

# Patient Monitor B155M/B125M/B125P/ B105M/B105P

## Technical Manual

Software Version 3.0



*General Electric Company*

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Revision 5  
English  
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# Language Policy

## Language Policy For Service Documentation

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 пациента в резултат на токов удар, 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>如果客户的维修服务人员需要非英文版本，则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服务人员、操作人员或患者造成电击、机械伤害或其他形式的伤害。</li></ul>
警告 (ZH-HK)	<p>本服務手冊僅提供英文版本。</p> <ul style="list-style-type: none"><li>倘若客戶的服務供應商需要英文以外之服務手冊，客戶有責任提供翻譯服務。</li><li>除非已參閱本服務手冊及明白其內容，否則切勿嘗試維修設備。</li><li>不遵從本警告或會令服務供應商、網絡供應商或病人受到觸電、機械性或其他的危險。</li></ul>
警告 (ZH-TW)	<p>本維修手冊僅有英文版。</p> <ul style="list-style-type: none"><li>若客戶的維修廠商需要英文版以外的語言，應由客戶自行提供翻譯服務。</li><li>請勿試圖維修本設備，除非您已查閱並瞭解本維修手冊。</li><li>若未留意本警告，可能導致維修廠商、操作員或病患因觸電、機械或其他危險而受傷。</li></ul>
UPOZORENJE (HR)	<p>Ovaj servisni priručnik dostupan je na engleskom jeziku.</p> <ul style="list-style-type: none"><li>Ako davatelj usluge klijenta treba neki drugi jezik, klijent je dužan osigurati prijevod.</li><li>Ne pokušavajte servisirati opremu ako niste u potpunosti pročitali i razumjeli ovaj servisni priručnik.</li><li>Zanemarite li ovo upozorenje, može doći do ozljede davatelja usluge, operatera ili pacijenta uslijed strujnog udara, mehaničkih ili drugih rizika.</li></ul>
VÝSTRAHA (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 výstrahy může dojít k poranění pracovníka prodejního servisu, obslužného personálu nebo pacientů vlivem elektrického proudu, respektive vlivem mechanických či jiných rizik.</li></ul>
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 uden at læse og forstå denne servicemanual.</li><li>Manglende overholdelse af denne advarsel kan medføre skade på grund af elektrisk stød, mekanisk eller anden fare for teknikeren, operatøren eller patienten.</li></ul>

WAARSCHUWING (NL)	<p>Deze onderhoudshandleiding is enkel in het Engels verkrijgbaar.</p> <ul style="list-style-type: none"> <li>Als het onderhoudspersoneel een andere taal vereist, dan is de klant verantwoordelijk voor de vertaling ervan.</li> <li>Probeer de apparatuur niet te onderhouden alvorens deze onderhoudshandleiding werd geraadpleegd en begrepen is.</li> <li>Indien deze waarschuwing niet wordt opgevolgd, zou het onderhoudspersoneel, de operator of een patiënt gewond kunnen raken als gevolg van een elektrische schok, mechanische of andere gevaren.</li> </ul>
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>
HOIATUS (ET)	<p>See 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 tölkteenuse osutamise eest.</li> <li>Ärge üritage seadmeid teenindada enne eelnevalt käesoleva teenindusjuhendiga tutvumist ja sellest aru saamist.</li> <li>Käesoleva hoiatuse eiramise võib põhjustada teenuseosutaja, operaatori või patsiendi vigastamist elektrilöögi, mehaanilise või muu ohu tagajärvel.</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 tästä varoitusta ei noudata, seurauksena voi olla huoltohenkilöstön, laitteiston käyttäjän tai potilaan vahingoittuminen sähköiskun, mekaanisen vian tai muun vaaratilanteen vuoksi.</li> </ul>
ATTENTION (FR)	<p>Ce manuel d'installation et de maintenance est disponible uniquement en anglais.</p> <ul style="list-style-type: none"> <li>Si le technicien d'un client a besoin de ce manuel dans une langue autre que l'anglais, il incombe au client de le faire traduire.</li> <li>Ne pas tenter d'intervenir sur les équipements tant que ce manuel d'installation et de maintenance 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>
WARNUNG (DE)	<p>Diese Serviceanleitung existiert nur in englischer Sprache.</p> <ul style="list-style-type: none"> <li>Falls ein fremder Kundendienst eine andere Sprache benötigt, ist es Aufgabe des Kunden für eine entsprechende Übersetzung zu sorgen.</li> <li>Versuchen Sie nicht diese Anlage zu warten, ohne diese Serviceanleitung gelesen und verstanden zu haben.</li> <li>Wird diese Warnung nicht beachtet, so kann es zu Verletzungen des Kundendiensttechnikers, des Bedieners oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.</li> </ul>

ΠΡΟΕΙΔΟΠΟΙΗΣΗ (EL)	Το παρόν εγχειρίδιο σέρβις διατίθεται στα αγγλικά μόνο. <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>Μηνεπιχειρήσετε 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>
FIGYELMEZTETÉS (HU)	Ezen karbantartási kézikönyv kizárolag angol nyelven érhető el. <ul style="list-style-type: none"><li>Ha a vevő szolgáltatója angoltól eltérő nyelvre tart igényt, akkor a vevő felelőssége a fordítás elkészítetése.</li><li>Ne próbálja elkezdeni használni a berendezést, amíg a karbantartási kézikönyvben leírtakat nem értelmezték.</li><li>Ezen figyelmezhetőségi figyelmen kívül hagyása a szolgáltató, működtető vagy a beteg áramütés-, mechanikai vagy egyéb veszélyhelyzet miatti sérülését eredményezheti.</li></ul>
ADVÖRUN (IS)	Þessi þjónustuhandbók er aðeins fáanleg á ensku. <ul style="list-style-type: none"><li>Ef að þjónustuveitandi viðskiptamanns þarfnað annas tungumáls en ensku, er það skylda viðskiptamanns að skaffa tungumálaþjónustu.</li><li>Reynið ekki að afgreiða tækið nema að þessi þjónustuhandbók hefur verið skoðuð og skilin.</li><li>Brot á sinna þessari aðvörun getur leitt til meiðsla á þjónustuveitanda, stjórnanda eða sjúklings frá raflosti, vélrænu eða öðrum áhættum.</li></ul>
AVVERTENZA (IT)	Il presente manuale di manutenzione è disponibile soltanto in lingua inglese. <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>Procedere alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto.</li><li>Il mancato rispetto della presente avvertenza potrebbe causare lesioni all'addetto alla manutenzione, all'operatore o ai pazienti provocate da scosse elettriche, urti meccanici o altri rischi.</li></ul>
警告 (JA)	このサービスマニュアルには英語版しかありません。 <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理解せずに、装置のサービスを行わないでください。</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さんが、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>
경고 (KO)	본 서비스 매뉴얼은 영어로만 이용하실 수 있습니다. <ul style="list-style-type: none"><li>고객의 서비스 제공자가 영어 이외의 언어를 요구할 경우, 번역 서비스를 제공하는 것은 고객의 책임입니다.</li><li>본 서비스 매뉴얼을 참조하여 숙지하지 않은 이상 해당 장비를 수리하려고 시도하지 마십시오.</li><li>본 경고 사항에 유의하지 않으면 전기 쇼크, 기계적 위험, 또는 기타 위험으로 인해 서비스 제공자, 사용자 또는 환자에게 부상을 입힐 수 있습니다.</li></ul>
BRĪDINĀJUMS (LV)	Šī apkopes rokasgrāmata ir pieejama tikai angļu valodā. <ul style="list-style-type: none"><li>Ja klienta apkopes sniedzējam nepieciešama informācija citā valodā, klienta pienākums ir nodrošināt tulkojumu.</li><li>Neveiciet aprīkojuma apkopi bez apkopes rokasgrāmatas izlasīšanas un saprašanas.</li><li>Šī brīdinājuma neievērošanas rezultātā var rasties elektriskās strāvas trieciena, mehānisku vai citu faktoru izraisītu traumu risks apkopes sniedzējam, operatoram vai pacientam.</li></ul>

ĮSPĖJIMAS (LT)	<p>Šis eksploatavimo vadovas yra tik anglų kalba.</p> <ul style="list-style-type: none"> <li>Jei kliento paslaugų tiekėjas reikalauja vadovo kita kalba – ne anglų, suteikti vertimo paslaugas pri- valo klientas.</li> <li>Neméginkite atlikti įrangos techninės priežiūros, jei neperskaitėte ar nesupratote šio eksploatavi- mo vadovo.</li> <li>Jei nepaisysite šio įspėjimo, galimi paslaugų tiekėjo, operatoriaus ar paciento sužalojimai dėl elek- tros šoko, mechaninių ar kitų pavojų.</li> </ul>
ADVARSEL (NO)	<p>Denne servicehåndboken finnes bare på engelsk.</p> <ul style="list-style-type: none"> <li>Hvis kundens serviceleverandør har bruk for et annet språk, er det kundens ansvar å sørge for over- settelse.</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 pa- sienten 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 serwisant klienta wymaga języka innego niż angielski, zapewnienie usługi tłumaczenia jest obowiązkiem klienta.</li> <li>Nie próbować serwisować urządzenia bez zapoznania się z niniejszym podręcznikiem serwisowym i zrozumienia go.</li> <li>Niezasłosowanie się do tego ostrzeżenia może doprowadzić do obrażeń serwisanta, operatora lub pacjenta w wyniku porażenia prądem elektrycznym, zagrożenia mechanicznego bądź innego.</li> </ul>
ATENÇÃO (PT-BR)	<p>Este manual de assistência técnica encontra-se disponível unicamente em inglês.</p> <ul style="list-style-type: none"> <li>Se outro serviço de assistência técnica solicitar a tradução deste manual, caberá ao 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>A não observância deste aviso pode ocasionar ferimentos no técnico, operador ou paciente decorrentes de choques elétricos, mecânicos ou outros.</li> </ul>
ATENÇÃO (PT-PT)	<p>Este manual de assistência técnica só se encontra disponível em inglês.</p> <ul style="list-style-type: none"> <li>Se qualquer outro serviço de assistência técnica solicitar este manual noutro idioma, é da respon- sabilidade 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 colocar em perigo a segurança do técnico, operador ou do paciente devido a choques eléctricos, mecânicos ou outros.</li> </ul>
ATENȚIE (RO)	<p>Acest manual de service este disponibil doar în limba engleză.</p> <ul style="list-style-type: none"> <li>Dacă un furnizor de servicii pentru clienți necesita 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 înțelegerei 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>
ОСТОРОЖНО! (RU)	<p>Данное руководство по техническому обслуживанию представлено 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 самостоятельно обеспечить перевод.</li> <li>Перед техническим обслуживанием оборудования обязательно обратитесь к данному руководству и поймите изложенные в нем сведения.</li> <li>Несоблюдение требований данного предупреждения может привести к тому, что специалист по техобслуживанию, оператор или пациент получит удар электрическим током, механическую травму или другое повреждение.</li> </ul>

<b>UPOZORENJE (SR)</b>	Ovo servisno uputstvo je dostupno samo na engleskom jeziku. <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 servisera, rukovaoca ili pacijenta usled strujnog udara ili mehaničkih i drugih opasnosti.</li> </ul>
<b>UPOZORNE- NIE (SK)</b>	Tento návod na obsluhu je k dispozícii len v angličtine. <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, kým si neprečítate návod na obľuhu a neporozumiete mu.</li> <li>Zanedbanie tohto upozornenia môže spôsobiť zranenie poskytovateľa služieb, obsluhujúcej osoby alebo pacienta elektrickým prúdom, mechanické alebo iné ohrozenie.</li> </ul>
<b>ATENCION (ES)</b>	Este manual de servicio sólo existe en inglés. <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>
<b>WARNING (SV)</b>	Den här servicehandboken finns bara tillgänglig på engelska. <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>
<b>OPOZORILO (SL)</b>	Ta servisni priročnik je na voljo samo v angleškem jeziku. <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>
<b>DİKKAT (TR)</b>	Bu servis kılavuzunun sadece İngilizcesi mevcuttur. <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>
<b>ЗАСТЕРЕЖЕННЯ (UK)</b>	Даний посібник з експлуатації доступний тільки англійською мовою. <ul style="list-style-type: none"> <li>Якщо постачальник послуг клієнта спілкується іноземною мовою, тоді клієнт зобов'язаний забезпечити переклад.</li> <li>Заборонено проводити огляд обладнання без попереднього звертання до даного посібника з експлуатації і розуміння інформації, поданої у ньому.</li> <li>Недотримання цього застереження може завдати шкоди здоров'ю постачальника послуг, оператора або пацієнта через ураження електричним струмом, механічну травму або інше ушкодження.</li> </ul>

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## Revision history

Revision	Date	Reason for change
1	2020-01-07	Initial release.
2	2020-04-20	Design change.
3	2020-05-19	Manufacture release.
4	2020-09-08	Update Disassembly, Service parts chapters, and some places of writings.
5	2021-02-04	Update for 802.1x contents, after CPU replacement procedure.

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# About this manual

## Intended use of this manual

As the monitor configuration may vary, some menus, displays and functions described may not be available in the monitor you are using.

This manual contains instructions necessary to install, maintain and service the device to the assembly level. It gives an overview of the patient monitoring system and contains information needed for system installation. Information for the planned and corrective maintenance of the device is also provided.

Use the manual as a guide for installation, maintenance and repairs considered field repairable. Where necessary the manual identifies additional sources of relevant information and technical assistance.

See each module's service manual for introduction, troubleshooting, disassembly and reassembly, service parts section.

See the supplemental information manual for the technical specifications, default settings and compatibility information, including electromagnetic compatibility.

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

## Intended audience of this manual

This manual is intended for service representatives and technical personnel who install, maintain, troubleshoot, or repair this device.

## Manual conventions

This manual uses the following styles to emphasize text or indicate action.

Item	Description
<b>bold</b>	Indicates hardware terms.
<b>bold</b>	Indicates software terms.
<i>italic</i>	Indicates terms for emphasis.
select	The word select means choosing and confirming.
<b>NOTE</b>	Note statements provide application tips or other useful information.

## Acquisition module naming conventions

In this manual, the following naming conventions are used to refer to different modules and module categories:

- E-miniC: Single-width airway module
- E-sCO, E-sCAiO: CARESCAPE respiratory modules
- N-CAiO: Airway Gas Option

- E-modules: All modules with the prefix E-

## Illustrations and names

This manual uses illustrations as examples only. Illustrations in this manual may not necessarily reflect all system settings, features, configurations, or displayed data.

Names of persons, institutions, and places and related information are fictitious; any similarity to actual persons, entities, or places is purely coincidental.

## Related documents

- B155M/B125M/B125P/B105M/B105P Patient Monitor User's Manual
- B155M/B125M/B125P/B105M/B105P Patient Monitor Supplemental Information Manual
- Supplies and accessories
- Service manuals for acquisition modules
- WLAN Deployment Guide
- iCollect user's manual
- CARESCAPE Network Configuration Guide
- CARESCAPE Wireless Network Configuration Guide
- Patient Monitoring Network Configuration Guide
- CIC Pro Clinical Information Center Operator's Manual
- CARESCAPE Central Station User's Manual
- HL7 Reference Manual
- Service for depot instruction

## Accessing manuals online

To access manuals online,

1. Go to <https://www.gehealthcare.com/documentationlibrary>.
2. Enter **Customer Documentation Portal** site.
3. Select **Modality to Monitoring Solutions (MS)** and **Products** to related products you want to search. Launch the search.
4. Identify and download the IFUs.

The IFUs are in PDF format, make sure the device has software to open the PDF files (e.g. Adobe® Acrobat® Reader).

## Accessing manuals on monitor

To access manuals on monitor:

1. Press the **on/off** button (more than 3 seconds) to turn on the monitor.

- 
2. Select  >  **E-Manual.**
  3. Select related manuals.

## Trademarks

GE, GE Monogram, and CARESCAPE are trademarks of General Electric Company.

12RL, DINAMAP, Trim Knob, UNITY NETWORK, D-fend, and Entropy are trademarks of General Electric Company or one of its subsidiaries.

## Third party trademarks

Masimo and SET are trademarks of Masimo Corporation.

Covidien, Nellcor and OxiMax are trademarks of a Medtronic company.

HL7 is a registered trademark of Health Level Seven (HL7), Inc.

All other third-party trademarks are the property of their respective owners.

## Manufacturer responsibility

GE is responsible for the effects on safety, reliability, and performance of the equipment only if:

- Assembly operations, extensions, readjustments, modifications, servicing, or repairs are carried out by authorized service personnel.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

## Product availability

### NOTE

Due to continual product innovation, design and specifications for these products are subject to change without notice.

Some of the products mentioned in this manual may not be available in all countries. Please consult your local representative for the availability.

# Safety

## Safety message signal words

Safety message signal words designate the severity of a potential hazard.

### DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

### WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

### CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

### NOTICE

Indicates a hazardous situation not related to personal injury that, if not avoided, could result in property damage.

## System safety

### WARNING

Do not perform any service activities on the monitor in the patient vicinity while a patient is being connected to the monitor.

### 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 the guidelines regulating the disposal of each product. If you have any questions concerning disposal of a product, please contact GE or its representatives.

For a complete list of system safety messages that apply to the entire system, refer to the user manual. For safety messages specific to parts of the system or to a certain installation or service task, refer to the relevant sections.

## Service requirements

Follow the service requirements listed below.

- Refer servicing of the equipment to qualified service personnel only. Service personnel servicing this product must have an appropriate technical qualification, or equivalent work experience, and be familiar with the service requirements described in this manual and in any related service documentation. Service training for the product is recommended.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to GE or to one of their authorized agents.
- 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 health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

## Equipment symbols

For user interface keys and symbols, please refer to "Monitoring basics" chapter.

	General warning sign.
	Caution. Highlights the fact that there are specific warnings or precautions associated with the device.
	Follow instructions for use.
	Consult operating instructions.
 eIFU indicator	Consult electronic instruction for use.
	Instructions For Use are supplied in electronic format.
	Electrostatic sensitive device. Connections should not be made to this device unless ESD precautionary procedures are followed.

	Non-ionizing electromagnetic radiation. Interference may occur in the vicinity of this device.
	Type BF (IEC 60601-1) protection against electric shock. Isolated (floating) applied part suitable for intentional external and internal application to the patient, excluding direct cardiac application.
	Type BF (IEC 60601-1) defibrillator-proof protection against electric shock. Isolated (floating) applied part suitable for intentional external and internal application to the patient, excluding direct cardiac application.
	Type CF (IEC 60601-1) protection against electric shock. Isolated (floating) applied part suitable for intentional external and internal application to the patient, including direct cardiac application.
	Type CF (IEC 60601-1) defibrillator-proof protection against electric shock. Isolated (floating) applied part suitable for intentional external and internal application to the patient including direct cardiac application.
	Power On/Off key.
	On the front cover: power indicator. On the back cover: alternating current.
	On the front cover: battery indicator. On the side: battery inside.
	Equipotentiality. Connect device to a potential equalization conductor.
X1	Recorder connector.
X3	B1X5-F2 connector (On B1X5-F2 Frame).
X4	Nurse call connector.
X5	Serial port.
X6	Defibrillator connector.
X7	B1X5-F2 connector (On monitor).
	USB connector.

	Ethernet connector.
<b>HDMI</b>	HDMI connector.
	Gas inlet.
	Gas outlet.
	Mini D-fend: Add date.
	Recorder (On B1X5-REC recorder).
	Recorder paper install direction.
	B1X5-F2 communication indicator.
	Fuse. Replace with indentical type and rating fuse (On B1X5-F2 Frame).
<b>IP22</b>	Degree of ingress protection (On monitor).
<b>IP21</b>	Degree of ingress protection (On B1X5-F2 Frame).
 YYYY-MM-DD	Date of manufacture. This symbol indicates the date of manufacture of this device. YY = year, MM = month, DD = day.
	Manufacturer name and address.
<b>REF</b>	Catalogue or orderable part number.
<b>SN</b>	Device serial number.
<b>UDI</b>	Every device has a unique marking for identification. The UDI marking appears on the device label.
	Atmospheric pressure limitations.

	Temperature limitations.
	Humidity limitations.
	Keep dry. Protect from rain.
	Fragile. Handle with care.
	This way up.
	<p>This symbol indicates that the 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.</p> <p>The separate collection symbol is affixed to a battery, or its packaging, to advise you that the battery must be recycled or disposed of in accordance with local or country laws. To minimize potential effects on the environment and human health, it is important that all marked batteries that you remove from the product are properly recycled or disposed. For information on how the battery may be safely removed from the device, please consult the service manual or equipment instructions.</p>
	Recycled materials or may be recycled.
	Recyclable Lithium-Ion.
<b>Rx ONLY U.S.</b>	Prescriptive Device. USA only. For sale by or on the order of a Physician.
<b>EAC</b>	Eurasian Economic Union countries only. Eurasian Conformity mark. Conformity to applicable technical regulations of Customs Union.
	Brazil only. Approved under ANATEL (Agência Nacional de Telecomunicações) requirements.
<b>CMIIT ID</b>	China only. China Ministry of Industry and Information Technology identification number for Radio Transmission Equipment Type Approval.
	Australia and New Zealand only. Regulatory Compliance Mark (RCM). Indicates compliance with electrical safety, EMC, electromagnetic energy, and telecommunications requirements applicable to each product.

	This product is restricted to indoor use, Restricted Member States as below: Belgium (BE), Bulgaria (BG), Czech Republic (CZ), Denmark (DK), Germany (DE), Estonia (EE), Ireland (IE), Greece (EL), Spain (ES), France (FR), Croatia (HR), Italy (IT), Cyprus (CY), Latvia (LV), Lithuania (LT), Luxembourg (LU), Hungary (HU), Malta (MT), Netherlands (NL), Austria (AT), Poland (PL), Portugal (PT), Romania (RO), Slovenia (SI), Slovakia (SK), Finland (FI), Sweden (SE) and United Kingdom (UK).
	Japan only. Approved under Japan TELEC requirements.
	Korea only. Approved under KCC (Korea Communications Commission) requirements. This device has been evaluated to use in a business environment, and there is a risk of radio interference if used in a home environment.
	Philippines only. The product comply the NTC (National Telecommunications Commission) requirements.
	Malaysia only. Malaysian Communication and Multimedia Commission (MCMC) certification mark.
	South Africa only. Approved under ICASA (Independent Communications Authority of South Africa) requirements.
	Brazil only. INMETRO certificate.
	MR Unsafe. Indicates that the device is not intended for use in an MR environment.
	This product is a medical device.

## Unique Device Identifier (UDI)

	Unique Device Identifier. (UDI) Every medical device has a unique marking for identification. The UDI marking appears on the device labeling. Note that this is only an example of a UDI marking. The device may have a DataMatrix code as in this example, or a linear barcode, or only alphanumeric identifiers with no barcode. Also the identifiers vary per product.
--	---

The characters used in the UDI marking represent specific identifiers. In the example above:

Device identifier:

- (01) = GS1 global trade item number (GTIN) of the device.
- 00840682140935 = Global trade item number.

Production identifiers:

- (21) = GS1 application identifier for the serial number of the device.
- VM18294000WA = Serial number.
- (11) = GS1 application identifier for the manufacturing date of the device.
- 180718= Manufacturing date: year-month-day (YYMMDD).

Note that for some product types the production identifier can have other elements instead of the ones listed above:

- (10) = GS1 application identifier for the batch or lot number, followed by the batch or lot number.
- (17) = GS1 application identifier for the expiration date of the device, followed by the expiration date.

# Using service interface

## Using service interface

This chapter introduces the following service interface:

- Service menu on monitor
- Remoter service (InSite RSvP)

## Service menu on monitor

The service menu on monitor covers all service features locally, such as: configuration, calibration and maintenance, software and firmware installation, diagnosis and service log, etc.

**Figure 1 Page 1**



**Figure 2 Page 2**



**NOTE**

The pictures in this chapter are for reference only. Details on the menu page can vary depending on the software version and the configuration of your device.

To access the service menu, select  > **Service** > enter **Username** and **Password** > select **Login**.

For more information on passwords, please refer to "Password management" in "Configuration" chapter.

For more information about local service menu usage, please see related chapters in this manual.

## InSite RSvP

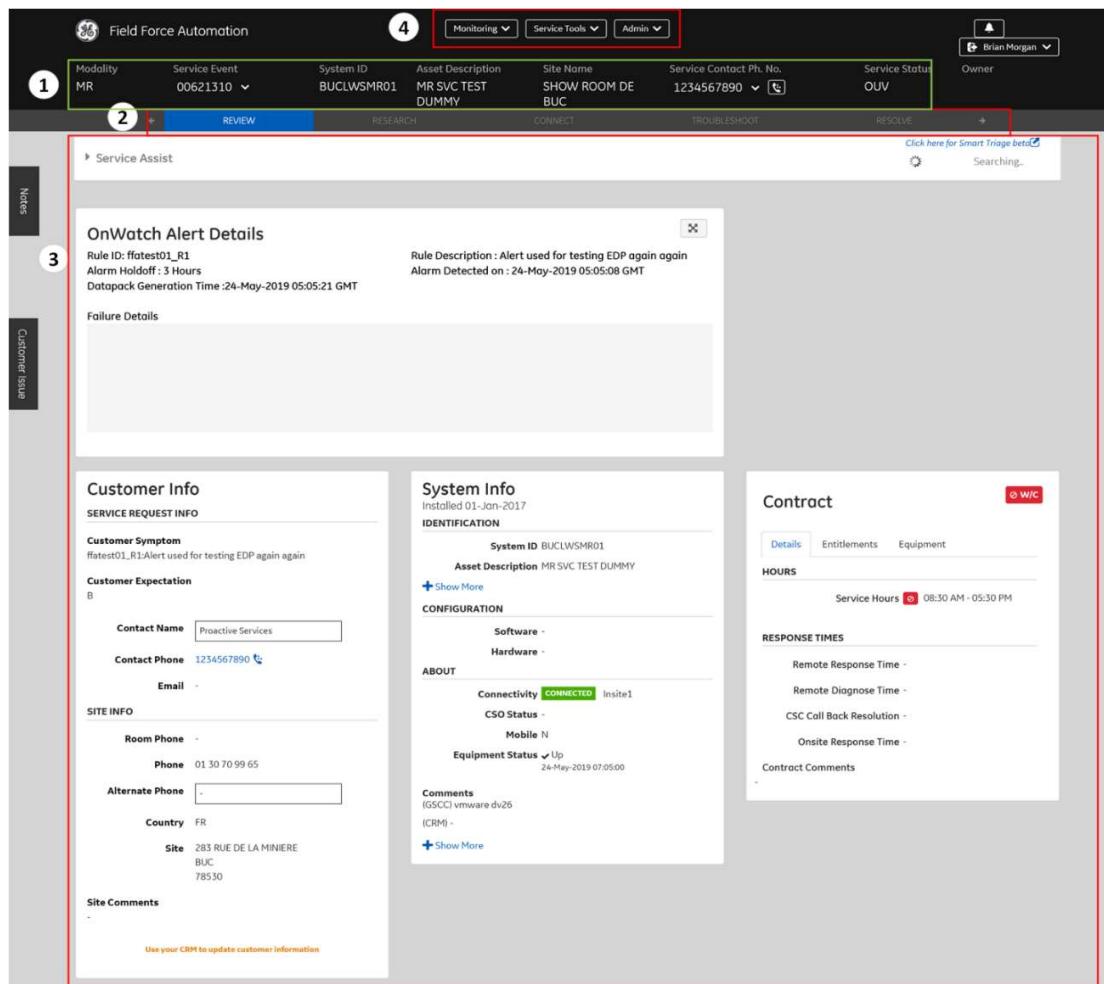
InSite RSvP is the GE remote service platform that provides a set of software applications to manage, diagnose and track systems at customer sites by using the Internet for secure communications between the customer's and GE's firewalls.

InSite RSvP consists of an enterprise server that resides at GE's support center, and a remote service agent that is installed to the monitor. The remote service agent can be configured and enabled using the service interface. Contact GE for more information about the InSite RSvP remote service platform.

## Field Force Automation

Field Force Automation (FFA) is a service platform for supporting the diagnosis and solution of service events remotely.

It integrates machine service data from the many sources you currently use into a single workflow, allowing you to analyze problems and provide solutions fast and easily.

**Figure 3 FFA navigation**

1.	Service Event Information: information about the service event
2.	Workflow Layouts: tabs that “walk you through” the process of handling the service event
3.	Workflow Widgets: little “applications” that show and collect information about the service event
4.	Tool menus: Menus for accessing other applications from FFA

For more information about FFA, please refer to DOC2333725 FFA User's Guide.

## Accessing the remote service with a service PC

### Checking the network settings of the target monitor

1. Select the  >  **Service** > enter **Username** and **Password**.
2. Select **Service** tab > **Network** > **TCP/IP** tab.
3. Check the following settings. Make sure the monitor can be connected to ethernet.
  - **IP Address**

- **Subnet Mask**
  - **Default Gateway**
4. Check the configuration for remote service if it is ok. Refer to [Configuring remote service on page 39](#) for details.

## FFA supported web browser in service PC

- Google Chrome version 35 or later.

**NOTE**

Turn off your popup blocker in Chrome. No Java or X-Windows clients need to be installed.

## Accessing Field Force Automation (FFA) over network with a service PC

FFA is an intranet-based application. You can access FFA from either inside or outside the GE intranet.

For this connection	Use this URL:
Intranet (inside the GE network)	<a href="https://ffa.health.ge.com">https://ffa.health.ge.com</a>
Internet (outside the GE network)	<a href="https://ffagehealthcare.com">https://ffagehealthcare.com</a>

1. Connect a service PC to ethernet.
2. Launch a web browser on the service PC.
3. Login the Field Force Automation (FFA) site.

You log onto FFA as you would log onto any SSO-protected site.

## Using the remote service with a service PC

### Starting an FFA workflow

1. In Google Chrome, navigate to FFA.
2. Select the **Workflow Type** to **Standard**.
3. Enter the target device's **CRM No.** in the **System ID** field.

The **CRM No.** can be found in target monitor:

- a. Select the  >  **Service** > enter **Username** and **Password**.
- b. Select **Service** tab > **Page2** vertical tab > **Remote Service** > **Config** tab.
4. Or, if you already have a Service Request ID, enter it in the **Service Request ID** field and select **Country of System**.
5. Select **Get Started** to launch the workflow.

## Enabling or disabling the remote service connection

You can enable and disable the operation of the remote service agent and connectivity to the GE back office server.

1. Discharge patient in monitor.
2. Select the  >  Service > enter **Username** and **Password**.
3. Select **Service** tab > **Page2** vertical tab > **Remote Service**.
4. Select **Enable** or **Disable**.
5. In FFA, select **CONNECT** tab, in **File Transfer** section, select **Connect** button for **Current User**.
6. Select **Status** tab in monitor, waiting for the status of remote service stable as following:

Item of status	Expected status	Explanation
<b>Running</b>	<b>YES</b>	Monitor has been configured and the process is running.
<b>Registered</b>	<b>YES</b>	Monitor has successfully established an HTTPS connection to the RSvP Enterprise.
<b>CRM Verified</b>	<b>YES</b>	CRM number has been verified that match with the asset record in CRM platform.
<b>Quarantine</b>	<b>NO</b>	There are no two or more systems are establishing connections with the RSvP Enterprise use the same CRM number.
<b>SFTP Active</b>	<b>YES</b>	File transfer connection have been active in FFA.

The symbol  on the upper right corner will turn green when **SFTP Active** is **YES**.

## Transferring logs via InSite RSvP

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Page2** vertical tab > **Remote Service**.
3. Select **Generate Logs**.
4. In FFA, download logs.

## Viewing logs

To view the log files, you need to install the 7-Zip tool in PC.

1. Using 7-Zip to open the related **.7z** or **.tar** file.
2. Using the Notepad to open the detail log files.

# Pre-installation requirements

## Unpacking

### **WARNING**

EXCESSIVE LEAKAGE CURRENT.

If the device has been transported or stored outside operating temperature range allow it to stabilize back to operating temperature range before removing it from the plastic bag.

### **CAUTION**

PACKAGING DISPOSAL.

Dispose of the packaging material, observing the applicable waste control regulations.

1. Confirm that the packing box is undamaged. If the box is damaged, contact the shipper.
2. Open the top of the box and carefully unpack all components.
3. Confirm that all components are undamaged. If any of the components is damaged, contact the shipper.
4. Confirm that all components are included. If any of the components is missing, contact your GE Healthcare distributor.

## Pre-installation checklist

Before you start installing a monitor ensure the following:

- All the system components are compatible.
- The wired and wireless network infrastructure is properly installed, configured and tested.
- Mounting solutions are properly installed.
- The installation site meets power and environmental requirements.

## Checking the compatibility of all system components

### **WARNING**

BEFORE INSTALLATION.

Compatibility is critical to safe and effective use of this device. Verify the compatibility of all system components and device interfaces, including hardware and software versions, prior to installation and use.

Check the compatibility of all the system components before installing the monitor.

1. Pay special attention before installing a new monitor to an existing CARESCAPE network. The compatibility may vary between different hardware and software versions.

2. Refer to Supplies and accessories, for compatible accessories, supplies and mountings.
3. Refer to Supplemental information manual, for compatible devices, including acquisition modules, input-output devices, and network devices.

## Network infrastructure

Ensure that an applicable network infrastructure is in place before the installation of a monitor.

Collect the network configuration information from the hospital IT or the related project documentation and installation files.

## Checking MC Network infrastructure

Before you connect any monitor to a wired network, ensure that the network infrastructure is properly installed, configured and tested. Refer to the CARESCAPE Network Configuration Guide or Patient Monitoring Network Configuration Guide for details.

Contact the hospital IT for the information you need to properly connect and configure the monitor to the network, or optionally familiarize yourself with the network infrastructure design documents:

1. Refer to Configuration chapter in this service manual to find out the information you will need to connect and configure a monitor to operate correctly in the MC Networks.
2. Ensure that the correct wall jacks and network patch cables are in place for the required network connections.
3. Find out if the IEEE 802.1X port based authentication is enabled to the monitor's MC network port at the installation site. If LAN 802.1X is enabled, please get the following information.
  - User name
  - Password
  - Anonymous Identity (optional)

## Checking wireless MC Network infrastructure

Before you connect any monitor to a wireless MC Network, ensure that the wireless network infrastructure is properly installed, configured and tested.

Refer to the 2000716-003 WLAN Configuration Guide and DOC1314463 WLAN Deployment Guide for details.

1. Ensure that the wireless coverage area is adequate for the installation.
2. Collect the required information ready for network configurations: refer to Configuration chapter.

## Checking HL7 Network infrastructure

The HL7 Network infrastructure must be installed according to 2062665-001 HL7 reference manual.

1. Collect the required information ready for network configurations: refer to Configuration chapter.

## Mounting solutions

GE devices provide reliable mounting attachments to the mounts listed in the Supplies and accessories. Follow mount manufacturer instructions for installation and loading.

Ensure that all the needed mounting hardware is properly installed.

## Power and environmental requirements

Check the patient monitor's supplemental information manual for power and environmental requirements.

### Checking power requirements

Ensure that the installation site has hospital-grade grounded power outlets and power cords for all system components.

### Checking environmental requirements

#### **WARNING**

#### INACCURATE RESULTS.

Do not use or store the equipment outside the specified temperature, humidity, or altitude ranges, or outside the specified performance range. Using or storing the equipment outside the specified operating environment or outside the specified performance range may cause inaccurate results.

#### **WARNING**

Environmental conditions may cause inaccurate readings and alarms, decreased perfusion, and/or low signal strength of SpO<sub>2</sub>:

Electromagnetic interference

Excessive ambient light

Electrical interference

Electrosurgery

Defibrillation - May cause inaccurate reading for a short amount of time.

Excessive patient/sensor motion. Artifact can simulate an SpO<sub>2</sub> reading, so that the device fails to sound an alarm. In order to ensure reliable patient monitoring, the proper application of the probe and the signal quality must be checked at regular intervals.

1. Install the monitor to a location that meets the specified environmental requirements of operating temperature, humidity and atmospheric pressure.
2. Place each device in a location with sufficient ventilation. Observe the ventilation openings of a device and make sure not to obstruct them.

### EMC warnings

#### **WARNING**

Other equipment may interfere with the system, even if that other equipment complies with CISPR emission requirements.

**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.

**WARNING**

Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless electrostatic discharge (ESD) precautions are used.

**WARNING**

Do not use the device in high electromagnetic fields (for example, during magnetic resonance imaging).

**WARNING**

EMC.

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 monitor comply with the relevant EMC requirements. X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation. Changes or modifications to this device/system not expressly approved by GE may cause EMC issues with this or other equipment. This device/system is designed and tested to comply with applicable standards and regulations regarding EMC and needs to be installed and put into service according to the EMC information stated as follows: This device/system 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. Mains power should be that of a typical commercial or hospital environment. Device is compliant to Class A.

**WARNING**

The device/system should not be used adjacent to, or stacked with, other equipment. Consult qualified personnel regarding device/system configuration.

**WARNING**

DEGRADED PERFORMANCE.

Do not use portable RF communications equipment (including peripherals such as antenna cables and external antennas) closer than 30 cm (12 inches) to any part of this device/system, including cables specified by the manufacturer. Otherwise, the performance of this device/system may degrade.

## EMC cautions

### **CAUTION**

Use of known RF sources, such as cell/portable phones, RFID, electronic article surveillance (EAS) systems, diathermy, or other radio frequency (RF) emitting equipment near the system may cause unexpected or adverse operation of this device/system. Consult qualified personnel regarding device/system configuration.

### **CAUTION**

Changes or modifications to this device/system not expressly approved by GE may cause EMC issues with this or other equipment.

# Hardware installation

## Hardware installation

### **WARNING**

PERSONAL INJURY.

To avoid personal injury to users or any other persons moving in the vicinity of the cables or tubing, route all cables and tubing in such a way that they do not present a tripping hazard.

### **WARNING**

EXPLOSION.

Do not use this system in the presence of flammable anesthetics, vapors or liquids.

### **WARNING**

After transferring or reinstalling the device, always check that it is properly connected and all parts are securely attached.

### **WARNING**

If you accidentally drop the monitor, modules, or frame, have it checked by authorized service personnel prior to clinical use.

### **WARNING**

EXCESSIVE TOUCH CURRENT.

To avoid excessive patient leakage current, do not simultaneously touch the patient and the electrical connectors in the monitor, or within the module housing or frame.

### **CAUTION**

LOSS OF MONITORING.

Leave space for circulation of air to prevent the device from overheating. The manufacturer is not responsible for damage to device caused by improperly vented cabinets, improper or faulty power, or insufficient wall strength to support device mounted on such walls.

### **WARNING**

Never install equipment above the patient.

## Mounting the monitor and frame

For the monitor, please install the mounting plate first to facilitate mounting options.

The frame have the integrated GCX mounting plate. You also can install the L-type mounting plate to the B1X5-F2 frame, to apply to more frame mounting options.

Refer to the Supplies and accessories for details of the compatible mountings for the patient monitor and frame.

**Figure 4 Samples of mounting**



Install the monitor and frame to the mounting hardware according to the instructions provided by mounting manufacturer.

### Required tool for install mounting plate

- Insulated PH2 screwdriver.

## Installing mounting plate to monitor

1. Remove 4 screws from bottom of the monitor.
2. Put the mounting plate on the bottom of the monitor, install 4 screws.

### NOTE

Please use the long screws delivered with mounting plate, but not the original monitor's screws.



## Installing L-type mounting plate to B1X5-F2 Frame

1. Put the L-type mounting plate to the bottom of the B1X5-F2 Frame, install 4 screws.



## Connecting a display

### NOTE

All installations must be compliant with IEC 60601-1 clause 16 and local electrical codes.

### NOTE

Make sure that all cables are securely connected.

You can connect one secondary, clone display to the monitor.

1. Check the compatibility of the display.  
The resolution of the external display should be 1280\*800 or 1366\*768.
2. Ensure that the display is installed to the mounting hardware according to the installation instructions included with the mounting hardware.
3. Refer to the display's user manual for more information about the display installation.

## Connecting B1X5-F2 module

1. Using the F2 connector line, connect **X3** and **X7**.
2. Using power cord connect B1X5-F2 to the wall outlet.
3. Check whether power LED lit .
4. Turn on the monitor, check whether communication LED lit .



## Connecting E-module

To use the E-module, your device need to be pre-configured with the integrated rack or connect the B1X5-F2 frame.

1. With the module properly oriented (module release latch facing down), align the insertion guide slot in the module with the insertion guide in the rack or frame.
2. Push the module into the rack or frame until it clicks.

## Connecting the B1X5-REC recorder

Please make sure the monitor is pre-configured with recorder fixing plate.

1. Using the recorder connector line, connect the recorder connector to **X1**.
2. When the monitor is power on, make sure the power indicator on recorder is lit.



## Inserting the B1X5-REC recorder

1. Align the recorder to the insertion guides.
2. Push down the recorder until it clicks.

## Connecting to the mains power

1. Connect power cords to the mains power supply inlet and to a wall outlet on all system components that require AC mains power input.
2. Secure all power cords by routing through the retaining clips or cable clamps, as applicable.

### NOTE

Before taking the monitor into use for first time, the battery should be fully charged. Keep the monitor connected to the mains until the battery charge symbol disappears.

## Connecting network

### Network compatibility

The monitor has been verified to be compatible with CARESCAPE\* Network environment.

The monitor is capable of EMR connectivity. The monitor HL7 (Health Level Seven) message is compliant with the IHE PCD-01 OBR/OBX format. There are two ways to acquire trended vital sign data from the monitor:

- HL7 directly from the monitor

- HL7 from the CARESCAPE Gateway

On the CARESCAPE network,

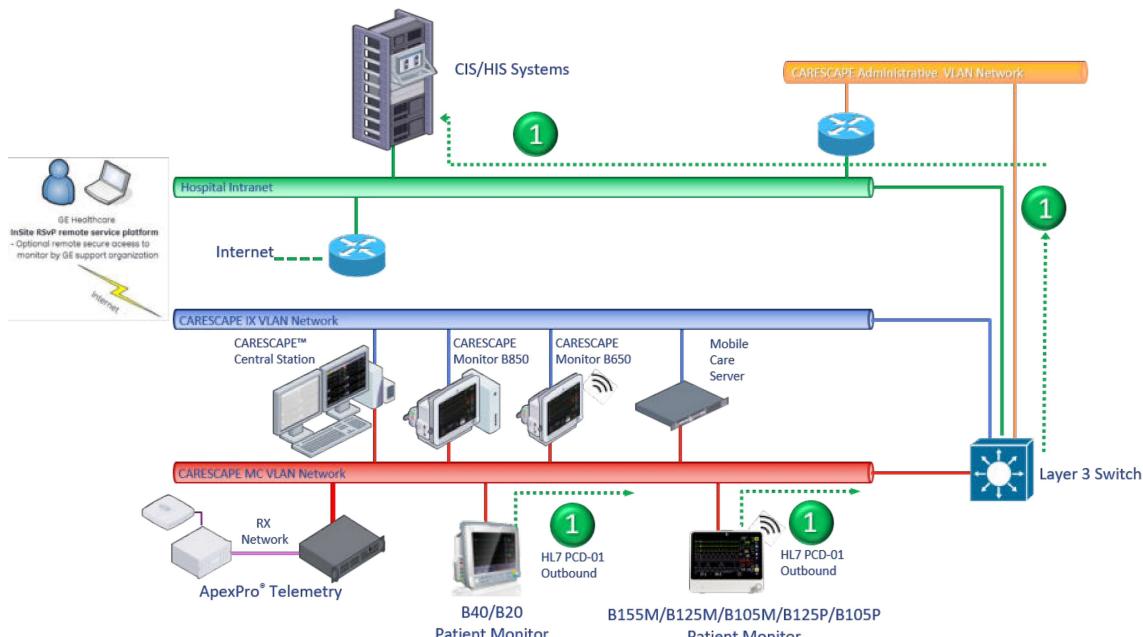
- The monitor is compatible with the following devices:
  - CARESCAPE Central Station v1, v2, and v2.1
  - CARESCAPE Gateway v2
  - Mobile Care Server v6.3
  - CARESCAPE CIC Pro Clinical Information Center v5.1
  - CARESCAPE Bridge v1
- The monitor can communicate with the following bedside monitors:
  - B155M/B125M/B125P/B105M/B105P VSP3.0
- The monitor supports maximum 1024 devices in MC network.
- The monitor can simultaneously respond with:
  - 10 views on the wireless network
  - 16 views on the wired network

#### NOTE

When the monitor **Radio Enable** in the service menu is set to **Disabled**, the monitor won't automatically allow 16 views. To switch to 16 views support, the WLAN license needs to be inactive.

## Network diagram

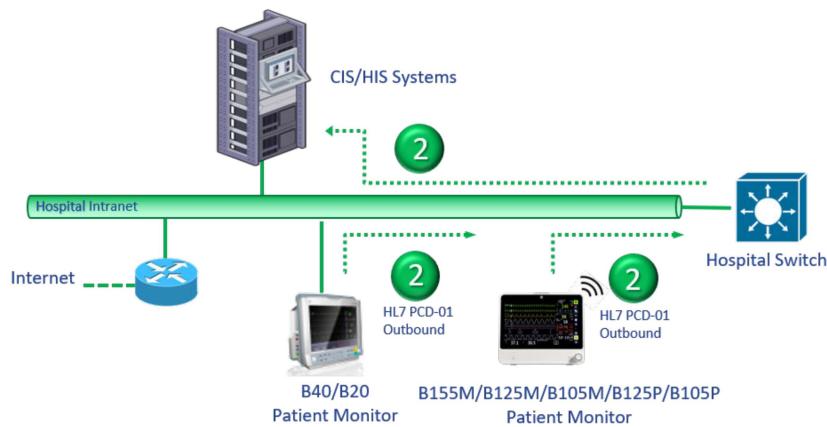
**Figure 5 CARESCAPE Network**



- HL7 outbound and InSite RSvP from monitor though CNI V2 switch.

**NOTE**

- Need unity network, HL7 network, and remote service license.

**Figure 6 Hospital Network**

- HL7 outbound from monitor though hospital switch.

**NOTE**

- Need HL7 network license.

**Connecting to the MC Network**

Tools needed: a MC Network patch cable.

1. Connect the one RJ-45 connector to the network port on the patient monitor.
2. Connect the other RJ-45 connector to the corresponding port on the wall-box.
3. Turn on the monitor and setup the network configuration, if needed.
4. Check that the network symbol and message **Network made** are displayed on the screen.

**Connecting iCollect**

iCollect and other data acquisition systems can be connected to serial port of the monitor, please check your device's configuration, whether have serial port.

Tools needed:

- 9 pin serial port connect line
1. Using 9 pin serial port connect line to connect the monitor and PC.

**NOTE**

Refer to the iCollect User's Manual for more information about the iCollect.

**After hardware installation**

After hardware installation, please:

- Perform installation checkout: refer to Chapter: Installation check
- Configure the monitor: refer to Chapter: Configuration

# Configuration

## Platform Configuration

The configuration of a monitor consists of platform configuration and clinical configuration.

This chapter describes:

- How to configure the platform ready to take the monitor into use for the first time.
- The configuration tasks need for administration and maintenance.

For information on how to perform the clinical configuration, including modes' settings, refer to the monitor's Supplemental Information Manual.

## Password management

### Setup password at first time to use

When first time turn on the monitor, the password setup wizard will be displayed on the screen. You need to setup all the monitor's passwords.

There are 2 ways to setup password: from USB disk to import setting file, or setup manually.

#### Import settings from USB at first time to use

The setting file can be exported from other monitor, refer to [Exporting settings on page 41](#).

1. Select **Settings Activation from USB Disk** tab.
2. Select the related setting file from **Setting Files** list.
3. Enter the decryption **Key for the File**.
4. Select **Activate & Restart**.

The monitor's settings and password have been setup, and the monitor will restart.

#### Setup password manually

1. Select **Set Password Manually** tab.
2. Enter and retype the passwords for **clinical** and **service**.  
The passwords are case sensitive. 8 digits at least.
3. If necessary, select the checkbox, and select the value for **Password expired duration(month)**.  
You have to change passwords after the month you selected.
4. If necessary, export password recovery key:  
The recovery key is used to reset password when you forget.

**NOTE**

Make sure the file system format for USB storage device should be FAT32.

- a. Insert USB disk to monitor.
  - b. Select the checkbox **Export Password Recovery Key to USB Disk**
5. Select **Activate & Restart**.

The password have been setup, and the monitor will restart.

## Changing passwords

Each account can change the password for itself and the lower level access.

**NOTE**

Username and password are case sensitive. You can view and change **Password Policy**.

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Change Password**.
3. Select **clinical** or **service** radio button as required.
4. Enter and retype the new passwords, then select **Confirm**.

## Setup the password policy

You can setup the password policy to enhance the security of the device.

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Change Password** > **Password Policy**
3. Setup the following items for **Basic Policy**, if necessary.
  - **Password Minimum Length**: Configure minimum allowed password length.
  - **Uppercase characters Minimum number**: Configure minimum number of uppercase letters (A ~ Z) in password.
  - **Lowercase characters Minimum number**: Configure minimum number of lowercase letters (a ~ z) in password.
  - **Digit Minimum number**: Configure minimum number of numeric characters (0 ~ 9) in password.
  - **Special characters Minimum number**: Configure minimum number of special characters in password.
4. Select **Advanced Policy** tab, select the check box and setup the following items, if necessary.
  - **Maximum repeating character length**: Configure number of forbidden repeated characters in password.
  - **Maximum monotonic sequence length**: Configure number of forbidden sequential characters in password.
  - **Password history**: Configure number of historical passwords be checked when set new password.
  - **Maximum error attempts**: Configure password lockout attempts. The username will be locked after error attempts reach the setup time.

- **Password expired duration(month):** Configure password lifetime duration.

## Bad password

When you set password, please avoid to use bad password as follow:

- **BAD PASSWORD: It is too simple**, for example "12345678"
- **BAD PASSWORD: It is based on a word in the forbidden list**, for example "Change Me", "Password"
- **BAD PASSWORD: It contains less than 5 different characters**, for example "aaaaaaaa"

## Password expired

After password expired, if user try to use old password **Login**, the monitor will go to **Change Password** menu automatically.

To change password is the necessary process. It is recommended you to change password immediately.

### NOTE

If give up to change password, user still can return back to the normal screen. But can't enter into **clinical** or **service** menu.

## Generate and export recovery key

You can generate and export the recovery key to USB disk. The recovery key is used to reset password when you forget.

### NOTE

Make sure the file system format for USB storage device should be FAT32.

1. Insert the USB disk to monitor.
2. Select the  >  **Service** > enter **Username** and **Password**.
3. Select **Change Password** > **Generate Recovery Key**.
4. Select **Generate**.

The recovery key have been generated and export to USB disk.

## Reset passwords

You can reset the password when forget. There two ways for resetting passwords:

- Via activation code, which contact GE service to get
- Via recovery key, which saved in USB disk

## Resetting password via activation code

1. Connect GE service to get the Expiration Date and Activation Code.
2. Select the  >  **Service** > enter **Username** and **Password**.
3. Select **Reset Password**.
4. Enter the **Expiration Date (YYYYMMDD)** and **Activation Code**.
5. Select **Confirm**.

Enter to **Change Password** menu to setup new password.

## Resetting password via recovery key in USB

If you have generated recovery key in USB before. You can use the recovery key to reset password.

1. Insert USB disk with recovery key files to the monitor.

2. Select the  >  Service > enter **Username** and **Password**.
3. Select **Reset Password**.
4. Select **Confirm** in Option 2 section.

Enter to **Change Password** menu to setup new password.

## Configuring wired CARESCAPE Network

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Network**.
3. Setup below items for **Network Config**, then select **Save Changes**.
  - a. Enter **Unit Name**.
  - b. Enter **Bed Name**.
  - c. Enter **MCS IP Address** to setup the Mobile Care Server's IP address which monitor will talk to.
4. Select **TCP/IP** tab.
5. Setup below items for TCP/IP Configuration, then select **Save Changes**.
  - a. Enter a **IP Address**.
  - b. Enter a valid **Subnet Mask** level.
  - c. Enter a valid **Default Gateway**.
  - d. Select the applicable **Speed and Duplex** option.

### NOTE

The monitors can't be as the Time Master, don't setup monitors with the highest IP address in CARESCAPE network.

The network configurations will be saved and active when the patient monitor is restarted.

## Configuring LAN 802.1X

If IEEE 802.1X port based authentication is in use for accessing network. Please consult hospital IT for the required information.

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Network** > **TCP/IP** tab > **LAN 802.1X** vertical tab.
3. Select check box for **Enable 802.1X**.
4. Select the **EAP Method**.
5. If **EAP Method** is **PEAP-MSCHAPV2**, setup following settings and select **Save**.

Item	Description	Comments
<b>Username</b> <b>Password</b>	Enter the user name and password at network <b>LAN 802.1X</b> menu.	Necessary. The username and password should be provided by hospital IT.
check box <b>Verify Server Certificate</b> <b>CA Certificate</b>	1. Enable to verify CA (Certificate Authority) Certificate. 2. Select one CA Certificate.	Optional Import the CA Certificate to monitor first, via USB disk. The CA certificate should be provided by hospital IT. For more information, see <a href="#">Importing CA Certificate to the monitor on page 37</a> .
check box <b>Enable Anonymous ID</b> <b>Anonymous ID</b>	1. Select check box <b>Enable Anonymous ID</b> . 2. Enter an <b>Anonymous ID</b> .	Optional The Anonymous ID is used as the unencrypted identity with EAP types that support a different tunneled identity. The Anonymous ID is provided by hospital IT.

6. If **EAP Method** is **EAP-TLS**, setup following settings and select **Save**.

Item	Description	Comments
<b>Client Certificate</b> <b>Identity</b> <b>Private Key</b> <b>Private Key Password</b>	1. Enter the <b>Identity</b> . 2. Select one <b>Client Certificate</b> . 3. The <b>Private Key</b> will be automatically filled in blank. 4. Enter the <b>Private Key Password</b> if have.	Necessary Generate Client Certificate, and Private key first. 1. The monitor generates Certificate Signing Request (CSR), Private key, and Private Key Password (if required). 2. Export the CSR files to USB disk, and deliver to hospital IT. 3. Hospital IT generates the Client Certificate and save back to the USB disk. 4. Import the Client Certificate to monitor. For more information, see: <ul style="list-style-type: none"><li>• <a href="#">Generating and importing the Client Certificate on page 37</a></li><li>• <a href="#">Importing CA Certificate to the monitor on page 37</a></li></ul>
check box <b>Verify Server Certificate</b> <b>CA Certificate</b>	1. Enable to verify CA (Certificate Authority) Certificate. 2. Select one CA Certificate.	Optional Import the CA Certificate to monitor first, via USB disk. The CA certificate should be provided by hospital IT. For more information, see <a href="#">Importing CA Certificate to the monitor on page 37</a> .

## Configuring HL7 Network

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Network** > **HL7 Config** tab.
3. Setup below items, then select **Save Changes**.
  - a. Enter **HL7 Receiver Ip** for HL7 receiver IP address.
  - b. Enter **HL7 Receiver Port** for HL7 receiver port.
  - c. Select values for **HL7 Interval**.
  - d. Select the **HL7 Patient Class**.

## Configuring iCollect serial port

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Network** > **S/5 Serial Config** tab.
3. Select a value for **Bits per second**.

## Configuring wireless CARESCAPE Network

### Configuring wireless network via USB disk

You can export/import the monitor settings via USB disk. This way can transfer most of the network settings, but you still need to check and adjust some settings manually, such as **SSID** and **Security Key**. Please refer to following sections for details.

- [Exporting settings on page 41](#)
- [Importing settings on page 41](#)
- [Configuring wireless Network basic settings manually on page 33](#)
- [Configuring wireless network advanced settings manually on page 36](#)

The second way to import wireless network settings, is to use WLAN configuration files. The WLAN configuration files are created by hospital IT and saved to the USB disk.

#### NOTE

Make sure the file system format for USB storage device should be FAT32.

#### NOTE

The WLAN configuration files should be stored in the following path on the USB disk: /B1x5/v2/wlancfg/.

Please refer to following steps to configure WLAN settings.

1. Insert the USB disk to the monitor.
2. Select the  >  Service > enter **Username** and **Password**.

3. Select the **Service** tab > **Page2** vertical tab > **WLAN Config**.
4. Select the **Advanced** tab > **USB Disk**.
5. Select the WLAN configuration files, and **Import WLAN Config**.
6. Return back, and select the **Basic** tab.
7. Select **Use File Config** check box.
8. Select **Config File** and **Apply**.

## Configuring wireless Network basic settings manually

1. Select the  >  **Service** > enter **Username** and **Password**.
2. Select the **Service** tab > **Page2** vertical tab > **WLAN Config** > **Manual Config**.
3. Select **Radio** tab. Configure the following settings, and then select **Apply**.

Item	Description	Comments
<b>Radio Enabled</b>	Enable/disable the WLAN radio.	
<b>SSID</b>	Enter the Service Set Identifier (SSID), also known as the network name.	The SSID of the wireless client must match the SSID of the wireless infrastructure. A valid SSID includes up to 32 case-sensitive ASCII characters, including space (ASCII decimal 32 to 126).
Adjust the following settings if needed.		
<b>Frequency Band</b>	Select the frequency band for the WLAN radio: <ul style="list-style-type: none"> <li>• 2.4 GHz</li> <li>• 5 GHz</li> <li>• 2.4 and 5 GHz</li> </ul>	The WLAN radio can communicate on the following frequency bands, protocols and data rates: <ul style="list-style-type: none"> <li>• 2.4 GHz, IEEE 802.11b, up to 11 Mbps</li> <li>• 2.4 GHz, IEEE 802.11g, up to 54 Mbps</li> <li>• 5 GHz, IEEE 802.11a, up to 54 Mbps</li> <li>• 2.4 and 5 GHz, IEEE 802.11n, up to 150 Mbps</li> </ul>
<b>Roaming Aggressiveness</b>	Select the background scan cycle: <ul style="list-style-type: none"> <li>• OFF</li> <li>• Low</li> <li>• Medium</li> <li>• High</li> </ul>	<ul style="list-style-type: none"> <li>• OFF: scanning is disabled.</li> <li>• Low: when rssi &gt; -65 dBm, one scan will occur every 5 seconds; when the RSSI is &lt; -65 dBm, one scan will occur every 2 seconds.</li> <li>• Medium:when the RSSI is &gt; -55 dBm,one scan will occur every 5 seconds; when the RSSI is &lt; -55 dBm, one scan will occur every 2 seconds.</li> <li>• High:when the RSSI is &gt; -45 dBm, one scan will occur every 5 seconds;when the RSSI is &lt;-45 dBm, one scan will occur every 2 seconds.</li> </ul>

Item	Description	Comments
<b>Safe Mode</b>	Enable/disable safe mode.	When safe mode is enabled, the monitor will only perform passive scans of all supported channels.
<b>Select Channel</b>	Select channels for <b>2.4 GHz or 5 GHz</b> .	The patient monitor supports IEEE 802.11d specifications. By factory default, all supported wireless channels are enabled. This means that the patient monitor can use any of the wireless channels that are allowed in the country of operation. Use this submenu only if further restriction of wireless channels is required to reduce the scanning time and improve roaming performance. Please consult with the IT department to determine which channels are in use.

4. Select **Security** tab. Setup the following settings, and select **Apply**.

Item	Description	Comments
<b>Security</b>	Choose the confidentiality method. <ul style="list-style-type: none"> <li>• Open</li> <li>• WPA-Personal</li> <li>• WPA2-Personal</li> <li>• WPA-Enterprise</li> <li>• WPA2-Enterprise</li> </ul>	
<b>Encryption</b>	Choose the Encryption method. <ul style="list-style-type: none"> <li>• TKIP</li> <li>• AES-CCMP</li> </ul>	Please consult Hospital IT for the required Encryption.
<b>Security Key and HEX</b>	Enter the Wi-Fi security password. Select <b>HEX</b> to use HEX string for the password.	Only available when security is <b>WPA-Personal</b> , or <b>WPA2-Personal</b> . The valid security key should be 8-63 ASCII case-sensitive characters (ASCII decimal 32 to 126), or 64 HEX characters (0-9 and A-F), if HEX have been selected. Please consult Hospital IT for the security key.
<b>EAP method</b>	Select the Extensible Authentication Protocol (EAP) method: <ul style="list-style-type: none"> <li>• EAP-TLS</li> <li>• TTLS-MSCHAPv2</li> <li>• PEAP-MSCHAPv2</li> <li>• PEAP-GTC</li> </ul>	Only available when Authentication is <b>WPA-Enterprise</b> , or <b>WPA2-Enterprise</b> . The selected EAP method may require the use of certificates (e.g. EAP-TLS). Please consult Hospital IT for the required EAP method.
<b>User Name and Password</b>	Enter the User Name and Password.	Only available when Authentication is <b>WPA-Enterprise</b> , or <b>WPA2-Enterprise</b> . Please consult Hospital IT for the required User Name and password.

Item	Description	Comments
<b>Select Certificate</b>	<ul style="list-style-type: none"> <li>Enable certificates if required.</li> <li>Select the certificate from USB storage device, or enter the password/identity.</li> </ul>	Refer to the table below for details.
<b>Enable 802.11r</b>	Enable/disable fast roaming.	Roaming performance can be negatively impacted (e.g. additional waveform dropout) when using non-fast roaming supported security methods (e.g. WPA-Enterprise).

**Table 1 Certificate Select**

Item	Description	Comments
<b>Enable CA Certificate</b> <b>Select CA Certificate</b>	<ol style="list-style-type: none"> <li>Enable to verify CA (Certificate Authority) Certificate.</li> <li>Select one CA Certificate.</li> </ol>	Import the CA Certificate to monitor first, via USB disk. The CA certificate should be provided by hospital IT. For more information, see <a href="#">Importing CA Certificate to the monitor on page 37</a> .
<b>Enable Client Certificate</b> <b>Select Client Certificate</b> <b>Enable Private Key</b> <b>Private key</b> <b>Enable Key Password</b> <b>Enter Private Key Password</b>	<ol style="list-style-type: none"> <li>Enable to verify Client Certificate</li> <li>Select one Client Certificate</li> <li>Enable the Private key.</li> <li>The Private key will be automatically filled in blank.</li> <li>Enter the Private key password if have.</li> <li>Enter the Private key password.</li> </ol>	Generate Client Certificate, and Private key first. <ol style="list-style-type: none"> <li>The monitor generates Certificate Signing Request (CSR), Private key, and Private Key Password (if required).</li> <li>Export the CSR files to USB disk, and deliver to hospital IT.</li> <li>Hospital IT generates the Client Certificate and save back to the USB disk.</li> <li>Import the Client Certificate to monitor.</li> </ol> For more information, see: <ul style="list-style-type: none"> <li><a href="#">Generating and importing the Client Certificate on page 37</a></li> <li><a href="#">Importing CA Certificate to the monitor on page 37</a></li> </ul>
<b>Enable Anonymous Identity</b> <b>Enter Anonymous Identity</b>	<ol style="list-style-type: none"> <li>Enable the Anonymous access.</li> <li>Enter an Anonymous Identity.</li> </ol>	The Anonymous ID is used as the unencrypted identity with EAP types that support a different tunneled identity. The Anonymous ID is provided by hospital IT.
<b>Enable Fast Reauth</b>	Enable the Fast Reauth.	This feature speeds up the authentication process for EAP methods that support it.

Select **Apply** after certificate selecting.

## Configuring wireless network advanced settings manually

The advanced settings are optional to configure.

1. Select the  >  **Service** > enter **Username** and **Password**.
2. Select the **Service** tab > **Page2** vertical tab > **WLAN Config** > **Advanced** tab.
3. Select the **QoS**. Configure the following settings, and select **Apply**.

Item	Description	Comments
<b>Real-Time Clinical Data DSCP</b>	Enter the DSCP marking to tag outgoing packets: real-time clinical information (waveforms, parameters, alarms), real-time network control information (time).	Recommended value is 46. Range is 32 to 47.
<b>Non-Real Time Clinical Data DSCP</b>	Enter the DSCP marking to tag outgoing non-real-time clinical decision support information (admission, histories, full disclosure, printing).	Recommended value is 0. Range is 0 to 7.
<b>Non-Real Time Non-Clinical Data DSCP</b>	Enter the DSCP marking to tag outgoing packets: non-real-time non-clinical decision support information (service, in-site).	Recommended value is 8. Range is 8 to 23.
<b>RTS Threshold</b>	Configure the RTS Threshold value.	Use the default RTS Threshold value, unless otherwise specified in the wireless network design. A valid RTS Threshold is a numeric value within the range of 64 to 2347.
<b>Fragmentation Threshold</b>	Configure the Fragmentation Threshold value.	Fragmentation Threshold specifies the maximum frame size a wireless device can transmit without fragmenting the frame. Use the default Fragmentation Threshold value, unless otherwise specified in the wireless network design. A valid Fragmentation Threshold is a numeric value within the range of 64 to 2346.

4. Back to the previous menu, select the **Antenna Config**. Setup the following settings, and select **Apply**

Item	Description	Comments
<b>Antenna</b>	Configure the antenna configuration. <ul style="list-style-type: none"> <li>• 2.4G Primary Only, 5G Primary Only</li> <li>• 2.4G Primary &amp; Secondary, 5G Primary Only</li> <li>• 2.4G Primary &amp; Secondary, 5G Primary &amp; Secondary</li> </ul>	The antenna configuration options are: <ul style="list-style-type: none"> <li>• Primary antenna only in 2.4G and 5G frequency band</li> <li>• Primary and Secondary antenna worked in the same time in 2.4G frequency band, primary antenna only in 5G frequency band</li> <li>• Primary and Secondary antenna worked in the same time in 2.4G and 5G frequency band</li> </ul>

5. Restart the monitor.

## Certificate build up and import

### Generating and importing the Client Certificate

You can generate the Client Certificate and Private key. The Client Certificate should be imported to monitor before using.

1. Create the Certificate Signing Request (CSR), Private key, and Private key password, if required.

- a. Select the  > **Service** > enter **Username** and **Password**.
- b. Select the **Service** tab > **Page2** vertical tab > **Certificate** > **Security Build**.
- c. Select the **Algorithm** for Private key.
- d. If needed, select **Enable Password** and enter the **Password** for Private key.

**NOTE**

Remember to recorder the password for the Private key. When configuring the certificate, this Private key password need to be entered.

- e. Select **Create** to create the Private key.
- f. Select **CSR** tab, enter the related information, which should be provided by hospital IT.

**NOTE**

This tab is available only when the Private key has been created.

- g. Select **Create** to create the CSR.

2. Export the CSR files to USB disk.

- a. Insert the USB disk to monitor.

**NOTE**

Make sure the file system format for USB storage device should be FAT32.

- b. Return to **Certificate** menu.

- c. Select **Export CSR**.

3. Deliver the CSR files to hospital IT, they generate the Client Certificate and save back to the USB disk.

4. Import the Client Certificate to the monitor.

- a. Insert the USB disk with Client Certificate to the monitor.

- b. Go to **Certificate** menu of the monitor.

- c. Select the related Client Certificate, select **Import Certificate**.

### Importing CA Certificate to the monitor

The CA Certificate is provided by hospital IT. They saved the CA Certificate to the USB disk.

**NOTE**

Make sure the file system format for USB storage device should be FAT32.

**NOTE**

The Certificate files should be stored in following path in USB disk: /B1x5/v2/ss1/certs/.

1. Insert the USB disk to the monitor.
2. Select the  >  Service > enter **Username** and **Password**.
3. Select the **Service** tab > **Page2** vertical tab > **Certificate**.
4. Select the related CA Certificate file, select **Import Certificate**.

## Setting time and date

**NOTE**

The monitor can't be the TIME MASTER in network. If the monitor is connected to the network, it follows the Central Station's time settings and the **Time and Date** is gray.

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Clinical** tab > **Time and Date**.
3. Set up following items, then select **Confirm**.
  - **Hour**
  - **Minutes**
  - **Year**
  - **Month**
  - **Day**
4. Select **Time Format** tab, and select the **Time Format**, if needed.

The manual time configuration takes effect immediately.

## Setting time zone

The **Time Zone** is enable only when the monitor is not connected to the network and patient is discharged.

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Clinical** tab > **Time Zone**.
3. Select **Daylight Savings** settings.
4. Select **DST adjustment** tab to adjust Daylight Savings Time.
5. Select **Time Source** tab to setup time sync source.
6. Select **NTP Config** tab to setup Network Time Protocol settings

For more details, see Supplemental Information Manual.

## Setting national requirements

Activate France specific defaults for the ECG HR adjustment range and the reminder beep behavior.

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Country Settings** > **National Reqs**.
3. Select the applicable option:

Value	Description
<b>None</b>	Normal defaults
<b>France</b>	Enables: <ul style="list-style-type: none"> <li>• Heart Rate high alarm limit maximum 280.</li> <li>• No <b>Reminder Volume</b> item in <b>Alarm Options</b>.</li> <li>• Reminder beep will sound every 2 minutes when alarms have been silenced permanently.</li> </ul>
<b>Germany</b>	Normal defaults

## Setting power filter

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Country Settings** > **Power filter**.
3. Select **ON** or **OFF** for power filter.

## Setting roving

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Roving**, and setup the following:
  - **Monitor Roving**: Select if monitor roving is allowed.
  - **Roving Between Units**: Select if roving between units is allowed.
  - **Manual Bed Entry**: Select if bed names can be entered manually.

## Configuring remote service

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Page2** vertical tab > **Remote Service**.
3. Select **Config** tab.  
The **CRM No.** is pre-configured, disable to edit.
4. Check the **Enterprise Server** and **Enterprise Port**, select **Save Changes**.  
The **Enterprise Server** and **Enterprise Port** are the GE InSite RSvP back office server address. There are have the pre-configured default value. Do not change this address unless explicit instructions are given to do so.

5. If a proxy server is in use for accessing Internet, select **Proxy Config** tab:
  - a. Enter **Proxy Host** and **Proxy Port**.
  - b. Enter **Proxy User** and **Proxy Password**, if the proxy server requires use authentication.
  - c. Select **Save Changes**.

All the changes will take effect immediately.

## Settings management

### Saving current settings

1. Adjust the current settings according to your clinical needs.
2. Select the  >  Service > enter **Username** and **Password**.
3. Select **Save Modes**.
4. Select **Save current settings to Target Mode**.

### Resetting to factory settings

You can reset the user modes' settings of a monitor to factory default.

#### NOTE

Resetting to factory defaults does not affect the following settings:

- licenses
  - passwords
1. Discharge the patient
  2. Select the  >  Service > enter **Username** and **Password**.
  3. Select **Save Modes**.
  4. Select **Target Mode** to reset.
  5. Select **Revert Target Mode to factory default**.

The settings reset will be activated immediately for the target mode.

### Selecting default mode

You can select the default mode for monitor to startup

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Save Modes > Default Mode** tab.
3. Select a mode for **Default Mode**.

## Transferring settings from a monitor to another

### Exporting settings

You can save the user settings to the USB storage device.

#### NOTE

Make sure the file system format for USB storage device should be FAT32.

1. Discharge the patient. Insert the USB storage device to the USB port of the monitor.
  2. Select the  > **Service** > enter **Username** and **Password**.
  3. Select **USB Import/Export** > **Export settings to USB Disk**.
  4. Enter an encryption **Key** for the settings' file, the length of key shall be at least 6. (This key will be used when import settings).
  5. Select **Export settings to USB Disk**.
- When finish to export settings, the screen return back and a message "**Export settings successfully.**" displays on the screen.
6. To remove the USB disk, select **Safe to remove USB Disk**.

### Importing settings

You can import the saved user settings from the USB storage device when:

- first time to use the monitor, refer to [Import settings from USB at first time to use on page 27](#) for more details.
  - other times, see following instruction.
1. Discharge the patient. Insert the USB storage device to the monitor's USB port.
  2. Select the  > **Service** > enter **Username** and **Password**.
  3. Select **USB Import/Export** > **Import settings from USB Disk**.
  4. Select the settings file from **Import Setting file list**.
  5. Enter the decryption **Key** for the settings' file.
  6. Select **Import settings from USB Disk**.
- When finish to export settings, the screen return back and a message "**Import settings successfully. Please restart the monitor.**" displays on the menu.
7. To remove the USB disk, select **Safe to remove USB Disk**.
  8. Restart the monitor.

### License management

- You can upload a license file that contains all acquired activation codes for license by the USB storage device.
  1. Discharge the patient. Insert the USB storage device with license file.

- 
2. Select the  >  Service > enter **Username, Password** > **Service** tab > **License** > **Import license from USB Disk**.

When finish to import license, the screen return back and a message “**Import license successfully. Please restart.**” displays on the menu.

- You can manually enter the required activation codes for license one by one, from **License** menu.

Restart is needed after import the license.

Contact authorized service personnel to acquire license file or activation codes for licenses.

**NOTE**

Make sure the file system format for USB storage device should be FAT32.

**NOTE**

The license file should be named as SN and stored in following path in USB disk: `B1x5/v2/1i  
cense/SQXXXXXXXXXX.txt`.

# Calibration and adjustments

## NIBP calibration

NIBP calibration shall be performed:

- If the NIBP Calibration Check failed.
- If the measured value is not within the specification limits.
- After replace mainboard.

## Required tools for NIBP

- Adult NIBP hose
- Adult NIBP cuff
- A rigid cylinder or pipe
- Digital manometer with a range of at least 0 to 1000 mmHg and accuracy 0.5% FS.
- Tubing parts to connect a manometer to the NIBP cuff and hose.

### NOTE

Use only accurate, properly maintained, calibrated and traceable calibration tools for the parameter calibration to ensure measurement accuracy.

### NOTE

See the Supplies and accessories for compatible accessories.

## Making connections

1. Connect an adult NIBP hose to the NIBP connector.
2. Connect an adult NIBP cuff to the hose.
3. Wrap the cuff around a rigid cylinder or pipe.
4. Connect the pressure manometer with pressure pump to the NIBP hose and NIBP cuff with a piece off tubing.
5. Ensure that all of the connections are leak-proof.



## Calibrating NIBP

1. Select the > Service > enter **Username** and **Password**.
2. Select **Service** tab > **Parameters** > **NIBP**.
3. Set the **Calibration Check** to **OFF**.
4. Set the **Protection** to **OFF**.  
Menu selection **Start** for **Calibration** now is enabled.
5. Select **Start** to start calibration. The NIBP calibration sequence starts with automatic zeroing. Wait until the message **Zeroing** is replaced by the message **Zeroed**.
6. Pump a 200 mmHg static pressure according to the manometer. The pressure measured by the monitor is updated in real time to the calibration menu.
7. When the pressure is stabilized, check the pressure reading from the manometer shall be 200 mmHg.
8. Select **Calibrate 200 mmHg** to make sure the two readings are the same.
9. Wait until a message **Calibrated** is shown.
10. Set the **Protection** back to **ON**.

### NOTE

You can use the calibration check function to verify the calibration after the calibration is completed.

## Invasive pressure calibration

Invasive pressure calibration shall be performed:

- Whenever the pressure transducer in use is replaced with a new type of transducer.
- if the invasive pressure functional check failed.
- If the measured value is not within the specification limits.
- After replace mainboard.

## Required tools

- Pressure manometer with a pressure pump
- Transducer adapter cable
- Invasive pressure transducer

### NOTE

See the Supplies and accessories for compatible accessories.

### NOTE

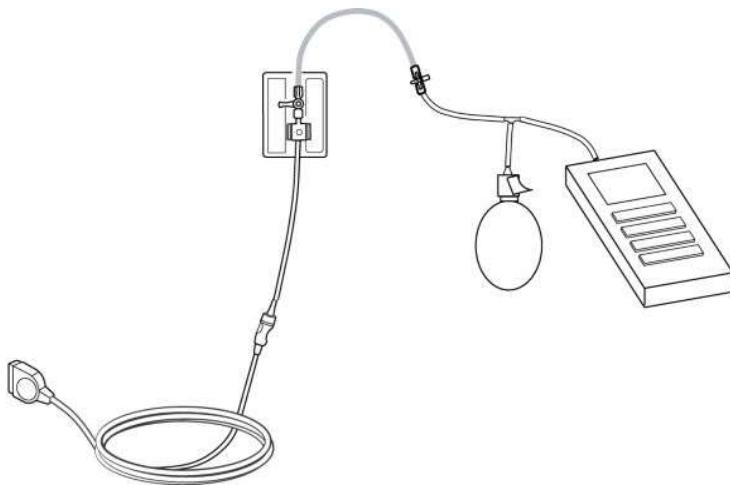
Use only accurate, properly maintained, calibrated and traceable calibration tools for the parameter calibration to ensure measurement accuracy.

### NOTE

The pressure transducer is a key component in the measurement setup. If possible, perform the invasive pressure calibration with the same type of pressure transducer that is used in daily clinical use.

## Making connections

1. Connect the transducer adapter cable to the red Inv BP connector.
2. Connect the invasive pressure transducer to the transducer adapter cable.
3. Connect the pressure manometer with a pressure pump to the transducer's pressure line with a piece of tubing.



## Calibrating invasive pressure

For channel P4's calibration, please refer to "E-COP module" Chapter.

1. Select the > **Service** > enter **Username** and **Password**.
2. Select **Service** tab > **Parameters** > **STP** > **Calibrations**.
3. Select **Calibrate P1** or **Calibrate P2**.
4. Select **Start Calibration**.

5. Prepare the transducer for the zeroing by opening the dome stopcock to room air.
6. The monitor will start automatic zeroing of the invasive pressure channel. Wait until the message **Zeroing** is replaced by value arrows.
7. Pump a  $200 \text{ mmHg} \pm 10 \text{ mmHg}$  static pressure with the pressure pump. The pressure measured by the monitor is updated in real-time to the calibration menu.
8. When the pressure is stabilized, check the pressure reading from the manometer.
9. Use arrows to adjust the reading measured by the monitor to match with the manometer reading.
10. Select **OK**.
11. Wait until the message **Calibrated** is shown.

Repeat the above procedure, steps 3 through 11, for the other invasive pressure channel.

## Calibrating invasive pressure (by simulator)

There is another method to calibrate IBP by simulator:

- Tools: IBP accessories and simulator.
  - Connection: Connect IBP accessories to the monitor and simulator.
1. Select the  >  **Service** > enter **Username** and **Password**.
  2. Select **Service** tab > **Parameters** > **STP** > **Calibrations**.
  3. Select **Calibrate P1** or **Calibrate P2**.
  4. Select **Start Calibration**.
  5. Set the P1 or P2 channel to 0 mmHg on the simulator.
  6. The monitor will start automatic zeroing of the invasive pressure channel. Wait until the message **Zeroing** is replaced by value arrows.
  7. Set a pressure of  $200 \text{ mmHg} \pm 10 \text{ mmHg}$  on the simulator. The pressure measured by the monitor is updated in real-time to the calibration menu.
  8. Use arrows to adjust the reading measured by the monitor to match with the simulator.
  9. Select **OK**.
  10. Wait until the message **Calibrated** is shown.

Repeat the above procedure, steps 3 through 10, for the other invasive pressure channel.

## Temperature calibration

Temperature calibration shall be performed:

- If the measured value is not within the specification limits.
- After mainboard replacement.

## Required tools

- P/N 884515-HEL Temperature calibration plugs
- Dual temperature adapter cable

**NOTE**

See the Supplies and accessories for compatible accessories.

**NOTE**

Use only accurate, properly maintained, calibrated and traceable calibration tools for the parameter calibration to ensure measurement accuracy.

## Making connections

1. Connect the dual temperature adapter cable to the brown temperature connector.
2. Check that the dual temperature adapter cable is configured for 400 series probes.

## Calibrating temperature

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Parameters** > **STP** > **Calibrations**.
3. Select **OFF** for **Protection**.
4. Select **Calibrate T1** or **Calibrate T2**.
5. Select **Start Calibration**.
6. Plug in the temperature calibration plug labeled with TEMP 25°C to the dual temperature adapter cable connector T1 or T2.
7. Wait until the value is shown, and select **Next**.
8. Plug in the temperature calibration plug labeled with TEMP 45°C to the dual temperature adapter cable connector T1 or T2.
9. Select **Next**.
10. Wait until the value is shown.
11. Wait until the message **Done** is shown.

Repeat the above procedure, steps 3 through 12, for the other temperature channel.

# Checkout procedures

## About the checkout procedures

This chapter describes the checkout procedures for the monitor.

The installation check covers the following devices:

- Monitor
- B1X5-F2 frame
- E-modules
- B1X5-REC recorder

The planned and corrective maintenance checks cover the following devices:

- Monitor
- B1X5-F2 frame
- B1X5-REC recorder

The relevant planned and corrective maintenance checks and service procedures for E-modules, refer to “E-COP module”, “E-sCAiO, E-sCO, N-CAiO module”, “E-miniC module”, “E-Entropy module”, and “E-NMT module” chapters.

The cleaning precautions, cleaning requirements, cleaning procedures, and recommended cleaning solutions are described in the monitor’s user manual.

For details about cleaning, disinfecting and sterilizing the accessories, see the instructions for use in the accessory package.

To help ensure the equipment remains in proper operational and functional order and maintains its essential performance and basic safety, follow the corrective and planned maintenance recommendations. The tests that are related to the essential performance and basic safety are marked with an asterisk \*.

Record the results of the check procedures to the eCheckforms.

## Required checkout procedures

Perform the following tests during installation, planned maintenance and corrective maintenance:

Checkout procedure	Required check procedure		
	Visual in-spections	Electrical safety test	Functional check
Installation check	Yes	No, if there is less than 12 months since the monitor was Manufactured. Check the date of manufacture of the device from the device plate.	Yes

<b>Checkout procedure</b>	<b>Required check procedure</b>		
	<b>Visual in-spections</b>	<b>Electrical safety test</b>	<b>Functional check</b>
Planned maintenance check	Yes	Yes	Yes
Corrective maintenance check <sup>*1</sup> (After detaching, replacing or upgrading:)	B1X5-REC recorder	Yes	No Start-up Test recorder
	B1X5-F2 frame	Yes	No Start-up Test B1X5-F2 frame
	Main board, SpO <sub>2</sub> board, parameter input boards inside the monitor	Yes	Yes All functional check steps
	Any other part inside the monitor	Yes	Yes, except the patient leakage current tests. All functional check steps

\*1 After replace mainboard, calibration for NIBP, IBP, and Temperature is needed.

## Installation check

The purpose of the installation check is to ensure that the patient monitoring system, including the connected devices, is properly installed and configured for use.

Perform the installation check after the hardware installation and platform configuration is completed before taking the monitor into clinical use.

The manufacturer has performed the electrical safety test for the monitor and acquisition modules during final inspection. You do not have to perform the electrical safety tests during the installation checkout, if there is less than 12 months since the monitor was manufactured. Check the date of manufacture of the device from the device plate.

## Planned maintenance check

The purpose of the planned maintenance check is to periodically check that the product remains safe to use and maintains its performance characteristics.

Perform the planned maintenance check every two years after installation.

### **WARNING**

SAFETY HAZARD.

To avoid risks to personnel and patient, or damage to the equipment, only perform maintenance procedures described in this manual. Unauthorized modifications can lead to safety hazards.

### **WARNING**

Planned maintenance should be carried out at recommended interval. Failure to implement the recommended maintenance schedule may cause equipment failure and possible health hazards.

**NOTE**

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.

## Corrective maintenance check

The purpose of the corrective maintenance check is to ensure that the product was repaired correctly, and to check that the product is safe to use and maintains its performance characteristics. Perform the corrective maintenance check after any corrective maintenance, before taking the monitor back into clinical use.

## Performing visual inspection

Perform the following visual inspection to the installed monitoring system:

1. Check that all product labeling, markings and symbols are intact and readable.
2. Check that the monitor and the connected devices do not have any visible damage.
3. Check that the monitor and the connected devices are properly mounted with specified mounting solutions.
4. Check that the cables between the patient monitor and the connected devices are intact, properly connected and secured to the right connectors.
5. Check that the acquisition modules are properly connected and locked.

## Electrical safety tests \*

Electrical safety tests provide a method of determining if potential electrical health hazards to the patient or operator of the device exist.

**WARNING**

EXCESSIVE LEAKAGE CURRENT.

Do not use a multiple socket outlet or extension cord in an ME system.

**WARNING**

EXCESSIVE LEAKAGE CURRENT.

A display or printer that is a non-medical grade device and is used within the patient environment, must always be powered from an additional transformer providing at least basic isolation (isolating or separating transformer). Using without an isolating transformer could result in unacceptable enclosure leakage currents.

## **WARNING**

EXCESSIVE LEAKAGE CURRENT.

To avoid summation of leakage currents when interfacing the device with other equipment, the devices may only be interconnected with each other or to parts of the system when it has been determined by qualified biomedical personnel that there is no danger to the patient, the operator, or the environment as a result. In those instances where there is any element of doubt concerning the safety of the connected devices, the user must contact the manufacturers concerned (or other informed experts) for proper use. In all cases, safe and proper operation should be verified with the applicable manufacturer's instructions for use, and system standards IEC60601-1 must be complied with.

## **Test setup**

The electrical safety test procedure described in this service manual is intended for the following system components:

- Monitor
- B1x5-F2 Frame
- E-modules

All system components must be properly connected to the monitor during the electrical safety tests.

### **Test conditions**

Perform electrical safety tests under normal ambient conditions of temperature, humidity and pressure.

### **Test equipment**

The test equipment required to perform electrical safety tests is listed below.

<b>Tool</b>	<b>Part number / requirement</b>
Safety Analyzer / Leakage Current Tester	<p>Perform the electrical safety tests using an electrical safety analyzer according to IEC 60601-1; 3.1 edition, AAMI ES60601-1 + C1 + A1 + A2, EN 60601-1 or CSA CAN/CSA-C22.2 NO. 60601-1:14.</p> <p>The schematics in this section show the principle of the test equipment. The actual configuration of the test equipment may vary.</p> <p>Refer to the instructions delivered with the safety analyzer to perform each test.</p>
Safety Test Body Kit	<p>P/N M1155870</p> <p>Instead of the test bodies in the safety test body kit, you may use other applicable test bodies with all pins connected together.</p>

The patient monitor being tested should be placed on an insulating surface.

### **NOTE**

Before proceeding, make sure that all test equipment is properly calibrated, maintained and functioning.

## Verifying power outlet

1. Verify that the power outlet is wired correctly according to the country's electrical code standard before starting the following electrical safety tests.

The results of the following tests will be inaccurate unless a properly wired power outlet is used.

## Verifying power cord and plug

### **WARNING**

Use only AC power cords recommended or manufactured by GE.

1. Verify that the power cord being used with the patient monitor is undamaged:
  - a. Inspect the power cord for wear or damage. If damage is suspected, test for continuity through each conductor of the power cord connector.
  - b. Replace the power cord, as necessary, with a regulatory-approved cord for the country of use.

## Ground integrity check

There are two alternative methods for checking the ground (earth) integrity:

- Ground continuity test
- Impedance of protective earth connection

These tests determine whether the device's exposed metal and power inlet's ground connection has a power ground fault condition.

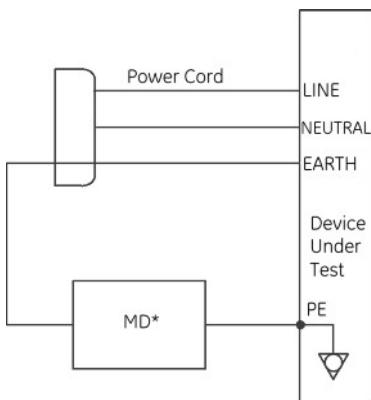
Perform the test in accordance to your local regulations.

### **NOTE**

Refer to the instructions delivered with the safety analyzer to perform each test.

## Testing ground continuity

The measuring device (MD) in the diagram below may be a digital multimeter or part of the safety analyzer.



Acceptance criteria:

- For equipment without a power supply cord, the impedance between the protective earth terminal and any accessible metal part which is protectively earthed shall not exceed 0.1 ohms.
- For equipment with a power supply cord, the impedance between the protective earth pin in the mains plug and any accessible metal part which is protectively earthed shall not exceed 0.2 ohms.

## Checking impedance of protective earth connection

This test is normally only required as a manufacturing production test to receive safety agency compliance. Some country agencies do require this test after field equipment repairs (i.e., Germany's DIN VDE 0751 standards). Consult your country/local safety agency if in doubt.

Preferably use a safety analyzer and test the equipment with the power supply cord.

Check compliance as follows:

1. A current of 25A from a current source with a frequency of 50 or 60 Hz with a no-load voltage not exceeding 6 V is passed for at least 5 seconds, but not more than 10 seconds, through the protective earth terminal or the protective earth pin in the mains plug and each accessible metal part which could become live in case of failure in basic insulation.
2. The voltage drop between the parts described is measured and the impedance determined from the current and voltage drop. It shall not exceed the values indicated.

When taking this measurement, flex the unit's power cord along its length. There should be no fluctuations in resistance.

Acceptance criteria:

- For equipment without a power supply cord, the impedance between the protective earth terminal and any accessible metal part which is protectively earthed shall not exceed 0.1 ohms.
- For equipment with a power supply cord, the impedance between the protective earth pin in the mains plug and any accessible metal part which is protectively earthed shall not exceed 0.2 ohms.

## Testing earth leakage current

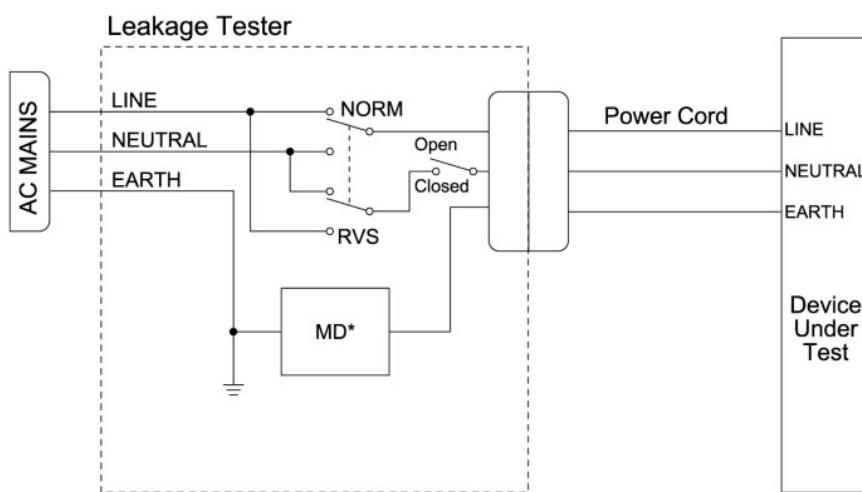
This test measures the current leakage flowing from the mains part through or across the insulation into the protective earth conductor of the device under test.

Perform this test both in Normal Condition (NC) and in a Single Fault Condition (SFC), where one of the supply conductors is open at a time. Perform the test with normal and reverse polarity

The test sequence described below is for reference only. You can also perform the subtests in a different order.

### NOTE

Refer to the instructions delivered with the safety analyzer to perform this test.



\* The measuring device (MD) represents the network and voltage measuring instrument and its frequency characters according to IEC 60601-1.

1. Configure the safety analyzer as follows (NC):
  - Polarity: NORMAL
  - Neutral: CLOSED
2. Power on the device under test.
3. Read and record the current leakage indicated on the safety tester.
4. Configure the safety analyzer as follows (SFC):
  - Polarity: NORMAL
  - Neutral: OPEN
5. Read and record the current leakage indicated on the safety tester.
6. Configure the safety analyzer as follows (SFC):
  - Polarity: REVERSED
  - Neutral: OPEN
7. Read and record the current leakage indicated on the safety tester.
8. Configure the safety analyzer as follows (NC):
  - Polarity: REVERSED
  - Neutral: CLOSED
9. Read and record the current leakage indicated on the safety tester.
10. Power off the device under test.

Acceptance criteria in Normal Condition (NC):

- All readings shall be less than or equal to 5 mA for installations that require compliance to EN/IEC 60601-1 requirements.
- All readings shall be less than or equal to 3 mA for installations that require compliance to ANSI/AAMI ES60601-1 requirements.

Acceptance criteria in Single Fault Condition (SFC) – one of the supply conductors open at a time:

- All readings shall be less than or equal to 10 mA.

## Testing touch leakage current

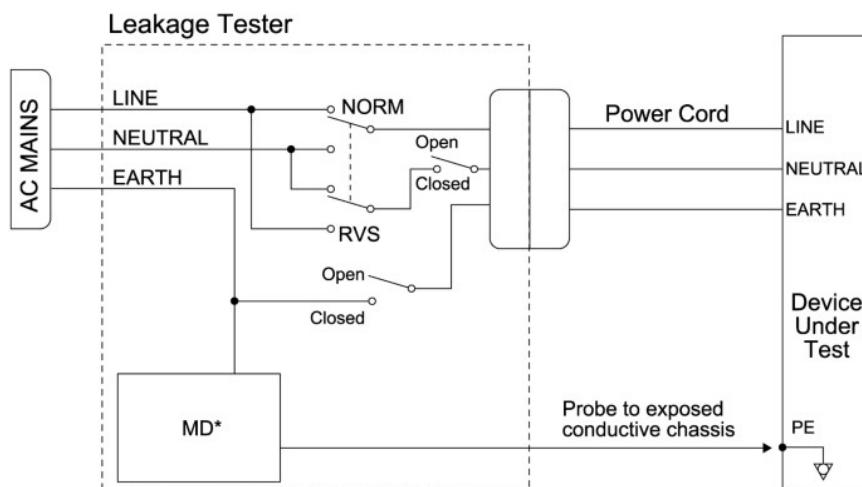
This test measures current leakage through the exposed conductive parts on the device under test.

Perform the test in Normal Condition (NC) and in two different Single Fault Conditions (SFC): 1) earth open and 2) one of the supply conductors open at a time. Perform the test with normal and reverse polarity.

The test sequence described below is for reference only. You can also perform the subtests in a different order.

### NOTE

Refer to the instructions delivered with the safety analyzer to perform this test.



\* The measuring device (MD) represents the network and voltage measuring instrument and its frequency characters according to IEC 60601-1.

1. Configure the safety analyzer as follows (NC):
  - Polarity: NORMAL
  - Neutral: CLOSED
  - Earth (GND): CLOSED
2. Power on the device under test.
3. Read and record the current leakage indicated on the safety tester.
4. Configure the safety analyzer as follows (SFC):
  - Polarity: NORMAL
  - Neutral: OPEN
  - Earth (GND): CLOSED
5. Read and record the current leakage indicated on the safety tester.
6. Configure the safety analyzer as follows (SFC):
  - Polarity: NORMAL
  - Neutral: CLOSED

- Earth (GND): OPEN
7. Read and record the current leakage indicated on the safety tester.
  8. Configure the safety analyzer as follows (SFC):
    - Polarity: REVERSED
    - Neutral: CLOSED
    - Earth (GND): OPEN
  9. Read and record the current leakage indicated on the safety tester.
  10. Configure the safety analyzer as follows (SFC):
    - Polarity: REVERSED
    - Neutral: OPEN
    - Earth (GND): CLOSED
  11. Read and record the current leakage indicated on the safety tester.
  12. Configure the safety analyzer as follows (NC):
    - Polarity: REVERSED
    - Neutral: CLOSED
    - Earth (GND): CLOSED
  13. Read and record the current leakage indicated on the safety tester.
  14. Power off the device under test.

Acceptance criteria in Normal Condition (NC):

- All readings shall be less than or equal to 100 µA

Acceptance criteria in Single Fault Condition (SFC) – earth open or one of the supply conductors open at a time:

- All readings shall be less than or equal to 300 µA for installations that require compliance to ANSI/AAMI ES60601-1 requirements.
- All readings shall be less than or equal to 500 µA for installations that require compliance to EN 60601-1 / IEC 60601-1 requirements.

## Patient leakage current tests

Patient leakage current tests consist of patient (source) leakage current tests and patient (sink) leakage current tests. Perform these patient leakage current tests for all the E-modules and Hemo module for monitor.

The following table specifies the monitor's component and the related patient connectors to be tested in the Patient (source) leakage current tests and in the Patient (sink) leakage current tests.

Use the safety test body kit, P/N M1155870 (or equivalent), to perform patient leakage current tests. This safety test body kit contains various patient connectors where all pins are shorted out together. For information on which test body to use for each patient connector, refer to the service instructions included in the safety test body kit.

**NOTE**

If not otherwise stated in the table below, each test body is connected directly to the specified connector in the patient module.

<b>Patient connectors to be tested</b>	
<b>Component</b>	<b>Patient connector</b>
Host	ECG & SpO2

## Testing patient (source) leakage current

This procedure measures the leakage current from an applied part connector of the device to ground.

Perform this test for all the E-modules and Hemo module for the monitor.

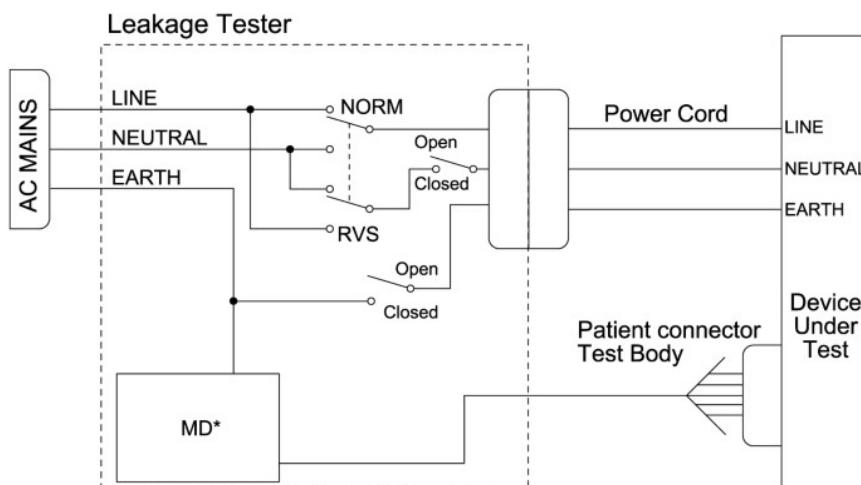
Perform the test in Normal Condition (NC) and in two different Single Fault Conditions (SFC): 1) earth open and 2) one of the supply conductors open at a time.

Perform the test with normal and reverse polarity.

The test sequence described below is for reference only. You can also perform the subtests in a different order.

**NOTE**

Refer to the instructions delivered with the safety analyzer to perform this test.



\* The measuring device (MD) represents the network and voltage measuring instrument and its frequency characters according to IEC 60601-1.

1. Configure the safety analyzer as follows (NC):
  - Polarity: NORMAL
  - Neutral: CLOSED
  - Earth (GND): CLOSED
2. Power on the device under test.
3. Read and record the current leakage indicated on the safety tester.
4. Configure the safety analyzer as follows (SFC):
  - Polarity: NORMAL

- Neutral: OPEN
  - Earth (GND): CLOSED
5. Read and record the current leakage indicated on the safety tester.
  6. Configure the safety analyzer as follows (SFC):
    - Polarity: NORMAL
    - Neutral: CLOSED
    - Earth (GND): OPEN
  7. Read and record the current leakage indicated on the safety tester.
  8. Configure the safety analyzer as follows (SFC):
    - Polarity: REVERSED
    - Neutral: CLOSED
    - Earth (GND): OPEN
  9. Read and record the current leakage indicated on the safety tester.
  10. Configure the safety analyzer as follows (SFC):
    - Polarity: REVERSED
    - Neutral: OPEN
    - Earth (GND): CLOSED
  11. Read and record the current leakage indicated on the safety tester.
  12. Configure the safety analyzer as follows (NC):
    - Earth (GND): REVERSED
    - Neutral: CLOSED
    - Earth (GND): CLOSED
  13. Read and record the current leakage indicated on the safety tester.
  14. Power off the device under test.
  15. Repeat this test for all the connected parameter modules and patient connectors specified in Table Patient connectors to be tested with each module.

Acceptance criteria in Normal Condition (NC):

- All readings shall be less than or equal to 10 µA (d.c.).

Acceptance criteria in Single Fault Condition (SFC) – earth open or one of the supply conductors open at a time:

- All readings shall be less than or equal to 50 µA (d.c.).

## Testing patient (sink) leakage current

This procedure measures the leakage current from an applied part connector of the device to ground when the applied part connector is connected to 250 V.

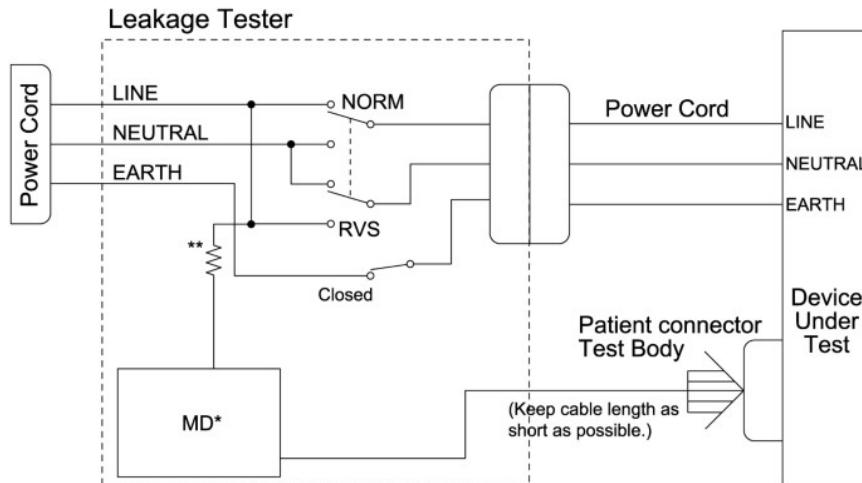
Perform this test for all the E-modules and Hemo module for the monitor.

Perform the test in Normal Condition (NC) with normal and reverse polarity.

The test sequence described below is for reference only. You can also perform the subtests in a different order.

### NOTE

Refer to the instructions delivered with the safety analyzer to perform this test.



\* The measuring device (MD) represents the network and voltage measuring instrument and its frequency characters according to IEC 60601-1.

\*\* According to IEC-60601, the impedance to protect the circuitry and the person performing the test, but low enough to accept currents higher than the allowable values of the leakage current to be measured.

### WARNING

SHOCK HAZARD.

The following step causes high voltage at the test body. Do not touch the test body.

1. Configure the safety analyzer as follows:
  - Polarity: NORMAL
  - Neutral: CLOSED
  - GND: CLOSED
2. Power on the device under test.
3. Read and record the current leakage indicated on the safety tester.
4. Configure the safety analyzer as follows:
  - Polarity: REVERSED
  - Neutral: CLOSED
  - GND: CLOSED
5. Read and record the current leakage indicated on the safety tester.
6. Power off the device under test.
7. Repeat this test for all the connected parameter modules and patient connectors specified in Table Patient connectors to be tested with each module

Acceptance criteria:

- All readings shall be less than or equal to 50 µA (d.c.).

## Completing electrical safety tests

1. Disconnect the safety analyzer from the power outlet.
2. Disconnect the test equipment from the patient monitor.
3. Disconnect the patient monitor's power cord from the leakage tester.

## Performing functional check

### Checking the startup

1. Turn on the power by press ON/OFF button more than 3 seconds.
2. Verify that the patient monitor starts up normally:
  - The yellow, red and blue alarm lights are lit momentarily.
  - The speaker gives an audible beep.
  - The normal welcoming screen appears with a status bar indicating the progress of the startup procedure.
  - Normal monitoring screen appears and there are no error messages on the screen.

#### NOTE

If you receive a **Condition battery** or a **Battery failure** message, refer to the troubleshooting instructions for battery conditioning or replacement.

3. Verify that the battery is fully charged.

If the battery is not fully charged, keep the monitor connected to the mains until the battery is fully charged. The battery must be fully charged before taking the monitor into use for the first time.

### Checking display

#### Testing picture quality

Perform this test both for the integrated main display and for the connect external display.

1. Verify that all text is readable and all images are clear.
2. Verify that the brightness is good. Adjust if necessary.

#### Testing touchscreen control

1. Verify the operation of a touchscreen by touching an active digit field. Verify that the related menu is opened.

#### Checking the time and date

1. Select the  >  **Service** > enter **Username** and **Password**.

2. Select **Clinical** tab > **Time and Date**.
3. Check the **Current Time** is correct, adjust the time and date if necessary.

**NOTE**

The monitor can't be set as TIME MASTER in network. You should adjust the time and date from the central station, if needed.

4. Select back arrow, select **Time Zone**.
5. Check and adjust the settings if necessary.

## Checking the device information

1. Select  **Monitor Info**.
2. Verify the following:
  - a. The version information are identified.
  - b. The network information are identified.

## Testing the B1X5-F2 frame

1. Ensure the frame is connected to the monitor.
2. Ensure one module is connected to the frame.
3. Using power cord connect the frame to the wall outlet.
4. Verify that the power LED and communication LED lit.

## Testing the B1X5-REC recorder

1. Select the  **Printing Setup**.
2. Configure the waveforms:
  - **Waveform 1: I**
  - **Waveform 2: II**
  - **Waveform 3: Resp**
3. Select **Print Waveforms**.
4. Verify that the recorder starts printing.
5. Let the recorder print for approximately 10 seconds.
6. Select the **Stop Printing** to stop printing.
7. Verify the following things from the printout:
  - The header line contains the date, time and some other applicable status.
  - The grid is clear.
  - The waveforms labels appear in the printout as configured.

## Testing wired MC Network

Perform the following test only if the patient monitor is connected to a wired MC Network.

If the monitor have bed to bed license, perform 2 to 7 steps.

1. Check that a network symbol is displayed in the upper right corner of the screen. And **Network made** displays on the screen.
2. Make sure that at least one other monitor is on the network. The other monitor must be in an admitted state and have an active parameter measurement signal.
3. Select the  >  **Other Patients**.
4. Select a care unit from **Unit** and **All Patients** from **Show**.
5. Select a patient bed from the list and select **View**.
6. Check that a window with parameters from the other monitor displays on the left side of the screen.
7. Close the view window.

## Testing wireless LAN Network

Perform the following test only if the monitor supports WLAN communication.

Wireless LAN functional check consists of two tests:

- The first test is for all wireless monitors. The purpose of this test is to ensure that each wireless monitor is correctly configured. The monitor is stationary during the test.
- The second test is for the wireless MC Network infrastructure. This test is recommended if the wireless monitors will be used during patient transfers. You may skip the test if the wireless monitors will only be used as stationary monitors at the bedside. Perform this test only during the installation, or when troubleshooting wireless connectivity issues.

### NOTE

The wireless network must be properly installed and the monitor must be within the wireless coverage area.

## Testing wireless LAN configuration

Check each wireless monitor according to the following procedure.

If the monitor have bed to bed license, perform 3 to 8 steps.

1. Disconnect the monitor under test from the wired MC Network, if connected.
2. Check that the wireless network connection and signal strength indicator is displayed in the upper right corner of the screen. And **Network made** displays on the screen.
3. Make sure that at least one other monitor is on the network. The other monitor must be in an admitted state and have an active parameter measurement signal.
4. Select the  >  **Other Patients**.
5. Select a care unit from **Unit** and **All Patients** from **Show**.
6. Select a patient bed from the list and select **View**.
7. Check that:
  - a. a window with parameters from the other monitor displays on the left side of the screen.
  - b. The waveforms are continuous and there is no data loss.

8. Close the view window.

## Checking performance of wireless MC Network infrastructure

1. Perform the test according to the guidelines described in Appendix A.

## Testing InSite RSvP connectivity

Perform the following test only if the remote service is configured and enabled.

1. Contact the local GE online support center to confirm that they can view the monitor.

## Checking parameters for installation

1. Connect the accessories to monitor (no need to connect to simulator or patient).
2. Admit a patient.
3. Verify the following:
  - a. ECG: **Leads off** will display in the waveform field.
  - b. SpO<sub>2</sub>: After connecting the SpO<sub>2</sub> cable and sensor, the sensor will be lit.
  - c. NIBP: Select , **NIBP cuff loose** will display in message field.
  - d. IBP: After connecting IBP cable and transducer, **InvBP's not Zeroed** will display in message field.
  - e. Temperature: After connecting the Temperature cable and sensor, **Performing temp test** will display in Temperature digit field for a few seconds.
  - f. C.O.: After connecting IBP cable and transducer, **InvBP's not Zeroed** will display in message field.
  - g. Gas: After installing the gas module, **Calibrating gas sensor** will display in CO<sub>2</sub> waveform field for about 1 minutes.
  - h. Entropy: After installing the E-Entropy module and cable, **No sensor** message will display in Entropy digit field.
  - i. NMT: After installing the E-NMT module and sensor, **EMG electrodes off** message will display in NMT digit field.

## Checking parameters for maintenance

### Required tools for functional check

#### NOTE

See the Supplies and accessories for compatible accessories.

- A multiparameter patient simulator that supports ECG, invasive pressure, and temperature measurements.
- Adapter cables to GE invasive pressure and temperature connectors.
- For ECG:
  - Multi-Link 5-lead ECG trunk cable, IEC or AHA

- Multi-Link 5-leadwire set, IEC or AHA
- For invasive pressure:
  - Dual IP adapter cable
- For temperature:
  - Dual temperature adapter cable.
- For SpO<sub>2</sub>:
  - SpO<sub>2</sub> interconnect cable
  - SpO<sub>2</sub> finger sensor
- For NIBP:
  - Adult NIBP hose
  - Adult NIBP cuff
  - A rigid cylinder or pipe
  - Digital manometer with a range of at least 0 to 1000 mmHg and accuracy 0.5% FS.
  - Tubing parts to connect a manometer to the NIBP cuff and hose.

## Configuring monitor for functional check

1. Configure ECG measurement:
  - a. Select the  >  **Screen Setup**. Configure the ECG1, ECG2 and ECG3 waveform fields to the screen with adequate priority.
  - b. Select the HR digit field and configure:
    - **ECG1 Lead:** II
    - **ECG2 Lead:** V1
    - **ECG3 Lead:** aVL
    - **Beat Volume:** 1 or greater
    - **Size:** 1x
  - c. Select the **Advanced** tab and configure:
    - **Pacemaker Detection:** Show
    - **Primary HR Source:** ECG
2. Configure impedance respiration:
  - a. Select the  >  **Screen Setup**. Configure the Resp waveform field to the screen with adequate priority.
  - b. Select Respiration digit field and configure:
    - **Measurement:** ON.
3. Configure SpO<sub>2</sub>:

- a. Select the  >  **Screen Setup**. Select SpO<sub>2</sub> waveform field to the screen with adequate priority.
4. Configure NIBP:
  - a. Select the  >  **Screen Setup**. Select **NIBP** digit field to the screen with adequate priority.
  - b. Select the NIBP digit field and configure:
    - Select **Use Default Inflation Pressure**
5. Configure invasive pressure measurement:
  - a. Select the  >  **Screen Setup**. Select **IBP1**, **IBP2**, waveform fields to the screen with adequate priority.
  - b. Select IBP1 digit field and configure:
    - **Label:** IBP1
    - **Scale (mmHg):** 0-250 mmHg
    - **Display Format:** Mean
  - c. Repeat step b. for IBP2 waveform.
6. Configure temperature:
  - a. Select the  >  **Screen Setup**. Select **T1** and **T2** parameter windows to the screen with adequate priority.

## Configuring simulator for functional check

For instructions on how to use and configure the simulators, refer to the simulators' documentation.

1. Configure the ECG settings as follows:
  - **ECG Rhythm:** a normal sinus rhythm
  - **Heart Rate:** 80-90 bpm
  - **Amplitude:** 1 mV
2. Configure the impedance respiration settings as follows:
  - **Baseline impedance:** 1000 Ω
  - **Amplitude:** 1 Ω
  - **Respiration rate:** 20 breaths per minute
  - **Lead selection:** II (LA or LL)
3. Configure the simulator's SpO<sub>2</sub> settings as follows:
  - **SpO2:** 90-100
4. Configure the simulator's invasive pressure channels IBP1, IBP2 as follows:
  - **Sensitivity:** 5 µV/V/mmHg
  - **InvBP output:** 0 mmHg static pressure or atmosphere
5. Configure the simulator's temperature settings for all temperature channels as follows:

- **Temperature:** 32-40 °C / 89.6-104 °F

## Testing ECG measurement \*

1. Test for normal sinus rhythm.
  - a. Check that the monitor displays the ECG leads II, V1 & aVL and the waveforms are noise-free. The monitor shall display a  $80 \pm 5$  bpm heart rate and an audible QRS tone sounds with each QRS complex. If necessary, turn up the QRS volume.
2. Check pacemaker detection:
  - a. Configure the simulator's ECG output to Asynchronous Pacemaker Pulse.
  - b. Check that pacemaker spikes are shown on the ECG waveform.
  - c. Configure the simulator's ECG output to 80 beats per minute, Normal Sinus Rhythm.
3. Check Asystole detection:
  - a. Configure the simulator's ECG output to Asystole.
  - b. Check that the **Asystole** alarm appears on the monitor screen.
  - c. Configure the simulator's ECG output to 80 beats per minute, Normal Sinus Rhythm.
4. Check leads off detection:
  - a. Detach the RA/R leadwire from the simulator.
  - b. Check that the Lead II waveform disappears from the ECG1 waveform field, followed by an **RA/R lead off** message.
  - c. Check that Lead II is replaced by Lead III in the ECG1 waveform field after a while.
  - d. Reconnect the RA/R leadwire to the simulator.
  - e. Check that Lead III is replaced with Lead II in the ECG waveform field.

## Testing impedance respiration measurement

1. Check the respiration rate:
  - a. Check that the RESP waveform is shown.
  - b. Check that the **RR** value is 20 ( $\pm 5$ ).
2. Check the apnea detection:
  - a. Configure the simulator's Apnea Simulation to **32 sec**.
  - b. Check that the monitor activates the **Apnea** alarm.
  - c. Configure the simulator's Apnea Simulation to **OFF**.

## Testing SpO<sub>2</sub> measurement \*

1. Connect the SpO<sub>2</sub> sensor to your finger and wait until a pulse is found.
2. Check that:
  - The SpO<sub>2</sub> reading appears in the digit field.
  - The plethysmographic waveform appears on the screen.

You can verify the functionality of a pulse oximeter probe and monitor with a functional SpO<sub>2</sub> tester but you cannot evaluate their accuracy with such a device. For more information, refer to the standard ISO 80601-2-61 Annex FF (Simulators, calibrators and functional testers for pulse oximeter equipment).

## Testing NIBP measurement \*

1. Check the NIBP tubing system for leaks and check if NIBP calibration is required.
  - a. Select the  >  Service > enter **Username** and **Password**.
  - b. Select **Service** > **Parameters** > **NIBP**.
  - c. Select **ON** for the **Calibration Check**.
  - d. Pump a 200 mmHg static pressure according to the manometer. The pressure measured by the device is updated in real-time to the calibration menu. Wait for a while until the pressure stabilizes.
  - e. Use the following table to evaluate the NIBP leakage and NIBP calibration status.

Observed results	Conclusion	Recommended action
NIBP is leaking.	Test failed. The NIBP tubing is leaking if the pressure does not stabilize and drops at a rate of 1 mmHg or more for every five seconds.	Troubleshoot the root cause for the NIBP leakage and correct the problem. <ol style="list-style-type: none"> <li>1. Check that the external NIBP test setup is not leaking. Correct the root cause for the leak and repeat the NIBP measurement test.</li> <li>2. Check that the internal NIBP tubing is not leaking. Re-perform all the check out procedures required after performing corrective maintenance to the module.</li> </ol>
NIBP is out of calibration.	Test failed. NIBP calibration is required, if the readings in the manometer and in the NIBP calibration menu differ more than ±1 mmHg.	<ol style="list-style-type: none"> <li>1. Calibrate NIBP.</li> <li>2. Perform functional check to retest the NIBP measurement.</li> </ol>
No leakage and NIBP is accurate.	Test passed. NIBP is working properly, if it is not leaking and it shows accurate readings.	Perform the next step of this procedure.

2. Disconnect the NIBP cuff and manometer from the module.

## Testing invasive pressure measurement \*

1. Zero the tested pressure channel:
  - a. Ensure that the simulator's invasive pressure output channel is configured to 0 mmHg static.
  - b. Select the digit field of the tested invasive pressure channel, Select **Zero**.
  - c. Check that a **Zeroing** message followed by a **Zeroed** message is shown in the menu.
2. Test a static pressure:
  - a. Configure the simulator's invasive pressure output channel to 200 mmHg static pressure.
  - b. Check that a flat pressure line appears on the related waveform field.

- c. Check that the reading in the digit field is  $200 \pm 10$  mmHg.
  - If the measured value is not within the specification limits, recalibrate the measurement.
3. Check the pressure waveform:
  - a. Configure the simulator's invasive pressure output channel to Arterial 120/80.
  - b. Check that the pressure waveform for the tested invasive pressure channel appears in the waveform window.
  - c. Check that the Sys/Dia (Mean) pressure values are shown in the related digit field.

## Testing temperature measurement \*

Perform the following steps to both the temperature channels.

### NOTE

The 'x' in the Tx refers to the temperature channel being tested.

1. Check that:
  - a. Tx temperature matches the configured simulator value chosen earlier  $\pm 0.1^\circ\text{C}/\pm 0.18^\circ\text{F}$ .
  - b. There are no error messages on the screen.
  - If the measured value is not within the specification limits, recalibrate the measurement.

## Completing the check procedure

1. Select patient information area > **Discharge Patient** > **Confirm** to discard any changes made to the patient monitor configuration during checkout.
2. Disconnect the test setup.
3. Complete the check form.

# Software download

## About this introduction

This instruction describes how to upload the software, firmware and e-manuals to the B155M/B125M/B125P/B105M/B105P patient monitor, with software version VSP 3.0.

The package is delivered in a USB storage device.

## Contents of the USB storage device

- All versions of software package and related e-manuals
- All versions of firmware package
- Download instruction: this document

## Installing software, firmware and e-manuals

### Preparing the USB disk

If need to copy the electronic package to your own USB disk, you should follow specific folder structure and naming rules.

#### NOTE

The namings are capital sensitive.

1. Make sure the file system format for USB disk should be FAT32, if not, please format the disk.
2. Create the related folders in the root of disk, the folder name and route as following:
  - "B1x5/v2/software/VSP\_x.x.x.x": for device main software
  - "B1x5/v2/software/VSP\_x.x.x.x/EManual": for the e-manuals
  - "B1x5/v2/NIBP/NIBP\_x.x.x.x": for NIBP firmware
  - "B1x5/v2/ECG/ECG\_x.x.x.x": for ECG firmware
  - "B1x5/v2/RECX/RECX\_x.x": for recorder firmware
  - "B1x5/v2/STP/STP\_x.x.x.x": for STP firmware (when the SpO<sub>2</sub> license is GE)
  - "B1x5/v2/TP/TP\_x.x.x.x": for TP firmware (when the SpO<sub>2</sub> license is Masmo or Nellcor)
3. Copy the target version of software/firmware package to the above related folder, rename the target package name if necessary:
  - "VSP\_x.x.x.x": for device main software and e-manuals
  - "NIBP\_x.x.x.x": for NIBP firmware
  - "ECG\_x.x.x.x": for ECG firmware

- “RECX\_x.x”: for recorder firmware
- “TP\_x.x.x.x”: for Masimo or Nellcor TP firmware
- “STP\_x.x.x.x”: for STP firmware

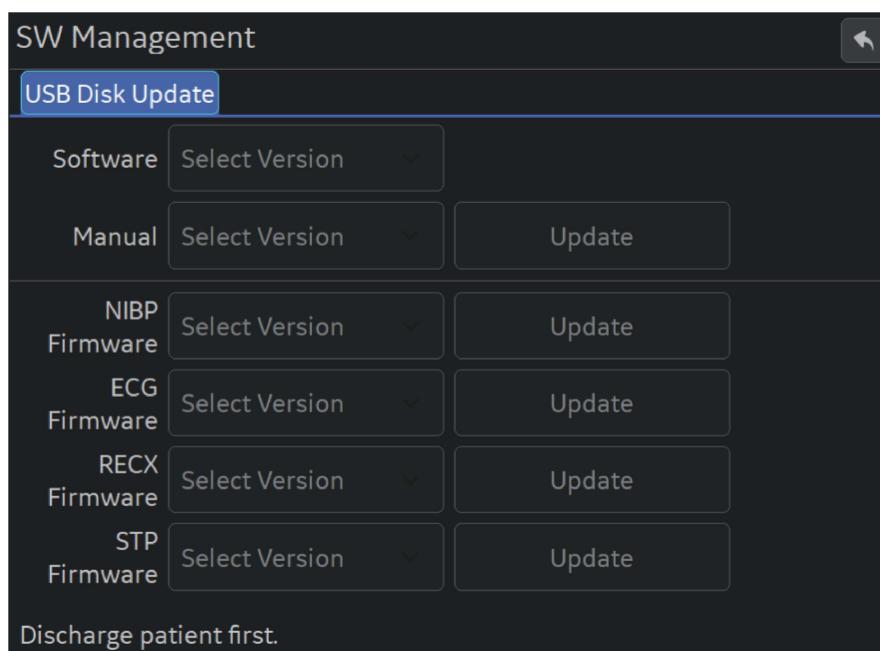
X is the version number.

For example:

```
B1x5/v2/software/VSP_3.0.1.0/detailed files
B1x5/v2/software/VSP_3.0.1.0/EManual/detailed files
B1x5/v2/NIBP/NIBP_2.0.1.0/detailed files
B1x5/v2/ECG/ECG_2.0.1.0/detailed files
B1x5/v2/RECX/RECX_0.5/detailed files
B1x5/v2/STP/STP_2.0.1.0/detailed files
B1x5/v2/TP/TP_2.0.1.0/detailed files
```

## Transferring the software, e-manuals, and firmware with USB

1. Discharge the patient. Disconnect E-modules from monitor, if have.
2. Insert the USB disk with the target software to monitor.
3. Select the  >  Service > enter **Username** and **Password**.
4. Select the **Service** tab > **Page2** vertical tab > **SW Management**.



- a. For software: select the version for target **Software** and **Manual**. Select **Update** for target software and e-manuals.
- b. For firmware: select the version for related firmware. Select **Update** for target firmware.

A message **Download successfully.** will display on the screen.

For main software, the monitor will automatically restart after successfully download.

## Performing post checkout

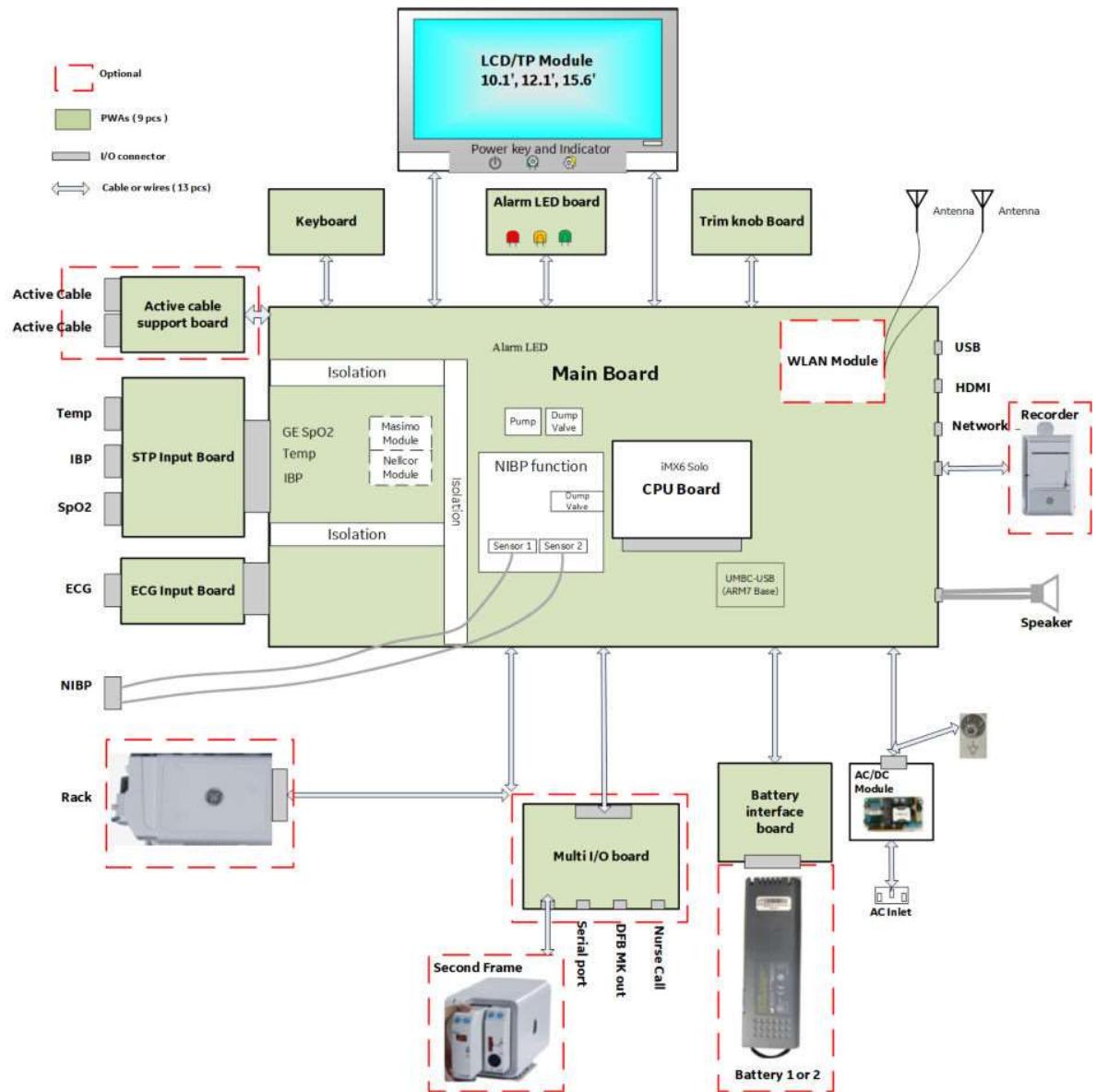
1. Select the  >  **Monitor Info**.
2. Verify that the related software/firmware versions are correct.

**NOTE**

There is no need to do any electrical safety tests and maintenance checkout after software/firmware, e-manuals download.

# Theory of operation

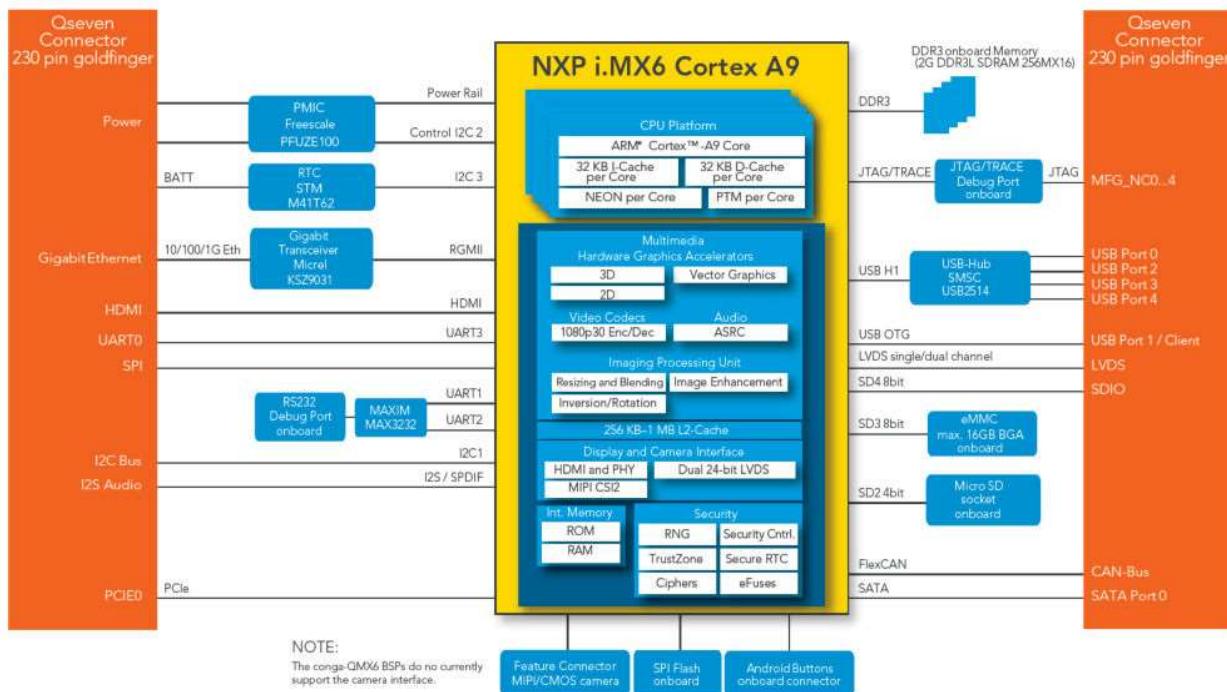
## System block diagram



# Main components

## CPU board

Figure 7 CPU board block diagram



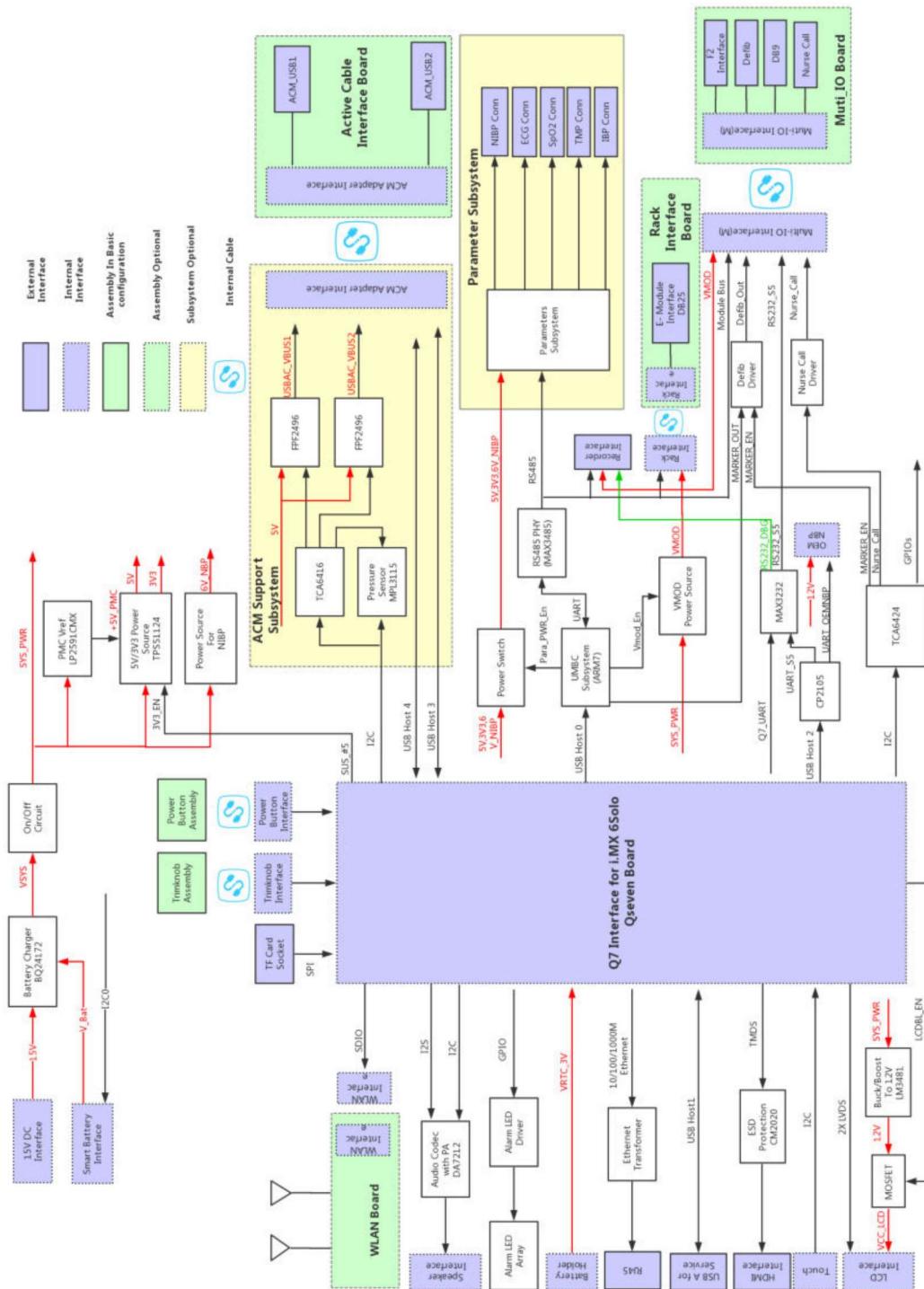
The main specifications are:

- NXP i.MX6 Solo ARM Cortex A9
- Up to 1.0 GHz<sup>\*1</sup>
- L2 cache 512kB
- Up to 2 GByte onboard DDR3 memory, 1066 MT/s

<sup>\*1</sup> Core Frequency: 1.0 GHz for commercial grade, 800 MHz for industrial grade

## Main board

**Figure 8 Main board block diagram**



The main board functions include the following functions.

- The power supply subsystem converts the output voltage of AC/DC unit and battery voltage to various supply voltages for the electronics of monitor. It provides:
  - 5V, 3.3V for system power
  - 3.3V, 6V for parameters
  - 12V for LCD
  - 15V for E-module and recorder
- The Parameter subsystem provides:
  - ECG
  - NIBP
  - SpO2
  - Temperature
  - IBP
- The UMBC subsystem with RS-485 module bus communication to following functions:
  - Parameter subsystem
  - RACK interface (E-module)
  - Recorder interface
  - Multi-IO interface (F2, Defib, Nurse call, serial port)
- Active cable management subsystem (Optional)
- The main board provide following internal interfaces:
  - Trim knob
  - Power button
  - Speaker
  - Alarm LED
  - WLAN (to WLAN board)
  - LCD and touch
  - Battery holder
  - TF card
  - ECG (to ECG input board)
  - STP (to STP input board)
  - SpO2 (to Masimo/Nellcor board)
  - RACK (to RACK interface board)
  - Recorder
  - Multi-IO (to Multi-IO board)
  - ACM adapter (to Active cable interface board) (Optional)
- The main board provide following external connectors:
  - RJ45 (Ethernet)

- USB type A
- HDMI

## AC/DC power supply

The AC/DC unit is a compact, medical, and switched-mode power supply with a universal AC input. The high-efficiency design minimizes heat dissipation.

It is designed for 65 W continuous output power, and 15V output voltage. It connects to the main board, the AC input may vary between 90-264 Vac, 47-63 Hz.

The AC/DC unit has over-temperature, overcurrent, and overvoltage protections.

## Battery

The monitor has a lithium-ion battery, located in the battery holder. When no power is received from the AC/DC unit, the main board connects battery to be the power source. The battery charging is controlled by the power supply subsystem on main board.

The screen symbols and monitor LED indicators indicate the battery charging level and possible failure.

## Display subsystem

### Display

The B105M/B105P patient monitor has an integrated 10.1" active matrix color TFT LCD panel with a LED backlight unit.

The B125M/B125P patient monitor has an integrated 12.1" active matrix color TFT LCD panel with a LED backlight unit.

The B155M patient monitor has an integrated 15.6" active matrix color TFT LCD panel with a LED backlight unit.

They provide wide viewing angle and supports WXGA (1280 \* 800 and 1366\*768 pixels) resolution. The video controller is integrated into the CPU board and it provides LVDS output to the LCD panel through the main board.

### LED backlight unit

The LCD module has an integrated, long-life LED backlight unit that is used to illuminate the LCD display. The LED backlight unit receives the +12 V input voltage from the main board. The backlight enable signal and brightness control is received from the CPU board.

### Touchscreen

The device has a capacitive touchscreen in the front of the LCD panel. The touchscreen detects the presence and location of a touch within the display area and communicates the information to the CPU board.

### B1X5-F2 frame

The optional B1X5 frame including the AC/DC module (the same as monitor) and connection interface.

## B1X5-REC Recorder

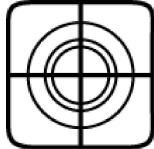
The optional recorder assembly consists of a 50 mm recorder and a recorder board.

### User interface parts

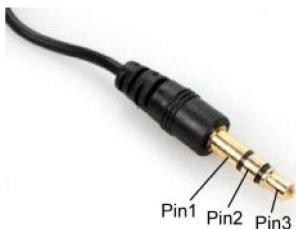
- Trim knob
- Power button
- Speaker
- Alarm LED
- LCD touch panel

## Non-standard connectors and signals

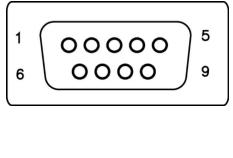
### Nurse call connector

Nurse call connector	Pin number	Signal
	1	GND
	2	NC
	3	NURSE_CALL

Recommended cable design:

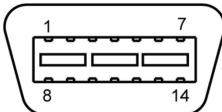


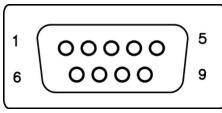
### Serial port connector

Serial port connector	Pin number	Signal Name
	1	GND
	2	SERIAL_RXD
	3	SERIAL_TXD
	4	NC
	5	GND
	6	NC
	7	SERIAL_CTS
	8	SERIAL_RTS

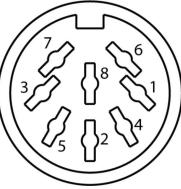
Serial port connector	Pin number	Signal Name
	9	NC

## B1X5-REC recorder connectors

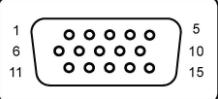
Recorder connector, (On the monitor)	Pin number	Signal
	1	GND
	2	RS485-
	3	RS485+
	4	GND
	5	NC
	6	NC
	7	GND
	8	VMOD (15V)
	9	VMOD (15V)
	10	VMOD (15V)
	11	GND
	12	GND
	13	GND
	14	GND

Serial port connector (On the recorder)	Pin number	Signal
	1	NC
	2	GND
	3	MOD_VDD (+15V power supply)
	4	GND
	5	RS485+
	6	NC
	7	GND
	8	MOD_VDD (+15V power supply)
	9	RS485-

## B1X5-F2 frame connectors

F2 connector (On the monitor)	Pin number	Signal
	1	NC
	2	VMOD (15V)
	3	RS485+
	4	GND
	5	GND
	6	NC
	7	RS485-
	8	VMOD (15V)

F2 connector (On the F2)	Pin number	Signal
	1	RS485+
	2	RS485-
	3	NC
	4	F2_ID
	5	F2_EN
	6	NC
	7	NC
	8	NC
	9	NC
	10	NC
	11	NC
	12	VMOD (15V)
	13	NC
	14	GND
	15	NC

## Defibrillator synchronization connector

Defibrillator Synchronization connector	Pin number	Signal
	1	GND
	2	GND
	3	GND
	4	GND
	5	Digital defibrillator synchronization marker out signal

Defibrillator Synchronization connector	Pin number	Signal
	6	NC
	7	GND

## Measurement principle

### ECG measurement principle

Electrocardiography analyzes the electrical activity of the heart by measuring the electrical potential produced with electrodes placed on the surface of the body.

ECG reflects:

- electrical activity of the heart
- normal/abnormal function of the heart
- effects of anesthesia on heart function
- effects of surgery on heart function

See the user's manual for electrodes' positions and other information.

### Respiration measurement principle

Impedance respiration is measured across the thorax between ECG electrodes. The respiration signal is made by supplying current between the electrodes and by measuring the differential current from the electrodes. The signal measured is the impedance change caused by breathing. The respiration rate is calculated from these impedance changes, and the respiration waveform is displayed on the screen.

### Pulse oximetry measurement principle

A pulse oximeter measures the light absorption of blood at two wavelengths, one in the near infrared (about 940 nm) and the other in the red region (about 660 nm) of the light spectrum. These wavelengths are emitted by LEDs in the SpO<sub>2</sub> probe, the light is transmitted through peripheral tissue and is finally detected by a PIN-diode opposite the LEDs in the probe. The pulse oximeter derives the oxygen saturation (SpO<sub>2</sub>) using an empirically determined relationship between the relative absorption at the two wavelengths and the arterial oxygen saturation SaO<sub>2</sub>.

In order to measure the arterial saturation accurately, pulse oximeters use the component of light absorption giving variations synchronous with heart beat as primary information on the arterial saturation.

A general limitation of pulse oximetry is that due to the use of only two wavelengths, only two hemoglobin species can be discriminated by the measurement.

The modern pulse oximeters are empirically calibrated either against fractional saturation SaO<sub>2</sub>frac;

$$SaO_2frac = \frac{HbO_2}{HbO_2 + Hb + Dyshemoglobin}$$
Formula 1

or against functional saturation  $SaO_2\text{func}$ :

$$SaO_2\text{func} = \frac{HbO_2}{HbO_2 + Hb} \quad \text{Formula 2}$$

Functional saturation is more insensitive to changes of carboxyhemoglobin and methemoglobin concentrations in blood.

The oxygen saturation percentage  $SpO_2$  measured by the module is calibrated against functional saturation  $SaO_2\text{func}$ . The advantage of this method is that the accuracy of  $SpO_2$  measurement relative to  $SaO_2\text{func}$  can be maintained even at rather high concentrations of carboxyhemoglobin in blood. Independent of the calibration method, pulse oximeters are not able to correctly measure oxygen content of the arterial blood at elevated carboxyhemoglobin or methemoglobin levels.

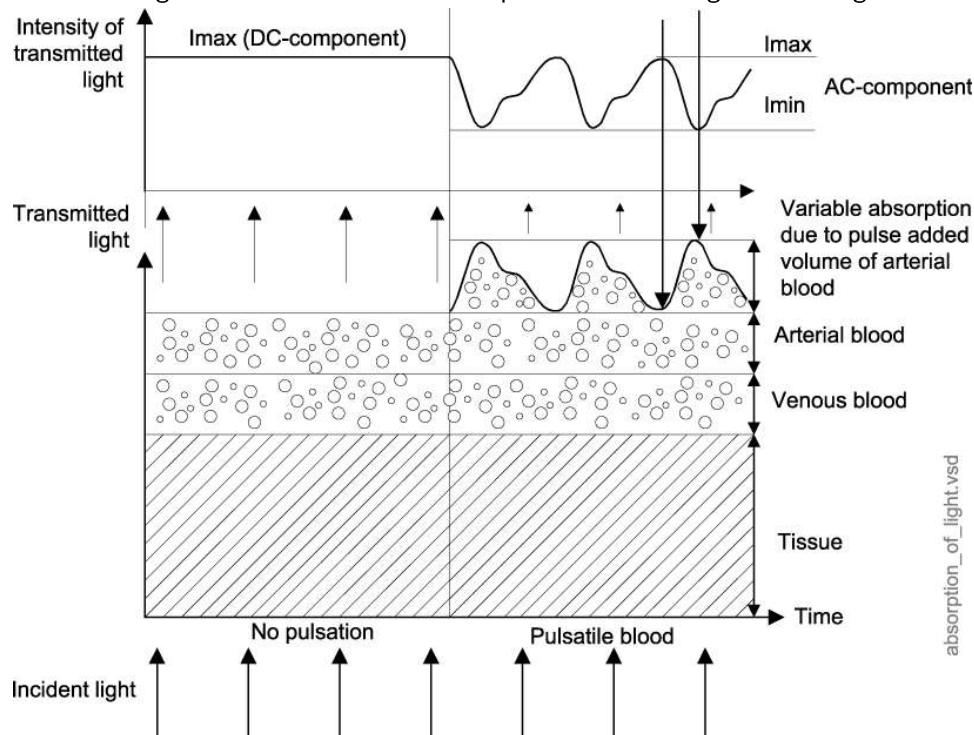
## Plethysmographic pulse wave

The plethysmographic waveform is derived from the IR signal and reflects the blood pulsation at the measuring site. Thus the amplitude of the waveform represents the perfusion.

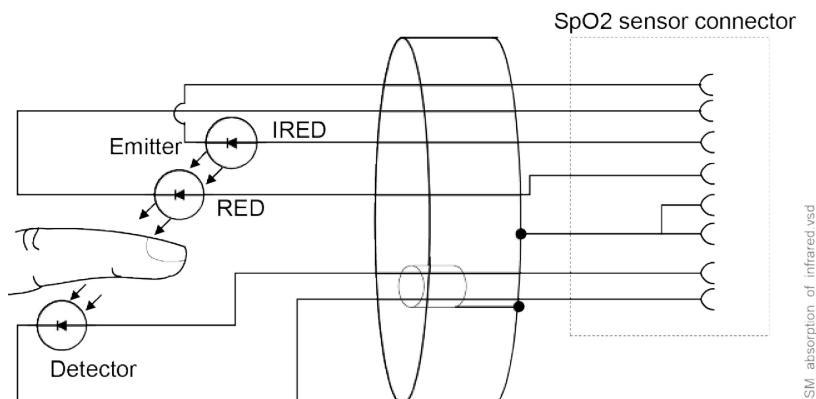
## Pulse rate

The pulse rate calculation is done by peak detection of the plethysmographic pulse wave. The signals are filtered to reduce noise and checked to separate artifacts.

The following illustration shows the absorption of infrared light in the finger:



The following illustration shows the layout and schematic diagram of pulse oximetry probe parts:



The standard probe is a finger clamp probe which contains the light source LEDs in one half and the photodiode detector in the other half. Different kinds of probes are available from GE.

## NIBP measurement principle

NIBP (Non-Invasive Blood Pressure) is an indirect method for measuring blood pressure.

The NIBP measurement is performed according to the oscillometric measuring principle. The cuff is inflated with a pressure slightly higher than the presumed systolic pressure, and deflated at a speed based on the patient's pulse, collecting data from the oscillations caused by the pulsating artery. Based on these oscillations, values for systolic, mean, and diastolic pressures are calculated.

The following parts are necessary for the NIBP measurement:

- a parameter module
- twin hose (adult or infant model)
- blood pressure cuffs (various sizes)

## Invasive blood pressure measurement principle

To measure invasive blood pressure, a catheter is inserted into an artery or vein. The invasive pressure setup, consisting of a connecting tubing, a pressure transducer, an intravenous bag of normal saline, all connected together by stopcocks, is attached to the catheter. The transducer is placed at the same level with the heart, and is electrically zeroed.

The transducer is a piezo-resistive device that converts the pressure signal to a voltage. The monitor interprets the voltage signal so that pressure data and pressure waveforms can be displayed.

## Temperature measurement principle

The temperature is measured by a probe whose resistance varies when the temperature changes, called NTC (Negative Temperature Coefficient) resistor.

The resistance can be measured by two complementary methods:

- Applying a constant voltage across the resistor and measuring the current that flows through it.
- Applying a constant current through the resistor and measuring the voltage that is generated across it.

These modules use the constant current method. The NTC resistor is connected in series with a normal resistor and a constant current is applied through them. The temperature dependent voltage can be

detected at the junction of the resistors, thus producing the temperature signal from the patient. The signal is amplified by analog amplifiers and further processed by digital electronics.

# Troubleshooting

## Troubleshooting guidelines

### NOTE

For the module troubleshooting, please refer to modules' service manual.

This chapter focuses on troubleshooting technical problems. Refer to the user's manual for troubleshooting monitoring problems and clinical configuration issues.

If a problem remains, contact technical support for service. To ensure accurate problem solving, please be prepared to provide the following information:

- Product name and serial number or UDI
- Hardware, firmware, and software versions
- Detailed problem description
- Error messages, if any
- Service Logs and system diagnosis information
- The remote diagnosis you have done

Perform the specified corrective maintenance check after any corrective maintenance to the product.

## Performing basic troubleshooting

Before beginning any detailed troubleshooting, complete the following steps:

1. Check if there are any error messages shown. For a list of possible causes and solutions, see Messages related to various technical issues.
2. Perform visual inspection to be sure that:
  - There is no physical damage.
  - All peripheral devices are connected properly.
  - The patient monitor and the connected peripheral devices are properly powered.
3. Verify the compatibility of all system components.  
For a list of the compatible devices, see the Supplemental Information Manual.  
For a list of the compatible accessories, see the Supplies and accessories.
4. Verify that the platform and clinical configurations are correct.  
For the clinical configuration see user's manual and for the platform configuration see Configuration chapter.
5. If you suspect loose parts or cable connections inside the monitor, disassemble the monitor to a level needed to perform an internal visual check. Check that:
  - All screws are tightened properly.
  - All cables are connected properly.

- There are no loose objects inside the patient monitor.

Perform the electrical safety test and the checkout procedure every time you have disassembled the patient monitor.

## Viewing and downloading service log

### Viewing service log

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab >**Service Log**.

You can view the **System Log**, and **Alarm Log**.

For **System Log**, you can filter by **Date**, **Keyword**, or enter **Search** contents.

### Downloading logs to USB disk

You can download the system logs, and diagnostic logs to an USB storage device for service use.

#### NOTE

Make sure the file system format for USB storage device should be FAT32.

1. Discharge the patient first.
2. Select the  >  Service > enter **Username** and **Password**.
3. Select **USB Import/Export** > **Export logs to USB Disk**.
4. Enter an encryption **Key** for the logs file, the length of key shall be at least 6.  
This key will be used when open the logs.
5. Select **Export logs to USB Disk**.

When finish to download logs, a message “**Export logs successfully.**” displays on the menu.

6. To remove the USB disk, select **Safe to remove USB Disk**.

### Viewing log files

To view the log files in USB storage device, you need to install the 7-Zip tool in PC:

1. Insert the USB storage device to the service PC, and open the USB storage device.  
The log files are on \B1x5\v2 folder of USB disk.
2. Using 7-Zip to open the related **.7z** or **.tar** file, and enter the key which you've set during export.  
Both of **.7z** and **.tar** files using the same key.
3. Using the Notepad to open detail files.

### Viewing monitor diagnosis

1. Select the  >  Service > enter **Username** and **Password**.
2. Select **Service** tab > **Diagnosis**.

- **System Info** tab: View the status of frame, battery, parameters, recorder, wired and wireless network.

Following table as example, the status data is fictitious.

Category	System Diagnosis	Status
Frame	Monitor Serial Number	SR20121234567WP
	Main CPU Software	VSP_3.0.1.0
	Main Board	SN:SDXXXXSN00
	CPU Board revision	002
	CPU Board Serial Number	12345678
	Uboot Software Version	U-Boot 2019.07-r23-HELIX_4.0
	UMBC Firmware	UMBC_2.0.0.0
	Frame temperature	48000
	RTC Status	OK
Battery	Present	On
	Quality	Condition
	Changing Status	Charging
	Remaining Time	--:--
	Capacity Precent	81
	Temperature	31
ECG/RESP	Present	On
	Firmware Version	ECG_2.0.0.4
	Bootloader Version	ECG_BL_2.0.0.0
	Cable Connected	On
	Cable Type	Ten lead cable
	Measurement Mode	Ten lead mode
	Filter Type	Monitoring
	RL	On
	RA	On
	LL	On
	LA	On
	V1	On
	V2	On
	V3	On
	V4	On
	V5	On
	V6	On
	ECG Module Error	No Error
	RESP Measurement Status	On

<b>Category</b>	<b>System Diagnosis</b>	<b>Status</b>
SpO2	Present	On
	STP Firmware	STP_2.0.0.4
	STP Bootloader	TPSTP_BL_2.0.0.0
	M-SAT Version	
	Source Type	GE
	Cable connected	On
	Probe connected	On
	Faulty Probe	No Faulty
	Incompatible Probe	Compatible
	Module Error	No Error
IBP	P1 Present	On
	P1 Transducer Connection	On
	P2 Present	On
	P2 Transducer Connection	On
	P4 Present	On
	P4 Transducer Connection	On
TEMP	T1 Present	On
	T1 Temperature Error	No Error
	T2 Present	On
	T2 Temperature Error	No Error
NIBP	Present	On
	Firmware Version	NIBP_2.0.0.4
	Bootloader Version	NIBP_BL_2.0.0.0
	Service Error	0
	Compatible	Compatible
	Overpressure	No
Gas	Connected	On
	Firmware Version	NIBP_2.0.0.4
	Module Type	Spectrolite
	Amt Pressure	0
	Sample Flow	0.0
	TPX Temperature	0.0
	CPU Temperature	0.0
	OM Temperature	0.0
	Need Check Water Trap	No
	Need replace Water Trap	No
	Need Service Gas Module	No

Category	System Diagnosis	Status
Entropy	Connected	Off
	Firmware Version	
	Cable Connected	Off
	Sensor Connected	Off
C.O.	Connected	Off
	Firmware Version	
	Catheter Connected	Off
	Sensor Connected	Off
NMT	Connected	Off
	Firmware Version	
	Cable Connected	Off
	Cable Type	Off
Recorder	Connected	Off
	Recording State	Idle
	Voltage is High	No
	Voltage is Low	No
	Overheated	No
	System Error	0
Ethernet	Connected	Off
	MAC Address	00:0c:29:00:b1:25
	IP Address	none
	Subnet Mask	none
	Gateway IP	none
WLAN	Present	On
	Enabled	On
	Connected	On
	Signal Strength	-80
	MAC Address	00:0c:29:00:b1:25
	IP Address	172.16.47.21
	Subnet Mask	255.255.0.0
	Gateway IP	172.16.254.254

- **LED** tab: Test the alarm light function.
- **Touch Screen** tab: View the touch screen status.
- **UMBC info** tab: View and test the UMBC information.

## Network diagnostics

### Pinging a TCP/IP network device

You can verify connectivity with a network device on the MC Network using **Ping**.

1. Select the  >  **Service** > enter **Username** and **Password**.
2. Select **Service** tag >**Network** >**TCP/IP** tag > **Ping** vertical tag.
3. In the **Address** field enter the IP address of a known device on the network.
4. Select **Ping**.

If you receive a reply, the monitor is able to connect to the network device.

If you do not receive a reply, make sure that the monitor is connected to an active network.

#### NOTE

The monitor withstands a maximum packet loss of 5 packets per 1 million and maximum latency of 250 ms without performance degradation.

### Viewing Wireless status

You can view the WLAN status and detected access points for troubleshooting WLAN related problems.

1. Select the  >  **Service** > enter **Username** and **Password**.
2. Select **Service** tag > **Page2** vertical tag > **WLAN Status**.

Consult Hospital IT for WLAN configuration.

## Messages

### Messages related to various situations

For information regarding alarm priorities and escalation times, see the supplemental information manual.

Make sure you are familiar with the generic layout of the screen. This will help you identify where on screen the following messages appear. The message location is indicated with the following abbreviations:

- MF = message field
- WF = waveform field
- DF = digit field

Message	Location	Possible causes	Suggested actions
• <b>Alarm setup changed from Central</b>	• MF	The alarm setup is retrieved from the central station.	• Check the alarm settings and adjust if necessary.
• <b>Alarms reset remotely</b>	• MF	The alarms were remotely paused from the remote device.	• No action required.

Message	Location	Possible causes	Suggested actions
• <b>All monitors disconnected</b> (Bed to Bed)	• MF	The monitor is disconnected from the network.	<ul style="list-style-type: none"> <li>Re-establish connection.</li> <li>If the problem persists, check the following:           <ol style="list-style-type: none"> <li>The network cable connection and condition.</li> <li>The monitor's network configuration.</li> <li>The network infrastructure hardware and configuration.</li> </ol> </li> </ul>
• <b>Alarm volume changed</b>	• MF	The network connection is lost, and the local alarm volume is increased.	<ul style="list-style-type: none"> <li>Readjust volume if needed.</li> </ul>
• <b>Battery empty</b>	• MF	The monitor is battery powered and less than 5 min of monitoring time is available with battery.	<ul style="list-style-type: none"> <li>Charge the battery by using the monitor on main power.</li> </ul>
• <b>Battery low</b>	• MF	The monitor is battery powered and less than 20 min of monitoring time is available with battery.	<ul style="list-style-type: none"> <li>Charge the battery by using the monitor on main power.</li> </ul>
• <b>Battery temperature high</b>	• MF	The battery's temperature is too high.	<ul style="list-style-type: none"> <li>Replace the battery.</li> </ul>
• <b>Call service UMBC error</b>	• MF	UMBC communication error, and UMBC communication is disabled.	<ul style="list-style-type: none"> <li>Replace the main board.</li> </ul>
• <b>Certificate close to expiration</b>	• MF	The CA and client certificate in system time is 0-14 days before expire time.	<ul style="list-style-type: none"> <li>Contact authorized service personnel to install another CA certificate.</li> </ul>
• <b>Certificate expired</b>	• MF	CA and client certificate is expired.	<ul style="list-style-type: none"> <li>Contact authorized service personnel to install another CA certificate.</li> </ul>
• <b>Condition battery</b>	• MF	Battery is not working properly.	<ul style="list-style-type: none"> <li>Replace the battery.</li> </ul>
• <b>CS Gateway communication failure</b>	• MF	An error occurred when trying to search for patient on the CARESCAPE Gateway.	<ul style="list-style-type: none"> <li>Check the network connectivity.</li> <li>Check the CARESCAPE Gateway whether is offline.</li> <li>Retry loading from the network.</li> </ul>
• <b>DEMO MODE</b>	• MF	DEMO mode has been enabled.	<ul style="list-style-type: none"> <li>To exit the DEMO mode: Contact authorized service personnel.</li> </ul>
• <b>Entering standby</b>	• MF	Activate standby has been selected.	<ul style="list-style-type: none"> <li>No action required.</li> </ul>
• <b>Frame temperature high</b>	• MF	The temperature inside the frame is over 70°C/158 °F.	<ul style="list-style-type: none"> <li>Turn off the monitor, wait for it cool down.</li> <li>Make sure there is sufficient ventilation.</li> <li>Check and clean monitor ventilation holes.</li> </ul>

Message	Location	Possible causes	Suggested actions
• <b>Identical IP address noticed</b>	• MF	Two or more monitors on the network have the same IP address.	<ul style="list-style-type: none"> <li>Disconnect the patient monitor that has the identical IP address.</li> <li>Change the IP address of the patient monitor that has the duplicate IP address.</li> </ul>
• <b>Identical unit&amp;bed name noticed</b>	• MF	Two or more monitors in the network have the same unit and bed name.	<ul style="list-style-type: none"> <li>Disconnect the patient monitor that has the identical unit and bed name.</li> <li>Change the unit and bed name of the duplicate patient monitor unit and bed name.</li> </ul>
• <b>License invalid</b>	• MF	License is invalid during start up.	<ul style="list-style-type: none"> <li>Check and reset the license.</li> </ul>
• <b>Monitor disconnected</b> (Bed to bed)	• MF	The monitor with alarm notification enabled is disconnected from the network.	<ul style="list-style-type: none"> <li>Re-establish the connection.</li> </ul>
• <b>Network: HL7</b>	• MF	When network connection between HL7 TCP Client application and monitor is made.	<ul style="list-style-type: none"> <li>No action required.</li> </ul>
• <b>Network down</b>	• MF	CARESCAPE Network connection has failed.	<ul style="list-style-type: none"> <li>Try to re-establish the connection.</li> <li>Check the configuration of network.</li> </ul> <p>For more information, see network troubleshooting.</p>
• <b>Network down: HL7</b>	• MF	No HL7 TCP Client is configured to connect to monitor on the network.	<ul style="list-style-type: none"> <li>Try to re-establish the connection.</li> <li>Check the configuration of network.</li> </ul> <p>For more information, see network troubleshooting.</p>
• <b>Network made</b>	• MF	When CARESCAPE network is connected.	<ul style="list-style-type: none"> <li>No action required.</li> </ul>
• <b>No battery backup</b>	• MF	Battery missing from the battery compartments.	<ul style="list-style-type: none"> <li>Replace the battery</li> </ul>
• <b>No patients found</b>	• MF	No patients were found when searching on CARESCAPE gateway.	<ul style="list-style-type: none"> <li>Verify or change search criteria.</li> <li>Manually enter patient information.</li> </ul>
• <b>Patient admitted</b>	• MF	The current patient has been admitted.	<ul style="list-style-type: none"> <li>No action required.</li> </ul>
• <b>Patient discharged</b>	• MF	The patient has been discharged.	<ul style="list-style-type: none"> <li>No action required.</li> </ul>
• <b>Printing</b>	• MF	Printing is occurring.	<ul style="list-style-type: none"> <li>Wait for the printing to finish.</li> </ul>
• <b>Printing Alarm</b>	• MF	An alarm has triggered printing.	<ul style="list-style-type: none"> <li>Wait for the printing to finish.</li> </ul>
• <b>Recorder: cover open</b>	• MF	The recorder cover is open.	<ul style="list-style-type: none"> <li>Close the recorder cover.</li> </ul>

Message	Location	Possible causes	Suggested actions
<ul style="list-style-type: none"> <li><b>Recorder: input voltage high</b></li> <li><b>Recorder: input voltage low</b></li> </ul>	• MF	There are problems with the recorder input voltage.	<ul style="list-style-type: none"> <li>Replace recorder.</li> </ul>
<b>Recorder: out of paper</b>	• MF	The recorder is out of paper.	<ul style="list-style-type: none"> <li>Replace recorder paper.</li> </ul>
<b>Recorder system error</b>	• MF	The local recorder is not working.	<ul style="list-style-type: none"> <li>Disconnect and reconnect the recorder cable.</li> <li>Replace recorder.</li> </ul>
<b>Recorder thermal array overheated</b>	• MF	There are problems with the recorder temperature. Long time printing.	<ul style="list-style-type: none"> <li>Try stopping the recording.</li> <li>Replace the recorder.</li> </ul>
<b>Recorder module removed</b>	• MF	Recorder module has been removed.	<ul style="list-style-type: none"> <li>Reconnect the recorder module if you need.</li> </ul>
<b>Replace battery</b>	• MF	Battery is not working properly.	<ul style="list-style-type: none"> <li>Replace the battery.</li> </ul>
<b>Restart needed</b>	• MF	The monitor should be restarted.	<ul style="list-style-type: none"> <li>Restart the monitor.</li> </ul>
<b>Saving</b>	• MF	The printing device is not available, and the records are saved for later printing.	<ul style="list-style-type: none"> <li>Check the printing device.</li> <li>Select a printing location.</li> </ul>

## Messages related to ECG measurement

For information regarding alarm priorities and escalation times, see the supplemental information manual.

Make sure you are familiar with the generic layout of the screen. This will help you identify where on screen the following messages appear. The message location is indicated with the following abbreviations:

- MF = message field
- WF = waveform field
- DF = digit field

Message	Location	Possible causes	Suggested actions
<b>Alarm setup changed from Central</b>	• MF	Any of the ECG alarms (HR, ST alarms) are turned ON/OFF or its limits are adjusted from the Central.	<ul style="list-style-type: none"> <li>Check the alarm settings at the Central.</li> </ul>
<b>Arrhythmia Paused</b>	• WF	ECG channels have not been available for analysis for the last 20 seconds or the internal HR calculation has not been updated for the last 30 seconds due to excessive artifact.	<ul style="list-style-type: none"> <li>Check the patient status.</li> <li>Check electrode placement.</li> <li>Prepare the patient's skin at electrode sites.</li> <li>Change or move electrodes.</li> </ul>
<b>Arrh Paused</b>	• MF		
<b>Artifact</b>	• WF	Muscle artifact or high/low frequency noise.	<ul style="list-style-type: none"> <li>Check electrode contact.</li> <li>Check lead placement.</li> <li>Perform skin preparation.</li> <li>Reposition/replace electrodes.</li> <li>Request the patient to remain still.</li> </ul>
<b>ECG measurements removed</b>	• MF	Lost ECG measurement.	<ul style="list-style-type: none"> <li>Replace main board.</li> </ul>

Message	Location	Possible causes	Suggested actions
• <b>ECG module error</b>	• MF	The ECG module communication problem.	<ul style="list-style-type: none"> <li>Check ECG input board connection.</li> <li>Replace ECG input board.</li> <li>Replace main board.</li> </ul>
• <b>Lead off</b>	• MF	One or more leadwires or electrodes disconnected. Other ECG leads are available for arrhythmia detection.	<ul style="list-style-type: none"> <li>Check the leadwire and electrode connections.</li> </ul>
• <b>LA/L lead off</b> • <b>LL/F lead off</b> • <b>RA/R lead off</b> • <b>RL/N lead off</b> • <b>V/C lead off</b> • <b>V2/C2 lead off</b> • <b>V3/C3 lead off</b> • <b>V4/C4 lead off</b> • <b>V5/C5 lead off</b> • <b>V6/C6 lead off</b>	• WF		
• <b>Lead changed</b>	• WF	The monitor automatically switches the ECG1 waveform selection to a measurable ECG Lead (I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5 or V6) if the current ECG1 waveform is not measurable.	<ul style="list-style-type: none"> <li>Check the lead. (Note that the ECG waveform changes according to the lead it is measured from.)</li> </ul>
• <b>Leads off</b>	• MF, WF	One or more of the connected electrodes is disconnected and arrhythmia detection is not possible.	<ul style="list-style-type: none"> <li>Check the connections.</li> </ul>

## Messages related to impedance respiration measurement

For information regarding alarm priorities and escalation times, see the supplemental information manual.

Make sure you are familiar with the generic layout of the screen. This will help you identify where on screen the following messages appear. The message location is indicated with the following abbreviations:

- MF = message field
- WF = waveform field
- DF = digit field

Message	Location	Possible causes	Suggested actions
• <b>Apnea deactivated</b>	• DF	The case has recently been patient admitted on the monitor, or the measurement has just been started.	<ul style="list-style-type: none"> <li>No action required.</li> </ul> <p>The message disappears after the monitor detects breaths.</p>
• <b>No breath deactivated</b>			
• <b>Lead I failed</b> • <b>Lead II failed</b> • <b>Lead RL-LL failed</b>	• WF, DF	One of the electrodes is off.	<ul style="list-style-type: none"> <li>Check the electrodes and their connections.</li> </ul>
• <b>Measurement off</b>	• WF, DF	ECG leads are not connected to the patient.	<ul style="list-style-type: none"> <li>Connect the ECG leads to the patient to start the impedance respiration measurement.</li> </ul>

Message	Location	Possible causes	Suggested actions
• <b>Small resp curve</b>	• DF	Signal amplitude < 0.4 Ohm	<ul style="list-style-type: none"> <li>Check the patient status.</li> <li>Check the electrodes placement.</li> </ul>

## Messages related to SpO<sub>2</sub> measurement

For information regarding alarm priorities and escalation times, see the supplemental information manual.

Make sure you are familiar with the generic layout of the screen. This will help you identify where on screen the following messages appear. The message location is indicated with the following abbreviations:

- MF = message field
- WF = waveform field
- DF = digit field

Message	Location	Possible causes	Suggested actions
• <b>Check Device</b>	• DF	Only for Masimo type. Module malfunction.	<ul style="list-style-type: none"> <li>Replace Masimo board.</li> <li>If the problem persists, replace the main board.</li> </ul>
• <b>Check SpO<sub>2</sub> probe</b>	• MF	There is no detectable SpO <sub>2</sub> signal, the sensor is faulty or is detached from the patient.	<ul style="list-style-type: none"> <li>Check the sensor and connections.</li> </ul>
• <b>Check Probe</b>	• DF		
• <b>Faulty Probe</b>	• DF	The sensor has failed, or not compatible.	<ul style="list-style-type: none"> <li>Replace the sensor.</li> </ul>
• <b>Identical SpO<sub>2</sub> modules</b>	• MF	There are two or more identical SpO <sub>2</sub> modules are connected to the same monitor.	<ul style="list-style-type: none"> <li>Remove identical SpO<sub>2</sub> modules.</li> </ul>
• <b>Incompatible Probe</b>	• DF	The sensor is not compatible.	<ul style="list-style-type: none"> <li>Replace the sensor.</li> </ul>
• <b>Incompatible SpO<sub>2</sub> Probe</b>	• MF		
• <b>Interference</b>	• DF	The measurement is disturbed.	<ul style="list-style-type: none"> <li>Check the sensor.</li> </ul>
• <b>Low Perfusion</b>	• DF	Low perfusion at the measurement point.	<ul style="list-style-type: none"> <li>Check the sensor and sensor positioning.</li> <li>Relocate the sensor to a better measurement site, if possible.</li> <li>Make sure the patient is not shivering.</li> </ul>
• <b>Low signal quality</b>	• DF	Only for Masimo type. The quality of the signal is questionable.	<ul style="list-style-type: none"> <li>Check the sensor and sensor positioning.</li> <li>Relocate the sensor to a better measurement site, if possible.</li> <li>Make sure the patient is not shivering.</li> </ul>
• <b>No SpO<sub>2</sub> probe</b>	• MF	Sensor is not connected to the monitor. Sensor is not compatible.	<ul style="list-style-type: none"> <li>Check connection between the sensor and the monitor.</li> <li>Replace the sensor.</li> </ul>
• <b>No Probe</b>	• DF		
• <b>No SpO<sub>2</sub> pulse</b>	• MF	No pulses detected.	<ul style="list-style-type: none"> <li>Try another measuring site.</li> </ul>
• <b>No Pulse</b>	• DF		

Message	Location	Possible causes	Suggested actions
• <b>Poor Signal</b>	• DF	When the low perfusion is detected.	<ul style="list-style-type: none"> <li>Check the sensor and sensor positioning.</li> <li>Relocate the sensor to a better measurement site, if possible.</li> <li>Make sure the patient is not shivering.</li> </ul>
• <b>Pulse Search</b>	• DF	Defective or damaged sensor or cable. Sensor is off of the patient. Detection of a repeatable pulse has stopped.	<ul style="list-style-type: none"> <li>Check the sensor and cable.</li> <li>Reposition or replace sensor.</li> </ul>
• <b>SpO2 faulty probe</b>	• MF	The sensor has failed, or not compatible.	<ul style="list-style-type: none"> <li>Replace the sensor.</li> </ul>
• <b>SpO2 measurement removed</b>	• MF	Only for Nellcor or Masimo type. Lost SpO <sub>2</sub> measurement.	<ul style="list-style-type: none"> <li>Replace Masimo or Nellcor board.</li> <li>If the problem persists, replace the main board.</li> </ul>
• <b>SpO2 module error</b>	• MF	Only for Nellcor or Masimo type. SpO <sub>2</sub> module recognize a communication problem.	<ul style="list-style-type: none"> <li>Replace Masimo or Nellcor board.</li> </ul>
• <b>SpO2 probe off</b>	• MF	The finger or earlobe may be too thin or the sensor is off the patient.	<ul style="list-style-type: none"> <li>Check the patient status.</li> <li>Reposition the SpO<sub>2</sub> sensor.</li> <li>Replace the SpO<sub>2</sub> sensor.</li> </ul>
• <b>Probe Off</b>	• DF		

## Messages related to NIBP measurement

For information regarding alarm priorities and escalation times, see the supplemental information manual.

Make sure you are familiar with the generic layout of the screen. This will help you identify where on screen the following messages appear. The message location is indicated with the following abbreviations:

- MF = message field
- WF = waveform field
- DF = digit field

Message	Location	Possible causes	Suggested actions
<ul style="list-style-type: none"> <li><b>Call service: Error x</b> where x = 0 - 18</li> </ul>	• DF	<ul style="list-style-type: none"> <li>• 0 = RAM test failure</li> <li>• 1 = ROM checksum failure</li> <li>• 2 = Pump on during idle or over current detected</li> <li>• 3 = Startup communication failure with safety CPU</li> <li>• 4 = Not in use</li> <li>• 5 = Calibration Not Protected</li> <li>• 6 = Valve stuck closed during cuff typing</li> <li>• 7 = Could not save calibration data</li> <li>• 8 = PT2 higher than 150 for greater than 15 seconds while idle, or pressure exceeds 15 mmHg for over 180 s for Adult, or pressure exceeds 5 mmHg for over 90 s for Neo.</li> <li>• 9 = Determination time too long</li> <li>• 10 = RTK 400Hz timer re-entry</li> <li>• 11 = RTK 50Hz timer re-entry</li> <li>• 12 = Not in use</li> <li>• 13 = RTK overrun</li> <li>• 14 = Too early AUTO START according to module check</li> <li>• 15 = Calibration data invalid on initialization or unit never calibrated</li> <li>• 16 = Communication timeout between main and safety CPU</li> <li>• 17 = Safety CPU report communication timeout</li> <li>• 18 = Wrong message rate in communication between main and safety CPU</li> </ul>	<ul style="list-style-type: none"> <li>• Restart the monitor.</li> <li>• Update the NIBP firmware.</li> <li>• Replace the main board.</li> </ul>
<ul style="list-style-type: none"> <li><b>NIBP call service error</b></li> </ul>	• MF		
<ul style="list-style-type: none"> <li><b>Check NIBP</b></li> </ul>	• MF	Systolic and/or diastolic results missing.	<ul style="list-style-type: none"> <li>• Check the patient status.</li> <li>• Check NIBP cuff and hoses.</li> <li>• Repeat the measurement.</li> </ul>
<ul style="list-style-type: none"> <li><b>Cuff loose</b></li> </ul>	• DF	Loose cuff or cuff hose.	<ul style="list-style-type: none"> <li>• Check the cuff and cuff hose.</li> </ul>
<ul style="list-style-type: none"> <li><b>Cuff occlusion</b></li> </ul>	• DF	Occlusion during measurement or overpressured cuff.	<ul style="list-style-type: none"> <li>• Check the cuff.</li> </ul>
<ul style="list-style-type: none"> <li><b>Cuff overpressure</b></li> <li><b>NIBP cuff overpressure</b></li> </ul>	• DF • MF	NIBP cuff has exceeded the maximum cuff pressure during an NIBP measurement.	<ul style="list-style-type: none"> <li>• Check NIBP cuff and hoses.</li> <li>• Perform NIBP calibration.</li> </ul>
<ul style="list-style-type: none"> <li><b>Incompatible NIBP</b></li> </ul>	• MF	NIBP firmware version is too low.	<ul style="list-style-type: none"> <li>• Update the NIBP firmware.</li> </ul>

Message	Location	Possible causes	Suggested actions
• <b>Long measurement time</b>	• MF, DF	The measurement time is long. The triggering values vary according to the module and inflation limits in use: • >2 min for adult/ child, 75 s to 80 s for infant	• Check the patient status. • Check the cuff and hose connections. • Restart the measurement.
• <b>NIBP manual</b>	• MF	During auto cycling • Loose cuff or cuff hose. • Long measurement time	• Check the cuff and cuff hose whether loose.
• <b>NIBP cuff loose</b>	• MF	Loose cuff or cuff hose.	• Check the cuff and cuff hose whether loose.
• <b>NIBP cuff occlusion</b>	• MF	Occlusion during measurement or overpressured cuff.	• Check the cuff.
• <b>NIBP measurement removed</b>	• MF	Lost NIBP measurement.	• Replace main board.
• <b>Select cuff size</b>	• MF	Try to start NIBP measurement with invalid cuff size selection.	• Select a valid cuff size from NIBP menu.
• <b>Unstable zero pressure</b>	• DF	Pressure is unstable at start of the NIBP measurement.	• Check the patient status. • Check hose and cuff position. • Repeat the measurement. • Calibrate NIBP
• <b>Weak pulsation</b>	• MF, DF	Weak or unstable oscillation signal.	• Check the patient status. • Reposition the cuff. • Repeat the measurement.

## Messages related to invasive pressures measurement

For information regarding alarm priorities and escalation times, see the supplemental information manual.

Make sure you are familiar with the generic layout of the screen. This will help you identify where on screen the following messages appear. The message location is indicated with the following abbreviations:

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- DF = digit field

Message	Location	Possible causes	Suggested actions
• <b>P1 over range</b> • <b>P2 over range</b> • <b>P4 over range</b>	• MF	Measurement is over range, or the sensor is faulty.  Transducer has not been zeroed correctly.	• Check the patient's pressure by alternative means. • Check the cable and connections. • Rezero the transducer. • Replace the sensor. • Replace the transducer. • Calibrate IBP.
• <b>Over range &gt; 320 mmHg</b> • <b>Over range &gt; 43 kPa</b>	• DF		

Message	Location	Possible causes	Suggested actions
<ul style="list-style-type: none"> <li><b>P1 under range</b></li> <li><b>P2 under range</b></li> <li><b>P4 under range</b></li> </ul>	• MF	<p>Measurement is under range, or the sensor is faulty.</p> <p>Transducer has not been zeroed correctly.</p>	<ul style="list-style-type: none"> <li>Check the patient's pressure by alternative means.</li> <li>Check the cable and connections.</li> <li>Rezero the transducer.</li> <li>Replace the sensor.</li> <li>Replace the transducer.</li> <li>Calibrate IBP.</li> </ul>
<ul style="list-style-type: none"> <li><b>P1, P2: Under range &lt; -40 mmHg</b></li> <li><b>P4: Under range &lt; -30 mmHg</b></li> <li><b>P1, P2: Under range &lt; -5 kPa</b></li> <li><b>P4: Under range &lt; -4 kPa</b></li> </ul>	• DF		
<ul style="list-style-type: none"> <li><b>ABP disconnect</b></li> <li><b>Art disconnect</b></li> <li><b>UAC disconnect</b></li> </ul>	• MF	Invasive pressure line is disconnected.	<ul style="list-style-type: none"> <li>Check the patient status.</li> <li>Check connections.</li> <li>If pressure drops because of zeroing, perform the zeroing process.</li> </ul>
<b>Calibrated</b>	• Menu	Channel calibrated successfully.	<ul style="list-style-type: none"> <li>Wait until the message disappears before starting a measurement.</li> </ul>
<b>Calibrating</b>	• Menu	Calibration of a channel is in progress.	<ul style="list-style-type: none"> <li>No action required.</li> </ul>
<b>Failed</b>	• Menu	<p>Pressure calibration failure due to time-out.</p> <p>Pulsating waveform detected during calibration.</p> <p>Gain is beyond the limits (<math>\pm 20\%</math> of the default gain).</p>	<ul style="list-style-type: none"> <li>Recalibrate. Start inflating the pressure within 45 seconds after the automatic zeroing is completed.</li> <li>Check the manometer reading to ensure that a static 100 to 300 mmHg pressure is present for calibration.</li> <li>Replace the transducer and recalibrate.</li> </ul>
<b>Failed: P&lt;100</b>	• Menu	Calibration reference value user entered is less than 100	<ul style="list-style-type: none"> <li>Recalibrate. Check the manometer reading to ensure that a static 100 to 300 mmHg pressure is present for calibration.</li> </ul>
<ul style="list-style-type: none"> <li><b>InvBP's not zeroed</b></li> <li><b>Not Zeroed</b></li> </ul>	<ul style="list-style-type: none"> <li>MF</li> <li>DF</li> </ul>	There is at least one invasive pressure channel that has not been zeroed.	<ul style="list-style-type: none"> <li>Perform zeroing for all channels.</li> </ul>
<b>No Px transducer</b>	• MF	No transducer connected to the channel indicated in the message, or the sensor is faulty.	<ul style="list-style-type: none"> <li>Connect a transducer.</li> <li>Check the cable and connections.</li> <li>Replace the sensor.</li> <li>Replace the transducer.</li> </ul>
<b>STP measurements removed</b>	• MF	Lost GE SpO <sub>2</sub> , Temperature, IBP measurement.	<ul style="list-style-type: none"> <li>Replace main board</li> </ul>

Message	Location	Possible causes	Suggested actions
• <b>Zero adj &gt; 100 mmHg</b>	• DF	IBP channel zeroed to over 100 mmHg pressure.	<ul style="list-style-type: none"> <li>Repeat the transducer zeroing.</li> <li>Replace the sensor.</li> <li>Replace the transducer.</li> <li>Re-zero the pressure channel.</li> </ul>
• <b>Zeroed</b>	• DF	Zeroing was successful.	<ul style="list-style-type: none"> <li>No action required.</li> </ul> <p>Message is automatically removed after 10 seconds.</p>
• <b>Zeroing</b>	• DF	IBP channel is currently being zeroed.	<ul style="list-style-type: none"> <li>No action required.</li> </ul> <p>Message is automatically removed and replaced with the zeroing results after completion.</p>
• <b>Zeroing failed</b>	• DF	Pulsating waveform detected. Defective transducer Offset is >150 mmHg.	<ul style="list-style-type: none"> <li>Open the transducer to room air and zero the channel.</li> <li>Replace the transducer, open it to room air, and zero the channel.</li> </ul>
• <b>Zero ICP separately</b>	• MF	The ICP channel must be zeroed separately from all other invasive pressures.	<ul style="list-style-type: none"> <li>Zero the channel using the <b>Zero</b> option found under the ICP channel setup menu.</li> </ul>

## Messages related to temperature measurement

For information regarding alarm priorities and escalation times, see the supplemental information manual.

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- DF = digit field

Message	Location	Possible causes	Suggested actions
• <b>Performing temp test</b>	• DF	Temperature is calibrating.	<ul style="list-style-type: none"> <li>No action required.</li> </ul>
• <b>STP measurements removed</b>	• MF	Lost GE SpO <sub>2</sub> , Temperature, IBP measurement.	<ul style="list-style-type: none"> <li>Restart monitor.</li> <li>Replace main board.</li> </ul>
• <b>Temperature error</b> • <b>T1 temperature error</b> • <b>T2 temperature error</b>	• DF • MF	Hardware or calibration test failure in the measurement device.	<ul style="list-style-type: none"> <li>Perform calibration.</li> <li>Replace main board.</li> </ul>

## Problems and solutions

This section lists the possible problems and solutions, the recommended actions are from easy to complex. Please try the first one, if the problem still persists, then try next one by one.

## Start-up failures

Problem	Possible causes	Recommended action
Failure to turn on the patient monitor, when the following conditions apply: <ul style="list-style-type: none"><li>• The patient monitor is connected to AC mains.</li><li>• The Mains voltage indicator is not lit.</li></ul>	Power cord is loose.	Ensure that the power cord is connected properly to the wall outlet and to the patient monitor.
	Power cord is faulty.	Check the power cord for wear and damage, and replace if necessary.
	The internal cable is loose or fault.	Check the following cable is intact and properly connected. <ul style="list-style-type: none"><li>• Cable between ON/Off key and main board.</li><li>• Cable between AC/DC module and the AC inlet</li><li>• Cable between AC/DC module and the main board</li></ul>
	AC/DC module issue	Replace AC/DC module.
	Main board issue	Replace the main board.
Failure to turn on the patient monitor, when the following conditions apply: <ul style="list-style-type: none"><li>• The patient monitor is not connected to AC mains.</li><li>• The monitor is powered from battery.</li></ul>	Battery empty	Check battery status.
	Battery failure	Charge or replace the battery.
	Battery interface board loose or fault.	Check battery interface board is intact connected. Replace the battery interface board.
	On/Off key not lit: Main board issue.	Replace the main board.
	On/Off key lit: CPU board issue.	Replace the CPU board.
Failure to turn on the patient monitor, when the following conditions apply: <ul style="list-style-type: none"><li>• The patient monitor is connected to AC mains.</li><li>• A full charged battery is installed.</li></ul>	On/off key fault	Check power key interface board is intact connected. Replace power key interface board. Replace front assembly.
	On/Off key not lit: Main board issue.	Replace the main board.
	On/Off key lit: CPU board issue.	Replace the CPU board.
The monitor starts, but the display remains black, or white.	The display cables are loose.	Check the display cable is intact and properly connected.
	The display issue.	Replace the display panel.
	CPU board issue.	Replace the CPU board.
The monitor can't start for 10 times in one start-up process, the screen will show "Monitor failed to start. Try again, or contact GE Service for support."	Internal cables .	Check the internal cables are intact and properly connected.
	CPU board issue.	Replace the CPU board.
	Interface parts on main board broken.	Replace the main board.

## User interface issues

Problem	Possible cause	Recommended action
Touchscreen is inoperative.	Touchscreen cable is loose.	Check the touchscreen cable is intact and properly connect to main board.

Problem	Possible cause	Recommended action
	Faulty touchscreen sensor.	Replace the front assembly.
Touchscreen is not responding to touch appropriately.	Emission interference.	Leave away or turn off EM disturbance sources
Alarm light does not illuminate. (audible alarms work and alarm message is visible)	Alarm light cable is loose. Alarm LED is fault.	Check the alarm light cable is intact connected. Replace the alarm light board.
Trim knob not working.	Trim knob cable is loose or fault. Trim knob issue.	Check the cable is intact and properly connect to main board. Replace the trim knob interface board Replace the trim knob
Audible alarms do not work.	Audible alarms are turned off. Speaker failure Tone generator or audio amplifier failure	Enable audible alarms from <b>Alarms Setup</b> . Adjust alarm volume to check whether the speaker is worked. If not, replace the speaker. Replace main board.

## Battery issue

Problem	Possible cause	Recommended action
The battery LED indicator orange flashing.	Battery over voltage. Battery precharge time-out fault Battery fast charge time-out fault	Replace the battery.
Can't charge battery	Battery issue Battery connection issue Main board issue	Replace the battery. Check the battery and chamber connection. Replace the battery chamber. Replace the main board.

## B1X5-F2 frame issues

Problem	Possible cause	Recommended action
The parameter module data is not shown on the monitor display (communication indicator is not lit).	The parameter module is defective. The module is not connected properly. The cable connecting frame to host is not properly connected, or is defective. The monitor's display screen is not configured to display the parameter. The frame is defective.	Go to corresponding module troubleshooting. Reconnect the module. Check the cable connections, or replace the cable. Go to <b>Screen Setup</b> to verify that the parameter is selected to show on the screen. Send the frame to repair.

<b>Problem</b>	<b>Possible cause</b>	<b>Recommended action</b>
The module can not be placed properly to frame	The E-Module rail or module connector (inside the frame) is defective.	Send the frame or the module to repair.
The frame have a power issue (Power indicator is not lit).	The AC/DC is defective.	Replace the AC/DC. (same as monitor's AC/DC FRU)

## B1X5-REC recorder issue

<b>Problem</b>	<b>Possible cause</b>	<b>Recommended action</b>
Recorder does not work.	The recorder connect cable is loose or fault.	Check the recorder connect cable is intact and properly connected.
	Recorder unit failure.	Replace the recorder unit.
	Main board issue	Replace the main board.
Recorder works but nothing appears on the paper.	Paper installed upsidedown.	Turn the paper roll over.
Record paper jam.	Not use the qualified paper.	Use qualified paper, recommend PN: 2106823-001.

## Acquisition module problems

Problem: an acquisition module does not work with the patient monitor.

- Select the  >  **Screen Setup**, check that the parameters are configured to the display.
- Do a visual check to the accessories used with the module. If in doubt, replace the accessories with known good ones.
- Connect another, similar, known good module to the suspect patient monitor and check if the module works normally:
  - YES: The suspect module is most likely faulty. Refer to module's troubleshooting instructions.
  - NO: The problem is most likely in the patient monitor. Continue troubleshooting the problem according to the related troubleshooting chart below.

Or,

- Connect the suspect acquisition module to another, similar, known good patient monitor and check if the module works normally:
  - YES: The problem is most likely in the patient monitor. Continue troubleshooting the problem according to the related troubleshooting chart below.
  - NO: The suspect module is most likely faulty. Refer to module's troubleshooting instructions.

<b>Possible cause</b>	<b>Recommended action</b>
Incompatible module	Refer to the patient monitor's supplemental information manual document to see the list of compatible modules.
Connection issue	<ul style="list-style-type: none"> <li>• Check the related cable connection</li> <li>• Replace the RACK input board</li> <li>• Replace the Multi-IO board</li> </ul>
B1X5-F2 issue	Check B1X5-F2 function, refer to B1X5-F2 troubleshooting.

Possible cause	Recommended action
Main board is faulty.	Replace the main board.

## Incorrect system time issue

Problem	Possible cause	Recommended action
System time is incorrect when monitor is not connected to network.	Time is not configured properly.	Configure date and time.
	CPU battery is empty.	<ol style="list-style-type: none"> <li>1. Replace CPU battery.</li> <li>2. Set date and time.</li> <li>3. Restart the monitor.</li> </ol>
System time is incorrect when monitor is connected to network.	Network device time synchronization error.	<p>If have new device connects to the CARESCAPE network, set the new device's time to be as close as the existing GE devices on the network. (within one minute or less)</p> <p>Contact the hospital IT to network device setup, for example, NTP.</p>

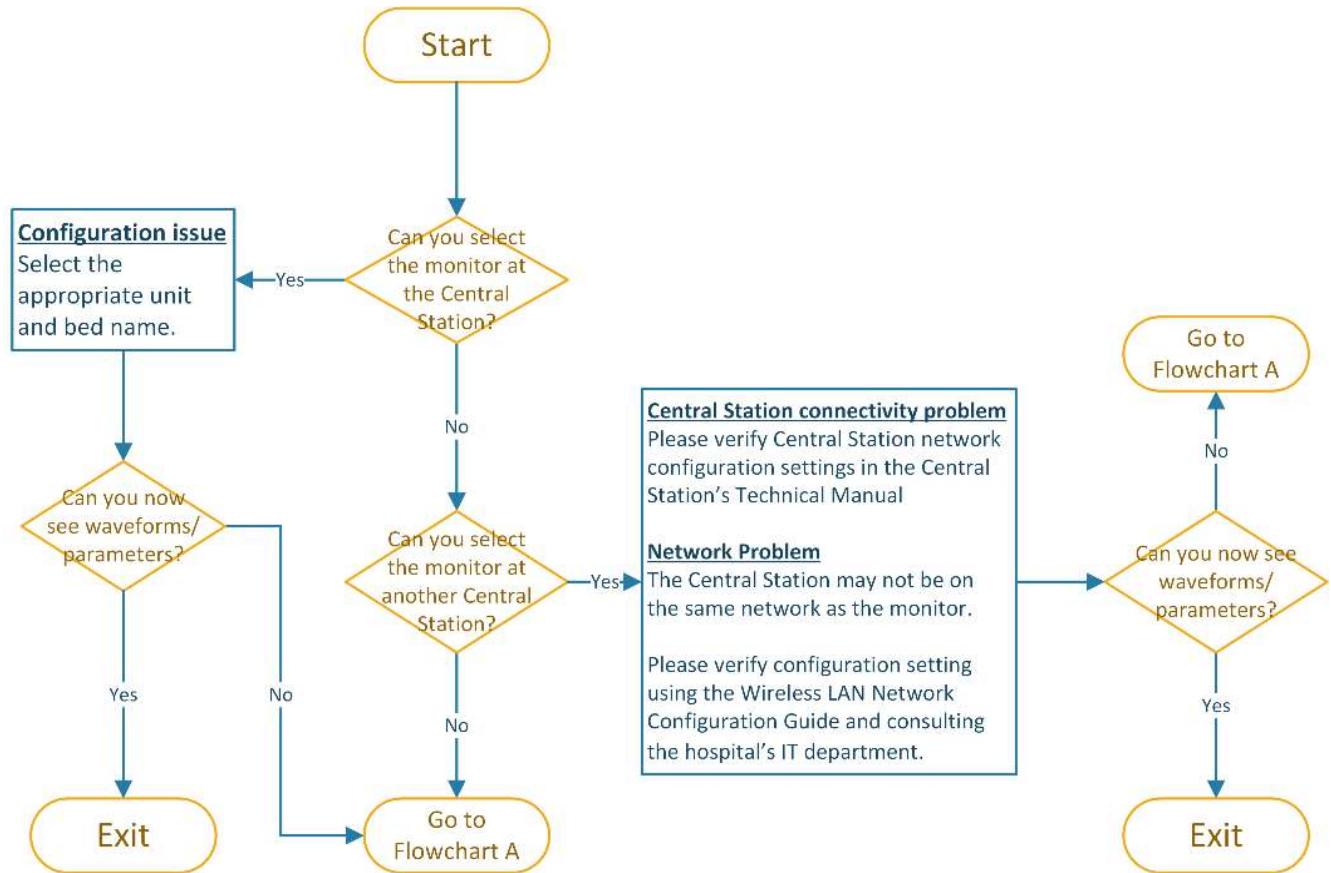
## Troubleshooting CARESCAPE Network communication

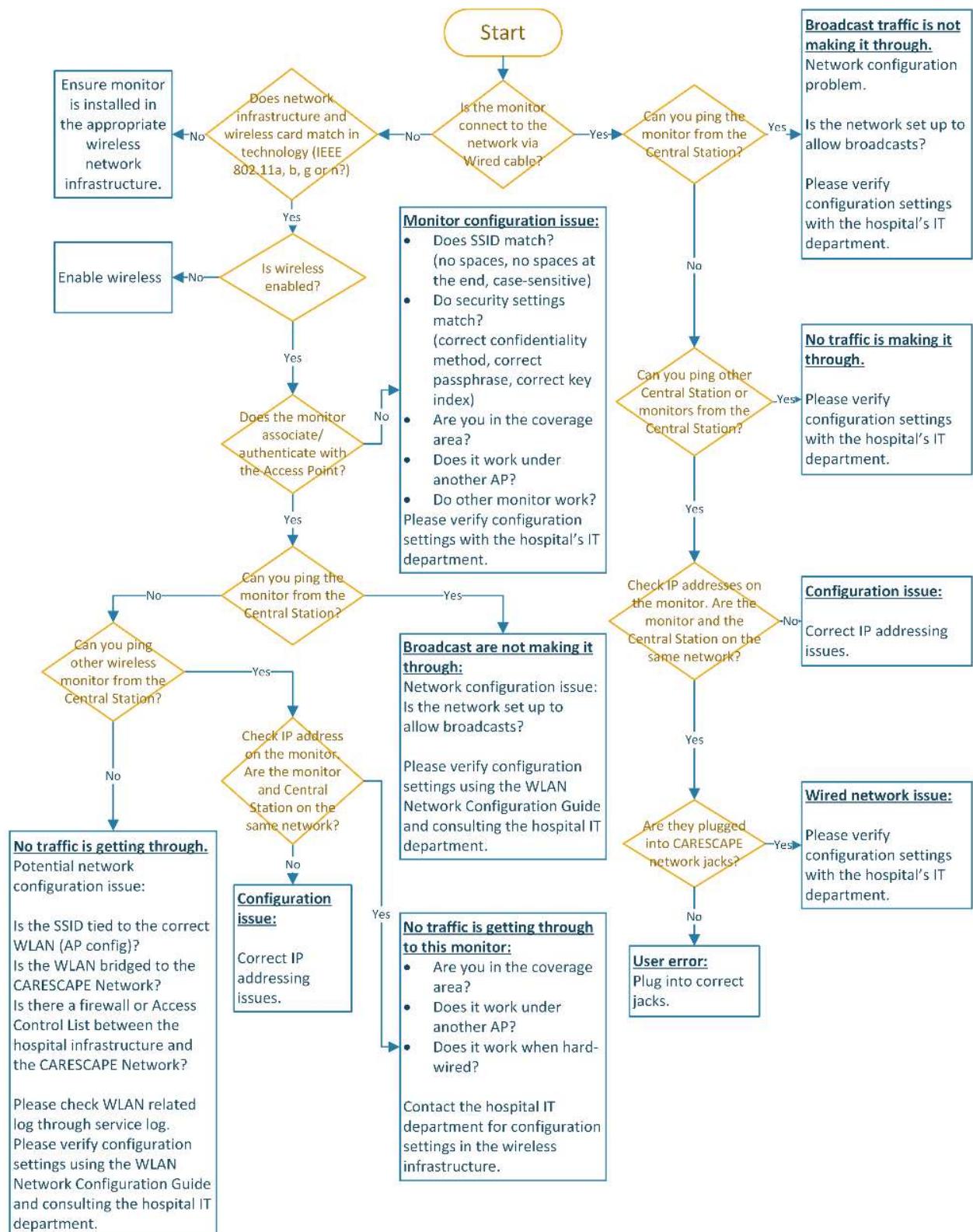
### MC network issues

Problem	Possible cause	Recommended action
There is no MC network traffic.	Network license is missing.	Check the monitor license.
	Incorrect configuration.	Reconfigure the monitor with correct unit name, bed name, IP address and Netmask.
	MC network traffic overload.	Contact the hospital IT to resolve the MC traffic overload.
	<p>The MC network port at the installation site has IEEE 802.1X port based authentication enabled, but the monitor is incorrectly configured:</p> <ul style="list-style-type: none"> <li>• The authentication has not been enabled on the monitor.</li> <li>• Authentication is enabled, but either <b>Password</b> and/or <b>Anonymous Identity</b> are incorrect, or have expired.</li> </ul>	<ul style="list-style-type: none"> <li>• Enable 802.1X authentication on the monitor.</li> <li>• Enter correct <b>Username</b> and <b>Password</b> and/or <b>Anonymous Identity</b>.</li> </ul>

## Can't find the target monitor at the CARESCAPE Central Station

**Figure 9 Network troubleshooting flowchart**



**Figure 10 Network troubleshooting flowchart A**

## Remote service connection issue

Problem: the remote service can't be connected.



Recommended action: Select the **Service** > **Service** > enter **Username** and **Password** > **Service** tab > **Page2** vertical tab > **Remote Service** > **Status** tab.

Check status and troubleshooting as following:

Item of status	Expected status	Toubleshooting if not match
Running	YES	<ul style="list-style-type: none"> <li>Select <b>RSvP Agent</b> tab, check monitor whether enable RSvP connection.</li> </ul>
Registered	YES	<ul style="list-style-type: none"> <li>Wait. the process may take several minutes.</li> <li>Select <b>Config</b> tab to check whether configured correct RSvP server and port.</li> <li>Select <b>Proxy Config</b> tab to check whether configured correct proxy. Consult hospital IT for more details.</li> <li>Check monitor's IP address, Subnet Mask and Gateway, make sure the monitor can be connect to ethernet.</li> <li>RSvP Enterprise issue, connect RSvP Enterprise technical person.</li> </ul>
CRM Verified	YES	CRM number haven't verified in CRM platform. Connect service CRM platform technical person.
Quarantine	NO	There are two or more devices are establishing connections with the RSvP Enterprise use the same CRM number. Connect service CRM platform technical person to manage CRM number.
SFTP Active	YES	In FFA, select <b>CONNECT</b> tab, check <b>File Transfer</b> section whether <b>Connect</b> for <b>Current User</b> .

## Hemo parameter issues

Table 2 Absence of parameter data

Problem	Possible cause	Recommended action
No parameter data	Parameter's accessories' issue.	Check the cable's compatibility and connection. Replace the related accessories.
	Related firmware issue.	Update to the latest firmware.
	STP input board fault for GE SpO2, IBP, temp ECG input board fault for ECG	Check the related input board is intact connected. Replace the related input board.
	Masimo or Nellcor board fault for Masimo/Nellcor SpO2	Replace the Masimo or Nellcor board
	Main board fault	Replace the main board

**Table 3 NIBP**

<b>Problem</b>	<b>Possible cause</b>	<b>Recommended action</b>
Air leakage	Hose or cuff leaking.	Check hose and cuff whether intact connected. Replace cuff. Replace cuff hose.
	Leakage inside the device.	Open the device to check pneumatics connection.

**Table 4 IBP**

<b>Problem</b>	<b>Possible cause</b>	<b>Recommended action</b>
Abnormally pressure.	Transducer wrongly positioned	Check mid-heart level and reposition transducer. Replace transducer.

# Disassembly and reassembly

## Disassembly guidelines

### **WARNING**

ELECTRIC SHOCK.

Always disconnect the device from the power line before you start the disassembly.

### **WARNING**

DISCONNECTION FROM MAINS.

When disconnecting the device from the power line, remove the plug from the wall outlet first. Then you may disconnect the power cord from the device. If you do not observe this sequence, there is a risk of coming into contact with line voltage by inserting metal objects, such as the pins of leadwires, into the sockets of the power cord by mistake.

### **WARNING**

SAFETY GROUND.

Remove power cord from the mains source by grasping the plug. Do not pull on the cable.

### **WARNING**

ELECTRIC SHOCK.

Always unplug the grounded cables when not in use. Leaving them connected could result in an electric shock from the ground contact in the other end.

### **NOTE**

Only a qualified service technician should perform field replacement procedures.

### **NOTE**

Perform the specified corrective maintenance check after any corrective maintenance to the product.

## ESD precautions

All external connectors of the device are designed with protection from ESD damage. However, if the device requires service, exposed components and assemblies inside are susceptible to ESD damage. This includes human hands, non-ESD protected work stations or improperly grounded test equipment. The following guidelines may not guarantee a 100% static-free workstation, but can greatly reduce the potential for failure of any electronic assemblies being serviced:

- Discharge any static charge you may have built up before handling semiconductors or assemblies containing semiconductors.
- Wear a grounded, antistatic wristband or heel strap at all times while handling or repairing assemblies containing semiconductors.

- Use properly grounded test equipment.
- Use a static-free work surface while handling or working on assemblies containing semiconductors.
- Do not remove semiconductors or assemblies containing semiconductors from antistatic containers until absolutely necessary.
- Do not slide semiconductors or electrical/electronic assemblies across any surface.
- Do not touch semiconductor leads unless absolutely necessary.
- Store the semiconductors and electronic assemblies only in antistatic bags or boxes.
- Handle all PCB assemblies by their edges.
- Do not flex or twist a circuit board.

## Reassembly precautions

Reassembly the monitor in reverse order of following disassembly instruction.

Pay attention to the following generic precautions when reassembling the patient monitor:

- Note the positions of any wires, cables or connectors. Mark them if necessary to ensure that they are reassembled correctly.
- Save and set aside all hardware for reassembly.
- GE recommends using the new fasteners (screws, washers, etc.) provided in the FRU kits rather than reusing the old fasteners. Some fasteners are not intended to be re-used .

When you fasten the screws:

- Visually ensure that the screws are properly attached.
- Do not use too much force, as this may damage the existing thread patterns.
- If you use a battery-operated tool, ensure that it is equipped with torque limiter and the torque is properly adjusted.
- When you attach self-tapping screws to light metal parts without existing threads (new light metal FRU parts), use a higher torque than is recommended for reassembled parts, but still not more than 1.6 Nm.
- Use only new screws for the light metal parts. Before fastening a screw, turn it counterclockwise until it drops into an existing thread pattern.

## Required tools

### NOTE

Use torque wrench and torque screwdriver to comply with the given torques.

- insulated PH1, PH2 screwdrivers, recommended length > 65 mm
- T15 torx screwdrivers
- 5.5 mm socket wrenches
- an insulated flat blade screwdriver (width 2.5 mm / 0.1 in)
- an antistatic ESD wristband

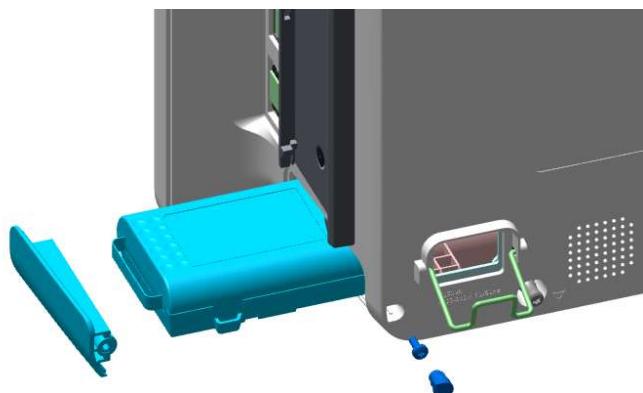
## Preparing for disassembly

1. Turn the monitor off.
2. Disconnect the monitor power cord, first from the wall outlet and then from the monitor.
3. Disconnect all external cables connected to the monitor.
4. Remove all acquisition modules.
5. Detach the monitor from the mounting.

## Disassembly procedures

### Replacing battery

1. Remove rubber and screw on the back cover.
2. Open the battery cover.
3. Pull out the battery from the cord.

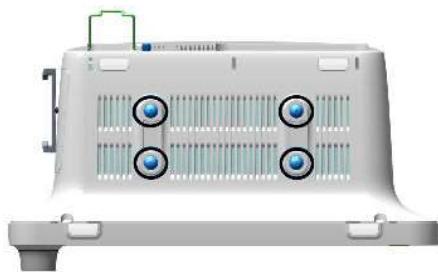


### Remove back cover

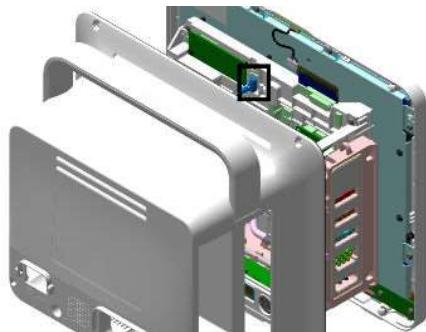
1. B125M/B125P/B105M/B105P: Remove 4 screws and equipotential connector on the back of the monitor.  
B155M: Remove 6 screws and equipotential connector on the back of the monitor.



2. remove 4 screws on the bottom of the monitor.

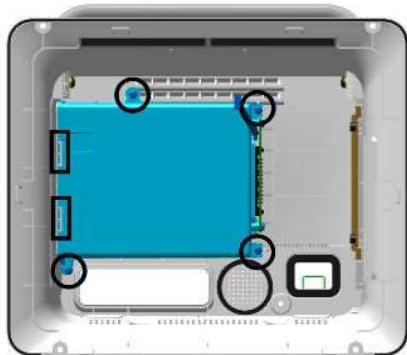


3. Open the back cover and disconnect the rack cable.



## Remove rack

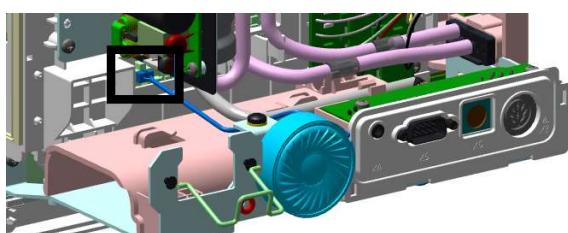
1. Remove 4 screws of the rack.
2. Disconnect 2 snaps and remove the rack.



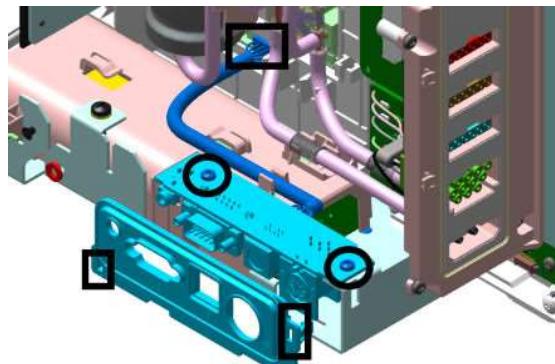
## Remove speaker, multi I/O, and battery chamber

Disassemble first:

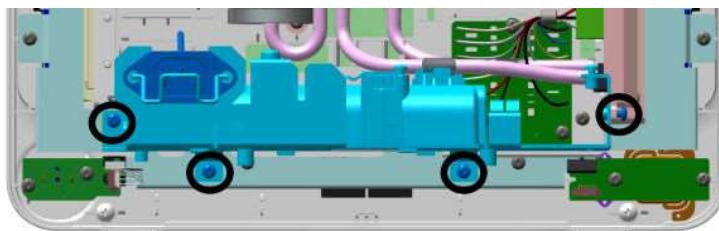
- [Remove back cover on page 110](#)
- 1. Disconnect the speaker cable and remove the speaker.



2. Disconnect the multi I/O cable and remove 2 screws.
3. Disconnect 2 snaps, and remove the multi I/O unit.



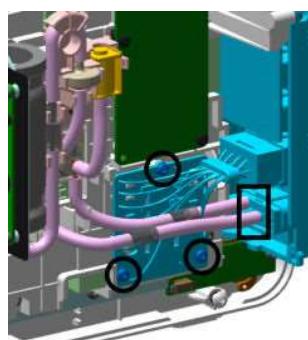
4. Disconnect the AC inlet.
5. Remove 4 screws on the bottom and side.
6. Remove the battery chamber.



## Remove Hemo input assembly (parameter assembly)

Disassemble first:

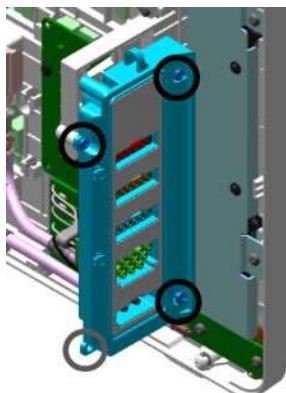
- [Remove back cover on page 110](#)
1. Remove 3 screws of ECG input board.
  2. Disconnect the NIBP tubes.



### Important

When reassembly, please check the direction of the flow first, there are arrows on the air filter to indicate.

3. Remove 4 screws.
4. Remove the Hemo input assembly.



## Remove NIBP pneumatic system

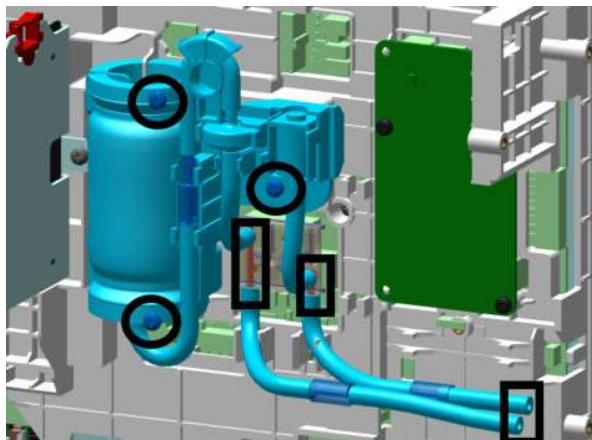
Disassemble first:

- [Remove back cover on page 110](#)
- 1. Remove 3 screws.
- 2. Remove the NIBP connector and tube.

**Important**

When reassembly, please check the direction of the flow first, there are arrows on the air filter to indicate.

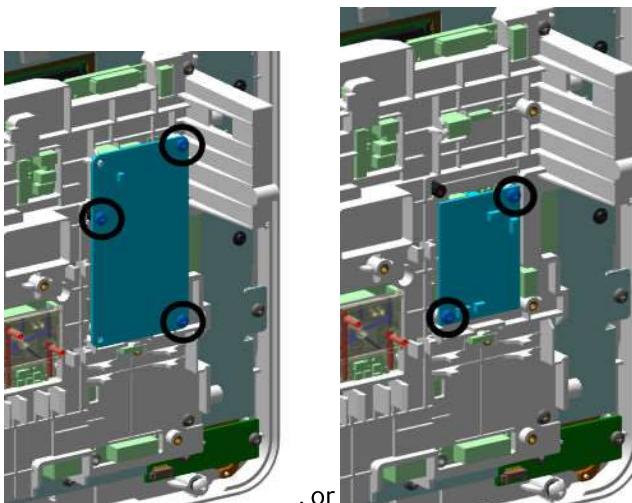
- 3. Remove the NIBP pneumatic system parts.



## Remove the Masimo/Nellcor board

Disassemble first:

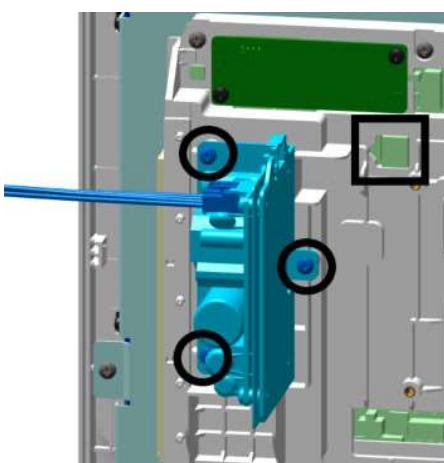
- [Remove back cover on page 110](#)
- 1. Masimo: Remove 3 screws.  
Nellcor: Remove 2 screws.
- 2. Remove the Masimo/Nellcor board.



## Remove AC/DC module

Disassemble first:

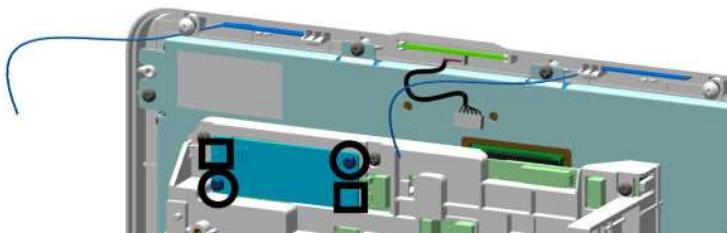
- [Remove back cover on page 110](#)
- 1. Disconnect the cable from main board.
- 2. Disconnect the AC inlet, if haven't.
- 3. Remove 3 screws for the AC/DC module.
- 4. Remove the AC/DC module.



## Remove WiFi board and antenna

Disassemble first:

- [Remove back cover on page 110](#)
- 1. Disconnect the antennas cables, and remove two antennas.
- 2. Remove 2 screws.
- 3. Remove WiFi board.



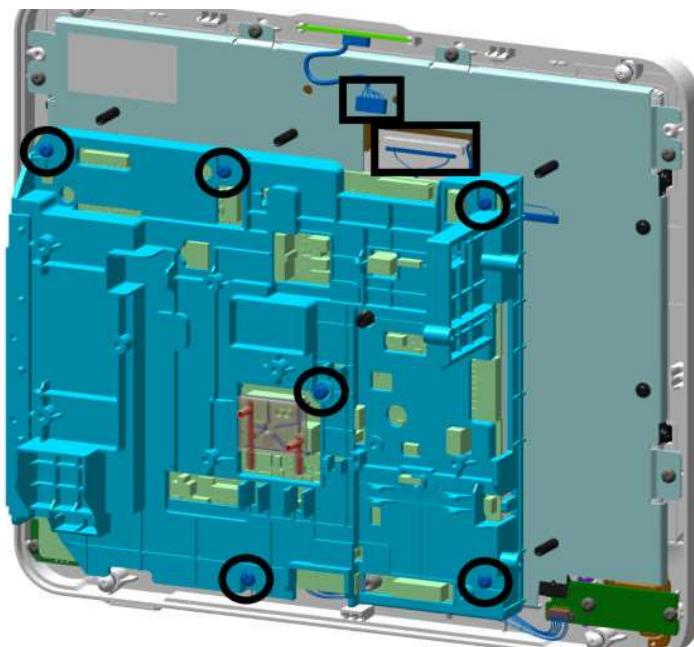
## Detach the middle unit from front unit

Disassemble first:

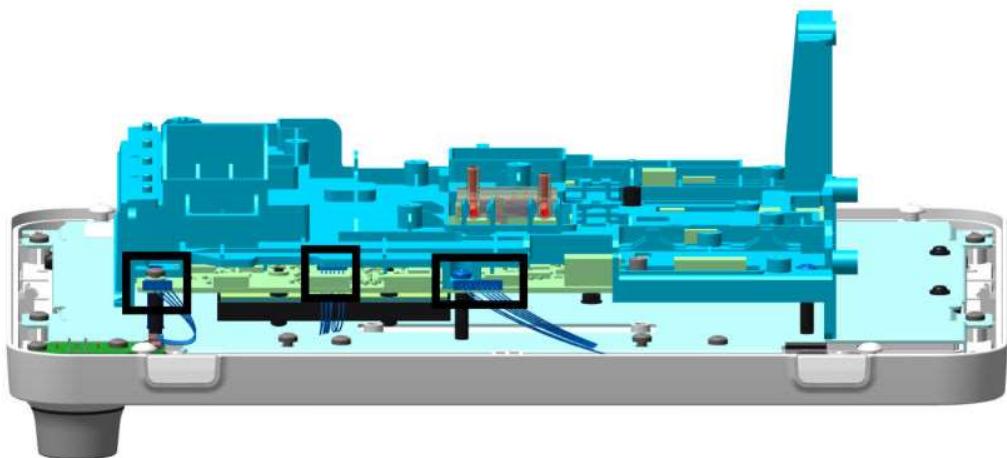
- [Remove back cover on page 110](#)
  - [Remove speaker, multi I/O, and battery chamber on page 111](#)
  - [Remove Hemo input assembly \(parameter assembly\) on page 112](#)
  - [Remove NIBP pneumatic system on page 113](#)
  - [Remove the Masimo/Nellcor board on page 113](#)
  - [Remove AC/DC module on page 114](#)
  - [Remove WiFi board and antenna on page 114](#)
1. Disconnect the alarm light cable.
  2. Remove 6 screws on the middle cover.
  3. Disconnect the LCD cable.

### NOTE

The window place for LCD cable is difference for B155M, B125 series, and B105 series.  
Please from LCD back to find.



4. Disconnect the Trim knob cable, touch panel cable, and power key cable (on the bottom).

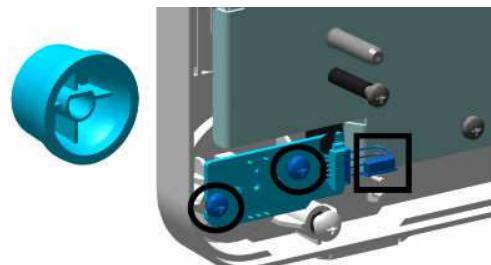


5. Detach the middle unit from front unit.

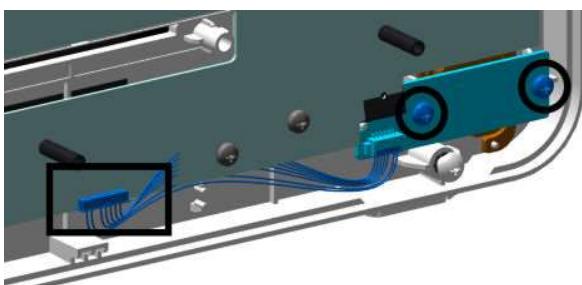
## Remove user interface parts (Trim Knob, power key, alarm light)

Disassemble first:

- [Remove back cover on page 110](#)
1. Disconnect the Trim Knob cable, and remove 2 screws.
  2. Remove Trim Knob board with the encoder.



3. Disconnect the power key cable, and remove 2 screws.
4. Remove the power key board and power key.



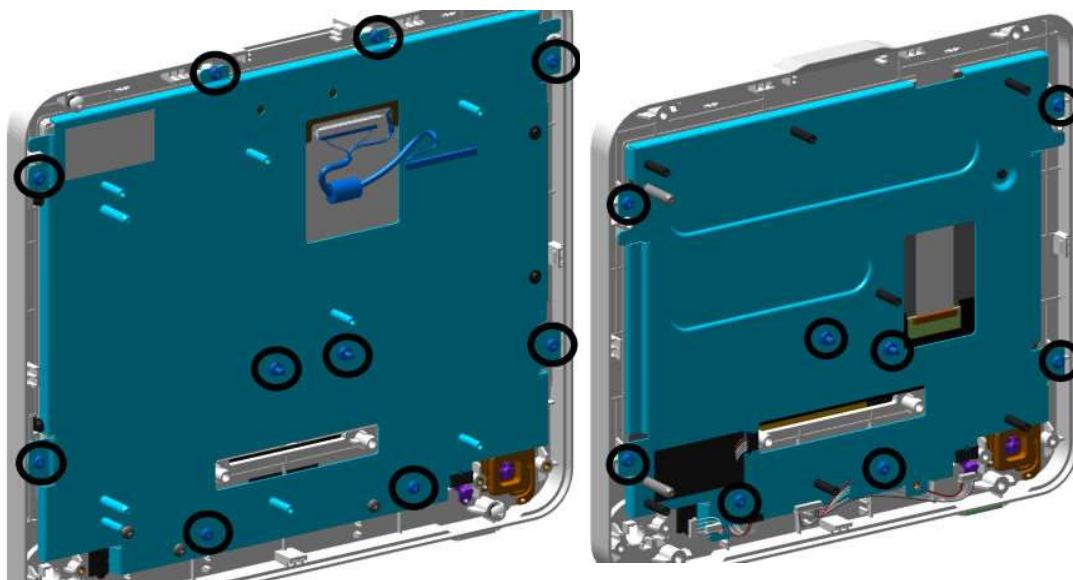
5. Disconnect the alarm light cable.
6. Remove the alarm light board.



## Remove the LCD

Disassemble first:

- Remove back cover on page 110
  - Remove speaker, multi I/O, and battery chamber on page 111 (Remove the battery chamber)
  - Detach the middle unit from front unit on page 115 (Remove the middle unit with all parts in it together)
1. For B155M/B125M/B125P: remove 10 screws.  
For B105M/B105P: remove 8 screws.
  2. Detach the LCD from Touch panel with front cover.

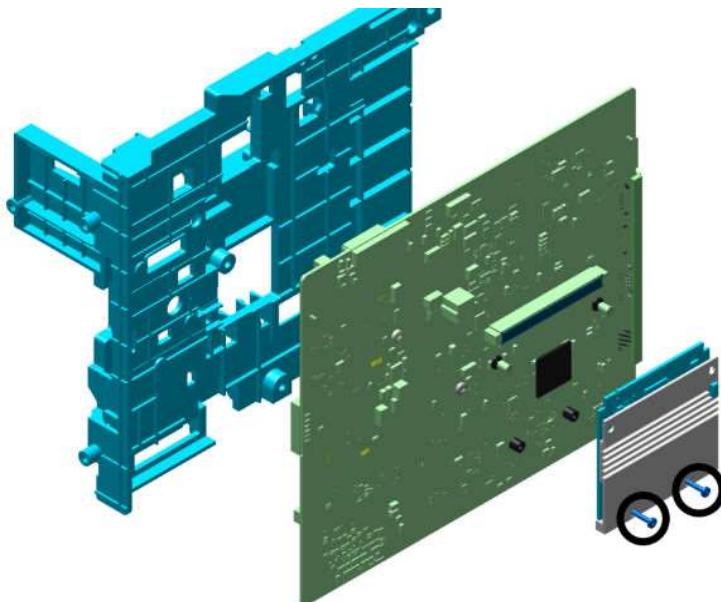


## Remove mainboard and CPU

Disassemble first:

- Remove back cover on page 110
- Remove speaker, multi I/O, and battery chamber on page 111
- Remove Hemo input assembly (parameter assembly) on page 112
- Remove NIBP pneumatic system on page 113
- Remove the Masimo/Nellcor board on page 113
- Remove AC/DC module on page 114

- Remove WiFi board and antenna on page 114
  - Detach the middle unit from front unit on page 115
1. Detach the middle cover from the mainboard.  
Replace the CPU RTC battery if needed.
  2. Remove 2 screws, remove the CPU board with heat sink.



## After replace the mainboard

Calibration for NIBP, IBP, and Temperature is needed after replace the mainboard. Refer to "Calibration and adjustments" chapter for more details.

## About CPU board replacement

To replace the CPU board, the monitor will lost:

- Software and e-manuals
- All of the settings
- license
- MAC address

## Before replace the CPU board

1. Record the monitor's serials number according to product label.
2. Record the monitor's country settings.
  - a. Select the  >  **Service** > enter **Username** and **Password**.
  - b. Select **Service** tab > **Country Settings**.
  - c. Record **Language**, **National Reqs**, **Power Frequency**, and **Power Filter**.
3. Export the user settings.

**NOTE**

Make sure the file system format for USB storage device should be FAT32.

- a. Insert the USB disk to the monitor.
- b. Select **Clinical** tab > **USB Import/Export** > **Export settings to USB Disk**.
- c. Enter an encryption **Key** for the settings' file, the length of key shall not be less than 6.
- d. Select **Export settings to USB Disk**.
- e. To remove the USB disk, select **Safe to remove USB Disk**.
4. Login the OAC website to get the license, put the license file to same USB disk: /B1x5/v2/license/SN.txt  
<http://oac.health.ge.com/oac/>.

## After replace the CPU board

1. Setup password when first time turn on the monitor after replace the CPU board.

- a. Select the  Service > enter **Username** and **Password**.

The initial password is the provided HLA password.

The **Change Password** menu displays.

- b. Enter and retype the new passwords for **Service**.
  - c. Select **Confirm**.

2. Download the latest version of software and e-manual.

For software and e-manual, please order the software USB FRU or upgrade kit.

For more information about how to download software and e-manual, please refer to the "Software download instruction".

3. Import the password and settings at first time to use.

- a. Insert the USB disk with user settings' file to the monitor.
  - b. Select **Settings Activation from USB Disk** tab.
  - c. Select the related setting file from **Setting Files** list.
  - d. Enter the decryption **Key for the File**.
  - e. Select **Activate & Restart**.

The monitor's settings and password have been setup, and the monitor will restart.

4. Input serial number.

- a. Select the  Service > enter **Username** and **Password**.
  - b. Select **Service** tab > **Page2** vertical tab > **Input Serial Number**.
  - c. Enter the serial number and input again to confirm.
  - d. Select **Save Serial Number**.

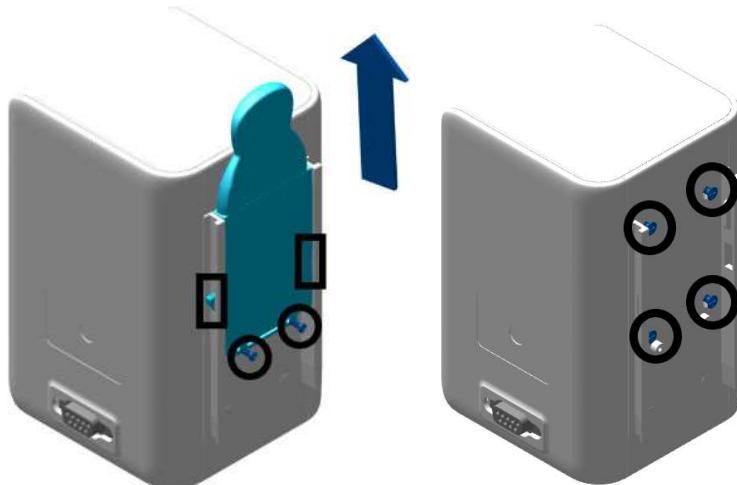
The monitor will automatically restart in 10 seconds.

5. Import the license.

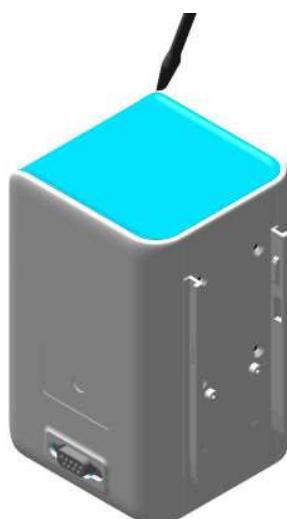
- a. Insert the USB disk with license file to the monitor.
  - b. Select **Service** tab > **License** > **Import license to USB Disk**.
  - c. Restart the monitor according to message.
6. Perform the country settings.
- a. Select **Service** tab > **Country Settings**.
  - b. Setup **Language**, **National Reqs**, **Power Frequency**, and **Power Filter** according to the records above.

## Detaching the recorder

1. Open the recorder door and remove the paper roll if installed.
2. Remove two screws, disconnect snaps and drag the tab out.
3. Remove four screws.



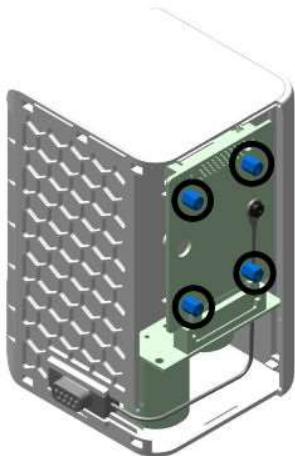
4. Release the cover (side) of the recorder by pressing with a flat blade screwdriver.



5. Open the door, remove two screws inside the recorder.



6. Remove 4 screws of the back board by socket wrench.



7. Pull the recorder out of the housing.

# Service parts

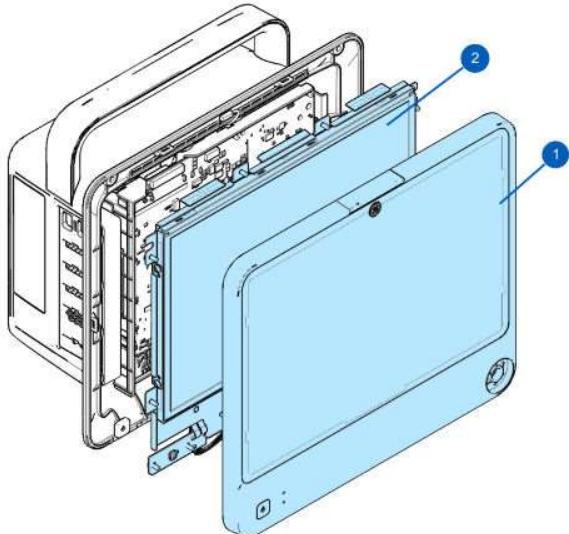
## Service parts

Perform the specified corrective maintenance check after any corrective maintenance to the product.

### Ordering parts

To order parts, contact your local GE representative. Contact information is available at <http://www.gehealthcare.com>. Make sure you have all necessary information at hand.

## Front cover and LCD

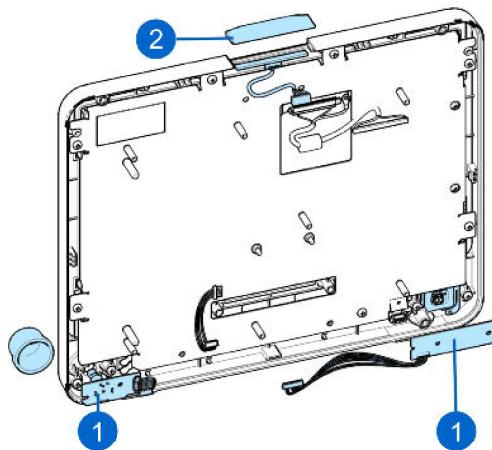


Item	Part number	Description
1	5808800-19	FRU B105M 10 INCH TP Assembly with Front Cover <sup>*1</sup> <ul style="list-style-type: none"><li>• B105M Front cover with TP</li></ul>
1	5808800-20	FRU B105P 10 INCH TP Assembly with Front Cover <ul style="list-style-type: none"><li>• B105P Front cover with TP</li></ul>
1	5808800-22	FRU B125M 12 INCH TP Assembly with Front Cover <sup>*1</sup> <ul style="list-style-type: none"><li>• B125M Front cover with TP</li></ul>
1	5808800-23	FRU B125P 12 INCH TP Assembly with Front Cover <ul style="list-style-type: none"><li>• B125P Front cover with TP</li></ul>
1	5808800-25	FRU B155M 15 INCH TP Assembly with Front Cover <sup>*1</sup> <ul style="list-style-type: none"><li>• B155M Front cover with TP</li></ul>
2	5808800-18	FRU B105M/B105P 10 INCH LCD Assembly <ul style="list-style-type: none"><li>• 10' LCD with frame</li><li>• Screws</li></ul>

Item	Part number	Description
2	5808800-21	FRU B125M/B125P 12 INCH LCD Assembly • 12' LCD with frame • Screws
2	5808800-24	FRU B155M 15 INCH LCD Assembly • 15' LCD with frame • Screws

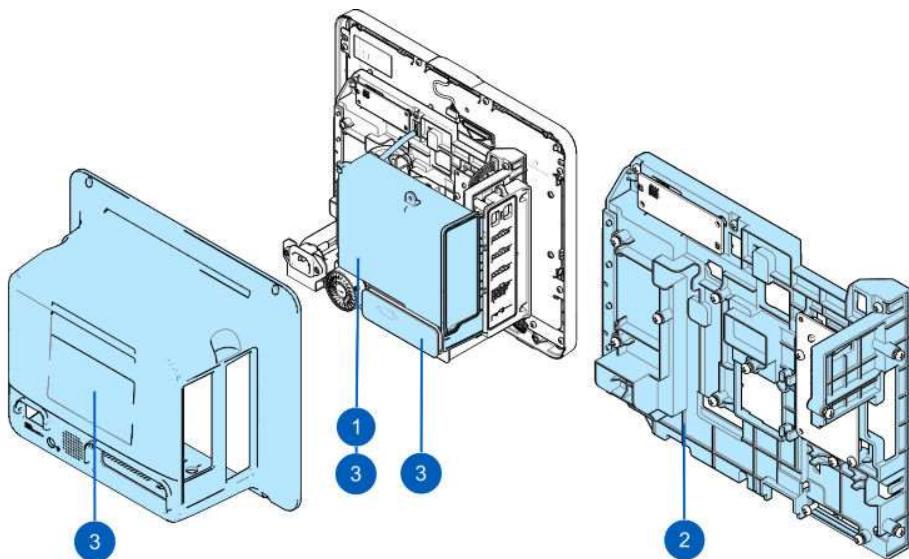
\*1 Order the WiFi Antenna (5808800-44) if the monitor has WiFi Function.

## Trim Knob, Power key, and Alarm light



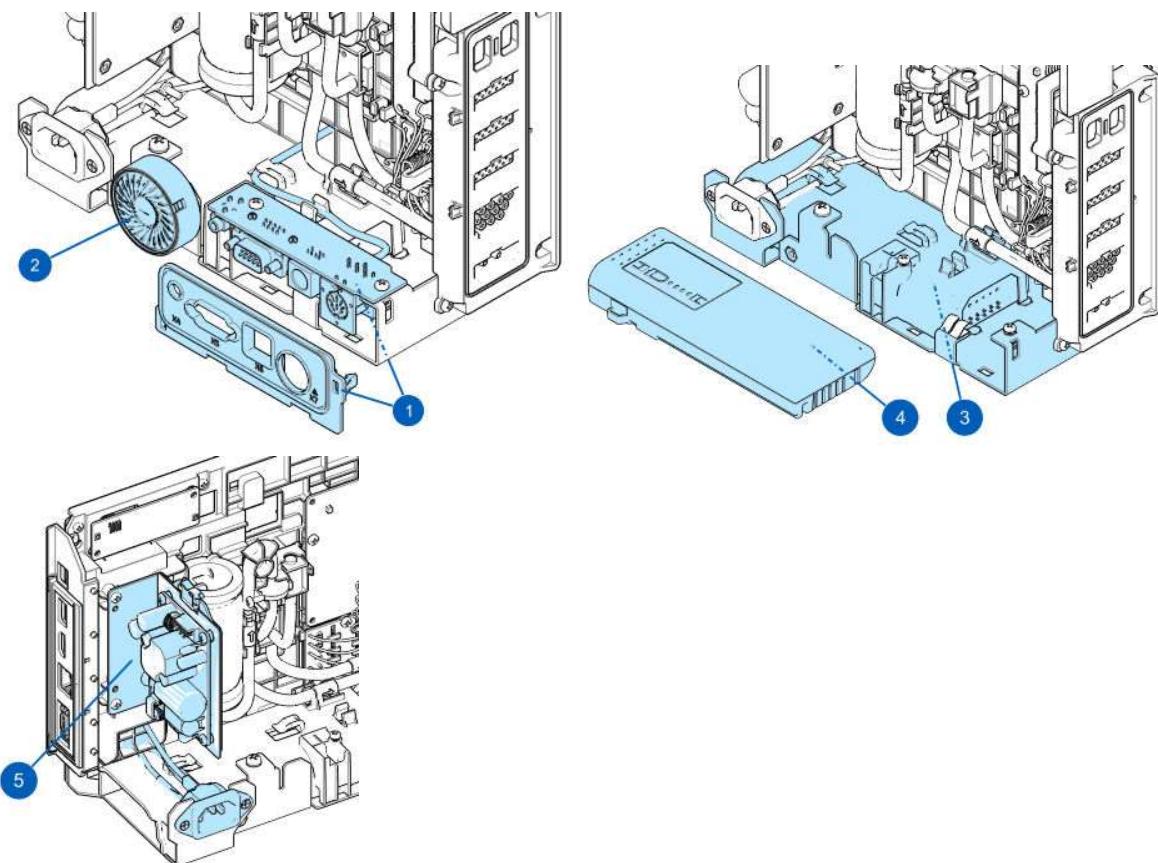
Item	Part number	Description
1	5808800-13	FRU B1X5M/B1X5P Power Key Assembly and Trim Knob Assembly • Power key board • Power key cable • Power key cable for 15' • Trim knob board • Trim knob cable • Screws
2	5808800-14	FRU B1X5M/B1X5P Alarm Board with Cable • Alarm LED board • Alarm LED cable

## Rack, inner frame, and back cover



Item	Part number	Description
1	5808800-38	FRU B1X5M/B1X5P RACK Assembly <ul style="list-style-type: none"> <li>• E-module housing</li> <li>• Screws</li> </ul>
2	5808800-32	FRU B1X5M/B1X5P Inner Frame <ul style="list-style-type: none"> <li>• Middle frame</li> </ul>
3	5808800-33	FRU B105M/B105P Back Cover W/ Rack <ul style="list-style-type: none"> <li>• 10' back cover</li> <li>• Multi I/O blank cover</li> </ul>
3	5808800-34	FRU B105M/B105P Back Cover W/O Rack <ul style="list-style-type: none"> <li>• 10' back cover without rack</li> <li>• Multi I/O blank cover</li> </ul>
3	5808800-35	FRU B125M/B125P Back Cover W/ Rack <ul style="list-style-type: none"> <li>• 12' back cover</li> <li>• Multi I/O blank cover</li> </ul>
3	5808800-36	FRU B125M/B125P Back Cover W/O Rack <ul style="list-style-type: none"> <li>• 12' back cover without rack</li> <li>• Multi I/O blank cover</li> </ul>
3	5808800-37	FRU B155M Back Cover W/ Rack <ul style="list-style-type: none"> <li>• 15' back cover</li> <li>• Multi I/O blank cover</li> </ul>

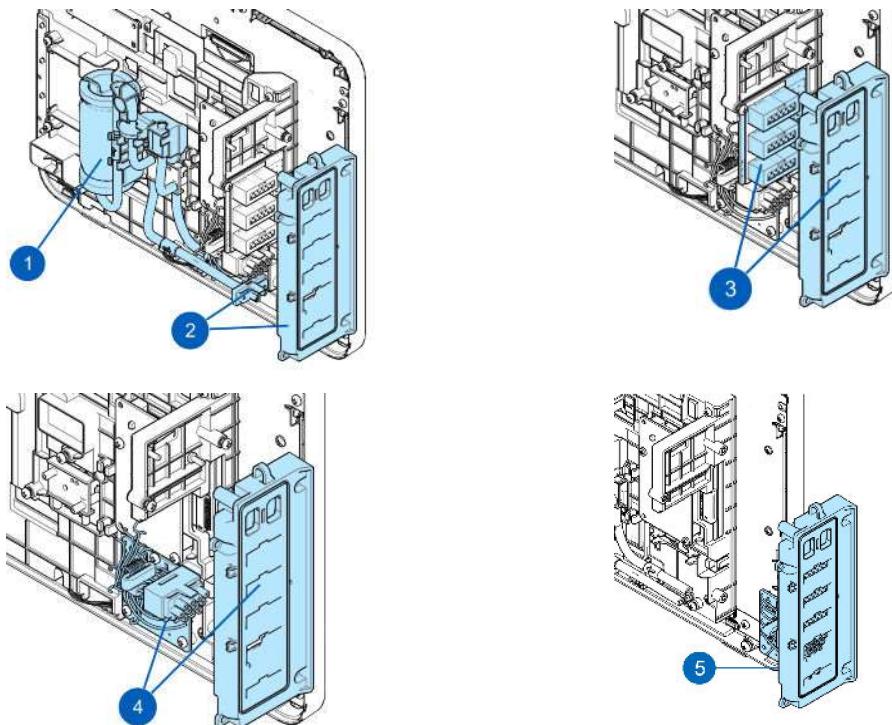
## Speaker, multi I/O, battery and ACDC assembly



Item	Part number	Description
1	5808800-15	FRU B1X5M/B1X5P Multi-IO Board with Cable <ul style="list-style-type: none"> <li>• Multi I/O board</li> <li>• Multi I/O cable</li> <li>• Multi I/O cover</li> <li>• Spring, grounding clip-on</li> <li>• Screws</li> </ul>
2	5808800-27	FRU B1X5M/B1X5P Speaker Assembly <ul style="list-style-type: none"> <li>• Speaker</li> </ul>
3	5808800-12	FRU B1X5M/B1X5P Battery Housing Assembly <ul style="list-style-type: none"> <li>• Battery top cover</li> <li>• Mounting fixing plate</li> <li>• Battery board with cable</li> <li>• Related kinds of screws</li> </ul>
4	5808800-30	FRU B1X5M/B1X5P Battery Low Capacity <ul style="list-style-type: none"> <li>• Battery</li> </ul>
4	2062895-001	FRU B1X5 V2.0 Battery high capacity <ul style="list-style-type: none"> <li>• Battery, FLEX-3S2P</li> </ul>

Item	Part number	Description
5	5808800-26	FRU B1X5M/B1X5P AC/DC Module <ul style="list-style-type: none"> <li>• ACDC module</li> <li>• AC-Inlet</li> <li>• Related kinds of screws</li> </ul>

## Hemo input parts

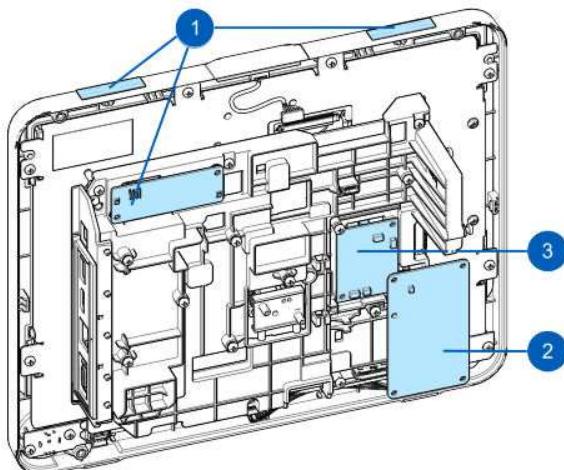


Item	Part number	Description
1	5808800-31	FRU B1X5M/B1X5P NIBP Pneumatic System <ul style="list-style-type: none"> <li>• Pneumatic system</li> </ul>
2	5808800-11	FRU B1X5M/B1X5P NIBP Connector Assembly <ul style="list-style-type: none"> <li>• NIBP connector with rubber</li> <li>• Parameter frame</li> <li>• Screws</li> </ul>
3	5808800-10	FRU B1X5M/B1X5P STP Input Board*1 <ul style="list-style-type: none"> <li>• STP input board</li> <li>• Parameter frame</li> <li>• STP imput sealing foam</li> <li>• Screws</li> </ul>
4	5808800-06	FRU B1X5M/B1X5P ECG Input Unit Assembly*1 <ul style="list-style-type: none"> <li>• ECG input module</li> <li>• Parameter frame</li> <li>• Related kinds of screws</li> </ul>

Item	Part number	Description
5	5808800-07	FRU B1X5M/B1X5P Parameter Assembly* <sup>1</sup> <ul style="list-style-type: none"> <li>• Parameter interface module</li> <li>• Screws</li> </ul>

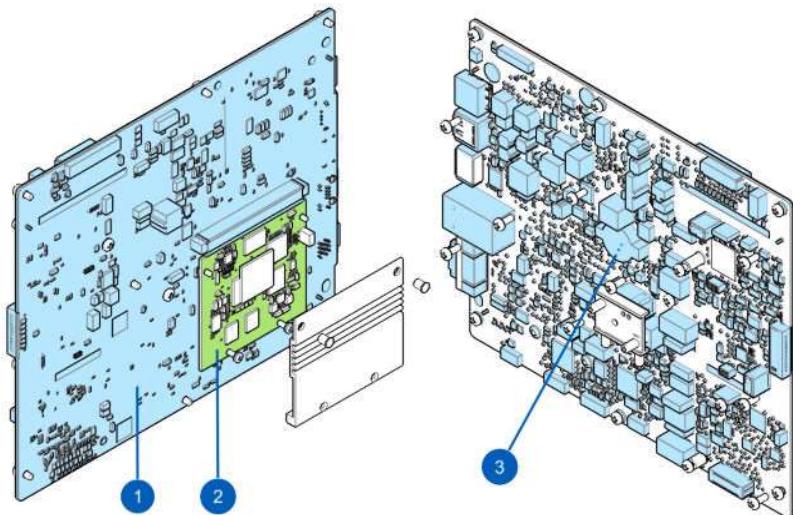
\*<sup>1</sup> The FRU not includes parameter label, please order FRU 5808800-09 for EN label, or FRU 5808800-08 global language label.

## WLAN, Masimo, and Nellcor SpO<sub>2</sub> board



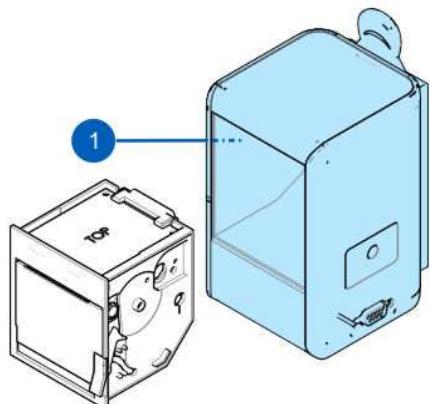
Item	Part number	Description
1	5808800-16	FRU B105M B125M WiFi Board with Antenna <ul style="list-style-type: none"> <li>• WLAN module board</li> <li>• 2 Wifi antenna, 26 cm</li> <li>• Screws</li> </ul>
1	5808800-17	FRU B155M WiFi Board with Antenna <ul style="list-style-type: none"> <li>• WLAN module board</li> <li>• Wifi antenna, 26 cm</li> <li>• Wifi antenna, 40 cm</li> <li>• Screws</li> </ul>
1	5808800-44	FRU B1X5M WiFi Antenna <ul style="list-style-type: none"> <li>• 3 Wifi antenna, 26 cm</li> <li>• 1 Wifi antenna, 40 cm</li> </ul>
2	5808800-43	FRU B1X5M Nellcor SpO <sub>2</sub> Board <ul style="list-style-type: none"> <li>• OEM, Masimo SpO<sub>2</sub> board</li> </ul>
3	5808800-42	FRU B1X5M Masimo SpO <sub>2</sub> Board <ul style="list-style-type: none"> <li>• OEM, Nellcor SpO<sub>2</sub> board</li> </ul>

## Mainboard and CPU board



Item	Part number	Description
1	5808800-02	FRU B1X5M/B1X5P Main Board for GE SpO2 <ul style="list-style-type: none"> <li>• Main board for STP</li> <li>• Manifold</li> <li>• Related kinds of screws</li> </ul>
1	5808800-03	FRU B1X5M Main Board for MASIMO/NELLCOR SpO2 <ul style="list-style-type: none"> <li>• Main board for TP</li> <li>• Manifold</li> <li>• Related kinds of screws</li> </ul>
1	5808800-04	FRU B1X5P Main Board <ul style="list-style-type: none"> <li>• Main board for P</li> <li>• Manifold</li> <li>• Related kinds of screws</li> </ul>
2	5808800-01	FRU B1X5M/B1X5P CPU Board <ul style="list-style-type: none"> <li>• CPU board</li> <li>• Screws</li> </ul>
3	5808800-05	FRU B1X5M/B1X5P CPU RTC Battery <ul style="list-style-type: none"> <li>• Battery, 2032 lithium, 3V</li> </ul>

## B1X5-REC Recorder



Item	Part number	Description
1	5808800-39	FRU B1X5M/B1X5P Thermal Printer Housing <ul style="list-style-type: none"> <li>• Thermal recorder module housing</li> <li>• Recorder fixing plastic plate</li> <li>• Recorder connection cable</li> <li>• Screws</li> </ul>

## Others

Part Number	Description
5808800-41	FRU B1X5M/B1X5P Software for Service Recovery (USB)
5808800-28	FRU B1X5M/B1X5P Recorder Connection Cable
5808800-29	FRU B1X5M/B1X5P F2 Connection Cable
5808800-08	FRU B1X5M/B1X5P Parameter Label Global Language
5808800-09	FRU B1X5M/B1X5P Parameter Label English

# E-COP module

## About this chapter

This chapter contains instructions for the planned and corrective maintenance, configuration and calibration of the acquisition module.

For the module instruction, troubleshooting, disassembly and reassembly and service parts section, please refer to Module's Service Manual.

## Maintenance check

### About the maintenance check procedures

This chapter describes the planned and corrective maintenance check procedures for the product. To help ensure the equipment remains in proper operational and functional order and maintains its essential performance and basic safety, follow the corrective and planned maintenance recommendations. The tests that are related to the essential performance and basic safety are marked with the \*.

The cleaning precautions, cleaning requirements, cleaning procedures, and recommended cleaning solutions are described in the monitor's user's manual.

For details about cleaning, disinfecting and sterilizing the accessories, see the instructions for use in the accessory package.

Record the results of the planned and the corrective maintenance check procedures to the eCheckforms delivered in the electronic manual media.

#### **WARNING**

SAFETY HAZARD.

To avoid risks to personnel and patient, or damage to the equipment, only perform maintenance procedures described in this manual. Unauthorized modifications can lead to safety hazards.

## Planned maintenance

#### **WARNING**

Planned maintenance should be carried out at recommended interval. Failure to implement the recommended maintenance schedule may cause equipment failure and possible health hazards.

Perform the planned maintenance procedure completely every 2 years after installation. Perform the procedure in the following order:

1. Visual inspection
2. Electrical safety test \*
3. Functional check

## Corrective maintenance

Service personnel shall perform the following checkout procedure after any corrective maintenance, before taking the module back into clinical use:

Performed service activity	Required checkout procedure		
	Visual inspection	Electrical safety test	Functional check
Product casing opened either for troubleshooting purpose or for replacing any of the internal parts.	All steps	All steps	All steps
Front cover, or an other external part, replaced.	All steps	Not applicable	Not applicable

## Performing visual inspection

1. Remove the module and check that:
  - a. The front cover is intact.
  - b. All connectors are intact, clean and attached properly.
  - c. The module casing and the latch are clean and intact.
  - d. The patient cables are clean and intact.

## Performing electrical safety test \*

Perform the electrical safety tests described in the monitor technical manual, "Checkout procedures" chapter. Perform following tests:

1. Patient (source) leakage current test
2. Patient (sink) leakage current test

## Performing functional check

### Required tools for E-COP module functional check

#### NOTE

See the Supplies and accessories for compatible accessories.

- A multiparameter patient simulator with adapter cables to GE invasive pressure and cardiac output connectors.
- Catheter connecting cable
- One of the following simulators depending on the module version:

- P/N 2089334-001 SvO<sub>2</sub> simulator is compatible with all E-COPSV-00 and COPSV-01 modules.
- P/N 890121 SvO<sub>2</sub> simulator is compatible with all the E-COPSV-00 modules, but only with those E-COPSV-01 modules with serial number SGQ14462015HA or lower.

## Making connections for the functional check

1. Turn on or restart the monitor and wait until the normal screen appears.
2. Ensure that the module is connected to the monitor.
3. Connect the multiparameter patient simulator with its invasive blood pressure adapter cable to the red invasive pressure connector in the module.
4. Connect the C.O. cables:
  - a. Connect the catheter connecting cable to the C.O. connector in the module.
  - b. Connect the catheter connecting cable's injectate probe connector and blood catheter (blood temperature) connector to the simulator according to the instructions in the patient simulator's manual.

## Configuring monitor for E-COP module functional check

1. Configure invasive pressure measurement:
  - a. Setup **IBP4** to the waveform field.
  - b. In the **IBP** menu configure:
    - **Label:** IBP4
    - **Scale (mmHg):** 0-200 mmHg
    - **Digit Format:** S/D/M
2. Configure cardiac output measurement:
  - a. Setup **C.O.** and **Temp** to the lower field.
  - b. In the **Cardiac output** menu configure:
    - **Catheter Type:** User defined
    - **Computation Constant:** 0.542
    - **Measurement Type:** Manual
    - **Injectate Volume:** 10 ml
    - **Ref Measurement:** Deselect

## Configuring simulator for E-COP module functional check

For instructions on how to use and configure the simulators, refer to the simulators' documentation.

1. Configure the invasive pressure channels of the simulator as follows:
  - **Sensitivity:** 5  $\mu$ V/V/mmHg
  - **InvBP output:** 0 mmHg static pressure or atmosphere
2. Configure the cardiac output channels of the simulator as follows:
  - **Baseline Temperature/Blood Temperature:** 37 °C
  - **Injectate temperature:** 0 °C or 2 °C

## Testing invasive pressure measurement \*

1. Zero the tested pressure channel:
  - a. Ensure that the simulator's invasive pressure output channel is configured to 0 mmHg static.
  - b. Select the digit field of the tested invasive pressure channel, Select **Zero**.
  - c. Check that a **Zeroing** message followed by a **Zeroed** message is shown in the menu.
2. Test a static pressure:
  - a. Configure the simulator's invasive pressure output channel to 200 mmHg static pressure.
  - b. Check that a flat pressure line appears on the related waveform field.
  - c. Check that the reading in the digit field is  $200 \pm 10$  mmHg.
    - If the measured value is not within the specification limits, recalibrate the measurement.
3. Check the pressure waveform:
  - a. Configure the simulator's invasive pressure output channel to Arterial 120/80.
  - b. Check that the pressure waveform for the tested invasive pressure channel appears in the waveform window.
  - c. Check that the Sys/Dia (Mean) pressure values are shown in the related digit field.

## Testing cardiac output measurement \*

### NOTE

This test is for functional check purpose only. Results can't be used for accuracy checking.

### NOTE

Check that the **T injectate** and **Tblood** values in the C.O. menu are close to the set values to ensure successful measurement. Adjust simulator, if necessary.

1. Select **Cardiac output** digit field > **Measurement** tab.
2. Select **START C.O.** to start a manual C.O. measurement.
3. Wait until the **Inject now!** message appears and inject a 5 l/min C.O. wave from the simulator.
4. Check that:
  - a. A thermodilution curve appears on the C.O. menu and the curve returns to the base level after the measurement is completed.
  - b. The measured C.O. value is updated and close to the simulator's set value.
  - c. There are no error messages on the screen.

### NOTE

To reject any noisy or erroneous measurement results, select the **Cancel/Reject Injection**

5. Repeat steps from 2) to 4) until you have 3 good measurement results.
6. Select **Confirm C.O.** to complete the C.O. measurement.
7. Check that the average of the measured C.O. values are updated to the **C.O.** digit field.

## Completing the check procedure

1. Select patient information area > **Discharge Patient** > **Confirm** to discard any changes made to the patient monitor configuration during checkout.
2. Disconnect the test setup.
3. Complete the check form.

## Configuration

There is no service configuration for this module.

## Invasive pressure calibration

Invasive pressure calibration shall be performed:

- Whenever the pressure transducer in use is replaced with a new type of transducer.
- if the invasive pressure functional check failed.
- If the measured value is not within the specification limits.
- After replace mainboard.

## Required tools

- Pressure manometer with a pressure pump
- Transducer adapter cable
- Invasive pressure transducer

### NOTE

See the Supplies and accessories for compatible accessories.

### NOTE

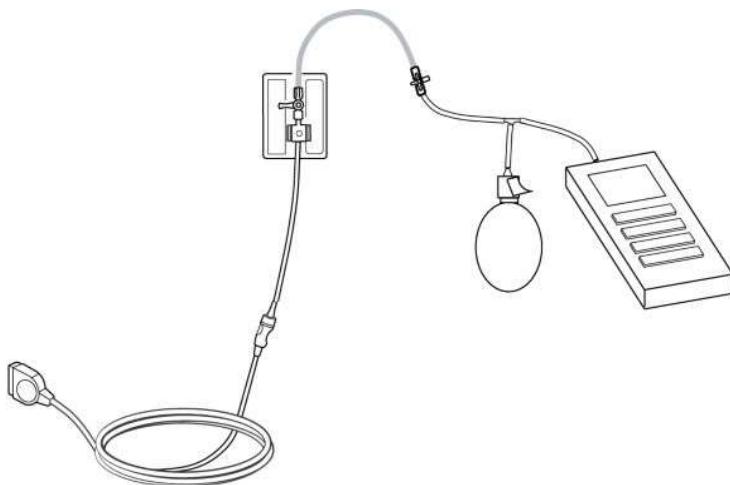
Use only accurate, properly maintained, calibrated and traceable calibration tools for the parameter calibration to ensure measurement accuracy.

### NOTE

The pressure transducer is a key component in the measurement setup. If possible, perform the invasive pressure calibration with the same type of pressure transducer that is used in daily clinical use.

## Making connections

1. Connect the transducer adapter cable to the red Inv BP connector.
2. Connect the invasive pressure transducer to the transducer adapter cable.
3. Connect the pressure manometer with a pressure pump to the transducer's pressure line with a piece of tubing.



## Calibrating invasive pressure

1. Select the  >  **Service** > enter **Username** and **Password**.
2. Select **Basic Service** tab > **Parameters** > **COP** > **Calibrations** tab.
3. Prepare the transducer for the zeroing by opening the dome stopcock to room air.
4. Select **Calibrate P4**.
5. The monitor will start automatic zeroing of the invasive pressure channel. Wait until the message **Zeroing** is replaced by the message **Zero Ok**.
6. Pump a  $200 \text{ mmHg} \pm 100 \text{ mmHg}$  static pressure with the pressure pump when the message **Create 200 mmHg pressure** is shown. The pressure measured by the module is updated in real-time to the calibration menu.
7. When the pressure is stabilized, check the pressure reading from the manometer.
8. Use the up-down spinner control in the calibration menu to adjust the reading measured by the module to match with the manometer reading. Select **Confirm** to complete the calibration when the two readings match each other.
9. Wait until the message **Calibrated** is shown.

### NOTE

The **Zero Failure** message is shown if the zeroing fails.

### NOTE

The **Calibration Error** message is shown, if you do not start inflating the pressure within 45 seconds after the automatic zeroing is completed, or if the calibration fails.

# E-sCAiO, E-sCO, N-CAiO module

## About this chapter

This chapter contains instructions for the planned and corrective maintenance, configuration and calibration of the acquisition module.

For the module instruction, troubleshooting, disassembly and reassembly and service parts section, please refer to Module's Service Manual.

## Maintenance check

### About the maintenance check procedures

This chapter describes the planned and corrective maintenance check procedures for the product. To help ensure the equipment remains in proper operational and functional order and maintains its essential performance and basic safety, follow the corrective and planned maintenance recommendations. The tests that are related to the essential performance and basic safety are marked with the \*.

The cleaning precautions, cleaning requirements, cleaning procedures, and recommended cleaning solutions are described in the monitor's user's manual.

For details about cleaning, disinfecting and sterilizing the accessories, see the instructions for use in the accessory package.

Record the results of the planned and the corrective maintenance check procedures to the eCheckforms delivered in the electronic manual media.

#### **WARNING**

##### SAFETY HAZARD.

To avoid risks to personnel and patient, or damage to the equipment, only perform maintenance procedures described in this manual. Unauthorized modifications can lead to safety hazards.

## Corrective maintenance

Perform the following checkout procedure after any corrective maintenance, before taking the module back into clinical use:

Performed service activity	Required checkout procedure	
	Visual inspection	Functional check
Front cover, or an other external part, replaced.	All steps	Not applicable
OM reference gas filter assembly	All steps	Check sample flow rate. *

Performed service activity	Required checkout procedure	
	Visual inspection	Functional check
Module case opened either for troubleshooting purpose or for replacing any of the internal parts.	All steps	All steps

## Planned maintenance

### WARNING

Planned maintenance should be carried out at recommended interval. Failure to implement the recommended maintenance schedule may cause equipment failure and possible health hazards.

Perform the planned maintenance procedure completely every 12 months after installation. Perform the procedure in the following order:

1. Replacement of planned maintenance parts
2. Visual inspection
3. Functional check

### Replacement of planned maintenance parts

Replace the following parts that wear in use at the recommended interval.

Description	Pieces	Replacement interval
Nafion tube, 230 mm (mainflow)	1	Once a year
OM reference gas filter assembly including O-ring	1	Once a year
PM sticker	1	Once a year
Nafion tube, 85 mm (zero line)	1	Once every 4 years
CO <sub>2</sub> absorber	1	Once every 4 years

GE Healthcare recommends that you replace the D-fend Pro water trap, the gas sampling line as part of the planned maintenance procedure.

### NOTE

See the Supplies and accessories for compatible accessories.

### Planned maintenance kits

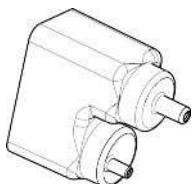
The required planned maintenance parts are included in PM kits.

Part number	Description
2093610-001	One year Planned Maintenance Kit for CARESCAPE Respiratory modules. <sup>*1</sup> The PM kit includes the required Nafion tube, 230 mm (mainflow), the OM reference gas filter assembly with an O-ring and a PM sticker.
2093594-001	Four year Planned Maintenance Kit for CARESCAPE Respiratory modules.

\*1 This kit does not include the CO<sub>2</sub> absorber and Nafion tube, 85 mm (zero line).

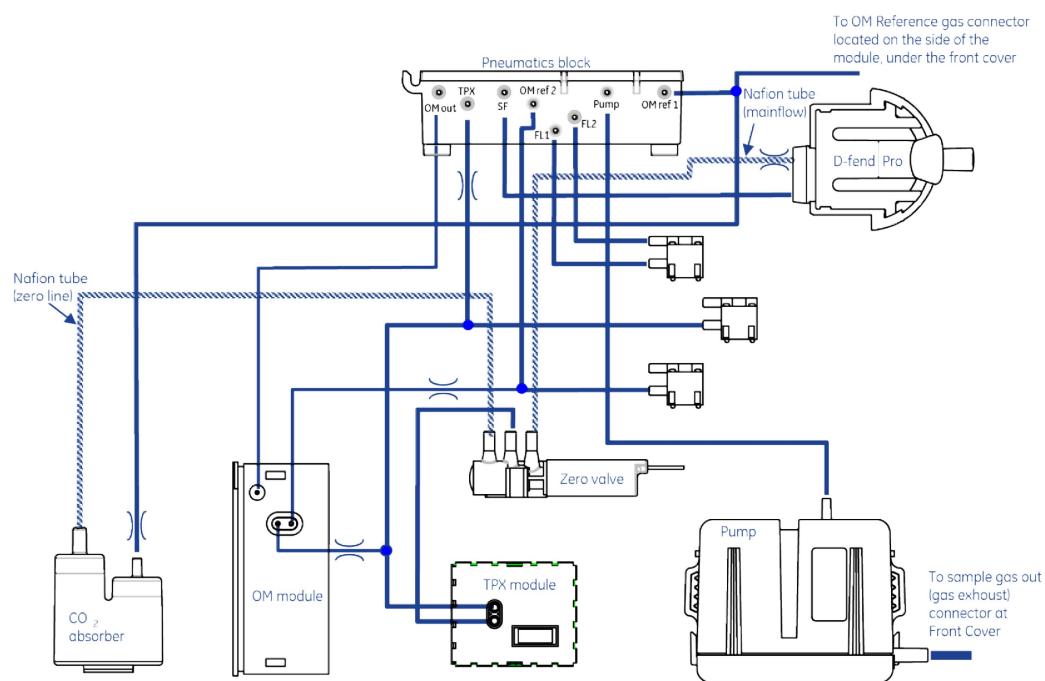
## Replacing planned maintenance parts

1. Replace the CO<sub>2</sub> absorber every 4 years.



2. Replace the special tubes (Nafion) and check the condition of the internal tubing.

a. Check that the tubing inside the module is not contaminated. Any contamination inside the tubing may indicate that the valves or sensors are contaminated, too. This can increase a risk of faulty operation in valves or sensors. The valves or gas sensors are not possible to clean in the field. Therefore, if you noticed any contamination in the module tubing, send the module to GE Healthcare for factory service.



### NOTE

The Nafion tubes do not include the silicon fittings they connect to. Use the original silicon fittings unless they are damaged or leaking.

3. Replace the OM reference gas filter assembly.
4. Check that the fan and ventilation hole are not covered in dust.

## Performing visual inspection

1. Remove the module and check that:
  - a. The front cover is intact.
  - b. All connectors are intact, clean and attached properly.

- c. The module casing and the latch are clean and intact.
  - d. The patient cables are clean and intact.
2. Check that the D-fend Pro and its connectors are clean and intact.

## Performing functional check

### Required tools for the functional check

#### NOTE

See the Supplies and accessories for compatible accessories.

- A barometer
- A mass flowmeter for measuring air flow, minimum measurement range from 0 to 200ml/min, accuracy 5% or better in the 0 to 200 ml/min range.
- P/N: 755534-HEL Calibration Gas Regulator
- P/N: 755583-HEL Calibration gas, CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>O, DESF, package of 1 can (with E-sCAiO module)
- P/N: 755581-HEL QUICK CAL calibration gas, CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>O, package of 4 cans (with sCO module)
- P/N: M1006864, Calibration Gas Regulator, US only
- P/N: 755571-HEL, Calibration Gas, 5% CO<sub>2</sub>, 54.5% O<sub>2</sub>, 36.0% N<sub>2</sub>O, 2.0% DESFLURANE, BAL N2 (with E-sCAiO module) US only
- P/N: 755587, Calibration Gas, CO<sub>2</sub>, O<sub>2</sub>, Balance, 4 cans/pkg (with E-sCO module) US only
- D-fend Pro water trap
- 3 m / 10 ft anesthesia gas sampling line
- A pressure manometer with either an integrated or a separate pressure pump
- Forceps

### Making connections for the functional check

1. Disconnect the module from the monitor for the first test.

- gas sampling system leak test

For the rest of the functional check steps:

2. Turn the monitor on and wait until the normal screen appears.
3. Ensure that the module is connected to the monitor.
4. Let the module warm up for at least 5 minutes.

### Configuring monitor for functional check

1. Setup the CO<sub>2</sub>, O<sub>2</sub>, AA to the waveform fields.

### Testing gas module features

Mark each task as complete on the checkout form.

1. Gas sampling system leak test. \*

**NOTE**

Disconnect the gas module from the monitor during the leak test.

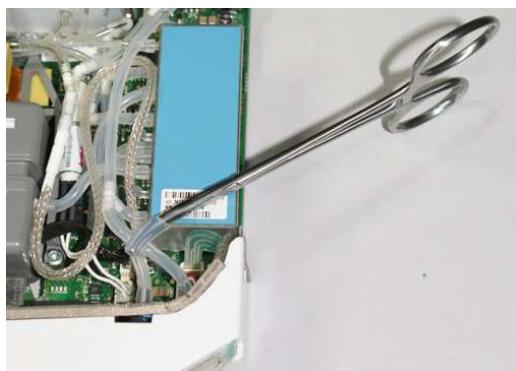
Check the gas sampling system for possible leakages.

- a. Disconnect the module from the monitor.
- b. Detach the module front cover and casing.
- c. Block the OM reference tube with the forceps. Correct positioning of the forceps is indicated by the figure below.

**NOTE**

Be careful when attaching the forceps to the tube and avoid stretching the tube.

Short pieces of silicone tubing on the forcep jaws can be used to protect the tube from breaks that may appear when the tube is compressed between the jaws.



- d. Connect a new D-fend Pro water trap to the module.
  - e. Connect a new gas sampling line to the sampling line connector in the water trap.
  - f. Connect the other end of the gas sampling line to a pressure manometer and a pressure pump.
  - g. Block the sample gas out (gas exhaust) connector.
  - h. Carefully pump 80 mmHg ± 20 mmHg pressure to the gas sampling system. Let the pressure stabilize for 10 - 20 seconds.
  - i. Check that the pressure reading does not drop more than 2 mmHg during 25 seconds.
  - j. Release the forceps, and attach the module casing. Make sure that the tubing fits nicely into the module casing.
2. Sample flow rate check \*

Check the sample flow rate.

Connect the module to the monitor.

**NOTE**

Anesthetic gas measurement is not available during the first 1 to 5 minutes after the module is connected due to warming up. A message '**Calibrating Gas Sensor**' is shown in the waveform field. Wait until warm-up is completed before proceeding with the next steps.

**NOTE**

The ambient temperature and air pressure influence the flow rate measured by the flow meter. A flow meter, which has been calibrated at 21.11°C (70°F) and 760 mmHg (1013 mbar), measures the flow rate correctly under the same conditions, i.e. in room

temperature at sea level. A flow rate correction as instructed by the manufacturer of the flow meter needs to be performed when measuring flow rate under other conditions, for example in high altitude.

- a. Connect the gas sampling line to the sampling line connector.
- b. Connect the other end of the gas sampling line to a flowmeter.
- c. Check the sample flow rate reading from the flowmeter. The flow rate should be within the specification limit  $120 \pm 20$  ml/min.

#### NOTE

Readjustment is needed, if the measured value is not within the specification limit.

### 3. Reference gas flow rate check \*

Check the flow rate in reference gas inlet:

- a. Connect the gas sampling line to the sampling line connector.
- b. Leave the other end of the gas sampling line open to room air.
- c. Connect the flowmeter to the OM reference gas inlet on the side of the module with a piece of tubing.
- d. Check that the **Reference Flow** is within the following range: 10 - 50 ml/min.
- e. Detach the water trap.
- f. Attach the front cover.

### 4. Fan \*

- a. Check that the gas module's fan is running behind the D-fend Pro water trap.
- b. Attach the water trap.

### 5. Zero valve operation \*

Select the calibration gas according to the module type and region. For more information, see the Required tools for the functional check section.

Test the zero valve functionality:

- a. Connect the gas regulator to the calibration gas container.
- b. Connect the gas sampling line to the sampling line connector.
- c. Connect the end of the gas sampling line to the regulator on the gas container. Leave the regulator overflow port open to room air.
- d. Select the  >  Service > enter **Username** and **Password**.
- e. Select the **Service** tab > **Parameters** > **Gas Unit** > **Gases** tab.
- f. Start feeding the specified calibration gas. Wait until the gas values shown in the Gases menu rise approximately to the level indicated in the labelling of the calibration gas container.

#### NOTE

The gas values in the **Gases** menu is in percentages (%).

- g. Open the zero valve to room air by selecting **Gas Control** tab > **Zero valve ctrl**.
- h. Check that the **CO2**, **N2O** and anesthesia agent values drop back near 0% and the O2 reading near 21% (room air).

- i. Stop feeding the calibration gas.
  - j. Turn the zero valve back to the normal measurement position by selecting **Zero valve ctrl**.
6. Gas calibration \*

Perform gas calibration according to the instructions in section Gas Calibration.

7. Agent identification \*

**NOTE**

Perform this test only for E-sCAiO, and N-CAiO modules.

Check agent ID unreliability:

- a. Feed the specified calibration gas for at least 30 seconds.
- b. Select **Gases** tab, check that the anesthesia agent is identified as Desflurane and the IDu value (=agent ID unreliability) is lower than 75.

If the value is higher, repeat the gas calibration and check the value again.

8. Ambient pressure \*

Use a barometer to check the operation of the absolute pressure sensor.

Check that the ambient pressure value shown in the **Gases** menu does not differ more than  $\pm 10$  mmHg (13.33 mbar) from the value shown by the barometer.

9. Occlusion detection \*

- a. Block the tip of the sampling line by your finger.
- b. Check that a **Sample line blocked** and a **Low gas sample flow** message appear on the screen within 30 seconds.

10. Air leak detection \*

- a. Detach the D-fend Pro water trap.
- b. Check that the message **Check water trap** appears on the screen within 30 seconds.
- c. Attach the water trap.

11. Gas exhaust blockage \*

- a. Block the gas exhaust connector with your finger.
- b. Check that the message **Check sample gas out** appears on the screen within 30 seconds.

12. Airway gases \*

- a. Breathe a minimum of 5 times to the tip of the sampling line.
- b. Check that a normal **CO<sub>2</sub>** waveform appears to the waveform field and the **EtCO<sub>2</sub>** and **FiCO<sub>2</sub>** values are updated to the digit field.

13. Apnea detection

- a. Stop breathing to the gas sampling line.
- b. Check that an **Apnea** alarm appears to the message field within 30 seconds.

## Completing the check procedure

1. Select patient information area > **Discharge Patient** > **Confirm** to discard any changes made to the patient monitor configuration during checkout.

2. Disconnect the test setup.
3. Complete the check form.

## Configuration

There is no service configuration for this module.

## Calibration and adjustments

### Sample flow rate adjustment

Sample flow rate shall be adjusted:

- if the sample flow rate check failed.

### Required tools

- A mass flowmeter for measuring air flow, minimum measurement range from 0 to 200 ml/min, accuracy 5% or better in the 0 to 200 ml/min range.
- 3 m / 10 ft anesthesia gas sampling line.

#### NOTE

See the Supplies and accessories for compatible accessories.

#### NOTE

Use only accurate, properly maintained, calibrated and traceable calibration tools for the parameter calibration to ensure measurement accuracy.

#### NOTE

If the flowmeter unit is not ml/min, it shall be converted to ml/min according to the instructions of the flow meter manufacturer.

#### NOTE

Refer to the flowmeter documentation for user instructions.

## Making connections

1. Ensure that the module is connected to the monitor.
2. Ensure that you have a new water trap in use.
3. Connect a new gas sampling line to the sampling line connector in the water trap.
4. Connect the other end of the gas sampling line to the flow meter.

#### NOTE

Before checking or adjusting the sample flow, make sure there is no leakage in the sampling system.

## Adjusting sample flow rate

1. Select the  >  **Service** > enter **Username** and **Password**.

2. Select **Service** tab > **Parameters** > **Gas Unit** > **Gas Control** tab.
3. Adjust the sample flow to the nominal value 120 ml/min by using the **Sample Flow Gain** up-down spinner controls:
  - a. To decrease the sample flow rate measured by the flow meter by approximately 7.5 ml / min, lower the gain value by 0.05.
  - b. To increase the sample flow rate measured by the flow meter by approximately 7.5 ml / min, lower the gain value by 0.05.
4. Select **Confirm**, then select **Gases** tab to check the effect of the gain adjustment. Wait until the sample flow value shown in the menu returns near to the nominal value 120 ml/min and then check the actual measured flow rate from the flow meter.
5. Repeat steps 3 and 4 until the flow meter shows a  $120 \pm 20$  ml /min flow rate.

**NOTE**

Adjust the flow rate according to the reading in the flow meter. The flow rate reading in the calibration menu is measured by the internal electronics and settles always back to the nominal 120 ml /min independent on the real flow rate.

## Gas calibration

**WARNING**

Since calibration gas contains anesthetic agents, always ensure sufficient ventilation of the room during calibration.

Gas calibration shall be performed:

- each time planned maintenance is performed.
- each time corrective maintenance is performed.

**NOTE**

Gas calibration is a normal user action. Refer to the monitor's user's manual for the recommended gas calibration interval in clinical use.

## Required tools

- P/N: 755534-HEL Calibration Gas Regulator
- P/N: 755583-HEL Calibration gas, CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>O, DESF, package of 1 can (with E-sCAiO and N-CAiO modules)
- P/N: 755581-HEL QUICK CAL calibration gas, CO<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>O, package of 4 cans (with E-sCO module)
- P/N: M1006864, Calibration Gas Regulator, US only
- P/N: 755571-HEL, Calibration Gas, 5% CO<sub>2</sub>, 54.5% O<sub>2</sub>, 36.0% N<sub>2</sub>O, 2.0% DESFLURANE, BAL N2 (with E-sCAiO and N-CAiO modules) US only
- P/N: 755587, Calibration Gas, CO<sub>2</sub>, O<sub>2</sub>, Balance, 4 cans/pkg (with E-sCO module) US only
- 3 m / 10 ft anesthesia gas sampling line

**NOTE**

Use only the specified GE Healthcare calibration gas for the gas calibration to ensure measurement accuracy. Do not use any other calibration gases. Check the calibration gas container's labeling to ensure that the calibration gas has not expired.

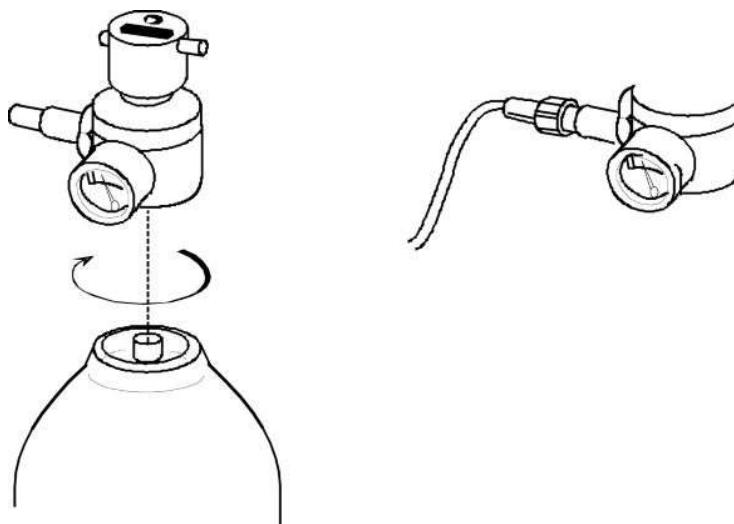
**NOTE**

Ensure that the gas regulator is functioning properly before gas calibration. Refer to the gas regulator's Instructions for Use letter for the annual maintenance instructions.

## Making connections

1. Ensure that the module is connected to the monitor.
2. Ensure that you have a new water trap in use.
3. Connect the gas regulator to the calibration gas container.
4. Connect a new gas sampling line to the sampling line connector in the water trap.
5. Connect the other end of the gas sampling line to the regulator on the gas container. Leave the regulator overflow port open to room air.

The following illustrates how to connect a gas regulator to the calibration gas container and a sampling line to the gas regulator:



## Calibrating gases

**NOTE**

Gas calibration is not available during the first five minutes after the module is connected. For maximum accuracy, let the monitor warm up for 30 minutes before starting calibration.

**NOTE**

Gas calibration is not available during a **Sample line blocked**, **Check water trap** and **Check sample gas out** alarm condition. Resolve the alarm condition before starting calibration.

1. Select the gas digit field > **Gas Calibrations**.
2. The monitor will start automatic zeroing of the gas sensors. Wait until the message **Zeroing** is replaced by the message **Zero OK** for all the measured gases.
3. Wait until the message **Feed gas** appears.

4. Open the regulator and feed the gas. The measured gas concentrations are displayed in real-time in the gas calibration menu. Wait until the measured gas concentrations are stabilized and the **Adjust** message appears for all the measured gases, then close the regulator.
5. Use the up-down spinner controls to adjust the gas value displayed in the calibration menu until they match the values on the calibration gas container.
6. Confirm by selecting **Accept**.
7. If the calibration is successful, the message **Calibration OK** is displayed for a few seconds. If the calibration fails, the message **Calibr. error** appears instead. In this case, start a new calibration by selecting **Recalibrate**.

**NOTE**

The message **Zero error** is shown in case the zeroing fails.

**NOTE**

The message **Calibr. error** is shown if:

- you do not start feeding gas within one minute after the automatic zeroing is completed
- you do not adjust value and **Accept** within one minute
- the calibration fails due to too large gain adjustment

# E-miniC module

## About this chapter

This chapter contains instructions for the planned and corrective maintenance, configuration and calibration of the acquisition module.

For the module instruction, troubleshooting, disassembly and reassembly and service parts section, please refer to Module's Service Manual.

## Maintenance check

### About the maintenance check procedures

This chapter describes the planned and corrective maintenance check procedures for the product. To help ensure the equipment remains in proper operational and functional order and maintains its essential performance and basic safety, follow the corrective and planned maintenance recommendations. The tests that are related to the essential performance and basic safety are marked with the \*.

The cleaning precautions, cleaning requirements, cleaning procedures, and recommended cleaning solutions are described in the monitor's user's manual.

For details about cleaning, disinfecting and sterilizing the accessories, see the instructions for use in the accessory package.

Record the results of the planned and the corrective maintenance check procedures to the eCheckforms delivered in the electronic manual media.

#### **WARNING**

##### SAFETY HAZARD.

To avoid risks to personnel and patient, or damage to the equipment, only perform maintenance procedures described in this manual. Unauthorized modifications can lead to safety hazards.

## Corrective maintenance

Perform the following checkout procedure after any corrective maintenance, before taking the module back into clinical use:

Performed service activity	Required checkout procedure	
	Visual inspection	Functional check
Front cover, or an other external part, replaced.	All steps	Not applicable

Performed service activity	Required checkout procedure	
	Visual inspection	Functional check
Mini D-fend O-rings	All steps	Perform the following tests: <ul style="list-style-type: none"> <li>• Check the gas sampling system for possible leakages.*</li> <li>• Check sample flow rate.*</li> </ul>
Module case opened either for troubleshooting purpose or for replacing any of the internal parts.	All steps	All steps

## Planned maintenance

### WARNING

Planned maintenance should be carried out at recommended interval. Failure to implement the recommended maintenance schedule may cause equipment failure and possible health hazards.

Perform the planned maintenance procedure completely every 12 months after installation. Perform the procedure in the following order:

1. Replacement of planned maintenance parts
2. Visual inspection
3. Functional check

## Replacement of planned maintenance parts

### Required parts

Replace the following parts that wear in use at the recommended interval.

Part number	Description	Pieces	Replacement interval
733382-HEL	Nafion Tube (#11)	1	Once a year
656565	Mini D-fend™ O-ring (#4)	2	Once a year
M1011471	Zero valve air filter (#16)	1	Once every 3 years

GE recommends that you replace the Mini D-fend water trap and the gas sampling line as part of the planned maintenance procedure.

### NOTE

See the Supplies and accessories for compatible accessories.

## Replacing the parts

1. Replace the zero valve air filter once every 3 years.
  - a. Use a small flat blade screwdriver to pull the old zero line air filter.
  - b. Attach a new zero line air filter into place.

2. Replace the special tube (Nafion) and check the condition of the internal tubing.
  - a. Replace the 300 mm nafion tube in the sample gas in line between the Mini D-fend water trap and the zero valve unit.
  - b. Check that the tubing inside the module is not contaminated. Any contamination inside the tubing may indicate that the valve or sensor is contaminated, too. This can increase a risk of faulty operation in valve or sensor. The gas sensor is not possible to clean in the field. Therefore, replace the whole miniCO<sub>2</sub> assembly with a new one.

**NOTE**

The nafion tube do not include the silicon fittings they connect to. Use the original silicon fittings unless they are not damaged or leaking.

3. Replace the Mini D-fend O-rings:
  - a. Detach the Mini D-fend.
  - b. Detach the old rubber O-rings that are around the metal Mini D-fend connectors e.g. using a small flat blade screwdriver. Pay special attention not to scratch the metal Mini D-fend connectors and thus causing leaking.
  - c. Set the new rubber O-rings into place and attach a new Mini D-fend.

## Performing visual inspection

1. Remove the module and check that:
  - a. The front cover is intact.
  - b. All connectors are intact, clean and attached properly.
  - c. The module casing and the latch are clean and intact.
  - d. The metal D-fend connectors and the D-fend O-rings are clean and intact.
  - e. The module and gas sampling tubes are clean and intact.

## Performing functional check

### Required tools for the functional check

**NOTE**

See the Supplies and accessories for compatible accessories.

- A barometer
- A mass flowmeter for measuring air flow, minimum measurement range from 0 to 200 ml/min, accuracy 5% or better in the 0 to 200 ml/min range.
- P/N: 755534-HEL Calibration Gas Regulator
- P/N: M1006864, Calibration Gas Regulator, US only
- P/N: 755580 Calibration Gas, 5% CO<sub>2</sub> and air, package of 4 cans
- P/N: 755587 Calibration Gas, CO<sub>2</sub>, O<sub>2</sub>, Balance, package of 4 cans, US only
- Mini D-Fend water trap
- 3 m / 10 ft gas sampling line

- A pressure manometer with either an integrated or a separate pressure pump

## Making connections for the functional check

1. Disconnect the module from the monitor for the first test.

- gas sampling system leak test

For the rest of the functional check steps:

2. Turn the monitor on and wait until the normal screen appears.
3. Ensure that the module is connected to the monitor.
4. Let the module warm up for at least 5 minutes.

## Configuring monitor for functional check

1. Configure **CO<sub>2</sub>** waveform to the screen with adequate priority.
2. Select the gas digit field.
3. Select **21-40%** for **FiO<sub>2</sub> level**.

## Testing CO<sub>2</sub> measurement

1. Gas sampling system leak test \*  
Check the gas sampling system for possible leakages.
  - a. Disconnect the module from the monitor.
  - b. Connect a new Mini D-fend water trap to the module.
  - c. Connect a new gas sampling line to the sampling line connector in the water trap.
  - d. Connect the other end of the gas sampling line to a pressure manometer and a pressure pump.
  - e. Block the "Sample Gas Out" connector.
  - f. Pump 100 mmHg ± 20 mmHg pressure to the gas sampling system. Let the pressure stabilize for approximately 10 seconds.
  - g. Check that the pressure reading does not drop more than 6 mmHg during 1 minute.
2. Sample flow check \*  
Check the sample flow rate.
  - a. Connect the module with the gas sampling line to the monitor.
  - b. Connect the gas sampling line to the sampling line connector in the water trap.
  - c. Connect the other end of the gas sampling line to a flowmeter.
  - d. Check the sample flow rate reading from the flowmeter. The flow rate shall be within the specification limit 150 ± 25 ml/min.

### NOTE

Readjustment is needed, if the measured value is not within the specification limits.  
Adjust the sample gas flow rate according to the instructions "Sample flow rate adjustment".

**NOTE**

If the sampling pump is noisy it indicates possible problems with motor bearing. In this case it is recommended to replace the noisy sampling pump with a new one.

**3. Zero valve operation \***

Test the zero valve functionality.

- a. Connect the gas regulator to the calibration gas container.
- b. Connect the end of the gas sampling line to the regulator on the gas container. Leave the regulator overflow port open to room air.
- c. Select the  >  **Service** > enter **Username** and **Password**.
- d. Select the **Service** tab > **Parameters** > **Gas Unit**.
- e. Select the **Gases** tab.
- f. Start feeding calibration gas. Wait until the CO<sub>2</sub> value in the Gases menu rises to approximately 5%.
- g. Open the zero valve to room air by selecting **Gas Control** tab > **Zero Valve ctrl**.
- h. Check that the CO<sub>2</sub> value in the menu drops back near to 0%.
- i. Stop feeding the calibration gas.
- j. Turn the zero valve back to the normal measurement position by selecting **Zero Valve ctrl**.

**4. Gas calibration \***

Perform gas calibration according to the instructions in "Gas calibration".

**5. Ambient pressure \***

Use a barometer to check the operation of the absolute pressure sensor.

- a. Check that the ambient pressure value shown in the Gas service menu does not differ more than ± 10 mmHg (13.33 mbar) from the value shown by the barometer.

**6. Occlusion detection \***

- a. Block the tip of the sampling line by your finger.
- b. Check that message **Sample line blocked** appears to the digit field within 30 seconds.

**7. Air leak detection \***

- a. Detach the Mini D-fend water trap.
- b. Check that message **Check Water Trap** appears to the digit field within 30 seconds.

**8. Gas exhaust blockage \***

- a. Block the gas exhaust connector with your finger.
- b. Check that the **Sample gas out** message appears in the digit field within 30 seconds.

**9. Airway gases \***

- a. Breathe a minimum of 5 times to the tip of the sampling line.
- b. Check that a normal CO<sub>2</sub> waveform appears to the waveform field and the EtCO<sub>2</sub> and FiCO<sub>2</sub> values are updated to the digit field.

**10. Apnea detection**

- a. Stop breathing to the gas sampling line.
- b. Check that an **Apnea** alarm appears to the message field within 30 seconds.

## Completing the check procedure

1. Select patient information area > **Discharge Patient** > **Confirm** to discard any changes made to the patient monitor configuration during checkout.
2. Disconnect the test setup.
3. Complete the check form.

## Configuration

There is no service configuration for this module.

## Calibration and adjustments

### Sample flow rate adjustment

Sample flow rate shall be adjusted:

- if the sample flow rate check failed.

### Required tools

- A mass flowmeter for measuring air flow, minimum measurement range 100-300 ml/min, accuracy 5% or better in the 100-300 ml/min range.
- 3 m / 10 ft gas sampling line

#### NOTE

See the Supplies and accessories for compatible accessories.

#### NOTE

Use only accurate, properly maintained, calibrated and traceable calibration tools for the parameter calibration to ensure measurement accuracy.

#### NOTE

If the flowmeter unit is not ml/min, it shall be converted to ml/min according to the instructions of the flow meter manufacturer.

#### NOTE

Refer to the flowmeter documentation for user instructions.

## Making connections

1. Ensure that the module is connected to the monitor.
2. Ensure that you have a new water trap in use.
3. Connect a new gas sampling line to the sampling line connector in the water trap.
4. Connect the other end of the gas sampling line to the flow meter.

**NOTE**

Before checking or adjusting the sample flow, make sure there is no leakage in the sampling system.

## Adjusting sample flow rate

1. Select the  >  **Service** > enter **Username** and **Password**.
2. Select the **Service** tab > **Parameters** > **Gas Unit**
3. Select the **Gas Control** tab.
4. Adjust the sample flow close to the nominal value 150 ml/min by using the **Sample Flow Gain** up-down spinner controls:
  - a. To decrease the sample flow rate measured by the flow meter by approximately 7.5 ml / min, add gain value by 0.05.
  - b. To increase the sample flow rate measured by the flow meter by approximately 7.5 ml / min, add gain value by 0.05.
5. Select **Confirm** to check the effect of the gain adjustment. Wait until the sample flow value shown in the menu returns near to the nominal value 150 ml/min and then check the actual measured flow rate from the flow meter.
6. Repeat steps 3 and 4 until the flow meter shows a  $150 \pm 25$  ml /min flow rate.

**NOTE**

Adjust the flow rate according to the reading in the flow meter. The flow rate reading in the menu is measured by the internal electronics and settles always back to the nominal 150 ml /min independent on the real flow rate.

## Gas calibration

**WARNING**

Since calibration gas contains anesthetic agents, always ensure sufficient ventilation of the room during calibration.

Gas calibration shall be performed:

- each time planned maintenance is performed.
- each time corrective maintenance is performed.

**NOTE**

Gas calibration is a normal user action. Refer to the monitor's user's manual for the recommended gas calibration interval in clinical use.

## Required tools

- P/N: 755534-HEL Calibration Gas Regulator
- P/N: M1006864, Calibration Gas Regulator, US only
- P/N: 755580 Calibration gas 5% CO<sub>2</sub> and air, package of 4 cans
- 3 m / 10 ft Gas sampling line

- P/N 755587 QUICK CAL calibration gas, US only

**NOTE**

Use only the specified GE Healthcare calibration gas for the gas calibration to ensure measurement accuracy. Do not use any other calibration gases. Check the calibration gas container's labeling to ensure that the calibration gas has not expired.

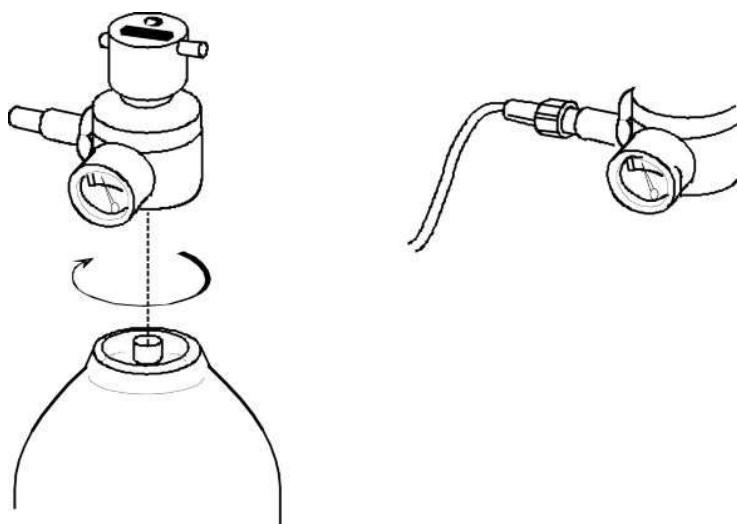
**NOTE**

Ensure that the gas regulator is functioning properly before gas calibration. Refer to the gas regulator's Instructions for Use letter for the annual maintenance instructions.

## Making connections

1. Ensure that the module is connected to the monitor.
2. Ensure that you have a new water trap in use.
3. Connect the gas regulator to the calibration gas container.
4. Connect a new gas sampling line to the sampling line connector in the water trap.
5. Connect the other end of the gas sampling line to the regulator on the gas container. Leave the regulator overflow port open to room air.

The following illustrates how to connect a gas regulator to the calibration gas container and a sampling line to the gas regulator:



## Calibrating gases

**NOTE**

Gas calibration is not available during the first five minutes after the module is connected. For maximum accuracy, let the monitor warm up for 30 minutes before starting calibration.

**NOTE**

Gas calibration is not available during a **Sample line blocked**, **Check water trap** and **Check sample gas out** alarm condition. Resolve the alarm condition before starting calibration.

1. Select the gas digit field > **Gas Calibrations**.
2. The monitor will start automatic zeroing of the gas sensor. Wait until the message **Zeroing** is replaced by the **Zero Ok** message.

3. Wait until the message **Feed gas** appears.
4. Open the regulator and feed the gas. The measured gas concentration is displayed in real-time in the gas calibration menu. Wait until the measured gas concentration is stabilized and the **Adjust** message appears, then close the regulator.
5. Use the up-down spinner controls to adjust the CO<sub>2</sub> value displayed in the calibration menu until match the value on the calibration gas container.
6. Confirm by selecting **Accept**.
7. If the calibration is successful, the message **Calibration OK** is displayed for a few seconds. If the calibration fails, the message **Calibr. error** appears instead. In this case, start a new calibration by selecting **Recalibrate**.

**NOTE**

The message **Zero Error** is shown in case the zeroing fails.

**NOTE**

The message **Calibr. error** is shown if:

- you do not start feeding gas within one minute after the automatic zeroing is completed
- you do not adjust value and **Accept** within one minute
- the calibration fails due to too large gain adjustment

# E-Entropy module

## About this chapter

This chapter contains instructions for the planned and corrective maintenance, configuration and calibration of the acquisition module.

For the module instruction, troubleshooting, disassembly and reassembly and service parts section, please refer to Module's Service Manual.

## Maintenance check

### About the maintenance check procedures

This chapter describes the planned and corrective maintenance check procedures for the product. To help ensure the equipment remains in proper operational and functional order and maintains its essential performance and basic safety, follow the corrective and planned maintenance recommendations. The tests that are related to the essential performance and basic safety are marked with the \*.

The cleaning precautions, cleaning requirements, cleaning procedures, and recommended cleaning solutions are described in the monitor's user's manual.

For details about cleaning, disinfecting and sterilizing the accessories, see the instructions for use in the accessory package.

Record the results of the planned and the corrective maintenance check procedures to the eCheckforms delivered in the electronic manual media.

#### **WARNING**

##### SAFETY HAZARD.

To avoid risks to personnel and patient, or damage to the equipment, only perform maintenance procedures described in this manual. Unauthorized modifications can lead to safety hazards.

## Planned maintenance

#### **WARNING**

Planned maintenance should be carried out at recommended interval. Failure to implement the recommended maintenance schedule may cause equipment failure and possible health hazards.

Perform the planned maintenance procedure completely every 2 years after installation. Perform the procedure in the following order:

1. Visual inspection
2. Electrical safety test \*
3. Functional check

## Corrective maintenance

Service personnel shall perform the following checkout procedure after any corrective maintenance, before taking the module back into clinical use:

Performed service activity	Required checkout procedure		
	Visual inspection	Electrical safety test	Functional check
Product casing opened either for troubleshooting purpose or for replacing any of the internal parts.	All steps	All steps	All steps
Front cover, or an other external part, replaced.	All steps	Not applicable	Not applicable

## Performing visual inspection

1. Remove the module and check that:
  - a. The front cover is intact.
  - b. All connectors are intact, clean and attached properly.
  - c. The module casing and the latch are clean and intact.
  - d. The patient cables are clean and intact.

## Performing electrical safety test \*

Perform the electrical safety tests described in the monitor technical manual, "Checkout procedures" chapter. Perform following tests:

1. Patient (source) leakage current test
2. Patient (sink) leakage current test

## Performing functional check

### Required tools for Entropy module functional check

#### NOTE

See the Supplies and accessories for compatible accessories.

- Entropy simulator, P/N: N-ES
- Entropy sensor cable

### Making connections for the functional check

1. Turn on or restart the monitor and wait until the normal screen appears.

2. Ensure that the module is connected to the monitor.

## Configuring monitor for Entropy module functional check

1. Configure Entropy waveform to the screen with adequate priority.
2. Press the **Entropy** module key to open the **Entropy setup** menu and select:
  - **Scale  $\mu$ V:** 250.
  - **Display format:** RE+SE
  - **Automatic ssensor check:** ON

### NOTE

Automatic sensor check may need to be disabled if the 70 Hz impedance check signal interferes with other equipment, such as EEG module with evoked potentials measurement.

## Testing entropy measurement \*

1. To check the module and sensor recognition:
  - a. Connect the entropy sensor cable to the module.
  - b. Check that the Entropy EEG waveform field and related information appears on the screen.
  - c. Check that **No sensor** message appears in the Entropy digit field.
2. To check the sensor:
  - a. Connect the Entropy simulator to the Entropy sensor cable.
  - b. Check that **Checking sensor** message appears in the Entropy digit field after a while.
  - c. Wait until all 3 electrodes are checked.
  - d. Check that all 3 sensors pass the check successfully: there is a green circle with a check mark for each tested electrode.

### NOTE

The monitor may show **No Entropy sensor** and **Demo data** messages when using Entropy simulator.

3. To check the measurement:
  - a. Wait about 30 seconds after the sensor check is completed and check that the EntrEEG waveform and RE & SE values appear on the screen.

## Completing the check procedure

1. Select patient information area > **Discharge Patient** > **Confirm** to discard any changes made to the patient monitor configuration during checkout.
2. Disconnect the test setup.
3. Complete the check form.

## Configuration

There is no service configuration for this module.

## Calibration and adjustments

No calibration or adjustments are needed for this module.

# E-NMT module

## About this chapter

This chapter contains instructions for the planned and corrective maintenance, configuration and calibration of the acquisition module.

For the module instruction, troubleshooting, disassembly and reassembly and service parts section, please refer to Module's Service Manual.

## Maintenance check

### About the maintenance check procedures

This chapter describes the planned and corrective maintenance check procedures for the product. To help ensure the equipment remains in proper operational and functional order and maintains its essential performance and basic safety, follow the corrective and planned maintenance recommendations. The tests that are related to the essential performance and basic safety are marked with the \*.

The cleaning precautions, cleaning requirements, cleaning procedures, and recommended cleaning solutions are described in the monitor's user's manual.

For details about cleaning, disinfecting and sterilizing the accessories, see the instructions for use in the accessory package.

Record the results of the planned and the corrective maintenance check procedures to the eCheckforms delivered in the electronic manual media.

#### **WARNING**

##### SAFETY HAZARD.

To avoid risks to personnel and patient, or damage to the equipment, only perform maintenance procedures described in this manual. Unauthorized modifications can lead to safety hazards.

## Planned maintenance

#### **WARNING**

Planned maintenance should be carried out at recommended interval. Failure to implement the recommended maintenance schedule may cause equipment failure and possible health hazards.

Perform the planned maintenance procedure completely every 2 years after installation. Perform the procedure in the following order:

1. Visual inspection
2. Electrical safety test \*
3. Functional check

## Corrective maintenance

Service personnel shall perform the following checkout procedure after any corrective maintenance, before taking the module back into clinical use:

Performed service activity	Required checkout procedure		
	Visual inspection	Electrical safety test	Functional check
Product casing opened either for troubleshooting purpose or for replacing any of the internal parts.	All steps	All steps	All steps
Front cover, or an other external part, replaced.	All steps	Not applicable	Not applicable

## Performing visual inspection

1. Remove the module and check that:
  - a. The front cover is intact.
  - b. All connectors are intact, clean and attached properly.
  - c. The module casing and the latch are clean and intact.
  - d. The patient cables are clean and intact.

## Performing electrical safety test \*

Perform the electrical safety tests described in the monitor technical manual, "Checkout procedures" chapter. Perform following tests:

1. Patient (source) leakage current test
2. Patient (sink) leakage current test

## Performing functional check

### Required tools for NMT module functional check

#### NOTE

See the Supplies and accessories for compatible accessories.

- NMT Simulator, P/N 871251-HEL
- NMT ElectroSensor
- NMT Sensor cable 3.3 m

## Making connections for the functional check

1. Turn on or restart the monitor and wait until the normal screen appears.
2. Ensure that the module is connected to the monitor.

## Configuring monitor for NMT module functional check

1. Setup NMT to waveform field.
2. Select NMT digit field and setup:
  - **Start with:** New patient
  - **Current:** Supra
  - **Stimulus Beep Volume:** 2
3. Select **Advanced** tab and setup:
  - **Stimulus Mode:** TOF

## Configuring simulator for NMT module functional check

For instructions on how to use and configure the simulators, refer to the simulators' documentation.

1. Turn the simulator on.
2. Set the switch on the simulator to **Fade off**.
3. Turn the response knob to **max**.

## Testing NMT measurement \*

1. To check the module and sensor recognition:
  - a. Connect the NMT sensor cable with a NMT ElectroSensor to the module.
  - b. Check that the NMT waveform field and related information appears on the screen.
  - c. Check that **Measurement OFF** message appears in the NMT digit field.
2. To check the supramaximal current search and reference setting:
  - a. Connect the NMT ElectroSensor leads to the NMT simulator.
  - b. Press the **Start-up** module key to start NMT measurement (TOF).
  - c. Check that:
    - The detected supramaximal current is less than or equal to 70 mA.
    - The **Supramax search** message changes to **Setting reference**.
3. To check the measurement with a simulator, check that:
  - a. The module gives four successive stimulus pulses with approximately 0.5-second intervals.
  - b. The responses for the four stimulus pulses are visible on the waveform field.
  - c. **TOF%** is within 95-105.
  - d. **Count** is 4.
  - e. **T1%** is within 95-105.
4. Press the **Stop Continue** module key to stop the measurement.

## Completing the check procedure

1. Select patient information area > **Discharge Patient** > **Confirm** to discard any changes made to the patient monitor configuration during checkout.
2. Disconnect the test setup.
3. Complete the check form.

## Configuration

There is no service configuration for this module.

## Calibration and adjustments

No calibration or adjustments are needed for this module.

# Verification procedure for wireless MC Network infrastructure

## Purpose and scope

The purpose of this test is to verify that wireless monitors operate reliably in customer's wireless network infrastructure. The test focuses on the wireless coverage areas that most likely have poor connectivity.

This test is recommended if the wireless monitors are going to be used in patient transfers within the wireless coverage area. You may skip the test, if the wireless monitors will only be used as stationary monitors at the bedside.

## Test plan

Each wireless installation is unique. It is often impractical and uneconomical to verify the whole wireless coverage area. Therefore, prepare a site-specific test plan that covers the areas where the monitors are most likely to face issues with the wireless communication.

When preparing the test plan, utilize the information provided in the pre-quote questionnaire, existing wireless network design documentation and site survey results. Discuss with the hospital IT specialists and clinical staff to identify the areas that are most likely for poor wireless communication, and prepare a test plan accordingly.

Consider the following aspects when you prepare the test plan:

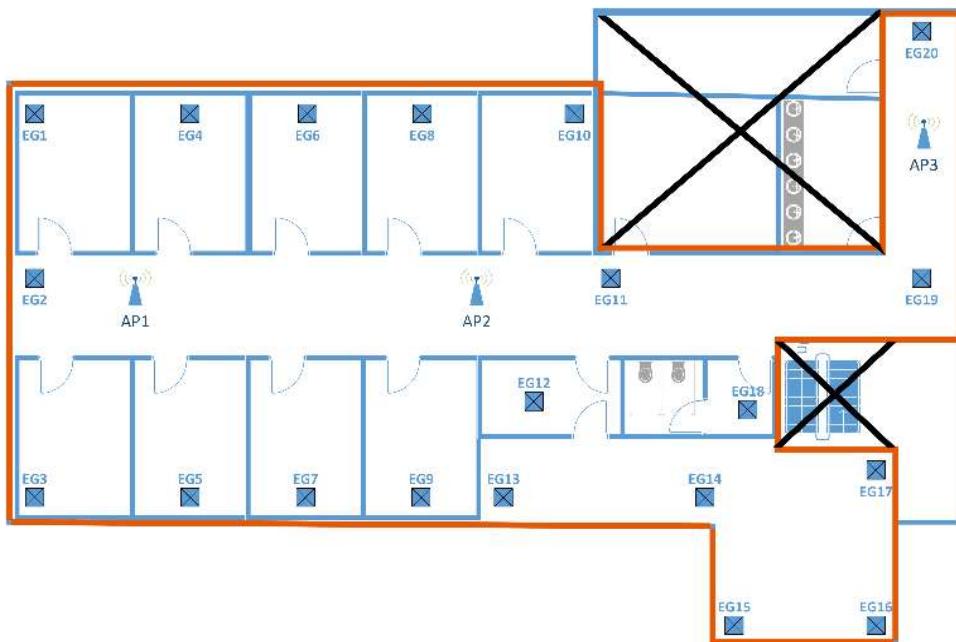
- Identify areas with known or obvious low signal strength.
- Identify areas with known sources of radio frequency interference, causing high noise floor and/or poor signal-to-noise ratio.
- Identify the special characteristics in the building layout (floors, wings patient rooms) and construction material used.
- Identify the time and areas of congestion, with high number of wireless clients and a lot of network traffic.
- Identify intended clinical workflow paths, including bedside locations and transport routes.

Prepare the test plan by documenting the intended walking path and test points to the floor plan, preferably to copy of a site survey document that shows the wireless coverage area, the location of wireless access points, signal strengths and sources of known radio frequency interferences.

Due to the dynamic nature of a wireless environment this test provides only a snapshot of the wireless network at the time of the test. This is not a comprehensive test that covers all possible use situations, network traffic situations, radio frequency interferences and possible other changes in the wireless environment.

### NOTE

In the sample floor plan below, EG1- EG20 represent possible test points. Take into account in your plan that some rooms and areas may not be accessible at the time of performing the survey.



## Overview of the test procedure

The test procedure covers the following:

- A wired monitor (stationary monitor) measures ECG and sends the ECG waveform data to the MC Network.
- A wireless monitor (transport monitor) shows the ECG waveform from the wired monitor in a bed-to-bed view.
- A tester moves the wireless monitor along a preplanned route in the wireless coverage area and ensures that the signal strength and transmit rate are adequate, and that the ECG waveform does not have any major gaps or interruptions during the transport between test points.

## Test equipment needed

Ensure that you have the following equipment and documentation available.

### Hardwired monitor, the stationary monitor

- A patient simulator.
- A patient monitor with hardwired MC Network connection.
- A compatible 5-lead ECG trunk cable and 5-leadwire set.

### Wireless monitor, the transport monitor

- A patient monitor with wireless MC Network connection and bed to bed license.
- A plastic roll cart for the patient monitor. To avoid RF impairment, do not use metal roll carts.

## Test setup

Install, configure and test the monitors in the same MC Network.

### Setting up the hardwired monitor

1. Connect the ECG cables to the monitor and to the patient simulator.
2. Turn on the patient monitor, and the patient simulator.
3. Configure the patient simulator to output ECG waveform with:
  - ECG rhythm: a normal sinus rhythm
  - Heart rate: 80 bpm
  - Amplitude: 1 mV

#### NOTE

Refer to the simulator documentation for details on how to use and configure the simulator.

4. Configure the monitor:
  - a. Select the ECG1, ECG2 and ECG3 waveform fields to the monitor screen with adequate priority.
  - b. Select the ECG digit field and setup:
    - **ECG 1 Lead: II**
    - **ECG 2 Lead: V1**
    - **ECG 3 Lead: aVL**
  - c. Select the information area to admit a patient.

### Setting up the wireless monitor

#### NOTE

Ensure that the patient monitor battery are fully charged.

1. Set up the connections:
  - a. Set up the wireless monitor on a roll cart.
  - b. Turn on the monitor.
2. Configure the monitor:
  - a. Select  >  **Other Patients**.
  - b. Select a care unit from **Unit** and **All Patients** from **Show**.
  - c. Select a patient bed of the stationary monitor and select **View**.

## Performing the test

Perform the test according to the test plan. Contact the nursing staff to ensure access to the needed areas before you start the test.

1. Move the roll cart to the starting point of the planned test route.

2. Stop at each test point and perform the following tasks:
  - a. On the transport monitor: Verify that ECG waveforms from the remote, stationary patient monitor display in the bed-to-bed view without any losses.
  - b. Select the  > **Service** > enter **Username** and **Password**.
  - c. Select **Service** tab > **Page 2** vertical tab > **WLAN Status**
  - d. Mark following items to the test form.
    - Test point: current point
    - Time: current time on monitor
    - RSSI: **Quality dBm for Signal**
    - Transmit rate: **Tx Rate Mbps**
  - e. Verify that the RSSI in dBm is greater than or equal to -60 dBm.
  - f. Verify that the Transmit Rate in Mbps is greater than or equal to 5.5 Mbps.
3. If there is a gap in the waveform, or the RSSI or the Transmit Rate is lower than specified:
  - Observe the length of the waveform loss.
  - Try to find the cause of the gap, for example, roaming or out of range situations.
4. Move the roll cart to the next test point along the walking path and repeat steps 2 and 3 at each test point until you have completed the test plan. While you move the roll cart from one test point to another, verify that there are no losses in the ECG waveforms.

**NOTE**

Momentary waveform losses up to 5 seconds are normal during roaming. If longer, or repeating waveform losses occur between test points, record the observations to the test form also.

## Summarizing and reporting

1. Complete the test form
2. Review and evaluate the test results together with GE personnel and the hospital IT specialists. Summarize, if additional testing is needed and/or if the WLAN infrastructure needs to be changed.

# Networking disclosure to facilitate network risk management

## Purpose and scope

This disclosure is intended to satisfy the requirements of IEC 60601-1 clause 14.13 and IEC/ISO 80001-1 clause 3.5 for disclosure of network-related specifications, requirements, and residual risks in order to facilitate the responsible organization's risk management activities (e.g. pursuant to 80001-1) for their networks incorporating the monitor.

## Purpose of the monitor connection to a network

The monitor is intended to be connected to a network in order to support the following functionality:

- Providing real-time patient data (i.e. parameters, waveforms and alarms) to compatible network devices such as central stations or other bedside monitors.
- Remote configuration (patient admission, alarm settings, etc.) from compatible network devices.
- Remote service by GE (InSite RSvP).

## Network interface technical specifications

Connection Name	Mission Critical (MC) network port
Physical network connection type	1000 Base-T Ethernet
Speeds and duplex modes supported	Autonegotiate
Default IP Address (from factory)	IP address: 172.16.X.X Subnet mask: 255.255.0.0 Gateway: 172.16.254.254
IP Addressing	IPV4 Static
QoS Support	IP layer DSCP tagging
Authentication Support	Optional support for IEEE 802.1X port based authentication

Connection Name	Wireless MC Network
General WLAN Standards/Certifications	Protocols: 802.11a/b/g/n Radio RF standards: <ul style="list-style-type: none"><li>• USA: FCC Part 15.247, 15.401-15.407</li><li>• EU: EN300328, EN301893</li></ul> EMI/EMS standards: <ul style="list-style-type: none"><li>• USA: FCC Part 15.207, 15.209</li><li>• EU: EN 301 489-1, EN 301 489-17</li></ul> Safety Compliance: IEC 60950-1:2005 (2nd Edition)/EN 60950-1:2006

Connection Name	Wireless MC Network
Antenna Gain	<b>2.4 GHz:</b> +2.2dBi Maximum <b>5 GHz:</b> +4.5dBi Maximum
Supported Channel Range	<b>2.4 GHz:</b> 1-14 <b>5 GHz:</b> 36-165
RF Output Power Range	<b>2.4 GHz EIRP:</b> up to +18.8 dBm <b>5 GHz EIRP:</b> up to +16.4 dBm NOTE: May be further restricted on some channels according to regulatory domain.
Supported Data Rates [Mbps] and Corresponding Receive Sensitivity [dBm, referenced to radiated output]	2.4 GHz (802.11 b): 11Mbps: Channel 1/-79 dBm, Channel 6/-81dBm , Channel 11/-78 dBm (Sensitivity corresponds to 8% max packet error rate with 1024 byte MPDU)  2.4 GHz (802.11 g): 54Mbps: Channel 1/ -68 dBm, Channel 6/ -67 dBm, Channel 11/ -66 dBm (Sensitivity corresponds to 10% max packet error rate with 1024 byte MPDU)  5 GHz (802.11 a): 54 Mbps: Channel 36/-67 dBm, Channel 48/-67 dBm , Channel 60/-68 dBm, Channel 100/-67 dBm, Channel 140/-68 dBm, Channel 165/-69 dBm (Sensitivity corresponds to 10% max packet error rate with 1024 byte MPDU)
Minimum Expected RSSI in Coverage Area	-65dBm ±5dB
Dynamic Frequency Selection	802.11h DFS
Transmit Power Control	None
MAC-layer QoS and Power Save Support	802.11e WMM: Customizable DSCP settings
Data Encryption Support	Wi-Fi Protected Access with TKIP and AES-CCMP
Authentication Support	WPA-Personal, WPA2-Personal, WPA-Enterprise, and WPA2-Enterprise
Over-the-air Configuration Support	None
Fast roaming Support	802.11 r
IP Addressing	IPv4 statically configured
IP Layer QoS	DSCP tagging per dataflow, 802.11e, WMM

## Network information flows

Flow Name	Realtime patient data
Network Connection on device	MC network
Usage Type/Function/Purpose	Clinical/Waveforms, parameters, trends, alarms, admit/discharge patient/Transmit clinical data to other devices on the network

<b>Flow Name</b>	<b>Realtime patient data</b>
Licensed/optional/required	Licensed
Communication Partner Device/IP Address/Network	Unity Devices / MC Network
Middle Layer Protocols	UDP
Application Layer Protocol and Encoding	Unity
Ports	37, 2000, 2001, 2006, 2007, 2008, 2009, 2010, 2011, 7000
Traffic characterization and Bandwidth Requirements	Outgoing unicast traffic is approximately 50 Kbps per patient view. Maximum of 10 views supported on wireless network. Maximum of 16 views supported on wired network.
Latency max	250 ms

<b>Flow Name</b>	<b>Ping</b>
Network Connection on device	MC network
Usage Type/Function/Purpose	Network troubleshooting
Licensed/optional/required	Required
Communication Partner Device/IP Address/Network	PC, Other Medical Devices / MC Network
Middle Layer Protocols	ICMP
Application Layer Protocol and Encoding	NA
Ports	NA
Traffic characterization and Bandwidth Requirements	On-demand, User-initiated

<b>Flow Name</b>	<b>HL7</b>
Network Connection on device	Ethernet
Usage Type/Function/Purpose	HL7 outbound to EMR system
Licensed/optional/required	Licensed
Communication Partner Device/IP Address/Network	HL7 Server
Middle Layer Protocols	TCP
Application Layer Protocol and Encoding	HL7
Ports	Customer defined, default port is 6000
Traffic characterization and Bandwidth Requirements	On-demand, 720 bps

<b>Flow Name</b>	<b>HTTPS proxy</b>
Network Connection on device	Ethernet
Usage Type/Function/Purpose	Network Services/InSite RSvP
Licensed/optional/required	Licensed (use only if InSite RSvP flow is enabled).
Communication Partner Device/IP Address/Network	Proxy server/Hospital

Flow Name	HTTPS proxy
Middle Layer Protocols	TCP
Application Layer Protocol and Encoding	HTTPS
Ports	Local port: ephemeral, remote port: 443.
Traffic characterization and Bandwidth Requirements	Periodic (4kbytes/minute) On-Demand (file transfers)

## Required characteristics and configuration for support

The network must meet the specific requirements above for all traffic flows associated with the subset of features, use cases and workflows required by the responsible organization's users.

## Potential risks to safety, effectiveness or security resulting from failure of IT network to provide the required

Loss of network connectivity can result in the following hazardous situations:

- Missed alarm at a remote viewing station (bedside or display).
- Complete or partial loss or deterioration of remote monitoring of waveform and parameter data at remote viewing device.

Product mitigations:

- Low alarm volume is increased if network communication fails.
- Audio off, audio pause are interrupted if network communication fails.
- User is notified of network communication failure, message is displayed until user acknowledges it.
- User is notified if a duplicate IP address is detected.
- User is notified if a duplicate unit/bed name.

In addition to the hazardous situations identified above, connection of the monitor to a network that includes other equipment could result in other unidentified risks to patients, operators or third parties. The responsible organization should identify, analyze, evaluate and control these risks on an ongoing basis including after changes to the network, which could introduce new risks and require additional analysis.

- changes in network configuration
- connection of additional items to the network
- disconnecting items from the network
- update of equipment connected to the network
- upgrade of equipment connected to the network



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