

MAC™ 2000 ECG Analysis System

Operator Manual

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Revision T

English

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The information in this manual applies only to MAC™ 2000. This applies to software version 1.1 and not to earlier software versions. Due to continuing product innovation, specifications in this manual are subject to change without notice.

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This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org/>). This product includes cryptographic software written by Eric Young (eay@cryptsoft.com). This product includes software written by Tim Hudson (tjh@cryptsoft.com).

This product complies with the requirements concerning medical devices from the following regulatory bodies. For more information about compliance, refer to the Regulatory and Safety Guide for this product.



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Continues on the next page

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Access other GE Healthcare Diagnostic Cardiology documents at the Customer Documentation Portal. Go to <https://www.gehealthcare.com/en/support/support-documentation-library> and scroll to the bottom of the page.

To access Original Equipment Manufacturer (OEM) documents, go to the device manufacturer's website.

Contents

| | |
|---|-----------|
| 1 Introduction | 11 |
| 1.1 Intended User of this Product..... | 11 |
| 1.2 Indications for Use..... | 11 |
| 1.3 Contraindications | 11 |
| 1.4 Prescription Device Statement..... | 12 |
| 1.5 Regulatory and Safety Information | 12 |
| 1.5.1 Safety Conventions..... | 12 |
| 1.5.2 Safety Hazards | 12 |
| 1.5.3 Classification of Medical Device | 15 |
| 1.5.4 Certification Information..... | 16 |
| 1.5.5 Recording ECGs During Defibrillation..... | 16 |
| 1.5.6 Accuracy of Input Signal Reproduction..... | 16 |
| 1.5.7 Modulating Effects in Digital Systems..... | 16 |
| 1.5.8 EMI/EMC/RF Safety Information | 17 |
| 1.5.9 Biocompatibility..... | 18 |
| 1.5.10 Legal Notice | 18 |
| 1.5.11 Supplies and Accessories..... | 18 |
| 1.5.12 Responsibility of the Manufacturer | 18 |
| 1.5.13 Responsibility of the Purchaser/Customer | 18 |
| 1.5.14 Product and Packaging Information..... | 18 |
| 1.5.14.1 Hardware Label Locations | 19 |
| 1.5.14.2 Symbol Descriptions | 20 |
| 1.5.14.3 Installation and Connection..... | 27 |
| 1.5.14.4 Training..... | 27 |
| 1.6 Equipment Identification | 27 |
| 1.6.1 Product Label | 27 |
| 1.6.2 Serial Number Format..... | 28 |
| 1.6.3 Device Address Label and Rating Plate..... | 28 |
| 1.6.4 Product Codes | 29 |
| 1.7 Service Information..... | 29 |
| 1.7.1 Service Requirements | 29 |
| 1.7.2 Warranty Information | 29 |
| 1.7.3 Additional Assistance..... | 30 |
| 1.8 Manual Information..... | 30 |
| 1.8.1 Manual Purpose | 30 |
| 1.8.2 Document Conventions | 30 |
| 1.8.2.1 Typographical Conventions | 30 |
| 1.8.2.2 Illustrations..... | 30 |
| 1.8.2.3 Notes | 31 |
| 1.9 Related Documents | 31 |
| 2 Product Overview | 32 |

| | |
|--|-----------|
| 2.1 Product Description | 32 |
| 2.2 Product Specifications | 32 |
| 2.2.1 Hardware Descriptions..... | 32 |
| 2.2.1.1 Front View | 33 |
| 2.2.1.2 Rear View | 33 |
| 2.2.1.3 Side View..... | 34 |
| 2.2.1.4 Standard Keypad | 35 |
| 2.2.1.5 Stress Keypad | 36 |
| 2.2.1.6 Stress Keys | 36 |
| 2.2.1.7 Hardware Specifications | 37 |
| 2.2.2 Optional Software Features | 37 |
| 2.2.3 Using the System | 38 |
| 2.2.3.1 Security Mode Window | 38 |
| 2.2.3.2 Startup Screen..... | 38 |
| 2.2.3.3 Using the Keypad..... | 39 |
| 2.2.3.4 ECG Data Acquisition | 40 |
| 2.2.3.5 External Storage | 40 |
| 2.3 Navigating the User Interface..... | 40 |
| 2.3.1 Resting ECG Power Up Mode | 41 |
| 2.3.2 Arrhythmia Power Up Mode..... | 42 |
| 2.3.3 Main Screen Power Up Mode..... | 42 |
| 2.3.4 Stress ECG Power Up Mode..... | 43 |
| 2.3.5 Order Manager Power Up Mode | 43 |
| 2.3.6 High Security Mode | 44 |
| 3 Setting Up the Equipment | 46 |
| 3.1 Inserting the Battery | 46 |
| 3.2 Connecting the AC Power | 46 |
| 3.3 Connecting the Patient Cable | 47 |
| 3.4 Applying the Ferrite Ring to Cables..... | 49 |
| 3.5 Connecting the Barcode Reader..... | 49 |
| 3.6 Connecting the LAN Option | 50 |
| 3.6.1 Connecting to LAN..... | 50 |
| 3.6.2 Connecting to WLAN..... | 50 |
| 3.7 Connecting External Devices (Stress Option)..... | 50 |
| 3.8 Connecting an Internal Modem | 51 |
| 3.9 Inserting the Paper..... | 51 |
| 3.10 Turning on the System | 51 |
| 3.11 Configuring the Device..... | 51 |
| 3.12 Testing the Device | 51 |
| 4 Preparing the Patient | 53 |
| 4.1 Preparing the Patient's Skin | 53 |
| 4.2 Electrode Placement | 54 |

| | |
|---|-----------|
| 4.2.1 Resting ECG Placement..... | 54 |
| 4.2.1.1 Standard 12-Lead Placement | 54 |
| 4.2.1.2 NEHB Placement | 55 |
| 4.2.2 Stress 12-Lead Placement | 55 |
| 5 Entering Patient Information | 57 |
| 5.1 Entering Patient Information With an Internal Keypad or External Keyboard | 57 |
| 5.2 Entering Patient Information with a Barcode Reader | 57 |
| 5.2.1 Scanning the Barcode | 58 |
| 5.3 Automatic Query | 58 |
| 5.3.1 Configuring Automatic Query | 59 |
| 5.3.2 Using the Barcode Reader to Query the Database and Select a Patient | 59 |
| 5.3.3 Using the Internal Keypad or External Keyboard to Query the Database and Select Patient | 60 |
| 6 Order Manager | 62 |
| 6.1 Communication Media | 62 |
| 6.2 Simple Orders | 62 |
| 6.3 Advanced Order Manager | 63 |
| 6.3.1 Downloading Orders..... | 63 |
| 6.3.2 Selecting and Completing Orders..... | 64 |
| 6.4 Using the Order Manager Interface..... | 64 |
| 6.4.1 Deleting Orders..... | 65 |
| 6.4.1.1 Accessing the Delete Orders Menu..... | 65 |
| 6.4.1.2 Deleting Specific Orders..... | 66 |
| 6.4.1.3 Deleting All Orders..... | 66 |
| 6.4.1.4 Deleting Completed Orders..... | 66 |
| 7 Recording a Resting ECG | 68 |
| 7.1 Hookup Advisor..... | 69 |
| 7.2 Resting ECGs | 70 |
| 7.2.1 Recording a Resting ECG..... | 70 |
| 7.2.2 ECG Options | 71 |
| 7.2.3 Post-Acquisition Options..... | 73 |
| 7.3 Full Disclosure | 75 |
| 7.3.1 Generating a Full Disclosure ECG Report | 75 |
| 7.3.2 Full Disclosure Report Setup | 76 |
| 7.4 Special Considerations | 77 |
| 7.4.1 Recording ECGs of Pacemaker Patients..... | 77 |
| 7.4.2 Recording ECGs During Defibrillation..... | 78 |
| 7.5 Generating a Rhythm Report (Manual Recording)..... | 79 |
| 8 Arrhythmia Mode Recording | 80 |
| 8.1 Recording in Arrhythmia Mode | 80 |
| 8.1.1 Recording Arrhythmia ECGs..... | 80 |
| 8.1.2 Arrhythmia Recording Options | 81 |

| | |
|---|------------|
| 8.2 Printing | 82 |
| 8.2.1 Printing an Arrhythmia Report..... | 82 |
| 8.2.2 Arrhythmia Printing Options..... | 82 |
| 8.3 Arrhythmia Codes..... | 83 |
| 9 RR Analysis | 84 |
| 9.1 RR Analysis Mode..... | 84 |
| 9.1.1 RR Analysis Setup | 84 |
| 9.1.2 Acquiring a Recording for an RR Analysis Report..... | 87 |
| 9.1.3 Output Options | 87 |
| 10 Stress Testing..... | 88 |
| 10.1 Stress Mode Interface | 89 |
| 10.1.1 Stress Test Information Bar | 89 |
| 10.1.2 Stress Test Keys | 90 |
| 10.1.3 Stress Options | 90 |
| 10.2 Conducting Stress Tests..... | 92 |
| 10.2.1 Conducting a Stress Test with a Treadmill or Ergometer | 92 |
| 10.2.2 Conducting a Stress Test with a Master's Step Device..... | 94 |
| 11 Managing Internal Storage | 96 |
| 11.1 Importing Records..... | 96 |
| 11.2 Printing the File Manager Directory | 97 |
| 11.3 Finding Records..... | 97 |
| 11.4 Editing Patient Data | 98 |
| 11.5 Previewing Records | 99 |
| 11.6 Deleting Records..... | 99 |
| 11.7 Printing Records..... | 100 |
| 11.8 Transmitting Records..... | 100 |
| 11.9 Exporting Records | 101 |
| 11.9.1 Setting Up Export Options..... | 101 |
| 11.9.2 Exporting Records | 102 |
| 12 System Configuration | 104 |
| 12.1 Basic Setup..... | 104 |
| 12.2 Resting ECG Setup | 108 |
| 12.3 Arrhythmia Setup..... | 118 |
| 12.4 Stress ECG Setup..... | 120 |
| 12.4.1 Stress ECG Settings..... | 121 |
| 12.4.2 Editing Stress Protocols..... | 124 |
| 12.5 Communication Setup | 127 |
| 12.6 Country Setup..... | 137 |

| | |
|---|------------|
| 12.7 Print Setup Report | 138 |
| 12.8 Patient Setup..... | 139 |
| 12.9 User Setup | 144 |
| 12.9.1 Configure the Password Rule | 145 |
| 12.9.2 Export Recovery Key | 147 |
| 12.9.3 Configure User | 147 |
| 12.10 Select Setup | 149 |
| 12.11 Import Setup | 150 |
| 12.12 Export Setup | 150 |
| 12.13 Options Setup | 151 |
| 12.14 Service Setup..... | 153 |
| 12.15 Date/Time Setup | 153 |
| 12.16 Order Manager Setup..... | 154 |
| 12.17 RR Analysis Setup..... | 155 |
| 12.18 PDF File Naming Convention..... | 155 |
| 12.18.1 Default Naming Convention..... | 155 |
| 12.18.2 Customizing the Naming Convention..... | 156 |
| 12.18.3 Exporting the Audit Trail | 156 |
| 13 Cleaning and Disinfection..... | 158 |
| 13.1 Inspect the Device..... | 158 |
| 13.2 Care at the Point of Use..... | 158 |
| 13.3 Preparation for Cleaning | 158 |
| 13.4 Clean and Disinfect Guidelines | 158 |
| 13.5 Visual Inspection, Cleaning and Disinfection Frequency | 159 |
| 13.6 Clean and Disinfect the Device and Trolley..... | 159 |
| 13.6.1 Inspect, Clean and Disinfect the Device and Trolley..... | 160 |
| 13.6.2 Clean the Device and Trolley | 160 |
| 13.6.3 Post-Clean Inspection | 160 |
| 13.6.4 Disinfect the Device and Trolley..... | 161 |
| 13.7 Clean and Disinfect Leadwires and Reusable Electrodes..... | 161 |
| 13.8 Storage | 162 |
| 13.9 Cleaning and Disinfection Agents | 162 |
| 13.10 Additional Information | 162 |
| 14 Maintenance..... | 163 |
| 14.1 Replacing Leadwire Adapters | 163 |
| 14.2 Paper Maintenance | 163 |
| 14.2.1 Replacing Paper..... | 164 |
| 14.2.2 Adjusting the Tray for Paper Size..... | 165 |
| 14.2.2.1 Adjusting the Tray for 8.5 x 11 inches or A4 | 165 |

| | |
|---|------------|
| 14.2.2.2 Adjusting the Tray for Modified Letter Paper (8.433 x 11 inches) | 165 |
| 14.2.3 Removing the Paper Pack | 166 |
| 14.2.4 Storing Thermal Paper | 166 |
| 14.3 Battery Maintenance | 166 |
| 14.3.1 Replacing the Battery | 167 |
| 14.3.2 Conditioning the Battery Pack | 168 |
| 14.3.3 Battery Status Indicator | 169 |
| 14.4 Supplies and Accessories | 169 |
| 15 Troubleshooting | 170 |
| 15.1 General Troubleshooting Tips | 170 |
| 15.2 Frequently Asked Questions (FAQ) | 170 |
| 15.3 Equipment Problems | 171 |
| 15.3.1 System Does Not Power Up | 171 |
| 15.3.2 ECG Data Contains Noise | 172 |
| 15.3.3 External Stress Equipment does not Move | 172 |
| 15.3.4 Paper Jams | 173 |
| 15.4 Import/Export/Save Errors | 173 |
| 15.4.1 SD Card Not Present | 173 |
| 15.4.2 Cannot Transmit Records via LAN | 173 |
| 15.4.3 Cannot Transmit Records Via WLAN (Silex Wireless Bridge) | 174 |
| 15.4.4 Cannot Transmit Records via Embedded Wireless Module | 174 |
| 15.4.5 Cannot Export to Shared Directories | 175 |
| 15.5 Acquisition/Printer Error Messages | 175 |
| 15.6 Report Errors | 175 |
| 15.6.1 ACI-TIPI Statement is not Included on Report | 175 |
| 15.7 System Errors | 176 |
| A Creating Barcodes | 178 |
| A.1 Setting Up the Patient Data Scheme | 179 |
| A.2 Configuring the Barcode Reader | 180 |
| A.2.1 Configuring the Barcode Reader Manually | 180 |
| A.2.2 Configuring the Barcode Reader Automatically | 182 |
| B Master Step Data | 183 |
| B.1 Master Step Table | 183 |
| B.2 ST-T Changes | 184 |
| C Technical Specifications | 186 |
| C.1 System Specifications | 186 |
| C.2 Silex Wireless Bridge | 191 |
| D Statement for MAC 2000 Silex Wireless Bridge | 193 |
| D.1 FCC Statement | 193 |

D.2 IC Statement..... 193

D.3 Complies with IMDA Standards 194

E Statement for MAC 2000 Embedded Wireless Module..... 195

E.1 FCC Statement..... 195

E.2 IC Statement 195

E.3 CE RED Information 196

Glossary 197

1 Introduction

This document describes the *MAC™ 2000 ECG Analysis System*, also referred to as the “product”, “system”, or “device”. The document is intended to be used by clinical professionals who use, maintain, and/or troubleshoot the system. Clinical professionals are expected to have a working knowledge of appropriate medical procedures, practices, and terminology used in the treatment of patients.

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

1.1 Intended User of this Product

The MAC™ 2000 ECG Analysis System is a portable ECG acquisition, analysis, and recording system that is intended for use by trained operators in a hospital or medical professional's facility environment, as well as used in clinics, physician offices, outreach centers, or wherever ECG testing is performed.

1.2 Indications for Use

The MAC™2000 ECG Analysis System is a portable device intended to be used by or under the direct supervision of a licensed healthcare practitioner using surface electrodes to acquire, analyze, display, and record information for adult and pediatric populations in a hospital, medical professional's facility, clinics, physician's office or outreach centers.

NOTE

Pediatric populations are defined as patients between the ages of 0 and 15 years.

The MAC™2000 ECG Analysis System provides the following modes of operation:

- Resting ECG mode
- Arrhythmia mode
- Exercise mode for exercise stress testing (optional)
- RR analysis mode for RR interval analysis (optional)

The basic system prints 6 or 12 leads of ECG and is upgradeable to provide software options such as 12-lead ECG measurement and interpretive analysis.

Arrhythmia detection is provided for the convenience of automatic documentation. Transmission and reception of ECG data to and from a central ECG cardiovascular information system is optional.

1.3 Contraindications

This system is not intended for use in the following manner:

- During patient transport
- With high-frequency surgical units
- As an intra-cardiac application
- As a vital signs physiological monitor

1.4 Prescription Device Statement

CAUTION



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

1.5 Regulatory and Safety Information

This section provides information about the safe use and regulatory compliance of this system. Familiarize yourself with this information, and read and understand all instructions before attempting to use this system. The system software is considered medical software. As such, it was designed and manufactured to the appropriate medical regulations and controls.

NOTE

Disregarding the safety information provided in this manual is considered abnormal use of this system and could result in injury, data loss, or a voided warranty.

1.5.1 Safety Conventions

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

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

Table 1-1 Definitions of Safety Conventions

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

1.5.2 Safety Hazards

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

WARNING



EQUIPMENT MALFUNCTION

Any attempt by unauthorized personnel to service the device could result in equipment malfunction and void the warranty.

This equipment contains no user-serviceable parts. Refer servicing to authorized service personnel.

WARNING**PATIENT INJURY-STRANGULATION**

Cables present a possible strangulation hazard.

To avoid possible strangulation, route all cables away from the patient's throat. Use a short version of cable for pediatric patients.

WARNING**PERSONAL INJURY-STUMBLING HAZARD**

Patients can become entangled in the cables and leadwires connected to the device, which could cause the patient to stumble or trip.

Route cables and leadwires in a way to avoid creating a stumbling hazard: keep them off the floor, and route leadwires away from the patient's legs and the healthcare provider's work area.

WARNING**MAGNETIC AND ELECTRICAL INTERFERENCE**

Magnetic and electric fields can interfere with the acquisition of ECG readings.

Make sure that all peripheral components operated in the vicinity of the device comply with the relevant EMC requirements. X-ray equipment, MRI devices, radio systems (cellular phones) and so forth, are possible sources of interference because they may emit higher levels of electromagnetic radiation. Verify the performance of the system before use.

WARNING**EXPLOSION HAZARD**

Using this device in the presence of anesthetic vapors or liquids can cause explosions.

Do not use this device in the presence of anesthetic vapors or liquids. Only persons with adequate training in the correct use of this device may use this device.

WARNING**EQUIPMENT FAILURE**

Polarizing electrodes (stainless steel or silver constructed) may cause the electrodes to retain a residual charge after defibrillation. A residual charge blocks acquisition of the ECG signal.

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

WARNING**PERSONAL INJURY**

Contact with patients during defibrillation can cause serious injury or death.

Do not contact patients during defibrillation. Patient signal inputs labeled with the CF symbol with paddles are protected against damage resulting from defibrillation voltages.

To ensure proper defibrillator protection, use only GE Healthcare recommended cables and leadwires. Proper placement of defibrillator paddles in relation to the electrodes is required to ensure successful defibrillation.

WARNING**INTERPRETATION HAZARD**

Results of the automated QT analysis are not considered a diagnosis.

A qualified physician or cardiologist must review and confirm the measurements and waveforms recorded by the system. It should be used only as an adjunct to the clinical history, symptoms, and results of other tests.

WARNING**INTERPRETATION HAZARD**

Computerized interpretation is only significant when used in conjunction with clinical findings.

A qualified physician must overread all computer-generated tracings.

WARNING**POOR SIGNAL QUALITY**

Improper skin preparation can cause poor signal quality during the ECG recording.

Careful skin preparation is the key to an interference-free ECG.

WARNING**IMPROPER USE**

This is a prescriptive device.

This equipment is intended for use by or under the direct supervision of a licensed healthcare practitioner.

WARNING**EXPLOSION HAZARD**

Batteries may explode in fires.

Do not dispose of the battery by fire. Follow local environmental guidelines concerning disposal and recycling.

WARNING**ELECTRIC SHOCK HAZARD/SYSTEM MALFUNCTION**

Liquids inside a device can cause electric shock or system malfunction.

Do not allow liquids to enter the device. If liquids enter the device, turn it off and inform your service technician. Do not use the device until it is checked by a service technician.

WARNING**ELECTRIC SHOCK**

Improper connection of this equipment may cause electric shock.

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

NOTE

Follow the instructions provided. Do not position equipment in a way that makes it difficult to disconnect the device when using an appliance coupler, mains plug, or other separable plug as a means of isolation.

1.5.3 Classification of Medical Device

The device is classified as follows, according to IEC 60601-1:

| Category | Classification |
|---|--|
| Type of protection against electrical shock | Class I internally powered equipment |
| Degree of protection against electrical shock | Type CF defibrillation-proof applied part |
| Degree of protection against solids | The IP code for this device is IP20. Protected against solid foreign objects with a diameter of 12.5 mm and greater. The object probe, a sphere 12.5 mm diameter, shall not fully penetrate. The jointed test finger 12 mm diameter, 80 mm length, shall have adequate clearance from hazardous parts. |
| Degree of protection against harmful ingress of liquids (IP20) | The IP code for this device is IP20. Non-protected This device is ordinary equipment (enclosed equipment without protection against ingress of liquids). |
| Degree of safety of application in the presence of flammable anesthetic mixture with air or with oxygen or with nitrous oxide | Equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or with nitrous oxide. |
| Method(s) of sterilization or disinfection recommended by the manufacturer | Not applicable |
| Mode of operation | Continuous operation |



1.5.4 Certification Information



Medical Equipment

With respect to electric shock, fire, and mechanical hazards only in accordance with UL 60601-1, and CAN/CSA C22.2 NO. 601.1.



This system bears CE mark 0459 indicating it conforms with the provisions of Council Directive 93/42/EEC concerning medical devices, and it fulfills the essential requirements of Annex I of this directive.

The system is in radio-interference protection class Bin accordance with EC 55011. The country of manufacture is indicated on the equipment labeling.

The product complies with the requirements of standard EN 60601-1-2 “Electromagnetic Compatibility — Medical Electrical Equipment”.

The medical device has a lifetime of 7 years with respect to the Council Directive 93/42/EEC essential requirement #4.

1.5.5 Recording ECGs During Defibrillation

This equipment is protected against the effects of cardiac defibrillator discharge to ensure recovery, as required by test standards. The patient signal input of the acquisition module is defibrillation-proof. Therefore, it is not necessary to remove the ECG electrodes prior to defibrillation.

When using stainless steel or silver electrodes, a defibrillator discharge current may cause the electrodes to retain a residual charge causing a polarization or DC offset voltage. This electrode polarization blocks acquisition of the ECG signal. To avoid this condition, if there is a situation where a defibrillation procedure might be necessary, use non-polarizing electrodes (which do not form a DC offset voltage when subjected to a DC current) such as silver/silver-chloride types.

If you use polarizing electrodes, GE Healthcare recommends disconnecting the leadwires from the patient before delivering the shock.

Electrode defibrillation recovery is the ability of the electrode to allow the ECG trace to return after defibrillation. GE Healthcare recommends using non-polarizing disposable electrodes with defibrillation recovery ratings as specified in AAMI EC12 5.2.2.4. AAMI EC12 requires that the polarization potential of an electrode pair does not exceed 100 mV 5 seconds after a defibrillation discharge.

Refer to the supplies and accessories reference guide for this system for a list of approved electrodes.

1.5.6 Accuracy of Input Signal Reproduction

- Overall System Error meets AAMI EC11 3.2.7.1 requirements. Overall System Error is between or within $\pm 5\%$ or $\pm 40 \mu\text{V}$, whichever is greater.
- Frequency Response meets AAMI EC11 3.2.7.2 requirements, using testing methods A and D. Frequency response is between or within $\pm 10\%$ between 0.67 and 40 Hz and between +0 and -10% for 20 ms, 1.5 mV triangular input.

1.5.7 Modulating Effects in Digital Systems

This device uses digital sampling techniques that may produce some variation in amplitudes of Q, R, and/or S waves from one heart beat to the next, which may be particularly noticeable in pediatric

recordings. If you observe this phenomenon, be aware that the origin of amplitude variations is not entirely physiological. For measuring voltages of Q, R, and S waves, GE Healthcare advises using the QRS complexes with the largest deflection of the particular waves.

1.5.8 EMI/EMC/RF Safety Information

This system is designed and tested to comply with applicable regulations regarding EMC and must be installed and put into service according to the EMC information stated in the Electromagnetic Compatibility appendix of the Service and/or Operator's manual. Changes or modifications to this system not expressly approved by GE Healthcare could cause EMC issues with this or other equipment. Mains power should be a standard commercial or hospital environment.

Before installing or using the device or system, be aware of the proximity of known RF sources, such as the following:

- Radio and TV stations
- Portable and mobile RF communication devices (cell phones, two-way radios)
- X-ray, CT, or MRI devices

These devices are also possible sources of interference as they may emit higher levels of electromagnetic radiation.

WARNING



EQUIPMENT MALFUNCTION/INTERFERENCE

Use of portable phones or other radio frequency (RF) emitting equipment near the system may cause unexpected or adverse operation.

Do not use portable phones or other electronic equipment that may emit radio frequency (RF) near this system.

WARNING



EQUIPMENT MALFUNCTION/INTERFERENCE

Do not use the equipment or system adjacent to, or stacked with, other equipment.

If adjacent or stacked use is necessary, test the equipment or system to verify normal operation in the configuration in which you are using it.

WARNING



ACCESSORIES/COMPONENTS

Adding accessories or components, or modifying the medical device or system, may result in increased EMISSIONS or decreased IMMUNITY of the device or system.

Use the following resources for more information on EMI/EMC and RF concerns:

- The Supplies and Accessories Reference Guide for your system
- Qualified GE Healthcare or approved third-party personnel
- The Electromagnetic Compatibility appendix in your system service or operator's manual

NOTE

Compliance provides reasonable protection against radio-frequency interference. However, there is no guarantee that interference will not occur in a particular installation. You can tell whether this device or system is causing interference by turning it off. If the interference stops, it was most likely caused by the device or system.

1.5.9 Biocompatibility

The parts of the system described in this manual that come into contact with the patient during the intended use, including all accessories, fulfill the biocompatibility requirements of the applicable standards. If you have questions in this matter, contact your GE Healthcare representative.

1.5.10 Legal Notice

GE Healthcare software contains several fields that can be filled in before performing an ECG. Some of these fields are required, while others are optional and left to the user to assess whether they are needed to perform the exam. The field **Race** is one of these optional fields. **Race** has been acknowledged by the medical profession as useful to analyze some pathologies. You should be aware that, in some jurisdictions, the processing of data revealing an individual's racial origin is subject to legal requirements, such as obtaining the patient's prior consent. If you elect to collect this type of data, it is your responsibility to ensure that you comply with all applicable legal requirements.

1.5.11 Supplies and Accessories

You should use only supplies and accessories that GE Healthcare recommends. For a list of recommendations, refer to the supplies and accessories reference guide for this system.

Contact GE Healthcare before using anything that is not recommended for this system.

1.5.12 Responsibility of the Manufacturer

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

- Assembly operations, extensions, readjustments, modifications, or repairs are performed by persons authorized by GE Healthcare.
- The electrical installation of the room where the device is used complies with the requirements of the appropriate local, state, and other government regulations.
- The equipment is used in accordance with the instructions for use.

1.5.13 Responsibility of the Purchaser/Customer

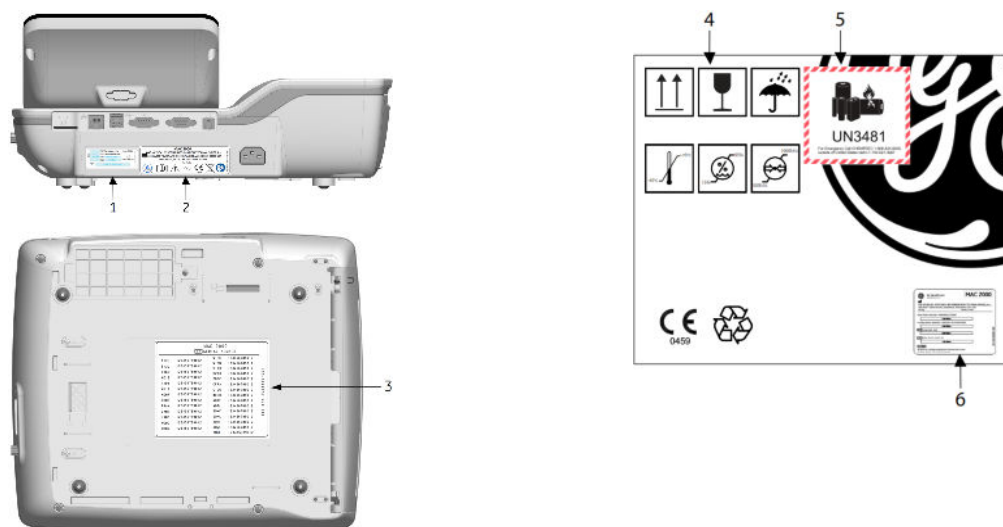
The customer is responsible for providing appropriate desks, chairs, electrical wall outlets, network connections, and analog phone lines, and for locating any of the system components described in this manual in compliance with all local, state, and national codes.

1.5.14 Product and Packaging Information

This section identifies the following:


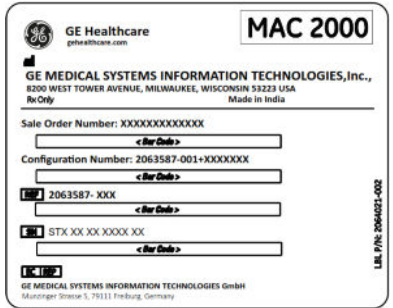
- Hardware labels and their locations, see [1.5.14.1 Hardware Label Locations on page 19](#).
- Symbol Descriptions, see [1.5.14.2 Symbol Descriptions on page 20](#).

1.5.14.1 Hardware Label Locations



| Item | Label | Location | Description |
|------|-------|----------------------------|---|
| 1 | | Back of the device | Product Label Identifies this device. See 1.6.1 Product Label on page 27 for a description of the label contents. |
| 2 | | Back of the device | Device Address Label and Rating Plate It provides regulatory and cautionary information. See 1.6.3 Device Address Label and Rating Plate on page 28 for an explanation of the label. |
| 3 | | Bottom cover of the device | The Option Code label Use the option codes to setup the purchased options in your system. See 12.13 Options Setup on page 151 for an explanation of the Option Codes. |
| 4 | | On the shipping package | Environmental symbols required for shipping |

Continues on the next page

| Item | Label | Location | Description |
|------|---|-------------------------|--|
| 5 |  The label features a red and white diagonal striped border. Inside, there is an illustration of three lithium-ion batteries, one of which is on fire. Below the illustration, the text 'UN3481' is prominently displayed. At the bottom, it reads: 'For Emergency Call CHEMTREC 1-800-424-9300, outside of United States call 0-1-703-527-3887'. | On the shipping package | Battery Shipping Label FRAGILE—Lithium Ion batteries can cause fire if damaged. |
| 6 |  The label is white with black text and a barcode. It includes the GE Healthcare logo and 'MAC 2000' in a box. The text reads: 'GE MEDICAL SYSTEMS INFORMATION TECHNOLOGIES, Inc., 8200 WEST TOWER AVENUE, MILWAUKEE, WISCONSIN 53228 USA Re-Only Made in India'. It also contains fields for 'Sale Order Number: XXXXXXXXXXXXX', 'Configuration Number: 2063587-001+XXXXXXXX', and '2063587- XXX'. There are several 'Bar Code' labels and a 'LOT' label. At the bottom, it says 'GE MEDICAL SYSTEMS INFORMATION TECHNOLOGIES GmbH Munzingen Strasse 5, 75111 Freiburg, Germany'. | On the shipping package | The shipping label |





1.5.14.2 Symbol Descriptions

The following table describes symbols or icons that may be on the device or its packaging. Not all of the symbols defined in the table apply to your device or its packaging.

Symbols are used to convey warnings, cautions, prohibitions, mandatory actions, or information. Any symbol on your device or packaging with markings in color indicates there may be a danger, warning, or mandatory action. Any symbol on your device or packaging that is in black and white provides additional information or may indicate a caution. Familiarity with these symbols assists in the use and disposal of the equipment.











For equipment symbols not shown, refer to the original equipment manufacturer (OEM) manuals.

Table 1-2 Symbol Descriptions

| Symbol | Description |
|---|---|
|  | Catalog or Orderable Part Number Indicates the manufacturer's catalog or part number. |
|  | Serial Number Indicates the manufacturer's serial number. |
|  | Batch Code or Lot Number Indicates the manufacturer's batch code or lot number. |
|  | Date of Manufacture (Year-Month) Indicates the original manufacture date for this device. |







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Table 1-2 Symbol Descriptions (Table continued)

| Symbol | Description |
|---|---|
|  | Manufacturer Indicates the name and address for the manufacturer of this device. It may also include the date it was manufactured. |
|  | Authorized Representative in the European Community Indicates the name and address of the authorized representative in the European Community for this device. |
|  | Unique Device Identification is a unique marking for identification of the medical device. |
| Rx Only | Rx Only US Federal law restricts this device to sale by or on the order of a physician. |
|  | 12SL Indicates the device uses the Marquette™ 12SL ECG Analysis Program to analyze and interpret ECG readings. |
| IPxy | IP Code (Ingress Protection Rating) Classifies and rates the degree of protection provided against the intrusion of solid objects (such as body parts like hands and fingers, dust, accidental contact), and liquids. The first numeral (x) represents the degree of protection against the ingress of solid objects. The second numeral (y) represents the degree of protection against the ingress of liquids. For products with an IPxy rating, see the <i>Classification of Medical Device</i> in this chapter for a description of that rating. Not all products have an IPxy rating. |
|  | Class II Equipment Identifies equipment that meets the safety requirements specified for class II equipment by IEC 60601-1. This device was designed so that it does not require a safety connection to electrical earth (US ground). No single failure results in dangerous voltage becoming exposed and causing an electric shock. This is achieved without relying on an earthed metal casing. |
|  | Consult Instructions for Use Consult the operating instructions. |
|  | Defibrillation-proof Type CF Applied Part Identifies a defibrillation-proof type CF applied part on medical equipment that complies with IEC 60601-1. This device meets the requirements for protection against electric shock for an earth-free (floating) applied part (one intended for contact with patients) for cardiac application. |
|  | No User- or Field-serviceable Parts Do not open or disassemble the device for any reason. |
|  | Protective Earth (ground) Identifies the terminal of a protective earth (ground) electrode or any terminal that is intended for connection to an external conductor for protection against electric shock in case of a fault. |
|  | Non-ionizing Electromagnetic Radiation Indicates that the equipment emits elevated, potentially hazardous, levels of non-ionizing radiation (electromagnetic energy) for diagnosis or treatment. |









Continues on the next page

Table 1-2 Symbol Descriptions (Table continued)

| Symbol | Description |
|---|---|
|  | <p>Follow Instructions For Use</p> <p>Read and understand the operator's manual before using the device or product.</p> <p><i>As a mandatory action sign, this symbol is identified by a blue background and white symbol.</i></p> |
|  | <p>CAUTION</p> <p>SAFETY GROUND PRECAUTION</p> <p>Pulling on the cable can cause the cord to deteriorate resulting in electrical problems.</p> <p>Remove the power cord from the mains source by grasping the plug. DO NOT pull on the cable.</p> |
|  | <p>CAUTION</p> <p>CONSULT ACCOMPANYING DOCUMENTS</p> <p>There may be specific warnings or precautions associated with the device that are not otherwise found on the label.</p> <p>Consult the accompanying documentation for more information about safely using this device.</p> |
|  | <p>CAUTION</p> <p>ELECTRIC SHOCK</p> <p>Indicates the presence of hazardous energy circuits or electric shock hazards.</p> <p>To reduce the risk of electric shock hazards, do not open this enclosure. Refer servicing to qualified personnel.</p> |
|  | <p>CAUTION</p> <p>HOT SURFACE</p> <p>Indicates that the marked item may be hot.</p> <p>Take appropriate precautions before touching the item.</p> |
|  | <p>WARNING</p> <p>BODILY INJURY</p> <p>Indicates the presence of mechanical parts that can result in pinching, crushing, or other bodily injury.</p> <p>To avoid risk of bodily injury, keep away from moving parts. Disconnect power before reaching into area or servicing.</p> <p><i>As a warning sign, this symbol is identified by a yellow background, black triangular band, and a black symbol.</i></p> |










Continues on the next page

Table 1-2 Symbol Descriptions (Table continued)

| Symbol | Description |
|---|---|
|  | <p>WARNING</p> <p> HAND CRUSHING HAZARD</p> <p>This device contains moving parts that could crush the user's hand.</p> <p>Keep hands clear of the device while it is in operation. Disconnect power before reaching into or servicing the device.</p> <p><i>As a warning sign, this symbol is identified by a yellow background, black triangular band, and a black symbol.</i></p> |
|  | <p>WARNING</p> <p> BODILY INJURY</p> <p>Indicates the presence of a sharp edge or object that can cause cuts or other bodily injury.</p> <p>To prevent cuts or other bodily injury, do not contact sharp edge of object.</p> <p><i>As a warning sign, this symbol is identified by a yellow background, black triangular band, and a black symbol.</i></p> |
|  | <p>WARNING</p> <p> BODILY INJURY</p> <p>Indicates the presence of a potential tip-over hazard that can result in bodily injury.</p> <p>To avoid risk of bodily injury, follow all instructions for maintaining the stability of the equipment during transport, installation, and maintenance.</p> <p><i>As a warning sign, this symbol is identified by a yellow background, black triangular band, and a black symbol.</i></p> |
|  | <p>WARNING</p> <p> PINCH POINT</p> <p>This device contains moving parts that could pinch body parts.</p> <p>Keep hands clear of the device while it is in operation. Disconnect the power before reaching into or servicing the device.</p> <p><i>As a general prohibition sign, this symbol is identified by a white background, red circular band and slash, and a black symbol.</i></p> |









Continues on the next page

Table 1-2 Symbol Descriptions (Table continued)

| Symbol | Description |
|---|--|
|  | <p>WARNING</p> <p> PERSONAL INJURY DO NOT REACH IN</p> <p>Reaching into the equipment can cause personal injury.</p> <p>Do not place hands into any openings.</p> <p><i>As a general prohibition sign, this symbol is identified by a white background, red circular band and slash, and a black symbol.</i></p> |
|  | <p>WARNING</p> <p> ENVIRONMENTAL OR HEALTH HAZARD</p> <p>Incinerating the device or product could present a risk to the environment or human health.</p> <p>Do not incinerate this device or product.</p> <p><i>As a general prohibition sign, this symbol is identified by a white background, red circular band and slash, and a black symbol.</i></p> |
|  | <p>WARNING</p> <p> BREAKAGE DUE TO HEAVY LOAD</p> <p>Heavy objects on the surface may cause it to break.</p> <p>Do not load objects heavier than the maximum permissible load indicated for a safe working load.</p> <p><i>As a general prohibition sign, this symbol is identified by a white background, red circular band and slash, and a black symbol.</i></p> |
|  | <p>Can Be Recycled</p> <p>Indicates you may recycle this material or device. Recycle or dispose of in accordance with local, state, or country laws.</p> |
|  | <p>Waste Electrical and Electronic Equipment (WEEE)</p> <p>Indicates this equipment contains electrical or electronic components that must not be disposed of as unsorted municipal waste but collected separately. Contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.</p> |
|  | <p>Contains <heavy metal chemical symbol></p> <p>Indicates this equipment contains heavy metal and must not be disposed of as unsorted municipal waste but collected separately. The example shows Lithium Ion.</p> |



Continues on the next page

Table 1-2 Symbol Descriptions (Table continued)









| Symbol | Description |
|---|--|
|  | <p>Environmental Friendly Use Period (EFUP)</p> <p>Per Chinese standard SJ/T11363–2006, indicates the number of years from the date of manufacture during which you can use the product before any restricted substances are likely to leak, causing a possible environmental or health hazard.</p> <p>NOTE</p> <ul style="list-style-type: none"> If the device contains less than the maximum concentration of restricted substances, the symbol contains a lowercase e This is also referred to as China RoHS. |
|  | <p>Japan RoHS</p> <p>Indicates the device or product meets the regulations limit or ban for specific substances in new electronic and electric equipment in Japan. The Green Mark (with the G) indicates the product is within the tolerances of hazardous chemicals.</p> <p>The Content Mark (with the R and letters below) indicates which hazardous substance(s) was used during the manufacturing of the electrical or electronic equipment that exceeds maximum tolerances.</p> |
|  | <p>Fragile</p> <p>Indicates the contents are fragile. Handle with care.</p> |
|  | <p>This Way Up</p> <p>Indicates the correct upright position of the package.</p> |
|  | <p>Do Not Stack</p> <p>Indicates that you should not stack the container or place a load on the container.</p> |
|  | <p>Keep Dry</p> <p>Indicates that you need to keep the container away from rain and other sources of moisture.</p> |
|  | <p>Humidity Limits</p> <p>Indicates upper and lower humidity limits for the transportation and handling of this package. They are indicated next to the upper and lower horizontal lines.</p> |
|  | <p>Atmospheric Limits</p> <p>Indicates the upper and lower barometric pressure limitations for the transportation and handling of this package. They are indicated next to the upper and lower horizontal lines.</p> |

Continues on the next page



Table 1-2 Symbol Descriptions (Table continued)

| Symbol | Description |
|---|---|
|  | Upper Temperature Limit Indicates the maximum temperature for transportation and handling of this package. The limit is indicated next to the upper horizontal line. |
|  | Temperature Limits Indicates the upper and lower temperature limits for the transportation and handling of this package. They are indicated next to the upper and lower horizontal lines. |

The following table describes certification symbols that may be used on your device or its packaging. The inclusion of a symbol in this table **does not** indicate that your product was certified by that symbol's governing body and is listed for reference only. To identify which organizations have certified your device, refer to the labeling on your device or its packaging.

| Certification Symbol | Description |
|---|--|
|  | UL Mark Indicates compliance with applicable Underwriters Laboratories requirements. |
|  | UL Listed Mark Indicates compliance with international or regional standards for Underwriters Laboratories safety requirements. |
|  | UL Listed, Canada/US Indicates compliance with international or regional standards for Underwriters Laboratories safety requirements in Canada and the United States. |
|  | UL Classification Mark Indicates this medical equipment is UL Classified with respect to electric shock, fire, and mechanical hazards only in accordance with UL 60601-1, CAN/CSA C22.2 NO. 601.1, and IEC 60601-2-25. |
|  | UL Classification Mark, Canada/US Indicates this medical equipment is UL Classified with respect to electric shock, fire, and mechanical hazards only in accordance with UL 60601-1, CAN/CSA C22.2 NO. 601.1, and IEC 60601-2-25 for the US and Canada. |
|  | CE Mark Indicates the device or product conforms with applicable EU (European Union) directives. |
|  | NRTL Certification Indicates the device or product has met the National Recognized Testing Laboratories certification. The NRTL certification attained is added to the mark of the applicable testing laboratory. The example displays the NRTL certification with the MET Laboratories mark. |
|  | China Metrology Certification Indicates the device or product complies with applicable China Metrology Certification requirements. |

Continues on the next page

| Certification Symbol | Description |
|--|--|
|   | TÜV Rheinland Indicates the device or product complies with applicable technical and safety requirements following testing by Technischer Überwachungs-Verein, (Technical Inspections Organization). |

1.5.14.3 Installation and Connection

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

Contact GE Healthcare for information before connecting any devices to this equipment that are not recommended in this manual or the supplies and accessories reference guide for this system.

1.5.14.4 Training

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

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

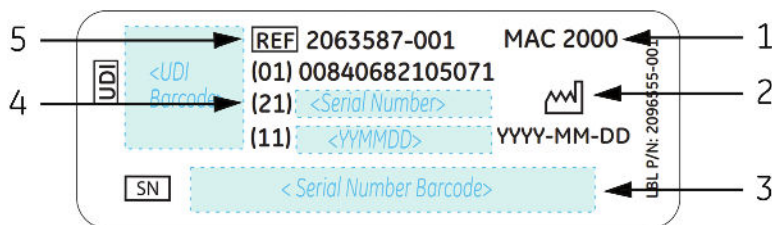
For more self-paced course offerings, tools, and reference guides you may find useful, please visit the GE Healthcare Education Store at <http://www.gehealthcare.com/educationstore>.

1.6 Equipment Identification

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

1.6.1 Product Label

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



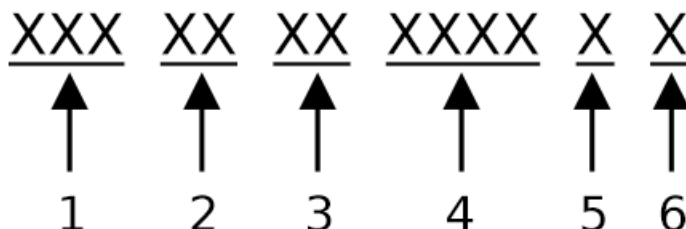
| Item | Description |
|------|--|
| 1 | Product description |
| 2 | Date of manufacture in YYYY-MM-DD format |
| 3 | Product bar code |

Continues on the next page

| Item | Description |
|------|--|
| 4 | Device serial number (See 1.6.2 Serial Number Format on page 28 for more information.) |
| 5 | Product part number |

1.6.2 Serial Number Format

Each device has a serial number that uniquely identifies it and provides important information. You need the product code and the entire serial number before servicing or requesting support for your product. The serial number format is shown in the following illustration:



| Item | Name | Description |
|------|------------------------------|---|
| 1 | Product Code | Three-letter code that uniquely identifies the product line. See 1.6.4 Product Codes on page 29 for more information. |
| 2 | Year Manufactured | Two-digit code identifying the year the device was manufactured. Values range from 00 to 99. For example: 00 = 2000, 04 = 2004, 05 = 2005 (and so on). |
| 3 | Fiscal Week Manufactured | Two-digit code identifying the week the device was manufactured. Values range from 01 to 52. GE Healthcare's fiscal weeks correspond to the calendar week. For example, 01 = first week in January. |
| 4 | Product Sequence | Four-digit number identifying the order in which this device was manufactured. Values range from 0001 to 9999. |
| 5 | Manufacturing Site | One-letter code identifying the site where the device was manufactured. For example, F = Milwaukee, N = Freiburg, P = Bangalore. |
| 6 | Miscellaneous Characteristic | For example, P = device is a prototype, R = device was refurbished, U = device was upgraded to meet the specifications of another product code, A = device is in production. |

1.6.3 Device Address Label and Rating Plate

The Device Address label and Rating Plate is laid out in the following format. Depending on the product, the label may vary slightly in format.



| Item | Description |
|------|---|
| 1 | Product description |
| 2 | Country of origin |
| 3 | Symbols See 1.5.14.2 Symbol Descriptions on page 20 for a description of the symbols used on this label. |
| 4 | Electrical rating of the device |
| 5 | Manufacturer name and address |

1.6.4 Product Codes

The product code identifies specific system platforms.

You can identify the product code using the serial number listed on the product label located in one of the following places:

- On the product label attached to the device.
- On the product label provided with the application CD.

For software application systems, you can view the serial number by launching the system application and clicking **Help > About**.

For information on launching the application, refer to the service or operator's manual for this system.

1.7 Service Information

This section provides information pertaining to the maintenance and servicing of the system.

Familiarize yourself with this information before requesting service from GE Healthcare or its authorized representatives.

1.7.1 Service Requirements

For systems with hardware provided by GE Healthcare, failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may result in equipment failure and possible safety hazards.

For software only products, maintenance of the hardware and operating system on which the software resides is the responsibility of the customer.

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

1.7.2 Warranty Information

This device is considered GE Healthcare-supplied hardware. Only authorized GE Healthcare service personnel should service the device. 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 Healthcare or to one of their authorized agents.

1.7.3 Additional Assistance

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

Contact your local GE Healthcare representative to request additional assistance.

1.8 Manual Information

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

Keep this manual with the equipment at all times and periodically review it. You should request training assistance from GE Healthcare, if needed.

1.8.1 Manual Purpose

The purpose of this manual is to provide the operator with information concerning the safety and use of their ECG system.

1.8.2 Document Conventions

This manual uses the following conventions.



1.8.2.1 Typographical Conventions

| Convention | Description |
|-----------------------------|--|
| Bold Text | Indicates keys on the keyboard, text to enter, or hardware items such as buttons or switches on the equipment. |
| Italicized-Bold Text | Indicates software terms that identify menu items, buttons or options in various windows. |
| CTRL+ESC | Indicates a keyboard operation. A plus (+) sign between the names of two keys indicates that while holding the first key, you should press and release the second key. For example, Press CTRL+ESC means to press and hold the CTRL key and then press and release the ESC key. |
| <space> | Indicates that you must press the spacebar. When instructions are given for typing a precise text string with one or more spaces, the point where you must press the spacebar is indicated as <space> . This ensures that the correct number of spaces is inserted in the correct positions within the literal text string. The purpose of the < > brackets is to distinguish the command from the literal text within the string. |
| Enter | Indicates that you must press the Enter or Return key on the keyboard. Do not type Enter . |
| > | The greater than symbol, or right angle bracket, is a concise method to indicate a sequence of menu selections. For example, the statement "From the main menu, select System > Setup > Options to open the Option Activation window" replaces the following: <ol style="list-style-type: none"> 1. From the main menu, select System to open the System menu. 2. From the System menu, select Setup to open the Setup menu. 3. From the Setup menu, select Options to open the Option Activation window. |

1.8.2.2 Illustrations

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

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

1.8.2.3 Notes

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

NOTE

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

1.9 Related Documents

For a complete list of related manuals, refer to the "Related Manuals" appendix in the service manual.

2 Product Overview

This chapter provides a description of the product, its features, and the requirements necessary to operate this system.

2.1 Product Description

This system provides two basic modes of operation:

- Resting ECG

This mode is the standard mode for your system.

- Arrhythmia

This mode is provided for the convenience of automatically generating documentation.

You can upgrade the basic system with two other modes of operation:

- Exercise

This mode is for exercise stress testing.

- RR Analysis

This mode is for RR intervals analysis.

The basic system prints 6 or 12 leads of ECG and provides optional transmission and reception of ECG data to and from a central ECG cardiovascular information system. You can also upgrade it with software options such as 12-lead ECG measurement and interpretive analysis.

2.2 Product Specifications

This section describes the device's hardware components and system specifications. Familiarize yourself with this information before using the device.

2.2.1 Hardware Descriptions

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

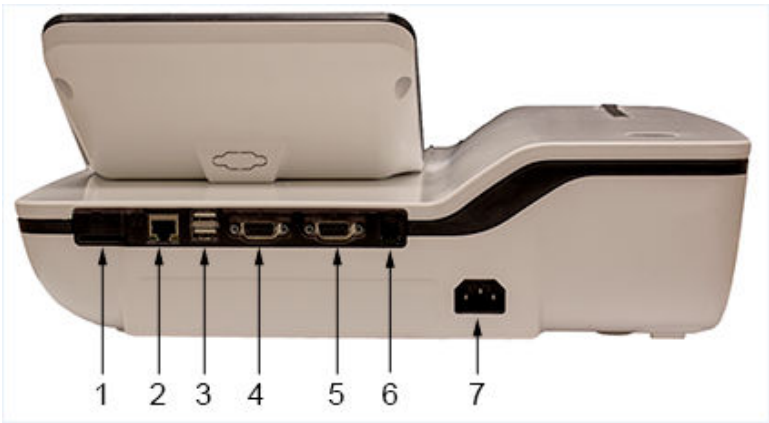
2.2.1.1 Front View



Table 2-1 Front View of Device

| Item | Name | Description |
|------|--------------------------|---|
| 1 | Display | Presents waveform and text data. |
| 2 | Function Keys | Selects menu options on the screen. |
| 3 | Keypad | Use to select menu options on the screen. |
| 4 | Printer door push button | Opens the printer door. |
| 5 | Printer/Printer door | Prints reports. |

2.2.1.2 Rear View



| Item | Name | Description |
|------|--------------|---|
| 1 | SD card slot | Connection for Secure Digital (SD) card. This system supports SD cards formatted for the FAT or FAT16 file systems. |

Continues on the next page

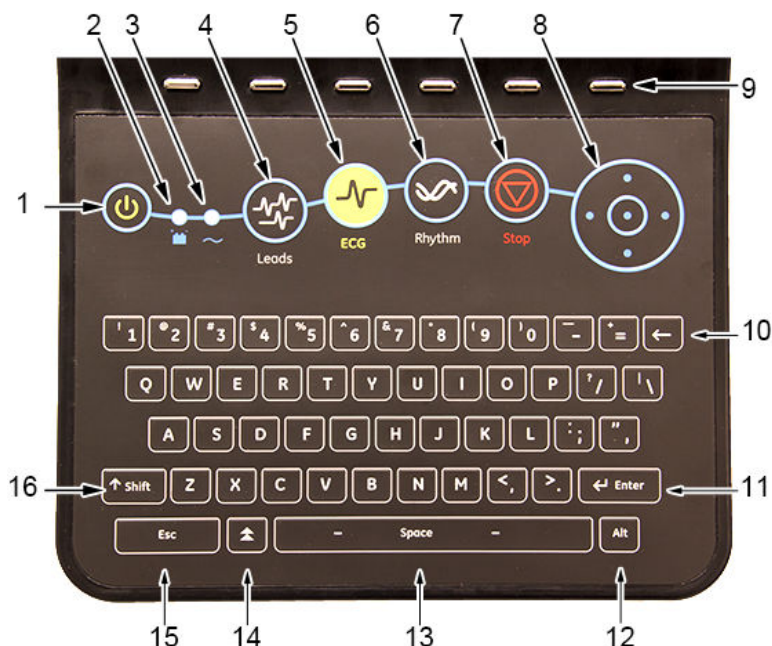
| Item | Name | Description |
|------|--------------------------|--|
| 2 | LAN or WLAN connection | RJ45 network connector used to connect Ethernet cable for wired LAN communication or LAN communication using Wireless bridge. |
| 3 | USB ports (2) | Standard Universal Serial Bus (USB) connector for USB devices, such as the optional barcode reader, an external non-multimedia USB keyboard or optional USB powered Wireless bridge. |
| 4 | COMM A port | Serial connector for data communication with CASE/Cardio-Soft/CS or MUSE systems. |
| 5 | COMM B port | Serial connector for stress devices (bicycle, ergometer, or treadmill). |
| 6 | Phone jack | RJ11 connector from the internal modem to an analog phone line. |
| 7 | AC Power Cord connection | Standard connector for the AC power cable. |

2.2.1.3 Side View



| Item | Name | Description |
|------|------------------------------|--|
| 1 | KISS connection | Connection port for the optional KISS Pump system. |
| 2 | ECG Patient Cable connection | D-sub 15-pin female connector for the acquisition cable. |

2.2.1.4 Standard Keypad



| Item | Name | Description |
|------|-----------------------------|---|
| 1 | Power on/off | Turns the system on or off. |
| 2 | Battery LED | Indicates various battery states: <ul style="list-style-type: none"> Steady amber indicates the battery is charging Flashing amber indicates the battery is low No light indicates the battery is neither charging nor low |
| 3 | Power LED | Indicates the unit is plugged in and receiving power. |
| 4 | Leads key | Scrolls through the leads and allows you to select the display formats for the lead sequence. |
| 5 | ECG key | Acquires and prints a 12-lead ECG. |
| 6 | Rhythm key | Prints real-time continuous rhythm. |
| 7 | Writer Stop | Stops the printing function. |
| 8 | Trimpad/Cursor Control keys | Provides movement through menus and windows. For descriptions on using the trimpad and cursor control keys, see 2.2.3.3.2 Using the Trimpad on page 39 . |
| 9 | Function keys | Use to select menu options on the screen. NOTE There is no marking on the keypad for the function keys. Up to six menu options may be available at any given time, and each option corresponds to a function key directly below the display. |
| 10 | Backspace key | Deletes characters. |
| 11 | Enter key | Use to advance the focus in a window or to select items from the screen. |

Continues on the next page

| Item | Name | Description |
|------|---------------------|---|
| 12 | Alt key | Switches between different input methods for Japanese and Korean keyboard languages. |
| 13 | Space bar | Enters a space in the text.As a secondary function, it moves through the menu lists. |
| 14 | Option key | Use to enter special characters on non-English keyboards. |
| 15 | ESC (escape) | Closes a window on a screen. |
| 16 | Shift key | Use to enter a capital letter.For example, press Shift + p to type a capital P . |

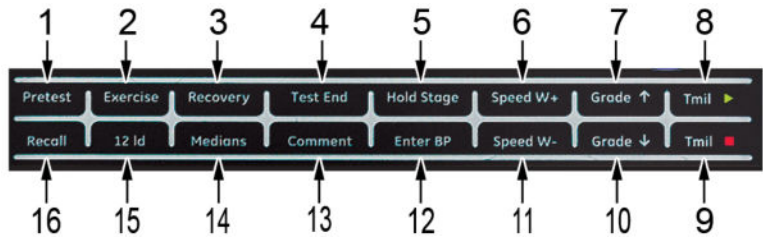
2.2.1.5 Stress Keypad

The stress keypad has the same keys as a standard keypad with the addition of specific stress keys. If you do not have the stress option, you do not have a stress keypad.





| Item | Name | Description |
|------|-------------|--|
| 1 | Stress keys | Controls stress equipment connected to the system. |

2.2.1.6 Stress Keys



| Item | Name | Description |
|------|---------------------------|---|
| 1 | Pretest stress key | Selects the pretest phase or advances to the next stage within the phase. |

Continues on the next page

| Item | Name | Description |
|------|--|--|
| 2 | Exercise stress key | Selects the exercise phase or advances to the next stage within the phase. |
| 3 | Recovery stress key | Selects the recovery phase or advances to the next stage within the phase. |
| 4 | Test End stress key | Selects the test end phase. |
| 5 | Hold Stage stress key | Remains at the current stage. |
| 6 | Speed W+ stress key (Speed/Load up) | Manually increases the treadmill speed or ergometer load. |
| 7 | Grade ↑ stress key (Grade up) | Increases the elevation of the treadmill. |
| 8 | Tmil  stress key | Starts the treadmill during the test. |
| 9 | Tmil  stress key | Stops the treadmill during the test. |
| 10 | Grade ↓ stress key (Grade down) | Decreases the elevation of the treadmill. |
| 11 | Speed W- stress key (Speed/Load down) | Manually decreases the treadmill speed or ergometer load. |
| 12 | Enter BP stress key | Allows you to enter blood pressure values or start a blood pressure measurement. |
| 13 | Comment stress key | Allows you to enter a comment during the stress test. |
| 14 | Medians stress key | Prints a median report during the test. |
| 15 | 12ld stress key | Prints a 12-lead report. |
| 16 | Recall stress key | Prints the previous 10 seconds of ECG. |

2.2.1.7 Hardware Specifications

See *Technical Specifications* chapter for a complete description of all hardware and system specifications for this device.

2.2.2 Optional Software Features

| Item | Description |
|---|--|
| QT Correction Formula | The system provides the following QT correction formulas: <ul style="list-style-type: none"> • Bazett (default) • Framingham • Fridericia |
| Hookup Advisor | Hookup Advisor alerts users of poor lead quality based on noise measurement and lead-off detection results. |
| ACI-TIPI | Acute Cardiac Ischemia Time-Insensitive Predictive Instrument (ACI-TIPI) Option (K974199). |
| Clinical Trials (CT) Data Guard and Audit Trail | CT Data Guard and Audit Trail supports 21 CFR part 11 compliance for the data generated using the device. Option includes password protection and time stamped audit trails. |

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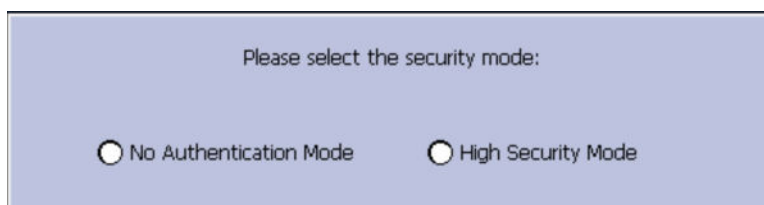
| Item | Description |
|-----------------------------|--|
| ECG Analysis/Interpretation | 12SL ECG Analysis Program (V22) K042177. |
| HEART exercise | HEART exercise v5.2.2.1. |

2.2.3 Using the System

This section describes the security mode window, startup screen, keypad use, and ECG data acquisition.

2.2.3.1 Security Mode Window

When you power up the device for the first time, a window displays asking you to select the security mode:



- If you select **No Authentication Mode**, press **Save**, the startup screen displays.
 - If you select **High Security Mode**, press **Save**, the system will create a user account. A dialog window displays to provide you the default user ID and the default password.
1. Select **OK**. You will be required to enter the user ID and password.
 2. In the **User ID** field, enter the default user ID.
 3. In the **Password** field, enter the default password.
 4. Press **Login**. A message displays: **Please change the default admin password at the first time of logging in.**
 5. Press **Change Password**.
 6. In the **Password** field, enter the new password.
 7. In the **Retype Password** field, retype the new password.
 8. Press **Save**, the startup screen displays as **Resting ECG Power Up Mode**.

2.2.3.2 Startup Screen

Depending on the options you selected for **Power up** mode in **Basic Setup**, one of the following screens is your startup screen:

- Resting ECG
- Stress ECG
- Arrhythmia
- Main Screen
- Order Manager
- A window prompting you to enter your User ID and Password.

NOTE

The password window is displayed only if you selected the **High Security Mode** option in **Basic Setup**. You can use the system to take a **STAT ECG** without logging into the system. Press the function key directly below the **STAT ECG** tab to select it.

2.2.3.3 Using the Keypad

You interact with the system by using the keypad. In addition to entering data as you would on any keypad, you can also use it to do the following tasks:

- Select menu options
- Navigate through data entry fields
- Control optional stress equipment

2.2.3.3.1 Using the Function Keys

You can configure the device and initiate an ECG reading by selecting menu options that are across the bottom of the display. Up to six menu options are available at any given time, and each option corresponds to a function key directly below the display.

Press the function key below the corresponding menu option to select it. The following table describes some of the possible options.

| Desired Action | Example Results |
|--|--|
| Take an ECG | Selecting the Resting ECG menu option opens the Resting ECG function and displays additional menu items related to taking a resting ECG. |
| Change a setting during an ECG recording | During a resting ECG, selecting the 25 mm/s option changes the speed of the waveform. Other options are available to change different settings. |
| Open a window | Selecting the Patient Data option opens the Enter Patient Data window. |
| Change menu options | Selecting the More option displays additional menu options. |
| Save your selections | Selecting the Save option allows you to save changes after entering data or changing a configuration. |

2.2.3.3.2 Using the Trimpad

Use the trimpad to navigate through data entry windows.



Press the arrows to move the cursor left, right, up and down through the data fields.

Press the center button to select the field in which the cursor is currently resting. If the field is associated with a list of valid value, that list is displayed.

2.2.3.3.3 Using the Stress Keys

If you purchased the optional stress module, use the stress keys on the keypad to control stress equipment connected to the system. For a description of the stress keys and their function, see [2.2.1.6 Stress Keys on page 36](#).

2.2.3.4 ECG Data Acquisition

ECG Data Acquisition provides the following:

- Samples with a minimum 500 Hz or 1000 Hz to the ECG processing algorithms and the application software
- Pace enhancement enable/disable through the user interface
- QRS detection and heart rate calculation
- Lead sequences with 6 or 12 leads, where each lead is an element of the set (I, II, III, aVR, aVL, aVF, D, A, J, V1...V6) with an optional -aVR

ECG Data Acquisition supports the following:

- Default high pass filter (0.04 Hz), if ADS is on high pass filter (0.56 Hz)
- Selectable low pass filter (20, 40, 100, 150 Hz)
- Selectable mains filter (50 Hz, 60 Hz)
- Anti Drift System (ADS): Baseline shift correction with finite impulse response high pass filter enable/disable through the user interface in Resting ECG, Stress, and RR analysis modes

The following are selectable data formats for external ECG storage:

- DCAR XML, 500 Hz uncompressed
- DCAR XML, 1000 Hz uncompressed
- Hilltop, 500 Hz DVS
- PDF

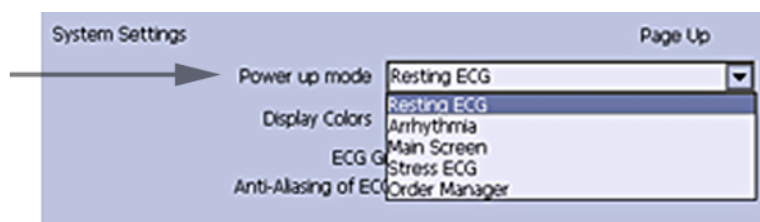
2.2.3.5 External Storage

This system supports a Secure Digital High Capacity (SDHC) card as external storage.

2.3 Navigating the User Interface

You can configure the system in a number of ways. The configuration choices you make determine the actions you need to perform in order to proceed from the **Power up** display to the **Main Menu**.

- The **Power up mode** selected in **Basic Setup** determines which window opens on startup.



- If **High Security Mode** is enabled, you are required to enter a user ID and password.

NOTE

A dialog window will open before the system enters into the selected **Power up mode** as set in System settings.



- The **BCRD** option in the **Option Code** window indicates that the **USB Barcode Reader support** is activated.

| Activated Options | |
|-------------------|---|
| Option | Description |
| CTDG | CT Data Guard |
| R12L | 12 lead resting waveform display |
| MI12 | Measurement and 12SL Interpretation |
| M300 | Internal storage 300 Resting ECGs |
| LANC | LAN to CardioSoft |
| LANM | LAN to MUSE |
| MODC | Modem or Serial to CardioSoft |
| MODM | Modem or Serial to MUSE |
| ERGO | Stress test with treadmill, bicycle or Master |
| E12L | 12 lead Stress test waveform display |
| CFRA | 21 CFR Part 11 audit trail |
| BCRD | USB Barcode Reader support |
| TIP1 | ACI-TIP1 |

The following sections describe how to navigate from the **Power up** screen to the **Main Menu** for the each possible logon configuration. Use the procedure that applies to your logon configuration settings.

- If your system is configured to power up in the **Resting ECG** mode, go to [2.3.1 Resting ECG Power Up Mode on page 41](#).
- If your system is configured to power up in the **Arrhythmia** mode, go to [2.3.2 Arrhythmia Power Up Mode on page 42](#).
- If your system is configured to power up in the **Main Screen** mode, go to [2.3.3 Main Screen Power Up Mode on page 42](#).
- If your system is configured to power up in the **Stress ECG** mode, go to [2.3.4 Stress ECG Power Up Mode on page 43](#).
- If your system is configured to power up in the **Order Manager** mode, go to [2.3.5 Order Manager Power Up Mode on page 43](#).

2.3.1 Resting ECG Power Up Mode

This procedure describes how to navigate to the **Main Menu** after powering on the system when **Resting ECG** is selected for **Power up mode** in **Basic Setup**.

NOTE

If you need to perform system setup functions, be sure you log in as a user who is assigned setup editing privileges.

If the system is configured for **Resting ECG Power Up Mode** and **High Security Mode** is not enabled, the **Resting ECG** screen opens on power up. To go to the **Main Menu**, press **More > Main Menu**.

If **High Security Mode** is enabled, when the window opens prompting for a user ID and password, use the following procedure:

NOTE

If you forgot the password, refer to [2.3.6 High Security Mode on page 44](#).

1. In the **User ID** field, enter your user ID.
2. In the **Password** field, enter your password.
3. Press **Login**.

The **Resting ECG** screen is displayed.

If the **Barcode Reader** option is enabled, a window opens prompting you to **Scan the Patient barcode**.

4. If the barcode reader prompt is not displayed, press **Cancel > More > Main Menu**.

2.3.2 Arrhythmia Power Up Mode

This procedure describes how to navigate to the **Main Menu** after powering on the system when **Arrhythmia** is selected for **Power up mode** in **Basic Setup**.

NOTE

If you need to perform system setup functions, be sure you log in as a user who is assigned setup editing privileges.

If the system is configured for **Arrhythmia Power Up Mode**, and **High Security Mode** is not enabled, the **Arrhythmia** screen opens on **Power up**. To go to the **Main Menu**, press **Cancel > More > Main Menu**.

If **High Security Mode** is enabled, when the window opens prompting for a user ID and password, use the following procedure:

NOTE

If you forgot the password, refer to [2.3.6 High Security Mode on page 44](#)

1. In the **User ID** field, enter your user ID.
2. In the **Password** field, enter your password.
3. Press **Login**.

The **Arrhythmia** screen is displayed.

If the **Barcode Reader** option is enabled, a window opens prompting you to **Scan the Patient barcode**.

4. If the barcode reader prompt is not displayed, press **Cancel > More > Main Menu**.

2.3.3 Main Screen Power Up Mode

This procedure describes how to navigate to the **Main Menu** after powering on the system when **Main Screen** is selected for **Power up mode** in **Basic Setup**.

NOTE

If you need to perform system setup functions, be sure you log in as a user who is assigned setup editing privileges.

If the system is configured for **Main Screen Power up mode** and does not have **High Security Mode** enabled, the **Main Menu** is displayed after powering up the system. You do not need to press any other keys in order to display the **Main Menu**.

If **High Security Mode** is enabled, when the window opens prompting for a user ID and password, use the following procedure:

NOTE

If you forgot the password, refer to [2.3.6 High Security Mode on page 44](#).

1. In the **User ID** field, enter your user ID.
2. In the **Password** field, enter your password.
3. Press **Login**.

The **Main Menu** is displayed.

2.3.4 Stress ECG Power Up Mode

This procedure describes how to navigate to the **Main Menu** after powering on the system when **Stress ECG** is selected for **Power up mode** in **Basic Setup**.

NOTE

If you need to perform system setup functions, be sure you log in as a user who is assigned setup editing privileges.

If the system is configured for **Stress ECG Power up mode** and **High Security Mode** is not enabled, the **Stress ECG** screen opens on power up. To go to the **Main Menu**, press **Cancel** > **More** > **Main Menu**.

If **High Security Mode** is enabled, when the window opens prompting for a user ID and password, use the following procedure:

NOTE

If you forgot the password, refer to [2.3.6 High Security Mode on page 44](#).

1. In the **User ID** field, enter your user ID.
2. In the **Password** field, enter your password.
3. Press **Login**.

The **Stress ECG** screen is displayed.

If the **Barcode Reader** option is enabled, a window opens prompting you to **Scan the Patient barcode**.

4. If the barcode reader prompt is not displayed, press **Cancel** > **More** > **Main Menu**.

2.3.5 Order Manager Power Up Mode

This procedure describes how to navigate to **Main Menu** after powering on the system when **Order Manager** is selected for **Power up mode** in **Basic Setup**.

NOTE

If you need to perform system setup functions, be sure you log in as a user who is assigned setup editing privileges.

If the system is configured for **Order Manager Power Up Mode** and it does not have **High Security Mode** enabled, press **Main Menu**. The **Order Manager** screen is displayed after turning on the system.

If **High Security Mode** is enabled, when the window opens prompting for a user ID and password, use the following procedure:

NOTE

If you forgot the password, refer to [2.3.6 High Security Mode on page 44](#).

1. In the **User ID** field, enter your user ID.
2. In the **Password** field, enter your password.
3. Press **Login**.

The **Order Manager** screen is displayed.

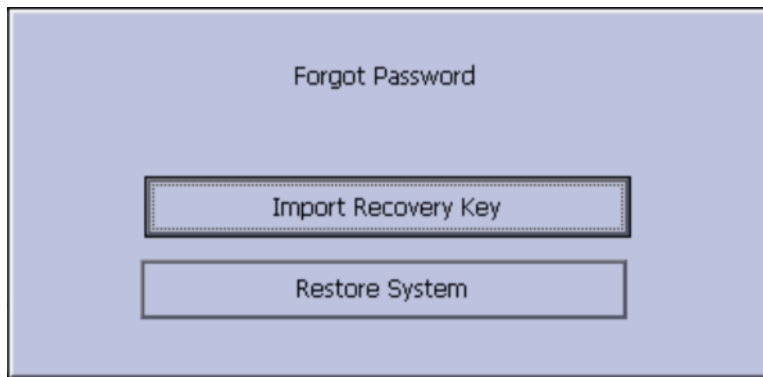
4. Press **Main Menu**.

2.3.6 High Security Mode

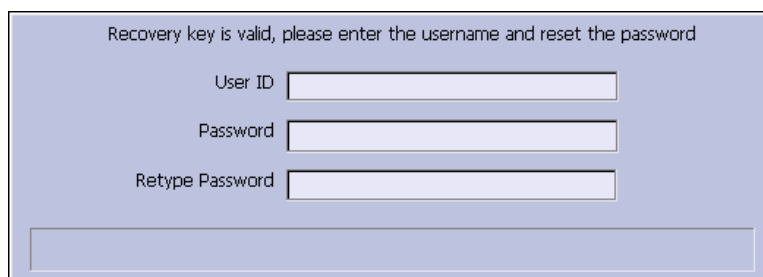
If **High Security Mode** is enabled, you are required to enter a user ID and password.

The dialog window will open before the system enters into the selected **Power up mode** as set in System settings.

1. In the **User ID** field, enter your user ID.
2. In the **Password** field, enter your password.
3. If you forgot the password, press **Forgot Password**.
4. A dialog window displays for you to select.



- If recovery key is exported to the SD card, insert the SD card then select **Import Recovery Key**. How to export recovery key, see [12.9 User Setup on page 144](#).



In the **User ID** field, enter your user ID.

In the **Password** field, enter the new password.

In the **Retype Password** field, retype the new password.

- If recovery key is not exported, select **Restore System**.

NOTE

The System Restore dialog displays a warning that system restore will reset your system to the original factory configuration, and all patient data, system settings, logs and user data will be lost and unrecoverable.

In the **Enter Serial Number** field, enter the serial number and press **Factory Defaults**.

Restart the system after the restore success.



3 Setting Up the Equipment

Setting up this system consists of the following steps:

1. [3.1 Inserting the Battery on page 46](#)
2. [3.2 Connecting the AC Power on page 46](#)
3. [3.3 Connecting the Patient Cable on page 47](#)
4. [3.4 Applying the Ferrite Ring to Cables on page 49](#)
5. [3.5 Connecting the Barcode Reader on page 49](#)
6. [3.6.1 Connecting to LAN on page 50](#)
7. [3.6.2 Connecting to WLAN on page 50](#)
8. [3.7 Connecting External Devices \(Stress Option\) on page 50](#)
9. [3.8 Connecting an Internal Modem on page 51](#)
10. [3.9 Inserting the Paper on page 51](#)
11. [3.10 Turning on the System on page 51](#)
12. [3.11 Configuring the Device on page 51](#)
13. [3.12 Testing the Device on page 51](#)

Each step is described in more detail in the following sections.

3.1 Inserting the Battery

The system is shipped with a lithium ion battery that is charged when inserted into the system connected to AC power.

NOTE

Do not use the system on battery power until the battery is fully charged, as indicated by the battery charging LED on the keysheet. You may use the system on AC power while the battery is charging.

3.2 Connecting the AC Power

This system can run using AC or battery power. When the device is plugged into an AC outlet, it uses AC power and charges the installed battery.

Use the following instructions to connect the system to an AC power outlet.



| Item | Description |
|------|--|
| 1 | Female end of the device's power cord connected to the back of the device. |
| 2 | Male end of the device's power cord connected to an AC outlet. |

1. Connect the female end of the device's power cord (1) to the AC power connector on the back of the device.
2. Plug the male end of the device's power cord (2) into an AC outlet.

NOTE

It is recommended that you plug the device into an uninterruptible power supply (UPS) or a surge suppressor.

3. Check the Power LED to make sure the device is receiving power from the AC outlet.

3.3 Connecting the Patient Cable

This system supports a variety of patient cables.

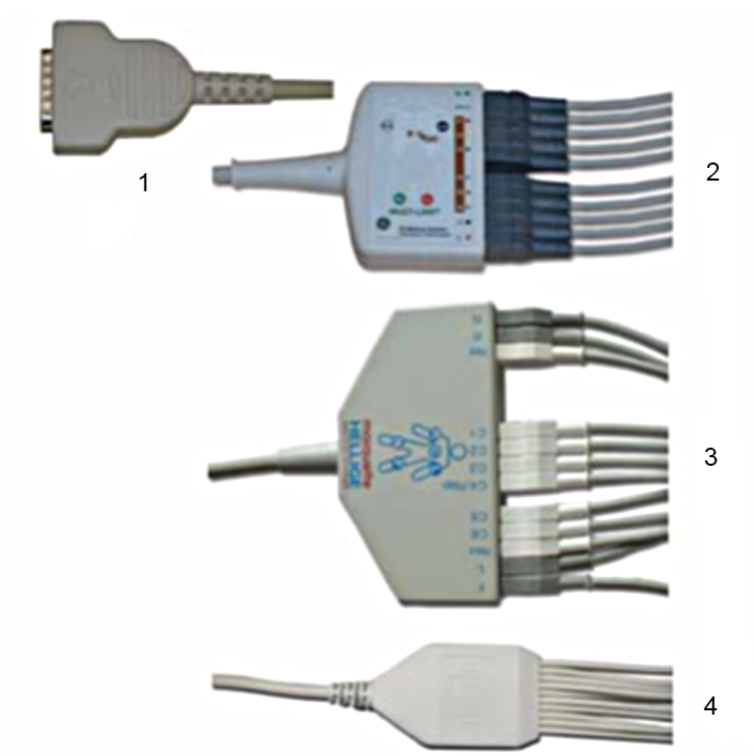
WARNING**HIGH-FREQUENCY BURNS**

Use of cables not supplied with this equipment can lead to serious injury.
Use only the acquisition cable that ships with this equipment.

CAUTION**INACCURACIES IN ECG**

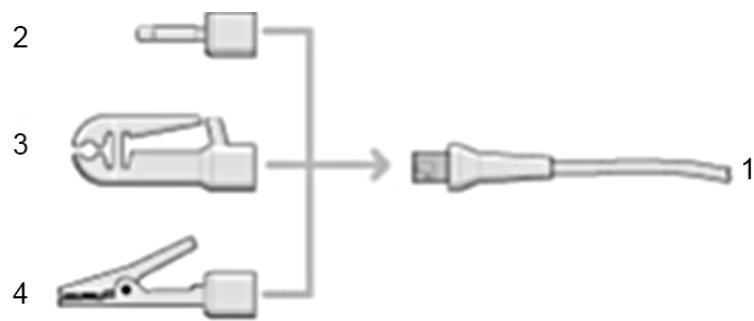
Improper connection can cause inaccuracies in the ECG.

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



| Item | Name | Description |
|------|------------------------------------|---|
| 1 | D-Sub 15-pin male connector | Connects to the system's ECG signal input connector. One end of each acquisition cable consists of a D-sub 15-pin male connector. |
| 2 | Multi-link Acquisition Cable Leads | The lead end of the multi-link acquisition cable attaches to the leadwire adapters and uses 10 or 12 leadwires. |
| 3 | NEHB Acquisition Cable Leads | The lead end of the NEHB acquisition cable attaches to the leadwire adapters and uses 12 leadwires. |
| 4 | Value Acquisition Cable leads | The lead end of the value acquisition cable consists of 10 leadwires. |

The leadwires require an adapter to connect to an electrode, as shown in the following diagram.



| Item | Description |
|------|--------------|
| 1 | Leadwire end |
| 2 | 4 mm pin |

Continues on the next page

| Item | Description |
|------|---------------|
| 3 | Grabber |
| 4 | Mactrode clip |

Use the following procedure to connect the patient cable:

1. Assemble the leadwires and adapters.
See [14.1 Replacing Leadwire Adapters on page 163](#).
2. Connect the leadwires to the front of the patient cable.
3. Connect the patient cable to the system.

Ensure the cable is seated securely.

3.4 Applying the Ferrite Ring to Cables

Before you connect the barcode reader, a LAN cable, a serial cable or a phone line to the device, make sure that you apply the ferrite ring:

1. Open a ferrite ring.
2. Wrap the cable around the ferrite ring as shown, and make sure that the distance between the ferrite ring and the cable port is less than 50 mm.



3. Fasten to lock the ferrite ring.



3.5 Connecting the Barcode Reader

If the optional barcode reader was purchased with the device, connect it to the USB port on the device. Before you connect the cable to the device, make sure that you apply a ferrite ring to the cable, see [3.4 Applying the Ferrite Ring to Cables on page 49](#).

NOTE

The BCRD option to use the reader is activated at the factory when the barcode reader is purchased with the device. However, you need to configure the barcode settings for your site before you can use the reader, see [A Creating Barcodes on page 178](#).

3.6 Connecting the LAN Option

This system is compatible with MUSE v8.0.1, v9.0.0 and MUSE NX, and with CardioSoft/CS v6.73 and later.

3.6.1 Connecting to LAN

If you purchased the LANC (LAN Communication to CardioSoft/CS) or LANM (LAN Communication to MUSE) options, connect a wired LAN Ethernet cable to the RJ45 network connector on the back of the device. Before you connect the cable to the device, make sure that you apply a ferrite ring to the cable, see [3.4 Applying the Ferrite Ring to Cables on page 49](#).

NOTE

This applies only if you are using the device as a stationary device. If you are using it as a mobile unit, do not connect the device to a LAN until you are ready to import, transmit, or export records.

3.6.2 Connecting to WLAN

If you purchased the LANC (LAN Communication to CardioSoft/CS) or LANM (LAN Communication to MUSE) options along with wireless bridge:

1. Connect the wireless bridge to the RJ45 network connector on the back of the device via Ethernet cable
2. Connect the Power cable of the Wireless bridge to USB port of the device

NOTE

Please check with GE representative if this solution is available in your country.

The required option(s) to use the wireless bridge are activated at the factory when the wireless bridge communication option is purchased with the device. However, the wireless bridge needs to be configured before you can use it, refer to *Mobile Link Wireless Communication Installation Manual* for detailed information.

3.7 Connecting External Devices (Stress Option)

If you purchased the stress option **ERGO**, connect the external stress device to the system using a serial cable to the COMM B port on the back panel of the device. Before you connect the cable to the device, make sure that you apply a ferrite ring to the cable, see [3.4 Applying the Ferrite Ring to Cables on page 49](#).

This system works with any of the following devices:

- GE model T2100 treadmill
- GE model T2000 treadmill
- eBike ergometer
- Master's Step (acoustic signal only)

3.8 Connecting an Internal Modem

If you purchased this system with the internal modem option, connect the modem to an analog phone line using the RJ11 connector on the back of the device. Before you connect the cable to the device, make sure that you apply a ferrite ring to the cable, see [3.4 Applying the Ferrite Ring to Cables on page 49](#).

MODC is Modem Communication to the CardioSoft/CS system.

MODM is Modem Communication to the MUSE system.

This system is compatible with MUSE v7.1.1, v8.0.1, and v9.0.0 and with CardioSoft/CS v6.51, v6.61, v6.71 and v6.73.

3.9 Inserting the Paper

Before you can print ECG reports, complete the following steps:

1. Make sure the system is set up for the correct paper size.

This device can print on the following papers: A4, standard letter (8.5 x 11 inches), or modified letter (8.433 x 11 inches).

For information on adjusting the printer for the paper size, see [14.2.2 Adjusting the Tray for Paper Size on page 165](#).

2. Insert the appropriately sized paper.

3.10 Turning on the System

1. Press the power button to turn on the system.
2. Verify the system welcome screen is displayed with no errors.

NOTE

If you encounter any problems powering on the system, see [15.3.1 System Does Not Power Up on page 171](#) for further troubleshooting instructions.

3.11 Configuring the Device

When the device is ready for operation, configure the system settings using the information in [12 System Configuration on page 104](#).

If you are applying the same settings to multiple devices at the site, export the settings to an SD card and use that card to import the settings to other systems.

3.12 Testing the Device

After you have set up and configured the device, test the device completely before using it with patients. Use the following test scenarios:

- Conducting and printing a resting ECG.
See [7 Recording a Resting ECG on page 68](#) for instructions.
- Conducting and printing an arrhythmia ECG.

See [8 Arrhythmia Mode Recording on page 80](#) for instructions.

- Conducting and printing a stress ECG.

See [10 Stress Testing on page 88](#) for instructions.

- Saving, importing, printing, deleting, transmitting, and exporting records.

See [11 Managing Internal Storage on page 96](#) for instructions.

4 Preparing the Patient

This chapter provides the procedures for preparing the patient's skin and properly placing electrodes.

NOTE

These instructions do not cover the application of electrodes for the KISS Electrode Application System (not available in the United States). To use the KISS system, see the KISS operator's manual for instructions.

4.1 Preparing the Patient's Skin

Careful skin preparation is the key to an interference-free ECG. Signal quality is indicated on the device via the Hookup Advisor indicator.

1. Select the electrode placement sites for ECG monitoring or diagnosis per the protocol specified by the hospital or physician.

Refer to [4.2 Electrode Placement on page 54](#) for diagrams and descriptions of electrode placement for various protocols.

2. Ensure that each site is dry, clean, and free of excessive hair.

NOTE

Do not use solvents to clean the skin; solvents trapped under electrodes may lead to abnormal skin reactions.

3. To prepare for a stress test, do the following:
 - a. Mark each electrode site with a felt tip pen.
 - b. Degrease each site with a skin preparation cream.
 - c. Use a mild abrasion to remove the mark left by the felt tip pen.
4. Apply electrodes to the prepared sites.

Electrodes should be placed only by a physician or ECG technician.

WARNING



SHOCK HAZARD

Touching the conductive elements cancels the protection provided by the isolated signal input.

Ensure that conductive parts of the electrodes or lead wires do not come in contact with other conductive parts.

5. Look at the lead-check screen for indication of lead problems.

NOTE

Use only electrodes and contact agents recommended by GE Healthcare. The signal quality on the lead-check screen is not indicated until the RA/R and RL/N electrodes are applied. If RA/R becomes disconnected, the system reports that all electrodes are off the patient.

4.2 Electrode Placement

This section describes various methods for placing electrodes for both resting and exercise ECGs.

NOTE

Some of the procedures for placing electrodes may not apply in all cases, depending on the system and options purchased.

CAUTION



DELAYED DIAGNOSIS

Improper connection of the leadwires will cause inaccuracies in the ECG.

Ensure the leadwires are connected properly. Trace each leadwire from its acquisition module label to its colored connector and then to its electrode to ensure that it is matched to the correct label leadwire connection location.

4.2.1 Resting ECG Placement

The following methods are applicable for resting ECGs.

4.2.1.1 Standard 12-Lead Placement

To acquire a standard 12-lead ECG, use the placement shown in the following diagram.

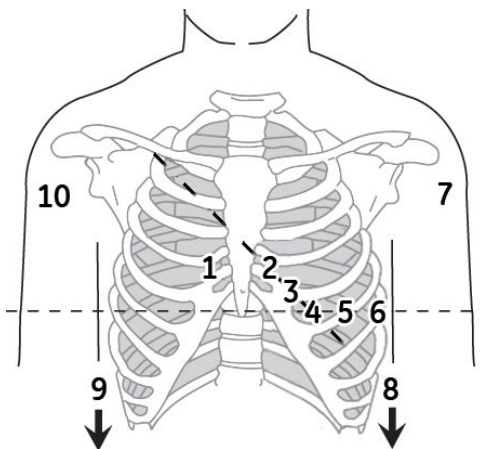


Table 4-1 12-Lead Electrode Placement

| | AHA Label | IEC Label | Description |
|---|-----------|-----------|---|
| 1 | V1 red | C1 red | Fourth intercostal space at the right sternal border |
| 2 | V2 yellow | C2 yellow | Fourth intercostal space at the left sternal border |
| 3 | V3 green | C3 green | Midway between location 2 and 4 |
| 4 | V4 blue | C4 brown | Mid-clavicular line in the fifth intercostal space |
| 5 | V5 orange | C5 black | Anterior axillary line on the same horizontal level as 4 |
| 6 | V6 purple | C6 purple | Mid-axillary line on the same horizontal level as 4 and 5 |
| 7 | LA black | L yellow | Left deltoid |

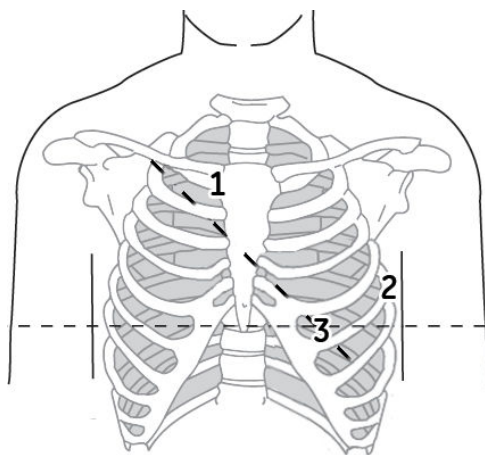
Continues on the next page

Table 4-1 12-Lead Electrode Placement (Table continued)

| | AHA Label | IEC Label | Description |
|----|-----------|-----------|--|
| 8 | LL | F green | Above left ankle (Alternate placement, upper leg as close to torso as possible) |
| 9 | RL green | N black | Above right ankle (Alternate placement, upper leg as close to torso as possible) |
| 10 | RA white | R red | Right deltoid |

4.2.1.2 NEHB Placement

To acquire a NEHB ECG, use the standard 12-lead electrode placement and items 1 and 2 as shown in the following diagram.



| | AHA Label | IEC Label | Description |
|---|-----------|-----------|---|
| 1 | A1 orange | Nst white | Attachment point of the second rib to the right sternal edge |
| 2 | A2 orange | Nax white | Fifth intercostal space on the left posterior axillary line (Same position as V7 or C7) |
| 3 | V4 blue | Nap white | Mid-clavicular line in the fifth intercostal space (Same position as C4) |

4.2.2 Stress 12-Lead Placement

To acquire a stress 12-lead ECG use the placement shown in the following diagram.

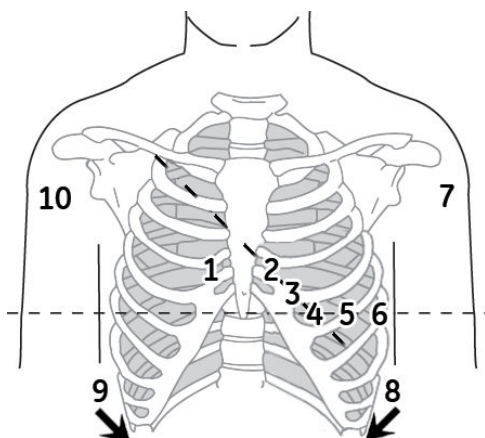


Table 4-2 12-Lead Stress Electrode Placement

| | AHA Label | IEC Label | Description |
|----|------------------|------------------|--|
| 1 | V1 red | C1 red | Fourth intercostal space at the right sternal border |
| 2 | V2 yellow | C2 yellow | Fourth intercostal space at the left sternal border |
| 3 | V3 green | C3 green | Midway between location 2 and 4 |
| 4 | V4 blue | C4 brown | Mid-clavicular line in the fifth intercostal space |
| 5 | V5 orange | C5 black | Anterior axillary line on the same horizontal level as 4 |
| 6 | V6 purple | C6 purple | Mid-axillary line on the same horizontal level as 4 and 5 |
| 7 | LA black | L yellow | Left deltoid |
| 8 | LL red | F green | Above left ankle (Alternate placement, upper leg as close to torso as possible) |
| 9 | RL green | N black | Above right ankle (Alternate placement, upper leg as close to torso as possible) |
| 10 | RA white | R red | Right deltoid |

5 Entering Patient Information

The following sections describe how to enter patient information using the following methods:

- With an internal keypad or external keyboard
- With a barcode reader

5.1 Entering Patient Information With an Internal Keypad or External Keyboard

Patient information should be entered for each new patient from whom readings are taken. Use the following procedure to enter the information if you do not use a barcode reader or if you want to modify or add to the patient data entered with a barcode reader.

NOTE

Patient information may be retained from a previous patient. Be sure to check the patient information screen for each new patient. Data assigned to the wrong patient causes erroneous patient information that can affect diagnosis and treatment of the patient(s).

1. Open the **Enter Patient Data** window.

For Resting ECG, press **Main Menu > Resting ECG > Patient Data** to open the window.

For Arrhythmia or Stress, the window opens automatically when you initially select the application.

For subsequent patients, you need to do one of the following to reopen the **Enter Patient Data** window.

- In Arrhythmia mode, press **Start Recording > New Patient**.
- In Stress mode, press **Patient Data**.

2. Enter the patient information, or press **Patient List** to select a patient from the established list.

NOTE

If you select a patient from the **Patient List**, only the first page of patient information is reused; you need to manually enter all subsequent pages.

3. Use the **Page up** and **Page down** keys to move through the patient data windows.

NOTE

If the **CTDG (Clinical Trial Data Guard)** option is activated, you enter clinical trial data on the last window.

4. When all the patient data has been entered, press **Save** to save the data.

5.2 Entering Patient Information with a Barcode Reader

Using a barcode reader can simplify the entry of patient information and reduce the chance of introducing errors. When you scan a patient's barcode, it retrieves the patient information encoded in the barcode. You can then verify or modify the information as appropriate.

Before you can use the barcode scanner, you need to verify that it is connected to the system and that the system is correctly configured to use the peripheral.

If it is not connected, follow the instructions for connecting and configuring the barcode reader in the section [3.5 Connecting the Barcode Reader on page 49](#) and [A Creating Barcodes on page 178](#).

5.2.1 Scanning the Barcode

Use the following procedure to scan the patient's barcode:

1. When the following prompt is displayed on the screen, scan the patient's barcode:

Scan the Patient Barcode



The following message is displayed on the screen: **Please wait.**

The barcode reader beeps. The first **Patient Data** window opens with the data from the patient's barcode entered in the appropriate fields.

2. Confirm that the data entered from the patient's barcode is accurate.
3. Enter or modify patient information as necessary.

Refer to [5.1 Entering Patient Information With an Internal Keypad or External Keyboard on page 57](#) for details.

4. After verifying that the patient information is correct, press **Save** to save the patient data.

5.3 Automatic Query

The method for downloading patient demographics or orders depends on the option you purchased.

You will use one of the following option codes:

- ADTF-ADT — Patient demographics download using the MUSE system or another similar application.
- ADTL-ADT — Patient demographics download using an application similar to the MUSE System.

NOTE

If the BCRD USB Barcode Reader option is not activated, or the length of the corresponding query key (**Patient ID** or **Visit**) is 0, the system does not parse the barcode, and displays the scanned content in the text box.

If the BCRD USB Barcode Reader option is activated, and the length of the corresponding query key (**Patient ID** or **Visit**) is not 0, the system parses the query key

according to the offset and length configured in [A.2.1 Configuring the Barcode Reader Manually on page 180](#), and displays the query key in the text box.

5.3.1 Configuring Automatic Query

1. From the **Main Menu**, press **System Configuration** > **Basic Setup**.
2. Configure the **site #** that you want to query the patient demographics or order, the default site number is 1.
3. Navigate to the **Input Method Settings** page by pressing **Page Down** > **Page Down**.
4. Configure the **Input Method Settings** according to your requirements.
5. If you need to input the query key (**Patient ID** or **Visit**) by scanning a multi-fields barcode, configure the query key barcode settings in **System Configuration** > **Patient Setup**.

See [A.1 Setting Up the Patient Data Scheme on page 179](#) and [A.2 Configuring the Barcode Reader on page 180](#) for the detailed instructions.

5.3.2 Using the Barcode Reader to Query the Database and Select a Patient

Use the following procedures to query the database and select the patient demographics using a barcode reader.

1. Navigate to **Resting ECG**.
2. Select the **Patient Data** menu.

A dialog box opens instructing you to scan the patient barcode.

3. Scan the patient barcode using the barcode reader.

The scanned **Patient ID** or **Visit** displays in the existing dialog box.

4. Press **OK** to begin querying the database.

After the automatic query is complete, the ADT or order is displayed in the **Enter Patient Data** window.

Enter Patient Data

| | |
|---------------|--------------------------|
| Patient ID | P003 |
| Visit | V001 |
| Last Name | UALLY |
| First Name | HAPPY |
| Date of Birth | 05.11.1959 DD.MM.YYYY |
| Height | cm |
| Weight | kg |
| Gender | Male |
| Phone Number | |
| Pacemaker | <input type="checkbox"/> |

Page Down

If more than one patient or order is found, a list displays. Select the patient or order from the list and press **Select** to continue.

- Click **Save** to accept the patient ADT or order.

NOTE

Confirm the patient data and test information data is correct before saving.

The patient demographic or order data is downloaded and displayed.

NOTE

For more information on the type of codes supported by the MAC 2000, see [A Creating Barcodes on page 178](#).

5.3.3 Using the Internal Keypad or External Keyboard to Query the Database and Select Patient

Use the following procedure to query the database and select the patient demographics using the internal keypad or external keyboard.

- Navigate to **Resting ECG**.
- Select the **Patient Data** menu.
A dialog box opens without **Patient ID** or **Visit** (depends on setup).
- Enter the **Patient ID** or **visit** (depends on setup) using the internal keypad or external keyboard.
- Press **OK** to begin querying the database.

After the automatic query is complete, the ADT or order is displayed in the **Enter Patient Data** window.

Enter Patient Data

Patient ID: P003

Visit: V001

Last Name: UALLY

First Name: HAPPY

Date of Birth: 05.11.1959 DD.MM.YYYY

Height: cm

Weight: kg

Gender: Male

Phone Number:

Pacemaker: ☐

Page Down



If more than one patient or order is found, a list displays. Select the patient or order from the list and press **Select** to continue.

- Click **Save** to accept the patient ADT or order.

NOTE

Confirm the patient data and test information data is correct before saving.

The patient demographic or order data (depends on setup) is downloaded and displayed.

6 Order Manager

The MAC 2000 system may retrieve orders from a Hospital Information System (HIS) through MUSE or non-MUSE systems. There are two types of order managers: Simple Orders and Advanced Order Manager.

You can complete orders using any of the communication media outlined in the following section.

6.1 Communication Media

MUSE or non-MUSE systems can communicate with the MAC 2000 system in the following ways:

- **SD Card**

If you are communicating to MUSE systems, this is only available with MUSE v7.1.1 or later.

- **Local Area Network (LAN)**

Connect the MAC system to the LAN through the communications port of the MAC system.

- **Direct Serial Connection**

Connect the MAC system to the remote system using a standard serial cable.

- **Wireless**

Connect the MAC system to the remote system using a wireless module connected to the MAC system.

NOTE

Please check with GE representative regarding wireless solution available in your country.

This system is compatible with MUSE v8.0.1, v9.0.0 and MUSE NX, and CardioSoft/CS v6.73 and later.

6.2 Simple Orders

Simple Orders provides an interface to quickly download and execute one order at a time. To use Simple Orders, you need to enable either the **SOML** or **SOMF** option. When the options are enabled, the **Orders** function key is available on the **Resting ECG** screen.

When you select the **Orders** function key, this system queries for orders in the default location you set in **Communication Setup**. As a response to this query, the system displays a list of available orders at the location specified. You can select a single order from the list. The **Patient Information** screen of the Resting ECG application opens with the information populated from the order.

Use the following procedure to execute orders in Simple Orders.

1. Navigate to **Resting ECG** in the application.
2. Select **More > Orders**.

The system displays a list of orders available at the default location.

3. Select an order and press **Load**.

The selected single order is automatically downloaded from the remote system and populated in the **Patient Information** screen.

You can also automatically execute a single order if the **Auto Execute Single Order** setting is enabled in **Resting ECG Setup** and only one open order for the given location is present in the remote system.

Use the following procedure to automatically execute a single order:

1. Navigate to **Resting ECG** in the application.
2. Select **More > Orders**.

The single order available at the default location is automatically downloaded from the remote system and populated in the **Patient Information** screen.

6.3 Advanced Order Manager

Advanced Order Manager provides an interface to download and store multiple orders on the system and execute them later. To use Advanced Order Manager, you need to enable either the **AOML** or **AOMF** option.

Advanced Order Manager is available as a separate application named **Order Manager** on the main menu of the system.

The Advanced Order Manager application has an interface that displays a list of orders that are already downloaded to the system. The application allows you to query for orders from the remote systems based on multiple locations. All matching orders are displayed as the response to this query and you can download a single order or multiple orders to the system. The downloaded orders are displayed as open resting ECG orders in the application main screen.

6.3.1 Downloading Orders

Regardless of the method you use to communicate with the remote system, use the following procedure to receive orders:

1. From the **Main Menu**, select **Order Manager**.
The **Order Manager** window opens.
2. Select **Load Orders**.
A pop-up window opens.
3. Enter the location(s) from which you want to retrieve orders.
Locations must match the locations used on the remote system. Separate multiple locations with commas (for example 1, 13, 55).
4. Press **Enter**.
The system connects to the remote system and retrieves a list of matching orders.
5. To select one order from the list, use the **Select** function key to select the order you want and press **Enter**.
If you need to select multiple orders, use the **trimpad** and the **Enter** key to highlight multiple orders.
6. After you have selected all the orders you want to download, press the **Load Orders** function key.
The system loads and stores the selected orders.
7. Proceed to [6.3.2 Selecting and Completing Orders on page 64](#).

The downloaded order list displays the **Patient Name, Patient ID, Room, Time, Type, Location,** and **Order Number.** The list changes as you navigate the list. You can select and execute only one order at a time from the list. When you select an order, the resting ECG application opens and the **Patient Information** window is populated with the patient demographics from the selected order.

An order is completed when the ECG record is saved or transmitted to the MUSE or non-MUSE system. Completed orders are marked as completed.

6.3.2 Selecting and Completing Orders

After you have orders on the system, use the following procedure to select and complete them.

1. On the **Order Manager** window, choose **Select**.

The cursor moves to the list of available orders.

2. Select the order you want to use and press **Enter**.

A window opens with the order details.

3. Do one of the following:

- To select a different order, select **Cancel**.

The detail window closes and you return to the **Order Manager** window.

- To use the selected order, select **Okay**.

- If the **TIPI** option is activated, the **Patient Information** window opens with the information from the order.

- If the **TIPI** option is not activated, select **Patient Data** to open the **Patient Information** window.

4. Enter or correct the patient data.
5. Acquire an ECG for the order and save or transmit the acquired ECG.
6. Select **Main Menu** to return to the **Main Menu** window.
7. Select **More > Order Manager** to return to the **Order Manager** application.

An asterisk (*) on the left side of the **Patient Name** indicates that the order is completed.

6.4 Using the Order Manager Interface

You can do the following things with orders:

- Sort the list.
- Print the list.
- Delete single, multiple, completed, or all stored orders.

| Order Manager | | | | | | |
|---|------------|----------|------|--------------|------|--------------|
| 14.12.2012 6:48:20 0/0 | | | | | | |
| List of orders - Total orders: 6 Selected Orders: 0 *--Completed order. | | | | | | |
| Patient Name | Patient ID | Location | Room | Time | Type | Order Number |
| Carrey, Mark | 00491 | 1 | 12 | 16:20 Dec-13 | ECG | 3006785 |
| Grey, Sarah | 00493 | 14 | 12 | 16:20 Dec-13 | ECG | 3006788 |
| Kumar, Varun | 00494 | 7 | 12 | 16:20 Dec-13 | ECG | 3006789 |
| Timothy, Mary | 00490 | 12 | 12 | 16:20 Dec-13 | ECG | 3006795 |
| Verma, Tarun | 00495 | 7 | 12 | 16:20 Dec-13 | ECG | 3006790 |
| William, Jerry | 00492 | 0 | 12 | 16:20 Dec-13 | ECG | 3006785 |
| Select Load Orders Delete Orders Sort Orders Print Main Menu | | | | | | |

| Option | Description |
|----------------------|---|
| Select | Selects the patient from the List of orders and displays the patient information in an editable format. |
| Load Orders | Obtains the orders from the MUSE system and displays them on the Order List Display screen. |
| Delete Orders | Provides the user a set of options to delete orders stored locally on the device. See 6.4.1 Deleting Orders on page 65 . |
| Sort Orders | Allows the user to sort the orders based on a user-selected field. |
| Print | Prints the selected order. |
| Main Menu | Returns the user to the Main Menu . |

6.4.1 Deleting Orders

You can automatically delete a stored order when the associated ECG record is automatically deleted, by enabling **Auto Order Deletion** in the **Order Manager Setup** screen. See [12.16 Order Manager Setup on page 154](#).

You can also configure automatic order deletion separately from automatic record deletion. In this case, the system does not automatically delete a stored order when the associated ECG record is manually deleted.

Use the following procedures to access the **Delete Orders** menu and delete orders stored locally on the device.

6.4.1.1 Accessing the Delete Orders Menu

Use the following procedure to access the **Delete Orders** menu.

- On the **Main Menu**, select **Order Manager**.
The **Order Manager Interface** window opens with a list of local orders displayed.
- Select **Delete Orders**.
The available options on the menu change.
- Do one of the following:
 - To select orders to delete, proceed to [6.4.1.2 Deleting Specific Orders on page 66](#).

- To delete all of the orders on the device, proceed to [6.4.1.3 Deleting All Orders on page 66](#).
 - To delete all completed orders on the device, proceed to [6.4.1.4 Deleting Completed Orders on page 66](#).
4. To cancel without deleting any order, select **Cancel**.

You return to the **Delete Orders** menu options.

6.4.1.2 Deleting Specific Orders

On the **Delete Orders** menu, use the following procedure to delete one or more specific orders.

The cursor is placed at the first order in the list of orders.

1. Select the order(s) you want to delete.
 - Use **Page Up**, **Page Down**, and the **trimpad** to navigate through the list of orders.
 - To select an order, highlight it and press **Enter**.
2. Select as many orders as necessary.

NOTE

If you select an order that has not been processed, a window opens to ask whether you want to delete the unprocessed order.

- Select **Yes** to continue deleting the unprocessed order.
 - Select **No** to cancel the selection.
3. After you have selected all of the orders to delete, select **Delete Selected**.
The following message is displayed: **Are you sure you want to delete the orders?**
 4. Do one of the following:

- To delete the selected orders, select **Yes**.
The orders are deleted and you return to the **Delete Orders** menu options.
- To cancel the deletion, select **No**.
The orders are not deleted and you return to the **Delete Orders** menu options.

6.4.1.3 Deleting All Orders

On the **Delete Orders** menu, use the following procedure to delete all of the orders.

1. Select **Delete All**.
The following message is displayed: **Are you sure you want to delete the orders?**
2. Do one of the following:
 - To delete all of the orders, select **Yes**.
The orders are deleted and you return to the **Delete Orders** menu options.
 - To cancel the deletion, select **No**.
The orders are not deleted and you return to the **Delete Orders** menu options.

6.4.1.4 Deleting Completed Orders

On the **Delete Orders** menu, use the following procedure to delete all completed orders:

1. Select **Del Completed**.

The following message is displayed: **Are you sure you want to delete all completed orders?**

2. Do one of the following:

- To delete all of the completed orders, select **Yes**.

The orders are deleted and you return to the **Delete Orders** menu options.

- To cancel the deletion, select **No**.

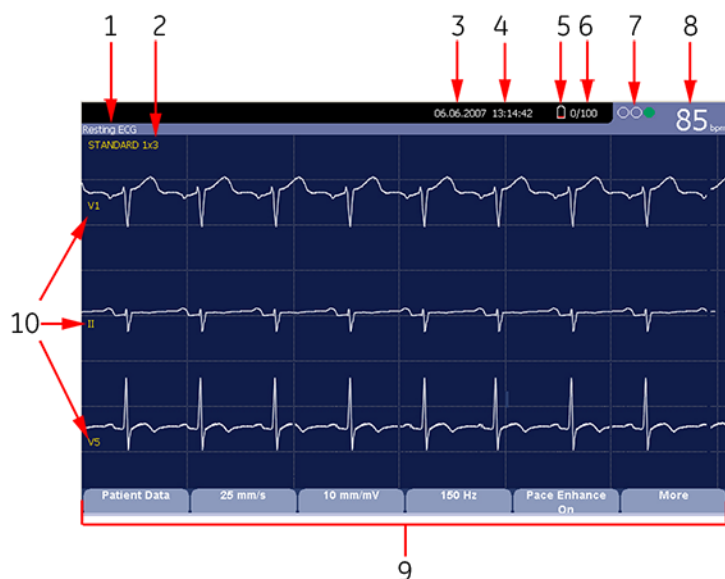
The orders are not deleted and you return to the **Delete Orders** menu options.

NOTE

Non-MUSE systems, such as EMR Gateway, are GE Healthcare proprietary systems.

7 Recording a Resting ECG

The Resting ECG function is part of the basic ECG cart system. **Resting ECG** mode is the default **Power up** mode. When the system is turned on, the Resting ECG display is similar to the following screen. You can modify the default in the **Basic Setup**.



| Item | Name | Description |
|------|----------------------------|--|
| 1 | ECG Type | The following are valid types of ECGs: <ul style="list-style-type: none"> • Resting ECG • Arrhythmia • Stress Test |
| 2 | Display Format | Format of current waveforms. Press Leads to cycle through all 12 leads. |
| 3 | Date | Current system date. |
| 4 | Time | Current system time. |
| 5 | Battery status indicator | Displays the current battery level. For a description of the battery status indicator see 14.3.3 Battery Status Indicator on page 169 . |
| 6 | Internal storage indicator | This indicator is displayed only if the internal storage option is enabled. It displays the approximate number of ECG records that you can store in the remaining memory. X represents the number of ECGs that you can store in the remaining memory. YY represents the total number of ECGs that the system can store. YY can be either 100 (if the M100 option is activated) or 200 (if the M200 option is activated). The difference equals the number of ECGs currently stored in the system. |

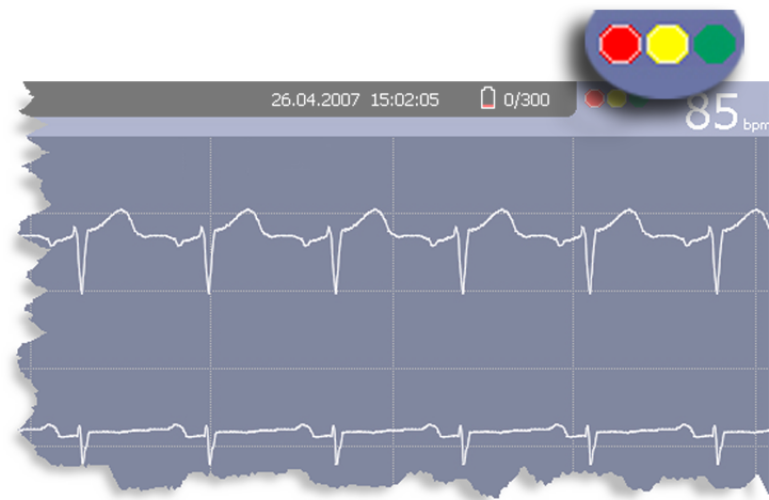
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| Item | Name | Description |
|------|--------------------------|---|
| 7 | Hookup Advisor Indicator | A tool for monitoring the quality of ECG signals. For more information, see 7.1 Hookup Advisor on page 69 . |
| 8 | Patient's Heart Rate | Current patient heart rate measured in beats per minute. |
| 9 | Menu Options | The list of available menu options changes depending on the function and the current location within that function. For more information, see 2.2.3.3.1 Using the Function Keys on page 39 . |
| 10 | Lead Labels | Identifies each waveform and indicates the waveform quality. Yellow = a noisy lead Red = disconnected lead |

7.1 Hookup Advisor

This system offers the Hookup Advisor feature, which is a tool for monitoring the quality of ECG signals, and is available in the Resting, Arrhythmia, and RR Analysis applications. It can reduce or eliminate the occurrence of poor technical quality ECGs, save time, and prevent the need for retakes.

The Hookup Advisor is displayed as a three-circle indicator in the upper right corner of the screen.



The following table describes each of the indicator's conditions.

| Indicator | Description |
|-----------|---|
| Red | Indicates a leadfail condition or extreme baseline shifts. The red indicator is always the left-most circle of the indicator and flashes when lit. |

Continues on the next page

| Indicator | Description |
|-----------|---|
| Yellow | <p>Indicates muscle artifact, power line interference, baseline wander, or electrode noise. The yellow indicator is always the middle circle of the indicator.</p> <p>NOTE</p> <p>In RR Analysis mode, the yellow indicator is not active. RR Analysis supports only the red and green indicators of Hookup Advisor.</p> |
| Green | <p>Indicates acceptable signal quality. The green indicator is always the right-most circle of the indicator.</p> |

When the lead quality is red or yellow, a message describing the lead problem or status is displayed on the screen.

Hookup Advisor continuously reviews the ECG data for acceptable lead quality.

When an ECG is acquired, Hookup Advisor runs a complete and more comprehensive assessment of the full 10 seconds of ECG data and possibly prompts the user regarding any poor lead quality conditions.

- If **Preview before analysis** is turned off in the system setup, a lead quality message and prompt may be displayed, depending on the current lead quality level and the Prompt level in the system setup. If a message and prompt is displayed, the lead quality indicator will reflect the overall 10-second lead quality.
- If **Preview before analysis** is enabled, the system setup Prompt level is disregarded and the system immediately displays the Preview screen. Any lead quality messages will be displayed in this screen along with the overall 10-second lead quality indicator.

In either case, users may then do either of the following:

- Select **Continue** to continue (print the ECG).
- Select **Cancel** to cancel.

7.2 Resting ECGs

A resting ECG is the default mode of the ECG cart system, although you may change this in the system configuration. This section describes how to record a resting ECG and the available options.

7.2.1 Recording a Resting ECG

The following steps describe how to conduct a resting ECG.

NOTE

To take a stat ECG, go directly to step 6.

1. Prepare the patient as described in [4 Preparing the Patient on page 53](#).
2. Select **Patient Data** and enter the patient data as described in [5 Entering Patient Information on page 57](#).
3. Adjust the **Speed**, **Gain** and **Low pass filter** until the waveforms are configured as desired.
4. If the patient has a pacemaker, turn on **Pace Enhance**.
For more information, see [7.2.2 ECG Options on page 71](#).
5. Select **More > Printer Leads** to scroll through the leads or change the lead format.

6. When the waveforms are configured, press **ECG** to begin the acquisition.

A progress bar indicates the percentage of the data acquired. When the acquisition is complete, one of the following occurs, depending on the setting of the **Preview Before Analysis** option on the **Resting ECG Setup** window.

- If the **Preview Before Analysis** option is enabled, a preview of the 10-second ECG is displayed. Continue with step 7.
 - If the **Preview Before Analysis** option is not enabled, the ECG data is analyzed and printed after it is acquired. Proceed to step 8.
7. While reviewing the preview, do one of the following:
 - Discard the reading and press **Cancel**. Begin again from step 3.
 - Wait for the menu options to change and then continue with step 8.
 8. Use the options to change patients, to print a copy of the ECG, or to save, transmit, or reanalyze the data.

For more information on each option, see [7.2.3 Post-Acquisition Options on page 73](#).

7.2.2 ECG Options

This system provides several options for configuring an ECG. The options, presented as option keys across the bottom of the display, are listed in the following tables.

Table 7-1 ECG Options—First Row

| Option | Description |
|---|---|
| Patient Data | Opens the patient data entry window. |
| 25 mm/s NOTE The initial measurement displayed is set in System Configuration > Resting ECG Setup . | Changes the speed of the waveform on the display and printout. Changing the speed also changes the speed at which the wiper bar moves across the display. Measurement is in millimeters per second (mm/s) and includes the following options: <ul style="list-style-type: none"> • 25 mm/s • 50 mm/s • 12.5 mm/s - 5 mm/s • 12.5 mm/s When the option includes two speeds (12.5 mm/s - 5 mm/s), the first speed is for the display and the second speed is for the printout. Changing the measurement here does not change the measurement set in System Configuration . |

Continues on the next page

Table 7-1 ECG Options—First Row (Table continued)

| Option | Description |
|--|--|
| 10 mm/mV NOTE The initial measurement displayed is set in System Configuration > Resting ECG Setup . | Changes the magnitude of the ECG signal on the display or in the report. Measurement is in millimeters per millivolt (mm/mV) and includes the following options: <ul style="list-style-type: none"> • 5 mm/mV • 10 mm/mV • 20 mm/mV • 40 mm/mV • 2.5 mm/mV • Automatic The larger the selected measurement, the larger the waveform. Only the representation of the waveform changes; signal strength is not affected. NOTE If Automatic is selected, the system calculates the best gain based on the peak-to-peak amplitudes of all displayed leads and the selected display format. Changing the measurement here does not change the measurement set in System Configuration . |
| 150 Hz NOTE The initial measurement displayed is set in System Configuration > Resting ECG Setup . | Eliminates noise in the waveform by restricting which frequencies are included. Frequencies are measured in Hertz (Hz) and include the following options: <ul style="list-style-type: none"> • 20 Hz • 40 Hz • 100 Hz • 150 Hz Selecting a frequency eliminates signals that exceed that frequency. The smaller the frequency selected, the more signal is filtered out. For example, a filter of 40 Hz displays only signals at 40 Hz or less; signals greater than 40 Hz are ignored. Changing the measurement here does not change the measurement set in System Configuration . |
| Pace Enhance | Improves the readability of pacemaker ECGs. Options are On and Off . |
| More | Toggles between the first row of options (previous) and the second row of options (following). |

Table 7-2 ECG Options—Second Row

| Option | Description |
|---|---|
| Printer Leads NOTE The initial measurement displayed is set in System Configuration > Resting ECG Setup . | Selects which leads to include in the printout. Options are: <ul style="list-style-type: none"> • First 6 • Second 6 • Rhythm 6 • 12 Use this option only when conducting rhythm ECGs. For more information, see 7.5 Generating a Rhythm Report (Manual Recording) on page 79 . Changing the measurement here does not change the measurement set in System Configuration . |
| ADS | Toggles the anti-drift system (ADS) on and off . ADS helps reduce baseline drift. |

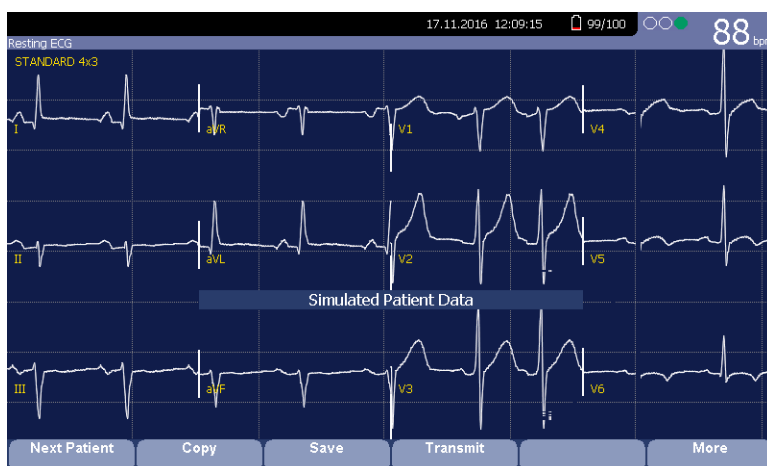
Continues on the next page

Table 7-2 ECG Options–Second Row (Table continued)

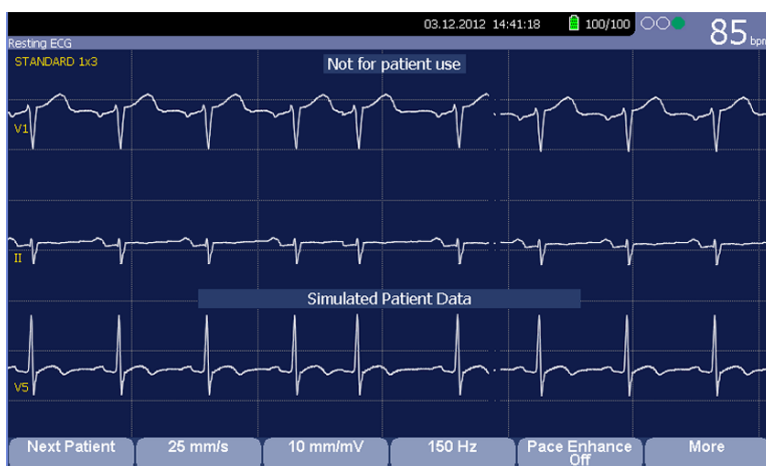
| Option | Description |
|------------------------|---|
| Full Disclosure | Press to start generating a Full Disclosure ECG report. See 7.3 Full Disclosure on page 75 for detailed instruction. |
| Main Menu | Exits Resting ECG and returns you to the Main Menu . |
| More | Toggles between the first row of options (previous) and the second row of options (following). |

7.2.3 Post-Acquisition Options

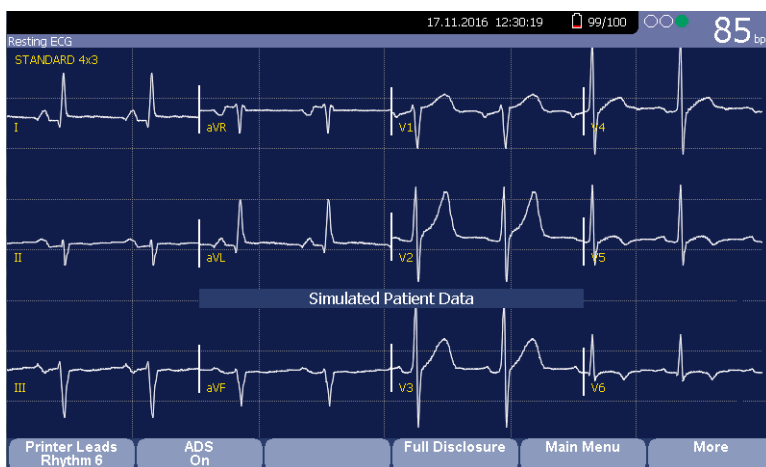
In addition to setup options, the Resting ECG functionality offers additional options after an ECG is acquired. The following screens and tables describe the option keys across the bottom of the display.



| Option | Description |
|---------------------|--|
| Next Patient | Displays two new options: <ul style="list-style-type: none"> • New Patient opens a blank Patient Information window. • Same Patient opens the Patient Information window populated with data from the previous patient. <p>NOTE</p> <p>Check the patient information before you start the next acquisition.</p> |
| Copy | Prints an additional (copy) ECG report. |
| Save | Stores the current ECG report. This option is available only if the internal storage option is enabled. |
| Transmit | Sends the current ECG report to the location defined on the Communication Setup window. This option applies only if a valid LAN communication option is enabled. Refer to 12 System Configuration on page 104 for more information. |
| RR Analysis | Allows you to enter into RR Analysis mode. |
| More | Returns to the setup options. For more details, refer to 7.2.2 ECG Options on page 71 . |



| Option | Description |
|---------------------|--|
| Next Patient | Opens the patient entry window allowing you to enter or select a new patient. |
| Speed | Changes the speed of the waveform on the display and printout. Changing the speed also changes the speed the wiper bar moves across the display. |
| Gain | Changes the magnitude of the ECG signal on the display or in the report. Measurement is in millimeter per millivolt (mm/mV). |
| Filter | Eliminates noise in the waveform by restricting which frequencies are included. Frequencies are measured in Hertz (Hz). |
| Pace Enhance | Standardizes the pace spike. Options are On and Off. |
| More | Toggles between the second and third row of acquisition options. |



| Options | Description |
|-----------------------------|--|
| Printer Leads Rhythm | Selects which leads to include in the printout. |
| ADS | Toggles the anti-drift system (ADS) on and off. ADS helps reduce baseline drift. |
| Full Disclosure | Select to start the full disclosure. |
| Main Menu | Exits the Resting ECG function and returns to the Main Menu. |
| More | Toggles between the second and third row of acquisition options. |

7.3 Full Disclosure

Full Disclosure allows you to acquire and save up to five minutes of ECG waveforms to print at a later time or view on a computer. You can manually cancel or finish acquisition at any time before the five minutes are concluded. Full Disclosure is optional and can be configured during system setup.

This section outlines the procedure for generating a Full Disclosure ECG report and describes the available setup, waveform, and output options.

7.3.1 Generating a Full Disclosure ECG Report

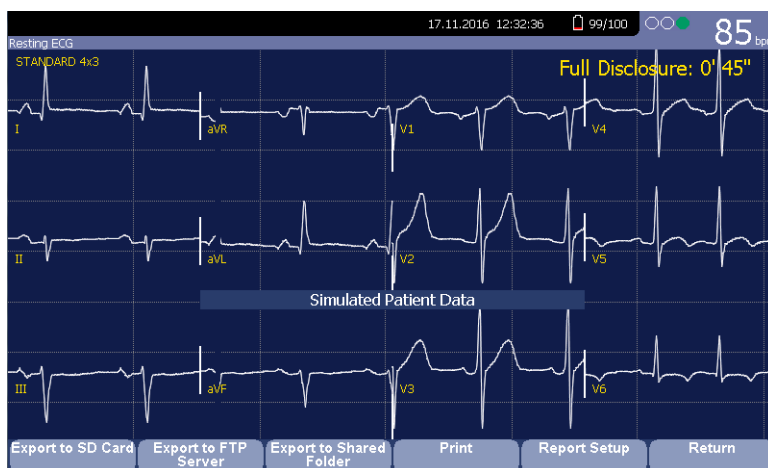
1. Configure the **Full Disclosure** setting in [12.2 Resting ECG Setup on page 108](#).
2. Prepare the patient as described in [4 Preparing the Patient on page 53](#).
3. From the **Main Menu**, press **Resting ECG** > **More** > **Full Disclosure** to open the **Full Disclosure** window.

The system automatically starts acquiring the full disclosure data, and the **Acquiring** message displays on the screen during the acquisition.

The system automatically completes the test after the pre-configured time, and you can continue with step 6.

Otherwise, go to step 4 or step 5.

4. Press **Finish** to complete acquiring the ECG. The following **Full Disclosure Report** window displays.



Continue with step 6.

5. Press **Cancel** to stop acquiring the ECG, and perform one of the following:
 - Press **Yes** to stop acquiring the ECG data and return to the **Resting ECG** window.
 - Press **No** to remain acquiring the ECG data, and continue with step 6.
6. In the **Full Disclosure Report** window, you can perform the following operations:

| Full Disclosure Report Window Field | Action |
|-------------------------------------|--|
| Export to SD Card | Press to export the ECG report to the SD card. |

Continues on the next page

| Full Disclosure Report Window Field | Action |
|-------------------------------------|--|
| Export to FTP Server | Press to export the ECG report to the configured FTP Server. See 12.5 Communication Setup on page 127 for detailed instruction on configuring the FTP server. |
| Export to Shared Folder | Press to export the ECG report to the configured Shared Folder. See 12.5 Communication Setup on page 127 for detailed instruction on configuring the Shared Folder. |
| Print | Press to print the ECG report to the thermal printer. |
| Report Setup | Press to setup the full disclosure report. See 7.3.2 Full Disclosure Report Setup on page 76 for detailed instructions. |
| Return | Press and then the following message displays: The current full disclosure record will be deleted. Do you want to continue? <ul style="list-style-type: none"> Press Yes to return to the Resting ECG window. Press No to remain in the current full disclosure report window. |

7.3.2 Full Disclosure Report Setup

1. Press **Report Setup** on the **Full Disclosure Report** window. The **Full Disclosure Report Setup** displays.
2. Perform the following actions to setup the full disclosure report format:

Full Disclosure Report Setup

Print

Report Format: one lead @ 25 mm/s

Lead: II

PDF Export Setup

Report Format: one lead @ 25 mm/s

Lead: II

| Fields | Description and Action |
|----------------------|---|
| Report Format | Click the drop-down arrow to determine how the full disclosure ECG report prints on the thermal printer. The choices are: <ul style="list-style-type: none"> • one lead @ 25mm/s • one lead @50 mm/s • 12 leads @ 25 mm/s |

Continues on the next page

| Fields | Description and Action |
|----------------------|--|
| Lead | <p>Click the drop-down arrow to determine which lead to print.</p> <p>The options are:</p> <ul style="list-style-type: none"> • I • II • III • aVR • aVL • aVF • V1 • V2 • V3 • V4 • V5 • V6 |
| Report Format | <p>Click the drop-down arrow to determine how the full disclosure ECG report exports to a PDF file.</p> <p>The options are:</p> <ul style="list-style-type: none"> • one lead @ 25mm/s |
| Lead | <p>Click the drop-down arrow to determine which lead to print on the PDF file.</p> <p>The options are:</p> <ul style="list-style-type: none"> • I • II • III • aVR • aVL • aVF • V1 • V2 • V3 • V4 • V5 • V6 |

7.4 Special Considerations

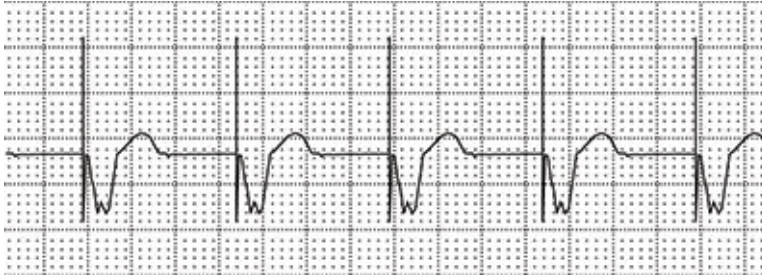
When recording ECGs, you need to make special considerations for the following situations:

- Recording ECGs of pacemaker patients
- Recording ECGs during defibrillation

7.4.1 Recording ECGs of Pacemaker Patients

Because of slow paper speed, pacer pulses cannot be displayed directly on the ECG recording. For example, with a paper speed of 50 mm/s and a pulse duration of only 0.5 ms, the width of the recorded pacer pulse would be only 0.025 mm.

If **Pace Enhance** is enabled, the recorder reduces the pulse amplitude and expands its width to make pacer pulses easier to identify. The system records the pulse with the correct polarity, a width of 5 ms, and equal amplitude in all leads. Depending on the polarity of the pacer pulse in leads I and II, the pacer pulse in lead III may be suppressed. The following figure of an ECG recording with pacer pulses shows the amplitude of the reverse current.



7.4.2 Recording ECGs During Defibrillation

NOTICE

EQUIPMENT DAMAGE

Damaged cables can cause mechanical problems.

Before connecting the cable to the device, check it for signs of physical damage. Do not use a damaged cable.

For patient safety, use only the original GE Healthcare patient cable.

WARNING



SHOCK HAZARD

Touching the patient, electrodes, or leadwires during defibrillation can cause a shock.

During defibrillation, do not touch the patient, the electrodes, or the leadwires.

Observe all defibrillator safety information.

This equipment is protected against the effects of cardiac defibrillator discharge to allow the ECG trace to return after defibrillation, as required by test standards.

The patient signal input is defibrillation-proof; it is not necessary to remove the ECG electrodes before defibrillating the patient if non-polarizing electrodes are being used.

When using stainless steel or silver electrodes, the defibrillator discharge current may cause the electrodes to retain a residual charge, causing an electrode polarization or DC offset voltage. This blocks ECG signal acquisition for several minutes. If polarizing electrodes are used, GE Healthcare recommends that you disconnect the leadwires from the patient before delivering the shock.

To prevent polarization, GE Healthcare recommends the use of non-polarizing disposable electrodes with defibrillation recover ratings as specified in AAMI EC12 3.2.2.4 (MMS PN 9623-105 Silver MacTrodes, MMS spec TP9623-003), which requires the polarization potential of an electrode pair not exceed 100 mV five seconds after a defibrillation discharge.

7.5 Generating a Rhythm Report (Manual Recording)

The **Resting ECG** mode allows you to generate Rhythm Reports, which are printed reports only. They do not have computer-generated interpretation or measurements, and you cannot store them to internal memory or transmit them. Use the following steps to generate a Rhythm Report.

1. Prepare the patient as described in [4 Preparing the Patient on page 53](#).
2. Verify that the system is in **Resting ECG** mode.
If the system is not in **Resting ECG** mode, on the **Main Menu** press **Resting ECG**.
3. Enter the patient data as described in [5 Entering Patient Information on page 57](#).
4. Adjust the **Speed**, **Gain**, and **Low Pass Filter** until the waveforms are configured as desired.
For more information, see [7.2.2 ECG Options on page 71](#).
5. If the patient has a pacemaker, press **Pace Enhance**.
For more information, see [7.2.2 ECG Options on page 71](#).
6. Press **Leads** to scroll through all 12 leads.
For more information on display formats, see [12.2 Resting ECG Setup on page 108](#).
7. Press **More > Printer Leads** to select the appropriate option.
For more information on the **Printer Leads** option, see [7.2.2 ECG Options on page 71](#).
8. Press **Rhythm** to begin recording the ECG.
9. Press **Stop** to stop the ECG recording.

If you press **Rhythm** after pressing **Stop**, the new report either begins printing immediately on the current sheet of paper or advances to a new page, depending on the setting of the field: **Start rhythm report on a new page**. This field is located on the **Resting ECG Setup** window. See [12.2 Resting ECG Setup on page 108](#) for details.

8 Arrhythmia Mode Recording

The Arrhythmia mode is part of the basic ECG cart system. The interface of the Arrhythmia mode is similar to the interface for the Resting ECG mode. For more information on the Resting ECG interface, see [7 Recording a Resting ECG on page 68](#).

8.1 Recording in Arrhythmia Mode

This section describes the process for recording an arrhythmia report, the waveform options, and the printing options.

8.1.1 Recording Arrhythmia ECGs

1. Prepare the patient as described in [4 Preparing the Patient on page 53](#).
2. Select **Main Menu > Arrhythmia**.
The **Enter Patient Data** window opens.
3. Enter the patient data as described in [5 Entering Patient Information on page 57](#).
4. Adjust the gain, speed, filter, and pacemaker enhancement as necessary.
Refer to [8.1.2 Arrhythmia Recording Options on page 81](#).
5. After the settings are adjusted as required, select **Start Recording** to begin the arrhythmia ECG.
6. After you have recorded an adequate amount of information, press **Stop Recording**.
Two new options become available: **Confirm Stop** and **Continue Recording**.
7. Do one of the following:
 - If you need to record additional information, press **Continue Recording**.
This returns to the recording mode. Repeat from step 6.
 - If you have determined enough information was recorded, press **Confirm Stop**.
Report options become available.

If you want to print the Arrhythmia recording, continue with [8.2.1 Printing an Arrhythmia Report on page 82](#).

8.1.2 Arrhythmia Recording Options

Table 8-1 Arrhythmia Options - First Row

| Option | Description |
|--|---|
| Start Recording | <p>Starts the arrhythmia reading.</p> <p>If you did not fill out the Patient Data to select a patient, you receive the following message: No Patient Selected. Do you want to continue without patient data?</p> <ol style="list-style-type: none"> 1. Select the No tab to continue. The Enter Patient Data window opens. 2. Enter the information on each page and select Save. 3. Select Start Recording. |
| 25 mm/s NOTE The initial measurement displayed is set in System Configuration > Arrhythmia Setup . | <p>Changes the speed of the waveform on the display and printout. Changing the speed also changes the speed at which the wiper bar moves across the display. Measurement is in millimeters per second (mm/s) and includes the following options:</p> <ul style="list-style-type: none"> • 25 mm/s • 50 mm/s • 12.5 mm/s - 5 mm/s • 12.5 mm/s <p>When the option includes two speeds (12.5 mm/s - 5 mm/s), the first speed is for the display and the second speed is for the printout.</p> <p>Changing the measurement here does not change the measurement set in System Configuration.</p> |
| 5 mm/mV NOTE The initial measurement displayed is set in System Configuration > Arrhythmia Setup . | <p>Changes the magnitude of the ECG signal on the display or in the report. Measurement is in millimeters per millivolt (mm/mV) and includes the following options:</p> <ul style="list-style-type: none"> • 5 mm/mV • 10 mm/mV • 20 mm/mV • 40 mm/mV • 2.5 mm/mV • Automatic <p>The larger the selected measurement, the larger the waveform. Only the representation of the waveform changes; signal strength is not affected.</p> <p>NOTE</p> <p>If Automatic is selected, the system calculates the best gain based on the peak-to-peak amplitudes of all displayed leads and the selected display format.</p> <p>Changing the measurement here does not change the measurement set in System Configuration.</p> |

Continues on the next page

Table 8-1 Arrhythmia Options - First Row (Table continued)

| Option | Description |
|--|--|
| 20 Hz NOTE The initial measurement displayed is set in System Configuration > Arrhythmia Setup . | Eliminates noise in the waveform by restricting which frequencies are included. Frequencies are measured in Hertz (Hz) and include the following options: <ul style="list-style-type: none"> • 20 Hz • 40 Hz • 100 Hz • 150 Hz Selecting a frequency eliminates signals that exceed that frequency. The smaller the frequency selected, the more signal is filtered out. For example, a filter of 40 Hz displays only signals at 40 Hz or less; signals greater than 40 Hz are ignored. Changing the measurement here does not change the measurement set in System Configuration . |
| More | Toggles between the first row of options (previous) and the second row of options (following). |

Table 8-2 Arrhythmia Options - Second Row

| Option | Description |
|---------------------|---|
| Pace Enhance | Improves the readability of pacemaker ECGs. Options are On and Off . |
| Patient Data | Opens the Patient Data Entry window. This tab is available only if you did not complete the Portent Data Entry window earlier. |
| Main Menu | Exits the Arrhythmia function and returns to the Main Menu . |
| More | Toggles between the first row of options and the second row of options |

8.2 Printing

You can manually generate an arrhythmia printout in a table format, an episode format, or a summary format.

8.2.1 Printing an Arrhythmia Report

Use the following procedure to print an Arrhythmia report.

1. Select the type of Arrhythmia report you want to print and press the appropriate function key.
 - To print the summary report, press **Print Summary**.
 - To print the table report, press **Print Table**.
 - To print the arrhythmia episodes, press **Print Episodes**.

Refer to [8.2.2 Arrhythmia Printing Options on page 82](#) for details.

2. Review the report as necessary.

For more information, refer to [8.3 Arrhythmia Codes on page 83](#).

8.2.2 Arrhythmia Printing Options

When printing an arrhythmia report, you have the following options:

| Option | Description |
|-----------------------|---|
| Print Summary | Prints a combined report that includes both the Table and Episode formats. |
| Print Table | Prints a breakdown of the recording in tabular format. The report includes: <ul style="list-style-type: none"> the analysis duration in minutes and seconds the artifact duration in minutes and seconds a code for each event type recorded the number of each event type recorded For a description of the possible event codes, refer to 8.3 Arrhythmia Codes on page 83 . |
| Print Episodes | Prints a standard waveform report of the recorded events. The signal from all recorded leads is printed and each event is marked with the corresponding arrhythmia code. For a description of the possible event codes, see 8.3 Arrhythmia Codes on page 83 . |
| Main Menu | Exits the Arrhythmia function and returns to the Main Menu . |
| More | Toggles between the arrhythmia recording options and the arrhythmia printing options. |

8.3 Arrhythmia Codes

The following table identifies the codes used on the Arrhythmia reports and the events they represent.

| Code | Arrhythmia Event |
|---------------|--|
| A | Artifact |
| ASYSTO | Asystole, limit value 3s |
| CPLT | Ventricular couplet (2 PVCs) |
| ESC | Ventricular escape beat |
| L | Learn phase |
| PAU1 | Pause of 1 missed beat |
| PAU2 | Pause of 2 missed beats |
| PCAP | Pacemaker capture |
| PERR | Pacemaker error |
| PSVC | Premature supraventricular contraction |
| PVC | Premature ventricular contraction |
| QRSL | Learned QRS complex |
| RUN | Ventricular run (3 PVCs) |
| VBIG | Ventricular bigeminy |
| VFIB | Ventricular fibrillation/flutter |
| VTACH | Ventricular tachycardia (>3 PVCs) |

9 RR Analysis

RR Analysis is an optional mode of the system. It detects hidden patterns underlying the complex dynamic phenomena of heart rate variability (HRV) and measures the cardiac RR intervals. This option is not available in the U.S.

9.1 RR Analysis Mode

This section outlines the procedure for generating an RR Analysis report and describes the available setup, waveform, and output options.

Table 9-1 RR Analysis Settings Window

| Option | Description |
|--------------------------|--|
| Start Test | Starts the RR Analysis test. |
| Patient Data | Opens the Patient Data Entry window. |
| RR Analysis Setup | Configures the RR Analysis test. See 9.1.1 RR Analysis Setup on page 84 for details. |
| Main Menu | Exits the RR Analysis mode and returns to the Main Menu . |

9.1.1 RR Analysis Setup

The **RR Analysis Setup** function allows you to configure the RR Analysis report, including:

- Target
 - Record lead
 - Waveform parameters
 - Report options
1. Prepare the patient as described in [4 Preparing the Patient on page 53](#).
 2. From the device **Main Menu**, press **RR Analysis**.
 3. Press **Patient Data** and enter the patient data as described in [5 Entering Patient Information on page 57](#).

4. Press **RR Analysis Setup** and adjust the setup options as necessary.

RR Analysis Settings

Target

Record Lead

Line Filter ☒

Pace Enhancement ☐

Gain [mm/mV]

Speed [mm/s]

Low Pass Filter [Hz]

ADS ☒

Rhythm Record ☒

RR Table ☒

| Field | Description |
|--------------------|---|
| Target | <p>Selects the target of the test.</p> <p>Available options are:</p> <ul style="list-style-type: none"> • 100 Beats • 200 Beats • 300 Beats • 400 Beats • 500 Beats • 1 min • 2 min • 3 min • 4 min • 5 min |
| Record Lead | <p>Selects which rhythm lead is displayed and stored.</p> <p>Available options are:</p> <ul style="list-style-type: none"> • I • II • III • aVR • aVL • aVF • V1 • V2 • V3 • V4 • V5 • V6 |

Continues on the next page

| Field | Description |
|-----------------------------|---|
| Line Filter | Enables/disables the line filter defined in Country Setup . See 12.6 Country Setup on page 137 for more information. |
| Pace Enhancement | Improves the readability of pacemaker ECGs. Options are On and Off . |
| Gain [mm/mV] | <p>Sets the magnitude of the ECG signal. Measurement is in millimeters per millivolt (mm/mV) and includes the following options:</p> <ul style="list-style-type: none"> • 2.5 mm/mV • 5 mm/mV • 10 mm/mV • 20 mm/mV • 40 mm/mV • Automatic <p>The larger the selected measurement, the larger the waveform. Only the representation of the waveform changes; signal strength is not affected.</p> <p>NOTE</p> <p>If Automatic is selected, the system calculates the best gain based on the peak-to-peak amplitudes of all displayed leads and the selected display format.</p> |
| Speed [mm/s] | <p>Changes the speed of the waveform on the display and printout. Changing the speed also changes the speed at which the wiper bar moves across the display.</p> <p>Measurement is in millimeters per second (mm/s) and includes the following options:</p> <ul style="list-style-type: none"> • 12.5 mm/s • 25 mm/s • 50 mm/s |
| Low Pass Filter [Hz] | <p>Eliminates noise in the waveform by restricting which frequencies are included. Frequencies are measured in Hertz (Hz) and include the following options:</p> <ul style="list-style-type: none"> • 20 Hz • 40 Hz • 100 Hz • 150 Hz <p>Selecting a frequency eliminates signals that exceed that frequency. The smaller the frequency selected, the more signal is filtered out. For example, a filter of 40 Hz displays only signals at 40 Hz or less; signals greater than 40 Hz will be ignored.</p> |
| ADS | Enables or disables ADS (Anti Drift System). |
| Rhythm Record | Enables/disables the printing of the rhythm lead waveform on the report. |
| RR Table | Enables/disables the printing of the RR table on the report. |

5. Press **Save** to record your settings.
6. Continue with [9.1.2 Acquiring a Recording for an RR Analysis Report on page 87](#).

9.1.2 Acquiring a Recording for an RR Analysis Report

1. Press **Start Test**.

The device begins to acquire the ECG. The target beats, acquired beats, and acquired time are updated in real time on the screen.

2. While the ECG is being acquired, you can do any of the following:

- Change the **Speed**.
- Change the **Gain**.
- Change **Low Pass Filter**.
- Toggle **Pace Enhancement**.

For more information on any of these options, see [12.17 RR Analysis Setup on page 155](#).

When the target is achieved, the system automatically stops, and displays a preview of the summary results, histogram, trendgram, and output options.

3. While reviewing the preview, execute one of the output options described in [9.1.3 Output Options on page 87](#).

9.1.3 Output Options

The following options are available after the RR Analysis test completes:

| Option | Description |
|--------------------------|--|
| Press Return . | Discards the reading and returns to pre-test status. Repeat the steps in 9.1.2 Acquiring a Recording for an RR Analysis Report on page 87 . |
| Press Main Menu . | Discards the reading, exits the RR Analysis mode, and returns to the Main Menu . |
| Press Print . | Accept the reading and prints the RR Analysis Report on the thermal printer. |
| PDF Export | Accepts the reading and exports the RR Analysis Report to a PDF file. |

10 Stress Testing

The Stress mode is an optional feature that allows you to conduct stress tests with any of the following devices.

| Stress Equipment | Description |
|---------------------------------------|---|
| Supported treadmills and ergometers | Supported equipment connects to the ECG cart system through the serial port labelled COMM A on the back of the device. You can control the equipment through this connection. When a test phase changes, a signal is sent from the system to the equipment to change the speed, grade, or load, as appropriate. You can also manually override the equipment from the ECG cart keyboard. See 10.1.2 Stress Test Keys on page 90 , for more information. Supported equipment includes the following: <ul style="list-style-type: none"> • T2000 and T2100 • eBike |
| Ergometers with remote start | This equipment also connects to the ECG cart system through the serial port labelled COMM A on the back of the device. However, the system does not control the equipment. Instead, when the equipment changes load, it signals the system, which changes test stages accordingly. |
| Unsupported treadmills and ergometers | Unsupported equipment does not connect to the ECG cart system. Instead of signaling the equipment when a test phase changes, the system notifies the operator, who manually adjusts the equipment's parameters. |
| Master Step | This equipment does not connect to the system. The system emits a tone to instruct the patient when to take a step. |

Stress tests include the following parameters:

- Patient data
- Waveform speed and gain
- Pacemaker enhancement
- Finite residual filter
- Printer leads
- Report format
- Target heart rate
- Test protocol

You cannot store the results of the test to internal storage or the external SD card. Instead, you must print the results. You can select any of the following report formats:

- **Summary Report**
- **Tabular Summary**
- **Trend Report**
- **ST Trend Report**
- **ST Summary Report**
- **Episode Report**

To use the Stress ECG mode, you must meet the following conditions:

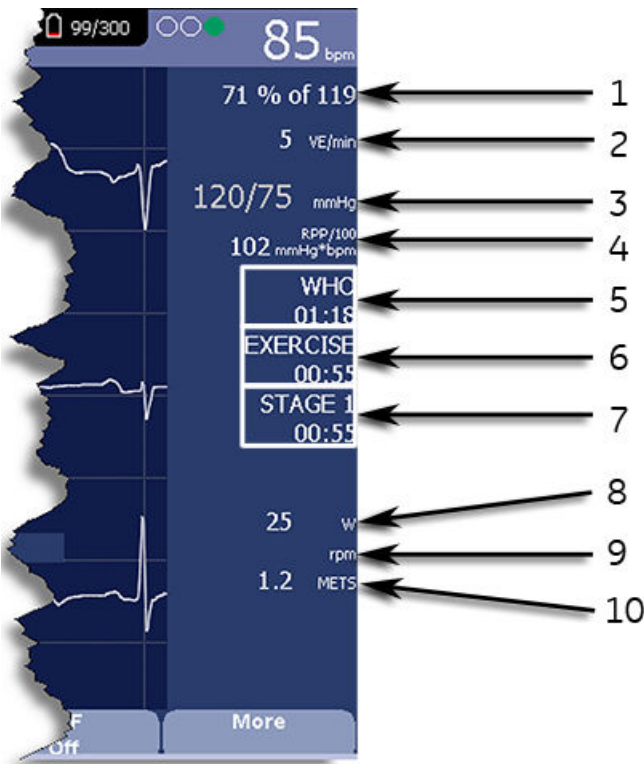
- ERGO option option **ERGO** You must purchase the ERGO option and add it to the system.
For more information, see [12.13 Options Setup on page 151](#).
- You must select the correct equipment on the **Basic System Setup**.
For more information, see [12.1 Basic Setup on page 104](#).
- You must configure the **Stress ECG Setup** correctly.
For more information, see [12.4.1 Stress ECG Settings on page 121](#).

10.1 Stress Mode Interface

The Stress ECG mode uses two special features: a *Stress Test Information Bar* and *Stress Test Keys*. It also offers several configuration options.

10.1.1 Stress Test Information Bar

The **Stress ECG** mode adds an information bar on the right side of the ECG cart system display, as seen in the following illustration. Descriptions of the bar's key elements follow the illustration.



| Item Number | Feature | Description |
|-------------|-------------|---|
| 1 | Target Rate | The target heart rate and the current heart rate's percentage of that target. |

Continues on the next page

| Item Number | Feature | Description |
|-------------|----------------|---|
| 2 | VE/min | Ventricular ectopics per minute (also known as premature ventricular contraction). This is calculated as the sum of all Premature Ventricular Contractions (PVCs) and Ventricular Escape beats (ESCs) detected in the past 60-second interval. |
| 3 | Blood Pressure | Blood pressure in mmHg (millimeters of mercury) or kPa (kilopascals), depending on the <i>Blood Pressure Unit</i> setting on the <i>Country Settings</i> window. For more information, see 12.6 Country Setup on page 137 . |
| 4 | RPP/100 | The Rate-Pressure Product divided by 100. The rate-pressure product is calculated by multiplying the systolic blood pressure with the current heart rate. The product is then divided by one hundred. For example, an RPP of 10200 displays as 102. |
| 5 | Protocol | Name of the current test protocol and its total duration in minutes and seconds. |
| 6 | Phase | Name of the current test phase and its total duration in minutes and seconds. |
| 7 | Stage | Name of the current test stage and its total duration in minutes and seconds. Displays in red when the system is in manual mode. |
| 8 | Speed/Load | Speed of the treadmill or load of the ergometer. Speed may be displayed as km/h (kilometers per hour) or mph (miles per hour) depending on the <i>Speed Unit</i> selected on the <i>Country Settings</i> window. Load is displayed in watts. For more information, see 12.6 Country Setup on page 137 . |
| 9 | Grade/RPM | The grade for a treadmill, in percent, or the revolutions per minute for an ergometer. |
| 10 | METS | Metabolic equivalent of the current exercise level. |

10.1.2 Stress Test Keys

The Stress keys are described in [2.2.1.6 Stress Keys on page 36](#).

10.1.3 Stress Options

This ECG cart system provides several options for configuring a Stress ECG. The options, presented as option keys across the bottom of the display, are listed in the following tables.

Table 10-1 Stress Option Keys – First Row

| Option | Description |
|---------------------|--------------------------------------|
| Patient Data | Opens the patient data entry window. |

Continues on the next page



Table 10-1 Stress Option Keys – First Row (Table continued)

| Option | Description |
|------------------------|--|
| Sweep Speed | <p>Changes the speed of the waveform on the display and printout. Changing the measurement also changes the speed of the wiper bar on the display.</p> <p>The measurement is in millimeters per second (mm/s) and includes the following options:</p> <ul style="list-style-type: none"> • 25 mm/s • 50 mm/s • 12.5 mm/s - 5 mm/s • 12.5 mm/s <p>When the option includes two measurements (12.5 mm/s - 5 mm/s), the first speed is for the display and the second speed is for the printout.</p> |
| Gain | <p>Changes the magnitude of the ECG signal on the display or in the report. The measurement is in millimeters per millivolt (mm/mV) and includes the following options:</p> <ul style="list-style-type: none"> • 5 mm/mV • 10 mm/mV • 20 mm/mV • 40 mm/mV • 2.5 mm/mV • Automatic <p>The larger the selected measurement, the larger the waveform. Only the representation of the waveform changes; signal strength is not affected.</p> <p>NOTE</p> <p>If Automatic is selected, the system calculates the best gain based on the peak-to-peak amplitudes of all the displayed leads and the selected display format.</p> |
| Low Pass Filter | <p>Toggles through the Low Pass Filter options: 20 Hz, 40 Hz, 100 Hz, and 150 Hz. It defaults to the setting selected on the Stress Setup window. (See 12.4.1 Stress ECG Settings on page 121 for more information.)</p> <p>If the ADS filter type was selected in Stress Setup, this softkey is displayed regardless of whether the filter is on or off. If the FRF filter type was selected in Stress Setup, this softkey is displayed only if the filter is off.</p> |
| ECG Filter Type | <p>Toggles on and off the ECG filter type (ADS or FRF) selected on the Stress Setup window. In addition, if the FRF filter type was selected, toggling the filter off also displays the Low Pass Filter softkey.</p> |
| More | <p>Toggles between the first and second row of options.</p> |

Table 10-2 Stress Text Option Keys – Second Row

| Option | Description |
|---------------------|---|
| Pace Enhance | Increases the readability of pacemaker ECGs. Options are On and Off . |

Continues on the next page

Table 10-2 Stress Text Option Keys – Second Row (Table continued)

| Option | Description |
|------------------------|---|
| Printer Leads | <p>Selects which leads to include in the printout. Options are:</p> <ul style="list-style-type: none"> • First Six • Second Six • Rhythm Six • 12 <p>Use this setting only when conducting rhythm ECGs. For more information, see 7.5 Generating a Rhythm Report (Manual Recording) on page 79.</p> |
| Select Protocol | Selects a predefined set of test criteria. For more information, see 12.4.2 Editing Stress Protocols on page 124 . |
| Report Format | Selects the components and episodes to include in the report. Allows you to override the defaults set on the Stress ECG Setup window. For more information, see 12.4.1 Stress ECG Settings on page 121 . |
| Target HR | Enter the maximum heart rate calculated for the patient based on weight, gender, age, and condition. The ECG cart system monitors the heart rate against this target. |
| More | Toggles between the first, second, and third row of options. |

Table 10-3 Stress Option Keys – Third Row

| Option | Description |
|------------------|--|
| Main Menu | Exits the Stress ECG function and returns to the Main Menu . |
| More | Toggles between the first, second, and third row of options. |

10.2 Conducting Stress Tests

There are two basic processes for conducting a stress test:

- Conducting a stress test with a treadmill or ergometer
- Conducting a stress test with a Master's Step device

Each process is described in this section. For information on the **Stress Mode** interface, see [10.1 Stress Mode Interface on page 89](#).

10.2.1 Conducting a Stress Test with a Treadmill or Ergometer

Use the following instructions to conduct a stress test with a treadmill or ergometer. The process is essentially identical for all devices with only minor differences between supported equipment, unsupported equipment, and ergometers with remote start. Deviations for specific accessories are noted where appropriate.

WARNING**PATIENT INJURY**

When on a moving treadmill, a patient could fall and sustain an injury.

To minimize the possibility of a falling caused by the belt's sudden movement, have the patient step onto the belt only after it begins moving.

When conducting stress tests on a supported treadmill, press the **Stop TM** button twice to immediately stop the belt in the case of an emergency (for example, if the patient stumbles or falls while the belt is moving).

1. Prepare the patient as described in [4 Preparing the Patient on page 53](#).
2. On the **Main Menu** press the **Stress ECG** option.
The **Enter Patient Data** window opens.
3. Enter patient data as described in [5 Entering Patient Information on page 57](#).
4. Adjust the stress options as necessary:
This includes the speed and gain, finite residual filter, pacemaker enhancement, printer leads, test protocol, report format, and target heart rate. For more information on setting these options, see [10.1.3 Stress Options on page 90](#).
5. Record a preliminary ECG.
This may be a seated, standing, supine, or hyperventilating ECG, depending on the requirements of the selected protocol.
6. Begin the pretest phase.
 - a. Have the patient get on the device.
 - b. Press the **Pretest** key.
 - c. Allow the patient to warm up before beginning the exercise phase of the test.

NOTE

On supported treadmills, press **Start TM** to start the belt.

7. When the patient is ready to begin the stress test, press the **Exercise** key.
During the test, you can use the stress keys to hold the current stage, enter blood pressure, add a comment, change the displayed leads, and toggle the finite residual filter. With supported equipment, you can also use the stress keys to adjust the equipment's speed, grade, or load. With unsupported equipment, the equipment must be adjusted manually at the equipment itself.
For more information on making these adjustments, see [10.1.2 Stress Test Keys on page 90](#).
8. When the exercise phase is complete, press the **Recovery** key to begin the recovery phase of the test.

NOTE

When using an ergometer with remote start, you do not need to press the **Recovery** key because the recovery phase begins automatically at the end of the last stage. However, you can press the **Recovery** key to begin the recovery phase before the last stage ends.

On supported treadmills, the belt begins to slow and the grade drops to 0%. On supported ergometers, the load begins to lighten. On unsupported treadmills and ergometers, these adjustments must be made manually.

Continue to monitor the patient and record the ECG until the device stops.

9. When the recovery phase is over, press the **Test End** key.

The menu options at the bottom of the screen change to **Confirm Test End** and **Continue Test**. Do one of the following:

- To return to the test, press **Continue Test**.

The previous menu options return. Continue to record the ECG as needed. When you are done, repeat this step.

- To stop the test, press **Confirm Test End**.

The menu options change. Continue to step 10.

10. Do any of the following, as necessary.

- Press **Next Patient** to test another patient.

You are warned that testing another patient discards the results of the current test. Do one of the following:

- Press **No** to cancel the change in patients and return to the current test.

You can either print the current test report or change the report formats.

- Press **Yes** to erase the current test results and test a new patient.

Repeat from step 3 for the next patient.

- Press **Print** to print the test's report.

The report prints with the selected format options.

- Press **Report Format** to modify the report format.

The **Report Format** window opens. Select the options you want to include in the report and press **Save**. You can now print the test's report.

10.2.2 Conducting a Stress Test with a Master's Step Device

Use the following instructions to conduct a stress test with a Master's Step device, if it is selected in **Basic Setup**.

1. Prepare the patient as described in [4 Preparing the Patient on page 53](#).

2. On the **Main Menu** press **Stress ECG**.

The **Enter Patient Data** window opens.

3. Enter patient data as described in [5 Entering Patient Information on page 57](#).

Be sure you enter accurate information for **Date of Birth**, **Gender**, and **Weight**. The number of steps is determined by these three parameters.

For more information on using Master's Step, see [B Master Step Data on page 183](#).

4. Adjust the stress options as necessary:

This includes the speed and gain, finite residual filter, pacemaker enhancement, printer leads, test protocol, report format, and target heart rate. For more information on setting these options, see [10.1.3 Stress Options on page 90](#).

5. Record a preliminary ECG.

This may be seated, standing, supine, or hyperventilating, depending on the requirements of the selected protocol.

6. Begin the pretest phase to allow the patient to warm up.

- a. Remove the leadwires from the patient, but leave on the electrodes.

This prevents the patient from tripping on the leadwires during the test.

- b. Instruct the patient to take a step whenever the system beeps.

- c. Press the **Pretest** key.

7. Press the **Exercise** key to begin the test.

The duration of the exercise phase is dependent on the selected protocol:

- **SINGLE** is 90 seconds
- **DOUBLE** is 180 seconds
- **TRIPLE** is 270 seconds

When the test is complete, the first **POST EXER.** stage begins and the **ELECTR.ON** message is displayed.

8. Reattach the leadwires to the electrodes.

The median report prints at pre-configured intervals during the post exercise stages. When the last post exercise stage is complete, a summary report with trends and tables prints.

11 Managing Internal Storage

The **File Manager** provides an interface to the system's optional internal storage. It provides the tools to:

- Import records from an external source
- Print the internal storage directory
- Search stored records
- Edit a record's patient data
- Delete records
- Print records
- Transmit records to an external device
- Export records to a secure digital card, shared directory, or FTP server

You can print resting ECGs or save them to internal storage. You can only print arrhythmia and stress ECGs.

You can store resting ECGs automatically or manually:

- To save resting ECG records automatically, on the **Resting ECG Settings** window, select the **Auto Store ECG** check box. For more information, see [12.2 Resting ECG Setup on page 108](#).
- To save resting ECG records manually, after the resting ECG is acquired, press **Save**. For more information, see [7.2.3 Post-Acquisition Options on page 73](#).

To enable internal storage, you must enable the M100 option, **Internal Storage for 100 ECGs**, or the M200 option, **Internal Storage for 200 ECGs** (at a 500 Hz sampling rate).

11.1 Importing Records

In addition to saving ECGs recorded with the system, you can also import ECG records to internal storage from the following sources:

- Secure Digital (SD) cards
- CardioSoft/CS systems connected via serial port or modem
- MUSE systems connected via modem

No additional set up is required to import from an SD card.

To import data via serial port or modem you need to do the following:

- Purchase and activate the appropriate communications option.
For more information, see [12.13 Options Setup on page 151](#).
- Configure the system's data communication settings.
For more information, see [12.5 Communication Setup on page 127](#).

NOTE

Imported records have a **Sent** status of **Recv** and you cannot edit, transmit or export them.

Use the following instructions to import a record into internal storage:

1. On the **Main Menu**, press **File Manager**.

The **File Manager** window opens.

2. Press **Import**.

The function keys change.



3. Select the appropriate import source from the following options:

- To import ECGs via serial port, press **Serial**.

The serial port opens. The system waits while the external device transmits the records.

- To import ECGs via modem, press **Modem**.

The modem initializes. The system waits while the external device transmits records.

- To import ECGs from an SD card, insert the SD card and press **SD Card**.

A list of the available ECGs on the card opens. Continue with step 4.

4. Select the records you want to import from the SD card.

5. When the correct records are selected, press **Import**.

11.2 Printing the File Manager Directory

Use the following instructions to print the directory of ECGs stored in internal memory:

1. On the **Main Menu** press **File Manager**.

The **File Manager** window opens.

2. Press **Print Directory**.

The directory prints on the writer.

11.3 Finding Records

The **File Manager** may have up to 200 records to manage (if the M200 option is enabled), making it difficult to find a specific record. To help you locate a record or a group of records, use the following instructions.

1. On the **Main Menu**, press **File Manager**.

The **File Manager** window opens.

2. Press **Search**.

The **Enter Search Criteria** window opens.

File Manager
Internal Directory Listing - Compatible Files: 1 Selected Files: 0

| Patient Name | Patient ID | Date | Time | Confirmed | Sent | Order Number |
|-----------------|------------|------|------|-----------|------|--------------|
| Soliman, Pietro | | | | | | |

Enter search criteria

Last Name

First Name

Patient ID

Date - -

Time :

Sent

Confirmed

Order Number

Search Clear All Return

3. Enter your search criteria.
4. Press **Search**.
The **File Manager** retrieves all the records that match your search criteria.
5. To clear the search results, do one of the following:
 - Press **Main Menu > File Manager**.
 - Press **Search > Return**.
 - Press **Search > Clear All > Search**.

11.4 Editing Patient Data

Use the following instructions to edit a record's patient data:

1. On the **Main Menu** press **File Manager**.
The **File Manager** window opens.
2. Press **Select**.
This enters the **File Manager** into **Select** mode.
3. Use the **trimpad** to select the record you want to edit.

NOTE

You cannot edit the patient data for records that were imported to internal storage. Imported records have a **Sent** status of **Recv**.

4. Press **Edit**.
The **Enter Patient Data** window opens.

The screenshot shows a software interface with a 'File Manager' window. A modal dialog box titled 'Enter Patient Data' is open, allowing for the entry or editing of patient information. The fields are as follows:

- Patient ID: 0000000001039048
- Last Name: Soloman
- First Name: Pietro
- Date of Birth: 22.03.1975 (format DD.MM.YYYY)
- Height: 140 cm
- Weight: 59.0 kg
- Gender: Male (dropdown menu)
- Phone Number: (empty field)
- Pacemaker: (unchecked checkbox)

At the bottom of the dialog box is a 'Page Down' button. The background window shows a table with columns for 'Patient Name' and 'Order Number', with 'Soloman, Pietro' listed under Patient Name.

5. Edit the information as appropriate.

For instructions on editing patient information, see [5 Entering Patient Information on page 57](#).

6. After the information is updated, press **Save**.

The updated information is saved, and you return to the **File Manager** window.

NOTE

If you only edit demographic information, the record is still transmitted to the MUSE system as an unconfirmed record.

11.5 Previewing Records

Use the following instructions to preview recorded patient data:

1. From the **Main Menu**, press **File Manager**.
The **File Manager** window opens.
2. Press **Select** and use the **trimpad** to select the record you want to preview.
3. Press **Preview**.
A window opens with the record for you to review.
4. After reviewing the record, press **Return** and return to the **File Manager**.

11.6 Deleting Records

Use the following instructions to delete all records from internal storage:

1. On the **Main Menu**, press **File Manager**.
The **File Manager** window opens.
2. Do one of the following.
 - To delete select records, press **Select** and use the **trimpad** to select the record(s) you want to delete.
 - To delete all the records in storage, press **Select All**.

3. Press **Delete**.

A window opens and prompts you confirm that you want to delete the selected record(s).

4. Do one of the following:
 - To cancel the deletion, press **No**.
 - To delete the record(s), press **Yes**.

11.7 Printing Records

Use the following instructions to print records:

1. On the **Main Menu**, press **File Manager**.

The **File Manager** window opens.

2. Do one of the following:
 - To print select records, press **Select** and use the **trimpad** to select the record(s) you want to print.
 - To print all the records in storage, press **Select All**.

3. Press **Print**.

The selected records are printed on the writer.

11.8 Transmitting Records

Use the following instructions to transmit records from internal storage to an external device.

Before transmitting a record, you must do the following:

- Purchase and activate a communication option.
See [12.13 Options Setup on page 151](#) for more information.
- Configure data communications.
See [12.5 Communication Setup on page 127](#) for more information.
- Connect the device to the communication option.
 - To set up a LAN connection to a CardioSoft/CS or MUSE system, see [3.6 Connecting the LAN Option on page 50](#).
 - To set up a WLAN connection to a CardioSoft/CS or MUSE system, see [3.6 Connecting the LAN Option on page 50](#).

NOTE

For more information on setting up a LAN connection to a MUSE system, refer to the *LAN Option Installation and Troubleshooting Guide*. For more information on setting up a LAN connection to a CardioSoft/CS system, refer to the LAN option to CardioSoft/CS connectivity server.

For more information on setting up a WLAN connection to a MUSE or CardioSoft/CS system, refer to the *MobileLink Wireless Communication Installation Manual*. To locate the part numbers for these manuals, refer to “Related Documents” in the service manual.

Use the following procedure to transmit records:

1. On the **Main Menu**, press **File Manager**.
The **File Manager** window opens.
2. Do one of the following:
 - To transmit select records, press **Select** and select the record(s) you want to transmit.

NOTE

You cannot transmit records that were imported to internal storage. Imported records have a **Sent** status of **Recv**.

- To transmit all the records in storage, press **Select All**.
3. Press **Transmit**.
One of two things happens, depending on the number of locations defined in **Communications Setup**:
 - If only one location is defined, the files are transmitted to the default location.
 - If multiple locations are defined, a window listing the locations opens. Select the correct location and press **OK**.

11.9 Exporting Records

You can export records from internal storage to a Secure Digital card or a shared directory, in either a Hilltop/XML or PDF format. The maximum number of records you can export in XML format is determined by which storage option is enabled:

- If **M100** is enabled, the maximum is 100.
- If **M200** is enabled, the maximum is 200 (with a sampling rate of 500 Hz).
- Records exported in PDF format have no maximum limit.

NOTE

The SD card capacity and manufacturer determine data transfer rates and storage space. This may affect the time required to read or write to the SD card. It may also limit the number of records that you can store on the card.

11.9.1 Setting Up Export Options

The requirements for setting up export differ depending on the export method:

- To export XML data to an SD card, you must first enable Export XML in **Communication Setup**.
- To export PDF files to an SD card, you must first enable the **PDFC** (PDF Export) system option. Refer to [12.13 Options Setup on page 151](#) for details.
- To export either Hilltop/XML or PDF to a shared directory, you must do the following:
 - Purchase and activate the **LANC** option or **WIFC** option.
See [12.13 Options Setup on page 151](#) for details.
 - Define the shared directory setting on **Communications Setup**.
See [12.13 Options Setup on page 151](#) for details.

11.9.2 Exporting Records

Once the necessary configurations are complete, use the following instructions to export records from internal storage:

1. On the **Main Menu**, press **File Manager**.

The **File Manager** window opens.

2. Select the record(s) you want to export.

- To export select records, press **Select** and use the **trimpad** to select the records you want to export.

NOTE

Records that are imported to internal storage cannot be exported from internal storage in Hilltop or XML formats; those records can be exported in PDF format. Imported records have a **Sent** status of **Recv**.

- To export all records in storage, press **Select All**.

3. Press **More > Export**.

The function keys change. Depending on which options were activated, the function keys may include **Hilltop XML**, **PDF**, and **Return**.

4. If you are exporting to an SD card, insert the card into the SD card slot.

Make sure the card has sufficient free space for the selected records and that it is not write-protected.

NOTE

If you do not enter the SD card into the SD card slot, you receive the following warning when attempting to export data to the card:

SD Card is not present.

Refer to [15.4.1 SD Card Not Present on page 173](#) for further instructions.

5. Press the appropriate function key:

- To export in both XML and Hilltop formats, press **Hilltop XML**.
- To export in PDF format, press **PDF**.
- To return to the previous set of function keys, press **Return**.

If you press **Hilltop XML** or **PDF**, one of two things happens, depending on your system configuration:

- If a shared directory was configured, the **Select Export Destination** window opens.

Go to step 6.

- If a shared directory was not configured, the records are automatically exported in the selected format to the SD card.

When the export is complete, one of two things happens, depending on the selected format:

- For the **Hilltop XML** format, the screen clears and the function keys change.
- For the **PDF** format, a summary window opens with the number of records that exported successfully and the number that failed to export. Press **OK** to close the summary window.

If you want to select additional records to export, return to step 2 or continue to step 6.

6. In the **Select Export Destination** window, select the appropriate export destination:

- To export to an SD card, select **SD Card**.
- To export to the shared directory, select **Shared Directory**.
- To export to the FTP server, select **FTP Server**.

NOTE

When exporting to a shared directory or an FTP server, the device logs on to the directory or FTP server with the user name and password defined on the **Communications Setup** window. If either of those values are incorrect, you receive an error message. Correct the user name and password on the **Communications Setup** window and repeat the export process.

7. Press **OK**.

12 System Configuration

System Configuration provides access to functions that allow you to customize the system settings and to utilities to help manage those settings. This chapter describes the settings managed by each function and the process followed by each utility.

NOTE

Configuration changes can cause data loss. After making configuration changes, you **MUST** return to the **Main Menu** to ensure the changes are saved.

Depending on which options were activated, some of these functions may not be available on your system.

12.1 Basic Setup

The **Basic Setup** function allows you to define the following information:

- Institutional identification
- Default physicians
- System settings
- ERGO option Stress test accessory (if the **ERGO** stress test option is activated)
- System security
- Time servers

NOTE

You must add physicians in **User Setup** before they can be picked as default physicians. For more information, see [12.9 User Setup on page 144](#).

For more information on the **ERGO** and **CFRA** options, see [12.13 Options Setup on page 151](#).

To access **Basic Setup**, on the **Main Menu**, press **System Configuration > Basic Setup**.

The following tables describe each setting available on **Basic Setup**.

Basic System Setup

Institution

Name

Street

City

Ordering Physician

Referring Physician

Attending Physician

Technician

Location

Site#

Cart#

Test Patient (temporary) ☐

Page Down

| Field | Description |
|---------------------------------|--|
| Name | The name of the institution. |
| Street | The street address of the institution. |
| City | The city where the institution is located. |
| Ordering Physician | The physician who ordered the ECG. Defaults on any patient records created on the system. |
| Referring Physician | The physician who referred the patient. Defaults on any patient records created on the system. |
| Attending Physician | The physician who supervised the ECG. Defaults on any patient records created on the system. |
| Technician | The technician who conducted the ECG. Defaults on any patient records created on the system. |
| Location | Location ID where the device is located. Defaults on any patient records created on the system. |
| Site # | This field is required to store ECG reports on a cardiology information system such as the MUSE system. |
| Cart # | Unique cart number of the device. Defaults on any patient records created on the system. |
| Test Patient (temporary) | <p>Enables/disables simulated ECGs. When enabled, simulated waveforms are generated in the resting, arrhythmia, RR analysis, or stress ECG functions. This is useful for demonstration, training, or testing purposes.</p> <p>NOTE</p> <p>This setting clears when the system is reset.</p> |

System Settings Page Up

Power up mode Resting ECG

Display Colors dark blue

ECG Grid on Display ☒

Anti-Aliasing of ECG Waveforms ☒

☒ Auto Standby

Disable wireless when in standby mode ☒

Auto Standby Time (1-255 min) 5

Page Down



| Field | Comment |
|--|---|
| Power up mode | Determines which screen is displayed when the system is powered on. Available options are: <ul style="list-style-type: none"> • Resting ECG (default) • Arrhythmia • Main Screen • Stress ECG • Order Manager |
| Display Colors | Determines the appearance of the ECG display. Select a color combination that is legible for you. |
| ECG Grid on Display | Determines whether a grid is displayed behind the waveforms. A grid may make reading the ECG easier. The default is on . |
| Anti-Aliasing of ECG Waveforms | Determines whether anti-aliasing is applied to waveforms to reduce distortion caused by the video display. The default is on . |
| Auto Standby | Determines whether the device automatically enters standby mode if it is inactive for a predefined time limit. It is enabled by default. If this field is checked, the following two fields become available (Disable Wireless When Standby and Auto Standby Time (1-255 min)). |
| Disable Wireless When in Standby mode | Determines whether the wireless function is disabled while the device enters the standby mode. It is disabled by default. NOTE If the embedded wireless module is installed, this option is disabled and cannot be enabled. |
| Auto Standby Time (1-255 min) | Identifies the amount of time, in minutes, that the device can remain inactive before it enters standby mode. Auto Standby uses this field. The default value is 5 mins. |

System Security Setup
Page Up

☒ High Security Mode
☐ Audit Trail
☐ Link Technician with login user
☐ Auto Logoff
Auto Logoff Time (1-255 min)

Time Server Settings

☐ Automatically synchronize with Time Server
Time Server Name
Last synchronization at
Last synchronized from Time Server

Input Method Settings

☐ Enable Data Retrieval
Query Key
Data Retrieval
Retrieve Orders from

| Field | Comment |
|---|--|
| High Security Mode | When High Security Mode is enabled, users are prompted to enter an ID and password when logging on to the system. You must add each user in User Setup . |
| Audit Trail | Copies the system audit trail in XML format to an SD card and then clears the audit trail on the system. For more information see 12.18.3 Exporting the Audit Trail on page 156 . |
| Link Technician with login user | Links the technician to the login user. When you enter patient data, the technician will be set to login user and is not editable. |
| Auto Logoff | Determines whether the system automatically logs the user off after a predefined period of inactivity. See also Auto Logoff Time . This is available only if High Security Mode is enabled. |
| Auto Logoff Time (1–255 min) | Determines the length of inactivity, in minutes, before the system logs off the user. This is available only if High Security Mode is enabled. |
| Automatically synchronize with Time Server | Enables/disables automatic synchronization with an external time server either on the institution's network or the Internet. You must activate a LAN option to set this option. |
| Time Server Name | Identifies the server with which the device synchronizes its time. This can be a server on the institution's network or on the Internet. Contact your server administrator for this information. |
| Last synchronization at | Display-only field that identifies when the last synchronization occurred. |
| Last synchronized from Time Server | Display-only field that identifies where the last synchronization occurred. |
| Enable Data Retrieval | If this option is enabled, the user can download patient demographics or orders. |
| Query Key | Allows a user to select Patient ID or Visit as a Query key. |
| Data Retrieval | Allows a user to select which data to query: Order , ADT , or Order then ADT . |
| Retrieve Orders from | Allows a user to select data origin: Cart , Remote , or Cart then Remote . |

If the **PDFC** option is enabled in **Options Setup**, the **System Settings – PDF Naming Settings** window displays.

The screenshot shows the 'System Settings' window with the 'PDF Naming Settings' section. At the top right of the window is a 'Page Up' button. Inside the settings section, there is a checkbox labeled 'Generate automatic file name'. Below this checkbox are nine numbered dropdown menus, each with a small arrow icon on the right side, indicating they are currently closed.

| Field | Description |
|-------------------------------------|---|
| Generate automatic file name | Select the checkbox; the numbered fields are enabled. Use the drop-down arrow to select each setting. |

For more information, see [12.18.2 Customizing the Naming Convention on page 156](#).

12.2 Resting ECG Setup

The **Resting ECG Setup** window allows you to define:

- Waveform parameters
- Waveform parameters
- Lead usage
- Analysis options
- Lead sequence
- Report options
- Storage options (if the internal storage option is activated)
- Transmission options (if a communications option is activated)
- Full Disclosure Setup

To access the **Resting ECG Setup** window, on the **Main Menu** press **System Configuration > Resting ECG Setup**.

The following tables describe each setting available on **Resting ECG Setup**.

Resting ECG Settings

Gain [mm/mV]

Speed [mm/s]

Low Pass Filter [Hz]

ADS ☒

Line Filter ☒

Enabled

6 leads : 1x6 ☐

6 leads : 2x3 ☒

12 leads : 2x6 ☐

12 leads : 4x3 ☒

Display Format

Display Lead Group

Page Down

| Field | Comment |
|--------------|---|
| Gain | <p>Sets the amplitude of the ECG signal. Measurement is in millimeters per millivolt and includes the following options:</p> <ul style="list-style-type: none"> • 2.5 mm/mV • 5 mm/mV • 10 mm/mV • 20 mm/mV • 40 mm/mV • Automatic <p>The larger the selected measurement, the larger the waveform. Only the representation of the waveform changes; signal strength is not affected.</p> <p>NOTE</p> <p>If Automatic is selected, the system calculates the best gain based on the peak-to-peak amplitudes of all displayed leads and the selected display format.</p> |
| Speed | <p>Changes the speed of rhythm printing and the wiper bar movement across the display.</p> <p>Measurement is in millimeters per second (mm/s) and includes the following options:</p> <ul style="list-style-type: none"> • 5 mm/s (rhythm) / 12.5 mm/s (display) • 12.5 mm/s • 25 mm/s • 50 mm/s |

Continues on the next page

| Field | Comment |
|---------------------------|--|
| Low Pass Filter | <p>Sets the maximum frequency to include in the waveform. Restricting frequencies can help eliminate noise in the waveform. Frequencies are measured in Hertz (Hz) and include the following options:</p> <ul style="list-style-type: none"> • 20 Hz • 40 Hz • 100 Hz • 150 Hz <p>Selecting a frequency eliminates signals above that frequency. For example, if you select 40, only signals that have a frequency of 40 Hz or lower are included in the waveform.</p> |
| ADS | Toggles the anti-drift system (ADS) on and off. ADS helps reduce baseline drift. |
| Line Filter | Enables/disables the line filter defined in Country Setup . |
| 6 leads: 1x6 | Enables/disables a display option that shows one six-waveform column. |
| 6 leads: 2x3 | Enables/disables a display option that shows two three-waveform columns. |
| 12 leads: 2x6 | Enables/disables a display option that shows two six-waveform columns. |
| 12 leads: 4x3 | Enables/disables a display option that shows four three-waveform columns. |
| Display Format | Selects the display format of the resting ECG. The default value is 3 leads: 1x3 . Other values depend on which of the previous two fields are set. |
| Display Lead Group | <p>Determines which group of leads is displayed. The available values depends on which Display Format is selected. For example, if 3 Leads: 1x3 is selected, the available values are:</p> <ul style="list-style-type: none"> • 3 rhythm leads • 1st group • 2nd group • 3rd group • 4th group |

Resting ECG Settings Page Up

Printer Leads Rhythm 6 ▼

Start rhythm report on new page ☒

Pace Enhancement ☐

Preview before Analysis Always ▼

Reanalysis ☐

QTC Calculation Bazett ▼

Screening Criteria ☐

Suppress normal statement ☐

Suppress abnormal/borderline ☐

Suppress all statements ☐

Suppress Reason Statements ☒

ACI-TIPI ☐

Sample Rate 500 Hz ▼

Page Down

| Field | Comment |
|--|---|
| Printer Leads | Identifies the default set of leads to use for printing. The values are: <ul style="list-style-type: none"> • First 6 • Second 6 • Rhythm 6 • 12 |
| Start rhythm report on new page | Determines whether the rhythm report prints on a separate page. |
| Pace Enhancement | Increases the readability of pacemaker ECG either by augmenting small pace pulses or by truncating large pace pulses. If enabled, pace enhancement is done in two steps: <ol style="list-style-type: none"> 1. Add a marker (1.5 mV amplitude, 6 ms duration) to the electrode signal. 2. Limit the sum to 0.5 mV in the lead signal. |
| Preview before Analysis | Determines waveform preview options. Values include: <ul style="list-style-type: none"> • No Waveforms are never previewed. • Always Waveforms are always previewed. • Yellow electrodes Waveforms are previewed when the Hookup Advisor indicator shows a yellow or red electrode. • Red electrodes Waveforms are previewed when the Hookup Advisor indicator shows a red electrode. For additional information, see 7.1 Hookup Advisor on page 69 . |

Continues on the next page

| Field | Comment |
|-------------------------------------|---|
| Reanalysis | <p>Enables/disables the reanalysis feature, which allows you to adjust the following ECG measurements:</p> <ul style="list-style-type: none"> • P Duration • PR Interval • QRS Duration • QT Interval <p>This is available only if Audit Trail is disabled and one of the following options is activated: ME12, MEHR, MI12, or MIHR.</p> <p>For more information on activating options, see 12.13 Options Set-up on page 151.</p> |
| QTC Calculation | <p>Determines which formula is used to correct QT calculations. Available options are:</p> <ul style="list-style-type: none"> • Bazett $QTc = QT \sqrt{HR/60}$ Bazett is available only if the MEHR or MIHR option is activated. • Framingham $QTc = QT + 154 (1 - 60/HR)$ Framingham is available only if the ME12 or MI12 option is activated. • Fridericia $QTc = QT^3 \sqrt{HR/60}$ Fridericia is available only if the ME12 or MI12 option is activated. <p>NOTE</p> <p>In all formulas, HR = Heart Rate.</p> |
| Screening Criteria | <p>Enables/disables the inclusion of the screen criteria.</p> <p>This setting is available only if the MI12 option is activated.</p> <p>If this field is enabled, Suppress reason statements field is available.</p> |
| Suppress normal statement | <p>Enable/disables the inclusion of the normal statement.</p> <p>This setting is available only if the MI12 option is activated.</p> |
| Suppress abnormal/borderline | <p>Enable/disables the inclusion of the abnormal/borderline statements.</p> <p>This setting is available only if the MI12 option is activated.</p> |
| Suppress all statements | <p>Enable/disables the inclusion of all statements.</p> <p>This setting is available only if the MI12 or MIHR option is activated.</p> |
| Suppress reason statements | <p>Enable/disables the inclusion of reason statements.</p> <p>This setting is available if the MI12 option is activated.</p> |

Continues on the next page

| Field | Comment |
|--------------------|--|
| ACI-TIPI | <p>Enables/disables the inclusion of the ACI-TIPI (Acute Cardiac Ischemia Time Insensitive Predictive Instrument) statement and enables the Chest Pain field on the Patient Information window.</p> <p>To include ACI-TIPI statements, the following conditions must be met:</p> <ul style="list-style-type: none"> • MI12 or ME12 system option is activated • TIPI system option is activated • ACI-TIPI is enabled • 10s ECG Report Format is enabled • Print Interpretation is enabled • Patient data includes: gender, date of birth, and chest pain indication • Patient cannot be a pediatric patient (15 years or younger) as calculated from the date of birth |
| Sample Rate | Determines the report frequency. Options are 500 Hz or 1000 Hz . 1000 HZ is supported only for XML output. |

Resting ECG Settings

Page Up

Lead Sequence

Sequence Name

| Lead | Label |
|------|-------|
| 1 | I |
| 2 | II |
| 3 | III |
| 4 | aVR |
| 5 | aVL |
| 6 | aVF |
| 7 | V1 |
| 8 | V2 |
| 9 | V3 |
| 10 | V4 |
| 11 | V5 |
| 12 | V6 |

Rhythm Leads

| | |
|---|----|
| 1 | V1 |
| 2 | II |
| 3 | V5 |
| 4 | V2 |
| 5 | V3 |
| 6 | V4 |

Page Down

| Field | Description |
|----------------------|--|
| Lead Sequence | <p>Determines the lead sequence to use. Values are:</p> <ul style="list-style-type: none"> • Standard • Cabrera • NEHB • SEQ4 <p>SEQ4 allows you to configure a custom 12-lead sequence using the following fields. If either 12SL option (ME12 or MI12) is activated, you must select leads I (-I), II (-II), V1, V2, V3, V4, V5, and V6 for a correct 12SL analysis.</p> |
| Sequence Name | Set the display name for a custom lead sequence. Available only if SEQ4 is selected for the Lead Sequence . |

Continues on the next page

| Field | Description |
|-------------------------|--|
| 1-12 Lead | Twelve fields that allow you to define the sequence in which the leads are displayed. Available only if SEQ4 is selected for the Lead Sequence . |
| 1-12 Label | Twelve fields that allow you to define the labels that are displayed/printed for the corresponding leads. Available only if SEQ4 is selected for the Lead Sequence . |
| 1-6 Rhythm Leads | Six fields that allow you to define the rhythm leads and their sequence. You can select the rhythm leads for all four lead sequences. |

| Field | Description |
|------------------------------|--|
| 10s ECG Report Format | <p>Determines how the 10s ECG report prints. If no format is selected, the report does not print.</p> <p>The values are:</p> <ul style="list-style-type: none"> • 1x10x12_25 • 1x10x12_50 • 2x10x6_25 • 1x10x3_25 • 2x5x6_25 • 2x5x6_50 • 2x5x6_25_SYN • 2x5x6_50_SYN • 2x5x6_25_R1 • 4x2.5x3_25 • 4x2.5x3_25_R1 • 4x2.5x3_25_R3 • 4x2.5x3_25_R2_P • H1 • H2 <p>If the CTDG option is enabled, the report format is 4x2.5x3_25_R2_P.</p> |

Continues on the next page

| Field | Description |
|---------------------------------------|---|
| Detailed Results Report Format | Determines how the Detailed Results report prints. If no format is selected, the report does not print. The values are: <ul style="list-style-type: none"> • Median_25 • Median_50 |
| Report Copies | Determines how many copies of the selected report print. The values are: <ul style="list-style-type: none"> • 0 • 1 • 2 • 3 • 4 • 5 |
| Print Interpretation | Determines whether ECG interpretation prints on the report. Available only if either the MI12 or MIHR option is activated. |
| Auto Store ECG | Determines whether the ECG is automatically stored on the internal storage. This is available only if the M100 or M200 internal storage option is activated. For more information, see 12.13 Options Setup on page 151 . |
| File Manager Sort by | Determines the field by which the File Manager sorts records in internal storage. This is available only if the M100 or M200 internal storage option is activated. Available options are: <ul style="list-style-type: none"> • Patient Name • Date • Patient ID • Order Number |
| Auto Transmit ECG | Determines whether the ECG is transmitted automatically to an external device. Available only if one of the communications options is activated. If the Auto Export for Pharma is enabled, the Auto Transmit ECG will be disabled by the system. For more information, see 12.13 Options Setup on page 151 . |
| Delete After Transmission | Determines whether the ECG is deleted from internal storage after it is transmitted to an external device. Available only if one of the communications options is activated. If the Auto Export for Pharma is enabled, the Delete After Transmission will be disabled by the system. For more information, see 12.13 Options Setup on page 151 . |
| Print Transmission Log | Determines whether the transmission log prints after an ECG is transmitted from File Manager to an external device. Available only if one of the communications options is activated. For more information, see 12.13 Options Setup on page 151 . |

Continues on the next page

| Field | Description |
|------------------------|---|
| Auto Export ECG | Determines whether the ECG is automatically exported in Hilltop, Hilltop/XML, or PDF format to the shared directory or FTP server location. Availability of Hilltop/XML format depends on whether Export XML option was enabled in Communication Setup . Availability of PDF format depends on PDFC option activation in Options Setup . Available if any of LANC , LANM , WIFC or WIFM option is activated. For more information, see 12.5 Communication Setup on page 127 . |
| Export Location | Determines where to export the report. Available options are Shared Directory and FTP Server Available if any of LANC , LANM , WIFC or WIFM option is activated. |

If the **PDFC** option is enabled, you receive the **Resting ECG Settings–PDF Export Setup** window.

| Field | Description |
|------------------------------|---|
| 10s ECG Report Format | Determines how the 10s ECG report prints to a PDF file. The options are: <ul style="list-style-type: none"> • 4x2.5x3_25 • 4x2.5x3_25_R1 • 4x2.5x3_25_R3 • MUSE1 • MUSE2 • 1x10x12_25 • 2x5x6_25 • 2x5x6_25_SYN • 2x5x6_50 • 2x5x6_50_SYN NOTE Options MUSE1 and MUSE2 are not available in the Chinese version. |
| Baseline Auto Adjust | Enables/disables the PDF export. Available only when the 1x10x12_25 of 10s ECG Report Format option is selected. |

Resting ECG Settings Page Up

Full Disclosure Setup

Print

Report Format: one lead @ 25 mm/s

Lead: II

Acquisition Time: 1 Minutes

PDF Export Setup

Report Format: one lead @ 25 mm/s

Lead: II

Auto Export: ☒

Location: Shared Directory

| Field | Description |
|----------------------------|---|
| Thermal Report Format | <p>Determines how the full disclosure ECG report prints on the thermal printer.</p> <p>The options are:</p> <ul style="list-style-type: none"> • one lead @ 25mm/s • one lead @50 mm/s • 12 leads @ 25 mm/s |
| Lead | <p>Determines which lead to print on the thermal printer.</p> <p>The options are:</p> <ul style="list-style-type: none"> • I • II • III • aVR • aVL • aVF • V1 • V2 • V3 • V4 • V5 • V6 |
| Acquisition Time (Minutes) | <p>Sets up the full disclosure ECG acquisition time. Available value is 1–5 (in minutes).</p> |
| PDF Report Format | <p>Determines how the full disclosure ECG report export to a PDF file.</p> <p>The options are:</p> <ul style="list-style-type: none"> • one lead @ 25mm/s |

Continues on the next page

| Field | Description |
|-------------|---|
| Lead | <p>Determines which lead to print to a PDF file.</p> <p>The options are:</p> <ul style="list-style-type: none"> • I • II • III • aVR • aVL • aVF • V1 • V2 • V3 • V4 • V5 • V6 • 12 Leads |
| Auto Export | Determines whether export the full disclosure ECG report to configured location. |
| Location | <p>Determines where the full disclosure ECG report export to.</p> <p>Available options are:</p> <ul style="list-style-type: none"> • SD Card • FTP Server • Shared Directory <p>See 12.5 Communication Setup on page 127 for detailed instructions on configuring the FTP server and shared directory.</p> |

12.3 Arrhythmia Setup

The **Arrhythmia Setup** function allows you to define:

- Waveform parameters
- Lead usage
- Analysis options
- Lead sequence
- Report options

To access **Arrhythmia Setup**, on the **Main Menu** press **System Configuration > Arrhythmia Setup**.

Most of the fields on the **Arrhythmia Setup** windows are the same as those on **Resting ECG Setup**. The following tables list the arrhythmia settings that are unique or differ from resting ECG. For all other fields, see [12.2 Resting ECG Setup on page 108](#).

Arrhythmia Setup

Gain [mm/mV]

Speed [mm/s]

Low Pass Filter [Hz]

ADS ☒

Line Filter ☒

Enabled

6 leads : 1x6 ☐

6 leads : 2x3 ☒

12 leads : 2x6 ☐

12 leads : 4x3 ☒

Display Format

Display Lead Group

Page Down

| Field | Description |
|------------|---|
| ADS | Enables/disables the Anti-Drift System , which helps reduce baseline shift. In Arrhythmia mode, this setting is always available. |

Arrhythmia Setup

Page Up

Pace Enhancement ☐

Rhythm Printing ☐

Printer Leads

Arrhythmia Event Printing

Episodes Printout in Summary Report

Page Down

| Field | Description |
|----------------------------------|---|
| Rhythm Printing | Determines whether the rhythm report starts automatically when recording starts. |
| Arrhythmia Event Printing | Determines which events print on the Arrhythmia Report: <ul style="list-style-type: none"> • All events • Unequal events • No event printing |

Continues on the next page

| Field | Description |
|--|---|
| Episodes Printout in Summary Report | <p>Determines how arrhythmia events print. Options are:</p> <ul style="list-style-type: none"> • Chronological order • Priority order • Only episodes with ventricular events • No episodes |

Arrhythmia Setup Page Up

Lead Sequence

Sequence Name

| | Lead | Label |
|---|------|-------|
| 4 | V2 | V2 |
| 5 | V4 | V4 |
| 6 | V6 | V6 |

| | Lead | Label |
|---|------|-------|
| 1 | I | I |
| 2 | II | II |
| 3 | III | III |



| Field | Description |
|-------------------------|---|
| Lead Sequence | <p>Determines the lead sequence to use. Arrhythmia Setup includes the following options in addition to the four options available in the Resting ECG Setup:</p> <ul style="list-style-type: none"> • STD_C • STD_RED • STD_LI • CABR_LI • NEHB_6 • HIGH_C |
| 1-6 Rhythm Leads | <p>Six fields that allow you to define the rhythm leads and their sequence. You can select the rhythm leads for all four lead sequences. If you chose any of the following in Lead Sequence, the rhythm leads are not displayed:</p> <ul style="list-style-type: none"> • STD_C • STD_RED • STD_LI • CABR_LI • NEHB_6 • HIGH_C |

12.4 Stress ECG Setup

Stress ECG Setup is available only if the **ERGO Stress Test** option was activated. For more information, see [12.13 Options Setup on page 151](#).

The **Stress ECG Setup** differs from the resting or arrhythmia ECGs. In addition to defining the stress ECG settings, you can create, edit, or delete test protocols.

12.4.1 Stress ECG Settings

The **Stress ECG Setup** function allows you to define:

- Waveform parameters
- Lead usage
- Analysis options
- Report options
- Lead sequence

To access the Stress ECG Setup, on the **Main Menu** press **System Configuration > Stress ECG Setup**.

Many of the fields on the **Stress ECG Setup** windows are the same as those on the **Resting ECG Setup** or the **Arrhythmia Setup**. The following tables list the settings that are unique or differ from the resting or arrhythmia setups. For all other fields, see [12.2 Resting ECG Setup on page 108](#) or [12.3 Arrhythmia Setup on page 118](#).

The screenshot shows the 'Stress Setup' window with the following settings:

- Gain [mm/mV]: 10
- Speed [mm/s]: 25
- Low Pass Filter [Hz]: 40
- ECG Filter Type: FRF
- FRF: ☒
- Line Filter: ☒
- Enabled: ☐
- 6 leads : 1x6: ☐
- 6 leads : 2x3: ☒
- 12 leads : 2x6: ☐
- 12 leads : 4x3: ☒
- Display Format: 3 leads : 1x3
- Display Lead Group: 3 Rhythm leads
- Page Down button

| Field | Comment |
|------------------------|---|
| ECG Filter Type | <p>Determines which method to use to filter the ECG signal. Options are:</p> <ul style="list-style-type: none"> • ADS definition ADS Anti-Drift System – reduces baseline shift • FRF definition FRF Finite Residual Filter – reduces noise and artifacts <p>The selection also determines the behavior of the Lower Pass Filter [Hz] and ADS/FRF fields.</p> |
| ADS/FRF | <p>Enables/disables the selected ECG Filter Type. The label for this field changes depending on the filter type selected.</p> |

Stress Setup
Page Up

Pace Enhancement

☐

Max Predicted HR Formula

WHO

▼

Target HR [%]

100

▼

Protocol

WHO

▼

Edit Protocols

J+x Point Formula

Rautaharju

▼

Calculation (E, J point)

Continuous

▼

Page Down

| Field | Comments |
|------------------------------------|---|
| Max Predicted HR Formula | <p>Determines the formula that predicts the patient's maximum heart rate. Options are:</p> <ul style="list-style-type: none"> WHO This formula, recommended by the World Health Organization, subtracts the patient's age from 220. For example, a patient who is 50 years old has a maximum predicted heart rate of $220 - 50 = 170$. AHA This formula, recommended by the American Heart Association, varies depending on the age of the patient. <ul style="list-style-type: none"> < 25 years old = 160 bpm > 75 years old = 115 bpm 25–75 years old = $160 - (\text{age} - 25) * 0.9$ For example, a patient who is 50 years old has a maximum predicted heart rate of $160 - (50 - 25) * 0.9 = 138$. |
| Target HR [%] | <p>Determines the percentage of the maximum predicted heart rate the stress test is targeting.</p> |
| Protocol/Master's Step Mode | <p>Determines which protocol conducts the stress test. The protocol determines the test phases, stages, stage durations, stage loads, and the times at which auto reports are printed and blood pressure is recorded.</p> <p>You can create custom protocols by selecting the Edit Protocols button.</p> <p>For more information, see 12.4.2 Editing Stress Protocols on page 124.</p> <p>NOTE</p> <p>If Master's Step device is selected as the Stress Test Device in Basic Setup (see 12.1 Basic Setup on page 104), this field is labeled Master's Step Mode instead of Protocol.</p> |

Continues on the next page

| Field | Comments |
|---------------------------------|--|
| J+x Point Formula | <p>Determines the method that calculates the post J-Point. Options are:</p> <ul style="list-style-type: none"> • 0 ms • 10 ms • 20 ms • 40 ms • 80 ms • Rautaharju (default value) • RR/16 <p>The numeric values (0 ms—80 ms) add the selected number of milliseconds to the J-point.</p> |
| Calculation (E, J point) | <p>Determines when the select J+x point formula is used. Valid options are:</p> <ul style="list-style-type: none"> • Single <p>The E and J points are calculated once in the beginning and remain unchanged during the stress test.</p> <ul style="list-style-type: none"> • Continuous <p>The E and J points are continuously updated during the PRETEST, EXERCISE, and RECOVERY phases of the stress test.</p> |

Stress Setup Page Up

Arrhythmia Event Printing No Event Printing ▼

Printer Leads 12 ▼

In-Test Reports Comparative Medians Report ▼

Median Report Speed [mm/s] 25 ▼

12-Lead Report 2x6 ▼

Summary Report Format

Summary Report ☒

Tabular Summary ☒

Trend Report ☒

ST Trend Report ☐

ST Summary Report ☒

Episodes Printout in Summary Report

Chronological Order ▼

Page Down

| Field | Comments |
|-----------------------------------|---|
| In-Test Reports | <p>Determines the format of the report. Options are:</p> <ul style="list-style-type: none"> • Median Report • Comparative Medians Report |
| Median Report Speed [mm/s] | <p>Determines the speed in millimeters per second at which the waveforms are represented on the report. Options are:</p> <ul style="list-style-type: none"> • 25 • 50 |

Continues on the next page

| Field | Comments |
|--|--|
| 12-lead Report | Determines the layout of a 12-lead report. Options are: <ul style="list-style-type: none"> • 1x12 One column showing 10 seconds from all 12 leads. • 2x6 Two columns each showing 5 seconds from 6 leads. |
| Summary Report | Determines whether the summary report format is included in the stress report. |
| Tabular Summary | Determines whether the tabular report format is included in the stress report. |
| Trend Report | Determines whether the trend report format is included in the stress report. |
| ST Trend Report | Determines whether the ST trend report format is included in the stress report. |
| ST Summary Report | Determines whether the ST summary report format is included in the stress report. |
| Episodes Printout in Summary Report | Determines how episodes are presented in the stress report. Options are: <ul style="list-style-type: none"> • Chronological Order • Priority Order • Only Episodes with Ventricular Events • No Episodes |

12.4.2 Editing Stress Protocols

The following pre-defined stress test protocols are available.

Table 12-1 Pre-defined Stress Test Protocols

| Device | Protocols | | |
|---------------|--------------|-----------|------------|
| Treadmills | BRUCE | MODBRUCE | NAUGHTON |
| | ELLESTAD | MODBALKE | USAFSAM |
| | SLOWUSAFSAM | CORNELL | BALKEWARE |
| | MODBALKEWARE | ADENOSINE | DOBUTAMINE |
| | PERSANTINE | | |
| Ergometers | WHO | WHO50 | WHO75 |
| | HOLLMANN | BAL | STD.FRANCE |
| | MODWHO | CONCONI | |
| Master's Step | SINGLE | DOUBLE | TRIPLE |

Most treadmill and ergometer protocols consist of three pre-defined *phases*: **Pretest**, **Exercise**, and **Recovery**. Each phase can include multiple stages that define the parameters of the test. The parameters differ slightly depending on the device, as seen in the following table.

Table 12-2 Stress Test Parameters

| Parameter | Treadmill | Ergometer | Master's Step | Comment |
|-------------------|-----------|-----------|-----------------|---------------------------------|
| Stage | √ | √ | The stage name. | The stage name. |
| Stage Time | √ | √ | √ | The stage duration, in minutes. |

Continues on the next page

Table 12-2 Stress Test Parameters (Table continued)

| Parameter | Treadmill | Ergometer | Master's Step | Comment |
|----------------------------|-----------|-----------|--|--|
| Speed | √ | | The treadmill speed in kilometers or miles per hour, depending on the Country Setup . | The treadmill speed in kilometers or miles per hour, depending on the Country Setup . |
| Grade [%] | √ | | | The percentage of increase in the treadmill's elevation. |
| Basic Load (W) | | √ | The load at which the ergometer operates, in watts. | The load at which the ergometer operates, in watts. |
| Store Median First | √ | √ | | The interval at which the first median reading is stored. |
| Store Median Repeat | √ | √ | The interval at which a subsequent median reading is stored. | The interval at which a subsequent median reading is stored. |
| BP First | √ | √ | | The interval at which the first blood pressure reading is stored. |
| BP Repeat | √ | √ | The interval at which subsequent blood pressure readings are stored. | The interval at which subsequent blood pressure readings are stored. |

You can modify the pre-defined protocols to create custom protocols. Use the following instructions to create a custom protocol:

1. On the **Main Menu** press **System Configuration > Stress ECG Setup**.
The **Stress ECG Setup** window opens.
2. Press **Page Down**.
The second page opens.
3. Select **Edit Protocols** and press either **Enter** or the **trimpad**.
For treadmills and ergometers, the **Select Protocol** window opens to display applicable protocols. Perform step 4 through step 16.
For **Master's Step** devices, the **Edit Master Step Post-Exercise** window opens to display the display the post-exercise stages. Perform step 8 through step 12.
4. Press **Add**.
A list of templates opens.
5. Select the template on which you want to base the new protocol.
The templates are based on the existing protocols. An **Empty Protocol** is also available.
6. Press **OK**.
The **Add Protocol** window opens.

7. Type a name for the new protocol and press **OK**.
The **Protocol** window opens with all the stages from the template. You can now add, edit, or delete stages.
 8. To add a stage, do the following:
 - a. Select the stage that precedes the new stage.
 - b. Press **Add Stage**.
The selected stage is duplicated.
 - c. Edit the duplicate stage as appropriate.
See step 9.
 9. To edit a stage, do the following:
 - a. Select the stage to edit.
 - b. Press **Edit**.
The **Edit Stage** window opens.
 - c. Modify the stage parameters as appropriate.
Refer to the table preceding these instructions for a description of each parameter.
 - d. When you are done, press **OK**.
The **Edit Stage** window closes.
 10. To delete a stage, do the following:
 - a. Select the stage you want to delete.
 - b. Press **Delete Stage**.
The selected stage is deleted.
 11. To remove custom **Master's Step** stages, press **Factory Defaults**.
- NOTE**
- Reset treadmills and ergometers to factory defaults at the protocol level. See step 15.
12. Repeat steps 8 through 10 as necessary.
 13. To rename the protocol, do the following:
 - a. Press **Edit Name**.
The **Edit Name** window opens.

NOTE

This option is not available when editing a **Master Step** protocol.

 - b. Change the name as appropriate.
 - c. Press **OK**.
The protocol's name is changed.
 14. When you are done with the stages, press **Save**.
This saves your changes and returns you to the previous window.
 15. To remove custom protocols, press **Factory Defaults**.

16. When the protocol is done, press **Return**.

The protocol is saved and you return to the **Select Protocol** window.

12.5 Communication Setup

The **Communication Setup** function allows you to define the following settings:

- Data Communication Settings and Shared Directory Settings
- FTP server settings
- Data Communication Locations
- Wired LAN Settings (if a LAN option is activated for wired communication or wireless communication via wireless bridge)
- Wireless LAN Settings (if a WLAN option is activated)
- Wireless Networking Settings (if a wireless option is activated for wireless communication via embedded wireless module)
- EAP Certificate Settings
- DCP Settings

NOTE

This system is compatible with MUSE v8.0.1, v9.0.0 and MUSE NX, and CardioSoft/CS V6.73 and later.

To access the **Communication Setup**, on the **Main Menu** press **System Configuration > More > Communication Setup**.

The following tables describe the settings on **Communication Setup**.

| Fields | Description |
|-------------------------|---|
| Default Location | Determines which of the four available communication locations is the default. The locations are defined on Page 2 of this <i>Communication Setup Fields</i> table. |

Continues on the next page

| Fields | Description |
|--|--|
| Export XML | <p>Determines whether ECG records are transmitted as XML. If this field is set, ECG records exported to anSD card are stored in both XML and Hilltop formats.If this field is not set, ECG records exported to an SD card are stored only in Hilltop format.</p> <p>NOTE</p> <p>This field is displayed only if the M100 or M200 (Internal storage) option is activated.</p> |
| Serial Baud Rate | <p>Determines the speed at which data is transmitted across the serial communications port when using a serial cable.</p> <p>NOTE</p> <p>This field is displayed only if the Modem Communications to CardioSoft (MODC) or Modem Communications to MUSE (MODM) option is activated.</p> |
| Allow Export Using Shared Directory | <p>Determines whether ECG records can be exported to a shared network drive.</p> <p>NOTE</p> <p>This field is displayed if the communication options (LANC, LANM, WIFM, or WIFC) is activated.If this field is checked, the following five fields become available (Share Name, Username, Password, Confirm, and Domain). If this field is checked, the following five fields become available (Share Name, Username, Password, Confirm, and Domain).</p> |
| Share Name | <p>Identifies the name of the shared network drive. It must be the share drive's name; IP addresses are not supported. This field allows a maximum of 256 characters.</p> <p>This field is available only if the Allow Export Using Shared Directory field is checked.</p> |
| Username | <p>Identifies the user name that the system uses to log on to the shared directory. The user must be set up on the domain with the appropriate permissions to access the shared directory. This field allows a maximum of 30 characters.</p> <p>This field is available only if the Allow Export Using Shared Directory field is checked.</p> |
| Password | <p>Identifies the password that the system uses to log on to the shared directory. This field allows a maximum of 30 characters.</p> <p>This field is available only if the Allow Export Using Shared Directory field is checked.</p> |
| Confirm | <p>Re-enter the password in this field to confirm that the password was entered correctly.</p> <p>This field is available only if the Allow Export Using Shared Directory field is checked.</p> |
| Domain | <p>Identifies the user's domain. This field allows a maximum of 30 characters.</p> <p>This field is available only if the Allow Export Using Shared Directory field is checked.</p> |

Continues on the next page

| Fields | Description |
|------------------------|---|
| Test Connection | Press to test whether the system can connect to the shared directory. This field is available only if Allow Export Using Shared Directory is activated. |

| Fields | Description |
|-------------------------------|--|
| Allow Export Using FTP | Determines whether ECG records can be exported to a FTP Server. Available only if the LAN Communications to CardioSoft/CS option (LANC), LAN Communications to MUSE option (LANM), Wireless Communications to MUSE option (WIFM) or Wireless Communications to CardioSoft/CS option (WIFC) has been activated. If this field is checked, the following six fields become available. |
| Secured FTP (FTPS) | Determines whether to set the FTP as a secured FTP. This field is available only if the Allow Export Using FTP field is checked. |
| FTP Server | Identifies the FTP server and path. This field allows a maximum of 256 characters. The format is ftp://ftp server/path . This field is available only if the Allow Export Using FTP field is checked. |
| Port | Identifies the port for incoming IP connections. The port values range from 1 to 65535. This field is available only if the Allow Export Using FTP field is checked. |
| Username | Identifies the user name the system uses to log on to the FTP server. The user must have write permission to the specific path of the FTP server. This field allows a maximum of 30 characters. This field is available only if the Allow Export Using FTP field is checked. If the FTP server supports anonymous login, both the username and password could be blank. |

Continues on the next page

| Fields | Description |
|------------------------|--|
| Password | <p>Identifies the password the system uses to log on to the FTP server. The password should contain only numeric, uppercase, and lowercase letters. This field allows a maximum of 30 characters.</p> <p>This field is available only if the Allow Export Using FTP field is checked.</p> <p>If the FTP server supports anonymous login, both the username and password could be blank.</p> |
| Test Connection | <p>Press to test whether the system can connect to the FTP server.</p> <p>This field is available only if the Allow Export Using FTP field is checked.</p> |

Data Communication Locations

Page Up

#1

Location

Device

Protocol

#2

Location

Device

Protocol

#3

Location

Device

Protocol

#4

Location

Device

Protocol

Page Down

| Field | Description |
|-----------------|--|
| Location | Identifies the name of a communication location that receives the transmission from the system. You can define up to four locations. |
| Device | <p>Identifies the type of device to use to transmit data to the location. Options are:</p> <ul style="list-style-type: none"> Serial LAN <p>Serial and LAN are available only if the corresponding option is activated.</p> <p>This field becomes active only after a corresponding location is entered.</p> |

Continues on the next page

| Field | Description |
|-----------------|---|
| Protocol | <p>Determines the protocol to use to communicate with the device. Options are:</p> <ul style="list-style-type: none"> • A5 • CSI • DCP <p>Select CSI for MUSE connections and A5 for CardioSoft/CS connections.</p> <p>DCP is available only if the selected device is LAN.</p> <p>NOTE</p> <ul style="list-style-type: none"> • When using DCP to connect to the MUSE 8.0.1 system and get orders, the MUSE system only returns orders that have a location value. • When using DCP to connect to the MUSE 8.0.1 system to get orders, the MUSE system does not return the order priority (Normal, Preop, Stat). |

This system can use several protocols to communicate test data and retrieve patients or orders. You should choose the protocol based on systems with which you want to connect, the data you want to send and receive, and the connection type (LAN, wireless, or serial).

- **DCP**

This is a newer protocol that is faster than CSI and A5. DCP does not require this system to use a fixed IP address. It is currently compatible with the MUSE 8.0 system or later, and other GE Healthcare systems that support DCP. It supports retrieving patient demographics and orders and sending patient tests. You can use it with LAN or wireless connections.

- **CSI**

This is a protocol that receives a connection from a server and requires a fixed IP address. It is currently compatible with all versions of the MUSE system and CardioSoft/CS system v6.73 and later. It supports retrieving patient demographics and orders and sending patient tests. You can use it with LAN, wireless, and serial connections.

- **A5**

This is a serial protocol that you can use for backward compatibility. It is compatible with all versions of the CardioSoft/CS system. It supports sending patient tests. You can use it with serial connections.

Wired LAN Settings Page Up

Cardiograph Device Name

Serial/IP Redirector Listen Port

☒ Obtain an IP address automatically (DHCP)

IP Address 0.0.0.0

Netmask 0.0.0.0

Gateway 0.0.0.0

☒ Obtain DNS server address automatically (DHCP)

Preferred DNS Server 0.0.0.0

Alternate DNS Server 0.0.0.0

Preferred WINS Server 0.0.0.0

Alternate WINS Server 0.0.0.0

Wireless LAN Settings Page Up

Cardiograph Device Name

Serial/IP Redirector Listen Port

☒ Obtain an IP address automatically (DHCP)

IP Address 0.0.0.0

Netmask 0.0.0.0

Gateway 0.0.0.0

☒ Obtain DNS server address automatically (DHCP)

Preferred DNS Server 0.0.0.0

Alternate DNS Server 0.0.0.0

Preferred WINS Server 0.0.0.0

Alternate WINS Server 0.0.0.0

Page Down

The following fields are only displayed if one or both of the following options are activated for Wired LAN or Wireless LAN communications.

NOTE

Please check with a GE Healthcare representative regarding the wireless solution available in your country.

- LAN communication to a CardioSoft/CS system (**LANC**)
- LAN communication to a MUSE system (**LANM**)
- Wireless communication to a CardioSoft/CS system (**WIFC**)
- Wireless communication to a MUSE system (**WIFM**)

| Field | Description |
|--|--|
| Cardiograph Device Name | Identifies the name of the device on the network. By default, the value is set to GE_<serial number> . A valid network device name contains between 1 and 20 alphanumeric and underscore characters. The first character must be a letter. This field is available only if a LAN or Wireless option was activated. |
| Serial/IP Redirector Listen Port | Identifies the port where the device should listen for incoming serial/IP connections. These communications must match the values defined on the transmitting MUSE system. This setting only applies to the CSI protocol. |
| Obtain an IP address automatically (DHCP) | Determines whether the device automatically receives an IP address from the network. If this box is checked and LAN communication to a MUSE system is enabled, you must configure the DHCP server to reserve a static IP address for the device. Contact your network administrator for assistance. If this field is checked, the IP Address , Netmask , and Gateway fields are display only. If this field is cleared, you must complete those fields. |
| IP Address | Identifies the IP address of the device. If the Obtain an IP address automatically (DHCP) field is cleared, you must define a unique IP address. |
| Netmask | Identifies the netmask of the device. If the Obtain an IP address automatically (DHCP) field is cleared, you must define a netmask. |
| Gateway | Identifies the IP address of the gateway for the device to use. If the Obtain an IP address automatically (DHCP) field is cleared, you must enter the gateway's IP address. |
| Obtain DNS service address automatically (DHCP) | Determines whether the device automatically obtains a DNS (Domain Name Server) IP address. If this field is checked, the following two fields are display-only. If this field is cleared, you must define the IP address of the DNS servers to use. |
| Preferred DNS Server | Identifies the IP address of the primary DNS server used to resolve Internet domain names. |
| Alternate DNS Server | Identifies the IP address of the secondary DNS server used to resolve Internet domain names. |
| Preferred WINS Server | Identifies the IP address of the primary WINS server used to resolve Windows host names. You must have the correct WINS address configured if you are using a shared folder for communication. NOTE This field only displays on the Wired LAN Settings screen. |
| Alternate WINS Server | Identifies the IP address of the secondary WINS server used to resolve Windows host names. You must have the correct WINS address configured if you are using a shared folder for communication. NOTE This field only displays on the Wired LAN Settings screen. |

The following fields are only displayed if one or both of the following options are activated for WLAN communications.

NOTE

These wireless network settings fields are applicable only if the wireless option is purchased. Please check with a GE Healthcare representative regarding the wireless solution available in your country. Please check with a GE Healthcare representative regarding the wireless solution available in your country.

- **WIFC** - wireless communication to a CardioSoft/CS system
- **WIFM** - wireless communication to a MUSE system

| Field | Description |
|----------------------------|---|
| Enable Wireless LAN | Enables/disables wireless LAN connectivity. Check the field to enable wireless. Clear the field to disable wireless. The field is cleared by default. |
| Network Name (SSID) | Specifies the name of the wireless local area network (WLAN). This field allows a maximum of 32 characters. NOTE When the network name is empty, the system connects to any available network. The system uses Infrastructure Mode (wireless access point) to provide the connection with Enterprise network or internet. The system uses Infrastructure Mode (wireless access point) to provide the connection with Enterprise network or internet. |
| Authentication | Specifies the authentication protocol. Values are: <ul style="list-style-type: none"> • Open • Shared • WPA-PSK • WPA2-PSK • WPA • WPA2 |

Continues on the next page

| Field | Description |
|---|---|
| Encryption | The user net configuration determines the encryption. Values are: <ul style="list-style-type: none"> • Disabled • WEP • TKIP • AES |
| Enable 802.1X authentication on this network | Enable/Disable 802.1X authentication. Check to enable 802.1X. Clear the field to disable 802.1X. |
| EAP Phase 1 | Specifies the EAP authentication method. Values are: <ul style="list-style-type: none"> • PEAP • TLS <p>Available for the embedded wireless module only</p> <ul style="list-style-type: none"> • TTLS <p>Available for the embedded wireless module only.</p> |
| EAP Phase 2 | Specifies the EAP authentication method. Values are: <ul style="list-style-type: none"> • MSCHAPV2 • MSCHAP • CHAP • PAP • GTC <p>NOTE</p> <p>If you are using the embedded wireless module:</p> <ul style="list-style-type: none"> • MSCHAPV2 and GTC are available if you select PEAP in EAP Phase 1. • MSCHAPV2, MSCHAP, CHAP, and PAP are available if you select TTLS in EAP Phase 1. |
| User name | The user name for EAP authentication. |
| User password | This is the password to use for EAP authentication. |

EAP Certificate Setting Page Up

☐ Validate Server

CA Certificate

Client Public Key

Client Private Key

Client Private Key Password

Page Down



| Field | Description |
|------------------------------------|---|
| Validate Server | Allows you to determine whether all clients must validate the server's certificate before they can establish a connection. To enable server validation, select the check box. This field is available only if PEAP or TLS is selected in the EAP Phase 1 field on the Wireless Networking Settings window. |
| CA Certificate | Allows you to choose a CA (Certificate Authority) certificate that the system can use to verify that the peer's server certificate is valid. If TLS is selected in the EAP Phase 1 field on the Wireless Networking Settings window, a CA certificate must be selected from the SD card root path. If PEAP or TLS is selected in the EAP Phase 1 field on the Wireless Networking Settings window, this field is optional. |
| Client Public Key | Allows you to choose a client public key used for client authentication. The key files must use the ".cer" extension on the root path of the SD card, or the files will not be recognized by the system. This field is available only if TLS is selected in the EAP Phase 1 field on the Wireless Networking Settings window. |
| Client Private Key | Allows you to choose a client private key used for client authentication. The key files must use the ".pvk" extension on the root path of the SD card, or the files will not be recognized by the system. This field is available only if TLS is selected in the EAP Phase 1 field on the Wireless Networking Settings window. |
| Client Private Key Password | Allows you to input a client private key password which is needed for installing a client certificate on the device. This field is available only if TLS is selected in the EAP Phase 1 field on the Wireless Networking Settings window. |

DCP Settings

Page Up

Discover DCP Devices...

☐ Secured DCP

Certificate Browse

DCP WS Address

http://

Test Device Connection

| Field | Description |
|----------------------------|---|
| Discover DCP Device | Allows you to discover GE Healthcare systems that support DCP servers on the same network subnet as this system. This command returns a list of DCP servers and you can select one of them for communication. Usually there is only one server from which to choose. If no servers are displayed, you can enter one manually. |

Continues on the next page

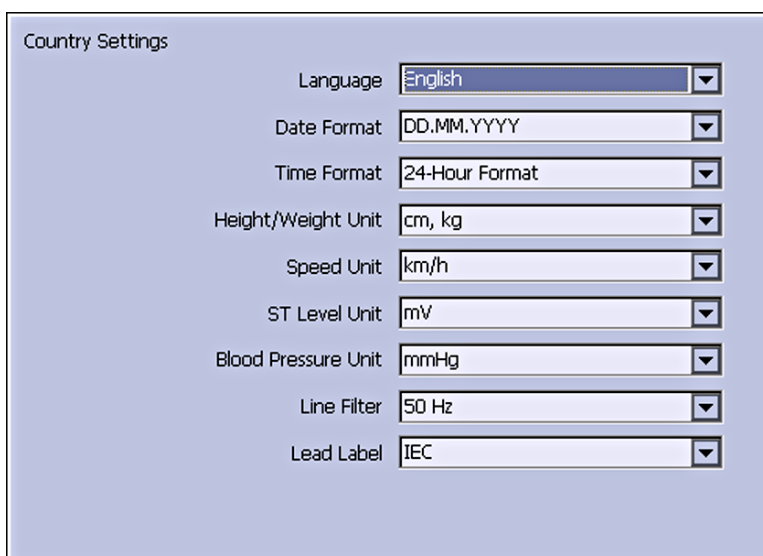
| Field | Description |
|-------------------------------|---|
| Secured DCP | Allows you to determine whether to set the DCP as a secured DCP. If you select this check box, you need to install a certificate in the Certificate text box. |
| Certificate | <p>This setting is active only if you enable the Secured DCP check box. Allows you to choose a certificate that the system can use to establish the secured DCP communication.</p> <ol style="list-style-type: none"> 1. Insert the SD card. 2. Select Browse to choose a certificate. <ul style="list-style-type: none"> • If successful, the certificate name displays in the text box. • If failed, an error message displays to tell you the reason of failure. <p>NOTE</p> <p>If you enable the Secured DCP check box but do not install a certificate, a message "Certificate cannot be empty." displays when you select Save for this DCP Settings page.</p> |
| DCP WS Address | <p>Displays the address of the DCP server to use for communication. You can locate this address using Discover DCP Device or enter it manually.</p> <ul style="list-style-type: none"> • If you enable the Secured DCP, the server address field displays as https://. Enter the server address as <server-name>:<port>/SendTest, where <server-name> is the server name or IP address and <port> is the server port number, usually 9241. • If you disable the Secured DCP, the server address field displays as http://. Enter the server address as <server-name>:<port>/SendTest, where <server-name> is the server name or IP address and <port> is the server port number, usually 9240. |
| Test Device Connection | Allows you to test the connection to the selected DCP server. The status of the connection displays in the text box. |

12.6 Country Setup

The **Country Setup** function allows you to define the following:

- System language
- Date and time formats
- Measurement units
- Line filter
- Lead label

To access the **Country Setup**, on the **Main Menu** press **System Configuration > More > Country Setup**.



Country Settings

Language: English

Date Format: DD.MM.YYYY

Time Format: 24-Hour Format

Height/Weight Unit: cm, kg

Speed Unit: km/h

ST Level Unit: mV

Blood Pressure Unit: mmHg

Line Filter: 50 Hz

Lead Label: IEC

The following table identifies the settings on **Country Setup**.

Table 12-3 Country Setup Fields

| Field | Comments |
|----------------------------|---|
| Language | Determines the language the interface and reports use. |
| Date Format | Determines the format in which dates are displayed. Options are: <ul style="list-style-type: none"> • DD.MM.YYYY • MM/DD/YYYY • YYYY-MM-DD |
| Time Format | Determines whether the system uses a 12-hour or a 24-hour format. |
| Height/Weight Unit | Determines whether the system uses metric measurements (cm, kg) or American measurements (in, lb) for patient weight and height. |
| Speed Unit | Determines whether the speed of stress devices is measured in kilometers per hour (km/h) or miles per hour (mph). |
| ST Level Unit | Determines whether the ST segment is measured in millivolts (mV) or millimeters (mm). |
| Blood Pressure Unit | Determines whether blood pressure is measured in millimeters of mercury (mmHg) or kilopascals (kPa). |
| Line Filter | Determines the frequency of the line filter. Options are 50 Hz and 60 Hz. |
| Lead Label | Determines whether the system labels leads using the standards of the International Electro-technical Commission (IEC) or the American Heart Association (AHA). |

12.7 Print Setup Report

The **Print Setup Report** utility prints a report of individual settings or the complete system settings. You may use the report to verify that all of your devices are configured identically or as a reference if you need to re-configure a device.



Use the following instructions to print a setup report:

1. On the **Main Menu** press **System Configuration > More > Print Setup Report**.
2. On the **Print Setup Report** window, select the report you want to print.
 - **Basic Setup**
 - **Resting Setup**
 - **Arrhythmia Setup**
 - **Stress Setup**
 - **RR Analysis Setup**
 - **Communication Setup**
 - **Country Setup**
 - **Patient Setup**
 - **User Setup**
 - **Options Setup**
 - **Order Manager Setup**
 - **Complete Setup**
3. When you are done, press **Return** to return to the **Main Menu**.

12.8 Patient Setup

The **Patient Setup** function allows you to define the following information:

- Available and required patient information

- Available test information
- Available clinical trial information

This is available only if the **CTDG CT Data Guard** option is activated.

- Barcode reader settings

This is available only if the **BCRD USB Barcode Reader** option is activated.

To access **Patient Setup**, on the **Main Menu** press **System Configuration > More > Patient Setup**.

The following tables identify the settings on **Patient Setup**.

| Field | Description |
|----------------------|--|
| Visit | Determines whether the Visit field is available when entering test information. |
| Patient ID | Determines whether the patient ID is required. On reports, it is labelled ID . |
| Secondary ID | Determines whether a secondary patient ID is available when entering patient data and whether it is required. It can only be required if it is first enabled. On reports, it is labelled ID 2 . |
| Last Name | Determines whether the patient's last name field is available when entering patient data and whether it is required. It can only be required if it is first enabled. |
| First Name | Determines whether the patient's first name field is available when entering patient data and whether it is required. It can only be required if it is first enabled. |
| Kanji Name | Determines whether the Kanji name field is available when entering patient data. |
| Date of Birth | Determines whether the date of birth field is available when entering patient data. |
| Age | Determines whether the age field is available when entering patient data. |

Continues on the next page

| Field | Description |
|--------------------------------------|--|
| Height | Determines whether the height field is available when entering patient data. |
| Weight | Determines whether the weight field is available when entering patient data. |
| Gender | Determines whether the gender field is available when entering patient data. |
| Race | Determines whether the race field is available when entering patient data. |
| Phone Number | Determines whether the phone number field is available when entering patient data. |
| Pacemaker | Determines whether the pacemaker field is available when entering patient data. |
| Enable Patient ID Check | Determines whether additional checks are performed to ensure that the patient ID meets the requirements of the national patient ID used in Scandinavian countries. If this field is set, you must select the appropriate Patient ID Type . |
| Patient ID Type | <p>This field is available only if the Enable Patient ID Check field is set. This field determines which type of ID is used and, therefore, which checks to perform. Options are:</p> <ul style="list-style-type: none"> • Swedish Patient ID • Danish Patient ID • Norwegian Patient ID <p>When a patient ID is entered, the system verifies its format, extracts the patient's gender and date of birth, and populates those fields if they are enabled.</p> |
| Patient ID Length (0-30) | <p>Defines the maximum length of the patient ID within the range of 0 to 30 characters.</p> <p>This field is available only if the Enable Patient ID Check field is cleared.</p> |
| Patient ID with leading zeros | <p>Determines whether the system should prefix the Patient ID with zeroes to fill in the length of the Patient ID specified in the field Patient ID Length.</p> <p>For example, If the user selected the length of the Patient ID field as 10 and entered the PID PID098, it is displayed by the system as 0000PID098.</p> |
| Sort Patient List by | <p>Determines the field by which the patient list is sorted. Options are:</p> <ul style="list-style-type: none"> • Patient ID • Secondary ID • Patient Name |

Test Information Setup

Enabled

Systolic BP ☒

Diastolic BP ☒

Print ☒

Location ☒

Room ☒

Order Number ☒

Indication ☒

Medications (0-3)

Print ☒

Ordering Physician ☒

Referring Physician ☒

Attending Physician ☒

Technician ☒

Print ☒

Extra Questions...

Page Up

Required Technician ☐

Page Down

| Field | Description |
|----------------------------|---|
| Systolic BP | Determines whether the systolic blood pressure field is available when entering test information. |
| Diastolic BP | Determines whether the diastolic blood pressure field is available when entering test information. |
| Print | Determine whether the following 5 fields will be printed on thermal or PDF report. |
| Location | Determines whether the location field is available when entering test information. |
| Room | Determines whether the room field is available when entering test information. |
| Order Number | Determines whether the order number field is available when entering test information. |
| Indication | Determines whether the indication field is available when entering test information. |
| Medications (0-3) | Determines the number of medications that you can enter into the test information window. |
| Print | Determine whether the following 4 fields will be printed on thermal or PDF report. |
| Ordering Physician | Determines whether the ordering physician field is available when entering test information. |
| Referring Physician | Determines whether the referring physician field is available when entering test information. |
| Attending Physician | Determines whether the attending physician field is available when entering test information. |
| Technician | Determines whether the technician field is available when entering test information and whether it is required. It is required only if it is enabled. |
| Print | Determine whether the following field will be printed on thermal or PDF report. |

Continues on the next page

| Field | Description |
|---------------------------|---|
| Extra Questions... | Opens the Extra Questions window, which allows you to define up to four custom fields. Each field consists of a Prompt and a Type . The Prompt can be up to 10 characters. The Type can be any of the following: <ul style="list-style-type: none"> • Alphanumeric • Numeric • Yes/No/Unknown |

| Field | Comments |
|----------------------------------|--|
| Visit Number | Determines whether the visit number field is available when entering clinical trial information. |
| Visit Type | Determines whether the visit type field is available when entering clinical trial information. |
| Dose Type | Determines whether the Dose Type field is available when entering clinical trial information. If this field is set, use Dose List... to define the types of doses that are available when entering clinical trial information. |
| Investigator ID | Determines whether the investigator ID field is available when entering clinical trial information. |
| Extra Questions | Opens the Extra Questions window, which allows you to define up to five custom clinical test fields. Each field consists of a Prompt and a Type . The Prompt can be up to 10 character. The Type can be any of the following: <ul style="list-style-type: none"> • Alphanumeric • Numeric • Yes/No/Unknown |
| Dose List | Opens the Dose List window, which allows you to define the dose types that will be available when entering clinical trial information. Doses are plain text up to 32 alphanumeric characters. The user can add up to 20 doses. |
| Project Code and Trial ID | Identifies the Project Code and Trial ID that are displayed when entering clinical trial information. Allows the user to define up to five sets of Project Code and Trial ID . |

Barcode Scanner Setup Page Up

Auto Configure

Total number of bytes

| | Offset | Length |
|----------------|--------------------------------|--------------------------------|
| Patient ID | <input type="text" value="0"/> | <input type="text" value="0"/> |
| Visit | <input type="text" value="0"/> | <input type="text" value="0"/> |
| First Name | <input type="text" value="0"/> | <input type="text" value="0"/> |
| Last Name | <input type="text" value="0"/> | <input type="text" value="0"/> |
| Year of Birth | <input type="text" value="0"/> | <input type="text" value="0"/> |
| Month of Birth | <input type="text" value="0"/> | <input type="text" value="0"/> |
| Day of Birth | <input type="text" value="0"/> | <input type="text" value="0"/> |
| Gender | <input type="text" value="0"/> | <input type="text" value="0"/> |

| Field | Comments |
|------------------------------|---|
| Auto Configure | Automatically configures the barcode reader. When you click this link, you are prompted to scan a configuration barcode created by the site's IT department. For more information on creating the barcodes, see A Creating Barcodes on page 178 . |
| Total number of bytes | Identifies the total number of bytes on the barcode. |
| Offset | Identifies the position of the initial character of the corresponding field. |
| Length | Identifies the number of characters for the corresponding field. |

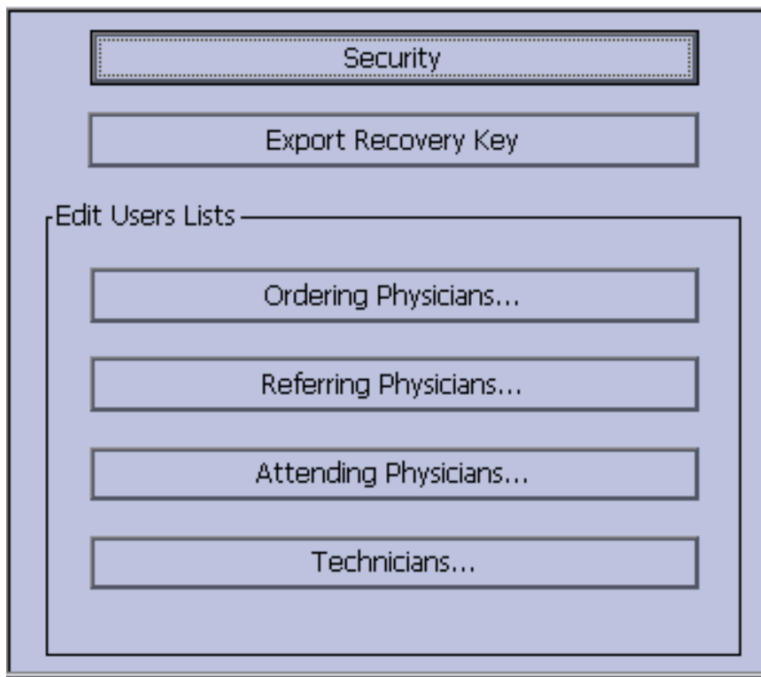
12.9 User Setup

The **User Setup** function allows you to define the following:

- User names
- User identification
- User roles
- User privileges

Users entered in setup can be selected for system defaults and patient information. If **High Security Mode** is enabled, anyone who uses the system must be set up as a user with a user ID, a password, and privileges to log on to the system. For more information on setting system defaults and enabling **High Security Mode**, see [12.1 Basic Setup on page 104](#).

To access **User Setup**, on the **Main Menu** press **System Configuration > More > User Setup**.



When you run **User Setup**, the **Edit User Lists** window opens to offer the options:

- Security
- Export Recovery Key

NOTE

This option displays only if **High Security Mode** is enabled.

- Ordering Physicians
- Referring Physicians
- Attending Physicians
- Technicians

12.9.1 Configure the Password Rule

In **User Setup > Edit User Lists** window, select **Security** to configure the password rule:

The screenshot shows a 'User Setup' dialog box with the following settings:

- Expiration:**
 - ☐ **User Password Expiration**
 - Minimum Validity Period (0-364 days): 0
 - Maximum Validity Period (2-365 days): 365
- Password Security:**
 - Minimum Password Length: 8
 - Prevent Reuse of Previous Password: 10
 - Password must Contain:**
 - Lowercase: ☐
 - Uppercase: ☐
 - Numeric: ☐
 - Special Characters: ☐
- Account Lockout:**
 - Account Lockout Attempts (0-99): 1
 - Account Lockout Duration (1-120 min): 1

| Field | Action | Description |
|---|---|---|
| User Password Expiration | Enable or disable this setting. | <p>If this setting is enabled, set the duration for password expiration in the Minimum validity period (0-364 days) and Maximum validity period (2-365 days) fields. The password expires after the configured duration, and the user is prompted to set a new password.</p> <p>If this setting is disabled, the password does not expire.</p> <p>Default value: Disabled</p> |
| Minimum validity period (0-364 days) | Set the minimum password expiration duration in days. User Password Expiration must be enabled. | <p>Default value for minimum: 0</p> <p>Allowed values for minimum: 0 to 364</p> <p>The password cannot be changed during the set period (in days).</p> |
| Maximum validity period (2-365 days) | Set the maximum password expiration duration in days. User Password Expiration must be enabled. | <p>Default value for maximum: 365</p> <p>Allowed values for maximum: 2 to 365</p> <p>The password will expire after the set time (in days).</p> |
| Minimum Password Length | Set the minimum number of characters required for a user password. | <p>While adding or modifying a user, if the user password does not meet the minimum number of required characters, the password is not accepted by the system.</p> <p>The password is not accepted by the system if the user does not add the minimum number of required characters.</p> <p>Default value: 8</p> <p>Allowed values: 8 to 14</p> |
| Prevent Reuse of Previous Password | Select a value from the drop-down list. | <p>Default value: 10</p> <p>Allowed values: 10 to 32</p> |
| Lowercase | Enable or disable this setting. | <p>If enabled, the user must add lowercase alphabet characters in the password.</p> <p>If disabled, the user does not need to add lowercase alphabet characters in the password.</p> <p>Default value: Disabled</p> |

Continues on the next page

| | | |
|---|---|--|
| Numeric | Enable or disable this setting. | If enabled, the user must add numeric characters in the password. If disabled, the user does not need to add numeric characters in the password. Default value: Disabled |
| Uppercase | Enable or disable this setting. | If enabled, the user must add uppercase alphabet characters in the password. If disabled, the user does not need to add uppercase alphabet characters in the password. Default value: Disabled |
| Special Characters | Enable or disable this setting. | Special Characters: ~`!@#\$%^&*()_+{} :\<>?[]\;',./ If enabled, the user must add special characters in the password. If disabled, the user does not need to add special characters in the password. Default value: Disabled |
| Account Lockout Attempts (0–99) | Select a value from the drop-down list to lock the account after failed logon attempts. | Default value: 5 Allowed values: 0 to 99 |
| Account Lockout Duration (1–120 min) | Select a value from the drop-down list to set the duration (in minutes) for the account to be locked. | Default value: 1 Allowed values: 1 to 120 |

12.9.2 Export Recovery Key

In **User Setup > Edit User Lists** window, if **High Security Mode** is enabled, follow below steps to **Export Recovery Key**:

1. Insert the SD card.
2. Press **Export Recovery Key**. A message displays: **Recovery key exported successfully**.

NOTE

The recovery key is used to recover the system when you forget your password. See [2.3.6 High Security Mode on page 44](#)

12.9.3 Configure User

In **User Setup > Edit User Lists** window, when you select one of below roles, a list of existing users with that role displays.

- Ordering Physicians
- Referring Physicians
- Attending Physicians
- Technicians

You can add, edit, and delete users.

The following table identifies the settings on **User Setup**.

| Field | Comment |
|---------------------------|---|
| Last Name | Identifies the user's surname. This field is required and allows a maximum of 40 alphanumeric characters. |
| First Name | Identifies the user's given name. This field is optional, but if used, allows a maximum of 20 alphanumeric characters. |
| User ID | Defines a unique ID for the user. If High Security Mode is enabled, the user needs to enter this ID to log on to the system. This field is required and allows a maximum of 30 alphanumeric characters. NOTE The system does not prevent duplicate IDs. If the same ID is used more than once, only the first user created with the ID is able to log on to the system. |
| MUSE ID | Defines the ID with which the user logs on to the MUSE system. This field is used if reports from this system are transmitted to a MUSE system. |
| Ordering | Determines whether the user fills the role of ordering physician. If this is the role that was selected on the Edit User List window, this field is checked by default. You may select multiple roles, but you must select at least one role. |
| Referring | Determines whether the user fills the role of referring physician. If this is the role that was selected on the Edit User List window, this field is checked by default. You may select multiple roles, but you must select at least one role. |
| Attending | Determines whether the user fills the role of attending physician. If this is the role that was selected on the Edit User List window, this field is checked by default. You may select multiple roles, but you must select at least one role. |
| Technician | Determines whether the user fills the role of technician. If this is the role that was selected on the Edit User List window, this field is checked by default. You may select multiple roles, but you must select at least one role. |
| Password | Defines the password the user must enter along with the User ID to log on to the system if High Security Mode is enabled. This field must be between 6 and 30 alphanumeric characters. |
| Retype Password | Confirms the password was entered correctly. |
| Edit Setup | Enables/disables the user's ability to edit system setup information. |
| Edit Date and Time | Enables/disables the user's ability to edit system date and time. |
| Edit Users | Enables/disables the user's ability to edit user information. |
| Edit Record | Enables/disables the user's ability to edit ECG records. |
| Delete Record | Enables/disables the user's ability to delete ECG records. |
| Transmit Records | Enables/disables the user's ability to transmit ECG records. |

NOTE

In the fields **Edit Users** and **Edit Setup**, privileges are required by the activated user to activate **High Security** mode.

In the fields **Edit Setup** and **Delete Record**, privileges are required by the activated user to export the system audit trail log.

12.10 Select Setup

The **Select Setup** utility allows you to save up to five system configurations and switch between them. This is useful if the system is shared by departments or used in multiple clinical trials.

Use the following instructions to save and load configuration files:

1. On the **Main Menu** press **System Configuration > More > More > Select Setup**.

The **Select Setup** window opens. The name of the setup the system is using currently is displayed in the **Loaded Setup** field.

2. To save a copy of the current setup, do the following:

- a. Press **Save As**.

The **Setup Name** window opens.

- b. Type a name for the configuration and press **Save**.

The configuration is saved, and the **Setup Name** window closes.

3. To load a different setup, do the following:

- a. Select the setup you want to load.

- b. Press **Load Setup**.

- c. Restart the system.

You must power the device off and then on for all setup changes to take effect, especially if the new setup includes a change to the language setting; the language does not change until the system restarts.

4. To delete a setup file, do the following:

- a. Select the file you want to delete.

- b. Press **Delete**.

You are prompted to confirm the deletion.

- c. Press **OK**.

NOTE

You cannot delete a configuration that is currently loaded.

5. To change the name of a system setup file, do the following:

- a. Select the setup file you want to change.

- b. Press **Edit Name**.

The **Setup Name** window opens.

- c. Type the new name and press **Save**.

6. To remove all custom settings, do the following:

- a. Select the setup file you want to reset.

- b. Press **Factory Defaults**.

- c. When prompted to confirm, press **Save**.

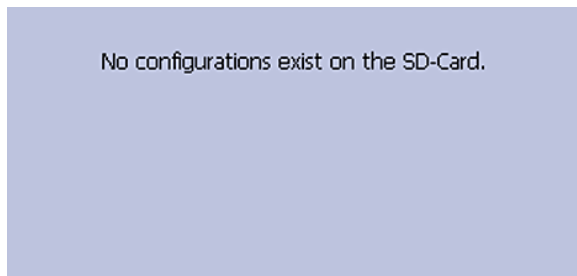
7. When you are done, press **Return** to exit.

12.11 Import Setup

The **Import Setup** utility allows you to import up to five system setup files from another device that were exported to an SD card. This feature is useful to sites with multiple systems that need to have the same or similar setups.

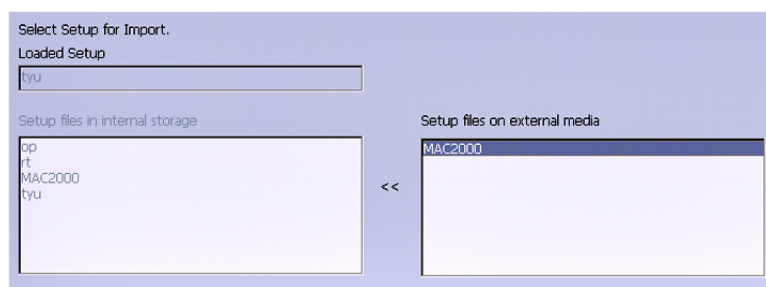
1. Insert the SD card with the saved setup file.

If you do not have a valid SD card, you receive the following message:



2. On the **Main Menu** press **System Configuration > More > More > Import Setup**.

The **Select Setup for Import** window opens.



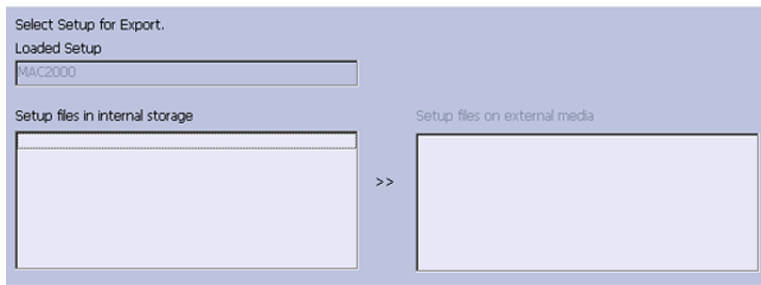
All saved settings on the device are listed in the left column. All saved settings on the SD card are listed in the right column.

3. In the right pane, select the setup file you want to import.
4. Press **Import**.
The selected file is copied to the device and is displayed in the left column.
5. Repeat step 3 through step 4 for each saved configuration file you want to import.
6. When you are done, press **Return**.

12.12 Export Setup

The **Export Setup** utility allows you to export saved settings from the device to an SD card. You can then use the SD card to import the settings to another device, greatly simplifying the installation and configuration of multiple devices.





1. Insert an SD card into the SD card slot in the back panel, as shown in the following illustration:



2. Push the SD card into the slot to seat it in place.
3. On the **Main Menu** press **System Configuration > More > More > Export Setup**.
The **Select Setup for Export** window opens. All saved settings on the device are listed in the left column. All saved settings on the SD card are listed in the right column.
4. In the left pane, select the setup file you want to export.
5. Press **Export**.
The selected file is copied to the SD card and is displayed in the right column.
6. Repeat step 4 through step 5 for each saved configuration file you want to export.
7. When you are done, press **Return**.

12.13 Options Setup

The **Options Setup** function allows you to activate options by entering **Option Codes**, which are generated for a specific serial number and can only activate options on the device with that serial number.

All purchased options are activated when the system ships. If you purchase a new option or re-activate an option, use the following instructions:

Activated Options

| Option | Description |
|--------|-------------|
| | |

Type option code and press enter to activate options.

Option Code

1. On the **Main Menu** press **System Configuration > More > More > Options Setup**.
2. In the **Option Code** field, type the 12-digit activation code.
You can find activation codes for purchased options on the **Active Code Summary Sheet** provided with the system or with additional purchased options.
3. Press **Enter**.
The **Option Activated** message is displayed at the bottom of the window.
4. Repeat step 2 through step 3 for any additional options you want to activate.
5. Press **Save** to save the configuration options.

| Option Code | Name |
|-------------|---|
| CTDG | CT Data Guard |
| R12L | 12-Lead display for Resting ECG. This is always active. |
| FULL | Full Disclosure |
| ME12 | 12SL Measurement |
| MEHR | HEART Resting Measurement |
| MI12 | 12SL Measurement and Interpretation |
| MIHR | HEART Resting Measurement and Interpretation |
| M100 | Storage for 100 ECGs |
| M200 | Storage for 200 ECGs |
| LANC | LAN Communication to the CardioSoft/CS system |
| LANM | LAN Communication to the MUSE system |
| MODC | Modem or serial communication to the CardioSoft/CS system |
| MODM | Modem or serial communication to the MUSE system |
| ERGO | Stress test with treadmill, bicycle, or Master's Step test. This is a 6-lead waveform display. |
| E12L | 12-Lead display for Stress Test |
| CFRA | 21 CFR Part 11 Audit Trail |

Continues on the next page

| Option Code | Name |
|-------------|---|
| BCRD | USB Barcode Reader |
| TIPI | ACI-TIPI (Acute Cardiac Ischemia — Time Insensitive Predictive Instrument) This option is disabled if MEHR or MIHR is enabled. |
| RRAN | RR analysis |
| PDFC | PDF file copy |
| WIFC | Wireless communications to a CardioSoft/CS system |
| WIFM | Wireless communications to a MUSE system |
| SOML | Simple Orders from non-MUSE systems |
| SOMF | Simple Orders from MUSE and non-MUSE systems |
| AOMF | Order Manager for MUSE and non-MUSE systems |
| AOML | Order Manager for non-MUSE systems |
| ADTF | ADT (Patient Demographics) downloaded from MUSE and non-MUSE systems |
| ADTL | ADT (Patient Demographics) downloaded from non-MUSE systems |

NOTE

To disable an option, go to **System Configuration > Option Codes**, type the text **disable <option code>** in the text box and press **OK**.

For example, to disable ADTL, type **disable ADTL** in the text box and press **OK**.

12.14 Service Setup

The **Service Setup** option allows service personnel to configure the following:

- **Device Settings**
- **Event Log**
- **System Diagnostics**
- **Software Update**
- **Format Flash**
- **Open Command Prompt**
- **Set Password**
- **WIFI Parameter Settings**
- **Wireless Country of Operation**

Service personnel need to enter the service password to gain access to the system.

Refer to the service manual for your system for more details.

12.15 Date/Time Setup

The **Date/Time Setup** function allows you to configure the system's date and time settings.

To access **Date/Time Setup**, on the **Main Menu** press **System Configuration > More > More > More > Date/Time Setup**.

Date and Time Setup

Date . . DD.MM.YYYY

Time : :

The following table identifies the settings on **Date/Time Setup**.

| Field | Description |
|-------------|--|
| Date | Sets the current system date. The format of the fields depends on the date format selected on Country Setup . For more information, see 12.6 Country Setup on page 137 . |
| Time | Sets the current system time. If the Automatically Synchronize with Time Server field is set on Basic Setup , any changes made to the time are overwritten during the next synchronization. For more information, see 12.1 Basic Setup on page 104 . NOTE Daylight Saving Time changes take effect only after a restart. |

12.16 Order Manager Setup

Order Manager Setup

Initial sort value

Auto Order Deletion ☐

Default Order Location(s),
e.g. 1,13,65:

| Field | Comment |
|----------------------------|---|
| Initial sort value | Determines how the Order Manager initially sorts the ECGs. Select one of the following values: <ul style="list-style-type: none"> • Patient Name • Patient ID • Location |
| Auto Order Deletion | If enabled, the system deletes orders associated with ECG files that were deleted automatically. Automatic deletion of ECG files can happen in the following conditions: <ul style="list-style-type: none"> • Delete after Transmission field on the Resting ECG Setup window is enabled and the associated ECG file was successfully transmitted to a receiving system. • After the successful transmission of an ECG file associated with an order, provided the ECG was never saved on the system. |

Continues on the next page

| Field | Comment |
|---|--|
| Default Order Location(s) , for example 1,13,65: | Identifies the locations displayed on the prompt when downloading orders. This will typically be the device's location (see 12.1 Basic Setup on page 104). If the device is used in multiple locations, enter multiple locations and separate them with commas: 1,3,10, and so on. |

12.17 RR Analysis Setup

The RR Analysis Setup function allows you to configure the RR Analysis report. For details, see [9.1.1 RR Analysis Setup on page 84](#).

12.18 PDF File Naming Convention

The device provides two types of naming conventions:

- Default Naming
- Customize Naming

12.18.1 Default Naming Convention

To help identify the exported PDF files, they are automatically named with the following descriptive components:

- *product_version_serial_ECGmode_cartID_creationdata.pdf*

For example:

- *GEMAC2000_1.0_SDS07410016WP_resting_1_2007-11-22T17-56-32.pdf*

The following table identifies each component in the example:

Table 12-4 Components of the File Naming Convention

| Value | Component Description |
|---------------|--|
| GEMAC2000 | Product name: this is always GEMAC2000. |
| 1.0 | Software version: this varies based on the software version installed. |
| SDS07410016WP | The device serial number: this varies from device to device. |
| resting | ECG mode: this is either resting (Resting ECG mode), rrana (RR Analysis mode) or full (Full Disclosure mode). |
| 1 | Cart ID: this varies from device to device. The Cart ID is the same as the Cart # field in Basic Setup . For more information, see 12.1 Basic Setup on page 104 . |

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Table 12-4 Components of the File Naming Convention (Table continued)

| Value | Component Description |
|---------------------|--|
| 2007-11-22T17-56-32 | <p>Creation data: this consists of the following subcomponents:</p> <ul style="list-style-type: none"> • 2007 - Year the PDF was written. • 11 - Month the PDF was written. • 22 - Date the PDF was written. • T - Indicates the following numbers are time. • 17 - Hour, in 24 hour format, the PDF was written. • 56 - Minute the PDF was written. • 32 - Second the PDF was written. |

12.18.2 Customizing the Naming Convention

Users can name the PDF files according to their own requirements by using given elements:

1. On the **Main Menu**, press **System Configuration**.
The **System Configuration** window opens.
2. Press **Basic Setup**.
The **Basic Setup** window opens.
3. Press **Page Down** to the **PDF Naming Settings** option.
4. Select the **Generate Automatic File Name** check box.

The following elements are available:

- **Patient ID**
- **Visit**
- **Last Name**
- **First Name**
- **Date of Birth**
- **Procedure**
- **Date of Test**
- **Export Date**
- **Secondary ID**

Procedure means **ECG Mode**. This is either **resting** (Resting ECG mode), **rrana** (RR Analysis mode) or **FullDisclosure** (Full Disclosure mode).

5. Press **Save** and return to the **System Configuration** window.

12.18.3 Exporting the Audit Trail

The **Audit Trail Export** function copies the system audit trail in XML format to an SD card and then clears the audit trail on the system. If a previous audit trail exists on the SD card, it is overwritten automatically by the new audit trail.

GE Healthcare recommends exporting the audit trail weekly to long term storage to meet archive requirements. If the audit trail is not exported regularly, it consumes storage space and reduces the number of ECGs that you can store on the device.

To export an audit trail, the following conditions must be met:

- **High Security Mode** must be enabled.

To enable **High Security Mode**, see [12.1 Basic Setup on page 104](#).

- **Audit Trail** must be enabled.

To enable **Audit Trail**, see [12.1 Basic Setup on page 104](#).

- You must have **Edit Setup** and **Delete Records** permissions set.

To set permissions for Edit Setup and Delete Records, see [12.9 User Setup on page 144](#).

Use the following procedure to export the audit trail to an SD card:

1. Insert an SD card into the device.
2. On the **Main Menu**, press **System Configuration** > **More** > **More** > **More** > **Export Audit** > **SD-Card**.

After the audit trail is copied to the SD card and cleared from the system a message notifies you that the export was successful.

Use the following procedure to export the audit trail to the Shared Directory:

1. Set up the Shared Directory, see [12.5 Communication Setup on page 127](#).
2. On the **Main Menu**, press **System Configuration** > **More** > **More** > **More** > **Export Audit** > **Shared Directory**.

After the audit trail is copied to the Shared Directory and cleared from the system a message notifies you that the export was successful.

Use the following procedure to export the audit trail to the FTP Server:

1. Set up the FTP Server, see [12.5 Communication Setup on page 127](#).
2. On the **Main Menu**, press **System Configuration** > **More** > **More** > **More** > **Export Audit** > **FTP Server**.

After the audit trail is copied to the FTP Server and cleared from the system a message notifies you that the export was successful.

After the XML file is exported, you can review or print the audit trail as needed. For more information on how to parse the XML file for viewing or printing, refer to the *GE Cardiology Open XML Reference Manual*. To locate the part number for this manual, refer to "Related Documents" in the service manual.

13 Cleaning and Disinfection

- Do not disassemble and reassemble the device during the cleaning and disinfection process.
- No special accessories are required.

13.1 Inspect the Device

Carefully inspect the device between uses to verify proper function.

Evidence of damage and wear on a device may include, but is not limited to, discoloration, excessive scratches, wear, and cracks. Improperly functioning devices, damaged, and excessively worn devices should not be used.

13.2 Care at the Point of Use

Clean instruments daily.

Soiled devices must be separated from non-contaminated devices to avoid contamination of personnel or surroundings.

13.3 Preparation for Cleaning

For multi-piece or complex instruments, refer to their disassembly instructions. The disassembly instructions are available in the *MAC™ 2000 Resting ECG Analysis System Service Manual*.

Contact your local GE Healthcare service representative for further information. For instruments produced by another manufacturer, reference the manufacturer's instructions for use.

13.4 Clean and Disinfect Guidelines

Observe the guidelines while cleaning and disinfecting the device.

- Follow cleaning instructions and observe hazards exactly as issued by GE Healthcare or other suppliers listed.
- Avoid exposure to hypochlorite solutions and solutions containing iodine or high chlorine content, as these will promote corrosion.
- Avoid exposure to highly alkaline conditions (pH > 11), as this can damage products (for example, aluminum parts).
- Never use conductive solutions or solutions that contain wax or wax compounds to clean the equipment.
- Do not immerse the device in any liquid as this may corrode metal contacts and affect signal quality.
- Do not drip or expose the writer assembly to any liquids.
- Do not allow fluid to pool around connection pins. If this happens, blot dry with a soft, lint-free cloth.
- Avoid contact with open vents, plugs, or connectors during the cleaning and disinfecting procedures.
- Never autoclave or steam-clean the device.

- Do not use until thoroughly dry.
- Do not use any of below materials to clean the device, because their use may damage equipment surfaces.
 - Organic solvents
 - Abrasive cleaners or solvents of any kind
 - Acetone
 - Ketone
 - Betadine
 - Sodium salts
 - Ammonia-based solvents
 - Abrasive cleaning agents
 - Virex®
 - Sani-Master®
 - PDI Sani-Cloth® Plus
 - Oxivir® Tb Wipes

13.5 Visual Inspection, Cleaning and Disinfection Frequency

The table indicates the frequency of visual inspection, cleaning, and disinfection procedures.

| Component | Visual Inspection | Cleaning | Disinfection |
|---|---|--------------------------------------|---|
| Device and Trolley NOTE Trolley is an optional purchase. | Daily, preferably before the equipment's first use each day | Daily, or more frequently, as needed | Follow the same frequency as cleaning. Disinfection must be performed after cleaning. |
| Leadwires | Refer to the supplier's instructions for leadwire cleaning and disinfection. | | |
| Reusable electrodes | Refer to the supplier's instructions for reusable electrode cleaning, disinfection and sterilization. | | |

13.6 Clean and Disinfect the Device and Trolley

If you purchase a trolley, the device and trolley are designed to require regular inspection and cleaning to function properly. The cleaning instructions for the device includes the touchscreen.

WARNING



ELECTRICAL HAZARD - Improper handling during inspection or cleaning could result in electrical shock. To avoid potential shock, observe these guidelines at all times:

13.6.1 Inspect, Clean and Disinfect the Device and Trolley

Perform a visual inspection to verify that the device meets the minimum conditions:

- The case and display screen are free of cracks and other damage.
- All plugs, cords, cables, and connectors are free of kinks, frays, and other damage.
- All cords and connectors are securely seated.
- All keys and controls operate properly.
- The trolley exterior is free of cracks and other damage.
- The accessory track is functioning properly.
- All cords and connectors are securely seated.
- The actuation lever is functioning properly.
- The castor wheels are functioning properly.

If you notice any items that need repair, contact an authorized service representative to make the repairs. Discontinue using the device until the repairs can be made.

13.6.2 Clean the Device and Trolley

NOTE

The automated washer-disinfector is not applicable for MAC™ 2000 medical devices.

1. Put on new gloves.
2. Gather approved agent(s).
3. Wipe all sides of the part, using as many fresh wipes as needed until clean.

NOTE

If using a spray, spray onto a clean, lint-free cloth to use as a wipe.

4. If there are any grooves, gaps, or buttons, wrap the wipe over a swab and/or plastic card.
Place the edge or tip in any groove, gap, or button, and gently drag the wrapped wipe.

NOTE

Use fresh wipes each time.

5. Ensure the device is visually clean.
6. Allow the device to air dry.
7. Discard wipes and gloves to clinical waste.

Do not reuse wipes.

13.6.3 Post-Clean Inspection

GE Healthcare devices should be visually inspected and functionally tested after cleaning and prior to disinfection for the items below:

- Cleanliness.
- Damage, including but not limited to corrosion (rust, pitting), discoloration, excessive scratches, flaking, cracks, and wear.

- Missing or worn part numbers.
- Proper functioning, including but not limited to the quality of ECGs; correct movement of hinges, joints, box locks, handles, ratchets, and couplings; proper alignment of jaws and teeth; and secure fastening of all locking mechanisms.

Do not use devices that are not functioning properly, that have unrecognizable markings, that have missing or worn part numbers, or that are damaged. Disassembled devices should be reassembled prior to disinfection unless otherwise instructed.

13.6.4 Disinfect the Device and Trolley

NOTE

The automated washer-disinfector is not applicable for MAC™ 2000 medical devices.

1. Put on new gloves.
2. Gather approved agent(s).
3. Wipe all sides of the part with wipes, using as many fresh wipes as needed.

NOTE

If using a spray, spray onto a clean, lint free cloth to use as a wipe.

4. If there are any grooves, gaps, or buttons, wrap the wipe over a swab and/or plastic card.
Place the edge or tip in any groove, gap, or button, and gently drag the wrapped wipe.

NOTE

Use fresh wipes each time.

5. Using fresh wipes, wipe the part to thoroughly wet.
6. Ensure the device stays wet for the wet time of the given agent.
7. Allow the device to air dry.
8. Discard wipes and gloves to clinical waste.

Do not reuse wipes.

13.7 Clean and Disinfect Leadwires and Reusable Electrodes

CAUTION



IMPROPER FUNCTIONING - Leadwires and electrodes that are not functioning properly could result in ECG distortion or failure. Carefully inspect instruments between uses to verify proper functioning

Refer to the supplier's instructions for leadwire cleaning and disinfection.

Refer to the supplier's instructions for reusable electrode cleaning, disinfection, and sterilization.

13.8 Storage

Store the device in a clean and dry, well-ventilated area protected from dust, moisture, insects, vermin, and extremes of temperature and humidity.

13.9 Cleaning and Disinfection Agents

The products below are compatible with the device and may be used for cleaning and disinfection.

- PDI Easy Screen Cleaning®
- PDI Super Sani-Cloth®
- Clinell® Sporidical Wipes
- PDI Sani-Cloth® AF3
- Clorox Healthcare® Hydrogen Peroxide Cleaner Disinfectant Wipes
- Clinell® Universal Range
- Mikrozid® Sensitive Wipes
- CaviWipes®
- Ethanol (ethyl alcohol) 75% (v/v)
- Isopropyl alcohol 70% (m/m)
- Propyl alcohol 50%
- Clorox Healthcare® Bleach Germicidal Wipes

13.10 Additional Information

- The cleaning and disinfection information is provided in accordance with ANSI/ AAMIST81, ISO 17664. The recommendations provided above have been validated as capable of preparing non-sterile GE Healthcare MAC™ 2000 medical devices. It remains the responsibility of the user to make sure that the cleaning and disinfection are performed using appropriate equipment, materials, and personnel and achieves the desired result. This requires validation and routine monitoring of the process. Any deviation from the provided recommendations should be properly evaluated for effectiveness and potential adverse consequences.
- All users should be qualified personnel trained on hospital policies and procedures, and current applicable guidelines and standards.
- Users should utilize appropriate Personal Protective Equipment (PPE) when cleaning and disinfecting devices in accordance with the Department of Environmental and Occupational Health and Safety's (OSHA) blood-borne pathogen guidelines or equivalent.

14 Maintenance

Regular maintenance, irrespective of usage, is essential to ensure that the equipment functions when required. This chapter provides basic maintenance information for the following components:

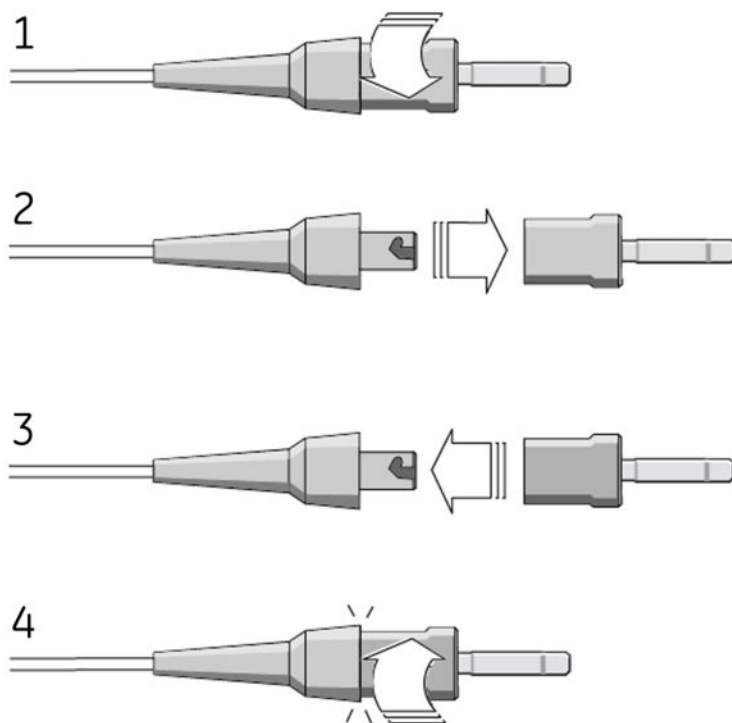
- Device
- Cables and leadwires
- Paper
- Battery

See the documentation provided with your peripherals for additional maintenance procedures.

This device does not require any calibration.

14.1 Replacing Leadwire Adapters

Although proper cleaning and storage prolong the life of leadwires, you eventually need to replace the leadwire adapters. The following illustration shows the proper method for replacing adapters.



14.2 Paper Maintenance

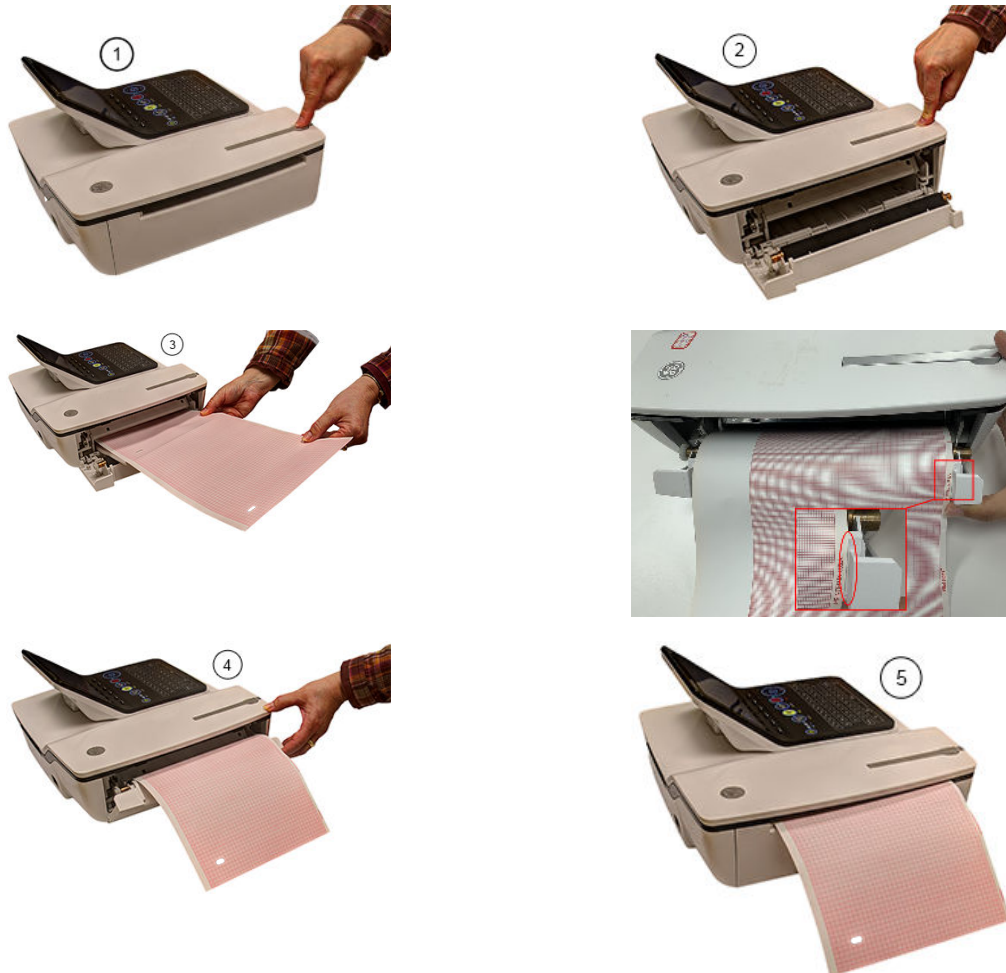
For the proper handling of the device's thermal writer, you need to know how to do the following:

- Replace the paper
- Adjusting the tray for paper size
- Remove the paper pack

- Store the thermal paper

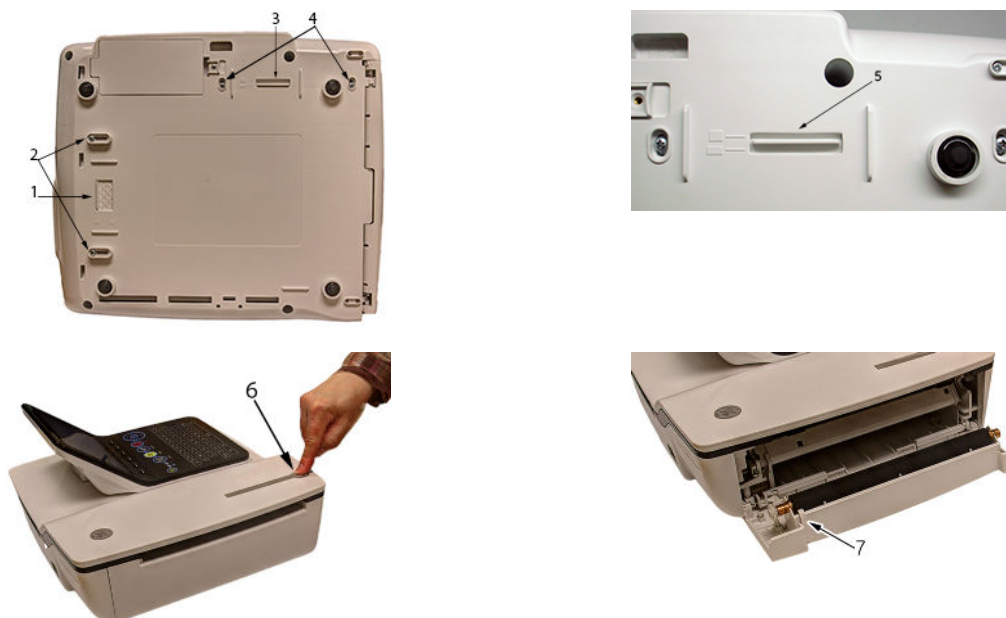
14.2.1 Replacing Paper

Use the following procedure to add or replace paper:



1. Press the push button on the top of the device (1) to open the printer door (2).
2. Extend the top sheet of the pack of paper and insert the pack into the paper compartment (3).
Align the top sheet of the paper to the line located on the near side of the printer door.
3. Close the printer door (4) until it clicks into place (5).

14.2.2 Adjusting the Tray for Paper Size



14.2.2.1 Adjusting the Tray for 8.5 x 11 inches or A4

1. Turn the device over so the bottom of the device is facing you.
2. Loosen the length and width fasteners (2 and 4) situated close to the paper spacers.
3. Slide the spacers (1 and 3) to the appropriate position for the paper size that you are using.
4. Tighten the screws (2 and 4) in the selected position.
5. Turn the device to the upright position and press the push button to open the printer door (6).
6. If you are using letter size (8.5 x 11 inches), remove the paper spacer post print (7).

NOTE

If you are using A4 paper, the paper spacer post print should be snapped on. By default, the tray is set to A4 paper and therefore the paper spacer post print is in place.

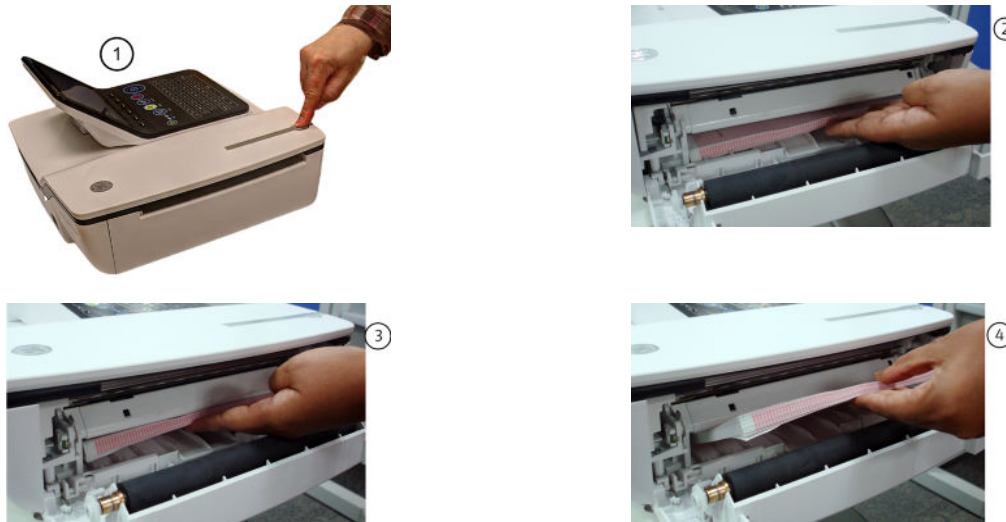
14.2.2.2 Adjusting the Tray for Modified Letter Paper (8.433 x 11 inches)

1. Press the push button to open the printer door (6) and insert the modified letter paper.
2. Turn the device over so the bottom of the device is facing you.
3. Loosen the screws for the paper tray spacer (4).
4. Slide the spacer (3) until it presses the paper that is already loaded.
Ensure that the paper spacer (5) is positioned in between the letter and A4 symbol.
5. Tighten the screws (4) with the spacer (5) at this position.
6. Loosen the other set of screws for the paper spacer (2).
7. Move the spacer (1) to the letter symbol.

8. Tighten the screws (2) with the spacer (1) at this position.

14.2.3 Removing the Paper Pack

Use the following procedure and pictures to remove the pack of paper from the device.



Use the following procedure to remove the paper pack from the printer:

1. Press the push button on the top of the device to open the printer door (1).
2. Lift up the pack of paper (2).
3. Press the pack of paper against the top plate of the paper compartment (3).
4. Pull the pack of paper out of the device (4).

14.2.4 Storing Thermal Paper

Refer to the instructions for use that accompany the thermal paper for information on storing of the thermal paper.

14.3 Battery Maintenance

The device uses a rechargeable battery containing lithium-ion cells. The battery contains an integrated electronic fuel gauge and a safety protection circuit.

Because of the bias current needed to operate the integrated electronics, the battery discharges even when it is not installed in the device. The rate at which it discharges is dependent on the ambient temperature at which it is stored. The higher the temperature, the more quickly it discharges. To prolong the battery's charge when not in use, store the battery in a cool, dry location.

A new, fully-charged battery should last for approximately 6 hours (typical) of continuous monitoring without printing. An on-screen LED indicates the condition and capacity of the battery's charge. (For more information on the battery gauge, refer to [2.2.1.1 Front View on page 33](#) and [15.7 System Errors on page 176](#)). When the LED flashes amber, connect the device to AC power to charge the battery to full capacity.

As the battery ages, the full charge capacity of the battery degrades and is permanently lost. As a result, the amount of charge that is stored and available for use is reduced. When the capacity is no longer sufficient for your daily operation, you need to replace the battery.

14.3.1 Replacing the Battery

WARNING



ENVIRONMENTAL HAZARD

Do NOT dispose of the battery by fire or burning.

Follow local environmental guidelines concerning disposal and recycling.

Use the following procedure to replace the battery:

1. Unplug the device from the AC adapter.
2. Gently turn the device over and remove the screw holding the battery cover.



3. Push the tab to remove the cover of the battery compartment.



4. Gently lift the cover of the battery compartment.



5. Remove the battery from the compartment.



6. Place the new battery in the compartment and push until it clicks into place.



7. Replace the cover on the battery compartment.
It should click into place.
8. Tighten the screw to hold the cover in place.

14.3.2 Conditioning the Battery Pack

To maintain the storage capacity of the battery installed in the device, GE Healthcare recommends that you condition the battery once every 6 months to recalibrate its electronic fuel gauge. A condition cycle consists of an uninterrupted “charge-discharge-charge” cycle.

Use the following instructions to condition the battery:

1. Insert the battery into a device that is not recording patient tests.
For details, refer to .
2. Disconnect the AC mains power from the device.
3. Enter the **Battery Status Service Diagnostic** window.
For details on accessing the **Battery Status Service Diagnostic** window, refer to this device's service manual.
4. Allow the battery to discharge until its **Charge Level** is less than 90%.
5. Turn off the device and reconnect the AC mains power.

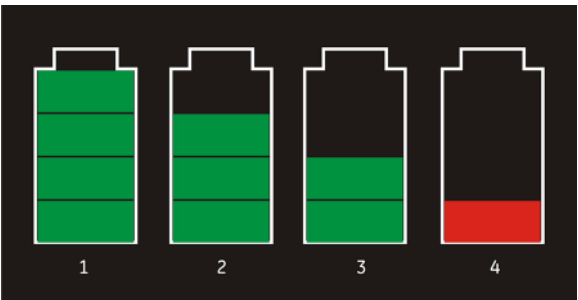
- 6. Allow the battery to fully charge.
The **Battery LED** is steady amber while it is charging and turns off when charging is complete.
- 7. Remove the AC mains power and turn on the device.
- 8. Allow the battery to discharge until the device shuts down.
- 9. Reconnect the AC mains power to the device and leave the device turned off.
- 10. Allow the battery to fully charge.

When the **Battery LED** indicator stops flashing and shines steadily, the battery is fully charged and the conditioning cycle is complete.

14.3.3 Battery Status Indicator

The battery status indicator is located on the top of the screen. For the exact location, see the screen in [7 Recording a Resting ECG on page 68](#).

The following diagram and table describe the battery status.



| Item | Description |
|------|--|
| 1 | The battery is fully charged and above 75%. |
| 2 | The battery charge is above 50%. |
| 3 | The battery charge is above 25%. |
| 4 | The battery charge is below 25%. This status is also used when the battery charge is unknown. |

14.4 Supplies and Accessories

For a list of available supplies and accessories, refer to the supplies and accessories reference guide for this device.

15 Troubleshooting

This section identifies some of the more common problems with the system and lists their potential causes and solutions. If the information in this section cannot resolve your issue, contact GE Healthcare Technical Support.

15.1 General Troubleshooting Tips

Use the following general troubleshooting tips to help diagnose problems not specifically discussed elsewhere in this chapter.

- Thoroughly inspect the equipment.

Disconnected or loose cables, missing hardware, and damaged equipment can cause what may seem to be unrelated symptoms or equipment failure.

For additional information, refer to [13.1 Inspect the Device on page 158](#).

- Verify the equipment was not modified.

Unauthorized modifications to the equipment may cause unexpected results, poor performance, or system failure.

If the equipment has unauthorized modifications, contact GE Healthcare Technical Support.

- Verify the software was not updated.

Updated software may change system functionality. If the user is unaware of the changes, they may seem to be unexpected results.

If the software has been updated, refer to the revised Operator's Manual to determine whether the update changed features.

- Verify whether there were changes in the equipment's location or environment that could cause the failure.

For example, equipment that emits radio waves could cause interference during acquisition.

If the environment or location has changed, try using the equipment in the original location to determine whether the problem persists.

- Verify the problem was not caused by operator error.

Repeat the scenario and compare that to the operation as described in the manual. If the operator deviated from the manual, repeat the task using the instructions as written.

If these steps do not resolve the problem, refer to the following sections for specific problems and solutions. If the problem still cannot be resolved, contact GE Healthcare Technical Support.

15.2 Frequently Asked Questions (FAQ)

This section addresses frequently asked questions concerning maintenance, system setup, and clinical topics.

| Question | Procedure |
|---|---|
| How do I save changes I have made to the System Configuration? | Refer to 12.12 Export Setup on page 150 . |
| How do I restore system setups from the SD card? | Refer to 12.11 Import Setup on page 150 . |
| How do I obtain a printed record of the System configuration file? | Refer to 12.7 Print Setup Report on page 138 . |
| I need to reactivate the options on my system. Where can I find the Option Codes? | The codes are listed on the last page of your printed setup report. Refer to 12.7 Print Setup Report on page 138 . They are also found on a label next to the battery compartment. |
| Why won't any of the ECGs I perform save to the SD card? | Refer to 11.9 Exporting Records on page 101 . |
| Should I clean the device? | Refer to 13 Cleaning and Disinfection on page 158 . |
| What is the capacity of the battery? | Refer to the Battery information in 2 Product Overview on page 32 and 2.2.1.7 Hardware Specifications on page 37 . |
| I need to provide the address of the device to the network administrator to enable the LAN communication option. How do I obtain the address? | After the LANM/LANC option is enabled and the network cable connected, you can obtain the IP address from 12.5 Communication Setup on page 127 . |

15.3 Equipment Problems

The following issues are discussed in this section:

- [15.3.1 System Does Not Power Up on page 171](#)
- [15.3.2 ECG Data Contains Noise on page 172](#)
- [15.3.3 External Stress Equipment does not Move on page 172](#)
- [15.3.4 Paper Jams on page 173](#)

15.3.1 System Does Not Power Up

If the system does not power up, do the following:

- Verify the device is turned on.
If it is not, turn the device on. Refer to [3.10 Turning on the System on page 51](#) for instructions.
- Verify the battery is installed and charged.
Refer to [15.7 System Errors on page 176](#) for instructions on verifying whether the battery is installed and charged.
Refer to for instructions on installing the battery.
- Verify the device is connected to an AC power outlet.
Refer to [3.2 Connecting the AC Power on page 46](#) for instructions.
- Verify the equipment is receiving power from the outlet.
If the device is receiving power, the **Power LED** is lit.

15.3.2 ECG Data Contains Noise

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

- Check the patient's position.
The patient should remain motionless during the acquisition of a resting ECG.
- Use the **Hookup Advisor** indicator to help determine the cause of the noise.
For more information, refer to [7.1 Hookup Advisor on page 69](#).
- Verify the electrodes are placed properly.
Refer to [4.2 Electrode Placement on page 54](#) for information on proper electrode placement.
- Verify the electrodes are applied correctly.
You must remove perspiration, excessive hair, lotions, and dead skin cells from the electrode site.
Refer to [4.1 Preparing the Patient's Skin on page 53](#) for more information.
- Check for defective or expired electrodes.
Replace the electrodes if there are any questions about their effectiveness.
- Check for defective, broken, or disconnected leadwires.
Replace the leadwires if there are any questions about their effectiveness. Refer to [3.3 Connecting the Patient Cable on page 47](#).
- Consider using filters, **ADS**, and **FRF** to help eliminate or reduce ECG noise.
For more information, refer to [7.2.2 ECG Options on page 71](#), [8.2.2 Arrhythmia Printing Options on page 82](#), or [10.1.3 Stress Options on page 90](#).

15.3.3 External Stress Equipment does not Move

If the external stress equipment does not move automatically when expected, do the following:

- Verify the correct stress equipment is selected in **Basic Setup**.
For more information, refer to [12.1 Basic Setup on page 104](#).
- Verify the selected stress equipment is supported.
For a list of supported stress equipment, refer to [3.7 Connecting External Devices \(Stress Option\) on page 50](#).
- Verify the stress equipment is connected to the cart.
External stress equipment is connected to the cart through a serial cable. For more information, refer to [2.2.1.2 Rear View on page 33](#).
- Verify the protocol is set up to activate the stress equipment.
The protocol can set the stress equipment's speed and grade or load. For more information, refer to [12.4.2 Editing Stress Protocols on page 124](#).
- Verify the **Stop TM** button is not depressed.
For more information, refer to [10.1.2 Stress Test Keys on page 90](#).

15.3.4 Paper Jams

If the paper jams while printing, do the following:

- Verify the paper was inserted correctly.
For details, refer to [14.2.1 Replacing Paper on page 164](#).
- Verify the paper tray spacers are set appropriately for the paper size.
For details, refer to [14.2.2 Adjusting the Tray for Paper Size on page 165](#).

15.4 Import/Export/Save Errors

The following issues are discussed in this section:

- [15.4.1 SD Card Not Present on page 173](#)
- [15.4.2 Cannot Transmit Records via LAN on page 173](#)
- [15.4.3 Cannot Transmit Records Via WLAN \(Silex Wireless Bridge\) on page 174](#)
- [15.4.4 Cannot Transmit Records via Embedded Wireless Module on page 174](#)
- [15.4.5 Cannot Export to Shared Directories on page 175](#)

15.4.1 SD Card Not Present

If you receive an error message stating that the SD card is not present or cannot be found, do the following:

- Verify an SD card is inserted into the card slot on the device.
For details, refer to [2.2.1.2 Rear View on page 33](#).
- Verify the SD card is seated firmly.
The SD card clicks into place when seated firmly.
- Verify the SD card is formatted for a **FAT** or **FAT16** file system.

To verify an SD card is formatted for the correct file system, do the following:

1. Insert the card into an SD card reader attached to a PC.
2. Copy any files you want to save from the SD card to a folder on the PC.
3. Using the Windows **Format** command, specify either **FAT** or **FAT16** for the file system and format the card.

NOTE

Formatting the SD card erases any existing files on the card.

4. Copy the files from the folder on the PC to the newly formatted SD card.

15.4.2 Cannot Transmit Records via LAN

If you receive an error while attempting to transmit records via LAN, verify the following:

1. Verify the correct communication option was activated.

The system supports two options for communicating via LAN:

- LANC (for communicating with a CardioSoft/CS system)
- LANM (for communicating with a MUSE system)

For more information on setting up LAN communication, see [12.13 Options Setup on page 151](#).

2. Verify the LAN cable is connected properly to the LAN connection slot.

For information on where the LAN cable connects to the device, see [2.2.1.2 Rear View on page 33](#).

3. Check the communication setup to verify whether the IP, Netmask, Gateway, and DNS addresses are all correct.

For details on checking addresses, see [12.5 Communication Setup on page 127](#).

15.4.3 Cannot Transmit Records Via WLAN (Silex Wireless Bridge)

If you receive an error while attempting to transmit records via Silex Wireless Bridge, use the following procedure:

1. Verify the correct communication option was activated.

The system supports two options for communicating over WLAN using Silex Wireless Bridge:

- LANC (for communicating with a CardioSoft/CS system)
- LANM (for communicating with a MUSE system)

For more information on setting up LAN communication, see [12.13 Options Setup on page 151](#).

2. Verify the ethernet cable is connected properly to the ethernet port of the Silex Wireless Bridge and the other end of the ethernet cable to ethernet port of the MAC2000 device.

For information on where the Silex Wireless Bridge connects to the device, see [2.2.1.2 Rear View on page 33](#).

3. Check communication setup to verify whether the **IP**, **netmask**, **gateway**, and **DNS** server addresses are all correct.

For details on checking addresses, see [12.5 Communication Setup on page 127](#).

15.4.4 Cannot Transmit Records via Embedded Wireless Module

If you receive an error while attempting to transmit records via the embedded wireless module, use the following procedure:

1. Verify the correct communication option was activated.

The system supports two options for communicating over a wireless network using the embedded wireless module:

- WIFC for communicating with a CardioSoft/CS system
- WIFM for communicating with a MUSE system

For more information on setting up LAN communication, see [12.13 Options Setup on page 151](#).

2. Check communication setup to verify whether the **IP**, **netmask**, **gateway**, and **DNS** server addresses are all correct.

For details on checking the IP addresses, see [12.5 Communication Setup on page 127](#).

3. Check whether the embedded wireless module is enabled and the authentication details are correct.

For information on the wireless networking settings, see “Wireless Networking Settings” in [12.5 Communication Setup on page 127](#).

15.4.5 Cannot Export to Shared Directories

To resolve errors received while attempting to export ECG records to a shared directory, do the following:

- Verify the **LANC** communication option was activated.

Refer to [12.13 Options Setup on page 151](#) for information on activating options.

- Verify connectivity by checking the following:

- The network cables are connected.
- The **IP**, **netmask**, **gateway**, and **DNS** server addresses are all correct.

Refer to [12.5 Communication Setup on page 127](#) for instructions on setting these values.

- The two systems can communicate.

To verify this, ping the device from the file server.

- Verify the logon information is correct.

Check the user name, password, and domain information. Refer to [12.5 Communication Setup on page 127](#) for information on the log on information.

- Verify share and directory permissions.

Ensure that the account used to log on to the shared directory has read/write/create permissions to both the share and the directory.

Refer to Microsoft Windows online help for instructions on how to set user permissions.

15.5 Acquisition/Printer Error Messages

If you receive an acquisition/printer error message, along with an error code, use the following table to determine what you need to do.

| Message | Action |
|---|--------------------------------|
| Message displays for a short duration and then stops. | No action to take. |
| Message displays persistently. | Try rebooting the system. |
| Message displays persistently, even after rebooting the system. | Contact GE Healthcare Service. |

15.6 Report Errors

This section addresses the following report error: [15.6.1 ACI-TIPI Statement is not Included on Report on page 175](#).

15.6.1 ACI-TIPI Statement is not Included on Report

If the ACI-TIPI statement is not displayed when expected, do the following:

- Verify the **ACI-TIPI** option is activated.

For information on activating the **ACI-TIPI** option, refer to [12.13 Options Setup on page 151](#).

- Verify **ACI-TIPI** is enabled on the ECG.

For information, refer to [12.2 Resting ECG Setup on page 108](#).

- Verify the information **ACI-TIPI** requires was entered.

The ACI-TIPI statement prints only if the patient's gender, date of birth, and chest pain indication are included in the patient information.

- Verify the patient is 16 years old or older.

The ACI-TIPI statement does not print for pediatric patients.



- Verify the original ECG was acquired in an electrocardiograph with the **ACI-TIPI** option.

If you attempt to print an ECG that was imported from an external device, the cart does not generate an ACI-TIPI statement; it prints only if the statement was saved as part of the ECG.

15.7 System Errors

The following table identifies some potential errors that may occur while you are operating the system, the possible causes, and a recommended course of action to resolve the error.

If performing the recommended actions does not resolve the problem, contact authorized GE Healthcare service personnel.

| Problem | Cause | Solution |
|--|---|---|
|  <p>This icon is displayed and the battery LED is flashing.</p> | System is operating from the battery and the battery charge is low. | Connect the system to an AC outlet to charge the battery. |
|  <p>This icon is displayed and the battery LED is not lit.</p> | System is operating from AC power and battery is not installed. | Install a battery. |
| The system does not power up while operating from battery power. | Battery is fully discharged. | Connect the system to an AC outlet to charge the battery |
| The system powers down while operating from battery power. | Battery is fully discharged | Connect the system to an AC outlet to charge the battery |

Continues on the next page

| Problem | Cause | Solution |
|---|--|--|
| You are prompted to enter User ID and/or Password while attempting to export records to a shared network directory. | The User ID and/or Password defined on the Communication Setup window (12.5 Communication Setup on page 127) are incorrect. | <ol style="list-style-type: none"> 1. Press Esc to close the prompt. 2. Exit the export program. 3. Run Communication Setup. 4. Enter the correct User ID and Password for the shared directory and save the new values. 5. Export the records. |
| User cannot log on to the system. | High Security Mode is enabled and the user's User ID or Password were entered incorrectly. | <p>Try the following:</p> <ul style="list-style-type: none"> • Verify the user is setup in the system. Refer to 12.9 User Setup on page 144. • Verify the user typed the User ID and Password correctly. • Contact the administrator to reset the user's User ID or Password. • Contact GE Healthcare technical support to obtain a temporary supervisor password. |
| The following error message is displayed while printing: Printer internal error – Printing not possible | The printer encountered a temporary condition that caused it to stop printing the current report. | <p>To restart any of the following reports, push the appropriate button:</p> <ul style="list-style-type: none"> • Rhythm Report in Resting ECG Mode • Arrhythmia recording in Arrhythmia Mode • In-test Reports in Stress Test Mode <p>All other reports restart automatically.</p> |
| The following error message is displayed while printing: Battery low – Printing not possible | The battery is low and does not have enough charge to power the printer. | <p>Try the following:</p> <ul style="list-style-type: none"> • Allow the battery to charge to 50% before printing again. • Connect the device to an AC outlet. • Power down the device then power it back on. |
| System frozen | The system encounters a temporary condition from inside or outside source. | <p>Try the following:</p> <ul style="list-style-type: none"> • Reboot the system. • If the wired LAN Ethernet cable is connected, disconnect the wired LAN Ethernet cable from the RJ45 network connector on the back of the device. • Contact GE Healthcare technical support. |

A Creating Barcodes

The following sections provide the information you need to configure bar codes.

The MAC 2000 barcode reader can read codes that consist of the following linear and 2-D symbologies:

- 39 Full ASCII
- PDF-417
- 128
- Interleaved Code 2 of 5
- Data Matrix

Table A-1 Code 39 Full ASCII

The barcode reader can read all standard ASCII characters.

Table A-2 PDF-417

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| A | B | C | D | E | F | G | H | I | J |
| K | L | M | N | O | P | Q | R | S | T |
| U | V | W | X | Y | Z | a | b | c | d |
| e | f | g | h | i | j | k | l | m | n |
| o | p | q | r | s | t | u | v | w | x |
| y | z | * | + | % | . | ! | & | (|) |
| : | ; | < | > | = | ? | | | | |

| | | | | | | | | | | | | | | | | | | |
|---------|---|---|----|---|---|---|---|---|---|---|---|-----|---|---|---|---|---|---|
| US | " | # | \$ | ' | , | - | / | @ | [| \ |] | ^ | _ | ` | [| | } | ~ |
| German | " | # | \$ | ' | , | - | / | § | Ä | Ö | Ü | ^ | _ | ` | ä | ö | ü | ß |
| French | " | £ | \$ | ' | , | - | / | à | ° | ç | § | N/A | _ | µ | é | ù | è | ´ |
| Italian | " | £ | \$ | ' | , | - | / | § | ° | ç | é | ^ | _ | ù | à | ò | è | ì |
| Spanish | " | | \$ | ' | , | - | / | | í | Ñ | ¿ | ^ | _ | ` | | ñ | ç | |

Table A-3 Code 128

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| A | B | C | D | E | F | G | H | I | J |
| K | L | M | N | O | P | Q | R | S | T |
| U | V | W | X | Y | Z | a | b | c | d |
| e | f | g | h | i | j | k | l | m | n |
| o | p | q | r | s | t | u | v | w | x |
| y | z | * | + | % | . | ! | & | (|) |
| : | ; | < | > | = | ? | | | | |

| | | | | | | | | | | | | | | | | | | |
|---------|---|---|----|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|
| US | " | # | \$ | ' | , | - | / | @ | [| \ |] | ^ | _ | ` | [| | } | ~ |
| German | " | # | \$ | ' | , | - | / | | | | | ^ | _ | ` | | | | |
| French | " | £ | \$ | ' | , | - | / | | | | | | _ | | | | | |
| Italian | " | £ | \$ | ' | , | - | / | | | \ | | ^ | _ | | | | | |
| Spanish | " | | \$ | ' | , | - | / | | | | | ^ | _ | ` | | | | |

Table A-4 Interleaved Code 2 of 5

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|

Table A-5 Data Matrix

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| A | B | C | D | E | F | G | H | I | J |
| K | L | M | N | O | P | Q | R | S | T |
| U | V | W | X | Y | Z | a | b | c | d |
| e | f | g | h | i | j | k | l | m | n |
| o | p | q | r | s | t | u | v | w | x |
| y | z | * | + | % | . | ! | & | (|) |
| : | ; | < | > | = | ? | | | | |

| | | | | | | | | | | | | | | | | | | |
|---------|---|---|----|---|---|---|---|---|---|---|---|-----|---|---|---|---|---|----|
| US | " | # | \$ | ' | , | - | / | @ | [| \ |] | ^ | _ | ` | [| | } | ~ |
| German | " | # | \$ | ' | , | - | / | § | Ä | Ö | Ü | ^ | _ | ` | ä | ö | ü | ß |
| French | " | £ | \$ | ' | , | - | / | à | ° | ç | § | N/A | _ | μ | é | ù | è | '' |
| Italian | " | £ | \$ | ' | , | - | / | § | ° | ç | é | ^ | _ | ù | à | ò | è | ì |
| Spanish | " | | \$ | ' | , | - | / | | ì | Ñ | ¿ | ^ | _ | ` | | ñ | ç | |

Regardless of which code is used, the site's IT department must do the following:

- Set up the patient data scheme.
- Configure the barcode reader.

NOTE

All data resides in fixed-width fields. The bar code must be programmed to add "trailing spaces" after fields shorter than the fixed length of the fields your system is using.

A.1 Setting Up the Patient Data Scheme

Use the following rules to set up a data scheme, including patient demographic data, for your barcodes.



Table A-6 Patient Data Scheme

| Item | Byte Length |
|-----------------------|---|
| Patient ID | The Patient ID length should not exceed the 30-character maximum and should be equal to the ID length set up on the system in the Patient Setup window. If the system is communicating with a MUSE system, the length of the Patient ID should be the same as the Patient ID that the MUSE system uses. |
| Last Name | 40 (maximum) |
| First Name | 20 (maximum) |
| Year of birth | 4 |
| Month of birth | 2 |
| Day of birth | 2 |
| Gender | 1 |
| Visit | 8 |

A.2 Configuring the Barcode Reader

Configure the barcode reader on the **Patient Setup** window. You can choose to configure it manually or automatically. The requirements for each method are described in the following sections.

A.2.1 Configuring the Barcode Reader Manually

The following table identifies the available fields for configuring your bar code reader.

NOTE

The system automatically checks the overlap between every 2 fields.

Once overlap issue is detected, the following message displays when saving the configuration: Once overlap issue is detected, the following message displays when saving the configuration:

Fields overlap found between [field name] and [field name].

NOTE

Once the total number of offset and length of one field is over 255 bytes, the system beeps once you are saving the configuration, and the highlight moves to the overflow field.

Table A-7 Automatic Bar Manual Bar Code Reader Configuration Fields

| Field | Description and Byte Length |
|------------------------------|--|
| Total number of bytes | Enter the total number of bytes contained in the patient bar code. This is usually the sum of the bytes listed in the following fields. The value can be from 0 to 255. Once the largest value of offset plus the largest value of length is more than the value you set in Total number of bytes , the system beeps once you save the configuration, the highlight moves to the Total number of bytes field, and the system automatically correct Total number of bytes value. |
| Patient ID offset | Enter the Patient ID's Offset . |

Continues on the next page

Table A-7 Automatic Bar Manual Bar Code Reader Configuration Fields (Table continued)

| Field | Description and Byte Length |
|------------------------------|---|
| Patient ID length | <p>Enter the Patient ID's Length.</p> <p>Be aware of the following criteria when setting the length:</p> <ul style="list-style-type: none"> • Can be from 0 to 30 • Should equal the ID length set up on the Patient Question window • Should equal the patient ID length for the MUSE CV system with which the MAC system communicates. |
| Visit offset | The patient's visit ID's Offset . |
| Visit length | <p>The length of the patient visit ID.</p> <p>The value can be from 0 to 19.</p> |
| First name offset | The patient's first name Offset . |
| First name length | <p>The patient's first name Length.</p> <p>Be aware of the following criteria when setting the length:</p> <ul style="list-style-type: none"> • value can be from 0 to 20 • should equal the length from the MUSE CV system with which the MAC system communicates. <p>NOTE</p> <p>The MAC system does not support “long” names; if the MUSE system uses long names, this field should be set to its maximum value.</p> |
| Last name offset | The patient's last name Offset . |
| Last name length | <p>The patient's last name Length.</p> <p>Be aware of the following criteria when setting the length:</p> <ul style="list-style-type: none"> • value can be from 0 to 40 • should equal the length from the MUSE CV system with which the MAC system communicates <p>NOTE</p> <p>The MAC system does not support “long” names; if the MUSE system uses long names, this field should be set to its maximum value.</p> |
| Year of birth offset | The year the patient was born. Enter the field's Offset |
| Year of birth length | <p>The year the patient was born. Enter the field's Length</p> <p>The length must be set to 4.</p> |
| Month of birth offset | The month the patient was born. Enter the field's Offset . |
| Month of birth length | <p>The month the patient was born. Enter the field's Length.</p> <p>The length must be set to 2.</p> |
| Day of birth offset | The day the patient was born. Enter the field's Offset . |
| Gender offset | The patient's gender. Enter the field's Offset . |
| Gender length | <p>The patient's gender. Enter the field's Length.</p> <p>The length must be set to 1.</p> |

A.2.2 Configuring the Barcode Reader Automatically

You can configure the barcode reader automatically by scanning a barcode that has been set up using the following information:

Table A-8 Automatic Bar Code Reader Configuration Fields

| Item | Character Used to Reserve Byte Space |
|----------------|--------------------------------------|
| Patient ID | 9 |
| First name | 5 |
| Last name | 6 |
| Year of birth | 3 |
| Month of birth | 1 |
| Day of birth | 2 |
| Gender | M or m for male F or f for female |
| Visit | 8 |

B Master Step Data

The following sections provide the information you need to run a **Master Step** stress test.

B.1 Master Step Table

The following table identifies the number of steps to set according to the patient's age, gender, and weight.

| Weight (kg) | Gender | Age (Years) | | | | | | | | | | | | | | |
|-------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-79 |
| 18-22 | Male | 35 | 36 | | | | | | | | | | | | | |
| | Female | 35 | 35 | 33 | | | | | | | | | | | | |
| 22-26 | Male | 33 | 35 | 32 | | | | | | | | | | | | |
| | Female | 33 | 33 | 32 | | | | | | | | | | | | |
| 27-31 | Male | 31 | 33 | 31 | | | | | | | | | | | | |
| | Female | 31 | 32 | 30 | | | | | | | | | | | | |
| 32-35 | Male | 28 | 32 | 30 | | | | | | | | | | | | |
| | Female | 28 | 30 | 29 | | | | | | | | | | | | |
| 36-40 | Male | 26 | 30 | 29 | 29 | 29 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 23 | 23 | 22 |
| | Female | 26 | 28 | 28 | 28 | 28 | 27 | 26 | 24 | 23 | 22 | 21 | 21 | 20 | 19 | 18 |
| 41-44 | Male | 24 | 29 | 28 | 28 | 28 | 27 | 27 | 26 | 25 | 24 | 23 | 22 | 22 | 21 | 22 |
| | Female | 24 | 27 | 26 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 18 | 17 |
| 45-49 | Male | 22 | 27 | 27 | 28 | 28 | 27 | 26 | 25 | 25 | 24 | 23 | 22 | 22 | 21 | 20 |
| | Female | 22 | 25 | 25 | 26 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 18 | 17 |
| 50-53 | Male | 20 | 26 | 26 | 27 | 27 | 26 | 25 | 25 | 24 | 23 | 22 | 22 | 22 | 21 | 20 |
| | Female | 20 | 23 | 23 | 25 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 18 | 17 | 16 |
| 54-58 | Male | 18 | 24 | 25 | 26 | 27 | 26 | 25 | 24 | 23 | 22 | 22 | 21 | 21 | 20 | 19 |
| | Female | 18 | 22 | 22 | 24 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 18 | 17 | 16 | 15 |
| 59-63 | Male | 16 | 23 | 24 | 25 | 26 | 25 | 24 | 23 | 23 | 22 | 21 | 20 | 20 | 19 | 18 |
| | Female | 16 | 20 | 20 | 23 | 23 | 22 | 21 | 20 | 19 | 19 | 18 | 17 | 16 | 15 | 15 |

Continues on the next page

| Weight (kg) | Gender | Age (Years) | | | | | | | | | | | | | | |
|-------------|--------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-79 |
| 64-67 | Male | | 21 | 23 | 24 | 25 | 24 | 24 | 23 | 22 | 21 | 20 | 20 | 19 | 18 | 18 |
| | Female | | 18 | 19 | 22 | 22 | 21 | 20 | 19 | 19 | 18 | 17 | 16 | 15 | 15 | 14 |
| 68-72 | Male | | 20 | 22 | 24 | 25 | 24 | 23 | 22 | 21 | 20 | 20 | 19 | 18 | 18 | 17 |
| | Female | | 17 | 17 | 21 | 20 | 20 | 19 | 19 | 18 | 17 | 16 | 16 | 15 | 14 | 13 |
| 73-76 | Male | | 18 | 21 | 23 | 24 | 23 | 22 | 22 | 21 | 20 | 19 | 18 | 18 | 17 | 17 |
| | Female | | 15 | 16 | 20 | 19 | 19 | 18 | 18 | 17 | 16 | 16 | 15 | 14 | 13 | 12 |
| 77-81 | Male | | | 20 | 22 | 23 | 23 | 22 | 21 | 20 | 19 | 18 | 18 | 17 | 17 | 16 |
| | Female | | 13 | 14 | 19 | 18 | 18 | 17 | 17 | 16 | 16 | 15 | 14 | 13 | 13 | 12 |
| 82-85 | Male | | | 19 | 21 | 23 | 22 | 21 | 20 | 19 | 19 | 18 | 17 | 16 | 16 | 15 |
| | Female | | | 13 | 18 | 17 | 17 | 17 | 16 | 16 | 15 | 14 | 14 | 13 | 12 | 11 |
| 86-90 | Male | | | 18 | 29 | 22 | 21 | 21 | 29 | 18 | 17 | 17 | 16 | 15 | 15 | 14 |
| | Female | | | 12 | 17 | 16 | 16 | 16 | 15 | 15 | 14 | 13 | 13 | 12 | 12 | 11 |
| 91-93 | Male | | | | 19 | 21 | 21 | 20 | 19 | 18 | 17 | 16 | 16 | 15 | 14 | 14 |
| | Female | | | | 16 | 15 | 15 | 15 | 14 | 14 | 13 | 13 | 12 | 11 | 11 | 10 |
| 94-99 | Male | | | | 18 | 21 | 20 | 19 | 18 | 17 | 17 | 16 | 15 | 14 | 14 | 13 |
| | Female | | | | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 11 | 11 | 11 | 10 |
| 100-104 | Male | | | | 17 | 20 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 13 | 12 |
| | Female | | | | 14 | 13 | 13 | 13 | 13 | 12 | 12 | 11 | 11 | 10 | 10 | 09 |

B.2 ST-T Changes

The existence of any ST-T change is assessed by classifying ST-T into three assessment levels:

- **Positive**

One of the following criteria must be met on 2 or more leads:

- ST Depression ≥ 0.1 mV
- ST Elevation ≥ 0.2 mV
- T wave change ≥ 1.0 mV

- **Borderline**

One of the following criteria must be met on any lead:

- ST Depression ≥ 0.05 mV

- ST Elevation ≥ 0.1 mV
- T wave change ≥ 0.5 mV
- **Negative**

This is assessed if neither the Positive nor Borderline criteria are met.

The following formulas are used to calculate the values in the previous criteria:

- ST depression = (rest ST - post J) - (post exercise ST - post J)
- ST depression = (rest ST - post J) - (post exercise ST - post J)
- T wave change = absolute value of (rest T wave amplitude - post-exercise T wave amplitude)
- (ST - post J: amplitude at the post J point)

When the assessment is positive or borderline, the lead with the largest change prints.

C Technical Specifications

C.1 System Specifications

Table C-1 Instrument Type

Microprocessor augmented automatic electrocardiograph; 10-leadwire, 12 lead simultaneous acquisition with programmable lead configuration.

Table C-2 Processing

| Item | Specifications |
|---------------------------|--|
| ECG Interpretation | Marquette 12SL ECG Analysis Program for Adults and Pediatrics |
| Computerized Measurements | 12-lead analysis |
| ECG Analysis Frequency | 500 or 1000 samples/second/channel |
| Digital Sampling Rate | 16000 samples/second/channel for normal data acquisition |
| Pace Sampling Rate | 75K samples/second/channel |
| ECG On-screen Preview | On-screen preview of acquired 10 second ECG waveform |
| Acquisition Mode | Provides 10 seconds of instantaneous ECG acquisition |
| Dynamic Range | AC Differential ± 5 mV, DC offset ± 300 mV |
| Resolution | 4.88 μ V $\pm 1\%$ per LSB @ 500SPS |
| Frequency Range | 0.04 to 150 Hz |
| Low Cutoff Frequency | 0.04 Hz (ADS Off) 0.56 Hz (ADS On) |
| High Cutoff Frequency | Configurable at 20 Hz, 40 Hz, 100 Hz or 150 Hz |
| Common Mode Rejection | >135 dB (with 50/60 HZ filter ON) |
| Input Impedance | >10M Ω @ 10 Hz |
| Patient Leakage | <10 μ A (Normal Condition), <50 μ A (Single Fault Condition) |
| Lead Detection | All disconnected lead detection except RL & RA |
| Heart Rate Meter | 30 to 300 BPM |
| Start-up Time | Less than 30 seconds |

Table C-3 Patient Information

| Item | Specifications |
|-------------------------------|--|
| Supported patient Information | Patient ID, Secondary Patient ID, Visit ID, Last name, First name, Height, Weight, Gender, Race, Pacemaker Patient, Systolic BP, Diastolic BP, Location#, Room, Order Number, Phone Number, Medication, Ordering physician, Referring physician, Attending physician, Technician, Test indication. |

Table C-4 Display

| Item | Specifications |
|------------|--|
| Type | 7" color TFT display with support of minimum 32K colors |
| Resolution | WVGA resolution –800x480 |
| Data | Heart rate, patient ID, clock, battery power indicator, waveforms, lead labels, speed, gain and filter settings, warning messages, prompts, help messages and 12 lead display. |

Table C-5 Writer

| Item | Specifications |
|--------------------|---|
| Technology | Thermal dot array |
| Speed | 5, 12.5, 25, & 50 mm/s |
| Number of Traces | Up to 12 ECG traces |
| Sensitivity/Gain | 2.5, 5, 10, 20, 40 mm/mV |
| Speed Accuracy | 5, 12.5 mm/s @ $\pm 5\%$ and 25, 50 mm/s @ $\pm 2\%$ |
| Amplitude Accuracy | $\pm 5\%$ |
| Resolution | Horizontal 40 dots/mm @ 25 mm/s, 8 dots/mm vertical |
| Paper Type | Z-fold Thermal Paper with pre-printed grid and perforation with Queue mark or Queue hole. |
| Paper Size | 215mm x 280mm (Letter), 210mm x 295mm (A4) and 214.2mm x 279.4mm (Modified Letter) |

Table C-6 Keyboard

| Item | Specifications |
|------|--|
| Type | Membrane keyboard with tactile feedback - Soft function keys, alphanumeric keys (Qwerty key set), writer controls and Trim Pad cursor controls |

Table C-7 Operating Modes and Additional Features

| Item | Specifications |
|------------------------|---|
| Resting ECG Mode | Records and prints 12-lead resting ECGs with 10 seconds duration as a standard feature. |
| Arrhythmia Mode | Continuously monitors ECG and prints report when arrhythmia events of the user-selected class occur. |
| Exercise Mode | Exercise mode for exercise stress testing |
| RR Analysis Mode | RR Analysis for RR intervals analysis. |
| Full Disclosure Mode | Store up to 5 minutes of 1 lead data in PDF format *This feature is not available in some countries. |
| Hookup Advisor | Provides visual indication of signal quality |
| Multi-language Support | Supports 19 languages in User Interface and 31 languages in User Manual |
| File Manager | Provides an interface for managing ECG records. |
| Order Manager | Provides an interface for managing orders. |

Continues on the next page

Table C-7 Operating Modes and Additional Features (Table continued)

| Item | Specifications |
|--------------|--|
| System Setup | Provides an interface for managing device configurations. |
| ADT Query | Provides an interface for querying patient demographics and orders |

Table C-8 Stress/Pharma Application Options

| Item | Specifications |
|----------------------------|--|
| Stress Testing Application | Ergometers supported include: eBike. Treadmills supported include: T2100, T2000 Master's Step device without interface (acoustic signal only) NOTE Ergometer, Master Step and Treadmill sold separately. |
| Pharma Application | Pharma application options include: <ul style="list-style-type: none"> • Date & Time Prompt upon log in • Auto Save and export to SD Card of Patient test record after acquisition • Audit trail export • CT Data Guard® • High security login protection |

Table C-9 External Peripherals

| Item | Specifications |
|-----------------------|---|
| Keyboard | Standard USB English Keyboard. |
| Barcode Symbolologies | Code 39, Code 39EX, Code 128, PDF-417, Interleaved Code 2 of 5, Data Matrix |

Table C-10 Communication

| Item | Specifications |
|------------------------------|---|
| RS232 Serial Cable | ECG Transmission with A5 & CSI Protocol |
| Supported MUSE/Cardiosoft/CS | Compatible with MUSE V8.0.1, V9.0.0 and MUSE NX/CardioSoft/CS V6.73 and later |
| RJ45 Wired LAN | ECG Transmission with CSI, DCP Protocol, FTPS and Shared directory |
| Wireless LAN (wireless) | ECG Transmission with CSI, DCP Protocol, FTPS and Shared directory |

Continues on the next page

Table C-10 Communication (Table continued)

| Item | Specifications |
|---|--|
| Wireless Authentication Protocols | <p>Wireless Bridge Option:</p> <ul style="list-style-type: none"> • Open • Shared • WPA2 with pre-shared key • WPA/WPA2 Mixed Mode with pre-shared key • WPA2 with PEAP • WPA/WPA2 Mixed Mode with PEAP • WPA2 with EAP-TLS • WPA/WPA2 Mixed Mode with EAP-TLS • WPA2 with EAP-TTLS • WPA/WPA2 Mixed Mode with EAP-TTLS • WPA2 with EAP-FAST • WPA/WPA2 Mixed Mode with EAP-FAST • WPA2 with LEAP • WPA/WPA2 Mixed Mode with LEAP <p>Embedded Wireless Module:</p> <ul style="list-style-type: none"> • Open • Shared • WPA – PSK* • WPA2-PSK* • WPA/WPA2 with PEAP • WPA/WPA2 with TLS • WPA/WPA2 with TTLS <p>* Certain network settings are required for wireless authentication. To determine whether your network is compatible, please refer to the MAC2000 site survey document 2053535-067.</p> |
| Wireless Encryption | <p>Wireless Bridge:</p> <ul style="list-style-type: none"> • Disabled (For Open authentication). • WEP (For Shared and Open authentications). • TKIP (for WPA/WPA2 Mixed Mode authentications). • AES (for WPA & WPA2 authentications). <p>Embedded Wireless Module:</p> <ul style="list-style-type: none"> • Disabled (For Open authentication). • WEP (For Shared and Open authentications). • TKIP (for WPA-PSK¹, WPA2-PSK¹, WPA² authentications). • AES (for WPA-PSK¹, WPA2-PSK¹, WPA² & WPA2² authentications). <p>¹ WPA-PSK and WPA2-PSK are personal authentication frameworks.</p> <p>² WPA and WPA2 are enterprise authentication frameworks.</p> |
| Secured Digital card, Serial, LAN and wireless communicates outbound to MUSE and Cardiosoft/CS. LAN and wireless communicates inbound to MUSE. | |

Table C-11 Storage

| Item | Specifications |
|--------------------|--|
| ECG Storage Format | XML format Hilltop format PDF storage format |
| Storage Capacity | Internal storage of 100 or 200 ECGs |

Table C-12 Accessories

| | |
|----------------------|--|
| ECG Cables/Leadwires | <ul style="list-style-type: none"> • IEC/AHA Value 10LD Patient Cable/Ldwr • 10-lead IEC/AHA Patient trunk cable • IEC/AHA (Nst, Nax) Lead wire set (ECG 10-L w/resist, Banana) • IEC/AHA Set of lead wires (4mm connector, 10 leads, defibrillator proof) |
| ECG Adapter | <ul style="list-style-type: none"> • IEC/AHA Kit Adapter 10 Set Banana • Electrode Prep Pads, CLIP Universal GE 10/PKG |
| Electrodes | <ul style="list-style-type: none"> • ECG Electrode Clamp (Large, 4/set) • Baby MAC electrodes • Silver Mactrode Plus 1000 / CASE • Electrode Application System KISS 10 Lead without pump |
| Other Accessories | <ul style="list-style-type: none"> • Electrode Cream 250g bottle, Electrode Spray • Country specific power cords • Z-fold Thermal Paper with pre-printed grid and perforation with Queue mark or Queue hole of size 215mm x 280mm (Letter) / 210mm x 295mm (A4) / 214.2mm x 279.4mm (Modified Letter) (150 sheets/pack, 1500 sheets/case) • USB Data Matrix Barcode scanner • Secure Digital High Capacity Card - 2GB/4GB/8GB/16GB/32GB |

Table C-13 Electrical

| Item | Specifications |
|--------------------------------|---|
| Power Supply | Internal AC/DC or battery operation |
| AC/DC operation specifications | |
| Input Voltage | 100 to 240 VAC $\pm 10\%$ |
| Input Current | Maximum 1.5A in voltage range 115V to 230V AC |
| Input Frequency | 47 to 63 Hz |
| Battery specifications | |
| Battery type | Replaceable and rechargeable, Lithium Ion |
| Battery capacity | 14.54V nominal voltage @ 3.5 AH $\pm 10\%$ 150 single page resting ECG recordings or 6 Hours (typical) of continuous monitoring without printing, at a minimum |
| Battery charge time | Approximately 3.5 hours after low battery shut down (with device off) to 90% full capacity |

Table C-14 Physical Specification

| Item | Specifications |
|--------|---|
| Height | 200 mm |
| Width | 390 mm |
| Depth | 330 mm |
| Weight | Approx. 5 Kg including battery, without paper |

Table C-15 Environmental Specification

| Item | Specifications |
|-------------|--|
| Temperature | Operating: 10°C to 40°C Transport/storage: -40°C to 70°C |
| Humidity | Operating: 20% to 95% RH non-condensing Transport/storage: 15% to 95% RH non-condensing |
| Pressure | Operating: 700 to 1060 hPa (Altitude range: 3010.9 to - 381.9 meters) Transport/storage: 500 to 1060 hPa (Altitude range: 5570 to - 380 meters) |

C.2 Silex Wireless Bridge

| | |
|----------------------------|--|
| Manufacturer/Model | GEH-BR-4600WAN2-01-XX |
| Physical Requirements | <ul style="list-style-type: none"> Dimension: 110.5 × 79.0 × 27.6 (mm) Weight: 130 (g) |
| Interface Requirements | <ul style="list-style-type: none"> Ethernet Port: 10M/100 Mbps BASE-T, support Auto MDIX Power Connector: 5.5 (outer)/2.1 (Inner) mm Diameter Indication: LED indication for Power, Wireless connection, Data communication |
| Power Requirements | <ul style="list-style-type: none"> Nominal Input Power: 5V Input Current: 750 mA |
| Wireless Requirements | <ul style="list-style-type: none"> Wireless LAN Protocol: IEEE 802.11a/b/g/n Wireless LAN Channel: IEEE 802.11b/g: Ch1~CH13 Encryption: WEP (64/128), WPA-PSK (TKIP/AES), WPA2-PSK (AES) IEEE802.1X enterprise authentication: EAP-PEAP, EAP-TLS, EAP-TTLS, EAP-FAST, EAP-LEAP |
| Frequency Band | <ul style="list-style-type: none"> 2.4 GHz 5 GHz |
| Environmental Requirements | <ul style="list-style-type: none"> Operating Temperature: 0 ~ 40 °C Operating Relative humidity: 20 ~ 80% Operating barometric pressures: 700 ~ 1060 hPa (Altitude range: 3010.9 to -381.9 meters) Non-Operating Temperature: -10 ~ +50 °C Non-Operating Relative humidity: 20% ~ 90% Non-Operating barometric pressures: 500 ~ 1060 hPa (Altitude range: 5570 to -380 meters) |

Continues on the next page

| | |
|----------------------------|---|
| Accessories | <ul style="list-style-type: none">• LAN Cable: Length 250 mm, RJ45 *2 connector• USB Power Cable: Length 260 mm, Type A Plug, Right angle USB connector, Right angle DC connector, Wire size 24 AWG |
| Certification Requirements | <ul style="list-style-type: none">• CE certification• FCC/IC certification• This product complies with the following Regulatory requirements for Australia, New Zealand, and Singapore.• EMC Directive: EN55032 Class B, EN55024, EN301489-1/-17 v1.8.1• RE Directive: EN 300-328 v2.1.1, EN 301-893 v1.8.5 (EN 301-893 v1.8.1 (Adaptivity), EN 301-893 v2.1.0 (Receiver Blocking)), EN 60950-1, EN 62311, EN301-489-1 v2.1.1, EN301-489-17 v3.1.1• This product is compliant with the EU's RoHS directive (2011/65/EU or newer)• This product is compliant with the EU's WEEE directive (2002/96/EC) |

D Statement for MAC 2000 Silex Wireless Bridge

The following sections provide the FCC/IC statement for MAC 2000 Silex Wireless Bridge.

NOTE

This device complies with Part 15 of FCC Rules and Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE

This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

D.1 FCC Statement

The MAC 2000 Silex Wireless Bridge contains transmitter module FCC ID: **N6C-SXPCEAN2**.

CAUTION



Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CAUTION



This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

D.2 IC Statement

The MAC 2000 Silex Wireless Bridge contains transmitter module IC: **4908A-SXPCEAN2**.

CAUTION



5150-5250 MHz and 5250-5350 MHz bands are restricted to indoor operations only.

CAUTION



High-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

D.3 Complies with IMDA Standards

The MAC 2000 Silex Wireless Bridge complies with IMDA Standards.

**Complies with
IMDA Standards
DA102737**

E Statement for MAC 2000 Embedded Wireless Module

The following sections provide the FCC/IC statement for MAC 2000 Embedded Wireless Module.

E.1 FCC Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

Please note that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with radio frequency exposure limits set forth by the FCC for an uncontrolled environment.

This equipment should be installed and operated with a minimum distance of 20cm between the device and the user or bystanders.

This device must not be co-located or operating in conjunction with any other antenna or transmitter.

E.2 IC Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause interference; and
2. this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. l'appareil ne doit pas produire de brouillage;
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with radio frequency exposure limits set forth by the Innovation, Science and Economic Development Canada for an uncontrolled environment.

This equipment should be installed and operated with a minimum distance of 20 cm between the device and the user or bystanders.

This device must not be co-located or operating in conjunction with any other antenna or transmitter.

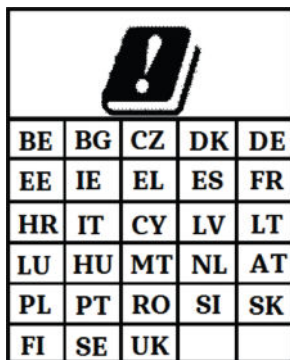
Cet équipement est conforme aux limites d'exposition aux radiofréquences définies par la Innovation, Sciences et Développement économique Canada pour un environnement non contrôlé.

Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre le dispositif et l'utilisateur ou des tiers.

Ce dispositif ne doit pas être utilisé à proximité d'une autre antenne ou d'un autre émetteur.

E.3 CE RED Information

The MAC 2000 embedded wireless module complies with CE RED 2014/53/EU.



This product is restricted to indoor use.

| | |
|--------------------------------|--|
| Frequency Range | 2.4 GHz frequency bands: 2.4-2.483 GHz 5 GHz frequency bands: 5.15-5.35 GHz, 5.47-5.725 GHz |
| Maximum RF Output Power (EIRP) | 20 dBm |

Glossary

ACS Acute Coronary Syndrome

ADT Admission, Discharge, Transfer

Filter A filter sets the upper frequency limit for the ECG waveform displayed on the Acquisition screen and the printout. Selecting a filter eliminates signals that exceed that frequency. The smaller the filter selected, the more signal is filtered out. For example, a filter of 40 Hz displays only signals less than 40 Hz; signals greater than 40 Hz are ignored.

Gain Gain indicates how many mm represent 1 mV of waveform data on the screen and printout. You can change the gain to modify the display or printout of the waveform to your preference. Changing the gain changes the amplitude of the waveforms. A higher gain makes the amplitude of the waveform appear higher; a lower gain makes the amplitude of the waveform appear lower.

The 10/5 mm/mV setting is used to display the limb leads (I, II, III, aVr, aVI, and aVf) at 10mm/mV and chest leads (V1 to V6) at 5 mm/mV. This is done to reduce or prevent waveform overlap in the chest leads, while avoiding tiny waveforms in the limb leads.

HIS Hospital Information System

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Speed Speed indicates the speed the ECG waveform displays on the screen and rhythm printout. You can change the speed to render the waveform slower or faster to aid in viewing or analysis of the waveform. A faster speed makes the waveform display more stretched out; a slower speed makes the waveform display closer together.

WLAN Wireless Local Area Network



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