



Technical Publication

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Rev. 4

Invenia™ ABUS 2.0

System Setup and Basic Service Manual

[Operating Documentation](#)

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Product Information

This manual is a reference for the **Invenia ABUS 2.0**.
It applies to Version 2.0 software or later.



Change history

Revision History

Revision	Date (YYYY-MM-DD)	Reason for change
Rev. 1	2018-07-19	Initial release
Rev. 2	2019-01-04	Update package information and unpacking procedure
Rev. 3	2019-01-18	Update revision number
Rev. 4	2019-04-07	Update device label information

List of Effected Pages (LOEP)

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Important precautions

Translation policy

WARNING

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

AVERTISSEMENT

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

ADVERTENCIA

ESpañol
(ES)

Este Manual de servicio está disponible en idioma inglés únicamente.

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

WARNUNG

Deutsch
(DE)

Dieses Wartungshandbuch ist nur auf Englisch verfügbar.

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

AVVERTENZA

italiano
(IT)

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.

WAARSCHUWING

Nederlands
(NL)

Deze servicehandleiding is alleen beschikbaar in het Engels.

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

ADVERTÊNCIA

Português
(PT-BR)

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.

HOIATUS!

Eesti
(ET)

Service Manual (Hooldusjuhend) on saadaval ainult ingliskeelsena.

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

OPOZORILO

Slovenščina
(SL)

Ta servisni priročnik je na voljo samo v angleščini.

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

警告

日本語
(JA)

このサービスマニュアルは英語版のみ提供されています。

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

警告

简体中文
(ZH-CN)

本维修手册仅提供英文版。

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

VARNING

Svenska
(SV)

Den här servicehandboken finns endast på engelska.

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

警告

繁體中文
(ZH-TW)

此服務手冊僅推出英文版。

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

경고

한국어
(KO)

이 서비스 설명서는 영어로만 제공됩니다.

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

FIGYELMEZTETÉS

Magyar
(HU)

A szervizkézikönyv kizárólag angol nyelven érhető el.

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

VAROVANIE

Slovenčina
(SK)

Táto servisná príručka je dostupná iba v anglickom jazyku.

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

VÝSTRAHA

česky
(CZ)

Tato servisní příručka je k dispozici pouze v angličtině.

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

UYARI

Türkçe
(TK)

Servis Kılavuzu yalnızca İngilizce olarak mevcuttur.

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

ADVARSEL

Dansk
(DA)

Denne servicemanual fås kun på engelsk.

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

ADVARSEL

Norsk
(NO)

Denne servicehåndboken er bare tilgjengelig på engelsk.

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

VAKAVA VAROITUS

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

ПРЕДУПРЕЖДЕНИЕ

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

AVERTISMENT

- Română**
(RO)
- Acest manual de service este disponibil doar în engleză.
- Dacă furnizorul de servicii al unui client solicită altă limbă decât engleza, este responsabilitatea clientului să ofere servicii de traducere.
 - Nu încercați să efectuați lucrări de service asupra echipamentului, în afară de cazul când ați consultat acest manual de service și l-ați înțeles.
 - Nerespectarea acestui avertisment poate avea ca rezultat rănirea furnizorului de servicii, a operatorului sau a pacientului ca urmare a electrocutării, pericolelor mecanice sau a altor pericole.

UPOZORENJE

Hrvatski
(HR)

Ovaj servisni priručnik dostupan je samo na engleskom jeziku.

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

ĮSPĖJIMAS

Lietuvių k.
(LT)

Šis priežiūros vadovas galimas tik anglų kalba.

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

BRĪDINĀJUMS

Latviski
(LV)

Šī apkalpes rokasgrāmata ir pieejama tikai anglu valodā.

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

UPOZORENJE

Српски
(SR)

Ovaj priručnik za servisiranje dostupan je samo na engleskom jeziku.

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

AVISO

Português
(Portugal)
(PT-PT)

Este manual de assistência está disponível apenas em inglês.

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

ПОПЕРЕДЖЕННЯ

Українська
(UK)

Цей посібник із технічного обслуговування доступний лише англійською мовою.

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

PERINGATAN

Bahasa
Indonesia
(ID)

Panduan Servis ini hanya tersedia dalam Bahasa Inggris.

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

คำเตือน

ไทย
(TH)

คู่มือซ่อมบำรุงนี้มีเฉพาะภาษาอังกฤษเท่านั้น

- หากผู้ให้บริการของลูกค้าต้องการจับภาษาอื่นนอกเหนือจากภาษาอังกฤษ ลูกค้าต้องเป็นผู้รับผิดชอบในการจัดเตรียมคู่มือซ่อมบำรุงฉบับแปล
- โปรดอย่าซ่อมบำรุงอุปกรณ์โดยไม่ศึกษา และทำความเข้าใจคู่มือซ่อมบำรุงนี้
- หากไม่ปฏิบัติตามคำเตือนนี้อาจส่งผลให้ผู้ให้บริการ ผู้ใช้งานอุปกรณ์ หรือผู้ป่วยได้รับบาดเจ็บจากไฟฟ้าช็อต อันตรายจากกลไกของอุปกรณ์ หรืออันตรายอื่นๆ

CẢNH BÁO

(VI) Tiếng Việt

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

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

ЕСКЕРТУ

(KK) Қазақ тілінде

Осы қызмет көрсету нұсқаулығы тек ағылшын тілінде қолжетімді.

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

BABALA

(TL) Tagalog

Available lamang sa Ingles ang Manwal ng Serbisyo ng 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 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.

Omission and errors

If there are any omissions, errors or suggestions for improving this documentation, please contact the GE Global Ultrasound 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 Medical Systems Ultrasound and Primary Care Diagnostics, LLC
9900 Innovation Drive
Wauwatosa, WI 53226

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

These issues will then be in the internal problem reporting tool and communicated to the writer.

Service Safety Considerations



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



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

For a complete review of all safety requirements, refer to Chapter 1 in the Service Manual.

Legal notes

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Chapter 1

Introduction

This chapter describes important issues related to safely servicing the Invenia ABUS™ 2.0. The service provider must read and understand all the information presented here before installing or servicing the Invenia ABUS 2.0.

Manual Overview

Contents in this manual

This manual provides installation and service information for the Invenia ABUS 2.0.

The manual is divided into ten chapters.

In the beginning of the manual, before Chapter 1, you will find the *Revision overview*, the *Important precautions* including *Translation policy*, *Damage in transportation*, *Certified electrical contractor statement*, *Omission & errors*, *Service safety considerations* and *Legal notes*, and the *Table of Contents*.

An Index has been included after Chapter 10.

Table 1-1: Contents in this manual

Chapter Number	Chapter Title	Description
1.	Introduction	Contains a content summary and warnings.
2.	Site preparations	Contains pre-setup requirements for the Invenia ABUS 2.0.
3.	System Setup	Contains setup procedure with procedure checklist.
4.	General Procedures and Functional Checks	Contains functional checks that must be performed as part of the installation, or as required during servicing and periodic maintenance.
5.	Components and Functions (Theory)	Contains functional explanations of the electronics.
6.	Service Adjustments	Contains instructions on how to make any available adjustments to the Invenia ABUS 2.0.
7.	Diagnostics/ Troubleshooting	Provides procedures for running diagnostic or related routines for the Invenia ABUS 2.0.
8.	Replacement procedures	Provides disassembly procedures and reassembly procedures for all changeable FRU.
9.	Renewal Parts	Contains a list of replacement parts for Invenia ABUS 2.0.
10.	Care & Maintenance	Provides maintenance procedures for Invenia ABUS 2.0.
Index	Index	A quick way to the topic you're looking for.

Typical users of the System Setup and Basic Service Manual

- GE Service Personnel (setup, maintenance, etc.)
- Invenia ABUS 2.0 User
- Licensed Hospitals' Service Providers
- Technical Trainers

Invenia ABUS 2.0 models covered by this manual

Table 1-2: Invenia ABUS 2.0 Models and Hardware/Software Compatibility

Model Number	Description	System SW	Application SW
H5018SS	Invenia ABUS 2.0, Global	Windows Embedded Standard 7 64-bit	Version 2.0.3 or later
H5018SC	Invenia ABUS 2.0, China	Windows Embedded Standard 7 64-bit	Version 2.0.3 or later

NOTE: When not otherwise specified, the contents of this manual applies to all Invenia ABUS 2.0 models.

Field Replaceable Units (FRUs)

Please refer to Chapter 8 in this manual.

How to turn the Invenia ABUS 2.0 ON and OFF

Please refer to Chapter 4 in this manual.

How to check for software version

To verify the software version on the instrument, please refer to Chapter 4 in this manual.

Purpose of the operator manual

The operator manual should be fully read and understood before operating the Invenia ABUS 2.0.

eIFU



Invenia ABUS 2.0 documentation is provided to the customer in the electronic Instruction for Use Kit (eIFU Kit) that is shipped with the Invenia ABUS 2.0. The eIFU Kit provides all of the manuals in all languages. Printed version is available, free of charge. Check with your GE representative.

Instrument Overview

Invenia ABUS 2.0

The Invenia ABUS* 2.0 displays three-dimensional data sets for viewing in three orthogonal planes and standard Ultrasound images, permitting Interpreting Physicians to quickly review, locate, and mark regions of interest.

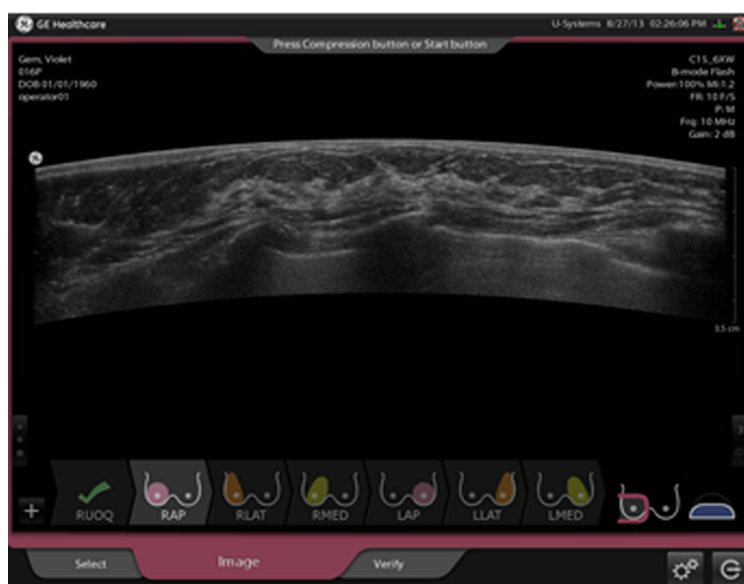


Figure 1-1. Invenia ABUS 2.0

The terms “scan station”, “product”, “device” or “instrument” may be used interchangeably throughout the manual to indicate the Invenia ABUS 2.0 product.

*ABUS=Automated Breast Ultrasound System

Components



Figure 1-2. Invenia ABUS 2.0 Overview

- | | |
|---|---|
| 1. Scan Head with C15-6XW Reverse Curve™ Ultra-broadband transducer | 5. Table with Ultrasound Coupling Lotion Holders |
| 2. Scan Arm | 6. System Standby Button (On/Off) |
| 3. Display Arm with Touch Screen Monitor | 7. Chassis containing Power Cord, Mains Power Switch, Network Connector, and USB port (not shown) |
| 4. Weight Tower | 8. Base and Locking Caster Wheels |

Signal flows from the transducer in the Scan Head (1), down the Weight Tower (4), through the Invenia ABUS 2.0 chassis (7), and finally to the Display (3).

System configuration is stored on the itself. All necessary software is loaded from the hard drive upon powerup.

Room Layout

The Invenia ABUS™ 2.0 can be placed at various positions around the exam table. The following figure shows the recommended clearance around the table.

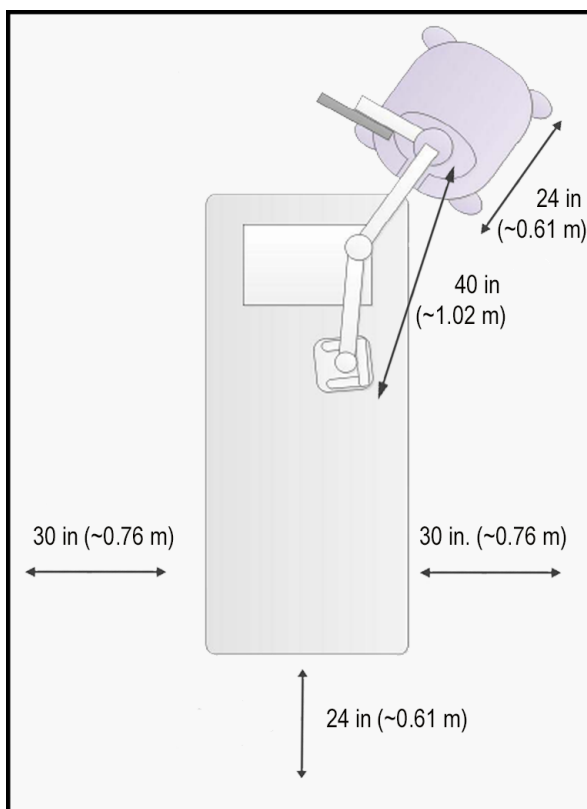


Figure 1-3. Minimum space around the exam bed.

Maximum arm reach is 40 inches (1.02 m)
~0.76 m, or 30" clear space recommended
~0.61 m, or 24" clear space recommended

View-on PACs

After performing the exam on the Invenia ABUS 2.0, the exam can be transferred manually or automatically to a DICOM-compatible viewing station for review. After the review, the exam can be sent to a PACS for archiving, or to some other form of manual archive.

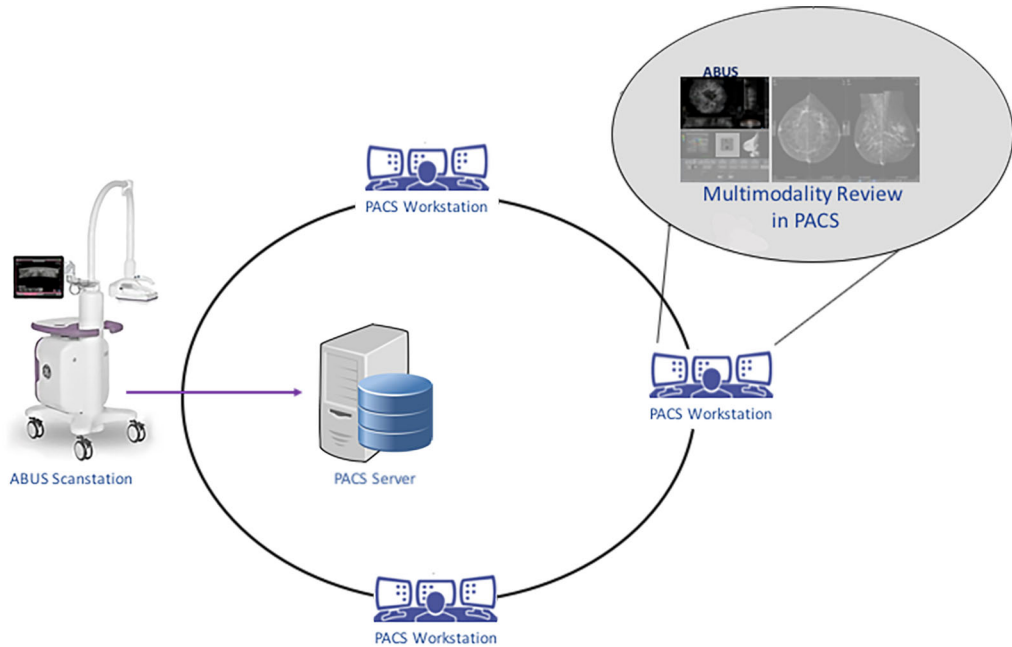


Figure 1-4. PACS network

Customers that want more integrated workflows or enterprises with multiple locations can benefit from the storage and View-on PACS capability.

Important conventions

Conventions used in book

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

Icons

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

Safety precaution messages

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

- DANGER
- WARNING
- CAUTION



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



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



CAUTION IS USED TO INDICATE THE PRESENCE OF A HAZARD THAT WILL OR CAN CAUSE MINOR PERSONAL INJURY AND PROPERTY DAMAGE IF INSTRUCTIONS ARE IGNORED. EQUIPMENT DAMAGE POSSIBLE.






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

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

Standard hazard icons

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







Table 1-3: Standard hazard icons

	ELECTRICAL
	MECHANICAL
	HEAT
	PINCH
	MAGNET PACEMAKER

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

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

Table 1-4: Standard Icons that indicates that a special procedure is to be used

Avoid Static Electricity	Tag and Lockout	Wear Eye Protection
		
Hand Protection	Foot Protection	Wear Eye Protection
		

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

Product icons

Always refer to the product's User Manual for a full list of labels used on the Invenia ABUS 2.0.

Label locations

It is important to refer to the current revision of the Invenia ABUS 2.0 Basic User Manual for a full list of product labels prior to servicing the system.

The following figure shows the location of the GE Cares Label on the Invenia ABUS 2.0 monitor.



Safety considerations

Introduction

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

Human Safety

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

Only personnel who have participated in an Invenia ABUS 2.0 Training Seminar are authorized to service the internal components of this equipment.



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



WHERE APPLICABLE, THERE ARE SEVERAL PLACES ON THE IMAGING ENGINE CHASSIS, THE AC DISTRIBUTION, DC DISTRIBUTION, AND TIP BOARD THAT ARE DANGEROUS. BE SURE TO POWER DOWN THE SYSTEM, TURN OFF THE MAINS POWER SWITCH AND DISCONNECT THE MAINS POWER CABLE FROM THE WALL OUTLET BEFORE YOU REMOVE ANY PARTS. BE CAUTIOUS WHENEVER POWER IS STILL ON AND COVERS ARE REMOVED.



If the covers are removed from an operating Invenia ABUS 2.0, some metal surfaces may be warm enough to pose a potential heat hazard if touched, even while in shutdown mode.

Human Safety (continued)



WARNING

Because of the limited access to cabinets and equipment in the field, placing people in awkward positions, GE has limited the lifting weight for one person in the field to 16 KG (35 LBS). Anything over 16 KG (35 LBS) requires 2 people.



WARNING

Attempts to move the Invenia ABUS 2.0 considerable distances or on an incline by one person could result in injury or damage or both.



Explosion
Hazard

Explosion Warning

DO NOT operate the equipment in an explosive atmosphere. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.



WARNING

DO NOT substitute parts or modify equipment

Because of the danger of introducing additional hazards, ONLY install GE approved parts. DO NOT perform any unauthorized modification of the equipment.



WARNING

Ensure that the Invenia ABUS 2.0 is turned off and unplugged

Wait for at least 20 seconds for capacitors to discharge as there are no test points to verify isolation.

Invenia ABUS 2.0 components may be energized. Always refer to LOTO warnings and cautions



WARNING

Tilting the console requires two people in order to avoid injury to service personnel and damage to the equipment.

Human Safety (continued)



^w WARNING

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



^w 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.



^w WARNING

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

Dangerous procedure warnings

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



DANGEROUS VOLTAGE WARNING

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



Heat warning

If the covers are removed from an operating Invenia ABUS 2.0, some metal surfaces may be warm enough to pose a potential heat hazard if touched, even while in shutdown mode.



Explosion Warning

DO NOT operate the equipment in an explosive atmosphere. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.



Equipment Modification Warning

DO NOT substitute parts or modify equipment

Because of the danger of introducing additional hazards, ONLY install GE approved parts. DO NOT perform any unauthorized modification of the equipment.

Electrical safety

Safe practices

Follow these guidelines to minimize shock hazards whenever you are using the Invenia ABUS 2.0:

- The Invenia ABUS 2.0 is equipped with a three-conductor AC power cable. This must be plugged into an approved electrical outlet with third wire 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



Electrical Warning

Connecting an Invenia ABUS 2.0 to the wrong voltage level will most likely damage it.

Transducer

Follow these guidelines before connecting the transducer to the Invenia ABUS 2.0:

- Inspect the transducer prior to each use for damage or degradation to the:
 - housing
 - lens
 - seal
 - connector pins
- Do not use a damaged or defective transducer.
- Never immerse the transducer connector or adapter into any liquid.

Mechanical safety



Personal Injury

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



Personal Injury

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



Personal Injury

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



Personal Injury

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



Personal Injury

To avoid injury when you move the Touch Screen Display and the Display Arm, do not put your finger, hand, or object on the joint of the Display or the Display arm.

Mechanical safety (continued)



Personal Injury

Invenia ABUS 2.0 weighs 100 kg (220 lb.) when ready for use. Care must be used when moving it or replacing its parts.

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

ALWAYS:

- be sure the pathway is clear
- use slow, careful motions



Equipment Damage

When the Invenia ABUS 2.0 is moved along any incline, use extreme caution since it may become unstable and tip over.



Loss of Data

While the software install procedure is designed to preserve data, ensure that all patient exams have transferred to an image viewer or storage, such as PACS.



Equipment Damage

Ultrasound transducers are highly sensitive medical instruments that can easily be damaged by improper handling. Use care when handling and protect from damage when not in use. do not use a damaged or defective transducer. Failure to follow these precautions can result in serious injury and equipment damage.



Equipment Damage

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

Mechanical safety (continued)



CAUTION

Equipment Damage

Before you move or transport the Invenia ABUS 2.0, make sure to lock the Touch Screen Display and Display Arm to prevent damage to the Invenia ABUS 2.0.



CAUTION

Equipment Damage

Keep the heat venting holes on the Touch Screen Display unobstructed to avoid overheating of the Display.



CAUTION

Equipment Damage

Practice good electrostatic discharge (ESD) prevention. Wear an anti-static strap when handling electronic parts and even when disconnecting/connecting cables.



CAUTION

Equipment Damage

Do not operate this Invenia ABUS 2.0 unless all board covers and frame panels are securely in place. System performance and cooling require this.



CAUTION

Equipment Damage

Be careful not to pinch any of the cables.

Mechanical safety (continued)



CAUTION

Equipment Damage

Do not transport Invenia ABUS 2.0 in a vehicle without locking the casters (wheels) and securing it as described in the User Manual.

NOTE: *Special care should be taken when transporting the Invenia ABUS 2.0 in a vehicle:*

- Before transporting, place the system in its special storage container.
- Ensure that the system is firmly secured while inside the vehicle.
- Secure system with straps or as directed otherwise to prevent motion during transport.
- Prevent vibration damage by driving cautiously. Avoid unpaved roads, excessive speeds, and erratic stops or starts.
- System must remain upright at all times. Severe damage may occur if transported other than upright.

Electromagnetic compatibility (EMC)

What is EMC?

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

Compliance

Invenia ABUS 2.0 conforms to all applicable conducted and radiated emission limits and to immunity from electrostatic discharge, radiated and conducted RF fields, magnetic fields and power line transient requirements.

For applicable standards, refer to the Safety Chapter of the Invenia ABUS 2.0 User's Manuals.

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

Electrostatic discharge (ESD) prevention



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

Always connect yourself, via an arm-wrist strap, to the advised ESD connection point located on the rear of the Invenia ABUS 2.0 (near the power connector).



Follow general guidelines for handling of electrostatic sensitive equipment.



Risk of electrical shock, Invenia ABUS 2.0 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.

Customer assistance

Contact information

If this equipment does not work as indicated in this service manual or in the user manual, or if you require additional assistance, please contact the GE Service or appropriate support resource. Note the following:

1. System ID serial number.
2. Software version.
3. Date and time of occurrence.
4. Sequence of events leading to issue.
5. Is the issue repeatable?

Refer to Figure 3-2 on page 3-35 to locate the System ID Serial Number on the Invenia ABUS 2.0. Specific label descriptions can be found in the user manuals.

Phone numbers for Customer Assistance

LOCATION	NUMBER	
USA GE Healthcare Ultrasound Service Engineering 9900 Innovation Drive (RP-2123) Wauwatosa, WI 53226, USA	Service	TEL: 1-800-437-1171
	Service Parts	TEL: 1-800-558-2040
	Online Center	TEL: 1-800-321-7937
	Application Support	TEL: 1-800-682-5327
		TEL: 1-262-524-5698
Canada	Service	TEL: 1-800-668-0732
	Application Support	TEL: 1-262-524-5698
Latin America	Service	TEL: +1-262-524-5300
	Application Support	TEL: +1-262-524-5698
EUROPE Ultrasound Europe GE Ultraschall Deutschland GmbH Beethovenstraße 239 Postfach 11 05 60, D-42655 Solingen Germany	Support	TEL: +49 (0) 212 2802 652
		FAX: +49 (0) 212 2802 431
EGM	Saudi Arabia Service Center	TEL: (+966) 800 429 2222
	UAE Service Center	TEL: +971 800 3646
Asia (Singapore) GE Ultrasound Asia Service Department - Ultrasound 298 Tiong Bahru Road #15-01/06 Central Placa Singapore 168730	Service Department	TEL: +65 6291-8528
		FAX: +65 6291-7006
Japan	Online Center	TEL: +81 42-846-9011
		FAX: +81 42-648-2905
China	Technical Support	TEL: +(86) 800-810 8188 TEL: +(86) 400-812 8188
ANZ	Service Support	TEL: +61 1800 659 465
Australia	Service Support	TEL: +(61) 1-800-659-465
India	Technical Support	TEL: 1800-425-8025 TEL: 1800-425-7255 TEL: 1800-102-7750
Korea	Technical Support	TEL: +(82) 1544-6119
Africa	Algeria Service Center	TEL: +213 2179 1212

System manufacturer

Table 1-5: System manufacturer

MANUFACTURER
GE Medical Systems Ultrasound and Primary Care Diagnostics, LLC 9900 Innovation Drive Wauwatosa, WI 53226

Returning parts

Returning the transducer and repair parts

Equipment being returned must be clean and free of blood and other infectious substances. Policy states that body fluids must be properly removed from any part or equipment prior to shipment. Employees, as well as customers, are responsible for ensuring that parts/equipment have been properly decontaminated prior to shipment. Under no circumstance should a part or equipment with visible body fluids be taken or shipped from a clinic or site (for example, body coils or an ultrasound transducer).

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

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

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

The Invenia ABUS 2.0 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.

If the system is sent for repair, please ensure that any patient information is backed up and erased from the system before shipping as per HIPAA regulation. It is always possible during system failure and repair to lose patient data. GE is not responsible for the loss of this data.

Returning the transducer and repair parts (continued)

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.

Chapter 2

Site Preparations

This chapter provides the information required to plan and prepare for the setup of an Invenia ABUS 2.0. Included are descriptions of the facility and electrical needs to be met by the purchaser of the Invenia ABUS 2.0.

General requirements

Invenia ABUS 2.0 environmental requirements

If the Invenia ABUS 2.0 is very cold or hot

When unpacking the Invenia ABUS 2.0, allow the temperature of the Invenia ABUS 2.0 to stabilize before powering up. The following table describes guidelines for reaching operational temperatures from storage or transport temperatures.



CAUTION

If the Invenia ABUS 2.0 is very cold or hot, do not turn on its power until it has had a chance to acclimate to its operating environment.

Table 2-1: Invenia ABUS 2.0 acclimation time

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

Cooling

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

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

Lighting

Bright light is needed for Invenia ABUS 2.0 setup, 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 Electromagnetic Interference (EMI) which could degrade image quality. These controls should be selected to minimize possible interference.

Electrical requirements

General requirements

The Invenia ABUS 2.0 requires a dedicated power and ground for the proper operation of its Ultrasound equipment. A separate power outlet with a minimum 10 amp circuit breaker for 100-240 VAC.

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 Invenia ABUS 2.0 is only a conduit.*



Power outage may occur. The Invenia ABUS 2.0 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.

Site power outlets

A dedicated AC power outlet must be within reach of the Invenia ABUS 2.0 without extension cords. Other outlets adequate for the external peripherals, medical and test equipment needed to support this Invenia ABUS 2.0 must also be present within 1 m (3.2 ft.) of the Invenia ABUS 2.0. Electrical installation must meet all current local, state, and national electrical codes.

Unit power plug

Refer to Chapter 9 for Power Plug part numbers. If the Invenia ABUS 2.0 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.

Power stability requirements

Voltage drop-out:

Max 10 ms.

Power transients (all applications):

Less than 25% of nominal peak voltage for less than 1 millisecond for any time of transient, including line frequency, synchronous, asynchronous, or aperiodic transients.

Table 2-2: Power Stability Requirement

Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% UT (>95% dip in UT) for 0.5 cycle	<5% UT (>95% dip in UT) for 0.5 cycle	Mains power quality should be that of a typical commercial or hospital environment.
	40% UT (60% dip in UT) for 5 cycles	40% UT (60% dip in UT) for 5 cycles	
	70% UT (30% dip in UT) for 25 cycles	70% UT (30% dip in UT) for 25 cycles	
	<5% UT (>95% dip in UT) for 5 s	<5% UT (>95% dip in UT) for 5 s	

EMI limitations

Ultrasound instruments are susceptible to Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transients in the air or wiring. They also generate EMI. The Invenia ABUS 2.0 complies with limits as stated on the EMC label. However there is no guarantee that interference will not occur in a particular installation.

Possible EMI sources should be identified before the Invenia ABUS 2.0 devices are set up.

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

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

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

See: 'EMI prevention/abatement' on *page 2-6* for EMI prevention tips.

EMI prevention/abatement

Table 2-3: EMI prevention/abatement

EMI RULE	DETAILS
Be aware of Radio Frequency sources	<ul style="list-style-type: none">• Keep the Invenia ABUS 2.0 at least 5 meters (15 feet) away from other EMI sources.• Special shielding may be required to eliminate interference problems caused by high frequency, high powered radio or video broadcast signals.
Ground the Ultrasound instrument	Poor grounding is the most likely reason an Ultrasound system will have noisy images. Check grounding of the power cord and power outlet.
Replace all screws, Radio Frequency gaskets, covers, cores	<ul style="list-style-type: none">• After you finish repairing or updating the Ultrasound system, replace all covers and tighten all screws.• Any cable with an external connection requires a magnet wrap at each end.• Install all covers. Loose or missing covers or Radio Frequency gaskets allow radio frequencies to interfere with the ultrasound signals.
Replace broken Radio Frequency gaskets	If more than 20% or a pair of the fingers on an Radio Frequency gasket are broken, replace the gasket. Do not turn on the Ultrasound system until any loose metallic part is removed.
Do not place labels where Radio Frequency gaskets touch metal	Where applicable, never place a label where Radio Frequency gaskets meet the Ultrasound system. Otherwise, the gap created will permit Radio Frequency leakage. Or, if a label has been found in such a position, move the label.
Take care with cellular phones	Cellular phones may transmit a 5 V/m signal; that could cause image artifacts.

Facility needs

Purchaser responsibilities

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

- Procuring the materials required
- Completing the preparations before delivery of the Ultrasound system (See Site Survey Planner below).
- 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 Ultrasound system than the interface kit allows, presents challenges to the installation team. To avoid delays during installation, such variances should be made known to the individuals or group performing the installation at the earliest possible date (preferably prior to the purchase).

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

Site Survey Planner

Use the Site Survey Planner to document the information required to install your Invenia ABUS system.

NOTE: *Your sales or support representative can obtain the Site Survey Planner file, **DOC1864913**.*

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.

Facility needs

The following are required:

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

The following are desired:

- 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, for Single Use Stabilization Membrane
- Storage for linens and equipment
- Nearby waiting room, lavatory, and dressing room
- Dual level lighting (bright and dim)
- Storage area for Single Use Stabilization Membranes and Ultrasound Coupling Lotion

Important Notices

NOTICE

General Electric, Affiliate, or Distributor Field Engineers and Application Specialists will setup the system.

This medical equipment is approved, in terms of the prevention of radio wave interference, to be used in hospitals, clinics and other institutions which are environmentally qualified. The use of this equipment in an inappropriate environment may cause some electronic interference to radios and televisions around the equipment.

Ensure that the following is provided for the new system:

- A separate power outlet with a minimum of a minimum 10 amp circuit breaker for 100-240 VAC.
- Take precautions to ensure that the console is protected from electromagnetic interference.

Precautions include:

- Operate the console at least 5 meters (15 feet) away from motors, typewriters, elevators, and other sources of strong electromagnetic radiation (non-medical grade UPS must be at least 2 meters (6 feet) away from console).
- Operation in an enclosed area (wood, plaster or concrete walls, floors and ceilings) helps prevent electromagnetic interference.
- Special shielding may be required if the console is to be operated in the vicinity of radio broadcast equipment.

Important Notices (continued)



WARNING

To avoid risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

To avoid risk of fire, the system power must be supplied from a separate, properly rated outlet.

Under no circumstances should the AC power plug be altered, changed, or adapted to a configuration rated less than specified. Never use an extension cord or adapter plug.

To help assure grounding reliability, connect to a “hospital grade” or “hospital only” grounded power outlet.



CAUTION

Use caution to ensure that the power cable does not disconnect during system use.

If the system is accidentally unplugged, data may be lost.



CAUTION

To avoid leakage current above safety limits as prescribed by IEC 60601-1 and to ensure continuity of protective earth. DO NOT connect Invenia ABUS 2.0 and mains-operated accessories to a single or multiple socket extension cord or power strip.

The Invenia ABUS 2.0 requires a dedicated power and ground for the proper operation of its Ultrasound equipment. A separate power outlet with a minimum 10 amp circuit breaker for 100-240 VAC.

Room Layout

The device can be placed at various positions around the exam table. The following figure shows the recommended clearance around the table.

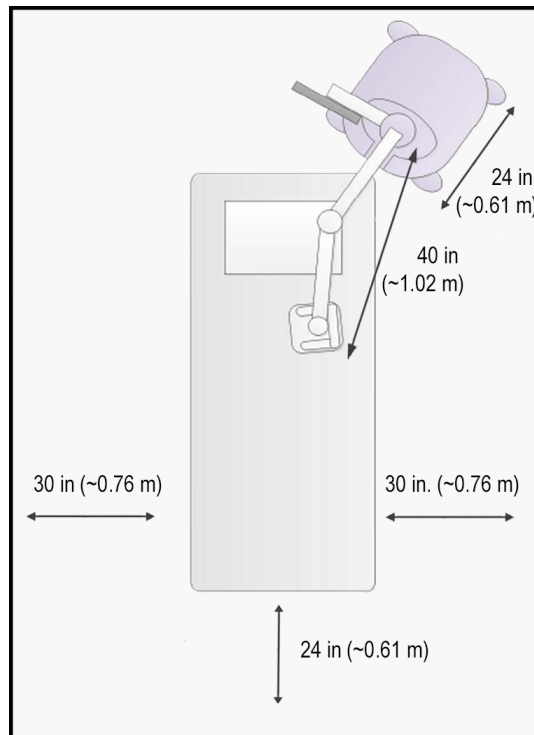


Figure 2-1. Position A – Desired Footprint

- Maximum arm reach is 40"
- ~0.76 m, or 30" clear side space recommended
- ~0.61 m, or 24" clear front and back space recommended

Room Layout (continued)



Figure 2-2. Invenia ABUS 2.0

Invenia ABUS 2.0 System Specifications

Features

- Multi-slice B-Mode image acquisition with frame-by-frame 3D position registration
- User-customizable workflow protocols
- Image Processing Algorithms
 - Tissue Equalization Algorithm (TEA)
 - Speckle Reduction
 - Nipple Shadow Compensation (NSC)
 - Breast Border Detection
 - Chest Wall Detection
- Acquisition Scout Images
 - Transverse Plane (Real-time)
 - Coronal Plane (Static, for Nipple Placement)
- DICOM 3.0 Compliant
 - Worklist (DMWL)
 - Modality Performed Procedure Step (MPPS)
 - Store (SCU)
- 10/100/1000 Base-T Ethernet
- User-Replaceable Fan Filter
- Remote Service Diagnostics

Scan Head Assembly Features

- Compression Assist
 - Increase/Decrease Compression
 - Start Scan (one-touch volume acquisition)
 - Abort Scan
- Ergonomic Arm with 3 Operator-selectable Levels of Compression between 5-20 lbs (2.25-9.7 kg)
- Integrated, extra-wide transducer:
 - C15-6XW Reverse Curve™
 - Frequency Range: 6-15 MHz
 - Aperture Length: 15.3 cm
 - Transducer Travel Distance: 16.9 cm
 - Number of Elements: 768
 - Element Pitch: 0.20 mm
 - Out-of-plane Aperture: 3.5 mm
 - Transducer Bandwidth: 85%
 - Imaging Depth: Up to 5.0 cm
- Single-Use Stabilization Membrane
- Single Volume Acquisition in less than 60 Seconds
- Multi-Row LED Task Lighting
- Removeable Scan Head Clear Cast Cover, for easier clean-up

Specifications

- Width: 23 inches (59 cm)
- Length: 26 inches (66 cm)
- Height (Arm):
 - Lowest Position 65 inches (165 cm)
 - Highest Position 85 inches (216 cm)
- Footprint: 4.2 sq. ft. (0.39 sq. m)
- Weight: 227 lbs (103 kg)
- Articulating Arm Reach (max): 39 inches (100 cm)
- Main Voltage: 100-240 VAC
- Maximum Current: 10 amps
- Mains Frequency: 50/60 Hz
- SSD Data Capacity: 200 GB (approximately 200 Studies), with Storage Status Indicator
- Study Transfer: Auto and Manual
- Display: 17" High Resolution LCD Touch Screen
- Cart: Mobile platform with 4-wheel steering and braking
- Operating System: MS Windows 7 Embedded Standard, 64 bit

Networking setup requirements

Invenia ABUS 2.0 connected to hospital's network

Supported networks:

10/100/1000 Base-T Ethernet

Purpose of the DICOM network function

DICOM 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 remote viewers 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.

DICOM setup requirements

To configure the Ultrasound system to work with other network connections, the site's network administrator must provide information to complete the form "Worksheet for DICOM Network Information". Ensure that there are no spaces in any field of the form.

Entries must include:

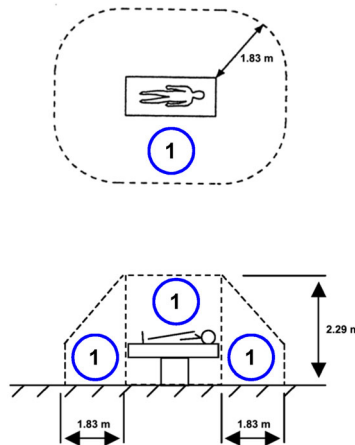
- A host name, local port number, AE Title, IP address and Net Mask for the Ultrasound system.
- The IP addresses for the default gateway and other routers at the site for ROUTING INFORMATION.
- The host name, IP address, port and AE Title for each device the site wants connected to the Ultrasound system for DICOM APPLICATION INFORMATION. A field for the make (manufacturer) and the revision of the device, is also included. This information may be useful for error solving.

Environmental Dangers

Commercial devices such as laser cameras, printers, VCRs and external monitors, usually exceed allowable leakage current limits and, when plugged into separate AC outlets, are in violation of patient safety standards. Suitable electrical isolation of such external AC outlets, or providing the device with extra protective earth, will be required in order to meet UL60601-1 and IEC60601-1 / IEC60601-1-1 standards for electrical leakage.

Patient Vicinity UL60601-1 (USA)**2.12.20DV (UL60601-1:2003)**

In area in which patients are normally cared for, the patient vicinity is the space with surfaces likely to be contacted by the patient or attendant who can touch the patient. This encloses a space within the room 1.83 m (6 ft.) beyond the perimeter of the bed (examination table, dental chair, treatment booth, and the like) in its intended location, and extending vertically 2.29 m (7.5 ft.) above the floor.



1. Patient environment

Chapter 3

System Setup

This chapter contains information needed to install Invenia ABUS 2.0.

Included is a procedure that describes how to receive and unpack the equipment and how to file a damage or loss claim.

How to set up the system and how to check and test the unit, transducer, and external peripherals for electrical safety are also included in this procedure.

Setup Time and Warnings

Average setup time

- Unpacking the Invenia ABUS 2.0: 1 hour
- DICOM Network Configuration: 3 hours or more, depending on the configuration

Setup warnings



^d DANGER

WHEN USING ANY TEST INSTRUMENT THAT IS CAPABLE OF OPENING THE AC GROUND LINE (I.G., METER'S GROUND SWITCH IS OPEN), DON'T TOUCH THE ULTRASOUND SYSTEM!



^c CAUTION

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



^c CAUTION

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



^c CAUTION

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



^c CAUTION

The system must be supplied by an adequately rated electrical circuit. The capacity of the supply circuit must be as specified.

Setup warnings (continued)



CAUTION

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

The following table describes guidelines for reaching operational temperatures from storage or transport temperatures.

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



CAUTION

Operator Manual

The User Manual should be fully read and understood before operating the Invenia ABUS 2.0 and kept near the Ultrasound instrument for quick reference.

Receiving and Unpacking the Equipment

Warnings for receiving and unpacking



CAUTION

Attempts to move the Invenia ABUS 2.0 considerable distances or on an incline by one person could result in injury or damage or both.



Two people are required whenever a part weighing 16 KG (35 lbs) or more must be lifted.



CAUTION

Remember to use relevant personal protecting equipment (PPE) during packing and unpacking. Check with your local EHS representative.

Work gloves are highly recommended to protect your hands while unpacking the crate.

Receiving the Invenia ABUS 2.0

Improper handling during transportation may harm the equipment inside the package, even if the package itself is undamaged.

Examine all packages

Examine package closely at time of delivery, as described in the procedure below.

Table 3-1: Examine all packages

Step	Task
1.	Is damage apparent? <ul style="list-style-type: none">• If YES; continue with the instructions in 'Damage in transportation' on <i>page 3-6</i>.• If NO; continue with the next step.
2.	Continue with the instructions in 'Unpacking the Invenia ABUS 2.0' on <i>page 3-9</i> .

Damage in transportation

Follow this procedure if damage is apparent:

1. 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.
2. Report the damage to the carrier.
 - 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.

Invenia ABUS 2.0 Transportation Box Label

The Invenia ABUS 2.0 transportation crate label is located at the front of the transportation crate.



Figure 3-1. Invenia ABUS 2.0 transportation box label

Invenia ABUS 2.0 Transportation Box Label (continued)

Table 3-2: Package Label Icons

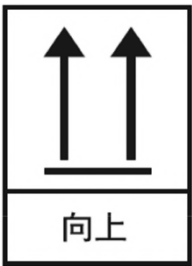



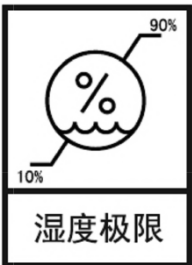
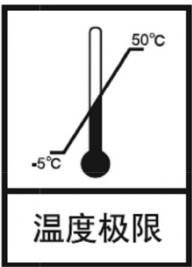
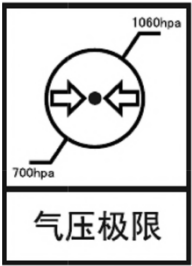
Label/Icon	Purpose/Meaning	Location
	Keep this way up.	Package
	Fragile.	Package
	Keep it away from rain.	Package
	2 levels at most.	Package

Table 3-2: Package Label Icons

Label/Icon	Purpose/Meaning	Location
	Humidity Limitation	Package
	Temperature Limitation	Package
	Pressure Limitation	Package

Unpacking the Invenia ABUS 2.0

Instructions and pry bar are provided in the materials attached to the shipping crate.

There are two sizes of Invenia ABUS 2.0 package, one is 1715x845x1650mm and the other is 1167x905x1807mm.



CAUTION

Wear gloves to protect your hands from wood splinters or metal edges.

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)

Step	Description	Illustration
1.	Position the crate to allow room at both narrow ends to unload the Invenia ABUS 2.0.	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)

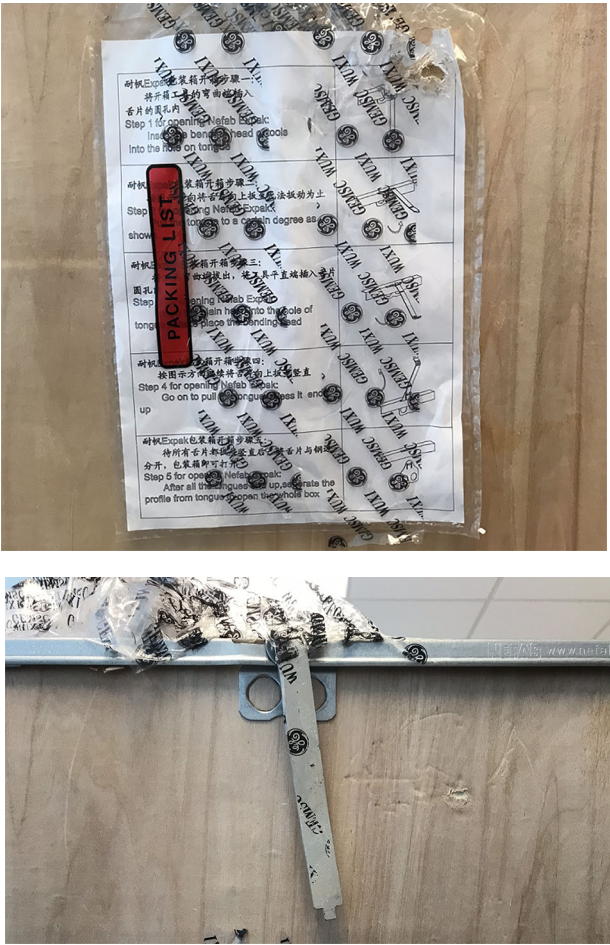
Step	Description	Illustration
2.	Locate the pry tool taped to one of the sides of the crate.	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)


Step	Description	Illustration
3.	<p>Remove the top of the crate.</p> <p>a. Use the pry tool to lift all of the metal tabs along the top of the crate.</p> <p>b. Lift the crate top until it clears the metal tabs, and set aside.</p> <p>NOTE: Ensure that the metal tabs are straightened until they are vertical, or the top will be difficult to remove.</p>	 <p>The illustration consists of three photographs. The top-left photo shows a close-up of a metal tab being lifted by a pry tool. The top-right photo shows a metal tab being straightened. The bottom photo shows a person wearing gloves lifting the top of the crate off the wooden base.</p>

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)



Step	Description	Illustration
4.	<p>Continue lifting the metal tabs along the side of the crate to remove all side panel.</p> <p>NOTE: Straighten the bottom tabs first, and then straighten the tabs on the side panels.</p> <p> CAUTION</p> <p>Use caution when removing the crate side panels.</p>	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)


Step	Description	Illustration
5.	Use a pair of scissors to remove the clear plastic wrapping.	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)

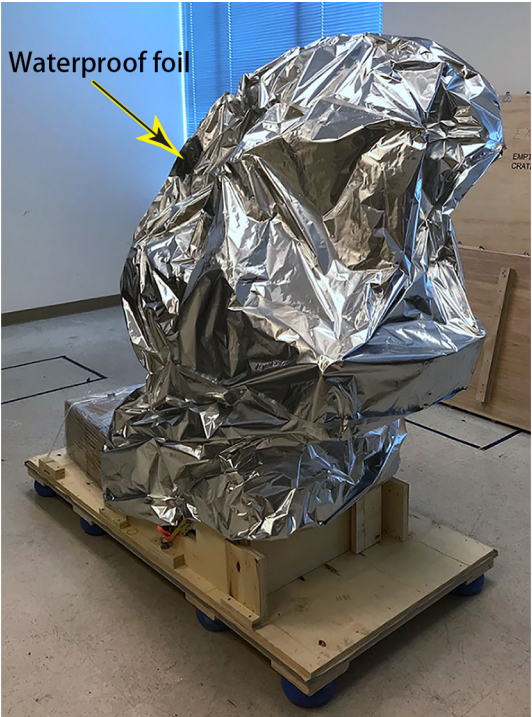
Step	Description	Illustration
6.	Remove the waterproof foil.	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)


Step	Description	Illustration
7.	Remove the accessories box (membranes, lotion, network cable, power cord, etc..)	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)


Step	Description	Illustration
8.	<p>Detach the orange safety strap that secures the Invenia to the crate base.</p> <p>Ratchet Strap Release Instructions:</p> <ol style="list-style-type: none">To release, pull and hold release tab on top assembly to override ratcheting function.Open ratchet until it is completely open and flat.Grab webbing from non-fixed side and pull to release webbing.	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)

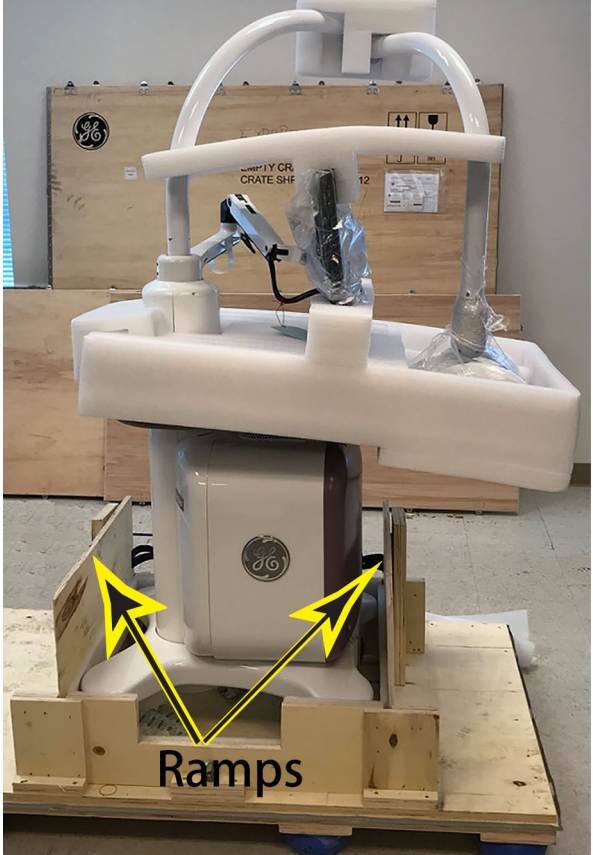
Step	Description	Illustration
9.	Remove the ramps from both sides of the Invenia ABUS 2.0.	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)


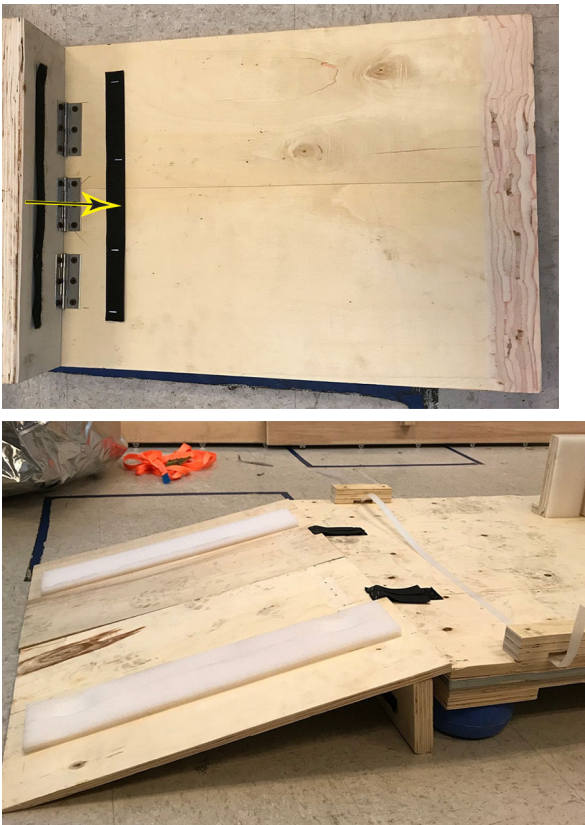
Step	Description	Illustration
10.	<p>Unfold both ramps. Then attach the ramps to the end of the crate with the black hook and loop straps.</p> <p> CAUTION: Ensure that the ramps are positioned with the white bounding boards outside of the black straps. These boards keep the wheels on the ramp.</p>	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)

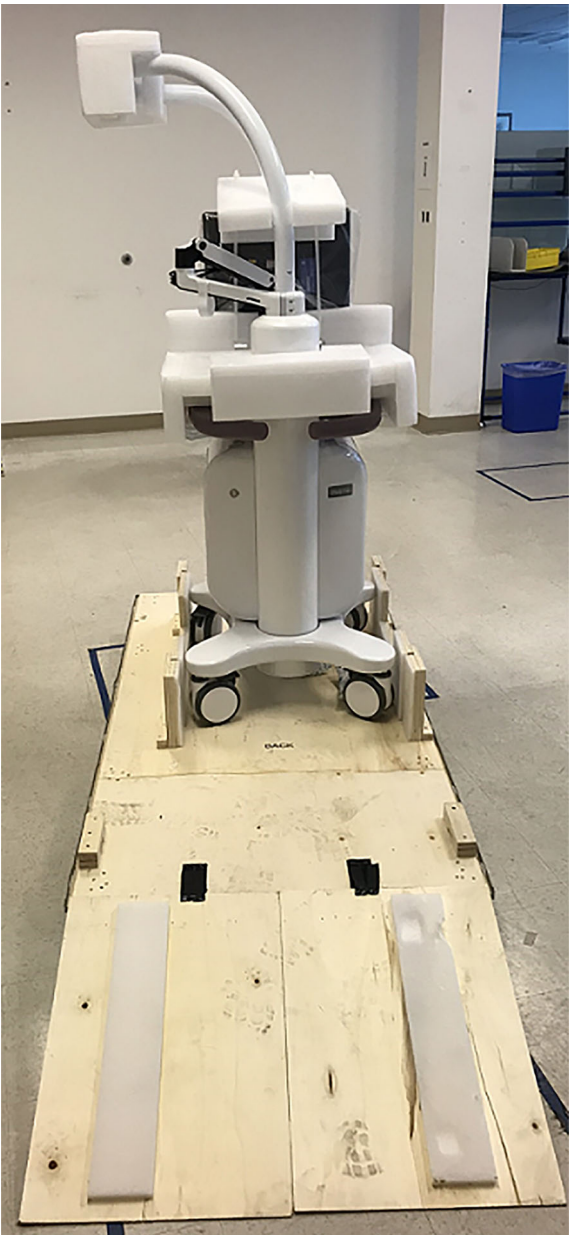
Step	Description	Illustration
11.	Unlock the caster wheels, and then carefully move the Invenia ABUS 2.0 down the ramp.	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)

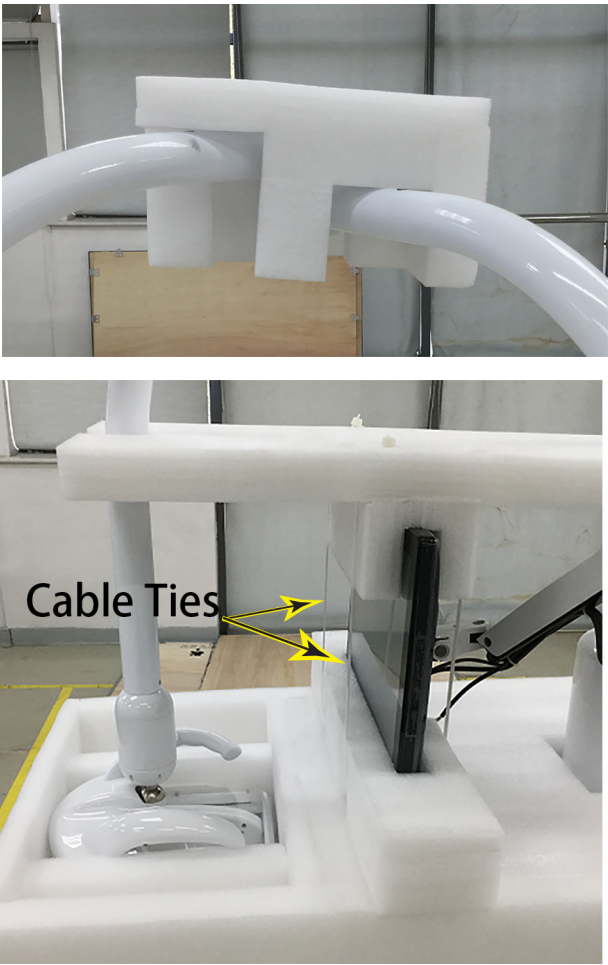
Step	Description	Illustration
12.	Remove the Scan Arm Assembly protective foam. Then, use a pair of scissors to cut the cable ties holding the protective Display Monitor foam.	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)



Step	Description	Illustration
13.	Move up the Scan Arm Assembly then remove the Scan Arm Assembly and Display monitor protective foam.	
14.	Remove the Tube Covers protective foam.	

Table 3-3: Unpacking the Invenia ABUS 2.0 (for Size 1715x845x1650mm)

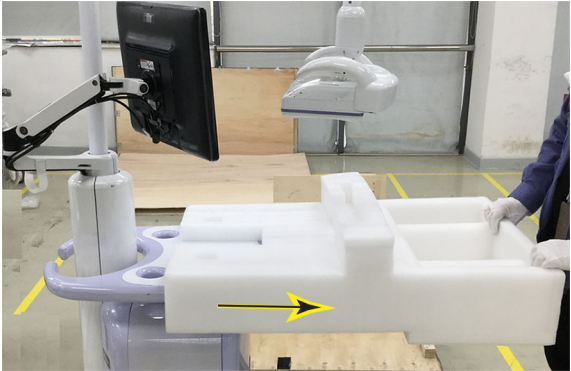

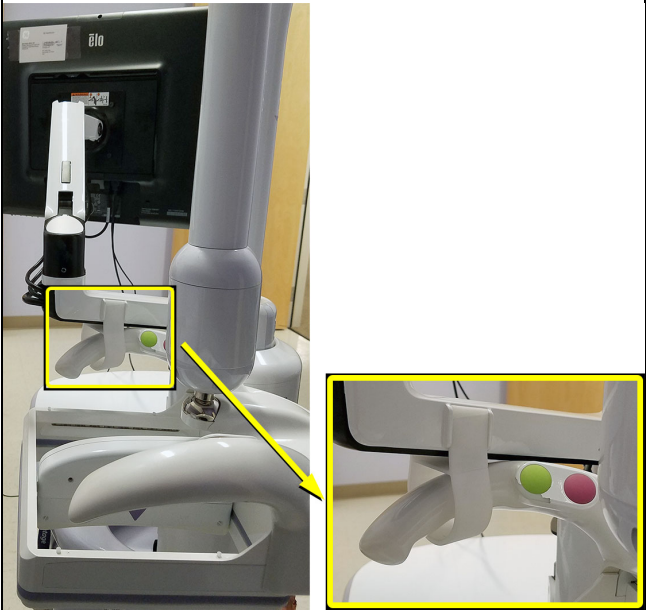
Step	Description	Illustration
15.	Remove the Service Table protective foam.	
16.	<p>Place the Scan Head Handle into the Transport Ring on the Articulating Display Arm.</p> <p> WARNING: Secure the Scan Head and Scan Arm PRIOR to moving the Invenia ABUS 2.0. Failure to do so may cause the Scan Head and Scan Arm to swing around the unit and cause personal injury or cause damage to the Scan Head or other equipment.</p>	
17.	Remove all of the packaging and place the removed packaging back into the crate to store for possible future use.	

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)

Step	Description	Illustration
1.	Position the crate to allow room which have enough space to unload the Invenia ABUS 2.0.	

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)


Step	Description	Illustration
2.	Unlock 4pcs Butterfly Lock, open the package door and put it down carefully.	

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)


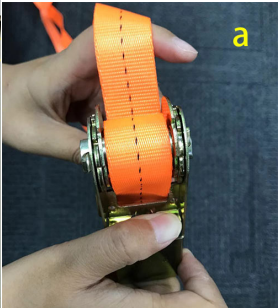
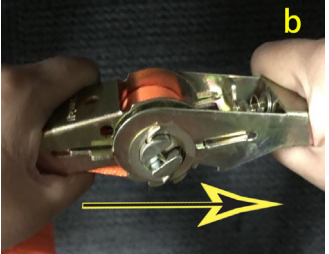
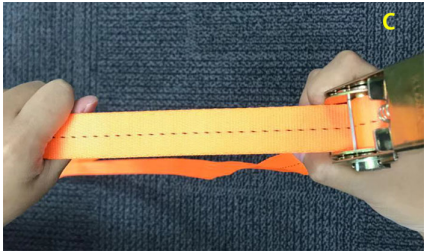
Step	Description	Illustration
3.	<p>Detach the orange safety strap that secures the two accessory boxes to the crate base.</p> <p>Ratchet Strap Release Instructions:</p> <ol style="list-style-type: none"> To release, pull and hold release tab on top assembly to override ratcheting function. Open ratchet until it is completely open and flat. Grab webbing from non-fixed side and pull to release webbing. 	   

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)


Step	Description	Illustration
4.	Take out the accessory box.	

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)


Step	Description	Illustration
5.	Remove the baffle, then untie the nylon cable which tie to seal the high barrier PE bag.	

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)


Step	Description	Illustration
6.	Unlock the caster wheels, and then carefully move the Invenia ABUS 2.0 down the ramp.	

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)

Step	Description	Illustration
7.	Use a pair of scissors to remove the clear plastic wrapping.	

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)

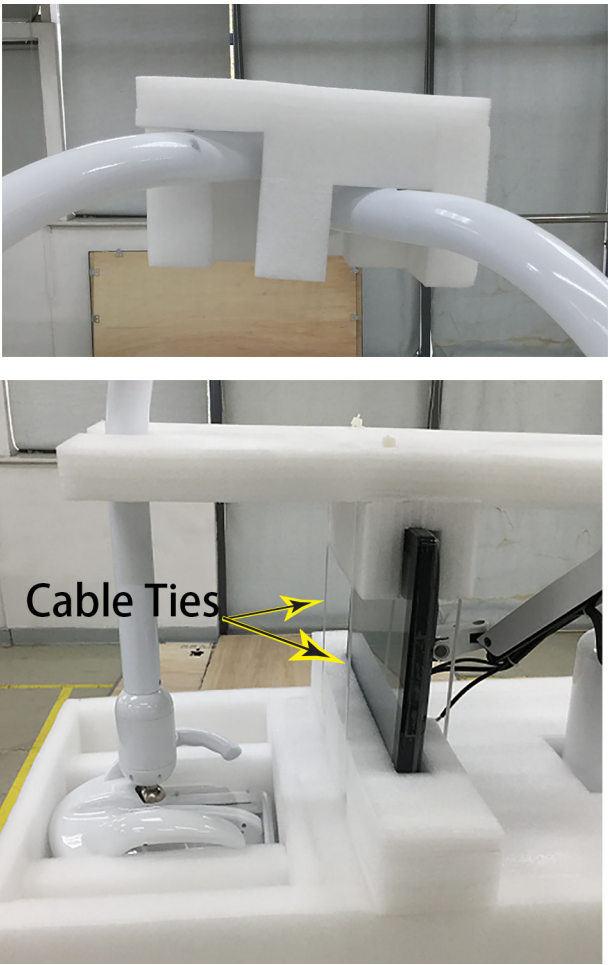
Step	Description	Illustration
8.	Remove the Scan Arm Assembly protective foam. Then, use a pair of scissors to cut the cable ties holding the protective Display Monitor foam.	

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)



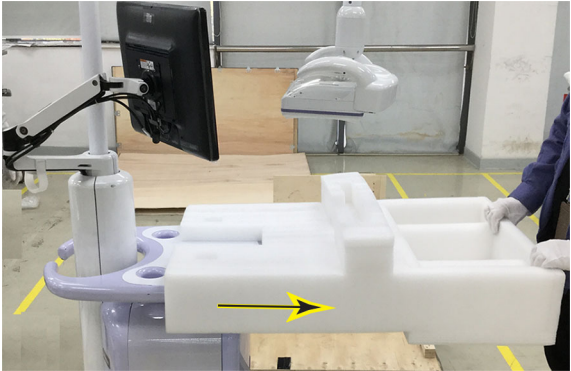

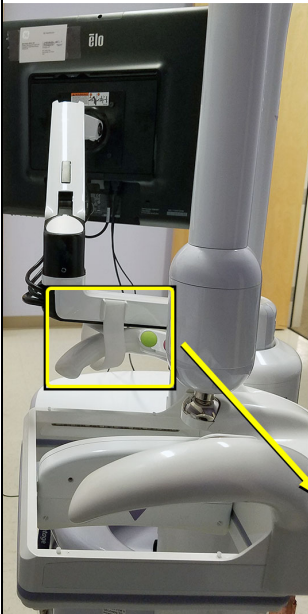
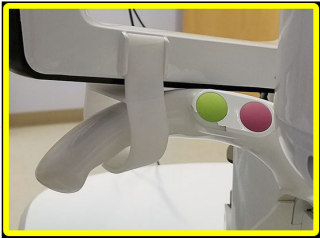
Step	Description	Illustration
9.	Move up the Scan Arm Assembly then remove the Scan Arm Assembly and Display monitor protective foam.	
10.	Remove the Tube Covers protective foam.	

Table 3-4: Unpacking the Invenia ABUS 2.0 (for Size 1167x905x1807mm)

Step	Description	Illustration
11.	Remove the Service Table protective foam.	
12.	<p>Place the Scan Head Handle into the Transport Ring on the Articulating Display Arm.</p> <p> WARNING: Secure the Scan Head and Scan Arm PRIOR to moving the Invenia ABUS 2.0. Failure to do so may cause the Scan Head and Scan Arm to swing around the unit and cause personal injury or cause damage to the Scan Head or other equipment.</p>	 
13.	Remove all of the packaging and place the removed packaging back into the crate to store for possible future use.	

Packing materials - recycling information

Packing materials

The packing materials for Invenia ABUS 2.0 are recyclable:

- The Transportation Box is made of spruce or similar material. ("PHYTOSANITARY CERTIFICATE" included in all shipments to The People's Republic of China.)
- Lever locking (hinges) are made of zinc plated steel.
- The inner reinforcements are made of Ethafoam (Polyethylene foam).
- The plastic foil is made of LDPE (Low Density Polyethylene).

Preparing for Setup

Verify customer order

Compare items received by the customer to that which is listed on the delivery order. Report any items that are missing, back ordered, or damaged.

Physical inspection

Verify that the device arrived intact (visual inspection).

If the device has been damaged, please refer to 'Damage in transportation' on *page i-15* in the beginning of this manual.

EMI protection

The Invenia ABUS 2.0 has been designed to minimize the effects of Electro-Magnetic Interference (EMI). Many of the covers, shields, and screws are provided primarily to protect the device from image artifacts caused by this interference. For this reason, it is imperative that all covers and hardware are installed and secured before the unit is put into operation.

See 'EMI limitations' on *page 2-5* for more information about EMI protection.

The Invenia ABUS 2.0 has been designed to minimize the effects of Electro-Magnetic Interference (EMI). Many of the covers, shields, and screws are provided primarily to protect the device from image artifacts caused by this interference. For this reason, it is imperative that all covers and hardware are installed and secured before the unit is put into operation.

Warning Label Locations

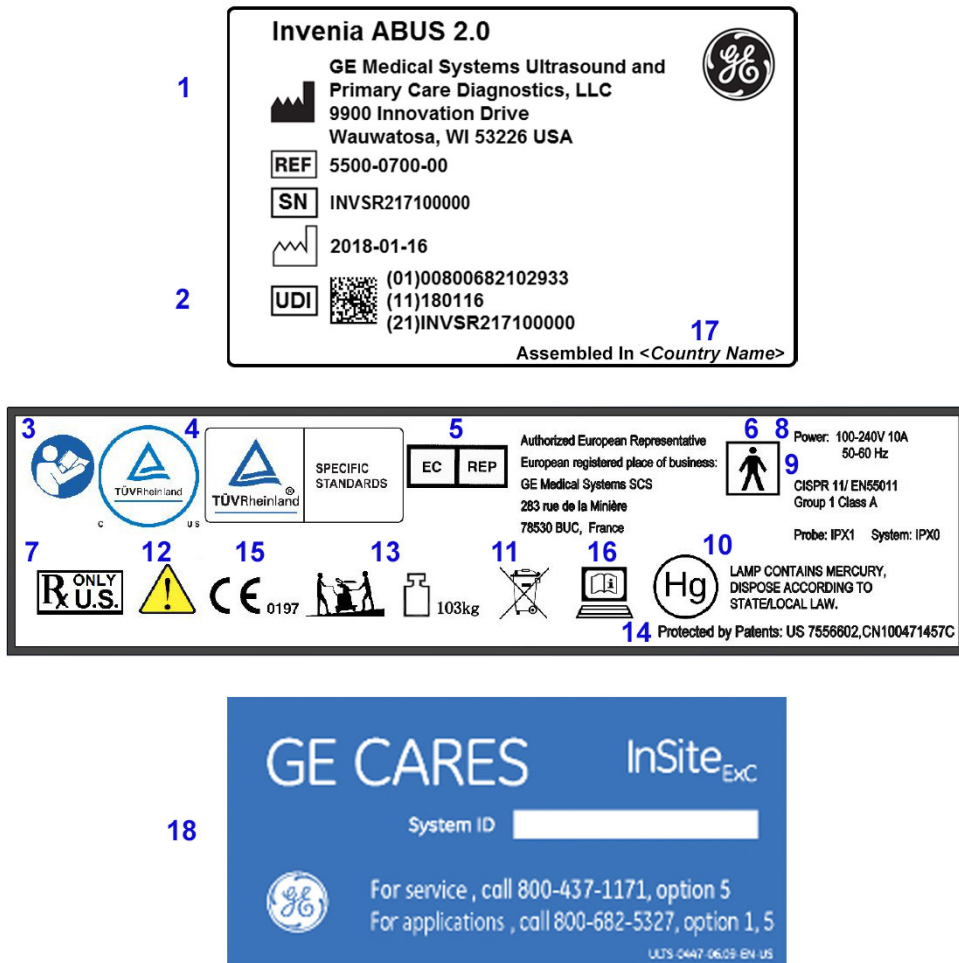


Figure 3-2. Rear Panel Label Location

Warning Label Locations (continued)

Table 3-5: Rear Panel Label Explanations

- | | |
|---|--|
| 1. Manufacturer's name and address | 10. Mercury Warning Label |
| 2. Unique Device Identification (UDI) Label. | 11. WEEE Symbol |
| 3. "ATTENTION - Consult accompanying documents" is intended to alert the user to refer to the operator manual or other instructions when complete information cannot be provided on the label. | 12. Possible shock hazard. Do not remove covers or panels. No user serviceable parts are inside. Refer servicing to qualified service personnel. |
| 4. TUV Rhineland Label: NRTL Listing and Certification Mark is used to designate conformance to nationally recognized product safety standards. The Mark bears the name and/or logo of the testing laboratory, product category, safety standard to which conformity is assessed, and a control number. | 13. The equipment weighs approximately 103 kg (227 lbs). To avoid possible injury and equipment damage when transporting from one area of use to another: <ul style="list-style-type: none">• Be sure the pathway is clear.• Limit movement to a slow careful walk.• Use two or more persons to move the equipment on inclines or long distance. |
| 5. Authorized European Representative address. | 14. Patents |
| 6. BF Applied Part | 15. CE Mark |
| 7. Prescription Device (For U.S.A. Only) | 16. eIFU Symbol |
| 8. Identification and Rating Plate—USA/Asia 120V console | 17. Country of Origin |
| 9. CISPR Emissions Label
Device and transducer IP Code | 18. GE Cares |

GE Cares Label Placement



Figure 3-3. GE Cares Label Location

Label Icon Description

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

Table 3-6: Label Icons







Label/Icon	Purpose/Meaning	Location
Identification and Rating Plate 	Manufacturer's name and address	Rating Plate
Identification and Rating Plate 	Date of manufacture	Rating Plate
	Serial Number	Rating Plate
	Catalog Number	Rating Plate
Type/Class Label	Used to indicate the degree of safety or protection.	Rating Plate
	United States only Prescription Requirement label	Rating Plate
	Use two people to transport device on inclines. This label also indicates the device weight.	Rating Plate
IP Code • IPX0 • IPX1	Indicates the degree of protection provided by the enclosure per IEC60529. Can be used in operating room environment.	Rating Plate

Table 3-6: Label Icons (Continued)















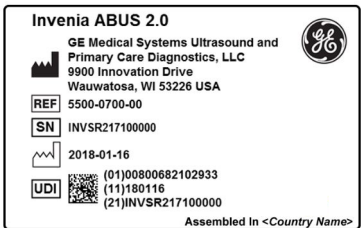
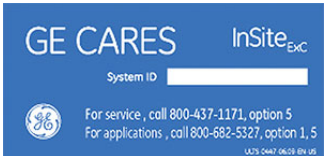
Label/Icon	Purpose/Meaning	Location
	Type BF Applied Part (man in the box) symbol is in accordance with IEC 60417-5333.	Rating Plate
	Authorized European Representative address	Rating Plate
	The CE Mark of Conformity indicates this equipment conforms with the Council Directive 93/42/EEC.	Rating Plate
	“ATTENTION - Consult accompanying documents” is intended to alert the user to refer to the operator manual or other instructions when complete information cannot be provided on the label.	Rating Plate
	Symbol indicating that the Instructions for Use are supplied in electronic form (eIFU).	Rating Plate
	“General Warning Sign”	Rating Plate
	Equipment weight: 103 kg (227 lbs).	Rating Plate
Patents	US 7556602, CN100471457C	Rating Plate
	“Mains OFF” indicates the power off position of the mains power breaker.	Rear Panel
	“Mains ON” indicates the power on position of the mains power breaker.	Rear Panel
	Power Switch CAUTION: This Power Switch DOES NOT ISOLATE Mains Supply.	• Power Standby Switch

Table 3-6: Label Icons (Continued)

Label/Icon	Purpose/Meaning	Location
	Single Use Only	Single-Use Stabilization Membrane
	This symbol indicates that waste electrical and electronic equipment must not be disposed of 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.	Rating Plate
	TUV Rheinland Listing Mark Monogram	Rating Plate
	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 device the backlight lamps in the monitor display contain mercury.	Rating Plate
	Product Label Unique Device Identification (UDI) Label. The UDI label consists of a series of alpha-numeric characters and barcode which uniquely identify the device as a medical device manufactured by General Electric.	Next to the Rating Plate
	GE CARES label with System ID and service phone number.	Monitor (rear panel)

Setup Warnings and Cautions



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



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



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

Setup Warnings and Cautions (continued)



CAUTION

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



CAUTION

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

The following table describes guidelines for reaching operational temperatures from storage or transport temperatures.

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



CAUTION

Operator Manual(s)

The User Manual(s) should be fully read and understood before operating the Invenia ABUS 2.0 and kept near the Ultrasound system for quick reference.

Electrical specifications



WARNING

Connecting an Invenia ABUS 2.0 to the wrong voltage level will damage it.

Verification of the system's voltage setting

Verify that the mains voltage specified for the Invenia ABUS 2.0 is available on-site.

The voltage setting for the unit is found on a label near the Mains Power Switch on the rear of the system. Refer to the Invenia ABUS 2.0 Basic User Manual, part number 4700-0041-00, for more information.

Connections on the Rear Panel

NOTE: *Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC standards (e.g. IEC60950 for data processing equipment and IEC60601-1 for medical equipment). Furthermore, all complete configurations shall comply with the valid version of the system standard IEC60601-1-1. Everybody who connects additional equipment to the signal input part or signal output part of Invenia ABUS 2.0, configures a medical system, and is therefore responsible that the Invenia ABUS 2.0 device complies with the requirements of the valid version of IEC60601-1-1. If in doubt, consult the technical service department or your local representative for GE.*

Connection from Invenia ABUS 2.0 to a DICOM destination on a network

You will need one network cable to connect the Invenia ABUS 2.0 to a wall outlet on the hospital's network.

1. Connect one end of the cable to the Ethernet connectors on Invenia ABUS 2.0.



2. Connect the other end of the cable to the wall outlet.

Location of the USB Flash Drive Ports

You can install the USB Flash Drive in one of the following USB ports on the Invenia ABUS 2.0: two on the back panel of the Display, and one on the back panel of the chassis (lower left, next to the Ethernet port).



Figure 3-4. USB Port on the Display



Figure 3-5. USB Port on the Chassis

NOTE: *USB Flash Drives approved for Invenia ABUS 2.0 are verified for EMC performance according to EN55011 class B. The use of any other USB Flash Cards will compromise this verification, and may cause interference on Invenia ABUS 2.0 itself, or on other electronic devices.*

Anti-Virus Software

All unused ports will be locked down; no anti-virus software is required. Anti-virus software is not recommended to be placed on the Invenia ABUS 2.0. No alterations or modifications can be done via software on this medical device unless outlined and approved by the manufacturer. Alterations or additions to software of the Invenia ABUS 2.0 voids all warranties and claims.

Switch ON the AC Power to Invenia ABUS 2.0



The Power button is used to turn the system On and Off. The Power button is located on the right front cover.

1. Switch ON the Power Mains Switch at the rear of the unit.
2. Press once on the **On/Off** button on the Invenia ABUS 2.0 to boot the unit.



WARNING

DO NOT unplug the power cord until after the complete shutdown procedure has been performed.

Power shut down

When you switch off the unit, the system performs an automatic shutdown sequence. Press the On/Off/Standby button to initiate the shutdown sequence.

Setting up the Invenia ABUS 2.0

Powering on the device

1. Connect the power cord to the system and to the room's AC outlet.
2. Connect the network cable (located on the rear panel) to the system and to the room's Ethernet connection.
3. Power up the system. See 'Switch ON the AC Power to Invenia ABUS 2.0' on *page 3-45*.

Logging in as Admin

1. Login with your Service Account.
 - a. Type Admin.
 - b. Enter your password.

When the system boots up from the Service Login, three icons appear in the bottom, right corner of the Touch Screen.

- **Minimize**: minimizes the Invenia ABUS 2.0 application software to display the Windows desktop. This icon is available only with the Service login.
- **Configuration** (gears): displays the configuration screens.
- **Exit**: closes the application software.



Figure 3-6. Service icons

Calibrating the Touch Screen Display

NOTE: *The Touch Screen Display is calibrated from the factory. Use this procedure only if calibration is noticeably offset.*



1. Tap the Configuration icon to display the General configuration screen and tap the System tab.
2. Tap the Calibrate Screen button to open the calibration function.

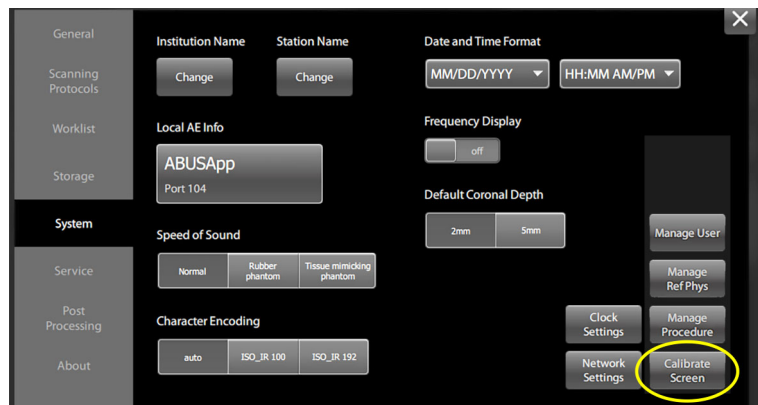


Figure 3-7. Calibrate Screen in System Configuration

3. Follow the onscreen instructions or tap the X in the upper right corner to close the configuration screen.

Entering Institution Name

Institution (or Hospital) name can be set from the System Configuration screen.



1. Tap the Configuration icon to display the General configuration screen and tap the System tab.
2. Tap the Institution Name button to open the screen.

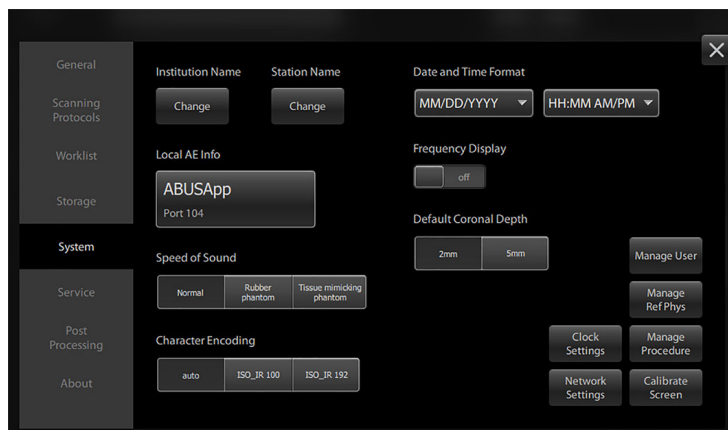


Figure 3-8. Institution Name in System Configuration

3. Follow the onscreen instructions or tap the X in the upper right corner to close the configuration screen.

Setting up Time and Date Setting



1. Tap the Configuration icon to display the General configuration screen and tap the System tab.
2. Tap the Clock Setting button to open the Windows clock setting function.

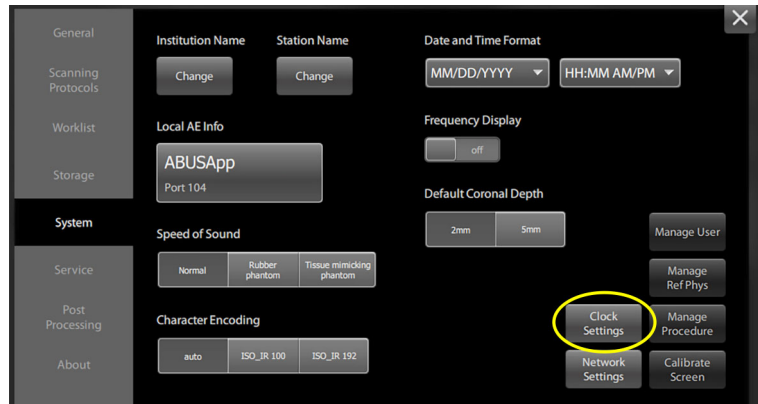


Figure 3-9. Clock setting in System Configuration

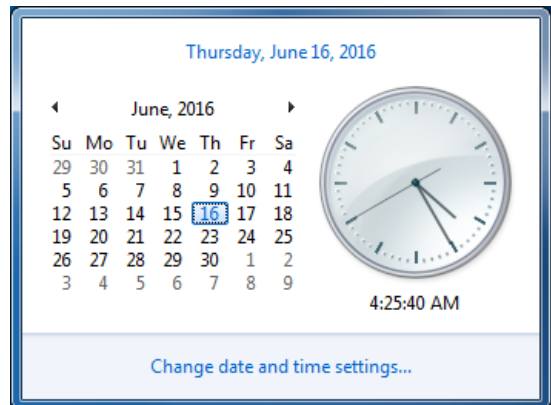


Figure 3-10. Windows Date and Time Settings

Setting up Time and Date Setting (continued)

3. Click on **"Change time zone"** and select appropriate time and location. Click Ok to close Time Zone Settings.
4. If necessary, click on **"change date and time..."** Click on **"OK"** to retain changes.

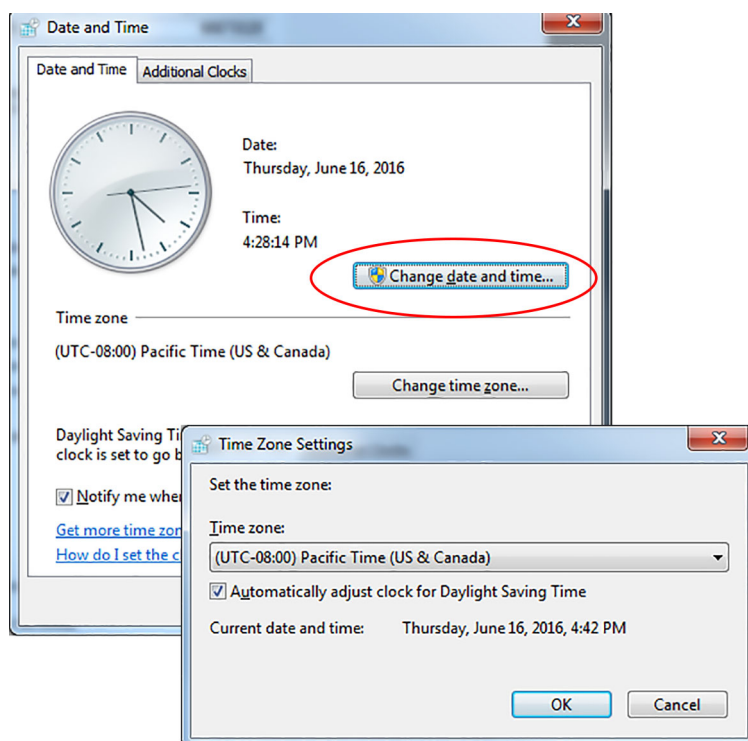


Figure 3-11. Select time zone

5. Continue to the next configuration step or tap the X in the upper right corner to close the configuration screen.

Setting up the Windows network

1. Tap the configuration icon, then the System tab.

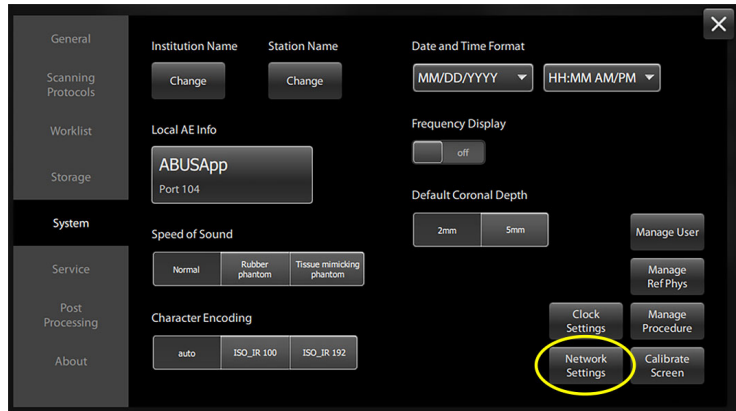


Figure 3-12. System Configuration

2. Click on the Network Setting button to open the Windows Connectivity screen.
3. Double-click the “Local Area Connection” box. The Local Area Connection Status pop-up appears.

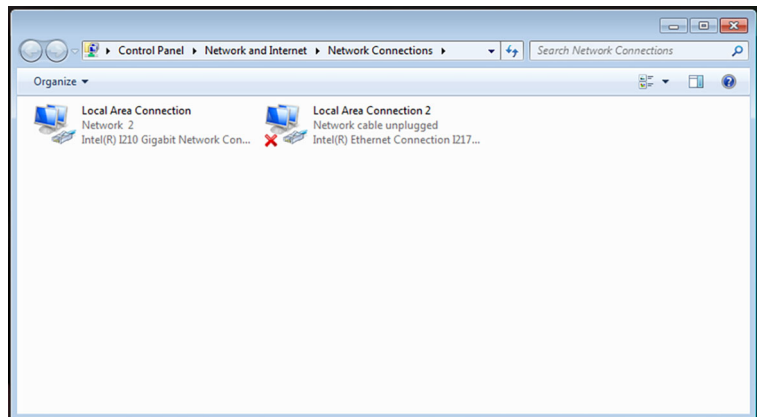


Figure 3-13. Windows Connectivity Screen

The Local Area Connection Status pop-up appears.

Setting up the Windows network (continued)

4. On the Local Area Connection Status pop-up, select “Properties” from the lower, left-hand corner of the pop-up.

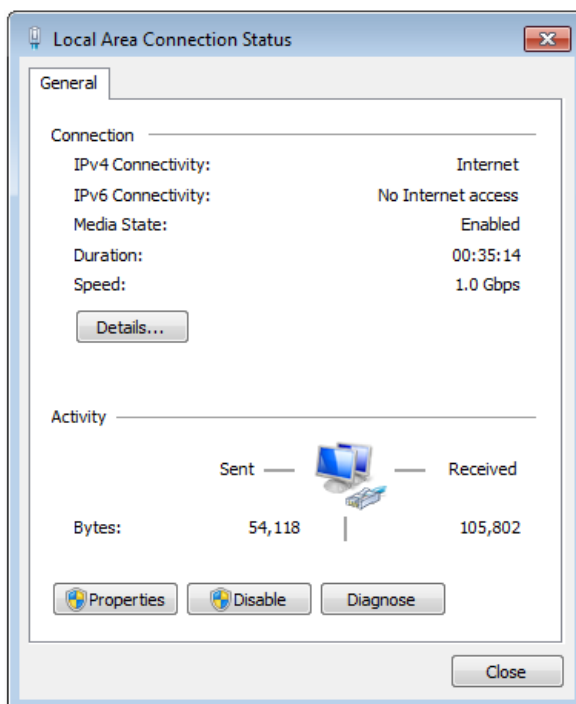


Figure 3-14. Local Area Connection Status Pop-Up

The Local Area Network Properties pop-up appears.

Setting up the Windows network (continued)

5. From the Local Area Network Properties pop-up, select "Internet Protocol Version 4 (TCP/IPv4)". The Internet Protocol Version 4 (TCP/IPv4) Properties pop-up appears.

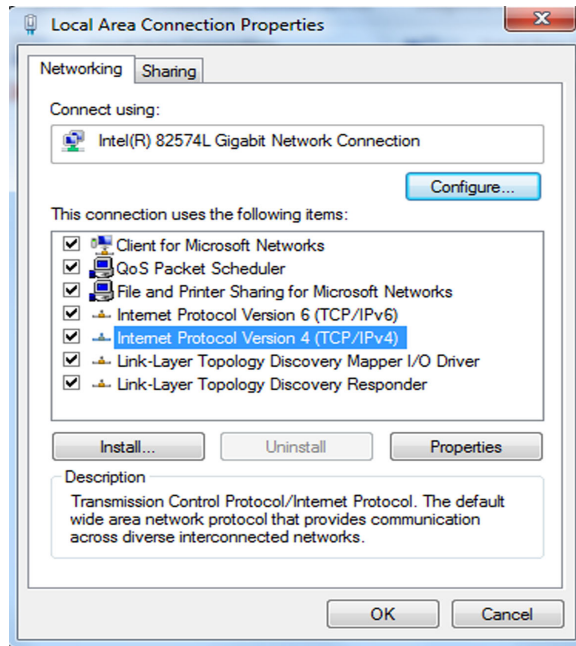


Figure 3-15. Local Area Network Properties Pop-Up

The Internet Protocol Version 4 (TCP/IPv4) Properties pop-up appears.

Setting up the Windows network (continued)

6. From the Internet Protocol Version 4 (TCP/IPv4) Properties pop-up, select the “Use the following IPv4 address:” radial button.

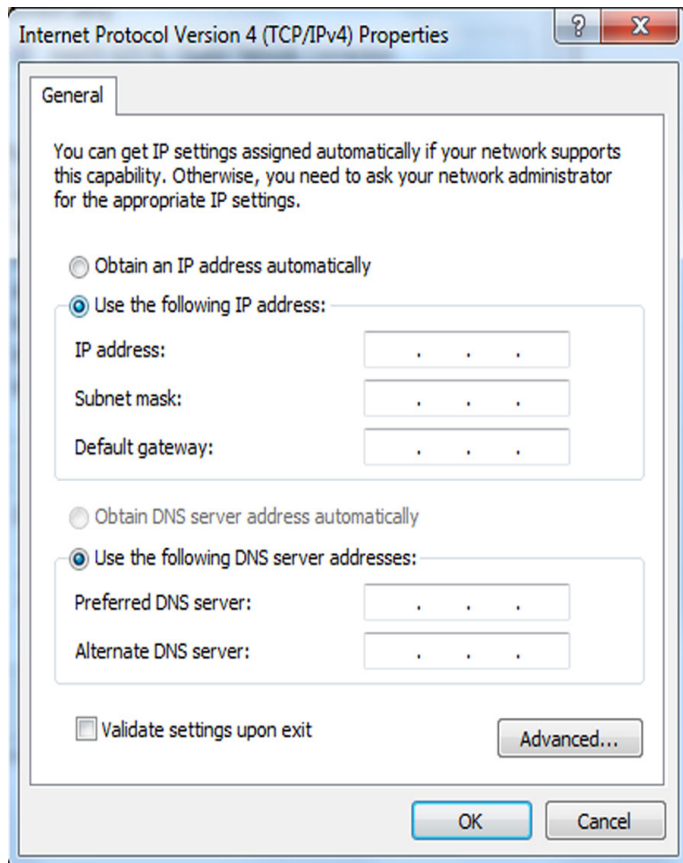
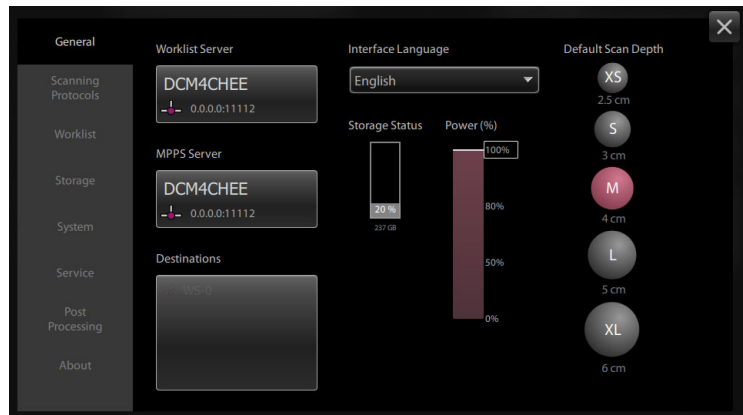


Figure 3-16. Protocol Version 4 (TCP/IPv4) Properties Pop-Up


7. Type in the following information:
 - IP address (IPv4 address)
 - Subnet prefix length
 - Default gateway

Setting up Connectivity between Invenia ABUS 2.0 and destinations

1. Refer to the Site Survey Planner for additional information.
2. Touch the Invenia ABUS 2.0 configuration icon, then the General tab.
3. Touch each Server button and enter the appropriate IP address and port numbers.
4. Touch the Destination button to add a new destination.



Customizing the Invenia ABUS 2.0

To access system customization, tap the configuration (gear) icon  in the lower, right-hand corner of the screen. Then select the desired Configuration Menu by touching one of the following buttons on the left-side of the menu:

- General
- Scanning Protocols
- Worklist
- Storage
- System
- Service (only displays when Service logs in with the Service Login and Password)
- Post-Processing
- About

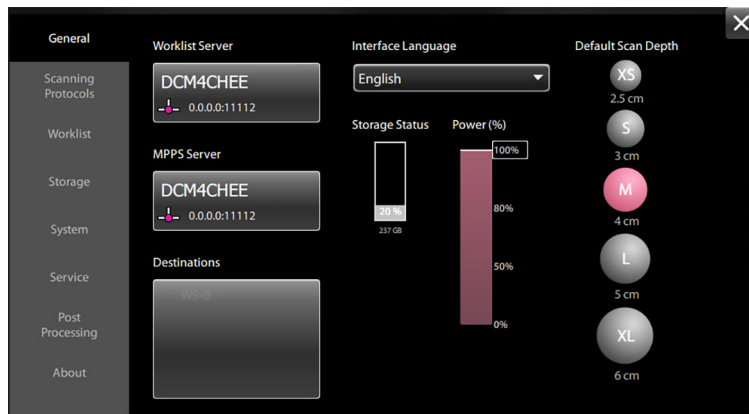


Figure 3-17. General Menu

General Configuration

From the General Configuration menu, you can configure the following:

NOTE: Only menu items in bold are described in this version of the Proprietary Service Manual.

1. **Worklist server location**
See 'Setting up Connectivity between Invenia ABUS 2.0 and destinations' on page 3-55 for more information.
2. MPPS Server location
3. **Destinations (single or multiple)**
4. **User Interface operating language**
5. **Manage System Storage.**
The Status gauge displays the Invenia ABUS 2.0 hard disk capacity (250GB)
6. Acoustic Power (%)
7. Scan depth (4.0cm is default)

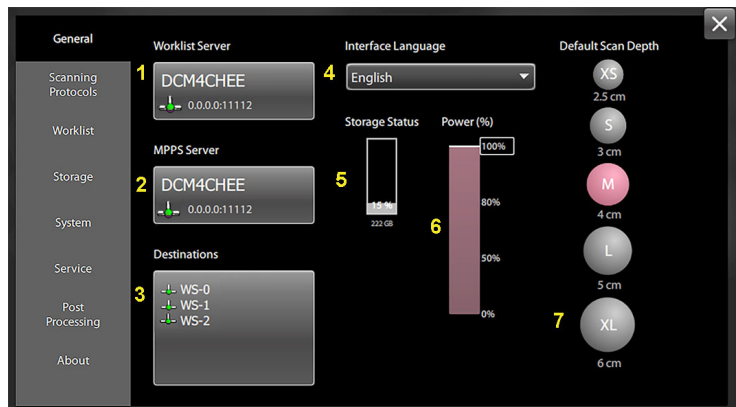


Figure 3-18. General Configuration Menu


General Configuration (continued)

Destinations

The Invenia ABUS 2.0 now supports the transfer of exams to more than one destination. This feature allows multiple destinations to be configured at the time of installation. The user can then select the destination that the exam will be transferred to, from the predefined worklist at the time exams are started.

1. Manually record all the IP addresses and port information of the destinations you will be pushing files to.
2. Sign in with your service account on the Invenia ABUS 2.0.

To add a destination

- a. Touch the **Configuration** button  and on the **General** tab touch the destination button.
- b. Touch the “+” button to add a new destination.

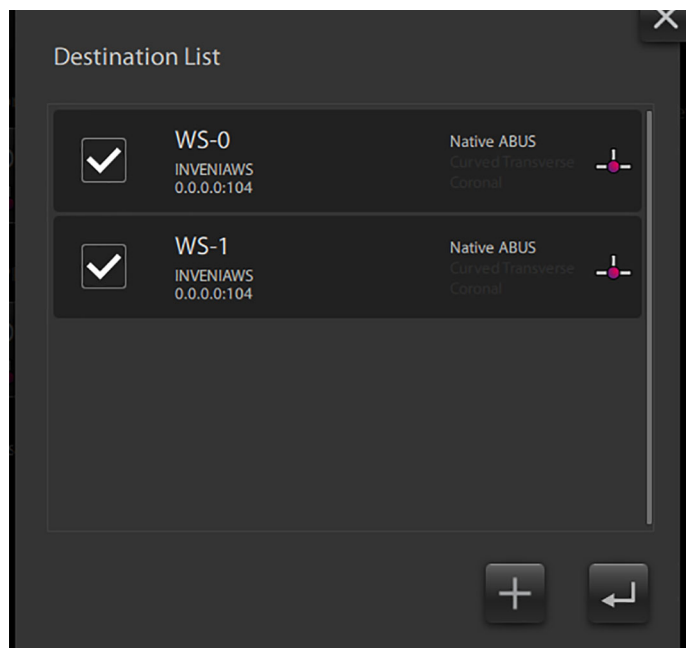


Figure 3-19. Destination List


- c. Enter a unique **Name** for display in the patient entry screen for the user to select at the time an exam is started. The name should have real meaning to the users who will select it as part of performing exams.

Figure 3-20. Destination Device

- d. Enter the **AE Title**, **IP Address** and **Port**.
- e. Touch the **Return** button  to save the changes.

NOTE: *Export Images Settings: Unless customer is planning on reading the Invenia ABUS 2.0 images on PACS do not modify the default settings.*

To delete a destination

- a. Touch the **Configuration** button , and on the General tab touch the **Destination** button.
- b. Select the Destination name to be deleted.
- c. Touch the **Trash** button to delete the entry.



User selection of destination for new exam.

- The default destination is the last one to be selected in the destination configuration (shown as highlighted)
- Any destination configured in the destination list can be selected prior to completing the exam information (manual or worklist). The drop down list is shown below.

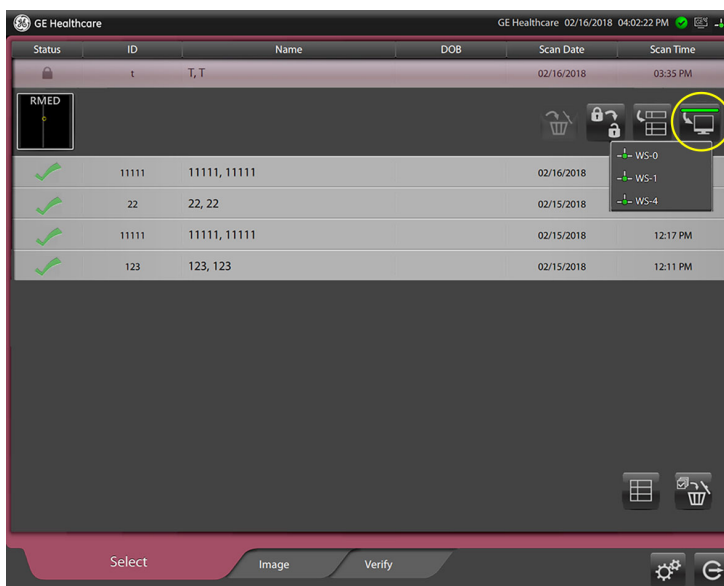


Figure 3-21. Selecting destination

User selection of destination to resend exam

- Display the completed exams list.
- Touch an exam that needs to be resent to a different destination.
- Touch the **Resend** button.
- Select the desired destination from the displayed list.

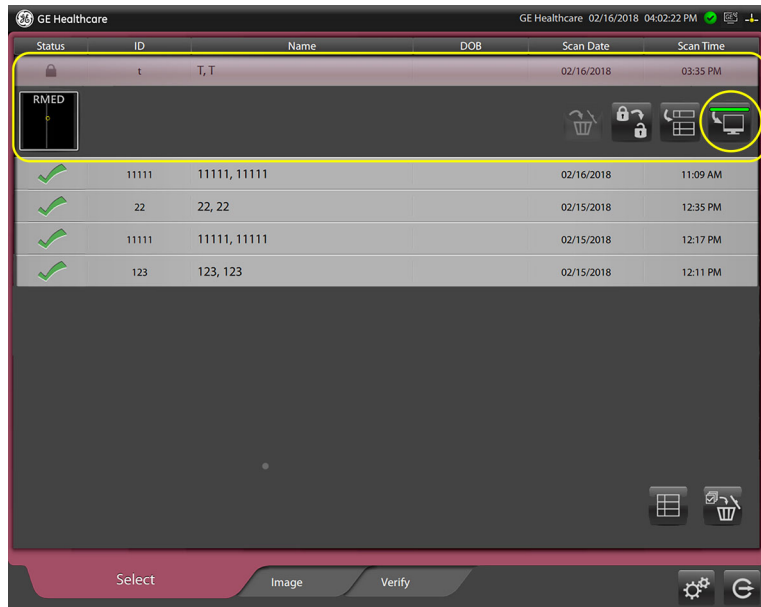


Figure 3-22. Completed Exams

Language Selection

The User Interface Language for input and display can be selected from the drop down list:

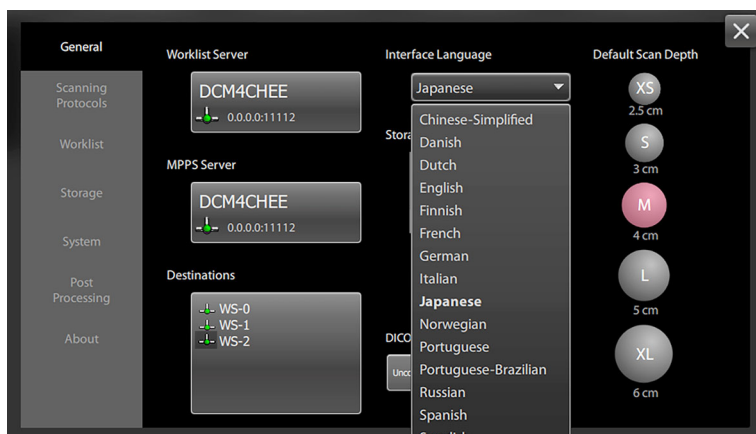



Figure 3-23.

Default Interface Language setting is English.

To change the User Interface Language:

1. Touch the **Configuration** button , and on the General tab select a language from the Interface Language Dropdown List.
2. At the prompt, **please restart for language changes to take effect**, power down the system by pressing the power button on the front of the unit.
3. Power on the system back on for the Interface Language selection to be applied. The onscreen keyboard will now display any language specific characters and user prompts and displays will be in the selected language.

NOTE: *An account with a password set with any specific language characters may not be accessible if the language setting is changed on the system.*

General Configuration (continued)

Date and Time Format

There are six date display formats and two time display formats available to be selected, based on user preference.

Date Formats

07/30/1999

30/07/1999

30/07/99

1999/07/30

1999-07-30

Jun/26/1999


Time Formats

06:30:20 PM (12 Hour Clock)

07/30/99 18:30:20 (24 Hour Clock)

Default settings are US date format (MM/DD/YY) and 12 hour clock (HH:MM[am|pm]).

To set the Date and Time:

1. Touch the **Configuration** button .
2. On the **System** tab, select the date and time display format from the dropdown lists of **Date** and **Time**, respectively.

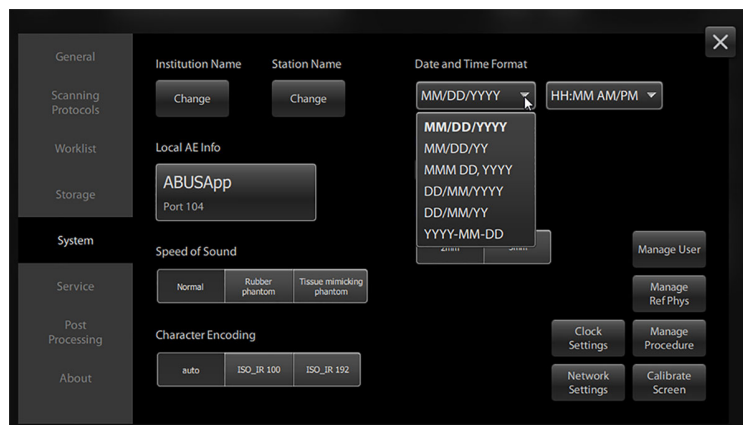


Figure 3-24. Date and Time Format

Scanning Protocols

The Scanning Protocol menu allows you to select from one of the four (4) preset workflow protocols:

- Perform Exam Starting on the patient's right
- Perform Exam Starting on the patient's left
- Perform complete exam from only the patient's right side (right side of the bed only)
- Perform complete exam from only the patient's left side (left side of the bed only)
- Specify location of the transducer's start position.

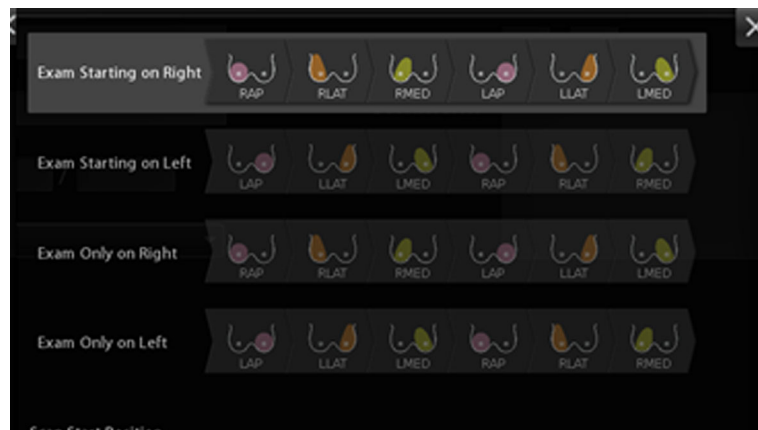


Figure 3-25. Scanning Protocol Configuration Menu

Worklist Configuration

The Worklist Configuration menu allows you to specify how the DICOM Worklist is displayed.

- Date Filter (Today, This Week, This Month)
- Modality Filter (Ultrasound, ABUS, All)
- Optional Worklist Columns:
 - Procedure
 - Referring Physician
 - Accession Number
 - Study ID
- Default Select Page (Worklist, Work Item Input)
- Procedure DICOM Tag (Administrator)

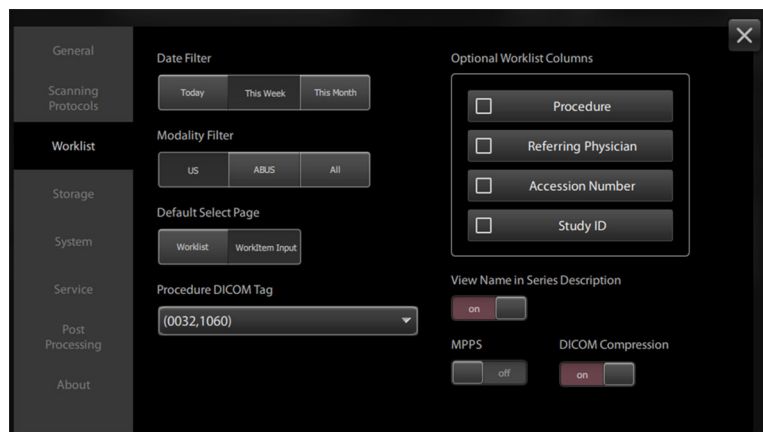


Figure 3-26. Worklist Configuration (User)

Worklist Configuration (continued)

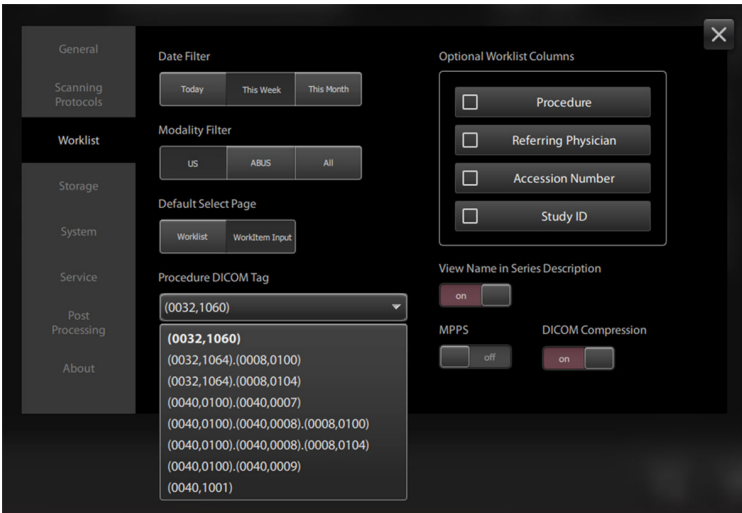


Figure 3-27. Worklist Configuration (Administrator)

The Procedure DICOM Tag (also known as the Modality Performed Procedure Step) is received from the Modality Worklist. A complementary service to Modality Worklist, Modality Performed Procedure Step (MPPS) enables a modality to send a report about a performed study, including data about the acquired images (begin/end time, duration, type of study, etc.). This facilitates better coordination of image storage servers by providing the server with a list of objects to send prior to or while actually sending such object.

Storage Configuration

The Storage Configuration menu allows you to configure how exam data is stored and deleted from the Invenia ABUS 2.0 hard drive. The Storage Forced Manual Cleanup lets you specify when the Invenia ABUS 2.0 will require exam data to be removed from the hard disk. The Auto Delete Shipped Data lets you specify the frequency to have exam data deleted from the Invenia ABUS 2.0 hard disk after it has already been successfully transfer to an imaging viewer. The following information is displayed:

- Storage Status
- Storage Forced Manual Cleanup (80%, 85%, 90%)
- Auto Delete Shipped Data (Never, After 3 months (90 days), After 1 month (30 days), or After 1 Week (7 days))
- Storage Warning

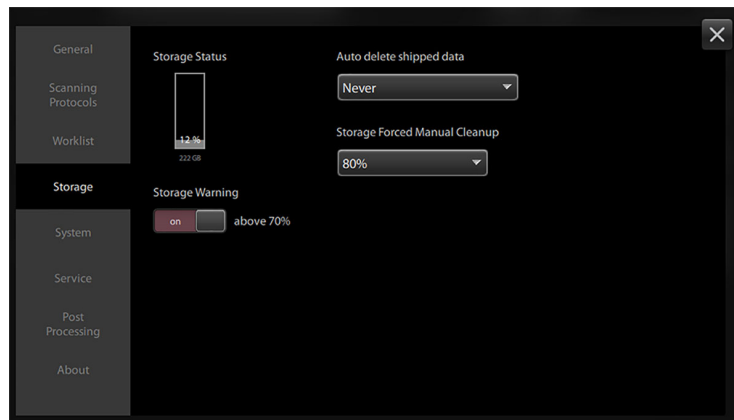


Figure 3-28. Storage Configuration Menu

Service Configuration Menu

From the Configuration Menu (Gears Icon), select **Service**.
The Service Configuration Menu appears.

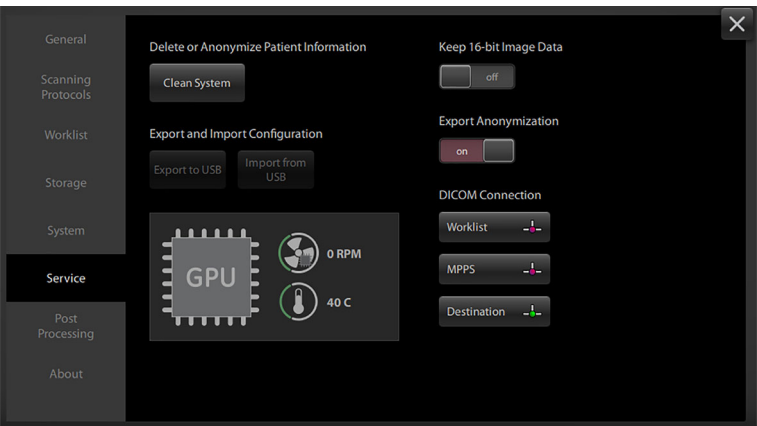


Figure 3-29. Service Configuration Menu

Table 3-7: Service Configuration Menu Functionality

Service Task	Description
Delete or anonymize patient information	Clean System: Completely removes all patient data out of the image data folder. Deletes any study on the Invenia ABUS 2.0.
Keep 16-bit data	ALWAYS set this to OFF .
Export Anonymization	On/Off -- When you export patient data to a USB drive, patient demographic information is removed.
GPU	<ul style="list-style-type: none">• Speed -- Speed of the GPU• Temperature -- Temperature of GPU and Motherboard
Export and Import Configuration	<ul style="list-style-type: none">• Export to USB -- Exports system configuration settings to USB.• Import from USB -- Imports system configuration settings to USB. NOTE: Reboot the system after importing the configuration.
DICOM Connection	<ul style="list-style-type: none">• Worklist -- DICOM Worklist Verify• MPPS -- DICOM MPPS Verify• Workstation DICOM Workstation Verify

About Page

The About Page shows the software version, lists 3rd Party Software used on the instrument. It also provides the online user manual through the Help “?” key.

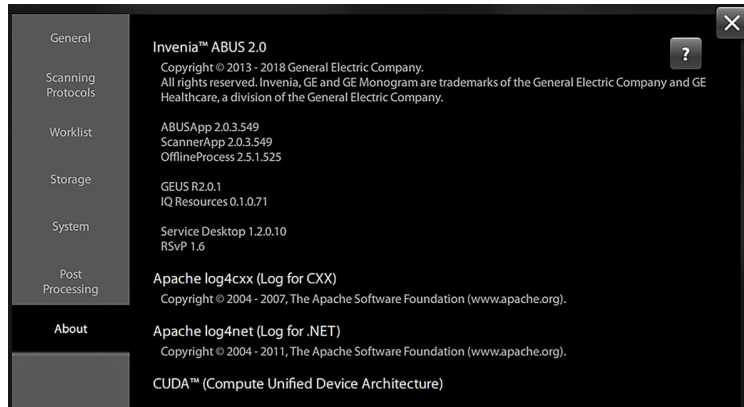


Figure 3-30. About Page

Checking connections between the Invenia ABUS 2.0 and destinations

1. Power down both the Invenia ABUS 2.0.
 - a. Boot up the destination first, then boot up the Invenia ABUS 2.0.
 - b. Log onto the Invenia ABUS 2.0. Look at the upper, right hand-corner of the Touch Screen and confirm that the Network Indicator is green.

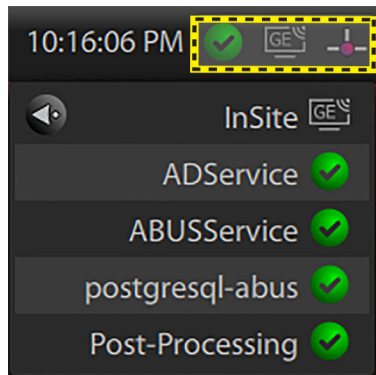


Figure 3-31. Network Indicator

2. Perform a scan on the Invenia ABUS 2.0.
3. At the Invenia ABUS 2.0, send a study from the software to the other destination:
 - a. Turn on system power, log in as a typical user, and run through the functional checks found in Chapter 4.
 - b. Perform a test study and end the exam. The study will transfer to the other destination.
4. At the other destination, confirm that the study was received from the Invenia ABUS 2.0.
5. At the other destination, transfer this study to PACS and confirm its receipt.

Paperwork after setup

NOTE: *During and after setup, the documentation (e.g. USB drives with documentation, User Manuals, Installation Manuals, etc.) for the Invenia ABUS 2.0 and the peripherals must be kept as part of the original Ultrasound system documentation. This ensures that all relevant safety and user information is available during the operation and service of the complete Ultrasound system.*

User's Manual(s)

Check that the correct User Manual(s) or CD with User Manuals, per software (SW) revision and language, for the system is included.

For a complete list of User's Manuals for Invenia ABUS 2.0, refer to Chapter 9 in this manual.

Product Locator Installation Card

NOTE: The Product Locator Installation Card shown may not be the same as the provided Product Locator card.

From the factory, a sheet with five Product Locator cards for transportation and one for Installation are included.



Mailing Address

GEHC - Americas
Product Locator - W523
P.O. Box 414
Milwaukee, WI 53201-0414

GIB, European Central Admin
Product Locator Cards
XEROX Office
VAKUUMTECHNOLÓGIAI GÉPGYÁR
FŐTÍ ÚT 14.1
1046 Budapest Hungary

Product Locator Card
Asia Service Operation
No. 1, Yongchang North Road
Beijing Economic and
Technologic Development Area
Beijing 100176 China


DESCRIPTION	PDA	MODEL	REV	SERIAL
		OCP	BS	ORD
		DISTRICT	CUSTOMER NO.	DATE (MO - DA - YR)

SHIPMENT

DESTINATION NAME AND ADDRESS

ZIP CODE

46-303268P1 Rev 14



Mailing Address

GEHC - Americas
Product Locator - W523
P.O. Box 414
Milwaukee, WI 53201-0414

GIB, European Central Admin
Product Locator Cards
XEROX Office
VAKUUMTECHNOLÓGIAI GÉPGYÁR
FŐTÍ ÚT 14.1
1046 Budapest Hungary

Product Locator Card
Asia Service Operation
No. 1, Yongchang North Road
Beijing Economic and
Technologic Development Area
Beijing 100176 China

DESCRIPTION	PDA	MODEL	REV	SERIAL
SYSTEM/LTD.		OCP	BS	ORD
		DISTRICT	ROOM	DATE (MO - DA - YR)

INSTALLATION

DESTINATION NAME AND ADDRESS

ZIP CODE

46-303268P1 Rev 14

Figure 3-32. Product Locator Installation Card (Example)

Chapter 4

Functional Checks

This chapter is designed to give the reader the ability to test the Invenia ABUS 2.0 functions. During new installations and Update Installations this chapter can be a great asset in determining if the Invenia ABUS 2.0 is working as it should.

General procedures

General Precautions



CAUTION

Invenia ABUS 2.0 requires all covers.

Operate this Ultrasound system only when all board covers and frame panels are securely in place. The covers are required for safe operation, good Ultrasound system performance and cooling purposes.

Overview

Some procedures are used more often than others. The intention with this section is to keep the most used procedures in one place.

Checking the Software Version

To check the version of software on the Invenia ABUS 2.0:

1. Log into the Invenia 2.0 2.0 software.
2. Click the configuration icon (lower, right corner of the Image tab) to open the System Configuration page.
3. Click **About** in the left column.

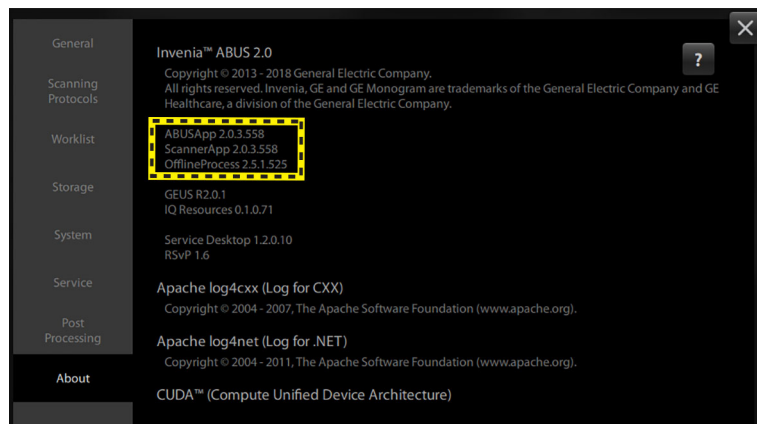


Figure 4-1. Invenia ABUS 2.0 Software Version

Power ON/Boot Up

Warnings



ALWAYS CONNECT THE ULTRASOUND SYSTEM TO A FIXED POWER SOCKET WHICH HAS THE PROTECTIVE GROUNDING CONNECTOR.



NEVER USE A THREE-TO-TWO PRONG ADAPTER; THIS DEFEATS THE SAFETY GROUND.



ENSURE THAT THE POWER CORD AND PLUG ARE INTACT AND THAT THE POWER PLUG IS THE PROPER HOSPITAL-GRADE TYPE (WHERE REQUIRED).



Invenia ABUS 2.0 Scan Station requires all covers.

Operate this Invenia ABUS 2.0 Scan Station only when all board covers and frame panels are securely in place. The covers are required for safe operation, good Ultrasound system performance and cooling purposes.



Use only power supply cords, cables and plugs provided by or designated by GE.

NOTE: *Do not cycle the Mains Power Switch ON-OFF-ON in less than five (5) seconds. When turning OFF the Mains Power Switch, the Invenia ABUS 2.0 Scan Station should de-energize completely before turning the Mains Power Switch ON.*

Connect AC (mains) Power to the Invenia ABUS 2.0

Connecting AC Power to the Invenia ABUS 2.0 ultrasound unit, involves preliminary checks of the power cord, voltage level and compliance with electrical safety requirements.

1. Ensure that the wall outlet is of appropriate type, and that the Power Mains Switch is turned off.
2. Uncoil the power cable, allowing sufficient slack so that the unit can be moved slightly.
3. Verify that the power cable is without any visible scratches or any sign of damage.
4. Verify that the on-site mains voltage is within the limits indicated on the rating label near the Power Mains Switch on the rear of the unit.
5. Connect the Power Cable's female plug to the Power Inlet at the rear of the unit.
6. Verify that the Power Mains Switch is in OFF position, if not, switch it OFF.
7. Connect the Power Cable's other end (male plug) to a hospital grade mains power outlet with the proper rated voltage, and the unit is ready for Power ON/Boot Up.

Switch ON the AC Power to Invenia ABUS 2.0

1. Switch ON the Power Mains Switch at the rear of the unit.



Figure 4-2. Power Mains Switch

2. Press once on the **On/Off** button on the Invenia ABUS 2.0 to boot the unit.



Figure 4-3. On/Off

Power shut down

When you switch off the unit by pressing the **Power** button, the system performs an automatic shutdown sequence.

NOTE: *If the system does not shut down by lightly pressing the Power button, you can press and hold down the Power button until the system shuts down.*

Moving and Transporting the Invenia ABUS 2.0

Moving the System

To move the system,

1. Position the articulating arm, Scan Head Assembly, and monitor and then lock into position.



Figure 4-4. Touch Screen and Articulating Arm Lock

2. Unlock the front and rear brakes.
3. Disconnect the power cord from the wall and from its connector on the rear of the system.
4. Disconnect the Ethernet cable from the wall and from its connector on the rear of the system.

NOTE: *The system weighs 103 kg (227 lbs).*



CAUTION

Secure the articulating arm and monitor prior to moving the system. Failure to secure the articulating arm and monitor could cause damage to the arm and/or monitor, other equipment, or other personnel.



CAUTION

Disconnect the power cord prior to moving the system. Failure to do so could cause you to run over the power cord or cause a tripping hazard.



CAUTION

Preparation before moving the system is important to minimize potential damage to sensitive components and to avoid safety hazards. Review the moving instructions prior to moving the system.



CAUTION

DO NOT park or leave the system unattended on a slope. Even if the rear brakes are locked, the system may slide down a ramp.

Transporting the System

Use extra care when transporting the system using vehicles. In addition to the instructions used when moving the system (see 'Moving the System' on *page 4-7* for more information), also perform the following:

1. Only use vehicles that are designed for transport of the Invenia ABUS 2.0.
2. Load and unload the system to a vehicle parked on a level surface.
3. Ensure that the transporting vehicle can handle the weight of the system plus the passengers.
4. Ensure that the load capacity of the lift (a minimum of 103 kg [227 lbs] is recommended) is capable of handling the weight of the system.
5. Ensure that the lift is in good working order.
6. Secure the system while it is on the lift so that it cannot roll. Use either wood chocks, restraining straps, or other similar types of constraints. Do not attempt to hold it in place by hand.

NOTE: *Strap the system below its handle so that the system does not break loose.*



Never ride on the lift with the system. A person's weight coupled with the weight of the system may exceed the load capacity of the lift.

7. Employ two to three persons to load and unload safely from a vehicle.

Transporting the System (continued)

8. Load the unit aboard the vehicle carefully and over its center of gravity. Keep the unit still and upright.

NOTE: *Do not lay the unit down on its side.*

9. Ensure that the system is firmly secured while inside the vehicle. Any movement, coupled with the weight of the system, could cause it to break loose.
10. Secure system with straps or as directed otherwise to prevent motion during transport.
11. Prevent vibration damage by driving cautiously. Avoid unpaved roads, excessive speeds, and erratic stops or starts.

At the new location

When the unit is in place at a new location:

1. Lock the wheel brakes.
2. Position the Articulating Display Arm, Scan Arm, and Scan Head Assembly away from a walking or work area.
3. Position the Scan Arm and Scan Head Assembly at the lowest position.

Where are the User Manuals and the Service Manual?

Both the User Manuals and the Service Manual may be downloaded from the Common Documentation Library.

You can download manuals from the [Common Documentation Library](http://www3.gehealthcare.com/en/Support/Support_Documentation_Library) (http://www3.gehealthcare.com/en/Support/Support_Documentation_Library).

Functional checks

Overview

This section describes the functional checks used with the Invenia ABUS 2.0. Functional checks are used to verify that the product works as specified after performing maintenance procedures. Functional checks may also be used during troubleshooting.

Performance Functional Checks

Power On/Boot Up Functional Check

Confirm that the system:

- Powers on when you press the On/Off/Standby control.
- That the transducer moves across the Scan Head Assembly.
- That the software runs through its initialization.
- And that each user type (User or Admin) can successfully login to the system.

Power Shut Down Functional Check

Confirm that the system exits the application and powers down.

Transducer Functional Check

Ensure that the transducer:

- Upon Power Up moves across the Scan Head Assembly.
- That the lights on the Scan Head Assembly light up.
- That the Transducer images as a scan is being performed.
- That the Transducer generates a 3D Volume.

Performance Functional Checks (continued)

B-Mode Functional Checks

Confirm that the system:

- Performs a B-Mode scan.
- Places B-Mode imaging parameters on the Touch Screen Monitor.
- Images evenly across the entire Touch Screen.

3D Volume Functional Checks

Confirm that the 3D Volume:

- Gets generated after each Scan View performed.

Performing the Exam

Confirm that the system can:

- Login the User.
- Access the Worklist and/or Enter Patient information manually.
- Perform the exam.
- Verify the exam.
- Send the exam to the Workstation / PACS.
- Perform Query/Retrieve process to PACS

Mechanical Functions Checks

Scan Head Assembly Functional Checks

Ensure that the Scan Head Assembly:

- Adjusts the Image Orientation to the Scan View being performed.
- Compression buttons work as specified.
- Start button initiates the scan.
- Stop button stops the scan.
- Rotates 360 degrees.
- Arm locks into position after compression has been applied.

Articulating Arm Functional Checks

Ensure that the Articulating Arm:

- Can be repositioned easily.
- Can be moved up/down with ease.
- Can be locked into position for transport.
- Can support the Scan Head Assembly.

Touch Screen Monitor Functional Checks

Ensure that the Touch Screen Monitor:

- Can be used to adjust the Scan View workflow.
- Can be used to specify Scan Depth.
- Can be used to type in Patient information.
- Doesn't drop any pixels.

Casters (Wheels) and Brakes Functional Checks

Examine the wheels frequently for defects to avoid breaking or jamming and the brakes lock.

Connectivity Functional Checks

Confirm the following:

- Exams transfer successfully
- InSite is active
- DICOM Worklist functions
- DICOM MPPS functions

For additional information see the Invenia ABUS 2.0 Basic User Manual (PN: 4700-0041-XX)

Chapter 5

Components and Functions (Theory)

This chapter examines the Invenia ABUS 2.0 architecture. It first identifies physical elements and then discusses the function of elements.

Introduction

Overview

This section identifies Invenia 2.0 device key elements.

The Invenia 2.0 is a device designed to perform ultrasound-scanned volume imaging of the breast.

The system has a cart, an articulating display arm with touch screen monitor, scan arm and a scan head with an integrated ultrasound transducer. The cart holds the Dual Box Chassis housing the two major electronics assemblies: the Ultrasound Box, and the PC Box.



Figure 5-1. Invenia ABUS 2.0

Key to numbered items in Figure 5-1:

1. Locking Casters
2. Base
3. Dual Box Chassis containing PC Box and Ultrasound Box
4. Weight Tower column
5. Service Table
6. Touchscreen Monitor mounted on Display Arm
7. Scan Arm
8. Hinge
9. Ball Joint (electronically lockable) supporting Scan Head
10. Scan Head with handles, housing Transducer

The following is a quick summary of the key elements and their major functions:

PC Box

The PC Box contains a system power supply, a PC motherboard with GPU (graphics processing unit) that image-processes 128 channels of ultrasound data from the cMST board. The GPU also performs graphics processing for the operator display. The PC software originates commands sent by USB 2.0 to the controllers for the Locking Ball Joint, the Scan Head and the Weight Tower internal motors or solenoids.

The PC Box communicates with the Scan Head Controller over a USB 2.0 link dedicated for that purpose. This USB cable is routed from PC to the Ultrasound Box. There its USB signals are routed in a custom (non USB connector) cable to the Weight Tower, and from there up the Arm to the Scan Head. A second PC USB link to the U/S Box is dedicated for Weight Tower control, and in the same way is connected and routed from the U/S Box to the Weight Tower.

Ultrasound Box

The Ultrasound Box contains three major electronics boards: 1) the cMST, 2) the MPSB Relay Board (transducer switching interface), and 3) the MFEPS power supply board with MCI daughterboard for cables to the Scan Head and Weight Tower motors and solenoids.

The cMST board handles the ultrasound analog signals, controls the relays in the MPSB Relay Board, and provides the control logic for the MFEPS power board. The cMST transfers

ultrasound data to the PC Box through a PCI Express connection.

The MFEPS power board gets input power from the PC Box's ACDC assembly, and it outputs all the low voltages needed by the cMST board. It supplies 12 VDC power for the U/S Box fans and 5 VDC for the MCI board. The board's daughter board, the MCI board, forwards the PC's motor control commands over USB protocols to the Weight Tower and Scan Head. The MFEPS also provides all voltage supplies needed to drive the ultrasound transducer.

The MSPB Relay Board handles switching between the ultrasound transducer in the Scan Head and any (future) auxiliary transducer.

Scan Head

The Scan Head contains the ultrasound transducer and the mechanism to mechanically scan the transducer sideways. The Scan Head Control board receives high level commands from the PC and performs the low-level local control to drive the scan stepping motor to move a transducer across the breast to acquire a sequence of 2D image slices that together represent a volume of tissue. This controller also monitors user interface activity at the Scan Head (the pushbuttons) and relays the pushbutton states to the PC. It also operates an electro-mechanically lockable Ball Joint fixing the scan head position, when commanded to do so by the PC.

Weight Controller

The Weight Control board is located within the Weight Tower. The board manages an electro-mechanical scan arm vertical locking mechanism and an automatic Scan Head weighting (compression) mechanism under command of the PC Box.

As mentioned before, the PC Box communicates with the Weight Controller over a USB 2.0 link dedicated for that purpose. This USB cable is routed to the Ultrasound Box where the USB signals are routed alongside other signal lines in a custom cable to the Weight Tower and Weight Controller board.

General physical design of the ABUS 2.0 system

The following diagram is a high-level view of the major blocks in the ABUS 2.0.

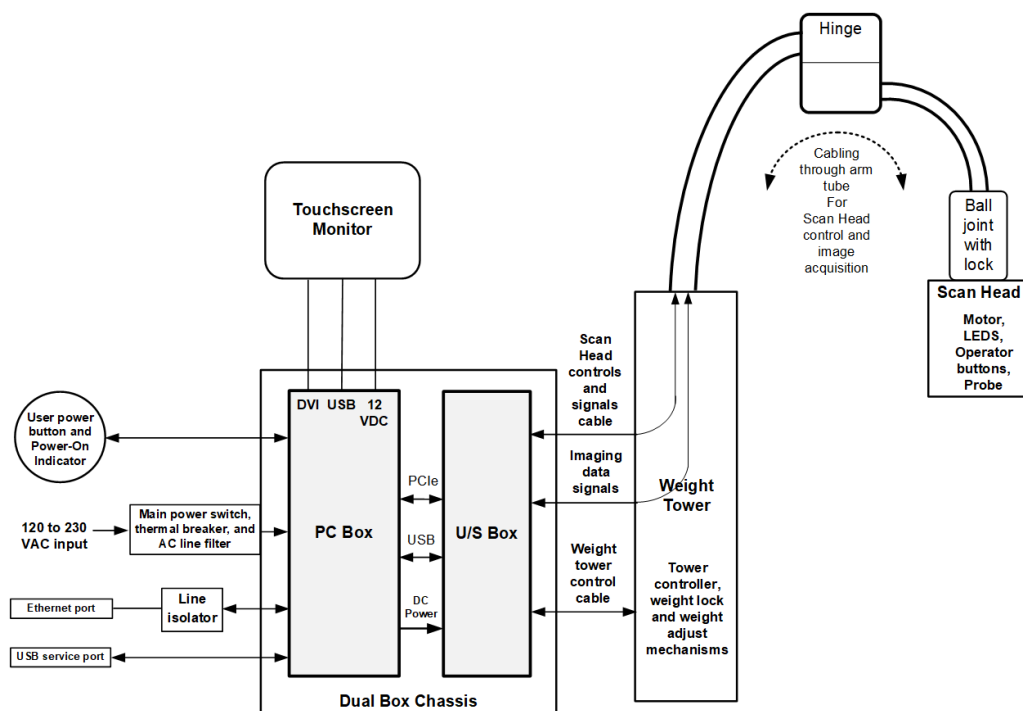


Figure 5-2. Invenia 2.0 block diagram

Physical / mechanical main elements

This section outlines the major pieces in the ABUS 2.0 system.

Major physical assemblies

The system's main physical elements are:

- Base (with casters, and fan filter)
- Dual Box Chassis (contains Ultrasound Box (providing front end electronics and PC Box (providing back end electronics))
- Service Table and covers
- Weight Tower (providing sliding Scan Arm, adjustable compression pressure to Scan Head, support for operator)

- touchscreen monitor assembly, and conveying cabling to Scan Head and Display)
- Scan Arm from the Weight Tower, providing support for, and adjustment of, Scan Head; includes electronically controlled lockable ball joint
- Scan Head Assembly including Scan Head with Transducer, and operator control buttons

Electrical, electronic, and computer main elements

These are contained inside the Dual Box Chassis. The two boxes are:

- Ultrasound Box containing the cMST board for ultrasound processing, MFEPS power board, and MPSB Relay Board
- PC Box containing the computer motherboard and associated components such as GPU and SSD, and the ACDC power supply box

Controls, indicators, and display

The system controls and their locations are:

Control	Location	Endpoint
ON/OFF Power Switch on chassis	lower	This connects to the PC motherboard
Display (Touch Screen)	on ergo display arm	This connects to the GPU card via DVI cable, and via USB to Motherboard
Scan Head pushbuttons	on Scan Head arms	These are sensed by the Scan control PWA within Scan Head. The board reports their state to the Motherboard via USB
Power Check OK LED	on top of PC Box	Driven from ACDC box; lights when all outputs from ACDC box are operational

General theory of operation

Introduction

The main purpose of the ABUS is to scan breast tissue and collect information about its condition. To do that, the ABUS performs ultrasonic imaging. That is done as follows:

The Transducer in the Scan Head has an array of 128 piezoelectric crystals. Each of the piezoelectric channel's signal is sent by an individual wire in the transducer cable back to the Ultrasound Box for processing.

The PC the GPU card convert the digital scan data into image form. The images are shown on the operator monitor and are stored in the PC memory in the SSD (solid state drive). From there the images can be sent to a compatible image viewer such as the GE Workstation for ABUS 2.0.

Image handling

For imaging, additional image enhancement, noise reduction, and speckle reduction algorithms are performed. The data is then converted to display scan data for the final image output.

The following figure outlines general flow of data from Invenia ABUS 2.0 to external systems for image data handling.

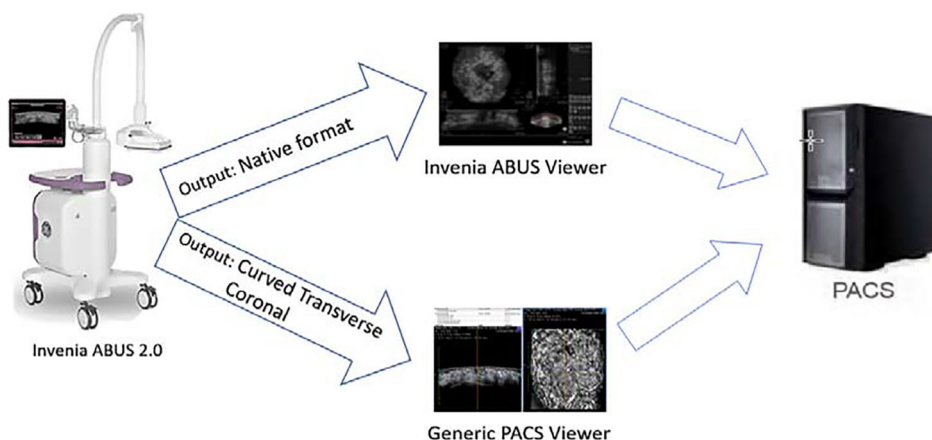


Figure 5-3. General image data flow

Image file management

Images are placed in data files for a patient. These files are automatically stored on a solid-state drive in the PC. They can be copied over Ethernet to a separate image viewing device (such as a GE Workstation) for image review and diagnosis, or to a USB drive, or to a PACS for storage.

System elements and their operation

This part of the manual discusses each major component in the architecture and explains how it operates.

Dual Box Chassis

The Dual Box Chassis has one compartment for the ultrasound components, and one compartment for the computer (PC) components and main power supply. The Ultrasound Box and the PC Box are each separately removable for servicing. This can be done after removing the outside covers of the Dual Box Chassis.

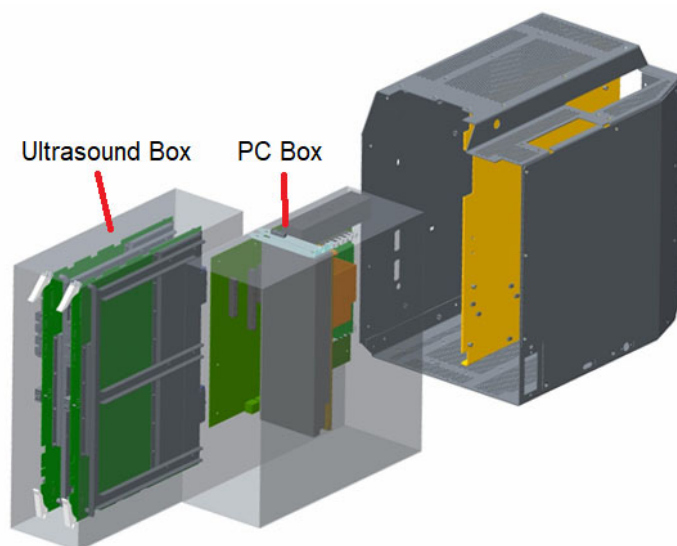


Figure 5-4. Dual Box Chassis

The Dual Box chassis design has upwards vertical airflow in all compartments to cool the ultrasound components, the PC Box's Motherboard and GPU, and the power supply and power supply PWAs.

The chassis grillwork on the bottom has round holes permitting air intake from below, through the removable air filter.

Ultrasound Box

Major components and their functions and operation

The main items in the Ultrasound Box are:

Table 5-1: Main components in the Ultrasound Box

Component	Purpose
cMST board	Provides ultrasound 128-channel processing
MFEPS board	Provides power to the cMST board and the Scan Head and Weight Tower
Motor Control Interface (daughterboard on the MFEPS board)	Routes commands from the PC to the motor control boards in the Scan Head and Weight Tower
MPSB Relay Board	Uses relays to switch signals from the cMST board to either the Scan Head transducer or (in future) an auxiliary transducer.
Ultrasound box fan tray	Provides air exhaust from the U/S Box for cooling

Ultrasound Box thermal and cooling

The Ultrasound Box has four fans, as shown in Figure 12. These pull air up into the box from its bottom; at the chassis top, air is exhausted under the Service Table. They are mounted on the Fan Control board in the Ultrasound Box, and commanded by the cMST board using an I2C interface. The 12 VDC power for the fan board comes from the MFEPS board.



Figure 5-5. Ultrasound Box fan tray

All fans and some board temperatures are monitored by system software through the PC Box Motherboard and the data can be viewed through the CSD (Common Service Desktop) on the touchscreen monitor

PC box

System control and digital computing functions are handled by the components in this chassis.

The PC Box contains a computer motherboard with CPU, RAM, solid state drive, and various support boards.

Mechanical design

The PC Box sits vertically, with air flow coming in from the bottom. Air is pulled up through the box by fans at the top. The box is removable as a single object; it is separate from the Ultrasound Box.

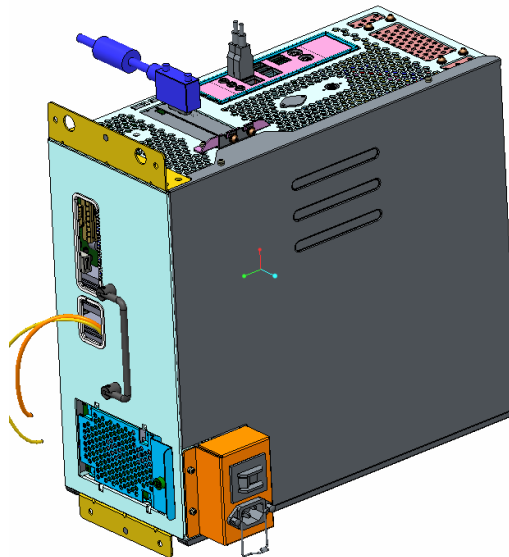


Figure 5-6. CAD view of PC Box

Major PC Box components and their functions and operation

The main items in the PC Box are:

Table 5-2: PC Box components

Component	Purpose
ACDC input box	Handles AC line power input; has main power switch with breaker and line filter. Connects to ACDC Box
ACDC box	Contains ACDC Power Supply feeding the ATX Power Control board (PWA) that distributes multiple voltage sources to the system
Motherboard (Extended-ATX form factor)	Has the CPU and provides various I/O
GPU (Graphics Processing Unit) card	Performs all graphics handling for the display
Solid State Drive data and power interface board	Connects power and data to the SSD
Solid State Drive	Provides mass data storage
Cooling fans	Provide air flow from the PC Box to cool it

Computing electronics in PC Box

Motherboard and CPU

Computing in the Invenia ABUS 2.0 is done in two places, the PC Box and the Ultrasound Box. PC Box computing is done by the Motherboard.

The ABUS is controlled by GE ABUS 2.0 application software running on the PC under the Windows 7 Embedded operating system.

GPU board

The GPU plugged into the Motherboard handles all graphics processing.

The GPU provides a DVI output for the touchscreen monitor. This GPU output connector is adjacent to the I/O Panel at the top of the PC Box.

SSD (Solid State Drive)

The PC Box has one Solid State Drive mounted within the Motherboard Compartment and the drive is accessible without dismantling the PC Box.

The solid-state drive stores the boot code for the system, the Windows 7 operating system, and the ABUS 2.0 application software that controls the ultrasound machine, the operator interface (user interface on the monitor) and user control pushbuttons.

Interface ports and connectors on PC Box

USB ports

The PC sends its commands over USB to the motor control board in the Scan Head and the motor control board in the Weight Tower.

The PC motherboard USB ports used for this are connected by cables to the Ultrasound Box MFEPS board USB ports dedicated for this.

An additional normal USB 2.0 port connects the PC to the Ultrasound Box's MFEPS power supply to allow the PC to monitor MFEPS status.

Ethernet network port

The Ethernet port on the PC I/O panel is cabled to the NET and USB relay board. That board line-isolates the Ethernet port.

Touchscreen monitor cabling

The monitor has three cables:

- 1) Power cable (female plug end) to the PC Box ACDC board,
- 2) Display graphics cable (DVI-D) to the PC Box GPU,
- 3) Touchscreen signals cable to the PC Box (USB).

PCIe connector for cable to U/S Box cMST board

The PC Box has an external-mounted PCIe connector, that provides signals to the PCIe cable between it and the U/S Box cMST board.

PC Box thermal and cooling

PC Box fans

For the PC section, two fans pull air up into the PC Box. Air exits from that box under the Service Table. The Service Table re-directs airflow and provides protection against liquid spills. The air also warms any containers sitting in the table holes that hold the coupling lotion/gel. The fans are driven from the PC Box Motherboard and are monitored by it. Fan failure is reported in the ABUS 2.0 Diagnostic software.

CPU heatsink

The CPU is equipped with a 2U passive heatsink. Its effectiveness depends on sufficient airflow from the Fan Tray. Therefore, system filter condition is important to proper CPU operation and lifetime.

GPU airflow

The GPU is the hottest component in the PC Box. Therefore, its longevity depends on having sufficient cooling air flow. For this reason it is important to keep the air filter clean.

Weight Tower

This section first identifies the purpose of the Weight Tower, describes key functions, lists the major components, and then describes the Weight Tower operation.

Key functions of Weight Tower

The Weight Tower physically supports the Scan Arm and Scan Head. It contains mechanical and electronic components to support operator positioning of the Scan Arm, and adjustment of Scan Head compression force.

Specifically, the Weight Tower:

1. Supports the Scan Arm and sliding adjustment of vertical and rotational position of the Scan Arm
2. Counterbalances the weight of the Scan Arm so it can be moved easily
3. Provides locking of Scan Head position
4. Provides adjustable compression pressure through an electromechanical system

Mechanical design

The mechanical design of the Weight Tower is described throughout the following sections.

Major components and their functions and operation

The main components in the Weight Tower are:

Table 5-3: Weight Tower main components

Component	Purpose
Turret	Supports the Scan Arm lower tubing and allows the Scan Arm to be raised or lowered and to be rotated freely
Upper Weight Assembly	Part of the counterbalancing mechanism for the Scan Arm.
Lower Weight Assembly	Contains the lower weight cylinder, stepped motor with lead screw to the Upper Weight, the motor and solenoid control board, the hex latch components, and the hex latch solenoid
Various pulleys and associated cables	These form an analog of a fulcrum lever that can be balanced by electro-mechanically shifting a weight

Tower operation before and during a scan

In setting up for the scan, the operator first sets up Scan Arm height, then adjusts Scan Head compression:

- The Tower supports height adjustment by enabling the operator to slide the Scan Arm up or down (and some rotation is enabled)
- The Tower balances the weight of the Scan Head Assembly and Transducer to make it easier for the operator to handle them
- The height adjustment mechanism supports performing compression at the selected height
- The Tower supports compression through its ability to have the operator command more or less pressure, by pressing the adjustment buttons on the right handle
- The Tower mechanism supports the goal of controlling the compression applied to the patient during an ultrasound examination, with the goal of keeping it nearly constant during a scan

The following steps outline the sequence for scan setup and pressure control.

1. Scan Arm positioning (manual height adjustment by operator)

Operator places the Scan Head Assembly and Transducer in position. This involves vertical movement of the Scan Arm. The Scan Arm is attached to the weight assembly at its base, so this adjustment moves the entire weight assembly up or down as a whole. However, it does not yet adjust weight.

2. Compression setting (operator command causes ABUS to adjust weight)

The operator may now press either of the pressure adjustment buttons to command the ABUS to increase or decrease pressure.

This action first locks the vertical position of the Scan Arm and the weight mechanism attached at its base, and then balances the weights to create the desired compression step value.

Vertical locking

The system does vertical locking so the Scan Head Assembly cannot move vertically during the scan. Also, the system sends a signal commanding the Ball Joint to lock position, so that the Scan Head cannot rotate during the scan.

Weight balancing

After vertical locking, the system then balances the weights in the Tower to provide the desired compression value (which can be one of three weight 'steps'). The balancing is done by adjusting positions of the weights within the weight assembly.

3. Start Scan

- a. Operator presses the Scan Button
- b. ABUS locks the current vertical position of the Scan Arm.
- c. The computer begins the scan.

At any time during the scan, the operator can release the locking of the Lower Weight by pressing the Abort Button (the red button located on the left-hand arm of the Scan Head Assembly). Then the Scan Arm is free to move.

Scan Arm Assembly

Scan Arm main parts

Figure 22 shows the key parts of the Scan Arm.



Figure 5-7. Scan Arm parts

- 1.Lower tube
- 2.Hinge assembly
- 3.Upper tube
- 4.Ball Joint assembly
- 5.Scan Head

This assembly is comprised of the lower arm tubing (1) from the Weight Tower, a hinge (2) at the top, upper arm tube (3), ball joint mechanism (4) for angular adjustment of Scan Head, and the Scan Head (5).

The Scan Arm can be slid up or down to position the Scan head, and rotated by means of the Hinge.

The Ball Joint on the end of the Scan Arm enables the operator to swivel the Scan Head and at start of a scan, the joint is electronically commanded to lock position.

The Scan Head holds the Ultrasound Transducer and contains the mechanism that moves the Transducer horizontally in a scan. It also has a lower portion having a magnetically-attached mesh screen to compress the breast tissue. The Scan Head arms enables position adjustment and have operator control pushbuttons.

Scan Arm parts functions

The Scan Arm Lower Tube (1) and Upper Tube (3) provide mechanical support for the Scan Head (5). The tubes are hollow and contain cabling to the Scan Head.

The bottom of the Lower Tube passes through a guide tube inside the Weight Tower; this allows the Lower Tube to slide up or down. The Lower Tube bottom is attached to a weight counterbalancing assembly, which enables the whole Scan Arm to be raised or lowered easily by an operator. The weight assembly also provides compression adjustment functions.

Hinge assembly

The top of the Lower Tube holds the Hinge Assembly (2) that enables horizontal rotation (swiveling) of the Upper Tube around its vertical center. The hinge moves freely, but is not loose and unstable. The hinge does not lock.

Ball Joint

The bottom of the Upper Tube supports the Ball Joint assembly from which the Scan Head hangs. The purpose of the Ball Joint is to enable the operator to swivel the Scan Head, and for the system to lock the Scan Head position before and during a scan.

The center of the Ball Joint is hollow to allow three cables to pass through it: the transducer cable and two smaller control board cables. If there is damage to a cable, it is not singly replaceable-instead, the entire Scan Arm must be replaced as a unit.

The Ball Joint can be disassembled but due to complexity is not field serviceable. Disassembly is not recommended.

Scan Head

Figure 5-7 identifies the parts of the Scan Head.

The Scan Head physically supports the Ultrasound Transducer, provides an operator with means for adjusting Transducer position, and has operator controls.

The Transducer is held in the Scan Head's center compartment area. The ABUS 2.0 uses the C15-6XW Reverse Curve Transducer. Each Transducer is serial numbered and its ID can be read from system diagnostics.

The head has two handles for position adjustment, and each handle has operator control pushbuttons.

The Scan Head has at its bottom a disposable magnetically-attached frame holding a fine-mesh Single-Use Stabilizing Membrane. During a scan, the head slides the Transducer over the membrane, which the system presses against the surface of the breast with adjustable compression. To prepare for a scan, the operator applies lubricating medium (lotion or gel) to the breast. This acoustically couples the tissue through the mesh to the Transducer and lubricates the Transducer's motion across the surface. After a scan, the operator must discard the membrane assembly and carefully clean the lotion from the Transducer. Note that accuracy of a scan requires a generally even layer of lotion across the breast. Uneven application such as missing patches can cause image artifacts.

Inside the head's controls compartment is a control electronics board and the stepping motor that moves the Transducer horizontally for a scan. Commands from the buttons are relayed by USB from the electronics board back down to the Ultrasound Box and from there, also by USB, to the PC Box.

The Scan Head has two LED lighting strips illuminating the inside area around the Transducer.



Figure 5-8. Scan Head Assembly

1. Buttons: Begin/Stop Scan
2. Transducer
3. Buttons: Increase/Decrease compression
4. Single-Use Stabilizing Membrane
5. Scan Head Assembly Cover
6. LED Lights
7. Multi-Axis Ball Joint Lock

Ultrasound transducer

The ABUS 2.0 system is designed to use compatible transducers (electrically and physically).

When the Scan Head Assembly and Transducer is ready to begin the scan, the Transducer is moved to 2 cm from the center (in either direction) of the Scan Head Assembly. This is so the Scan Head Assembly can be centered on the patient's nipple.



Figure 5-9. Transducer with Positioning Arrows

Arrows on the sides of the Transducer indicate where to position the breast nipple on the Transducer for different View Types (Lateral, Anterior/Posterior, and Medial).

Arrows identify these position types

1. Anterior/Posterior
2. Lateral and Medial
3. Not Used

Stabilizing Membrane

The Scan Head senses whether the membrane is attached, and if it is missing, the system alerts the operator with the error message “No membrane is detected”. Also, a missing membrane is reported in the Service Desk Diagnostics.

If a Membrane is not in place, the scan cannot begin until the membrane has been properly mounted.

Handles and operator control pushbuttons

The Scan Head has a left and a right handle. These are used for head positioning and for the operator to adjust compression either manually or by pushbutton.

The left handle has two pushbuttons, one to start a scan and one to abort a scan. The right handle has two pushbuttons, one to increase compression and one to decrease compression. Pressing a button once changes the weight by one step (about 7 pounds force). The touchscreen displays a picture identifying compression state.

Display arm assembly with Touchscreen Monitor

This assembly comprises the lower arm (also known as the extension arm), the upper arm which is rotatable and which swivels from side to side (called the Articulating Display Arm) and the touchscreen monitor.

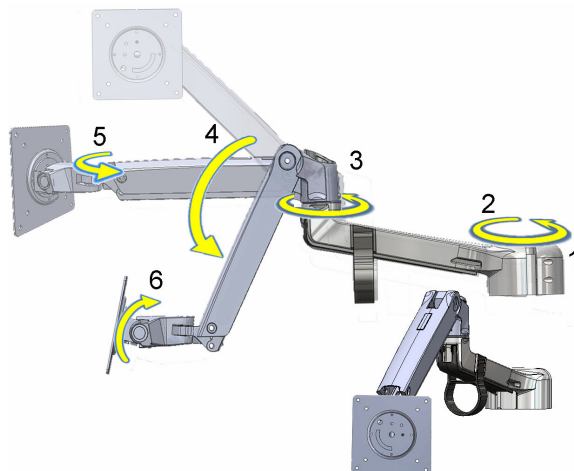


Figure 5-10. Display Arm and Monitor

The components of the arm are:

- 1.Shoulder joint
- 2.Extension arm
- 3.Elbow joint
- 4.Lift arm
- 5.Wrist joint
- 6.Display joint

Controls, displays, and ports

User controls

ABUS operator controls include:

1. Buttons on the Scan Head handles

These control Start / Stop scan, and compression adjustment.

2. Controls on the touchscreen monitor screen

These provide control of system settings and scan parameters. Refer to the User Manual for full discussion of this topic.

3. (User-operable) Power on/off switch.

This illuminated pushbutton switch on the side of the Dual Box chassis cover is for operator use in normal daily operation. It lights green when the system is on. There is also a power switch with thermal circuit breaker.

Scan Head controls

The two handles on the Scan Head provide operator control pushbuttons.

The left handle buttons are:

- start scan (green button)
- stop/abort scan (red button)

The right handle buttons are:

- decrease Scan Head pressure (up arrow)
- increase Scan Head pressure (down arrow)

Touchscreen

The Touchscreen is touch-sensitive and supports the system software detecting touches and gestures. It also provides an onscreen keyboard for entering patient data. For details refer to the Invenia 2.0 2.0 Basic User Manual (P/N 4700-0041-00).

Operator power switch

Although the ABUS 2.0 has a main power switch (with breaker) on the ACDC input box, the ABUS provides a separate Operator Power Switch pushbutton on the side of the chassis. This is intended to be used for daily operations. The status of this pushbutton is sensed by the Motherboard.

User displays and indicators

Touchscreen monitor

The Invenia ABUS 2.0 has a touchscreen display monitor that provides users with onscreen data entry, operating information and scan images. It has on-screen touch activated controls for system operation. The monitor shows error conditions and present graphics showing details about Scan Head Assembly positioning, such as need for pressure adjustment or position relative to the patient.

Additional indicators and illumination

Scan Head Illumination

The Scan Head has two rows of white LEDs (left and right) that light up the patient work surface (breast tissue).

Other indicators

Inside the Scan Head electronics compartment is a blue LED that flashes to show that the head has communication with the cMST board.

The Power Check OK indicator on the top of the PC Box lights green when all DC power supply voltages are ready.

External access ports

The base of the rear chassis cover has an externally-accessible Ethernet port and a USB port.

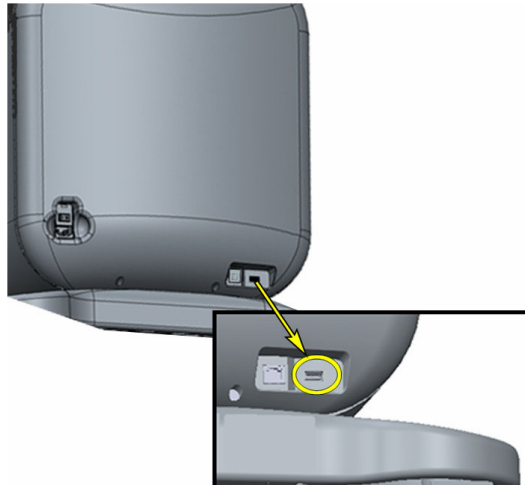


Figure 5-11. Ethernet and USB service port

Electrical / Electronic

Power

Power for the system originates in the PC Box chassis and is distributed in there to other PC Box components and to the touchscreen monitor. It is also distributed to the Ultrasound Box MFEPS board which provided power to U/S Box components and to the Scan Head and Weight Tower.

Power-up sequence

Before the ABUS can be powered up, these items must be in place or be done:

- a) The system must be plugged into mains power.
- b) The ABUS main power switch in the ACDC Input assembly on the side of the PC Box must be turned on.

Service-Related

Diagnostics

A section of the Service Desktop application provides machine and system diagnostics.

The system monitors a number of items and it logs and reports their fault conditions.

Monitored items include:

- fans
- temperatures of cMST board, MFEPS, and motherboard
- voltages at key boards
- run status of various hardware

The system does not actively monitor cable continuity or unplugged connectors.

The ABUS 2.0 supports Remote Diagnostics.

Access to these requires a network connection. (Ethernet port on to local network.)

Use of the Remote Diagnostics requires a User ID and an authorized password. For further information refer to Troubleshooting section of this document.

Glossary

AAF	Anti Aliasing Filter	This is used to clean signals.
ADC	Analog to Digital Converter	Converts signals that are analog voltages into digitally coded values
AFE	Analog Front End	Analog signal handling circuit. A custom component in the ABUS 2.0 system.
BEP	Back End Processor	An alternate name for the PC in the ABUS 2.0 system.
MFEPS	Front end power supply	Board that powers the Scan Head
DSP	Digital signal processor	The Texas Instrument DSP, TMS320C6455 on the CMST board.
FE	Front End	Components of the system that are functionally nearest the Scan Head are referred to as front end components.
GPU	Graphics Processing Unit	A PC board dedicated to graphics processing
LNA	Low Noise amplifier	An amplifier designed so that it does not introduce much noise into low-level signals
MCI	Motor Control Interface	The MCI board in the Ultrasound Box relays control commands originating at the PC for the Scan Head and Weight Tower motors.
MPSB	MPSB relay board	Relay board switches the 128 channel-signals between handheld and ABUS 2.0 port transducer. (Handheld not used at present - future option)
PACS		
PC Box	Personal Computer Box	This module contains the PC motherboard and related components
PGA	Programmable Gain Amplifier	An amplifier whose gain can digitally controlled
VCAT	Voltage Controlled Attenuator	A voltage divider whose ratio for dividing down the input can be set electronically

Chapter 6

Service Adjustments and Lubrication

This chapter describes how to test and make adjustments to the Invenia ABUS 2.0. You can use these to test the system for errors.

Service Adjustments



This Chapter only covers the components or assemblies that require adjustments for the Invenia ABUS 2.0.

System adjustments need to be performed by trained, qualified personnel. Contact GE for training.

Scan Head Drive Screw Damper Adjustment

When Drive Screw Dampers are not seated correctly and the Transducer is traveling across the Scan Head and nears the end of the travel there will be a “binding” sound. This is due to the Drive Screw Dampers in the Scan Head Brackets slightly moving out of position. The Motor assembly travels across a Rail that is mounted in the Scan Head assembly and when one or both of these Dampers move out of position the Drive Screw will become slightly bent and cause this “binding” sound as the Motor travels toward the end of the Drive Screw.

Table 6-1:

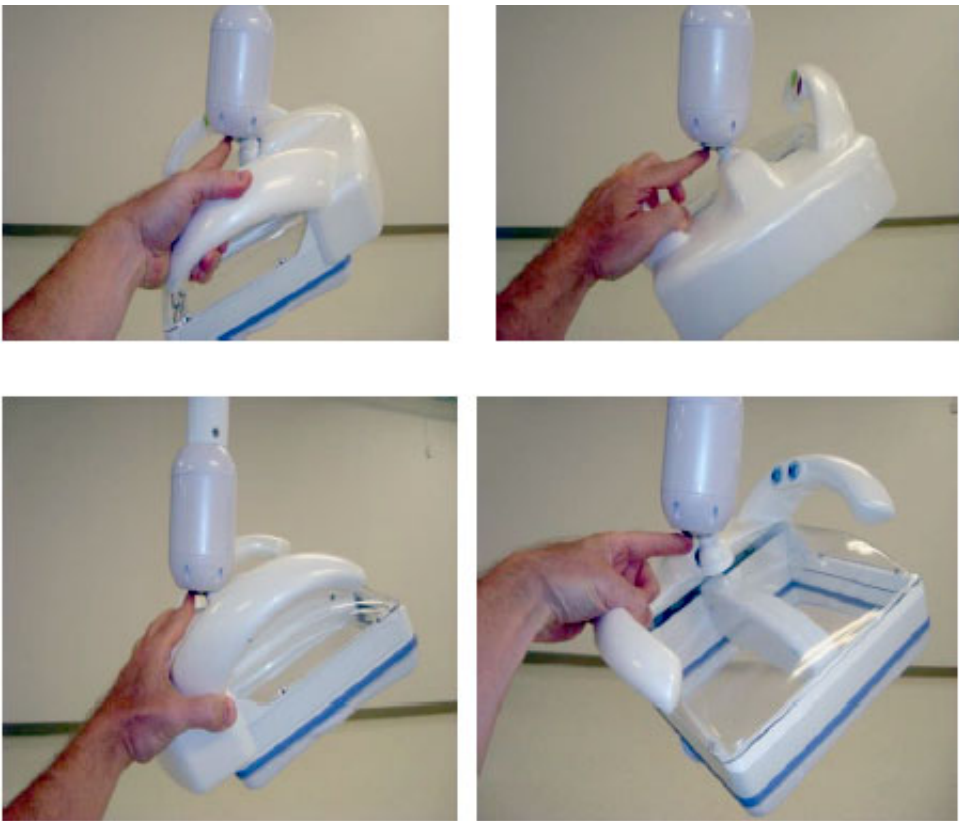
Steps	Illustration
<p>1. Looking at the Drive Screw Dampers on the inside of the Scan Head you will find that one or both Dampers will be elongated (oval) where the Drive Screw goes through it.</p> <p><i>NOTE: Do not apply grease to damper or motor lead screw.</i></p>	
<p>2. To fix the displaced damper, pull slightly out on the Drive Screw; now push the Drive Screw and Damper back into place. Put a little more pressure on the Damper then the Drive Screw when pushing.</p> <p>When Damper and Drive Screw are in the correct position, the Drive Screw will be centered in the Dampers.</p>	

Ball Joint Lubrication

Perform this procedure only if the ball joint is squeaking.

The following lubricant is required to grease the nickel-plated ball joint: DuPont™ Krytox® 227 Synthetic Performance Lubricant (P/N 2301-0478-00)

Table 6-2: Ball Joint Lubrication Points

Steps	Illustration
1. Apply a thin film of lubricant to lower half of the nickel-plated ball joint while tipping Scan Head in all four directions. Clean off any excess lubricant from the painted surfaces.	
2. Remove the: <ul style="list-style-type: none">• Scan Head Membrane, if in place•• Scan Head Cassette from the Scan Head• Clear Cast Cover	
3. Rest the Scan Head Assembly on a flat, safe surface. The Scan Head Assembly must be supported for this procedure.	

Chapter 7

Diagnostics/Troubleshooting

This chapter describes how to setup and run the tools and software that help maintain image quality and system operation. Very basic host, system and board level diagnostics are run whenever power is applied. Some Service Tools may be run at the application level.

Service safety considerations



DANGER

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



WARNING

IF THE COVERS ARE REMOVED FROM AN OPERATING Invenia ABUS 2.0, SOME METAL SURFACES MAY BE WARM ENOUGH TO POSE A POTENTIAL HEAT HAZARD IF TOUCHED, EVEN WHILE IN SHUTDOWN MODE.



WARNING

USE ALL PERSONAL PROTECTION EQUIPMENT (PPE) SUCH AS GLOVES, SAFETY SHOES, SAFETY GLASSES, AND KNEELING PAD TO REDUCE THE RISK OF INJURY.

Gathering troubleshooting data

Collecting vital system information

The following information is necessary to properly analyze data or images being reported as a malfunction or a Invenia ABUS 2.0 being returned to the manufacturer:

This information is normally collected with Alt+D or Gather Logs.

Navigate to **Configuration > System > About**.

Product Name = Invenia ABUS 2.0

From Software, record:

- Software Version
- Software Revision
- Software Part Number
- Build Name
- Build View
- Build Date

Collecting a screen capture with logs

The error logs will be collected using Insite.

- Error Logs
- Crash Log (protected information)
- Vital Product Data
- DICOM Logs
- Windows Event Logs
- Diagnostic Logs
- Service Logs

Service Desktop

Introduction

The Service Desktop is used with other GE Ultrasound products, and provides the Field Service Engineer (who services several product lines) with a recognizable service interface.

This section describes the features of the Service Desktop.

These are the different levels of access to the Service desktop:

- **Basic Service access** (Class A) – a user locally logged into the machine with Basic Service Access privilege. This level provides limited access to Service desktop widgets and utilities.

Connecting to Service Desktop

1. Log into the Invenia ABUS 2.0. using your service ID and password.



Figure 7-1. Login Screen

2. In the application software, locate and click the light colored GE icon in the Invenia ABUS 2.0 screen to open the Connectivity Menu. See the following figure.

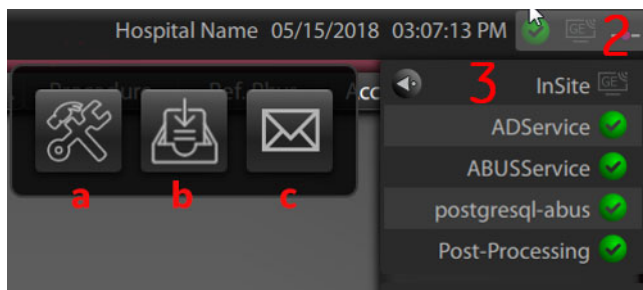


Figure 7-2. Invenia ABUS 2.0 Connectivity Menu


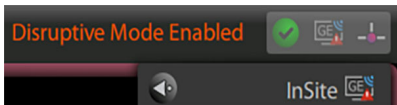



NOTE:

In the Invenia ABUS 2.0 software, the customer interface to the Service Desktop is called "InSite".



3. Click the Insite arrow to open the Service Desktop icons:
 - a. Service Desktop icon
 - b. Gather Logs (Alt+D)
 - c. Request for Service (RFS)

Table 7-1: InSite Icons

Item	Icon	Description
1.		InSite Indicators <ul style="list-style-type: none"> • White InSite connected to GE. User can send requests for service, but service is not connected. • White with blue radio waves. Service is connected and investigating the problem. • Red=Service desktop is active, Service is connected and has disrupted normal processes to troubleshoot the problem. 
2.		Service Desktop <ul style="list-style-type: none"> • Shares an Invenia ABUS 2.0 desktop with a GE Online Service Engineer.
3.		Gather Logs <ul style="list-style-type: none"> • Opens a Service Dispatch with GE Service.
4.		Contact GE - Request for Service <ul style="list-style-type: none"> • Opens a Service Dispatch with GE Service. See next page.

Color status

Throughout the Service desktop, colors indicate the following:

- Green – Status is normal
- Orange – Status is a warning
- Red – Status is an error

Licenses

BASIC ACCESS (Class C)

With Service Basic Access, these are the available options:

- HOME
- Utilities
 - Delete Files
 - Gather Logs
 - Third Party Licenses
- Agent Configuration

Basic Class Access

Basic configurations vary depending upon the purchased service level.

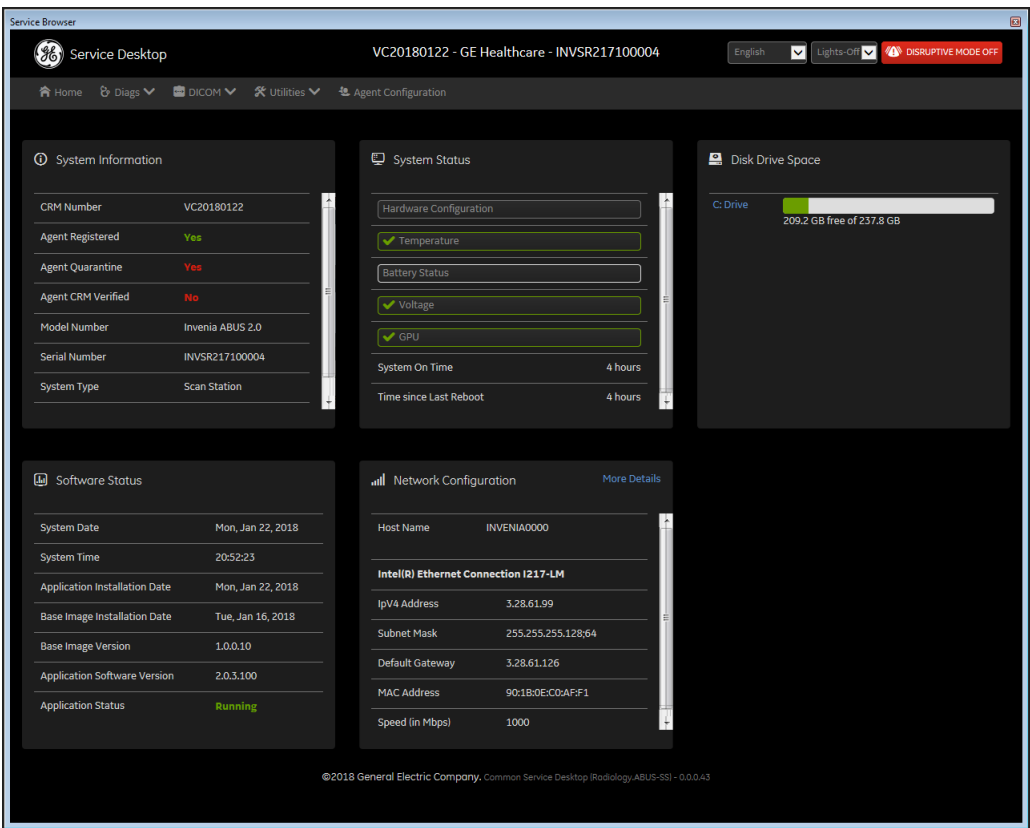


Figure 7-3. Home with Class M Access

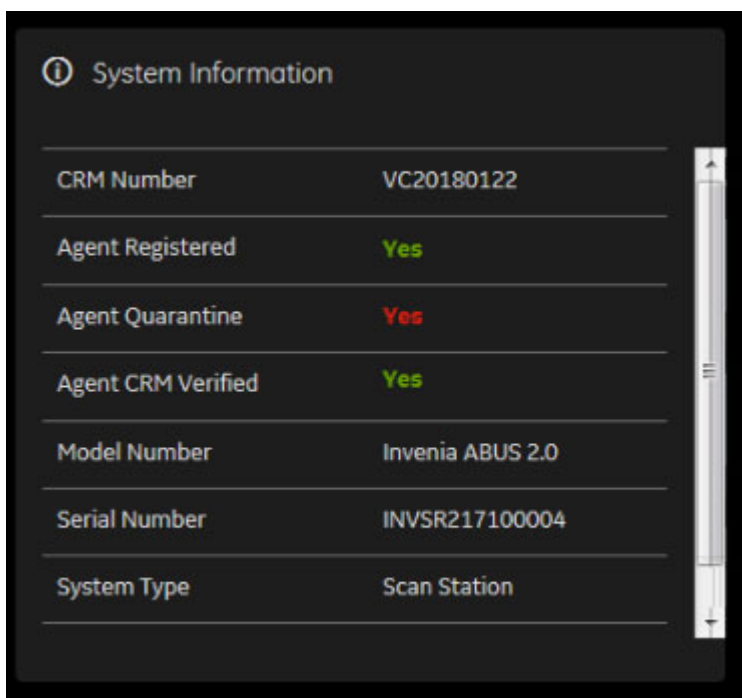
System Information

System Information displays general information about the Invenia ABUS 2.0. When the Invenia ABUS 2.0 has been successfully configured with the back office, these elements will have the corresponding values:

- **Agent Registered** will be **Yes**
- **Agent Quarantine** will be **No**
- **Agent CRM Verified** will be **Yes**

The information on **System Information** is available to all service class licenses.

To access **System Information**, navigate to **Utility > Service > Home**.



The screenshot shows a 'System Information' window with a list of system parameters and their values. The window has a title bar with an information icon and the text 'System Information'. The list is as follows:

Parameter	Value
CRM Number	VC20180122
Agent Registered	Yes
Agent Quarantine	Yes
Agent CRM Verified	Yes
Model Number	Invenia ABUS 2.0
Serial Number	INVS217100004
System Type	Scan Station

Figure 7-4. System Information

System Information (continued)

This table shows all the elements available on **System Information** with descriptions.

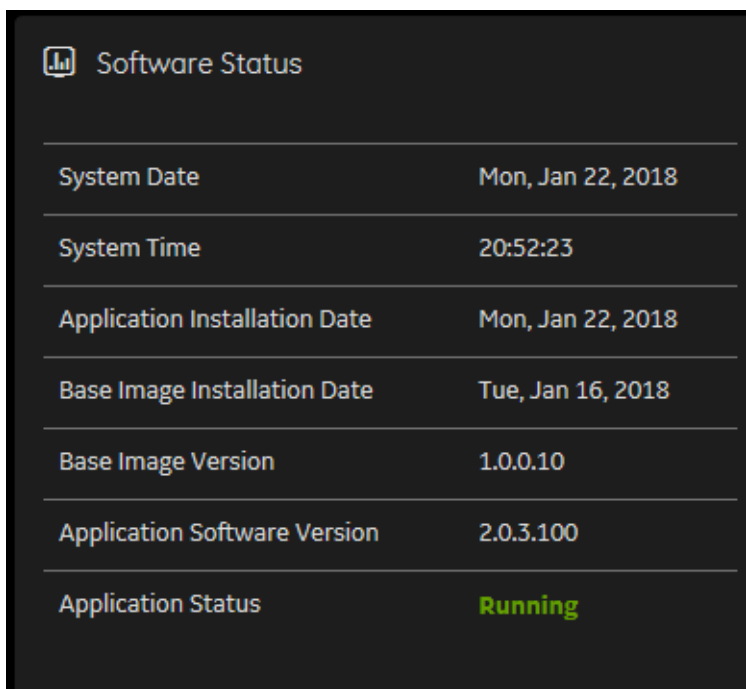
Element	DESCRIPTION
CRM Number	Customer Relationship Management (CRM) number. System identifier assigned to the customer unit by the service region.
Agent Registered	Registered status of the agent. Valid values are: Yes – The agent is registered in the back office. No – The agent is not registered in the back office. Not Available – The agent is not running or has not been configured.
Agent Quarantine	Quarantine status of the agent. Valid values are: Yes – The agent has more than one device registered with the same CRM Number in the back office. No – The agent has one device registered with the listed CRM Number in the back office. Not Available – The agent is not running or has not been configured.
Agent CRM Verified	CRM verified status of the agent. Valid values are: Yes – The agent is verified in the back office. No – The agent is not verified in the back office. Not Available – The agent is not running or has not been configured.
Model Number	GE part number for the Invenia ABUS 2.0. The same number as listed on the rating plate.
Serial Number	Serial number of the Invenia ABUS 2.0. The same number as listed on the rating plate.
System Type	Product name of the Invenia ABUS 2.0.
Facility	Name of the hospital or facility where the Invenia ABUS 2.0 is installed.

Software Status

Use **Software Status** to view general information about the software installed on the Invenia ABUS 2.0.

The information on Software Status is available to all service class licenses.

To access **Software Status**, navigate to **Utility > Service > Home**.



The screenshot shows a dark-themed window titled "Software Status" with a small icon. It contains a table with seven rows of system and application information. The "Application Status" row is highlighted with a green background and the word "Running" in green text.

Software Status	
System Date	Mon, Jan 22, 2018
System Time	20:52:23
Application Installation Date	Mon, Jan 22, 2018
Base Image Installation Date	Tue, Jan 16, 2018
Base Image Version	1.0.0.10
Application Software Version	2.0.3.100
Application Status	Running

Figure 7-5. Software Status

Software Status (continued)

This table shows all the elements available on **Software Status** with descriptions.

Element	DESCRIPTION
System Date	Current date in the format <day>, <month> <date> <year>.
System Time	Local time based on the last time the system desktop was refreshed in the format <hh:mm:ss>.
Application Installation Date	Date the application software was installed. The application software includes the Invenia ABUS 2.0 product-specific software.
Base Image Installation Date	Date the base image software was installed. The base image software includes the Windows operating system and other supporting software.
Base Image Version	Version number of the base image software.
Application Software Version	Version number of the application software.
Application Status	Status of the application. Valid values are: Running Stopped

System Status

Use **System Status** to view status information on the Invenia ABUS 2.0. Specifically, do the following:

The information on **System Status** is available to Basic access licenses.

To access **System Status**, navigate to **Utility > Service > Home**.

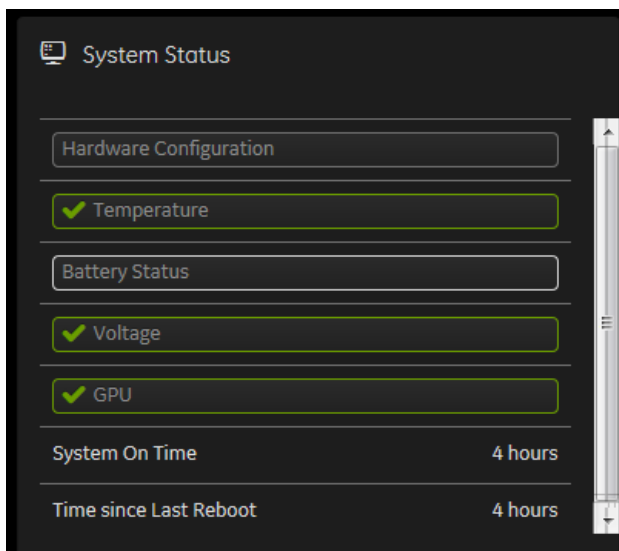


Figure 7-6. System Status

System Status (continued)

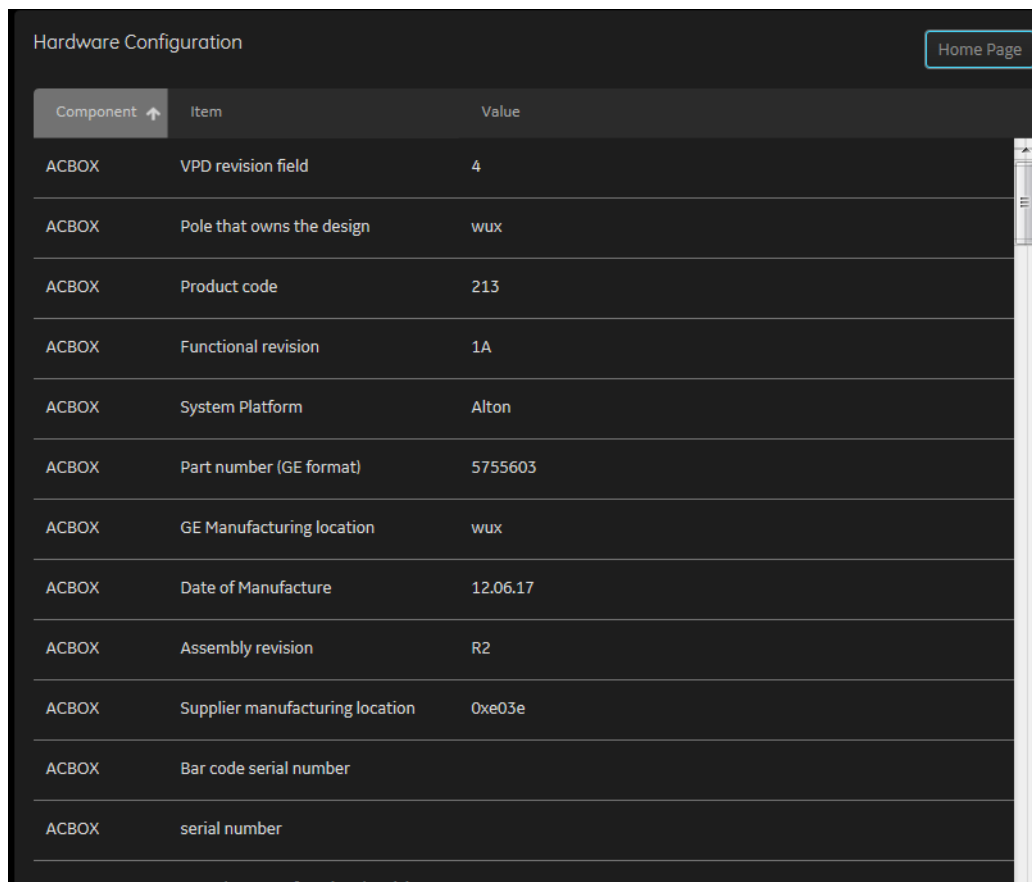
This table shows all the elements available on **System Status** with descriptions.

Element	DESCRIPTION
Hardware Configuration	Displays the contents of the hardware configuration file.
Temperature	Displays the temperature monitoring of the Invenia ABUS 2.0 as normal, warning, or error using the standard colors and icons. Includes temperature out-of-spec events including an overall count of event warnings and errors for the last 30 days or the last status checkpoint whichever is sooner. Temperature displays temperature a graph for the configured monitoring points.
Voltage	Displays the voltage monitoring of the Invenia ABUS 2.0 as normal, warning or error using the standard colors and icons. Includes voltage out-of-spec events including an overall count of the event warnings and errors for the last 30 days or last status checkpoint whichever is sooner.
Bootup Issues	Based on the latest occurrence, displays all abnormal boots of the Invenia ABUS 2.0 for either the past 30 days or the latest check point.
Alert Logs	Based on the latest occurrence, displays all alerts generated by the Invenia ABUS 2.0 for either the past 30 days or the latest check point.
USB Devices	Displays the USB connected devices and their status.
System On Time	Displays the time the Invenia ABUS 2.0 was turned on.
Time Since Last Reboot	Displays the time the Invenia ABUS 2.0 was last rebooted.

Hardware Configuration

Hardware Configuration displays the contents of the hardware configuration file which includes all the vital product data (VPD).

To access **Hardware Configuration**, navigate to **Utility > Service > Home**, and then under System Status, select Hardware Configuration.



Component	Item	Value
ACBOX	VPD revision field	4
ACBOX	Pole that owns the design	wux
ACBOX	Product code	213
ACBOX	Functional revision	1A
ACBOX	System Platform	Alton
ACBOX	Part number (GE format)	5755603
ACBOX	GE Manufacturing location	wux
ACBOX	Date of Manufacture	12.06.17
ACBOX	Assembly revision	R2
ACBOX	Supplier manufacturing location	0xe03e
ACBOX	Bar code serial number	
ACBOX	serial number	

Figure 7-7. Hardware Configuration

This table shows all the elements available on **Hardware Configuration** with descriptions.

Element	DESCRIPTION
Component	Hardware component.
Item	Parameter with the vital product data (VPD).
Value	Actual value of the Item.

Temperature

Use **Temperature** to troubleshoot problems with monitored FRUs and the fans. Specifically, use these pages:

- FRU Status
- Graphs
- Fan Status

To access **Temperature**, navigate to **Utility > Service > Home**, and then under **System Status**, select **Temperature**.

Graphs

Graphs displays trend graphs for selected elements which have been selected as key indicators of overall temperature status inside the card rack.

To access this page, under **System Status**, select **Temperature** and then select **Graphs**.

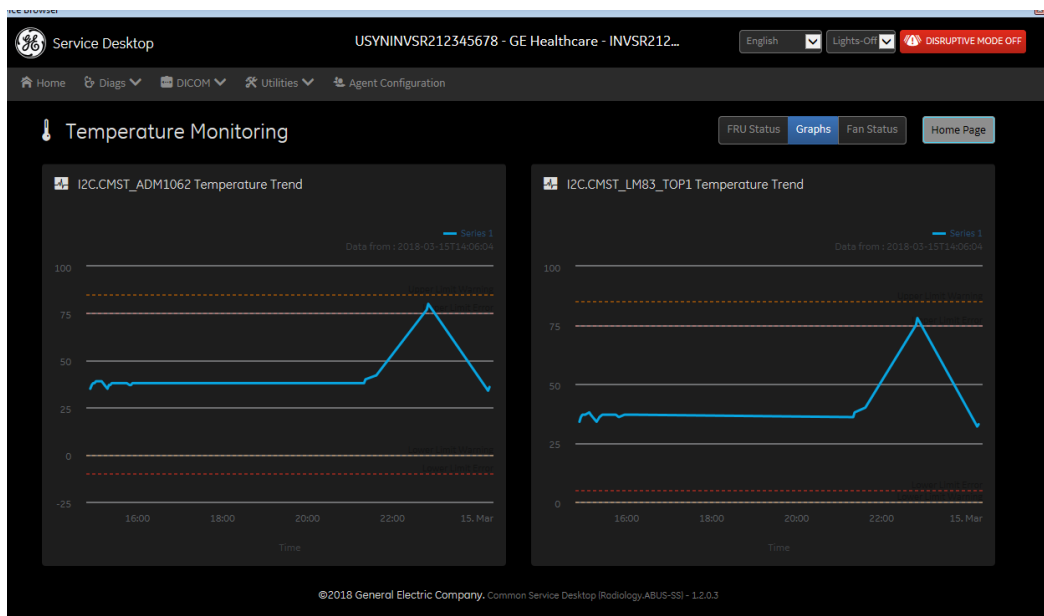


Figure 7-8. Graphs

Fan Status

Fan Status displays the details for each fan. The peak level of operation for the fans is 2500 RPM.

To access this page, under System Status, select **Temperature** and then select **Fan Status**.

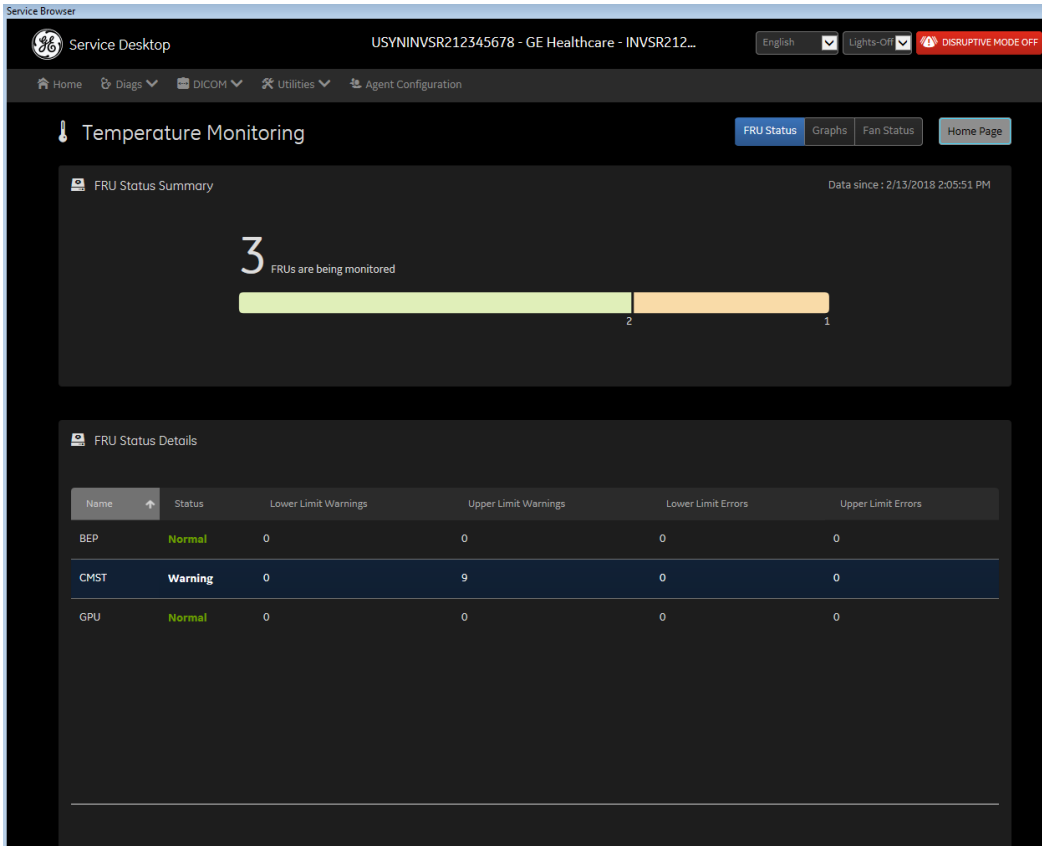


Figure 7-9. Fan Status

Fan Status (continued)

This table shows all the elements available on **Fan Status** with descriptions.

Element	DESCRIPTION
Monitoring Point	Name of the fan. Fan_control – Indicates the overall control of fan speed. Rack Fan # – Indicates individual fan on the fan tray.
Device	Device monitoring the parameters.
Status	Status of the fan. Valid values are: Normal – Indicates that the fan is operating within the allowable range. Warning – Indicates that the fan is operating close to the limit of the allowable range. Error – Indicates that the fan is operating outside the allowable range.
Lower Limit Warnings	Number of low limit temperature warnings.
Upper Limit Warnings	Number of high limit temperature warnings.
Lower Limit Errors	Number of low limit temperature errors.
Upper Limit Errors	Number of high limit temperature errors.

Voltage

Use **Voltage** to troubleshoot problems with monitored FRUs and the AC voltage of the Invenia ABUS 2.0. Specifically, use these pages:

- FRU Status
- AC Voltage

To access Voltage, navigate to Utility > Service > Home, and then under System Status, select Voltage.

FRU Status

FRU Status displays a summary of the voltages for the FRUs being monitored and the details for each FRU.

To access this page, under **System Status**, select **Voltage** and then select **FRU Status**.

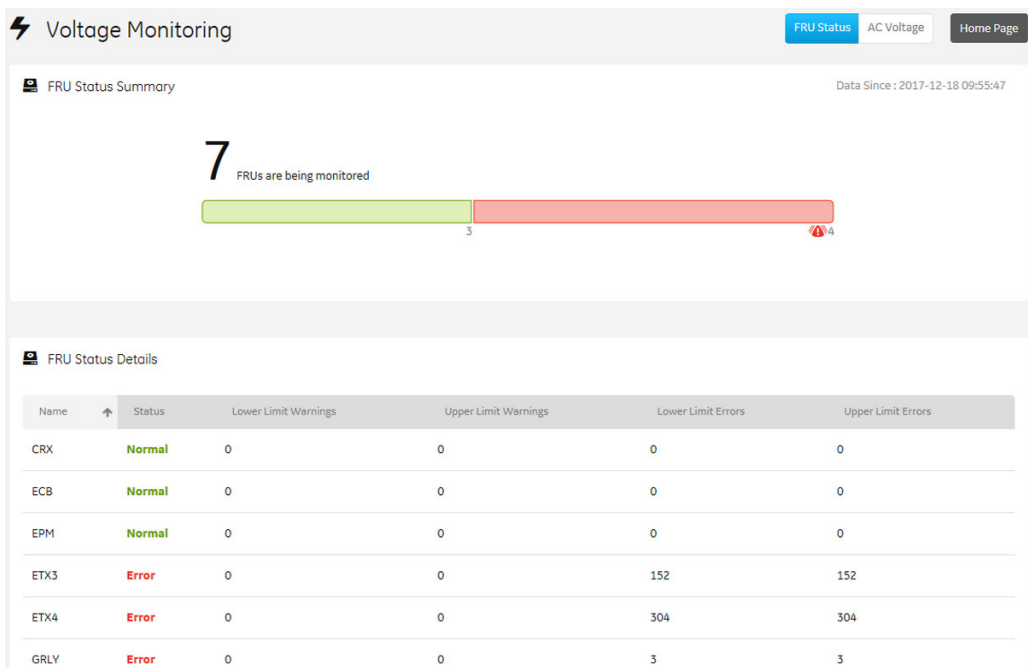


Figure 7-10. FRU Status

FRU Status (continued)

FRU Status displays a summary of the voltages for the FRUs being monitored and the details for each FRU.

To access this page, under System Status, select Voltage and then select FRU Status.

This table shows all the elements available on FRU Status with descriptions.

Element	DESCRIPTION
Name	Name of the FRU.
Status	Status of the voltage for the FRU. Valid values are: Normal – Indicates that the voltage is within the allowable range. Warning – Indicates that the voltage is close to the limit of the allowable range. Error – Indicates that the voltage is outside the allowable range.
Lower Limit Warnings	Number of low limit voltage warnings.
Upper Limit Warnings	Number of high limit voltage warnings.
Lower Limit Errors	Number of low limit voltage errors.
Upper Limit Errors	Number of high limit voltage errors.

Alert Logs

Alert Logs displays the details for each alert. Alerts are status logs typically reported as a result of an error. Alerts are sent to the back office to be managed and reported to service.

To access this page, under System Status, select Alert Logs.

Alert Logs

Home Page

Alerts

Data Since : 2017-12-19 12:15:21

Alert id	Sub System	Rule	Description	Value	Lower Limit	Upper Limit	Severity	First Alert Time	Last Alert Time	Last Alert LocalTime	Last Alert Sent Time	Count
FAN_CTRL_FAULT_Fan_Control	EPH	FAN_CTRL_FAULT	Fan control fault	255	0	231	1	2017-12-20T14:41:04Z	2018-01-05T13:24:40Z	2018-01-05T07:24:40	2018-01-05T13:24:40Z	2

Figure 7-11.

This table shows all the elements available on Alert Logs with descriptions.

Element	DESCRIPTION
Alert ID	Identifier for the alert log that has been sent to the back office.
Sub System	Hardware component.
Rule	Code for the alert. Alerts are filtered in the back office using rule codes.
Description	Description of the alert log.
Value	Current value read for the associated hardware component.
Lower Limit	Value for the lower limit for the associated hardware component.
Upper Limit	Value for the upper limit for the associated hardware component.
Severity	Severity of the alert. These are the valid values: 1 - Error. Out of specification 2 - Warning 3 - Normal
First Alert Time	Time the alert first occurred.
Last Alert Tlme	Time the alert last occurred.
Last Alert Local Time	Time (local) the alert last occurred.
Last Alert Sent Time	Time the alert was last sent to the back office.
Count	Number of times that the alert has occurred.

Disk Drive Space

Use Disk Drive Space to view the hard drive partitions including total size and available free space in GB. Includes the overall health of the drive in one of these colors:

- **Red** – Available free space is less than 10% of the total size.
- **Orange** – Available free space is more than 10% and less than 20% of the total size.
- **Green** – Available free space is more than 20% of the total size.

The information on Disk Drive Space is available to Class C and Class M licenses.

To access Disk Drive Space, navigate to **Utility > Service > Home**.

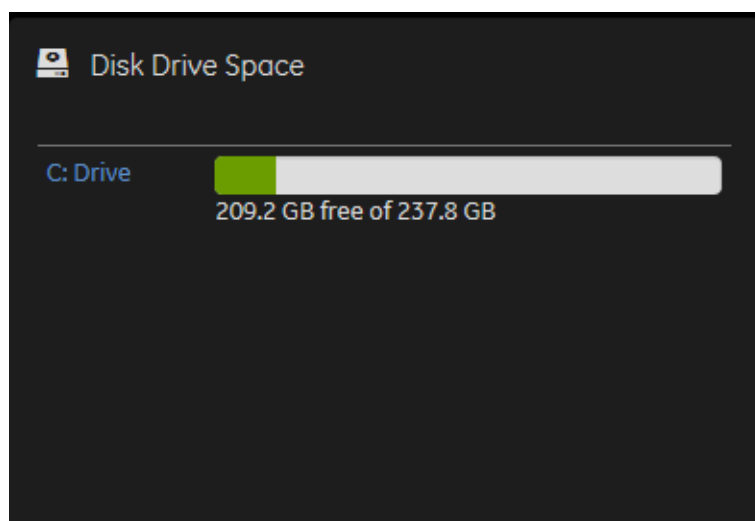


Figure 7-12. Disk Drive Space

This table shows all the elements available on Disk Drive Space with descriptions.

Element	DESCRIPTION
C: Drive	C: partition shows the graphical representation of the following: Used space in GB Available free space in GB

Network Configuration

Use **Network Configuration** to view network (wired) information (the full ipconfig details) for the network configured with the Invenia ABUS 2.0.

The information on Network Configuration is available to Class M licenses.

To access **Network Configuration**, navigate to **Utility > Service > Home**.

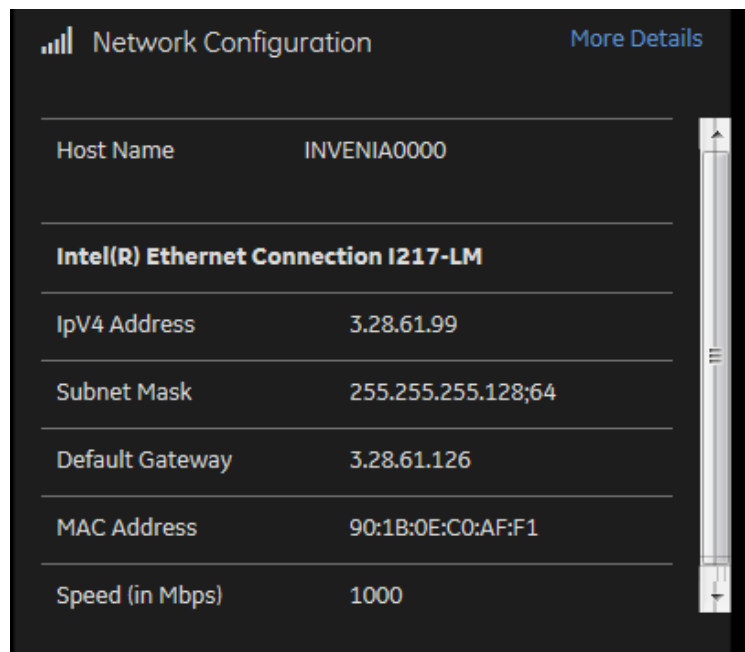


Figure 7-13. Network Configuration

Network Details

Windows IP Configuration

Host Name: E70013
 Primary Dns Suffix:
 Node Type: Hybrid
 IP Routing Enabled.....: No
 WINS Proxy Enabled.....: No
 DNS Suffix Search List.....: clients.am.health.ge.com

Ethernet adapter Ethernet:

Connection-specific DNS Suffix .: clients.am.health.ge.com
 Description: Intel(R) Ethernet Connection (2) I219-LM #2
 Physical Address.....: 00-20-CE-FF-41-04
 DHCP Enabled.....: Yes
 Autoconfiguration Enabled: Yes
 IPv4 Address.....: 3.62.12.26(Preferred)
 Subnet Mask.....: 255.255.254.0
 Lease Obtained.....: Tuesday, December 19, 2017 11:12:40 AM
 Lease Expires.....: Tuesday, December 19, 2017 7:42:40 PM
 Default Gateway.....: 3.62.12.254
 DHCP Server.....: 3.40.208.30
 DNS Servers.....: 10.220.220.220
 10.220.220.221
 Primary WINS Server.....: 3.20.68.29
 Secondary WINS Server.....: 3.249.105.112
 NetBIOS over Tcpip.....: Enabled

Name: Ethernet

DisplayName	DisplayValue
Flow Control	Rx & Tx Enabled
Interrupt Moderation	Enabled
IPv4 Checksum Offload	Rx & Tx Enabled
Jumbo Packet	Disabled
Large Send Offload V2 (IPv4)	Enabled
Large Send Offload V2 (IPv6)	Enabled

Figure 7-14. Network Configuration with More Details

Network Configuration (continued)

This table shows all the elements available on **Network Configuration** with descriptions.

Element	DESCRIPTION
Host Name	Name of the local host for the Invenia ABUS 2.0.
More Details	Displays the ipconfig details.
Wired Connection	
IPv4 Address	Local IP address for the wired network connection.
IPv6 Address	Local IP address for the wired network connection.
Subnet Mask	Local subnet mask for the wired network.
Default Gateway	Default gateway for the wired network.
MAC Address	Address for the MAC for the wired network.
Speed (Mbps)	Speed of the wireless connection.
Wireless Connection	
IP Address	IP address for the wireless network connection.
Subnet Mask	Subnet mask for the wireless connection.
Default Gateway	Default gateway for the wireless connection.
MAC Address	Address for the MAC for the wireless connection.
Speed (Mbps)	Speed of the wireless connection.
Status	Current status of the wireless connection.

Utilities

Gather Logs

Gather Logs provides a way to collect system logs and place the log files in the *D:\Service* directory for retrieval by the online center. These log files do not include protected data such as crash dumps and keyboard shadow logs. The customer can collect logs (including protected data) using Alt+D when Protected Data is checked. Log files are compressed into a .zip file and the file path and name display. If the application software is not running, use the **Gather Logs** shortcut on the Windows desktop.

The information on Gather Logs is available to all service class licenses.

To gather log files:

1. Navigate to **Utility** (second page) > **Service** > **Utilities** > **Gather Logs**.

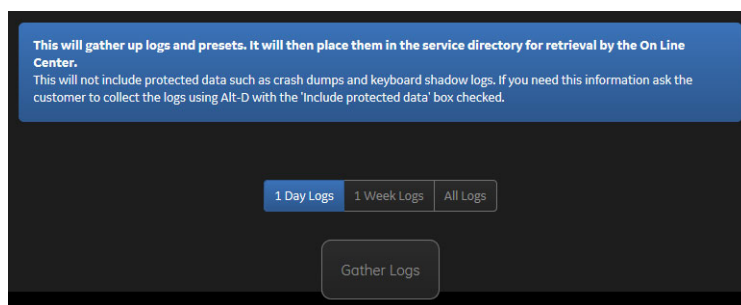


Figure 7-15. Gather Logs

2. Select one of the following options shown in the following table:

Element	DESCRIPTION
1 Day Logs	When selected, gathers log files for one day.
1 Week Logs	When selected, gathers log files for one week.
All Logs	When selected, gathers all available log files.
Gather Logs	Select to gather the log files for the selected time period.

3. Click **Gather Logs**. In the resulting dialog box, record the location of the log files and click OK.
4. When the gather log operation is complete, click the notification icon in the banner to view the location of the log files.

To remotely start, restart, or shut down the **Invenia ABUS 2.0**:

- a. Navigate to Utility (second page) > Service > Utilities > Disruptive Mode Utility and set Disruptive mode to On.
- b. Navigate to Utility (second page) > Service > Utilities > System Shutdown and then select an operation:
 - To shut down the Invenia ABUS 2.0, select Shutdown System.
 - To restart the Invenia ABUS 2.0, select Restart System.
 - To shut down the application software, select Shutdown Application.
 - To retain the current setting for Disruptive mode.
 - a. Select Retain Disruptive Mode.
 - b. Click Submit Request.

Third Party License

Third Party Software Licenses displays the third-party software licenses used as part of the service platform.

The information on Third Party Software Licenses is available to all service class licenses.

To access Third Party Software Licenses, select Utility (second page) > Service > Utilities > Third Party Software Licenses.

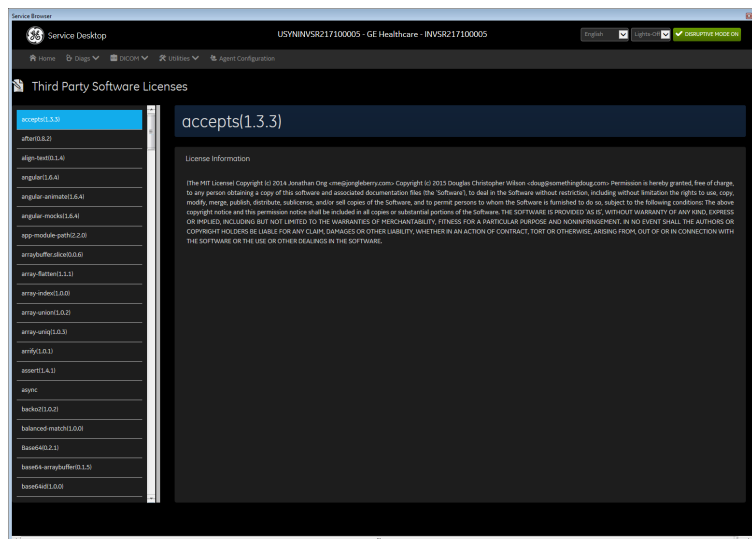


Figure 7-16. Third Party Software Licenses

Troubleshooting and System Messages

Invenia ABUS 2.0 Troubleshooting and System Messages

Troubleshooting

Table 7-2: Invenia ABUS 2.0 Messages

Symptom	Action to Take
Blank Screen	Troubleshoot the following: <ul style="list-style-type: none"> • Is the system plugged in? • Is the system turned on and the power button lit (green)? • Does the transducer initialize (move across the face of the Scan Head Assembly)?
If the system powers on with an error on the screen.	Reboot the system, up to three (3) times. If the error still appears, contact GE Service.
Mechanical Noise / Thumping	Contact GE Service. DO NOT spray any spray or oil, or apply any grease to any part of the system.
Multi-Axis Lock Stops Working	Contact GE Service.
System Overheating	Clean the filter. CAUTION: DO NOT operate the system without an air filter.
Image doesn't transfer from the Invenia ABUS 2.0 system	Confirm that the Workstation Network Indicator light is green. Shut down both the Invenia ABUS 2.0 and Workstation; then 1st reboot the Workstation, and 2nd reboot the Invenia ABUS 2.0.
Lines in the Image	Remove the transducer, then reverse it 180 degrees and plug it back in. If you still see lines on the image, but on the opposite side of the screen, then the transducer is defective. If the lines are still on the same side of the screen, then the issue is on the acquisition board or the TIP board. In either case, contact GE Service.
Intermittent Operation, System Lock-Ups, System Slow-Downs, Overheating, Poor Image Quality	Clean the system filter and let the system cool down for 30 minutes to 1 hour. Keep the system a distance of 18 inches (~0.46 m) from curtains. CAUTION: DO NOT operate the system without a filter.

System Messages

Table 7-3: Invenia ABUS 2.0 Messages

Symptom	Action to Take
Blank Screen	Troubleshoot the following: <ul style="list-style-type: none"> • Is the system plugged in? • Is the system turned on and the power button lit (green)? • Does the transducer initialize (move across the face of the Scan Head Assembly)?
If the system powers on with an error on the screen.	Reboot the system, up to three (3) times. If the error still appears, contact GE Service.
Mechanical Noise / Thumping	Contact GE Service. DO NOT spray any spray or oil, or apply any grease to any part of the system.
Multi-Axis Lock Stops Working	Contact GE Service.
System Overheating	Clean the filter. CAUTION: DO NOT operate the system without an air filter.
Image doesn't transfer from the Invenia ABUS 2.0 system	Confirm that the Workstation Network Indicator light is green. Shut down both the Invenia ABUS 2.0 and Workstation; then 1st reboot the Workstation, and 2nd reboot the Invenia ABUS 2.0.
Lines in the Image	Remove the transducer, then reverse it 180 degrees and plug it back in. If you still see lines on the image, but on the opposite side of the screen, then the transducer is defective. If the lines are still on the same side of the screen, then the issue is on the adcquisition board or the TIP board. In either case, contact GE Service.
Intermittent Operation, System Lock-Ups, System Slow-Downs, Overheating, Poor Image Quality	Clean the system filter and let the system cool down for 30 minutes to 1 hour. Keep the system a distance of 18 inches (~0.46 m) from curtains. CAUTION: DO NOT operate the system without a filter.

Noise Troubleshooting

Introduction

Before you start troubleshooting electronic noise, you should read the following subsections:

- 'General recommendations' on *page 7-32*
- 'EMI prevention/abatement' on *page 2-6*
- 'Overview of types of noise' on *page 7-34*

When talking to the customer, try to gather as much information as possible about the conditions when the noise appear:

Is the noise present...

... all the time?

... after some time of use? (After how long time?)

... at special times of the day (or night)? When?

... at all locations in the hospital, or only in one room/area?

... from time to time, no special pattern of time is observed?

General recommendations

Ultrasound instruments are susceptible to Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transients in the air or wiring. They also generate EMI. The Invenia ABUS 2.0 complies with limits as stated on the EMC label. However there is no guarantee that interference will not occur in a particular installation.

Possible EMI sources should be identified before the Invenia ABUS 2.0 is installed.

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

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

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

**EMI prevention/
abatement**

Table 7-4: EMI prevention/abatement

EMI RULE	DETAILS
Be aware of Radio Frequency sources	<ul style="list-style-type: none"> • Keep the Invenia ABUS 2.0 at least 5 meters (15 feet) away from other EMI sources. • Special shielding may be required to eliminate interference problems caused by high frequency, high powered radio or video broadcast signals.
Ground the Ultrasound system	Poor grounding is the most likely reason an Ultrasound system will have noisy images. Check grounding of the power cord and power outlet.
Replace all screws, Radio Frequency gaskets, covers, cores	<ul style="list-style-type: none"> • After you finish repairing or updating the Invenia ABUS 2.0, 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 Invenia ABUS 2.0 until any loose metallic part is removed.
Do not place labels where Radio Frequency gaskets touch metal	Where applicable, never place a label where Radio Frequency gaskets meet the Ultrasound system. Otherwise, the gap created will permit Radio Frequency leakage. Or, if a label has been found in such a position, move the label.
Use GE specified harnesses and peripherals	The interconnect cables are grounded and require ferrite beads and other shielding. Also, cable length, material, and routing are all important; do not change from what is specified.
Take care with cellular phones	Cellular phones may transmit a 5 V/m signal; that could cause image artifacts.
Properly route peripheral cables	Where applicable, do not allow cables to lie across the top of the Card Rack or hang out of the peripheral bays. Loop the excess length for peripheral cables inside the peripheral bays. Attach the monitor cables to the frame.
System won't shut down	Press and hold down the power button until the system shuts down. ONLY do this if the system does not shut down normally (light press of the power button).

Different Power Outlet

Connect the unit to another power outlet and verify if the noise changes or disappear.

NOTE: *Invenia ABUS 2.0 requires a dedicated power and ground for the proper operation of its Ultrasound equipment. This dedicated power shall originate at the last distribution panel before the Ultrasound system.*

The Invenia ABUS 2.0 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.

Different system

Try another Invenia ABUS 2.0 at the same location and look for the same noise. If the noise is present on the new system too, the noise is most likely from an external source/equipment.

Different location

Move the Scan Head Assembly to another location and verify if the noise changes or disappear. This may help you to locate an external noise source.

Try to move the Scan Head Assembly to:

- another location inside the room
- another room
- another floor

Disconnect external cables

Disconnect network cable to verify if the noise disappears.

Overview of types of noise

There are different types of noise. Use the information next to classify the noise and possible cause.

Noise picked up from the air

Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transients in the air.

If picked up by a transducer cable, the noise will be coherent -“penlight noise” pointing down in the picture - due to the fact that the noise is received on all channels.

- Is it a problem on the transducer?
Remove transducer, reverse (flip it), and replace transducer.
- Is it a problem on one of the transducer connectors only?

Noise Received via the External Cables

Move the Scan Head Assembly to another location and verify any changes.

Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transients in the wiring. The noise can enter the system via the mains power cable, transducer cable(s) or any other external connected cable(s).

To troubleshoot this type of noise, disconnect cables that are not needed for the basic use of the Scan Head Assembly. Check for any change in the noise each time a cable has been disconnected from the Invenia ABUS 2.0.

- Network cable

Verify if the noise change or disappear when the cables are removed.

Often, this type of noise is due to grounding problems in the mains power system or that the Invenia ABUS 2.0 is sharing a power line with other equipment.

Intermittent noise

- Is there any equipment that is turned on and off near the Invenia ABUS 2.0 ?
- Is the noise present all around the clock or only at special occasions?

Self generated noise (noise generated inside the unit)

- Self generated noise may be due to either:
 - heat problems
 - hardware problems
 - software problems

Heat problems

Heat problems are usually starting when Invenia ABUS 2.0 has been ON for some time.

If Invenia ABUS 2.0 has been used for scanning for some time before the noise appears, it may be due to either heat problems or some software related issues. By doing a restart you may learn some more about the cause.

Restart the system.

- If the noise is present after the restart, the cause is most likely due to heat problems.
- If the noise is gone after the restart, it may be due to either the setup/adjustments of the or a software failure.

Some possible causes for heat problems:

- Fan filters need to be cleaned or replaced.
- Room temperatures outside the allowed temperature limits.
- Fans are worn-out.
- Hardware problems.

Hardware problems

A hardware is an error/malfunction in either the transducer or the main unit.

A hardware issue may be an error/malfunction on a card.

Software problems

Check if a newer software version is available. A software update may include noise fixes. If needed, update the software.

The following messages may appear during the scan. Please refer to the cause/action information provided when trying to resolve the issue.

Table 7-5: Invenia ABUS 2.0 Messages

System Message	Cause/Action to Take
[Patient Name] is already selected for this scan	You have already selected a patient for this scan.
Abort finished. Ready for next scan.	You can start the next scan; the previous scan was aborted.
Aborted	The scan has been aborted.
Aborting	The current scan is being ended.
Are you sure you want to logout?	Prompts the user to confirm that they intended to stop using the system.
Dataset is not available	The selected patient's dataset is no longer available. It cannot be re-sent to the workstation.
Imaging Engine Initializing....	The system is in the process of starting up.
Please check the scantype	The user must select a scan type before scanning can begin.
Please input patient information.	Prompts the user to fill in all patient information fields prior to starting the scan.
Please mark all nipple positions	The nipple positions on the scan must be set before proceeding with further action on the system.
Please select a new patient	You need to select a new patient in order to begin the scan.
Please unlock Scan Head Assembly first	Login to begin scanning.
Please wait until processing is finished	The system is still processing the current task; please wait to start the next task.
Press compression button	Apply compression before starting the scan.
Press Compression button or Start button	Apply compression, then press Start to begin the scan.
Press Scan Button on Scan Head to Start Scanning	Press Start on the Scan Head Assembly to begin the scan.
Press Start button to start scan	Press Start on the Scan Head Assembly to begin the scan.

Table 7-5: Invenia ABUS 2.0 Messages

System Message	Cause/Action to Take
Processing...	The acquired image data is being processed for display. Wait until the acquisition is complete before performing any further actions.
Scan finished	The system has completed scanning for this View Type.
Scan limit reached	Confirm system Storage Status via the General Configuration page.
Scan order for this patient already selected	The scan order has already been specified for this patient. You can select additional View Types for this patient via the Select Tab.
Scan started	Allow the scan to complete, or Abort the scan.
Invenia ABUS 2.0 Initializing...	The system is in the process of starting up.
Scanning	The system is performing the scan.
Select scan order	Specify the workflow.
Select scan type	Specify the View Types you want to use for this patient.
The user name or password you entered is incorrect.	A valid user name and password must be entered to use the system.
There are scans missing for this patient. Are you sure you want to finish?	Inform the user that there are scans that have been selected to be completed for the patient and these scans have not yet been completed. Prompts user to select whether or not they would like to finish the session before completing all scheduled scans.
There are scans missing for this patient. Are you sure you want to logout?	Inform the user that there are scans that have been selected to be completed for the patient and these scans have not yet been completed. Prompts the user to select whether or not they would like to finish the exam before logging off and allowing another user to use the system.
Transducer is moving. Please wait.	Please allow the transducer to complete the scan.
You must first select a patient	A patient must be selected from the Worklist before scanning can begin.
Please finish the current scan!	The current scan is processing, the user must finish the current scan.

Invenia ABUS 2.0 Messages

The following messages may appear during the review. Please refer to the cause/action information provided when trying to resolve the issue.

Table 7-6: Messages

System Message	Cause/Action to Take
An application entity can only be set to Print or Store, not both.	Select Print or Store.
Are you sure you want to delete all these series/images?	Confirm selection.
Are you sure you want to delete these studies?	Confirm selection.
Are you sure you want to delete this study?	Confirm selection.
Are you sure you want to delete this series/image?	Confirm selection.
Are you sure you want to log off?	Confirm selection.
Are you sure you want to remove all calipers?	Confirm selection.
Automatic export items can't be deleted.	Informational message.
Can't load report data.	Informational message.
Delete confirmation	Confirm selection.
DICOM connection test failed.	Informational message.
DICOM connection test passed.	Informational message.
Do you want to resume the last saved session?	Confirm selection.
Export from DICOM server is not supported.	Informational message.
Failed to export users.	Informational message. Please try the operation again.
Failed to retrieve images from the DICOM server.	Informational message. Please try the operation again.
Invalid port number. Port number can only have four digits.	Confirm the port number.
Invalid printer, or no printer, is installed.	Check printer installation.
No DICOM images found at the folder <folder>.	Informational message.
No images are retrieved.	This message appears when a non-service user tries to change the local Port or AE Title.
Only Service users can change the local settings.	This message appears when a non-service user tries to change the Local Port or AE Title.
Only three lines of text are allowed for Institute Address.	Informational message. Please try the operation again.

Table 7-6: Messages (Continued)

System Message	Cause/Action to Take
Please enter a User name.	Informational message. Please try the operation again.
Please retrieve the study before you load it.	Informational message. Please try the operation again.
Unable to restore study. Please load it from the study pane.	Informational message. Please try the operation again.
Please restart DICOM receive application to make the changes effective.	Informational message. Please try the operation again.
Please select a location to export the study(s) to.	Informational message. Please try the operation again.
Printer error.	Informational message. Please try the operation again.
Please select another study.	Informational message. Please try the operation again.
Please select either Export To Disk or Export to DICOM Servers for exporting.	Informational message. Please try the operation again.
Printer error.	Check the printer and try the operation again.
Report file [file name] already exists.	Change export filename.
Retrieve completed	Informational message.
Retrieving study <id>.	Informational message.
Study doesn't exist.	Informational message. Please try the operation again.
The Invenia ABUS 2.0 application has encountered a problem.	Please restart the application.
The Invenia ABUS 2.0 disk space is below [configured free space]%. Reviewed studies will automatically be deleted to free space.	Informational message. Please manage disk space.
The Study doesn't exist.	Informational message. Please try the operation again.
The study <id> of the patient <id> already exists. Do you want to overwrite?	Confirm selection.
The user name already exists. Please choose a different user name.	Informational message. Please try the operation again.
The view type of the image stored in the Invenia ABUS 2.0 Storage can't be changed.	Informational message.
Unauthorized to access the printer.	Informational message.

Table 7-6: Messages (Continued)

System Message	Cause/Action to Take
UsysDcmReceiveApp is missing in the installation directory ... Failed to start.	Contact service for re-installation
You have images in the data pane.	Informational message.
You have images in the data pane. Are you sure you want to open a new study?	Confirm selection.
You have images pending in the DICOM queue.	Informational message.
You must restart Invenia ABUS 2.0 for the configuration changes to take effect.	Please restart the application.

Invenia ABUS 2.0 Error Log

Invenia ABUS 2.0 creates three error logs per day:

Daily error logs

- ABUSApp_(serial number).(date).log.uct
- ScannerApp_(serial number).(date).log.uct
- ScannerAppMtCtrlLib_(serial number).(date).log.uct

Filename	Date/Time	File Type	Size
ABUSApp_JNVF1490050.2015-11-17.log.uct	11/17/2015 4:46 PM	UCT File	3,486 KB
ABUSApp_JNVF1490050.2015-11-18.log.uct	11/18/2015 4:06 PM	UCT File	3,394 KB
ABUSApp_JNVF1490050.2015-11-19.log.uct	11/19/2015 4:21 PM	UCT File	4,298 KB
ABUSApp_JNVF1490050.2015-11-20.log.uct	11/20/2015 3:48 PM	UCT File	2,047 KB
ABUSApp_JNVF1490050.2015-11-23.log.uct	11/23/2015 4:12 PM	UCT File	1,845 KB
ABUSApp_JNVF1490050.2015-11-24.log.uct	11/24/2015 3:46 PM	UCT File	2,230 KB
ABUSApp_JNVF1490050.2015-11-25.log.uct	11/25/2015 1:20 PM	UCT File	1,436 KB
ABUSApp_JNVF1490050.2015-11-27.log.uct	11/27/2015 2:14 PM	UCT File	2,177 KB
ABUSApp_JNVF1490050.2015-11-30.log.uct	11/30/2015 2:53 PM	UCT File	486 KB
ABUSApp_JNVF1490050.2015-12-01.log.uct	12/1/2015 11:14 AM	UCT File	18 KB
ScannerApp_JNVF1490050.2015-11-17.log.uct	11/17/2015 4:46 PM	UCT File	780 KB
ScannerApp_JNVF1490050.2015-11-18.log.uct	11/18/2015 4:06 PM	UCT File	548 KB
ScannerApp_JNVF1490050.2015-11-19.log.uct	11/19/2015 4:21 PM	UCT File	905 KB
ScannerApp_JNVF1490050.2015-11-20.log.uct	11/20/2015 3:39 PM	UCT File	315 KB
ScannerApp_JNVF1490050.2015-11-23.log.uct	11/23/2015 4:12 PM	UCT File	363 KB
ScannerApp_JNVF1490050.2015-11-24.log.uct	11/24/2015 3:46 PM	UCT File	378 KB
ScannerApp_JNVF1490050.2015-11-25.log.uct	11/25/2015 1:20 PM	UCT File	218 KB
ScannerApp_JNVF1490050.2015-11-27.log.uct	11/27/2015 2:14 PM	UCT File	304 KB
ScannerApp_JNVF1490050.2015-11-30.log.uct	11/30/2015 2:53 PM	UCT File	79 KB
ScannerApp_JNVF1490050.2015-12-01.log.uct	12/1/2015 11:08 AM	UCT File	7 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-11-17.log.uct	11/17/2015 2:39 PM	UCT File	263 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-11-18.log.uct	11/18/2015 3:57 PM	UCT File	193 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-11-19.log.uct	11/19/2015 4:16 PM	UCT File	321 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-11-20.log.uct	11/20/2015 3:39 PM	UCT File	127 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-11-23.log.uct	11/23/2015 4:01 PM	UCT File	123 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-11-24.log.uct	11/24/2015 3:36 PM	UCT File	131 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-11-25.log.uct	11/25/2015 8:15 AM	UCT File	73 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-11-27.log.uct	11/27/2015 9:46 AM	UCT File	111 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-11-30.log.uct	11/30/2015 2:53 PM	UCT File	85 KB
ScannerAppMtCtrlLib_JNVF1490050.2015-12-01.log.uct	12/1/2015 11:15 AM	UCT File	18 KB

ABUSApp_(serial number).(date).log.uct
 ScannerApp_(serial number).(date).log.uct
 ScannerAppMtCtrlLib_(serial number).(date).log.uct

Figure 7-17. ABUS daily error logs

```

2015-12-01 08:19:42 INFO shmem - AbsSt ScanHead @x Right
2015-12-01 08:19:42 INFO shmem - AbsSt Scan Unready (Disable Plus, Minus, Start buttons)
2015-12-01 08:19:42 INFO shmem - AbsSt AutoSOS disabled
2015-12-01 08:19:42 INFO shmem - AbsSt Set ScanHead Center Position
2015-12-01 08:19:42 INFO shmem - AbsSt ScnHdTest disabled
2015-12-01 08:19:42 INFO audit - Power percentage changed: 100
2015-12-01 08:19:42 INFO audit - Cleared Selected Work Item
2015-12-01 08:19:43 INFO audit - Setting - keepDom6Anonymized: 0
2015-12-01 08:19:43 INFO audit - Setting - DICOM Local AE Info: ABUSApp: 104
2015-12-01 08:19:43 INFO shmem - ScanHeadOriChangeEnabled:1
2015-12-01 08:19:43 INFO audit - Scan Init
2015-12-01 08:19:43 INFO shmem - ScanSt Scan Initializing-Getting ready
2015-12-01 08:19:44 INFO acq3n - Load success :C:\YF_Resources\VS_ImgCnfFiles\C15_6XWFlashAnglesFocusSpharmonicsMix_2s_10MHZ5CM10HZ_CS889.imgcnf
2015-12-01 08:19:44 INFO acq3n - rowsPerFrame = 511200 colsPerFrame = 64 numFrames = 2
2015-12-01 08:19:44 INFO acq3n - Allocated 130867200 bytes of memory for receive buffer 0
2015-12-01 08:19:44 INFO acq3n - Load success :C:\YF_Resources\VS_ImgCnfFiles\C15_6XWFlashAnglesFocusSpharmonicsMix_2s_10MHZ5CM10HZ_CS9.imgcnf
2015-12-01 08:19:44 INFO acq3n - rowsPerFrame = 543840 colsPerFrame = 64 numFrames = 2
2015-12-01 08:19:44 INFO acq3n - Allocated 139223040 bytes of memory for receive buffer 0
2015-12-01 08:19:44 INFO acq3n - Load success :C:\YF_Resources\VS_ImgCnfFiles\C15_6XWFlashAnglesFocusSpharmonicsMix_2s_10MHZ5_CM10HZ_CS9.imgcnf
2015-12-01 08:19:44 INFO acq3n - rowsPerFrame = 543840 colsPerFrame = 64 numFrames = 2
2015-12-01 08:19:44 INFO acq3n - Allocated 139223040 bytes of memory for receive buffer 0
2015-12-01 08:20:00 INFO acq3n - Vs_HardwareOpen() Completed normally as expected.
2015-12-01 08:20:00 INFO acq3n - boards = 2
2015-12-01 08:20:00 INFO acq3n - chips = 4
2015-12-01 08:20:00 INFO acq3n - channels = 8
2015-12-01 08:20:00 INFO acq3n - highVoltageOutputMinimum = 1.6 highVoltageOutputMaximum = 96 highVoltageOutputGranularity = 0.025
2015-12-01 08:20:00 INFO acq3n - Vs_ShiScanheadSelectedGet return code: "Success". Details: Completed normally as expected.
2015-12-01 08:20:00 INFO acq3n - connector = 1
2015-12-01 08:20:00 INFO acq3n - Vs_ShiScanheadSelect return code: "Success". Details: Completed normally as expected.
2015-12-01 08:20:00 INFO acq3n - Vs_ShiScanheadPresentGet return code: "SHI Scanhead Is Connected". Details: A scanhead is connected on the Verasonics Scan
2015-12-01 08:20:00 INFO acq3n - Vs_ShiScanheadIdGet return code: "Success". Details: Completed normally as expected.
2015-12-01 08:20:00 INFO acq3n - scanhead id = 96 Trans.id = 65632
2015-12-01 08:20:00 INFO acq3n - tpcHvMuxHvRailsResulting = 90.0277 tpcHvMuxLogicRailResulting = 4.99836
2015-12-01 08:20:00 DEBUG acq3n - m_pThreadAcq->IsStopped() after
2015-12-01 08:20:00 DEBUG acq3n - Vs_SequenceIsRunning() after
2015-12-01 08:20:01 INFO acq3n - sequence loaded in 1373753669 nanos

```

Figure 7-18. ABUSApp_(serial number).(date).log.uct

```

2015-11-30 07:22:49,783 INFO ScannerApp - C:\YF_Resources\ScannerAppConfig\ScanStationStateConfig.xml.uct, C:\Users\ABUSPRO\AppData\Local\Temp\tmp7437.LMG
2015-11-30 07:22:49,860 INFO ScannerApp - Load StateConfig Completed
2015-11-30 07:22:49,863 INFO ScannerApp - State INIT
2015-11-30 07:23:03,892 INFO StateMachine - TransStateByEventENTER INIT by Event ScanMotorStoppedAtHomeLimit
2015-11-30 07:23:03,893 INFO StateMachine - TransStateByEventFAIL INIT by ScanMotorStoppedAtHomeLimit
2015-11-30 07:23:04,001 INFO StateMachine - TransStateByEventENTER INIT by Event InitFinEvent - All of the motors are home
2015-11-30 07:23:04,411 INFO StateMachine - TransStateByEventSUCCESS WAIT_CENTER from INIT by InitFinEvent - All of the motors are home
2015-11-30 07:23:14,867 INFO StateMachine - TransStateByEventENTER WAIT_CENTER by Event ScanMotorMoveComplete
2015-11-30 07:23:14,870 INFO StateMachine - TransStateByEventSUCCESS SCANHEAD_CENTER from WAIT_CENTER by ScanMotorMoveComplete
2015-11-30 07:29:54,592 INFO StateMachine - TransStateByEventENTER SCANHEAD_CENTER by Event ScanMotorReadyNoMemEvent
2015-11-30 07:29:54,795 INFO StateMachine - TransStateByEventSUCCESS MEMB_DETACHED from SCANHEAD_CENTER by ScanMotorReadyNoMemEvent
2015-11-30 07:30:00,242 INFO ScannerApp - Membr Detect: True State:MEMB_DETACHED
2015-11-30 07:30:00,244 INFO StateMachine - TransStateByEventENTER MEMB_DETACHED by Event Membrane - attached
2015-11-30 07:30:00,648 INFO StateMachine - TransStateByEventSUCCESS WAIT_INFERIOR from MEMB_DETACHED by Membrane - attached
2015-11-30 07:30:03,087 INFO StateMachine - TransStateByEventENTER WAIT_INFERIOR by Event ScanMotorMoveComplete
2015-11-30 07:30:03,691 INFO StateMachine - TransStateByEventENTER WAIT_INFERIOR by Event ScanMotorMoveComplete
2015-11-30 07:30:03,694 INFO StateMachine - TransStateByEventSUCCESS ZERO_WEIGHT from WAIT_INFERIOR by ScanMotorMoveComplete
2015-11-30 07:30:03,699 INFO StateMachine - TransStateByEventFAIL ZERO_WEIGHT by ScanMotorMoveComplete
2015-11-30 07:33:51,130 INFO ScannerApp - Button Pushed WeightPlus
2015-11-30 07:33:51,133 INFO StateMachine - TransStateByEventENTER ZERO_WEIGHT by Event WeightPlusButtonEvent
2015-11-30 07:33:51,942 INFO StateMachine - TransStateByEventSUCCESS WAIT_WEIGHTING from ZERO_WEIGHT by WeightPlusButtonEvent
2015-11-30 07:33:53,067 INFO StateMachine - TransStateByEventENTER WAIT_WEIGHTING by Event WeightControlMotorMoveComplete
2015-11-30 07:33:53,269 INFO StateMachine - TransStateByEventSUCCESS WEIGHTING_LOCKED from WAIT_WEIGHTING by WeightControlMotorMoveComplete
2015-11-30 07:33:54,189 INFO ScannerApp - Button Pushed WeightPlus
2015-11-30 07:33:54,189 INFO StateMachine - TransStateByEventENTER WEIGHTING_LOCKED by Event WeightPlusButtonEvent
2015-11-30 07:33:54,793 INFO StateMachine - TransStateByEventSUCCESS WAIT_WEIGHTING from WEIGHTING_LOCKED by WeightPlusButtonEvent
2015-11-30 07:33:55,917 INFO StateMachine - TransStateByEventENTER WAIT_WEIGHTING by Event WeightControlMotorMoveComplete
2015-11-30 07:33:56,120 INFO StateMachine - TransStateByEventSUCCESS WEIGHTING_LOCKED from WAIT_WEIGHTING by WeightControlMotorMoveComplete
2015-11-30 07:34:05,730 INFO ScannerApp - Button Pushed Start
2015-11-30 07:34:05,733 INFO StateMachine - TransStateByEventENTER WEIGHTING_LOCKED by Event StartButton (center) Pressed
2015-11-30 07:34:05,939 INFO StateMachine - TransStateByEventSUCCESS WAIT_BALL_LOCKING_CENTER from WEIGHTING_LOCKED by StartButton (center) Pressed
2015-11-30 07:34:06,238 INFO StateMachine - TransStateByEventENTER WAIT_BALL_LOCKING_CENTER by Event BallLockMotorMoveComplete

```

Figure 7-19. ScannerApp_(serial number).(date).log.uct

Logs information from the Scan Head Assembly (Membrane, Buttons Pushed), Scan Arm (i.e. Ball Joint Lock) and Weight Controller (motor controller)

For example: -ENTER MEMB_DETACHED by Event Membrane - attached

Logs information from the Scan Head Assembly (Membrane, Buttons Pushed), Scan Arm (i.e. Ball Joint Lock) and Weight Controller (motor controller)

For example: -ENTER MEMB_DETACHED by Event Membrane
- attached

Collecting Error Logs

Since there is not an ALT + D function, you might have to download the logs by selecting each individual file under the /Log folder:

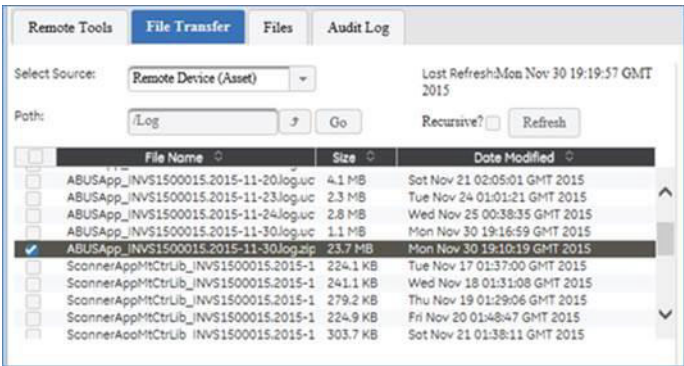


Figure 7-20. Downloading Log File

Name	Date modified	Type	Size
ABUSApp_INVS1400069.2015-12-01.log.uct	12/1/2015 3:57 PM	UCT File	0 KB
ScannerApp_INVS1400069.2015-12-01.log.uct	12/1/2015 3:57 PM	UCT File	0 KB
ScannerAppMtCtrlLib_INVS1400069.2015-12-01.log.uct	12/1/2015 3:58 PM	UCT File	0 KB

Figure 7-21. Example of downloaded error logs

Common Error Codes for the Invenia ABUS 2.0

The Invenia ABUS 2.0 system error messages have been improved to provide an easier troubleshooting experience for field engineers and remote technical support team members. The Invenia 2.0 system displays an error/information message along with an error code. The error code displayed uses the same error code rule (5 digit number) implemented with the Invenia R1 system:

Error Code (total 5 digits)		
First 1 digit	Second 1 digit	Third 3 digits
1 - ABUSApp related	1 - Acquisition related	Acquisition error code
	2 - Scanhead related	001 - Scanhead id does not match.
	3 - Renderer related	001 - Image renderer initialization failed.
	4 - System status related	
2 - ScannerApp related	1 - Initialization related	ScannerApp initialization related error code
	2 - USB related	ScannerApp USB related error code after initialization
3 - GEUS related	1 - Failure Type	GEUS fatal error information category (requires system shutdown)
	2 - Info Type	GEUS information error information category (warning/information)
	3 - Service Type	GEUS service error information category (pass to service app)

NOTE: The software team ensured that the new GEUS (Ultrasound Box) error codes does not overlap with old Verasonics (VDAS/ Acquisition) codes. Thus, the error codes related to GEUS and VDAS are unique to each system design.

Error Code Identifications

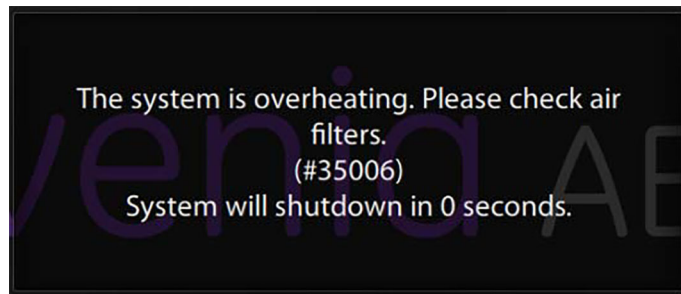
Ultrasound Box (GEUS) error code examples:

Example 1

Error code 35006 is related to high temperature readings in the Ultrasound Box. Since this problem could be caused by a blocked or partially blocked air-filter, the user is instructed to check the system air filter first.

If the system continues to overheat, the customer places a service call.

The service team can easily search the Service Manual by the error code and follow the troubleshooting steps: check the cMST temperature monitoring readings and run the system diagnostics available in the Service Desktop to determine if the problem is caused by the Ultrasound Box fans or possible temperature reading errors on the cMST board sensors.

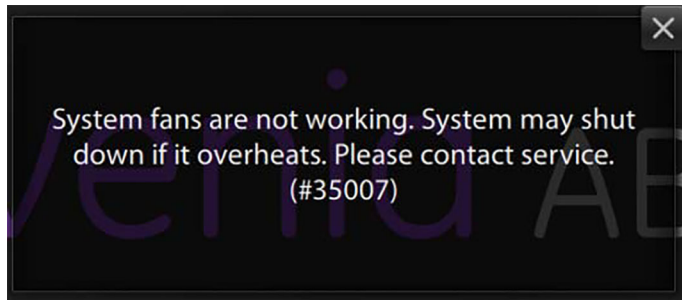


Ultrasound Box (GEUS) error code examples: (continued)

Example 2

Error code 35007 is related to a problem with the Ultrasound Box fans (fan tray assembly). This problem could be caused by a defective fan in the fan tray assembly, or an issue with 12V fan voltage supplied by MFESP board.

The service team can easily search the Service Manual by the error code and follow the troubleshooting steps: check the MFESP fan monitoring readings and run the system diagnostics available in the Service Desktop to determine the root cause of the problem.



The Invenia 2.0 system displays an error/information message along with an error code, and codes are linked to troubleshooting action items in the Service Manual. However, some error codes/problems may still require the service team to collect and to analyze the system error logs.

Error Code List

Error Code	Category	Description
11001	Acquisition	Failed to initialize acquisition (missing frontend JSON file, possible transducer disconnection)
12001	Acq-scanhead	Scanhead id does not match.
13001	Renderer	Image renderer initialization failed.
14001	System status	GPU Max temperature exceeded
14002	System status	Power Max exceeded
21001	ScannerApp Init	Initialization success
21002	ScannerApp Init	Weight motor init home failed
21003	ScannerApp Init	Scan motor init home failed
21004	ScannerApp Init	Ball motor init home failed
21005	ScannerApp Init	Scanhead controller USB COM port not detected
21006	ScannerApp Init	Weight controller USB COM port not detected
21007	ScannerApp Init	Scanhead and Weight controller USB COM port not detected
22001	ScannerApp USB	Scanhead controller USB COM port not detected
22002	ScannerApp USB	Weight controller USB COM port not detected
31000	GEUS Unknown	Unknown GEUS Error Code received
31001	GEUS Failure	GEUS fatal error requiring system shutdown
31002	GEUS Failure	GEUS fatal error requiring system restart
31001	GEUS Failure	GEUS fatal error DSP not detected requiring system restart
32001	GEUS Info	GEUS information error
32002	GEUS Info	GEUS information error requiring system restart
33001	GEUS Service	GEUS service type error information category

Error Code List (continued)

GE US		Error Messages
35001	GEUS Failure	ERR_TRANSMIT_001 - Transmit Overload
35002	GEUS Failure	ERR_SETUP_002 - A setup problem occurred. Please reselect transducer to continue
35003	GEUS Failure	ERR_MAJOR_SETUP_003 - A major setup problem occurred. Application will restart
35004	GEUS Failure	ERR_UNRECOVERABLE_004 - An unrecoverable problem occurred. System will shutdown.
35005	GEUS Failure	ERR_UNKNOWN_SETUP_005 - An unknown setup problem occurred. System will NOT Scan
35006	GEUS Failure	ERR_OVERHEATING_006 - The system is overheating. The system will shut down soon! Please check air filters.
35007	GEUS Failure	ERR_FAN_FAILURE_007 - Fan failure. The system will shut down soon!
35008	GEUS Failure	ERR_VOLTAGE_008 - System voltage fault. The system will shut down soon!
35009	GEUS Failure	ERR_POWER_009 - Power supply voltage fault. The system will shut down soon!
35010	GEUS Failure	ERR_FAN_FAULT_010 - The fan is fault and the system is overheating. System will be shutdown!
35011	GEUS Failure	ERR_BEP_011 - Bep Monitor abnormal, System will be shutdown!
35012	GEUS Failure	ERR_APPLICATION_012 - Please reselect the application once again to continue.

Error Code List (continued)

GE US		Info Messages
36001	GEUS Info	INFO_TRANSDUCER_REMOVE_001 - Transducer at port %d is removed!
36002	GEUS Info	INFO_TRANSDUCER_INSERT_002 - transducer %s at port %d is inserted
36003	GEUS Info	INFO_TRANSDUCER_INDEFINITE_003 - Indefinite Transducer Error :transducer %s in connector %
36004	GEUS Info	INFO_TRANSDUCER_NOT_ACCEPTED_004 - transducer in connector %d not accepted by system
36005	GEUS Info	INFO_SYSTEM_SHUTDOWN_005 - Do you want to shut down the system?
36006	GEUS Info	INFO_MAJOR_SETUP_006 - A minor setup problem occurred. Image quality may not be optimal
36007	GEUS Info	INFO_BEP_VOL_007 - Bep Voltage is out of range!
36008	GEUS Info	INFO_BEP_FAN_008 - Bep Fan is abnormal!
36009	GEUS Info	INFO_TEMP_009 - Bep temperature is out of range!
36010	GEUS Info	INFO_TRANSDUCER_010 - Transducer is disconnected
36011	GEUS Info	INFO_DIAG_MODE_011 - Enter Diagnostics Mode
36012	GEUS Info	INFO_TRANSDUCER_SCANHEAD_REMOVE_012 - Transducer scan head is disconnected
36013	GEUS Info	INFO_TRANSDUCER_SCANHEAD_NOT_ACCEPTED_013 - The transducer is not supported
36014	GEUS Info	INFO_MPSB_BROKEN_014 - The MPSB is broken

Chapter 8

Replacement Procedures

This chapter describes how to remove and replace the system's filter and transducer.

Warnings and important information

Warnings



Energy Control and Power Lockout for Invenia ABUS 2.0.

When servicing parts of the Invenia ABUS 2.0 where there is exposure to voltage greater than 30 volts:

1. Follow LOCKOUT/TAGOUT procedures.
2. Turn off the Power Mains Switch.
3. Unplug the Invenia ABUS 2.0.
4. Maintain control of the Invenia ABUS 2.0 power plug.
5. Wait for at least 30 seconds for capacitors to discharge as there are no test points to verify isolation.
6. Remove/disconnect the battery, if present.

Invenia ABUS 2.0 components may be energized.



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 35 LBS (16 KG). Anything over 35 LBS (16 KG) requires 2 people.



At least two people are needed when replacing casters (wheels) or adjusting brakes.



Avoid contacting used parts before disinfecting.

Warnings (continued)



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

Always connect yourself, via an arm-wrist strap, to the advised ESD connection point located on the rear of the Invenia ABUS 2.0 (near the power connector).



Follow general guidelines for handling of electrostatic sensitive equipment.

NOTE: *Use an ESD compatible work space or the ESD-kit during parts replacement.*



The waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately.

Please contact the manufacturer or other authorized disposal company to decommission your equipment.



Manpower

Two people are required for:

- Anything over 35 LBS (16 KG)

Returning/shipping transducers and repair parts

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

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

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

Parts Disposal

Used Media and Used Parts Disposal



The waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately.

Please contact the manufacturer or other authorized disposal company to decommission your equipment.

Properly dispose of all old or used parts and media according to current policies and procedures. Never keep old software or leave old software at the customer site.

Cleaning the Filter / Replacement

Clean the filter on a monthly basis. This will also be performed by the Service Engineer during their normal PM process. To clean or replace the Filter,

Table 8-1: Cleaning the Filter

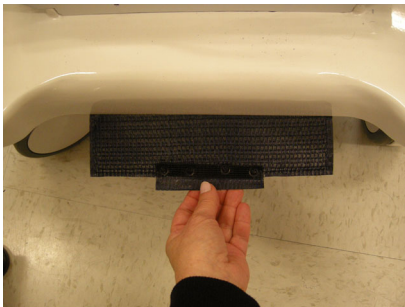
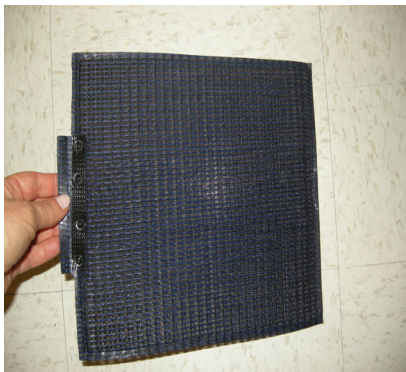
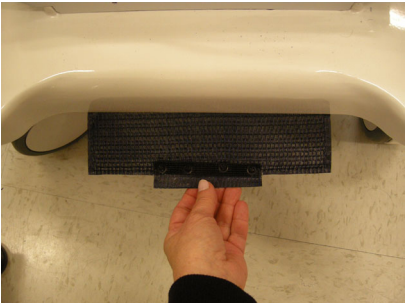
Steps	Illustrations
1. Power down the system.	
2. Remove the filter which is located on the bottom of the Invenia ABUS 2.0. The filter is attached using Velcro.	
3. Vacuum the filter.	

Table 8-1: Cleaning the Filter

Steps	Illustrations
4. Replace the filter, velcro side up.	

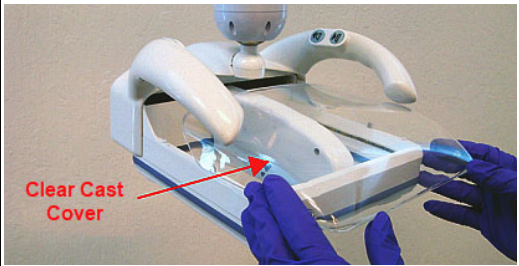

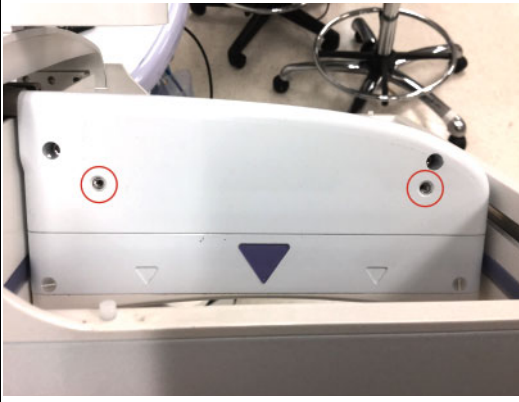
Filter Replacement Functional Check


Confirm that the system:

- Powers on when you press the On/Off/Standby control.
- That the transducer moves across the Scan Head Assembly.
- That the software runs through its initialization.
- That each user type (User, Admin) can successfully login to the system.
- And that the system images the patient successfully.



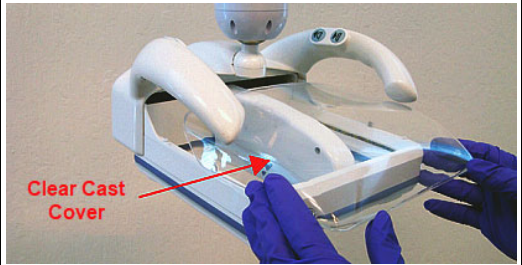
Replacing the Transducer


To remove the transducer

1.	Power down the system by pressing the Power button on the front cover.	
2.	Turn off the switch on the Power Entry Module/Power Cord Socket, then remove the Power Cord. Maintain control of the power cord according to local lockout tagout requirements.	
3.	Remove the Scan Head assembly Clear Cast Cover.	
4.	Remove the Stabilizing Membrane.	
5.	<p>Remove the four (4) screws securing the Transducer Cover assembly to the Transducer adapter mounting.</p> <p>NOTE: There are two (2) screws on either side of the Transducer Adapter Mounting.</p>	

6.	<p>Hold the Transducer with one hand and the Transducer Cover assembly with the opposite hand. Gently pull the Transducer away from the Transducer Cover.</p>	
----	---	--

Replacing the Transducer (continued)

Step	Description	Illustration
1.	Hold the Transducer Adapter mounting with one hand and the Transducer Cover assembly with the opposite hand. Gently push the Transducer into the Transducer Adapter mounting.	
2.	<p>Insert the four (4) screws (1500-0097-00) into the Transducer Adapter mounting and torque the screws to 10 in-lbs. (1.15 N-m)</p> <p>NOTE: There are two (2) screws on either side of the Transducer Adapter Mounting.</p>	
3.	Install the Scan Head assembly Clear Cast Cover.	

4.	Attach the Stabilizing Membrane.	
5.	Plug the power cord into the Power Entry Module/Power Cord Socket and switch the power on.	
6.	Power the system on by pressing the Power Button on the front of the system.	
7.	Perform system functional checks listed in the Functional Checks section.	

Transducer Functional Check

Ensure that the transducer:

- Upon Power Up moves across the Scan Head Assembly.
- That the lights on the Scan Head Assembly light up.
- That the transducer images as a scan is being performed.
- That the transducer generates a 3D Volume.

B-Mode Functional Checks

Confirm that the system:

- Performs a B-Mode scan.
- Places B-Mode imaging parameters on the Touch Screen Monitor.
- Images evenly across the entire Touch Screen.

3D Volume Functional Checks

Confirm that the 3D Volume:

- Gets generated after each Scan View performed.

Performing the Exam

Confirm that the system can:

- Login the User.
- Access the Worklist and/or Enter Patient information manually.
- Perform the exam.
- Verify the exam.
- Send the exam to the Workstation / PACS.
- Perform Query/Retrieve process to PACS

Replacing the Power Cord

To remove the power cord,

1. Locate the power cord receptacle on the back of the system.

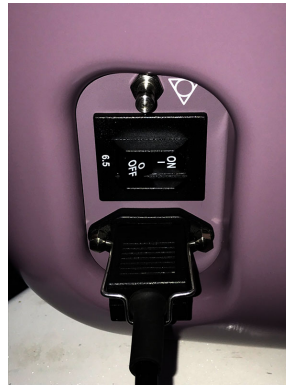


Figure 8-1. Power Cord in Receptacle

2. Pull the steel retaining clip upwards.
3. Disconnect the power cord from its receptacle by pulling the power cord straight out.



CAUTION

Removing the power cord without lifting the steel retaining clip may damage the system.

To replace the power cord

1. Locate the power cord receptacle on the back of the system.
2. Align the power cord prongs to match the receptacle, then securely push the cord straight back into the receptacle.
3. Pull the steel retaining clip down to retain the plug in the system.

System Backup and Software Load

System Backup and Software reloading needs to be performed by trained, qualified personnel. Contact GE for training.

Notice against user modification

Never modify this product, including system components, software, cables, and so on. User modification may cause safety hazards and degradation in system performance. All modification must be done by a GE qualified person.



This equipment contains dangerous voltages that are capable of serious injury or death.

If any defects are observed or malfunctions occur, stop operating the equipment and perform the proper action for the patient. Inform a qualified service person and contact a Service Representative for information.

There are no user serviceable components inside the console. Refer all servicing to qualified service personnel only.

Ensure that unauthorized personnel do not tamper with the unit.

Internal Component Replacement

Internal System components **MUST ONLY** be serviced by trained, qualified personnel.

Contact GE for training.

- Covers and Service Table
- Scan Head Assembly
- Articulating Arm and Tower
- Monitor Display
- Internal Imaging Components
- Caster Wheels



WARNING

This equipment contains dangerous voltages that are capable of serious injury or death.

If any defects are observed or malfunctions occur, stop operating the equipment and perform the proper action for the patient. Inform a qualified service person and contact a Service Representative for information.

There are no user serviceable components inside the console. Refer all servicing to qualified service personnel only.

Ensure that unauthorized personnel do not tamper with the unit.

Chapter 9

Renewal Parts

This chapter lists the renewal parts available for the Invenia ABUS 2.0.

List of Abbreviations

Table 9-1: List of Abbreviations

ABBREVIATION	DESCRIPTION
3D	THREE DIMENSIONAL
ABUS	AUTOMATED BREAST ULTRA SOUND
ASSY	ASSEMBLY
FRU	FIELD REPLACEMENT UNIT
CTRL	CONTROL
DMM	DIGITAL MULTIMETER
EXT.	EXTERNAL
I/O	INPUT/OUTPUT
INT	INTERNAL
LCD	LIQUID CRYSTAL DISPLAY
PCIe	PCI EXPRESS
PS	POWER SUPPLY
PCA	PRINTED CIRCUIT ASSEMBLY
PWA	PRINTED WIRE ASSEMBLY
PWR	POWER
QTY	QUANTITY USED PER Invenia ABUS 2.0
SSD	SOLID STATE DRIVE

Reordering Supplies

Table 9-2: Replacement Part Numbers

Part Number/ ECAT	Description
3787-0006-00	Filter
3787-0044-00	Transducer
3787-0013-00	Power Cords:
3787-0017-00	A.C. Power Cable Switzerland
3787-0014-00	A.C. Power Cable UK/Ireland
3787-0021-00	A.C. Power Cable Australia
3787-0015-00	A.C. Power Cable Denmark
3787-0022-00	A.C. Power Cable Italy
3787-0023-00	A.C. Power Cable Argentina
3787-0011-00	A.C. Power Cable Israel
3787-0012-00	A.C. Power Cable N.America
3787-0019-00	A.C. Power Cable Europe
3787-0020-00	A.C. Power Cable China
3787-0018-00	A.C. Power Cable Brazil
3787-0016-00	A.C. Power Cable Japan
3787-0008-00	A.C. Power Cable S. Africa/India
3787-0008-00	Planar Touch Screen 17" Monitor

Table 9-3: Accessory Part Numbers

Part Number/ ECAT	Description
5486351 E8365EC	PolySonic Ultrasound Lotion (Non-Sterile) -- 8.5oz dispenser bottles
5489491 E8365EF	PolySonic Ultrasound Lotion (Non-Sterile) -- 1 US gallon with refillable dispenser
5486348 E8340AB	ABUS Single-Use Stabilization Membrane - non-Sterile, (50 pack)
2102-0121-00	Monster Cable Screen Clean LCD Touch Screen Cleaner (not available in all markets)
	<ul style="list-style-type: none"> • ProteX Ultra Disinfectant Wipes - 60 ct Soft-pack w/ stay-put adhesive backing (not available in all markets) • ProteX Ultra Disinfectant Wipes -- 120 ct Canister pack (not available in all markets)

Table 9-3: Accessory Part Numbers

Part Number/ ECAT	Description
	Dispatch Hospital Cleaner Disinfectant Towels with Bleach – Clorox
	Clinell Universal Wipes - GAMA Healthcare Ltd.
3500-0684-00	Invenia ABUS 2.0 Starter Kit:, contains: <ul style="list-style-type: none">• Lotion, Ultrasound Coupling Pack, non-sterile (12 pack)• Invenia ABUS 2.0 Single Use Stabilization Membrane (50 pack)• Country-specific power cords (see below)

Chapter 10

Care and Maintenance

*This chapter describes **Care and Maintenance** on the Invenia ABUS 2.0 and peripherals. These procedures are intended to **maintain the quality** of the Ultrasound **system's performance**. Read this chapter completely and familiarize yourself with the procedures before performing a task.*

Why Do Maintenance?

Keeping Records

It is good business practice that ultrasound facilities perform and maintain records of periodic and corrective maintenance. The Ultrasound Equipment Quality Check (EQC) form provides the customer with documentation that the Invenia Automated Breast Ultrasound System (ABUS) is maintained on a periodic basis.

A copy of the Ultrasound EQC form should be kept in the same room or near the ultrasound system.

NOTE: *Leave a copy of the Ultrasound Equipment Quality Check form with the customer and request that it be kept in the same room or near the ABUS unit.*

Customer Quality Assurance Program

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.

As a GE service representative, you can help the customer with establishing, performing and maintaining records for a quality assurance program.

Periodic Maintenance Inspections

The Invenia Automated Breast Ultrasound System does not require scheduled maintenance, therefore the maintenance tasks and schedule described in this manual are recommendations only, except in the following cases:

- The customer has a service contract with GE to perform maintenance at specific times.
- The customer has a Quality Assurance program that requires additional tasks and/or inspections at a different frequency than is recommended in this manual.

NOTE: *If preventative maintenance is performed, it should be done by a qualified ABUS-trained service person.*

Care and Maintenance Schedule

The following Care and Maintenance Schedule (Table 10-1) gives your customers guidelines for maintaining their Invenia ABUS 2.0 instrument and outlines items that may require special attention.

As the GE Service Representative, you can emphasize that it is the customer's responsibility to perform the tasks as indicated in the Care and Maintenance Schedule to ensure a high level of safety and performance of the Invenia ABUS 2.0 instrument.

NOTE: *The service procedures and recommended intervals shown in the Care and Maintenance Task Schedule are based on average patient load. If conditions exist which exceed typical usage and patient load, then recommend an increase in periodic maintenance frequencies.*

Table 10-1: Care and Maintenance Schedule

Cleaning/ Disinfecting	Screen Cleaner	Dry, Non- abrasive Cleaning Cloth	Disinfecti ng Wipes	Vacuum	Electrical Safety Analyzer/ Volt Meter	Fre- quency
Scan Head Assembly		X	X			After Each Patient
Touch Screen	X					Daily
Cabinet (Console, Display Arm, and Weight Tower)		X	X			Weekly
Air Filter				X		Monthly
Electrical Safety Test (Chassis)					X	Varies by Institution
Electrical Safety Test (Transducer)					X	Varies by Institution

Cleaning

Cleaning takes about 15 minutes to perform.
Refer to the Invenia ABUS 2.0 user documentation whenever necessary.



Biological
Hazard

Possible risk of infection. Do not handle soiled or contaminated transducer and other components that have been in patient contact. Follow appropriate cleaning and surface-level disinfecting procedures before handling the equipment.

Table 10-2: Cleaning

Task	Invenia ABUS 2.0
Clean Console	Clean the console with disinfecting wipes.
Clean Scan Head Assembly	Clean the Scan Head Assembly using the cleaning procedure on page 10-6.
Clean Touch Screen	<ol style="list-style-type: none"> 1. Turn off the Touch Screen Display. 2. Using the LCD-approved cleaning kit, clean the Touch Screen. 3. Turn the Touch Screen back on and verify calibration is still accurate.
Clean Filter(s)	Clean the Invenia ABUS 2.0 air filter using the procedure on page 10-6.

NOTE: *The germicidal wipes listed below are approved for use with the Invenia ABUS 2.0.*

List of Approved Disinfecting Wipes:

For the following disinfecting wipes, only chemical compatibility was tested—the efficacy of these wipes as germicidal agents was not evaluated:

1. Sani-Cloth HB Germicidal Wipes - PDI
2. Sani-Cloth AF3 Germicidal Wipes - PDI
3. Asepti-Wipes II Germicidal Wipes - Ecolab
4. Protex Ultra-Wipes - Parker Labs
5. Oxycide Daily Disinfectant Wipe Cleaner - Ecolab
6. Distel High-Level Disinfectant Wipes - Tristel

For the following disinfecting wipes, C. Diff was tested and passed:

1. Dispatch Hospital Cleaner Disinfectant Towels with Bleach – Clorox
2. Clinell Universal Wipes – GAMA Healthcare Ltd

Cleaning Scan Head Assembly



Biological
Hazard

Possible risk of infection. Do not handle soiled or contaminated transducer and other components that have been in patient contact. Follow appropriate cleaning and surface-level disinfecting procedures before handling the equipment.

Table 10-3: Cleaning the Scan Head




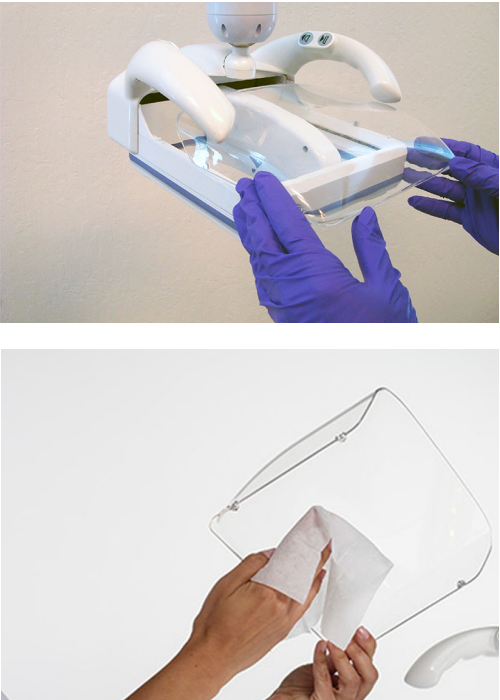




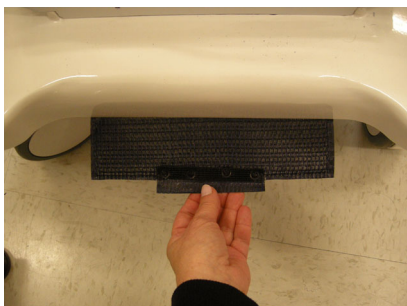
Steps	Illustrations
<p>1. Remove and dispose of Scan Membrane.</p>	 
<p>2. Use dry, non-abrasive cleaning cloth to wipe off lotion (if present) from the Scan Head Assembly.</p> <p>Use disinfecting wipes to clean away residual lotion and other debris from the patient contact areas. See list of approved wipes on page 10-5.</p>	

Table 10-3: Cleaning the Scan Head (Continued)

Steps	Illustrations
<p>3. Remove and clean the plastic Clear Cover of the Scan Head Assembly.</p>	
<p>CAUTION: Be sure to properly seat the plastic Clear Cover securely after cleaning.</p> 	
<p>4. Use disinfectant wipe to clean all portions of the transducer and Scan Head Assembly that comes in contact with the patient's breast. See note on approved disinfectant wipes on page 10-5.</p> <p>Inspect transducer for wear.</p>	
<p>CAUTION: DO NOT use an alcohol-based solution to clean the transducer.</p> 	

Cleaning Air Filter

Table 10-4: Cleaning the Air Filter

Steps	Illustrations
1. Power down the system.	
2. Remove the air filter, which is located on the bottom of the Invenia ABUS 2.0.	
3. Vacuum the air filter.	
4. Replace the air filter, velcro side up.	

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