GE Healthcare

MAC™ 5500/MAC™ 5500 HD
Resting ECG Analysis System
Service Manual

Software Version 10
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Publication Information

The information in this manual only applies to MAC**™** 5500 and MAC**™** 5500 HD system software version 10. It does not apply to earlier software versions. Due to continuing product innovation, specifications in this manual are subject to change without notice.

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The document part number and revision are on each page of the document. The revision identifies the document's update level. The revision history of this document is summarized in the following table.

Revision	Date	Description
A	31 January 2011	Initial release.
B	14 August 2012	Updated the following sections: • *Safety Messages* • *Related Documentation* • *Parts List* Removed *Parts and Accessories.* Refer to the operator manual for supplies and accessories information.
C	3 May 2013	Updated to address the following new components: PCB (801212–008), display assembly (2026799–002), and communications board (2022332–004).
D	18 August 2013	Corrected display part numbers in Appendix B, "Software/Hardware Compatibility", per SPR HCSDM00225973.
E	21 February 2014	Updated several part numbers with new ROHS-compliant versions.
F	14 July 2014	Manual updated for RoHS regulatory compliance.
G	31 January 2019	• Updated to remove Authorized European representative. • Added the Instructions for Use. • Updated UL Symbol.

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Service Manual Language Information

WARNING (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.
ПРЕДУПРЕЖДЕНИЕ (BG)	Това упътване за работа е налично само на английски език. • Ако доставчикът на услугата на клиента изиска друг език, задължение на клиента е да осигури превод. • Не използвайте оборудването, преди да сте се консултирали и разбрали упътването за работа. • Неспазването на това предупреждение може да доведе до нараняване на доставчика на услугата, оператора или пациент в резултат на токов удар или механична или друга опасност.
警告 ZH-CN	本维修手册仅提供英文版本。 • 如果维修服务提供商需要非英文版本，客户需自行提供翻译服务。 • 未详细阅读和完全理解本维修手册之前，不得进行维修。 • 忽略本警告可能对维修人员，操作员或患者造成触电、机械伤害或其他形式的伤害。

Service Manual Language Information (cont'd.)

警告 (ZH-TW)	本維修手冊只提供英文版。 • 如果客戶的維修人員有英語以外的其他語言版本需求，則由該客戶負責 提供翻譯 服務。 • 除非您已詳閱本維修手冊並了解其內容，否則切勿嘗試對本設備進行維 修。 • 不重視本警告可能導致維修人員、操作人員或病患因電擊、機械因素或 其他因素 而受到傷害。
UPOZORENJE (HR)	Ove upute za servisiranje dostupne su samo na engleskom jeziku. • Ukoliko korisnički servis zahtijeva neki drugi jezik, korisnikova je odgovornost osigurati odgovarajući prijevod. • Nemojte pokušavati servisirati opremu ukoliko niste konzultirali i razumjeli ove upute. • Nepoštivanje ovog upozorenja može rezultirati ozljedama servisnog osoblja, korisnika ili pacijenta prouzročenim električnim udarom te mehaničkim ili nekim drugim opasnostima.
VAROVÁNÍ (CS)	Tento provozní návod existuje pouze v anglickém jazyce. • V případě, že externí služba zákazníkům potřebuje návod v jiném jazyce, je zajištění překladu do odpovídajícího jazyka úkolem zákazníka. • Nesnažte se o údržbu tohoto zařízení, aniž byste si přečetli tento provozní návod a pochopili jeho obsah. • V případě nedodržování této varování může dojít k poranění pracovníka prodejního servisu, obslužného personálu nebo pacientů vlivem elektrického proudu, respektive vlivem mechanických či jiných rizik.
ADVARSEL (DA)	Denne servicemanual findes kun på engelsk. • Hvis en kundes tekniker har brug for et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelse. • Forsøg ikke at servicere udstyret medmindre denne servicemanual har været konsulteret og er forstået. • Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk, mekanisk eller anden fare for teknikeren, operatøren eller patienten.
WAARSCHUWING (NL)	Deze service manual is alleen in het Engels verkrijgbaar. • Indien het onderhoudspersoneel een andere taal nodig heeft, dan is de klant verantwoordelijk voor de vertaling ervan. • Probeer de apparatuur niet te onderhouden voordat deze service manual geraadpleegd en begrepen is. • Indien deze waarschuwing niet wordt opgevolgd, zou het onderhoudspersoneel, de gebruiker of een patiënt gewond kunnen raken als gevolg van een elektrische schok, mechanische of andere gevaren.
HOIATUS (ET)	Käesolev teenindusjuhend on saadaval ainult inglise keeles. • Kui klienditeeninduse osutaja nõuab juhendit inglise keelest erinevas keeles, vastutab klient tõlketeenuse osutamise eest. • Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist. • Käesoleva hoiatuse eiramine võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärjel.

Service Manual Language Information (cont'd.)

VAROITUS (FI)	Tämä huolto-ohje on saatavilla vain englanniksi. • Jos asiakkaan huoltohenkilöstö vaatii muuta kuin englanninkielistä materiaalia, tarvittavan käännöksen hankkiminen on asiakkaan vastuulla. • Älä yritä korjata laitteistoa ennen kuin olet varmasti lukenut ja ymmärtänyt tämän huolto-ohjeen. • Mikäli tätä varoitusta ei noudateta, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.
CẢNH BÁO (VI)	Tài Liệu Hướng Dẫn Sửa Chữa chỉ có bản tiếng Anh. • Nếu các đơn vị cung cấp dịch vụ cho khách hàng yêu cầu một ngôn ngữ nào khác tiếng Anh, thì khách hàng sẽ có trách nhiệm cung cấp các dịch vụ dịch thuật. • Không được sửa chữa thiết bị trừ khi đã tham khảo và hiểu Tài liệu Hướng dẫn Sửa chữa. • Không tuân thủ những cảnh báo này có thể dẫn đến các tổn thương cho người thực hiện sửa chữa, người vận hành hay bệnh nhân, do sốc điện, các rủi ro về cơ khí hay các rủi ro khác.
WARNUNG (DE)	Diese Serviceanleitung ist nur in englischer Sprache verfügbar. • Falls der Kundendienst eine andere Sprache benötigt, muss er für eine entsprechende Übersetzung sorgen. • Keine Wartung durchführen, ohne diese Serviceanleitung gelesen und verstanden zu haben. • Bei Zuwiderhandlung kann es zu Verletzungen des Kundendiensttechnikers, des Anwenders oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.
ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)	Το παρόν εγχειρίδιο σέρβις διατίθεται στα αγγλικά μόνο. • Εάν το άτομο παροχής σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει υπηρεσίες μετάφρασης. • Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό εκτός εάν έχετε συμβουλευτεί και έχετε κατανοήσει το παρόν εγχειρίδιο σέρβις. • Εάν δεν λάβετε υπόψη την προειδοποίηση αυτή, ενδέχεται να προκληθεί τραυματισμός στο άτομο παροχής σέρβις, στο χειριστή ή στον ασθενή από ηλεκτροπληξία, μηχανικούς ή άλλους κινδύνους.
FIGYELMEZTETÉS (HU)	Ez a szerviz kézikönyv kizárólag angol nyelven érhető el. • Ha a vevő szerviz ellátója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészíttetése. • Ne próbálja elkezdeni használni a berendezést, amíg a szerviz kézikönyvben leírtakat nem értelmezték és értették meg. • Ezen figyelmeztetés figyelmen kívül hagyása a szerviz ellátó, a működtető vagy a páciens áramütés, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.
AÐVÖRUN (IS)	Þessi þjónustuhandbók er eingöngu fáanleg á ensku. • Ef að þjónustuveitandi viðskiptamanns þarfnast annars tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálaþjónustu. • Reynið ekki að afgreiða tækið nema þessi þjónustuhandbók hefur verið skoðuð og skilin. • Brot á að sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklingi frá raflosti, vélrænum eða öðrum áhættum.

PERINGATAN (ID)	Manual servis ini hanya tersedia dalam bahasa Inggris. • Jika penyedia jasa servis pelanggan memerlukan bahasa lain selain dari Bahasa Inggris, merupakan tanggung jawab dari penyedia jasa servis tersebut untuk menyediakan terjemahannya. • Jangan mencoba melakukan servis terhadap perlengkapan kecuali telah membaca dan memahami manual servis ini. • Mengabaikan peringatan ini bisa mengakibatkan cedera pada penyedia servis, operator, atau pasien, karena terkena kejut listrik, bahaya mekanis atau bahaya lainnya.
AVVERTENZA (IT)	Il presente manuale di manutenzione è disponibile soltanto in Inglese. • Se un addetto alla manutenzione richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione. • Si proceda alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto. • Il non rispetto della presente avvertenza potrebbe far compiere operazioni da cui derivino lesioni all'addetto, alla manutenzione, all'utilizzatore ed al paziente per folgorazione elettrica, per urti meccanici od altri rischi.
警告 (JA)	このサービスマニュアルは英語版しかありません。 • サービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。 • このサービスマニュアルを熟読し、十分に理解をした上で装置のサービスを行ってください。 • この警告に従わない場合、サービスを担当される方、操作員あるいは患者が、感電や機械的又はその他の危険により負傷する可能性があります。
경고 (KO)	본 서비스 지침서는 영어로만 이용하실 수 있습니다. • 고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우, 번역 서비스를 제공하는 것은 고객의 책임입니다. • 본 서비스 지침서를 참고했고 이해하지 않는 한은 해당 장비를 수리하려고 시도하지 마십시오. • 이 경고에 유의하지 않으면 전기 쇼크, 기계상의 혹은 다른 위험으로부터 서비스 제공자, 운영자 혹은 환자에게 위해를 가할 수 있습니다.
BRĪDINĀJUMS (LV)	Šī apkalpotāju rokasgrāmata ir pieejama tikai angļu valodā. • Ja apkalpošanas sniedzējam nepieciešama informācija citā, nevis angļu, valodā, klienta pienākums ir nodrošināt tās tulkošanu. • Neveiciet aprīkojuma apkopi, neizlasot un nesaprotot apkalpotāju rokasgrāmatu. • Šī brīdinājuma neievērošana var radīt elektriskās strāvas trieciena, mehānisku vai citu risku izraisītu traumu apkopes sniedzējam, operatoram vai pacientam.
ĮSPĖJIMAS (LT)	Šis eksploatavimo vadovas yra prieinamas tik anglų kalba. • Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba - ne anglų, numatyti vertimo paslaugas yra kliento atsakomybė. • Nemėginkite atlikti įrangos techninės priežiūros, nebent atsižvelgėte į šį eksploatavimo vadovą ir jį supratote. • Jei neatkreipsite dėmesio į šį perspėjimą, galimi sužalojimai dėl elektros šoko, mechaninių ar kitų paslaugų tiekėjui, operatoriui ar pacientui.

Service Manual Language Information (cont'd.)

ADVARSEL (NO)	Denne servicehåndboken finnes bare på engelsk. • Hvis kundens serviceleverandør trenger et annet språk, er det kundens ansvar å sørge for oversettelse. • Ikke forsøk å reparere utstyret uten at denne servicehåndboken er lest og forstått. • Manglende hensyn til denne advarselen kan føre til at serviceleverandøren, operatøren eller pasienten skades på grunn av elektrisk støt, mekaniske eller andre farer.
OSTRZEŻENIE (PL)	Niniejszy podręcznik serwisowy dostępny jest jedynie w języku angielskim. • Jeśli dostawca usług klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta. • Nie należy serwisować wyposażenia bez zapoznania się i zrozumienia niniejszego podręcznika serwisowego. • Niezastosowanie się do tego ostrzeżenia może spowodować urazy dostawcy usług, operatora lub pacjenta w wyniku porażenia elektrycznego, zagrożenia mechanicznego bądź innego.
AVISO (PT-BR)	Este manual de assistência técnica só se encontra disponível em inglês. • Se o serviço de assistência técnica do cliente não for GE, e precisar de outro idioma, será da responsabilidade do cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica. • O não cumprimento deste aviso pode por em perigo a segurança do técnico, operador ou paciente devido a choques elétricos, mecânicos ou outros.
AVISO (PT-PT)	Este manual técnico só se encontra disponível em inglês. • Se a assistência técnica do cliente solicitar estes manuais noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução. • Não tente reparar o equipamento sem ter consultado e compreendido este manual técnico. • O não cumprimento deste aviso pode provocar lesões ao técnico, ao utilizador ou ao paciente devido a choques eléctricos, mecânicos ou outros.
AVERTISMENT (RO)	Acest manual de service este disponibil numai în limba engleză. • Dacă un furnizor de servicii pentru clienți necesită o altă limbă decât cea engleză, este de datoria clientului să furnizeze o traducere. • Nu încercați să reparați echipamentul decât ulterior consultării și înțelegerii acestui manual de service. • Ignorarea acestui avertisment ar putea duce la rănirea depanatorului, operatorului sau pacientului în urma pericolelor de electrocutare, mecanice sau de altă natură.
ПРЕДУПРЕЖДЕНИЕ (RU)	Настоящее руководство по обслуживанию предлагается только на английском языке. • Если сервисному персоналу клиента необходимо руководство не на английском, а на каком-то другом языке, клиенту следует обеспечить перевод самостоятельно. • Прежде чем приступать к обслуживанию оборудования, обязательно обратитесь к настоящему руководству и внимательно изучите изложенные в нем сведения. • Несоблюдение требований данного предупреждения может привести к тому, что специалисты по обслуживанию, операторы или пациенты получат удар электрическим током, механическую травму или другое повреждение.

Service Manual Language Information (cont'd.)

UPOZORENJE (SR)	Ovo servisno uputstvo je dostupno samo na engleskom jeziku.
	• Ako klijentov serviser zahteva neki drugi jezik, klijent je dužan da obezbedi prevodilačke usluge.
	• Ne pokušavajte da opravite uređaj ako niste pročitali i razumeli ovo servisno uputstvo.
	• Zanemarivanje ovog upozorenja može dovesti do povređivanja servisera, rukovaoca ili pacijenta usled strujnog udara, ili mehaničkih i drugih opasnosti.
VAROVANIE (SK)	Tento návod na obsluhu je k dispozícii len v angličtine.
	• Ak zákazníkov poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednosťou zákazníka.
	• Nepokúšajte sa o obsluhu zariadenia skôr, ako si neprečítate návod na obsluhu a neporozumiete mu.
	• Zanedbanie tohto varovania môže vyústiť do zranenia poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanickým alebo iným nebezpečenstvom.
OPOZORILO (SL)	Ta servisni priročnik je na voljo samo v angleškem jeziku.
	• Če ponudnik storitve stranke potrebuje priročnik v drugem jeziku, mora stranka zagotoviti prevod.
	• Ne poskušajte servisirati opreme, če tega priročnika niste v celoti prebrali in razumeli.
	• Če tega opozorila ne upoštevate, se lahko zaradi električnega udara, mehanskih ali drugih nevarnosti poškoduje ponudnik storitev, operater ali bolnik.
ADVERTENCIA (ES)	Este manual de servicio sólo existe en inglés.
	• Si el encargado de mantenimiento de un cliente necesita un idioma que no sea el inglés, el cliente deberá encargarse de la traducción del manual.
	• No se deberá dar servicio técnico al equipo, sin haber consultado y comprendido este manual de servicio.
	• La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.
VARNING (SV)	Den här servicehandboken finns bara tillgänglig på engelska.
	• Om en kunds servicetekniker har behov av ett annat språk än engelska ansvarar kunden för att tillhandahålla översättningstjänster.
	• Försök inte utföra service på utrustningen om du inte har läst och förstår den här servicehandboken.
	• Om du inte tar hänsyn till den här varningen kan det resultera i skador på serviceteknikern, operatören eller patienten till följd av elektriska stötar, mekaniska faror eller andra faror.
UYARI (TR)	Bu servis kılavuzunun sadece İngilizcesi mevcuttur.
	• Eğer müşteri teknisyeni bu kılavuzu İngilizce dışında bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer.
	• Servis kılavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz.
	• Bu uyarıya uyulmaması, elektrik, mekanik veya diğer tehlikelerden dolayı teknisyen, operatör veya hastanın yaralanmasına yol açabilir.

Service Manual Language Information (cont'd.)

ЗАСТЕРЕЖЕННЯ (UK)	Дане керівництво з сервісного обслуговування постачається виключно англійською мовою. • Якщо сервісний інженер потребує керівництво іншою мовою, користувач зобов'язаний забезпечити послуги перекладача. • Не намагайтеся здійснювати технічне обслуговування даного обладнання, якщо ви не читали, або не зрозуміли інформацію, надану в керівництві з сервісного обслуговування. • Недотримання цього застереження може призвести до травмування сервісного інженера, користувача даного обладнання або пацієнта внаслідок електричного шоку, механічного ушкодження або з інших причин невірного обслуговування обладнання.
CẢNH BÁO (VI)	Tài Liệu Hướng Dẫn Sửa Chữa chỉ có bản tiếng Anh. • Nếu các đơn vị cung cấp dịch vụ cho khách hàng yêu cầu một ngôn ngữ nào khác tiếng Anh, thì khách hàng sẽ có trách nhiệm cung cấp các dịch vụ dịch thuật. • Không được sửa chữa thiết bị trừ khi đã tham khảo và hiểu Tài liệu Hướng dẫn Sửa chữa. • Không tuân thủ những cảnh báo này có thể dẫn đến các tổn thương cho người thực hiện sửa chữa, người vận hành hay bệnh nhân, do sốc điện, các rủi ro về cơ khí hay các rủi ro khác.

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1

Introduction

This chapter provides general information required for the proper care of the product and use of the manual. Familiarize yourself with this information before using or servicing the product.

Product Information

This section provides a general overview of the product. A detailed description of the product can be found in Chapter 2, System Overview.

Indications for Use

The MAC 5500/5500 HD ECG Analysis System is intended to acquire, analyze, display, and record electrocardiographic information from adult and pediatric populations. Basic systems deliver 3, 6, 12, or 15 lead ECG's, interpretive analysis, vector loops, and can be upgraded to provide software analysis options such as high resolution signal averaging of QRS and P wave portions of the electrocardiogram. Transmission and reception of ECG data to and from a central ECG cardiovascular information system is optional.

The MAC 5500 HD is intended to be used under the direct supervision of a licensed healthcare practitioner, by trained operators in a hospital or medical professional's facility.

Prescription Device Statement

CAUTION: United States federal law restricts this device to sale by or on the order of a physician.

Installation and Connection

If the installation of this equipment, in the USA, will use 240 V rather than 120 V, the source must be a center-tapped, 240 V, single-phase circuit.

Contact GE Healthcare for information before connecting any devices to this equipment not recommended in this manual.

Equipment Symbols

The following symbols may appear on the product or its packaging.

Symbol	Description
	Type BF equipment. The acquisition module is protected from defibrillation shocks.
	Alternating Current
	Equipotential
	Charge the battery. The flashing amber LED next to this symbol indicates you must connect the system to AC power to recharge the battery.
	LAN port for connecting an Ethernet cable with a standard RJ-45 jack.
	Internal modem port for connecting a phone line with a standard RJ-11 jack.
	Waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.
	Recycle the battery.
	Consult the accompanying documentation.
CLASSIFIED c (UL) US MEDICAL EQUIPMENT UL60601-1 CAN/CSA C22.2 No.601.1 E180632	Classified with respect to electric shock, fire, mechanical, and other specified hazards only in accordance with applicable UL standards.
	To reduce the risk of electric shock, do NOT remove cover (or back). Refer servicing to qualified personnel.
(Hg)	This product consists of devices that may contain mercury, which must be recycled or disposed of in accordance with local, state, or country laws. (Within this system, the backlight lamps in the monitor display contain mercury.)
	Manufacturer name and address.
	Consult instructions for use.

Symbol	Description
![PCT GOST marking]	PCT. GOST marking symbolizing conformity with applicable Russian Gosstandart technical and safety standards.
Rx Only	USA Only: For use only on or by order of a physician.

Product and Packaging Labeling

This section identifies the product labels and their locations on the product and packaging.
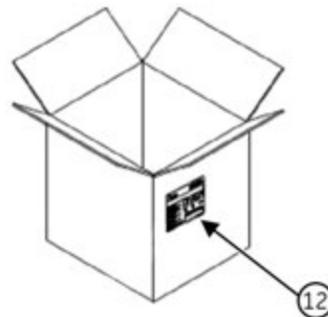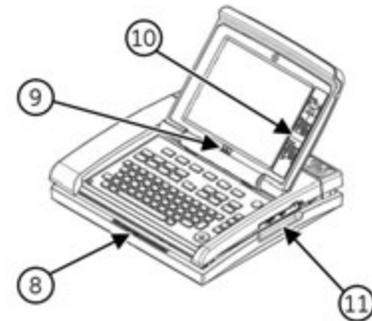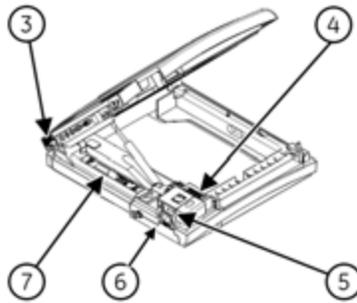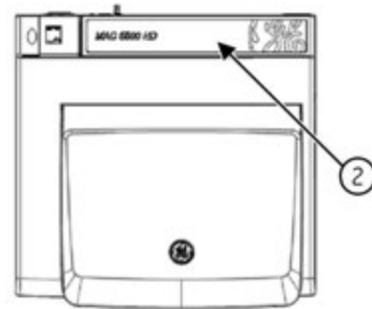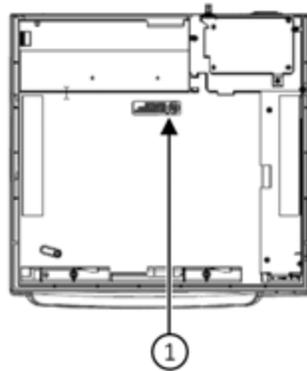
Refer to the previous illustrations for the locations of the labels identified in the following table.

No.	Label	Description
1	**Hg** LAMP CONTAINS MERCURY, DISPOSE ACCORDING TO STATE/LOCAL LAW.	Located on the bottom of the device, this label indicates the device contains mercury and must be disposed of in accordance with state and local laws.
2	MAC 5500 HD	Located on the cover of the device, this label identifies the product's model number.
3		Located on the back of the device, this label contains the Disposal and GOST labels. Refer to "Equipment Symbols" on page 16 for detailed descriptions of the symbols.
4	REF <Product Part Number> <Product Description> SN <Serial Number> YYYY-MM <Barcode> GE MEDICAL SYSTEMS INFORMATION TECHNOLOGIES, INC. 8200 WEST TOWER AVE MILWAUKEE, WISCONSIN USA MADE IN <COUNTRY>	Located inside the writer compartment, this label uniquely identifies this unit. Refer to "Product Label" on page 20 for detailed information.
5	CLASSIFIED c(UL)us MEDICAL EQUIPMENT UL60601-1 CAN/CSA C22.2 No.601.1 E180632	Located on the back of the device, this label provides regulatory and cautionary information. Refer to "Equipment Symbols" on page 16 for detailed descriptions of the symbols.
6	100-240VAC 50-60Hz 0.85A	Located on the back of the device, this label identifies the device's electrical ratings.
7	MAC PAC 12V, 3500mAH GEN5-4T P/N 901770-001 NiMH	Located inside the battery compartment, this label provides information about the specifications and disposal of the battery. Refer to "Equipment Symbols" on page 16 for detailed descriptions of the symbols.
8	CAUTION: U.S. Federal law restricts this device to sale by or on the order of a physician	Located on the front of the device, this label indicates that, in the USA, federal law restricts sale of the device to or on the order of a physician.
9	12SL MARQUETTE	Located below the display, this label indicates the device uses the Marquette™ 12SL™ ECG Analysis Program to analyze and interpret ECG readings.

10		Located to the right of the display, this label instructs the user on where to place leads.
11		Located on the right side of the device, this label distinguishes between the LAN RJ-45 port and the internal modem RJ-11 port.
12		Located on the package, the shipping label contains the following information: • Product description • Sales order number • Configuration number • Model number • Serial number • Storage conditions • Regulatory compliance • Country of Origin
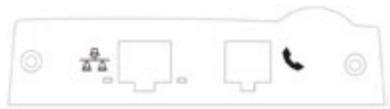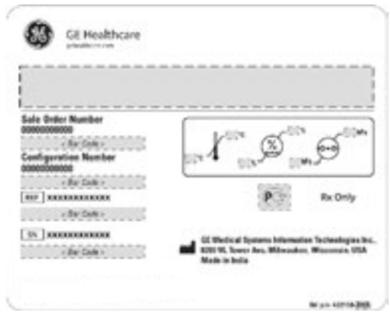
Equipment Identification

Every GE Healthcare device has a product label that identifies the product name, part number, manufacturing information, and unique serial number. This information is required when contacting GE Healthcare for support.

Product Label

The product label is laid out in the following format. Depending on the product, the label may vary slightly in format, but it contains the same information.
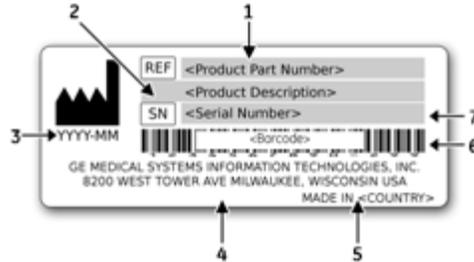
Product Label Format

Item	Description
1	Product part number
2	Product description
3	Date of manufacture in YYYY-MM format
4	Manufacturer name and address
5	Country of origin
6	Product bar code
7	Unit serial number (See "Serial Number Format" on page 20 for more information.)

Serial Number Format

Each device has a serial number that uniquely identifies the device and provides important information about the device. The serial number format is shown in the following illustration:
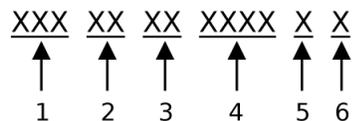
Serial Number Format

Item	Name	Description
1	Product Code	A three-letter code that uniquely identifies the product line. Refer to "Product Codes" on page 21 for more information.
2	Year Manufactured	A two-digit code identifying the year the device was manufactured. Values range from 00 to 99. For example: 00 = 2000, 04 = 2004, 05 = 2005 (and so on).

Serial Number Format (cont'd.)

Item	Name	Description
3	Fiscal Week Manufactured	A two-digit code identifying the week the device was manufactured. Values range from 01 to 52. GE Healthcare's fiscal weeks correspond to the calendar week. For example, 01 = the first week in January.
4	Product Sequence	A four-digit number identifying the order in which this device was manufactured. Values range from 000 to 9999.
5	Manufacturing Site	A one-letter code identifying the site where the device was manufactured. For example, F = Milwaukee, N = Freiburg, P = Bangalore
6	Miscellaneous Characteristic	For example, P = the device is a prototype, R = the device was refurbished, U = the device was upgraded to meet the specifications of another product code.

Product Codes

The product code identifies specific system platforms. You need the product code before servicing or requesting support for your device.

You can identify the product code using the device's serial number, which can be located in one of the following places:

- On the product label attached to the base of the device.

- On the product label provided with the application CD.

- In the application on IT systems:
  Launch the system application and click **Help** > **About** to view the serial number. For information on launching the application, refer to the product's service or operator's manual.

Regulatory and Safety Information

This section provides information about the safe use and regulatory compliance of this device. Familiarize yourself with this information and read and understand all instructions before attempting to service this device.

NOTE:
Disregarding the safety information provided is considered abnormal use of this device and could result in injury, loss of data, and void any existing product warranties.

Safety Conventions

A **Hazard** is a source of potential injury to a person, property, or the system.

This manual uses the terms DANGER, WARNING, CAUTION, and NOTICE to point out hazards and to designate a degree or level of seriousness. Familiarize yourself with the following definitions and their significance.

Definitions of Safety Conventions

Safety Convention	Definition
DANGER	Indicates an imminent hazard, which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potential hazard or unsafe practice, which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potential hazard or unsafe practice, which, if not avoided, could result in moderate or minor injury.
NOTICE	Indicates a potential hazard or unsafe practice, which, if not avoided, could result in the loss or destruction of property or data.

Safety Messages

The following messages apply to the system as a whole. Specific messages may also be provided elsewhere in the manual.

WARNING:
   PATIENT MONITORING — This device does not provide alarms and is not intended to be used as electrocardiographic monitoring equipment (vital signs physiological monitor).

   If patient monitoring is required, use a device that has been qualified for that use.

WARNING:
   ACCIDENTAL SPILLS — If liquids enter a device, take the device out of service and have it checked by a service technician before it is used again.

   To avoid electric shock or device malfunction, liquids must not be allowed to enter the device.

WARNING:
   BATTERY OPERATION — If the integrity of the protective earth conductor is in doubt, operate the unit from its battery.

WARNING:
   CABLES — To avoid possible strangulation, route all cables away from the patient's throat.

WARNING:
   CONNECTION TO MAINS — This is class I equipment.

   The mains plug must be connected to an appropriate power supply.

WARNING:
DEFIBRILLATOR PRECAUTIONS — **Do not** come into contact with patients during defibrillation. Otherwise, serious injury or death could result.

Patient signal inputs labeled with the CF and BF symbols with paddles are protected against damage resulting from defibrillation voltages.

To ensure proper defibrillation protection, use only the recommended cables and leadwires.

Proper placement of defibrillator paddles in relation to the electrodes is required to ensure successful defibrillation.

WARNING:
ELECTRODES — Polarizing electrods (stainless steel or silver constructed) may cause the electrodes to retain a residual charge after defibrillation. A residual charge will block acquisition of the ECG signal.

Whenever patient defibrillation is a possibility, use non-polarizing electrodes (silver or silver chloride construction) for ECG monitoring.

WARNING:
MAGNETIC AND ELECTRICAL INTERFERENCE — Magnetic and electrical fields are capable of interfering with the proper performance of the device.

For this reason, make sure that all external devices operated in the vicinity of the device comply with the relevant EMC requirements. X-ray equipment or MRI devices are possible sources of interference as they may emit higher levels of electromagnetic radiation.

WARNING:
EXPLOSION HAZARD — Do NOT use in the presence of flammable anesthetics vapors or liquids.

WARNING:
INTERPRETATION HAZARD — Computerized interpretation is only significant when used in conjunction with clinical findings.

A qualified physician must overread all computer-generated tracings.

WARNING:
OPERATOR — Medical technical equipment such as this system must be used only by qualified and trained personnel.

WARNING:
SHOCK HAZARD — Improper use of this device presents a shock hazard. Strictly observe the following guidelines. Failure to do so may endanger the lives of the patient, user, and bystanders.

When disconnecting the device from the power line, remove the plug from the wall outlet before disconnecting the cable from the device; otherwise, there is a risk of coming into contact with line voltage by inadvertently introducing metal parts in the sockets of the power cord.

Devices may be connected to other devices or to parts of systems only after making certain that there is no danger to the patient, operators, or environment as a result. Standards IEC 60601–1–1/EN60601–1–1 must be complied with in all cases.

WARNING:
SITE REQUIREMENTS — Improper placement of the device and/or accessories may result in a hazard to the patient, operator, or bystanders.

Do not route cables in a way that they may present a stumbling hazard.

Connectors for patient cables and leadwires are designed to prevent accidental disconnection.

For devices installed above the patient, adequate precautions must be taken to prevent them from dropping on the patient.

WARNING:
TREADMILLS — Avoid rapid changes in treadmill speed and/or grade during a stress test.

CAUTION:
PROPER LEADWIRE CONNECTION — Improper connection will cause inaccuracies in the ECG.

Trace each individual leadwire from its acquisition module label to the colored connector and then to the proper electrode to ensure that it is matched to the correct label location.

CAUTION:
ACCESSORIES (SUPPLIES) — Parts and accessories used must meet the requirements of the applicable IEC 60601 series safety standards and essential performance standards, and/or the system configuration must meet the requirements of the IEC 60601–1–1 medical electrical systems standards.

To ensure patient safety, use only parts and accessories manufactured or recommended by GE Healthcare.

CAUTION:
ACCESSORIES (EQUIPMENT) — The use of accessory equipment that does not comply with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system.

Consideration relating to the choice of equipment shall include:

- Use of the accessory in the patient vicinity, and

- Evidence that the safety certification of the accessory has been performed in accordance with the appropriate IEC 60601–1 and/or IEC 60601–1–1 harmonized national standard.

CAUTION:
BATTERY POWER — If a device equipped with an optional battery pack will not be used or connected to the power line for a period of over six months, remove the battery.

CAUTION:
BEFORE INSTALLATION — Compatibility is critical to safe and effective use of this device. Please contact your local sales or service representative prior to installation to verify equipment compatibility.

CAUTION:
DISPOSABLES — Disposable devices are intended for single use only. They should not be reused as performance may degrade or contamination could occur.

CAUTION:
DISPOSAL — At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with local, state, or federal guidelines regulating the disposal of such products.

If you have questions concerning the disposal of the product, please contact GE Healthcare or its representative.

CAUTION:
EQUIPMENT DAMAGE — Devices intended for emergency application must not be exposed to low temperatures during storage and transport to avoid moisture condensation at the application site.

Wait until all moisture has vaporized before using the device.

CAUTION:
ELECTRIC SHOCK — To reduce the risk of electric shock, do not remove cover or back.
Refer servicing to qualified personnel.

CAUTION:
OPERATOR — Medical technical equipment such as this electrocardiograph system must only be used by persons who have received adequate training in the use of such equipment and who are capable of applying it properly.

CAUTION:
POWER REQUIREMENTS — Before connecting the device to the power line, check that the voltage and frequency ratings of the power line are the same as those indicated on the unit's label. If this is not the case, do not connect the system to the power line until you adjust the unit to match the power source.

In the USA, if the installation of this equipment will use 240V instead of 120V, the source must be center-tapped, 240V single-phase circuit.
This equipment is suitable for connection to public mains as defined in CISPR 11.

CAUTION:
SERVICEABLE PARTS — This equipment contains no user serviceable parts.

Refer servicing to qualified service personnel.

CAUTION:
SUPERVISED USE — This equipment is intended for use under the direct supervision of a licensed health care practioner.

Responsibility of the Manufacturer

GE Healthcare is responsible for the safety, reliability, and performance of hardware supplied by GE Healthcare only if the following conditions are met:

- Assembly operations, extensions, readjustments, modifications, or repairs are performed by persons authorized by GE Healthcare.

- The electrical installation of the room where the device is used complies with the requirements of the appropriate local, state, and other government regulations.

- The equipment is used in accordance with the instructions for use.

Responsibility of the Purchaser/Customer

The customer is responsible for providing appropriate desks, chairs, electrical wall outlets, network connections, and analog phone lines, and for locating any of the system components described in this manual in compliance with all local, state, and national codes.

Service Information

This section provides information pertaining to the maintenance and servicing of the system. Familiarize yourself with this information before requesting service from GE Healthcare or its authorized representatives.

Service Requirements

Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible safety hazards.

Regular maintenance, irrespective of usage, is essential to ensure that the components of this system are always functional when required.

Additional Assistance

GE Healthcare maintains a trained staff of application and technical experts to answer questions and respond to issues and problems that may arise during the installation, maintenance, and use of this system.

Contact your local GE Healthcare representative to request additional assistance.

Manual Information

This section provides information for the correct use of this manual.

Manual Purpose

This manual supplies technical information for service representatives and technical personnel so they can maintain the equipment to the assembly level. Use it as a guide for maintenance and electrical repairs considered field repairable. Where necessary the manual identifies additional sources of relevant information and or technical assistance.

See the operator's manual for the instructions necessary to operate the equipment safely in accordance with its function and intended use.

Document Conventions

This manual uses the following conventions.

Typographical Conventions

Convention	Description
Bold Text	Indicates keys on the keyboard, text to enter, or hardware items such as buttons or switches on the equipment.
Italicized-Bold Text	Indicates software terms that identify menu items, buttons or options in various windows.
CTRL+ESC	Indicates a keyboard operation. A plus (+) sign between the names of two keys indicates that while holding the first key, you should press and release the second key. For example, Press **CTRL+ESC** means to press and hold the **CTRL** key and then press and release the **ESC** key.
<space>	Indicates that you must press the spacebar. When instructions are given for typing a precise text string with one or more spaces, the point where you must press the spacebar is indicated as **<space>**. This ensures that the correct number of spaces is inserted in the correct positions within the literal text string. The purpose of the < > brackets is to distinguish the command from the literal text within the string.
Enter	Indicates that you must press the **Enter** or **Return** key on the keyboard. Do not type *Enter*.
>	The greater than symbol, or right angle bracket, is a concise method to indicate a sequence of menu selections.
	For example, the statement "From the main menu, select *System* > *Setup* > *Options* to open the *Option Activation* window" replaces the following:
	1. From the main menu, select *System* to open the *System* menu.
	2. From the *System* menu, select *Setup* to open the *Setup* menu.
	3. From the *Setup* menu, select *Options* to open the *Option Activation* window.

Illustrations

All illustrations in the manual are provided as examples only. Depending on system configuration, screens in the manual may differ from the screens on your system.

All patient names and data are fictitious. Any similarity to actual persons is coincidental.

Notes

Notes provide application tips or additional information that, while useful, are not essential to the correct operation of the system. They are called out from the body text through a flag word and indentation, as follows:

NOTE:
The tip or additional information is indented below the **NOTE** flag word.

Related Documentation

The following documents are referenced in this manual and provide additional information that may be helpful in the installation, configuration, maintenance, and use of this product.

Part Number	Title
2036070-006	*Marquette™ 12SL™ ECG Analysis Program Physician's Guide*
2046275-016	*MAC™ 5500/MAC™ 5500 HD Resting ECG Analysis System Operator Manual*
2020299-021	*MobileLink™ Wireless Communications Installation Manual*
2020299-025	*LAN Option for MAC™ Resting ECG Systems Installation and Troubleshooting Guide*
2025521-001	*KISS™ Multilead Operator's Manual*
2044854–112	*Modular MAC™ ECG Trolley Service Manual*
2056914–001	*Modular MAC™ ECG Trolley Assembly Instructions* (US)
2056914–002	*Modular MAC™ ECG Trolley Assembly Instructions* (Non-US)

Training

This manual is intended as a supplement to, not a substitute for, thorough product training. If you have not received training on the use of the system, you should request training assistance from GE Healthcare.

To see available training, go to the GE Healthcare training Web site (www.gehealthcare.com/training). Select *Education>Product Education-Technical>Diagnostic Cardiology*.

For more self-paced course offerings, tools, and reference guides you may find useful, please visit the GE Healthcare Education Store at www.gehealthcare.com/educationstore.

2

System Overview

The MAC 5500/MAC 5500 HD resting ECG analysis system is a 15-lead, 12-channel system with a 10.4 inch (264 mm) diagonal display, active patient cable, battery operation, and late potential electrocardiography. There are also options for communication capabilities.

Hardware Description

This section identifies the key components of the MAC system hardware. Familiarize yourself with these components, their location, and their use before attempting to use or service the equipment.

Front View

	Name	Description
1	Display Screen	View the waveform and text data.
2	Modem Port	Connect to a telephone line.

	Name	Description
3	LAN Port	Connect to a LAN cable. LEDs provide information about connection status. • The green LED indicates a good Ethernet link. • The amber LED flashes to indicate network traffic.
4	Keyboard	Controls the system and enters data.

Back View
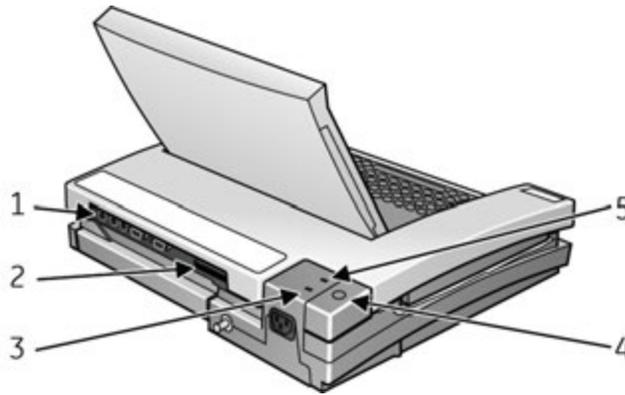
	Name	Description
1	Back panel connectors	Connect to peripherals.
2	Secure data card slot	Insert a secured data (SD) card for external storage.
3	Green AC Power	Indicates the system is connected to AC power.
4	Internal access button	Opens the system to change paper or battery.
5	Amber battery light	Indicates the battery is charging.

Internal View
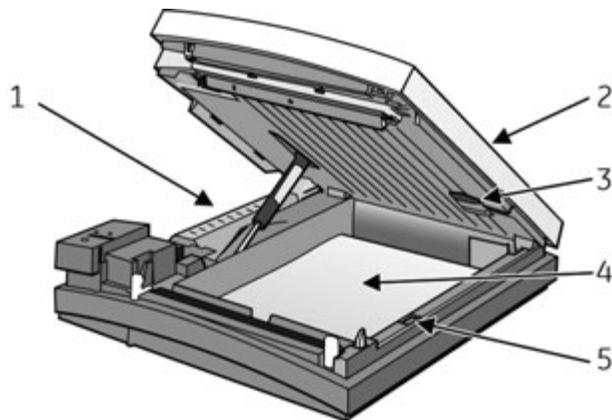
	Name	Description
1	Battery	Supplies power when unit is not connected to AC power. Recharge the battery when the battery icon flashes on-screen.
2	Writer door	Provides access to the writer, paper tray, and battery.
3	Acquisition module connector	Connects the unit to an acquisition module.
4	Paper tray	Contains the paper used to print ECGs.
5	Paper size selector	Adjusts the paper tray for STD (US Letter) or A4 paper sizes.

Back Panel

WARNING:

CURRENT LEAKAGE — Keep current leakage within acceptable limits when connecting auxiliary equipment to this device.

Total system current leakage must not exceed 100 microamperes.
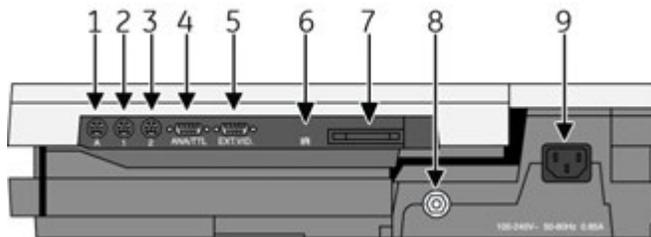
	Name	Description
1	A	Connects to an optional card reader, bar code reader, or PS/2 keyboard for entering patient information.
2	1	Connects to a GE KISS pump. When using the exercise option, connects to a T2000 treadmill or external blood pressure device. **NOTE:** Ergoline bicycle ergometers must be connected to both this port and the ANA/TTL port.
3	2	Connects to a local transmission cable, serial line, modem, or client bridge (wireless option).
4	ANA/TTL	Connects to a device requiring analog data or a TTL trigger. When using the exercise option, connects to an analog treadmill, ergometer cable, or TTL trigger. **NOTE:** Ergoline bicycle ergometers must be connected to both this port and port 1.
5	EXT.VID.	Connects to an external video display.

	Name	Description
6	IR	Exchanges ECG data with a MAC system or MUSE CV system via infrared transmission. **NOTE:** Depending on the age of your system, infrared transmission may not be supported.
7	Card slot	Houses a system card for external data storage or to update software.
8	Ground lug	Connects to non-grounded peripheral devices to ensure equipotential.
9	Main AC Power	Connects the system to an AC power supply via power cable.

3

Installation

This chapter describes how to assemble the MAC 5500 system and optional accessories on the optional MAC Series Trolley, and it identifies the requirements and configurations for using select devices with the ST option.

General Assembly

The following sections describe these tasks:

- Adjusting the trolley height
- Attaching MAC device to the MAC Series trolley
- Attaching the optional external modem
- Attaching the magnetic card reader
- Attaching the bar code reader
- Attaching the MAC device to a Type-S trolley

NOTE:
These instructions describe the process only for the MAC Series trolley (1). For general assembly instructions for the modular MAC trolley (2), refer to the *Modular MAC Trolley Assembly Instructions* identified in .
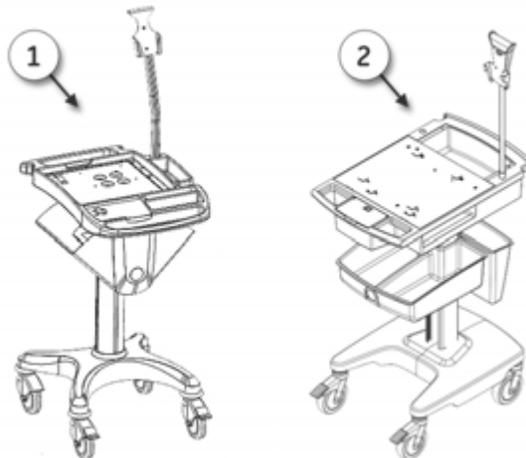
Use the following illustration of a completed assembly as a reference when attaching the optional accessories.

Callout	Description
1	MAC Device
2	Acquisition Module Arm and Holder
3	Front Panel
4	Locking Caster
5	Swivel Caster
6	Trolley Serial Number

NOTE:
Because the optional trolley is made by another vendor for GE Healthcare, its serial number format is different from that shown in "Serial Number Format" on page 20.

Adjusting Trolley Height

The optional MAC Series Trolley can be assembled for one of two heights: 92.07 cm (36.25 inches) or 84.45 cm (33.25 inches). The trolley is normally shipped at the 92.07 cm (36.25 inches) height but can be changed to fit your needs. To change to the lower height, use the following steps.

1.   Tip the trolley on its side and using a 1/2-inch socket wrench, remove the 4 outer 1/2-inch bolts and slide the base assemble up on the column

2.   Remove the remaining bolts and mounting plate.

3.   Flip the mounting plate and reverse the procedure.

CAUTION:
    EQUIPMENT DAMAGE — Over tightening the bolts may cause them to strip.

    Do not over tighten.
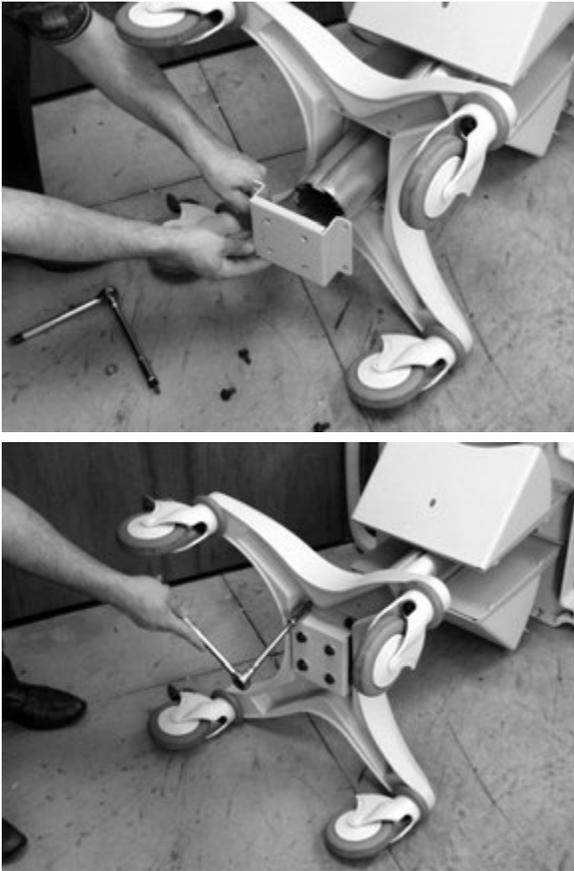
Attaching the MAC Device to the MAC Series Trolley

Use the following procedure to attach the MAC resting ECG analysis system to the trolley assembly.

1. Lock the wheels to prevent the trolley from rolling.

2. Remove the end panel by pulling it out and up.

3. Place the unit on the trolley surface, then slide it forward until the unit is firmly in place and under the tab at the rear of the tray.

4. Secure the MAC unit to the trolley by tightening the three captive screws located under the trolley tray.
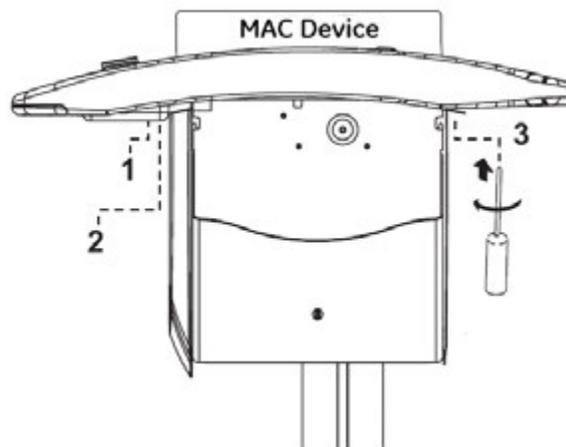
5. Replace the end panel by pushing it up and in until you hear a snap.

6. Unlock the wheels to allow free movement of the trolley.

Attaching the Optional External Modem Kit

An internal modem is standard on the MAC system. If you purchased the optional external modem kit, the modem and its mounting bracket come assembled and ready to attach to the trolley. Use the following instructions.

1. Locate the modem mounting site under the acquisition module support arm at the rear of the trolley.
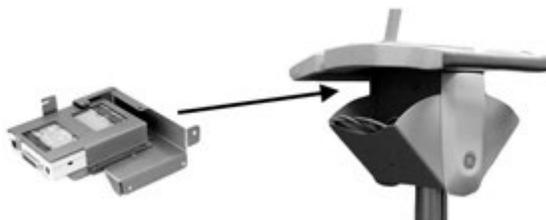
2. Slide the assembly in place so that the bracket slot catches on the bracket lip.

3. Tighten the three mounting screws to secure the modem to the trolley.

4.   Plug the modem cable into connector port 2 on the MAC unit.

5.   Refer to the operator's manual for information on using the modem.

Attaching the Magnetic Card Reader

The magnetic card reader and its mounting bracket are assembled and ready to install on the trolley (1). The kit also includes parts for two different trolley styles; disregard and do not use the additional parts (2).
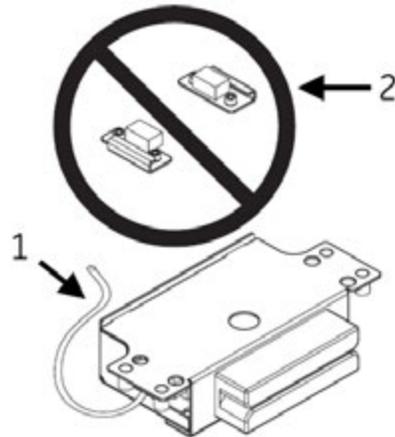
Use the following instructions to install the magnetic card reader and its mounting bracket on the trolley.

1. Remove both end panels by pulling them out and up at the bottom.

2. Using a Phillips screw driver, fasten the card reader assembly under the front handle, aligning it with the holes provided under the front handle.

3.   Route the cable around the trolley column towards the rear as shown in the following illustration.

4.   At the front, hold the cable to the side so it clears the front panel as you replace the panel.

5.   Plug the cable connector into port A then replace the back panel.

6.   Refer to the operator's manual for information on using the card reader.

Attaching the Bar Code Reader

The bar code reader is provided with a cable clamp and mounting bracket. Use the following instructions to attach the bar code reader and its cable mounting bracket on the trolley.

1. Fasten the cable clamp bracket to the underside of the rear handle using a Phillips screw driver and the self tapping screws provided.

    CAUTION:
    EQUIPMENT DAMAGE — Over tightening the screws may cause them to strip.

    Do not over tighten.
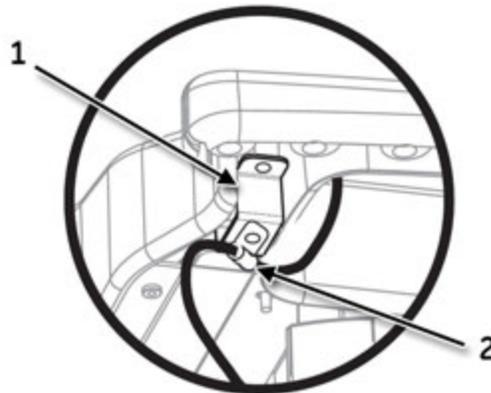
2. Press the internal access button to open the MAC device and then plug the cable connector into port A.

1) Port A, 2) Internal Access Button

Opening the MAC device before attaching the cable clamp allows you to place the correct amount of slack to free the cable from stress when the device needs to be re-opened.

3. Fasten the cable and clamp to the clamp bracket and close the device.

   Verify that there is enough slack to allow free movement of the cable when re-opening the device.
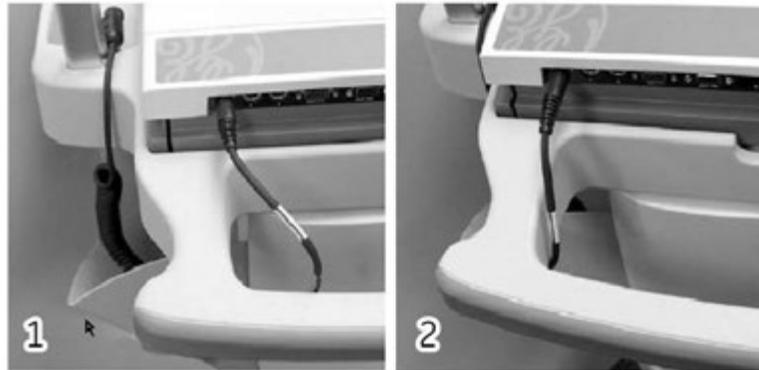
1) Sufficient slack, 2) Insufficient slack

4. Refer to the operator's manual for information on using the bar code reader.

Attaching the MAC Device to a Type-S Trolley

If you have an existing Type-S trolley, use the following instructions to attach the MAC Resting ECG Analysis System.

1.   Mount the MAC device to the Type-S trolley as shown in the following illustration.
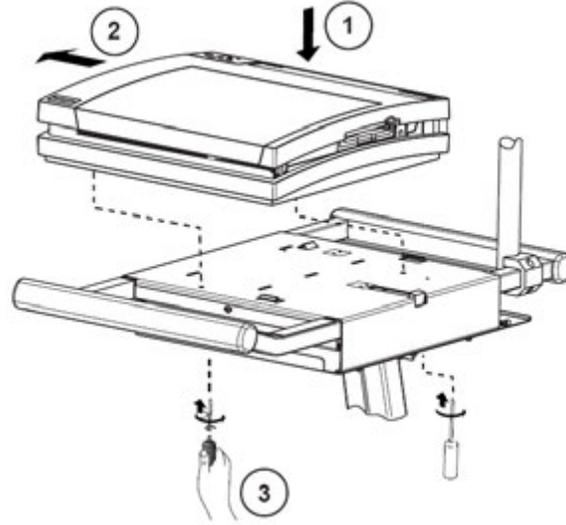
2.   Route a patient cable through the trolley and fasten it with a cable clamp as shown in the following illustration.
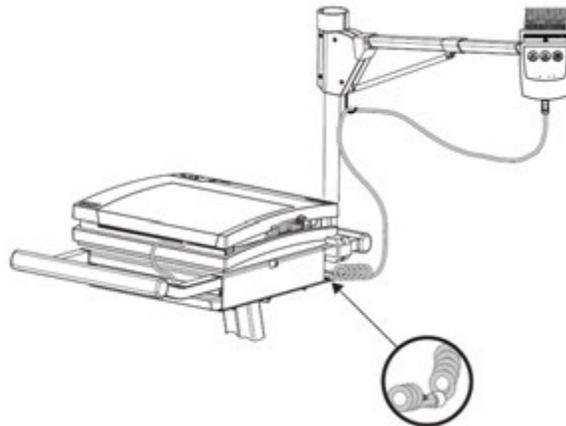
MAC 5500 ST Requirements and Configuration

The following sections describe the connection and configuration requirements for select external devices that are compatible with the MAC 5500 ST option. The devices are grouped according to device type.

- Blood pressure units
- Treadmills
- Bicycle ergometers

Blood Pressure Units

The MAC 5500 device is compatible with the following blood pressure units.

Colin — Model ST-780

Connection Requirements

- Connect the MAC 5500 port 1 to the Colin serial port.
  The customer is responsible for providing the necessary cabling. Refer to "COM1 (COM3/4) Pins (J3)" on page 79 for details on cable wiring.

- Connect the MAC 5500 ANA/TTL port to the Colin QRS trigger input.
  The customer is responsible for providing the necessary cabling. Refer to "Analog Pins (J6)" on page 80 for details on cable wiring.

Device Configuration

None.

MAC 5500 Configuration

At the MAC 5500 *Main Menu*, complete the following:

1. Select *System Setup*.
2. Enter *System Password*.
3. Select *Exercise Test* > *Inputs/Outputs*.
4. Change *Blood Pressure* to *Nipon-Colin*.

Sun Tech — Model Tango

Connection Requirements

- Connect the MAC 5500 port 1 to the Sun Tech serial port.
  The customer is responsible for providing the necessary cabling. Refer to "COM1 (COM3/4) Pins (J3)" on page 79 for details on cable wiring.

- Connect the MAC 5500 ANA/TTL port to the Sun Tech QRS trigger input.
  The customer is responsible for providing the necessary cabling. Refer to "Analog Pins (J6)" on page 80 for details on cable wiring.

Device Configuration

At the *Tango Main Menu*, complete the following:

1. Select *Utilities* > *Device*.
2. Scroll to *ECG Trigger* and press **Enter**.
3. Scroll to *DIGITAL* ↗ and press **Enter**.

4. Scroll to *EXIT* and press **Enter**.

5. Scroll to *Test Parameters* and press **Enter**.

6. Highlight *Technique* and press **Enter**.

7. Scroll to *DKA* and press **Enter**.

8. Scroll to *EXIT* and press **Enter**.

9. Scroll to *EXIT* and press **Enter** to return to the display screen.

MAC 5500 Configuration

At the MAC 5500 *Main Menu*, complete the following:

1. Select *System Setup*.

2. Enter *System Password*.

3. Select *Exercise Test* > *Inputs/Outputs*.

4. Change *Blood Pressure* to *Suntech*.

Ergoline — Model Ergoline 900 / eBike

Connection Requirements

• Connect the MAC 5500 port 1 to the Ergoline serial port.
  Use GE Healthcare cable PN 2008114-001.

• Connect the MAC 5500 ANA/TTL port to the Ergoline QRS trigger input.
  Use GE Healthcare cable PN 2008110-001.

Device Configuration

Refer to the Ergoline 900 / eBike operator's manual for complete configuration instructions.

MAC 5500 Configuration

At the MAC 5500 *Main Menu*, complete the following:

1. Select *System Setup*.

2. Enter *System Password*.

3. Select *Exercise Test* > *Inputs/Outputs*.

4. Change *Blood Pressure* to *Ergoline Ergometer*.

Treadmills

The MAC 5500 device is compatible with the following treadmills.

GE Healthcare Treadmill Model T2000 / T2100

Connection Requirements

Use cable PN 2007918-001 (T2000 / T2100) to connect from the MAC 5500 port 1 to the treadmill serial port.

Device Configuration

None

MAC 5500 Configuration

At the MAC 5500 *Main Menu*, complete the following:

1. Select *Edit Protocol*.

2. For each protocol that will be used with this treadmill, set the *Test Type* to one of the following:.

   - Treadmill in MPH
   - Treadmill in Km/H

Refer to the operator's manual for complete instructions on editing protocols.

Analog Treadmills

Connection Requirements

GE Healthcare provides no cables for connecting the MAC 5500 device with analog treadmills. The customer is responsible for making the appropriate cable. Speed and grade signals for controlling analog treadmills are available on pins 2 (Slow Analog Output) and 8 (Fast Analog Output) of the ANA/TTL port.

Use the following procedure to configure pin 2:

1. Select *System Setup* > *Exercise Test* > *Input/Outputs*.

2. Set *Slow Analog Output* to *Workload*.

Use the following procedure to configure pin 8:

1. Select *System Setup* > *Exercise Test* > *Input/Outputs*.

2. Set *Fast Analog Output* to *Workload*.

Pins 1, 4, and 5 of the ANA/TTL port are tied to ground.

Device Configuration

None

MAC 5500 Configuration

At the MAC 5500 *Main Menu*, complete the following:

1. Select *Edit Protocol*.

2. For each protocol that will be used with this treadmill, set the *Test Type* to one of the following:.

   - Analog Treadmill in MPH
   - Analog Treadmill in Km/H

Refer to the operator's manual for complete instructions on editing protocols.

Bicycle Ergometers

The MAC 5500 device can connect to the following bicycle ergometers.

Ergoline 900 / eBike

Connection Requirements

Use GE Healthcare cable 2008110-001 to connect the corresponding device to the MAC 5500 ANA/TTL port.

Device Configuration

Refer to the ergometer's operator's manual for instructions on configuring the device.

MAC 5500 Configuration

At the MAC 5500 *Main Menu*, complete the following:

1. Select *Edit Protocol*.

2. For each protocol that will be used with this ergometer, set the *Test Type* to one of the following:

    *   Ergometer in Watts

    *   Ergometer in KPM

    Refer to the operator's manual for complete instructions on editing protocols.

3. From the *Main Menu*, select *System Setup* > *Exercise Test* > *Inputs/Outputs*.

4. Set *Slow Analog Output* to *Workload*.
    This configures Pin 2 on the ANA/TTL port.

5. Set *Fast Analog Output* to *Workload*.
    This configures Pin 8 on the ANA/TTL port.

4

Troubleshooting

This chapter provides general and specific information to help you isolate service problems. It consists of the following sections:

- "Diagrams"
- "General Fault Isolation"
- "Diagnostic Tests"
- "Equipment Problems"
- "System Errors"
- "Frequently Asked Questions"
- "Input and Output Connectors"
- "CPU PCB Input/Output Signals"

Diagrams

The following diagrams can be used to help isolate issues to a specific component. Once you identify the component resonsible for a service problem, refer to Chapter 5, "Maintenance" for instructions on repairing or replacing it.

PCB Diagrams

The following illustrations diagram the structure of the PCB, the connections to and from the PCB, and the connections to the supported display assemblies.

PCB Block Diagram

PCB Connections Diagram
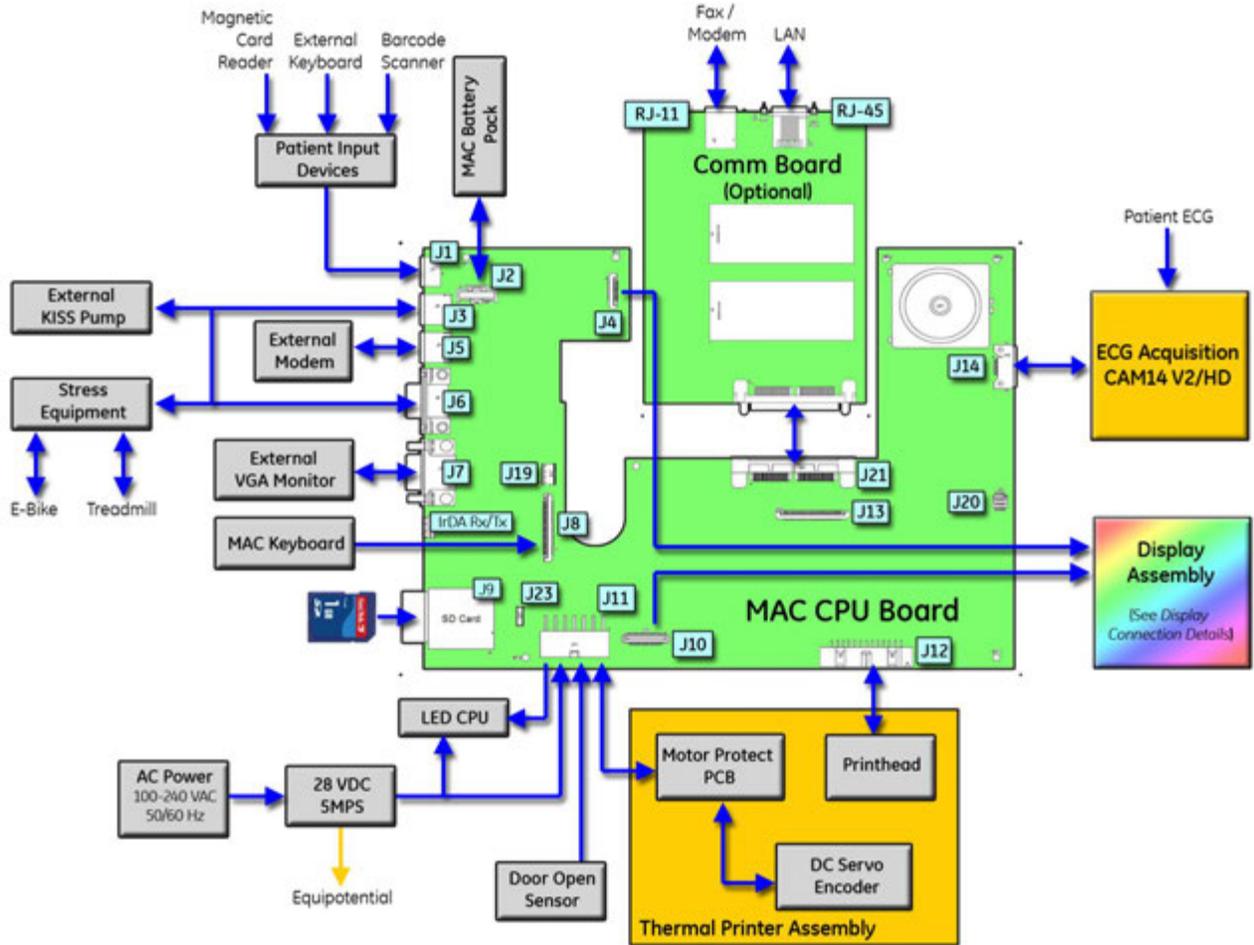
Display Connection Details Diagram

Assy Display MAC5500 AUO LVDS-LED (2017484-004)

CPU J4 → Backlight Flex PWA → LVDS Converter PWA → LVDS/LED 10.4" Color TFT LCD Panel (2017484-004)

CPU J10 →

Assy Display MAC5000 (2017484-001), Assy Display MAC5500 (2017484-003)

CPU J4 → Backlight Flex PWA → CCFL Backlight Inverter PWA → CCFL/CMOS 10.4" Color TFT LCD Panel

CPU J10 →
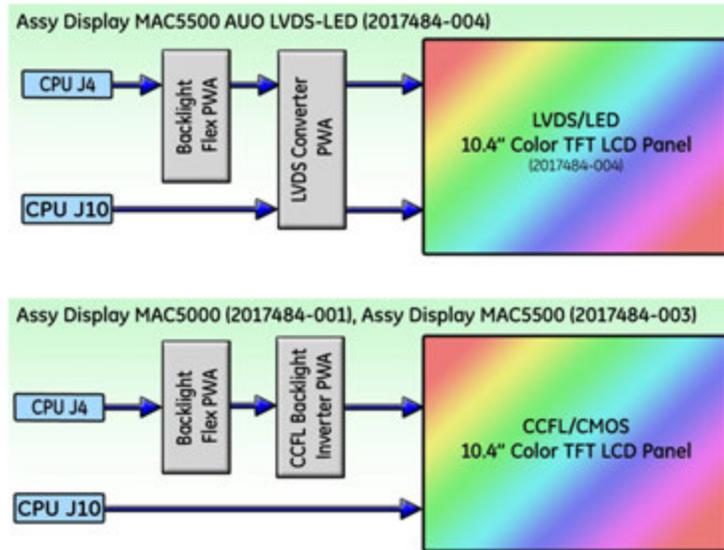
LVDS/LED Display Assembly Diagram

The following illustration diagrams the connections for the LVDS/LED display assembly (2017484–004), and the table that follows it identifies those connections.

LVDS/LED Display Assembly Connections
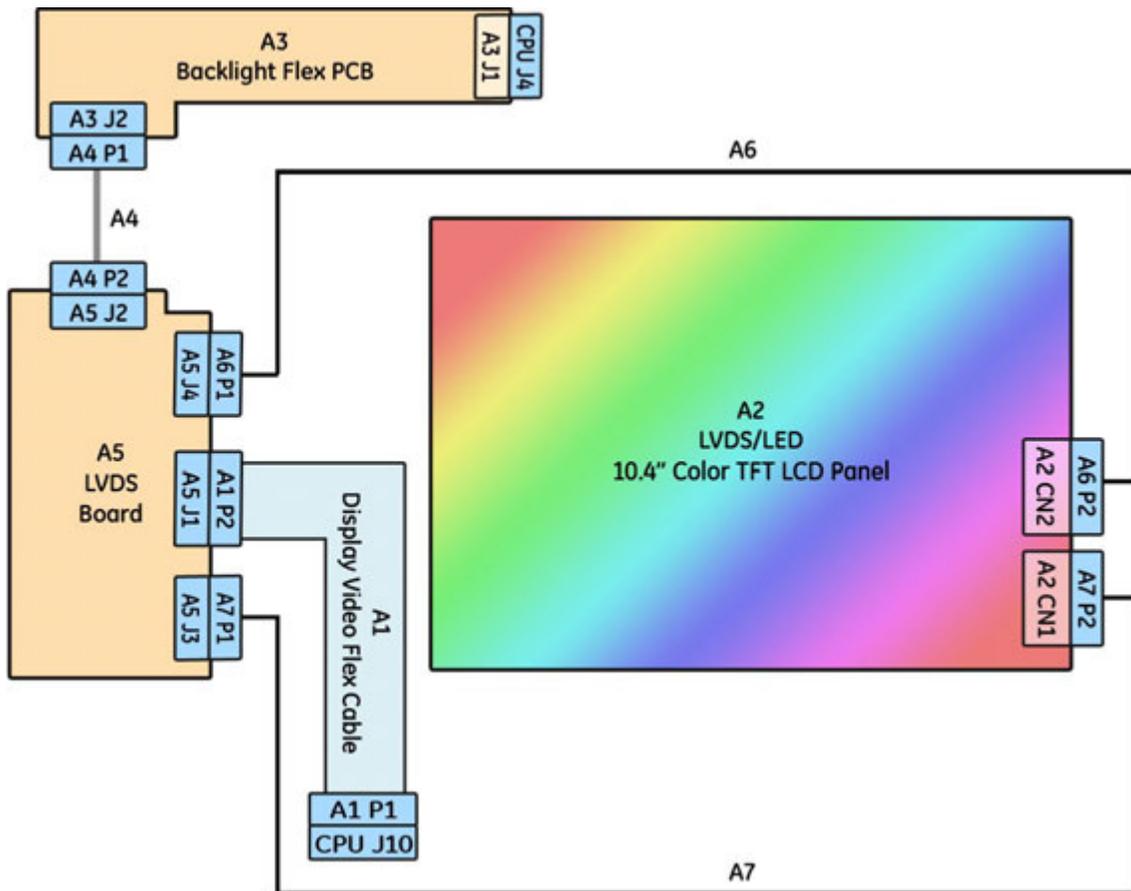
Item	GE Part Number	Description
A1	2001378–006	ASSY DISPLAY CABLE MAC5500 (CMOS)
A2	2062074–001	LVDS/LED LCD PANEL
A3	2034923–002	FLEX ASSY MAC BACKLIGHT MICROSEMI
A4	2034900–004	MAC5500 PWR CABLE MAIN BOARD TO LVDS
A5	2061540–001	PWA MAC5500 LVDS DRV BRD ROHS
A6	2059174–001	MAC5500 LVDS TO DISPLAY PWR CABLE
A7	2059277–001	ASSY MAC5500 LCD DATA CABLE

General Fault Isolation

Use the following general methods for isolating system faults before starting any detailed troubleshooting procedures.

Power-Up Self-Test

Power up the device. During power-up, the system conducts a series of internal tests, as shown in the following diagram.
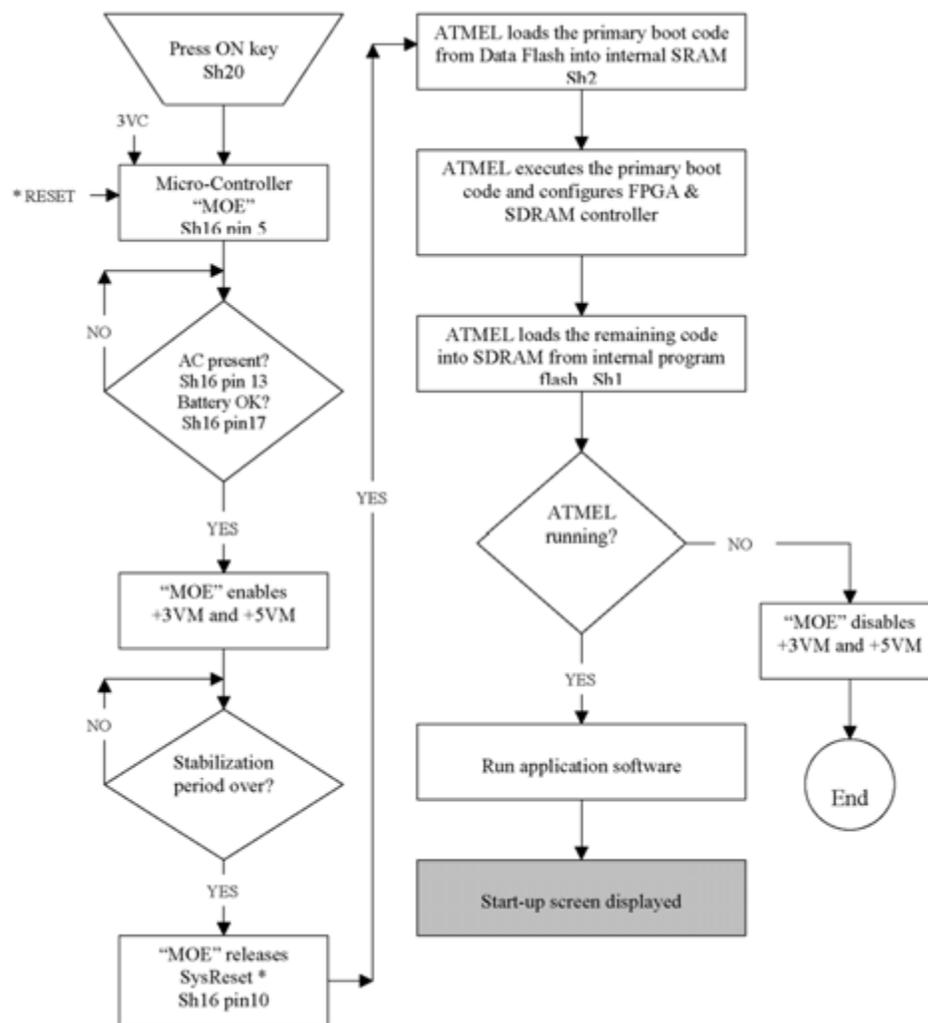
If the start screen opens normally, all circuits passed their tests.

If the start screen does not open normally, or if error messages were displayed during start up, all circuits did not pass their tests. In this event, ask yourself the following questions:

• Is the device turned on?
  Refer to the operator's manual for instructions on powering up the device.

• Is the battery installed?

Refer to Chapter 5, "Maintenance", for instructions on checking and replacing the battery.

- Is the device receiving AC power?
Verify the following:

  - The power cord is connected to both the AC Mains on the back of the device and an AC outlet.

  - The green AC power light is lit, indicating the device is receiving power from the AC outlet.

  Refer to "Hardware Description" on page 29 for the location of the AC Mains and AC power light.

- Is the writer door closed?
Refer to Chapter 5, "Maintenance", for instructions on opening and closing the writer door.

- Have there been any changes in the use, location, or environment of the equipment that could cause the failure?
Electromagnetic equipment—such as cell phones, radios, televisions, and so on—can interfere with the device and cause system failures. Verify the environment meets minimum requirements described in Appendix C, "Electromagnetic Compatibility".

- Has the equipment hardware or software been modified since last use?
Check with the hospital's staff to determine whether the hardware or software has been modified in any way.

- Is operator error the cause of the problem?
Try to repeat the scenario exactly and compare that to the proper operation of the equipment described in the operator's manual.

Visual Inspection

A thorough visual inspection of the equipment can save time. Small things—disconnected cables, foreign debris on circuit boards, missing hardware, loose components—can frequently cause symptoms and equipment failures that may appear to be unrelated and difficult to track.

Area	Look for the following problems
I/O connectors and cables	- Fraying or other damage - Bent prongs or pins - Cracked housing - Loose plug screws
Interface cables	- Excessive tension or wear - Loose connections - Out-of-place strain reliefs
Fuses	- Incorrect type or rating - Overloads or failures

Area	Look for the following problems
Circuit boards	• Moisture, dust, or debris (above and below) • Missing components • Loosely seated components • Burn damage or overheated smell • Improperly seated PCB • Solder problems: cracks, splashes on board, incomplete feedthrough, prior modifications, repairs
Ground wires/wiring	• Loose wires or ground strap connections • Faulty wiring • Pinched wires • Incorrectly placed wires
Mounting hardware	Loose or missing screws or other hardware, especially fasteners used as connections to ground planes on PCBs
Power source	• Faulty wiring, especially at the AC outlet • Shared power circuit **NOTE:** Power source problems can cause static discharge, resetting problems, and noise.

Diagnostic Tests

The system provides the following diagnostic tests to help you verify that the device is operating properly:

- *Display Tests*
- *Speaker Test*
- *Keyboard Test*
- *Writer Tests*
- *Battery Tests*
- *Communication Tests*
- *Acq. Module Tests*
- *Analog I/O Tests*
- *Floppy Drive Tests*
- *Internal Memory Tests*
- *SD Card Tests*

You run the tests from the **System Setup** menu. To access that menu, you need to enter the service password. If you do not know the service password, you can create a temporary master password to gain access.

Loading System Diagnostic Tests

Use the following procedure to access the system diagnostic tests.

1. From the resting ECG screen, select *Main Menu* > *More* > *System Setup*.

    You are prompted for the service password.

2. Type the password and press **Enter**.

    The *System Setup* menu opens.

    NOTE:
    The default password is "system". If this has been changed and you do not know the new password, you can generate a temporary master password that allows access to the *System Setup* menu. Refer to "Setting the Master Password" on page 59 for details.

3. On the *System Setup* menu, press **Shift** + **F5**.

    You are prompted to enter the service password.

4. Type **prod** and press **Enter**.

    The *System Diagnostics* menu opens.

Setting the Master Password

If you do not know the system password to access the *System Setup* menu, you can use the following procedure to generate a temporary master password. This procedure can only be used once.

1. When prompted to enter the service password, type **meimac** and press **Enter**.

    The system displays a random 6–digit number (876743, for example).

2. Write down the number and create a new 6–digit number by adding alternating digits in the following manner:

    - first and third digits
    - second and fourth digits
    - third and fifth digits
    - fourth and sixth digits
    - fifth and first digits
    - sixth and second digits

    Disregard the numerals in the 10s column and join the remaining digits. The following table explains how to use this process using the previous example of 876743.

Digits to Add	Resulting Number	Use this digit
8+6	14	4
7+7	14	4
6+4	10	0
7+3	10	0

Digits to Add	Resulting Number	Use this digit
4+8	12	2
3+7	10	0

In this example, the resulting 6–digit number you would use is 440020.

3. Type the new 6–digit number and press **Enter**.

    The *System Setup* menu opens.

    Because this process works only once, you should use the following procedure to change the system password before proceeding to any diagnostic test:

    a. Select *Basic System* > *Miscellaneous Setup*.

    b. Type a new password in the *System password* field and press **Enter**.

        Note the new password for future reference.

    c. Select *Save Setup* > *To system*.

    d. Contact GE Healthcare Technical Support and provide them with the customer information, device serial number, and password.

Display Tests

The system provides two display tests:

- Pixel Verification
- Test Patterns

Pixel Verification

Use the Pixel Verification test to determine whether any screen pixels are not working. Loss of pixels may require replacement of the LCD display.

1. From the *System Diagnostics* menu, select *Display Tests* > *Pixel Verification Test*.

    A lighted bar is displayed on the screen.

2. Using the arrow pad, move the bar across the display and look for any missing pixels.

3. To turn on all the pixels simultaneously, press **F1**.

4. To exit the test, press **Enter**.

Gray Scale Test Patterns

Use the Test Patterns to confirm the display's contrast is within normal range. This test is typically used only by manufacturing to verify the screen's intensity.

1. From the *System Diagnostics* menu, select *Display Tests* > *Gray Scale Test Patterms*.

    One bright square and one dim square are displayed.

2. Verify the contrast between the two squares is within normal range.

3. Press any key to display the next test pattern.

    One of two test patterns is displayed.

    - If the system color option is enabled, a 32–color test palette is displayed.
    - If the system color option is not enabled, various grey scale test patterns are displayed.

4. Verify there are no problems with the test pattern displayed.

5. Press any key to exit the test.

Speaker Test

Use the Speaker Test to verify that the speaker and sound chip on the CPU are working correctly.

1. From the **System Diagnostics** menu, select **Speaker Test**.

    Two options are displayed: **Loud** and **Soft**.

2. Select the desired option and press **Enter** to produce a tone.

    NOTE:
    The difference between the two tones is minimal.

3. Verify the selected tone is audible.

    If the tone is not audible, it could indicate a problem with the speaker or the sound chip on the CPU.

4. Select **Return** and press **Enter** to return to the **System Diagnostics** menu.

Keyboard Test

Use the Keyboard Test to verify that all the keys are functioning properly.

1. From the **System Diagnostics** menu, select **Keyboard Test**.

    A graphic image of the keyboard is displayed on the screen.
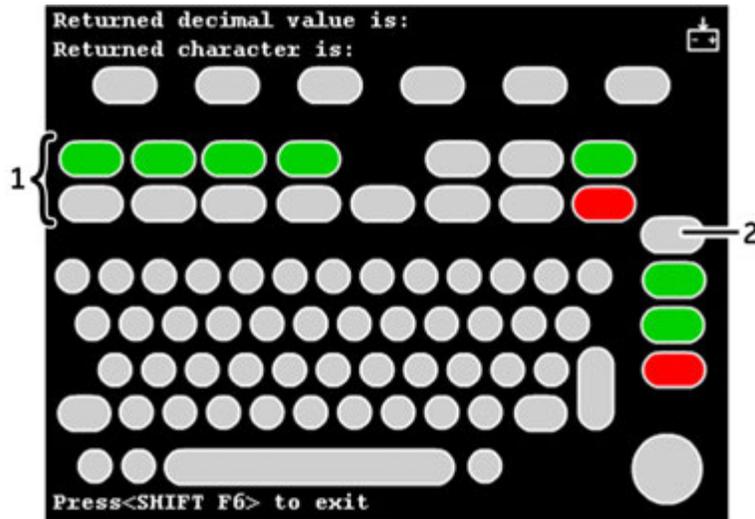
NOTE:
The stress keys (1) are available only on the MAC 5500 ST keyboard. These keys will not be available for testing on any other keyboard or system.

Pressing the **Leads** key (2) displays the word *Copy* if the key is functioning properly.

2. Press each key on the keyboard and verify the following:

   • The corresponding key on the screen is highlighted.

   • The character and decimal value of the key is displayed at the top of the screen.

   NOTE:
   It is normal for a dim background image to remain on the screen when you press the next key.

3. To test the **Shift** keys, press each in combination with a letter and verify that a capital letter is displayed on the screen.

4. To test the arrow pad, do the following:

   a. Press the middle button and verify the word *IN* is displayed on the screen.

   b. Press each arrow and verify the position of the arrow on the display changes and that the system beeps each time you press an arrow.

5. When you are done, press **Shift** + **F6** to exit the test.

Writer Tests

Use the writer tests to check the writer's motor speed control, paper speed, paper tracking, paper cueing, and print head quality.

During the tests, verify the following:

• The first character printed is not distorted.
A distorted character indicates a problem with the start-up speed.

• The paper does not become skewed or crushed.

Skewed or crushed paper indicates a problem with paper cueing.

- The triangles and diagonal lines printed on the paper are straight and uniform. Curved or wavering lines could indicate a problem with paper speed, tracking, or cueing.

- The lines printed on the paper are clean and unbroken. Gaps, smears, blotches, and other defects indicate a problem with the print head quality.

- The paper perforations align with the tear bar on the writer door after cueing. Misaligned perforations could indicate a problem with paper tracking or cueing.

- The paper travels smoothly. Jerky movement or paper jams could indicate a problem with paper tracking.

In addition to these general observations that should be made with all the writer tests, each test has specific observations that should be conducted, as described in the following sections.

C-Scan Tests

The three available C-Scan tests combine the Test Pattern I and Roller tests. They are used by the writer vendor.

Test Pattern I

The three Test Pattern I tests check the motor speed control and paper speed at three different rates:

- 50 mm/s

- 25 mm/s

- 5 mm/s

Each test prints the following test pattern at the selected rate:
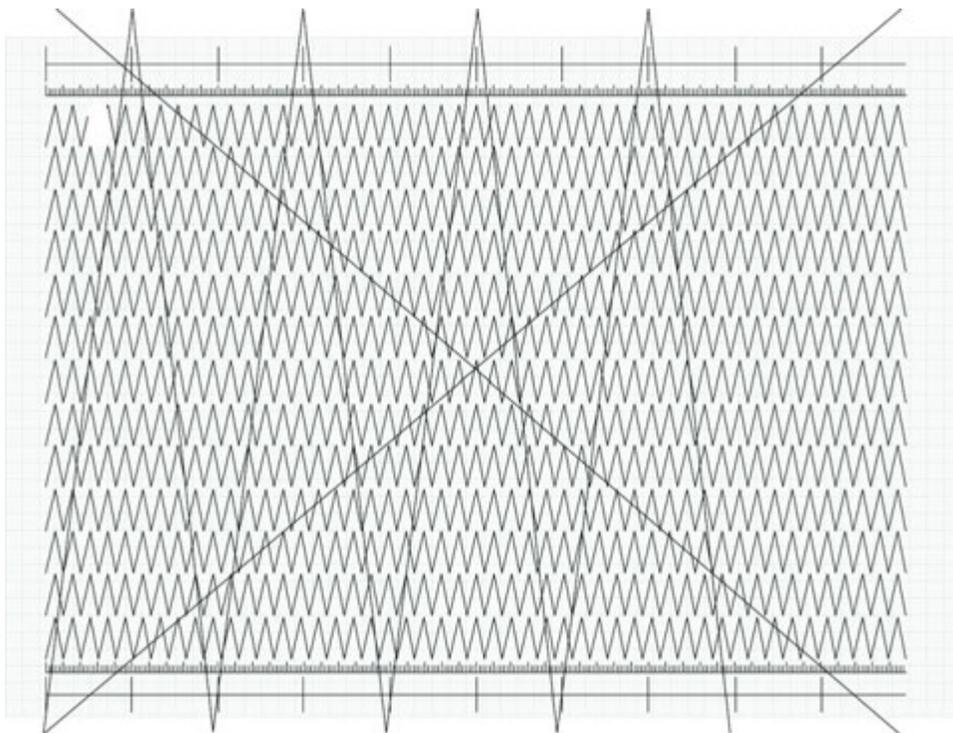
After printing the three test patterns, verify the following:

- Each test pattern is 250 mm ± 5mm long from start to finish.
  Use the grids located on the top and bottom of each page for reference. If the printout is out of range, the paper speed is too fast or too slow. Replace the thermal assembly. Refer to *"Replacing the Writer Roller/Carriage Assembly" on page 127*.

- The long diagonal lines across the test pattern are straight.
  If the lines are wavy or curved, the paper speed is not constant or the roller is out of round. Replace the thermal writer assembly. Refer to *"Replacing the Writer Roller/Carriage Assembly" on page 127*.

- The test pattern printing is consistent.
  A white or black line across the pattern indicates a defective or missing printhead. Replace the thermal printhead. Refer to *"Replacing the Printhead" on page 123*.

Roller Test

The Roller Test checks paper cueing, roller condition, and print head quality. It generates an alternating pattern of light and dark wavy bands, as seen in the following illustration.

After the printout completes, check the following:

- The pattern begins approximately 13–14 mm from the end of the page.
  A larger or smaller gap between the end of the page and the pattern could indicate a problem with paper cueing.

- The dark wavy bands are unbroken.
  Isolated light spots indicate a flat spot on the roller and may indicate that the print carriage assembly needs to be replaced.
  A solid white line across the length of the page indicates a missing print head dot.

- The lines are evenly distributed.
  Lines that are too close together at the start of the test indicate an incorrect startup speed.

  NOTE:
  Uneven darkness can appear if AC power is on during the test.

Test Pattern II

Test Pattern II combines the Test Pattern I (page 63) and Roller Test (page 64):

- The first three pages consist of a series of triangular waveforms and various hashmarks.
- The fourth page is a partial roller test.

Test Pattern II Continuous

Test Pattern II Continuous performs Test Pattern II until **Stop** is pressed.

Continuously Run Out Paper

The Continuously Run Out Paper test ejects paper until the paper tray is empty. Manufacturing uses this test to determine how well the unit self-corrects tracking problems.

Battery Tests

Use the battery tests to monitor the battery's status, discharge rate, and charge rate. Test results are stored in memory and can be printed out. Each test is described in the following sections.

Battery Status

The Battery Status constantly updates and displays the following information:

- Percent of charge remaining
- Battery voltage
  With a reading of 80% or more for percent of charge remaining, the battery voltage should be between 15 and 24 volts. If battery voltage is below 15 volts, the battery may need to be replaced. Refer to "Replacing the Battery" on page 99.
- Battery current
  If battery current is less than -0.7 amps when AC power is not applied, the main CPU may need to be replaced. For example: consider replacing the main CPU if the battery current is -0.8 amps when AC power is not applied. Refer to "CPU Board" on page 116.
- Battery temperature
  A temperature reading over 45° C (113° F) indicates a failure. If the temperature is more than 10° C (50° F) over the ambient temperature, consider replacing the battery. Refer to "Replacing the Battery" on page 99.
- Ambient temperature inside the unit
  Indicates the temperature inside the unit. The temperature displayed is accurate to within ±5° C (41° F) within the range of 0° C to 50° C (32° F to 122° F). Ambient temperatures outside that range cannot be displayed.
- Minimum and maximum battery temperatures
- Minimum and maximum ambient temperature
- Current battery charging status

Battery Discharge Test

The Battery Discharge Test completely discharges the battery, if necessary, then monitors a charge cycle. This test can take several hours.

NOTE:
Prior to running this test, disable Automatic Shutdown in the System Setup. Refer to the *MAC™ 5500/MAC™ 5500 HD Resting ECG Analysis System Operators Manual* for details.

To cancel the test at anytime, press **esc**.

1. Plug the unit into AC (mains) power.
2. Select **Battery Discharge Test**.

    The battery discharge test window opens and the unit begins to charge the battery. Once the battery is fully charged, the following message is displayed:

`Turn the AC power to the unit OFF`

3. Unplug the unit from AC (mains) power and select *OK*.

4. Select ***Battery Discharge Test.***

   The battery begins to discharge. When the battery has fully discharged, the unit will shut off.

5. Reconnect the unit to AC power and turn the unit on.

6. Do one of the following:

   - To view the results online, select ***Battery Discharge Test*** again.
     The results from the previous test remain in memory until the test is run again. Monitored information written to the internal memory includes:

     - Discharge capacity (in mAH)

       NOTE:
       The battery's minimum discharge capacity is 2000 mAH. Consider replacing the battery if this number is less than 2000 mAH. Refer to "Replacing the Battery" on page 99.

     - Battery temperature

     - Battery charge status

     - Percent of charge remaining

   - To print the results, proceed to "Print Charge/Discharge Test Results" on page 68.

Battery Charge Test

This test completely discharges the battery, if necessary, then monitors a charge cycle.

NOTE:
This test can take up to 6 hours to run. The ***Battery Discharge Test*** (page 66) is a better indicator of the condition of the battery.

1. To perform the Battery Charge test, unplug the unit from AC (mains) power.

2. Select ***Battery Charge Test***.

   The ***Battery Charge*** test window opens and the unit begins to discharge the battery.

3. Once the unit has fully discharged the battery, plug the unit back into AC (mains) power.

   The battery begins to charge.

4. When the battery charge test is complete, do one of the following:

   - To view the test results online, select ***Battery Charge Test***.
     The test results remain in memory until the test is run again.

Monitored information is written to internal memory and includes:

- Charge rate (in mAH)
- Battery temperature
- Battery charge status

- To print the test results, proceed to *"Print Charge/Discharge Test Results" on page 68*.

Print Charge/Discharge Test Results

The Print Charge/Discharge Test Results prints the results of the Battery Charge Test (page 67) and Battery Discharge Test (page 66).

Communication Tests

The Communication Tests verify the COM port, external modem, internal modem, and Ethernet connections are functioning properly.

COM Port Loopback Test

The ***Communications Port Loopback Test*** sends various ASCII characters out the COM port's transmit lines and expects the same character to return in its receive lines.

Perform the following steps for each listed COM port,

1. Select the COM port and press **Enter**.

2. Follow the instructions on screen and install loopback jumpers in the selected serial port.

   Refer to *"Input and Output Connectors" on page 79* for the pin locations of each port.

   When the test is complete, ***Passed*** or ***Failed*** will be returned for various baud rates, depending on the results. If any test fails, it may indicate the COMM port is defective. To repair a defective COMM port, replace the CPU board. Refer to *"CPU Board" on page 116*.

3. When the test is complete, remove the jumpers.

External Modem Test

The External Modem Test verifies that the COM2 port can successfully communicate with an optional external modem.

NOTE:
Although COM 2 is also used to connect the wireless client bridge, this test is designed to check a modem only. It cannot be used to test the wireless client bridge.

1. Connect a modem to COM2, if necessary.

2. Select *External Modem Test*.

    The test checks the connection to the modem and does one of the following:

    - If the system can communicate with the modem, the test returns and displays the modem's ID number, firmware revision, and current parameter settings.

    - If the system cannot communicate with the modem, the system displays *N/A* for the modem's ID number, firmware revision, and current parameter settings.

3. Press any key to exit the test.

4. Disconnect the modem from COM2, if necessary.

Internal Modem Test

The Internal Modem Test verifies that the system can successfully communicate with the internal modem.

1. Select *Internal Modem Test*.

    The Internal Modem Interrogation window opens and displays one of the following:

    - If the system can communicate with the modem, the test returns and displays the modem's ID number, firmware revision, and current parameter settings.

    - If the system cannot communicate with the modem, the system displays *N/A* for the modem's ID number, firmware revision, and current parameter settings.

        NOTE:
        If the test fails, consider replacing the communication board. Refer to .

2. Press any key to exit the test.

Ethernet Module Test

The Ethernet Module Test verifies the system can communicate via the Ethernet connection.

1. Select **Ethernet Module Test**.

    The Ethernet Module Interrogation window opens and displays one of the following:

    *   If the system can communicate via the Ethernet, the test returns and displays the device IP address, subnet mask, and MAC address information.

```
Model :       MTXCSEM
Version :     3.01

IP:           10.168.0.152
Subnet Mask:  255.255.255.0
Gateway:      10.168.0.254
Port Number:  3002
MAC Address:  00:08:00:d2:15:e6

                            Test Completed
```

    NOTE:
        If the LAN connection on the communication board returns information but network communication problems still exist, use the LED status indicators on the LAN connection to see if the connection to the network is active. You can also use a ping command from the MUSE server to see if the MUSE system can find the unit on the network.

    *   If the system cannot communicate with the modem, the system displays **N/A** for the device IP address, subnet mask, and MAC address information.

    NOTE:
        If the test fails, consider replacing the communication board. Refer to .

2. Press any key to exit the test.

Acquisition Module Test

The Acquisition Module Test does the following:

*   Tests whether the acquisition module is powered

*   Tests whether the acquisition module is communicating

*   Indicates when one of the three acquisition module buttons is pressed

*   Displays the acquisition module lead wire noise

*   Displays the software version of the acquisition module

    *   CAM 14 V2 displays Acquisition Software V: 1x

    *   CAM HD displays Acquisition Software V: 2x

To run the test, connect all the leads to the RL lead on the patient cable, keep the leads separated and away from any external power supply, and select *Acquisition Module Test*.

NOTE:
An effective way to situate the leads correctly is to connect them to a patient simulator that is turned off.

When the test is complete, the following screen opens with the test results:
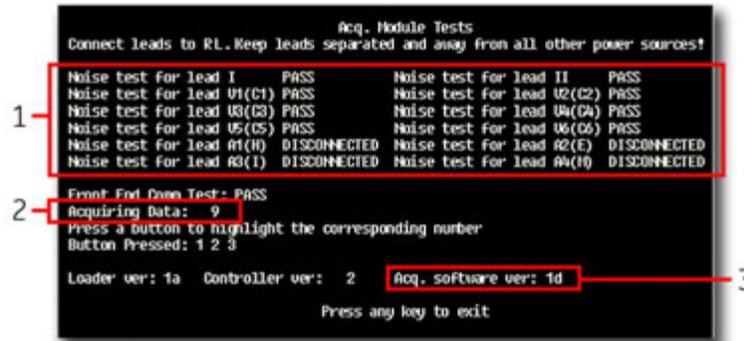
1) Acquisition Board Noise Floor; 2) Acquisition Board Communication Test; 3) Acquisition Board Software Version

NOTE:
The *Button Pressed* test does not apply to the MAC 3500.

Analog I/O Tests

The Analog I/O Tests check the system's ANA/TTL connection. If any of the tests fail, it may indicate the CPU board needs to be replaced. Refer to "CPU Board" on page 116.

Analog Output Test

The Analog Output Test monitors the following output values:

- +12V
- DC Output 1
- DC Output 2
- ECG Output
- TTL Trigger Output

To conduct the test, select *Analog Output Test*, select the output value you want to monitor, and follow the on-screen instructions.

For example, to test DCOut 1, you would select *Analog Output Test* > *DCOut 1*. Following the instructions on the screen, you would connect an oscilloscope to pin 2 and the ground to pin 4 or 5 and check the oscilloscope reading.

Repeat this process for the other selections. If any readings do not match, the CPU may need to be replaced.

Analog Input Test

The Analog Input Test monitors the voltage of the DC input of the ANA/TTL connector.

To conduct this test, select **Analog Input Test** and follow the on-screen instructions to connect a DC power supply to the DC input pins of the **ANA/TTL** connector. The test will check the voltage of the DC input and display the results on the screen.

DCOut Loopback Test

The DCOut Loopback Test monitors the connection of the DC Outputs to the DC Inputs.

To conduct the test, select **DCOut Loopback Test** and follow the on-screen instructions to connect the DC outputs to the analog input pins on the **ANA/TTL** connector. The test then sends all possible values out of the DC Outputs and confirms that the same values are received by the Analog Inputs. Refer to "Input and Output Connectors" on page 79 for pin locations.

When the test is complete, **Passed** or **Failed** will be displayed on the screen, depending on the results.

ECGOut/QRSTrigger Loopback Test

The ECGOut/QRSTriggger Loopback Test monitors the connection of the ECG Outputs and TTL Trigger Outputs to the DC Inputs.

To conduct the test, select **ECGOut/QRSTrigger Loopback Test** and follow the on-screen instructions to connect the ECG outputs and QRS trigger outputs to the analog input pins on the **ANA/TTL** connector. The test then sends all possible values out of the ECG outputs and a square wave out of the QRS trigger output and confirms that the same values are received by the Analog Inputs. Refer to "Input and Output Connectors" on page 79 for pin locations.

When the test is complete, **Passed** or **Failed** will be displayed on the screen, depending on the results.

Floppy Drive Tests

NOTE:
The Floppy Drive Test is not applicable for MAC 5500 or MAC 3500 systems.

Internal Memory Tests

The Internal Memory Tests check bad blocks and the amount of free memory in the device's internal storage.

1. Select **Internal Memory Tests** from the **System Diagnostics Main Menu**.

    The number of bad blocks and the amount of free memory is displayed.

2. Press any key to continue.

    A prompt is displayed to ask whether you want to format the internal memory.

3. Do one of the following:

    *   To format internal memory, press **F**.

        CAUTION:
        POTENTIAL DATA LOSS — Reformatting will erase all data in memory, including patient data and custom stress protocols. It will not affect the system software or settings.

        Do not format internal memory if you have not transmitted all the patient data.

    *   To exit the test without formatting internal memory, press any other key.

SD Card Tests

The SD Card Tests perform a series of read/write tests on an SD card to verify that the card is functioning properly.

CAUTION:
POTENTIAL DATA LOSS — This test formats the SD card, which will erase any data on the card.

Do not use an SD card if it contains data that has not yet been transmitted.

1. Insert an SD card that is not write-protected.

2. Select **SD Card Tests**.

    The tests run and the results display on the screen.

    NOTE:
    If the card is not formatted, an error message will be displayed at the bottom of the screen. To format a card, insert the SD card and copy data to the card using the Copy All command from File Manager. The system will prompt you to format the card. Follow on-screen prompts. Refer to the operator's manual for details.

3. If the test fails, replace the SD card and repeat the test.

    If the test fails again, the CPU board may need to be replaced. Refer to "CPU Board" on page 116.

Equipment Problems

This section identifies some common problems you may experience with the equipment, lists some possible causes for those problems, and suggests corrective actions.

Poor Quality ECGs

Poor quality ECGs can be caused by environmental factors, inadequate patient preparation, or hardware failures related to the acquisition module, leadwires, cables, or problems with the unit.

If you are receiving ECGs of poor quality, connect the unit to a simulator to obtain an ECG report. If the resulting report is of poor quality, the problem probably resides within the unit or connectors and additional troubleshooting is necessary. If the resulting report is of good quality, the problem is external to the unit, such as inadequate patient preparation.

ECG Data Noise

If the acquired ECG data displays unacceptable noise levels, do the following:

- Verify proper electrode placement.
- Verify proper electrode application.
  Perspiration and dead skin must be removed from the electrode site.
- Check for defective or out-of-date electrodes.
- Check for defective, broken, or disconnected leadwires.
- Check the patient's position.
  The patient should remain motionless during the acquisition of a resting ECG.

Missing ACI-TIPI Report

If the ACI-TIPI report does not print as expected, do the following:

- Verify that the ACI-TIPI option is enabled.
- Verify the selected report includes *Interpretation*.
- Verify the information required for the ACI-TIPI report (age range, gender, chest pain complaints) was entered.
- Verify the patient was not a pediatric patient (less than 16 years of age).
- Verify the original ECG was acquired by an electrocardiograph with the ACI-TIPI option.

No BP from External Device

If an external device is not returning the patient's blood pressure to the unit, do the following:

- Check the protocol used with the device to ensure that blood pressure is supposed to be returned.
- Check the configuration on the external device.

- Check the cables (serial and TTL) to make sure they are seated firmly in both devices.
- Check the TTL trigger.

Treadmill/Ergometer Does Not Move

If the connected treadmill or ergometer does not move during the test, do the following:

- Verify the correct protocol for the device is being used.
- Check the cables (serial and TTL) to make sure they are seated firmly in both devices.
- Check the input and out settings.
- Check the Emergency Stop switch.

System Errors

The following table lists symptoms of some common system errors you may experience, identifies possible causes for those errors, and suggests some corrective actions you can take.

If the corrective actions do not resolve the errors, contact GE Healthcare Technical Support or an authorized third-party service provider.

Symptom	Cause	Solution
(battery icon) appears on-screen	No battery is installed.	Install a battery and connect the unit to an AC outlet to charge the battery.
(battery icon) blinks intermittently	The battery charge is low.	Connect the unit to an AC outlet to charge the battery.
(door icon) appears on screen	The writer door is open.	Close the writer door.
The system does not power up when operating from battery power.	The battery is completely discharged.	Connect the unit to an AC outlet to charge the battery.
The system shuts down when operating from battery power.	The battery is completely discharged, or the **Automatic Shutdown** feature is enabled.	Connect the system to an AC wall outlet to charge the battery, or power on the system.
"X" Lead disconnected message appears.	Electrode(s) are disconnected.	Reconnect the electrode(s).
The following message is displayed: **MODEM ERROR. The remote device is not responding. Would you like to retry?**	Modem may not be connected. If using the wireless option, the client bridge may not be connected.	Connect the modem or client bridge and retry.
	(Wireless option only) The MAC 5500 unit is not within range of an access point.	Relocate the unit within range of an access point and retry transmission.
Cannot use the system because Device Password does not work.	Device Password has been changed or has not been adequately communicated to the staff.	Override the Device Password prompt by pressing the following keys at the same time: (key icons)

NOTE:
> For information about troubleshooting the MobileLink, see the *MobileLink Installation Guide*.

Frequently Asked Questions

This section answers frequently asked questions (FAQs) in the following categories:

- Maintenance
- System Setup
- Clinical
- Transmission

Maintenance

The following FAQs relate to the maintenance of the device.

How do I save changes to the System Settings?

To save changes to the System Settings, do the following:

1. After making a change, return to the **System Settings** menu by pressing the **esc** key.
2. Select **System Setup** > **Save Setup** > **To System**.
3. After the settings have been saved, select **Main Menu** to exit **System Setup**.

Why won't the ECGs I perform save to an SD card?

Do the following:

- Verify that the SD card is fully inserted into the drive.
- Verify that you are using a supported SD card.
- Verify that the SD card is not write-protected.
- Replace the SD card and try again.
- Verify the system is set up to save records automatically.
  If the system is not set up to save records automatically, you must manually save the ECG by selecting **Store**.

How do I format an SD card?

Most secure digital cards do not require formatting. In the event that an unformatted card is used in the system, the following message is displayed:

This SD Card cannot be read and requires formatting. Formatting will destroy all data on this SD Card. Are you sure you want to format?

If this message is displayed, select **Yes** to format the card.

How do I clean the device?

Refer to for instructions on cleaning the device.

What is the battery capacity?

When completely charged, a new battery can generate approximately 100 ECGs with one page reports or run for six hours continuous operation without printing. This capacity diminishes as the battery ages.

NOTE:
GE Healthcare recommends the device be plugged into an AC outlet whenever it is not in use.

System Setup

The following FAQs relate to the setup of the device. For more detailed information on any of these questions, refer to the operator's manual.

How do I get the location number to populate automatically?

Use the following procedure to configure the system to automatically populate the *Location* field when entering patient data.

1. Select *System Setup* > *Basic System* > *Miscellaneous Setup*.

2. In the *Location* field, type the location number to use as a default and press **Enter**.

3. Press **esc** twice to return to *System Setup*.

4. Select *Save Setup* > *To System*.

   The settings are saved.

5. Select *Main Menu* to exist *System Setup*.

How do I change the questions displayed when entering patient data?

Use the following procedure to customize the *Patient Questions*, which are asked when starting a test.

1. Select *System Setup* > *Basic System* > *Patient Questions*.

2. Define the patient questions and their response types.

   These questions will be asked when you enter patient data for a new test. The response type determines the kind of data that can be entered in response to the questions.

3. Press **esc** twice to return to *System Setup*.

4. Select *Save Setup* > *To System*.

   The settings are saved.

5. Select *Main Menu* to exist *System Setup*.

Can you set up a unique password for the Delete function?

No. The password for *System Setup* and the *Delete* function are the same.

Clinical

The following FAQs relate to the clinical use of the device. For more detailed information on any of these questions, refer to the operator's manual.

How do I change the look of the ECG report?

Use the following procedure to change the report format:

1. Select **System Setup** > **ECG**.

2. Select the type of ECG report to change.

   - *Resting ECG Reports*
   - *Pediatric ECG Reports*
   - *15 Lead Reports*

3. Select **Unconfirmed Reports** from the menu.

4. Find the report type you want printed for the selected ECG.

5. Enter the number of copies to print in the appropriate column.

   - To include the MAC 5500 or 12SL Interpretation included on the ECG, enter the number of copies you want in the **with** column.

   - To exclude the MAC 5500 from the ECG, enter the number of copies you want in the **without** column.

6. Click the **View Report Type** to see examples of the report formats.

7. Press **esc** twice to return to the **System Setup**.

8. Select **System Setup** > **Save Setup** > **To System**.

   The changes are saved to the local memory.

9. Select **Main Menu** to exist **System Setup**.

What is the difference between Hi-Res and Phi-Res?

The Hi-Res function looks at the entire complex whereas the Phi-Res function focuses on the P wave.

Can you transmit an edited record as unconfirmed?

The answer depends on what was edited. If you edit only demographic information, the record is still transmitted to the MUSE system as an unconfirmed record. However, if you edit the interpretation, the data will not be saved unless the record is confirmed at the MAC 5500. The record is transmitted to the MUSE system as a confirmed record as well.

Do I have to enter all the data on the Patient Data screen?

In **System Setup** > **Basic System** > **Patient Questions** you can require that the patient identification number, or medical record number, be entered. It is not a requirement to enter any other data. However, we recommend that you enter the patient name and identification number, at the least. If you are transmitting to the MUSE system, you will want to enter the Location number as well. If an emergency situation dictates that you must complete the test without entering the patient data, make sure you edit the record to add the missing information before you transmit it to the MUSE system.

Transmission

The following FAQ relates to transmitting records to the MUSE system.

For more detailed information about this question, refer to the operator's manual.

Why do I lose Referring MD and Technician names when transmitting to the MUSE system?

Your MAC system may be transmitting to the SDLC modem on the MUSE system instead of the CSI modem. Check in **System Setup** to make sure you are transmitting to the MUSE system CSI phone number.

Input and Output Connectors

The following sections detail the input/output signals for system connectors. The pin-by-pin descriptions identify the signal names and pin outs for each connector on the unit.

A Pins (J1)

A Pins (J1)

Pin	Names	Diagram
1	Data	
2	NC	
3	Ground	
4	+5V	
5	Clock	
6	NC	

COM1 (COM3/4) Pins (J3)

COM1 (COM3/4) Pins (J3)

Pin	Name	Diagram
1	COM3 TxD	
2	COM3 RxD	
3	COM1 TxD	
4	Ground	
5	COM1 RxD	
6	COM4 TxD	
7	+12V	
8	COM4 RxD	

COM2 Pins (J5)

COM2 Pins (J5)

Pin	Names	Diagram
1	RTS	
2	CTS	
3	TxD	
4	Ground	
5	RxD	
6	DTR	
7	+12V	
8	DSR	

Analog Pins (J6)

Analog Pins (J6)

Pin	Names	Diagram
1	+12V	
2	DC Output 1	
3	TTL Trigger Output	
4	Ground	
5	Ground	
6	DC Output 2	
7	DC Input 1	
8	ECG Output	
9	DC Input 2	

EXT. VID. Pins (J7)

EXT. VID. Pins (J7)

Pin	Names	Diagram
1	Red Video	
2	Green Video	
3	Blue Video	
4	Ground	
5	Ground	
6	Ground	
7	Ground	
8	Ground	
9	NC	

EXT. VID. Pins (J7) (cont'd.)

Pin	Names	Diagram
10	Ground	
11	Ground	
12	NC	
13	Horizontal Sync	
14	Vertical Sync	
15	NC	

CPU PCB Input/Output Signals

The following sections detail the input/output signals for the CPU PCB. The pin-by-pin descriptions identify the associated signal names.

Battery Pack/Monitor (J2)

Battery Pack/Monitor (J2)

Pin	Signal
1	18V Battery power
2	18V Battery power
3	Battery temperature sensor
4	3V Temperature sensor power
5	Battery ground
6	Battery ground

LCD Backlight (J4)

LCD Backlight (J4)

Pin	Signal
1	12V Power
2	12V Power
3	12V Power
4	Ground
5	Ground
6	Brightness select
7	Backlight enable
8	NC
9	Ground
10	Ground

Keyboard (J8)

Keyboard (J8)

Pin	Signal
1	Resistor ground
2	Ground
3	Ground
4	Ground
5	Ground
6	Sense4
7	Sense2
8	Sense1
9	Sense0
10	Sense3
11	Sense5
12	Sense6
13	Sense7
14	Drive0
15	Drive1
16	Drive2
17	Drive3
18	Drive4
19	Ground
20	Power key
21	Drive5
22	Drive6
23	Drive7
24	Drive8
25	Drive9
26	Drive10

LCD (J10)

LCD (J10)

Pin	Signal
1	Ground
2	Clock
3	Hsync
4	Vsync

LCD (J10) (cont'd.)

Pin	Signal
5	Ground
6	R0 (LSB)
7	R1
8	R2
9	R3
10	R4
11	R5 (MSB)
12	Ground
13	G0 (LSB)
14	G1
15	G2
16	G3
17	G4
18	G5 (MSB)
19	Ground
20	B0 (LSB)
21	B1
22	B2
23	B3
24	B4
25	B5 (MSB)
26	Ground
27	Data enable
28	3V Power
29	3V Power
30	NC
31	NC

Power Supply/Motor (J11)

Power Supply/Motor (J11)

Pin	Signal
1	Motor Encoder B
2	5V Power
3	Motor A
4	Motor Encoder A

Power Supply/Motor (J11) (cont'd.)

Pin	Signal
5	Ground
6	Motor B
7	NC
8	28V Power
9	Ground
10	Battery Charge LED
11	28V Power
12	Ground
13	Door open detect
14	Ground

Thermal Printer (J12)

Thermal Printer (J12)

Pin	Signal
1	Thermal printer power
2	Thermal printer power
3	Thermal printer power
4	Thermal printer power
5	Thermal printer power
6	Thermal printer power
7	Thermal printer power
8	Ground
9	Ground
10	Ground
11	Ground
12	Ground
13	Ground
14	Ground
15	Cue sense
16	NC
17	5V Main power
18	Ground
19	Data strobe
20	Data strobe

Thermal Printer (J12) (cont'd.)

Pin	Signal
21	Data strobe
22	Data strobe
23	Data load
24	Data clock
25	Print head temperature
26	Pixel Data

Floppy Disk Drive (J13)

Floppy Disk Drive (J13)

Pin	Signal
1	5V Power
2	Index
3	5V Power
4	Drive Select 0
5	5V Power
6	Disk change
7	NC
8	NC
9	NC
10	Motor Select 0
11	NC
12	Direction
13	NC
14	Step
15	Ground
16	Write data
17	Ground
18	Write gate
19	Ground
20	Track 0
21	Ground
22	Write protect
23	Ground
24	Read data

Floppy Disk Drive (J13) (cont'd.)

Pin	Signal
25	Ground
26	Head select

Acquisition Module (J14)

Acquisition Module (J14)

Pin	Signal
1	Power
2	Ground
3	TX+ (RS485)
4	TX- (RS485)
5	RX+ (RS485)
6	RX- (RS485)
7	NC
8	NC
9	NC
19	NC

5

Maintenance

Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required. But even with a regular maintenance regime, the device may eventually need servicing. Therefore, this chapter describes both typical maintenance procedures and standard service procedures.

WARNING:
> MAINTENANCE — Failure on the part of all responsible individuals, hospitals, or institutions employing the use of this device to implement the recommended maintenance schedule may cause equipment failure and possible health hazards. The manufacturer does not in any manner, assume the responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

Required Tools and Supplies

In addition to a standard set of hand tools, you may need the following items

Tools and Supplies

Item	Part Number
#10 Torx driver	
#6 Torx driver	
Phillips screwdriver	
Leakage Current tester	• MT-1216–02 AAMI (for 220V) • MT-1216–01 AAMI (for 110V)
Multifunction micro-simulator	MARQ 1
Precision dust remover	
Lint-free soft cloth	TX609
PS2 style keyboard (Japan only)	

System Cleaning and Inspection

When inspecting and cleaning your system, take the following precautions:

- Turn off the system.
- Do NOT immerse any part of the equipment in liquid.
- Do NOT use organic solvents, ammonia based solutions, or abrasive cleaning agents. These may damage the equipment surfaces.

Inspecting the MAC System

Perform a visual inspection of all equipment and peripheral devices daily. If you notice any items that need repair, do not use the equipment until an authorized service person has completed the repairs.

- Check the case and display screen for cracks or other damage.
- Inspect all plugs, cords, cables, and connectors for fraying or other damage.
- Verify that all cords and connectors are securely seated.
- Inspect keys and controls for proper operation:
  - Toggle keys should not stick in one position.
  - Knobs should rotate fully in both directions.

Inspecting Power Cords

Perform a thorough visual inspection of the power supply cord prior to conducting any electrical testing. When inspecting the power cord, look for any of the following:

- Obvious physical wear, contamination, or aging
- Worn, cracked or damaged outer sheath; exposed or frayed wiring
- Worn, cracked, or damaged plastic on the plug or socket ends
- Worn, cracked, or damaged strain relief where the wire connects to the plug and socket
- Loose plug or socket connectors, bent metal blades, or bent ground pin on the plug end
- Plating wear, damage, discoloration, oxidation, or corrosion of the metal blades, ground pin, and contacts
- Discolored sheath, plug, or socket insulation that may indicate age or overheating
- Missing or illegible safety-related markings and labels

If the power cord shows any of these signs, remove it from service and replace it with the appropriate GE Healthcare replacement part. Repairs or modifications to the power cord are not allowed.

Cleaning and Disinfecting Exterior Surfaces

Clean and disinfect the exterior surfaces of all equipment and peripheral devices monthly, or more frequently if needed.

Cleaning and Disinfecting the Surfaces

Proper cleaning and disinfecting prolongs the life of the product. Failure to use the proper cleaning solutions or to follow proper procedures can result in the following:

- Damage or corrosion
- Product discoloration
- Metal part corrosion
- Unit malfunction
- Voided warranty

Use the following procedure to clean the equipment's exterior surfaces. Be sure to observe all cautions when cleaning the device.

1. To clean, wipe with a lightly moistened cloth.

   Use a mild soap and water solution to moisten the cloth.

   Do NOT use any of the following cleaning products, or products that contain the same active ingredients and solutions, which are known to cause the problems previously listed:

   - Sani-Cloth® Wipes
   - Ascepti® Wipes
   - HB Quat®
   - Clorox® Wipes (they do not contain bleach)
   - Over-the-counter detergents (such as Fantastic®, Tilex®, and so on)

2. To disinfect, wipe with a soft, lint-free cloth moistened with an appropriate disinfectant.

   Use the following solutions, as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996):

   - Sodium hypochlorite (5.2% household bleach) minimum 1:500 dilution (minimum 100 ppm free chlorine) and maximum 1:10 dilution.
   - Any sodium hypochlorite wipe product that meets the previous guidelines can be used.

3. Dry with a clean cloth or paper towel.

Cautions

- Follow the cleaning instructions exactly.
- Wring excess disinfectant from wipe before using.
- Never immerse the device, cables, or leadwires in any liquid, as this may corrode metal contacts and affect signal quality.
- Do not allow fluid to pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.
- Never use conductive solutions or solutions that contain chlorides, wax, or wax compounds to clean the device, cables, or leadwires.

- Never use solutions or products that contain any type of Ammonium Chloride such as, but not limited to:
  - Dimethyl Benzyl Ammonium Chloride
  - Quaternary Ammonium Chloride solutions
  - Abrasive cleaners or solvents of any kind
  - Acetone
  - Ketone
  - Betadine
  - Alcohol-based cleaning agents
  - Sodium salts
- Never autoclave or steam clean the device, cables, or leadwires.
- Do not use until thoroughly dry.

Cleaning the Interior

- Check for dust buildup on the surfaces of the interior circuit boards, components, and power supply.
- Use commercially available compressed air to blow away the accumulated dust. Follow the manufacturer's directions.

Cleaning the Thermal Printhead

Clean the thermal printhead every three months or more often if used heavily. A build-up of thermal paper coating on the printhead can cause light or uneven printing.

Use a solution containing alcohol on a nonwoven, nonabrasive cloth such as Techni-Cloth to wipe off the printhead (1). Do not use paper toweling, as it can scratch the printhead.

Cleaning, Disinfecting, and Storing ECG Cables and Leadwires

In addition to keeping the MAC system clean and in good repair, it is important to keep the leadwires clean and disinfected. This section provides instructions for cleaning, disinfecting, and storing ECG cables and leadwires to extend their life and protect patients.

NOTE:

> This information applies to the Multi-Link cable and leadwires. For systems with the optional KISS system, see the KISS operator's manual for cleaning and disinfecting information.

Cleaning and Disinfecting Leadwires

Proper cleaning and disinfecting prolongs the life of cables and leadwires. Failure to use the proper cleaning solutions or to follow proper procedures can result in the following:

- Damage or corrosion
- Diminished signal quality
- Product discoloration
- Metal part corrosion
- Brittle wires and connectors
- Reduced cables and leadwires life
- Unit malfunction
- Voided warranty

Use the following procedure to clean and disinfect the cables and leadwires.

1. Remove cables and leadwires from the device or system before cleaning.

2. Use care in cleaning leadwires to prevent pulling the long wires from the connector ends. Metal connections can be pulled away from the connectors.

3. To clean, wipe with a lightly moistened cloth.

   Use a mild soap and water solution to moisten the cloth.

   Do NOT use any of the following cleaning products, or products that contain the same active ingredients and solutions, which are known to cause the problems previously listed:

   - Sani-Cloth® Wipes
   - Ascepti® Wipes
   - HB Quat®
   - Clorox® Wipes (they do not contain bleach)
   - Over-the-counter detergents (such as Fantastic®, Tilex®, and so on)

4.   To disinfect, wipe with a soft, lint-free cloth moistened with an appropriate disinfectant.

     Use the following solutions, as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996):

     • Sodium hypochlorite (5.2% household bleach) minimum 1:500 dilution (minimum 100 ppm free chlorine) and maximum 1:10 dilution.

     • Any sodium hypochlorite wipe product that meets the previous guidelines can be used.

5.   Observe the following guidelines when cleaning and disinfecting cables and leadwires.

     • Do NOT immerse either end of a cable or leadwire connector.
       Immersing or "soaking" the connector ends may corrode metal contact ends and affect signal quality.

     • Do NOT let fluid "pool" around connection pins.
       If this happens, blot dry with a soft, lint-free cloth.

6.   Dry with a clean cloth or paper towel.

Cautions

• Follow the cleaning instructions exactly.

• Wring excess disinfectant from wipe before using.

• Never immerse the device, cables, or leadwires in any liquid, as this may corrode metal contacts and affect signal quality.

• Do not allow fluid to pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

• Never use conductive solutions or solutions that contain chlorides, wax, or wax compounds to clean the device, cables, or leadwires.

• Never use solutions or products that contain any type of Ammonium Chloride such as, but not limited to:

  • Dimethyl Benzyl Ammonium Chloride

  • Quaternary Ammonium Chloride solutions

  • Abrasive cleaners or solvents of any kind

  • Acetone

  • Ketone

  • Betadine

  • Alcohol-based cleaning agents

  • Sodium salts

• Never autoclave or steam clean the device, cables, or leadwires.

• Do not use until thoroughly dry.

Storage

Store cables and leadwires by hanging them vertically in a dry, well-ventilated area. Do NOT coil leadwires or cables around the device.

Cleaning, Disinfecting, and Storing Handheld Devices

In addition to keeping the MAC system, leadwires, and cables clean and in good repair, it is important to keep the associated acquisition modules clean and disinfected as well. This section provides instructions for cleaning, disinfecting, and storing the acquisition modules to extend their life and protect patients.

Cleaning and Disinfecting Acquisition Modules

Proper cleaning and disinfecting prolongs the life of acquisition devices. Failure to use the proper cleaning solutions or to follow proper procedures can result in the following:

- Appearance of waveforms when not connected to a patient, resulting in false alarms instead of lead failure alarms
- Brittle and cracked device case
- Melting, dulling, or distortion of the case
- Total device failure, requiring replacement
- Unit malfunction
- Voided warranty

Use the following procedure to clean and disinfect the cables and leadwires.

1. Remove cables, leadwires, and batteries from the device before cleaning.

   Make sure to firmly close the battery door after removing the batteries.

2. To clean, wipe with a lightly moistened cloth.

   Use a mild soap and water solution to moisten the cloth.

   Do NOT use any of the following cleaning products, or products that contain the same active ingredients and solutions, which are known to cause the problems previously listed:

   - Sani-Cloth® Wipes
   - Ascepti® Wipes
   - HB Quat®
   - Clorox® Wipes (they do not contain bleach)
   - Over-the-counter detergents (such as Fantastic®, Tilex®, and so on)

3. To disinfect, wipe with a soft, lint-free cloth moistened with an appropriate disinfectant.

   Use the following solutions, as recommended in the APIC Guidelines for Selection and Use of Disinfectants (1996):

   - Sodium hypochlorite (5.2% household bleach) minimum 1:500 dilution (minimum 100 ppm free chlorine) and maximum 1:10 dilution.
   - Any sodium hypochlorite wipe product that meets the previous guidelines can be used.

4. Allow the cleaning solution/disinfectant to remain on the device for a minimum of one minute, or per hospital guidelines.

5. Wipe off the cleaning solution/disinfectant with a clean, moistened cloth.

6. Dry with a clean cloth or paper towel.

Cautions

- Follow the cleaning instructions exactly.

- Wring excess disinfectant from wipe before using.

- Never immerse the device, cables, or leadwires in any liquid, as this may corrode metal contacts and affect signal quality.

- Do not allow fluid to pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.

- Never use conductive solutions or solutions that contain chlorides, wax, or wax compounds to clean the device, cables, or leadwires.

- Never use solutions or products that contain any type of Ammonium Chloride such as, but not limited to:

  - Dimethyl Benzyl Ammonium Chloride

  - Quaternary Ammonium Chloride solutions

  - Abrasive cleaners or solvents of any kind

  - Acetone

  - Ketone

  - Betadine

  - Alcohol-based cleaning agents

  - Sodium salts

- Never autoclave or steam clean the device, cables, or leadwires.

- Do not use until thoroughly dry.

Storage

Use the following guidelines when storing acquisition modules:

- Always remove the batteries when the device is not in use, even for short periods of time.

- Store in a dry, well-ventilated area.

- Hang the device, using a holder if available.

- If leadwires are attached, they should hang straight.

- Do not coil leadwires or cables around the device.

Battery Compartment Cleaning

NOTE:
This procedure applies only for frequency hopping telemetry transceivers. It should not be used for other devices.

Under normal operation, the battery compartment should not require cleaning. If the battery compartment should require cleaning, use the following instructions.

CAUTION:

DEVICE MALFUNCTION — Cleaning the battery compartment in a manner other than that described in the following procedure may cause the unit to malfunction and void the warranty.

The battery compartment is not waterproof. Make certain fluids do not enter the electronics through the air holes in the battery compartment floor.

1.   Remove the battery from the battery compartment.

2.   Clean the device with a gauze pad or cloth lightly moistened with one of the following agents:

   • Water

   • Soap

3.   Use a cloth lightly moistened with distilled water to rinse away the cleaning solution. Make certain that moisture does not enter the electronics area below the battery compartment floor.

4.   Dry thoroughly with a lint-free cloth and allow the battery compartment to air dry completely prior to closing the compartment door.

Paper Maintenance

Proper paper maintenance ensures optimum ECG printouts. Paper maintenance includes:

• Setting the correct paper size

• Loading the paper

Setting the Correct Paper Size

The MAC system can accommodate standard (US Letter) and A4 fanfold thermal ECG paper. To ensure that the paper feeds correctly, you must adjust the paper guide

1.   Open the MAC writer drawer.
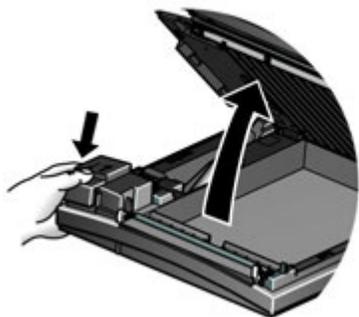
2.   To set the tray for A4 paper, slide the paper guide toward the rear of the device.
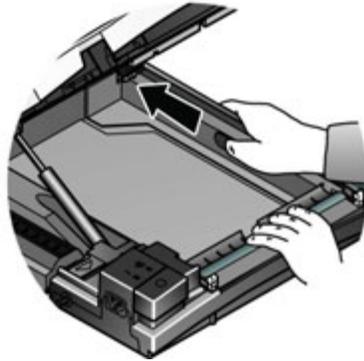
3.   To set the tray for standard (US Letter) paper, slide the guide toward the front of the device.
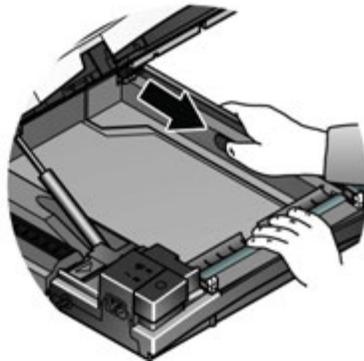
4.   You are now ready to load your paper.

Loading the Paper

Use the following instructions to load paper into the MAC system. Refer to the following illustration.
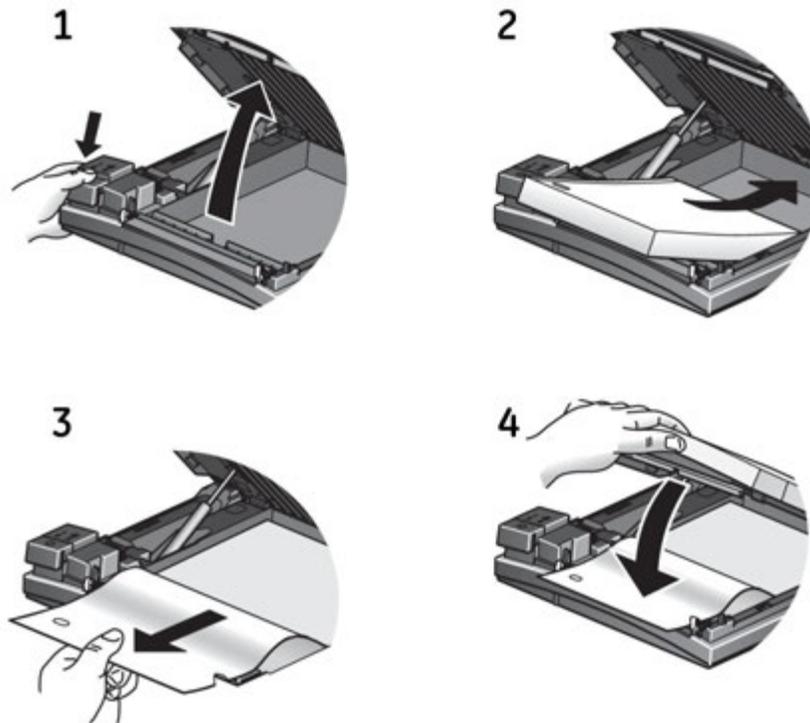
1. Open the writer drawer.
2. Place the pad of paper with the holes on the left.
3. Advance the first sheet of paper.
4. Close the writer drawer securely.

Battery Maintenance

Proper battery maintenance prolongs the battery life and ensures that the MAC system will operate when needed. Proper maintenance consists of the following:

*   Charging the battery
*   Conditioning the battery
*   Replacing the battery

Charging the Battery

A fully charged battery ensures that the MAC system will operate without being connected to an AC outlet. The MAC system's battery should be charged at the following times:

*   Before initial use
*   Between acquisitions

- When the battery is low
- When the battery is completely discharged

To determine when the battery is low, use the battery gauge icon that appears in the upper right corner of the system screen.
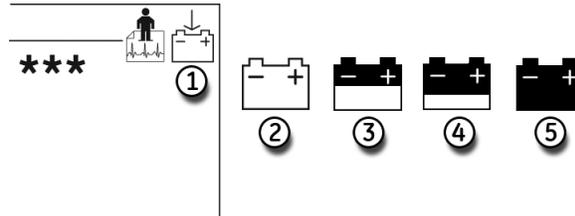
Item	Description
1	Battery gauge icon position.
2	Battery fully charged.
3	Battery 1/2 charged.
4	Battery 1/4 charged.
5	Battery fully discharged.

NOTE:
> The system may run for a long time after the fully-discharged icon appears. When the battery is fully discharged, the system will power off. To operate your system at that time, you must connect the system to an AC wall outlet.

Use the following procedure to charge the battery:

1. Power off the system.

2. Connect the system to an AC wall outlet.

   To indicate the battery is charging, the amber battery light glows (1) and the charging battery icon is displayed on the screen (2).
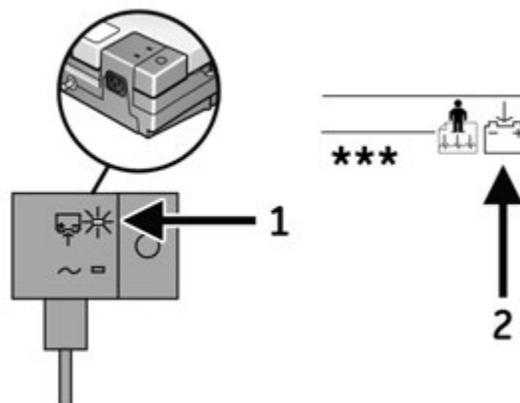
3. Charge the system for 4–5 hours or until the battery gauge icon indicates a full charge.

NOTE:

If the battery is fully charged or exceeds safe charging temperature, the system will not charge the battery.

Conditioning the Battery

In addition to normal system use, periodic deep discharge cycles may be required to ensure consistent battery performance. A deep discharge cycle occurs when the battery is discharged until the system shuts down and then recharged until it is full.

GE Healthcare recommends one deep discharge cycle once every three months, but does not recommend over-exercising the battery with multiple deep discharge cycles.

Replacing the Battery

No matter how well you maintain your battery, you will eventually need to replace it. Refer to the following illustration for instructions on how to replace the battery.
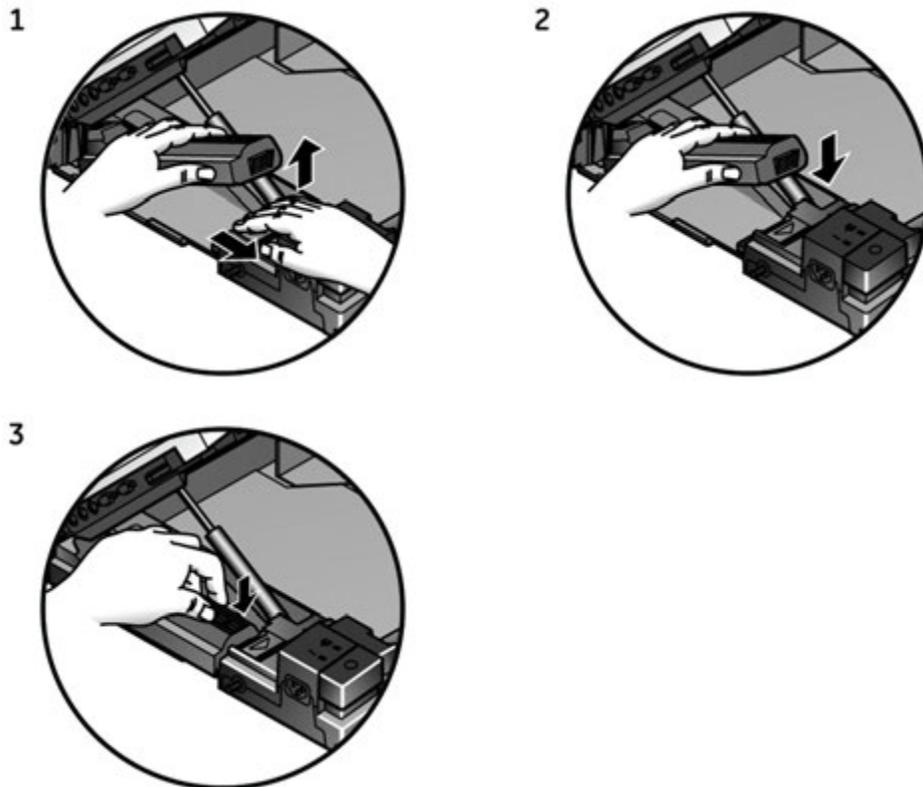
WARNING:

BATTERY PACK DISPOSAL — Do NOT dispose of the battery pack by fire or burning.

Follow local environmental guidelines concerning disposal and recycling.

WARNING:

CHEMICAL BURN — If battery fluid contacts your skin, eyes, or clothing, immediately wash the area with clean water and see a doctor.

Cable Replacement

During the normal life of the product, it will be necessary to periodically replace the patient cable and leadwire adapters. This section describes those procedures.

Replacing Patient Cables

Use the following procedure to replace the patient cable.

1. Press the internal access button to open the unit.

2. Press the connector release tabs and pull the connector loose.

3. Pull the cable from the retaining tabs.
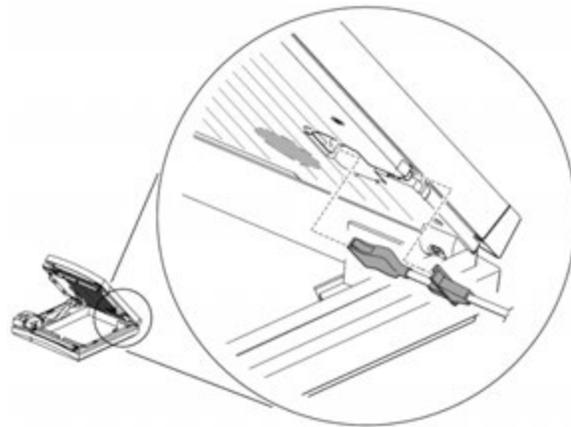
4. Reassemble the cable by reversing the previous steps.

Replacing Leadwire Adapters

The following diagram shows how to replace the acquisition leadwire adapters:
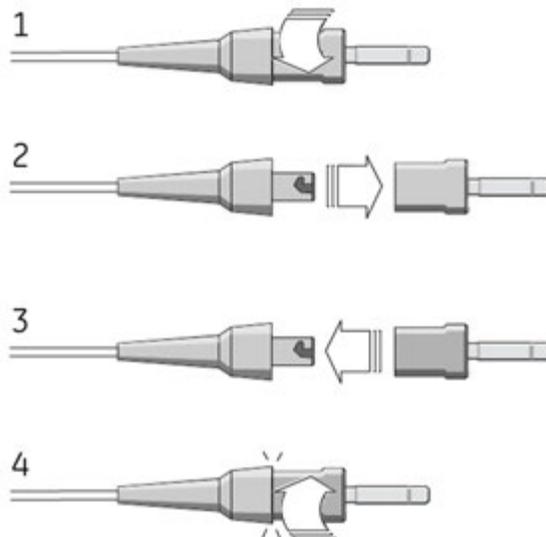
Checking Electrical Safety

The device should be checked annually for current leakage and ground continuity. For details, see *"Electrical Safety Checks" on page 134*.

Disassembly/Reassembly Instructions

After identifying a component that needs repair or replacement (refer to Chapter 4, *"Troubleshooting"*), use the procedures described in the following sections to remove and replace the component.

Before disassembling any component, do the following:

- Process any ECGs remaining in storage, if possible.
- Print system settings for future reference, if possible.
- Disconnect the unit from AC wall outlet and remove the power cord from the unit.
- Remove the battery.
- Remove the chart paper.
- Take precautions against electromagnetic discharge damage.

Removing the Device from the Trolley

If your MAC system is mounted on a trolley, you must remove it from the trolley before servicing it. The method for removing the device depends on the type of trolley.

MAC Series Trolley

1. Lock the wheels, remove the rear trolley panel, and loosen the three captive screws located under the trolley.
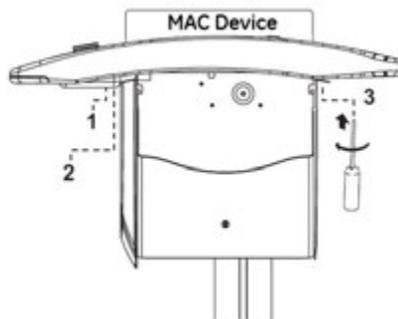
2. Pull the device up and toward you.
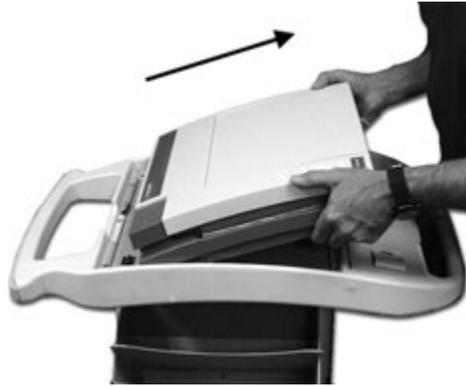
3. Lift the device from the trolley.

Type-S Trolley

To remove the device from the Type-S trolley, perform the steps shown in the following illustration.
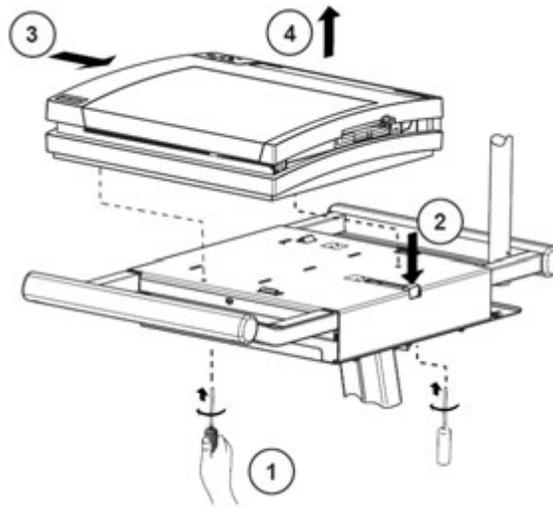
Modular MAC Trolley

To remove the device from the modular MAC trolley, perform the following steps.
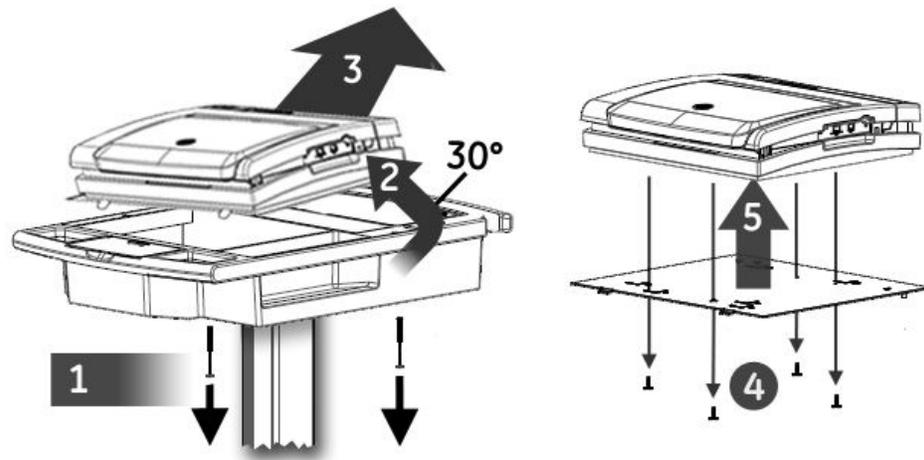
1. Remove the bolts connecting the mounting tray to the trolley top.
2. Tilt the rear of the device and mounting tray to a 30° angle.
3. Slide the device and mounting tray toward the back of the trolley to remove them.
4. Remove the screws securing the device to the mounting tray.
5. Lift the device from the mounting tray.

The device is now ready to be serviced.

Replacing the Power Supply

Use the following procedure to replace the power supply.

NOTE:
  A #10 Torx driver is required for this procedure.

1. Turn the unit over so the bottom side is facing up.
2. Using a #10 Torx driver, remove the screws (1) holding the power supply in place.
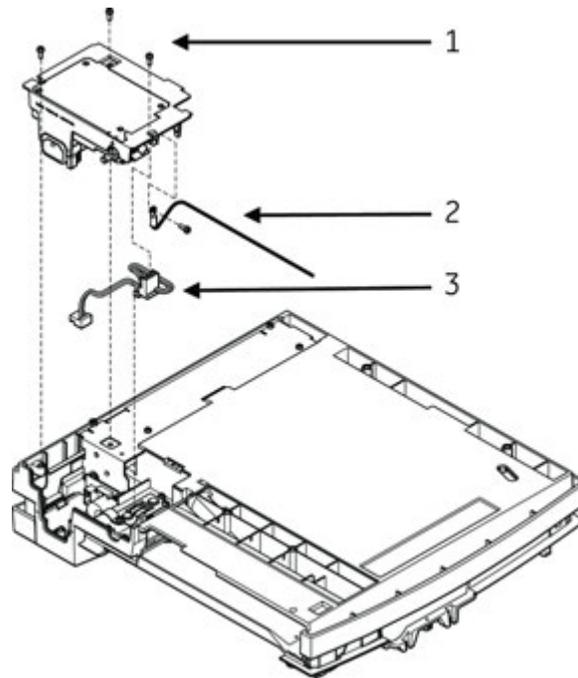
3. Lift the power supply to expose the ground wire (2) and wiring harness (3).

4. Remove P2 from J2 on the power supply assembly and the ground wire connection (2) from the power supply chassis.

5. Reverse the previous steps to attach a new power supply.

   NOTE:
   Before replacing the screws (1), ensure that the ground wire (2) is routed through the notch in the plastic and not pinched.

Top Cover

It is often necessary to remove the top cover in order to service other components in the device. The following sections explain how to remove and replace the top cover.

Removing the Top Cover

Use the following procedure to remove the top cover.

NOTE:
It is not necessary to remove the power supply prior to removing the top cover.

A #10 Torx driver is required for this procedure.

1. Remove the battery.

   Refer to "Replacing the Battery" on page 99 for details.

2. Turn the unit over so the bottom side is facing up and remove the TORX screw through the hole on the right rear corner of the unit.
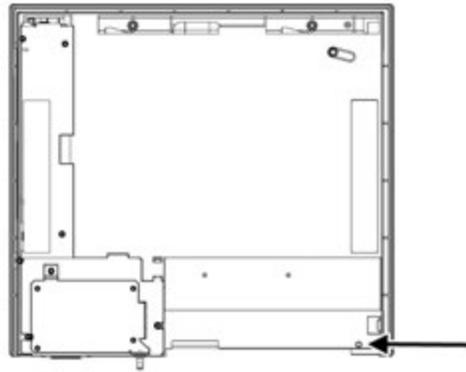
This screw is only visible and accessible with the battery removed.

3. Turn the unit right side up and press the internal access button and raise the top of the unit.

4. Remove the four (4) Torx screws identified in the following illustration.
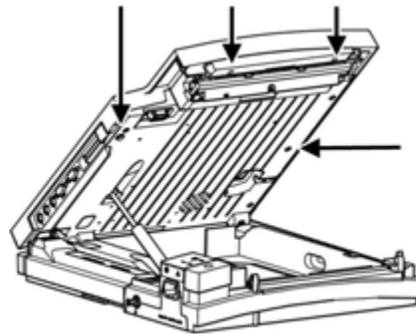
5. Lower the top of the unit and lock in place.

6. Raise the display to the vertical position.

    If the display is not at a 90° angle to the base, you will not be able to remove the top cover.

7. Gently lift the rear of the top cover free from the unit.

    The display may need to be moved slightly to help free the cover.

    NOTE:
    The top cover holds the bezel that surrounds the rear panel connectors, so the bezel may fall free at this time.

8. At the front of the top cover, gently pull the thin strip of plastic free from under the keyboard.

    The entire top assembly is now loose.

    NOTE:
    It may be helpful to rotate the top cover 45° to provide a larger opening to clear the display.

9. Carefully lift the top assembly up and clear of the raised display.

Replacing the Top Cover

Use the following procedure to replace the top cover.

1. Raise the display to the vertical position.

2. Make sure the bezel surrounding the rear panel connectors is in place.

3. Lower the top cover down around the display and set it in position.

4. Snap the rear of the top cover in place and then, gently pulling on the thin plastic strip at the front of the top cover, position it in place under the keyboard assembly.

5. Replace the screws removed in disassembly.

Display/Keyboard Assembly

The following sections describe how to remove and reassemble the display and keyboard assembly.

Removing the Display/Keyboard Assembly

Use the following procedure to remove the display/keyboard assembly.

NOTE:
A #10 Torx driver is required for this procedure.

1. Remove the top cover.

   Refer to "Removing the Top Cover" on page 104 for details.

2. Disconnect the three cables connecting the display/keyboard assembly to the main PCB.

   NOTE:
   Two of these cables have locked connectors that must be lifted up to release them.

3. Working from the outside of the top, remove the two Torx mounting screws located on the right side of the assembly (1).
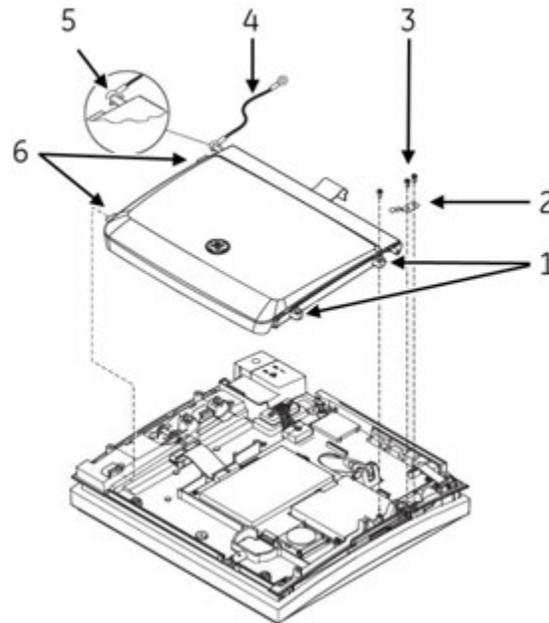
4. Remove the two Torx screws (3) from the hinge bracket and remove the hinge bracket (2).

5. Remove the screw from the display ground (4) at the left of the hinge rod (5).

6. Slide the display hinge (metal rod) (5) to the left to release it from the right-side mounting detent.

   A flat blade screw driver may be used to help slide the rod.

7. Slightly lift up on the right-hand side of the display/keyboard assembly, and pull the assembly to the right to free the tabs (6) from their mounting slots.

   NOTE:
   Do not lift the right side of the display too high or the plastic tabs may be damaged.

Do any of the following:

- To replace the display's LVDS converter, proceed to "Replacing the LVDS Converter" on page 108.

- To replace any display cables, proceed to "Replacing the Display Cables" on page 111.

- To replace the keyboard or display assembly, proceed to "Reassembling the Display/Keyboard Assembly" on page 115.

Replacing the LVDS Converter

Use the following procedure to replace the LVDS PCB assembly required by the AUO-V1 LCD display. See "LVDS Converter PWA Kit (2073125–001)" on page 140 for kit information.

1. Remove the display/keyboard assembly from the device.

   See "Removing the Display/Keyboard Assembly" on page 106 for instructions.

2. Remove the trim bezel from the display assembly.

3. Remove the ten screws that secure the assembly to the display cover.

4. Gently flip over the display assembly, so the LCD panel is face down, and remove the display cover.

5.   Disconnect all the cables from the LVDS board on the display assembly.

6.   Gently lift the LVDS board from the display assembly and clean any remaining adhesive (1) from the plastic bezel.
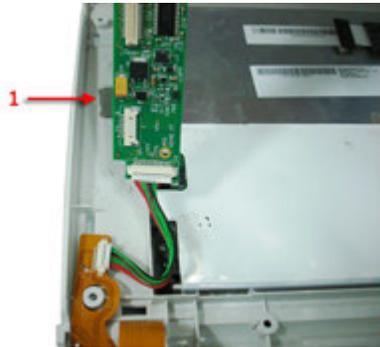
NOTE:
        Dispose of the old LVDS board in compliance with all applicable local and federal laws.

7.   Affix the adhesive pads on the back of the LVDS PWA as shown in the following photograph.

8.   Attach the MAC5500 power cable to the LVDS.

9.   Position the LVDS board as shown and firmly press until the adhesive pads firmly adhere to the display bezel.

10.   Reconnect all the cables to the LVDS.

11.   Reattach the display cover.

12.   Gently flip over the assembly so the LCD is facing up and reattach the ten screws that secure the assembly to the display cover.

13. Reattach the trim bezel to the display assembly.

14. Reattach the display assembly to the device.

See "Reassembling the Display/Keyboard Assembly" on page 115 for instructions.

Replacing the Display Cables

Use the following procedure to replace the cables required by the AUO-V1 LCD display. See "AUO-V1 LCD Harness Kit (2073088–001)" on page 141 for kit information.

1. Remove the display/keyboard assembly from the device.

See "Removing the Display/Keyboard Assembly" on page 106 for instructions.

2. Remove the trim bezel from the display assembly.

3. Remove the ten screws that secure the assembly to the display cover.

4. Gently flip over the display assembly, so the LCD panel is face down, and remove the display cover.

5. To replace faulty data and power cables, do the following:

a. Disconnect and remove the faulty cable(s).

Refer to the following table for a list of the cables and their connection points.

Item	Cable	Starting Connection	Ending Connection
1	LCD Data Cable (2059277–001)	LVDS Board	LCD Panel
2	Assembly Display Cable (2001378–006)	LVDS Board	Mainboard[1]
3	LVDS-Display Power Cable (2059174–001)	LVDS Board	LCD Panel
4	Mainboard-LVDS Power Cable (2034900–004)	LVDS Board	Flex Cable

1 Disconnected when the keyboard/display assembly is removed from the device.

b. Connect the replacement cable(s), ensuring that the cable sleeves do not cross the plastic ribs near the edge of the LCD panel.

c. If necessary, use the adhesive pad provided with the harness kit to secure the cables.

6.   To replace a faulty flex cable, do the following:

    a.   Disconnect the Mainboard to LVDS Power Cable (2034900–004) from the flex cable (1), if it was not disconnected during step 5.

    b.   Pull the flex cable from the display assembly.

    c.   Clean the display bezel where the flex cable was affixed.

The flex cable uses adhesive to adhere to the bezel. Removing it leaves a residue that must be cleaned to ensure the new flex cable adheres firmly. To ensure the area is adequately cleaned, observe the following guidelines:

- Use a 50/50 mixture of isopropyl alcohol and water.

- Use reagent grade solvent, since common household materials frequently contain oils to minimize drying effects on the skin, which can often interfere with the performance of pressure sensitive adhesive.

- Use disposable wipes that do not contain oils to remove the cleaning solvents.

    d.   Note the location of the stickers on the back of the new flex cable.

These stickers will need to be peeled in step e and step f to expose the adhesive used to affix the flex cable to the display bezel.

e.   Bend the left side of the flex cable, remove sticker 1, and affix the cable over the two pins on the display bezel (3), as shown in the following photograph.
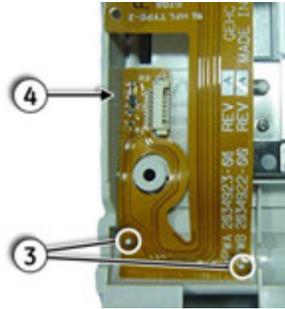
To ensure the adhesive adheres firmly to the bezel, observe the following guidelines:

- Use a hard-edged plastic tool to provide the recommended pressure to ensure maximum surface contact.

- Ensure the ambient temperature is between 70°F (21°C) and 100°F (38°C)

f.   Remove sticker 2 and affix the cable to the display bezel (4), as shown in the previous photograph.

Observe the adhesive guidelines outlined in step e.

g.   Reconnect the Mainboard to LVDS Power Cable (2034900–004) to the flex cable (1),
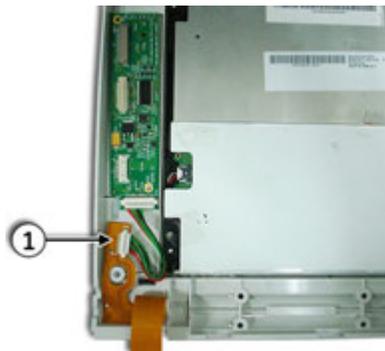
7.   Reattach the display cover.

8. Gently flip over the assembly so the LCD is facing up and reattach the ten screws that secure the assembly to the display cover.

9. Reattach the trim bezel to the display assembly.

10. Reattach the display assembly to the device.

See "Reassembling the Display/Keyboard Assembly" on page 115 for instructions.

Reassembling the Display/Keyboard Assembly

Use the following procedure to reassemble the display/keyboard assembly.

For information on replacements, see "Keyboard" on page 143 and "Display" on page 140.

1. Insert both flex cables (1) through the flex cable slots (2) and position them as shown (3).
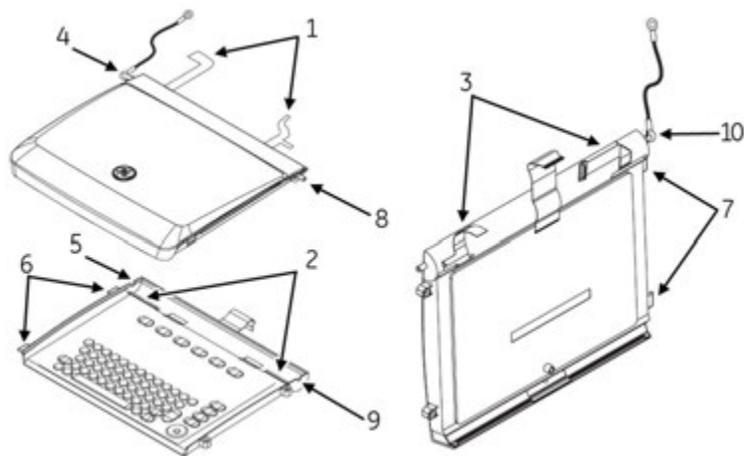
2. Tilt the display/keyboard assembly to the left and with the roll pin (4) of the hinge (metal rod) parallel to the left hinge base (5), insert the rod into the left hinge base and lower the display/keyboard assembly in place.

3. Slide the tabs (6) into their mounting slots (7) and set the display/keyboard assembly in place.

4. Connect the three cables from the display/keyboard assembly to the main PCB.

   Be sure to lift the locks up prior to attempting to insert the cables into the connectors.

5. Slide the metal rod of the display hinge (8) to the right until it locks into the right hinge base (9).

6. Replace the hinge bracket with the two Torx screws removed earlier.

7. Replace the screw and display ground at the left of the hinge rod (10).

8. Replace the two Torx mounting screws on the right side of the assembly.

9. Remount the top cover on the device.

   Refer to "Replacing the Top Cover" on page 106 for details.

CPU Board

Replacing the CPU board consists of the following tasks:

- Removing the CPU board
- Replacing the CPU board
- Installing the software
- Configuring the service-only setup
- Restoring the system setup
- Restoring options
- Disabling options

Each task is described in the following sections.

NOTE:
Before you begin, save the current System Setup to an SD card and print a System Setup report. This will be used to restore the system setups after replacement of the CPU board.

Removing the CPU Board

Use the following procedure to remove the CPU board from the unit.

1.   Remove the battery following the procedure described in "Replacing the Battery" on page 99.

2.   Remove the top cover following the procedure described in "Removing the Top Cover" on page 104.

3.   Remove the display/keyboard assembly following the procedure described in "Removing the Display/Keyboard Assembly" on page 106.

4.   Disconnect all remaining cable connections from the main PCB.

      These include cables to the following:

      • power supply

      • printhead

      • battery connect PCB

      • acquisition module cable

5.   Remove the COMM board.

      See "Replacing the COMM Board" on page 124 for instructions.

6.   With a Torx driver, remove the 11 mounting screws holding the main PCB in place.

      The screws are located around the outside edges of the main PCB. Set aside the screws and the black display grounding cable for use with the new board.

7.   Lift the main PCB from the unit.

Replacing the CPU Board

Use the following procedure to replace the CPU board you removed.

1.   Insert the new CPU board in place and mount it using the screws set aside during disassembly.

      Be sure to use one of the 11 mount screws to reinstall the black display ground cable to the same location from which it was removed; on the 801212–008 board, this is designated as MT9.

2.   Install the COMM board.

      See "Replacing the COMM Board" on page 124 for instructions.

3.   Reassemble the top cover and display/keyboard assemblies by reversing the steps for removal.

4.   Carefully insert the flat display flex cable through the ferrite located near the right rear of the display.

5.   Insert the rear bezel into the slot on the back of the unit as shown in the following photograph.
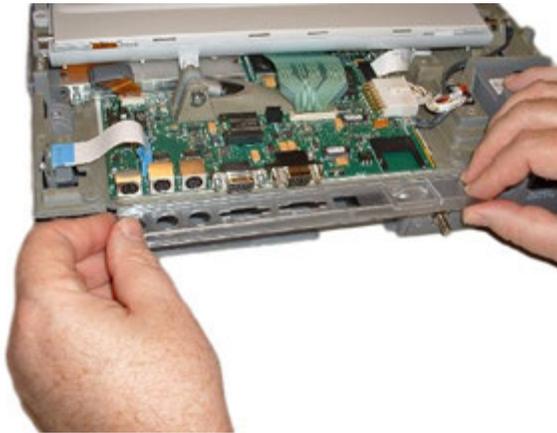
6.   Rotate the bezel to the upright position as shown in the following photograph.
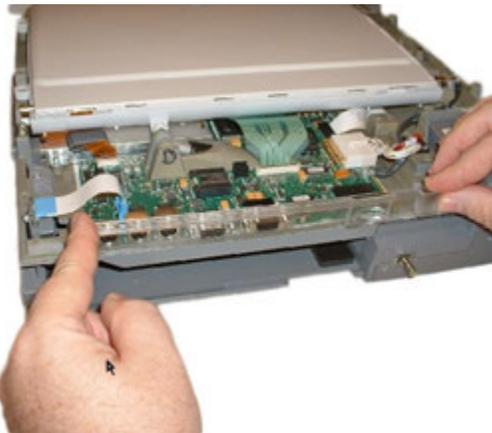
7.   With the new bezel in place, replace the top cover by reversing the steps described previously.

After the new CPU board has been installed, you are ready to install the software (page 118), configure the service setup (page 121), restore the system setup (page 122), restore your options (page 123, and, if necessary, disable any unneeded options (page 123).

Installing the Software

Two methods exist for installing software on the device. The standard method uses prompts displayed on the user interface. A special method is available for when the user interface is unavailable; it uses LEDs on the PCB to indicate installation status.

Installing the software

The MAC software is provided on an SD card.

NOTE:
> Before applying a software update, do the following:

> - Confirm the update is compatible with the main board in your device.
>
>   - Updates with boot code version B4 or higher **cannot** be applied to devices with the –007 main board (P/N 801212-007).
>
>   - Updates with software version 10A, 9C, or earlier cannot be applied to devices with the –008 main board (P/N 801212-008).
>
> - Connect the device to AC power.
>   Keep the device connected to AC power and do not power off the device during the update.

Use the following procedure to install the software using the user interface.

1. Press **Power** to turn on the device.

2. From the *Main Menu*, select *System Setup*.

3. Enter the system password. and press **Enter**.

4. Press **Shift + F3**.

    The following message is displayed:

    Please Insert SD Card
    Press 'Esc' to cancel

5. Insert the SD card.

    The following message is displayed:

    Current Version: xx.xx
    New Software Version: yy.yy
    Press 'Enter' to start update.

6. Press **Enter**.

    NOTE:
    > If the device is not connected to AC power, the message *Please switch to AC Power* is displayed. Connect the device to an AC outlet.

    A series of messages flash on the screen to indicate the installation progress. One of two things will happen:

    - If the boot code on the device and the boot code on the SD card are the same version, the following messages are displayed:
      Programming Over
      System will shut down
      Press any key to continue...
      Press any key to shut down the device. Skip to step 8.

    - If the boot code on the device and the boot code on the SD card are different versions, the following messages are displayed:
      Current Boot Version: xx.xx
      New Boot Version: yy.yy
      Press 'Enter' to start Installation
      Proceed to step 7.

7.   Do one of the following:

- To cancel the update to the boot code, press any key other than **Enter**.
The following messages are displayed:
Boot code not updated.
Can update later from service setup.

- To update the boot code, press **Enter**.
The following messages are displayed:
Programming Primary Boot
Programming Over
System will shut down
Press any key to continue...
Press any key to shut down the device.

8.   After the device shuts down, press **Power** to restart the device.

9.   On the *Resting ECG* screen, verify the software version has been updated.

Installing the software when the user interface is unavailable

Use this method to install the software application on devices on which the user interface is not available. This will typically be in cases where the application software cannot be found on the device.

On device boot up, the boot loader program built into the **ATMEL AT91RM9200** processor fetches the primary boot code from the SPI data flash. The primary boot code contains a small application that updates the main software application in the device's **NAND FLASH** memory.

If the primary boot code cannot find a valid software application in the **NAND FLASH**, or even if it can, it looks for a special SD card with a dummy file named *update.com* in the card's root directory. If it detects the SD card, it downloads the software application code from the SD card to the **NAND FLASH** and shuts down the device. If the primary boot code cannot detect a valid code within 2 minutes and 6 seconds, the device shuts down.

Because the device's display is not available when the software application cannot be found, the onboard LEDs, **DS1** (Red) and **DS2** (Green), flash status codes to indicate progress. To ensure the LEDs are visible, the device's top cover must be removed before you begin the installation.

NOTE:
A copy of the primary boot program (pages with ID "Bn" where n is the 3-bit PCB ID code 1-8) is kept in **NAND FLASH**. This is updated when the software is updated. For 006 and 007 boards, the FPGA image is X3 and the primary boot code image is B3. For 008 board, the FPGA image is X4 and the primary boot code image is B4.

1.   To prevent the system from shutting down during the update, reset the system's timeout controller by doing the following:

a.   Disconnect the device from AC power.

b.   Remove and reinsert the battery.

See "Replacing the Battery" on page 99 for instructions.

2.   Remove the top cover.

This is required to make the on-board LEDs visible. See "Removing the Top Cover" on page 104 for details.

3. Connect the device to AC power.

Keep the device connected to AC power during the software update.

4. Insert the SD card with the required application software.

Before inserting the SD card, confirm that the dummy file ***update.com*** is located in the card's root directory.

5. Power on the device.

NOTE:
Do not power off the device during the update.

The on-board LEDs flash a series of codes to indicate installation progress. Refer to the following table for a description of those status codes.

DS1 (Red)	DS2 (Green)	Status
Off	Flashing	No SD card detected for software updated.
Off	On	Copying image files from SD card to **SDRAM**.
Off	Off	Erasing and/or formatting the **NAND FLASH**. Applicable only during the software update process.
On	Off	Programming the **NAND FLASH**.
Flashing	Flashing	Successful completion of programming.
Flashing	Off	Error — Could program all the image files but error in programming the status page 'Z0'.
On	On	Error — Could not program all the image files as well as the status page 'Z0'.
On	Flashing	Error — Could not program all the image files but the status page 'Z0' updated successfully

When the installation completes successfully, both LEDs will begin to flash.

6. Do one of the following:

- Wait for the device to shut down.
  After the installation is complete, the Watch Dog Timer (WDT) will eventually timeout and shut down the device.

- Manually shut down the device.
  If you do not want to wait for the device to timeout, you can manually power down the device.

7. Remove the SD card.

8. Power on the device.

The device should now boot up with the updated software. On the Resting ECG screen, verify the new software version.

Configuring the Service-Only Setup

Use the following procedure to configure the system's service-only settings. You need the following information before beginning this procedure:

- System serial number

This is the number that was used when the option codes for this system were generated. The number entered here must match the serial number on the system label.

- Printhead resistance
  This number can be found on the printhead label.

- System language
  Verify with the customer what language to select.

1. From the *Main Menu*, select *System Setup*.

   The *System Setup* menu opens.

2. Press **Shift** + **F2**.

   You are prompted for the service password.

3. Type the service password and press **Enter**.

   The *Service-Only Setup* window opens.

```
Service Only Setup


Serial Number:              _____

Update Primary Boot:        _____

Print head resistance:      _____

Keyboard:                   _____


Return
```

4. Enter the system's serial number.

5. Verify that *Update Primary Boot* is set to *No*.

6. Enter the *Print head resistance*.

7. Select the appropriate language for the *Keyboard*.

8. Select *Return*.

Restoring the System Setup

Use the following procedure to restore the system setup.

NOTE:
Before beginning this procedure, you must have the SD card on which you backed up the system setup before removing the CPU board. See "CPU Board" on page 116.

1. Power up the cart, if necessary.

2. From the *Main Menu*, select *System Setup*.

3. Enter the system password and press **Enter**.

4. Select *Restore Setup*.

5. Select *From SD Card*.

Restoring options

Use the following procedure to restore the system options that had been installed on the CPU board that was removed. These options are printed on a label located on the bottom of the paper tray, as shown in the following illustration.

NOTE:

Use the activator codes shown on the label on your system. The activator codes shown in the previous figure are examples only.

1. Power on the cart, if necessary.

2. From the *Main Menu*, select *System Setup* > *Basic System* > *Option Activation*.

3. Type the 12–digit activation code and press **Enter**.

4. Repeat step 3 for each option to be activated.

5. Highlight *Return* and press **Enter** to return to the *Basic System* menu.

Disabling options

It may occasionally be necessary to disable an option. In the rare instance that you need to disable an option, use the following procedure.

1. From the *Main Menu*, select *System Setup* > *Basic System* > *Option Activation*.

2. In the *Option Code* field, type **x** followed by the option's existing activation code.

    The corresponding option will be disabled.

3. To re-enable the option, reenter the activation code (without the **x**).

4. Repeat for each option to be disabled.

Replacing the Printhead

Use the following procedure to replace the thermal printhead.

1. Remove the top cover using the procedures described in .

2. Using a Phillips head screwdriver, remove the two screws that hold the printhead to the printhead mounting plate.

3. Open the writer assembly.

4. Disconnect and remove the printhead.

5. Record the resistance value of the new printhead.

6. Connect the new printhead to the ribbon cable.

7. Hold the printhead firmly in place against the two metal tabs on the printhead mounting plate and tighten the two screws.

8. Replace the top cover using the procedure described in "Replacing the Top Cover" on page 106.

9. Power up the unit.

10. Go to the **Service Only Setup** menu and enter the new printhead resistance value.

    Refer to "Configuring the Service-Only Setup" on page 121 for details on how to enter the printhead resistance.

11. Run the Writer Test.

Replacing the COMM Board

Replacing the communications board consists of two tasks:

- Switching the COMM board

- Setting up LAN communcations

Each task is described in the following sections.

Switching the COMM Board

Use the following procedure to switch the communications board.

1. Remove the AC power cable and battery.

2. Using a #10 Torx driver, remove the two screws from the panel surrounding the LAN and modem ports.

3. Grasp the side edges of the communications board and work it back and forth in the slot as you pull it out along its rails.

4. Insert the new communications board, sliding it onto the rails until it is seated in place.

5. Replace the panel surrounding the LAN and modem ports.

6. Replace the battery and AC power cable.

Setting up LAN Communications

Use the following procedure to set up the system's LAN communications after switching the COMM board. For more information, refer to the *LAN Option for MAC™ Resting ECG Systems Installation and Troubleshooting Guide*.

NOTE:
Before beginning this process, acquire the IP address, gateway, and subnet mask from the network administrator.

1. Power on the MAC device.

2. From the *Main Menu*, select *System Setup*.

3. If prompted, enter the system password.

4. From the *System Setup* menu, select *Basic System* > *Network Setup*

    The *Network Setup* window opens.

5. Enter the *IP Address*, *Subnet Mask*, and *Gateway* provided by the network administrator.

6. Enter the *Port Number* used by the MUSE system.

7. Select *Return* and press **Enter**.

    The *Network Setup* window closes.

8. On the *Basic System* menu, select *Transmission* and press **Enter**.

    The *Transmission* window opens.

9. Enter the following information.

Field	Value
Use IR for serial line	No
Serial line baud rate	115.2K
Default location	Ethernet (MUSE)

10. Select *Return* and press **Enter**.

    The *Transmission* window closes.

11. On the *Basic System* menu, select *Return* and press **Enter**.

    The *Basic System* menu closes.

12. On the *System Setup* menu, select *Save Setup* > *To System*.

    This saves the settings to the communication board and displays the following message:

    Please Wait.

    This should take approximately 16 to 19 seconds. If it takes less than 16 seconds, the settings were not saved successfully. Repeat a second time.

13. Wait at least 10 minutes and verify the MAC device can communicate with the MUSE system.

    Windows File Server 2000/2003 has an ARP cache that regenerates the MAC Address/Physical Address table every 10 minutes. When you replace the communications board, you change the MAC Address/Physical Address. By waiting at least 10 minutes, you allow the MUSE operating system to regenerate the MAC Address/Physical Address cache so the MAC device is able to communicate again with the MUSE system.

    NOTE:
    If the MAC device cannot communicate with the MUSE system after 10 minutes, cycle the power on the MAC device and wait another 10 minutes to reverify the device can communicate with the MUSE system. Cycling the power ensures the network settings are reread from the communications board.

14. Perform all necessary functional checkouts.

    Refer to "Functional Checkouts" on page 131.

Replacing the Writer Roller/Carriage Assembly

Use the following procedure to replace the writer roller/carriage assembly.

1. Remove the power supply following the procedure described in "Replacing the Power Supply" on page 103.

2. Inside the power supply compartment, disconnect the cable that connects to the writer assembly.

3. Open the unit to access the paper compartment and move the paper size bracket to the A4 position to expose one of the writer assembly mounting screws.

    Refer to "Setting the Correct Paper Size" on page 95 for details.

4. Remove the screw and return the paper size bracket to the 8.5 × 11 position.

5. Close the unit and turn it over so the bottom side is up.

6. Remove the four screws located on the underside of the writer roller/carriage assembly and lift the writer from the bottom of the unit.

7. Reverse the previous steps to insert the new writer roller/carriage assembly.

Replacing the Trolley Casters

Use the following procedure to replace the casters on the MAC Series trolley.

1. Remove the MAC unit and all loose items from the trolley and then place the trolley on its side.

2. Locate the slot under the arrow on the bearing dust cap and, using a small blade screwdriver, pry the cap from the caster to be removed.
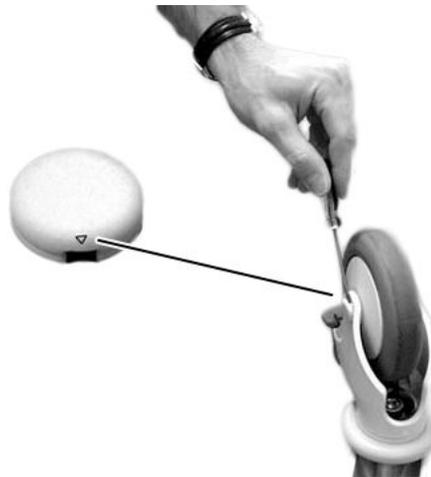
3. Using an Allen wrench, remove the wheel shaft and wheel from the caster.

4. Using an Allen wrench, remove the bolt holding the caster to the trolley.

5. Install the replacement caster on the trolley.

    NOTE:
    Ensure that the pins align with the holes on the fixed caster before fastening the caster to the trolley.
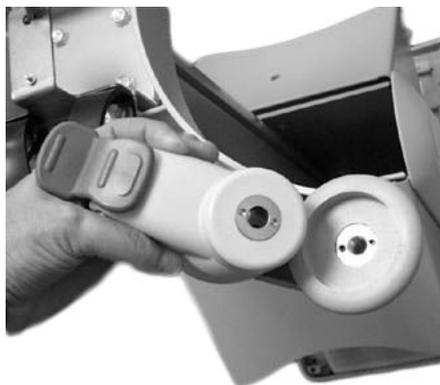
6. Install the wheel and attach it with the wheel bearing shaft and nut.

7. Using a small mallet, tap the bearing dust covers back in place.
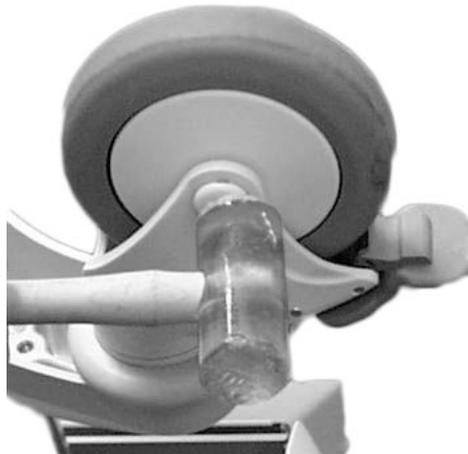
8. Set trolley upright and check the alignment and free movement of casters.

9. Replace the MAC unit.

Replacing the Barcode Reader Cable

Use the following procedure to replace the cable on a barcode reader.

1. Position the barcode reader so the label (1) is in front.

2.   Carefully peel back the label (2) so the pin hole is revealed.

3.   Insert a paper clip into the pin hole (3) until the cable latch is fully depressed and
        remove the cable (4).

4. Insert the new cable into the handle of the barcode reader until it snaps into place.

5. Fold the label into its original position.

6. Perform all applicable functional checkouts.

   Refer to "Functional Checkouts" on page 131 for details.

Functional Checkouts

After replacing a FRU or performing certain tasks, it is necessary to also inspect the unit and perform a series of checks to ensure the unit is functioning properly. The following tables identify the tools, inspections, and checkout procedures to perform.

To use the tables, locate the relevant FRU or task in the first column and note the required Tools, Visual Inspections, and Checkout Procedure(s) for the item. Then locate the corresponding instructions in the sections following the tables.

NOTE:
The FRU checkout procedure for any listed FRU also applies to its internal PCBs and components. Perform the applicable product or product configuration dependant procedures when an asterisk * is listed.

FRU Repairs

FRU Description	Tools	Visual Inspection	Checkout Procedure(s)
CAM 14	1, 5	1, 2, 7	1, 2, 3
CAM 14 I/F Cable	1, 5	1, 2, 7	1, 2, 3
CAM HD	1, 5	1, 2, 7	1, 2, 3, 11
Battery Pack	1, 5	5	1, 3, 12
Motherboard	1, 2, 3, 4, 5	3, 5, 8, 9	1, 2, 3, 4, 14, 21 *5 through 9
Roller Assy	1, 2, 4, 5	8	1, 2, 3, 16
Writer Assy	1, 2, 4, 5	8	1, 2, 3, 16

FRU Repairs (cont'd.)

FRU Description	Tools	Visual Inspection	Checkout Procedure(s)
Display Assy	1, 2, 4, 5	3, 7, 8	1, 2, 3, 13
Keyboard Assy	1, 2, 4, 5	3, 8	1 ,2, 3, 15
Power Supply Assy	1, 2, 3, 4, 5	8, 9	1 ,2, 3, 21
Plastics	1, 2, 3, 4, 5	7, 8, 9	1, 3, *21 *Bottom Plastic Replacement Only
Trolley or Casters	2, 5	6, 8	10
AC Power Cord	3, 5	4	1, 3
Non-Listed FRUs	1, 2, 4, 5	8, 9	1, 2, 3, 4, 21 *5 through 9

Option Repairs

FRU / Option	Tools	Visual Inspection	Checkout Procedure(s)
External Modem	1, 2, 5	8	1, 3, 5, 18
Internal Modem (Comm PCB)	1, 2, 4, 5	8	1, 3, 5, 18
SD Card Storage	1, 5, 6	N/A	1, 3, 4, 19
Wireless Serial Server	1, 2, 5	8	1, 3, 5
LAN (Comm PCB)	1, 2, 5	8	1, 3, 5, 20
Barcode Reader	1, 2, 5	8	1, 3, 8
Mag Card Reader	1, 2, 5	8	1, 3, 9
Treadmill or Ergometer I/F Cable	1, 2, 5	8	1, 3, 6
Blood Pressure Monitor	1, 2, 5	8	1, 3

Non-FRU Repairs

FRU Description	Tools	Visual Inspection	Checkout Procedure(s)
No Parts Replaced	1, 5	1, 2, 3, 4, 5, 6, 7	1, 3, 4 *5 through 9
Software Update	1, 5, 6	N/A	1, 2, 3, 4 *5 through 9
Hardware Upgrade	1, 2, 4, 5	8, 9	1, 2, 3, 4, 21 *5 through 9
Annual Electrical Safety Checkout	1, 2, 3, 5	7, 8, 9	1, 2, 3, 21

Tools

1.   ECG Simulator

2.   Standard hand tools including a #10 and a #6 Torx Driver

3.   Current Leakage Tester

4.   Anti-static wrist strap

5.   Applicable Service and/or Operator Manual as needed for reference

6.   SD Card

Visual Inspection

Inspect the following for excess wear and or any visual signs of damage.

1.   Passed check for defective or broken patient cable/leadwires and out of date electrodes?

2.   Discussed electrode placement, skin prep, and patient related requirements with ECG Tech?

3.   Keyboard/LCD passed inspection?

4.   AC Power cord passed inspection?

5.   Battery (swollen or leaky) passed inspection?

6.   Trolley and casters passed inspection?

7.   External surfaces passed inspection?

8.   Fasteners replaced and secured?

9.   All harnesses' and internal wiring has been secured?

Checkout Procedures

Perform the applicable checkout procedure.

Operational Checks

1.   Power-up self-test passed?

2.   Simulated recorded rhythm strip successful?

3.   Simulated recorded ECG successful?

4.   Simulated ECG stored on media successful?

5.   Simulated ECG data transmitted successfully to MUSE?

6.   Exercise device successfully communicates with device?

7.   Blood pressure monitor successfully communicates with device?

8.   Barcode reader successfully communicates with device?

9.   Magnetic card reader successfully communicates with device?

10.   Trolley casters lock successfully?

11.   HD displayed on the ECG screen?[1]

Diagnostic Tests

12.   Battery Status Test meets Battery Current expectation?

13.   Display diagnostic test successful?

14.   Speaker test successful?

15.   Keyboard test successful?

16.   Writer diagnostic tests successful?

17.   Read/Write Floppy Diagnostic Test successful? (Accurate test does not have to be performed)?

18.   External/Internal Modem Test successful?

19.   SD Card Test successful?

20.   Ethernet Module Test successful?

Electrical Safety Checks

21.   Current leakage and ground continuity test results meet requirements?

Perform electrical safety checks when indicated. All indicated electrical safety checks require a pass/fail indication for steps performed. Record the measurement values in your debrief.

---

1.   HD is displayed only if the following conditions are met: (1) a CAM HD is attached, (2) v10 software is installed, and (3) the HDMD option is activated.

Electrical Safety Checks

Step		Condition[1]	UUT — ON[2]	Result		Leakage Current Limits
Earth Leakage Current				`		
1	Forward Polarity	NC	_____ µA	Pass/Fail		300 µA
2	Neutral open, Forward Polarity	SFC	_____ µA	Pass/Fail		1,000 µA
3	Neutral open, Reverse Polarity	SFC	_____ µA	Pass/Fail		1,000 µA
4	Reverse Polarity	NC	_____ µA	Pass/Fail		300 µA
Enclosure Leakage Current						
1.	Forward Polarity	NC	_____ µA	Pass/Fail		100 µA
2.	Neutral open, Forward Polarity	SFC	_____ µA	Pass/Fail		300 µA
3.	Ground open, Forward Polarity	SFC	_____ µA	Pass/Fail		300 µA
4.	Ground open, Reverse Polarity	SFC	_____ µA	Pass/Fail		300 µA
5.	Neutral open, Reverse Polarity	SFC	_____ µA	Pass/Fail		300 µA
6.	Reverse Polarity	NC	_____ µA	Pass/Fail		100 µA
Patient Leakage Current to Ground[3]						
1.	Forward Polarity	NC	_____ µA	Pass/Fail		10 µA
2.	Neutral open, Forward Polarity	SFC	_____ µA	Pass/Fail		50 µA
3.	Ground open, Forward Polarity	SFC	_____ µA	Pass/Fail		50 µA
4.	Ground open, Reverse Polarity	SFC	_____ µA	Pass/Fail		50 µA
5.	Neutral open, Reverse Polarity	SFC	_____ µA	Pass/Fail		50 µA
6.	Reverse Polarity	NC	_____ µA	Pass/Fail		10 µA
Patient Leakage Current Mains on Applied Part						
1.	Forward Polarity Neutral / Ground Closed	SFC	_____ µA	Pass/Fail		5000 µA
2.	Reverse Polarity Neutral / Ground Closed	SFC	_____ µA	Pass/Fail		5000 µA
Ground Continuity						
1.	AC mains power cord ground prong to exposed metal surface (ground lug)	N/A	_____ Ὼ	Pass/Fail		Less than 200mὩ

1 NC — Normal ConditionSFC — SIngle Fault ConditionN/A — Not Applicable
2 UUT — Unit Under Test
3 All SIPs/SOPs grounded.

6

Parts List

The field replaceable units (FRUs) listed in this chapter supply enough detail for you to order the parts for field service. The parts are listed by function.

The following items may not be assigned separate manufacturing part numbers because they are normally part of a larger assembly. Since they are considered field replaceable units (FRUs), they have specific service part numbers so they can be ordered and replaced by service technicians. Contact Tech Support for FRU information for assemblies used on previous configurations.

NOTE:
Verify part numbers before ordering service parts (field replaceable units). See the tech memo series for this product for changes or additions to this list.

For Technical Support parts reference, see PN 2026609-001, MAC 5500 Assembly.

Barcode Reader

The following FRUs relate to the barcode reader option.

Barcode Reader FRUs

Item	Part Number
Kit 2D Barcode Imager MAC5000, English	2031240-001
Kit 2D Barcode Imager MAC5000, German	2031240-002
Kit 2D Barcode Imager MAC5000, French	2031240-003
Kit 2D Barcode Imager MAC5000, Spanish	2031240-004
Kit 2D Barcode Imager MAC5000, Swedish	2031240-005
Kit 2D Barcode Imager MAC5000, Italian	2031240-006
Kit 2D Barcode Imager MAC5000, Norwegian	2031240-009
Kit 2D Barcode Imager MAC5000, Danish	2031240-010
Kit 2D Barcode Imager MAC5000, Czech	2031240-011
Kit 2D Barcode Imager MAC5000, Hungarian	2031240-014
Kit 2D Barcode Imager MAC5000, Polish	2031240-015
Kit 2D Barcode Imager MAC5000, Finnish	2031240-020
Compact PS/2 Barcode Scanner Cable[2]	2055394-001

CAM

The following FRUs relate to the CAM acquisition module.

CAM FRUs

Item	Part Number
Kit CAM14 Resting ECG W/AHA Adapter	901142-001
Kit CAM14 Resting ECG W/IEC Adapter	901142-002
Kit CAMHD Resting ECG W/AHA Adapter	901142-009
Kit CAMHD Resting ECG W/IEC Adapter	901142-010
CAM 14 Acquisition Holder (for new trolley only)	2026528-001

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2.   Replaces 2018629-001. Both cables are interchangeable.

Circuit Board

The following FRUs relate to system circuit boards.

Circuit Board FRUs

Item	Part Number
PCB ASSY MAC CPU ROHS **NOTE:** This board works on MAC 3500 and MAC 5500 devices running MAC software versions 9D and 10B or *later*. It does not work on MAC 5000 devices. It is loaded with factory software that is not intended for patient use. If you are replacing a previous CPU, you must order an SD card with the appropriate software version; attempting to install earlier versions on a system with this board will cause the system to fail. Always reload the same or newer version of the software. Do not downgrade the software to a lower version. To use a CAM HD acquisition module in HD mode with this board, software version 10B must be installed and the HDMD option must be activated; otherwise, the acquisition will processed in standard mode.	801212-008
PCB ASSY MAC5500 XM COMM BOARD ROHS **NOTE:** This board is compatible with MAC software versions 9D and 10B or *later*. When replacing an earlier board, you must order an SD card with the appropriate software version. This board is compatible with CPU board 801212-008. It is not compatible with CPU boards 801212-007 or 801212-006.	2022332-004
Battery/LED Circuit Board	801222-002
Comm Board Guide	2025484-001

For more information, see Appendix B, "Software/Hardware Compatibility".

Display

The following FRU relates to the system's video display.

Display FRUs

Item	Part Number
FRU DISPLAY AUO V1 MAC5000AAY / MAC5500SCD **NOTE:** Compatible with the following: • MAC 5500 devices with product codes SCD and SGM • MAC software v9x and v10x • CPU boards 801212-008, 801212-007, and 801212-006	2019106-007

LVDS Converter PWA Kit (2073125–001)

The following kit provides the LVDS converter required by the AUO-V1 LCD display (2019106-007).
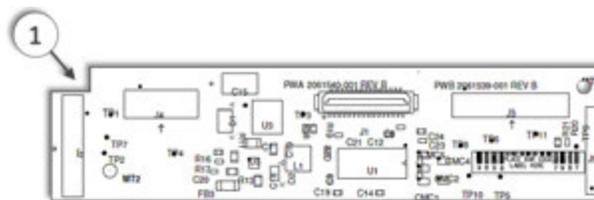
Item	Description	Part Number	Qty
1	PCB ASSY MAC5500 / MAC3500 LVDS DRV BRD ROHS	2061540-001	1
*	Pad Flopy MAC Series	421193-002	2

* Not shown.

AUO-V1 LCD Harness Kit (2073088–001)

The following kit provides the cables required to service the AUO-V1 LCD display (2019106-007).
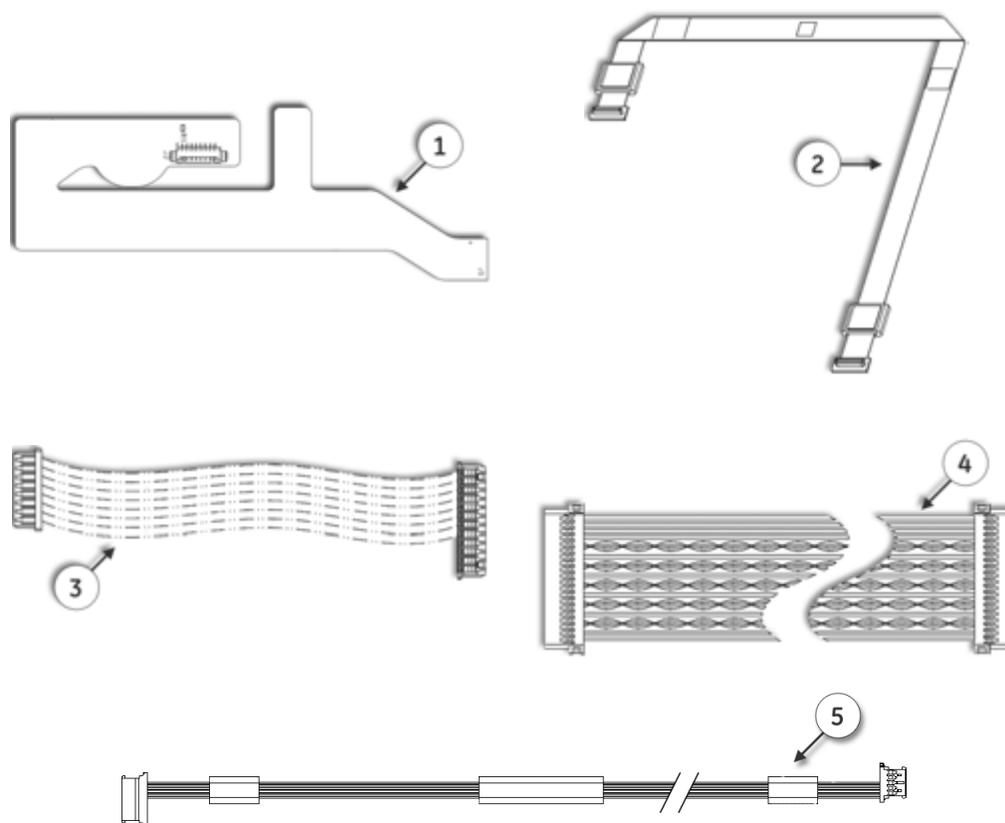
Item	Description	Part Number	Qty
1	Flex Assy MAC Backlight Microsemi	2034923-002	1
2	Assy Display Cable MAC5500	2001378-006	1
3	MAC5500 Pwr Cable Main Board to LVDS	2034900-004	1
4	Assy MAC5500 LCD Data Cable	2059277-001	1
5	MAC5500 LVDS to Display Pwr Cable	2059174-001	1
*	Pad Flopy MAC Series	421193-001	1

* Not shown.

Display Plastic Cover Kit (2073124–001)

The following kit provides the plastic housing required to service the AUO-V1 LCD display (2019106-007).
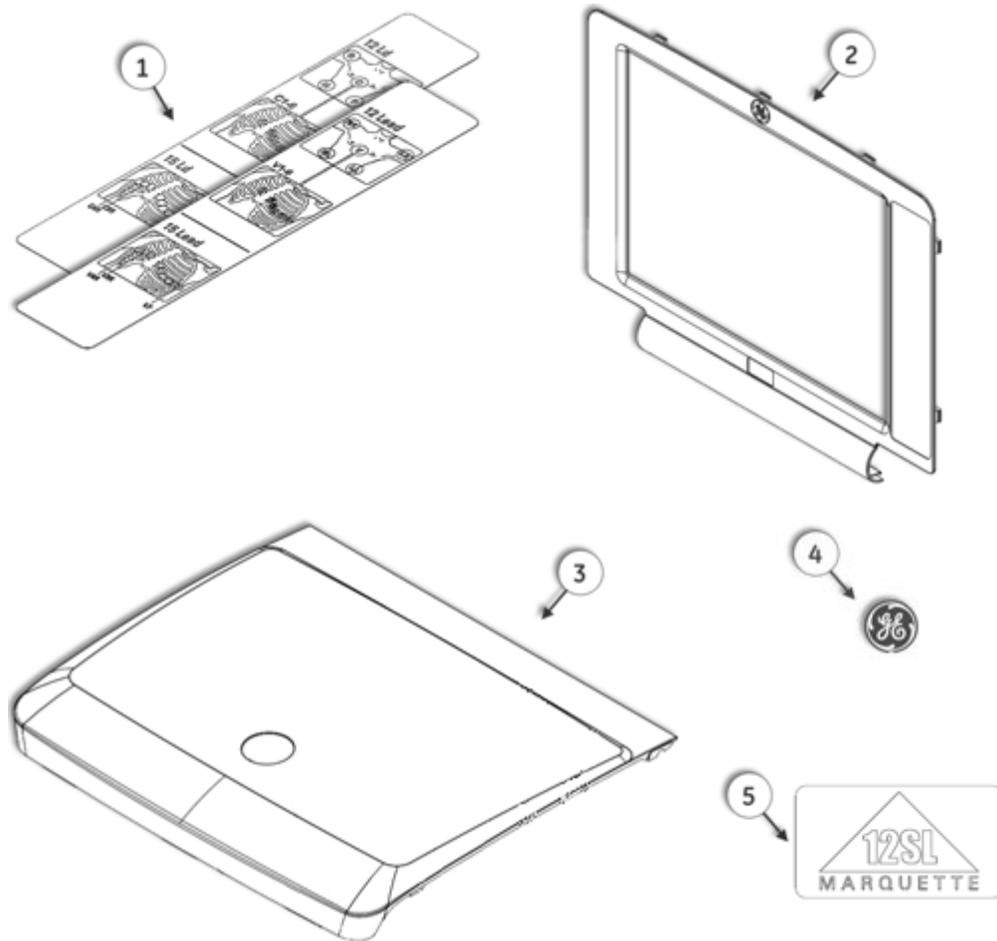
Item	Description	Part Number	Qty
1	Label Kit Lead Placement MAC5500	2008169–001	1
2	Trim Display MAC5000	2017316–001	1
3	Cover Display MAC5000	2017315–001	1
4	Nameplate 30MM GE Logo	2007786–016	1
5	Label 12SL MAC5000	2008168–001	1

Keyboard

The following FRUs relate to the system's keyboards.

Keyboard FRUs

Item	Part Number
Keyboard Assembly (Resting), English	421115-101
Keyboard Assembly (Stress), English	421115-201
Keyboard Assembly (Resting), German	421115-102
Keyboard Assembly (Stress), German	421115-202
Keyboard Assembly (Resting), French	421115-103
Keyboard Assembly (Stress), French	421115-203
Keyboard Assembly (Resting), Spanish	421115-104
Keyboard Assembly (Stress), Spanish	421115-204
Keyboard Assembly (Resting), Swedish	421115-105
Keyboard Assembly (Stress), Swedish	421115-205
Keyboard Assembly (Resting), Italian	421115-106
Keyboard Assembly (Stress), Italian	421115-206
Keyboard Assembly (Resting), Japanese	421115-107
Keyboard Assembly (Stress), Japanese	421115-207
Keyboard Assembly (Resting), Dutch	421115-108
Keyboard Assembly (Stress), Dutch	421115-208
Keyboard Assembly (Resting), Norwegian	421115-109
Keyboard Assembly (Stress), Norwegian	421115-209
Keyboard Assembly (Resting), Danish	421115-110
Keyboard Assembly (Stress), Danish	421115-210
Keyboard Assembly (Resting), Czech	421115-111
Keyboard Assembly (Stress), Czech	421115-211
Keyboard Assembly (Resting), Simplified Chinese	421115-113
Keyboard Assembly (Stress), Simplified Chinese	421115-213
Keyboard Assembly (Resting), Hungarian	421115-114
Keyboard Assembly (Stress), Hungarian	421115-214
Keyboard Assembly (Resting), Polish	421115-115
Keyboard Assembly (Stress), Polish	421115-215
Keyboard Assembly (Resting), Finnish	421115-116
Keyboard Assembly (Stress), Finnish	421115-216

Hardware

The following FRUs are hardware required by, or in order to service, the system.

Hardware FRUs

Item	Part Number
Top Cover Top Cover Label **NOTE:** Top Cover and Top Cover Label must be ordered together.	2017413-001 2026595-001
Panel Rear Connector **NOTE:** This panel supports Infrared and is used on all MAC 5500 units with the product code SCD.	2023119-001
Panel Rear Connector MAC5500 HD **NOTE:** This panel does not support Infrared and is used on all MAC 5500 HD units with the product code SGM.	2023119–002
MAC 5500 HD Product ID Label	2054345-001
#10 Torx Screws (M3 X 8MM TORX SEMS)	418545-001

Magnetic Card Reader

The following FRUs relate to the magnetic card reader option.

Magnet Card Reader FRUs

Item	Part Number
Magnetic Card Reader Kit, English	2018627-001
Magnetic Card Reader Kit, German	2018627-002
Magnetic Card Reader Kit, French	2018627-003
Magnetic Card Reader Kit, Spanish	2018627-004
Magnetic Card Reader Kit, Swedish	2018627-005
Magnetic Card Reader Kit, Italian	2018627-006
Magnetic Card Reader Kit, Norwegian	2018627-009
Magnetic Card Reader Kit, Danish	2018627-010

Media

The following FRUs relate to media required by, or in support of, the system.

Media FRUs

Item	Part Number
V10B Programmed SD Card	2026831–008
SD card for external storage (512 MB)	2027268-004
SD card for external storage (2GB) **NOTE:** Supported only by MAC5500 HD units and units upgraded to v10. MAC systems do not support SD High Capacity (SDHC) cards.	2027268-005
CD-R MUSE 12SL Statement Library Update **NOTE:** Upgrades MUSE 5E and MUSE 7.x systems to 12SL v22 for compatibility with the MAC v10 software.	2056460-001

External Modem

The following FRUs relate to the system's external modem option.

External Modem FRUs

Item	Part Number
MAC 5000 Country Modem PTO Option Class	MAC5000_MODEM
Country-specific external modem	2005264–0xx

Power

The following FRUs relate to powering the system. FRUs related to powering optional features are listed with those features.

Power FRUs

Item	Part Number
Battery Assembly	900770-001
Power Supply Assembly	421117-002
Power Cord Generic PTO Option Class	POWERCORDS
Power Cord 125V 6FT Stress	80274-006
Power Cord 125V 6FT SE	80274-004
Power Cord CONT Euro 10A 250V 8FT	401855-001
Power Cord British 10A 250V 8FT	401855-002

Power FRUs (cont'd.)

Item	Part Number
Power Cord Italian 10A 250V 8FT	401855-003
Power Cord Israeli 10A 250V 8FT	401855-004
Wire Harness 10A 125V 6.5FT	401855-005
Wire Harness 10A 250V 6.5FT	401855-006
Power Cord Swiss 10A 250V 8FT	401855-007
Power Supply Cord, Indian 10A 250V 2.5M	401855-108
Danish 220VAC/50HZ,STRESS	401855-009
Power Cord Australian 10A 250V 8FT	401855-010
Power Cord Chinese 10A 250V 2.5M	401855-012
Power Cord 10A 8FT CONT Euro Stress	401855-101
Power Cord 10A 8FT British Stress	401855-102
Power Cord Italian 10A 8FT Stress	401855-103
Power Cord Israeli 10A 8FT Stress	401855-104
Power Cord Swiss 10A 8FT Stress	401855-107
Power Cord Indian 10A 8FT Stress	401855-108
Power Cord, Danish 10A 8FT Stress	401855-109
Power Cord AUST 10A 8FT Stress	401855-110
Power Cord 16A, Euro	401855-201
Power Cord 13A, British	401855-202
Power Cord 16A, Italian	401855-203
Power Cord 16A, Israeli	401855-204
Power Cord 15A AUST	401855-210
Power Cord Stress 125V 15A 12FT	405535-002
Power Cord RA 125V 13A 10FT	405535-006
Power Cord RA 125V 13A 12FT	405535-001

MAC Series Trolley

The following FRUs relate to the optional MAC series trolley. For FRUs related to the Modular MAC ECG Trolley, refer to the *Modular MAC ™ ECG Trolley Service Manual*.

Trolley FRUs

Item	Part Number
Trolley Caster Fixed (Anti-Static)	2017784-002
Trolley Caster Swivel (Anti-Static)	2017785-002

Item	Part Number
Trolley Caster Kit (Anti-Static)	2024418-001
CAM 14 Acquisition Holder (for new trolley only)	2026528-001

Wireless

The following FRUs relate to the system's wireless option.

Wireless FRUs

Item	Part Number
Silex Wireless Serial Server (Global)	2034529-004
Silex Wireless Serial Server Assembly (USA)	2034530-004
FIPS Wireless Silex Serial Server (US government use only)	2047733-001
FIPS Wireless Silex Serial Server Assembly (US government use only)	2034530-003
Power Supply — Wireless Silex Serial Server **NOTE:** Compatible with all FIPS and non-FIPS servers.	2026825-002
Silex antenna **NOTE:** Compatible with all FIPS and non-FIPS servers.	108-00014-50
Silex Serial Server Antenna Cable **NOTE:** Compatible with all FIPS and non-FIPS servers.	131-00030-50
1" Square Dual Lock **NOTE:** Required whenever the Silex server and/or power supply will be mounted on a MAC Modular Trolley.	2056811-001

NOTE:
The global Silex Wireless Serial Server (2034529-004) and Silex Wireless Serial Server Assembly (2034530-004) replace, and are compatible with, the following parts:

- Silex Wireless Serial Server (US), 2034529-001

- Silex Wireless Serial Server (Europe), 2034529-002

- Silex Wireless Serial Server Assembly (US), 2034530-001

- Silex Wireless Serial Server Assembly (Europe), 2034530-002

For additional information, refer to the *MobileLink™ Wireless Communications Installation Manual*.

Writer

The following FRUs relate to the system's thermal writer.

Writer FRUs

Item	Part Number
Printhead	2029559-001
Writer Assembly	421108-009
Universal Service Writer Kit	2031810-002
Roller Assembly	422396-003
Writer Release Button	2005920-001
Leaf Spring	417565-001
Gas Cylinder	416015-001
MAC Writer Base Hinge Plastic Front Right	417467–002
MAC Writer Base Hinge Plastic Front Left	417467–001

A

Technical Specifications

This appendix provides the technical specifications of the MAC system.

Display

Display Specifications

Item	Description
Type	264mm (10.4 in.) diagonal graphics backlit AM LCD
Resolution	640 x 480 pixels, with waveform enhancement
Displayed Data	Heart rate, patient name, ID, clock, waveforms, lead labels, speed, gain and filter settings, warning messages, prompts and help messages

Computerized Eletrocardiograph

Computerized Eletrocardiograph Specifications

Item	Description
Instrument Type	15-lead (14 channel) microprocessor-augmented, automatic electrocardiograph
Analysis Frequency	500 samples/s (sps)
ECG Storage	200 records (maximum) on internal, non-volatile memory. Facility to archive ECG records on removable media (SD card).
Digital Sampling Rate	4000 samples/s/channel
Analysis	Pediatric and vectorcardiography Optional: 12SL analysis, HI-RES and PHI-RES late potential analysis
Pre-acquisition	Provides 10 seconds of instantaneous ECG acquisition
Dynamic Range	AC differential: ±5 mV DC offset:: ±320 mV
Resolution	4.88 µV/LSB @ 250 sps, 1.22 µV/LSB @ 500 sps
Frequency Response	–3 dB @ 0.01 to 150 Hz

Item	Description
Common Mode Rejection	>140 dB (123 dB with AC filter disabled)
Input Impedance	>10 MΩ @ 10Hz, defibrillator protected
Pace Detection	750 μV @ 50 μs duration, Orthogonal LA, LL and V6
Special Acquisition Functions	Disconnected lead detection, electrode impedance, AC noise, baseline wander, and muscle tremor
Communication	MAC and MUSE system compatible RS-232 Optional: Modem, LAN, FAX, and wireless transmission, remote retrieval (remote query)

Writer

Writer Specifications

Item	Description
Type	Thermal dot array
Speeds	5, 12.5, 25, 50 mm/s (same as display)
Number of Traces	3, 6, 12, or 15 user-selectable (same as display)
Sensitivity/Gain	2.5, 5, 10, 20, 10/5 (split calibration) mm/mV (same as display)
Speed Accuracy	± 2%
Amplitude Accuracy	± 5%
Resolution	Horizontal 1000 dpi @ 25 mm/s, 200 dpi vertical
Paper Type	Thermal z-fold, perforated, fan fold
Paper Size	A Size: 215.9 mm x 276.4 mm (8.5 in. x 11 in.) A4 Size: 210 mm x 297.5 mm (8.27 in. x 11.7 in.)

Keyboard

Keyboard Specifications

Item	Description
Type	Sealed elastomer with soft function keys, alphanumeric keys, writer controls and TrimPad cursor controls

Electrical

Electrical Specifications

Item	Description
Power Supply	AC or battery operation
Voltage	100–240 VAC, +10, −15%

Electrical Specifications (cont'd.)

Item	Description
Current	0.5A @ 115 VAC, 0.3A @ 240 VAC, typical
Frequency	50–60 Hz, ±10%
Battery Type	User replaceable, 18V @ 3.5 AH ±10%, rechargeable NiMH pack
Battery Capacity	100 single-page reports (typical) or 6 hours continuous operation (without printing)
Battery Charge Time	Approximately 4.5 hrs. from total discharge with display off. **NOTE:** Cannot charge battery at or above 45° C; best if below 40° C.

Vectorcardiography

Vectorcardiography Specifications

Item	Description
Report Formats	Vector loops of component vectors (P, QRS, ST-T)
Sensitivity	20, 40, 80, 160 mm/mV
Time Resolution	2 ms

Hi-Res and PHi-Res Signal-Averaged Electrocardiography

Hi-Res and PHi-Res Specifications

Item	Description
Frequency Response/Input	-3 dB @ 0.01 and 250 Hz
Frequency Response/Output	
Upper Limit	250 Hz
Lower Limit	0.01, 25, 40 or 80 Hz
Sensitivities	
Raw Data and Template	20 mm/mV
Average Beat	20 mm/mV and 50 mm/mV
Filtered Signals and Vector Magnitude	1 mm/µV
Analysis Sampling Rate	1000 samples per second per channel
Digital Sampling Rate	4000 samples per second per channel
High/Low Pass Filters	Spectral filter using Fast Fourier Transform (FFT)

Hi-Res and PHi-Res Specifications (cont'd.)

Item	Description
ADC Resolution	1.22 µV/LSB
Analysis Resolution	0.1525 µV/LSB

Physical (without Trolley)

Physical Specifications (without trolley)

Item	Description
Height	9.4 cm (3.7 in) with display closed
Width	38.1 cm (15.0 in)
Depth	35.1 cm (13.8 in)
Weight	6.8 kg (15 lb) without paper

Environmental

Environmental Specifications

Item	Description
Temperature	
Operating	10° C to 40° C (50° F to 104° F) [3]
Storage	-40° C to 70° C (-40° F to 158° F)*
Relative Humidity	
Operating	20% to 95% RH non-condensing
Storage	15% to 95% RH non-condensing
Atmospheric Pressure	
Operating	700 to 1060 hPa
Storage	500 to 1060 hPa
Disposal	
Batteries	Disposing of battery by fire or burning will cause the battery to explode. The battery is recyclable. Follow local environmental guidelines concerning disposal and recycling. Batteries may be returned to GE Healthcare for recycling.
Device	Recyclable

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3.   Paper discoloration may occur at higher temperatures

Safety

Item	Description
Certification	• UL 60601-1 classified • UL classified for CAN/CSA C22.2 No. 601.1 • CB certified for IEC 60601-1 • Meets applicable AAMI EC-11 requirements
Type of Protection Against Electrical Shock	Class 1, internally powered
Degree of Protection Against Ingress of Liquids	Ordinary
Handling of Disposable Supplies and Other Consumables	Use only parts and accessories manufactured or recommended by GE Healthcare. Follow manufacturer's instructions for use for disposable/consumable products. Follow local environmental guidelines concerning the disposal of hazardous materials.
Patient Mode of Operation	Continuous
Patient Leakage Current	<10 µA
Degree of Protection Against Electrical Shock	Type BF defibrillation protection for the patient cable (acquisition module)
Maintenance Frequency	User should inspect the device daily and clean the device routinely as needed. Use a commercially available, industrial strength disinfectant cleaner on any part of the equipment (other than electrodes) that comes into direct contact with the patient. For detailed maintenance information, refer to Chapter 5, "Maintenance".
Repair Guidelines	Calibration instructions, equipment descriptions, and all other information which will assist qualified technical personnel in repairing those parts of the equipment designated as repairable are available in the field service manual for the equipment. Upon request, circuit diagrams and component parts lists for printed circuit boards deemed repairable by qualified technical personnel will be made available.

MAC™ 5500/MAC™ 5500 HD

B

Software/Hardware Compatibility

Before ordering software upgrades or replacement CPUs, communication boards, or display assemblies, you need to know which components are compatible.

Display Compatibility

The following display assemblies are interchangeable and compatible with 801212–006, 801212–007, and 801212–008 circuit boards. However, the components used to construct the display assemblies are not interchangeable.

Compatible Display Assemblies

Part Number	Description	Display Type (10.5")		
		Make	Model	Type
2017484–001	Display Assembly MAC 5500/MAC 5000	NEC	-64E	CCFL/CMOS
2017484–002	Display Assembly MAC 5500/MAC 5000	NEC	-59D	CCFL/CMOS
2017484–003	Display Assembly MAC 5500/MAC 5000	AUO	-V0	CCFL/CMOS
2017484–004	Display Assembly MAC 5500/MAC 5000	AUO	-V1	LED/LVDS

Compatible Display FRU Kits

Part Number	Description	Display Type (10.5")		
		Make	Model	Type
2019106–002	FRU Display MAC5000 PROD CODE MH	NEC	-59D	CCFL/CMOS
2019106–003	FRU Display MAC5000 PROD CODE MP/WT	NEC	-64E	CCFL/CMOS
2019106–004	FRU Kit Display AUO	AUO	-V0	CCFL/CMOS
2019106–005	FRU Kit Display AUO	AUO	-V0	CCFL/CMOS
2019106-007	FRU Kit Display AUO	AUO	-V1	LED/LVDS

Circuit Board Compatibility Matrix

Not all supported software versions are compatible with all CPU/Comm board combinations. You must know which software versions are compatible with which CPU and Comm boards before you replace either board or upgrade your software.

The following table identifies which software versions are compatible with which CPU/Comm board combinations.

Supported Hardware/Software Combinations

Main Board	Primary Board Boot Code	Software Application	Comm Boards		
			-002	-003	-004
-008	B4	10B	✔	✔	✔
		9D	✔	✔	✔
-007	B3	10B	✔	✔	✔
		10A	✔	✔	✘ 1
		9D	✔	✔	✔
		9C	✔	✔	✘ 2
-006	B3	10B	✔	✔	✔
		10A	✔	✔	✘ 1
		9D	✔	✔	✔
		9C	✔	✔	✘ 2

[1] The 2022332–004 Comm Board is not compatible with the version 10A software. If you need to upgrade to this comm board on a device with version 10A software, you must upgrade to software version 10B.

[2] The 2022332–004 Comm Board is not compatible with the version 9C software. If you need to upgrade to this comm board on a device with 9C software, you must upgrade to software version 9D.

Supported Software Update Paths

The following table identifies the supported software update paths for each supported main board. Attempting any unlisted update could result in issues either with the update process itself or with the device after the update is complete.

Supported Software Update Paths

Main Board	Update	
	From	**To**
-008	v9D	v10B
	v10B	v9D
-007	v10A	v10B
	v10A	v9D
	v9C	v10B
	v9C	v9D
-006	v10A	v10B
	v10A	v9D
	v9C	v10B
	v9C	v9D

Software Compatibility with the -008 CPU

The 801212–008 main board is NOT compatible with versions 9C or 10A. The -008 board has a new Numonyx (Micron), 512MB NAND Flash chip that requires boot code version B4 and software versions 9D or 10B.

The boot code will prevent you from installing version 9C or 10A on a device with the 801212–008 main board.

C

Electromagnetic Compatibility

Changes or modification to this system not expressly approved by GE Healthcare could cause EMC issues with this or other equipment. This system is designed and tested to comply with applicable regulation regarding EMC and needs to be installed and put into service according to the following EMC information.

WARNING:
Use of portable phones or other radio frequency (RF) emitting equipment near the system may cause unexpected or adverse operation.

WARNING:
The equipment or system should not be used adjacent to, or stacked with, other equipment. If adjacent or stacked use is necessary, the equipment or system should be tested to verify normal operation in the configuration in which it is being used.

Guidance and Manufacturer's Declaration - Electromagnetic Emissions

The device described in this manual is intended for use in the following electromagnetic environment. It is the responsibility of the customer or user to ensure that the device is used in such an environment.

Emission Test	Compliance	Electromagnetic Environment — Guidance
RF emissions CISPR11	Group 1	The equipment uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR11	Class A	Class A Equipment is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions EN 61000-3-2	Class A	
Voltage fluctuations/Flicker emissions EN 61000-3-3	Complies	

Guidance and Manufacturer's Declaration - Electromagnetic Immunity

The device described in this manual is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the device is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment - Guidance
Electrostatic discharge (ESD) EN 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst EN 61000-4-4	± 2 kV for power supply lines ±1 kV for input/output lines	± 2 kV for power supply lines ±1 kV for input/output lines	Mains power should be that of a typical commercial or hospital environment.
Surge EN 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines EN 61000-4-11	<5% Ut (>95% dip in Ut) for 0.5 cycles 40% Ut (60% dip in Ut) for 5 cycles 70% Ut (30% dip in Ut) for 25 cycles <5% Ut (>95% dip in Ut) for 5 sec	<5% Ut (>95% dip in Ut) for 0.5 cycles 40% Ut (60% dip in Ut) for 5 cycles 70% Ut (30% dip in Ut) for 25 cycles <5% Ut (>95% dip in Ut) <5% Ut (>95% dip in Ut)	Mains power should be that of a typical commercial or hospital environment. If the user of the MAC 5500 requires continued operation during power mains interruptions, it is recommended that the MAC 5500 be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field EN 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristics of a typical location in a typical commercial or hospital environment.

NOTE:
Ut is the AC mains voltage prior to application of the test level.

Guidance and Manufacturer's Declaration - Electromagnetic Immunity

The device described in this manual is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the device is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
			Portable and mobile RF communications equipment should not be used closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
Conducted RF EN 61000-4-6	3 Vrms 150 KHz to 80 MHz	3 V rms	$d = 1.2 \sqrt{P}$
Radiated RF EN 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2 \sqrt{P}$ 80 MHZ to 800 MHz
			$d = 2.3 \sqrt{P}$ 800 MHZ to 2.5 GHz
			where **P** is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer, and d is the recommended separation distance in meters (m).
			Field strengths from fixed RF transmitters, as determined by an electromagnetic site surveya, should be less than the compliance level in each frequency rangeb.
			Interference may occur in the vicinity of equipment marked with the following symbol:

NOTE:
At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE:
These guidelines may not apply in all situations. Electromagnetic propagation is affected by reflection from structures, objects, and people.

1. Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the equipment.

2. Over the frequency range 150 KHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances

The table below provides the recommended separation distances (in meters) between portable and mobile RF communication equipment and the device described in this manual.

The device is intended for use in the electromagnetic environment on which radiated RF disturbances are controlled. The customer or the user of the device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the device as recommended in the following table, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter in Watts	Separation Distance in Meters (m) According to Frequency of Transmitter			
	150 kHz to 80 MHz outside ISM bands $d=1.2\ \sqrt{P}$	150 kHz to 80 MHz in ISM bands $d=1.2\ \sqrt{P}$	80 MHz to 800 MHz $d=1.2\ \sqrt{P}$	800 MHz to 2.5 GHz $d=2.3\ \sqrt{P}$
0.01	0.12	0.12	0.12	0.23
0.1	0.38	0.38	0.38	0.73
1	1.2	1.2	1.2	2.3
10	3.8	3.8	3.8	7.3
100	12	12	12	23

NOTE:
At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

For transmitters rated at a maximum output power not listed in the previous table, the recommended separation distance [d] in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (w) according to the transmitter manufacturer.

NOTE:
These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Compliant Cables and Accessories

WARNING:
The use of accessories, transducers, and cables other than those specified may result in increased emissions or decreased immunity performance of the equipment or system.

The following table lists cables, transducers, and other applicable accessories with which GE Healthcare claims EMC compliance.

NOTE:
Any supplied accessories that do not affect EMC compliance are not included.

Part Number	Description	Maximum Lengths
900770-001	MAC Pac Battery	NA
900995-002	CAM 14	NA
2016560-001	Cable Assembly Host MAC 5500	1.7m
2016560-003	Cable Assembly Host MAC 5500ST	5.4m
901142-001	Kit CAM 14 Resting W/AHA Adapters	NA
901142-002	Kit CAM 14 Resting W/IEC Adapters	NA
901142-005	Kit CAM 14 Stress W/AHA Adapters	NA
901142-007	Kit CAM 14 Stress W/IEC Adapters	NA
2047566-001	Serial Comm. Cable 8 Pin Mini DIN	6.1m
416070-001	External Video Cable	1.8m
2007918-001	Treadmill Cable MAC 5500ST to T2000	6.0m
405535-006	Power Supply Cord US 13A 125V	3.0m
401855-xxx	Power Supply Cords 10A 250V	2.5m
2005264-XXX	MAC 5500 External Modem Kits	NA
2018626-XXX	MAC 5500 Barcode Scanner Kits	NA
2035979-XXX	2D Barcode Scanner Kit	N/A
2018627-XXX	MAC 5500 Magnetic Card Reader Kits	NA
2034530-XXX	MAC 5500 Wireless Kits	NA

MAC™ 5500/MAC™ 5500 HD