

GE Healthcare

# MAC™ 3500

## Resting ECG Analysis System

### Service Manual

Software Version 10  
2046275-019 Revision H



MAC™ 3500 Resting ECG Analysis System  
English  
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## Publication Information

The information in this manual only applies to MAC™ 3500 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 History

Revision	Publication Date	Description
A	28 February 2011	Initial release of the document.
B	14 August 2012	Updated the following sections: <ul style="list-style-type: none"><li>• <i>Indications for Use</i></li><li>• <i>Safety Messages</i></li><li>• <i>Parts Lists</i></li></ul> Removed <i>Parts and Accessories</i> . Refer to the operators manual for supply and accessory 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	Updated block diagrams, revised procedure for replacing the LVDS Converter Board, and clarified the procedure for replacing the COMM board per SPR HCSDM00206035. Corrected part numbers in <a href="#">Appendix B, "Software/Hardware Compatibility"</a> per SPR HCSDM00225973.
E	21 February 2014	Updated several part numbers with new ROHS-compliant versions.
F	8 September 2014	Updated for RoHS compliance.
G	5 December 2014	Updated the Tech Specs for RoHS compliance.
H	31 January 2019	Updated the following: <ul style="list-style-type: none"><li>• Manual review and update per the "Keep It Simple" service initiative.</li><li>• Removed EC REP information.</li><li>• Added the Instructions for Use.</li><li>• Updated UL symbol.</li></ul>

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## Service Manual Language Information

WARNING (EN)	<p>This service manual is available in English only.</p> <ul style="list-style-type: none"> <li>• If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services.</li> <li>• Do not attempt to service the equipment unless this service manual has been consulted and is understood.</li> <li>• Failure to heed this warning may result in injury to the service provider, operator, or patient, from electric shock, mechanical or other hazards.</li> </ul>
ПРЕДУПРЕЖДЕНИЕ (BG)	<p>Това упътване за работа е налично само на английски език.</p> <ul style="list-style-type: none"> <li>• Ако доставчикът на услугата на клиента изиска друг език, задължение на клиента е да осигури превод.</li> <li>• Не използвайте оборудването, преди да сте се консултирали и разбрали упътването за работа.</li> <li>• 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.</li> </ul>
警告 (ZH-CN)	<p>本维修手册仅提供英文版本。</p> <ul style="list-style-type: none"> <li>• 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。</li> <li>• 未详细阅读和完全理解本维修手册之前，不得进行维修。</li> <li>• 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。</li> </ul>
警告 (ZH-TW)	<p>本維修手冊只提供英文版。</p> <ul style="list-style-type: none"> <li>• 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。</li> <li>• 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。</li> <li>• 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。</li> </ul>
UPOZORENJE (HR)	<p>Ove upute za servisiranje dostupne su samo na engleskom jeziku.</p> <ul style="list-style-type: none"> <li>• Ukoliko korisnički servis zahtijeva neki drugi jezik, korisnikova je odgovornost osigurati odgovarajući prijevod.</li> <li>• Nemojte pokušavati servisirati opremu ukoliko niste konzultirali i razumjeli ove upute.</li> <li>• Nepoštivanje ovog upozorenja može rezultirati ozljedama servisnog osoblja, korisnika ili pacijenta prouzročenim električnim udarom te mehaničkim ili nekim drugim opasnostima.</li> </ul>
VAROVÁNÍ (CS)	<p>Tento provozní návod existuje pouze v anglickém jazyce.</p> <ul style="list-style-type: none"> <li>• V případě, že externí služba zákazníkům potřebuje návod v jiném jazyce, je zajištění překladu do odpovídajícího jazyka úkolem zákazníka.</li> <li>• Nesnažte se o údržbu tohoto zařízení, aniž byste si přečetli tento provozní návod a pochopili jeho obsah.</li> <li>• 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.</li> </ul>

## Service Manual Language Information (cont'd.)

ADVARSEL (DA)	<p>Denne servicemanual findes kun på engelsk.</p> <ul style="list-style-type: none"> <li>• Hvis en kundes tekniker har brug for et andet sprog end engelsk, er det kundens ansvar at sørge for oversættelse.</li> <li>• Forsøg ikke at servicere udstyret medmindre denne servicemanual har været konsulteret og er forstået.</li> <li>• Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk, mekanisk eller anden fare for teknikeren, operatøren eller patienten.</li> </ul>
WAARSCHUWING (NL)	<p>Deze service manual is alleen in het Engels verkrijgbaar.</p> <ul style="list-style-type: none"> <li>• Indien het onderhoudspersoneel een andere taal nodig heeft, dan is de klant verantwoordelijk voor de vertaling ervan.</li> <li>• Probeer de apparatuur niet te onderhouden voordat deze service manual geraadpleegd en begrepen is.</li> <li>• 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.</li> </ul>
HOIATUS (ET)	<p>Käesolev teenindusjuhend on saadaval ainult inglise keeles.</p> <ul style="list-style-type: none"> <li>• Kui klienditeeninduse osutaja nõuab juhendit inglise keelest erinevas keeles, vastutab klient tõlketeenuse osutamise eest.</li> <li>• Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist.</li> <li>• Käesoleva hoiatuse eiramine võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärjel.</li> </ul>
VAROITUS (FI)	<p>Tämä huolto-ohje on saatavilla vain englanniksi.</p> <ul style="list-style-type: none"> <li>• Jos asiakkaan huoltohenkilöstö vaatii muuta kuin englanninkielistä materiaalia, tarvittavan käännöksen hankkiminen on asiakkaan vastuulla.</li> <li>• Älä yritä korjata laitteistoa ennen kuin olet varmasti lukenut ja ymmärtänyt tämän huolto-ohjeen.</li> <li>• Mikäli tätä varoitusta ei noudateta, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.</li> </ul>
ATTENTION (FR)	<p>Ce manuel technique n'est disponible qu'en anglais.</p> <ul style="list-style-type: none"> <li>• Si un service technique client souhaite obtenir ce manuel dans une autre langue que l'anglais, il devra prendre en charge la traduction et la responsabilité du contenu.</li> <li>• Ne pas tenter d'intervenir sur les équipements tant que le manuel technique n'a pas été consulté et compris.</li> <li>• Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.</li> </ul>

## Service Manual Language Information (cont'd.)

<p>WARNUNG (DE)</p>	<p>Diese Serviceanleitung ist nur in englischer Sprache verfügbar.</p> <ul style="list-style-type: none"> <li>Falls der Kundendienst eine andere Sprache benötigt, muss er für eine entsprechende Übersetzung sorgen.</li> <li>Keine Wartung durchführen, ohne diese Serviceanleitung gelesen und verstanden zu haben.</li> <li>Bei Zuwiderhandlung kann es zu Verletzungen des Kundendiensttechnikers, des Anwenders oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.</li> </ul>
<p>ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)</p>	<p>Το παρόν εγχειρίδιο σέρβις διατίθεται στα αγγλικά μόνο.</p> <ul style="list-style-type: none"> <li>Εάν το άτομο παροχής σέρβις ενός πελάτη απαιτεί το παρόν εγχειρίδιο σε γλώσσα εκτός των αγγλικών, αποτελεί ευθύνη του πελάτη να παρέχει υπηρεσίες μετάφρασης.</li> <li>Μην επιχειρήσετε την εκτέλεση εργασιών σέρβις στον εξοπλισμό εκτός εάν έχετε συμβουλευτεί και έχετε κατανοήσει το παρόν εγχειρίδιο σέρβις.</li> <li>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.</li> </ul>
<p>FIGYELMEZTETÉS (HU)</p>	<p>Ez a szerviz kézikönyv kizárólag angol nyelven érhető el.</p> <ul style="list-style-type: none"> <li>Ha a vevő szerviz ellátója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészítése.</li> <li>Ne próbálja elkezdni használni a berendezést, amíg a szerviz kézikönyvben leírtakat nem értelmezték és értették meg.</li> <li>Ezen figyelmeztetés figyelmen kívül hagyása a szerviz ellátó, a működtető vagy a páciens áramütés, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.</li> </ul>
<p>AÐVÖRUN (IS)</p>	<p>Þessi þjónustuhandbók er eingöngu fáanleg á ensku.</p> <ul style="list-style-type: none"> <li>Ef að þjónustuveitandi viðskiptamanns þarfnast annars tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálþjónustu.</li> <li>Reynið ekki að afgreiða tækið nema þessi þjónustuhandbók hefur verið skoðuð og skilin.</li> <li>Brot á að sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklingi frá raflosti, vélrænum eða öðrum áhættum.</li> </ul>
<p>PERINGATAN (ID)</p>	<p>Manual servis ini hanya tersedia dalam bahasa Inggris.</p> <ul style="list-style-type: none"> <li>Jika penyedia jasa servis pelanggan memerlukan bahasa lain selain dari Bahasa Inggris, merupakan tanggung jawab dari penyedia jasa servis tersebut untuk menyediakan terjemahannya.</li> <li>Jangan mencoba melakukan servis terhadap perlengkapan kecuali telah membaca dan memahami manual servis ini.</li> <li>Mengabaikan peringatan ini bisa mengakibatkan cedera pada penyedia servis, operator, atau pasien, karena terkena kejut listrik, bahaya mekanis atau bahaya lainnya.</li> </ul>

## Service Manual Language Information (cont'd.)

AVVERTENZA (IT)	<p>Il presente manuale di manutenzione è disponibile soltanto in Inglese.</p> <ul style="list-style-type: none"> <li>Se un addetto alla manutenzione richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione.</li> <li>Si proceda alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto.</li> <li>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.</li> </ul>
警告 (JA)	<p>このサービスマニュアルは英語版しかありません。</p> <ul style="list-style-type: none"> <li>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。</li> <li>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。</li> <li>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。</li> </ul>
CẢNH BÁO (VI)	<p>Tài Liệu Hướng Dẫn Sửa Chữa chỉ có bản tiếng Anh.</p> <ul style="list-style-type: none"> <li>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.</li> <li>Không được sửa chữa thiết bị trừ khi đã tham khảo và hiểu Tài liệu Hướng dẫn Sửa chữa.</li> <li>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.</li> </ul>
ЕСКЕРТУ (KK)	<p>Бұл қызмет көрсету бойынша нұсқаулығы тек ағылшын тілінде қолжетімді.</p> <ul style="list-style-type: none"> <li>Тұтынушының қызмет провайдері ағылшын тілінен басқа тілдегі нұсқаны талап етсе, аудару бойынша қызметтерімен қамтамасыз ету тұтынушы жауапкершілігінде болуы тиіс.</li> <li>Бұл қызмет көрсету бойынша нұсқаулығын назарға алып, түсінбегенше, жабдыққа қызмет көрсетуден бас тартыңыз.</li> <li>Бұл ескертуді елемей қызмет провайдері, оператор немесе емделушінің электр шоғынан, механикалық немесе басқа қауіптер нәтижесінде жарақат алуына әкелуі мүмкін.</li> </ul>
BRĪDINĀJUMS (LV)	<p>Šī apkalpotāju rokasgrāmata ir pieejama tikai anglu valodā.</p> <ul style="list-style-type: none"> <li>Ja apkalpošanas sniedzējam nepieciešama informācija citā, nevis anglu, valodā, klienta pienākums ir nodrošināt tās tulkošanu.</li> <li>Neveiciet aprīkojuma apkopi, neizlasot un nesaprotot apkalpotāju rokasgrāmatu.</li> <li>Šī brīdinājuma neievērošana var radīt elektriskās strāvas trieciena, mehānisku vai citu risku izraisītu traumu apkopes sniedzējam, operatoram vai pacientam.</li> </ul>
ISPĖJIMAS (LT)	<p>Šis eksploataavimo vadovas yra prieinamas tik anglų kalba.</p> <ul style="list-style-type: none"> <li>Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba - ne anglų, numatyti vertimo paslaugas yra kliento atsakomybė.</li> <li>Nemėginkite atlikti įrangos techninės priežiūros, nebent atsižvelgėte į šį eksploataavimo vadovą ir jį supratote.</li> <li>Jei neatkreipsite dėmesio į šį perspėjimą, galimi sužalojimai dėl elektros šoko, mechaninių ar kitų paslaugų tiekėjui, operatoriui ar pacientui.</li> </ul>

## Service Manual Language Information (cont'd.)

ADVARSEL (NO)	<p>Denne servicehåndboken finnes bare på engelsk.</p> <ul style="list-style-type: none"> <li>• Hvis kundens serviceleverandør trenger et annet språk, er det kundens ansvar å sørge for oversettelse.</li> <li>• Ikke forsøk å reparere utstyret uten at denne servicehåndboken er lest og forstått.</li> <li>• Manglende hensyn til denne advarselen kan føre til at serviceleverandøren, operatøren eller pasienten skades på grunn av elektrisk støt, mekaniske eller andre farer.</li> </ul>
OSTRZEŻENIE (PL)	<p>Niniejszy podręcznik serwisowy dostępny jest jedynie w języku angielskim.</p> <ul style="list-style-type: none"> <li>• Jeśli dostawca usług klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta.</li> <li>• Nie należy serwisować wyposażenia bez zapoznania się i zrozumienia niniejszego podręcznika serwisowego.</li> <li>• Niezastosowanie się do tego ostrzeżenia może spowodować urazy dostawcy usług, operatora lub pacjenta w wyniku porażenia elektrycznego, zagrożenia mechanicznego bądź innego.</li> </ul>
AVISO (PT-BR)	<p>Este manual de assistência técnica só se encontra disponível em inglês.</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• Não tente reparar o equipamento sem ter consultado e compreendido este manual de assistência técnica.</li> <li>• O não cumprimento deste aviso pode por em perigo a segurança do técnico, operador ou paciente devido a choques elétricos, mecânicos ou outros.</li> </ul>
AVISO (PT-PT)	<p>Este manual técnico só se encontra disponível em inglês.</p> <ul style="list-style-type: none"> <li>• Se a assistência técnica do cliente solicitar estes manuais noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução.</li> <li>• Não tente reparar o equipamento sem ter consultado e compreendido este manual técnico.</li> <li>• O não cumprimento deste aviso pode provocar lesões ao técnico, ao utilizador ou ao paciente devido a choques eléctricos, mecânicos ou outros.</li> </ul>
AVERTISMENT (RO)	<p>Acest manual de service este disponibil numai în limba engleză.</p> <ul style="list-style-type: none"> <li>• Dacă un furnizor de servicii pentru clienți necesită o altă limbă decât cea engleză, este de datoria clientului să furnizeze o traducere.</li> <li>• Nu încercați să reparați echipamentul decât ulterior consultării și înțelegerii acestui manual de service.</li> <li>• Ignorarea acestui avertisment ar putea duce la rănirea depanatorului, operatorului sau pacientului în urma pericolelor de electrocutare, mecanice sau de altă natură.</li> </ul>
ПРЕДУПРЕЖДЕНИЕ (RU)	<p>Настоящее руководство по обслуживанию предлагается только на английском языке.</p> <ul style="list-style-type: none"> <li>• Если сервисному персоналу клиента необходимо руководство не на английском, а на каком-то другом языке, клиенту следует обеспечить перевод самостоятельно.</li> <li>• Прежде чем приступать к обслуживанию оборудования, обязательно обратитесь к настоящему руководству и внимательно изучите изложенные в нем сведения.</li> <li>• Несоблюдение требований данного предупреждения может привести к тому, что специалисты по обслуживанию, операторы или пациенты получат удар электрическим током, механическую травму или другое повреждение.</li> </ul>

## Service Manual Language Information (cont'd.)

UPOZORENJE (SR)	<p>Ovo servisno uputstvo je dostupno samo na engleskom jeziku.</p> <ul style="list-style-type: none"> <li>Ako klijentov serviser zahteva neki drugi jezik, klijent je dužan da obezbedi prevodilačke usluge.</li> <li>Ne pokušavajte da opravite uređaj ako niste pročitali i razumeli ovo servisno uputstvo.</li> <li>Zanemarivanje ovog upozorenja može dovesti do povređivanja serviser, rukovaoca ili pacijenta usled strujnog udara, ili mehaničkih i drugih opasnosti.</li> </ul>
VAROVANIE (SK)	<p>Tento návod na obsluhu je k dispozícii len v angličtine.</p> <ul style="list-style-type: none"> <li>Ak zákazníkov poskytovateľ služieb vyžaduje iný jazyk ako angličtinu, poskytnutie prekladateľských služieb je zodpovednosťou zákazníka.</li> <li>Nepokúšajte sa o obsluhu zariadenia skôr, ako si neprečítate návod na obsluhu a neporozumiete mu.</li> <li>Zanedbanie tohto varovania môže vyústiť do zranenia poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanickým alebo iným nebezpečenstvom.</li> </ul>
OPOZORILO (SL)	<p>Ta servisni priročnik je na voljo samo v angleškem jeziku.</p> <ul style="list-style-type: none"> <li>Če ponudnik storitve stranke potrebuje priročnik v drugem jeziku, mora stranka zagotoviti prevod.</li> <li>Ne poskušajte servisirati opreme, če tega priročnika niste v celoti prebrali in razumeli.</li> <li>Če tega opozorila ne upoštevate, se lahko zaradi električnega udara, mehanskih ali drugih nevarnosti poškoduje ponudnik storitev, operater ali bolnik.</li> </ul>
ADVERTENCIA (ES)	<p>Este manual de servicio sólo existe en inglés.</p> <ul style="list-style-type: none"> <li>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.</li> <li>No se deberá dar servicio técnico al equipo, sin haber consultado y comprendido este manual de servicio.</li> <li>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.</li> </ul>
VARNING (SV)	<p>Den här servicehandboken finns bara tillgänglig på engelska.</p> <ul style="list-style-type: none"> <li>Om en kunds servicetekniker har behov av ett annat språk än engelska ansvarar kunden för att tillhandahålla översättningstjänster.</li> <li>Försök inte utföra service på utrustningen om du inte har läst och förstår den här servicehandboken.</li> <li>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.</li> </ul>
UYARI (TR)	<p>Bu servis kılavuzunun sadece İngilizcesi mevcuttur.</p> <ul style="list-style-type: none"> <li>Eğer müşteri teknisyeni bu kılavuzu İngilizce dışında bir başka lisandan talep ederse, bunu tercüme ettirmek müşteriye düşer.</li> <li>Servis kılavuzunu okuyup anlamadan ekipmanlara müdahale etmeyiniz.</li> <li>Bu uyarıya uyulmaması, elektrik, mekanik veya diğer tehlikelerden dolayı teknisyen, operatör veya hastanın yaralanmasına yol açabilir.</li> </ul>



## Service Manual Language Information (cont'd.)

<p>ЗАСТЕРЕЖЕННЯ (UK)</p>	<p>Дане керівництво з сервісного обслуговування постачається виключно англійською мовою.</p> <ul style="list-style-type: none"> <li>• Якщо сервісний інженер потребує керівництво іншою мовою, користувач зобов'язаний забезпечити послуги перекладача.</li> <li>• Не намагайтеся здійснювати технічне обслуговування даного обладнання, якщо ви не читали, або не зрозуміли інформацію, надану в керівництві з сервісного обслуговування.</li> <li>• Недотримання цього застереження може призвести до травмування сервісного інженера, користувача даного обладнання або пацієнта внаслідок електричного шоку, механічного ушкодження або з інших причин невірної обслуговування обладнання.</li> </ul>
<p>CẢNH BÁO (VI)</p>	<p>Tài Liệu Hướng Dẫn Sửa Chữa chỉ có bản tiếng Anh.</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• Không được sửa chữa thiết bị trừ khi đã tham khảo và hiểu Tài liệu Hướng dẫn Sửa chữa.</li> <li>• 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.</li> </ul>



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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 3500 ECG Analysis System is intended to acquire, analyze, display, and record resting electrocardiographic information from adult and pediatric populations. Basic systems deliver 3, 6, 12, or 15 lead ECGs, including interpretive analysis. Transmission and reception of ECG data to and from a central ECG cardiovascular information system is optional.

The MAC 3500 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.

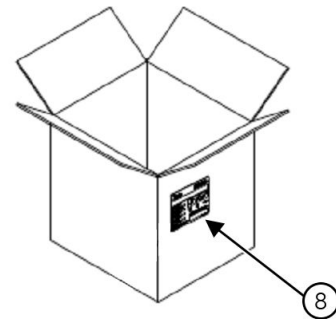
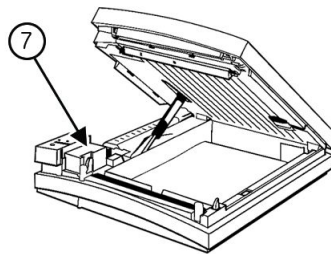
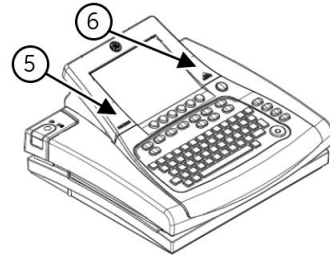
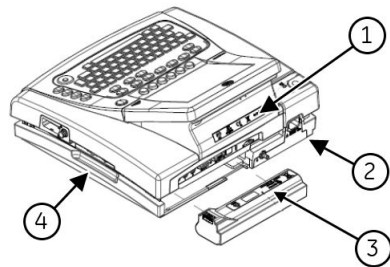
Symbol	Description
	Type BF equipment. The acquisition module is protected from defibrillation shocks.
	Alternating Current
	Equipotential
	Charge the battery. The flashing amber LED next to this symbol indicates you must connect the system to AC power to recharge the battery.
	LAN port for connecting 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 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.
	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.




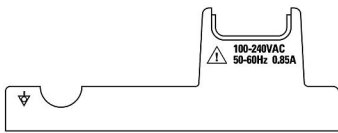





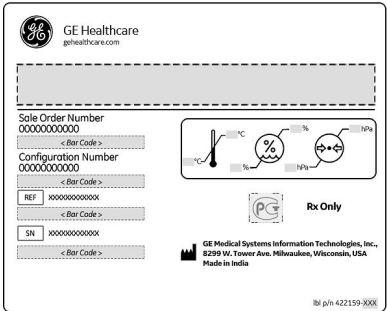
Symbol	Description
	PCT. GOST marking symbolizing conformity with applicable Russian Gosstandart technical and safety standards.
<b>Rx Only</b>	USA Only: For use only on or by order of a physician.

## 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.

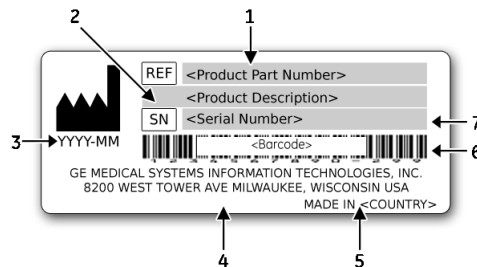
No.	Label	Description
1		Located on the back of the device, this label provides regulatory and cautionary information. Refer to “ <a href="#">Equipment Symbols</a> ” on page 16 for detailed descriptions of the symbols.
2		Located on the back of the device, this label identifies the device's electrical ratings.
3		Located inside the battery compartment, this label provides information about the specifications and disposal of the battery. Refer to “ <a href="#">Equipment Symbols</a> ” on page 16 for detailed descriptions of the symbols.
4		Located on the right side of the device, this label distinguishes between the LAN RJ-45 port and the internal modem RJ-11 port.
5		Located to the left of the display, this silk-screened label identifies the model number.
6		Located to the right of the display, this silk-screened label indicates the device uses the Marquette™ 12SL™ ECG Analysis Program to analyze and interpret ECG readings.
7		Located inside the writer compartment, this label uniquely identifies this unit. Refer to “ <a href="#">Product Label</a> ” on page 20 for detailed information.
8		Located on the package, the shipping label contains the following information: <ul style="list-style-type: none"> <li>• Product description</li> <li>• Sales order number</li> <li>• Configuration number</li> <li>• Model number</li> <li>• Serial number</li> <li>• Storage conditions</li> <li>• Regulatory compliance</li> <li>• Country of Origin</li> </ul>

## 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 <a href="#">"Serial Number Format" on page 20</a> 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:

XXX	XX	XX	XXXX	X	X
↑	↑	↑	↑	↑	↑
1	2	3	4	5	6

## Serial Number Format

Item	Name	Description
1	Product Code	A three-letter code that uniquely identifies the product line. Refer to <a href="#">“Product Codes” on page 21</a> 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).
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 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
<b>DANGER</b>	Indicates an imminent hazard, which, if not avoided, will result in death or serious injury.
<b>WARNING</b>	Indicates a potential hazard or unsafe practice, which, if not avoided, could result in death or serious injury.
<b>CAUTION</b>	Indicates a potential hazard or unsafe practice, which, if not avoided, could result in moderate or minor injury.
<b>NOTICE</b>	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 electrodes (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 practitioner.

## 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 provides information necessary for the configuration and safe operation of this equipment in accordance with its function and intended use. It is not intended as a replacement for, but a supplement to, thorough product training. Keep it with the equipment at all times. Additional manuals may be ordered by contacting GE Healthcare.

Refer to the service manual for technical information related to the maintenance and repair of the equipment.

### Document Conventions

This manual uses the following conventions.

## Typographical Conventions

Convention	Description
<b>Bold Text</b>	Indicates keys on the keyboard, text to enter, or hardware items such as buttons or switches on the equipment.
<i><b>Italicized-Bold Text</b></i>	Indicates software terms that identify menu items, buttons or options in various windows.
<b>CTRL+ESC</b>	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 <b>CTRL+ESC</b> means to press and hold the <b>CTRL</b> key and then press and release the <b>ESC</b> 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.
<b>Enter</b>	Indicates that you must press the <b>Enter</b> or <b>Return</b> key on the keyboard. Do not type <i>Enter</i> .
>	<p>The greater than symbol, or right angle bracket, is a concise method to indicate a sequence of menu selections.</p> <p>For example, the statement "From the main menu, select <b>System</b> &gt; <b>Setup</b> &gt; <b>Options</b> to open the <b>Option Activation</b> window" replaces the following:</p> <ol style="list-style-type: none"> <li>1. From the main menu, select <b>System</b> to open the <b>System</b> menu.</li> <li>2. From the <b>System</b> menu, select <b>Setup</b> to open the <b>Setup</b> menu.</li> <li>3. From the <b>Setup</b> menu, select <b>Options</b> to open the <b>Option Activation</b> window.</li> </ol>

## 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	<i>Marquette™ 12SL™ ECG Analysis Program Physician's Guide</i>
2046275-018	<i>MAC™ 3500 Resting ECG Analysis System Operator Manual</i>
2020299-321	<i>MobileLink™ Wireless Communications Installation Manual</i>
2020299-025	<i>LAN Option for MAC™ Resting ECG Systems Installation and Troubleshooting Guide</i>
2025521-001	<i>KISS™ Multilead Operator's Manual</i>
2044854-012	<i>Modular MAC™ ECG Trolley Service Manual</i>
2056914-001	<i>Modular MAC™ ECG Trolley Assembly Instructions (US)</i>
2056914-002	<i>Modular MAC™ ECG Trolley Assembly Instructions (Non-US)</i>

## 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](http://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](http://www.gehealthcare.com/educationstore).

## System Overview

The MAC™ 3500 resting ECG analysis system is a 12-lead, 12-channel system with a 6.5 inch (165 mm) diagonal display, active patient cable, and battery operation. There are also options for communication capabilities

## Hardware Description

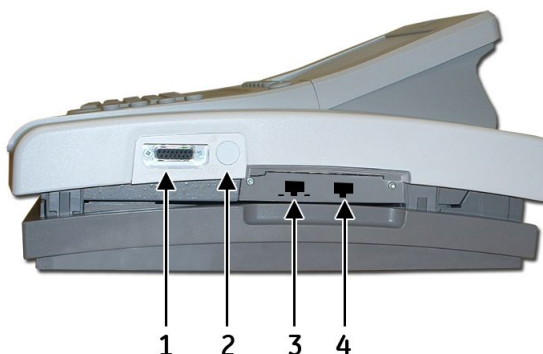
This section identifies the key components of the MAC system hardware. Familiarize yourself with these components, their location, and their use before attempting to use the equipment.

### Front View



	Name	Description
1	Display Screen	View the waveform and text data.
2	Keyboard	Controls the system and enters data.

## Side View



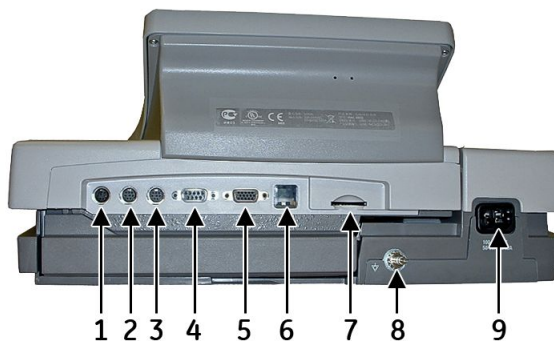
	Name	Description
1	ECG signal input connector	Connects to the acquisition module.
2	KISS pump connector	Optional feature that connects to the KISS pump.
3	LAN port	Connects to a local area network (LAN) via a cable. LEDs provide information about the connection status. <ul style="list-style-type: none"><li>• The green LED indicates a good Ethernet link.</li><li>• The amber LED flashes to indicate network traffic.</li></ul>
4	Modem port	Connects to a telephone line.

## Back View

**WARNING:**

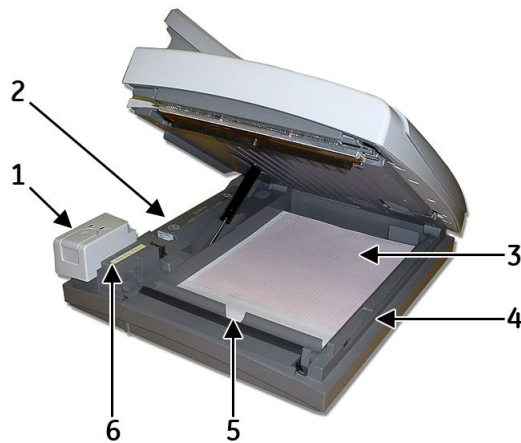
CURRENT LEAKAGE — Keep current leakage within acceptable limits when connecting auxiliary equipment to this device.

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. <b>NOTE:</b> 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. <b>NOTE:</b> Ergoline bicycle ergometers must be connected to both this port and port 1.
5	EXT.VID.	Connects to an external video display.
6	IR	Exchanges ECG data with a MAC system or MUSE CV system via infrared transmission. <b>NOTE:</b> 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.

## Internal View



	Name	Description
1	Latch	Opens the unit for access to the battery and paper tray. Also contains two indicator lights: a green light indicates when the unit is attached to AC power and an amber light indicates the battery is charging.
2	Battery	Supplies power when unit is not connected to AC power. Recharge the battery when the battery icon flashes on-screen.
3	Paper tray	Contains the paper used to print ECGs.
4	Paper size selector	Adjusts the paper tray for STD (US Letter) or A4 paper sizes.
5	Option activation code label	List of all option activation codes for this device; found underneath the paper in tray next to the black front roller.
6	Serial number ID tag	Indicates the serial number of the device.



# 3

## Trolley Assembly

For instructions to assembly the trolley, see *Modular MAC Trolley*, 2056914-001.



# 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”

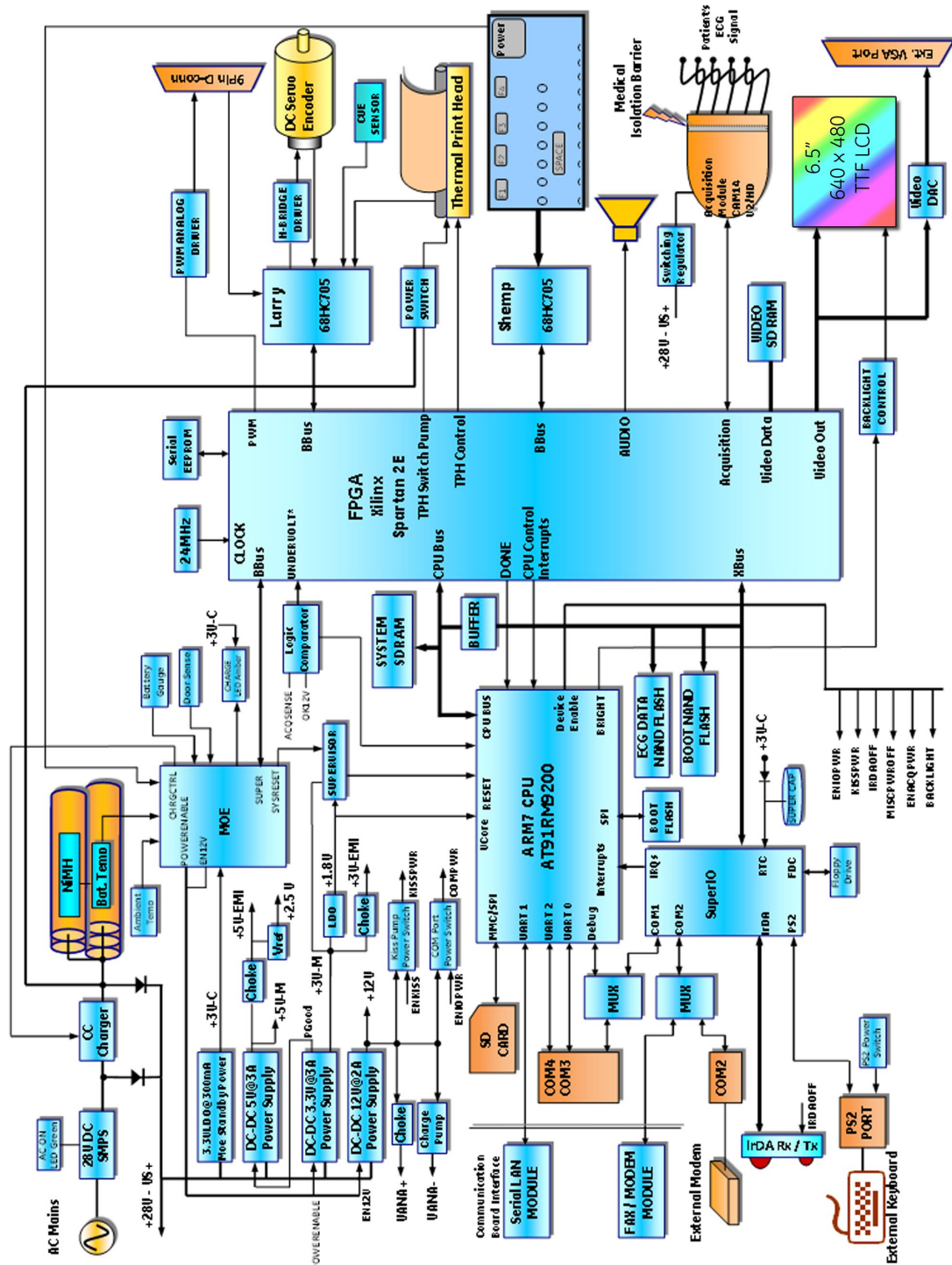
## Diagrams

The following diagrams can be used to help isolate issues to a specific component. Once you identify the component responsible for a service problem, refer to [Chapter 5](#), “Maintenance” for instructions on repairing or replacing it.

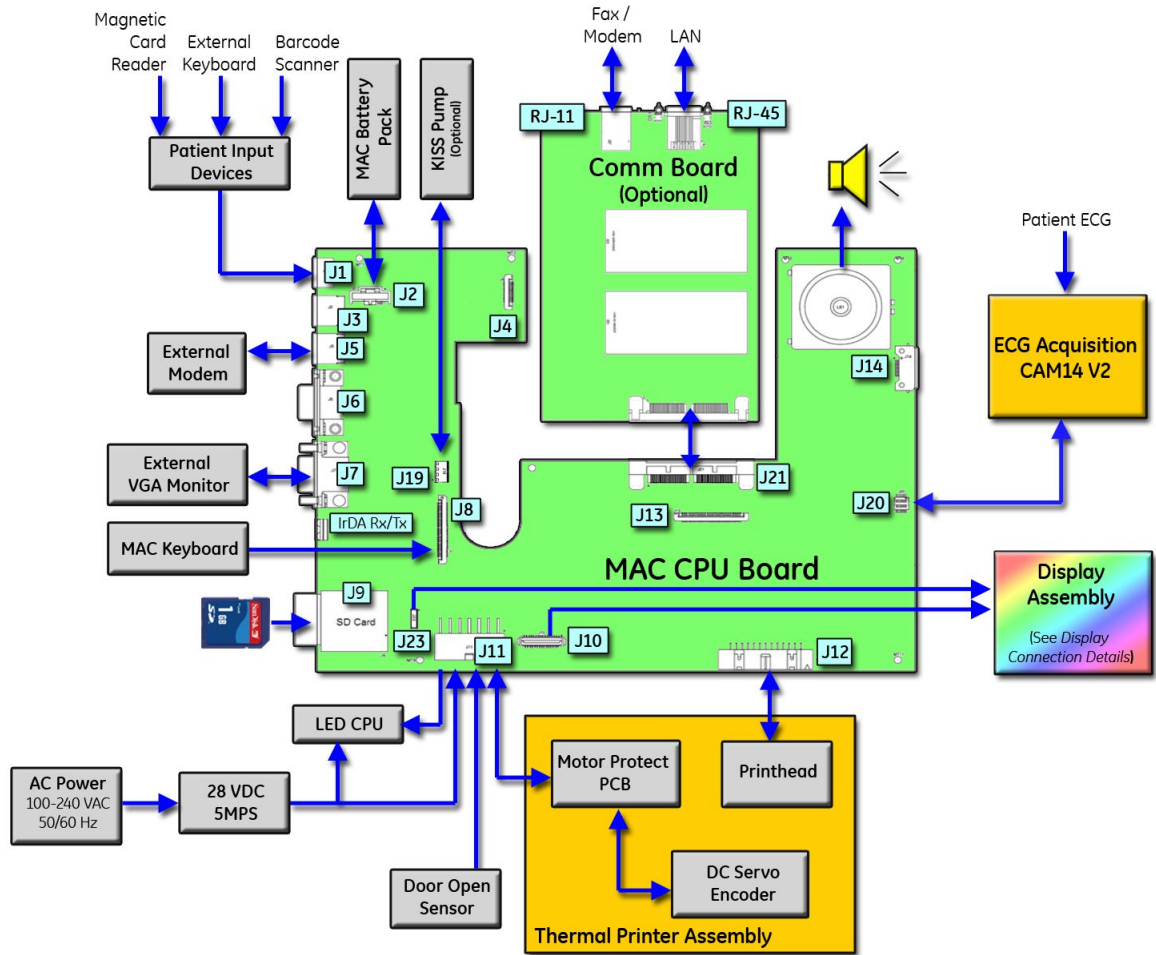
# PCB\_Diagrams

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

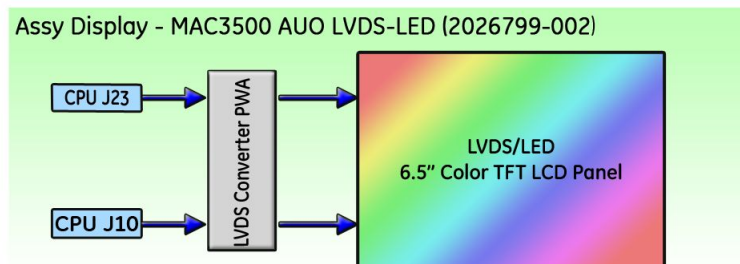
## PCB Block Diagram



## PCB Connections Diagram



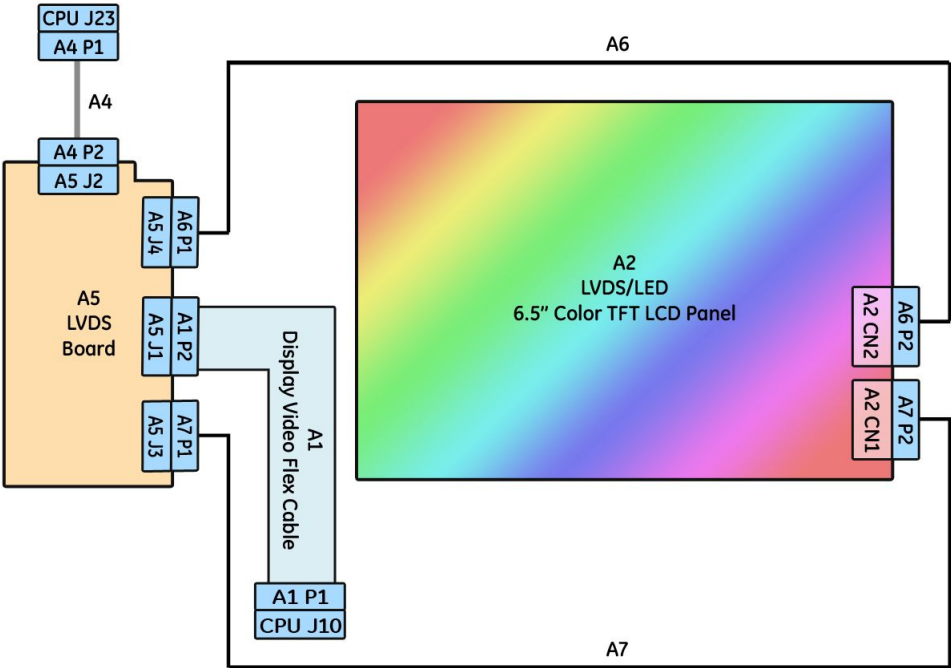
## Display Connection Details Diagram



# LVDS/LED Display Assembly Diagram

The following illustration diagrams the connections for the LVDS/LED display assembly (2026799-002), and the table that follows it identifies those connections.

## LVDS/LED Display Assembly Connections



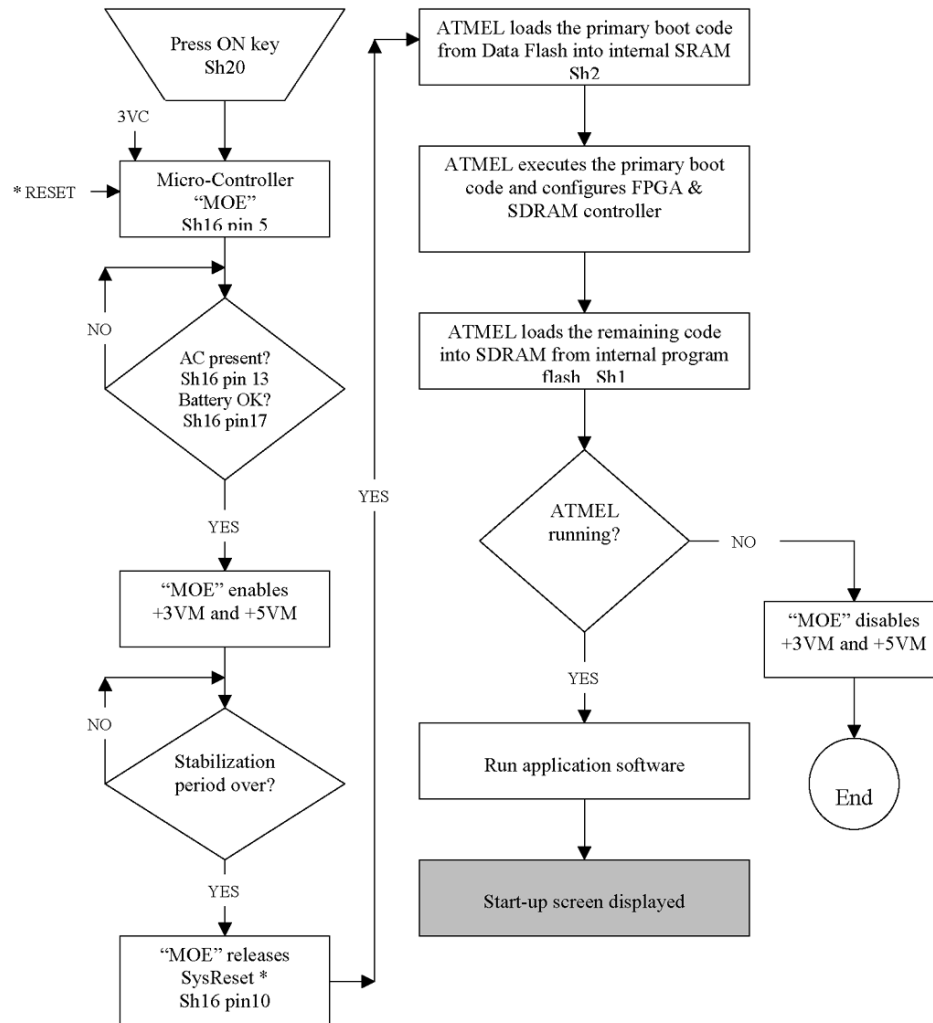
Item	GE Part Number	Description
A1	2024701-001	ASSY DISPLAY CABLE MAC3500 (CMOS)
A2	2062075-001	LVDS/LED LCD Panel
A4	2024701-001	MAC3500 PWR CABLE MAIN BOARD TO LVDS
A5	2061540-001	PWA MAC5500 LVDS DRV BRD ROHS
A6	2059277-001	ASSY MAC3500 BACKLIT CABLE-AUO
A7	2059322-001	MAC3500 LCD CABLE

# 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, 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	<ul style="list-style-type: none"> <li>• Fraying or other damage</li> <li>• Bent prongs or pins</li> <li>• Cracked housing</li> <li>• Loose plug screws</li> </ul>
Interface cables	<ul style="list-style-type: none"> <li>• Excessive tension or wear</li> <li>• Loose connections</li> <li>• Out-of-place strain reliefs</li> </ul>
Fuses	<ul style="list-style-type: none"> <li>• Incorrect type or rating</li> <li>• Overloads or failures</li> </ul>



Area	Look for the following problems
Circuit boards	<ul style="list-style-type: none"> <li>• Moisture, dust, or debris (above and below)</li> <li>• Missing components</li> <li>• Loosely seated components</li> <li>• Burn damage or overheated smell</li> <li>• Improperly seated PCB</li> <li>• Solder problems: cracks, splashes on board, incomplete feedthrough, prior modifications, repairs</li> </ul>
Ground wires/wiring	<ul style="list-style-type: none"> <li>• Loose wires or ground strap connections</li> <li>• Faulty wiring</li> <li>• Pinched wires</li> <li>• Incorrectly placed wires</li> </ul>
Mounting hardware	Loose or missing screws or other hardware, especially fasteners used as connections to ground planes on PCBs
Power source	<ul style="list-style-type: none"> <li>• Faulty wiring, especially at the AC outlet</li> <li>• Shared power circuit</li> </ul> <p><b>NOTE:</b> Power source problems can cause static discharge, resetting problems, and noise.</p>

## 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 42](#) 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 Patterns**.  
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

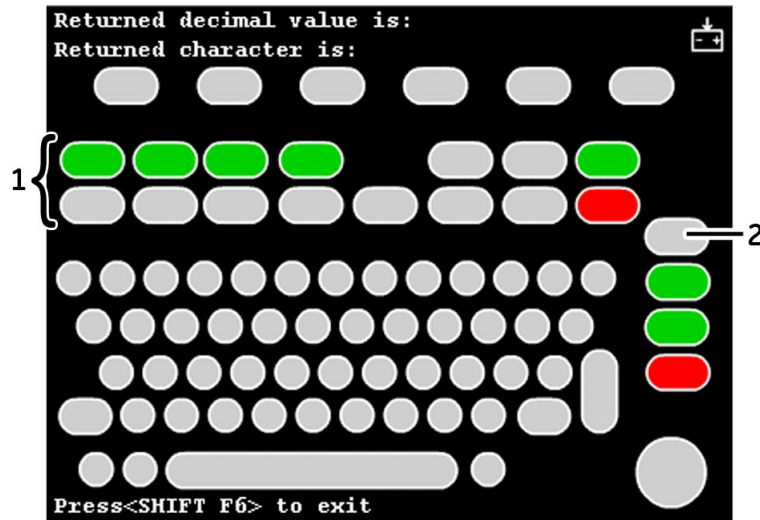
Use the Speaker Test to verify that the speaker and sound chip on the CPU are working correctly.

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

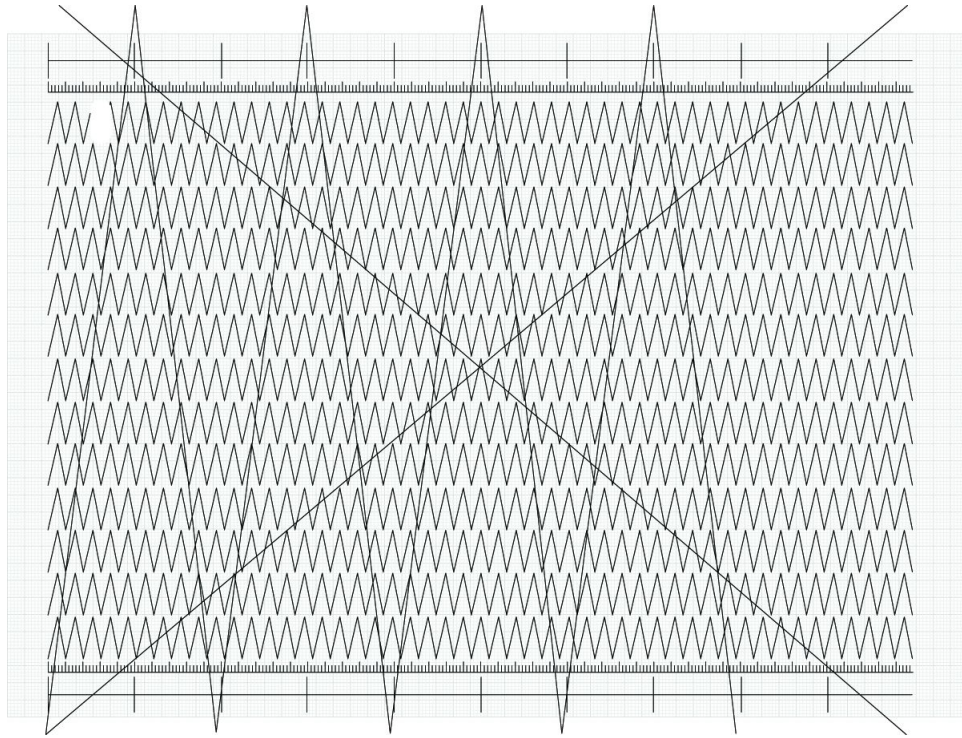
The three available C-Scan tests combine the Test Pattern I and Roller tests. They are used by the writer vendor.

#### 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:



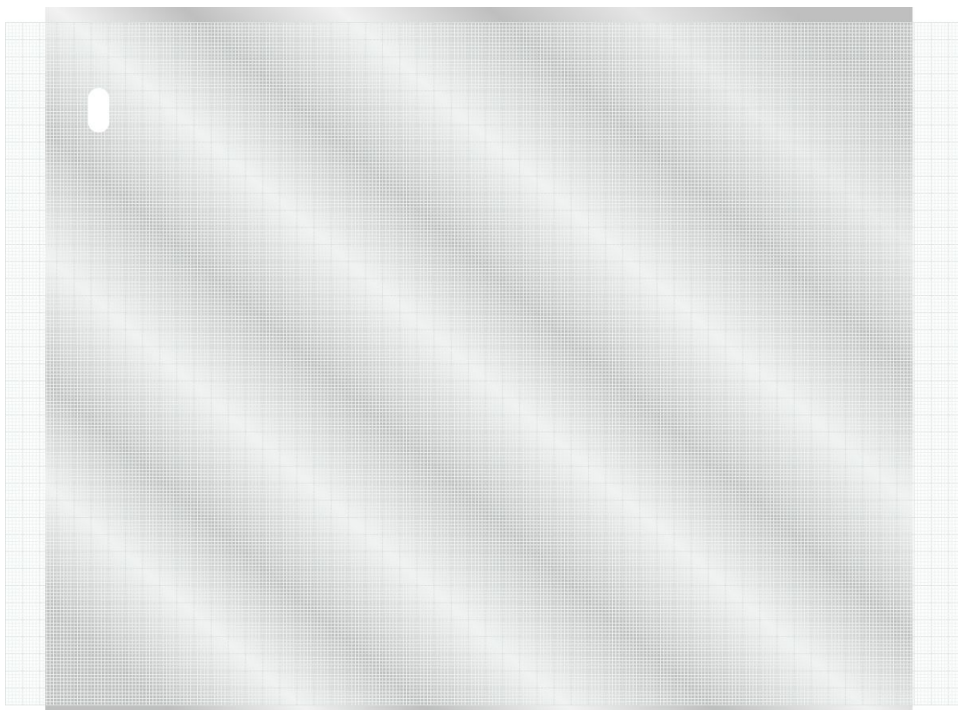
After printing the three test patterns, verify the following:

- Each test pattern is 250 mm  $\pm$  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 100](#).
- 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 100](#).
- 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 98](#).

## 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 46](#)) and Roller Test ([page 47](#)):

- 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 78](#).
- 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 ["Replacing the CPU Board" on page 91](#).
- 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 78](#).
- 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 78](#).

- Battery temperature
- Battery charge status
- Percent of charge remaining
- To print the results, proceed to ["Print Charge/Discharge Test Results" on page 51](#).

## 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 49](#)) 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 51](#).

## Print Charge/Discharge Test Results

The Print Charge/Discharge Test Results prints the results of the Battery Charge Test ([page 50](#)) and Battery Discharge Test ([page 49](#)).

## 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 61](#) 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 [“Replacing the CPU Board” on page 91](#).

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 ["Replacing the COMM Board" on page 90](#).
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 [“Replacing the COMM Board” on page 90](#).

2. Press any key to exit the test.

## Acquisition Module Test

The Acquisition Module Test does the following:

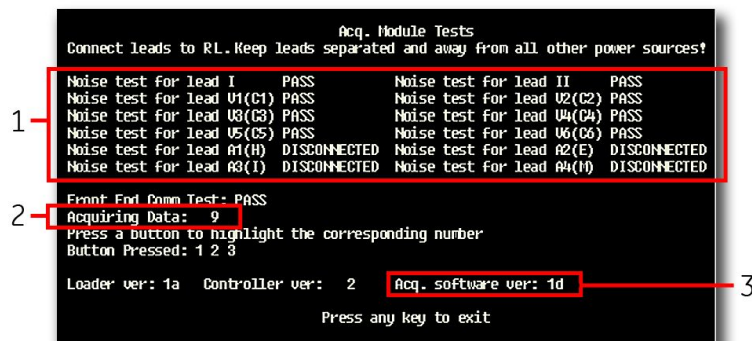
- Tests whether the acquisition module is powered
- Tests whether the acquisition module is communicating
- Indicates when one of the three acquisition module buttons is pressed
- Displays the acquisition module lead wire noise
- Displays the software version of the acquisition module
  - CAM 14 V2 displays 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 ["Replacing the CPU Board" on page 91](#).

**NOTE:**

Analog I/O Test do not work without the ST12/ST15 stress options.

## 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 61](#) 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/QRSTrigger 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 61](#) 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 ["Replacing the CPU Board" on page 91](#).



## 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.

## 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
 appears on-screen	No battery is installed.	Install a battery and connect the unit to an AC outlet to charge the battery.
 blinks intermittently	The battery charge is low.	Connect the unit to an AC outlet to charge the battery.
 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.

Symptom	Cause	Solution
The system shuts down when operating from battery power.	The battery is completely discharged, or the <b>Automatic Shutdown</b> feature is enabled.	Connect the system to an AC wall outlet to charge the battery, or power on the system.
"X" <b>Lead disconnected</b> message appears.	Electrode(s) are disconnected.	Reconnect the electrode(s).
The following message is displayed: <b>MODEM ERROR. The remote device is not responding. Would you like to retry?</b>	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:  +  + 

**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 **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 [“Cleaning and Disinfecting Exterior Surfaces” on page 72](#) 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**.

## 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**.

## 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

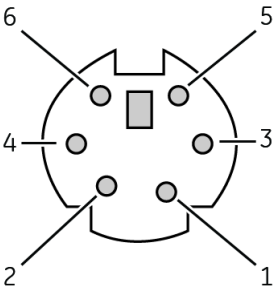
The following FAQ relates to transmitting records to the MUSE system.  
For more detailed information about this question, refer to the operator's manual.

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	
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



## Keyboard (J8) (cont'd.)

Pin	Signal
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
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)

## LCD (J10) (cont'd.)

Pin	Signal
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
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

### Thermal Printer (J12) (cont'd.)

Pin	Signal
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
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

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

Pin	Signal
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
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

## KISS Pump (J19)

### KISS Pump (J19)

Pin	Signal
1	KISS Pump Power (12V DC)
2	NC

## KISS Pump (J19) (cont'd.)

Pin	Signal
3	GND
4	GND

## Acquisition Module (J20)

## Acquisition Module (J20)

Pin	Signal
1	TX- (RS485)
2	TX+ (RS485)
3	RX- (RS485)
4	RX+ (RS485)
5	GND
6	Power 12V
7	NC
8	NC
9	NC
10	NC

## LCD Backlight (J23)

## LCD Backlight (J23)

Pin	Signal
1	GND
2	GND
3	Power 5V DC
4	Power 5V DC
5	Relay Port 1 (Resistance)
6	Relay Port 2 (Resistance)



# 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
#10 Torx driver
#6 Torx driver
Phillips screwdriver
Leakage Current tester
ECG Simulator
Precision dust remover
Lint-free soft cloth
PS2 style keyboard (Japan only)
Loopback Jumper

## 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.
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.

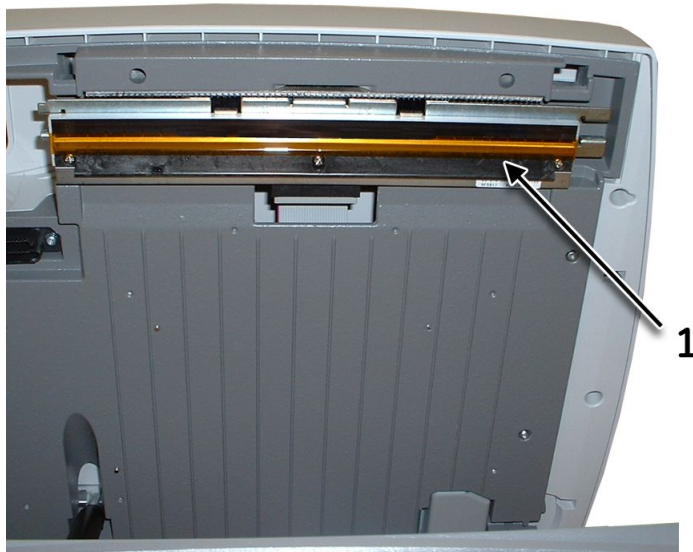
## Cleaning the Interior

- 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.



## Paper Maintenance

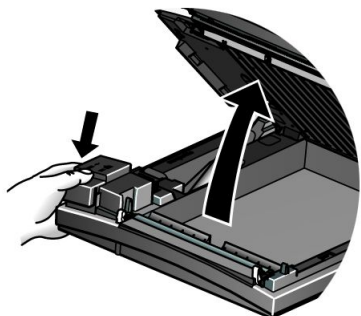
Proper paper maintenance ensures optimum ECG printouts. Paper maintenance includes:

- Setting the correct paper size
- Loading the paper

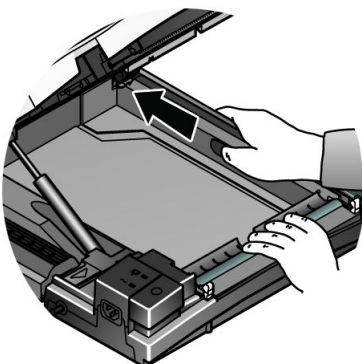
## Setting the Correct Paper Size

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

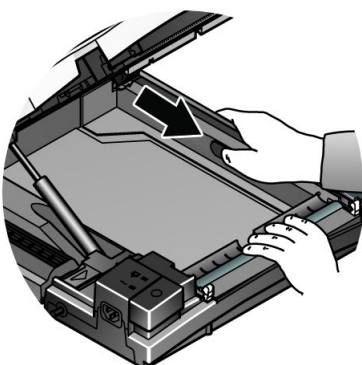
1. Open the MAC writer drawer.



2. To set the tray for A4 paper, slide the paper guide toward the rear of the device.



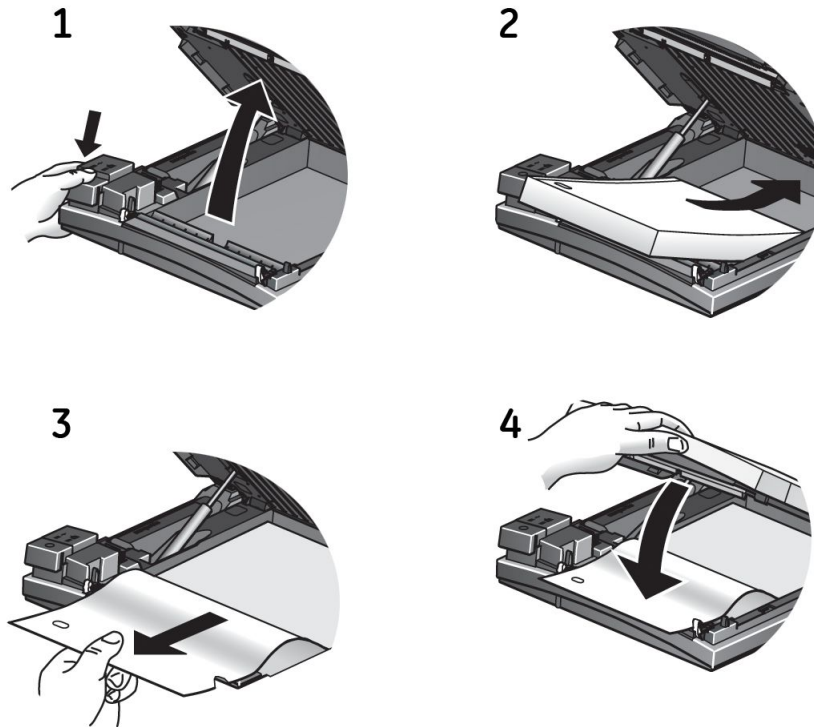
3. To set the tray for standard (US Letter) paper, slide the guide toward the front of the device.



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:

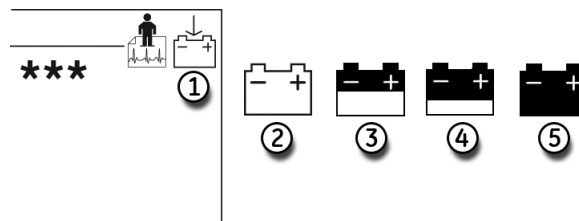
- Charging the battery
- Conditioning the battery
- Replacing the battery

## 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.

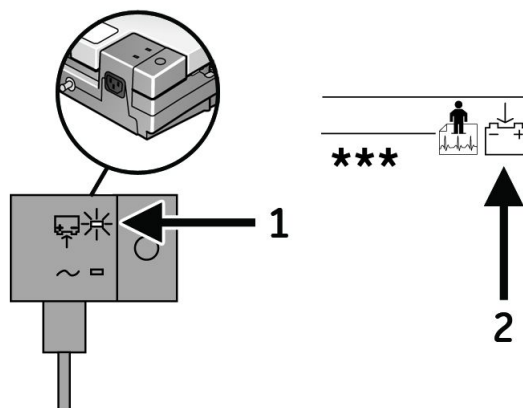
**NOTE:**

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.

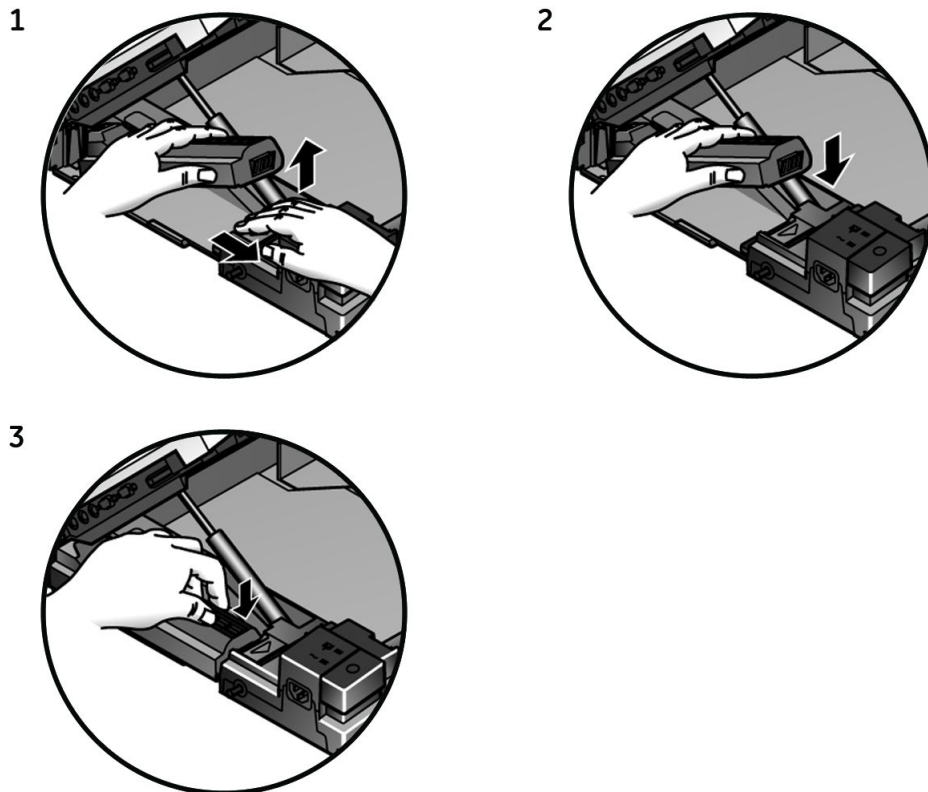
## Conditioning the Battery

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.

## Checking Electrical Safety

The device should be checked annually for current leakage and ground continuity. For details, see [“Electrical Safety Checks” on page 105](#).

## 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.

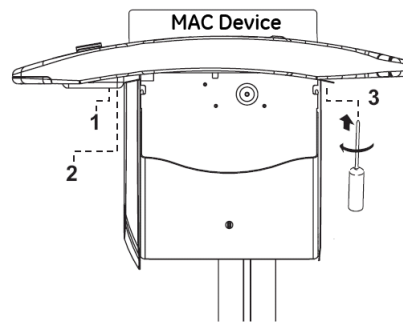
- Remove the battery.
- Remove the chart paper.
- Take precautions against electromagnetic discharge damage.

## 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.

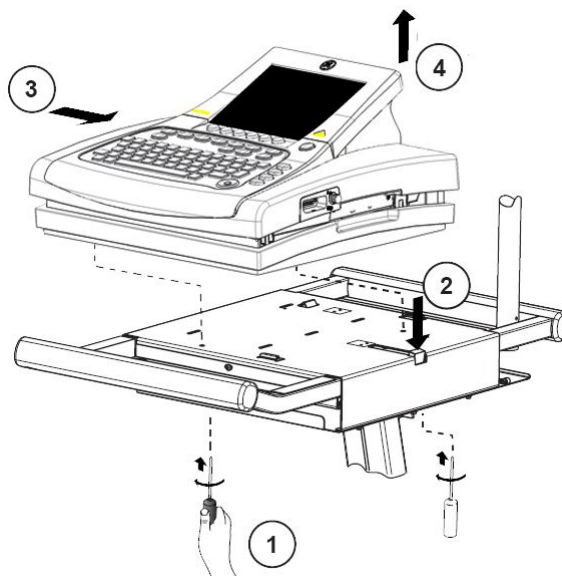


3. Lift the device from the trolley.



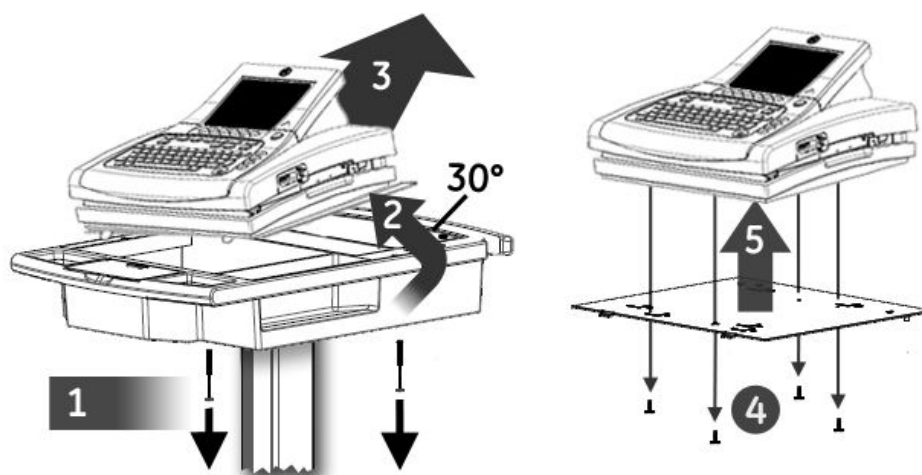
## Type-S Trolley

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.

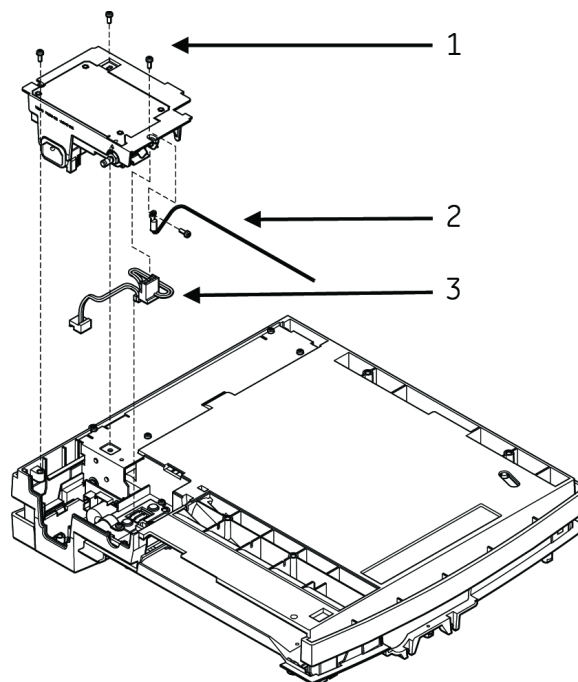
## Replacing the Power Supply

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.

## Replacing the Keypad

Use the following procedure to replace the keypad.

1. Remove the three fasteners from under the top cover at the front of the unit.



2. Remove the two fasteners that secure the display panel cover at the back of the unit and remove the display cover.



3. Remove the two fasteners securing the top of the keypad.



4. Pull up on the keypad assembly to release it from the top cover.  
You will hear snapping sounds as each of the eight plastic standoffs is released.

**NOTE:**

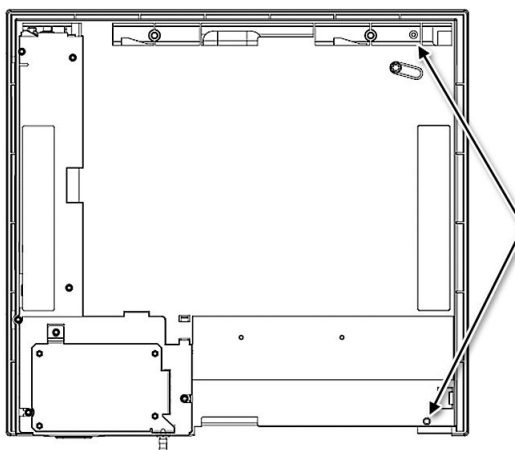
The eight plastic standoffs should remain with the keypad. However, if any remain in the top cover, use a set of small pliers to extract them from the cover. Take care not to damage the rubber cover, which is permanently affixed to the top cover.

5. Place the new keypad in position on the top cover.  
Be sure to align the eight plastic standoffs with the appropriate holes in the top cover.
6. After the keypad is properly aligned, push down on the keypad at each of the eight standoff locations until each snaps into place.
7. Reverse step 1 through step 3 to secure the keypad and display cover.

## Replacing the Top Cover/Keyboard Assembly

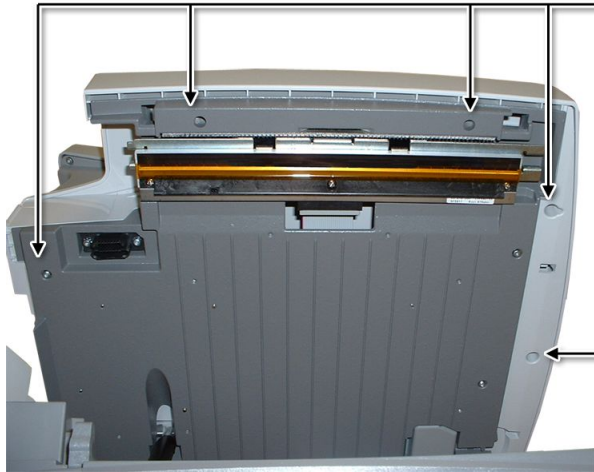
Removal of the Top Cover/Keyboard assembly is required in order to replace the following:

- Printhead assembly  
Refer to [“Replacing the Printhead” on page 98](#)
  - Main PCB board  
Refer to [“Replacing the CPU Board” on page 91](#)
  - Acquisition PCB  
Refer to [“Replacing the Acquisition Board” on page 89](#).
1. Remove the battery as described in [“Replacing the Battery” on page 78](#).
  2. Turn the unit over so the bottom side is up and remove the two Torx fasteners shown in the following figure.



3. Turn the unit right-side up, press the writer button, and raise the top of the unit.

4. Remove the five Torx fasteners from inside the paper tray shown in the following figure.



5. Remove the two fasteners that secure the display panel cover at the back of the unit and then remove the display cover.



6. Remove the two fasteners holding the two ground wires on either side of the display.
7. Remove the two fasteners at the top of the display panel bracket.
8. Pivot up the display to access the cable connections on the main PCB.

**NOTE:**

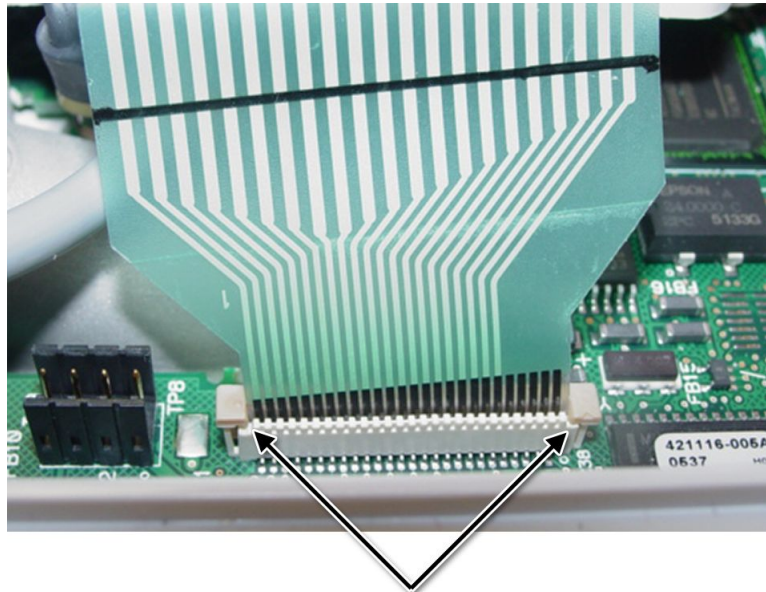
If a KISS pump is installed, remove it in order to access the display panel connectors from the main board. See ["Replacing the Optional KISS Pump" on page 89](#).

9. Disconnect the following cables from the main PCB board:

- Blue ribbon cable
- Display light cable
- Keyboard ribbon cable

**NOTE:**

Do not force the cable from its connector. Raise both ends of the plastic locking bar (shown in the following figure) and gently rock the ribbon cable free from the connector.



10. Reverse step 1 through step 9 to attach the new assembly.

**NOTE:**

When reconnecting the keyboard ribbon cable, lift both ends of the locking bar as you insert the cable. When the cable is firmly seated, push down on both ends of the locking bar to secure the cable.

Also, be sure to pull the two ground cables through so they can be reconnected to the display panel. If the unit has a KISS pump, you will also need to ensure that the KISS pump suction tube and power supply cable are pulled through.

## Replacing the Display Assembly

Use the following procedure to replace the display assembly.

1. Remove the battery as described in [“Replacing the Battery”](#) on page 78.
2. Remove the two fasteners that secure the display panel cover at the back of the unit and remove the display cover.

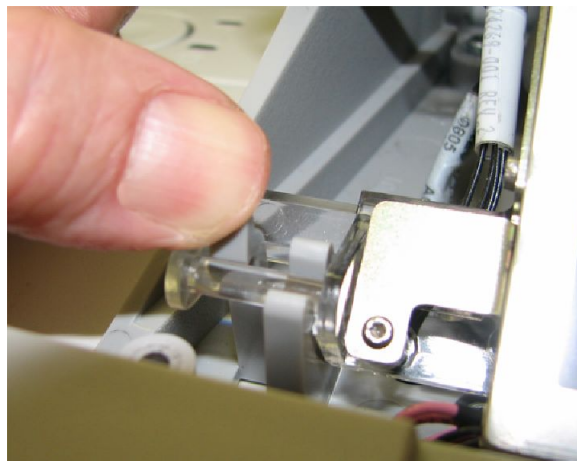


3. Remove the two fasteners holding the two ground wires on either side of the display.
4. Pivot up the display to access the cable connections on the main PCB.

**NOTE:**

If a KISS pump is installed, it must be removed to access the display panel connectors from the main board. See [“Replacing the Optional KISS Pump” on page 89](#).

5. Disconnect the following cables from the main PCB board:
  - Blue ribbon cable
  - Display light cable
6. Push back on each of the tabs holding the display assembly to the pivot, as shown in the following figure, and gently pull the display assembly free.



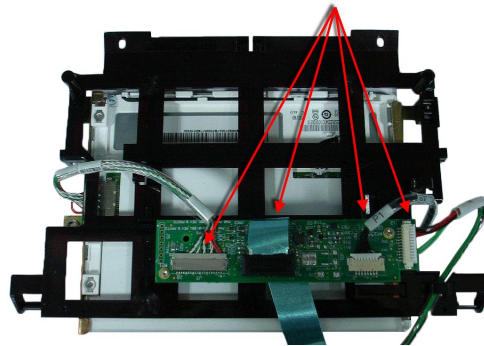
7. Reverse step 1 through step 6 to attach a new display assembly to the unit.



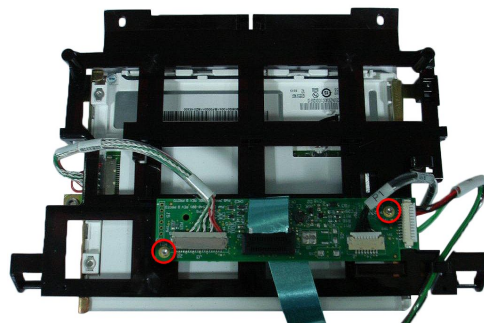
## Replacing the LVDS Converter Board

Use the following procedure to replace the LVDS converter board required by the AUO LCD display (P/N 2062075-001).

1. Remove the display assembly from the device.  
See ["Replacing the Display Assembly" on page 86](#) for instructions.
2. Disconnect all cables from the LVDS converter board.



3. Remove the screws fastening the LVDS converter board to the display assembly.



**NOTE:**

Dispose of the old LVDS converter board in compliance with all applicable local and federal laws.

4. Attach the new LVDS converter board to the display assembly using the two screws removed in step 3.
5. Reconnect all the cables that were disconnected in step 2.
6. Reattach the display assembly to the device.  
See ["Replacing the Display Assembly" on page 86](#) for instructions.



## Replacing the Optional KISS Pump

Use the following procedure to replace the optional KISS pump.

1. Remove the battery as described in [“Replacing the Battery” on page 78](#).
2. Remove the two fasteners that secure the display panel cover at the back of the unit and remove the display cover.



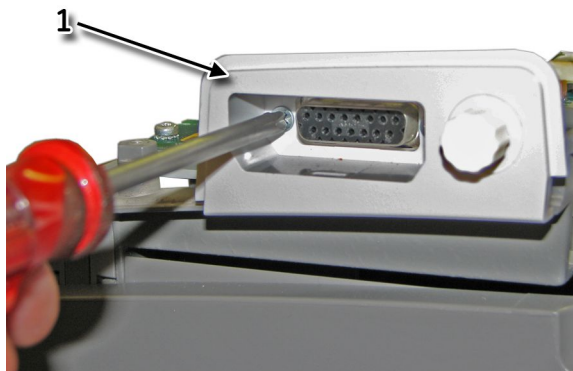
3. Remove the two fasteners at the top of the display panel.
4. Remove the two fasteners holding the two ground wires on either side of the display.
5. Pivot up the display to access the pump assembly.
6. Press the clip at the suction line connection and separate the suction line from the KISS pump assembly.
7. Disconnect the two exhaust lines.
8. Disconnect the pump power cable from the pump.
9. Using a #10 Torx driver, remove the four fasteners holding the KISS pump bracket in place and remove the KISS pump assembly.
10. Reverse step 1 through step 9 to attach the new KISS pump assembly.

## Replacing the Acquisition Board

Use the following procedure to remove the acquisition board.

1. Remove the battery as described in [“Replacing the Battery” on page 78](#).
2. Remove the top cover as described in [“Replacing the Top Cover/Keyboard Assembly” on page 84](#).

3. Using a Phillips screw driver, remove the two screws holding the acquisition connector bracket (1) to the acquisition board.



4. Remove the three fasteners securing the acquisition board to its mounting bracket.
5. Pull up on the cable connector to disconnect it from the main CPU board.
6. Remove the acquisition board from the unit.
7. Reverse step 1 through step 6 to assemble the new acquisition board.

## Replacing the COMM Board

Replacing the communications board consists of two tasks:

- Switching the COMM board
- Setting up LAN communications

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 COMM board. Rock the board side to side 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

For more information, refer to the *LAN Option for MAC™ Resting ECG Systems Installation and Troubleshooting Guide*.

## Replacing the 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.

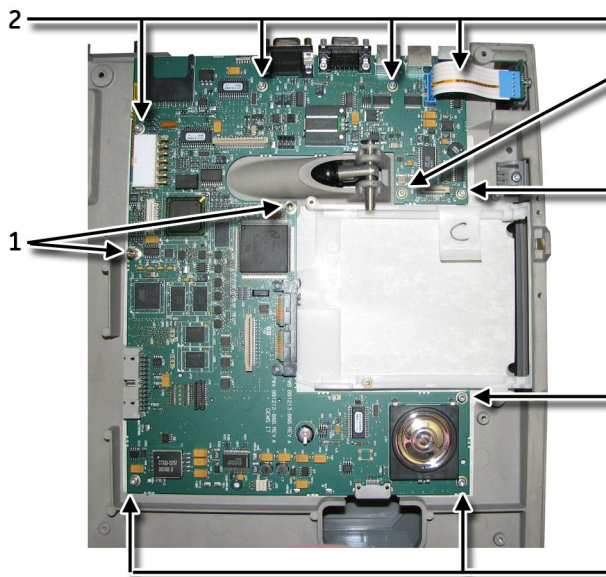
## Removing the CPU Board

Use the following procedure to remove the CPU board.

**NOTE:**

Before you begin, save the current system settings to an SD card and print the System Setup report. This will be used to restore the system settings after replacing the board.

1. Remove the battery as described in [“Replacing the Battery” on page 78](#).
2. Remove the top cover as described in [“Replacing the Top Cover/Keyboard Assembly” on page 84](#).
3. Remove the COMM board as described in [“Replacing the COMM Board” on page 90](#).
4. Pull up on the brown ribbon cable to disconnect it from the main CPU board.
5. Remove the acquisition board as described in [“Replacing the Acquisition Board” on page 89](#).
6. Remove the four Torx fasteners securing the acquisition board mount and remove the acquisition board mount.
7. Remove the fasteners securing the two grounding straps to the standoffs and remove the straps.
8. Using a 5.5 mm socket wrench or small pliers, carefully remove the two ground standoffs (1).



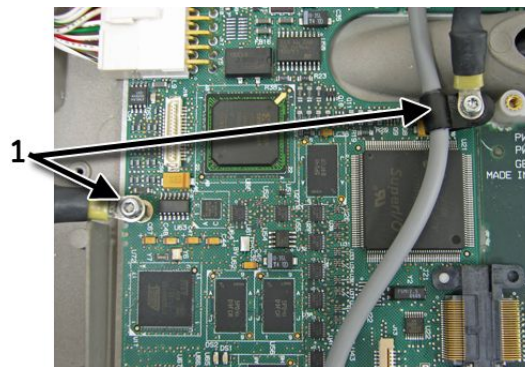
9. Disconnect the battery cable (J2), the power cable (J11), and the printhead cable (J12) from the main CPU board.
10. Remove the nine Torx fasteners (2) securing the CPU board.
11. Lift the CPU board from the lower frame.

## Reassembling the CPU Board

After removing the CPU board, use the following procedures to reassemble the new CPU board in the MAC device.

1. Insert the new CPU board and secure it with the nine Torx screws set aside during disassembly.
2. Connect the battery cable (J2), the power cable (J11), and the printhead cable (J12) from the main CPU board.
3. Using a 5.5 mm socket wrench or small pliers, carefully insert the two ground standoffs removed during disassembly.
4. Fasten the two grounding straps (1) to the standoffs.

When replacing the fasteners that secure the two grounding straps, be sure to route the straps as shown in the following figure.



5. Replace the acquisition board mount and secure it with the four Torx fasteners removed during disassembly.
6. Replace the acquisition board as described in [“Replacing the Acquisition Board” on page 89](#).
7. Reconnect the brown ribbon cable to the main CPU board.
8. Replace the COMM board as described in [“Replacing the COMM Board” on page 90](#).
9. Replace the top cover as described in [“Replacing the Top Cover/Keyboard Assembly” on page 84](#).
10. Replace the battery as described in [“Replacing the Battery” on page 78](#).

## 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 78](#) for instructions.
2. Remove the top cover.

This is required to make the on-board LEDs visible. See ["Replacing the Top Cover/Keyboard Assembly" on page 84](#) 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 <b>SDRAM</b> .
Off	Off	Erasing and/or formatting the <b>NAND FLASH</b> . Applicable only during the software update process.
On	Off	Programming the <b>NAND FLASH</b> .
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

**Service Only Setup**

Serial Number: \_\_\_\_\_

Update Primary Boot: \_\_\_\_\_

Print head resistance: \_\_\_\_\_

Keyboard: \_\_\_\_\_

Update Acquisition Module: \_\_\_\_\_

**Return**

opens.

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 ["Replacing the CPU Board" on page 91](#).

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.

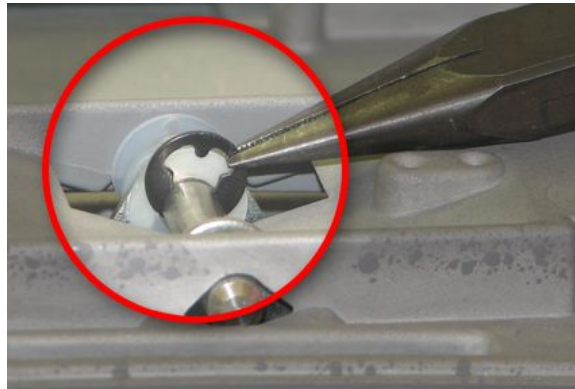
1. From the **Main Menu**, select **System Setup > Basic System > Option Activation**.
2. In the **Option Code** field, type **x** followed by the option's existing activation code. The corresponding option will be disabled.
3. To re-enable the option, reenter the activation code (without the **x**).
4. Repeat for each option to be disabled.

## Replacing the Printhead

Use the following procedure to replace the thermal printhead.

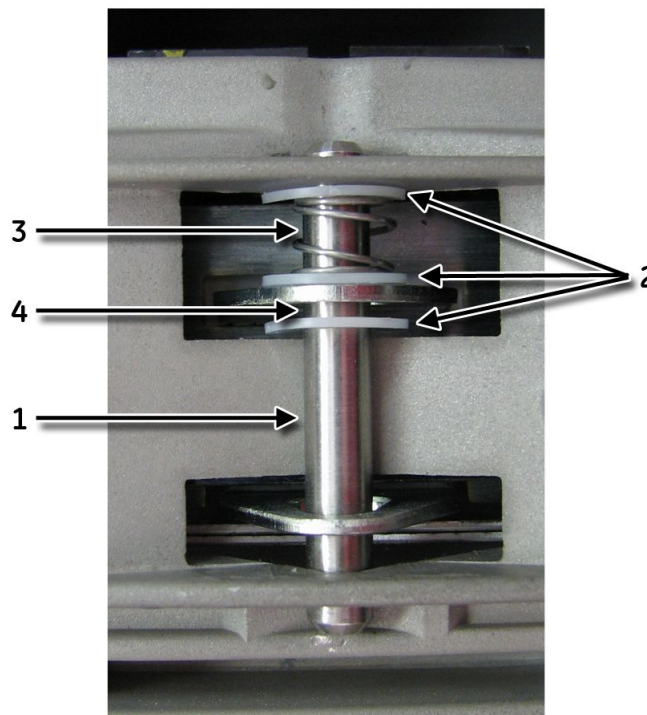
1. Remove the battery as described in [“Replacing the Battery” on page 78](#).
2. Remove the top cover as described in [“Replacing the Top Cover/Keyboard Assembly” on page 84](#).
3. Disconnect the ribbon cable from the connector on the printhead.
4. Close the top of the unit so it snaps into place.

5. Remove the E-ring from the steel pin that holds the printhead assembly in place.



6. Slide the steel pin out of the assembly.

Set aside the steel pin (1), the three plastic washers (2), the compression spring (3), and the E—ring (4) for the printhead reassembly. The relative order of each component is shown in the following figure. Use this reference for reassembly. Paper tracking problems may result if these components are not reassembled properly.



7. Push the access button to open the unit and remove the printhead.
8. Reverse step 1 through step 6 to attach the new printhead.

## 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 82](#).
2. Inside the power supply compartment, disconnect the cable connected 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.

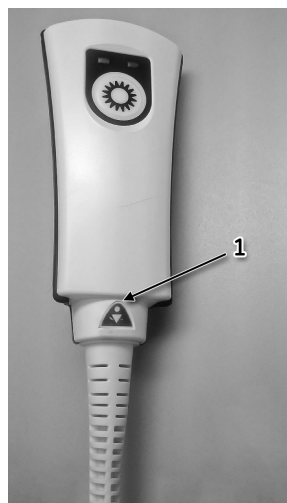
Refer to [“Setting the Correct Paper Size” on page 75](#) for details.

4. Remove the screw and return the paper size bracket to the 8.5 x 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 step 1 through step 6 to insert the new writer roller/carriage assembly.

## 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 101](#) 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)
Acquisition Module	1, 5	1, 2	1, 2, 3
Battery Pack	1, 5	3	1, 3, 11
Motherboard	1, 2, 3, 4, 5	3, 5, 8, 9	1, 2, 3, 4, 14, 20 *5 through 8
Roller Assy	1, 2, 4, 5	6	1, 2, 3, 15
Writer Assy	1, 2, 4, 5	6	1, 2, 3, 15
Display Assy	1, 2, 4, 5	3, 7, 8	1, 2, 3, 12
Keyboard Assy	1, 2, 4, 5	1, 6	1, 2, 3, 14
Power Supply Assy	1, 2, 3, 4, 5	6, 7	1, 2, 3, 20
Plastics	1, 2, 3, 4, 5	5, 6, 7	1, 3, *20 *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, 20 *5 through 8

**Option Repairs**

FRU / Option	Tools	Visual Inspection	Checkout Procedure(s)
External Modem	1, 2, 5	6	1, 3, 5, 17
Internal Modem (Comm PCB)	1, 2, 4, 5	6	1, 3, 5, 17
SD Card Storage	1, 5, 6	N/A	1, 3, 4, 18
Wireless Serial Server	1, 2, 5	6	1, 3, 5
LAN (Comm PCB)	1, 2, 5	6	1, 3, 5, 19

### Option Repairs (cont'd.)

FRU / Option	Tools	Visual Inspection	Checkout Procedure(s)
Barcode Reader	1, 2, 5	6	1, 3, 8
Mag Card Reader	1, 2, 5	6	1, 3

### Non-FRU Repairs

FRU Description	Tools	Visual Inspection	Checkout Procedure(s)
No Parts Replaced	1, 5	1, 2, 3, 4, 5	1, 3, 4 *5 through 8
Software Update	1, 5, 6	N/A	1, 2, 3, 4 *5 through 8
Hardware Upgrade	1, 2, 4, 5	6, 7	1, 2, 3, 4, 20 *5 through 8
Annual Electrical Safety Checkout	1, 2, 3, 5	5, 6, 7	1, 2, 3, 20

## 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. Keyboard/LCD passed inspection?
2. AC Power cord passed inspection?
3. Battery (swollen or leaky) passed inspection?
4. Trolley and casters passed inspection?
5. External surfaces passed inspection?
6. Fasteners replaced and secured?

## Checkout Procedures

Perform the applicable checkout procedure.

## Operational Checks

1. Power-up self-test passed?
2. Simulated printed rhythm strip successful?
3. Simulated printed ECG successful?
4. Simulated ECG stored on media successful?
5. Simulated ECG data transmitted successfully?
6. Exercise device successfully communicates with device?
7. Blood pressure monitor successfully communicates with device?
8. Barcode reader successfully communicates with device?
9. Trolley casters lock successfully?

## Diagnostic Tests

1. Battery Status Test meets Battery Current expectation?
2. Display diagnostic test successful?
3. Speaker test successful?
4. Keyboard test successful?
5. Writer diagnostic tests successful?
6. Read/Write Floppy Diagnostic Test successful? (This test does not need to be performed as the MAC3500 does not have a floppy drive.)
7. External/Internal Modem Test successful?
8. SD Card Test successful?
9. Ethernet Module Test successful?



## Electrical Safety Checks

20. 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.

### Electrical Safety Checks

Step		Condition <sup>1</sup>	UUT — ON <sup>2</sup>	Result	Leakage Current Limits
<b>Earth Leakage Current</b>					
1	Forward Polarity	NC	_____ $\mu$ A	Pass/Fail	300 $\mu$ A
2	Neutral open, Forward Polarity	SFC	_____ $\mu$ A	Pass/Fail	1,000 $\mu$ A
3	Neutral open, Reverse Polarity	SFC	_____ $\mu$ A	Pass/Fail	1,000 $\mu$ A
4	Reverse Polarity	NC	_____ $\mu$ A	Pass/Fail	300 $\mu$ A
<b>Enclosure Leakage Current</b>					
1.	Forward Polarity	NC	_____ $\mu$ A	Pass/Fail	100 $\mu$ A
2.	Neutral open, Forward Polarity	SFC	_____ $\mu$ A	Pass/Fail	300 $\mu$ A
3.	Ground open, Forward Polarity	SFC	_____ $\mu$ A	Pass/Fail	300 $\mu$ A
4.	Ground open, Reverse Polarity	SFC	_____ $\mu$ A	Pass/Fail	300 $\mu$ A
5.	Neutral open, Reverse Polarity	SFC	_____ $\mu$ A	Pass/Fail	300 $\mu$ A
6.	Reverse Polarity	NC	_____ $\mu$ A	Pass/Fail	100 $\mu$ A
<b>Patient Leakage Current to Ground<sup>3</sup></b>					
1.	Forward Polarity	NC	_____ $\mu$ A	Pass/Fail	10 $\mu$ A
2.	Neutral open, Forward Polarity	SFC	_____ $\mu$ A	Pass/Fail	50 $\mu$ A
3.	Ground open, Forward Polarity	SFC	_____ $\mu$ A	Pass/Fail	50 $\mu$ A
4.	Ground open, Reverse Polarity	SFC	_____ $\mu$ A	Pass/Fail	50 $\mu$ A
5.	Neutral open, Reverse Polarity	SFC	_____ $\mu$ A	Pass/Fail	50 $\mu$ A
6.	Reverse Polarity	NC	_____ $\mu$ A	Pass/Fail	10 $\mu$ A
<b>Patient Leakage Current Mains on Applied Part</b>					
1.	Forward Polarity Neutral / Ground Closed	SFC	_____ $\mu$ A	Pass/Fail	5000 $\mu$ A
2.	Reverse Polarity Neutral / Ground Closed	SFC	_____ $\mu$ A	Pass/Fail	5000 $\mu$ A
<b>Ground Continuity</b>					
1.	AC mains power cord ground prong to exposed metal surface (ground lug)	N/A	_____ $\Omega$	Pass/Fail	Less than 200m $\Omega$

1 NC — Normal Condition SFC — Single Fault Condition N/A — Not Applicable

2 UUT — Unit Under Test

3 All SIPs/SOPs grounded.

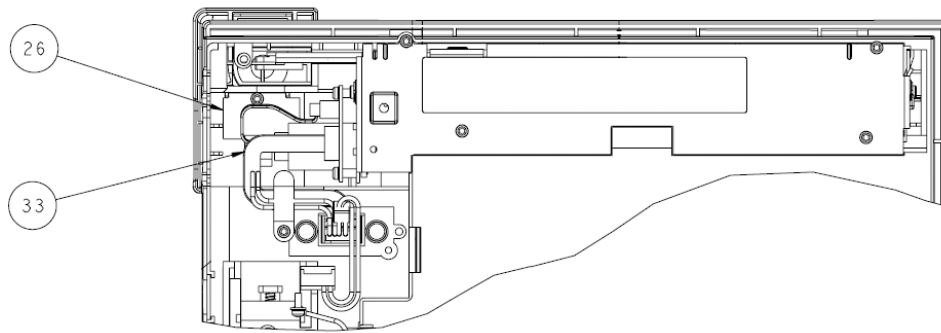
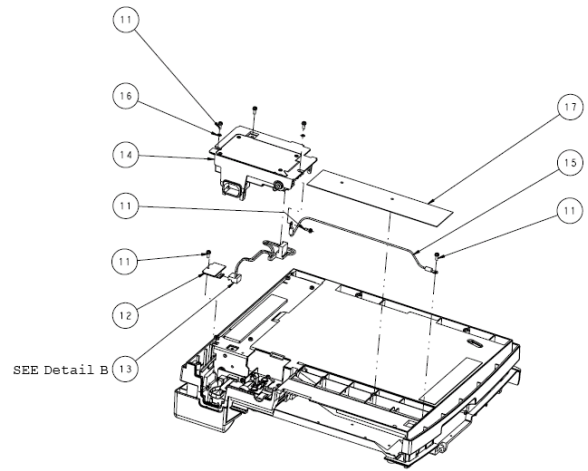
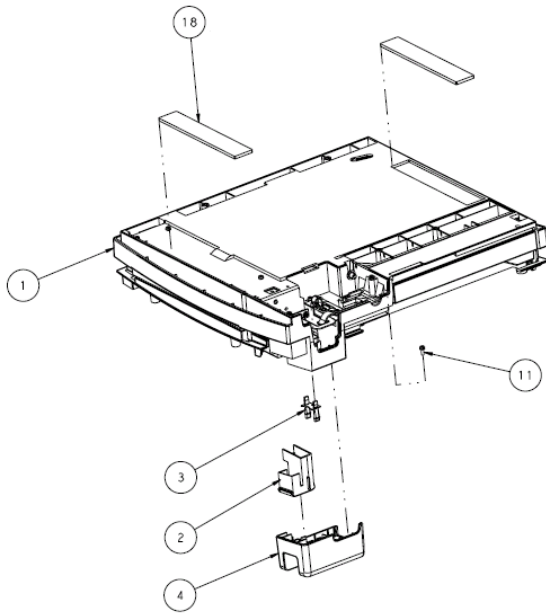


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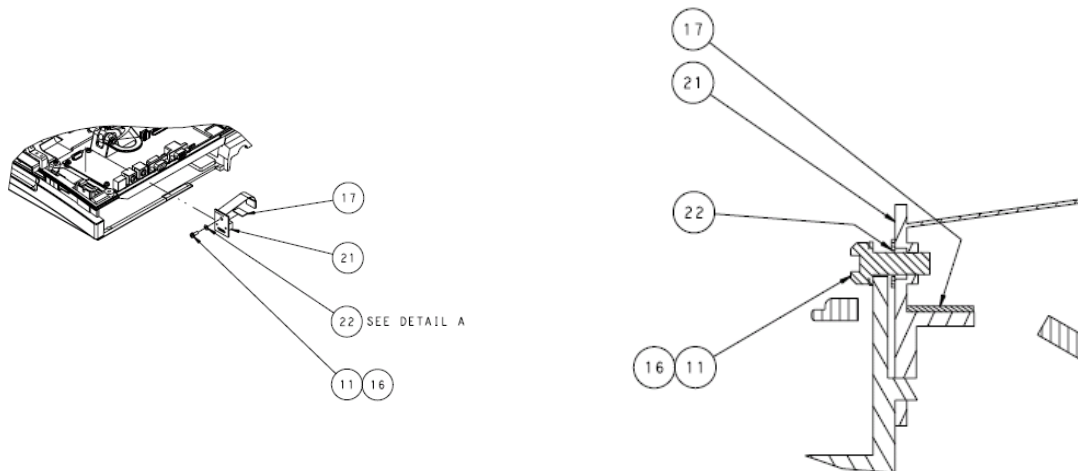
## Parts List

The Field Replaceable Unit lists in this chapter supply enough detail for you to order parts for the assemblies, standalone FRUs, and FRU kits considered field serviceable. Only assemblies, items, and kits with part numbers are considered FRUs.

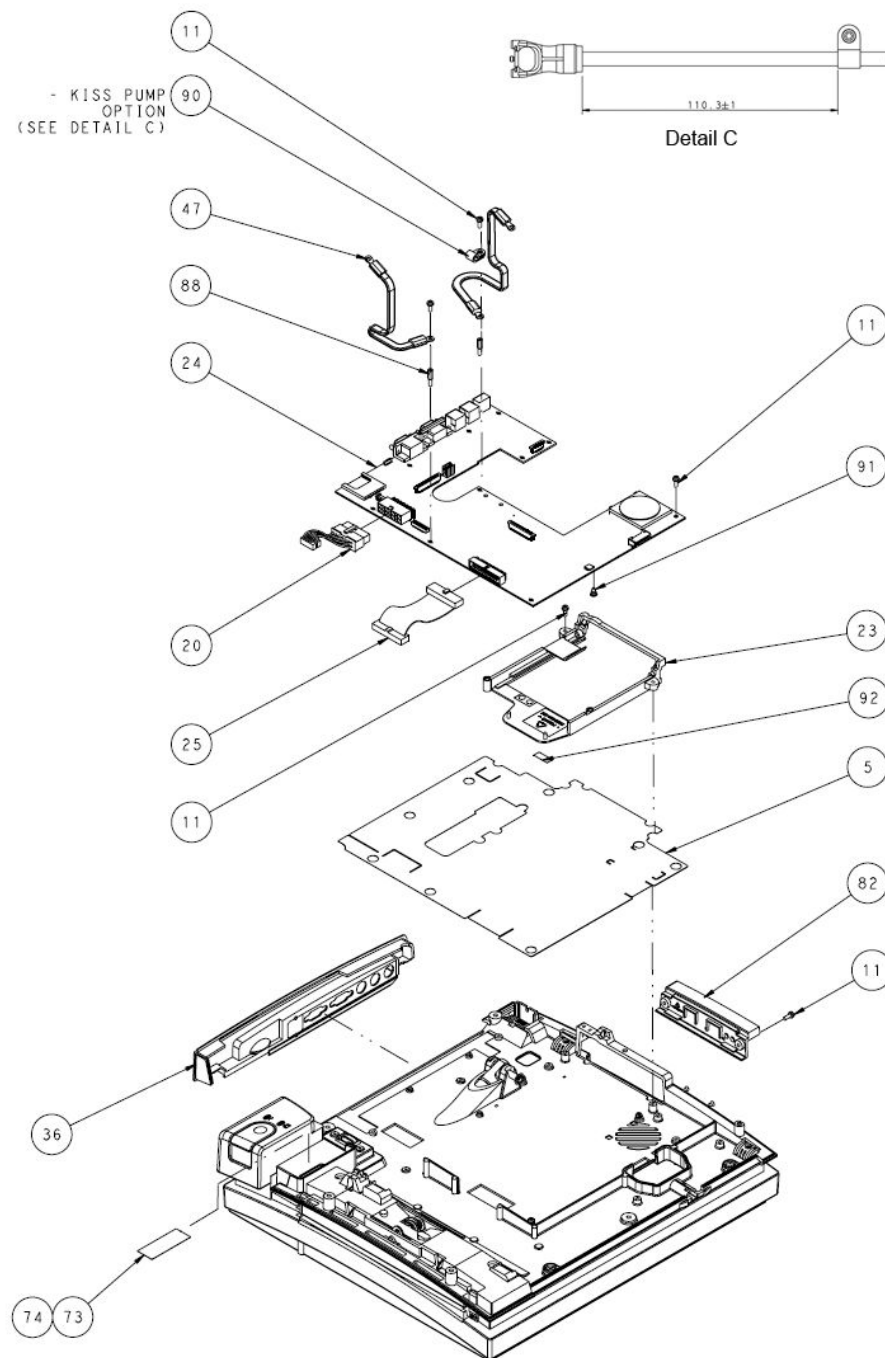
# Upper-Level Assemblies



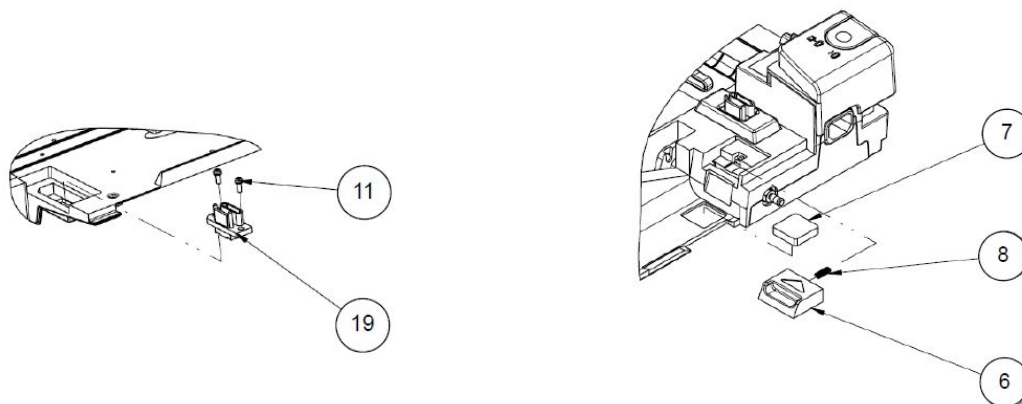
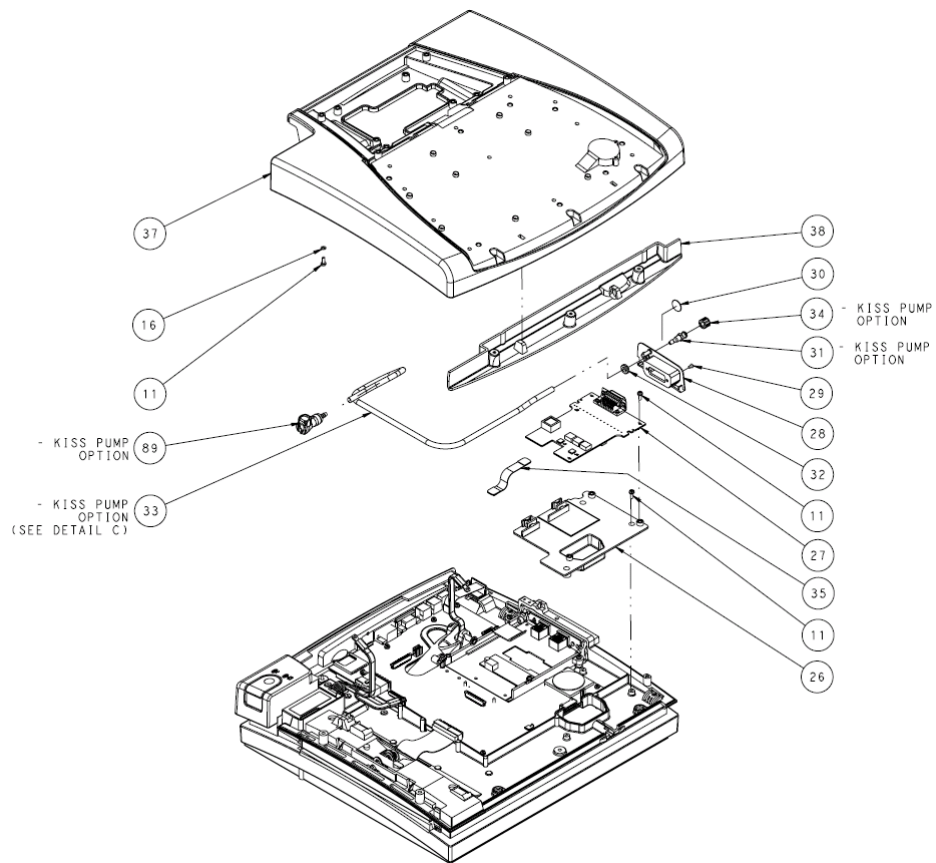
**DETAIL B**

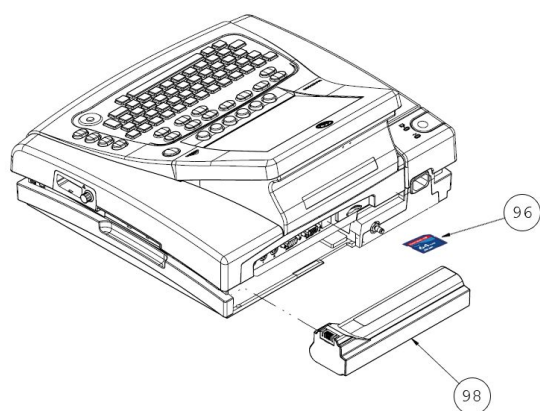
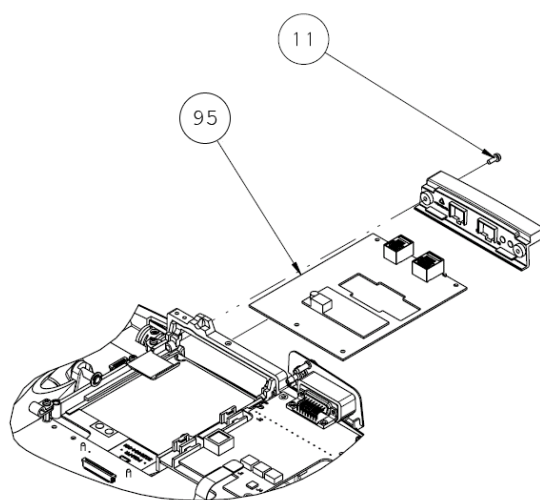
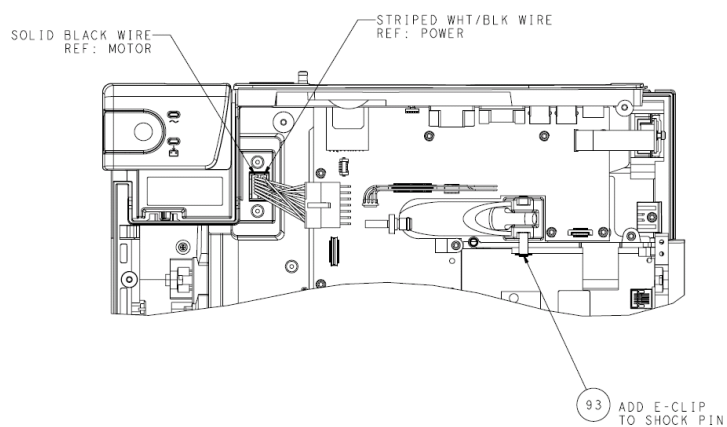


**DETAIL A**



## Parts List





Except where noted, items with no part number are not available as standalone FRUs; they are available only with the full assembly.

### Upper Level Assemblies

Item	Part Number	Description
1		PRINTER THERMAL MAC3500 See <a href="#">"Universal Writer Kit (P/N 2031810-002)"</a> on page 119 for details.
2		BTN 3500 WRITER Not available as a standalone FRU. See <a href="#">"MAC 3500 Plastics Kit (P/N 2030898-001)"</a> on page 128.
3		LIGHT PIPE MAC3500 Not available as a standalone FRU. See <a href="#">"MAC 3500 Plastics Kit (P/N 2030898-001)"</a> on page 128.
4		HLDR BUTTON MAC3500 Not available as a standalone FRU. See <a href="#">"MAC 3500 Plastics Kit (P/N 2030898-001)"</a> on page 128.
5	419759-002	INSULATOR BD MAC SERIES
6	416298-001	BUTTON BATTERY MAC SERIES
7	419752-001	SPRING BATTERY MAC SERIES
8	419753-001	SPRING, BAT. BUTTON MAC
11		M3 X 8MM TORX SEMS Not available as a standalone FRU. See <a href="#">"Hardware Kit for MAC 3500 (P/N 2030869-001)"</a> on page 127.
12	801222-002	PCB LED BOARD MAC 5000
13	700645-010	HARNESS PS/LED/MOTOR
14	421117-002	ASSY POWER SUPPLY MAC 5000
15	700686-001	HARNESS GROUND MAG MAC 5000
16	4520-004	WASHER FLAT SS #4,
17	420016-001	LABEL SET MAC5000 BOTTOM COVER
18	419755-001	PAD BOTTOM MAC SERIES
19	419957-001	CONN VERT MINI-DRAWER 14P
20	700682-001	HARNESS PWR TO CPU BD
21	801220-002	PCB MAC 5000 BATTERY TRANS
22	4550-014	WASH NYL .28 OD .12 ID .03THK
23		RAIL COMMUNICATION BOARD Not available as a standalone FRU. See <a href="#">"MAC 3500 Plastics Kit (P/N 2030898-001)"</a> on page 128.



## Upper Level Assemblies (cont'd.)

Item	Part Number	Description
24	801212-008	PCB ASSY MAC CPU ROHS This board works on MAC 3500 and MAC 5500 devices running MAC software versions 9D and 10B or <i>later</i> . 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.
25	700687-002	CABLE ASSY PRTHD SNSR W/O FER
26		PLASTIC BRACKET, ACQ BOARD Not available as a standalone FRU. See <a href="#">“MAC 3500 Plastics Kit (P/N 2030898-001)” on page 128.</a>
27	2022328-001	PCB CAM MAIN
28		PLASTIC CONNECTOR COVER Not available as a standalone FRU. See <a href="#">“MAC 3500 Plastics Kit (P/N 2030898-001)” on page 128.</a>
29	80177736	SCR FH #4-40X1/4" ZINC AHNL.DIN965
30		LABEL LUER MAC3500 Not available as a standalone FRU. See <a href="#">“MAC 3500 Plastics Kit (P/N 2030898-001)” on page 128.</a>
31		CONNECTOR LUER FEMALE Not available as a standalone FRU. See <a href="#">“MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)” on page 133.</a>
32		NUT LOCK Not available as a standalone FRU. See <a href="#">“MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)” on page 133.</a>
33	82204620	TUBING PVC 3X1 GREY
34		PLUG LUER MALE Not available as a standalone FRU. See <a href="#">“MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)” on page 133.</a>
35		FLEX CKT ASSY CAM Not available as a standalone FRU. See <a href="#">“Harness Kit for MAC 3500 (P/N 2030871-002)” on page 132.</a>
36		PANEL REAR MAC3500 Not available as a standalone FRU. See <a href="#">“MAC 3500 Plastics Kit (P/N 2030898-001)” on page 128.</a>
37		PLASTIC TOP COVER Not available as a standalone FRU. See <a href="#">“MAC 3500 Top Cover Kit (P/N 2030899-001)” on page 130.</a>

## Upper Level Assemblies (cont'd.)

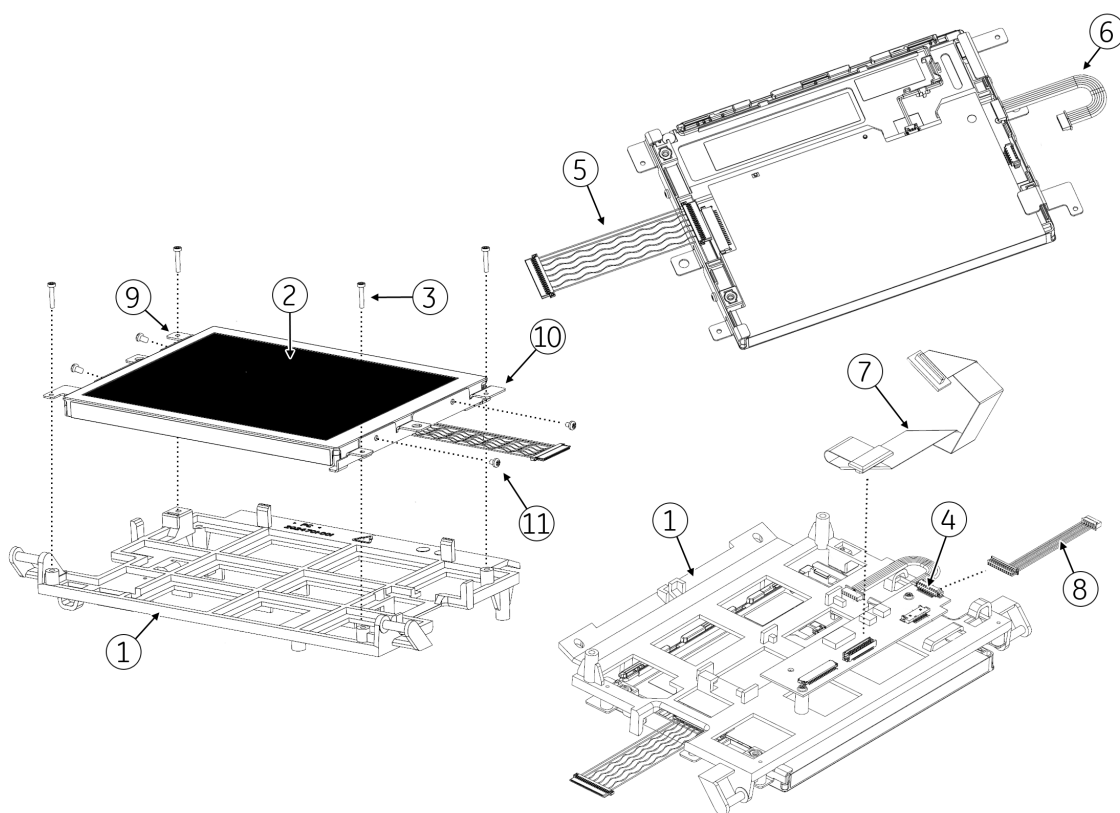
Item	Part Number	Description
38		PLATE TOP COVER MAC3500 Not available as a standalone FRU. See "MAC 3500 Top Cover Kit (P/N 2030899-001)" on page 130.
39		KYBD UNIVERSAL MAC3500 Not available as a standalone FRU. See "MAC 3500 Top Cover Kit (P/N 2030899-001)" on page 130.
40		COVER KISS PUMP MAC3500 Not available as a standalone FRU. See "MAC 3500 Plastics Kit (P/N 2030898-001)" on page 128.
47		HARN LCD DISPLAY GROUND Not available as a standalone FRU. See "Harness Kit for MAC 3500 (P/N 2030871-002)" on page 132.
65	2026801-001	ASSY DISPLAY BEZEL MAC 3500
70		PLASTIC KEYBOARD BEZEL Not available as a standalone FRU. See "MAC 3500 Plastics Kit (P/N 2030898-001)" on page 128.
72		LABEL CE/UL MAC3500 Not available as a standalone FRU. See "MAC 3500 Plastics Kit (P/N 2030898-001)" on page 128.
73		LABEL PRODUCT/SERIAL/MFG LOCATION SIZE A Not available as a standalone FRU. This item is available only as part of the entire assembly.
74		LABEL CLEAR OVERLAMINATE
75		BAG POLY 22X22X47IN ANTI-STATIC
76		PACKAGING CARTON 524 X 270 X 444.5 Not available as a standalone FRU. This item is available only as part of the entire assembly.
77		LABEL CARTON MAC3500
78		FILLER RH FOAM END CAP
79		FILLER LH FOAM END CAP MAC3500
82		PANEL BLANK COMMUNICATION MAC3500 Not available as a standalone FRU. See "MAC 3500 Plastics Kit (P/N 2030898-001)" on page 128.
86	2026799-002	ASSY DISPLAY — MAC3500 AUO LVDS-LED See "MAC 3500 Display Assembly (P/N 2026799-002)" on page 116 for detailed information.
87	2022882-002	PUMP KISS ASSY MAC 3500 See "MAC 3500 KISS Pump Assembly (P/N 2022882-002)" on page 118 for detailed information.

## Upper Level Assemblies (cont'd.)

Item	Part Number	Description
88		SPACER MALE/FEMALE M3 X 10 HEX Not available as a standalone FRU. See <a href="#">"Hardware Kit for MAC 3500 (P/N 2030869-001)" on page 127.</a>
89		FITTING PNEU 1/8" QUICK FEMALE Not available as a standalone FRU. See <a href="#">"MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)" on page 133.</a>
90		CLAMP CABLE 4.78MM ID BLK NYL Not available as a standalone FRU. See <a href="#">"MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)" on page 133.</a>
91		SNAP RIVET NYLON .124 DIA Not available as a standalone FRU. See <a href="#">"Hardware Kit for MAC 3500 (P/N 2030869-001)" on page 127.</a>
92		ADHESIVE BEZEL CORNER Not available as a standalone FRU. See <a href="#">"MAC 3500 Plastics Kit (P/N 2030898-001)" on page 128.</a>
93		FSTNR E-RING Not available as a standalone FRU. See <a href="#">"Hardware Kit for MAC 3500 (P/N 2030869-001)" on page 127.</a>
94		PACKAGING BOX ACCESSORIES MAC3500
95	2022332-004	PCB ASSY MAC5500 XM COMM BOARD ROHS <b>NOTE:</b> This board is compatible with MAC software versions 9D and 10B or <i>later</i> . 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.
96	900770-001	BATTERY PACK ASSY MAC PAC
98	2026831-008	V10B Programmed SD Card
99	2056460-001	CD-R MUSE 12SL Statement Library Update (not shown) This product upgrades MUSE 5E and MUSE 7.x systems to 12SL v22 for compatibility with the MAC v10 software.

For more information on the compatibility of the CPU (801212-008) and the Comm Board (2022332-004), see [Appendix B, "Software/Hardware Compatibility"](#).

## MAC 3500 Display Assembly (P/N 2026799-002)



Except where noted, items with no part number are not available as standalone FRUs; they are available only with the full assembly.

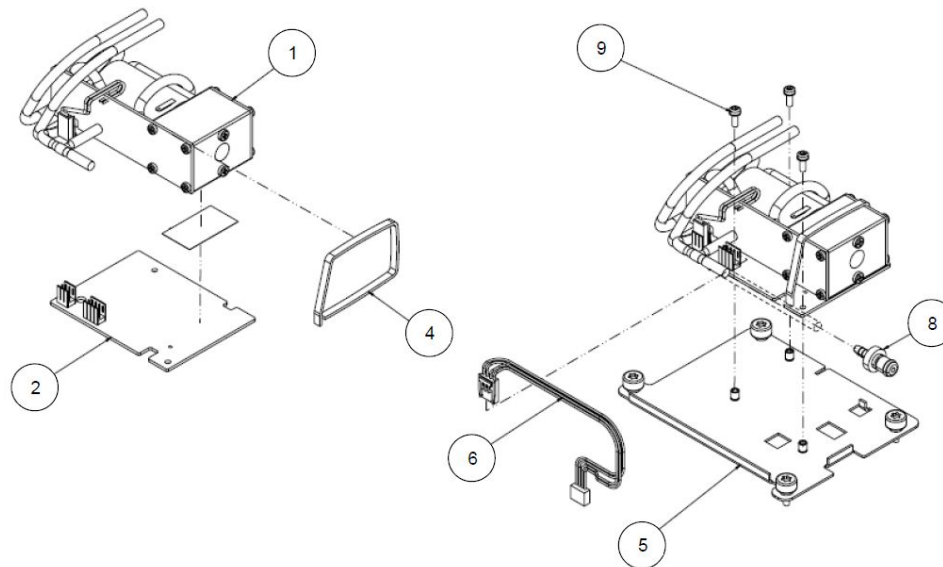
### MAC 3500 Display Assembly (P/N 2026799-002)

Item	Part Number	Description
1	2024701-001	BRACKET DISPLAY MAC3500
2	2062075-001	AUO DISPL LCD 6.5 G065VN01 — V2 AUO
3	417866-002	SCREW 1 X .375 PNHD TORX 6
4	2061540-001	LVDS Converter Board
5	2059322-001	MAC3500 LCD Cable Available only in a FRU kit. See <a href="#">“Harness Kit for MAC 3500 (P/N 2030871-002)” on page 132</a> for more information.
6	2059255-001	ASSY MAC3500 BACKLIT CABLE-AUO Available only in a FRU kit. See <a href="#">“Harness Kit for MAC 3500 (P/N 2030871-002)” on page 132</a> for more information.
7	2024271-002	ASSY DISPLAY CABLE MAC3500 Available only in a FRU kit. See <a href="#">“Harness Kit for MAC 3500 (P/N 2030871-002)” on page 132</a> for more information.

## MAC 3500 Display Assembly (P/N 2026799-002) (cont'd.)

Item	Part Number	Description
8	2034900-003	MAC3500 PWR CABLE MAIN BOARD TO LVDS Available only in a FRU kit. See <a href="#">“Harness Kit for MAC 3500 (P/N 2030871-002)”</a> on page 132 for more information.
9	2027896-010	BRACKET — LF
10	2027897-010	BRACKET MTG RIGHT — 18D
11	411508-002	SCREW METRIC PH M2 X 3 W/COAT

## MAC 3500 KISS Pump Assembly (P/N 2022882-002)

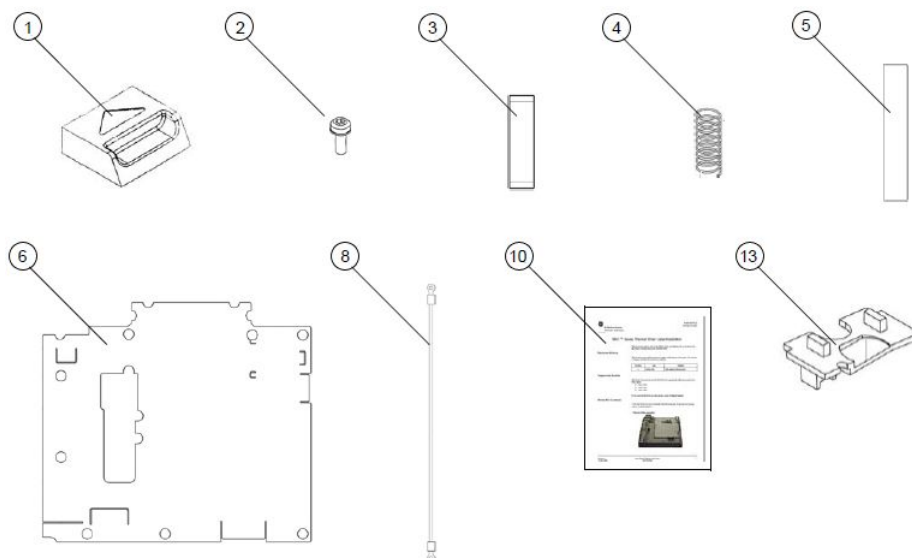


Except where noted, items with no part number are not available as standalone FRUs; they are available only with the full assembly.

### MAC 3500 KISS Pump Assembly (P/N 2022882-002)

Item	Part Number	Description
1		ASSY KISS PUMP
2		PCB HOLDER PUMP
4		CABLE STRIP 293 X 4,8 MM
5		BRACKET KISS PUMP MAC3500 Not available as a standalone FRU. See <a href="#">"MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)"</a> on page 133.
6		ASSY WIRE SET KISS PUMP MAC3500 Not available as a standalone FRU. See <a href="#">"MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)"</a> on page 133.
8		FITTING PNEU 1/8" QUICK MALE Not available as a standalone FRU. See <a href="#">"MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)"</a> on page 133.
9		M3 X 8MM TORX SEMS Not available as a standalone FRU. See <a href="#">"Hardware Kit for MAC 3500 (P/N 2030869-001)"</a> on page 127.

## Universal Writer Kit (P/N 2031810-002)

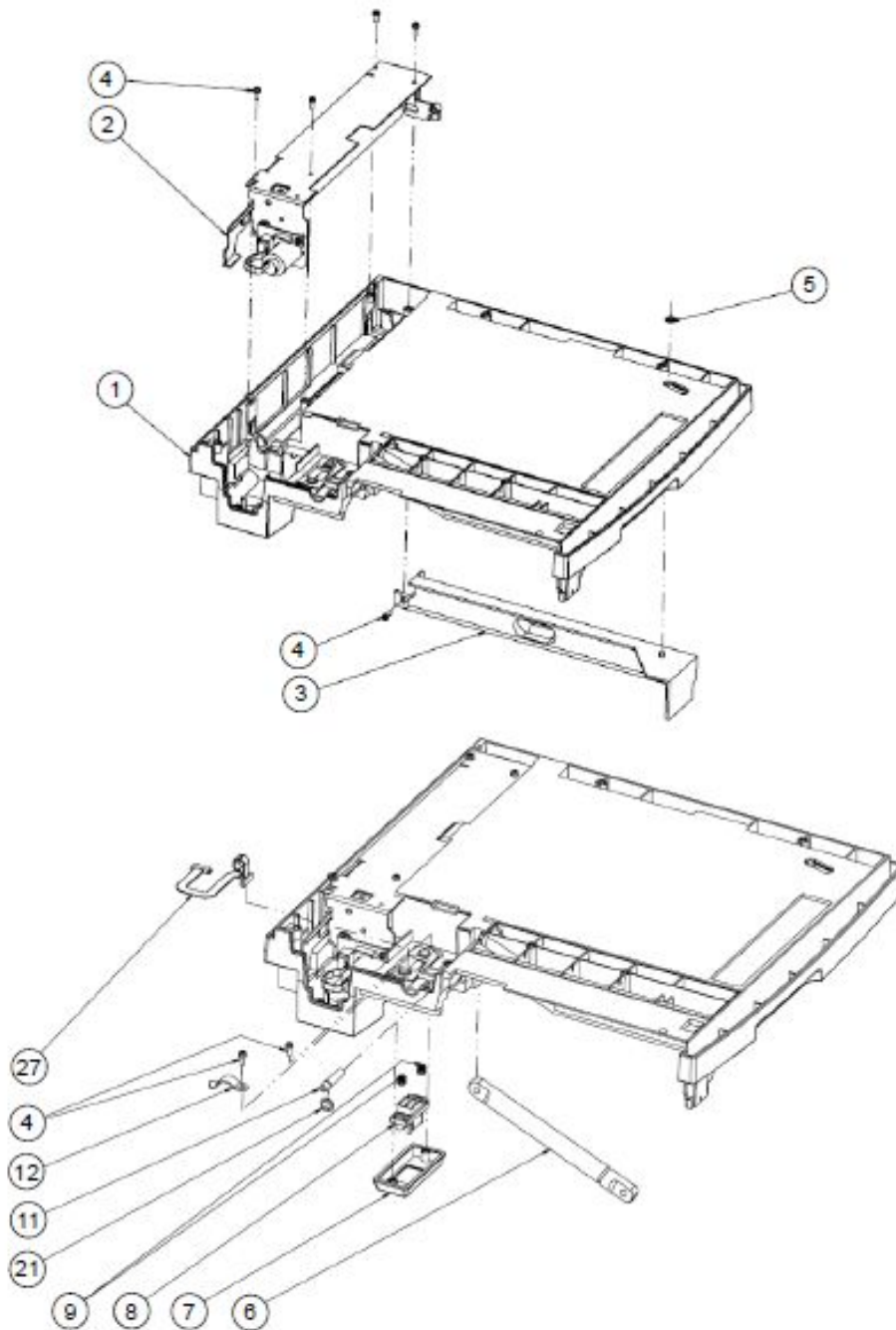


Except where noted, items are not available as standalone FRUs; they are available only with the full assembly.

### Universal Writer Kit (P/N 2031810-002)

Item	Description	Qty
1	BUTTON BATTERY MAC SERIES	1
2	M3 X 8MM TORX SEMS	1
3	SPRING BATTERY MAC SERIES	1
4	SPRING, BAT. BUTTON MAC	1
5	PAD BOTTOM MAC SERIES	2
6	INSULATOR BD MAC SERIES	1
7	PRINTER THERMAL MAC3500 See "Universal Writer Kit (P/N 2031810-002)" on page 119 for details.	1
8	HARNESS GROUND MAG MAC 5000	1
9	LABEL SET MAC5000 BOTTOM COVER (not shown)	1
10	INSTALLATION INSTRUCTIONS	1
11	LABEL LED MAC SERIES (not shown)	1
12	LABEL CE/UL MAC5000 (not shown)	1
13	LIGHTPIPE MAC 5000	1
14	ADHESIVE LIGHTPIPE MAC SERIES (not shown)	1
15	LABEL PHYSICIAN MAC5000 (not shown)	1
16	BAG ANTI-STATIC 6x8	1

## Thermal Writer Assembly (P/N 421108-009)



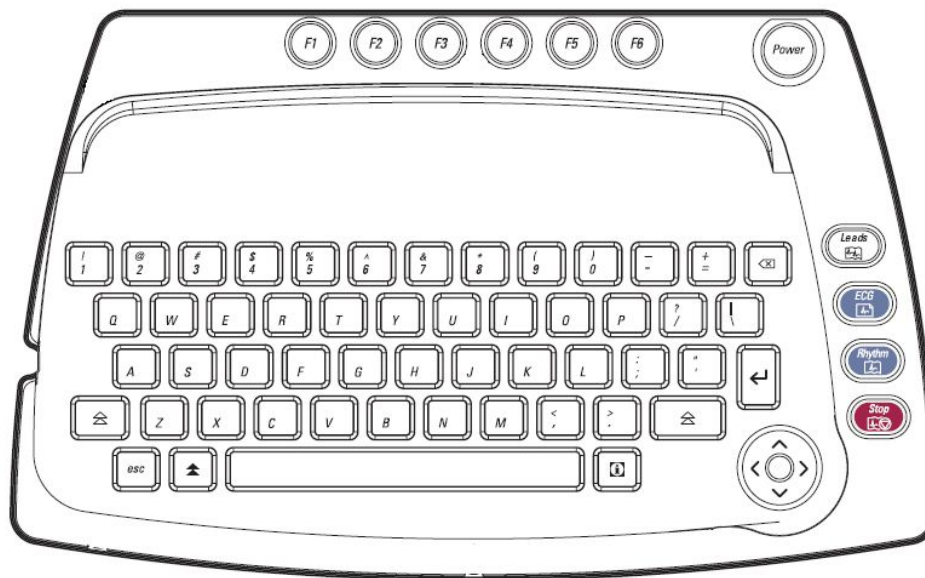


Except where noted, items with no part number are not available as standalone FRUs; they are available only with the full assembly.

### Thermal Writer Assembly

Item	Part Number	Description
1		BASE, WRITER MAC SERIES
2	422396-003	ASSY ROLLER MAC SERIES WRITER
3		SPACER PAPER MAC SERIES
4		M3 X 8MM TORX SEMS Not available as a standalone FRU. See <a href="#">"Hardware Kit for MAC 3500 (P/N 2030869-001)" on page 127.</a>
5		CLIP, INT. STAR
6	416015-001	SHOCK CYLINDER
7		COVER AMP CONNECTOR MAC SERIES
8		CONN VERT MINI-DRAWER 14P
9		SPRING, CONNECTOR MAC
11		PIN SHOCK
12		FSTNR WIRE CLIP
13	2029559-001	PRINthead MAC SERIES WRITER Part Number 422397-001 can be substituted for this part if available.
14		FRAME WRITER
15		HINGE FRT MAC SERIES
16		HINGE RR MAC SERIES
17		WSHR NYLON 6.4 ID
18		PIN SHOCK UPPER
19		SPRING CPRSN HEADPIN
20		WSHR NYLON -PRINthead
21		FSTNR E-RING Not available as a standalone FRU. See <a href="#">"Hardware Kit for MAC 3500 (P/N 2030869-001)" on page 127.</a>
22		PIN PRINthead
23		STATIC BRUSH 1212
24		SPRING PRINthead
25		PRINthead WELDMENT
26		SCR MACH PNHD M3 X 6 SIMS
27		CABLE ASSY RBN MOTOR PCB

## Keyboards

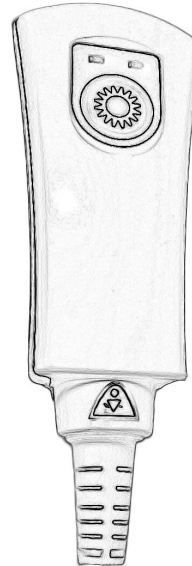


MAC 3500 Keyboard (English)

### Keyboards

Part Number	Description
2022885-001	KYBD MAC 3500
2022885-002	KYBD GER MAC3500
2022885-003	KYBD FRE MAC3500
2022885-004	KYBD SPA MAC3500
2022885-005	KYBD SWE MAC3500
2022885-006	KYBD ITA MAC3500
2022885-007	KYBD JAP MAC3500
2022885-008	KYBD DUT MAC3500
2022885-009	KYBD NOR MAC3500
2022885-010	KYBD DAN MAC3500
2022885-011	KYBD CZE MAC3500
2022885-013	KYBD CHN MAC3500
2022885-014	KYBD HUN MAC3500
2022885-015	KYBD POL MAC3500
2022885-020	KYBD FIN MAC3500

# Bar Code Scanner



## Bar Code Scanner

Part Number	Description
2031240-001	KIT 2D BARCODE IMAGER MAC5000 ENGLISH
2031240-002	KIT 2D BARCODE IMAGER MAC5000 GERMAN
2031240-003	KIT 2D BARCODE IMAGER MAC5000 FRENCH
2031240-004	KIT 2D BARCODE IMAGER MAC5000 SPANISH
2031240-005	KIT 2D BARCODE IMAGER MAC5000 SWEDISH
2031240-006	KIT 2D BARCODE IMAGER MAC5000 ITALIAN
2031240-009	KIT 2D BARCODE IMAGER MAC5000 NORWEGIAN
2031240-010	KIT 2D BARCODE IMAGER MAC5000 DANISH
2031240-011	KIT 2D BARCODE IMAGER MAC5000 CZECH
2031240-014	KIT 2D BARCODE IMAGER MAC5000 HUNGARIAN
2031240-015	KIT 2D BARCODE IMAGER MAC5000 POLISH
2031240-020	KIT 2D BARCODE IMAGER MAC5000 FINNISH
2055394-001	Compact PS2 Barcode Scanner Cable <sup>1</sup>

1. Replaces, and is interchangeable with, 2018629-001.

## Modems

### Modems

Part Number	Description
2005264-001	KIT MAC 5000 EXT MODEM 56K US
2005264-002	KIT MAC 5000 GLOBAL EXT MODEM 56K
2005264-003	KIT MAC 5000 EXT MODEM 56K ASTL
2005264-004	KIT MAC 5000 EXT MODEM 56K CZEC
2005264-005	KIT MAC 5000 GLOBAL EXT MODEM 56K
2005264-006	KIT MAC 5000 EXT MODEM 56K JAP
2005264-007	KIT MAC 5000 EXT MODEM 56K NZEA

## Wireless Option

### Wireless Option

Part Number	Description
2034529-005	Silex Wireless Serial Server SX-500 (Global) This is not a FRU.
2034529-008	Silex Wireless Serial Server SX-500 (USA) This is not a FRU.
2034530-006	Silex Wireless Serial Server SX-500 (US government use only) This is not a FRU.
2034530-003	FIPS Wireless Silex Serial Server Assembly (US government use only) This is not a FRU.
2026825-002	Power Supply — Wireless Silex Serial Server <b>NOTE:</b> Compatible with all FIPS and non-FIPS servers.
2038517-001	Silex antenna <b>NOTE:</b> Compatible with all FIPS and non-FIPS servers.
131-00014-00	Silex Serial Server Antenna Cable <b>NOTE:</b> Compatible with all FIPS and non-FIPS servers.
2056811-001	1" Square Dual Lock <b>NOTE:</b> Required whenever the Silex server and/or power supply will be mounted on a MAC Modular Trolley.

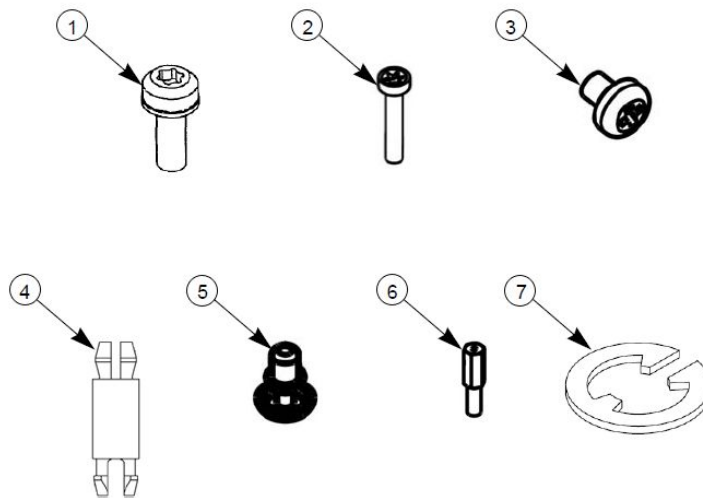
# Power Cords

## Power Cords

Part Number	Description
401855-001	PWR CRD CONT EURO 10A 250V 8FT
401855-002	PWR CORD BRITISH 10A 250V 8FT
401855-003	PWR CORD ITALIAN 10A 250V 8FT
401855-004	PWR CORD ISRAELI 10A 250V 8FT
405535-006	PWR SPLY CRD RA HOSP GRD 13A 125V 10FT
401855-007	PWR CORD SWISS 10A 250V 8FT
401855-008	PWR CORD INDIAN 10A 250V 8FT
401855-010	PWR CORD AUSTRALN 10A 250V 8FT
401855-012	PWR SPLY CRD RA CHINA 10A 250V 2.5M



## Hardware Kit for MAC 3500 (P/N 2030869-001)

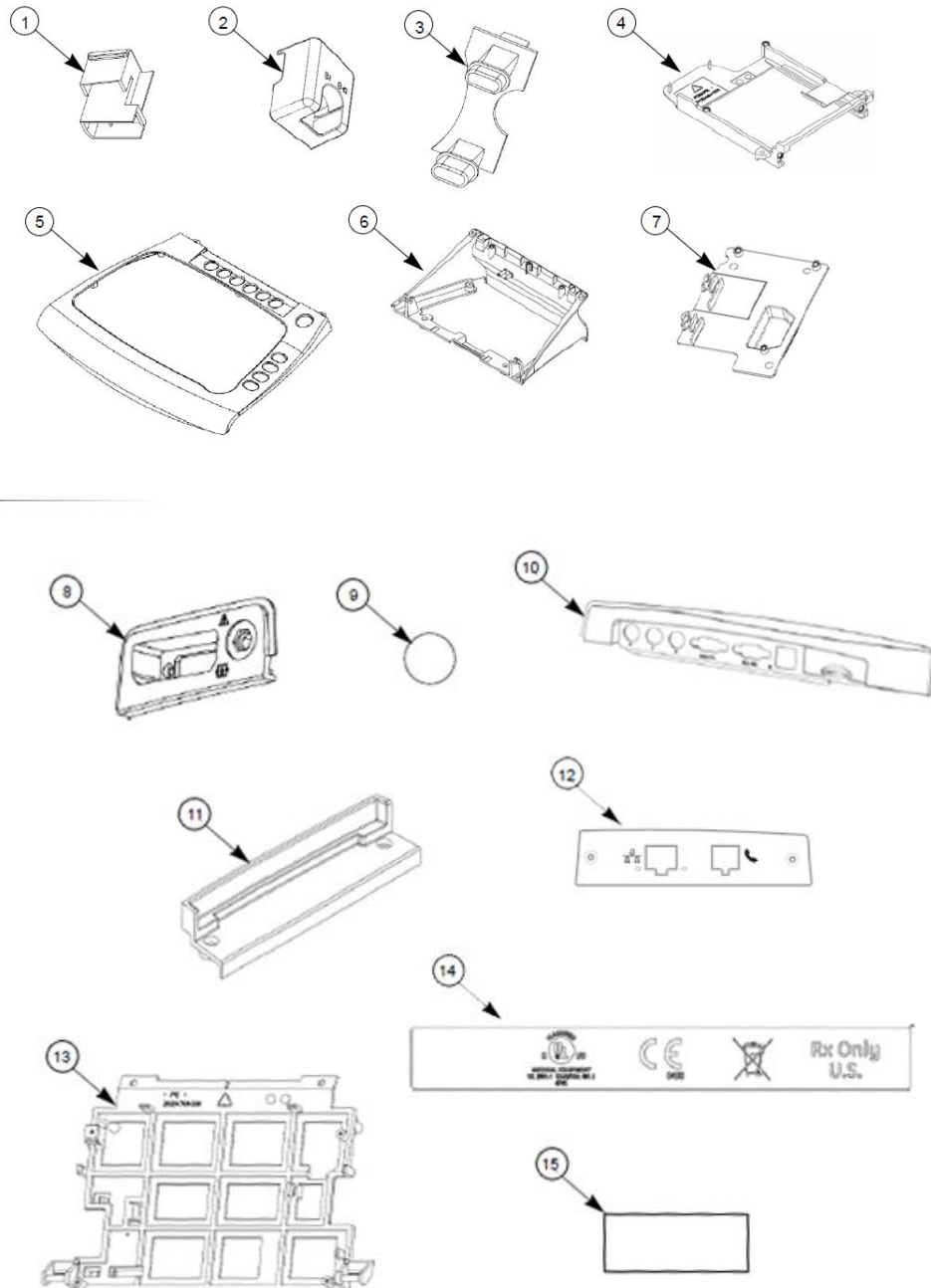


Items are not available as standalone FRUs; they are available only with the full kit.  
Items are not drawn to relative scale. Figures are provided for reference only.

### Hardware Kit for MAC 3500 (P/N 2030869-001)

Item	Description	Qty
1	M3 X 8MM TORX SEMS	40
2	SDREW 1 X .375 TORX T-6 FHP	6
3	SCREW METRIC PH M2 X 3 W/COAT	4
4	STANDOFF PLASTIC SNAP	8
5	SNAP RIVET NYLON .124 DIA	1
6	SPACER MALE/FEMALE M3 X 10 HEX	2
7	FSTNR E-RING	1

# MAC 3500 Plastics Kit (P/N 2030898-001)



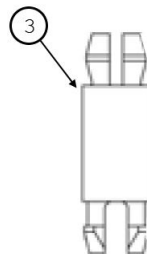
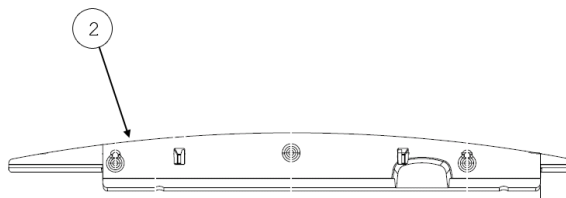
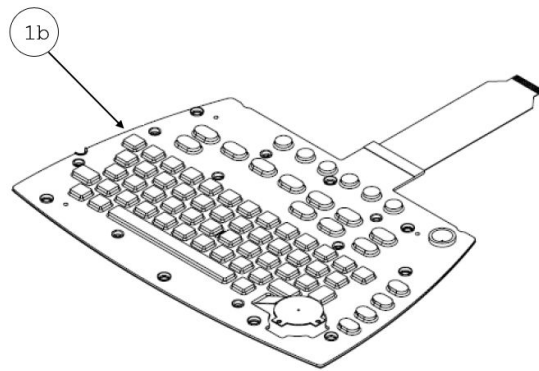
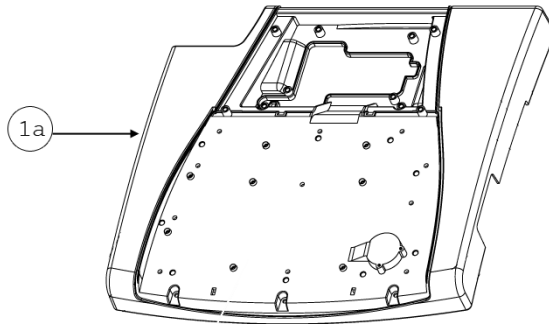


Items are not available as standalone FRUs; they are available only with the full kit.  
Items are not drawn to relative scale. Figures are provided for reference only.

#### MAC 3500 Plastics Kit (P/N 2030898-001)

Item	Description	Qty
1	BTN 3500 WRITER	1
2	HLDR BUTTON MAC3500	1
3	LIGHT PIPE MAC3500	1
4	RAIL COMMUNICATION BOARD	1
5	PLASTIC KEYBOARD BEZEL	1
6	COVER KISS PUMP MAC3500	1
7	PLASTIC BRACKET, ACQ BOARD	1
8	PLASTIC CONNECTOR COVER	1
9	LABEL LUER MAC3500	1
10	PANEL REAR MAC3500	1
11	PANEL BLANK COMMUNICATION MAC3500	1
12	PANEL COMMUNICATION MAC3500	1
13	BRACKET DISPLAY MAC3500	1
14	LABEL CE/UL MAC3500	1
15	ADHESIVE BEZEL CORNER	1

## MAC 3500 Top Cover Kit (P/N 2030899-001)



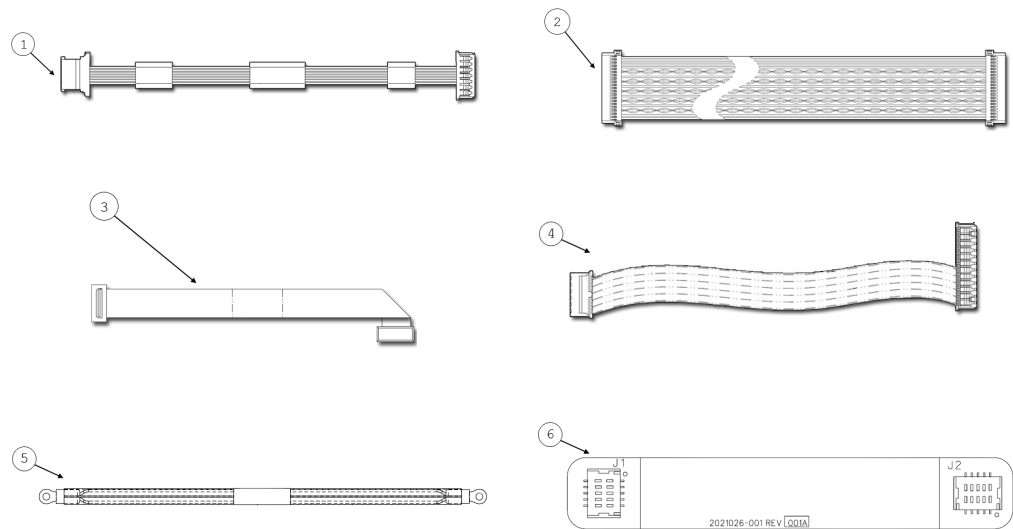
Items are not available as standalone FRUs; they are available only with the full kit.  
Items are not drawn to relative scale. Figures are provided for reference only.

**MAC 3500 Top Cover Kit (P/N 2030899-001)**

Item	Description	Qty
1a	PLASTIC TOP COVER	1
1b	KYBD UNIVERSAL MAC3500	1
2	PLATE TOP COVER MAC3500	1
3	STANDOFF PLASTIC SNAP	8

Items 1a and 1b comprise a single assembly.

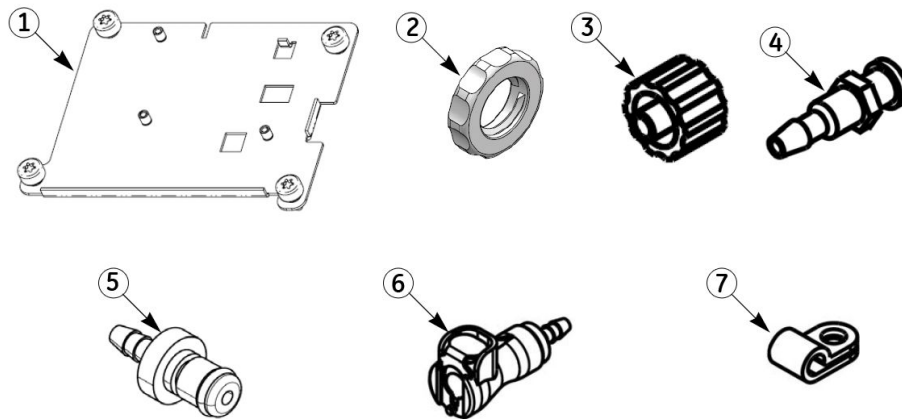
# Harness Kit for MAC 3500 (P/N 2030871-002)



## Harness Kit for MAC 3500 (P/N 2030871-002)

Item	Description	Qty
1	ASSY MAC3500 BACKLIT CABLE-AUO	1
2	MAC3500 LCD CABLE	1
3	Assembly Display Cable MAC3500	1
4	MAC3500 Power Cable Main Board to LVDS	1
5	HARN LCD DISPLAY GROUND	2
6	FLEX CKT ASSY CAM	1

## MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)



### MAC 3500 KISS Pump Hardware Kit (P/N 2030872-002)

Item	Description	Qty
not shown	ASSY WIRE SET KISS PUMP MAC3500	1
1	BRACKET KISS PUMP MAC3500	1
2	NUT LOCK	1
3	PLUG LUER MALE	1
4	CONNECTOR LUER FEMALE	1
5	FITTING PNEU 1/8" QUICK MALE	1
6	FITTING PNEU 1/8" QUICK FEMALE	1
7	CLAMP CABLE 4.78MM ID BLK NYL	1

## Secure Digital (SD) Cards (External Storage)



### SD Cards

Part Number	Description
2027268-004	CARD SECURE DIGITAL - 512MB
2027268-005	CARD SECURE DIGITAL - 2GB Only MAC systems running version 10 software and systems upgraded to version 10 software support SD High Capacity (SDHC) cards. Earlier systems cannot use high capacity cards.



# Technical Specifications

This appendix provides the technical specifications of the MAC system.

## Instrument Type

### Instrument Type Specifications

Item	Description
Instrument type	Microprocessor augmented automatic electrocardiograph.
Leadwire configurations	10-leadwire acquisition with programmable lead configuration 12-leadwire acquisition with NEHB configuration.

## Processing

### Processing Specifications

Item	Description
ECG Interpretation	GE Marquette 12SL ECG Analysis Program for Adults and Pediatrics
Computerized measurements	12-lead analysis
ECG storage	50 ECGs in internal memory
External archiving	Optional secure digital card supports up to a maximum of 50 ECGs Supports 64 MB to 2 GB SD cards
Digital sampling rate	4,000 samples/second/channel
Pre-acquisition:	Provides 10 seconds of instantaneous ECG acquisition
Dynamic range	AC Differential +5 mV DC offset +320 mV
Frequency response	- 3 dB @ 0.01 to 150 Hz
Common mode rejection	>140 dB (123 dB with AC filter disabled)
Digital sampling rate	4,000 samples/second/channel
Input impedance	>10 MΩ @ 10 Hz, defibrillator protected

## Processing Specifications (cont'd.)

Item	Description
Patient leakage	<10 $\mu$ A
Pace detect	Orthogonal LA, LL, and V6; 750 $\mu$ V @ 50 $\mu$ s
Special acquisition functions	Disconnected lead detection, electrode impedance, excessive, AC noise, baseline wander, and muscle tremor messages
Heart rate meter	30 to 300 BPM $\pm$ 10% or 5 BPM, whichever is greater. Heart rates outside this range will not be displayed.

## Display

### Display Specifications

Item	Description
Type	6.5 in (165 mm) diagonal graphics backlit AM LCD (color optional)
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. Six leads maximum.

## 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, or 12 user-selectable traces (same as display)
Sensitivity/Gain	2.5, 5, 10, 20, 10/5 (split calibration) mm/mV (same as display)
Speed Accuracy	$\pm$ 2%
Amplitude Accuracy	$\pm$ 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	100V -240V +/- 10% tolerance
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. <b>NOTE:</b> Cannot charge battery at or above 45° C; best if below 40° C.

# Physical (without Trolley)

## Physical Specifications (without trolley)

Item	Description
Height	19.3 cm (7.6 in)
Width	38.1 cm (15.0 in)
Depth	35.1 cm (13.8 in)
Weight	Approximately 7.0 kg (15.5 lbs) <sup>2</sup> Approximately 7.4 kg (16.3 lbs) <sup>3</sup>

# Magnetic Card Reader

## Magnetic Card Reader Specifications

Item	Description
Character set	ANSI/ISO ALPHA alphanumeric characters ANSI/ISO BCD (subset of ASCII [ISO 646 IRV:1991])
Height	1.17 in. (28 mm)
Length	3.94 in. (100 mm)
Width	1.34 in. (34 mm)
Temperature range	50°F to 104°F (10°C to 40°C)

2. including battery without paper

3. including KISS pump and battery without paper

### Magnetic Card Reader Specifications (cont'd.)

Item	Description
Humidity	10% to 90%
Agency conformance:	Complies with FCC Class A.

## Bar Code Reader

### Bar Code Reader Specifications

Item	Description
Symbologies	Code 39 (extended), PDF-417, Code 128, Data Matrix, Interleaved 2 of 5.
Width	2.02 in. (51.3 mm)
Length	4.26 in. (108.2 mm)
Illumination LEDs	526 nm
Rotational Sensitivity	360 Degrees
Min X Dimension	0.17 mm (6.6 mils)
Reading Distance	Up to 22.6 cm (8.9 in), assuming a 13 mil barcode element
Ambient	Total darkness to 100,000 Lux (sunlight)
Communications	RS-232 up to 115.2K baud
Power Supply	5 VDC +/- 5%
Scanning Current	450 mA
Idle Current	50 mA
Operating Temp	32°F to +122°F (0°C to 50°C)
Storage Temp	-40°F to +158°F (-40°C to +70°C)
Humidity	95%, non-condensing at +50°C (122°F)
Agency compliance	RoHS and WEEE Compliant

## Environmental

### Environmental Specifications

Item	Description
Temperature	
Operating	10° C to 40° C (50° F to 104° F) <sup>4</sup>
Storage	-40° C to 70° C (-40° F to 158° F)*
Relative Humidity	
Operating	20% to 95% RH non-condensing

4. Paper discoloration may occur at higher temperatures

## Environmental Specifications (cont'd.)

Item	Description
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

## Safety

Item	Description
Certification	<ul style="list-style-type: none"> <li>UL 60601-1 classified</li> <li>UL classified for CAN/CSA C22.2 No. 601.1</li> <li>CB certified for IEC 60601-1</li> <li>Meets applicable AAMI EC-11 requirements</li> </ul>
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 Medical Systems Information Technologies. 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 $\mu$ A
Degree of Protection Against Electrical Shock	Type BF defibrillation protection for the patient cable (acquisition module)

Item	Description
Maintenance Frequency	<p>Daily visual inspection and routine cleaning (if needed) performed by user. Use a commercially available, industrial strength disinfectant cleaner on any part of the equipment (other than electrodes) which comes into direct contact with the patient.</p> <p>Every six months routine maintenance checks and test procedures performed by qualified technical personnel.</p>
Repair Guidelines	<p>Calibration instructions, equipment descriptions, and all other information which will assist qualified technical personnel in repairing those parts of the equipment designated as repairable is available in the field service manual for the equipment.</p> <p>We will make available upon request circuit diagrams and component parts lists for printed circuit boards deemed repairable by qualified technical personnel.</p>



# 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
2026799-001	Display Assembly MAC 3500	NEC	—18D	CCFL/CMOS
2026799-002	Display Assembly MAC 3500 AUO LVDS-LED	AUO	-V2	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	✓	✓	✗ <sub>1</sub>
		9D	✓	✓	✓
		9C	✓	✓	✗ <sub>2</sub>
-006	B3	10B	✓	✓	✓
		10A	✓	✓	✗ <sub>1</sub>
		9D	✓	✓	✓
		9C	✓	✓	✗ <sub>2</sub>

<sup>1</sup> 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.

<sup>2</sup> 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 versions 9C or 10A on a device with the 801212-008 main board.







# 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.  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.
RF emissions CISPR11	Class A	
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) for 5 sec	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
<p>Conducted RF EN 61000-4-6</p> <p>Radiated RF EN 61000-4-3</p>	<p>3 Vrms 150 KHz to 80 MHz</p> <p>3 V/m 80 MHz to 2.5 GHz</p>	<p>3 V rms</p> <p>3 V/m</p>	<p>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.</p> $d = 1.2 \sqrt{P}$ <p><math>d = 1.2 \sqrt{P}</math> 80 MHz to 800 MHz</p> <p><math>d = 2.3 \sqrt{P}</math> 800 MHz to 2.5 GHz</p> <p>where <b>P</b> 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).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range.</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 

**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
<b>NOTE:</b> 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
21612113	Electrode Application system KISS, 10 leads without pump
22340305	Patient Trunk cable, 12 wire NEHB, IEC
22341808	Patient Trunk Cable, IEC, 10 Wire
22341809	CABLE TRUNK 10-LEAD MAC500/1200 ML AHA
38401765	SET LEADWIRE 4MM 10/SET IEC
38401766	SET of Electrode Leads (2 pcs) 4 mm, plug (IEC) NEHB, Resistor
38401816	SET LEADW ML 4MM 10-LEAD 0.7M/1.3M IEC
38401817	SET LEADW ML 4MM 10-LEAD 0.7M/1.3M AHA
21612202	Electrode Application system KISS, 12 leads without pump
400073-001	Serial Comm cable 8 pin mini din
900770-001	MAC PAC Battery
416070-001	External Video Cable
700520-002	Analog/TTL Interface cable
405535-006	Power Supply Cord US 13 A 125 V
401855-001	Power Supply Cord European 10 A 250V
401855-002	Power Supply cord British 10 A 250 V
401855-003	Power Supply cord Italian 10 A 250 V
401855-004	Power Supply cord Israeli 10 A 250 V
401855-007	Power Supply cord Swiss 10 A 250 V
401855-008	Power Supply cord Indian 10 A 250V
401855-010	Power Supply cord Australian 10 A 250 V
2005264-XXX	MAC 5000 External Modem Kit
2018626-XXX	MAC 5000 Barcode Scanner Kit
2018627-XXX	MAC 5000 Magnetic Card Reader Kit
2014403-XXX	MAC 5000 Wireless Kit
2023922-XXX	MAC 5000 Secure Wireless Kit







GE Medical Systems  
*Information Technologies, Inc.*  
8200 West Tower Avenue  
Milwaukee, WI 53223 USA  
Tel: +1 414 355 5000  
+1 800 558 5120 (US Only)

GE Medical Systems *Information Technologies, Inc.*, a General Electric Company, going to market as GE Healthcare.

[www.gehealthcare.com](http://www.gehealthcare.com)

