replaced.

Figure 8-24 pull out the probe holder

8.10.2 Probe Holder (Kit) - Installation Procedure

1. Insert the new Probe Holder from the kit.

8.11 Replacement of the Probe Holder for Endocavity probes

Manpower

One person, 5 minutes

Tools

Phillips screwdriver PH1 and PH2

8.11.1 Probe Holder (endocavity) - Removal Procedure

1. Loosen 4 screws and then remove the Probe Holder for Endocavity probes.

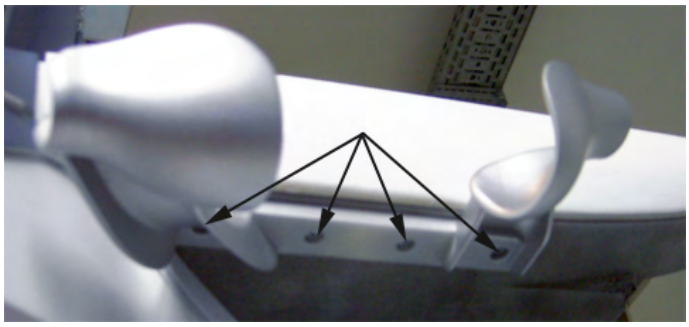


Figure 8-25 loosen screws and then remove probe holder

8.11.2 Probe Holder (endocavity) - Installation Procedure

1. Place the new Probe Holder at its original position and fasten it with 4 screws.

8.12 Replacement of the Trackball Ring

Manpower

One person, 1 minute

Tools

none

8.12.1 Trackball Ring - Replacement Procedure

1. Remove the Trackball Ring by turning it counterclockwise (red arrow).

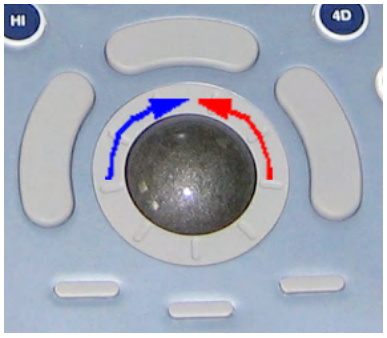


Figure 8-26 Trackball with Trackball "fixation" ring

2. Mount the Trackball Ring by turning it clockwise (blue arrow).

8.13 Replacement of Key Caps (by special native language keys)

Note *The table in Section 9.8 "Options and Upgrades" on page 9-24 shows the available Key Cap Kits. Keys to be removed depend on the (special native) language kit.*

Note *The FRU part depends on Console (RTU). The console version (**R**afi or **W**hanam) is shown in the System Info page (see Figure 7-1 on page 7-3).*

Manpower

One person, 30 minutes

Tools

small-sized slotted screwdriver or tweezers

Preparations

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .

8.13.1 Key Caps - Removal Procedure

1. Place a small slotted screwdriver between the Key Cap to be removed and its neighboring Key Cap.
2. Gently lift the Key Cap, until it is completely loosened from its base.

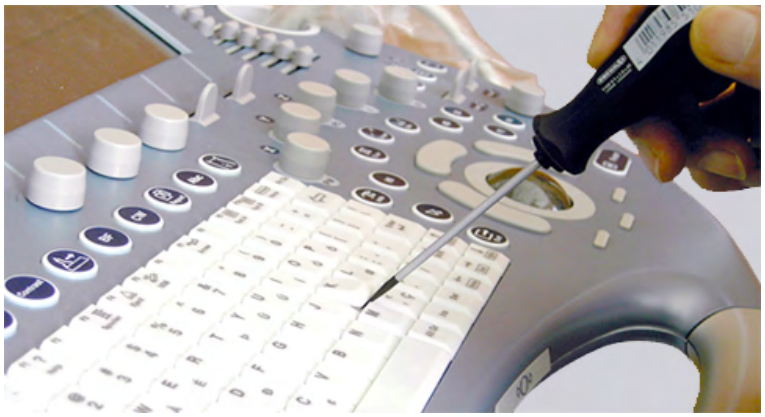


Figure 8-27 key cap replacement

3. Remove the Key Cap.

8.13.2 Key Caps - Installation Procedure

1. Carefully place the appropriate Key Cap in position on the keyboard, taking care to place the plastic alignment pin in the correct position so that the Key Cap is the right way up and reads correctly.

Note *Depending on the used version, it might be possible that you have to cut off the pins of the larger keys (such as the Shift key) before mounting them.*

2. Push the Key Cap down until it snaps into position.
3. Power On/Boot Up the system as described in *Section 4.2.1 on page 4-3* .
4. Setup the Keyboard Language Layout as described in *Section 6.4 on page 6-7* and then type with the keyboard to check the function of each key.

8.14 Replacement of the Caps for TGC Sliders and/or Rotation Digipots

Note *The FRU part depends on Console (RTU). The console version (**R**afi or **W**hanam) is shown in the System Info page (see Figure 7-1 on page 7-3).*

Manpower

One person, 10 minutes

Tools

none (poss. small-sized slotted screwdriver or tweezers)

8.14.1 Caps for TGC Sliders and/or Rotation Digipots - Replacement Procedure

1. Remove the caps for Slider-potentiometer TGC and/or Rotation Digipots.

Note *Do not loose integrated metal spring in each Rotation Digipot cap.*

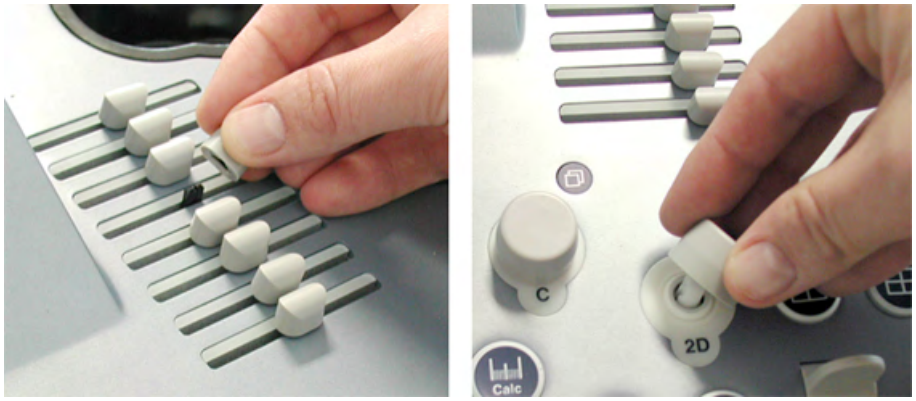


Figure 8-28 remove caps

2. Mount the caps for Slider-potentiometer TGC and/or Rotation Digipots.

8.15 Replacement of the Caps for Hardkeys

Note *The FRU part depends on Console (RTU). The console version (**R**afi or **W**hanam) is shown in the System Info page (see Figure 7-1 on page 7-3).*

Note *Replacement procedure depends on key caps that have to be replaced!*

- *If just the circle key caps have to be replaced, refer to: Section 8.15.1 on page 8-24*
- *If trackball buttons or mode key slices have to be replaced too, please contact your local distributor or GE service representative*

8.15.1 Replacement of Circle Key Caps only

Note *The FRU part depends on Console (RTU). The console version (**R**afi or **W**hanam) is shown in the System Info page (see Figure 7-1 on page 7-3).*

Manpower

One person, approx. 1 minute/cap

Tools

small-sized slotted screwdriver or tweezers

8.15.1.1 Circle Key Caps - Replacement Procedure

1. By means of a small slotted screwdriver, carefully push against the Circle Key Cap.
2. Lift the cap, until it is completely loosened from its base.

Figure 8-29 push against the circle cap and lift it

3. Place the new Key Cap down until it snaps into position.

8.16 Replacement of Fuses at Power Supply Module (RSP)

Manpower

One person, 30 minutes

Tools

small-sized slotted screwdriver

Preparations

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .

8.16.1 Fuses at Power Supply Module (RSP) - Replacement Procedure

1. Open the fuse protection at the power inlet block **(1)** with a small-sized slotted screwdriver.

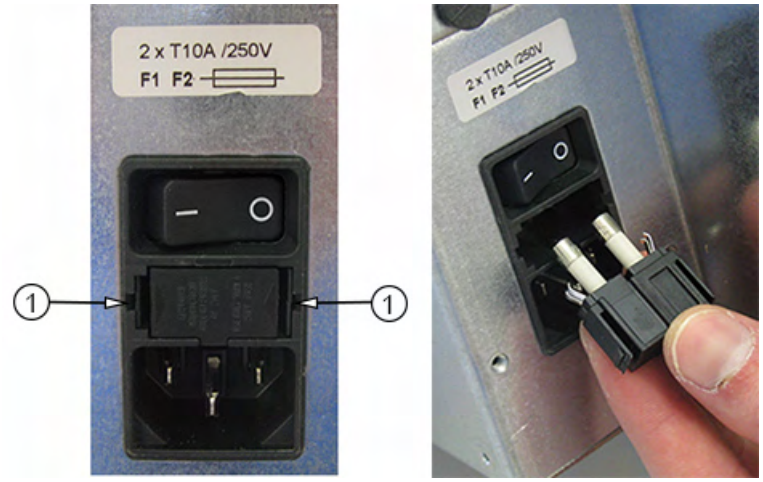


Figure 8-30 exchange fuses

2. Remove the fuse holder and exchange fuses.

8.17 Replacing optional Peripherals / How to mount Peripherals at a later date

Note *Normally auxiliary devices and peripherals come pre-installed with the Voluson E-Series system.*

Manpower

One person, 30 - 60 minutes (depending on peripherals)

Tools

slotted screwdriver

Preparations

Content in this section

Note *The VGA Image (Video) Resizer is required whenever the used Secondary “Patient” Monitor has a different screen resolution than the Voluson E-Series system!*

Caution
A Secondary "Patient" Monitor **MUST NEVER** be connected to the Voluson E-Series systems mains supply directly! Always connect it to an appropriate Isolation Transformer (see *Section 9.10.4 on page 9-37*).

Warning
After each installation, the leakage currents have to be measured according to IEC 60601-1, UL 60601-1, IEC 62353 or other relevant standard.

8.17.1 Mounting/Replacing a Secondary "Patient" Monitor

Note *A Secondary Monitor is **NOT intended for diagnostic use**. It is an additional device used to allow the patient to watch the proceedings.*

8.17.1.1 Preparing the Isolation Transformer

Figure 8-31 Isolation Transformer kit for Secondary Monitor

Caution
For changing the input/output voltage or fuses the isolation transformer should not be connected. The wrong fuses and position of the input/output voltage selector may cause major damage on connected peripherals.

1. Before using the Isolation Transformer you must check the input/output voltage settings to meet the ratings of the line power available in your location or country.
2. For changing the input/output voltage, remove the label by means of a small socket wrench.
3. Switch both voltage selectors (input **as well as** output voltage) to 115V or 230V. Consider that changing the input/output voltage also requires to change the fuses!

Figure 8-32 change input/output voltage

4. For changing the fuses, open the fuse protection at the power inlet block with a small screwdriver, remove the fuse holder and exchange fuses.

115V (100-130V) -> **4AT**

230V (220-240V) -> **2AT**

Figure 8-33 exchange fuses

5. Assure that the connected loads can be operated with the chosen voltage.

8.17.1.2 Connection of a Secondary Monitor and Isolation Transformer

Note *DO NOT connect a Secondary Monitor to the Voluson E-Series via USB cable. Use the supplied VGA cable.*

Caution
A Secondary "Patient" Monitor **MUST NEVER** be connected to the Voluson E-Series systems mains supply directly! Always connect it to an appropriate Isolation Transformer (see *Section 9.10.4 on page 9-37*).

Caution
The transformer must be out of the reach of the patient. However, it needs to be within cable length from the monitor and a socket. The transformer is IPX 0. There is no protection against ingress of liquids!

Caution
All necessary modifications to wall and buildings must be performed by a professional to avoid structural damage and electrical hazard.

Note *For connection scheme see: Figure 3-23 on page 3-33 .*

1. Plug the VGA cable (from Secondary Monitor) to the **VGA Out** connector on the external I/O connector panel (GES) on the rear of the system.
2. Place the isolation transformer on the floor or mount it on the wall.
3. Plug the Power cable (from Secondary Monitor) to the isolation transformer. The Power cable of the transformer itself connect to a wall socket.
4. Use this power switch to power on the Transformer.

Note *Wait ~ 1 minute before turning on your monitor.*

5. Press the main power switch on the Secondary Monitor.
6. Power On/Boot Up the system as described in *Section 4.2.1 on page 4-3* .
7. Compare the picture on the newly installed monitor with the picture on the Voluson E-Series monitor.
8. Measure Leakage Currents according to IEC 60601-1 respectively UL 60601-1.

Note *If you need to change the configuration of the newly installed monitor, please, refer to the manual of the Secondary Monitor, which is enclosed in the Wall mount kit.*

Note *The monitor needs to be switched of separately at the main power switch of the monitor.*

8.17.2 Mounting/Replacing the VGA Image (Video) Resizer

Note *The VGA Image (Video) Resizer is required whenever the used Secondary "Patient" Monitor has a different screen resolution than the Voluson E-Series system!*

8.17.2.1 VGA Image Resizer - Installation Procedure

Note *Following steps describe, how to install the VGA Image Resizer (if it was not mounted before).*

1. Power Off/Shutdown the system as described in *Section 4.2.2 on page 4-4* .
2. Open the right side door **(A)** of the Voluson E-Series system.
3. Connect the power supply of the VGA Image Resizer to the power cable plug behind the door **(1)**.

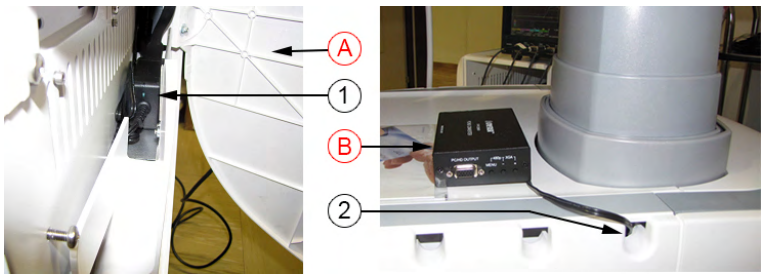


Figure 8-34 power cable plug behind door

4. Lead the cable through an opening **(2)** and close the door.
5. Peel off the protective film from the adhesive tapes (on bottom of Image Resizer Box) and fix the image resizer box on the Top Cover of the Voluson E-Series system **(B)**.
6. Connect the RGB Video Cable from the **VGA Out** connector (on Voluson E-Series system) to the **PC/HD IN** connector on the Image Resizer box **(3)**.

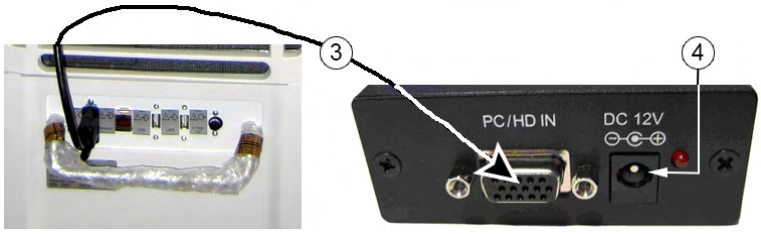


Figure 8-35 VGA video connection

Note *Place the cable in a way, that it can not get damaged when moving the Voluson E-Series system, or when the height of the User Interface gets adjusted.*

7. Connect the DC-Power Output from the Power Supply to the **DC 12V** Input connector at the Resizer box **(4)**.
8. Connect your Secondary Monitor to the Image Resizer box at its **PC/HD OUTPUT** connector **(5)**.

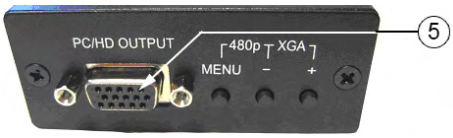


Figure 8-36 connector for Secondary Monitor

9. Power On/Boot Up the system as described in *Section 4.2.1 on page 4-3* .
10. Adjust the VGA Image Resizer settings as described in *Section 3.4.9.1 on page 3-31* .
11. Measure Leakage Currents according to IEC 60601-1 respectively UL 60601-1.

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Chapter 9

Renewal Parts

This chapter gives an overview of replacement parts available for the Voluson E-Series system.

It might be possible that some probes, options or features are NOT available

- *in some countries.*
- *at the time of release of this Service Manual.*

Content in this chapter

9.1 List of Abbreviations

AC	Alternating Current
ADC	Analog to Digital Converter
ASIC	Application Specific Integrated Circuit
Assy	Assembly
BEP	BackEnd Processor
CPU	Central Processing Unit
CRU	Customer Replaceable Unit
CSD	Common Service Desktop
DAC	Digital to Analog Converter
DC	Direct Current
DSP	Digital Signal Processing
DVI	Digital Visual Interface
EUM	Electronic User Manual
FE	FrontEnd
FRU	Y = Replacement part / N = Non Stock part
GGF	Beamformer Module
HDD	Hard Disk Drive
HVPS	High Voltage Power Supply
Int	Internal
I/O	Input/Output
LCD	Liquid Crystal Display
LVPS	Low Voltage Power Supply
MAN	ECG Module
PCI	Peripheral Component Interconnect
PWA	Printed Wire Assembly
RFM	(RF-Interface & Beamformer) FE Mainboard
RSE	Pencil Probe Board (CW-Doppler)
RSP	Power Supply Module
RSX	(Beamformer Receiver/Transmitter) Extension Board for FE Mainboard (RFM)
RTB	Distribution Board Bottom
RTF	Probe Control Board
RTH	Distribution Board USB-Hub
RTT	Distribution Board Top
RTU	Control Console
RTV	Video Converter Board
SMBus	System Management Bus
UI	User Interface
UIS	Ultrasound Application Software

9.2 Parts List Groups

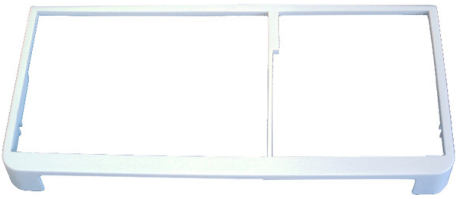
Figure 9-1 Console Views

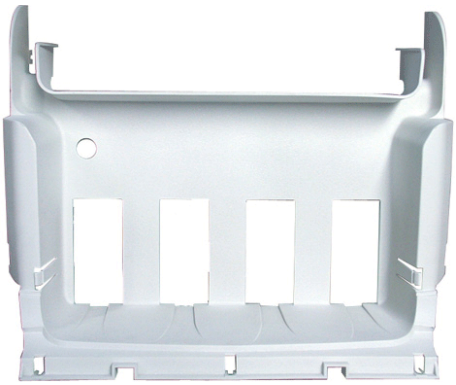
Table 9-1 Mechanical and user accessible parts

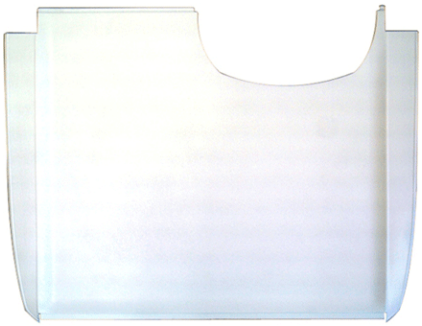
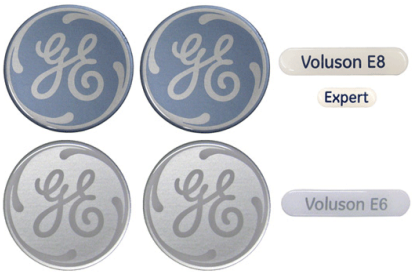
Item	Part Group Name	Description
100 -	*"Housing - Mechanical Hardware Parts & Covers" on page 9-4*	Housing Covers (except UI and Monitor), Caster Wheels, Handle
200 -	*"User Interface" on page 9-8*	Console (keyboard, trackball, display, special knobs and switches) Loudspeakers, Disk Drive, Probe holder, Console Covers, etc.
300 -	*"Monitor + Monitor Replacement Parts" on page 9-17*	Monitor + Monitor Replacement Parts
400 -	*"Main Power Modules" on page 9-18*	Primary and Secondary Power Supply Module
500 -	Main Board Module - *"FrontEnd (US-Part) Components" on page 9-19* - *"BackEnd (PC-Part) Components" on page 9-21*	. Ultrasound (FrontEnd) Components PC-Part (BackEnd) Components
600 -	*"Options and Upgrades" on page 9-24*	Software Options and Upgrades
700 -	*"Miscellaneous Cables" on page 9-26*	
800 -	Optional Peripherals and Accessories - *"Recording Tools" on page 9-33* - *"Printers" on page 9-34* - *"Drives and additional Devices" on page 9-36* - *"Optional Equipment" on page 9-37*	. DVD recorder and Cable Kits B/W Printer, Color Printer, DeskJet Printer USB Stick, HDD Drive, WLAN, etc. Secondary Patient Monitor, etc.
	"System Manuals" on page 9-40	
900 -	Probes - *"2D-Probes - Curved Array Probes" on page 9-41* - *"2D-Probes - Linear Array Probes" on page 9-43* - *"2D-Probes - Phased Array Probes" on page 9-44* - *"Real-Time 4D Volume Probes" on page 9-45* - *"CW-Doppler - Pencil Probes" on page 9-48*	
950 -	*"Biopsy Needle Guides" on page 9-49*	

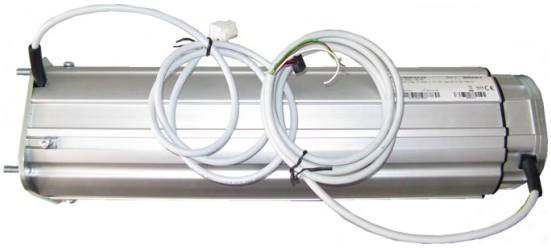
9.3 Housing - Mechanical Hardware Parts & Covers

Table 9-2 Housing - Mechanical Hardware Parts & Covers

Item	Part Name	Part Number	Description	Qty	CRU	FRU
101	Back Cover	*KTZ134641*	Back Cover incl. Filter Grid for Voluson E-Series 	1	N	Y
102	Back Top Cover	*KTZ134644*	Back Top Cover for Voluson E-Series 	1	N	Y
103	Voluson Cover	*KTZ134696*	Voluson Cover for Voluson E-Series 	1	N	Y
104	Footrest Cover	*KTZ134633*	Footrest Cover for Voluson E-Series 	1	N	Y
105	Front Frame	*KTZ134637*	Front Frame for Voluson E-Series 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
106	Front Cover	*KTZ134639*	Front Cover (Beamformer) for Voluson E-Series 	1	N	Y
107	Handle (rear)	*KTZ134638*	rear Handle for Voluson E-Series 	1	N	Y
108	Hook Connector	*KTZ134642*	Hook Connector for Voluson E-Series 	1	N	Y
109	Small parts kit	KTZ280053	“odds and ends” kit incl. quick release devices for locking footrest cover (4 pcs.), GE label (2 pcs.), different screws (40 pcs.), etc.	-	-	Y
110	Side Cover incl. Door (left)	*KTZ196218*	left Side Cover incl. Door for probe cables 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
111	Side Cover incl. Door (right)	*KTZ196224*	right Side Cover incl. Door for probe cables 	1	N	Y
112	Top Cover	*KTZ134643*	Top Cover for Voluson E-Series 	1	N	Y
113	Labels (doors, User Interface)	KTZ280100	Labels for doors and User Interface: GE logo (**2** pcs.) + label on UI (**1** pcs.) “blue”, for Voluson E8, “Expert” label (**1** pcs.) for Voluson E8 Expert, GE logo (**2** pcs.) + label on UI (**1** pcs.) “silver”, for Voluson E6 	-	Y	Y
114	Caster back ("Steinco")	*KTZ220492*	back Caster Wheel steerable, **1** pcs. 	2	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
115	Caster back ("Steinco") version 2	*KTZ302365*	right back Caster Wheel (steerable with lock) **1** pcs. 	1	N	Y
116	Caster front ("Steinco") version 2	*KTZ220869*	front Caster Wheel steerable (**1** pcs.) swivel lock is only possible if wheel is set towards the front 	2	N	Y
117	Caster front universal ("Tente")	*KTZ304057*	Caster front, 2 pcs. (lockable) incl. hexagon bolts, washers, lock-nuts and quick fastener (N/A at EC250) 	2	N	Y
118	Caster back universal ("Tente")	*KTZ304058*	Caster back, 2 pcs. (1 pcs. is lockable) incl. hexagon bolts, washers and lock-nuts 	1 / 1	N	Y
119	Lifting Column, 12V	*KTZ302806*	Lifting Column, 12V 	1	N	Y

Note *DO NOT mix "Steinco" and new universal "Tente" Casters. Please identify the used Casters before ordering!*

9.4 User Interface

Note *Before ordering spare parts for a Console (RTU) you have to identify which version is in use!!!*

Note *Please observe that some FRU parts depend on the Console (RTU) version.*

Table 9-3 User Interface

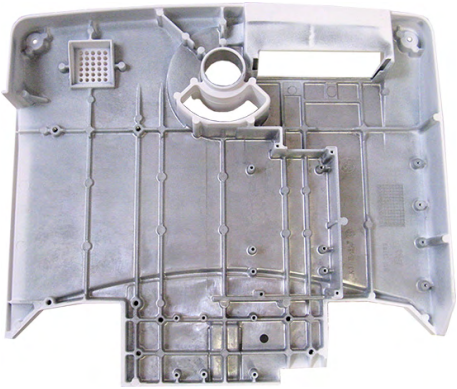
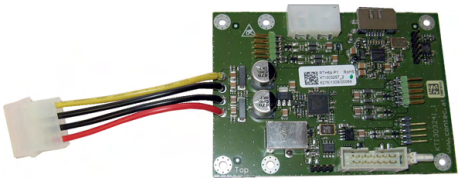
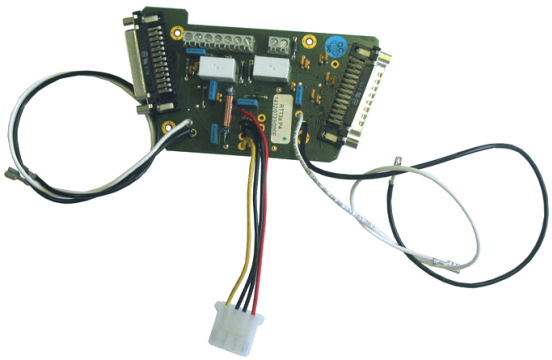
Item	Part Name	Part Number	Description	Qty	CRU	FRU
201	Cable Holder	*KTZ134656*	Probe Cable Holder (1 pcs.) for Voluson E-Series 	2	Y	Y
202	Probe Holder for Endocavity probes	*KTZ134657*	Holder for Endocavity probes 	1	Y	Y
203	Probe Holder Kit	*KTZ134697*	Probe Holder Kit (insert 1-4) for Voluson E-Series 	1	Y	Y
204	Console Rubber bar 1.8m	KTZ220621	Console Rubber bar 1.8m (sealing between Console Cover and Trolley) 	1	N	Y

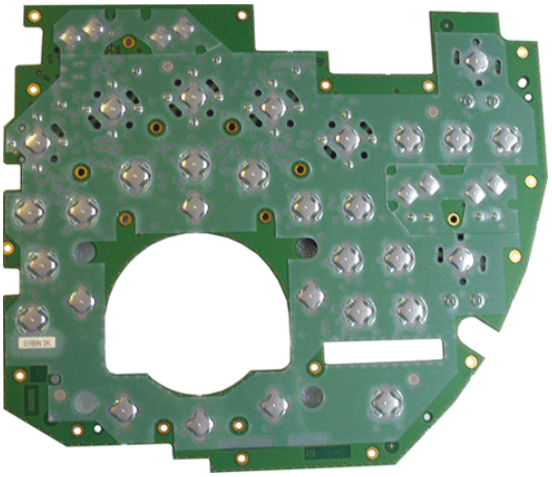
Item	Part Name	Part Number	Description	Qty	CRU	FRU
205	Caps for TGC Sliders (R)	*KTZ220870*	Caps for TGC Slide potentiometers on RTU3/4/5/6 Console, 8 pcs. with premounted brackets 	8	Y	Y
206	Caps for TGC Sliders (W)	*KTZ280223*	Caps for TGC Slide potentiometers on RTU50 Console, 8 pcs. with premounted brackets 	8	Y	Y
207	Caps for Rotation digipots (R)	*KTZ220871*	Caps for Rotation digipots on RTU3/4/5/6 Console, 10 pcs. with premounted brackets 	10	Y	Y
208	Caps for Rotation digipots (W)	*KTZ280224*	Caps for Rotation digipots on RTU50 Console, 10 pcs. with premounted brackets 	10	Y	Y

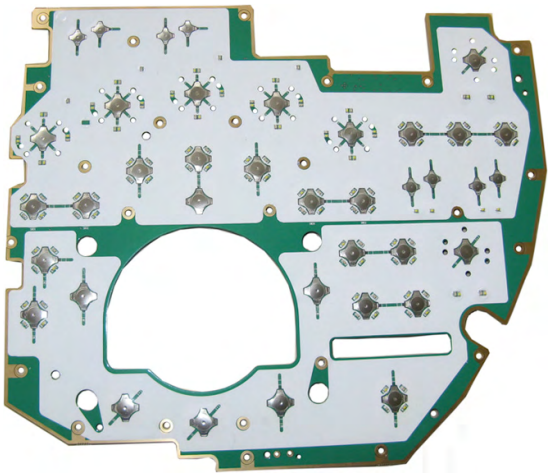
Item	Part Name	Part Number	Description	Qty	CRU	FRU
209	Caps for Hardkeys 2 (R)	*KTZ300424*	all caps for hardkeys on RTU3/4/5/6 Console 	1	Y	Y
210	Function Key Set (W)	*KTZ280225*	all caps for hardkeys on RTU50 Console 	1	Y	Y
211	Caps for Keyboard keys 2 (R)	*KTZ300425*	set includes all caps for alphanumeric keyboard keys on RTU3/4/5/6 Console - English, (check if special key cap kit is needed; see: *Table 9-8 on page 9-24*) 	1	N	Y
212	Digipot Encoder (R)	*KTZ220875*	Digipot Encoder , 10 pcs. 	10	N	Y
213	Digipot Encoder (W)	*KTZ280231*	Digipot Encoder , 10 pcs. 	10	N	Y
214	Console Back Cover	*KTZ134646*	Console Back Cover for Voluson E-Series 	1	N	Y

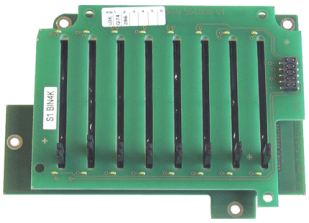
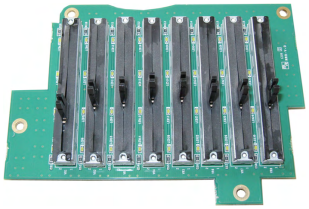
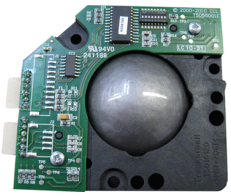
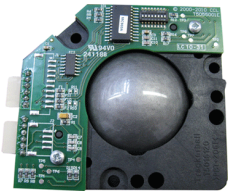
Item	Part Name	Part Number	Description	Qty	CRU	FRU
215	RTU6 Console (R)	*KTZ302696*	Voluson E-Series Console incl. English keyboard, trackball, display, logo stickers, special knobs and switches 	1	N	Y
216	RTU50 Console (W)	*KTZ280226*	Voluson E-Series Console incl. English keyboard, trackball, display, logo stickers, special knobs and switches 	1	N	Y
217	Console Top Cover with Touchscreen (R)	*KTZ280183*	Voluson E-Series Console Top Cover with premounted Touchscreen, incl. logo stickers 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
218	Console Top Cover	*KTZ280227*	Voluson E-Series Console Top Cover **without** Touchscreen, incl. logo stickers 	1	N	Y
219	Console Front Handle	*KTZ280106*	Console Front Handle for Voluson E-Series; 2 parts (upper and bottom part) 	1	N	Y
220	Console Bottom Housing	*KTZ280281*	Voluson E-Series Console Bottom Housing 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
221	Console Back Housing	*KTZ280286*	Voluson E-Series Console Back Housing 	1	N	Y
222	Disk Drive 3 DVD+(R)W - SATA	*KTZ303258*	DVD+(R)W Writer internal (no own cabinet) 	1	N	Y
223	RTH6.Px - Distribution Board USB-Hub	*KTZ303257*	Distribution Board USB-Hub 	1	N	Y
224	RTH6b.Px - Distribution Board USB-Hub	*KTZ304007*		1	N	Y
225	RTT3.P3 - Distribution Board Top	*KTZ221014*	Distribution Board Top *<u>Compatibility:</u> Can replace RTT1-2 (KTZ220503), if RTH is also exchanged!* 	1	N	Y
226	RTT3.P3 - Distribution Board Top (RoHS)	*KTZ280290*		1	N	Y
227	Loudspeaker Top Console	*KTZ208132*	Loudspeaker on User Interface (1 pcs.) 	2	N	Y

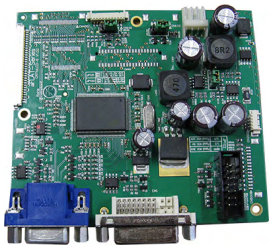
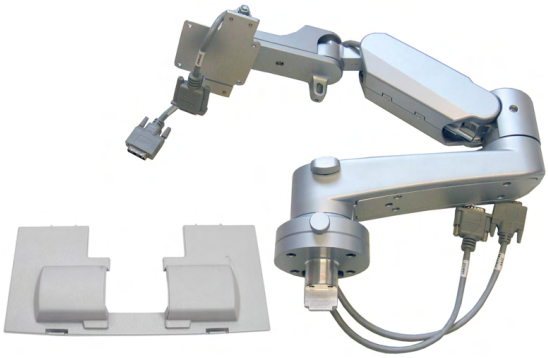
Item	Part Name	Part Number	Description	Qty	CRU	FRU
228	Fan User Interface	*KTZ220645*	Fan User Interface 	1	N	Y
229	Console Alphanumeric board 3 (R)	*KTZ302739*	Alphanumeric Keyboard incl. alphanumeric keyboard - English, (check if special key cap is needed; see: *Table 9-8 on page 9-24*) 	1	N	Y
230	Console Interface board 2 (R)	*KTZ280065*	Console Interface Board *Compatibility: If this board is used on a BT06 system, some key caps have to be exchanged!* 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
231	Console Main Board left A/N (W)	*KTZ280232*	Console Main Board left incl. alphanumeric keyboard - English, (check if special key cap kit is needed; see: *Table 9-8 on page 9-24*) 	1	N	Y
232	Console Main Board right (W)	*KTZ280234*	Console Main Board right 	1	N	Y
233	A/N Keyboard (W)	*KTZ280233*	Alphanumeric Keyboard - English, (check if special key cap kit is needed; see: *Table 9-8 on page 9-24*) 	1	N	Y
234	Console Touchscreen (W)	*KTZ280235*	Console Touchscreen Display 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
235	TGC-Slide potentiometers (R)	*KTZ220874*	TGC-Slide potentiometers **Note:** 2 versions are available that are fully compatible. 	1	N	Y
236	TGC-Slide potentiometers (W)	*KTZ280228*	TGC-Slide potentiometers 	1	N	Y
237	Trackball Ring (R)	*KTZ220868*	Trackball fixation ring 	1	Y	Y
238	Trackball Ring (W)	*KTZ280230*	Trackball fixation ring 	1	Y	Y
239	Trackball Kit (R) - mechanical	*KTZ220867*	mechanical sampling Trackball Kit , generates X-Y-coordinates of trackball-movements like a PC-mouse (can replace KTZ280063) 	1	N	Y
240	Trackball Kit (W)	*KTZ280229*	mechanical sampling Trackball Kit , generates X-Y-coordinates of trackball-movements like a PC-mouse 	1	N	Y

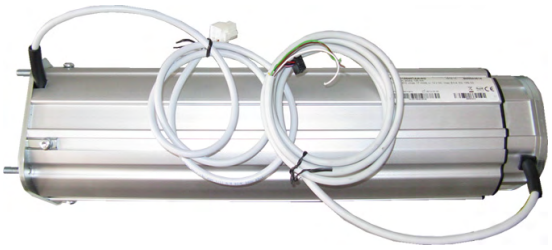
9.5 Monitor + Monitor Replacement Parts

Table 9-4 Monitor + Monitor Replacement Parts

Item	Part Name	Part Number	Description	Qty	CRU	FRU
301	Monitor Color LCD 19” (MDM110) complete	*KTZ303710*	19” Color Image LCD Monitor complete 	1	N	Y
302	Monitor Color LCD 19” (MDM120) complete	*KTZ304061*		1	N	Y
303	LCD Controller Board MDM110	*KTZ303715*	LCD Controller Board MDM110 	1	N	Y
304	Monitor Arm 19” (incl. cables and cover)	*KTZ280247*	Holder for Voluson E-Series Monitor, premounted monitor cables and monitor back cover 	1	N	Y
305	Monitor Cable Set (2 cables)	*KTZ280251*	Monitor Cable Set (Power and DVI Video Cable) 	1	N	Y

9.6 Main Power Modules

Table 9-5 Main Power Modules

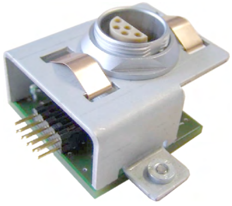
Item	Part Name	Part Number	Description	Qty	CRU	FRU
401	RSP2.Px - Power Supply EC250	*KTZ302752*	Power Supply Module (RSP) 	1	N	Y
402	RSP3-3c - Power Supply EC300	*KTZ303892*	Power Supply Module (RSP) Note: Software version Ext.7 (14.0.7) or higher required. 	1	N	Y
403	Fuse Set	*KTZ280043*	Fuses for Power Supply (T1.25A, T1.6A, T10A and T15A; 10 pcs. each = 40) 	-	N	Y
404	Lifting Column, 12V	*KTZ302806*	Lifting Column, 12V 	1	N	Y

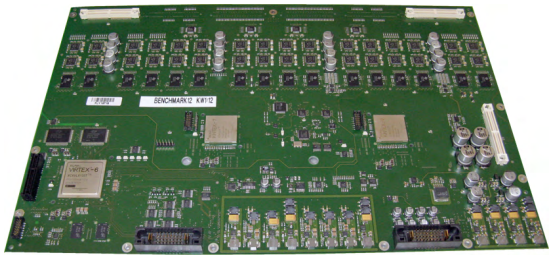
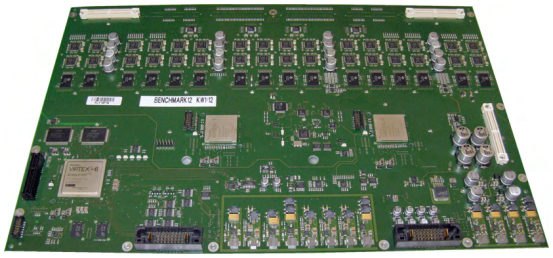
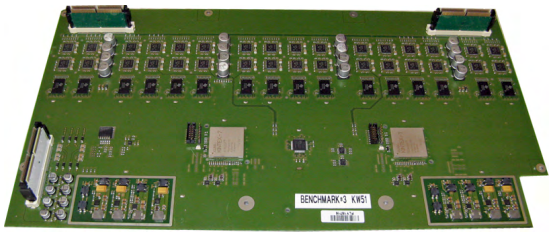
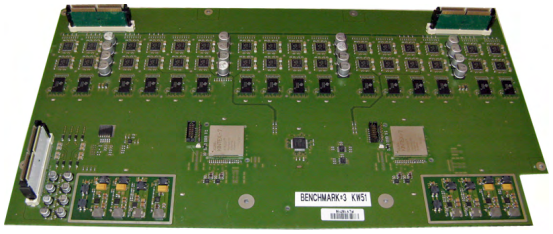
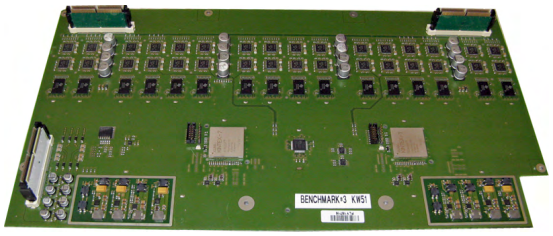
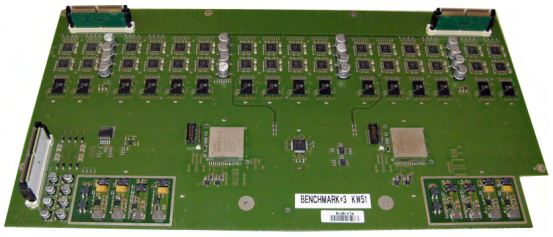
9.7 Main Board Module

Content in this section

9.7.1 FrontEnd (US-Part) Components

Table 9-6 FrontEnd (US-Part) Components

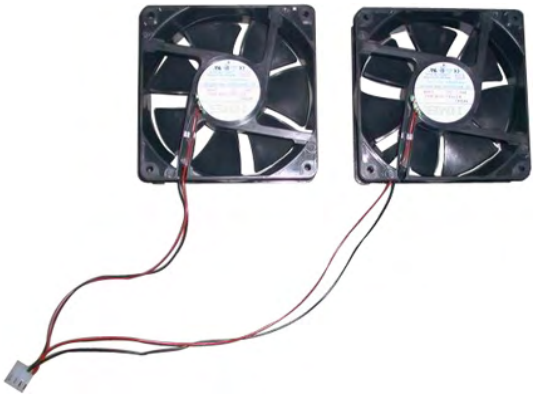
Item	Part Name	Part Number	Description	Qty	CRU	FRU
501	RTF100.Px - Probe Control Board	*KTZ280307*	Probe Control Assembly (Voluson E6 **only** 	1	N	Y
502	RTF200.Px - Probe Control Board	*KTZ280308*	Probe Control Assembly (Voluson E8 **only** 	1	N	Y
503	RTF300.Px - Probe Control Board	*KTZ302927*	Probe Control Assembly (256 Ch. + e4D), compatible to all versions 	1	N	Y
504	RTF300d.P15 - Probe Control Board	*KTZ280306*		1	N	Y
505	RSE10 Pencil Probe Board	*KTZ302856*	Pencil Probe Board 	1	N	Y

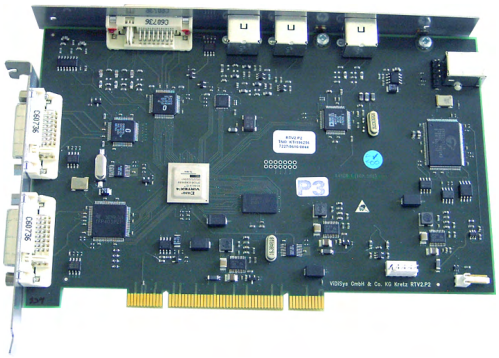
Item	Part Name	Part Number	Description	Qty	CRU	FRU
506	RFM201 - FE-Mainboard without MUX	*KTZ303916*	FE-Mainboard (128 Ch.); **without** MUX 	1	N	Y
507	RFM220 - FE-Mainboard + CW-steerable; without MUX	*KTZ303052*	FE-Mainboard + CW-steerable (128 Ch.); **without** MUX 	1	N	Y
508	RFM221 - FE-Mainboard + CW-steerable; without MUX	*KTZ303915*		1	N	Y
509	RSX10 - Extension Board for RFM	*KTZ303250*	Extension Board for FE-Mainboard RFM (128 Ch.) 	1	N	Y
510	RSX110 - Extension Board for RFM	*KTZ303759*	Extension Board for FE-Mainboard RFM (64 Ch.) 	1	N	Y
511	RSX20 - Extension Board for RFM + CW-steerable	*KTZ303054*	Extension Board for FE-Mainboard RFM + CW-steerable (128 Ch.) 	1	N	Y
512	RSX120 - Extension Board for RFM + CW-steerable	*KTZ303760*	Extension Board for FE-Mainboard RFM + CW-steerable (64 Ch.) 	1	N	Y

9.7.2 BackEnd (PC-Part) Components

Table 9-7 BackEnd (PC-Part) Components

Item	Part Name	Part Number	Description	Qty	CRU	FRU
551	Graphic Card 4, EC250	*KTZ302900*	Graphic Card for PC-Motherboard  or 	1	N	Y
552	Battery Lithium CR2032 (3V)	*KTZ208791*	Lithium Battery CR2032 (3V) for PC-Motherboard 	1	N	Y
553	Hard Disk Drive (HDD)	*KTZ302446*	Hard disk drive SATA 500 Gbyte (Western Digital or Hitachi) System/Boot DVD (see: *Table 9-8 on page 9-24*) is **required**. 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
554	Fan Set (2 fan) for PC - BackEnd	*KTZ134698*	Fan for PC-box (2 fan) - BackEnd 	1	N	Y
555	Back End Processor (BEP) Kit, EC250 **(BT13.5)**, incl. housing and cables	*KTZ302875*	Kit contains ATX Motherboard "ADVANTECH", CPU ooler, RAM, Fan(s), housing + internal cables premounted 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
556	RTB4.P6 - Distribution Board Bottom	*KTZ221016*	Distribution Board Bottom 	1	N	Y
557	RTB4.P6 - Distribution Board Bottom (RoHS)	*KTZ280291*		1	N	Y
558	RTV2a.P2 - Video Management Board	*KTZ196208*	Video Management Board 	1	N	Y

9.8 Options and Upgrades

Table 9-8 Software Options and Upgrades

Item	Part Name	Part Number	Description	Qty	CRU	FRU
601	System/Boot DVD EC250 (BT13.5 - Ext.8, 14.0.8)	KTZ304065	bootable DVD for System HDD recovery Contents: SP with newest MS patches, Linux rescue partition, System C: Image (Windows 7), UISApp, Backup, EUM, Database Repair Tool, etc. Note: Refer to SN79009, which is the best source for the latest revision.	1	Y	Y
	System/Boot DVD EC250 (BT13.5 - Ext.7, 14.0.7)	KTZ304054				
	System/Boot DVD EC250 (BT13.5 - Ext.6, 14.0.6)	KTZ304036				
	System/Boot DVD EC250 (BT13.5 - Ext.5, 14.0.5)	KTZ304033				
	System/Boot DVD EC250 (BT13.5 - Ext.4, 14.0.4)	KTZ304023				
	System/Boot DVD EC250 (BT13.5 - Ext.3, 14.0.3)	KTZ304010				
	System/Boot DVD EC250 (BT13.5 - Ext.2, 14.0.2)	KTZ280304				
	System/Boot DVD EC250 (BT13.5 - Ext.1, 14.0.1)	KTZ280300				
602	Upgrade Kit: Voluson E6 (BT13.5) to Voluson E8 (BT13.5)	H48691JU	BT13.5 Upgrade kit (incl. new Hardware components, System DVD, System Manuals, etc.) + labels: “GE Logo” (doors) and “Voluson E8” (User Interface)	-	N	N
603	Upgrade Kit: Voluson E8 (BT13.5) to Voluson E8 Expert (BT13.5)	H48691JT	encrypted Software Option string (password) which is specific for each Voluson E8 ultrasound system + “Expert” label (User Interface)	-	N	N
604	Upgrade Kit: new Voluson E-Series BT13.5 version	H48691JR	encrypted Software Option string (password) which is specific for each Voluson E-Series ultrasound system	-	N	N
605	Advanced 4D	H48681FM	encrypted Software Option string (password)	-	N	N
606	VOCAL II - Volume Calculation	H48681FN	encrypted Software Option string (password)	-	N	N
607	Advanced VCI - Volume Contrast Imaging	H48681FP	encrypted Software Option string (password)	-	N	N
608	Interface for DICOM 3 Standard	H48681FR	encrypted Software Option string (password)	-	N	N
609	STIC “Basic” - Spatio-Temporal Image Correlation	H48681FS	encrypted Software Option string (password)	-	N	N
610	Coded Contrast Imaging - Contrast Media	H48681FT	encrypted Software Option string (password)	-	N	N
611	SonoVCAD - Heart	H48681FW	encrypted Software Option string (password)	-	N	N
612	SonoAVC - Sono Automated Volume Count	H48681FX	encrypted Software Option string (password)	-	N	N
613	SonoVCAD labor	H48681FY	encrypted Software Option string (password)	-	N	N
614	Anatomical M-Mode	H48681FZ	encrypted Software Option string (password)	-	N	N
615	Advanced STIC * - Spatio-Temporal Image Correlation	H48681GD	encrypted Software Option string (password)	-	N	N
616	SonoNT	H48681GA	encrypted Software Option string (password)	-	N	N
617	Elastography	H48681GB	encrypted Software Option string (password)	-	N	N
618	SRI Advanced	H48681GC	encrypted Software Option string (password)	-	N	N
619	V-SRI	H48681TK	encrypted Software Option string (password)	-	N	N

Item	Part Name	Part Number	Description	Qty	CRU	FRU
620	HD*Live* (Europe and Latin America only)	H48691KK	encrypted Software Option string (password)	-	N	N
621	RLS Option (Russian Language Support)	H48691KG	encrypted Software Option string (password)	-	N	N
622	4D View Package (PC software)	H48691KL	encrypted Software Option string (password)	-	N	N
623	CW-Doppler Upgrade Kit external	H48681XK	CW-Doppler Upgrade Kit incl. Hardware and encrypted Software Option string (password) + upgrade instructions for Voluson E-Series systems	-	N	N
624	Key Cap Kit - Swedish	*KTZ280015*	kit includes special native language keys (Rafi)	-	Y	Y
625	Key Cap Kit - Swedish (W)	*KTZ280238*	kit includes special native language keys (Whanam)	-	Y	Y
626	Key Cap Kit - Danish	*KTZ280014*	kit includes special native language keys (Rafi)	-	Y	Y
627	Key Cap Kit - Danish (W)	*KTZ280239*	kit includes special native language keys (Whanam)	-	Y	Y
628	Key Cap Kit - Norwegian	*KTZ280013*	kit includes special native language keys (Rafi)	-	Y	Y
629	Key Cap Kit - Norwegian (W)	*KTZ280240*	kit includes special native language keys (Whanam)	-	Y	Y
630	Key Cap Kit - Finnish	*KTZ280012*	kit includes special native language keys (Rafi)	-	Y	Y
631	Key Cap Kit - Finnish (W)	*KTZ280241*	kit includes special native language keys (Whanam)	-	Y	Y
632	Key Cap Kit - Spanish	*KTZ280011*	kit includes special native language keys (Rafi)	-	Y	Y
633	Key Cap Kit - Spanish (W)	*KTZ280242*	kit includes special native language keys (Whanam)	-	Y	Y
634	Key Cap Kit - French	*KTZ280010*	kit includes special native language keys (Rafi)	-	Y	Y
635	Key Cap Kit - French (W)	*KTZ280243*	kit includes special native language keys (Whanam)	-	Y	Y
636	Key Cap Kit - German	*KTZ280005*	kit includes special native language keys (Rafi)	-	Y	Y
637	Key Cap Kit - German (W)	*KTZ280237*	kit includes special native language keys (Whanam)	-	Y	Y
638	Key Cap Kit - Italian	*KTZ280004*	kit includes special native language keys (Rafi)	-	Y	Y
639	Key Cap Kit - Italian (W)	*KTZ280244*	kit includes special native language keys (Whanam)	-	Y	Y
640	Key Cap Kit - Russian	*KTZ280264*	kit includes special native language keys (Rafi)	-	Y	Y
641	Key Cap Kit - Russian (W)	*KTZ280265*	kit includes special native language keys (Whanam)	-	Y	Y

Note *A sales order has to be obtained for item 602 - 623!*

Software Options (item 605 - 621): Once the order has been processed, the option string can be either entered by the customer, FE or Applications support.

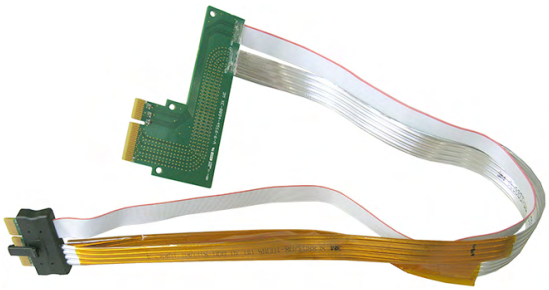
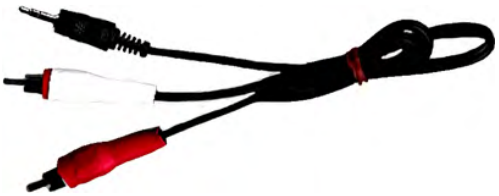
Note *For more detailed description of Software options and their functions, see: Section 5.1.4 "Description of Software Options" on page 5-12 .*

Note *Not every feature is released in every country. Please contact Sales & Marketing in your region for information on feature availability.*

Note *Please observe that some FRU parts depend on the Console (RTU) version.*

9.9 Miscellaneous Cables

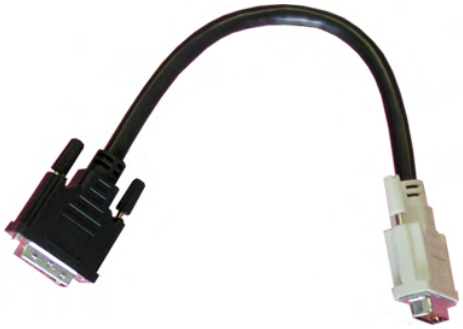
Table 9-9 Miscellaneous Cables

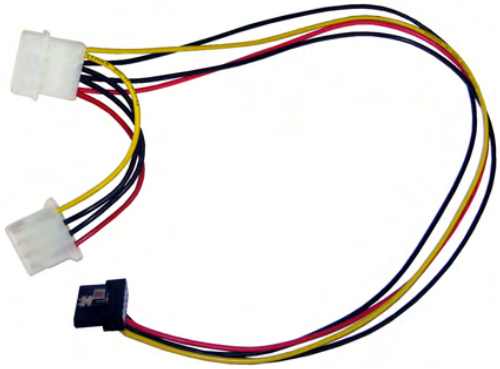
Item	Part Name	Part Number	Description	Qty	CRU	FRU
701	SATA Data Cable for HD-Drive	KTZ300244	SATA Data Cable for HD-Drive 	1	N	Y
702	PCI-E Connection Cable (FEP - BEP)	KTZ303121	PCI-E Connection from FrontEnd to BackEnd Cable 	1	N	Y
703	Cable Stereo Jack Cinch	KTZ212074	Cable from PC-Sound-StereoJack to DVD Shelf 	2	N	Y
	Cable Stereo Jack Cinch - RoHS	KTZ280285		2	N	Y
704	KVX1 Network Cable	KTZ212016	Network Cable from external rear panel (GES) to the Voluson E-Series (internal) rear panel 	1	N	Y
	KVX1 Network Cable - RoHS	KTZ280284		1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
705	Monitor Cable Set (2 cables)	*KTZ280251*	Monitor Cable Set (Power and DVI Video Cable) 	1	N	Y
706	Power Cord - Europe 230V	KTZ220388	Power Cord Europe 230V/240V used at Mains Input Connector C14 (10A type) 	-	Y	Y
707	Power Cord - USA (Hops. grade)	KTZ220389	Power Cord USA Hospital Grade used at Mains Input Connector C14 (10A type) 	-	Y	Y
708	Power Cord - China	KTZ220391	Power Cord China used at Mains Input Connector C14 (10A type) 	-	Y	Y
709	Power Cord - Australia	KTZ220392	Power Cord Australia used at Mains Input Connector C14 (10A type) 	-	Y	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
710	Power Cord - India	KTZ220387	Power Cord India used at Mains Input Connector C14 (10A type) 	-	Y	Y
	Power Cord - India RoHS	KTZ280289		-	Y	Y
711	Power Cord - United Kingdom (UK)	KTZ220476	Power Cord United Kingdom (UK) 240V used at Mains Input Connector C14 (10A type) 	-	Y	Y
712	Power Cord - South Africa	KTZ220477	Power Cord South Africa used at Mains Input Connector C14 (10A type) 	-	Y	Y
713	Power Cord - Argentina	KTZ220478	Power Cord Argentina used at Mains Input Connector C14 (10A type) 	-	Y	Y
714	Power Cord - Israel	KTZ220479	Power Cord Israel used at Mains Input Connector C14 (10A type) 	-	Y	Y
715	Power Cord - Switzerland	KTZ220480	Power Cord Switzerland used at Mains Input Connector C14 (10A type) 	-	Y	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
716	Power Cord - Denmark	KTZ220481	Power Cord Denmark used at Mains Input Connector C14 (10A type) 2 pcs. 	-	Y	Y
717	Power Cord - Brazil	KTZ280185	Power Cord Brazil used at Mains Input Connector C14 (10A type) 	-	Y	Y
718	Power Cord - Extension	KTZ301990	Power Cord Extension for C13 connector (2m) 	-	Y	Y
719	Console Cable	KTZ220876	Console Cable 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
720	Cable DVI (Digital Visual Interface) from DVI Output (on Graphic card) to RTV	KTZ208574	Cable DVI (Digital Visual Interface) from DVI Output (on Graphic card) to RTV 	1	N	Y
	Cable DVI (Digital Visual Interface) from DVI Output (on Graphic card) to RTV - RoHS	KTZ280283		1	N	Y
721	Monitor Power Connection Cable (Console rear panel -> RTH)	KTZ300054	Monitor Power Connection cable from Console rear panel to Distribution board USB-Hub (RTH) 	1	N	Y
722	USB Cable	KTZ212125	USB Cable for printers (2m); part of cable harness 	1	N	Y
	USB Cable - RoHS	KTZ280287		1	N	Y
723	USB to PC-Motherboard	KTZ207029	USB for PC-Slot, Connector on Backpanel. Cables are connected to PC-Board. Leads the USB-signals to the PC-Backpanel  <u>Note:</u> This cable can also be used when replacing the USB connectors beside the DVD Drive in the Top Console. Therefore remove connectors from the metal bracket and mount them next to DVD Drive.	1	N	Y
	USB to PC-Motherboard - RoHS	KTZ280297		1	N	Y
724	GES16 External I/O Connection Panel	*KTZ302817*	External Rear Panel incl. VGA, USB, Network and S-Video cables to the Voluson E-Series system (internal) 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
725	Adapter S-Video -> RCA Jack (Cinch)	KTZ196334	Adapter S-Video -> RCA Jack (Cinch) to be used in combination with GES15 	1	N	Y
726	VGA cable for Secondary Monitor	KTZ220527	VGA cable to connect Secondary Patient Monitor (15m) 	-	N	Y
727	Cable Harness 2	*KTZ280257*	Cable Harness 2 (Grounding, Console, V-Rec OUT, Monitor DVI, USB UI and USB Hub cable), connector plate, fourfold distributer cable, cable tube, tie-wraps, etc. 	1	N	Y
728	2nd HDD Power Cable	KTZ280126	S-ATA Power Y-splitter cable for data transfer from old to new HDD 	-	N	Y
729	SATA Data Cable for DVD-Drive	KTZ303261	SATA Data cable for DVD-Drive 	1	N	Y
730	SATA Power Cable for DVD-Drive	KTZ303260	SATA Power cable for DVD-Drive 	1	N	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
731	USB Cable for ECG module	KTZ303296	USB cable for ECG module 	1	N	Y
732	ECG patient cable	KTZ303297	ECG patient cable, IEC Type 			

9.10 Optional Peripherals and Accessories

Content in this section

9.10.1 Recording Tools

Table 9-10 Optional Peripherals and Accessories - Recording Tools

Item	Part Name	Part Number	Description	Qty	CRU	FRU
801	DVD recorder - PAL/NTSC (Sony DVO-1000MD)	*KTZ154759* *H48651ND*	DVD recorder (PAL/NTSC) without cable kit **Note:** If cables are needed, please order KTZ280190. 	-	N	Y
802	USB Video recorder (VISK MR-200)	*KTZ280268* *H48691NY*	USB Video recorder incl. connection kit and remote control "Rec" switch 	-	N	Y
803	Connection Kit 2 (Video/DVD recorder to VE6/VE8)	KTZ280190	Connection Kit for Video/DVD recorder 	-	N	Y

Note *Illustrations may not correspond to the actual product!*

9.10.2 Printers

Table 9-11 Optional Peripherals and Accessories - Printers

Item	Part Name	Part Number	Description	Qty	CRU	FRU
811	Digital BW Video Printer (e.g., Sony UP-D898MD)	*KTZ220507* *H48651ML*	Digital B/W Video Printer, USB-Port 	-	N	Y
812	Digital B/W Video Printer (Mitsubishi P95D)	*KTZ302617* *H48681TH*	Digital B/W Video Printer, USB-Port 	-	N	Y
813	Digital Color Printer (Sony UP-D25MD)	*5389822* *H46831B*	Digital Color Printer, A6, USB-Port 	-	N	
814	Digital Color Printer (Mitsubishi CP30D)	*KTZ302616* *H48681TJ*	Digital Color Printer, USB-Port 	-	N	Y
815	DeskJet Color Printer Bluetooth (HP Officejet 100)	*KTZ300182* *H48661MT*	DeskJet Color Line Printer Bluetooth incl. Ink, Bluetooth Adapter(s) + power cable US and EU 	-	N	Y

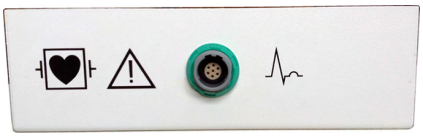
Item	Part Name	Part Number	Description	Qty	CRU	FRU
816	Color Laser Printer (HP LaserJet M451)	*5456780* *H48701EZ*	Color Laser Printer for 220V systems 	-	N	Y
817	Color Laser Printer (HP LaserJet M451)	*5438549* *H48701FA*	Color Laser Printer for 110V systems 	-	N	Y

Note *Illustrations may not correspond to the actual product!*

9.10.3 Drives and additional Devices

Table 9-12 Optional Peripherals and Accessories - Drives and additional Devices

Item	Part Name	Part Number	Description	Qty	CRU	FRU
821	LAN Optical Isolation Box	EP200132 H45021EC	LAN Patient Isolation Box 	-	Y	Y
822	USB Stick	*2411544* *H48651TB*	USB Flash Memory Stick 	-	Y	Y
823	USB-RS232 Connection kit PRY	KTZ195858	Converter from USB to RS-232 Serial Port (Connection Module - Report, incl. Driver CD and documentation) data) 	-	Y	Y
	USB-RS232 Connection kit PRY - RoHS (replaces KTZ195858)	KTZ280279 H46681S		-	Y	Y
824	Wireless Network Interface	*KTZ196269* *H48671DT*	Wireless Network Interface (“Netgear” WLAN Adapter) 	-	Y	Y
825	USB-WLAN Stick Japan	*KTZ280076* *H48681TR*	USB-WLAN Stick Japan 	-	Y	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
826	ECG-preamplifier (MAN10)	*KTZ280258* *H48691LN*	consists of ECG-preamplifier and patient connection cable 	-	N	Y
	ECG-preamplifier (MAN30)	*KTZ304009* *H48691LN*		-	N	Y
827	ECG patient cable	KTZ303297	ECG patient cable, IEC Type 	-	Y	Y

Note *Illustrations may not correspond to the actual product!*

9.10.4 Optional Equipment

Table 9-13 Optional Peripherals and Accessories - Optional Equipment

Item	Part Name	Part Number	Description	Qty	CRU	FRU
831	Isolation Transformer kit	*H48671WN*	Isolation Transformer kit for Secondary Monitor incl. power cord set for US, EU and ROW (rest of world), monitor power cable, fuses, documentation, etc. 	-	-	N
832	Isolation Transformer	*KTZ220714*	Isolation Transformer **without** cables, etc. 	-	Y	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
833	Fuses for Isolation Transformer	KTZ196333	Fuses for Isolation Transformer (2AT, 4AT; 10 pcs. each = 20) 	-	Y	Y
834	VGA Image Resizer	KTZ280074 H48681SH	VGA Image Resizer (resizer box, power supply, cables, documentation, etc.), Note: Required whenever the used Secondary Monitor has a different screen resolution than the system. 	-	Y	Y
835	RIC-Holder	KTZ225469	Probe holder used for Real-time 4D endocavity probes (RIC) during disinfection process 	-	Y	Y
836	Probe holder Inlay	KTZ302677	Probe holder Inlay for Real-time 4D endocavity probes (RIC) 	-	Y	Y
837	Footswitch (GP26)	*KTZ196270* *H48651T*	Scan/Freeze Footswitch 	-	Y	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
838	Footswitch 3 buttons	*5380960* *H48681WS*	Footswitch 3 buttons 	-	Y	Y
839	UPS (**U**ninterruptible **P**ower **S**upply) for 100-130V AC countries	H48691PD	Medical-grade UPS protection with built-in line-interactive voltage regulation (corrects brownouts as low as 82V and overvoltages as high as 142V back to normal 120V levels). 	-	-	N
840	UPS (**U**ninterruptible **P**ower **S**upply) for 220-240V AC countries	H48691PE	Medical-grade UPS protection with built-in line-interactive voltage regulation (corrects brownouts as low as 155V and overvoltages as high as 274V back to normal 230V levels). 	-	-	N
841	Power Filter	*H48701EL*	Power Filter to eliminate EMC noise (filter incl. cables) 	-	-	N

Note *Illustrations may not correspond to the actual product!*

9.11 System Manuals

9.11.1 System Manuals for EC250

Service Manuals

Part Name	Part Number - Voluson E8	Part Number - Voluson E6
Service Manual	KTD106657	KTD106657

User Manuals

Part Name	Part Number - Voluson E8	Part Number - Voluson E6
Basic User Manual - English	H48691EL	H48691JP
Basic User Manual - German	H48691EN	H48691JN
Basic User Manual - Spanish	H48691EM	H48691JM
Basic User Manual - Italian	H48691EP	H48691JL
Basic User Manual - French	H48691ER	H48691JK
Basic User Manual - Portuguese (Brazil)	H48691ES	H48691JJ
Basic User Manual - Portuguese (European)	H48691ET	H48691JH
Basic User Manual - Danish	H48691EU	H48691JG
Basic User Manual - Dutch	H48691EW	H48691JF
Basic User Manual - Finnish	H48691EX	H48691JE
Basic User Manual - Greek	H48691EY	H48691JD
Basic User Manual - Norwegian	H48691EZ	H48691JC
Basic User Manual - Polish	H48691HR	H48691JB
Basic User Manual - Russian	H48691FA	H48691JA
Basic User Manual - Swedish	H48691FB	H48691J
Basic User Manual - Turkish	H48691FC	H48691HZ
Basic User Manual - Czech	H48691FD	H48691HY
Basic User Manual - Hungarian	H48691FE	H48691HX
Basic User Manual - Latvian	H48691FF	H48691HW
Basic User Manual - Lithuanian	H48691FG	H48691HU
Basic User Manual - Estonian	H48691FH	H48691HT
Basic User Manual - Slovakian	H48691FJ	H48691HS
Basic User Manual - Romanian	H48691FK	H48691EA
Basic User Manual - Bulgarian	H48691FL	H48691EB
Basic User Manual - Croatian	H48691FM	H48691EC
Basic User Manual - Serbian	H48691FN	H48691ED
Basic User Manual - Japanese	H48691FP	H48691EF
Basic User Manual - Korean	H48691FR	H48691EG
Basic User Manual - Chinese	H48691FS	H48691EH
Basic User Manual - Indonesian	H48691FT	H48691EJ
Basic User Manual - Slovenian	H48691FU	H48691EK

Part Name	Part Number - Voluson E8	Part Number - Voluson E6
Advanced Reference Manual - English	H48691HC	H48691HC
Advanced Acoustic Output References - English	KTI303156	KTI303156

9.12 Probes

Content in this section

Note *Please observe that some probes are not applicable on all Voluson E-Series systems (depending on system type and/or configuration).*

9.12.1 2D-Probes - Curved Array Probes

Table 9-14 2D Curved Array Transducers

Item	Part Name	Part Number	Description	Qty	CRU	FRU
900	4C-D	5162351 H4001BC	broadband curved array transducer, 2.0 - 5.0 MHz, 128 Elements Applications: Abdominal, Obstetrics, Gynecology 	-	Y	Y
901	C1-5-D	5304539 H40452LE	broadband curved array transducer, 2.0 - 5.0 MHz, 192 Elements Applications: Abdominal, Obstetrics, Gynecology 	-	Y	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
902	C4-8-D	5336339 H48681AS	broadband curved array transducer, 2.0 - 8.0 MHz, 192 Elements Applications: Abdominal, Obstetrics, Gynecology, Urology, Pediatrics 	-	Y	Y
903	IC5-9-D	5212417 H40442LK	endocavity broadband curved array transducer, 4.0 - 9.0 MHz, 192 Elements, field of view: max. 175° Applications: Obstetrics, Gynecology, Urology 	-	Y	Y

9.12.2 2D-Probes - Linear Array Probes

Table 9-15 2D Linear Array Transducers

Item	Part Name	Part Number	Description	Qty	CRU	FRU
910	11L-D	5410800 H40432LN	broadband linear array transducer, 4.0 - 10.0 MHz, 192 Elements, electronically steerable Applications: Small Parts, Peripheral Vascular, Pediatrics, Orthopedics 	-	Y	Y
911	9L-D	5499510 H40442LM	broadband linear array transducer, 3.0 - 8.0 MHz, 192 Elements, electronically steerable Applications: Small Parts, Peripheral Vascular, Pediatrics, Orthopedics 	-	Y	Y
912	ML6-15D	5271060 H40452LG	1,25D Matrix linear array transducer, 4.0 - 13.0 MHz, 336 Elements / 3 rows (= 1008) Applications: Small-Part (Breast), Peripheral Vascular, Pediatrics, Orthopedics (Musculoskeletal), Neonatal, Urology 	-	Y	Y

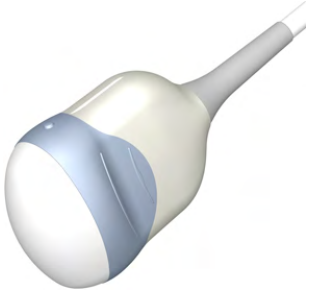
9.12.3 2D-Probes - Phased Array Probes

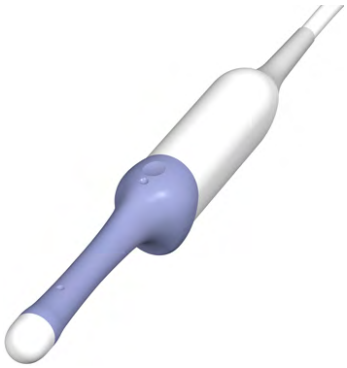
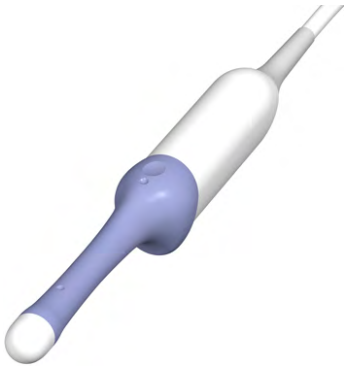
Table 9-16 2D Phased Array Transducers

Item	Part Name	Part Number	Description	Qty	CRU	FRU
920	3SP-D	KTZ280293 H48681AZ	broadband phased array transducer, 1.0 - 5.0 MHz, 64 Elements Applications: Abdominal, Obstetrics, Cardiology, Pediatrics, Neurology 	-	Y	Y
921	S4-10-D	5394804 H45302LA	broadband phased array transducer, 4.0 - 9.0 MHz, 128 Elements Applications: Small Parts, Cardiology, Pediatrics 	-	Y	Y

9.12.4 Real-Time 4D Volume Probes

Table 9-17 Real-Time 4D Volume Probes

Item	Part Name	Part Number	Description	Qty	CRU	FRU
930	RAB2-5-D	KTZ303980 H48651MN	Real-time 4D broadband electronic curved-array transducer 1.0 - 4.0 MHz, 192 Elements Applications: Abdominal, Obstetrics, Gynecology, Interventional Radiology 	-	Y	Y
931	RAB4-8-D	KTZ303983 H48651MP	Real-time 4D broadband electronic curved-array transducer 2.0 - 8.0 MHz, 192 Elements Applications: Abdominal, OB, Gyn, Pediatrics, Urology, Interventional Radiology 	-	Y	Y
932	RAB6-D	KTZ303986 H48681MG	UltraLight Real-time 4D broadband electronic curved-array transducer 2.3 - 7.3 MHz, 192 Elements Applications: Abdominal, OB, Gyn, Pediatrics, Urology, Interventional Radiology 	-	Y	Y
933	RM6C*	KTZ303993 H48671ZG	1,5D Abdominal Matrix Array Real-time 4D broadband electronic transducer 2.0 - 6.0 MHz, 192 Elements / 5 rows (= 960) Applications: Abdominal, OB, Gyn, Pediatrics, Urology, Interventional Radiology 	-	Y	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
934	RIC5-9-D	KTZ303987 H48651MS	Real-time 4D endocavity broadband electronic curved array transducer 4.0 - 9.0 MHz, 192 Elements, field of view: max. 175° Applications: Gynecology/Fertility, Obstetrics, Urology 	-	Y	Y
935	RIC6-12-D*	KTZ303991 H48651NA	Real-time 4D endocavity broadband electronic curved array transducer 5.0 - 13.0 MHz, 256 Elements, field of view: max. 190° Applications: Gynecology/Fertility, Obstetrics, Urology 	-	Y	Y
936	RSP6-16-D	KTZ303997 H48651MR	Real-time 4D broadband electronic linear array transducer 6.0 - 18.0 MHz, 192 Elements Applications: Small Parts, Peripheral Vascular, Pediatrics, Urology, Orthopedics 	-	Y	Y

Item	Part Name	Part Number	Description	Qty	CRU	FRU
937	RM14L	KTZ303992 H48681AR	1,5D Linear Matrix Array Real-time 4D broadband electronic transducer 4.0 - 14.0 MHz, 192 Elements / 5 rows (= 960) Applications: Small Parts, Peripheral Vascular, Pediatrics, Orthopedics 	-	Y	Y
938	RNA5-9-D	KTZ303994 H48651MY	Real-time 4D neonatal broadband electronic curved array transducer 3.0 - 9.0 MHz, 192 Elements, field of view: max. 144° Applications: Abdominal, Small Parts, Obstetrics, Cardiology, Pediatrics 	-	Y	Y

Note *Probes marked with an asterisk (*****) are not applicable at Voluson E6 systems.*

Note *The probe "RIC6-12-D" and "RM6C" are only applicable at Voluson E8 Expert systems. i.e. "Expert" option is purchased an therefore **P**ermanently activated.*

9.12.5 CW-Doppler - Pencil Probes

Table 9-18 CW-Doppler - Pencil Probes

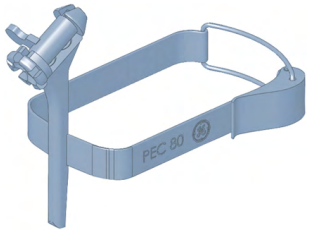
Item	Part Name	Part Number	Description	Qty	CRU	FRU
945	P2D	KTZ280051 H4830JE	Continuous Wave (CW) Doppler pencil probe with a center frequency of 2.0 MHz (no B-image), 2 Elements Applications: Cardiology (suprasternal), Peripheral Vascular, Neurology 	-	Y	Y
946	P6D	KTZ280050 H4830JG	Continuous Wave (CW) Doppler pencil probe with a center frequency of 6.0 MHz (no B-image), 2 Elements Applications: Cardiology, Peripheral Vascular, Pediatrics 	-	Y	Y

9.13 Biopsy Needle Guides

Table 9-19 2D Curved Array Transducers

Item	Part Name	Part Number	Description	Qty	CRU	FRU
950	****** (disposable)	E8385MJ	disposable Biopsy needle guide for probe **IC5-9-D** needle diameter: 16-18GA (gauge); 1.2 - 1.6 mm 	-	-	N
951	****** (reusable)	H40412LN	reusable Biopsy needle guide for probe **IC5-9-D** needle diameter: < 1.65 mm 	-	-	N
952	PEC63	H46721R	reusable Biopsy needle guide for probe **RIC5-9-D** / **RIC6-12-D** needle diameter: < 1.8 mm 	-	-	N
953	RIC Single-angle bracket	H48681GF	disposable Biopsy needle guide for probe **RIC5-9-D** / **RIC6-12-D** needle diameter: 16-18GA (gauge); 1.2 - 1.6 mm 	-	-	N
954	RIC Single-angle bracket + Latex Cover	H48691Z		-	-	N
955	PEC84	H48671WT	reusable Biopsy needle guide for probe **RRE5-10-D** needle diameter: < 1.4 mm 	-	-	N
956	PEC74	H48621Y	reusable Biopsy needle guide for probe **RAB2-5-D / RAB4-8-D** needle diameter: < 1 mm, 1.4 mm, 2.2 mm 	-	-	N
957	RAB Single-angle bracket	H46701AE	Non Sterile Single Angle Bracket needle guide for probe **RAB2-5-D / RAB4-8-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N

Item	Part Name	Part Number	Description	Qty	CRU	FRU
958	PEC75	H46721W	reusable Biopsy needle guide for probe **RSP6-16-D** needle diameter: < 1 mm, 1.4 mm, 2.2 mm 	-	-	N
959	RSP Single-angle bracket	H46701AD	Non Sterile Single Angle Bracket needle guide for probe **RSP6-16-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N
960	PEC76	H48651DG	reusable Biopsy needle guide for probe **RNA5-9-D** needle diameter: < 1 mm, 1.4 mm, 2.2 mm 	-	-	N
961	RNA Single-angle bracket	H46701AF	Non Sterile Single Angle Bracket needle guide for probe **RNA5-9-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N
962	RAB6 Biopsy Starter Kit	H48681ML	Biopsy Starter Kit for UltraLight probe **RAB6-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N

Item	Part Name	Part Number	Description	Qty	CRU	FRU
963	PEC80	H48651PP	reusable Biopsy needle guide for probe **RM14L** needle diameter: < 1 mm, 1.4 mm, 2.2 mm 	-	-	N
964	PEC81	H48651PN	reusable Biopsy needle guide for probe **RM6C** needle diameter: < 1 mm, 1.4 mm, 2.2 mm 	-	-	N
965	4C Multi-angle bracket	E8385NA	Non Sterile Multi Angle Bracket needle guide starter kit for probe **4C-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N
966	C1-5-D Biopsy guide	H40432LE	Non Sterile Multi Angle Bracket needle guide for probe **C1-5-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N
967	C4-8-D Biopsy guide	H48681AT	Non Sterile Multi Angle Bracket needle guide for probe **C4-8-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N
968	12L-RS Multi-angle bracket	H40432LC	Non Sterile Multi Angle Bracket needle guide for probe **11L-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N

Item	Part Name	Part Number	Description	Qty	CRU	FRU
969	9L Multi-angle bracket	H4906BK	Non Sterile Multi Angle Bracket needle guide for probe **9L-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N
970	ML6-15D Biopsy kit	H40432LJ	Non Sterile Multi Angle Bracket needle guide for probe **ML6-15-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N
971	3SP Multi-angle bracket	H46222LC	Non Sterile Multi Angle Bracket needle guide for probe **3SP-D** needle diameter: 8.5FR, 14-23GA (gauge); > 0.6 mm - < 2.1 mm 	-	-	N

Chapter 10

Care and Maintenance

*This chapter describes **Care and Maintenance** on the Voluson E-Series system and its peripherals. These procedures are intended to **maintain the quality** of the Voluson E-Series **systems performance**. Read this chapter completely and familiarize yourself with the procedures before performing a task.*

Content in this chapter

Caution: Practice good ESD prevention.

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

Warning
Where applicable, there are several places on the backplane and the AC distribution that are dangerous. Be sure to disconnect the Voluson E-Series ultrasound system power plug and switch off the main circuit breaker before you remove any parts. Be cautious whenever power is still on and covers are removed.

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

Caution

The system requires all covers. Do not operate the Voluson E-Series system unless all board covers and frame panels are securely in place. The covers are required for safe operation, good system performance and cooling purposes. When covers are removed, EMI may be present.

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.

10.1 Why do Maintenance

10.1.1 Periodic Maintenance Inspections

It has been determined by engineering that your Voluson E-Series system does not have any high wear components that fail with use, therefore no Periodic Maintenance Inspections are mandatory. However, some Customers Quality Assurance Programs may require additional tasks and/or inspections at a different frequency than listed in this manual.

10.1.2 Keeping Records

It is good business practice that ultrasound facilities maintain records of periodic and corrective maintenance. The Ultrasound Equipment Quality Check form provides the customer with documentation that the ultrasound system is maintained on a periodic basis.

A copy of the Ultrasound Equipment Quality Check form should be kept in the same room or near the Voluson E-Series ultrasound system.

10.1.3 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 system. The program must be directed by a medical physicist, the supervising radiologist/physician or an appropriate designer.

Routine quality control testing must occur regularly. The same tests are performed during each period so that changes can be monitored over time and effective corrective action can be taken.

Testing results, corrective action and the effects of corrective action must be documented and maintained on the site.

Your GE service representative can help you with establishing, performing and maintaining records for a quality assurance program. Please contact us for coverage information and/or price for service.

10.2 Maintenance Task Schedule

10.2.1 How often should Care and Maintenance Tasks be performed?

The Customer Care Schedule (see: *Table 10-1 on page 10-3*) specifies how often your Voluson E-Series should be serviced and outlines items requiring special attention.

Note *It is the customer's responsibility to ensure that the Voluson E-Series care & maintenance is performed as scheduled in order to retain its high level of safety, dependability and performance.*

Your GE Service Representative has an in-depth knowledge of your Voluson E-Series 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 Voluson E-Series for an average patient load (10 per day) and not use it as a primary mobile 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.*

Abbreviations used in the Customer Care Schedule *Table 10-1*:

- D = Daily
- W = Weekly
- M = Monthly
- A = Annually

Table 10-1 customer care schedule

Item	Service at indicated Time	D	W	M	A	Notes
Air Filter Grid	Remove the filter grid and clean the air filter grid with vacuum cleaner from outside.			•		more frequently depending on your environment
Air Filter Grid	Remove filter grid, back top cover and back cover and clean the housing from inside. (vacuum cleaner and soft brush)				•	more frequently depending on your environment
AC Mains Cable	Inspect AC mains cable			•		mobile systems check weekly
Cables and Connectors	Check if all cables are fixed and well seated at the correct position and if there is no mechanical damage visible.				•	also after corrective maintenance
User Interface	Clean alphanumerical keyboard, functional keys, digital potentiometers, TGC potentiometers. (vacuum cleaner, lukewarm soap water on a soft, damp cloth)		•			Be careful not to get the cloth too wet so that moisture does not enter the loudspeakers, TGC-Slider, or other keys!
LCD Monitor, Touch Panel and Probe holder	Clean LCD monitor surface, Touch Panel and probe holder with a fluid detergent in warm water on a soft, damp cloth.		•			Be careful not to get the cloth too wet so that moisture does not enter the entire system.
Mechanical parts	Clean and inspect the mechanical function of wheels, casters, brakes and swivel locks as well as side door, foot rest, front and rear handle, and monitor holder. Remove dust and coupling gel.			•		mobile systems check daily
Control Console movement	Check translation/rotation and height adjustment (elevation)				•	more frequently at mobile systems
Trackball Check	Check proper operation (cursor movement X, Y direction)	•				If failure occurs go to trackball cleaning.
Trackball Cleaning	Remove trackball ring; open the trackball housing and take out the trackball (see *Section 7.9.3 on page 7-25*). Clean the trackball (and X,Y axes) with soft tissue and screwdriver shaft.				•	
Disk Drives (Data Backup)	Test image filing (Archive) import and export data capability (DVD/CD Drive)		•	•*		* save the image filing data weekly or at least monthly on DVD/CD depending on the number of examinations
Safe Probe Operation	Clean probes and probe cables and check acoustic lens housing (cracks) and probe cables. In case of mechanical damage, don't use them! Danger: Safety risk for operator and patient.	•*				* or before each use
Probe Air bubbles	To detect air bubbles in filling liquid, shake the probe carefully and check for abnormal noise.					
Probe Connectors	Remove dust/dirt of all probe connectors. Clean with vacuum cleaner if dust is visible.			•		
Ultrasound system Leakage Current Checks					•	Also after corrective maintenance or as required by your facilities QA program.
Peripheral Leakage Current Checks					•	Also after corrective maintenance or as required by your facilities QA program.
Surface Probe Leakage Current Checks					•	Also after corrective maintenance or as required by your facilities QA program.
Endocavity Probe Leakage Current Checks					•	Also after corrective maintenance or as required by your facilities QA program.

Item	Service at indicated Time	D	W	M	A	Notes
Measurement Accuracy Checks					•	Also after corrective maintenance or as required by your facilities QA program.
Probe/Phantom Checks	Check gain and TGC changes, vary the focus and check reaction on screen. *NOTE! The use of a Phantom is not required during Preventive Maintenance. Customer may use it as part of their Quality Assurance Program tests.*				•	Also after corrective maintenance or as required by your facilities QA program.
Functional Checks of all probes *Section 10.4.2 on page 10-5*					•	Also after corrective maintenance or as required by your facilities QA program.

10.3 Tools required

10.3.1 Special Tools, Supplies and Equipment used for Maintenance

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 IEC 62353 or other relevant national regulation.*

Table 10-2 overview of supplies and equipment used for maintenance

Tools	Comments
Digital Volt Meter (DVM)	minimum 5% accuracy, 3.5 digit and 200 Ohm range required
Anti Static Kit	including anti-static mat, wrist strap, cables and conductive ground cord
Anti Static Vacuum Cleaner	•
QIQ Phantom	*NOTE! The use of a Phantom is not required during Preventive Maintenance. Customer may use it as part of their Quality Assurance Program tests.*
CD-RW Media	(minimum quad speed)
DVD+RW Disc Media blank	blank 4,7GB DVD+RW disc
B/W Printer Cleaning Sheet	see printer user manual for requirements
Color Printer Cleaning Sheet	see printer user manual for requirements
Disposable Cloves	•

10.4 System Maintenance

10.4.1 Preliminary Checks

The preliminary checks take about 15 minutes to perform. Refer to the Voluson E-Series user documentation whenever necessary.

Table 10-3 system checks

Step	Item	Description
1	Ask and Listen	Ask the customer if they have any problems or questions about the equipment.
2	Power up	• Turn the system power on and verify that all fans and peripherals turn on. • Watch the displays during power up to verify that no warning or error messages are displayed.
3	Probes	Verify that the ultrasound system properly recognizes all probes.
4	Displays	Verify proper display on the LCD monitor and Touch Panel (when present).
5	Presets	“Full Backup” all customer presets to an appropriate media (see: *Section 4.4.3 "Save Full System Configuration (Full Backup)" on page 4-34*).
6	Image Archive	Backup the Image Archive onto appropriate media (see: *Section 4.4.6.1 "Save Image Archive" on page 4-39*).

10.4.2 Functional Checks

The functional checks take about 60 minutes to perform. Refer to the Voluson E-Series user documentation whenever necessary.

10.4.2.1 Ultrasound System Checks

Table 10-4 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	M Mode	Verify basic M Mode operation. Check the basic ultrasound system controls that affect this mode of operation.
3	C Mode	Verify basic CFM Mode (Color Flow Mode) operation. Check the basic ultrasound system controls that affect this mode of operation.
4	PD Mode	Verify basic PD Mode (Power Doppler Mode) operation. Check the basic ultrasound system controls that affect this mode of operation.
5	Doppler Modes	Verify basic Doppler Mode operation (PW and CW if available). Check the basic ultrasound system controls that affect this mode of operation.
6	3D Mode	Verify basic 3D Mode operation. Check the basic ultrasound system controls that affect this mode of operation.
7	RealTime 4D Mode (optional)	Verify basic RealTime 4D Mode operation. Check the basic ultrasound system controls that affect this mode of operation.
8	*Applicable Software Options	Verify the basic operation of all optional modes. Check the basic system controls that affect each option`s operation.
9	Keyboard Test	Perform the Keyboard Test Procedure to verify that all keyboard controls are OK.
10	LCD Monitor	Verify basic LCD Monitor display functions.
11	Touch Panel	Verify basic Touch Panel display functions.
12	Peripherals	see: *Section 10.4.2.2 "Peripheral/Option Checks" on page 10-6*

Note ** Some software may be considered standard depending upon system model configuration.*

10.4.2.2 Peripheral/Option Checks

If any peripherals or options are not part of the ultrasound system configuration, the check can be omitted. Refer to *Section 3.8 "On-board optional Peripherals" on page 3-62* for a list of approved peripherals.

Table 10-5 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	Color Deskjet (Bluetooth) Printer	Verify hardcopy output of the Deskjet (Bluetooth) printer. Clean heads and covers if necessary.
5	DICOM	Verify that DICOM is functioning properly. Send an image to a DICOM device.
6	Footswitch	Verify that the footswitch is functioning as programed. Clean as necessary.
7	ECG	Verify basic operation with customer.
8	Cellular Modem	Verify basic operation.

10.4.2.3 Mains Cable Inspection

Table 10-6 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 kind.
3	Verify	Verify that the LINE, NEUTRAL and GROUND wires are properly attached to the terminals, and that no strands may cause a short circuit.
4	Verify	Inlet connector retainer is functional.

10.4.3 Physical Inspection

Table 10-7 physical checks

Step	Item	Description
1	Labeling	Verify that all ultrasound system labeling is present and in readable condition.
2	Covers	Where applicable, verify all covers are secured in place and are properly aligned with other covers. Replace any covers that are damaged.
3	Control Console and Keyboard	Inspect the control console and keyboard. Record any damaged or missing items. (Replace faulty components, as required).
4	Control Console Movement	• Where applicable, verify ease of control console movement in all acceptable directions. • Where applicable, ensure that it latches in position as required.
5	Control Console Lighting	Check proper operation of all control console and TGC lights.
6	LCD Monitor	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.*
7	Monitor Light	Check for proper operation of any monitor lights, if available.
8	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.
9	Shielding & Covers	Check to ensure that all EMI shielding, internal covers, air flow panels and screws are in place. Missing covers and hardware could cause EMI/RFI problems during scanning.
10	Probe Holders	Where applicable, inspect the Probe Holders for cracks or damage.
11	Power and System Status Indicators	Check for proper operation of all Power and System Status Indicators.
12	External I/O	Check all connectors for damage and verify that the labeling is good.
13	Wheels and Brakes	• Check all wheels and casters for wear and verify operation of foot brake, to stop the system from moving, and release mechanism. • Check all wheel locks and wheel swivel locks for proper operation.
14	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.

10.4.4 Cleaning

The Basic User Manual of the Voluson E-Series system provides a complete description of system/probe care, maintenance, cleaning and disinfection.

Note *Consider the exposure times and temperatures recommended by the manufacturer of the cleaning agent. In the case of heavy soiling pre-clean with a damp cloth.*

10.4.4.1 General Cleaning

Frequent and diligent cleaning of the Voluson E-Series ultrasound system reduces the risk of spreading infection from person to person, and also helps to maintain a clean work environment.

Table 10-8 general cleaning

Step	Item	Description
1	Console	Use a fluid detergent in warm water on a soft, damp cloth to carefully wipe the entire system. Be careful not to get the cloth too wet so that moisture does not enter the console. **Caution:** DO NOT allow any liquid to drip or seep into the system.
2	LCD Monitor + Touch Panel	Clean LCD Monitor surface and Touch Panel with a fluid detergent in warm water on a soft, damp cloth. **Caution:** DO NOT spray any liquid directly onto the Voluson E-Series covers, LCD Monitor, keyboard, etc.

10.4.5 Probe Maintenance

10.4.5.1 Probe related Checks

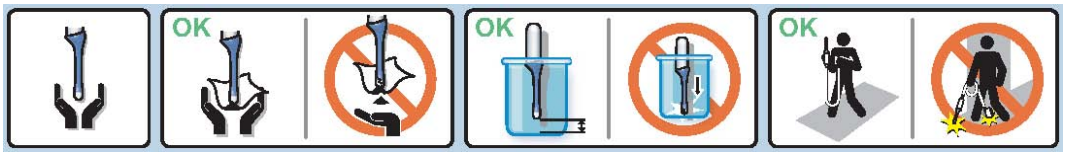
Table 10-9 probe related checks

Step	Item	Description
1	Probes	Thoroughly check the ultrasound system probe connectors and remove dust from inside the connector sockets if necessary. Visually check for bent, damaged or missing pins.
2	Probes	Verify that the ultrasound system properly recognizes all probes.
3	Probe Holder	Clean probe holders (they may need to be soaked to remove excess gel).

10.4.5.2 Basic Probe Care

The Voluson E-Series system user manuals and various probe handling cards provide a complete description of probe care, maintenance, cleaning and disinfection. Ensure that you are completely familiar with the proper care of GE probes.

Ultrasound probes can be easily damaged by improper handling. Review the Basic User Manual of Voluson E-Series for more details. Failure to follow these precautions can result in serious injury and equipment damage. Failure to properly handle or maintain a probe may also void its warranty.



Any evidence of wear indicates the probe cannot be used.

Do a visual check of the probe pins and ultrasound system sockets before plugging in a probe.

10.4.5.3 Basic Probe Cleaning and/or Disinfection

Refer to the Basic User Manual of the Voluson E-Series system for details on cleaning and disinfection.

Caution
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.

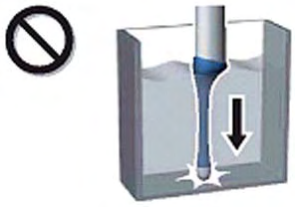
Caution
Failure to follow the prescribed cleaning or disinfection procedures will void the probes warranty. Do not soak or wipe the lens with any product not listed in the Voluson E-Series Basic User Manual and/or care card. Doing so could result in irreparable damage to the probe.

Caution
Disinfect a defective probe before you return it. Be sure to tag the probe as being disinfected.

Caution
Follow the Care Card instructions supplied with each probe (inside the probe boxes) for disinfectants and gels that are compatible with the surface material of the probes.

Note *For the latest list of compatible cleaning solutions and disinfectants refer to: http://www.gehealthcare.com/usen/ultrasound/products/probe_care.html.*

Please be aware of the sensitive probe head. TAKE EXTREME CARE!



NEVER place or store a probe on its scan head!

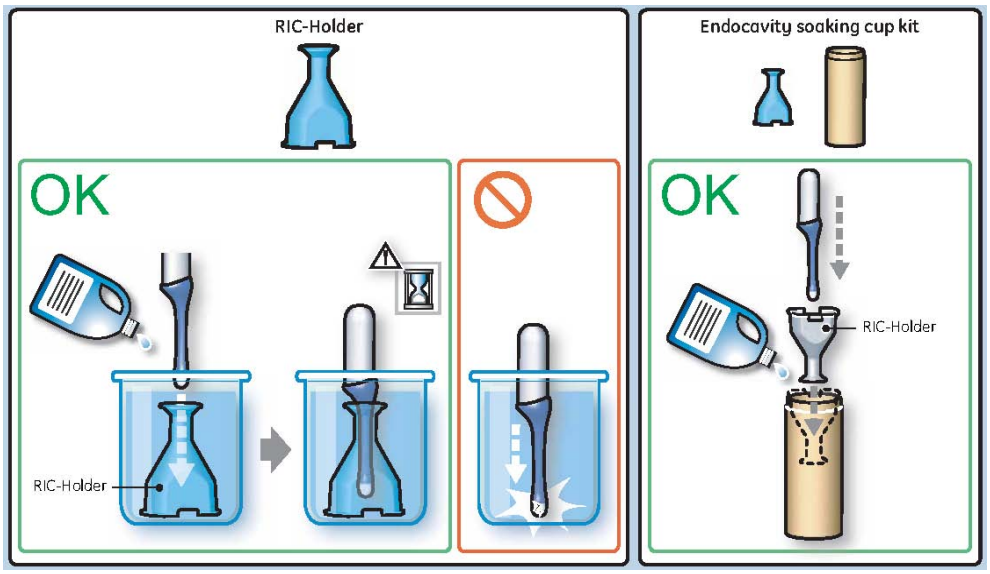
When disinfecting a probe, ensure that there is sufficient space between the probe and the container bottom!

10.4.5.4 Disinfection by means of the RIC-Holder

Especially for Real-time 4D endocavity probes (RIC), it is necessary to take extreme care when transporting the system with the probe attached, or during the disinfection process. Inadequate handling may lead to dead elements, shocked head mechanics, etc.

The RIC-Holder (especially developed for RIC Real-time 4D endocavity probes) guarantees that the sensitive probe head does not hit the bottom of the container during the disinfection procedure.

Note *Instructions are supplied with each RIC-Holder (KTZ225469).*



10.5 Using a Phantom

The use of a Phantom is not required during Preventive Maintenance. Customer may use it as part of their Quality Assurance Program tests.

10.6 Electrical Safety Tests

10.6.1 Safety Test Overview

Warning

Energy Control and Power Lockout for Voluson E-Series:

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

1. Follow LOTO (Lockout/Tagout) procedures.
2. Turn off the breaker.
3. Unplug the Voluson E-Series system.
4. Maintain control of the Voluson E-Series system power plug.
5. Wait for at least 30 seconds for capacitors to discharge as there are no test points to verify isolation.

Ultrasound system components may be energized.

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 planned maintenance (PM) 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.

Prior to initiating any electrical test, the system must be visually inspected. Perform 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 probe enclosure and lens for cracks, holes and similar defects.

Caution
For all instructions in this section: In case of using an UPS (uninterruptable power supply) the terms outlet, wall outlet, AC wall outlet or power outlet refer to the AC wall outlet to which the UPS power input is connected to. 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.

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 Voluson E-Series system or individual probes which fail any portion of the safety test.

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

Caution
Compare all safety-test results with safety-test results of previously performed safety tests (e.g., last year ect). 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 Voluson E-Series system under test must not be connected to other electrical equipment. Remove all interconnecting cables and wires. The system under test must not be contacted by users or patients while performing these tests.

Caution: Possible risk of infection.
Do not handle soiled or contaminated probes and other components that have been in patient contact. Follow appropriate cleaning and disinfecting procedures before handling the equipment.

10.6.2 Leakage Current Limits

The following acceptance limits and test conditions are summarized from IEC 60601 including national deviations and IEC 62353 and in some cases are lower than that specified by the standards. In accordance with these standards, fault conditions like Reverse Polarity of the supply mains and Open Neutral are no longer required for field evaluation of leakage current. 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 VAC or 220-240 VAC (VAC = Volt mains).

Table 10-10 leakage current limits for operation on 100-130 Volt mains (US/Canada/Japan)

Leakage Current Test	System Power	Grounding/PE Conductor	Limit mA	Limit µA
Earth Leakage	On and Off	N/A	0.3*	300*
Chassis/Enclosure Leakage	On and Off	Closed Open	0.1 0.3*	100 300*
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	5.0	5000
Type CF Applied Parts (sink leakage, mains voltage on applied part)	On and Off	Closed	0.05	50
** UL 60601-1 standard*				

Note *Open Grounding is also known as "Lift Ground".*

Table 10-11 leakage current limits for system operation on 220-240 Volt mains

Leakage Current Test	System Power	Grounding/PE Conductor	Limit mA	Limit µA
Earth Leakage	On and Off	Open and Closed	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	5.0	5000
Type CF Applied Parts (sink leakage, mains voltage on applied part)	On and Off	Closed	0.05	50
Values based on IEC 60601				

*Table 10-12 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.*

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 IEC 62353 or other relevant national regulation.*

Table 10-13 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 and 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 Defibrillator-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 Defibrillator-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.	

10.6.3 Outlet Test - Wiring Arrangement - USA & Canada

Test all outlets in the area for proper grounding and wiring arrangement by plugging in the neon outlet tester and noting the combination of lights that are illuminated. Any problems found should be reported to the hospital immediately and the receptacle should not be used.

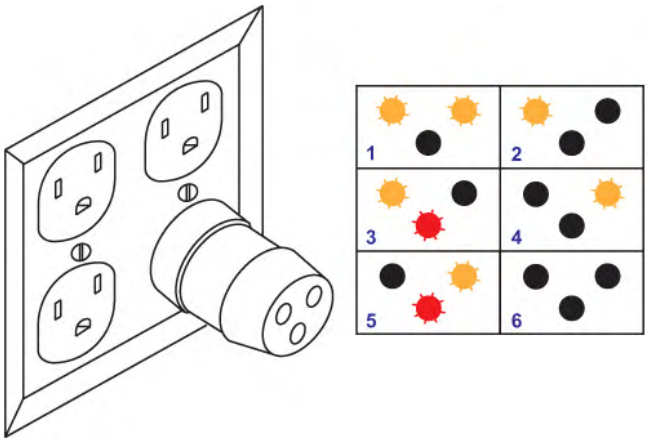


Figure 10-1 Typical Alternate Outlet Tester

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

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

10.6.4 Grounding Continuity

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.

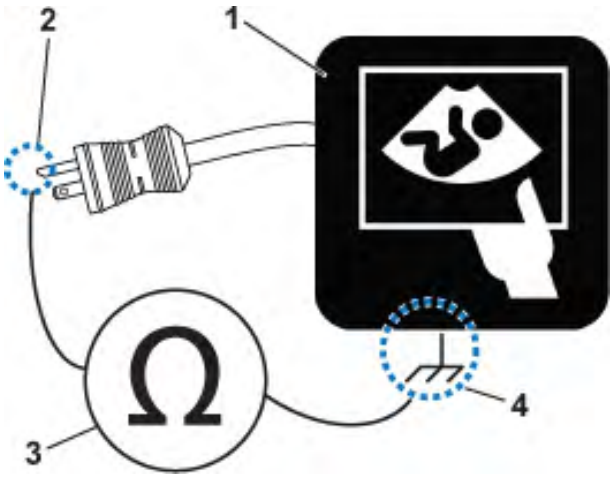


Figure 10-2 Ground Continuity Test

1	Ultrasound System	3	Ohmmeter
2	Ground Pin	4	accessible Metal Parts such as: • Potential equilibrium connector • Monitor housing • Probe connector

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

10.6.5 Chassis Leakage Current Test

Warning: Electric Shock Hazard!
When the meter's ground switch is OPEN, DO NOT touch the Voluson E-Series system!

Caution: Equipment damage possibility!
Never switch the Polarity and the status of Neutral when the Voluson E-Series system is powered ON. Be sure to turn the the Voluson E-Series system power OFF before switching them using the POLARITY switch and/or the NEUTRAL switch.

10.6.5.1 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 meter is connected to parts of the equipment, easily contacted by the user or patient.

Record the highest reading.

10.6.5.2 Generic Procedure

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

- *Table 10-10 on page 10-11* , or
- *Table 10-11 on page 10-11* , as applicable.

Record the highest reading of current.

1. Connect the Safety analyzer to an AC wall outlet.
2. Plug the equipment under test into the receptacle on the panel of the meter.
3. Connect the meter to an accessible metal surface (see: *Table 10-14*) of the Voluson E-Series using the cable provided with the meter.
4. Select the "Chassis" or "Enclosure Leakage" function on the meter.
5. Test opening and closing the ground with the Voluson E-Series system on and off.

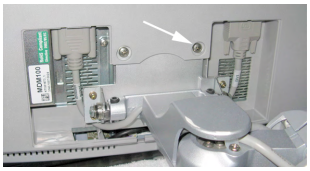
Note *For more information, refer to the safety analyzer's user manual that will be used to perform the test.*

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

- *Table 10-10 on page 10-11* , or
- *Table 10-11 on page 10-11* , as Chassis/Enclosure Leakage.

Follow the test conditions described for respective test points shown in the table below.

Table 10-14 chassis leakage current test condition

Test	Condition	Test Point (image)
1	**Potential equilibrium connector** (rear of system, on power supply RSP)	
2	**Monitor housing** (mounting screw for LCD Monitor housing, rear of monitor)	
3	**Probe connector** (probe mounting receptacle on front of system)	

10.6.5.3 Data Sheet for Enclosure/Chassis Leakage Current

Table 10-15 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 system.

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

Table 10-15 Typical Data Format for recording Enclosure/Chassis Leakage Current

Unit under Test:				Date of Test:	
Test Conditions		Measurement/Test Point Location			
System Power	Grounding/PE	*Potential equilibrium connector*	*Monitor housing*	*Probe connector*	
off	closed				
off	open				
on	closed				
on	open				

10.6.6 Isolated Patient Lead (Source) Leakage-Lead to Ground

Caution: Equipment damage possibility!
Never switch the Polarity when the Voluson E-Series system is powered ON. Be sure to turn the Voluson E-Series system power OFF before switching the polarity using the POLARITY switch.

10.6.6.1 Definition

This test measures the current which would flow to ground from any of the isolated ECG leads. The meter simulates a patient who is connected to the monitoring equipment and is grounded by touching some other grounded surface. Measurements should be made with the ground open and closed, with power line polarity normal and reversed, and with the Voluson E-Series ultrasound system on and off.

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

10.6.6.2 Generic Procedure

1. Connect the Safety analyzer to an AC wall outlet.
2. Plug the equipment under test into the receptacle on the panel of the meter.
3. Connect the ECG cable to the Voluson E-Series system and the patient leads to the analyzer.
4. Select the "Patient Lead Leakage" function on the meter.
5. Test opening and closing the ground with the Voluson E-Series system on and off.

Note *For more information, refer to the safety analyzer's user manual that will be used to perform the test.*

Measurements should be made under the test conditions specified in:

- *Table 10-10 on page 10-11* , or
- *Table 10-11 on page 10-11* , 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.

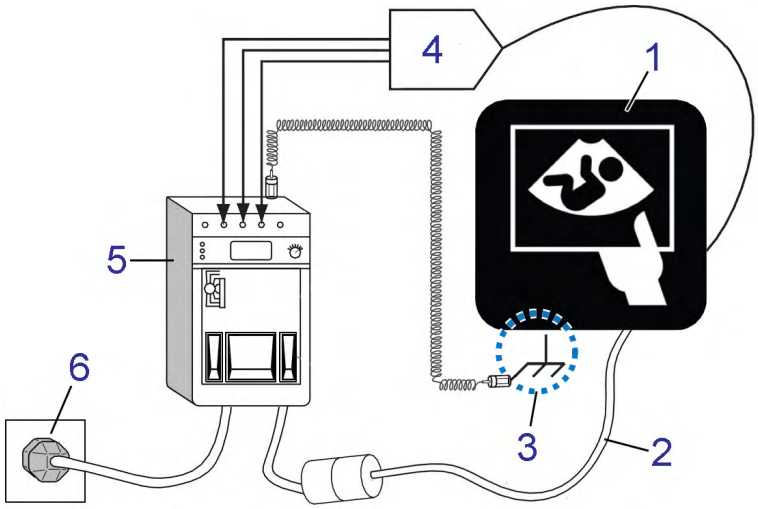


Figure 10-3 Set Up for test of Earth Leakage Current, UL60601-1/IEC60601-1

1	Voluson E-Series 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

10.6.7 Isolated Patient Lead (Source) Leakage-Lead to Lead

This test is also known as Patient Auxiliary Current.

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 10-10 on page 10-11* , or:
- *Table 10-11 on page 10-11* , as applicable.

Record the highest leakage current measured.

10.6.7.1 Lead to Lead Leakage Test Record

Table 10-16 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 10-10 on page 10-11* , or
- *Table 10-11 on page 10-11* , 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 an AC wall outlet.
2. Plug the equipment under test into the receptacle on the panel of the meter.
3. Connect the ECG cable to the Voluson E-Series system and the patient leads to the analyzer.
4. Select the "Patient Lead Leakage" function on the meter.
5. Test opening and closing the ground with the Voluson E-Series system on and off.

Note *For more information, refer to the safety analyzer's user manual that will be used to perform the test.*

Table 10-16 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-LA*	*LA-LL*	*LL-RA*
off	closed			
off	open			
on	closed			
on	open			

Note *Values in italics font are given as examples only.*

10.6.8 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.

10.6.8.1 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.*

10.6.8.2 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 10-10 on page 10-11* , or
- *Table 10-11 on page 10-11* , 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.*

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.

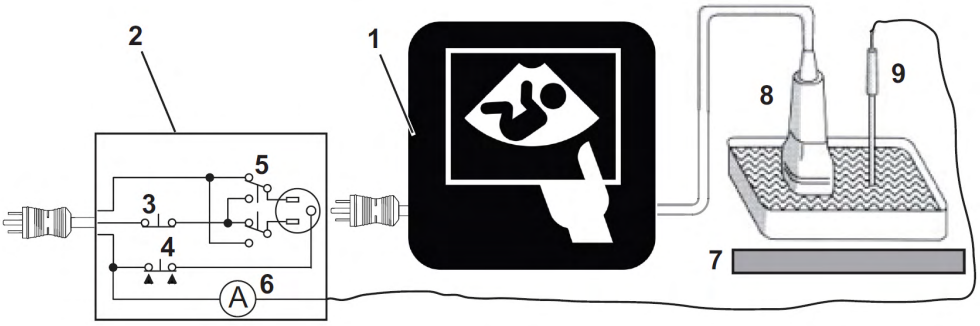


Figure 10-4 Set Up for Probe Leakage Current

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

Note *Each probe will have some amount of leakage current, dependent on its design. Small variations in probe leakage currents are normal from probe to probe. Other variations will result from differences in line voltage and test lead placement.*

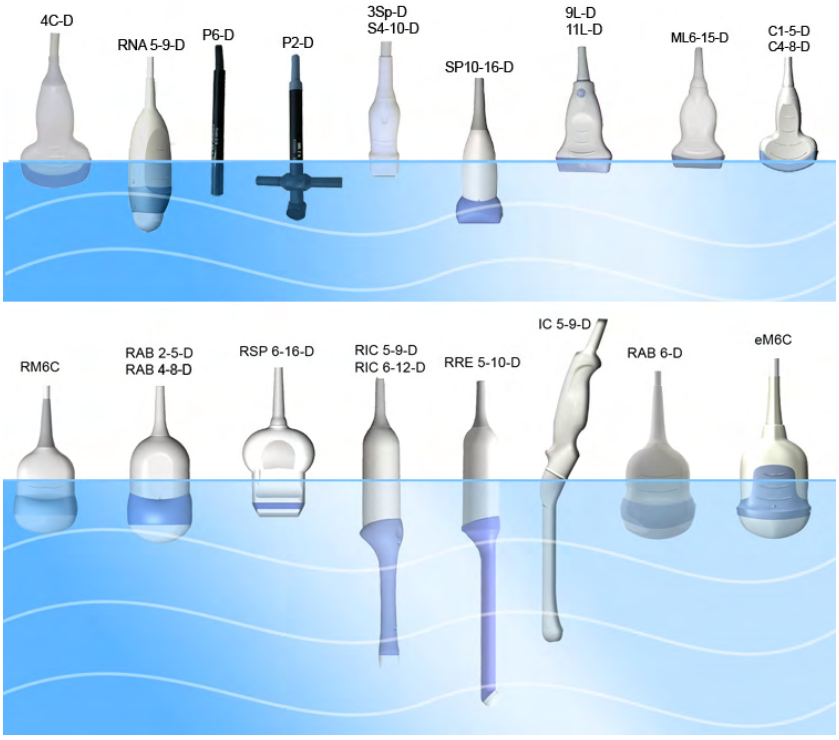
The ultrasound probes imaging area is immersed in the Saline solution along with a grounding probe from the test meter to complete the current path.

This test is also known as Patient Leakage Current.

1. Turn the Voluson E-Series system OFF.
2. Connect the Safety analyzer to an AC wall outlet.
3. Set the Safety analyzer's function switch to "Chassis" or "Enclosure Leakage".
4. Plug the Voluson E-Series system's power cord into the test meter.
5. Plug the Chassis Ground Probe (saline probe) into the test meter's “CHASSIS” connector.
6. Connect the ultrasound probe to be tested to the Voluson E-Series system.
7. Immerse the saline probe in the saline solution.
8. Immerse the Voluson E-Series 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 shown below.

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



Equipment damage possibility. Never switch the Polarity or the status of the Neutral when the Voluson E-Series system is powered on.

Power off the Voluson E-Series 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 leakage meter to avoid possible power supply damage.

9. Test opening and closing the ground with the Voluson E-Series system on and off.
   a. Power ON the Voluson E-Series.
   b. After the Voluson E-Series 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 10-10 on page 10-11* , or
      * *Table 10-11 on page 10-11* , 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 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.

Table 10-17 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	*4C-D*	*11L-D*	*RIC5-9-D*	RM6C
off	closed				
off	open				
on	closed				
on	open				

Note *Values in italics font are given as examples only.*

10.6.8.3 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 full lead combination under each set of test conditions specified in:

- *Table 10-12 on page 10-11*

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 meter.
3. Connect the ultrasound probe to be tested to the Voluson E-Series system.
4. Immerse the saline probe in the saline solution.
5. Immerse the Voluson E-Series probe´s face (imaging area of the probe) into the saline solution.
6. Select the "Patient Lead Leakage" function on the meter.
7. Test with closed ground with the Voluson E-Series system on and off.

Note *For more information, refer to the safety analyzer's user manual that will be used to perform the test.*

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

Table 10-18 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-D*	*11L-D*	*RIC5-9-D*	RM6C
off	closed				
on	closed				

Note *Values in italics font are given as examples only.*

10.7 When there's too much Leakage Current...

10.7.1 AC/DC fails

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

10.7.2 Chassis fails

Check the ground on the power cord and plug for continuity. Ensure the ground is not broken, frayed, or intermittent. Replace any defective part.

Tighten all grounds. Ensure star washers are under all ground studs. Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and 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.*

10.7.3 Probe fails

Test another probe to isolate if the fault lies with the probe or the 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.*

Test the probe in another connector to isolate if the fault lies with the probe or the system. If excessive leakage current is slot dependent, inspect the system connector for bent pins, poor connections, and ground continuity.

If the problem remains with the probe, replace the probe.

10.7.4 Peripheral fails

Tighten all grounds. Ensure star washers are under all ground studs.

Inspect wiring for bad crimps, poor connections, or damage.

10.7.5 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.

In case of using an UPS (Uninterruptible Power Supply), perform the tests in the “Electrical Safety tests” section without using the UPS (i.e. directly connect the Voluson E-Series system to the AC wall outlet). If this leads to a pass result, the specific UPS must no longer be used.

10.7.6 New Voluson E-Series system

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

10.7.7 ECG fails

Inspect cables for damage or poor connections.

10.8 Ultrasound Equipment Quality Check

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

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