GE Healthcare

MAC™ 800
Resting ECG Analysis System
Operator's Manual

Software Version 2.0.x
2060026-001 Revision C

MAC 800 Resting ECG Analysis System
English

Publication Information

The information in this manual applies only to the MAC™ 800 Software Version 2.0.x. It does not apply to earlier product versions. Due to continuing product innovation, specifications in this manual are subject to change without notice.

This product complies with the requirements concerning medical devices from the following regulatory bodies:

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

Revision	Date	Comments
A	9 February 2012	Internal business release of document.
B	27 February 2012	Initial customer release of document.
C	21 March 2012	Added the Order Manager Setup and updates to Product Specifications: Certification section.

To access other GE Healthcare manuals, go to the Common Documentation Library (CDL), located at http://www.gehealthcare.com/usen/service/biomed_tech_selfservice/services_user_doc/products/support.html and click ***Cardiology***.

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

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Introduction

This document describes the MAC™800 Resting ECG Analysis System, also referred to as “the system” or “the device”.

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

Indications for Use

The MAC™ 800 Resting ECG Analysis System is a portable ECG acquisition, analysis, and recording system intended to:

- acquire, analyze, display, and record information from adult and pediatric populations,
- be used under the direct supervision of a licensed health care practitioner,
- be used 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 to record ECG signals from surface electrodes,
- offer two basic modes of operation: (1) resting ECG mode and (2) arrhythmia mode
- print 3- and 6 leads of ECG,
- be upgradeable to provide software options such as 12-lead ECG measurement and interpretive analysis,
- provide for the optional transmission and reception of ECG data to and from a central ECG cardiovascular information system.

NOTE:

Pediatric population is defined as patients between the ages of 0 and 15 years.

Arrhythmia detection is provided for the convenience of automatic documentation.

Contraindications

This MAC™ 800 device is NOT intended:

- to be used during patient transport,
- to be used for intracardiac applications,
- to be used as a vital signs physiological monitor,
- to provide alarms for arrhythmia detection.

Prescription Device Statement

CAUTION:

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

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, loss of data, and void any existing product warranties.

Safety Conventions

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

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

Definitions of Safety Conventions

Safety Convention	Definition
DANGER	Indicates an imminent hazard, which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potential hazard or unsafe practice, which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potential hazard or unsafe practice, which, if not avoided, could result in minor personal injury or product/property damage.

Safety Hazards

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

WARNING:

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

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

WARNING:

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

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

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

The mains plug must be connected to an appropriately grounded power supply.

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

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

Whenever patient defibrillation is a possibility, use nonpolarizing (silver/silver chloride construction) electrodes for ECG monitoring.

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

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

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

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

A qualified physician must overread all computer-generated tracings.

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

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

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

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

WARNING:
DROPPING HAZARD — For devices installed above the patient, adequate precautions must be taken to prevent them from dropping on the patient.

WARNING:
PACKAGING DISPOSAL — Dispose of all packaging material, observing all applicable waste control regulations and keeping out of children's reach.

WARNING:
ELECTRIC SHOCK — To reduce the risk of electric shock, do NOT remove cover (or back).

Refer servicing to qualified personnel.

WARNING:
BURN PROTECTION — To ensure defibrillator protection and protection against high-frequency burns, use only GE Healthcare-recommended cables and leadwires.

Otherwise, serious injury could result.

WARNING:
HIGH-FREQUENCY PRECAUTIONS — Do not use the device with high-frequency surgical devices.

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

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

CAUTION:
TRIPPING HAZARD — To avoid tripping injuries, keep patient cables off the floor and route them away from patient legs and the healthcare provider's work area.

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

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

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

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

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

Wait until all moisture has vaporized before using the device.

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

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

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

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

Refer servicing to qualified service personnel.

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

RF Caution

Radio Frequency (RF) devices may interfere with the use or accuracy of the device or system. When installing or using the device or system, you should consider the proximity of known RF sources, such as:

- 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 a possible source of interference as they may emit higher levels of electromagnetic radiation.

WARNING:
EQUIPMENT: Do not use the device or system adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, observe the device or system to verify normal operation in the configuration in which it is being used.

See the *Electromagnetic Compatibility* section found in the service manual for recommended separation distances.

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.

- See the supplies and accessories manual for your system for qualified accessories and/or components, if applicable.
- Consult with qualified personnel regarding changes to the device or system configuration.

EMI/EMC Requirements

The device or system is labeled under the original equipment manufacturers label (for example, USA FCC 47CFR15, CE EU EMC 2004/108/EC), and deemed sufficient by GE Healthcare to be in compliance with EN/IEC 60601-1-2 when used according to the device or system's intended use. Hardware supplied by GE Healthcare meets the applicable country requirements.

Classification	Description
Class B	The device or system is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.

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 probably caused by the device or system.

Classification

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

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 harmful ingress of water	Ordinary Equipment (enclosed equipment without protection against ingress of water).

Degree of safety of application in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide	Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide
Method(s) of sterilization or disinfection recommended by the manufacturer	Not applicable
Mode of operation	Continuous operation

NRTL Certification Mark

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.

Biocompatibility

The parts of the system described in this operator's manual, including all accessories, that come in contact with the patient during the intended use, fulfill the biocompatibility requirements of the applicable standards. If you have questions in this matter, please contact GE Healthcare or its representatives.

Legal Notice

Our equipment contains several fields which can be filled in before performing an ECG. While some of these fields are required, some are optional and left to the user to assess whether they are needed to perform the exam. A field *RACE* is one of these optional fields. It 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.

General Information

Recording ECGs During Defibrillation

It is not necessary to remove the ECG electrodes prior to defibrillation; the patient signal is defibrillation-proof.

Use silver-silver chloride electrodes. A defibrillator discharge may cause stainless steel or silver electrodes to retain a residual charge, which could cause a polarization that blocks the acquisition of the ECG signal for several minutes.

We recommend using non-polarizing disposable electrodes with defibrillation recovery ratings as specified in AAMI EC 12.3.2.2.4 (SilverTRACE family of electrodes). AAMI EC12 requires that the polarization potential of an electrode pair does not exceed 100 mV5 seconds after a defibrillation discharge.

If other electrodes are used, disconnect the patient cable from the system before delivering the defibrillation shock.

NOTE:
If excessive DC voltages are present at the electrode, then a message is displayed indicating a Lead Off condition.

ADS (cubic spline correction) can cause a signal delay of approximately 2 seconds; therefore they should be disabled if the patient has to be defibrillated while the ECG is being recorded.

Accuracy of the Input Signal Reproduction

- Overall System Error is tested using the method described in AAMI EC11 3.2.7.1. Overall System Error is less than +/-5%.
- Frequency Response is tested using the method described in AAMI EC11 3.2.7.2 methods A and D.

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 this phenomenon is observed, the clinician should be aware that the origin of amplitude variations is not entirely physiologic. For measuring voltages of Q, R, and S waves, it is advisable to use the QRS complexes with the largest deflection of the particular waves.

Modem Requirements

Modems supplied by GE Healthcare are designed to comply with applicable country requirements (such as USA FCC 47CFR68, CE EU R&TTE 1999/5/EC). Refer to the device for a registration number and ringer equivalence number (REN). The modem is designed for use on standard device telephone lines. Connection to telephone company-provided coin service (central office implemented systems) is prohibited. Connection to party lines service is subject to state tariffs.

An analog telephone line is required. A digital PBX line does not work. If you have any questions about your telephone line, such as how many pieces of equipment you can connect to it, the telephone company provides this information upon request.

The registration number and ringer equivalence number (REN) are listed on the equipment label. To assure proper service from your telephone company, connect no more than five RENs per telephone line. In some cases, you may not be able to use five RENs on a given line.

If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical, they notify you in advance of this disconnection. If advance notice is not feasible, you are notified as soon as possible. When you are notified, you are given the opportunity to correct the problem and you are informed of your right to file a complaint.

Parts and Accessories Information

WARNING:

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

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

If the installation of this equipment in the U.S.A. uses 240V rather than 120V, the source must be a center-tapped, 240V, single-phase circuit.

Parts and accessories must meet the requirements of the applicable 60601 safety standards, and/or the system configuration must meet the requirements of the 60601-1-1 Medical Electrical Systems standard.

Using accessory equipment that does not comply with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

- Use of the accessory in the Patient Vicinity.
  Patient vicinity is defined as a space, within a location intended for the examination and treatment of patients, extending 1.83m (6 ft.) beyond the normal location of the bed, chair, table, treadmill, or other device(s) supporting the patient during examination and treatment, and extending vertically to 2.5m (8 ft. 2.4 in.) above the floor.
- Evidence that the safety certification of the accessory was performed in accordance with the appropriate 60601-1 and/or 60601-1-1 standard(s).

Responsibility of the Manufacturer

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

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

Responsibility of the Purchaser/Customer

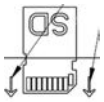
The customer is responsible for providing appropriate desks, chairs, electrical wall outlets, network connections, and analog phone lines, and for locating any of the system components described in this manual in compliance with all local, state, and national codes.

Symbols

The following symbols may appear on the device or its packaging. Familiarity with these symbols assists in the safe use and disposal of the equipment. For equipment symbols not shown, refer to the original equipment manufacturers (OEM) manuals.

	Defibrillation-proof type CF equipment.
	Equipotential ground point
	Indicates that the device uses the Marquette™ 12SL™ ECG Analysis Program to analyze and interpret ECG readings. **NOTE:** The 12SL™ is tested utilizing databases of real ECGs. Correct implementation of 12SL™ was tested with 70,000 simulated ECGs on a target platform.
	Indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.
	The separate collection symbol is affixed to a battery, or its packaging, to advise you that the battery must be recycled or disposed of in accordance with local or country laws. The letters below the separate collection symbol indicate whether certain elements are contained in the battery. To minimize potential effects on the environment and human health, it is important that all marked batteries that you remove from the product are properly recycled or disposed. For information on how the battery may be safely removed from the device, please consult the service manual or equipment instructions. Information on the potential effects on the environment and human health of the substances used in batteries is available at the following urls: http://www.epa.gov/mercury/about.htm http://www.cdc.gov/niosh/npg/npgd0383.html http://www.epa.gov/lead/ http://www.cdc.gov/niosh/npg/npgd0368.html http://www.cdc.gov/niosh/npg/npgd0087.html http://www.epa.gov/epaoswer/hazwaste/minimize/factshts/cadmium.pdf
	Consult instructions for use.

	Catalogue (part) number.
	Serial number.
	Date of manufacture.
	Manufacturer address.
	Recyclable.
	Atmospheric limits.
	Temperature limits.
	Humidity limits.
	Keep dry.
	Fragile.
	Alternating current.
	Battery symbol. The flashing amber LED next to this symbol indicates you must connect the system to AC power to re-charge the battery.

	Environment-friendly Use Period per Chinese standard SJ/T11363-2006 (China specific).
	Secure Digital (SD) Card.
	Batch or lot number.
	Authorized European Representative.
	CCC Mark - China Compulsory Certification mark
	TÜV Rheinland NRTL Certification Mark.
	China Metrology Certification.
	Indicates conformity with applicable European directives.

IP20	The International Protection (IP) rating indicates the device's classification against solid and liquid ingress per IEC/EN 60529. The classification format is IPxy and is defined as follows:
	• x indicates the classification for solid objects according to the following list:
	  • 0 – Not protected
	  • 1 – Protected against objects >= 50 mm in diameter
	  • 2 – Protected against objects >= 12.5 mm in diameter
	  • 3 – Protected against objects >= 3.5 mm in diameter
	  • 4 – Protected against objects >= 1.0 mm in diameter
	  • 5 – Dust protected
	  • 6 – Dust tight
	• y indicates the classification for liquid according to the following list:
	  • 0 – Not protected
	  • 1 – Protected against vertical dripping
	  • 2 – Protected against dripping with a 15 degree tilt
	  • 3 – Protected against spraying
	  • 4 – Protected against splashing
	  • 5 – Protected against jetting
	  • 6 – Protected against powerful jetting
	  • 7 – Protected against immersion up to 1 minute
	  • 8 – Protected against immersion beyond 1 minute

	USA only. For use by or on the order of a Physician, or persons licensed by state law.

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/usen/education/index.html). Under the *Technical Service Education* section, select *Diagnostic Cardiology*.

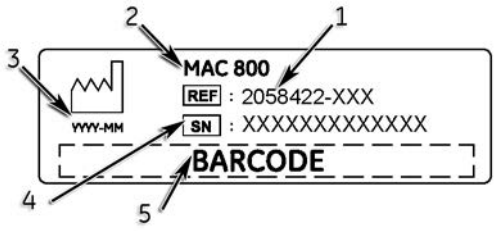
For more self-paced course offerings, tools, and reference guides you may find useful, please visit the GE Healthcare Education Store at www.gehealthcare.com/educationstore.

Equipment Identification

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

Product Label

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

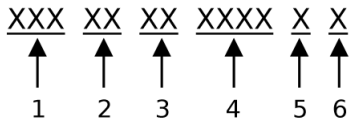


Product Label Format

Item	Description
1	Product part number
2	Product description
3	Date of manufacture in YYYY-MM format
4	Unit serial number (See "Serial Number Format" on page 22 for more information.)
5	Product barcode

Serial Number Format

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



Serial Number Format

Item	Name	Description
1	Product Code	A three-letter code that uniquely identifies the product line. Refer to "Product Codes" on page 23 for more information.
2	Year Manufactured	A two-digit code identifying the year the device was manufactured. Values range from 00 to 99. For example: 00 = 2000, 04 = 2004, 05 = 2005 (and so on).
3	Fiscal Week Manufactured	A two-digit code identifying the week the device was manufactured. Values range from 01 to 52. GE Healthcare's fiscal weeks correspond to the calendar week. For example, 01 = the first week in January.
4	Product Sequence	A four-digit number identifying the order in which this device was manufactured. Values range from 000 to 9999.
5	Manufacturing Site	A one-letter code identifying the site where the device was manufactured. For example, F = Milwaukee, N = Freiburg, P = Bangalore
6	Miscellaneous Characteristic	For example, P = the device is a prototype, R = the device was refurbished, U = the device was upgraded to meet the specifications of another product code.

Product Codes

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

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

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

Service Information

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

Service Requirements

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

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

Hardware Supplied by GE Healthcare

For hardware supplied by GE Healthcare, only authorized GE Healthcare service personnel should service the equipment. 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.

Additional Assistance

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

Contact your local GE Healthcare representative to request additional assistance.

Manual Information

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

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

Intended Audience

This manual is written for 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.

Manual Purpose

This manual describes the safe and effective operation of the system.

Document Conventions

This manual uses the following conventions.

Typographical Conventions

Convention	Description
Bold Text	Indicates keys on the keyboard, text to enter, or hardware items such as buttons or switches on the equipment.
Italicized-Bold Text	Indicates software terms that identify menu items, buttons or options in various windows.
CTRL+ESC	Indicates a keyboard operation. A plus (+) sign between the names of two keys indicates that while holding the first key, you should press and release the second key. For example, Press **CTRL+ESC** means to press and hold the **CTRL** key and then press and release the **ESC** key.

Convention	Description
<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 are inserted in the correct positions within the literal text string. The purpose of the < > brackets is to distinguish the command from the literal text within the string.
Enter	Indicates that you must press the **Enter** or **Return** key on the keyboard. Do not type ***Enter***.
>	The greater than symbol, or right angle bracket, is a concise method to indicate a sequence of menu selections. For example, the statement "From the main menu, select ***System*** > ***Setup*** > ***Options*** to open the ***Option Activation*** window" replaces the following: 1. From the main menu, select ***System*** to open the ***System*** menu. 2. From the ***System*** menu, select ***Setup*** to open the ***Setup*** menu. 3. From the ***Setup*** menu, select ***Options*** to open the ***Option Activation*** window.

Illustrations

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

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

Notes

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

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

Related Documents

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

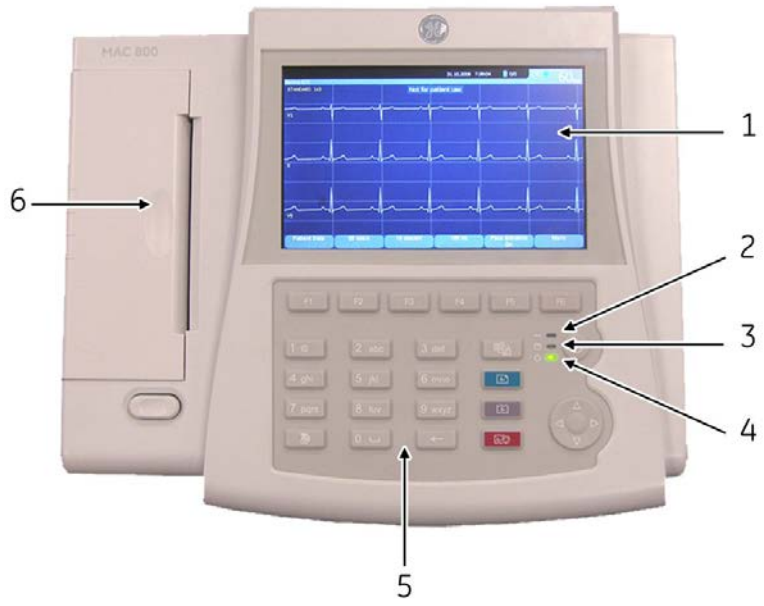
Part Number	Document Title
416791-004	*Marquette 12SL ECG Analysis Program Physician's Guide*
2020299–025	*LAN Option Installation and Troubleshooting Guide*
2002197-001	*ACI-TIPI Physician's Guide*
2060026–001	*MAC™ 800 Resting ECG Analysis System Service Manual*
2060026–002	*MAC™ 800 Supplies and Accessories Reference Manual*

2

Equipment Overview

Equipment Description

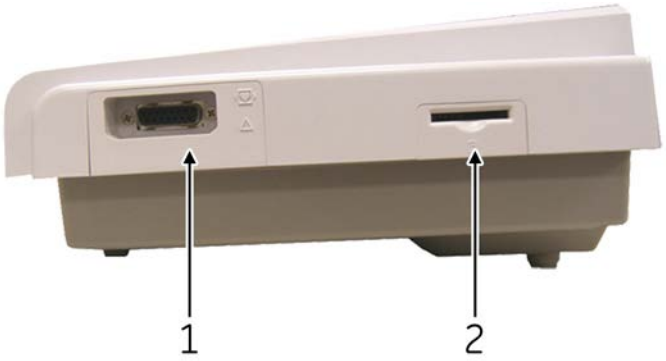
Front View



Item	Name	Description
1	Display	Presents waveform and text data.
2	Power LED	Indicates the device is plugged in and receiving power.

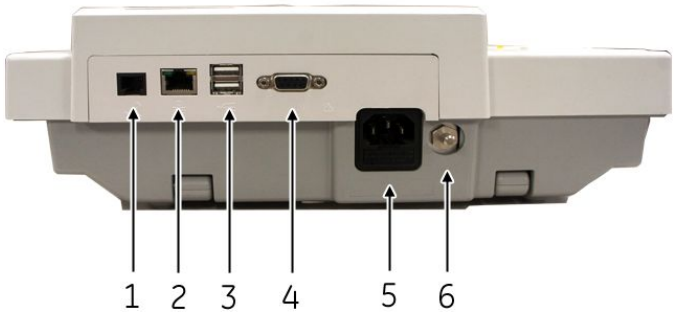
Item	Name	Description
3	Battery LED	Indicates various battery states: • Solid amber light indicates the battery is charging. • Flashing amber light indicates the battery is low. • Off indicates the battery is neither charging nor low.
4	Operating LED	Indicates the system is running.
5	Keyboard	Input device for controlling the system or entering data. See "Keyboard Layout" on page 30. for more information.
6	Writer	Prints reports.

Side View



Item	Name	Description
1	ECG signal input connector	D-sub 15–pin female connector for the acquisition cable.
2	SD card slot	Secure Digital card slot. Insert card as indicated by the icon. The system supports only SD cards formatted for the FAT16 or FAT32 file systems.

Rear View



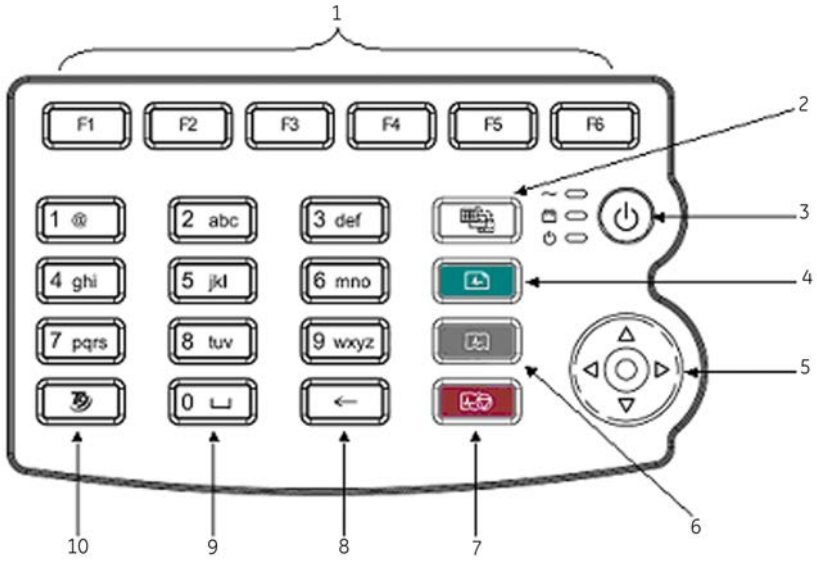
Item	Name	Description
1	Modem Port	RJ11 connector from the optional internal modem to an analog phone line.
2	LAN connection	RJ45 network connector. The LEDs indicate LAN status. • The steady green LED to the right of this port indicates a good ethernet connection. • The flashing amber LED to the left of this port indicates network traffic.
3	USB connector	Universal Serial Bus connector for USB devices, such as an optional barcode reader, a magnetic card reader, an external USB keyboard, a laser printer, or a USB WiFi device.
4	COMM Port	Serial connector for data communication with CASE/CardioSoft or the MUSE system with a serial cable.
5	AC power connector	Standard connector for the AC power cable.
6	Equipotential grounding lug	Used to connect non-grounded peripheral devices to ensure equipotential.

Bottom View

Item	Name	Description
1	Battery	Rechargeable lithium-ion battery.
2	Carrying handle	Handle for carrying the device.

Keyboard Layout

Your keyboard may differ slightly from the following illustration.

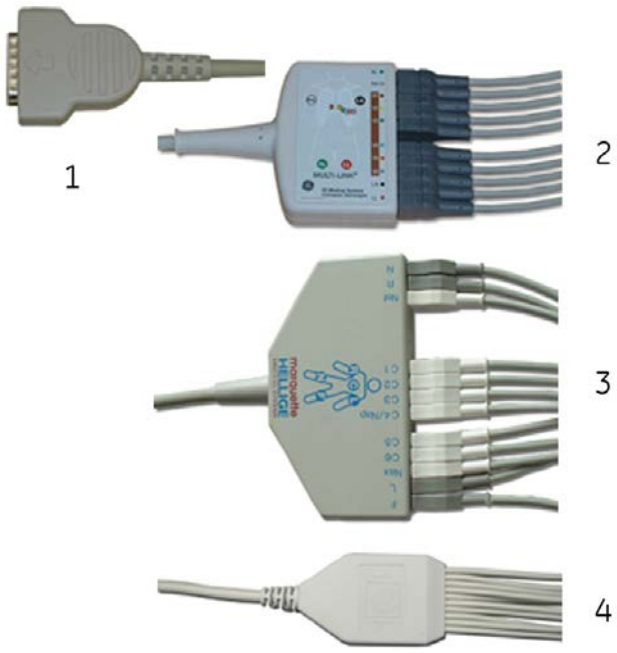


Item	Name	Description
1	Function Keys (**F1** through **F6**)	Selects menu options on the screen. Refer to "Selecting Menu Options" on page 39 for details.
2	**Leads** key	Changes the leads when the screen is displaying waveforms.
3	Power Button	Turns the system on and off.

Item	Name	Description
4	**ECG** key	Acquires a resting ECG and prints a 10-second report in ***Arrhythmia*** mode.
5	Trimpad	The arrows move the cursor left, right, up, or down to highlight a menu or screen item. Pressing the center button selects the highlighted item.
6	**Rhythm** key	Prints a continuous, real-time rhythm strip. Press **Stop** to stop the rhythm strip from printing. (The Rhythm report is not stored and cannot be transmitted.)
7	**Stop** key	Stops the writer from printing.
8	**Backspace** Key	Deletes characters.
9	**Space** Key	Adds a space between typed characters.
10	**T9** Key	Switches between different input methods. For more information, refer to "Entering Data Using the T9 Key" on page 40.

Acquisition Modules

The system supports a variety of acquisition modules.



WARNING:

BURN PROTECTION — Using cables other than those shipped with the system can result in serious injury.

To ensure defibrillator protection, and protection against high-frequency burns, use only the acquisition cable that ships with this equipment.

CAUTION:

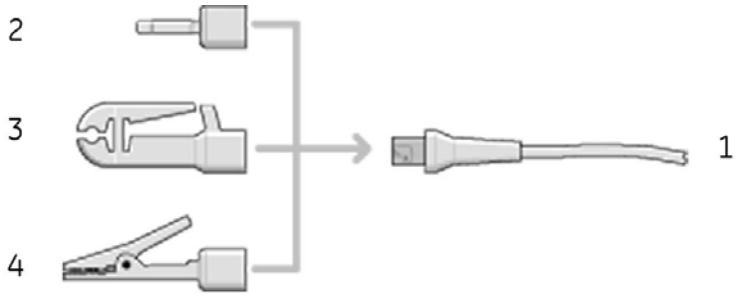
PROPER LEADWIRE CONNECTION — Improper connection of the leadwires can cause inaccuracies in the ECG.

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.

Leadwire Adapters

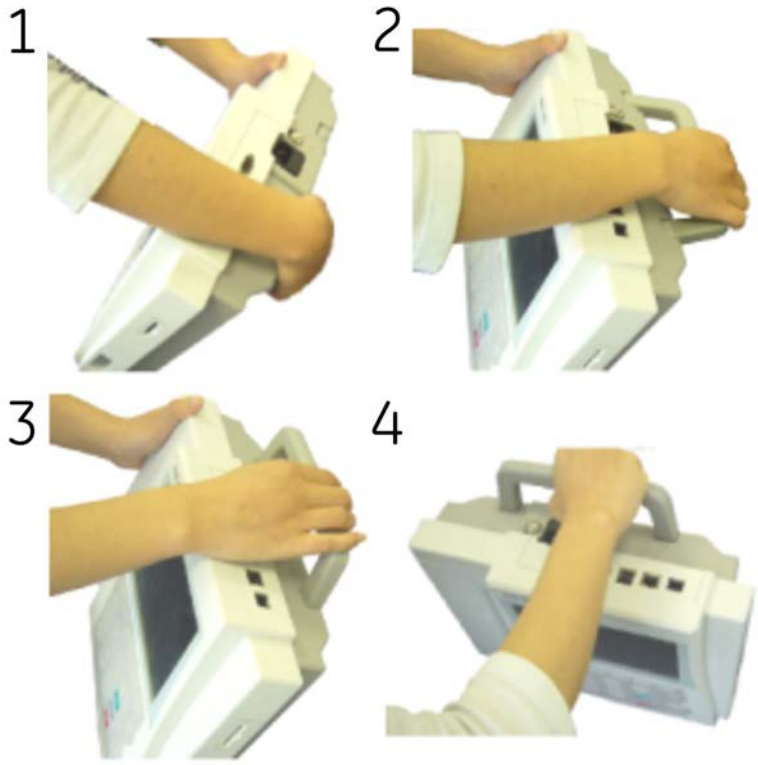
The leadwires require an adapter to connect to an electrode, as shown in the following illustration.



Item	Description
1	leadwire end
2	4 mm pin
3	grabber
4	Mactrode clip

Carrying Handle

When you need to move the system, you can use the carrying handle for convenience. Observe the following steps to use the handle correctly.



Setting Up the Equipment

Setting up this system consists of the following steps:

1. Inserting the battery.
2. Connecting the AC power adapter.
3. Connecting leadwires.
4. Inserting paper.
5. Connecting a magnetic card reader.
6. Connecting a barcode reader.
7. Connecting the optional internal modem.
8. Connecting the LAN.
9. Connecting the external laser printer.
10. Turning on the system.
11. Configuring the system.
12. Testing the equipment.

Each step is described in more detail on the following pages.

Inserting the Battery

This system is shipped with a lithium-ion battery that charges when it is inserted into the system connected to AC power.

1. Gently turn over the device and find the empty battery compartment.
2. Insert the battery as shown in the following illustration.

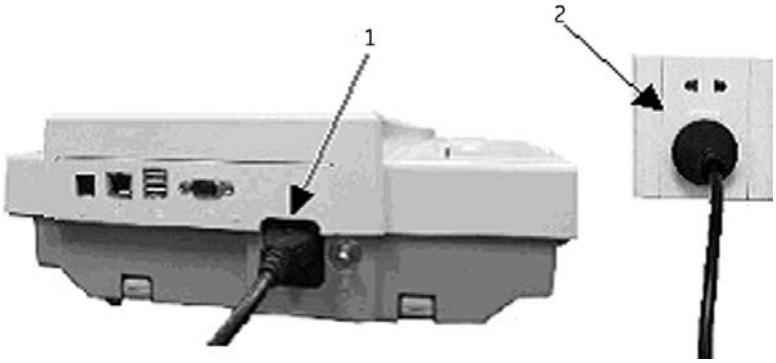
NOTE:
The battery charges when it is inserted into a system that is connected to AC power. You may begin using the system connected to AC power. Do not use the system on battery power until the battery is fully charged as indicated by the on-screen battery gauge and the solid amber LED next to the display.

Connecting the AC Power Adapter

The 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.

NOTE:
The system should be connected to an independent power socket and used alone in the patient environment.

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



1. Connect the female end of the device's power cord to the AC power connector on the rear of the device. (1)
2. Plug the male end of the device's power cord into an AC outlet. (2)
3. Check the Power LED to make sure the device is receiving power from the AC outlet.

   For more information, refer to "Front View" on page 27.

Connecting Leadwires

Use the following instructions to connect your leadwires and acquisition module to the device.

WARNING:

ELECTRICAL SHOCK — Injury can result from connecting the patient cables directly to an AC power outlet.

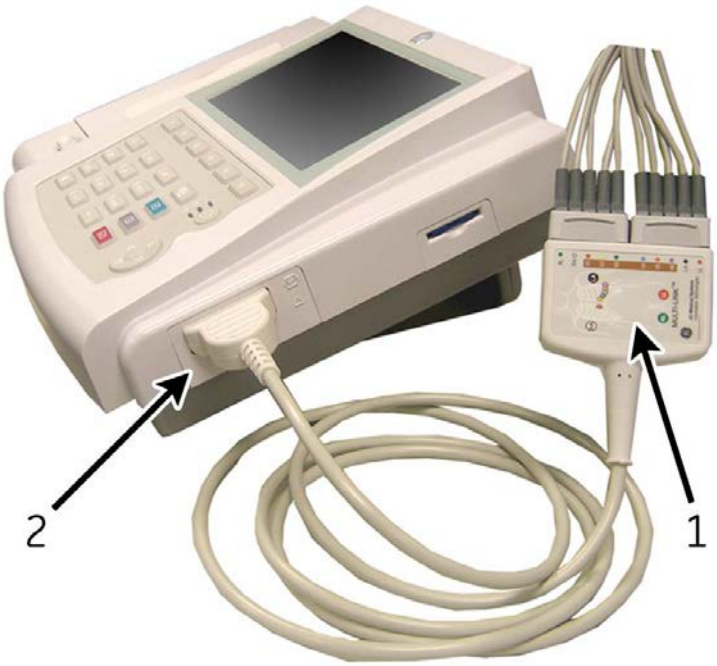
Connect patient cables only to the ECG Signal Input Connector on the device.

1. Assemble the leadwires and adapters.

   Refer to the *MAC™ 800 v2.0 Supplies and Accessories Reference Manual* for details.

2. Connect the leadwires to the front of the acquisition module (1).

   Refer to "Acquisition Modules" on page 31 for more information.



3. Connect the acquisition cable to the device (2).

   Ensure the cable is seated snugly.

Inserting Paper

Before printing ECG reports, insert the 110 mm z-fold paper into the device. Refer to the *MAC™ 800 v2.0 Supplies and Accessories Reference Manual* for instructions.

Connecting a Magnetic Card Reader

This system supports third-party magnetic card readers capable of reading magnetic strips that adhere to ISO 7810, 7811-1, 7811-2, 7811-3, 7811-4, and 7811-5 standards.

To use a third-party card reader with the system, connect it to the device's USB port. Refer to the magnetic card reader's documentation for additional information.

NOTE:

Do not connect a magnetic card reader if the barcode reader option (*BCRD*) is enabled. If the *BCRD* option is enabled, the system expects a barcode reader and the magnetic card reader does not function correctly.

Connecting the Barcode Reader

If you purchased the optional barcode reader, connect it to the USB port on the device. Refer to the barcode reader's documentation for additional information.

NOTE:

The ***BCRD*** option, which must be enabled in the system in order to use the reader, is activated at the factory when the barcode reader is purchased with the system. You must configure the barcode settings for the site before using the reader. Refer to "Patient Setup" on page 109.

Connecting the Optional Internal Modem

If the system was purchased with the internal modem option, connect the modem to an analog phone line using the RJ11 connector on the rear of the device. See "Rear View" on page 29 for details.

Connecting to a LAN

If you purchased the *LANC* (LAN Communication to CardioSoft) or *LANM* (LAN Communication to MUSE) options, connect an ethernet cable to the RJ45 network connector on the back of the device. See the *LAN Option Installation and Troubleshooting Guide* for information on configuring the LAN connection.

If you purchased the *WIFC* (WiFi Communication to CardioSoft) or *WIFM* (WiFi Communication to MUSE) options, connect the WiFi module on the USB port on the back of the device. See the *LAN Option Installation and Troubleshooting Guide* for information on configuring the WiFi connection.

NOTE:

If you are using this device as a mobile device, do not connect it to a LAN until you are ready to import, transmit, or export records.

Connecting an External Laser Printer

You can use this system with an external USB laser printer connected to its USB port or a network printer connected to its LAN connection. You must use the printer away from the patient vicinity and it must:

- Be compliant with IEC60950 or equivalent standards
- Be compliant with the PCL5e language or higher
- Be compliant with the PJL language or higher (only the network printer)
- Have a minimum of 600 dpi resolution
- Have a minimum of 8 MB of memory

Refer to the printer's documentation for setup information.

NOTE:
If connection problems occur, the printer is connected to the device, or the connected network printer is not compliant with PJL language. The following error is displayed: ***Printer Connection Failed.***

NOTE:
If you are using a network printer, save all reports before printing. The system may display the message: ***Send Successfully***. This message may display whether the report prints or does not print. If the reports do not print, you will have to generate the reports again.

Refer to the printer manual for detailed printer setup information.

Turning on the System

Press **Power** to power on the system. Verify the system's welcome screen is displayed with no errors.

If you encounter any problems powering on the system, refer to "Troubleshooting" on page 129 for troubleshooting instructions.

Configuring the System

When the system is ready for operation, configure the system settings using the information in "System Configuration" on page 87.

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 devices.

Testing the Device

After the system is set up and configured, test it completely before using with patients. Test scenarios include:

- Conducting and printing a resting ECG
  "Recording a Resting ECG" on page 51 for instructions on resting ECGs.
- Conducting and printing an arrhythmia ECG
  "Arrhythmia Mode Recording" on page 65 for instructions on arrhythmia ECGs.
- Conducting and printing an RR analysis
  "RR Analysis" on page 71 for instructions on RR Analysis.
- Saving, importing, printing, deleting, transmitting, and exporting records
  "Managing Internal Storage" on page 77 for instructions on using internal storage.

System Description

Start Up Screen

Depending on what options were selected for ***Power up mode*** in ***Basic Setup***, the start up screen is one of the following:

- ***Resting ECG***
- ***Arrhythmia***

- ***Main Screen***
- A window prompting you to enter ***User ID*** and ***Password***.

NOTE:
The password window opens only if the ***High Security Mode*** option is selected in ***Basic Setup***. You can press **F1** (***STAT ECG***) to begin taking an ECG without logging in to the system.

Using the Keyboard

You interact with the system by using the keyboard. In addition to entering data as you would any keyboard, use it to:

- Select menu options
- Navigate through data entry fields

For a complete description of the keyboard features, refer to "Keyboard Layout" on page 30. For information on entering data using the keyboard, refer to "Entering Data Using the T9 Key" on page 40.

Selecting Menu Options

Configure the system and initiate ECG readings by selecting menu options that are arranged 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 (**F1**– **F6**) directly below the display.

Press a function key to select the corresponding menu option. Depending on the selected option, one of the following results occurs:

- Take an ECG
  For example, selecting the ***Resting ECG*** menu option opens the Resting ECG function.
- Change a setting
  For example, during a resting ECG, selecting the ***25 mm/s*** option changes the speed of the reading.
- Open a window
  For example, the ***Patient Data*** option opens the ***Enter Patient Data*** window.
- Save your selections
  After entering data or changing a configuration, you may have the option to save your changes by selecting the ***Save*** menu option.

Navigating Data Entry Windows

Use the **trimpad** to navigate through data entry windows.

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

Press the center button to select the current field. If the field is associated with a list of valid values, that list is displayed.

Entering Data Using the T9 Key

Twenty-six letters are mapped to 8 numeric keys (from 2 to 9). Pressing a key multiple times cycles through each letter associated with that key. For example, *ACE* is entered by pressing **2 222 33**. Because mapping is many-to-one, converting number sequences to a word can be ambiguous.

T9 Text Input is available in the following languages: Chinese (Simplified), Czech, Danish, Dutch, English, Finnish, French, German, Hungarian, Italian, Japanese, Korean (Hangul), Norwegian, Polish, Portuguese, Russian, Slovak, Spanish, and Swedish.

Use the following instructions to input information using the **T9** key  .

- To input numbers
  Press **T9** until the input method indicator is “123” and then press **0** through **9** to enter numbers.
- To input letters
  Press **T9** until the input method indicator is “ABC” (for uppercase) or “abc” (for lowercase) and then press **2** through **9** to enter the corresponding letters printed on the keys. Press **0** to enter a space.
  To toggle through the available letters, press the key repeatedly in succession. When the desired letter is displayed, pause before pressing the next key.
- To input symbols
  Press **T9** until the input method indicator is “@” and press **1** to display the available symbols.
  Available symbols are:
  . \ — _ @ + , ‘ ? ! “ ( ) / : ; & % * = < > $ [ ] { } ~ ^ | « » • € ¥ £ © ® º ¿ ª °
  To toggle through the available symbols, use the left and right arrows on the **trimpad** until the desired symbol is displayed. Press the central button on the **trimpad** to select the symbol.
- To delete a character
  Press the **backspace** key.

3

Preparing the Patient

This chapter provides the procedures for preparing the patient's skin and properly placing electrodes. Some of the procedures for placing electrodes may not apply in all cases, depending on the system and options purchased.

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 "Electrode Placement" on page 42 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. 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.

4. 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 electrode is applied. If RA/R becomes disconnected, the system will report that all electrodes are off the patient.

Electrode Placement

This section describes various methods for placing electrodes for resting ECGs.

CAUTION:

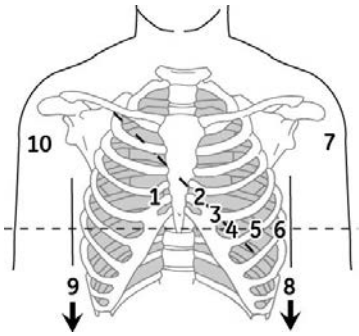
PROPER LEADWIRE CONNECTION — Improper connection will cause inaccuracies in the ECG.

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

Resting ECG Placement

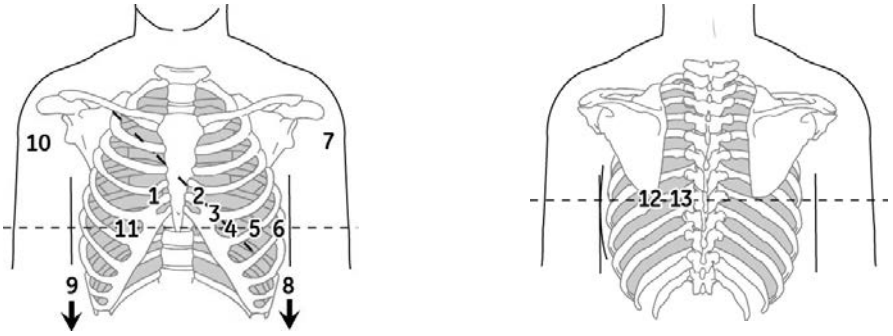
The following methods are applicable for resting ECGs.

Standard 12 Lead Placement



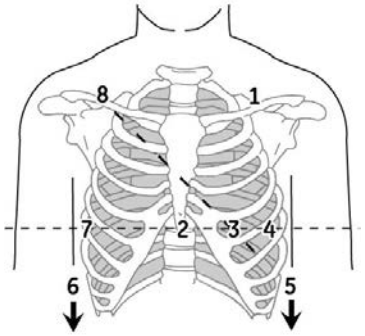
	AHA Label	IEC Label	Description
1	V1 Red	C1 Red	Fourth intercostal space at the right sternal border
2	V2 yellow	C2 yellow	Fourth intercostal space at the left sternal border
3	V3 green	C3 green	Midway between location 2 and 4
4	V4 blue	C4 brown	Mid-clavicular line in the fifth intercostal space
5	V5 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

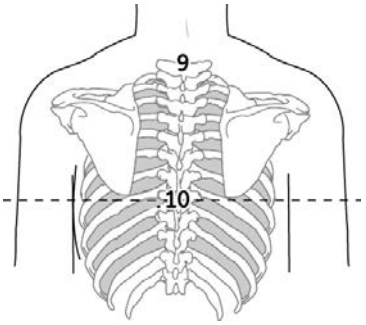
Standard 15 Lead Placement



	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
11	V4R gray	C4R gray	Right anterior chest opposite of 4
12	V8 gray	C8 gray	Under left midscapular line
13	V9 gray	C9 gray	Left paraspinal border

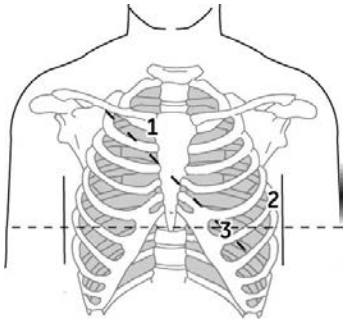
Frank X, Y, Z Placement





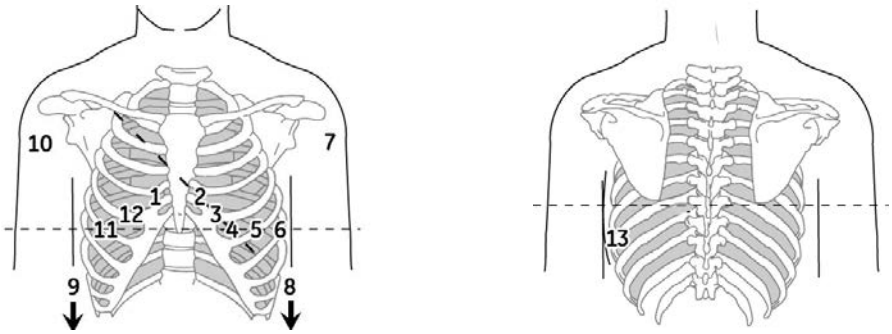
	AHA Label	IEC Label	Description
1	LA black	L yellow	Just below the clavicle of the left arm
2	E orange	E light blue	Mid-sternum on the same horizontal level as 3 and 4
3	V4 blue	C4 brown	Mid-clavicular line in the fifth intercostal space
4	V6 purple	C6 purple	Mid-axillary line on the same horizontal level as 3
5	LL red	F green	Left leg, lower abdominal quadrant
6	RL green	N black	Right leg, lower abdominal quadrant
7	I orange	I light blue	Right mid-axillary line on the same horizontal level as 3 and 4
8	RA white	R red	Just below the clavicle of the right arm
9	H orange	H light blue	Back of neck, avoid the carotid artery and jugular vein
10	M orange	M light blue	Center of spine on the same horizontal level as 3 and 4

NEHB Placement



	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 V8 or C8)
3	V4 blue	Nap white	Mid-clavicular line in the fifth intercostal space (Same position as C4)

Pediatric 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	LA black	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
11	V4R gray	C4R gray	Mid-clavicular line in the fifth right intercostal space
12	V3R gray	C3R gray	Halfway between 1 and 11
13	V7 gray	C7 gray	Same horizontal level of 4 in the left posterior axillary line

4

Entering Patient Information

Entering Patient Information Manually

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.

CAUTION:

ACCURATE PATIENT INFORMATION — 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).

Make sure that you enter patient information for the correct patient.

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

   To open the window for ***Resting ECG*** and ***RR Analysis***, press **F3** (***Patient Data***).

   For ***Arrhythmia*** ECGs, the window opens automatically when you initially select the application.

   For subsequent patients, press ***Stop Recording*** > ***Confirm Stop*** > ***More*** > ***Start Recording*** > ***New Patient*** to reopen the ***Enter Patient Data*** window.

   NOTE:

   The ***Patient List*** is available only if the optional internal storage is enabled.

   If you select a patient from the patient list, only the first page of patient information is reused: you must manually reenter all subsequent pages.

2. Enter the necessary patient information or press **F1** ***Patient List*** to select a patient from a list of patients.

   NOTE:

   If the ***Test Patient*** setting has been enabled in ***System Configuration*** > ***Basic Setup***, the **F1** (***Patient List***) setting will be disabled.

   Refer to "Entering Data Using the T9 Key" on page 40 for additional information on entering data.

3. Use the **F3** and **F4** keys to move backward and forward through the patient data windows.

   The **F4** key moves forward one screen.

   The **F3** key moves backward one screen.

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

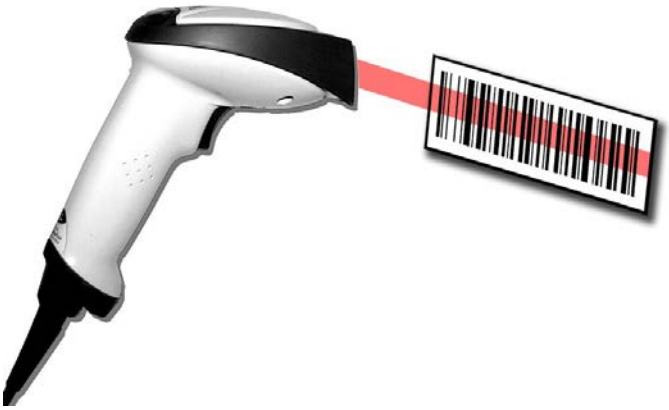
4. When all the patient data has been entered, press the **F6** key to save the data.

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.

To use the barcode reader, it must be connected to the USB port on the device's rear panel and properly configured. Refer to "Patient Setup" on page 109 for instructions on setting up the optional barcode reader.

1. When the ***Scan the Patient Barcode*** prompt appears on the screen, scan the patient's barcode.



   The following message is displayed on the screen and the barcode reader beeps: ***Please wait***. 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 "Entering Patient Information Manually" on page 47 for details.

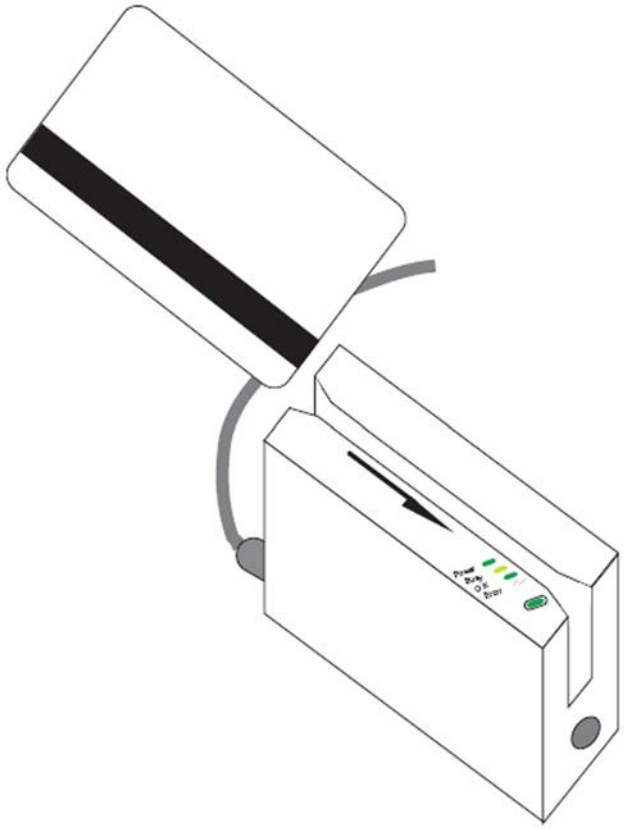
4. After verifying that the patient information is correct, press the **F6** key to save the patient data.

Entering Patient Information with a Magnetic Card Reader

Using a magnetic card reader can simplify the entry of patient information and reduce the introduction of errors. When you swipe a patient's magnetic card, it retrieves the patient information encoded in the card's magnetic strip. You can then verify or modify the information as appropriate.

To use a magnetic card reader, it must be connected to the USB port on the device's rear panel and properly configured. Refer to "Magnetic Card Reader Configuration" on page 139 for instructions on setting up a third-party magnetic card reader.

1. The following prompt will appear on the screen: ***Swipe the Patient Card***.
   a. Swipe the patient's magnetic card through the card reader.



   b. When you swipe the card, the following message is displayed on the screen: ***Please wait.***

      After the data is processed, the first ***Patient Data*** window opens with the data from the patient's card entered in the appropriate fields.
2. Confirm that the data entered from the patient's card is accurate.
3. Enter or modify patient information as necessary.

   Refer to "Entering Patient Information Manually" on page 47 for more details.
4. After verifying that the patient information is correct, press the **F6** key to save the patient data.

Receive Orders from a MUSE System

Preparation

The MUSE system can communicate orders to this system in the following ways:

- Via modem (internal or external) (only if modem or serial communication to the MUSE system is enabled)
- Via LAN (only if LAN communication to the MUSE system is enabled)
- Via WiFi (only if WiFi communication to the MUSE system is enabled)

Load the Orders

1. Select ***Order Manager***. The ***Order Manager*** interface opens.
2. Select ***Load Orders***.
3. Enter the location(s) from which the device should retrieve the orders.

Select the Orders to Receive

1. Select one or more orders.
2. Select ***Load Orders*** again. The system stores the orders

Select an Order to Complete

1. Choose ***Select***.
2. Select an order.
3. Select ***OK*** to proceed with selecting this order.

   The system will do one of the following:

   - The Resting ECG screen displays.
   - Allow you to select ***Cancel*** to abort the selection of this order. You can then select a different order to complete.

Complete the Order

1. Select ***Patient Data***.

   The patient data window for this patient displays.
2. Enter patient data or modify the patient data that is displayed.
3. Select ***Save*** to save patient information or ***Cancel*** to return to Resting ECG screen.
4. Acquire a 10s ECG to complete this order.

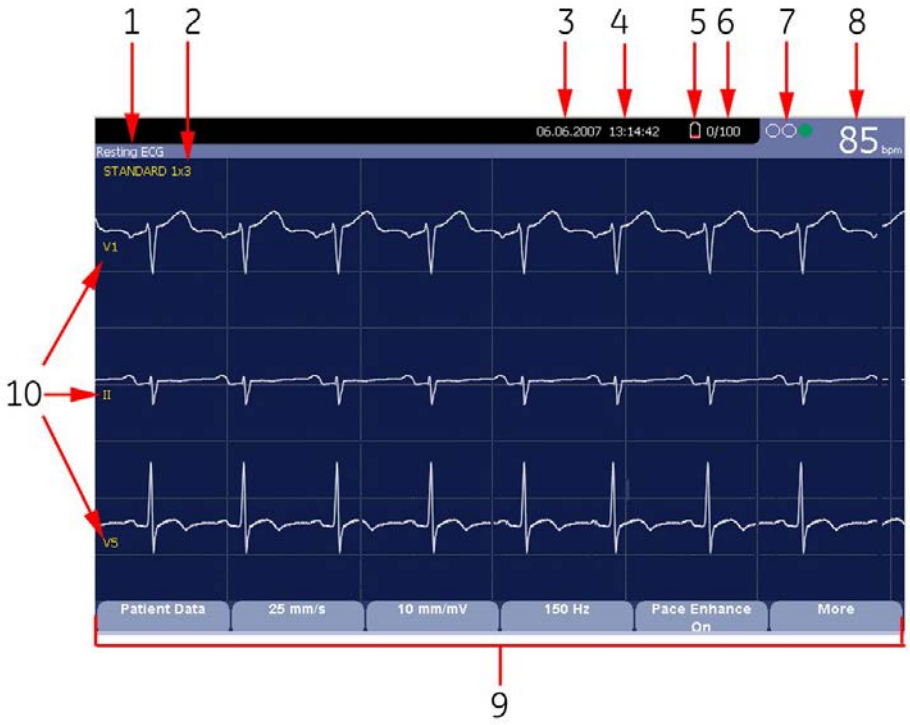
   This system will then go to the ECG test.

5

Recording a Resting ECG

Introduction

The Resting ECG function is part of the basic 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 figure. You can modify the default in the ***Basic Setup***.



Resting ECG Display		
Item	**Name**	**Description**
1	ECG Type	Type of ECG. Valid types are ***Resting ECG***, ***Arrhythmia***, and ***RR Analysis***.
2	Display Format	Format of current waveforms. Press **Leads** to cycle through all 12 leads.

Resting ECG Display		
Item	**Name**	**Description**
3	Date	Current system date.
4	Time	Current system time.
5	Battery status indicator	Displays the current battery level. This is displayed only when the device is operating on battery.
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.
7	Hookup Advisor Indicator	See "Hookup Advisor Module" on page 61 for more information.
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, refer to ."Selecting Menu Options" on page 39.
10	Lead Labels	Identifies each waveform and indicates the waveform quality. Red = disconnected lead

Resting ECGs

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

Recording a Resting ECG

The following steps describe how to conduct a resting ECG.

NOTE:
To take a stat ECG, do one of the following:

- If the password screen is displayed, press ***STAT ECG***.
- If the password screen is not displayed, go directly to step 2.

1. Prepare the patient as described in "Preparing the Patient" on page 41.
2. Verify the system is in ***Resting ECG*** mode.

   If the system is not in the ***Resting ECG*** mode, on the ***Main*** menu press **F1** to select ***Resting ECG***.
3. Enter the patient data as described in "Entering Patient Information" on page 47.

4. Adjust the ***Speed***, ***Gain***, and ***Low Pass Filter*** until the waveforms are configured as desired.

   For more information, refer to "ECG Options" on page 53.

5. If the patient has a pacemaker, press **F5** to turn on ***Pace Enhance***.

   For more information, refer to "ECG Options" on page 53.

6. Press **Leads** to scroll through the leads or change the lead format.

   For more information on display formats, refer to "Resting ECG Setup" on page 91.

7. 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. Proceed to step 8.
   - If the ***Preview Before Analysis*** option is not enabled, the ECG data is analyzed and printed after it is acquired. Continue with step 9.

8. While reviewing the preview, do one of the following:

   - Discard the reading and begin over by pressing **F3** (***Cancel***) and repeat from step 4.
   - Accept the reading by pressing **F4** (***Continue***).
     The menu options change to allow you to manage the acquisition. Proceed to step 9.
   - If the ***Laser Printer (LPRT)*** option is enabled, you can press ***Laser Printer*** to print the reading to a laser printer attached to the device.
     The ECG is printed on the laser printer. You return to the main ECG screen, where you can take another ECG.

9. Use the options to change patients or print a copy, or to save, transmit, or reanalyze the data.

   For more information on each option, refer to "Post-Acquisition Options" on page 56.

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.

Option	Description
Patient Data	Opens the patient data entry window.
Sweep Speed	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 millimeter per second (mm/s) and includes the following options: • 25 mm/s • 50 mm/s • 12.5 mm/s - 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.
Gain	Changes the magnitude of the ECG signal on the display or in the report. Measurement is in millimeter per millivolt (mm/mV) and includes the following options: • 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 appears. Only the appearance 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.

Option	Description
Filter	Eliminates noise in the waveform by restricting which frequencies are included. Frequencies are measured in Hertz (Hz) and include the following options: • 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. **CAUTION:** INACCURATE READINGS — Using the filter can result in a cleaner waveform, but selecting a frequency that is too low could alter the waveform's morphology, resulting in an inaccurate reading. Use the filter only to eliminate excessive noise and use the highest frequency that provides a readable waveform.
Pace Enhance	Standardizes the pace spike. Options are ***On*** and ***Off***.
More	Toggles between the first row of options (above) and the second row of options (below).
Printer Leads	Selects which leads to include in the printout. Options are: • First Six • Second Six • Rhythm Six Use this option only when conducting rhythm ECGs. For more information, refer to "Generating a Rhythm Report (Manual Recording) " on page 57.
ADS	Toggles the anti-drift system (***ADS***) on and off. ***ADS*** helps reduce baseline drift.
Main Menu	Exits the ***Resting ECG*** function and returns to the ***Main Menu***.

Post-Acquisition Options

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

Option	Description
Page 1	
Next Patient	Opens the patient entry window allowing you to enter or select a new patient.
Print	Prints the ECG report.
Save	Stores the current ECG report. Not available in either of the following conditions: • neither the M100 nor M300 internal storage option is enabled, or • ECGs are set up to save automatically
Transmit	Sends the current ECG report to the location defined on the ***Communication Setup*** window. This option applies only if a valid LAN, WiFi, Modem communication option is enabled. Refer to "System Configuration" on page 87 for more information.
RR Analysis	Enters the RR Analysis Modality. Available only if the ***RRAN*** option is enabled.
More	Toggles between the first and second row of acquisition options.
Page 2	
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.
Page 3	
Printer Leads	Selects which leads to include in the printout.

Option	Description
Reanalyze	Allows you to edit the global measurement and T-wave dispersion. This feature is available only if: • Audit Trail is disabled on the ***Basic Setup*** window • Either measurement option (ME12 or MI12) is enabled • Reanalysis option is selected in the ***Resting ECG Setup*** window
Laser Print	This feature is available only if the ***Laser Printer (LPRT)*** option is enabled. Prints the ECG report to an external USB laser printer or network laser printer.
ADS	Toggles the anti-drift system (***ADS***) on and off. ***ADS*** helps reduce baseline drift.
Main Menu	Exits the Resting ECG function and returns to the Main Menu.

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 "Preparing the Patient" on page 41.
2. Verify that the system is in ***Resting ECG*** mode.

   If the system is not in ***Resting ECG*** mode, on the ***Main Menu*** press **F1** to select ***Resting ECG***.
3. Enter the patient data as described in "Entering Patient Information" on page 47.
4. Adjust the ***Speed***, ***Gain***, and ***Low Pass Filter*** until the waveforms are configured as desired.

   For more information, refer to "ECG Options" on page 53.
5. If the patient has a pacemaker, press **F5** to turn on ***Pace Enhance***.

   For more information, refer to "ECG Options" on page 53.
6. Press **Leads** to scroll through all 12 leads.

   For more information on display formats, refer to "Resting ECG Setup" on page 91.
7. Press **F6** to select ***More***.
8. Press **F1** to select the appropriate ***Printer Leads*** option.

   For more information on the ***Printer Leads*** option, refer to "ECG Options" on page 53.
9. Press **Rhythm** to begin recording the ECG.
10. 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. Refer to "Resting ECG Setup" on page 91 for details.

ECG Reanalysis

You can reanalyze ECGs if the following conditions are met:

- The ***Audit Trail*** option is disabled on the ***Basic Setup*** window
- Either the ***Measurement and 12SL Interpretation*** system option (MI12) or the ***Measurement 12SL*** system option (ME12) is enabled
- ***Reanalysis*** is selected on the ***Resting ECG Setup*** window

Reanalysis allows you to modify the ***Global Measurements*** fiducial points on acquired waveforms. Refer to the *Marquette 12SL ECG Analysis Program Physician's Guide* for additional information.

Reanalyzing an ECG

Use the following procedure to reanalyze a resting ECG.

For additional information, refer to "Reanalyzing Layout" on page 59 and "Reanalysis Options" on page 60.

1. After acquiring an ECG, press ***More*** > ***More*** > ***Reanalyze***.

   For instructions on acquiring a resting ECG, refer to "Recording a Resting ECG" on page 52.

2. Review the waveforms to determine the accuracy of the system-selected fiducial points.

   For a better view of individual waveforms, press **Leads** to toggle through the waveforms. Refer to "Reanalyzing Layout" on page 59 for more information.

3. After you have analyzed the waveforms, use the following procedure to adjust the fiducial points:

   a. Press **F1** (***Next***) to toggle through the fiducial points.

      The selected point changes size and is highlighted green.

   b. When the correct point is selected, use the **trimpad** to adjust its position.

   c. To verify correct positioning, refer to the values in the ***Measurement Legend*** in the lower left corner of the display.

      For more information on the ***Measurement Legend***, refer to "Reanalyzing Layout" on page 59.

   d. Repeat step a through step b for each fiducial point you want to adjust.

4. When you are done adjusting the fiducial points, do one of the following:

   - Discard your adjustments and start over.

     a. Press **F4** (***Restore***).
     The original readings are restored.

     b. Return to step 2 to start over.

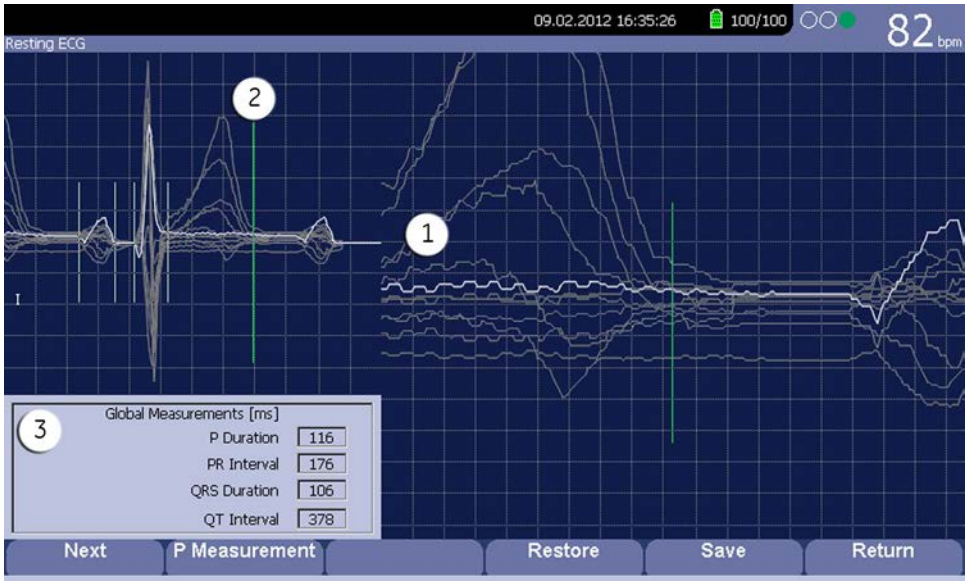
   - Save your adjustments; press **F5** (***Save***).

The changes are saved.

5. After all your changes are made, press **F6** (***Return***) to return to the original menu options.

Reanalyzing Layout

Selecting the ***Reanalysis*** option after acquiring a resting ECG displays the following screen. The screen's key features are described in the following table.



Item	Feature	Description
1	***Waveforms***	A composite view of the ECG reading generated by superimposing the median waveforms from all 12 leads. Press **Leads** to toggle through the individual waveforms. The selected waveform is brighter than the others.
2	***Fiducial Points***	Each fiducial point is represented by a vertical line through the composite waveforms. Press **F1** (***Next***) to toggle through the fiducial points. When a point is selected, it increases in size and is highlighted green. You can adjust a selected fiducial point by pressing the left and right arrows on the **trimpad**.
3	***Measurement Legend***	The measurement, in milliseconds (ms), for the following: • P Duration • PR Interval • QRS Duration • QT Interval As you adjust the fiducial points, these measurements adjust accordingly.

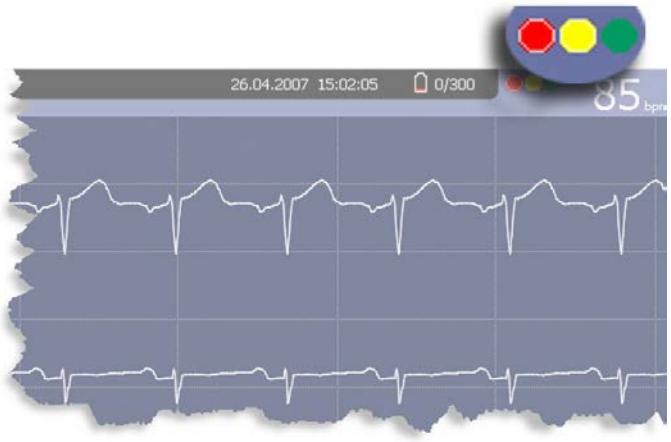
Reanalysis Options

The following options are available when reanalyzing an ECG.

Function Key	Option	Description
F1	***Next***	Cycles through the following fiducial points on the superimposed waveforms: • ***P-onset*** • ***P-offset*** • ***QRS-onset*** • ***QRS-offset*** • ***T-offset*** As it cycles through each point, the selected point is doubled in size and highlighted green for ease of visibility. Use the left and right arrows on the **trimpad** to move the selected point. As you adjust points, the corresponding measurements in the ***Measurement Legend*** adjust accordingly.
F2	***P Measurement***	Toggles the format of the ***P Duration*** and ***PR Interval*** measurements in the ***Measurement Legend*** and toggles the fiducial points from solid lines (certain) to dotted lines (uncertain). This is available only when the ***P-onset*** or ***P-offset*** fiducial points are selected.
F4	***Restore***	Returns all fiducial points to their original positions. Use this option to undo any changes and begin over.
F5	***Save***	Applies the waveform marker changes to the ECG record. When the ECG is next printed, it is reanalyzed with the new settings.
F6	***Return***	Exits the reanalysis function and returns to the ***Resting ECG*** mode. **NOTE:** Make sure you press **F5** (***Save***) to save your changes first. Otherwise, you lose your changes.

Hookup Advisor Module

The ***Hookup Advisor*** module is a visual indication of the quality of lead signals. Monitoring it helps reduce or eliminate poor quality ECGs, saving time and preventing the need to take additional ECGs.



The ***Hookup Advisor*** indicator is positioned in the upper right corner of the screen, to the left of the heart rate. The following table describes each of the indicator's conditions.

Hookup Advisor

Indicator	Description
Red	Indicates a leadfail condition or extreme baseline shifts. A corresponding message is displayed.
Yellow	Indicates muscle artifact, power line interference, baseline wander, or electrode noise. A corresponding message is displayed.
Green	Indicates acceptable signal quality.

When you receive a red or yellow indicator, identify and correct the error before proceeding with the ECG. Enable and configure the ***Hookup Advisor*** function in the ***Resting ECG Setup***. Refer to "Resting ECG Setup" on page 91 for details.

Special Consideraitons

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

- Recording ECGs of pacemaker patients
- Recording ECGs during defibrillation

Recording ECGs of Pacemaker Patients

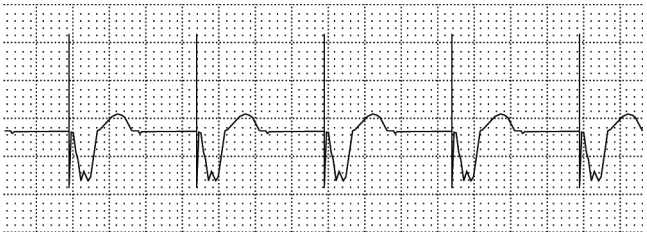
WARNING:

INCORRECT HR, NO HR ALARM — If several adverse conditions exist at once, the possibility that the pacer pulses are interpreted (and counted) as QRS complexes should be considered. At the same time, QRS complexes might be suppressed in certain situations.

Pacemaker patients should always be watched closely.

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.



Recording ECGs During Defibrillation

WARNING:

EQUIPMENT DAMAGE — Damaged cables can cause mechanical problems.

Before connecting the cable to the device, check it for signs of mechanical 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.

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.

6

Arrhythmia Mode Recording

The Arrhythmia mode is part of the basic system. It allows you to manually generate an arrhythmia printout in a table format, an episode format, or a summary format.

The interface of the Arrhythmia mode is identical to the interface for the Resting ECG mode. For more information on the interface, refer to "Introduction" on page 51. In addition to the same waveform options (speed, gain, filter, pace enhance, and patient data) as the Resting ECG mode, arrhythmia mode also offers an anti-drifting system (ADS) that helps reduce baseline shift.

Arrhythmia Mode

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

Printing an Arrhythmia Report

Use the following steps to record an arrhythmia report:

1. Prepare the patient as described in "Preparing the Patient" on page 41.
2. On the ***Main Menu*** press **F2** (***Arrhythmia***).

   The ***Enter Patient Data*** window opens.
3. Enter the patient data as described in "Entering Patient Information" on page 47.
4. Adjust the ***gain***, ***speed***, ***filter***, ***antidrift system***, and ***pacemaker detection*** as necessary.

   Refer to "Arrhythmia Options" on page 66, for details.
5. After the settings are adjusted as required, press **F1** (***Start Recording***) to begin the arrhythmia report.
6. After you have recorded an adequate amount of information, press **F1** (***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 **F5** (***Continue Recording***).

This returns to the recording mode. Repeat from step 6.

- If you have determined enough information was recorded, press **F2** (***Confirm Stop***).
  Report options become available.

8. Select the type of Arrhythmia Report you want to print and press the appropriate function key.
   - To print the summary report, press **F1** (***Print Summary***).
   - To print the table report, press **F2** (***Print Table***).
   - To print the episodes report, press **F3** (***Print Episodes***).

   Refer to "Printing Options" on page 68 for details.
9. Review the report as necessary.

   For more information, refer to "Arrhythmia Codes" on page 68.

Arrhythmia Options

The system provides several options for configuring an Arrhythmia report. The options, presented as option keys across the bottom of the display, are listed in the following table.

Function Key	Option	Description
F1	***Start/Stop Recording***	Starts and stops the arrhythmia reading.
F2	***Sweep Speed***	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 millimeter per second (mm/s) and includes the following options: • 25 mm/s • 50 mm/s • 12.5 mm/s - 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.

Function Key	Option	Description
F3	***Gain***	Changes the magnitude of the ECG signal on the display or in the report. Measurement is in millimeter per millivolt (mm/mV) and includes the following options: • 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 appears. Only the appearance 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.
F4	***Filter***	Eliminates noise in the waveform by restricting which frequencies are included. Frequencies are measured in Hertz (Hz) and include the following options: • 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. **CAUTION:** INACCURATE READINGS — Using the filter can result in a cleaner waveform, but selecting a frequency that is too low could alter the waveform's morphology, resulting in an inaccurate reading. To avoid this, use the filter only to eliminate excessive noise and use the highest frequency that provides a readable waveform.
F5	***ADS***	Toggles the anti-drift system (***ADS***) ***on*** and ***off***. ADS helps reduce baseline drift.
F6	***More***	Toggles through the softkey options.

Function Key	Option	Description
F6	***More***	Toggles through the softkey options.
F1	***Pace Enhance***	Standardizes the pace spike. Options are ***On*** and ***Off***.
F3	***Patient Data***	Opens the ***Patient Data Entry*** window.
F5	***Main Menu***	Exits the ***Arrhythmia*** function and returns to the ***Main Menu***.

Printing Options

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

Function Key	Option	Description
F1	***Print Summary***	Prints a combined report that includes both the ***Table*** and ***Episode*** formats.
F2	***Print Table***	Prints a breakdown of the recording in tabular format. The report includes: • 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 "Arrhythmia Codes" on page 68.
F3	***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, refer to "Arrhythmia Codes" on page 68.

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

Code	Arrhythmia Event
PAU2	Pause of 2 missed beats
PCAP	Pacemaker capture
PERR	Pacemaker malfunction
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)

7

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.

RR Analysis Mode

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

Printing an RR Analysis Report

Use the following steps to generate an RR Analysis report:

1. Prepare the patient as described in "Preparing the Patient" on page 41.
2. From the device ***Main Menu*** press ***RR Analysis***.
3. Press ***Patient Data*** and enter the patient data as described in "Entering Patient Information" on page 47.
4. Press ***RR Analysis Setup*** and adjust the setup options as necessary.

   Setup options include target, record lead, gain, speed, filter, pacemaker detection, rhythm record, and RR table. Refer to "RR Analysis Options" on page 72 for details.
5. Press ***Save*** to record your settings.
6. 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.
7. While the ECG is being acquired, you can do any of the following:
   - Change the ***Sweep Speed***.
   - Change the ***Gain***.
   - Change ***Low Pass Filter***.
   - Toggle ***Pace Enhancement***.

   For more information on any of these options, refer to "Waveform Options" on page 72.

When the target is achieved, a preview of the summary results, histogram, and trendgram is displayed.

8. While reviewing the preview, do any of the following:

   - Discard the reading and start over.
     Press ***Return*** and repeat from 6.
   - Discard the reading and return to the ***Main Menu***.
     Press ***Main Menu***.
   - Accept the reading and print the report on the thermal printer.
     Press ***Print***.
   - Accept the reading and print the report on an external laser printer.
     Press ***Laser Print***.
   - Accept the reading and export the results to a PDF file.
     Press ***PDF Export***.

   For more information on each option, refer to "Output Options" on page 73.

RR Analysis Options

The following options are available before you begin an RR Analysis test:

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. Refer to "RR Analysis Setup" on page 74 for details.
Main Menu	Exits the RR Analysis mode and returns to the ***Main Menu***.

Waveform Options

The following options are available during the RR Analysis test:

Option	Description
Stop Test	Stops the RR Analysis test.
Sweep Speed	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 millimeter per second (mm/s) and includes the following options: • 12.5 mm/s • 25 mm/s • 50 mm/s

Option	Description
Gain	Changes the magnitude of the ECG signal on the display or in the report. Measurement is in millimeter per millivolt (mm/mV) and includes the following options: • 2.5 mm/mV • 5 mm/mV • 10 mm/mV • 20 mm/mV • 40 mm/mV • Automatic The larger the selected measurement, the larger the waveform appears. Only the appearance 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.
Low Pass Filter	Eliminates noise in the waveform by restricting which frequencies are included. Frequencies are measured in Hertz (Hz) and include the following options: • 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 will be ignored. **CAUTION:** INACCURATE READINGS — Using the filter can result in a cleaner waveform, but selecting a frequency that is too low could alter the waveform's morphology, resulting in an inaccurate reading. To avoid this, use the filter only to eliminate excessive noise and use the highest frequency that provides a readable waveform.
Pace Enhance	Improves the readability of pacemaker ECGs. Options are ***On*** and ***Off***.

Output Options

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

Option	Description
Print	Prints the RR Analysis Report on the thermal printer.
PDF Export	Exports the RR Analysis Report to a PDF file.

Option	Description
Laser Print	Prints the RR Analysis Report to an external USB laser printer or network laser printer.
Main Menu	Exits the RR Analysis mode and returns to the ***Main Menu***.
Return	Returns to pre-test status.

RR Analysis Setup

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

- Target
- Record lead
- Waveform parameters
- Report options

To access the RR Analysis Setup function from the device ***Main Menu***, press ***RR Analysis***> ***RR Analysis Setup***.

The following table describes each available setting on the ***RR Analysis*** *Setup* window.

Field	Description
Target	Selects the target of the test.
Record Lead	Selects which rhythm lead is displayed and stored.
Line Filter	Enables/disables the line filter defined in ***Country Setup***. Refer to "Country Setup" on page 108 for more information.
Pace Enhance	Improves the readability of pacemaker ECGs. Options are ***On*** and ***Off***.
Gain	Sets the magnitude of the ECG signal. Measurement is in millimeter per millivolt (mm/mV) and includes the following options: • 2.5 mm/mV • 5 mm/mV • 10 mm/mV • 20 mm/mV • 40 mm/mV • Automatic The larger the selected measurement, the larger the waveform appears. Only the appearance 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.

Field	Description
Sweep Speed	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. • 12.5 mm/s • 25 mm/s • 50 mm/s
Low Pass Filter	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: • 20 Hz • 40 Hz • 100 Hz • 150 Hz 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.
High Pass Filter	Sets the minimum 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. • 0.04 Hz • 0.08 Hz • 0.16 Hz • 0.31 Hz Selecting a frequency eliminates signals that fall below that frequency. For example, if you select 0.16, only signals that have a frequency of 0.16 Hz or higher are included in the waveform.
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.

8

Managing Internal Storage

Introduction

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
- review records
- delete records
- print records
- transmit records to an external device
- export records to a secure digital card, shared directory, or FTP server

Only resting ECGs can be saved to internal storage; arrhythmia and RR analysis can only be printed.

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, refer to "Resting ECG Setup" on page 91.
- To save resting ECG records manually, after the resting ECG is acquired, press **F3** (***Save***).
  For more information, refer to "Post-Acquisition Options" on page 56.

To enable internal storage, either the M100 *Internal Storage for 100 ECGs* option or the M300 *Internal Storage for 300 ECGs* must be enabled.

For information on enabling the internal storage option, refer to "Options Setup" on page 115.

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
- MUSE systems connected via modem

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

- Purchase and activate the appropriate communications option.
  For more information refer to "Options Setup" on page 115.
- Configure the system's data communication settings.
  For more information, refer to "Communication Setup" on page 100.

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

1. From the ***Main Menu***, press **F3** (***File Manager***).

   The ***File Manager*** window opens.

2. Press **F3** (***Import***).

   The function keys change.

3. Insert the SD card and press **F1** (***SD Card***).

   A list of the available ECGs on the card opens.

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

5. When the correct records are selected, press **F1** (***Import***).

   The selected records are imported from the SD card into internal storage.

   NOTE:
   Imported records have a ***Sent*** status of ***Recv*** and cannot be edited, transmitted, or exported in either Hilltop or XML format; however, they can be exported in PDF format.

Printing the File Manager Directory

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

1. From the ***Main Menu***, press **F3** (***File Manager***).

   The ***File Manager*** window opens.

2. Press **F4** (***Print Directory***).

   The directory prints on the writer.

Finding Records

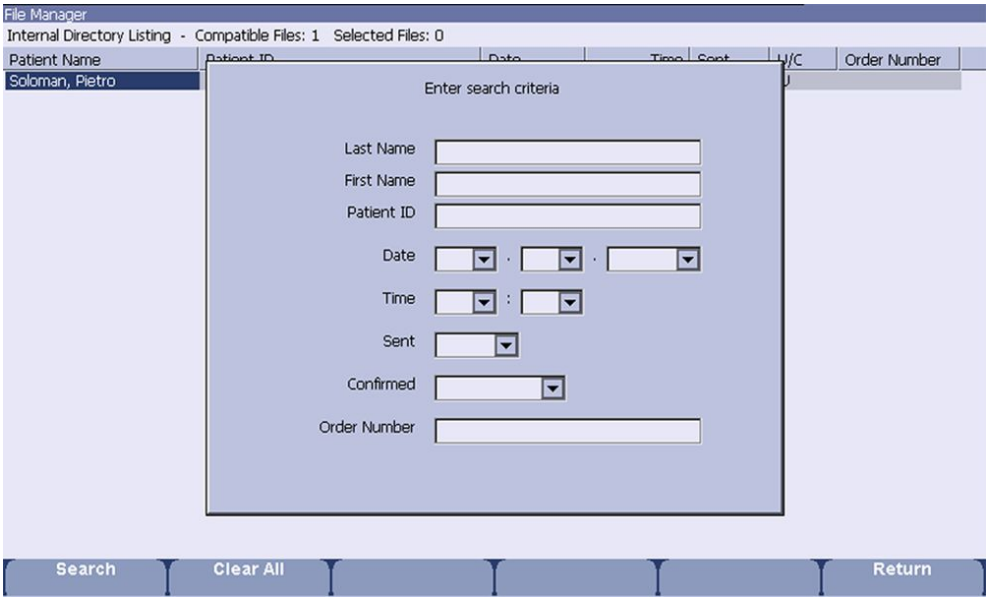
The ***File Manager*** may have up to 300 records to manage, making it difficult to find a specific record. To help you locate a record or a group of records, use the following instructions:

1. On the ***Main Menu***, press **F3** (***File Manager***).

   The ***File Manager*** window opens.

2. Press **F5** (***Search***).

   The ***Enter Search Criteria*** window opens.



3. Enter your search criteria.
4. Press **F1** (***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 **F6** (***Main Menu***) > **F3** (***File Manager***).
   - Press **F5** (***Search***) > **F6** (***Return***).

Editing Patient Data

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

1. From the ***Main Menu***, press **F3** (***File Manager***).

   The ***File Manager*** window opens.

2. Press **F1** (***Select***).

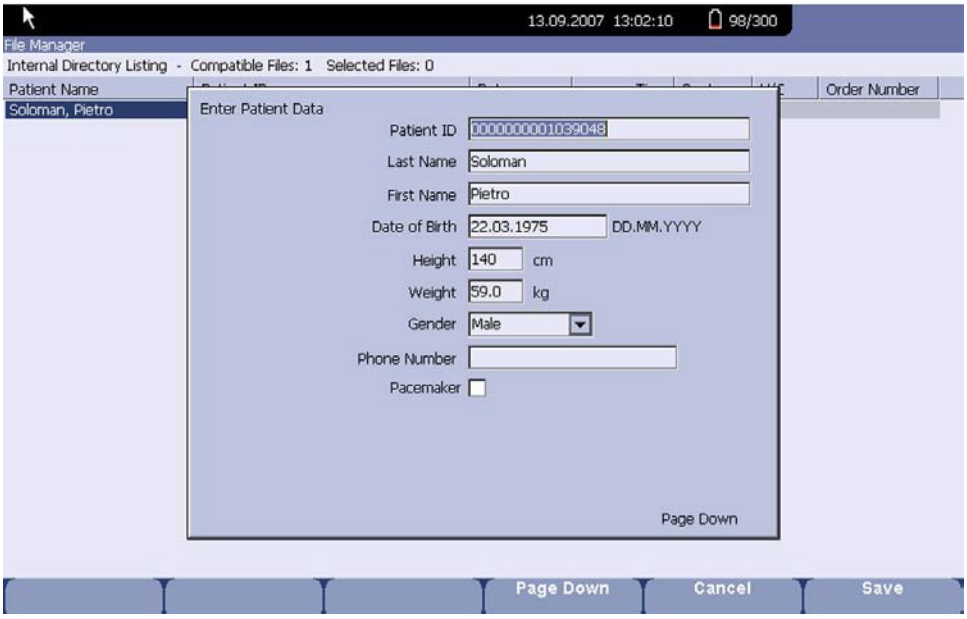
   This enters the ***File Manager*** into ***Select*** mode.

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 **F1** (***Edit***).

   The ***Enter Patient Data*** window opens.



5. Edit the information as appropriate.

   For instructions on editing patient information, refer to "Entering Patient Information" on page 47.

6. After the information is updated, press **F6** (***Save***).

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

Reviewing Records

Use the following instructions to review recorded patient data:

1. From the ***Main Menu***, press **F3** (***File Manager***).

   The ***File Manager*** window opens.

2. Press **F5** (***Search***) and use the **trimpad** to select the record(s) you want to review.

3. Press **F6** (***More***) > **F3** (***Review***).

   A window opens with the record for you to review.

4. After reviewing the record, press ***Return*** and return to the ***File Manager***.

Deleting Records

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

1. On the ***Main Menu***, press **F4** (***File Manager***).

   The ***File Manager*** window opens.

2. Do one of the following.

   - To delete select records, press **F1** (***Select***) and use the **trimpad** to select the record(s) you want to delete.
   - To delete all the records in storage, press **F2** (***Select All***).

3. Press **F2** (***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 **F5** (***No***).
   - To delete the record(s), press **F6** (***Yes***).

Printing Records

The system supports printing to both the internal thermal writer and to an external laser printer. Use the following instructions to print records:

1. On the ***Main Menu***, press **F3** (***File Manager***).

   The ***File Manager*** window opens.

2. Do one of the following:

   - To print select records, press **F1** (***Select***) and use the **trimpad** to select the record(s) you want to print.
   - To print all the records in storage, press **F2** (***Select All***).

3. Do one of the following:

   - To print to the internal thermal printer, press **F3**, ***Print***.
     The selected records are printed on the writer.
   - To print to an external laser printer, press ***Laser Print***.
     The selected records are printed on the designated laser printer.

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.
  Refer to "Options Setup" on page 115 for more information.
- Configure data communications.

Refer to "Communication Setup" on page 100 for more information.

- Connect the device to the communication option.
  - To set up a LAN connection to a CardioSoft system, refer to "Connecting to a LAN" on page 37.
  - To set up a LAN connection to a MUSE system, refer to *LAN Option Installation and Troubleshooting Guide*.
  - To set up a WiFi connection to a CardioSoft system, refer to "Connecting to a LAN" on page 37.
  - To set up a WiFi connection to a MUSE system, refer to *LAN Option Installation and Troubleshooting Guide*.

1. On the ***Main Menu***, press **F3** (***File Manager***).

   The ***File Manager*** window opens.

2. Do one of the following:

   - To transmit select records, press **F1** (***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 **F2** (***Select All***).

3. Press **F6** (***More***) > **F4** (***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 **F6** (***OK***).

Exporting Records

You can export records from internal storage to a Secure Digital card, a shared directory, or an FTP server 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 ***M300*** is enabled, the maximum is 200.
- 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. GE Healthcare recommends you use SD cards with a capacity of 2GB or smaller, either supplied by GE Healthcare or manufactured by SanDisk.

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 "Options Setup" on page 115 for details.
- To export either Hilltop/XML or PDF to a shared directory or an FTP server, you must do the following:
  - Purchase and activate the ***LAN Communications to CardioSoft*** (***LANC***) option *or* ***WiFi Communications to CardioSoft (WIFC)*** option.
    Refer to "Options Setup" on page 115 for details.
  - Define the shared directory settings or FTP server setting on ***Communications Setup***.
    Refer to "Communication Setup" on page 100 for details.

Exporting Records

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

1. On the ***Main Menu***, press **F3** (***File Manager***).

   The ***File Manager*** window opens.

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

   - To export select records, press **F1** (***Select***) and use the **trimpad** to select the records you want to export.

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

   - To export all records in storage, press **F2** (***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 "SD Card not Present" on page 131 for further instructions.

5. Press the appropriate function key:
   - To export in XML format, 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 or an FTP server was configured, the ***Select Export Destination*** window opens.
     Go to step 6.
   - If a shared directory and an FTP server 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***.

PDF File Naming Convention

The device provides two types of naming conventions:

- Default Naming
- Customize Naming

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:

`GEMAC800_2.0_SDS07410016WP_resting_1_2007-11-22T17-56-32.pdf`

The following table identifies each component in the example:

Value	Component Description
GEMAC800	Product name: this is always GEMAC800.
2.0	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) or ***rrana*** (RR Analysis mode).
1	Cart ID: this varies from device to device.
2007-11-22T17-56-32	Creation data:. this consists of the following subcomponents: • 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.

Customize 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 Configration*** 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.

5. Press ***Save*** and return to the ***System Configuration*** window.

   The following elements are available:

   - ***Patient ID***
   - ***Last Name***
   - ***First Name***
   - ***Date of Birth***
   - ***Procedure***

Procedure means ***ECG Mode***. This is either ***resting*** (Resting ECG mode) or ***rrana*** (RR Analysis mode).

- ***Date of Test***
- ***Export Date***

9

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.

CAUTION:

POTENTIAL DATA LOSS — Configuration changes can cause data loss.

After making configuration changes, you MUST return to the ***Main Menu*** to ensure the changes are saved.

Setup Functions

Setup functions fall into the following categories:

- Basic system settings
- Resting ECG settings
- Arrhythmia settings
- Communication settings
- Country settings
- Patient settings
- User settings
- Options
- Service settings
- Date and time
- Order manager settings

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

Basic Setup

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

- Institutional identification
- Default physicians
- System settings

- Printer settings
- PDF Naming settings
- System security
- Time servers

NOTE:
You must add physicians in ***User Setup*** before they can be picked as default physicians. For more information, refer to "User Setup" on page 113.

To access ***Basic Setup*** from the device ***Main Menu***, press **F4** (***System Configuration***) > **F1** (***Basic Setup***).

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

Field	Comment
Page 1	
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 #	Site number where the device is located. (Defaults on any patient records created on the system). 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).

Field	Comment
Test Patient (temporary)	Enables/disables simulated ECGs. When enabled, simulated waveforms are generated in the resting, arrhythmia, or RR Analysis ECG functions. This is useful for demonstration, training, or testing purposes. **NOTE:** This setting clears when the system is reset.
Page 2	
Power up mode	Determines which screen is displayed when the device is powered on. Available options are: • ***Resting ECG*** • ***Arrhythmia*** • ***Main Menu*** ***Resting ECG*** is the default value.
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. This helps reduce power consumption and increases the life of the device. See also ***Auto Standby Time***.
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.
Page 3	

Laser Printer	Printer Type:
	• USB Printer
	• Network Printer
	  • IP Address
	  • Port Number
	NOTE:
	IP Address and ***Port Number*** are available only when ***Network Printer*** is chosen.

Field	Comment
PDF Naming	***On/Off*** PDF ***Automatic Naming*** Rule. • ***Patient ID*** • ***Last Name*** • ***First Name*** • ***Date of Birth*** • ***Procedure*** • ***Date of Test*** • ***Export Date***
Page 4	
High Security Mode	Enables/disables high security mode. You can activate it only if at least one user with ***Edit Users*** and ***Edit Setup*** privileges is configured with a password. When ***High Security Mode*** is enabled, users are prompted to enter an ID and password when logging on to the device. You must add each user in ***User Setup***. For more information, refer to "User Setup" on page 113.
Audit Trail	Determines whether the device creates an audit trail of activity. This is available only if ***High Security Mode*** is enabled and the ***CFRA*** audit trail option is activated. For information on activating the CFRA option, refer to "Options Setup" on page 115.
Auto Logoff	Determines whether the device 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 (1255 min)	Determines the length of inactivity, in minutes, before the device 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.

Resting ECG Setup

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

- 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)

To access the ***Resting ECG Setup*** from the device ***Main Menu***, press **F4** (***System Configuration***) > **F2** (***Resting ECG Setup***).

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

Field	Comment
Page 1	
Gain	Sets the amplitude of the ECG signal. Measurement is in millimeter per millivolt and includes the following options: • 2.5 mm/mV • 5 mm/mV • 10 mm/mV • 20 mm/mV • 40 mm/mV • Automatic The larger the selected measurement, the larger the waveform. Only the appearance 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.
Sweep Speed	Changes the speed of rhythm printing and the wiper bar movement across the display. Measurement is in millimeter per second (mm/s) and includes the following options: • 5 mm/s (rhythm) / 12.5 mm/s (display) • 25 mm/s • 50 mm/s

Field	Comment
Low Pass Filter	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: • 20 Hz • 40 Hz • 100 Hz • 150 Hz 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.
High Pass Filter	Sets the minimum 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. • 0.04 Hz • 0.08 Hz • 0.16 Hz • 0.31 Hz Selecting a frequency eliminates signals that fall below that frequency. For example, if you select 0.16, only signals that have a frequency of 0.16 Hz or higher are included in the waveform.
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***. Refer to "Country Setup" on page 108, for more information.
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. Available only if the ***R12L system*** option is enabled.
12 leads: 4x3	Enables/disables a display option that shows four three-waveform columns. Available only if the ***R12L system*** option is enabled.
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 four fields are set.

Field	Comment
Display Lead Group	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: • 3 rhythm leads • 1st group • 2nd group • 3rd group • 4th group If either of the 12–lead display formats is selected, this field is not available, since all 12 leads are displayed.
Page 2	
Printer Leads	Identifies the default set of leads to use for printing. The values are: • First 6 • Second 6 • Rhythm 6
Start rhythm report on new page	Determines whether the rhythm report should begin on a its own page.
Pace Enhancement	Increases the readability of pacemaker ECG either by augmenting small pace pulses or by truncating large pace pulses. If enabled, pace enhance is done in two steps: 1. Add a marker (1.5mV amplitude, 6 ms duration) to the electrode signal. 2. Limit the sum to 0.5mV in the lead signal.
Hookup Advisor	Enables/disables the ***Hookup Advisor*** option, which visually indicates the quality of lead signals. For more information, refer to "Hookup Advisor Module" on page 61.

Field	Comment
Preview before Analysis	Determines waveform preview options. Values include: • ***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, refer to "Hookup Advisor Module" on page 61.
ECG Acquisition	Determines the ECG acquisition mode. Values include: • ***Pre-Acquisition*** Uses the last 10 seconds of ECG data already stored in the system. • ***Post Acquisition*** Acquires 10 new seconds of ECG data after you press **ECG** key.
Reanalysis	Enables/disables the reanalysis feature, which allows you to adjust the following ECG measurements: • ***P Duration*** • ***PR Interval*** • ***QRS Duration*** • ***QT Interval*** Available only if ***Audit Trail*** is disabled and either the ME12 or MI12 option is activated. For more information on activating options, refer to "Options Setup" on page 115. For more information on the reanalysis feature, refer to "ECG Reanalysis" on page 58.

Field	Comment
QTC Calculation	Determines which formula is used to correct QT calculations. Options are: • Bazett QTc = QT √HR/60 • Framingham QTc = QT + 154 (1 — 60/HR) • Fridericia QTc = QT $^{3}\sqrt{}$HR/60 In all formulas, HR = Heart Rate. Available only if the ME12 or MI12 option is activated.
Screening Criteria	Enables/disables the inclusion of the screen criteria. This setting is available only if the ***MI12*** option is activated. It is disabled by default.
Suppress normal statement	Enables/disables the inclusion of the normal statement. This setting is available only if the ***MI12*** option is activated.
Suppress abnormal/borderline	Enables/disables the inclusion of the abnormal/borderline statements. This setting is available only if the ***MI12*** option is activated.
Suppress all statements	Enables/disables the inclusion of all statements. This setting is available only if the MI12 option is activated.
Suppress reason statement	Enables/disables the inclusion of reason statements. This setting is available only if the ***Screening Criteria*** field is enabled. It is enabled by default. **NOTE:** Reason statements are not yet available for all languages.

Field	Comment
ACI-TIPI	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. To include ACI-TIPI statements, the following conditions must be met: • ***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 must include: 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. For additional information, refer to the *ACI-TIPI Physician's Guide*.
Sample Rate	Determines the report frequency. Options are ***500 Hz*** or ***1000 Hz***. 1000 HZ is supported only for XML output.
Page 3	
Lead Sequence	Determines the lead sequence to use. Values are: • ***Standard*** • ***Cabrera*** • ***NEHB*** • ***SEQ4*** ***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.
Sequence Name	Set the display name for a custom lead sequence. Available only if ***SEQ4*** is selected for the ***Lead Sequence***.
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/print for the corresponding leads. Available only if ***SEQ4*** is selected for the ***Lead Sequence***.

Field	Comment
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.
Page 4	
10s ECG Report Format	Determines how the 10s ECG report will print on the internal writer. If no format is selected, the report will not print.
Detailed Results Report Format	Determines how the ***Detailed Results*** report prints. If no format is selected, the report prints without the median report page.
Report Copies	Determines how many copies of the selected report print.
Print Interpretation	Determines whether ECG interpretation will print on the report. Available only if the MI12 option is activated. For more information, refer to "Options Setup" on page 115.
Auto Store ECG	Determines whether the ECG will automatically be stored on the internal storage. Available only if the M100 or M300 internal storage option is activated. For more information, refer to "Options Setup" on page 115.
File Manager Sort By	Determines the field by which the ***File Manager*** will sort records in internal storage. Available only if the M100 or M300 internal storage option is activated.
Auto Transmit ECG	Determines whether the ECG is transmitted automatically to an external device. Available only if one of the communications options is activated. For more information, refer to "Options Setup" on page 115.
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. For more information, refer to "Options Setup" on page 115.
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, refer to "Options Setup" on page 115.

Field	Comment
Auto-Export ECG	Exports the ECG record automatically. The values are: • ***<blank>*** (do not export) • ***Hilltop*** • ***Hilltop/XML*** • ***PDF*** Available only if LANC or WIFC options are activated.
Export Location	The location of auto-export ECG records. The values are: • ***Shared Directory*** • ***FTP Server*** Available only if LANC or WIFC option is activated.
Page 5	
Laser Printer Settings	
10s ECG Report Format	Determines how the 10s ECG report prints on an external laser printer. The options are: • 4x2.5x3_25 • 4x2.5x3_25_R1 • 4x2.5x3_25_R3 • MUSE1 (Not available in Chinese Version) • MUSE2 (Not available in Chinese Version) • 1x10x12_25 • 2x5x6_25 • 2x5x6_25_Syn
Report Copies	Determines how many copies of the 10s ECG report prints on an external laster printer. Valid values range from 0 to 5.
Paper Size	Determines the page size of the report when it prints on a laser printer. Valid values are ***A4*** and ***Letter***.
Print Grids	Determines whether the grid prints on the report when printed on a laser printer.
Baseline Auto Adjust	On/Off **NOTE:** The system automatically adjusts the gain to a proper value before adjusting baseline. Available only when the ***1x10x12_25*** of ***10s ECG Report Format*** option is selected.

Field	Comment
PDF Export Setting	
10s ECG Report Format	Determines how the 10s ECG report prints to a PDF file. The options are: • 4x2.5x3_25 • 4x2.5x3_25_R1 • 4x2.5x3_25_R3 • MUSE1 (Not available in Chinese Version) • MUSE2 (Not available in Chinese Version) • 1x10x12_25 • 2x5x6_25 • 2x5x6_25_Syn
Baseline Auto Adjust	On/Off Available only when the ***1x10x12_25*** of ***10s ECG Report Format*** option is selected.

Arrhythmia Setup

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

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

To access ***Arrhythmia Setup*** from the device ***Main Menu***, press **F4** (***System Configuration***) > **F3** (***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, refer to "Resting ECG Setup" on page 91.

Field	Comment
Page 2	
Rhythm Printing	Determines whether the rhythm report starts automatically when recording starts.
Arrhythmia Event Printing	Selects which arrhythmia events print. Options are: • All events • Unequal events • No event printing

Field	Comment
Episodes Printout in Summary Report	Determines how arrhythmia events print. Options are: • Chronological order • Priority order • Only episodes with ventricular events • No episodes
Page 3	
Lead Sequence	Determines the lead sequence to use. ***Arrhythmia Setup*** includes the following options in addition to the four options available in the ***Resting ECG Setup***: • ***STD_C*** • ***STD_RED*** • ***STD_LI*** • ***CABR_LI*** • ***NEHB_6*** • ***HIGH_C***

Communication Setup

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

- Basic communication settings
- Shared directory settings (if LAN and/or WiFi options are activated)
- FTP server settings (if LAN and/or WiFi options are activated)
- Destination location settings
- Modem settings (if a modem option is activated)
- LAN settings (if a LAN option is activated)
- WLAN Settings (if a WiFi option is activated)
- DCP Settings (if LAN and/or WiFi options are activated)

To access the ***Communication Setup*** from the device ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F1** (***Communication Setup***).

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

Field	Comment
Page 1	
Default Location	Determines which of the four available communication locations is the default. The locations are defined on Page 2 of this *Communication Setup Fields* table.

Field	Comment
Export XML	Determines whether ECG records are transmitted as XML. If set, ECG records exported to SD card are stored in both XML and Hilltop formats. If not set, ECG records exported to SD card are stored only in Hilltop format.
Serial Baud Rate	Determines the speed at which data is transmitted across the serial communications port.
Allow Export Using Shared Directory	Determines whether ECG records can be exported to a shared network drive. Available only if the ***LAN Communications to CardioSoft*** option (***LANC***) or ***WiFi Communications to CardioSoft*** option (***WIFC***) has been activated. If this field is checked, the following five fields become available (***Share Name***, ***Username***, ***Password***, ***Confirm***, and ***Domain***).
Share Name	Identifies the name of the shared network drive. It must be the share's name; IP addresses are not supported. This field allows a maximum of 256 characters. This field is available only if the ***Allow Export Using Shared Directory*** field is checked.
Username	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. This field is available only if the ***Allow Export Using Shared Directory*** field is checked.
Password	Identifies the password that the system will use to log on to the shared directory. The password should contain only numeric, uppercase, and lowercase letters. This field allows a maximum of 30 characters. Available only if the ***Allow Export Using Shared Directory*** field is checked.
Confirm	Re-enter the password in this field to confirm that the password was typed correctly. This field is available only if the ***Allow Export Using Shared Directory*** field is checked.
Domain	Identifies the user's domain. This field allows a maximum of 30 characters. This field is available only if the ***Allow Export Using Shared Directory*** field is checked.
Page 2	

Field	Comment
Allow Export Using FTP Server	Determines whether ECG records can be exported to a FTP Server. Available only if the ***LAN Communications to CardioSoft*** option (***LANC***) or ***WiFi Communications to CardioSoft*** option (***WIFC***) has been activated. If this field is checked, the following three fields become available.
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.
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.
Password	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. 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.
Page 3	
Location	Identifies the name of a communication location that receives the transmission from the system. You can define up to four locations.
Device	Identifies the type of device to use to transmit data to the location. Options are: • Serial • Modem • LAN Modem and LAN are available only if the corresponding option was activated. This field becomes active only after a corresponding location is entered.
Phone Number	Identifies the location's phone number. This field is available only if the selected device is ***Modem***.

Field	Comment
Protocol	Determines the protocol to use to communicate with the device. Options are: • A5 • CSI • DCP Select CSI or DCP for MUSE connections and A5 for CardioSoft connections.
Page 4	
Dialing Method	Determines whether the system uses a tone or pulse to dial.
PIN Dialing	Identifies whether a personal identification number (PIN) is required to dial out. If this field is checked, you must complete the following three fields (***Delay***, ***Service Provider Number***, ***PIN Number***).
Delay	Determines how long, in seconds, the system should pause between dialing the ***Service Provider Number*** and the ***PIN Number*** and between dialing the ***PIN Number*** and the ***Outside Line***.
Service Provider Number	Identifies the service provider's access telephone number.
PIN Number	Identifies the personal identification number to enter.
Outside Line	Identifies any access numbers that must be dialed to reach an outside line.
Manual Dialing	Determines whether the system automatically dials. If this field is checked, the connection must be made manually. If this field is cleared, the system automatically dials and you must complete the following fields: • ***Dialing Method*** • ***Dialtone Required*** • ***PIN Dialing***
Page 5 — This page is available only if the LAN option is activated.	
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*** option was activated.

Field	Comment
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.
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 MACxxxx. 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 four 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.
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.

Field	Comment
Page 6 — This page is available only if the WiFi option is activated.	
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 unavailable when the LAN option is 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 field is only available when the WiFi option is activated. This field is unavailable when the LAN option is activated.
Obtain an IP address automatically (DHCP)	Determines whether the device automatically receives an IP address from the network. If this box is checked and WiFi communication to a MUSE system is enabled, you must configure the DHCP server to reserve a static IP address for the MACxxxx. 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 MAC device automatically obtains a DNS (Domain Name Server) IP address. If this field is checked, the following four fields are display-only: ***Preferred DNS Server***, ***Alternate DNS Server***, ***Preferred WINS Server*** and ***Alternate WINS Server***. If this field is cleared, you must define the IP address of the DNS servers to use.

Field	Comment
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.
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.
Page 7 — This page is available only if the WiFi option is activated.	
Active WiFi	On/Off WiFi **NOTE:** In order to connect to WiFi, please insert the USB WiFi device after the device status indicates it is working. Otherwise, WiFi is not connected correctly.
Network name	Specifies the name of the wireless local area network (WLAN). This field allows a maximum of 30 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.
Authentication type	Specifies the authentication protocol. Options include: • Open authentication • Shared authentication • WiFi Protected Access with pre-shared key (WPA-PSK) • WiFi Protected Access 2 with pre-shared key (WPA2-PSK)

Field	Comment
Encryption type	The user net configuration determines the encryption type. Options include: • ***No*** - Select this option to use 802.1X certification without WEP Key. This option is available when the user configures access point association in Open mode or Share mode. This is a typical setting for wireless hotspots. • ***WEP*** - Select this option for data encryption through WEP Key. You may use this option in open mode association and share mode association. • ***TKIP*** - Select this option for temporal key integrity protocol. Select this option if the access point needs WPA or WPA2 association, and is configured for TKIP data encryption. • ***AES*** - Select this option to use advanced encryption standard protocol. Select this option if the access point needs WPA or WPA2 association, and is configured for AES data encryption.
Key Index	This field is only available when the encryption type is WEP. Valid values are 1–4. This field depends on the user's network configuration.
Key	ASC II or Hexadecimal characters (0-9, A-F) for encryption. This field depends on the user's network configuration.
Page 8 — This page is available only if DCP and LAN/WiFi options are both activated.	
Searching DCP Server...	Opens the ***DCP Server List*** window. The DCP servers search results will display a maximum of five records in the window. The list displayed includes: • Total DCP Servers • DCP Server name, model, and address

Field	Comment
DCP Server Address	Enter or select, the correct server address from the DCP server list. The format required is: `HTTP://IP Address:Port number/Server string`
Testing Server Connection	Tests whether the device can connect to the DCP server. One of the following test results will display: • ***Connect Successfully*** • ***Connect Failed*** **NOTE:** In order to test the DCP connection, the device must be connected to a LAN or WiFi.

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*** from the ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F2** (***Country Setup***).

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

Field	Comments
Language	Determines the language the interface and reports use.
Date Format	Determines the format in which dates are displayed. Options are: • 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.

Field	Comments
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 Electrotechnical Commission (IEC) or the American Heart Association (AHA).

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.
- Magnetic card reader
  For complete information, refer to "Magnetic Card Reader Configuration" on page 139.
- Barcode reader settings
  This is available only if the ***BCRD USB Barcode Reader*** option is activated

To access ***Patient Setup*** from the MAC system ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F4** (***Patient Setup***).

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

Field	Comment
Patient Information Setup Window	
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.

Field	Comment
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.
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	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: • Swedish Patient ID • Danish Patient ID • Norwegian Patient ID 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.
Patient ID Length (3-30)	Defines the maximum length of the patient ID within the range of 3 to 30 characters. This field is available only if the ***Enable Patient ID Check*** field is cleared.

Field	Comment
Leading "0"	Enable/Disable ***Leading "0"***. When the patient ID consists of numbers, the system automatically adds the Arabic numeral "0" before the IDs that do not meet the set length (the range is 3-30 according to the user). For example, the set length of the patient ID is nine numbers, but the input patient ID is 123, then the system automatically adjusts the patient ID to 000000123.
Sort Patient List by	Determines the field by which the patient list is sorted. Options are: • Patient ID • Secondary ID • Patient Name
Test Information Window	
Systolic BP	Determines whether systolic blood pressure is available when entering test information.
Diastolic BP	Determines whether diastolic blood pressure is available when entering test information.
Location	Determines whether location is available when entering test information.
Room	Determines whether room is available when entering test information.
Order Number	Determines whether order number is available when entering test information.
Indication	Determines whether indication is available when entering test information.
Ordering Physician	Determines whether the ordering physician is available when entering test information.
Referring Physician	Determines whether referring physician is available when entering test information.
Attending Physician	Determines whether attending physician is available when entering test information.
Technician	Determines whether technician is available when entering test information and whether it is required. It is required only if it is enabled.
Medications (0-3)	Determines the number of medications that you can enter into the test information window.

Field	Comment
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: • Alphanumeric • Numeric • Yes/No/Unknown
Clinical Trial Setup Window	
Visit Number	Determines whether visit number is available when entering clinical trial information.
Visit Type	Determines whether visit type is available when entering clinical trial information.
Dose Type	Determines whether Dose Type 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 investigator ID is available when entering clinical trial information.
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: • Alphanumeric • Numeric • Yes/No/Unknown
Dose List...	Opens the ***Dose List...*** window, which allows you to define the dose types that are available when entering clinical trial information. Doses are plain text up to 32 alphanumeric characters.
Project Code and Trial ID...	Opens the ***Project Code and Trial ID...*** window. You can only input up to five groups of ***Project Code*** and ***Trial ID*** in this window.
Barcode Scanner or Magnetic Card Reader Setup	
Peripheral Device Selection	Determines whether the MAC device is connected to a magnetic card reader, an optional barcode scanner, or no peripheral device at all.

Field	Comment
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, refer to "Creating Barcodes" on page 135. This field is available only when the ***Barcode Scanner*** is selected in the ***Peripheral Device Selection***.
Total number of bytes	Identifies the total number of bytes on the barcode or magnetic strip.
Offset	Identifies the position of the initial character of the corresponding field.
Length	Identifies the number of characters for the corresponding field.

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 "Basic Setup" on page 87.

To access ***User Setup*** from the ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F5** (***User Setup***).

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

- Ordering Physicians
- Referring Physicians
- Attending Physicians
- Technicians

When you select one of these roles, a list of existing users with that role opens. You can now 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 30 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.
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.

Field	Comment
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.

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:

1. From the ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F6** (***More***) > **F4** (***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 the center key on the **trimpad** to 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 **F6** (***Save***) to save the configuration options.

The following table identifies the available options. You are given an activation code for each purchased option.

Code	Item Number	Name
CTDG	2037986–001	CT Data Guard
R12L	2037986–002	12–Lead display for Resting ECG. This is always active.
ME12	2037986–003	12SL Measurement
MI12	2037986–004	12SL Measurement and Interpretation
M100	2037986–005	Storage for 100 ECGs
M300	2037986–015	Storage for 300 ECGs
LANC	2037986–006	LAN Communication to the CardioSoft system
LANM	2037986–007	LAN Communication to the MUSE system
WIFC	2037986–024	WiFi Communication to CardioSoft

Code	Item Number	Name
WIFM	2037986–025	WiFi Communication to MUSE
MODC	2037986–008	Modem or serial communication to the CardioSoft system
MODM	2037986–009	Modem or serial communication to the MUSE system
CFRA	2037986–010	21 CFR Part 11 Audit Trail
BCRD	2037986–011	USB Barcode Reader
TIPI	2037986–012	ACI-TIPI
RRAN	2037986–013	RR Analysis
PDFC	2037986–014	PDF Export
LPRT	2037986–023	Laser Print

Service Setup

The ***Service Setup*** option allows service personnel to configure the following:

- ***Device settings***
- ***Event log***
- ***System diagnostics***

Refer to the *MAC 800 Service Manual* for details.

Date/Time Setup

The ***Date/Time Setup*** function allows you to configure the system's date and time settings.

To access ***Date/Time Setup*** from the ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F6** (***More***) > **F6** (***More***) > **F1** (***Date/Time Setup***).

The following table identifies the settings on ***Date/Time Setup***.

Field	Comment
Date	Sets the current system date. The format of the fields depends on the date format selected on ***Country Setup***. For more information, refer to "Country Setup" on page 108.
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, refer to "Basic Setup" on page 87.

Field	Comment
Time Zone	Identifies the time zone in which the device is located. This field is available only if ***Automatically synchronize with Time Server*** is enabled in ***Basic Setup***. Refer to "Basic Setup" on page 87.
Adjust clock for daylight savings time	Determines whether the system automatically adjusts the system time for daylight savings time. This field is available only if ***Automatically synchronize with Time Server*** is enabled in ***Basic Setup***. Refer to "Basic Setup" on page 87 for more information.

Order Manager Setup

To configure the system's ***Order Manager***, from Main Menu, press **F4** (***System Configuration***) > **F6** (***More***) > **F6** (***More***) > **F6** (***More***) > **F2** (***Order Manager Setup***), and complete the fields described in the following table.

Field	Comment
Initial sort value	Determines how the ***Order Manager*** initially sorts the ECGs. Select one of the following values: • ***Patient name*** • ***Patient ID*** • ***Location*** • ***Time*** • ***Stat***
Auto order delete	Determines whether the system will automatically delete orders under the following conditions: • the orders have been successfully transmitted to a receiving device, and • the associated ECGs have been transmitted and deleted. This field is NOT dependent on the ***Delete after transmit*** field on the ***Basic Setup*** window. Both fields operate independently.
Default order locations	Identifies the locations displayed on the prompt when downloading orders. This will typically be the device's location (see "Basic Setup" on page 87). If the device is used in multiple locations, enter multiple locations and separate them with commas: 1,3,10, and so on.

Setup Utilities

The setup utilities available in ***System Configuration*** allow you to print, switch, export, and import system settings and export the audit trail.

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. From the ***Main Menu***, press **F5** (***System Configuration***) > **F6** (***More***) > **F3** (***Print Setup Report***).
2. On the ***Print Setup Report*** window, select the report you want to print.
   - ***Basic Setup***
   - ***Resting Setup***
   - ***RR Analysis Setup***
   - ***Arrhythmia Setup***
   - ***Communication Setup***
   - ***Country Setup***
   - ***Patient Setup***
   - ***User Setup***
   - ***Options Setup***
   - ***Order Manager Setup***
   - ***Complete Setup***
3. When you are done, press **F6** (***Return***) to return to the ***System Configuration***.

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. From the ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F6** (***More***) > **F1** (***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 **F3** (***Save As***).

      The ***Setup Name*** window opens.

   b. Type a name for the configuration and press **F6** (***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 **F1** (***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 **F2** (***Delete***).

      You are prompted to confirm the deletion.
   c. Press **F6** (***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 **F4** (***Edit Name***).

      The ***Setup Name*** window opens.
   c. Type the new name and press **F6** (***Save***).
6. To remove all custom settings, do the following:
   a. Select the setup file you want to reset.
   b. Press **F5** (***Factory Defaults***).
   c. When prompted to confirm, press **F6** (***Yes***).
7. When you are done, press **F6** (***Return***) to exit.

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 the SD card.
2. From the ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F6** (***More***) > **F3** (***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.
3. In the left pane, select the setup file you want to export.
4. Press **F1** (***Export***).

   The selected file is copied to the SD card and is displayed in the right column.

5. Repeat step 3 through step 4 for each saved configuration file you want to export.
6. When you are done, press **F6** (***Return***).

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.
2. From the ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F6** (***More***) > **F2** (***Import***).

   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 **F1** (***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 **F6** (***Return***).

Exporting Audit Trail

The ***Export Audit*** function copies the system audit trail in XML format to an SD card. The Audit Trail tracks the creation, transmission, and deletion of records, changes to the system setup, and tracks the ID of the users who made each change.

Audit trail log files are saved to the ***audittrail*** directory on the SD card. Their filenames are in the format `audittrail_x.log`, where x is a number. When a log file is saved to the SD card, the system determines whether the card already contains an audit trail log file and names the new file accordingly. For example, if the card does not contain a log file, the new file is named `audittrail_0.log`; subsequent files are increments of 1: `audittrail_1.log`, `audittrail_2.log`, `audittrail_3.log`, and so on.

After the log file is exported to the SD card, it is cleared from the MAC system.

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 system.

To export an audit trail, the following conditions must be met:

- ***High Security Mode*** must be enabled.
  See "Basic Setup" on page 87.
- ***Audit Trail*** must be enabled.
  See "Basic Setup" on page 87.
- The user must have the ***Edit Setup*** and ***Delete Records*** permissions set.
  See "User Setup" on page 113.

Use the following instructions to export the audit trail to an SD card:

1. Insert an SD card into the device.
2. On the ***Main Menu***, press **F4** (***System Configuration***) > **F6** (***More***) > **F6** (***More***) > **F6** (***More***) > **F4**(***Export Audit***).
   After the audit trail is copied to the SD card 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 manual***.

10

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
- Battery

See the documentation provided with your peripherals for additional maintenance procedures.

WARNING:

EQUIPMENT FAILURE/HEALTH HAZARDS — Failure on the part of all responsible individuals, hospitals, or institutions employing this device to implement the recommended maintenance schedule may result in equipment failure and possible health hazards.

The sole responsibility for performing the recommended maintenance rests with the individuals, hospitals, or institutions employing the device. The manufacturer does not in any manner assume the responsibility for performing the recommended maintenance schedule unless an Equipment Maintenance Agreement exists.

Device Maintenance

The device is designed to require little more than regular inspection and cleaning to function properly. Qualified GE Healthcare service personnel should perform any additional maintenance.

CAUTION:

ELECTRICAL HAZARD — Improper handling during inspection or cleaning could result in electrical shock.

To avoid potential shock, observe the following guidelines at all times:

- Before inspecting or cleaning the device, turn it off, unplug it from AC power, and remove the battery.
- Do NOT immerse any part of the equipment in water.

Inspecting the Equipment

Perform a visual inspection daily, preferably before the equipment's first use each day. During the inspection, verify that the device meets the following 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.

If you notice any items that need repair, contact an authorized service representative to make the repairs. Discontinue using the device until the appropriate repairs can be made.

Cleaning the Device

Clean the exterior surface of the device monthly, or more frequently if needed.

Cleaning Materials to Use

Use the following materials to clean the device:

- Mild dishwashing detergent
- Clean, soft cloth
- Water

Cleaning Materials to Avoid

DO NOT use any of the following materials to clean the device, because their use may damage equipment surfaces.

- Organic solvents
- Ammonia-based solvents
- Abrasive cleaning agents
- Alcohol
- Virex
- Sani-Master

Cleaning the Device Surfaces

Use the following procedure to clean the surfaces of the device.

1. Dilute mild dishwashing detergent in water to create a cleaning solution.
2. Soak a clean cloth in the solution and wring out any excess.
3. Thoroughly wipe the surface of the device with the damp cloth.

   Do NOT drip the solution or any liquid on the writer assembly.

   Avoid contact with open vents, plugs, or connectors.
4. Repeat step 2 and step 3 as necessary until the surface is adequately cleaned.
5. Wipe the surfaces with a dry, clean cloth or paper towel.

Battery Maintenance

The 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 2 hours of normal operation. An on-screen gauge indicates the condition and capacity of the battery's charge. (For more information on the battery gauge, refer to "Front View" on page 27 and "System Errors" on page 133.) When the gauge flashes amber, connect the MAC system 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.

Battery Safety

Observe the following warnings whenever handling the battery.

WARNING:
EXPLOSION OR FIRE — Using non-recommended batteries could result in injury/burns to patients or users and may void the warranty.

Use only batteries recommended or manufactured by GE Healthcare.

WARNING:
PHYSICAL INJURY — Leaks from battery cells can occur under extreme conditions. The liquid is caustic to eyes and skin.

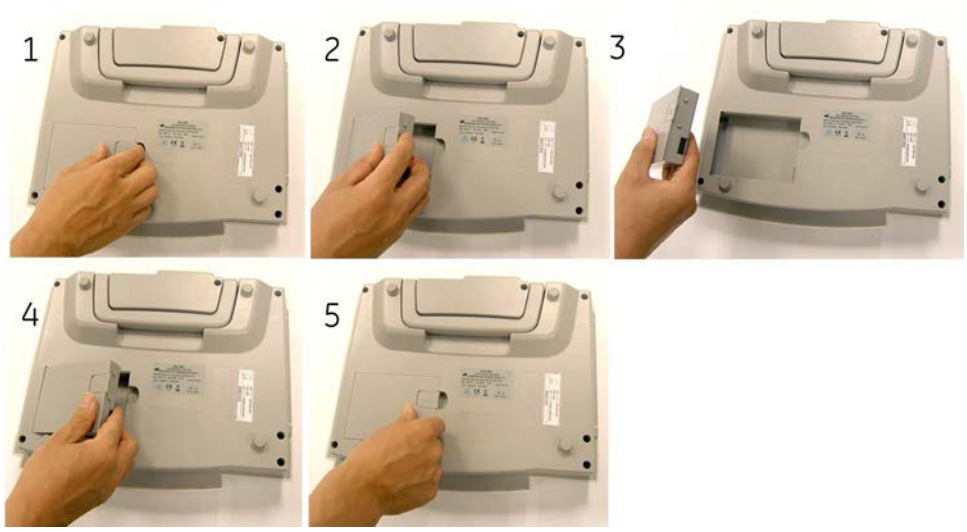
If the liquid comes in contact with eyes, skin, or clothing, flush with clean water and seek medical attention.

WARNING:
ENVIRONMENTAL HAZARD — Do NOT dispose of the battery by fire or burning.

Follow local environmental guidelines concerning disposal and recycling.

Replacing the Battery

When the battery's full-charge capacity can no longer operate the for an adequate length of time, use the following instructions to replace the battery:



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 "Replacing the Battery" on page 126.

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 the *'s Resting ECG Analysis 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 solid 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 turns solid, the battery is fully charged and the conditioning cycle is complete.

Supplies and Accessories

For a list of available supplies and accessories for the device, refer to the *MAC™ 800 v2.0 Supplies and Accessories Reference Manual*.

A

Troubleshooting

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 appear to be unrelated symptoms or equipment failure.
  For additional information, refer to "Inspecting the Equipment" on page 124.
- 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 appear as 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.

Equipment Problems

The following issues are discussed in the remainder of this chapter.

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 "Turning on the System" on page 38 for instructions.
- Verify the battery is installed and charged.
  Refer to "System Errors" on page 133 for instructions on verifying whether the battery is installed and charged.
  Refer to "Replacing the Battery" on page 126 for instructions on installing the battery.
- Verify the device is connected to an AC power outlet.
  Refer to "Connecting the AC Power Adapter" on page 34 for instructions.
- Verify the equipment is receiving power from the outlet.
  If the device is receiving power, the **Power LED** is lit.

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 "Hookup Advisor Module" on page 61.
- Verify the electrodes are placed properly.
  Refer to "Electrode Placement" on page 42 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 "Preparing the Patient's Skin" on page 41 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 "Connecting Leadwires" on page 36.
- Consider using filters and *ADS* to help eliminate or reduce ECG noise.
  For more information, refer to "ECG Options" on page 53 or "Arrhythmia Options" on page 66.

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 "Options Setup" on page 115.
- Verify ***ACI-TIPI*** is enabled on the ECG.
  For information, refer to"Resting ECG Setup" on page 91.
- Verify the ***ACI-TIPI*** required information 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 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.

Paper Jams

If the paper jams while printing, verify the paper was inserted correctly. For details, refer to the *MAC™ 800 v2.0 Supplies and Accessories Reference Manual*.

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 "Rear View" on page 29.
- Verify the SD card is seated firmly.
  The SD card clicks into place when seated firmly.
- Verify the SD card is formatted for a ***FAT16*** or ***FAT32*** 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 ***FAT16*** or ***FAT32*** 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.

Cannot Import or Transmit Records via Modem

If you receive an error while attempting to import or transmit ECG records via modem, do the following:

- Verify the correct communication option was activated.

The system supports two options for communicating via modem: ***MODC*** (for communicating with a CardioSoft system) and ***MODM*** (for communicating with a MUSE system). For more information, refer to "Options Setup" on page 115.

- Verify the modem is connected to an analog telephone line using a standard RJ11 phone jack.
  For more information, refer to "Rear View" on page 29.
- Verify the device is plugged into an AC outlet and that the device is powered on.
- Check ***Communications Setup*** to verify the following:
  - The correct modem type is selected.
  - The correct dialing method is selected and configured accurately.

  For details, refer to "Communication Setup" on page 100.
- If transmitting records, check the selected location to verify the following:
  - ***Modem*** is the selected device.
  - The ***Phone Number*** is correct.
  - The correct ***Protocol*** is selected.
    For details, refer to "Communication Setup" on page 100.

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*** or ***WIFC*** communication option was activated.
  Refer to "Options Setup" on page 115 for information on activating options.
- Verify connectivity by doing the following:
  - If wired LAN is used, verify that the network cables are connected.
  - If wireless LAN is used, verify WIFI module is inserted to USB port of the device, and the wireless networking setting is configured properly.
    Refer to "Communication Setup" on page 100 for instructions on settings.
  - Verify the IP, netmask, gateway, and DNS server addresses are all correct.
    Refer to "Communication Setup" on page 100 for instructions on settings.
  - Ping the device from the file server to verify that the two devices can communicate.
- Verify the logon information is correct.
  Check the user name, password, and domain information. Refer to "Communication Setup" on page 100 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.

Cannot Export to FTP Server

To resolve errors received while attempting to export ECG records to a FTP server, do the following:

- Verify the LANC or WIFC communication option was activated.

Refer to "Communication Setup" on page 100 for information on activating options.

- Verify connectivity by doing the following:
  - If a wired LAN is used, verify that the network cables are connected.
  - If a wireless LAN is used, verify that the WIFI module is inserted in the USB port on the device, and the wireless networking setting is configured properly. Refer to "Communication Setup" on page 100 for instructions on settings.
  - Verify the IP, netmask, gateway, and DNS server addresses are all correct. Refer to "Communication Setup" on page 100 for instructions on settings.
  - Ping the device from the file server to verify that the two devices can communicate.
- Verify the FTP server name or IP address, and export path are correct.
- Verify the logon information is correct.
  Check the user name and password. Refer to "Communication Setup" on page 100 for information on the logon information.
- Verify FTP server permissions.
  Ensure that the account used to log on to the FTP has write permissions to the FTP path.

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 service personnel.

Problem	Cause	Solution
Battery Error message is displayed.	The battery is installed incorrectly, or the battery is not functioning correctly.	Verify the battery contacts are clean. Notify service to check and replace the battery.
The battery LED flashes intermittently when operating from battery power.	Battery charge is low.	Connect the system to an AC wall outlet to charge the battery.
The following message is displayed: ***The writer door is open.***	The writer door is closed incorrectly.	Close the door correctly.
The system powers down while operating from battery power.	Battery is fully discharged	Connect the system to an AC wall outlet to charge the battery or power the device.
The following message is displayed: ***Lead disconnected.***	One or more electrodes is disconnected.	Reconnect the electrodes.

Problem	Cause	Solution
The following message is displayed: ***MODEM ERROR: The remote device is not responding. Would you like to retry***	Modem is not connected or is out of range.	Connect the modem and retry, or move the device back into range.
	(Ethernet option only) Bad LAN connection.	Verify that the LAN cable is connected to the LAN port, the Link LED (green) lights, and the Activity LED (yellow) flashes.

B

Creating Barcodes

The following sections provide the information you need to configure barcodes.

The barcode reader can read Code 39, 39EX, 128, PDF-417 (2-D), Interleaved Code 2 of 5, and Data Matrix barcodes.

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.

Setting Up the Patient Data Scheme

Use the following rules to set up a data scheme, including patient demographic data, for your barcodes.

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

Configuring the Barcode Reader

The barcode reader is configured on the system ***Patient Setup*** window. You can choose to configure it manually or automatically. The requirements for each method are described in the following sections. For instructions on configuring the barcode reader, refer to "Patient Setup" on page 109.

Configuring the Barcode Reader Manually

To configure the barcode reader manually, you need to enter the following information on the system ***Patient Setup*** window.

Field	Number of bytes
Total number of bytes	_____
Patient ID offset	_____
Patient ID length	_____
First name offset	_____
First name length	_____
Last name offset	_____
Last name length	_____
Year of birth offset	_____
Year of birth length	_____
Month of birth offset	_____
Month of birth length	_____
Day of birth offset	_____
Day of birth length	_____
Gender offset	_____
Gender length	_____

Configuring the Barcode Reader Automatically

You can configure the barcode reader automatically by scanning a barcode that has been set up to identify the fields on the barcode, their offset, and their maximum length.

A field is identified by using its corresponding code. The field codes are shown in the following table.

Field	Code
Month of birth	1
Day of birth	2
Year of birth	3
First name	5
Last name	6
Patient ID	9
Gender	F

A field's offset, or position, is determined by the order in which its field code appears.

The field length is determined by the number of times its field code is repeated.

For example, suppose if you want the following information in the barcode:

Field	Length
Patient ID	10
Last name	15
First name	10
Gender	1

You would set up this information as follows:

99999999996666666666666665555555555F

Because the barcode is set up for fixed length fields, the barcode generator must be programmed to add trailing spaces if data is shorter than the maximum field length. For example, using the previous configuration, a patient barcode may appear as follows:

1234567890Jones Robert M

C

Magnetic Card Reader Configuration

A magnetic card contains patient data in the form of a string of fixed-length fields, as seen in the following example.

The following table describes each field in the record.

	Name	Comment	Length	Position	
				Starting	Ending
1	***Data Header***	Separates records	1	1	1
2	***Patient ID***	Unique ID	6	2	7
3	***First Name***	Given name	13	8	20
4	***Last Name***	Surname	10	21	30
5	***Birth Date***	01-31	2	31	32
6	***Birth Month***	01-12	2	33	34
7	***Birth Year***	Examples: 1960, 1985, 2008	4	35	38
8	***Gender***	F, M	1	39	39
		Total bytes:	39		

NOTE:

The field lengths, order, and positions shown are examples only. They may differ on your system.

Understanding the Data Header

Before configuring the system's magnetic card reader, you need to understand the impact of the data header on the configuration file.

The data header is a special character that indicates the beginning of a record. ISO standards dictate that the header should be a semicolon (;).

The way in which the magnetic card reader handles the data header affects the configuration file. Some card readers include the data header when the records are read. Others strip it out. You need to account for this difference when you define ***Offset*** and ***Total Bytes*** in the magnetic card reader's configuration file.

Use the following procedure to identify how the magnetic card reader handles the data header:

1. Connect a magnetic card reader to a PC.
2. Run ***Microsoft Notepad*** or some other ASCII text editor.
3. With ***Notepad*** active, swipe a magnetic card through the card reader. The information on the card is displayed in ***Notepad***.
4. Examine the record in ***Notepad***.
   - If the first character is a semi-colon, the card reader includes the data header. The ***Offset*** of each field and the ***Total Bytes*** of the configuration file need to be increased by 1.
   - If the first character is alphanumeric, the card reader strips the data header.

Configuring the Magnetic Card Reader

You configure the magnetic card reader on the system's ***Patient Setup*** window (refer to "Patient Setup" on page 109). To configure the card reader for the example in the introduction, enter the information shown in the following table.

Field	Offset	Length
Patient ID	1	6
First name	7	13
Last name	20	10
Year of birth	34	4
Month of birth	32	3
Day of birth	30	2
Gender	38	1
	Total bytes:	39

Offset is the number of characters to the left of the field, not the field's starting position. To calculate the Offset, add the Offset and Length of the preceding field in the record. For example, the Offset of ***First Name*** is 7, which is the ***Patient ID*** Offset (1) plus the ***Patient ID*** Length (6).

NOTE:

Patient ID has an Offset of 1 because it is preceded by the single character data header. If the magnetic card reader stripped the header from the record, the ***Patient ID*** Offset would be 0, and all subsequent Offsets would shift accordingly.

Total Bytes is the sum of all the field lengths in the record. If the card reader includes the data header, Total Bytes is the sum of all field lengths plus the data header. In this case, the sum of all field lengths is 38. You need to add a length of one for the data header and the Total Bytes is 39.

D

Product Specifications

Specifications

Features and Functions	
Electrical Specifications	• Power Input: single phase AC power or internal battery • AC Power Voltage: 100V - 240V, ±10% • AC Power Frequency: 50Hz - 60 Hz, +5%, -6% • Fusion: 5×20 mm, F2AL, 250V • Power Input of device: ≤80VA • Internal Battery: 7.2V@4.5 AH ±10%, rechargeable Lithium-Ion • Battery Capacity: 1000 single page reports or 2 Hours continuous display (without printing)
Recording	• Type: thermal dot-matrix printer • Recording Channels: 3 or 6 • Resolution: Vertical: ≥ 8 points/mm Horizontal: ≥ 16 points/mm, paper speed: 25 mm/s ≥ 8 points/mm, paper speed: 25 mm/s • Speed: 5 mm/s, 25 mm/s, 50 mm/s • Sensitivity/Gain: 2.5 mm/mV, 5 mm/mV, 10 mm/mV, 20 mm/mV, 40 mm/mV ± 5% • Printer Paper: 140 mm x 110 mm (L x W), thermal Z-fold

Features and Functions	

Input	• Dynamic Range:
	  • ± 10 mV, differential signals between any two electrode connections for AC
	  • ±300 mV, for superimposed DC voltage (polarization voltage)
	• Sample Resolution: 4.88µV
	• Polarization Voltage: ±300 mV DC voltage
	• Frequency Response: 0.04 Hz -150 Hz
	• Smallest Detectable Signal: 10 Hz, 20 µVp-p
	• Common Mode Rejection Ratio:
	  • > 90 dB
	• Input Impedance: >10 MOhm, defibrillation-proof
	• Input Loop Current: 0.1 µA (excluding N electrode)

ECG Processing	• ECG Analysis (option): 12SL™ adult and pediatric analysis • Storage (option): 100 or 300 records • Storage Medium (option): SD card • Acquisition Modes: Pre- and Post-acquisition, 10s continuous acquisition • Prompt Information: Lead Off, AC Power Interference, Baseline Wander, Muscle Noise, and others • Heart Rate Display: Range 30 BPM–300 BPM (±10% or 5 BPM), whichever is greater. • RR Analysis (option): • Selectable Targets: 1, 2, 3, 4, 5 minutes or 100, 200, 300, 400, 500 beats • Display Options: Single-lead Waveform, Real-time RR Histogram, Summary Report, Trendgram
Display	• Type: 7 inches color TFT LCD • Resolution: 800×480 • Display Options: Operation Mode, Real-time Heart Rate, Time/Data, Patient Information, Battery status, Lead Quality, Storage Status, and so forth.
Keyboard	Membrane keypads with tactile feedback, including function keys, alphanumeric keys, control keys, and trimpad
ECG Calibration	Calibration Voltage: 1 mV, ± 5%, pulse width 200 ms (speed independent)

Features and Functions	
Baseline	Automatic adjustment to optimal range, based on signal amplitude
Anti-drift System (ADS)	Automatic compensation of baseline fluctuations caused by polarization voltage fluctuations at the lead electrodes
Lead Connection	System notification when leads are not connected
Mains Operation and Battery Operation	• Power Selection: automatic switching between AC and internal battery • Battery Charging: automatic when the device is operated by AC power • Battery Shutdown: automatic when the battery voltage falls below the specified level • Battery Charge Time: ≤4.5 hours for depleted battery • Storage temperature: 0°C - 45°C • Battery Life: 1 yr (approx.) • Internal Clock Battery Life: 5 yrs (approx.); replacement by GE Healthcare service only
Operation position	Horizontal
Operation Environment	• Temperature: +5°C - +40°C • Relative Humidity: 25% - 95% • Pressure: 700 hPa - 1060 hPa
Storage and Transport	• Temperature: -30°C - +60°C • Relative Humidity: 10% - 95% • Pressure: 500 hPa -1060 hPa **NOTE:** Avoid rain, snow ingress, and mechanical shock during transportation with common conveyance. Store in ventilated warehouse without exposure to bright light and corrosive substance. Take the packaged device out from packaging carton to check power on function upon the store duration over 6 months. Repack it after the test is complete.
Physical Dimensions	330 mm (Width) x 280 mm (Depth) x 120 mm (Height)
Weight	3 kg (approx.) with battery and without paper
Disposal	Recycle the battery: Do NOT dispose of the battery by fire or burning. Follow local environmental guidelines concerning disposal and recycling.

Features and Functions	
Safety	• Class: Class I with internal power • Type: CF defibrillation-proof • Patient Leakage Current: < 10 µA • Operation Mode: Continuous **NOTE:** To ensure patient safety, use only parts and accessories manufactured or recommended by GE Healthcare. Use these devices under the instruction of manufacturer. Dispose of the hazardous material in compliance with local, state, or federal guidelines regulating the disposal of such products.
Languages	• English • German • French • Italian • Spanish • Portuguese (Brazilian Portuguese) • Hungarian • Polish • Czech • Slovak • Simplified Chinese • Russian • Korean • Japanese • Finnish • Swedish • Dutch • Norwegian • Danish
Acquisition & Analysis	• Analog acquisition module • Marquette 12SL interpretation • Marquette 12SL Hook-up Advisor

Features and Functions	
Connectivity	• Secure Digital card • Serial port (option) • Internal modem (option) • Support for USB barcode (GE-supported) (option) • Transmit acquired ECG to MUSE system (option) • Transmit acquired ECG to CardioSoft system (option) • LAN (transmission to GE ECG management System) (option) • WiFi (transmission to GE ECG management system) (option)
Application Options	• RR Analysis • 12–Lead display • 12SL Measurement and Interpretation • ECG storage • Laser Printing • Data communication • PDF Export • Pharma package ~ 21 CFR part 11 audit tool and CT Data Guard

Features and Functions	
Warranty	1 year
Certifications	• IEC 60601-1: 1988 +Amd-1: 1991, +Amd-2: 1995 General Requirements for Basic Safety and Essential Performance • IEC 60601-1-1: 2000 Medical Electrical Equipment: General Requirements for Safety Collateral Standard: Safety Requirements for Medical Electrical Systems • IEC 60601-1-2: 2007 General Requirements for Safety - Collateral Standard: Electromagnetic Compatibility- Requirements and Tests • IEC 60601-1-4: 2000 General requirements for safety - Collateral Standard: Programmable electrical medical systems • IEC 60601-1-6: 2006 General Requirements for Safety and essential performance Collateral Standard - Usability • IEC 60601-2-25: 1993 +Amd-1: 1999 Safety of Electrocardiographs • IEC 60601-2-51: 2003 Safety and performance of ECG recorders • EN 55011:2007/A2:2007 Industrial, scientific and medical (ISM) radio-frequency Equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement. • AAMI EC11: 1991/(R)2001/(R)2007 Diagnostic Electrocardiographic Devices • ANSI/AAMI EC13:2002 Cardiac Monitors, Heart Rate Meters, and Alarms (Onscreen heart rate meter, claus 4.2.7 only) • ANSI/AAMI EC57:1998/(R)2003 Testing and Reporting Performance Results of Cardiac Rhythm and ST-segment Measurement Algorithms (All classes except 4.3.3.2, 4.3.3.3, and 4.6.) • UL 60601-1:2003 Medical Electrical Equipment, part 1: General Requirements for Safety • CAN/USA C22.2 No. 601.1 • GB 9706.1-2007 Medical Electrical Equipment - Part 1: General requirements for safety • GB 10793-2000 Medical Electrical Equipment - Part 2: Particular requirements for the safety of electrocardiographs • YY1139-2000 Single and multichannel electrocardiograph.

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