GE Healthcare

MAC™ 800
Resting ECG Analysis System

Software Version 1

Operator's Manual

2031504-182 Revision F

NOTE

This manual applies to the MAC™ 800 Resting ECG Analysis System, software version 1. Due to continuing product innovation, specifications in this manual are subject to change without notice.

This product complies with regulatory requirements of the following European Directive 93/42/EEC concerning medical devices.

CE
0459

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1 Introduction

Manual Information

Purpose

This manual describes the safe and effective operation of the MAC™ 800 Resting ECG Analysis System.

Intended Audience

This manual is written for clinical professionals who use, maintain, and/or troubleshoot the MAC™ 800 Resting ECG Analysis System. Clinical professionals are expected to have a working knowledge of appropriate medical procedures, practices, and terminology used in the treatment of patients.

Revision History

The document part number and revision appear at the bottom of each page. The revision identifies the document's update level.

Revision History, PN 2031504-182		
Revision	Date	Comment
A	11 July 2008	Initial release of document.
B	15 August 2008	Revised document assembly instructions.
C	10 October 2008	Various changes per validation results.
D	5 December 2008	Various changes per pilot site feedback.
E	12 January 2009	Add High-Frequency Device warning.
F	24 July 2009	■ Updated SD Card information ■ Corrected part number for *LAN Option Installation and Troubleshooting Guide* ■ Updated European address on back cover ■ Updated Equipment Symbols

Conventions

The following conventions are used throughout this manual.

Bold	Indicates keys on the keyboard, text to be entered, or hardware items such as buttons or switches on the equipment.
Italics	Indicates software terms that identify menu items, buttons, or options in various windows.
[Key1] + [Key2]	Indicates a keyboard operation. A (+) sign between the names of two keys indicates that you must press and hold the first key while pressing the second key once. For example, "Press **Ctrl** + **Esc**" means to press and hold down the **Ctrl** key while pressing the **Esc** key.
Enter	Indicates you must press the "**Enter**" or "**Return**" key on the keyboard. Do not type "enter".

Product References

The name of the product described in this manual is MAC 800 ECG Analysis System. It will be referred to as "the system" or "the device" throughout this document.

Illustrations and Names

All illustrations in this manual are provided as examples only. They may not necessarily reflect your system's setup or the data on your system.

In this manual, all names appearing in examples and illustrations are fictitious. The use of any real person's name is purely coincidental.

Safety Information

Safety Messages

The terms danger, warning, and caution are used throughout this manual to point out hazards and to designate a degree or level of seriousness.

Definitions

Familiarize yourself with the safety message definitions and significance.

Hazard is defined as a source of potential injury to a person.

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.

NOTE provides application tips or other useful information to assure that you get the most from your equipment.

Applicable Messages

The following safety information applies to the MAC 800 ECG Analysis System.

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 unit 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
RF INTERFERENCE — Known RF sources, such as cell phones, radio or TV stations, and two-way radios, may cause unexpected or adverse operation of this device

Consult qualified personnel regarding system installation.

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-recommended cables and leadwires.

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

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

Whenever patient defibrillation is a possibility, use non-polarizing (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-recommended cables and leadwires.

Otherwise, serious injury could result.

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

CAUTION
ACCESSORIES (SUPPLIES) — To ensure patient safety, use only parts and accessories manufactured or recommended by GE.

Parts and accessories used must meet the requirements of the applicable IEC 60601 series safety standards and essential performance standards, and/or the system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard.

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

ACCESSORIES (EQUIPMENT) — The use of accessory equipment not complying 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; and

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

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 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 unit's label. If this is not the case, do not connect the system to the power line until you adjust the unit to match the power source.

In the 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

RESTRICTED SALE — U.S. federal law restricts this device to sale by or on the order of a physician.

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.

CAUTION

EQUIPMENT CONFIGURATION — The equipment or system should not be used adjacent to, or stacked with other equipment.

If adjacent or stacked use is necessary, test the equipment or system to verify normal operation.

Classification

The unit 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 product 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 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.

Responsibility of the Manufacturer

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

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

General Information

Recording ECGs During Defibrillation

It is not necessary to remove the ECG electrodes prior to defibrillation; the patient signal is defibrilation-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 will block 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 mV 5 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 will appear 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.

Installation and Connection

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

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

Parts and Accessories

To ensure patient safety, use only parts and accessories manufactured or recommended by GE. Browse to www.gehealthcare.com to obtain information about GE-recommended supplies and accessories.

Parts and accessories used must meet the requirements of the applicable IEC 601 series safety standards, and/or the system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard.

The use of ACCESSORY equipment not complying 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; and
- evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 60601-1 and/or IEC 60601-1-1 harmonized national standard.

Equipment Symbols

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

Defibrillation-proof type CF equipment.

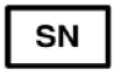
Equipotential ground point

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.

Attention, see instructions for use

Consult instructions for use.

Catalogue (part) number.



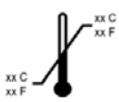
Serial number.

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.


Push button to turn device on, off, or standby


Leads key. Used to change the leads when the screen is being used to display waveforms.


ECG key. Used to acquire a resting ECG, to print a 10-second report in Arrhythmia mode.


Rhythm key. Used to print a continuous, real-time rhythm ECG rhythm strip. Press the Stop key to stop the rhythm strip from printing. (Rhythm report is not stored and can not be transmitted.)


Stop key. Used to stop the writer from printing.


Cursor control keys. Push to change or select the displayed menu item.


Enter button. Push to change or select the displayed menu item.


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 >= 50mm in diameter
  - 2 – Protected against objects >= 12.5mm in diameter
  - 3 – Protected against objects >= 3.5mm in diameter
  - 4 – Protected against objects >= 1.0mm in diamter
  - 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

PCT. GOST marking symoblizing conformity with applicable Russian Gosstandart technical and safety standards.

USA only.

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

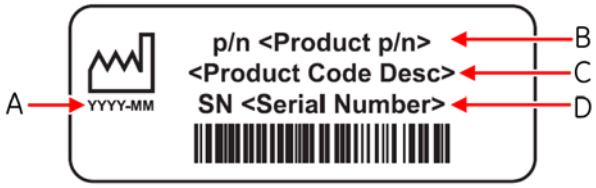
Service Requirements

Refer equipment servicing to GE authorized service personnel only. Any unauthorized attempt to repair equipment under warranty voids that warranty.

It is the user's responsibility to report the need for service to GE or to one of their authorized agents.

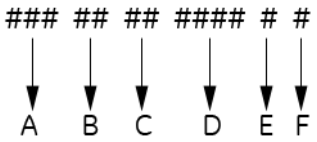
Product Identification

Every GE Healthcare product carries a serial number label that identifies the model, the product code, and the unit's serial number, as seen in the following illustration and table.



A	Date of manufacture in YYYY-MM format.
B	Product part number.
C	Product description code.
D	Unit serial number.

The following illustration and table identify the basic structure of the serial number itself.

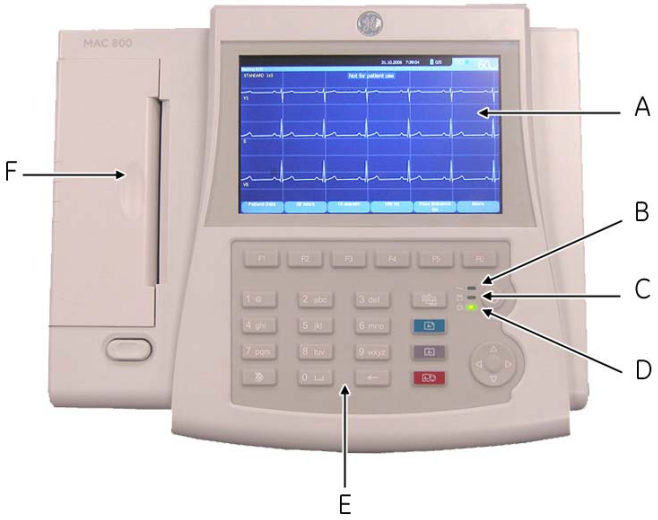


A	The product code for MAC 800 systems is SDS.
B	Year Manufactured (00-99): 07 = 2007, 08 = 2008, and so on.
C	Fiscal Week Manufactured
D	Production Sequence Number
E	Manufacturing Site
F	Miscellaneous Characteristic

2 Equipment Overview

Equipment Description

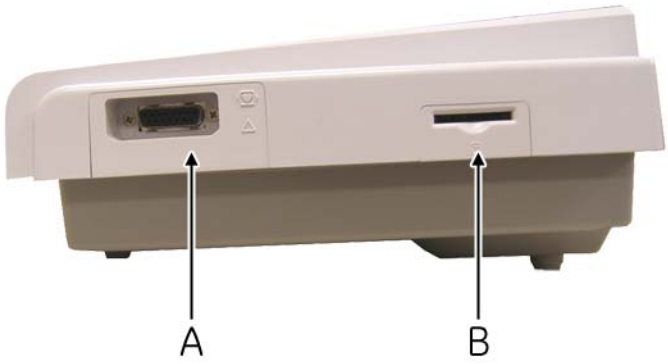
Front View



005

	Name	Description
A	Display	Presents waveform and text data.
B	Power LED	Indicates the unit is plugged in and receiving power.
C	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.
D	Operating LED	Indicates the system is running.
E	Keyboard	Input device for controlling the system or entering data. See “Keyboard Layout” on page 2-5 for more information.
F	Writer	Prints reports.

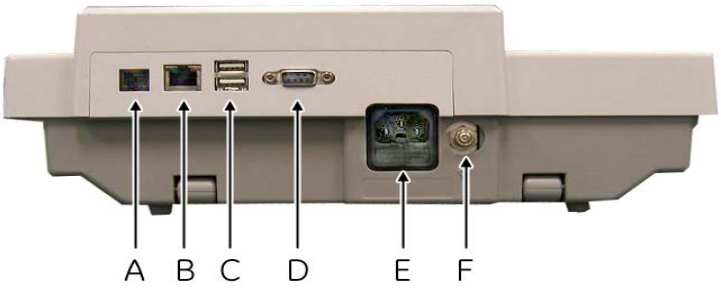
Side View



004

	Name	Description
A	ECG signal input connector	D-sub 15-pin female connector for the acquisition cable.
B	SD card slot	Secure Digital card slot. Insert card as indicated by the icon. The MAC 800 system supports only SD cards formatted for FAT or FAT16 file systems.

Back View



003

	Name	Description
A	Modem Port	RJ11 connector from the optional internal modem to an analog telephone line.
B	LAN connection	RJ45 network LAN connector. The LEDs indicate LAN status. ■ The green LED right of this port indicates a good Ethernet connection. ■ The amber LED left of this port flashes indicates network traffic.

	Name	Description
C	USB connector	Universal Serial Bus connector for USB devices, such as the optional barcode reader, a magnetic card reader, or an external USB keyboard.
D	COMM Port	Serial connector for data communication with CASE/ CardioSoft or MUSE system with a serial cable.
E	AC power connection	Standard connector for the AC power cable.
F	Equipotential grounding lug	Connect non-grounded peripheral devices to ensure equipotential.

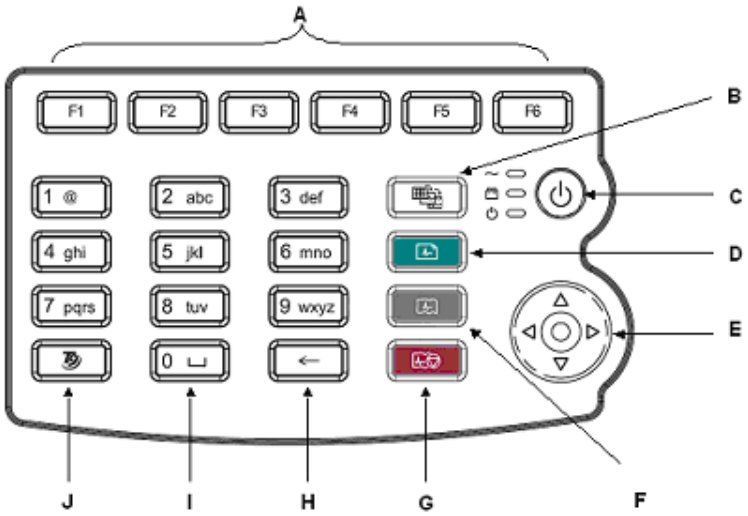
Bottom View

066A

	Name	Description
A	Battery	Rechargeable lithium-ion battery.
B	Carrying handle	Handle for carrying the MAC 800 unit.

Keyboard Layout

Your keyboard may differ slightly from that shown.

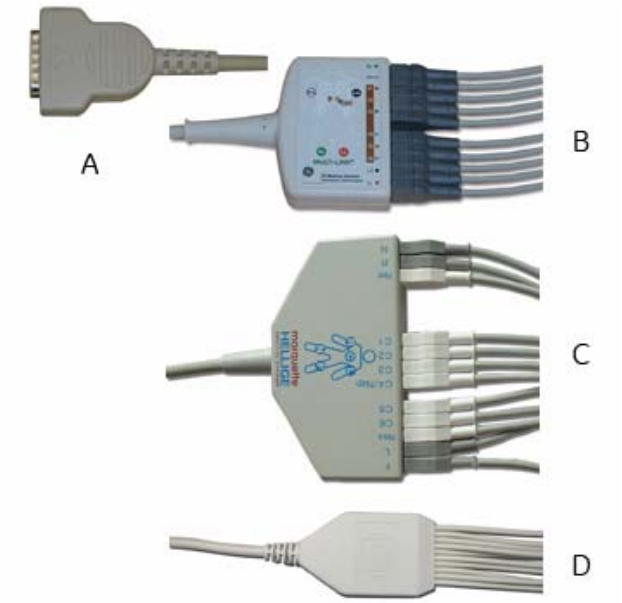


002

	Name	Description
A	Function Keys (F1 through F6)	Selects menu options on the screen. Refer to "Selecting Menu Options" on page 2-13 for details.
B	**Leads** key	Changes the leads when the screen is being used to display waveforms.
C	Power Button	Turns the unit on and off.
D	**ECG** key	Acquires a resting ECG and prints a 10-second report in *Arrhythmia* mode.
E	Trimpad	The arrows move the cursor left, right, up, or down. The center button moves the focus within a window or selects the currently active item.
F	**Rhythm** key	Prints a continuous, real-time rhythm ECG strip. Press the **Stop** key to stop the rhythm strip from printing. (Rhythm report is not stored and cannot be transmitted.)
G	**Stop** key	Stops the writer from printing.
H	**Backspace** Key	Deletes characters.
I	**Space** Key	Adds a space between typed characters.
J	T9 key	Switches between different input methods. For more information, refer to "Entering Data Using the T9 key" on page 2-14.

Acquisition Modules

The MAC 800 system supports a variety of acquisition modules.



041A

WARNING

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

Otherwise, serious injury could result.

CAUTION

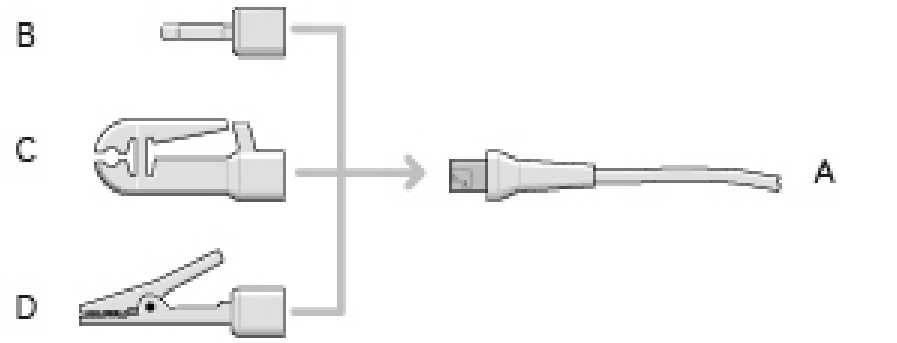
PROPER LEADWIRE CONNECTION — Improper connection will cause inaccuracies in the ECG.

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.

	Name	Description
A	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.
B	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.
C	NEHB Acquisition Cable Leads	The lead end of the NEHB acquisition cable attaches to the leadwire adapters and uses 12 leadwires.
D	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.



A leadwire end

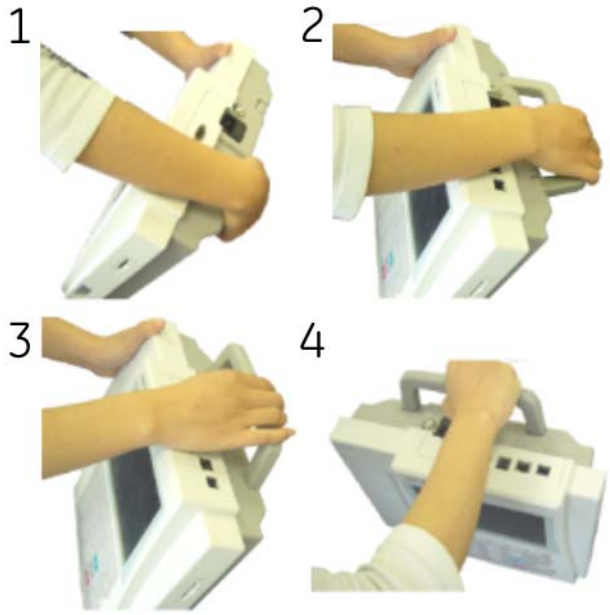
B 4 mm pin

C grabber

D mactrode clip

Carrying Handle

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



067A

Setting Up the Equipment

Setting up the MAC 800 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 unit.
11. Configuring the system.
12. Testing the equipment.

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

Inserting the Battery

The MAC 800 system is shipped with a lithium-ion battery that is charged when inserted into a MAC 800 system connected to AC power.

1. Gently turn unit over and find the empty battery compartment.
2. Insert the battery as shown.

NOTE

The battery charges when it is inserted in a MAC 800 system that is connected to AC power. You may begin using the system connected to AC power. However, 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.

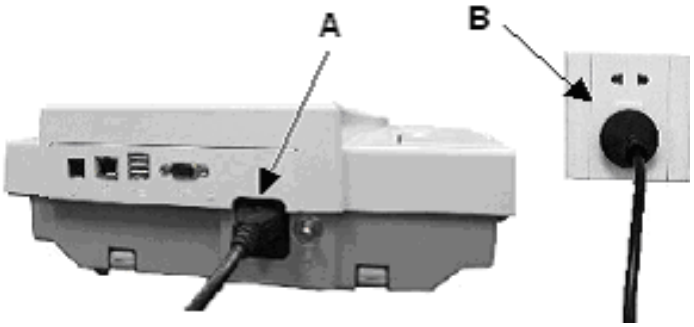
Connecting the AC Power Adapter

The MAC 800 system can run using AC or battery power. When the unit 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 system to an AC power outlet.



042A

1. Connect the female end of the unit's power cord to the AC power connector on the back of the unit. (A)

2. Plug the male end of the unit's power cord into an AC outlet. (B)
3. Check the Power LED to make sure the unit is receiving power from the AC outlet.

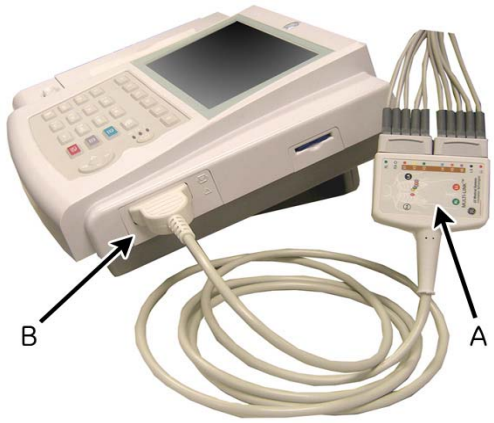
   For more information, refer to "Front View" on page 2-2.

Connecting Leadwires

Use the following instructions to connect your leadwires and acquisition module to the MAC 800 unit.

WARNING
ELECTRICAL SHOCK — To avoid potential injury resulting from electrical shock, DO NOT attempt to connect the patient cables directly to an AC power outlet.

Connect patient cables only to the ECG Signal Input Connector on the MAC 800 unit, as described in the following procedure.



011A

1. Assemble the leadwires and adapters.

   Refer to "Replacing Leadwire Adapters" on page 10-7 for details.
2. Connect the leadwires to the front of the acquisition module. (A)

   Refer to "Acquisition Modules" on page 2-6 for more information.
3. Connect the acquisition cable to the MAC 800 system. (B)

   Ensure the cable is seated snugly.

Inserting Paper

Before printing ECG reports, insert the MAC 800 110mm z-fold paper. Refer to "Replacing Paper" on page 10-8 for instructions.

Connecting a Magnetic Card Reader

The MAC 800 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 MAC 800 system's USB port. Refer to the magnetic card reader's documentation for additional information.

NOTE

Do not connect a magnetic card reader if the bar code reader option (*BCRD*) is enabled. If the *BCRD* option is enabled, the system will expect a bar code reader and the magnetic card reader will not function correctly.

Connecting the Barcode Reader

If the optional barcode reader was purchased with the unit, connect it to the MAC 800 system's USB port. 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 unit. However, the barcode settings must be configured for the site before the reader can be used. Refer to "Patient Setup" on page 9-18 for details.

Connecting the Optional Internal Modem

If the MAC 800 system was purchased with the internal modem option, connect the modem to an analog phone line using the RJ11 connector on the back of the unit. See "Back View" on page 2-3 for details.

Connecting to a LAN

If the *LANC* (LAN Communication to Cardiosoft) or *LANM* (LAN Communication to MUSE) options were purchased, connect an ethernet cable to the RJ45 network connector on the back of the MAC 800 unit. See *LAN Option Installation and Troubleshooting Guide* (PN 2020299-025) for information on configuring the LAN connection.

NOTE

If the MAC 800 unit will be used as a mobile unit, do not connect the device to a LAN until you are ready to import, transmit, or export records.

Connecting an External Laser Printer

The MAC 800 system can be used with an external laser printer connected to its USB port. The printer must be used away from the patient vicinity and must:

- be compliant with IEC60950 or equivalent standards,
- be compliant with the PCL5e language or higher,
- have a minimum of 600 dpi resolution, and
- have a minimum of 8 MB memory.

Refer to the printer's documentation for setup information.

Turning on the System

Press the **Power** button to power on the system. Verify the following:

- The **Power LED** lights.
- The selected MAC 800 startup screen appears with no errors.

If you encounter any problems powering on the system, refer to Appendix A for troubleshooting instructions.

Configuring the Device

When the device is ready for operation, configure the system settings using the information in Chapter 9.

If the same settings will be applied to multiple devices at the site, export the settings to an SD card and use that card to import the settings to other MAC 800 systems.

Testing the Device

After the MAC 800 unit has been set up and configured, test the device completely before using it with patients. Test scenarios include:

- Conducting and printing a resting ECG

  Refer to Chapter 5 for instructions on resting ECGs.
- Conducting and printing an arrhythmia ECG

  Refer to Chapter 6 for instructions on arrhythmia ECGs.
- Conducting and printing an RR analysis

  Refer to Chapter 7 for instructions on RR Analysis.
- Saving, importing, printing, deleting, transmitting, and exporting records

  Refer to Chapter 8 for instructions on using internal storage.

System Description

Start Up Screen

Depending on what options have been selected for *Power up mode* in *Basic Setup*, the start up screen will be one of the following:

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

  NOTE

  The password window will appear only if the *High Security Mode* option is selected in *Basic Setup*. The system can be used to take a *STAT ECG* without having to log in. Press the *STAT ECG* softkey to begin taking an ECG without logging into the MAC 800 system.

Using the MAC 800 Keyboard

You interact with the MAC 800 system by using the keyboard to:

- Enter data
- Select menu options
- Navigate through data entry fields

For a complete description of the MAC 800 keyboard features, refer to "Keyboard Layout" on page 2-5. For information on entering data using the keyboard, refer to "Entering Data Using the T9 key" on page 2-14.

Selecting Menu Options

Configure the device and initiate ECG readings by selecting menu options that appear across the bottom of the display. Up to six menu options may be available at any given time, and each option corresponds to a function key (**F1**–**F6**) directly below the display.

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

- Start 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 will be 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  .

1. To input numbers, press the T9 key until the input method indicator is “123” and then press 0 through 9 to enter numbers.

2. To input letters, press the T9 key 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.

3. To input symbols, press the T9 key until the input method indicator is “@” and press 1 to display the available symbols.

   Available symbols are:

   . \ - _ @ + , ' ? ! " ( ) / : ; & % * = < > $ [ ] { } ~ ^ | 《 》
   • € ¥ £ © ® º ¿ ª °

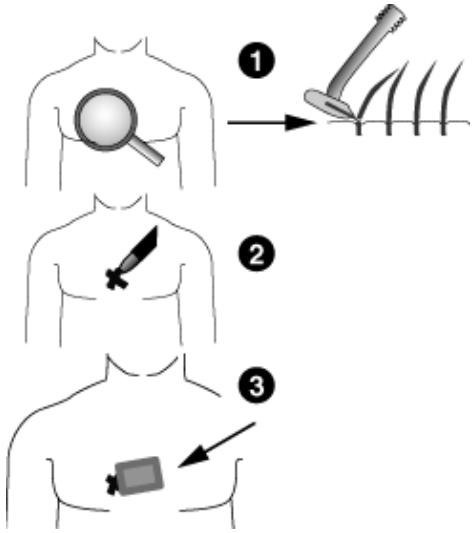
   To toggle through the available symbols, use the left and right arrows on the trimpad until the desired symbol is displayed. Press the central button on the trimpad to select the symbol.

4. To delete a character, press the backspace key.

3 Preparing the Patient

Prepare the Patient's Skin

Careful skin preparation is the key to an interference-free ECG. The signal quality is shown on the Hookup Advisor indicator.



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1. Shave any hair from each electrode site and degrease each electrode site with alcohol.
2. Apply electrode to prepared area.

WARNING
SHOCK HAZARD — Ensure that conductive parts of the electrodes or lead wires do not come in contact with other conductive parts, including earth.

This would cancel the protection provided by the isolated signal input.

WARNING
SHOCK HAZARD — The operator shall not touch the SIP (Signal Input Part) / SOP (Signal Output Part) and the patient simultaneously.

3. Verify the leads are all connected and working properly.

NOTE

You can use the *Hookup Advisor* to review connection quality before beginning the ECG. For more information, refer to "Hookup Advisor" on page 5-12.

Applying Electrodes

The placement of electrodes varies depending on whether you wish to acquire a standard 12-lead ECG or an NEHB ECG. Both methods are described in this section.

WARNING

ELECTRICAL SHOCK — To avoid electrical shock, do not touch the SIP/SOP (Signal Input Part/Signal Output Part) and the patient simultaneously.

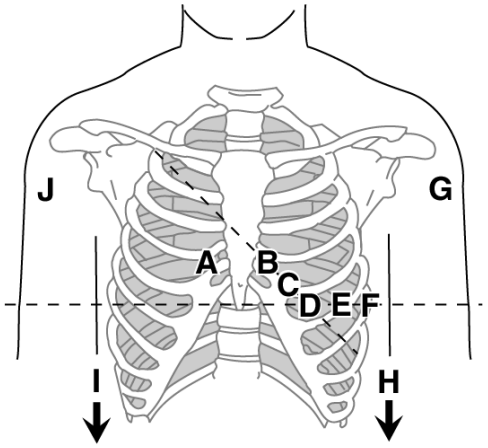
CAUTION

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.

Standard 12 Lead Placement

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



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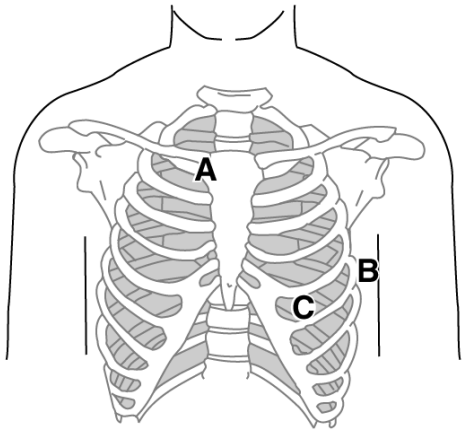
	AHA Label	IEC Label	Electrode Placement
A	V1 red	C1 red	Fourth intercostal space at the right sternal border.
B	V2 yellow	C2 yellow	Fourth intercostal space at the left sternal border.
C	V3 green	C3 green	Midway between location B and D.
D	V4 blue	C4 brown	Mid-clavicular line in the fifth intercostal space.
E	V5 orange	C5 black	Anterior axillary line on the same horizontal level as D.
F	V6 purple	C6 purple	Mid-axillary line on the same horizontal level as D and E.
G	LA black	L yellow	Left deltoid. (Alternate placement: left wrist.)
H	LL red	F green	Above left ankle. (Alternate placement, upper leg as close to torso as possible.)
I	RL green	N black	Above right ankle. (Alternate placement, upper leg as close to torso as possible.)
J	RA white	R red	Right deltoid. (Alternate placement: right wrist.)

NEHB Lead Placement

To acquire a NEHB ECG, use the standard 12 lead electrode placement and items A and B as shown in the following figure.



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	AHA Label	IEC Label	Electrode Placement
A	A1 orange	Nst white	Attachment point of the 2nd rib to the right sternal edge.
B	A2 orange	Nax white	5th intercostal space on the left posterior axillary line. (Same position as V7 or C7.)
C	V4 blue	Nap white	Mid-clavicular line in the fifth intercostal space. (Same position as C4.)

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 magnetic card reader, or if you want to modify or add to the patient data entered with a barcode reader or magnetic card 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.

   For *Resting* ECG and *RR Analysis*, the window is opened by pressing the *Patient Data* softkey.

   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.

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

   Refer to "Entering Data Using the T9 key" on page 2-14 for additional information on entering data.

   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: all subsequent pages must be entered manually.

3. Use the *Page Up* and *Page Down* softkeys to move backward and forward through the patient data windows, respectively.

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

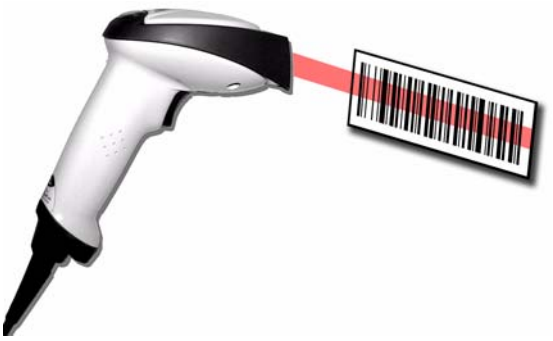
4. When all the patient data has been entered, press the *Save* softkey to save the data.

Entering Patient Information with a Barcode Reader

Using a barcode reader can simplify the entry of patient information and reduce the introduction of 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 MAC 800 back panel and properly configured. Refer to Chapter 9 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.



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   A *Please wait* message is displayed on the screen and the barcode reader beeps. The first *Patient Data* window opens with the data from the patient's barcode entered in the appropriate fields.

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

   Refer to "Entering Patient Information Manually" on page 4-2 for details.

4. After verifying that the patient information is correct, press the *Save* softkey 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 MAC 800 back panel and properly configured. Refer to Chapter 9 for instructions on setting up a third-party magnetic card reader.

1. When the *Swipe the Patient Card* prompt appears on the screen, swipe the patient's magnetic card through the card reader.

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   A *Please wait* message is displayed on the screen. After the data has been 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.

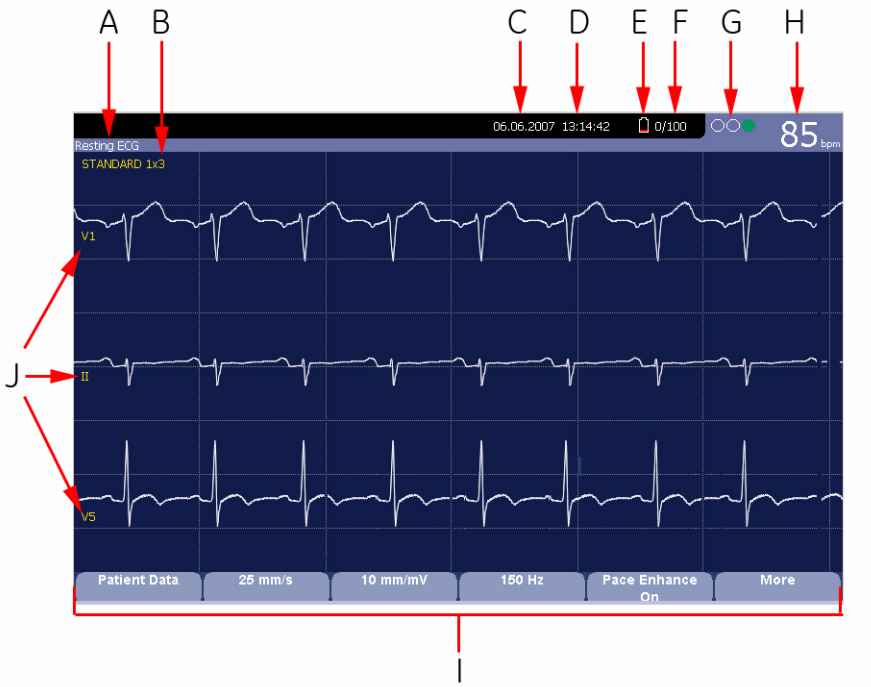
   Refer to "Entering Patient Information Manually" on page 4-2 for details.

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

5 Recording a Resting ECG

Introduction

The Resting ECG function is part of the basic MAC 800 system. *Resting ECG* mode is the default *Power up mode*. When the system is turned on, the Resting ECG display will appear, similar to the following figure. The default can be modified in the *Basic Setup*.



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Resting ECG Display		
Item	Name	Description
A	ECG Type	Type of ECG. Valid types are *Resting ECG, Arrhythmia*, and *RR Analysis*.
B	Display Format	Format of current waveforms. Press the **Leads** key to cycle through all 12 leads.
C	Date	Current system date.
D	Time	Current system time.
E	Battery status indicator	Displays the current battery level. Appears only when the unit is operating on battery.
F	Internal storage indicator	Appears only if the internal storage option is enabled. Format is: *Approximate number of ECG records that can be stored in remaining memory / Maximum number of ECG records that can be stored*

Resting ECG Display (Continued)		
Item	Name	Description
G	Hookup Advisor Indicator	See "Hookup Advisor" on page 5-12 for more information.
H	Patient's Heart Rate	Current patient heart rate measured in beats per minute.
I	Menu Options	The available menu options. The list of available options changes depending on the function and the current location within that function. For more information, refer to "Selecting Menu Options" on page 2-13.
J	Lead Labels	Identifies each waveform and indicates waveform quality. Yellow = noisy lead. Red = disconnected lead.

Resting ECGs

A resting ECG is the default mode of the MAC 800, although this may be changed in the system configuration. This section describes how to record a resting ECG as well as 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 the *STAT ECG* softkey.
- If the password screen is not displayed, skip directly to step 7.

1. Prepare the patient as described in Chapter 3.
2. Verify the system is in *Resting ECG* mode.

   If the system is not in the *Resting ECG* mode, press the *Resting ECG* softkey at the *Main Menu*.
3. Enter the patient data as described in Chapter 4.
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 5-4.
5. If the patient has a pacemaker, press the *Pace Enhance* softkey.

   For more information, refer to "ECG Options" on page 5-4.

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

   For more information on display formats, refer to "Resting ECG Setup" on page 9-5.

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

   A progress bar indicates the percentage of the data acquired. When the acquisition is complete, one of two things will occur, 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 shown on the display. Proceed to step 8.
   - If the *Preview Before Analysis* option is not enabled, the ECG data will be analyzed and printed after it has been acquired. Skip to step 9.

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

   - To discard the reading and begin over, press *Cancel* and repeat from step 4.
   - To accept the reading, press *Continue*.

     The menu options change to allow you to manage the acquisition. Proceed to step 9.
   - To print the reading to a laser printer attached to the device, press *Laser Print*.

     The ECG is saved and printed on the laser printer. You return to the main ECG screen, where you can take another ECG.

9. Use the options to edit patient information, to print a copy, or to save, transmit, or reanalyze the data.

   For more information on each option, refer to "Post-Acquisition Options" on page 5-6.

ECG Options

The MAC 800 provides several options for configuring an ECG. The options, presented as option keys across the bottom of the display, are listed in the following table.

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 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 amplitude 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 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	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 Used only when conducting rhythm ECGs. Refer to "Generating a Rhythm Report (Manual recording)" on page 5-8 for more information.
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 the ECG has been acquired. Presented as option keys across the bottom of the display, they are listed in the following table.

Option	Description
Page 1	
Next Patient	Opens the patient entry window to allow 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. Applies only if a valid LAN or Modem communication option is enabled. Refer to Chapter 9 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 to allow you to enter or select a new patient.
Speed	Changes the speed of the waveform on the display and printout. Change 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.
Reanalyze	Allows you to edit the global measurement and T-wave dispersion. Available only if: ■ the Audit Trail is disabled on the *Basic Setup* window, ■ either measurement option (ME12 or MI12) is enabled, and ■ the Reanalysis option is selected in the *Resting ECG Setup* window.

Option	Description
Laser Print	Prints the ECG report to an external USB laser printer.
Main Menu	Exits the Resting ECG function and return 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 will not have computer-generated interpretation or measurements, and they cannot be stored to internal memory or transmitted. Use the following steps to generate a Rhythm Report.

1. Prepare the patient as described in Chapter 3.
2. Verify the system is in *Resting ECG* mode.

   If the system is not in the *Resting ECG* mode, press the *Resting ECG* softkey at the *Main Menu*.
3. Enter the patient data as described in Chapter 4.
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 5-4.
5. If the patient has a pacemaker, press the *Pace Enhance* softkey.

   For more information, refer to "ECG Options" on page 5-4.
6. Press the **Leads** key to scroll through all 12 leads.

   For more information on display formats, refer to "Resting ECG Setup" on page 9-5.
7. Press the *More* softkey.
8. Press the *Printer Leads* softkey to select the appropriate option.

   For more information on the Printer Leads option, refer to "ECG Options" on page 5-4.
9. Press the **Rhythm** key to begin recording the ECG.
10. Press the **Stop** key to stop the ECG recording.

If you press the **Rhythm** key after pressing the **Stop** key, the new report will either begin printing immediately on the current sheet of paper or advance to a new page, depending on the setting of the *Start rhythm report on a new page* field on the *Resting ECG Setup* window. Refer to "Resting ECG Setup" on page 9-5 for details.

ECG Reanalysis

You can reanalyze ECGs if the following conditions have been 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, and
- *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* (416791-004) for additional information.

Reanalyzing an ECG

Use the following procedure to reanalyze a resting ECG.

For additional information, refer to "Reanalysis Layout" on page 5-10 and "Reanalysis Options" on page 5-11.

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

   For instructions on acquiring a resting ECG, refer to "Recording a Resting ECG" on page 5-3.

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

   For a better view of individual waveforms, use the **Leads** key to toggle through the waveforms. See "Reanalysis Layout" on page 5-10 for more information.

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

   a. Press the *Next* softkey 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 "Reanalysis Layout" on page 5-10.

   d. Repeat step a through step c for each fiducial point to be adjusted.

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

- To discard your adjustments and start over, press the *Restore* softkey.

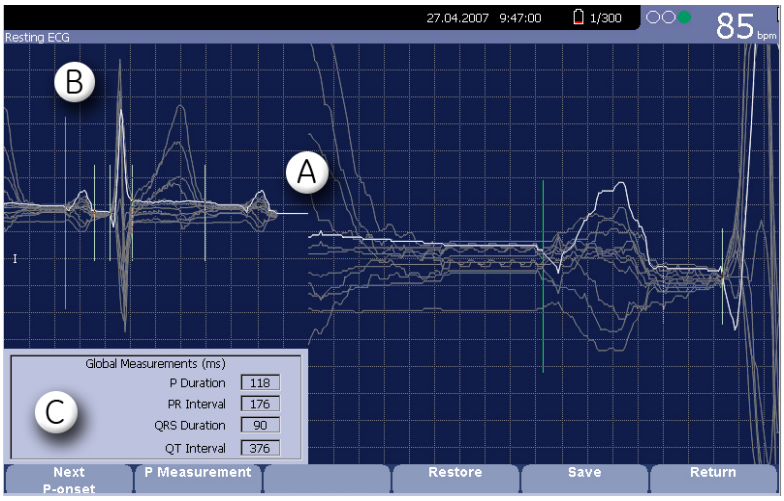
  The original readings are restored. Return to step 2 to start over.
- To save your adjustments, press the *Save* softkey.

  The changes are saved

5. Repeat from step 2 to make adjustments in the other edit mode.
6. After all your changes have been made, press the *Return* softkey to return to the original menu options.

Reanalysis 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.



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	Feature	Description
A	Waveforms	A composite view of the ECG reading generated by superimposing the median waveforms from all 12 leads. Press the Leads key to toggle through the individual waveforms. The selected waveform is brighter than the others.

	Feature	Description
B	Fiducial Points	Each fiducial point is represented by a vertical line through the composite waveforms. Press the *Next* softkey to toggle through the fiducial points. When a point is selected, it increases in size and is highlighted green. A selected fiducial point can be adjusted by pressing the left and right arrows on the trimpad.
C	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

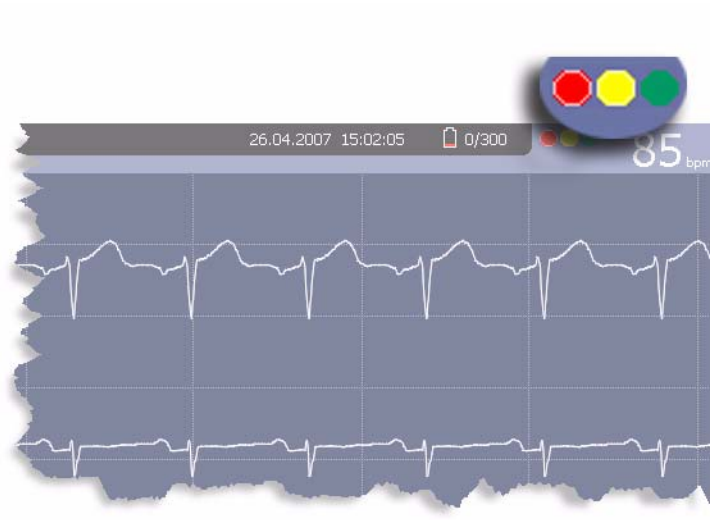
The following options are available when reanalyzing an ECG.

Option	Description
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.
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). Available only when the *P-onset* or *P-offset* fiducial points are selected.

Option	Description
Restore	Returns all fiducial points to their original positions. Use this option to undo any changes and begin over.
Save	Applies the waveform marker changes to the ECG record. When the ECG is next printed, it will be reanalyzed with the new settings.
Return	Exits the reanalysis function and returns to the *Resting ECG* mode. If you select this option before you press the *Save* softkey to save your changes, you will lose your changes

Hookup Advisor

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



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The *Hookup Advisor* 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.

Indicator	Description
Red	Indicates a lead-fail 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 a red or yellow indicator is lit, identify and correct the error before proceeding with the ECG.

Hookup Advisor is enabled and configured in the *Resting ECG Setup*. Refer to "Resting ECG Setup" on page 9-5 for more information.

Special Considerations

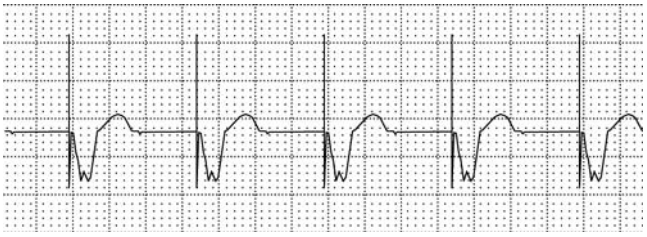
When recording ECGs, special considerations must be made for the following situations:

- Recording ECGs of pacemaker patients
- Recording ECGs during defibrillation

Recording ECGs of Pacemaker Patients

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

If Pulse 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.



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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, however, QRS complexes might be suppressed in certain situations. Therefore, pacemaker patients should always be watched closely.

Recording ECGs during Defibrillation

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.

However, 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 will block ECG signal acquisition for several minutes. If polarizing electrodes are used, GE recommends that the leadwires be disconnected from the patient before delivering the shock.

To prevent polarization, GE 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 100mV five seconds after a defibrillation discharge.

WARNING
EQUIPMENT DAMAGE — For patient safety, use only the original GE patient cable. Before connecting the cable to the device, check it for signs of mechanical damage. Do not use a damaged cable.

WARNING
SHOCK HAZARD — During defibrillation, do not touch the patient, the electrodes, or the leadwires.

Observe all defibrillator safety information.

6 Arrhythmia Mode Recording

Introduction

The Arrhythmia mode is part of the basic MAC 800 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 5-2. 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 Chapter 3.
2. From the MAC 800 *Main Menu*, press the *Arrhythmia* softkey

   The *Enter Patient Data* window opens.
3. Enter the patient data as described in Chapter 4.
4. Adjust the gain, speed, filter, anti-drift system, and pacemaker detection as necessary.

   Refer to "Arrhythmia Options" on page 6-3 for details.
5. When the settings have been adjusted as required, press the *Start Recording* softkey to begin the arrhythmia report.
6. After you have recorded an adequate amount of information, press the *Stop Recording* softkey.

   Two new options become available: *Confirm Stop* and *Continue Recording*.
7. Do one of the following:

   - If additional information needs to be recorded, press the *Continue Recording* softkey.

     This returns to the recording mode. Repeat from step 6.
   - If you have determined enough information has been recorded, press the *Confirm Stop* softkey.

     Report options become available.

8. Select the type of Arrhythmia Report to print and press the appropriate function key.
   - To print the summary report, press the *Print Summary* softkey.
   - To print the table report, press the *Print Table* softkey.
   - To print episodes report, press the *Print Episodes* softkey.

   Refer to "Printing Options" on page 6-5 for details.
9. Review the report as necessary.

   For more information, refer to "Arrhythmia Codes" on page 6-5.

Arrhythmia Options

The MAC 800 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.

Option	Description
Start/Stop Recording	Starts and stops the arrhythmia reading.
Sweep 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. 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.

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: ■ 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.
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.
ADS	Toggles the anti-drift system (ADS) on and off. ADS helps reduce baseline drift.
More	Toggles through the softkey options.
Pace Enhance	Standardizes the pace spike. Options are *On* and *Off*.

Option	Description
Patient Data	Opens the patient data entry window.
Main Menu	Exits the Arrhythmia function and returns to the Main Menu.

Printing Options

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

Option	Description
Print Summary	Prints a combined report that includes both the Table and Episode formats.
Print Table	Prints a breakdown of the recording in tabular format. The report includes: ■ the analysis duration in minutes and seconds, ■ the artifact duration in minutes and seconds, ■ a code for each event type recorded, and ■ the number of each event type recorded. For a description of the possible event codes, refer to "Arrhythmia Codes" on page 6-5.
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 6-5

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 3 s
CPLT	Ventricular couplet (2 PVCs)
ESC	Ventricular escape beat
L	Learn phase
PAU1	Pause of 1 missed beat
PAU2	Pause of 2 missed beats

Code	Arrhythmia Event
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

Introduction

RR Analysis is an optional mode of MAC 800 system. It detects hidden patterns underlying the complex dynamic phenomena of heart rate variability (HRV) and measures the cardiac RR intervals. 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 Chapter 3.
2. From the MAC 800 *Main Menu*, press the *RR Analysis* softkey.

   You can also access RR Analysis from the Resting ECG mode after an ECG has been acquired. For more information, refer to "Post-Acquisition Options" on page 5-6.
3. Press the *Patient Data* softkey and enter the patient data as described in Chapter 4.
4. Press the *RR Analysis Setup* softkey 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 7-3 for details.
5. Press the *Save* softkey to record your settings.
6. Press the *Start Test* softkey.

   The device begins to acquire the ECG. The analysis target, 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 the low pass filter.
   - Toggle pace enhancement.

   For more information on any of these options, refer to "Waveform Options" on page 7-3.

   When the target is achieved, a preview of the summary results, histogram, and trendgram is shown on the display.

8. While reviewing the preview, do any of the following.
   - To discard the reading and begin over, press the *Return* softkey and repeat from step 6.
   - To discard the reading and return to the *Main Menu*, press the *Main Menu* softkey.
   - To accept the reading and print the report on the thermal printer, press the *Print* softkey.
   - To accept the reading and export the results to a PDF file, press the *PDF Export* softkey.
   - To accept the reading and print the report on an external laser printer, press the *Laser Print* softkey.

   For more information on each option, refer to "Output Options" on page 7-5.

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 7-5 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. Changing the waveform speed also changes the speed the wiper bar moves across the display. Measurement is in millimeter per second (mm/s) and includes the following options: ■ 12.5mm/s ■ 25mm/s ■ 50mm/s

Option	Description
Gain	Changes the magnitude of the ECG signal on the display. Measurement is in millimeter per millivolt (mm/mV) and includes the following options: ■ 2.5mm/mV ■ 5mm/mV ■ 10mm/mV ■ 20mm/mV ■ 40mm/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 base 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: ■ 20Hz ■ 40Hz ■ 100Hz ■ 150Hz 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 40Hz displays only signals at 40Hz or less; signals greater than 40Hz 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 Enhancement	Improves the readability of pacemaker ECG. 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.
Laser Print	Prints the RR Analysis Report to an external 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 reach the RR Analysis Setup function from the MAC 800 *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 will be displayed and stored.
Line Filter	Enables/disables the line filter defined in *Country Setup*. Refer to "Country Setup" on page 9-17 for more information.
Pace Enhancement	Improves the readability of pacemaker ECGs. Options are *On* and *Off*.

Field	Description
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. 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 rate the wiper bar moves across the display. Measurement is in millimeter per second (mm/s) and includes the following options. ■ 12.5mm/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. ■ 20Hz ■ 40Hz ■ 100Hz ■ 150Hz 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.

Field	Description
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. ■ 0.04Hz ■ 0.08Hz ■ 0.16Hz ■ 0.31HZ 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,
- delete records,
- print records,
- transmit records to an external device, and
- export records to a secure digital card or shared directory.

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

Resting ECGs can be stored automatically or manually:

- To save resting ECG records automatically, set the *Auto Store ECG* check box on the *Resting ECG Settings* window.

  For more information, refer to "Resting ECG Setup" on page 9-5.
- To save resting ECG records manually, press the *Save* softkey after the resting ECG has been acquired.

  For more information, refer to "Post-Acquisition Options" on page 5-6.

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 9-23.

Importing Records

In addition to saving ECGs recorded with the MAC 800 device, you can also import ECG records to internal storage from the following sources:

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

No additional set up is required to import from an SD card. However, you must do the following to import data via serial port or modem:

- Purchase and activate the appropriate communications option.
  For more information refer to "Options Setup" on page 9-23.
- Configure the system's data communication settings.
  For more information, refer to "Communication Setup" on page 9-13.

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

1. From the *Main Menu*, press the *File Manager* softkey.

   The *File Manager* window opens.

2. Press the *Import* softkey.

   The function keys change.

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3. Select the appropriate import source:

   - To import ECGs from an SD card, insert the SD card and press the *SD Card* softkey.
     A list of the available ECGs on the card opens. Proceed to step 4.
   - To import ECGs via serial port, press the *Serial* softkey.
     The serial port opens. The device waits for the external device to transmit records.
   - To import ECGs via modem, press the *Modem* softkey.
     The modem initializes. The device waits for the external device to transmit records.

4. Select the records to be imported from the SD card.
5. When the correct records are selected, press the *Import* softkey.

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 the *File Manager* softkey.

   The *File Manager* window opens.

2. Press the *Print Directory* softkey.

   The directory prints on the MAC 800 writer.

Finding Records

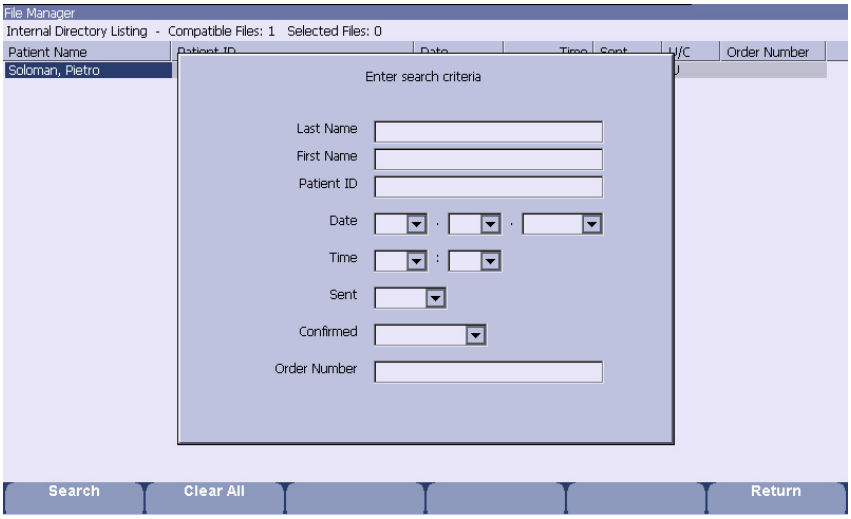
The *File Manager* may have up to 300 records to manage, making it difficult to find a specific record. To help you locate a record or a group of records, use the following instructions.

1. From the *Main Menu*, press the *File Manager* softkey.

   The *File Manager* window opens.

2. Press the *Search* softkey.

   The *Enter Search Criteria* window opens.



3. Enter the search criteria.
4. Press the *Search* softkey.

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

Editing Patient Data

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

1. From the *Main Menu*, press the *File Manager* softkey.

   The *File Manager* window opens.
2. Press the *Select* softkey.

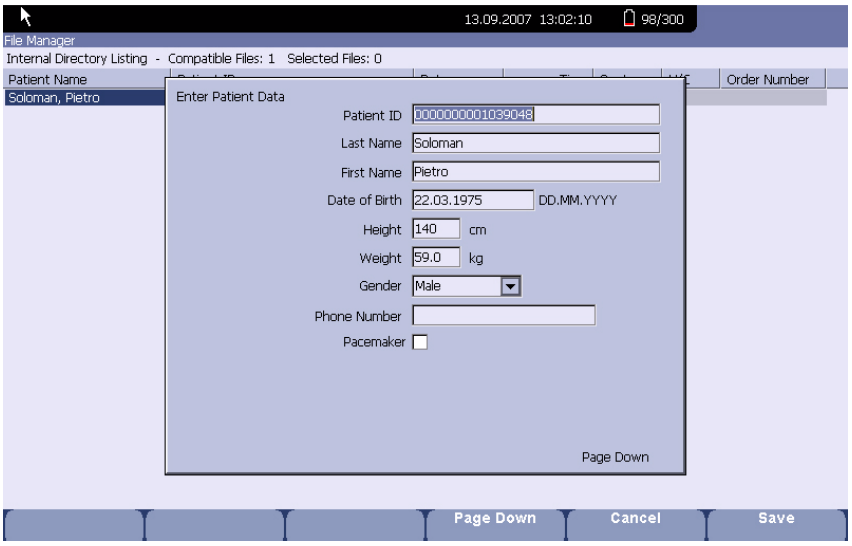
   This enters the *File Manager* into select mode.
3. Use the trimpad to select the record to be edited.

   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 the *Edit* softkey.

   The *Enter Patient Data* window opens.



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5. Edit the information as appropriate.

   For instructions on editing patient information, refer to Chapter 4.

6. When the information has been updated, press the *Save* softkey.

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

Deleting Records

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

1. From the *Main Menu*, press the *File Manager* softkey.

   The *File Manager* window opens.

2. Do one of the following.

   - To delete select records, press the *Select* softkey and use the trimpad to select the record(s) to be deleted.
   - To delete all the records in storage, press the *Select All* softkey.

3. Press the *Delete* softkey.

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

4. Do one of the following:

   - To cancel the deletion, press *No*.
   - To delete the record(s), press *Yes*.

Printing Records

The MAC 800 system supports printing to both the internal thermal writer and to an external laser printer. Use the following instructions to print records.

1. From the *Main Menu*, press the *File Manager* softkey.

   The *File Manager* window opens.

2. Do one of the following.

   - To print select records, press the *Select* softkey and use the trimpad to select the record(s) to be printed.
   - To print all the records in storage, press the *Select All* softkey.

3. Do one of the following:

   - To print to the internal thermal printer, press the *Print* softkey.

     The selected records are printed on the MAC 800 writer.
   - To print to an external laser printer, press the *Laser Print* softkey.

     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 9-23 for more information.
- Configure data communications.

  Refer to "Communication Setup" on page 9-13 for more information.

- Connect the MAC 800 unit to the communication device.
  - To set up a LAN connection to a Cardiosoft system, see "Connecting to a LAN" on page 2-11.
  - To set up a LAN connection to a MUSE system, see the *LAN Option for MAC Series Installation and Troubleshooting Guide* (PN 2020299-025).

1. From the *Main Menu*, press the *File Manager* softkey.

   The *File Manager* window opens.

2. Do one of the following.

   - To transmit select records, press the *Select* softkey and select the record(s) to be transmitted.

     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 the *Select All* softkey.

3. Press the *Transmit* softkey.

   One of two things happens, depending on the number of locations defined in *Communications Setup*.

   - If only one location is defined, the files are transmitted to the default location.
   - If multiple locations are defined, a window listing the locations opens. Select the correct location and press *OK*.

Exporting Records

You can export records from internal storage to a Secure Digital card or to a shared directory in either an 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 can be stored on the card. GE Healthcare recommends you use SD cards with a capacity of 2GB or smaller and 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, no additional set up is required.

To export PDF files to an SD card, you must first enable the *PDFC* (PDF Export) system option. Refer to "Options Setup" on page 9-23 for details.

To export either XML or PDF to a shared directory, you must do the following:

- Purchase and activate the *LAN Communications to Cardiosoft* (*LANC*) option.

  Refer to "Options Setup" on page 9-23 for details.
- Define the shared directory settings on *Communications Setup*.

  Refer to "Communication Setup" on page 9-13 for details.

Exporting Records

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

1. From the *Main Menu*, press the *File Manager* softkey.

   The *File Manager* window opens.

2. Select the record(s) to be exported.

   - To export select records, press the *Select* softkey and use the trimpad to select the records to be exported.

     NOTE

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

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

3. Press *More* > *Export*.

   The softkeys change. Depending on which options have been activated, the softkeys may include *Hilltop XML*, *PDF*, and *Return*.

4. To export to an SD card, insert the card into the SD Card slot.

   The card must have sufficient free space for the selected records and must not be write protected.

   NOTE

   If you do not enter the SD card into the MAC 800 SD Card slot, you will receive a warning (*SD-Card is not present*) when you attempt to export data to the card. Refer to "SD Card Not Present" on page A-4 for instructions on how to proceed.

5. Press the appropriate softkey.

   - To export in XML format, press *Hilltop XML*.
   - To export in PDF format, press *PDF*.
   - To return to the previous set of softkeys, press *Return*.

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

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

     Skip to step 6.
   - If a shared directory has not been 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 softkeys 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.

     You can now select additional records to export. Return to step 2.

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*.

NOTE

When exporting to a shared directory, the MAC 800 device logs on to the directory with the user name and password defined on the *Communications Setup* window. If either of those values are incorrect, you will receive an error message. Correct the user name and password on the *Communications Setup* window and repeat the export process.

7. Press *OK*.

   The selected records are exported to the selected destination. 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 softkeys 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.

   You can now select additional records to export. Return to step 2.

PDF File 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_1.0_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 will always be GEMAC800.
1.0	Software version. This will vary depending on the software version installed.
SDS07410016WP	Unit serial number. This will vary from unit to unit.
resting	ECG mode. This will be either *resting* (Resting ECG mode) or *rrana* (RR Analysis mode).

Value	Component/Description
1	Cart ID. This will vary from unit to unit.
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.

9 System Configuration

Introduction

System Configuration provides access to functions that allow you to customize the MAC 800 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 — After making configuration changes, you MUST return to the MAC 800 *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

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

Basic Setup

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

- Institutional identification
- Default physicians
- System settings
- System security
- Time servers

NOTE
Physicians must be added in *User Setup* before they can be picked as default physicians. For more information, refer to "User Setup" on page 9-21.

To reach the *Basic Setup* from the MAC 800 *Main Menu*, press *System Configuration* > *Basic Setup*.

The following table describes 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 device.
Referring Physician	The physician who referred the patient. Defaults on any patient records created on the device.
Attending Physician	The physician who supervised the ECG. Defaults on any patient records created on the device.
Technician	The technician who conducted the ECG. Defaults on any patient records created on the device.
Location	Location ID where the device is located. Defaults on any patient records created on the device.
Site #	Site number where the device is located. Defaults on any patient records created on the device. 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 device.
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 unit is reset.
Page 2	
Power up mode	Determines which screen will appear when the device is powered on. Available options are: ■ *Resting ECG* ■ *Arrhythmia* ■ *Main Menu* *Resting ECG* is the default value.

Field	Comment
Display Colors	Determines the appearance 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. Default is on.
Anti-Aliasing of ECG Waveforms	Determines whether anti-aliasing will be applied to waveforms to reduce distortion caused by the video display. Default is on.
Auto Standby	Determines whether the device will automatically enter 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. Used by the *Auto Standby* field.
Page 3	
High Security Mode	Enables/disables high security mode. It can be activated only if at least one user with *Edit Users* and *Edit Setup* privileges has been 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. Each user will need to be added to *User Setup*. For more information, refer to "User Setup" on page 9-21.
Audit Trail	Determines whether the device will create an audit trail of activity. 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 9-23.
Auto Logoff	Determines whether the device will automatically log the user off after a predefined period of inactivity. See also *Auto Logoff Time*. Available only if *High Security Mode* is enabled.
Auto Logoff Time (1-255 min)	Determines the length of inactivity, in minutes, before the device will log off the user. 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. A LAN option must be activated to set this option.

Field	Comment
Time Server Name	Identifies the server with which the device will synchronize 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 reach the *Resting ECG Setup* from the MAC 800 *Main Menu*, press *System Configuration* > *Resting ECG Setup*.

The following table describes each setting available on the *Resting ECG Setup*.

Field	Comment
Page 1	
Gain [mm/mV]	Sets the magnitude of the ECG signal. Measurement is in millimeter per millivolt and includes the following options. ■ 2.5 ■ 5 ■ 10 ■ 20 ■ 40 ■ 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.
Speed [mm/s]	Changes the speed of rhythm printing and that the wiper bar moves across the display. Measurement is in millimeter per second (mm/s) and includes the following options. ■ 5 (rhythm) / 12.5 (display) ■ 25 ■ 50
Low Pass Filter [Hz]	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 ■ 40 ■ 100 ■ 150 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.

Field	Comment
High Pass Filter [Hz]	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 ■ 0.08 ■ 0.16 ■ 0.31 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.
Line Filter	Enables/disables the line filter defined in Country Setup. Refer to "Country Setup" on page 9-17 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. Default value is *3 leads: 1x3*. Other values depend on which of the previous four fields are set.
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.

Field	Comment
Page 2	
Printer Leads	Identifies the default set of leads used 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" on page 5-12.
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 indicates a yellow or red electrode. ■ Red electrodes Waveforms are previewed when the Hookup Advisor indicates a red electrode. For additional information, refer to "Hookup Advisor" on page 5-12.
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 pressing the ECG hardkey.

Field	Comment
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 9-23. For more information on the reanalysis feature, refer to "ECG Reanalysis" on page 5-9.
QTC Calculation	Determines which formula will be used to correct QT calculations. Options are: ■ Bazett $QTc = QT\sqrt{\frac{HR}{60}}$ ■ Framingham $QTc = QT + 154\left(1 - \frac{60}{HR}\right)$ ■ Fridericia $QTc = QT\sqrt[3]{\frac{HR}{60}}$ 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.

Field	Comment
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.
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* must be enabled ■ *10s ECG Report Format* must be enabled ■ *Print interpretation* must be 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 (2002197-001).
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 configure a custom 12-lead sequence using the following fields. If either 12SL option (ME12 or MI12) is activated, leads I (-I), II (-II), V1, V2, V3, V4, V5, and V6 must be selected 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 will appear. Available only if *SEQ4* is selected for the *Lead Sequence*.

Field	Comment
1–12 Label	Twelve fields that allow you to define the labels that will appear/print for the corresponding leads. Available only if *SEQ4* is selected for the *Lead Sequence*.
1–6 Rhythm Leads	Six fields that allow you to define the rhythm leads and their sequence. You can select the rhythm leads for all four lead sequences.
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 will print. If no format is selected, the report will not print.
Report Copies	Determines how many copies of the selected report will 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 9-23.
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 9-23.
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 will automatically be transmitted to an external device. Available only if one of the communications options is activated. For more information, refer to "Options Setup" on page 9-23.
Delete after Transmission	Determines whether the ECG will be 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 9-23.
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 9-23.

Field	Comment
Page 5	
10s ECG Report Format	Determines how the 10s ECG report will print on an external laser printer. If no format is selected, the report will not print.
Report Copies	Determines how many copies of the 10s ECG report will print 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 will print on the report when it prints on a laser printer.
10s ECG Report Format	Determines how the 10s ECG report will print to a PDF file. If no format is selected, the report will not print.

Arrhythmia Setup

The *Arrhythmia Setup* function allows you to define:

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

To reach the *Arrhythmia Setup* from the MAC 800 *Main Menu*, press *System Configuration* > *Arrhythmia Setup*.

Most of the fields on the *Arrhythmia Setup* windows are the same as those on the *Resting ECG Setup*. The following table lists the arrhythmia settings that are unique or differ from the resting ECG. For all other fields, refer to "Resting ECG Setup" on page 9-5.

Field	Comment
Page 1	
ADS	Enables/disables the *Anti-Drift System*, which helps reduce baseline shift. In Arrhythmia mode, this setting is always available.
Page 2	
Rhythm Printing	Determines whether the rhythm report will start automatically when recording starts.

Field	Comment
Arrhythmia Event Printing	Selects which arrhythmia events will print. Options are: ■ All events ■ Unequal events ■ No event printing
Episodes Printout in Summary Report	Determines how arrhythmia events will 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:

- Basic communication settings
- Shared directory settings
- Destination location settings
- Modem settings (if a modem option is activated)
- LAN settings (if a LAN option is activated)

To reach the *Communication Setup* from the MAC 800 *Main Menu*, press *System Configuration* > *More* > *Communication Setup*.

The following table describes the settings on *Communication Setup*.

Field	Comment
Page 1	
Default Location	Determines which of the four available communication locations will be the default. The locations are defined on page 2 of *Communication Setup*.

Field	Comment
Export XML	Determines whether ECG records will be transmitted as XML. If set, ECG records exported to SD card will be stored in both XML and Hilltop formats. If not set, ECG records exported to SD card will be stored only in Hilltop.
Serial Baud Rate	Determines the speed at which data will be 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*) has been activated. If this field is checked, the following five fields become available.
Share Name	Identifies the name of the shared network drive. It must be the share's name; IP addresses are not supported. Maximum of 256 characters. Available only if the *Allow Export Using Shared Directory* field is checked.
Username	Identifies the user name that the MAC 800 system will use 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. Maximum of 30 characters. Available only if the *Allow Export Using Shared Directory* field is checked.
Password	Identifies the password that the MAC 800 system will use to log on to the shared directory. Numeric only. 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. Available only if the *Allow Export Using Shared Directory* field is checked.
Domain	Identifies the user's domain. Maximum of 30 characters. Available only if the *Allow Export Using Shared Directory* field is checked.
Page 2	
Location	Identifies the name of a communication location that will receive the transmission from the MAC 800 system. Up to four locations can be defined.

Field	Comment
Device	Identifies the type of device to be used to transmit data to the location. Options are: ■ Serial ■ Modem ■ LAN Modem and LAN will be available only if the corresponding option has been activated. This field becomes active only after a corresponding location has been entered.
Phone Number	Identifies the location's phone number. Available only if the selected device is *Modem*.
Protocol	Determines the protocol to be used to communicate with the device. Options are: ■ A5 ■ CSI Select CSI for MUSE connections and A5 for Cardiosoft connections.
Page 3	
Dialing Method	Determines whether the system will use 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, the following three fields need to be completed.
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 will automatically dial. 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 *Dialing Method*, *Dialtone Required*, and *PIN Dialing* fields.

Field	Comment
Page 4	
Cardiograph Device Name	Identifies the name that identifies the MAC 800 unit 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 has been activated.
Serial/IP Redirector Listen Port	Identifies the port the device should listen to 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 MAC 800 device will automatically receive an IP address from the network. If this box is checked and LAN communication to a MUSE system is enabled, the DHCP server must be configured to reserve a static IP address for the MAC 800 unit. 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 MAC 800 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 MAC 800 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 to be used by the MAC 800 device. 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 800 device will automatically obtain a DNS (Domain Name Server) IP address. If this field is checked, the following two fields are display-only. If this field is cleared, you must define the IP address of the DNS servers to use.
Preferred DNS Server	Identifies the IP address of the primary DNS server used to resolve Internet domain names.
Alternate DNS Server	Identifies the IP address of the secondary DNS server used to resolve Internet domain names.

Country Setup

The *Country Setup* function allows you to define:

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

To reach the *Country Setup* from the MAC 800 *Main Menu*, press *System Configuration* > *More* > *Country Setup*.

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

Field	Comments
Language	Determines the language used by the interface and reports.
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 will use a 12-hour or a 24-hour format.
Height/Weight Unit	Determines whether the system will use metric measurements (cm, kg) or English measurements (in, lb) for patient weight and height.
Blood Pressure Unit	Determines whether blood pressure will be 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 will label 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:

- Available and required patient information
- Available test information
- Available clinical trial information
  Only if the *CTDG CT Data Guard* option is activated.
- Magnetic card reader
  For complete information, refer to Appendix C.
- Barcode reader settings
  Only if the *BCRD USB Barcode Reader* option is activated

To access *Patient Setup* from the MAC 800 *Main Menu*, press *System Configuration* > *More* > *Patient Setup*.

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

Field	Comment
Patient Information Setup Window	
Patient ID	Determines whether the patient ID is required. On reports, it will be labelled *ID*.
Secondary ID	Determines whether a secondary patient ID will be available when entering patient data and whether it is required. It can only be required if it is first enabled. On reports, it will be labelled *ID 2*.
Last Name	Determines whether the patient's last name will be 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 will be 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 will be available when entering patient data.
Date of Birth	Determines whether date of birth will be available when entering patient data.
Age	Determines whether age will be available when entering patient data.
Height	Determines whether height will be available when entering patient data.
Weight	Determines whether weight will be available when entering patient data.

Field	Comment
Gender	Determines whether gender will be available when entering patient data.
Race	Determines whether race will be available when entering patient data.
Phone Number	Determines whether phone number will be available when entering patient data.
Pacemaker	Determines whether pacemaker will be available when entering patient data.
Enable Patient ID Check	Determines whether additional checks will be 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	Available only in the *Enable Patient ID Check* field is set. Determines which type of ID will be 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 will verify its format, extract the patient's gender and date of birth, and populate those fields if they have been enabled.
Patient ID Length (3-30)	Defines the maximum length of the patient ID within the range of 3 to 30 characters. Available only if the *Enable Patient ID Check* field is cleared.
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 will be available when entering test information.
Diastolic BP	Determines whether diastolic blood pressure will be available when entering test information.
Location	Determines whether location will be available when entering test information.

Field	Comment
Room	Determines whether room will be available when entering test information.
Order Number	Determines whether order number will be available when entering test information.
Indication	Determines whether indication will be available when entering test information.
Ordering Physician	Determines whether the ordering physician will be available when entering test information.
Referring Physician	Determines whether referring physician will be available when entering test information.
Attending Physician	Determines whether attending physician will be available when entering test information.
Technician	Determines whether technician will be available when entering test information and whether it will be required. It can be required only if it has been enabled.
Medications (0-3)	Determines the number of medications that can be entered into the test information window.
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 will be available when entering clinical trial information.
Visit Type	Determines whether visit type will be available when entering clinical trial information.
Dose Type	Determines whether Dose Type will be available when entering clinical trial information. If this field is set, use the *Dose List...* button to define the types of doses that will available when entering clinical trial information.
Investigator ID	Determines whether investigator ID will be available when entering clinical trial information.
Project Code	Identifies the Project ID that will appear when entering clinical trial information.
Trial ID	Identifies the trial ID that will appear when entering clinical trial information.

Field	Comment
Extra Questions...	Opens the *Extra Questions* window, which allows you to define up to five custom clinical test fields. Each field consists of a *Prompt* and a *Type*. The *Prompt* can be up to 10 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 will be available when entering clinical trial information. Doses are plain text up to 32 alphanumeric characters.
Barcode Scanner or Magnetic Card Reader Setup	
Peripheral Device Selection	Determines whether the unit will be connected to a magnetic card reader, an optional barcode scanner, or no peripheral device at all.
Auto Configure	Automatically configures the barcode reader. When you click this link, you will be prompted to scan a configuration barcode created by the site's IT department. For more information on creating the barcodes, refer to Appendix B. Available only when *Barcode Scanner* is select in *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:

- 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 will use the MAC 800 device must be set up as a user with a user ID, a password, and privileges to be able to log on to the device. For more information on setting system defaults and enabling *High Security Mode*, see "Basic Setup" on page 9-2.

To reach *User Setup* from the MAC 800 *Main Menu*, press *System Configuration* > *More* > *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. Required. 30 alphanumeric characters.
First Name	Identifies the user's given name. Optional. 20 alphanumeric characters.
User ID	Defines a unique ID for the user. If *High Security Mode* is enabled, the user will need to enter this ID to log on to the device. Required. 30 alphanumeric characters.
MUSE ID	Defines the ID with which the user logs onto the MUSE system. Used if reports from this system will be 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 will be checked by default. Multiple roles may be selected, but at least one role must be selected.
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 will be checked by default. Multiple roles may be selected, but at least one role must be selected.
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 will be checked by default. Multiple roles may be selected, but at least one role must be selected.
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 will be checked by default. Multiple roles may be selected, but at least one role must be selected.

Field	Comment
Password	Defines the password the user must enter along with the *User ID* to log on to the device if *High Security Mode* is enabled. Numeric only. Must be between 6 and 30 characters.
Retype Password	Confirms the password was entered correctly.
Edit Setup	Enables/disables the user's ability to edit system setup information.
Edit Date and Time	Enables/disables the user's ability to edit system date and time.
Edit Users	Enables/disables the user's ability to edit user information.
Edit Record	Enables/disables the user's ability to edit ECG records.
Delete Record	Enables/disables the user's ability to delete ECG records.
Transmit Records	Enables/disables the user's ability to transmit ECG records.

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 be used to activate options on the device with that serial number.

All purchased options will be activated when the device ships. However, if you purchase a new option or re-activate an option, use the following instructions.

1. From the *Main Menu*, press *System Configuration* > *More* > *More* > *Options Setup*.
2. Type the 12-digit activation code in the *Option Code* field.

   You can find activation codes for purchased options on the Active Code Summary Sheet provided with the device or with additional purchased options.
3. Press the **Enter** key

   The *Option Activated* message appears at the bottom of the window.
4. Repeat step 2 through step 3 for any additional options to activate.
5. Press the *Save* softkey to save the configuration options.

The following table identifies the available options. You will be 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. 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 Cardiosoft
LANM	2037986-007	LAN Communication to MUSE
MODC	2037986-008	Modem or serial communication to Cardiosoft
MODM	2037986-009	Modem or serial communication to MUSE
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

Service Setup

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

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

See the *MAC 800 Service Manual* for details.

Date/Time Setup

The *Date/Time Setup* function allows you to configure the MAC 800 system's date and time settings.

To reach *Date/Time Setup* from the MAC 800 *Main Menu*, press *System Configuration* > *More* > *More* > *More* > *Date/Time Setup*.

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

Field	Comment
Date	Sets the current system date. The format depends on the date format selected on *Country Setup*. See "Country Setup" on page 9-17.
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 will be overwritten during the next synchronization. For more information, refer to "Basic Setup" on page 9-2.
Time Zone	Identifies the time zone in which the device is located. Available only if *Automatically synchronize with Time Server* is enabled in Basic Setup. See "Basic Setup" on page 9-2.
Adjust clock for daylight savings time	Determines whether the system will automatically adjust the system time for daylight savings time. Available only if *Automatically synchronize with Time Server* is enabled in Basic Setup. Refer to "Basic Setup" on page 9-2 for more information.

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 MAC 800 devices are configured identically or to reference if you need to reconfigure a device.

Use the following instructions to print a setup report.

1. From the *Main Menu*, press *System Configuration* > *More* > *Print Setup Report*.
2. On the *Print Setup Report* window, select which report to print.

- *Basic Setup*
- *Resting Setup*
- *RR Analysis Setup*
- *Arrhythmia Setup*
- *Communication Setup*
- *Country Setup*
- *Patient Setup*
- *User Setup*
- *Options Setup*
- *Complete Setup*

3. When you are done, press the *Return* softkey to go to the *Main Menu*.

Select Setup

The *Select Setup* utility allows you to save up to five system configurations and switch between them. This is useful if the device 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 *System Configuration* > *More* > *More* > *Select Setup*.

   The *Select Setup* window opens. The name of the setup currently being used by the system appears in the *Loaded Setup* field.

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

   a. Press the *Save As* softkey.

      The *Setup Name* window opens.

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

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

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

   a. Select the setup to load.

   b. Press the *Load Setup* softkey.

   c. Reboot the unit.

      The unit must be powered off and on for all setup changes to take effect, especially if the new setup includes a change to the language setting: language will not change until the unit reboots.

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

   a. Select the file to delete.

   b. Press the *Delete* softkey.

      You are prompted to confirm the deletion.

   c. Press *OK*.

   NOTE
   You cannot delete a configuration that is currently loaded.

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

   a. Select the setup file to change.

   b. Press the *Edit Name* softkey.

      The *Setup Name* window opens.

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

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

   a. Select the setup file to reset.

b. Press the *Factory Defaults*. softkey

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

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

Export Setup

The *Export Setup* utility allows you to export saved settings from the MAC 800 system to an SD card. This SD card can then be used to import the settings to another MAC 800 system, greatly simplifying the installation and configuration of multiple MAC 800 systems.

1. Insert the SD card.
2. From the *Main Menu*, press *System Configuration* > *More* > *More* > *Export Setup*.

   The *Select Setup for Export* window opens. All saved settings on the device are listed in the left column. All saved settings on the SD card are listed in the right column.
3. In the left pane, select the setup file to be exported.
4. Press the *Export* softkey.

   The selected file is copied to the SD card and appears in the right column.
5. Repeat step 3 through step 4 for each saved configuration file to be exported.
6. When you are done, press the *Return* softkey.

Import Setup

The *Import Setup* utility allows to import up to five system setup files from another MAC 800 system 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 *System Configuration* > *More* > *More* > *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 to be imported.
4. Press the *Import* softkey.

   The selected file is copied to the device and appears in the left column.

5. Repeat step 3 through step 4 for each saved configuration file to be imported.
6. When you are done, press the *Return* softkey.

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 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 will be named *audittrail_0.log*; subsequent files are incremented by 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 800 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 will consume storage space and reduce the number of ECGs that can be stored on the device

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

- *High Security Mode* must be enabled.
  See "Basic Setup" on page 9-2.
- *Audit Trail* must be enabled.
  See "Basic Setup" on page 9-2.
- The user must have the *Edit Setup* and *Delete Records* permissions set.
  See "User Setup" on page 9-21.

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

1. Insert an SD card into the MAC 800 unit.
2. From the *Main Menu*, press *System Configuration* > *More* > *More* > *More* > *Export Audit*.

   When the audit trail has been copied to the SD card and cleared from the system, a message will appear to notify you the transfer was successful.

After the XML file has been 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 (PN 2025762-163).

10 Maintenance

Introduction

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:

- MAC 800 device
- Cables and leadwires
- Paper
- Battery
- Supplies and accessories

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

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

MAC 800 Maintenance

The MAC 800 ECG Analysis System is designed to require little more than regular inspection and cleaning to function properly. Any additional maintenance should be performed by qualified GE service personnel.

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 system, 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 MAC 800 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 (2)
- 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 MAC 800 Surfaces

Use the following procedure to clean the surfaces of the MAC 800 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 MAC 800 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.

Cable and Leadwire Maintenance

Proper care and maintenance of the cables and leadwires used by the MAC 800 ECG Analysis System consists of:

- Cleaning the cables and leadwires,
- Storing the cables and leadwires, and
- Replacing the cables and leadwires.

NOTE
The information in this section applies to the Multi-Link acquisition cable and leadwires.

Sanitizing Cables and Leadwires

Cables and leadwires come into contact with patients and, therefore, should be cleaned and disinfected after every use. If necessary, they can also be sterilized.

Before cleaning and disinfecting the cables and leadwires, you need to know:

- What cleaning materials can be used
- What disinfectants can be used
- What cleaning materials should be avoided

Cleaning Materials to Use

Use the following materials to clean the cables and leadwires:

- Mild dishwashing detergent
- Clean, soft cloth (2)
- Water

Disinfectant to Use

In accordance with the APIC Guidelines for Selection and Use of Disinfectants (1996), use sodium hypochlorite (5.2% household bleach) to disinfect the cables and leadwires.

Sodium hypochlorite can be in the form of a liquid or a wipe as long as it falls within the following range:

- Minimum dilution of 1:500 (minimum of 100 ppm free chlorine)
- Maximum dilution of 1:10

Cleaning Materials To Avoid

DO NOT use the following materials to clean the cables or leadwires:

- Sani-Cloth® Wipes
- Ascepti® Wipes
- HB Quat®
- Clorox® Wipes
- Over-the-counter detergents (Fantastic®, Tilex®, etc.).
- Conductive solutions
- Solutions or products that contain any of the following:
  - Abrasive cleaners or solvents
  - Acetone
  - Alcohol-based cleaning agents
  - Ammonium Chloride
  - Betadine
  - Chlorides, wax, or wax compounds
  - Ketone
  - Sodium salts

Use of these materials or materials that contain similar active ingredients and solutions could result in:

- Product discoloration,
- Metal part corrosion,
- Brittle wires and connectors,
- Reduced product life,
- Unit malfunction, and
- Void warranty.

Cautions

Observe the following cautions when cleaning cables and leadwires:

- Never immerse cables or leadwires in any liquid.
- Never pour or spray any liquid directly onto cables or leadwires
- Never permit fluid to seep into connections or openings.
- Never autoclave or steam clean cables or leadwires.
- Always wipe gently to avoid pulling long wires from the connectors.
- Always remove cables and leadwires from the device before cleaning.

Failure to observe these cautions could result in damage to the contact metal ends, thereby affecting signal quality.

Cleaning Cables and Leadwires

Use the following procedure to clean the cables and leadwires.

NOTE
Cleaning removes dirt and marks but does not disinfect.

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 exterior of the cables and leadwires with the damp cloth.
4. Repeat step 2 and step 3 as necessary until adequately cleaned.
5. Wipe with a dry, clean cloth or paper towel and let air dry.

Disinfecting Cables and Leadwires

Use the following procedure to disinfect the cables and leadwires.

NOTE
Clean and dry the cables and leadwires before disinfecting them.

1. Use a lint-free cloth or wipe with a solution of Sodium Hypochloride.
2. Wring excess liquid from the cloth.
3. Gently wipe the cabling.
4. Wipe off the disinfectant with a clean, lightly moistened cloth.

   NOTE
   If fluid pools around the connectors, blot dry with a soft, lint-free cloth.

5. Wipe with a dry, lint-free cloth and let air dry for at least 30 minutes.

   NOTE
   Drying times vary based on the environmental conditions.

   DO NOT use excessive drying techniques, such as ovens, forced heat, or sun drying.

Sterilizing Cables and Leadwires

Although NOT RECOMMENDED, cables and leadwires can be sterilized with ethylene oxide gas (EtO) at a maximum temperature of 50° C (122° F). Follow the instructions provided by the sterilizer manufacturer.

NOTE
Frequent sterilization reduces the useful life of cables and leadwires.

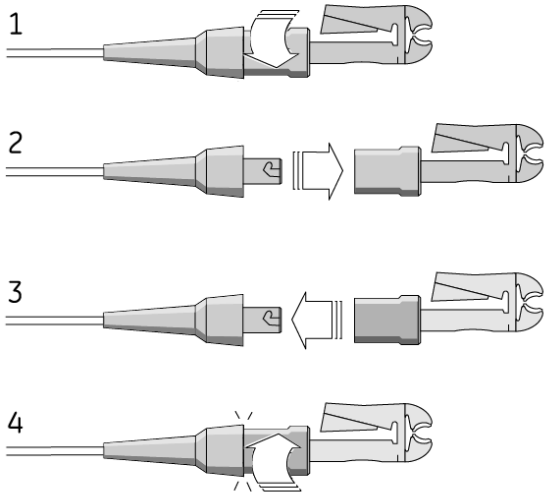
Storing Cables and Leadwires

To ensure that the cables and leadwires are in proper working order, use the following guidelines to store them between use:

- Store in a dry, well-ventilated area.
- Hang cables and leadwires vertically.
- Do not coil cables or leadwires around the device.

Replacing Leadwire Adapters

Although proper cleaning and storage prolong the life of leadwires, you will eventually need to replace the leadwire adapters. The following illustration shows the proper method for replacing adapters.



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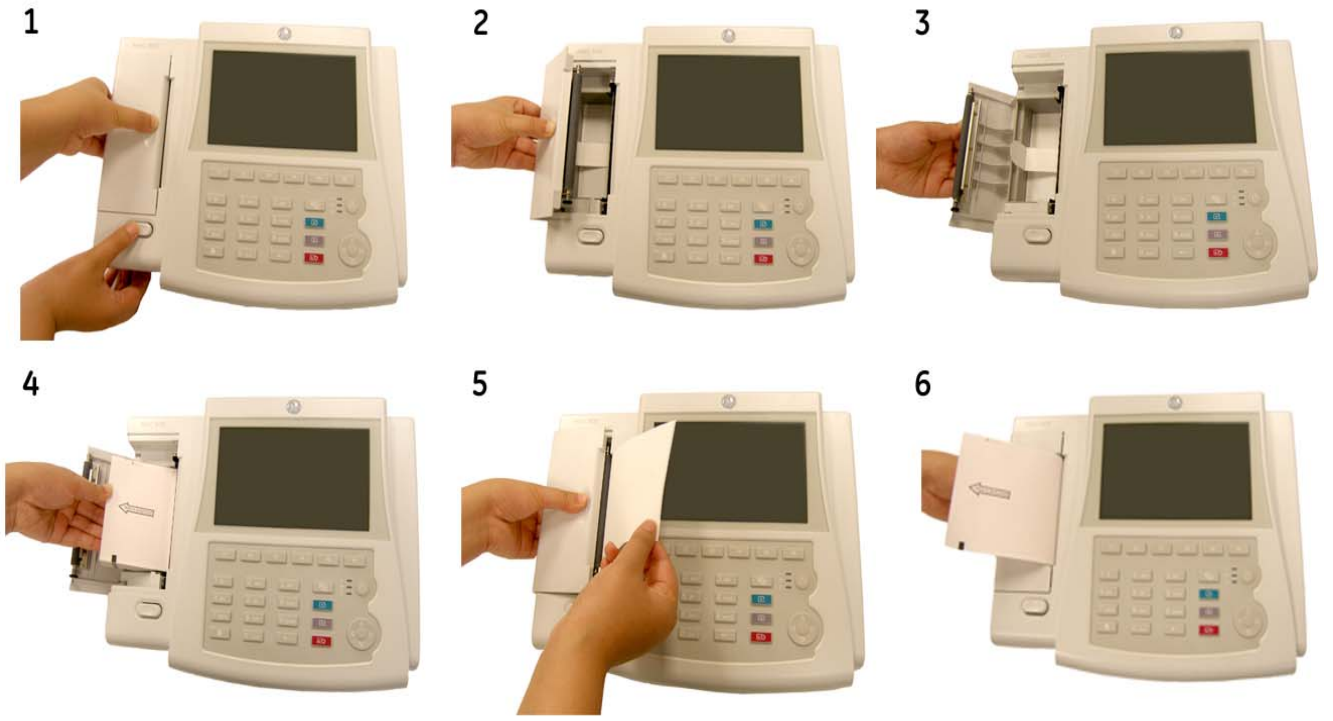
Paper Maintenance

For the proper handling of the MAC 800 thermal writer, you need to know how to:

- Replace paper
- Store thermal paper

Replacing Paper

Use the following procedure to replace the paper in the MAC 800 thermal writer.



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1. Press the paper tray release button and lift the writer door.
2. Open the writer door fully.
3. Make sure the paper lift tab is pulled forward.
4. Place the pad of paper into the paper compartment on top of the paper lift tab.
5. Fold out the first sheet of the pad to the right and close the door, taking care to position the paper on the positioning mark on the top cover.
6. Press the writer door firmly until it latches.

Storing Thermal Paper

To avoid deterioration or fading of thermal paper and ensure maximum image life, follow these precautions:

- Store thermal paper separately in manila folders or polyester/ polyimide protectors.
- Keep the paper cool and dry.

  Temperature must be below 86°F (30°C). Relative humidity must be <65%.
- Avoid exposure to bright light or ultraviolet sources.

  Sunlight, fluorescent lights, and similar lighting cause yellowing of paper and fading of tracings.
- Avoid contact with cleaning fluids and solvents, such as alcohols, ketones, esters, ether, and so on.
- Do not use mounting forms, pressure-sensitive tapes, and labels that use solvent-based adhesives.

  Use only products with starch- or water-based adhesives.
- Keep the paper separate from the following:
  - carbon and carbonless forms
  - non-thermal chart papers
  - any products containing tributyl phosphate, dibutyl phthalate, or any other organic solvents (often contained in medical and industrial charts)
  - document protectors, envelopes, or sheet separators made of polystyrene, polypropylene, polyethylene, polyvinyl chloride, or other vinyl chlorides

Battery Maintenance

The MAC 800 ECG Analysis System 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 will discharge 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 2-2 and "System Errors" on page A-6). When the gauge flashes amber, connect the MAC 800 system to AC power to charge the battery to full capacity.

As the battery ages, the full charge capacity of the battery will degrade and be 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 will need to replace the battery.

Battery Safety

Observe the following warnings whenever handling the MAC 800 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.

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

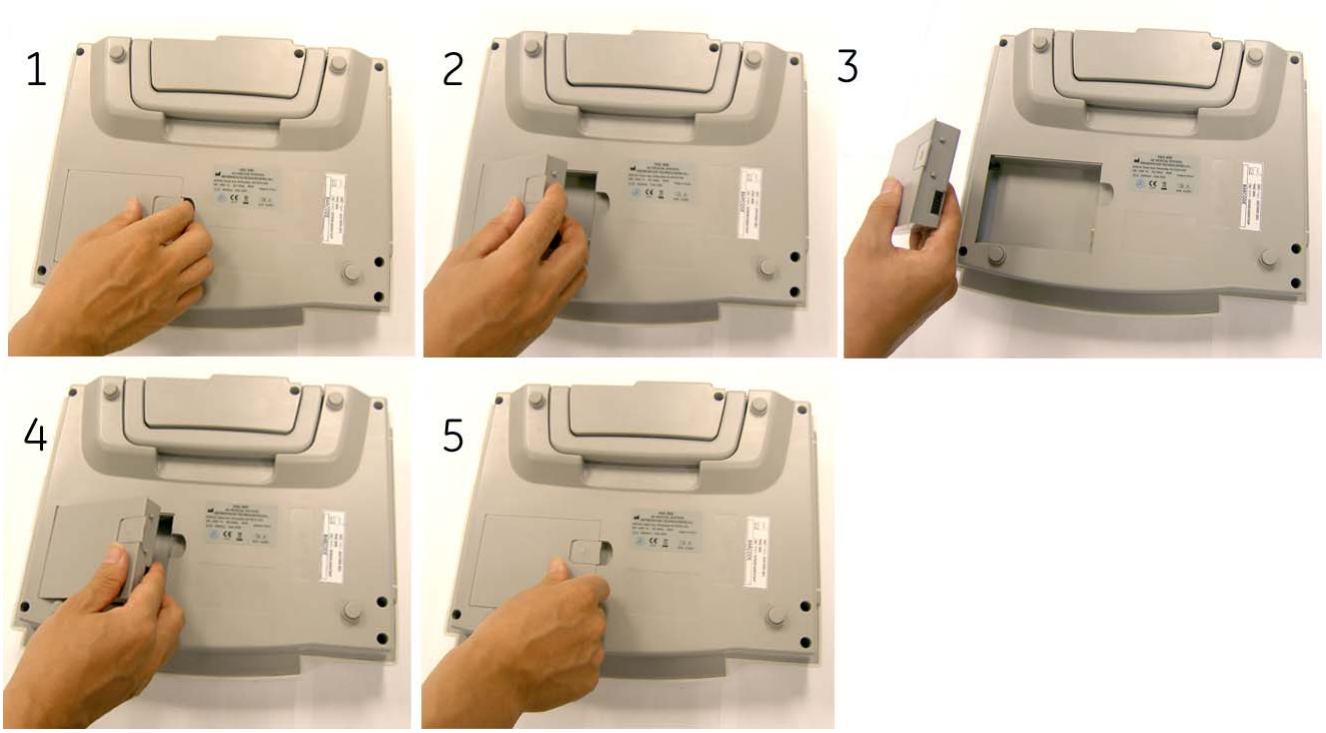
If the liquid comes in contact with eyes, skin, or clothing, flush with clean water and seek medical attention.

WARNING
BATTERY PACK DISPOSAL — 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 MAC 800 device for an adequate length of time, use the following instructions to replace the battery.



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Conditioning the MAC 800 Battery Pack

To maintain the storage capacity of the battery installed in the MAC 800 unit, GE 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 MAC 800 battery.

1. Insert the battery into a MAC 800 unit that is not being used to record patient tests.

   For details, refer to “Replacing the Battery” on page 10-10.

2. Disconnect the AC mains power from the MAC 800 unit.
3. Enter the *Battery Status Service Diagnostic* window.

   For details on how to access the *Battery Status Service Diagnostic* window, refer to the *MAC 800 Resting ECG Analysis System Service Manual*.

4. Allow the battery to discharge until its *Charge Level* is less than 90%.
5. Turn off the unit and reconnect the AC mains power.
6. Allow the battery to fully charge.

   The **Battery LED** will be solid amber while it is charging and turn off when charging is complete.

7. Remove the AC mains power and turn on the MAC 800 unit.
8. Allow the battery to discharge until MAC 800 unit shuts down.
9. Reconnect the AC mains power to the MAC 800 unit and leave the unit 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 MAC 800 ECG Analysis System, refer to the *MAC 800 ECG Analysis System Service Manual* (2031504-159).

A Troubleshooting

General Troubleshooting Tips

The following general troubleshooting tips can be used 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 10-3.
- Verify the equipment has not been modified.

  Unauthorized modifications to the equipment may cause unexpected results, poor performance, or system failure.

  If the equipment has had unauthorized modifications, contact GE Technical Support.
- Verify the software has not been 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 have been 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 section for specific problems and solutions. If the problem still cannot be resolved, contact GE Technical Support.

Equipment Problems

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

System Will Not Power Up

If the system will not power up, do the following:

- Verify the unit is turned on.

  If it is not, turn the unit on. Refer to "Turning on the System" on page 2-12 for instructions.
- Verify the battery is installed and charged.

  Refer to "System Errors" on page A-6 for instructions on verifying whether the battery is installed and charged.

  Refer to "Replacing the Battery" on page 10-10 for instructions on installing the battery.
- Verify the unit is connected to an AC power outlet.

  Refer to "Connecting the AC Power Adapter" on page 2-9 for instructions.
- Verify the equipment is receiving power from the outlet.

  If the unit is receiving power, the Power LED will be 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 *Hookup Advisor* to help determine the cause of the noise.

  For more information, refer to "Hookup Advisor" on page 5-12
- Verify the electrodes are placed properly.

  Refer to "Applying Electrodes" on page 3-3 for information on proper electrode placement.
- Verify the electrodes have been applied correctly.

  Perspiration, excessive hair, lotions, and dead skin cells must be removed from the electrode site.

  Refer to "Prepare the Patient's Skin" on page 3-2 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 2-10.
- Consider using filters and *ADS* to help eliminate or reduce ECG noise.

  For more information, refer to "ECG Options" on page 5-4 or "Arrhythmia Options" on page 6-3.

ACI-TIPI Statement is Not Included on Report

If the ACI-TIPI statement does not appear 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 9-23.
- Verify ACI-TIPI is enabled on the ECG.

  For information, refer to "Resting ECG Setup" on page 9-5.
- Verify the ACI-TIPI required information was entered.

  The ACI-TIPI statement will print 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 will 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 MAC 800 device will not generate an ACI-TIPI statement; it will print 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 "Replacing Paper" on page 10-8.

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 back of unit.

  For details, refer to "Back View" on page 2-3.
- Verify the SD card is seated firmly.

  The SD card will click into place when seated firmly.
- Verify the SD card is formatted for FAT or FAT16 file systems.

  To verify an SD card is formatted for FAT or FAT16 file systems, do the following:

  1. Insert the card into an SD card reader attached to a PC.
  2. Copy any files to keep from the SD card to a folder on the PC.
  3. Using the Windows *Format* command, specify either FAT or FAT16 as the file system and format the card.

     NOTE

     Formatting the SD card will erase 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 has been activated.

  The MAC 800 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 9-23.
- Verify the modem is connected to an analog telephone line using a standard RJ11 phone jack.

  For more information, refer to "Back View" on page 2-3.
- Check *Communications Setup* to:
  - Verify the correct modem type is selected.
  - Verify the correct dialing method is selected and configured accurately.

  For details, refer to "Communication Setup" on page 9-13.
- If transmitting records, check the selected location to:
  - Verify *Modem* is the selected device.
  - Verify the *Phone Number* is correct.
  - Verify the correct *Protocol* is selected.

  For details, refer to "Communication Setup" on page 9-13.

Cannot Export to Shared Directories

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

- Verify the LANC communication option has been activated.

  Refer to "Options Setup" on page 9-23 for information on activating options.
- Verify connectivity by doing the following:
  - Verify that the network cables are connected.
  - Verify the IP, netmask, gateway, and DNS server addresses are all correct.

    Refer to "Communication Setup" on page 9-13 for instructions on setting these values.
  - Ping the MAC 800 unit 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 9-13 for information on the logon 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 Windows online help for instructions on how to set user permissions.

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 displays	The battery is installed incorrectly, or the batter 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 writer door is open message displays	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 unit.
Lead disconnected message displays	One or more electrodes is disconnected.	Reconnect the electrodes.
MODEM ERROR: The remote device is not responding. Would you like to retry?	Modem is not connected.	Connect the modem and retry, or move 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

Introduction

The barcode reader can read any of the following symbologies:

- Code 39
- Code 39EX
- Code 128
- PDF-417
- Interleaved Code 2 of 5
- Data Matrix

Regardless of which symbology is used, the site's IT department must:

- 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 MAC 800 system is communicating with a MUSE system, the length of the patient ID should also be the same as that used by the MUSE system.
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 MAC 800 *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 9-18.

Configuring the Barcode Reader Manually

To configure the barcode reader manually, you will need to enter the following information on the MAC 800 *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

The barcode reader can be configured automatically by scanning a bar code 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 you want the following information in the barcode.

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

This information would be set up as follows:

9999999999666666666666665555555555F

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

Introduction

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.

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

NOTE

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

Understanding the Data Header

Before configuring the MAC 800 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 it reads the records. 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 will appear 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 MAC 800 *Patient Setup* window (see "Patient Setup" on page 9-18). To configure the card reader for the example in the introduction, you would 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	2
Day of birth	30	2
Gender	38	1
		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; add a length of one for the data header and the Total Bytes is 39.

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