GE Healthcare

MAC™ 600

Resting ECG Analysis System

Operator's Manual

Software Version 1.0
2047426-001 Revision K

MAC 600 Resting ECG Analysis System
English

Publication Information

The information in this document applies only to MAC™ 600 Resting ECG Analysis System Version 1.0. It does not apply to earlier product versions. Due to continuing product innovation, specifications in this document are subject to change without notice.

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MAC ECG Carts

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Printing the Wrong ECG for a Patient

Computerized electrocardiographs can print ECGs that have been previously acquired. Consequently, if ECGs are consecutively acquired without any patient information, the probability of inadvertently printing a previously acquired ECG and using it as if it is the patient's current ECG is increased.

To avoid the problem, acquire ECGs using the steps outlined in this document. Always check the date/time stamped on the report to see if it matches the date/time when you acquired the ECG.

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Pay Attention to Acquisition Date and Time

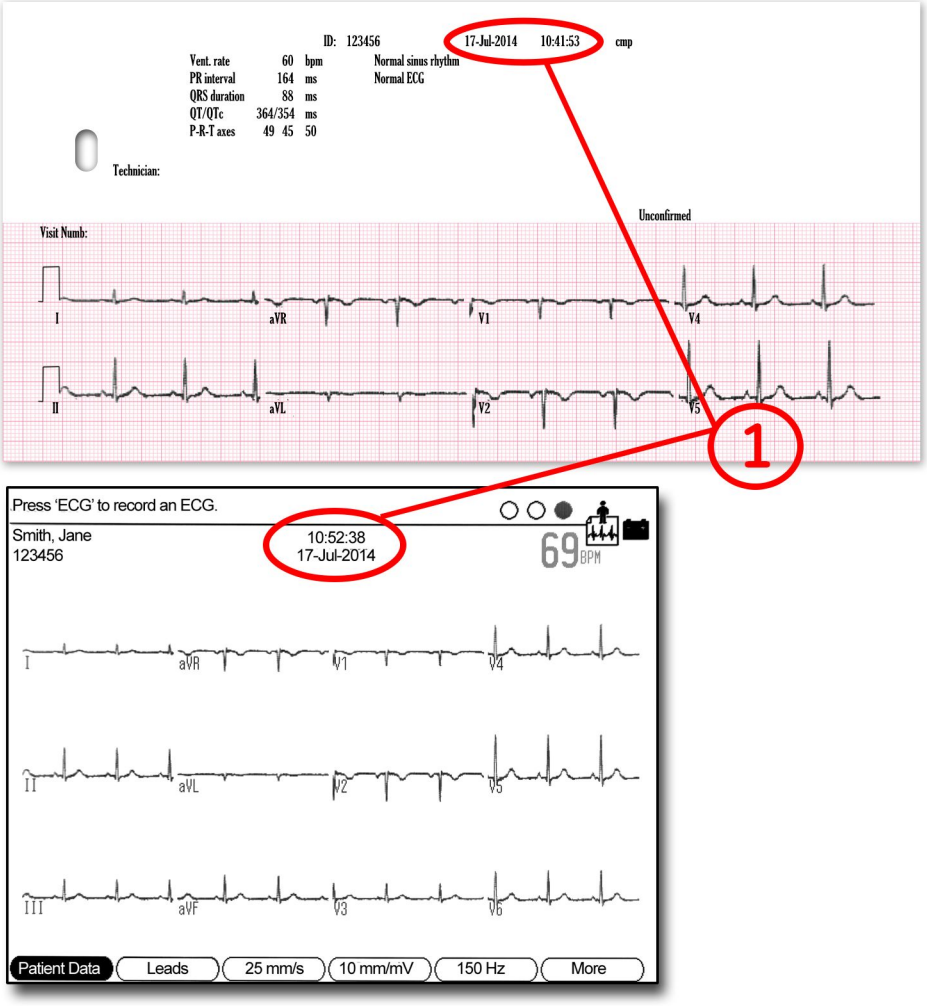
Every printed report contains the date and time when the ECG was acquired. This is for several reasons:

- If there is no patient identification information on the report, it serves as the only unique identifier for that report.
- If multiple ECGs are acquired for a patient, the date/time is used to sort the set of serial ECGs so a physician can make sense of the ECG changes necessary for identifying specific conditions.[1]
- To properly assess a patient and interpret their ECG, it is important to know when the ECG was taken in relation to the patient's symptoms and/or treatment. [1, 2, 3]
- Acquiring a timely ECG has been found to be the most important factor in reducing time-to-treatment for emergency cardiac catheterization lab procedures.[4, 5, 6, 7] Therefore, the date and time of an ECG is a required metric for European data registries used to evaluate and improve time-to-treatment.[8, 9, 10, 11]

As a result, GE Healthcare prints the acquisition date/time on every report and this practice has been adopted as a safety and performance requirement for computerized electrocardiographs in Europe.[12]

How To Check Date And Time Of ECG Acquisition

Before delivering an ECG report that you acquired, always confirm that the date and time stamped on the report matches the current date and time displayed on the electrocardiograph. See the following example:


ID: 123456
17-Jul-2014 10:41:53
cmp
Vent. rate 60 bpm
PR interval 164 ms
QRS duration 88 ms
QT/QTc 364/354 ms
P-R-T axes 49 45 50
Normal sinus rhythm
Normal ECG
Technician:
Unconfirmed
Visit Numb:
I
aVR
V1
V4
II
aVL
V2
V5
1
Press 'ECG' to record an ECG.
Smith, Jane
123456
10:52:38
17-Jul-2014
69 BPM
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
Patient Data
Leads
25 mm/s
10 mm/mV
150 Hz
More

Item	Description
1	Time/Date stamped on printed report should match the time and date that you acquired the ECG.

Steps for Acquiring an ECG

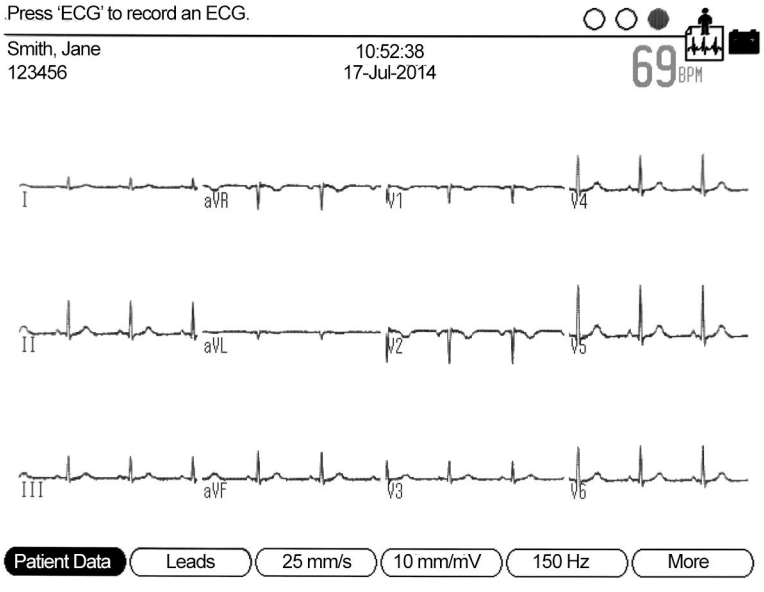
There are many educational materials available that describe proper skin preparation, lead placement, and so on, to obtain a quality ECG recording. Instead of reiterating these, this document focuses on the interaction between the user and the computerized electrocardiograph to eliminate the possibility that a previously acquired ECG could be mistakenly printed and used as if it is the patient's current ECG.

1. **Turn The Device On And Connect The Patient**

   The following diagram represents the layout of the screen when the device is turned on. As each lead-wire is attached to the patient, the ECG signal for that lead is updated on the display in real-time.

   The overall purpose of this display is to help the user determine whether the quality of the ECG signal is adequate for obtaining a 12-lead ECG record that can be printed, transmitted and/or stored. The user can select specific ECG leads for closer inspection while applying different gain or filter settings. Since it takes some time for the skin/electrode interface to

settle before a quality ECG can be obtained, it is customary during this phase of the test to enter patient information.



The bottom of the screen has labels that indicate the current function of the soft keys located directly underneath the display. Some devices have fewer soft keys or dedicated hard keys for these functions.[1]

2. **Enter Patient Identification**

When possible, enter patient identification information. Regulatory bodies have already identified that a leading cause of medical errors is the lack of patient identification information on clinical reports. Since computerized electrocardiographs can store and print previously acquired ECGs, there is a possibility that a printed report can be associated with the wrong patient. Sometimes, there are situations when patient information cannot be entered, such as during an emergency. However, if ECGs are routinely acquired without any patient information, the probability of inadvertently printing a previously acquired ECG and mistakenly using it as if it is the patient's current ECG is increased.

It is possible to configure some GE Healthcare electrocardiographs to require some form of patient identification to be entered before an ECG is acquired. However, if a user does not want to ever enter any patient information, then the aforementioned configuration will be rendered useless and turned off.

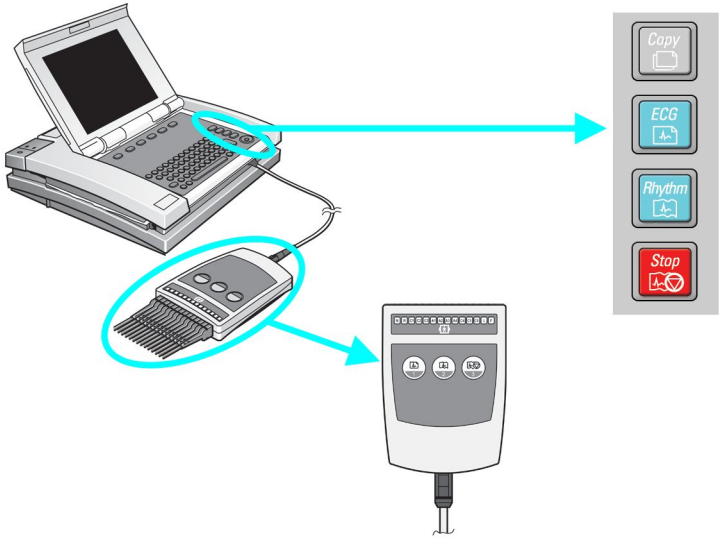
Options to consider: Bar code scanner or other automated approach

If your clinical environment uses bar codes, some GE Healthcare electrocardiographs can be optionally configured with a bar code scanner. This makes it very easy to enter accurate patient demographics from the patient's wrist band or a printed label. In a matter of seconds, an ECG record can be uniquely identified and associated with the correct patient information without any typographical errors. GE Healthcare devices can also support card readers or other sophisticated solutions, such as automatically interfacing with systems that provide patient information.

1. The MAC 1200 has no soft keys. All functions are supported via hard keys. For example, patient information is selected via a dedicated hard key. MAC 600, MAC 800 have 4 soft keys. MAC 1600, MAC 2000, MAC 3500, MAC 5000, MAC 5500, and MAC 5500 HD have 6 soft keys as shown in step 1.

3. **Press The Hard Key To Acquire An ECG**

To acquire a 12-lead ECG record, press the hard key of the electrocardiograph dedicated for this purpose.[2] On some device models, the patient cable also has a hard key for acquiring an ECG.

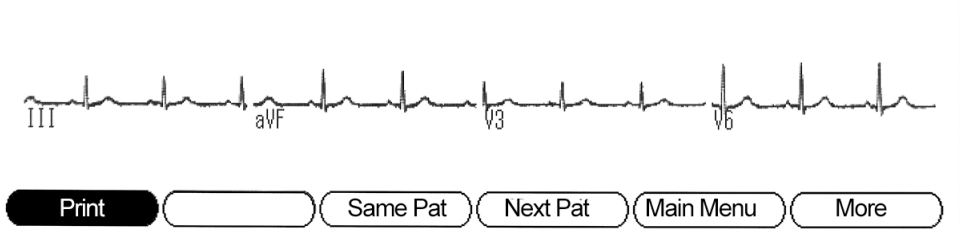


If you press the hard key again, another ECG will be acquired with a later time stamp of acquisition.

2. On the MAC 1200, the hard key is green and labeled "start". For the other MAC carts, they hard key is labeled "ECG".

4. **Print / Copy Keys Now Enabled**

   At this point, the screen menu will display as follows.[3]



   This is the only point in the workflow when the print/copy keys are active. The purpose of the print/copy keys is to allow you to inspect the ECG report on the display before printing it or, if necessary, generate extra copies.

   During this step, if you press the hard key to record an ECG, it will acquire another ECG using the same demographics. But even more importantly, this freshly acquired ECG will replace the prior one that was waiting to be printed with the print/copy keys.

5. **Select Any Other Soft Key - Print/Copy Keys Become Disabled**

   If "Same Pat" or "Next Pat" is selected, the device will return to step 1 with the patient demographics appropriately retained or cleared.[4]

6. **When You Are Finished**

   Turn the device off.[5] Or, if it is preferable to leave the device on, put it back to the "Main Menu" or select "Next Pat". Do not leave the device in a state where it is in the process of acquiring

3. Some devices can be configured to have a print preview screen. In this case, the screen is no longer showing real-time waveforms. Instead, the report that has just been acquired is displayed. If you want to accept that report, you select "continue" and then the next screen that is displayed shown in step 4.
4. On the MAC 1200, if the hard key "Pat Info" is pressed, the hard "Copy" key will be disabled.
5. Some devices can be configured to automatically turn off.

an ECG report for a patient. Remember, the next person may have less training than you do. So please leave the device in a state that is ready to start a new test.

What You Should Do:

Any of the following actions will prevent the occurrence of printing the wrong ECG for a patient:

- Pushing the ECG button to record an ECG, or
- Pushing “Next Patient”, “Same Patient”, or “Main Menu” after ECG test is complete, or
- Turning the device off between use, or
- Entering patient information for each patient.
- Always check the date / time of acquisition to see if it matches the time that you acquired the ECG.

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Publication Information

Revision History

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

Revision	Date	Description
A	29 August 2016	Internal release.
B	2 December 2016	Initial customer release.

To access other GE Healthcare Diagnostic Cardiology documents, go to the Common Documentation Library (CDL), located at www.gehealthcare.com/documents, and click ***Cardiology***.

Additional Assistance

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

Contact your local GE Healthcare representative to request additional assistance.

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

Date of first CE mark — 2010.

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

Revision	Date	History
A	01 October 2009	Initial release of manual
B	14 October 2009	Revised per feedback from validation
C	28 June 2011	Revised Intended Use statement. Added CardioSoft configuration. Updated Serial Transmission.
D	15 July 2013	Updated the TUV symbol, the product label, and the Back View photo.
E	7 July 2016	Added warning and symbols. Updated back view image of product.
F	28 June 2017	Removed cleaning procedures for patient cables, leadwires, and electrodes.
G	13 July 2017	Updated images of Back View in Equipment Overview and in Connecting the ACDC Power Adapter in Maintenance.
H	15 February 2019	Updated Certification Information.

J	11 November 2021	Updated graphics on page 35, 36 and 45. Added "Cleaning Materials to Use" and "Cleaning Materials to Avoid" sections in Appendix A.
K	01 April 2022	Updated Certification Information. Added "Ordering Optional Accessories" Added "Note in ECG Options – After Acquiring an ECG Updated Deleting Stored ECGs Updated Using SD (Secured Data) Card Updated Accessing the Setup Function Updated System Password information in Miscellaneous Setup Added Change Password Added Reset Password Updated Storage Format Information in Storage. Added Security Information

To access other GE Healthcare Diagnostic Cardiology documents, go to the Common Documentation Library (CDL), located at www.gehealthcare.com/documents, and click **Cardiology**.

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

This document describes the MAC 600 Resting ECG Analysis System, also referred to as the " product", "system", or "device". This document is intended to be used by qualified medical personnel who have received proper medical and product training, and those who use, maintain, and/or troubleshoot the MAC 600 system.

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

To see available training, go to the GE Healthcare training website (www.gehealthcare.com/training). Select Education>Product

Education-Technical> Diagnostic Cardiology.

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

Contents

1 Introduction

2 Equipment Overview

6 System Setup

1

Introduction

Manual Information

Purpose

This manual contains information necessary for safe and effective operation of the MAC™ 600 ECG Analysis System.

Intended Audience

This manual is intended for qualified medical personnel who have received proper medical and product training, and those who use, maintain, and/or troubleshoot the MAC 600 system. Product training may be completed by reviewing and understanding the contents of this manual.

The person using the MAC 600 system is expected to have a working knowledge of appropriate medical procedures, practices, and terminology used in the treatment of patients.

Indications for Use

The MAC 600 Resting ECG Analysis System is intended to acquire, analyze, display, and record electrocardiographic information for adult and pediatric populations.

The basic systems deliver 3 or 12 lead ECGs, and can be upgraded to provide software analysis options, such as interpretive analysis of the electrocardiogram.

Transmission of ECG data to a central ECG cardiovascular information system is optional.

The MAC 600 is intended to be used by trained operators in a hospital or medical professional's facility environment as well as used in clinics, physician offices, outreach centers or wherever ECG testing is performed to record ECG signals from surface electrodes.

Contraindications

The MAC 600 device is NOT intended:

- to be used as a vital signs physiological monitor
- to be used during patient transport
- to be used for intra-cardiac applications
- to be used with high frequency surgical units

Clinical Benefits

The clinical benefits of the MAC 600 Resting ECG Analysis System include: analysis of ECG data (QRS Complex) for diagnostic interpretation by the clinician/physician to assist with clinical decision making in the care of patients with heart disease. These clinical benefits follow the devices' intended uses and indications for use.

Product Reference

The product described in this manual is the MAC 600 Resting ECG Analysis System. It will be referred to as the “MAC 600”, “the system”, or “the device” throughout this document.

Illustrations

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.

Blank Pages

The blank pages at the end of a chapter are left blank intentionally. You may use them for notes or ignore them.

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. Familiarize yourself with their 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 Hazard Messages

This section lists the warnings that are applicable to the MAC 600 Resting ECG Analysis System.

WARNING:

ACCIDENTAL SPILLS If liquids have entered a device, switch off the device and inform Service.

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

WARNING:
MATERIAL INGRESS If materials have entered a device, switch off the device and inform your service representative.

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

WARNING:
BATTERY OPERATION If the integrity of the functional earth conductor is in doubt, operate the unit from its battery.

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

WARNING:
CONNECTION TO MAINS The mains plug must be connected to an appropriate power supply.

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

WARNING:
ELECTODE CABLES Electrode cables should not be connected to an AC power outlet.

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

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 symbols with paddles are protected against damage resulting from defibrillation voltages.

To ensure proper defibrillator protection, use only the recommended cables and leadwires.

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

WARNING:
ELECTRODES Polarizing electrodes (stainless steel or silver constructed) may cause the electrodes to retain a residual charge after defibrillation.

A residual charge will block acquisition of the ECG signal.

WARNING:
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.

WARNING:
SITE REQUIREMENTS Do not route cables in a way that they may present a stumbling hazard.

For safety reasons, all connectors for patient cables and leadwires are designed to prevent inadvertent disconnection, should someone pull on them. For devices installed above the patient, adequate precautions must be taken to prevent them from dropping on the patient.

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

WARNING:
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.

WARNING:
ELECTRIC SHOCK To reduce the risk of electric shock, do NOT remove the front or back cover. Do not try to open external ACDC power supply.

Refer servicing to qualified personnel.

WARNING:
ELECTRIC SHOCK Improper connection of this equipment may cause electric shock.

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

WARNING:
LOW BATTERY SHUT DOWN If the battery is not charged for a long enough period of time, or after multiple attempts to power on following a low-battery shut down, charge the battery for a minimum of half an hour before using the device. It is recommended that you keep the unit charged to avoid a low-battery shut down.

The battery supplied with the system has a shelf life of six months.

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

WARNING:
ACCESSORIES (SUPPLIES) To ensure patient safety, use only parts and accessories manufactured or recommended by GE Medical Systems *Information Technologies*.

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.

WARNING:
SERVICEABLE PARTS This equipment contains no user serviceable parts.

Refer servicing to qualified service personnel.

WARNING:
SUPERVISED USE This equipment is intended for use under the direct supervision of a licensed healthcare practitioner.

WARNING:
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.

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:
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.

Classification

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

Type of protection against electrical shock	Class I medical device
Degree of protection against electrical shock	Type CF defibrillation-proof applied part
Degree of protection against 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

Certification Information

The MAC 600 system bears the CE mark "CE-0459", notified body GMED, indicating its conformity with the provisions of the Council Directive 93/42/EEC, concerning medical devices and fulfils the essential requirements of Annex I of this directive.

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

Medical Equipment

Classified with respect to electric shock, fire, mechanical, and other specified hazards only in accordance with UL 60601-1, CAN/CSA C22.2 No. 601.1, IEC 60601-2-25, IEC 60601-1, IEC 60601-1-2, IEC 60601-2-51.

Biocompatibility

The parts of the product described in this manual, including all accessories that are intended to come in contact with the patient during the intended use, fulfill the biocompatibility requirements of the applicable standards. Please contact GE Healthcare or its representatives with any questions.

Responsibility of the Manufacturer

GE Healthcare 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 Healthcare.
- 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

This equipment is protected against the effects of cardiac defibrillator discharge to ensure recovery, as required by test standards.

The patient signal input of the acquisition module is defibrillation-proof. Therefore, it is not necessary to remove the ECG electrodes prior to defibrillation.

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

If polarizing electrodes are used, we recommend disconnecting the leadwires from the patient before delivering the shock.

Electrode defibrillation recovery is the ability of the electrode to allow the ECG trace to return after defibrillation. We recommend using non-polarizing disposable electrodes with defibrillation recovery ratings as specified in AAMI EC12 4.2.2.4. (MMS P/N 9623-105 Silver MacTrodes, MMS spec.

TP9623-003). AAMI EC12 requires that the polarization potential of an electrode pair does not exceed 100mV, 5 seconds after a defibrillation discharge.

Recording ECGS of Pacemaker Patients

WARNING:

PATIENT HAZARD If several adverse conditions exist at once, pacer pulses might be interpreted and counted as QRS complexes. Pacemaker patients should always be watched closely

The system does not support analog detection of pacer pulse.

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 ± 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.

EMI/EMC/RF Safety Information

Users should consider RF sources, such as radio or TV stations and hand-held or mobile two-way radios, when installing and operating a medical device or system.

Operating the system near radio frequency (RF) and electromagnetic interference (EMI) above the conditions defined in the EMC Standard EN60601-1-2 for Radiated Immunity (field strengths above 3 volts per meter) may cause waveform distortions.

Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the accompanying service manual. Portable and mobile RF communications equipment can affect medical electrical equipment.

The use of accessories, transducers, and cables other than those specified, with the exception of transducers and cables sold by the manufacturer of the system as replacement parts for internal components, may result in increased emissions or decreased immunity of the system.

The system should not be used adjacent to or stacked with other equipment and, that if it is necessary to use this system adjacent to or stacked with other equipment, the system should be observed to verify normal operation in the configuration in which it will be used. Review the AAMI Committee Technical Information Report (TIR) 18, "Guidance on Electromagnetic Compatibility of Medical Devices for Clinical/Biomedical Engineers". This guidance document provides a means to evaluate and manage the EMI environment in the hospital.

The following actions can be taken to reduce the risk of medical device EMI and achieve EMC:

- Assess the EMC environment of the healthcare facility (for example, identify radio transmitters in and around the facility) and identify areas where critical medical devices are used (for example, ER, ICU, CCU, NICU).
- Increase the distance between sources of EMI and susceptible devices.
- Remove the devices that are highly susceptible to EMI.
- Lower the power transmitted from electrical and electronic equipment (EMI sources) under hospital control (for example, paging systems).

- Label devices susceptible to EMI.
- Educate healthcare facility staff (nurses and doctors) to be aware of, and to recognize, potential EMI related problems.

Security Information

This section provides information about the security information for the user.

- The user should ensure that password needs to be changed during initial configuration. Also the user may implement administrative controls.
- The user should ensure that password cannot be changed back to defaults. Also the user may implement administrative controls.
- The system does not allow the password complexity to be configured, customer may implement administrative controls.
- The user should implement administrative controls to not use a terminal server along with the device.
- The user should implement administrative controls for a more secure wipe of the SD card.

Parts and Accessories

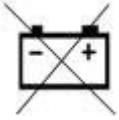
The use of accessory equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system.

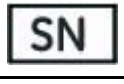
Consideration relating to the choice shall include:

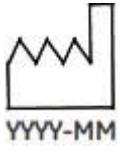
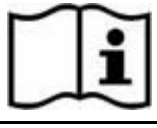
- use of the accessory in the patient vicinity; and
- evidence that the safety certification of the accessory has been performed in accordance to the appropriate IEC 60601-1 and/or IEC 60601-1-1 harmonized national standard.

Device Symbols

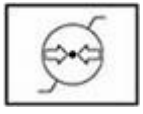
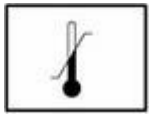
The following symbols may appear on the product, accessories, its packaging, and its documentation.

Symbol	Description
	Type CF equipment. The acquisition module is protected from defibrillation shocks.
	Do NOT throw the battery into the garbage.
	Alternating current.
	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.
	Do not throw or dispose of in fire.

Symbol	Description
	The flashing amber LED next to this symbol on keypad indicates you must connect the system to AC power to recharge the battery. The arrow on top of the battery symbol on display indicates that the battery is charging.
	The packaging of this product can be recycled.
	Consult accompanying documents.
	Unique Device Identification is a unique marking for identification of the medical device.
	Serial number.
	Catalogue number (Part number).

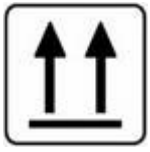
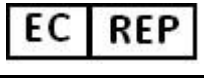
Symbol	Description
	Lot number.
	**Eurasian Conformity Mark.** The single conformity mark for circulation of products on the markets of member-states of Customs Union. This product passed all conformity assessment (approval) procedures that correspond to the requirements of applicable technical regulations of the Customs Union.
	Date of Manufacture (Year-Month)
	Consult instructions for use.

Symbol	Description
	Follow Instructions For Use Read and understand the operator's manual before using the device or product. *As a mandatory action sign, this symbol is identified by a blue background and white symbol.*
	Indicates the device or product conforms with applicable EU (European Union) directives.
	Classified with respect to electric shock, fire, mechanical, and other specified hazards only in accordance with UL 60601-1, CAN/CSA C22.2 No. 601.1, IEC 60601-2-25, IEC 60601-1, IEC 60601-1-2, IEC 60601-2-51.

Symbol	Description
	Environment-friendly Use Period per Chinese standard SJ/T11363-2006 (China specific).
	Environment-friendly Use Period per Chinese standard SJ/T11363-2006 (China specific).
	Atmospheric pressure limitation.
	Temperature limitation.
	Humidity limitation.

Symbol	Description
	Recycle the battery.
	Manufacturer name and address.
	Indoor use only.
	No serviceable parts.
	PCT. GOST marking symbolizing conformity with applicable Russian Gosstandart technical and safety standards.

Symbol	Description
	China Metrology Certification.
	CCC Mark - China Compulsory Certification mark.
	CCC Mark - China Compulsory Certification mark for safety and EMI.
IP20	Indicates that the device is classified as type 20 for solid and water ingress per IEC/EN 60529. In IP20, the 2 indicates protection against ingress of solid objects, > = 12 mm diameter, and the 0 indicates no protection against ingress of water.
	DC In
	Secure Digital (SD) Card.
	Serial Port.

Symbol	Description
	This side up.
	Keep dry.
	Fragile.
	Authorized European Representative.
	DC output connector polarity.
Rx Only U.S.	USA only. For use by or on the order of a Physician, or persons licensed by state law.

Symbol	Description
	Power button on the key pad on the device. Turns the system on and off.
	Leads key on the key pad on device.
	ECG key on the key pad on the device. Acquires an ECG.
	Rhythm key on the key pad on the device. Prints a continuous, real-time rhythm ECG strip.
	Stop key on the key pad on the device. Stops the Writer.

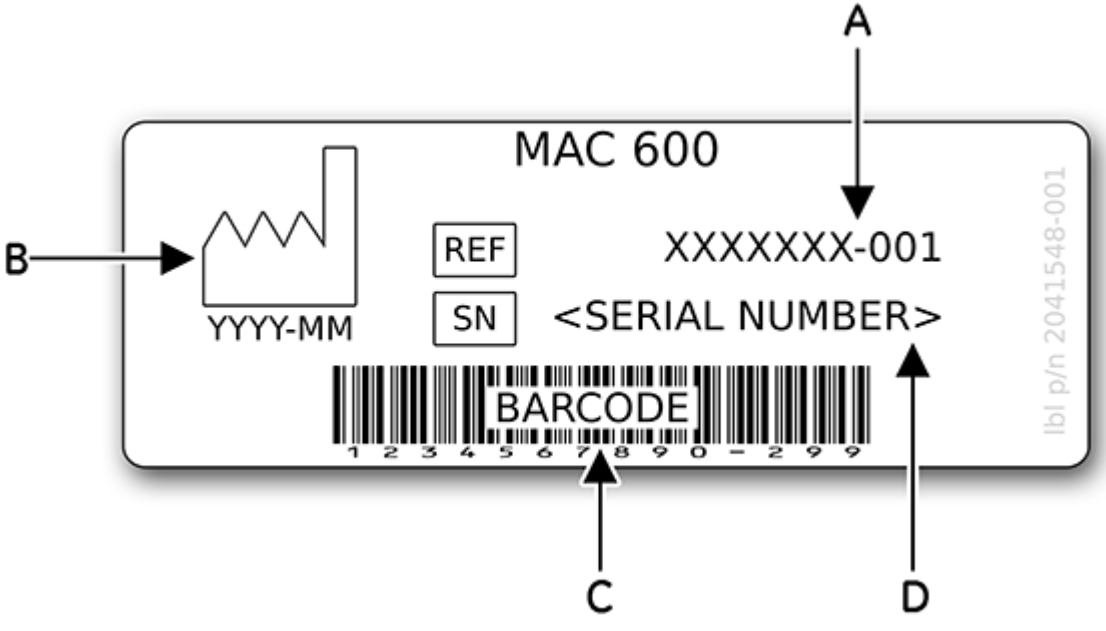
Service Information

Service Requirements

Refer equipment servicing to GE Healthcare 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 Healthcare or to one of their authorized agents.

Serial Number Label Format

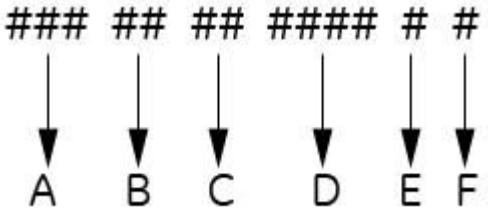
The serial number label appears on the back of the device. See "Back View" on page 43. The label appears similar to the following illustration.



A	Part number of product
B	Date of manufacture in YYYY-MM format
C	Barcode
D	Serial Number of the product

Serial Number Format

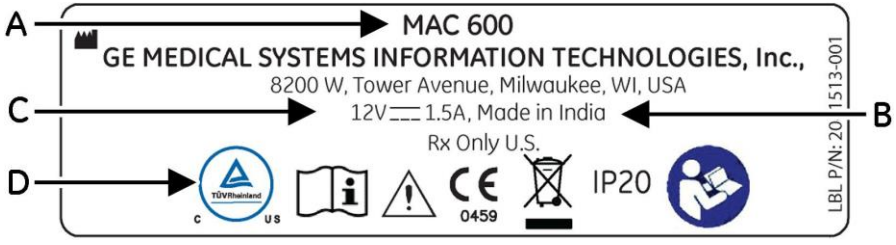
Every GE device has a serial number for identification. The serial number is located on the serial number label on the back of the device. See "Back View" on page 43. The serial number appears similar to the following:



Label	Description
A	The product code for MAC 600 systems is SF7
B	Year Manufactured (00-99) 00 = 2000 01 = 2001 02 = 2002
C	Fiscal Week Manufactured
D	Production Sequence Number
E	Manufacturing Site
F	Miscellaneous Characteristic

Product Label

The product label is located on the rear side of the device next to the external power inlet module.



Label	Description
A	Product name (MAC 600)
B	Country of Origin
C	Input power rating
D	Symbols

2

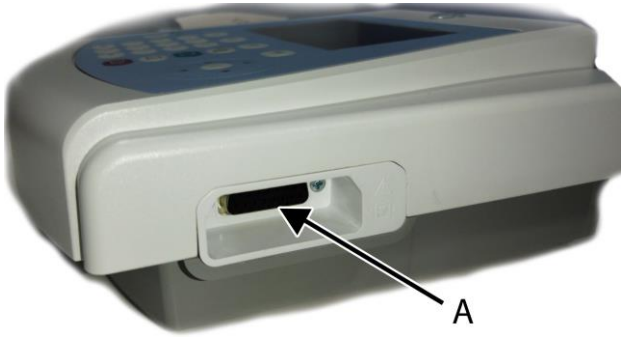
Equipment Overview

Front View

	Name	Description
A	Writer/Printer	Prints ECG reports

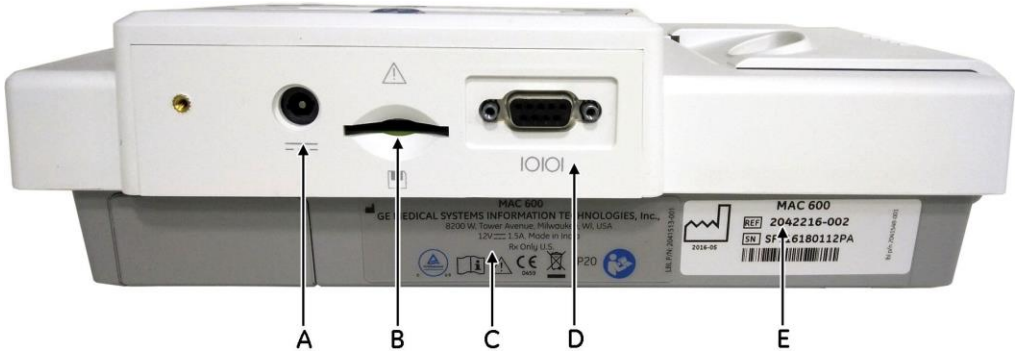
B	Display screen	Displays the waveform and text data
C	Keypad	Means of input to operate the system and to enter data

Side View



	Name	Description
A	ECG signal input connector	Connect the patient cable here

Back View



	Name	Description
A	⎓	Used to connect a GE Healthcare specified ACDC power adaptor
B		Used to insert SD card. The system supports SD cards that are formatted for the FAT16 file systems. (FAT16 may also be indicated as FAT file system.)
C	Product label	Product label of device
D	IOIOI	Used to insert serial cable
E	Serial Number label	Serial number Label of device

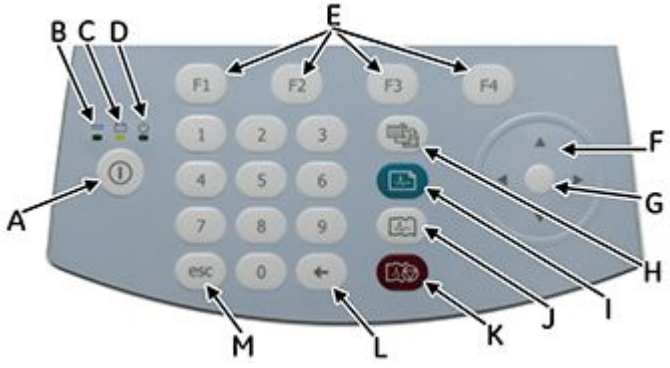
Inside View

	Name	Description
A	Printer roller	Connects the paper to thermal print head
B	Print head	Thermal print head
C	Lifting Tape	Helps lift the z-fold paper pack
D	Spindle	Holds roll paper

Bottom View

	Name	Description
A	Battery Compartment	Holds the rechargeable Lithium-ion battery
B	Option Code Label	Displays the option code label (Optional)

Keypad



The keypad has 0-9 keys that can be used for entering numbers and alphabets into the system. For information about changing settings to enable entering alphabets into the system see "PatientQuestions" on page 104.

	Name	Description
A	Power	Turns the system on or off
B	**Power LED**	Indicates the unit is plugged in and receiving DC power
C	**Battery LED**	Indicates battery status as given below: • Solid amber light indicates the battery is charging • Flashing amber light indicates the battery is low • Off indicates battery is fully charged or that the battery is not being charged

	Name	Description
D	**ON /OFF LED**	A glowing LED indicates that the system is turned on
E	Function Keys (**F1** through **F4**)	Selects menu options that appear across the bottom of the display
F	**Arrow pad**	Moves the cursor left, right, up, or down
G	**Enter**	Press this key every time you want to confirm a selection
H	**Leads**	Scrolls through the leads on display and changes leads during rhythm print
I	**ECG**	Acquires an ECG. Press to acquire a 12SL resting ECG, including optional measurements and interpretation.
J	**Rhythm**	Prints a continuous, real-time rhythm ECG strip. Press the **Stop** key to stop the rhythm strip from printing.
K	**Stop**	Stops the Writer
L	**Backspace**	Press to delete characters
M	**esc**	Press to return to the previous menu

Getting Started

Before using the system, charge the battery to full power for 3 to 4 hours. The following sections describe the process of setting up the MAC 600 device.

Confirming the Box Contents

Remove the device and accessories from the box, and keep on a flat dry surface, away from direct sunlight, heat sources, and dust. Verify that you have received the following:

- MAC 600 Resting ECG Analysis device
- ACDC power adapter with power cord
- Battery (inside the unit)
- *MAC 600 Operator's Manual*
- CD containing *MAC 600 Service Manual* and *12 SL Physicians Guide*
- Roll paper spindle
- *MAC 600 Quick Reference Guide*

Ordering Optional Accessories

The following are . To purchase these optional accessories, contact GE Healthcare Customer Service. Refer to the *MAC 600 Service Manual* for the accessory part numbers.

- Reusable clamp and bulb electrodes
- Disposable electrodes
- Electrode gel
- Patient cable/s
- 2 GB SD Card
- Serial Cable
- Multilink Patient Cable
- Baby Electrode
- Z-fold paper
- Roll Paper
- Carry Case

Purchasing Software Options

The following features are purchasable options and available on the system only after they are enabled.

- Color (display color)
- 12SL measurement
- 12SL measurement and interpretation
- External storage (SD card)
- Transmission
- XML ECG storage format
- PDF ECG storage format

NOTE:
PDF generation is not supported for the Russian language.

This manual describes all the above options. To obtain an option activation code to enable the above options, contact GE Healthcare Customer Service.

Connecting the Patient Cable

Plug the patient cable to the side of the system as show in section "Side View" on page 42.

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.

Loading the Paper

Before printing ECG reports, ensure that the thermal recording paper is loaded into the system.

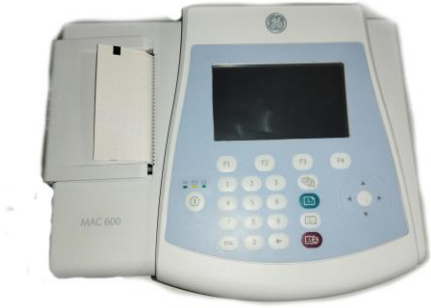
The device supports the following standard thermal recording papers:

- Z-fold paper (Part number - 2030887-001)
- Roll paper (Part number - 2030888-001)

To load the Z-fold pack into the device, refer to the following procedure.

1. Open the Writer door.
2. Place the Z-fold pack inside the Writer compartment.
3. Lift the first sheet of the Z-fold paper pack.
4. Close the Writer door.
5. Ensure the following after you close the Writer door.
    a. The paper is positioned on the Writer roller.
    b. The Writer door is firmly latched.
    c. The grid on the paper faces up.

To load the roll paper into the device, do the following:



1. Open the Writer door.
2. Remove the leftover paper from the spindle and slide the paper roll onto the spindle.
3. Place the roll, with the print side (red grid) facing the thermal print head, into the compartment by fitting the spindle into the grooves on either side.
4. Unroll the beginning of the paper and close the Writer door.
5. Overlap the unrolled paper on the Writer door.
6. Set the paper type to *Roll* by selecting ***Setup > ECG > Writer Setup > Paper***.

Turning on the System

Press the **Power** key to turn on the system. After the system has turned on, verify the following:

- The ON/OFF LED lights up.
- The startup screen appears without any errors, or, the system prompts you to enter the date and time.
  Enter the date and time if prompted.

If you encounter any problems powering on the system, see "General Troubleshooting Tips" on page 141 for troubleshooting instructions

Configuring the Device

When the device is ready for operation, configure the system settings using the procedures in "System Setup" on page 91.

If the same settings are to be applied to multiple devices, save the settings to an SD card and use the card when you configure the system settings of other MAC 600 systems. For more information, see "Save Setup" on page 121 and "Restore Setup" on page 123.

NOTE:
The system settings can be stored onto an SD card even when the external storage option is not enabled on the device.

Checking the Functions of the Device

After the system has been set up and configured, check the following before using it with patients:

- Make sure you can acquire and print a resting ECG. See "Acquiring an ECG" on page 55 for instructions on how to acquire resting ECGs.
- Make sure you can store and transmit records. See "Auto Storage and Auto Transmit" on page 67.

Your device is now ready for use.

Operating the System

This section will familiarize you with the following:

- Startup screen
- Selecting menu options
- Using the arrow pad

Startup Screen

The startup screen appears as shown in the following figure:

Menu options appear across the bottom of the display. Each menu option corresponds to a function key (**F1**–**F4**) directly below the display. You can view four menu options at a time. Select the ***More*** option to view the additional menu options.

	Name	Description
A	Information line	Displays a message which helps you perform a task.
B	Time	Displays the current system time.
C	Date	Displays the current system date.

	Name	Description
D	Hookup Advisor Indicator	Displays the quality of lead signals. See "Hookup Advisor" on page 64. for more information.
E	Battery status indicator	Displays the current battery level.
F	Patient's Heart Rate	Displays the patient heart rate measured in beats per minute.
G	Software Version	Displays the system's software version during the first few seconds of power up.
H	Lead Labels	Identifies each waveform on the display.
I	Menu options	Displays the available menu options.

Selecting the Menu Options

To select a menu option, press a function key below it. Depending on the selected option, one of the following results occurs:

- A window opens
  For example, selecting the ***Patient Data*** option opens the ***Enter Patient Data*** window.
- A setting is changed
  For example, selecting the ***25 mm/s*** option changes the Writer speed.
- Additional menu options are displayed
  For example, selecting the ***More*** option will display additional menu options.

Using the Arrow Pad

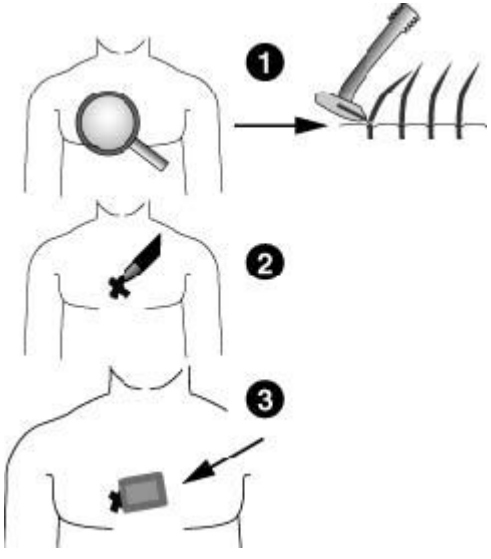
- To move the cursor left, right, up, and down through the data entry fields, press the corresponding arrow keys on the arrow pad
- To select the current field, press the **Enter** key.
- To confirm a selection, press the **Enter** key.

3

Preparing the Patient

Prepare the Patient's Skin

Careful skin preparation is the key to an interference-free ECG. The lead signal quality is shown on the ***Hookup Advisor*** indicator. See "Hookup Advisor" on page 64.



1. Shave any hair from each electrode site and degrease each electrode site with alcohol.
2. Dry the skin completely.

3. Apply the electrodes to the prepared area.

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

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

WARNING:
CONDUCTIVE PARTS Keep the conductive parts of lead electrodes and associated parts away from other conductive parts, including earth.

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

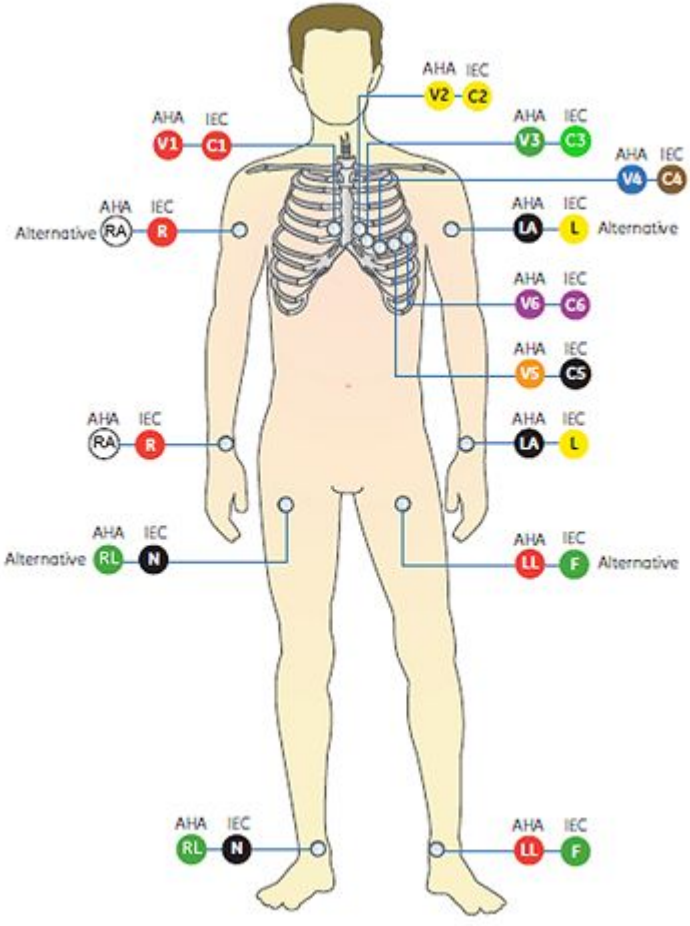
NOTE:
Use only electrodes and contact agents recommended by GE Healthcare. The signal quality on the lead-check screen will not be indicated until the RL/N electrode has been applied. When RA/ R becomes disconnected, the system will display ***Limb Lead Disconnected***.

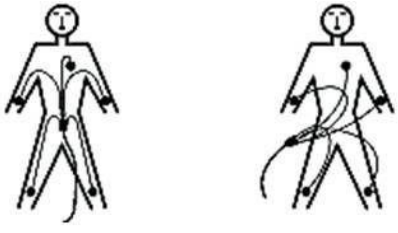
Applying Resting Electrodes

CAUTION:
PROPER LEADWIRE CONNECTION Improper connection will cause inaccuracies in the ECG. For multi-link , trace each individual leadwire in the patient cable module to the colored connector and then to the proper electrode to ensure that it is matched to the correct label location

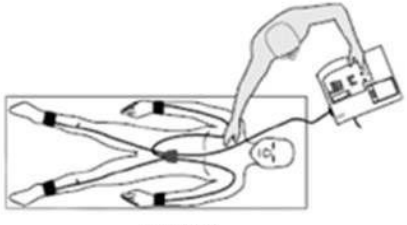
Standard 12 Lead Placement

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


AHA IEC
V2 C2
AHA IEC
V1 C1
AHA IEC
V3 C3
AHA IEC
V4 C4
AHA IEC
Alternative RA R
AHA IEC
LA L
Alternative
AHA IEC
V6 C6
AHA IEC
V5 C5
AHA IEC
RA R
AHA IEC
LA L
AHA IEC
Alternative RL N
AHA IEC
LL F
Alternative
AHA IEC
RL N
AHA IEC
LL F



Correct Incorrect



Correct

12–Lead Electrode Placement

AHA Label	IEC Label	Description
V1 red	C1 Red	Fourth intercostal space at the right sternal border.
V2 yellow	C2 yellow	Fourth intercostal space at the left sternal border.
V3 green	C3 green	Midway between C2/V2 and C4/V4.
V4 blue	C4 brown	Mid-clavicular line in the fifth intercostal space.

12–Lead Electrode Placement (cont'd.)

AHA Label	IEC Label	Description
V5 orange	C5 black	Anterior auxiliary line on the same horizontal level as C4/V4.
V6 purple	C6 purple	Mid-auxillary line on the same horizontal level as C4/V4 and C5/V5.
LA black	L yellow	Above left wrist (alternative placement: left deltoid).
LL	F green	Above left ankle (alternate placement: upper leg as close to torso).
RL green	N black	Above right ankle (alternate placement: upper leg close to torso).
RA white	R red	Above right wrist (alternative placement: right deltoid).

4

Acquiring an ECG

Recording a Resting ECG

When the system is turned on, the ***Startup*** screen opens.

the following steps describe how to acquire a resting ECG:

1. Prepare the patient as described in "Preparing the Patient" on page 55.
2. Ensure that the patient cable is connected and the system is turned on.
3. Enter the patient data as described in "Entering Patient Information" on page 64".
4. Adjust the ***Speed***, ***Gain***, and ***filter*** until the waveforms are configured as desired.
   For more information, see "ECG Options – Before Acquiring an ECG" on page 65.
5. Press the **Leads** key to scroll through the leads.

6. Press the **ECG** key to begin the acquisition.

   A message indicating that the data is being acquired is displayed on the screen. When the acquisition is complete, one of two things will occur, depending on the ***Preview before print*** setting in ***Setup > ECG > ECG Analysis***.

   - If ***Preview before print*** is enabled, a preview of the 10 second ECG is shown on the display. Proceed to step 7.
   - If ***Preview before print*** is not enabled, the ECG data will be analyzed and printed after it has been acquired. Skip to step 8.

7. While viewing the preview, do one of the following:

   - To accept the reading press **F1** (Continue).
   - To toggle between the following displays, press **F2** (Analysis/Rhythm).
     - the analysis/measurement of the acquired ECG
     - the waveform of the acquired ECG
   - To store the current ECG report on the SD card, press **F3** (Store). Press **F1** to continue. To exit the preview screen, press **F1** (Continue) or **F4** (Cancel).
   - To discard the reading and begin over, press **F4** (Cancel) and repeat from step 4.

     NOTE:
     If the system is configures to auto store and auto transmit the acquired ECG, pressing ***Cancel*** will cancel the storage and transmission.

8. Use the menu options to print a copy, to store the data, or to move on to the next patient.

   For a description of each option, see "ECG Options – After Acquiring an ECG" on page 68.

Entering Patient Information

Patient information should be entered for each new patient from whom readings are taken.

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. To select ***Patient data***, press **F1**.

   The following screen opens.

2. Enter the patient ID in the ***ID number*** field.

   To insert a dash when entering the patient ID, press **F1**.

   To insert a + symbol when entering the patient ID, press **F2**.

   NOTE:

   To require the entry of a patient identification number before an ECG can be recorded, and to set up the ID length, see "Patient Questions" on page 102.

3. Enter the patient's data of birth in the ***Date of birth*** field.

   NOTE:
   To set up the patient's age in years/months/weeks/days/hours format, see "Patient Questions" on page 102.

4. Enter the patient's gender in the ***Gender*** field.

   NOTE:
   If the Gender field does not appear in the ***Patient data***window, you will need to enable it. See "Patient Questions" on page 102.

5. Press ***Return***.

ECG Options – Before Acquiring an ECG

The system provides options for configuring an ECG. The options, which are presented as menus across the bottom of the display, are listed in the following table.

Option	Description
Patient Data	Opens the patient data entry window.
Speed	Changes the speed of the waveform on the display and printout. Measurement is in millimeter per second (mm/s) and includes the following options: ● 25 mm/s ● 50 mm/s ● 5 mm/s ● 12 mm/s **NOTE:** The ECG reports are printed at a speed of 25 mm/s or 50 mm/s only.
Gain	This changes the magnitude of the 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 ● 10/5 mm/mV For the 10/5 setting, limb leads appear at 10 mm/mV and precordial leads appear at 5 mm/mV. The larger the selected measurement, the larger the waveform appears. Only the appearance of the waveform changes; signal strength is not affected.

Option	Description
Filter	Attenuates noise in the waveform by restricting the frequencies that 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 the signal is filtered out. For example, a filter of 40 Hz includes only signals at 40 Hz or less; signals greater than 40 Hz will be ignored.
Setup	Opens the ***System Setup*** window.
File Manager	Opens the ***File Manager*** window.

NOTE:

If you select the ***Setup*** or ***File Manager*** menus, the ***Speed***, ***Gain***, and ***Filter*** settings will be reset to the default values or the last set of values.

ECG Options – After Acquiring an ECG

After you acquire and print an ECG, the system displays menu options across the bottom of the screen. They are listed in the following table.

Option	Description
Print	Prints another report of the same ECG. Before printing, you can change the report format, speed, gain and filter settings.
Store	Stores the current ECG report. **NOTE:** XML and PDF files are not encrypted.
Next Pat	Exits the current screen and clears patient information.
Same Pat	Retains the patient information and exits the current screen. The system discards the current ECG and allows you to acquire another ECG for the same patient.
File Manager	Opens the ***File Manager*** window.
New Format	Opens the ***Resting ECG Reports*** window.

Hookup Advisor

The Hookup Advisor is a visual indication of the quality of lead signals. Monitor the Hookup Advisor to help reduce or eliminate poor quality ECGs. This will save time and prevent the need to take additional ECGs.

Hookup Advisor is enabled and configured in the ***ECG Acquisition*** menu. To reach the ***ECG Acquisition*** menu, select ***Setup***>***ECG***>***ECG Acquisition***. See "ECG Acquisition" on page 99.

In addition to enabling/disabling the Hookup Advisor feature, you can set the level at which the system acknowledges poor signal quality. The acknowledgement level can be set to yellow, red (default), or never.

Indicator	Description
Red	Indicates a lead-fail condition or extreme baseline shifts. The red indicator is always the left circle of the indicator.
Yellow	Indicates muscle artifact, power line interference, baseline wander, or electrode noise. The yellow indicator is always the middle circle of the indicator.
Green	Indicates acceptable signal quality. The green indicator is always the right circle of the indicator.

When a red or yellow indicator is lit, identify and correct the error before acquiring the ECG,

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

- If Pre-acquisition is enabled in ***System Setup***, the lead quality (Hookup Advisor circles, see "Startup Screen" on page 53) indicator will reflect the entire previous 10 seconds of ECG data. Any displayed messages will be updated on a real-time basis to reflect adjustments/ improvements to the lead quality. After the lead quality problems are fixed, the message ***"Please wait..."*** will be displayed until the entire 10 second period is free from lead quality proble
- When Pre-acquisition is not enabled, the Hookup Advisor level and messages will respond to a fixed poor lead quality problem within 2 to 3 seconds.

If Hookup Advisor is disabled and an ECG is acquired, the system may display a message indicating the poor lead quality conditions.

You may choose one of the following:

- select ***Continue*** to continue (print the ECG), or
- select ***Cancel*** to cancel.

Generating a Rhythm Report (Manual Recording)

The system 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 or transmitted. Use the following steps to generate a Rhythm Report.

1. Prepare the patient as described in "Preparing the Patient" on page 55.
2. Ensure that the patient cable is connected and the system is turned on.
3. Enter the patient data as described in "Entering Patient Information" on page 64.

   NOTE:
   In a Rhythm Report only the patient ID is printed.

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

   For more information, see "ECG Options – Before Acquiring an ECG" on page 65.
5. Press the **Leads** key to scroll through the leads.
6. Press the **Rhythm** key to begin printing.

   NOTE:
   If the display shows more than 3 leads, the system will display 3 leads from the group configured as autorhythm and will begin rhythm printing with those 3 leads.

7. Press the **Leads** key to print the next 3 leads.
8. Press the **Stop** key to stop printing.

Auto Storage and Auto Transmit

The device has the ability to auto save and auto transmit acquired ECGs.

Configuring Auto Storage

Perform the following procedure to configure the device to auto save an acquired ECG in ***xml*** format.

1. Within the system setup function, select ***Storage***.
2. In ***Auto ECG Storage***, select the type of stored ECGs.
3. Select the storage format.
4. In ***Store XML format***, select ***Yes*** to store ECG in XML format.
5. Select ***Return.***

Perform the following procedure to auto save an ECG in PDF format, after you configured the device to auto save an acquired ECG in xml format.

1. Within the ***System Setup*** function, select ***PDF Configuration***.
2. In ***Store PDF Format***, select ***Yes***.
3. Select ***Yes*** to enable the grid lines to appear in the PDF.
4. Select the report format for the ECG.

5. In ***PDF File Name Configuration***, select the tpe of configuration.

   For more information, see "PDF Configuration" on page 118.

6. Select ***Return***.

NOTE:

The PDF reports can be transferred from an SD card to a computer and then can be printed like any PDF document.

ECG prints from stored ECG reports are not of diagnostic quality and should be used for reference only.

Be aware of the following scenarios for printing of the PDF report from the computer:

- The printed PDF report may not be to scale, since there can be settings in the printer to auto scale the contents to fit the paper size.
- To print the PDF report to scale, disable auto scale settings in the printer and ensure the paper type selected is A4.
- When the PDF report is printed to scale, some details on the margins of the report may not print depending on the printer used.

Configuring Auto Transmit

Perform the following procedure to configure the device to auto transmit an acquired ECG.

1. Within the system setup function, select ***Transmission***.
2. In ***Auto ECG Transmission***, select the type of transmitted ECGs.
3. In ***Serial line baud rate***, select a baud rate.

4. In ***Default Location***, choose the destination for the transmitted file.
5. Select ***Return***.

NOTE:
If the transmission of the ECG fails, the file will be saved on the SD card.

NOTE:
If you have chosen ***MUSE Network*** as the type of transmission, verify the configuration for ***Site***, ***Location***, and ***Cart number*** in ***Miscellaneous setup***.

5

File Manager

Introduction

File Manager is an optional feature and is available when the SD card storage option is enabled.

File Manager provides an interface to the system's external storage. It provides functions to do the following:

- print stored ECGs
- display stored ECGs
- transmit stored ECGs to an external device
- delete stored ECGs
- save stored ECGs in XML format
- save stored ECGs in PDF format

Accessing the File Manager

To access ***File Manager***, do the following:

NOTE:
Before accessing ***File Manager***, ensure that an SD card with stored ECGs is inserted in the SD card slot. If there is no card in the SD card slot, the following message appears on the screen: ***Please Insert SD Card Press 'Esc' to cancel***.

1. From the startup screen, choose the ***More*** option by pressing the **F4** key.
2. To open ***File Manager***, press **F3**.

   The screen displays a list of stored ECG reports as shown in the following figure.

The menu that appears across the bottom of ***File Manager*** and its functions are described in the following table.

Function	Description
Select	Selects a file.
Select All	Selects all files stored on the SD card.
Report Setup	Defines the report format, speed, gain, and filter settings for printing the stored ECGs.
Location	Allows you to select the location where the file is to be transmitted.
Setup	Opens the ***System Setup*** window.
Resting ECG	Opens the ***Resting ECG*** window.

To select an ECG report from the displayed list, do the following:

1. In ***File Manager***, choose the ***Select*** option by pressing the **F1** key.

   This will highlight the first file in the list of files stored on the SD card.
2. To highlight the file of your choice, press the **Up** or **Down** keys on the arrow pad.
3. To confirm your selection, press the **Enter** key.

Printing the Stored ECGs

1. Press ***Select***.
2. Select one or more ECGs.
3. Select ***Print***.

   The selected ECG(s) will be printed. For information on print settings, see "Report Setup" on page 78.

Report Setup

The ***Report Setup*** function helps you to define the following parameters for the stored ECGs to be printed:

- Report format
- Speed
- Gain
- Filter

The following table describes the menus and functions under ***Report Setup***.

Function	Description
Report Format	Selects the report format for printing a stored ECG.
Speed	Changes the Writer's speed setting
Gain[1]	Changes the Writer's gain setting
Filter[1]	Changes the Writer's filer setting

To select the report format to print a stored ECG, perform the following procedure.

1. Select ***Report Setup***>***Report Format***.

   The ***Resting ECG reports*** window opens.

2. Enter the number of copies of the report for the desired report format.

3. Change the settings for ***Auto gain*** and ***Auto shift***.
4. Select ***Return*** to exit the ***Resting ECG reports*** window.

NOTE:
Changes made here affect only the current ECG. Once another ECG is recorded, the reports specified in the system setup are printed. See "System Setup" on page 91.

Displaying the Stored ECGs

1. Press ***Select***.
2. Select one or more ECGs.
3. Select ***Display***.

The following table describes the menus under the display option.

Function	Description
Medians/Rhythm	Toggles between the display of ECG raw data and the ECG median data.
Analysis/Rhythm	Toggles between the display of ECG analysis and the ECG waveform.
Print	Prints the selected file
Next	Displays the next file only if you have select two or more files.
Return	Exits to the directory of files.

Transmitting Stored ECGs through Serial Line

Press the **F3** key to transmit a stored ECG through a serial line to either a PC running a terminal emulation program or the MUSE Server/Client

NOTE:
The serial cable part number is 2047854-001.

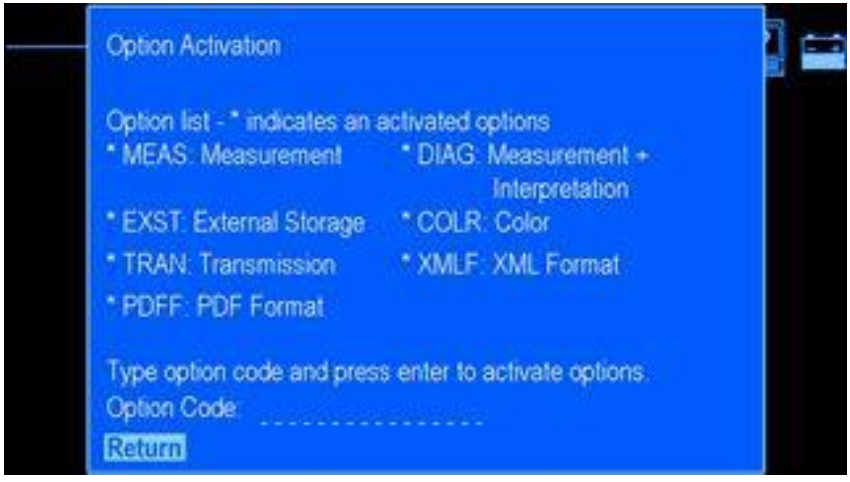
The Serial Port settings at the PC or MUSE Server/Client should be:

- Baud rate: 115.2 Kbps
- Data Bits: 8
- Parity: None
- Stop Bits: 1

1. At the MAC 600, verify that the ***EXST: External Storage*** and ***TRANS: Transmission*** options are activated by performing the following the steps:
   a. Select ***Setup***.
   b. Type the passcode `1111` and press ***Enter***.

c. Select ***Basic***>***Option Activation***.

The ***Option Activation*** screen opens.



d. Make sure that ***EXST: External Storage*** and ***TRANS: Transmission*** are activated.

Contact your GE Healthcare Sale Representative to purchase this feature if it is not available.

2. Set up communication to the MAC 600 by performing steps in "Transmission" on page 121,

Transmitting Stored ECGs in XML Format

1. Connect one end of the serial cable to the serial port on the system. Connect the other end of the serial cable to the serial port of a computer running a terminal emulation program,
2. Select ***File Manager***>***Location***>***XML Output***.
3. Press ***Select***.

4. Select one or more files.
5. Select ***Transmit***.

   The selected file(s) will be transmitted in XML format.

Transmitting Stored ECGs to the MUSE System

1. Connect one end of the serial cable to the serial port on the system. Connect the other end of the serial cable to the serial port of the MUSE Server/Client.
2. Select ***File Manager***>***Location***>***MUSE Network***.
3. Press ***Select***.
4. Select one or more files.
5. Select ***Transmit***.

   The selected file(s) will be transmitted to MUSE.

   NOTE:
   If MUSE version 5E.12 or higher is used, the stored ECGs and XML files in the SD card can be directly transferred to the MUSE system through an SD card reader.

Transmitting Stored ECGs to CardioSoft v6.61

The steps for transmitting stored ECGs to CardioSoft v6.61 are the same as the steps for transmitting stored ECGs to the MUSE system. See "Transmitting Stored ECGs to the MUSE System" on page 82.

Before you can transmit stored ECGs to CardioSoft v6.61, you need to configure it for transmission.

NOTE:
You may only transmit stored ECGs through a serial line to the CardioSoft system version 6.61. Make sure it is installed before you proceed.

Stored ECGs on an SD card can be transferred directly to the CardioSoft system (version 6.51 or higher) through an SD card reader.

Do the following:

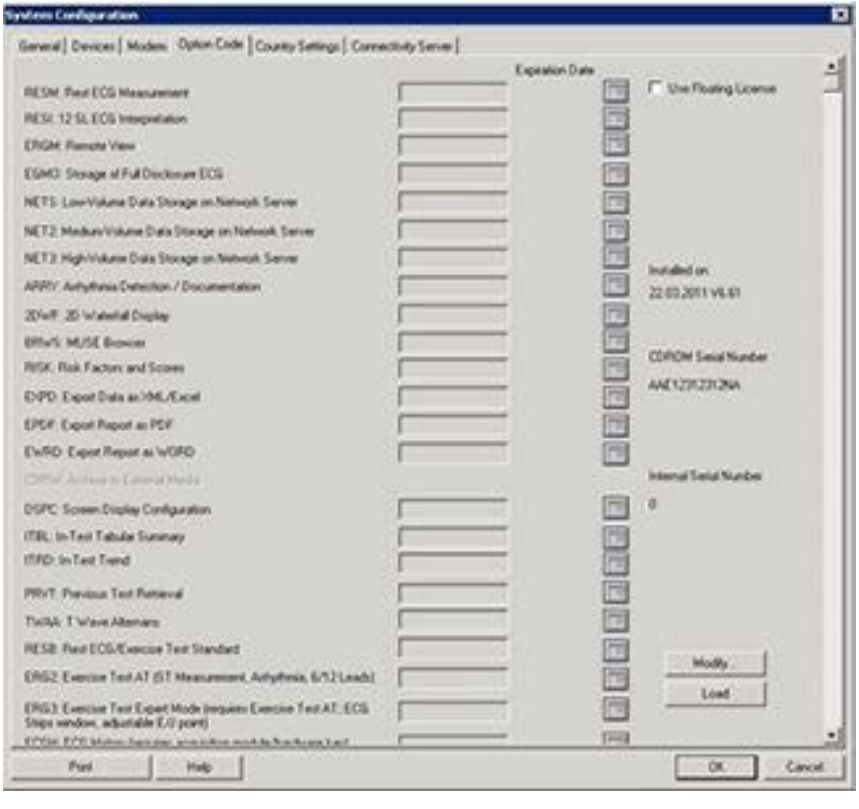
- When using the database server as a connectivity server, make sure that the RESB software option is activated (requires dongle). For instructions, see the CardioSoft Installation manual, P/N 2040396-004, Section 3.
- Install the connectivity server software from the CardioSoft v. 6.61 CD.
- Configure Cardiosoft v6.61 for serial communication by performing the following steps:

1. On the **Connectivity Server**, open Windows Explorer.
2. Create a new folder and name it `MAC 600`.
3. Share the folder with ***Full control permissions to Everyone***.

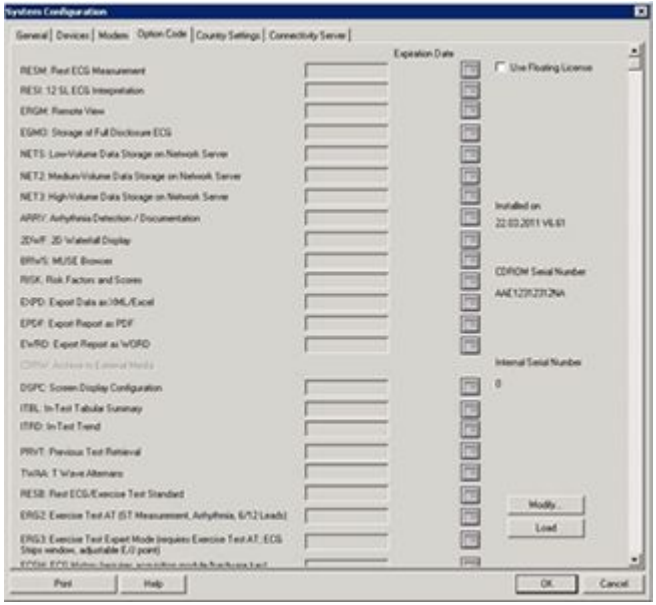
   NOTE:
   For enhanced security, only the user name running the connectivity server service needs to have read-write permission on the folder.

4. Start the CardioSoft software.

5. 5. At the CardioSoft home screen, click the ***System Configuration*** button on the right panel
The ***System Configuration*** window opens.



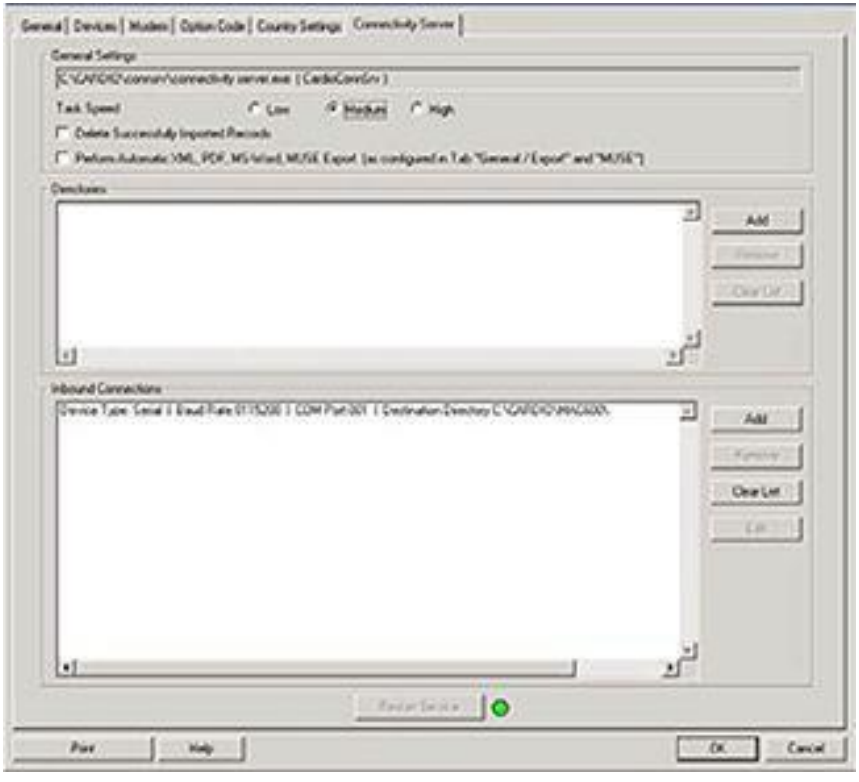
6. Click the ***Option Code*** tab to open it.



7. Verify that the option ***RESB: Resting ECG/Exercise Test Standard*** is activated.

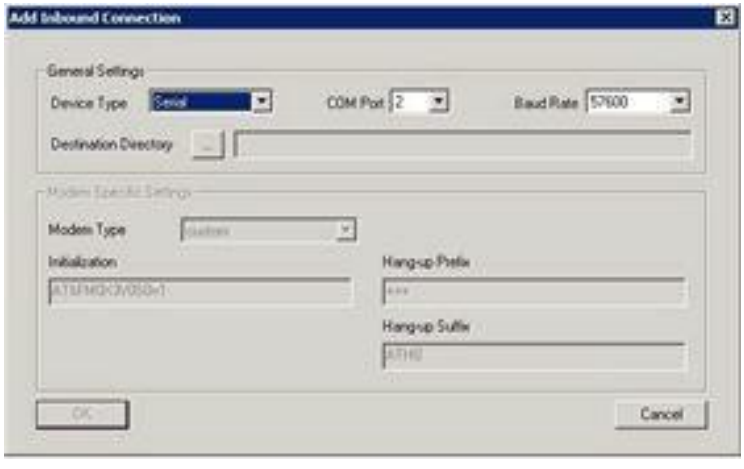
   If the option is not activated, see the CardioSoft Operator Manual.

8. Click on the ***Connectivity Server*** tab to open it.



9. Add an ***Inbound Connection*** by clicking ***Add***.

   The ***Add Inbound Connection*** window opens.



10. Select the following:
    - ***Device Type – Serial***
    - ***COM Port*** – select the correct port for your facility
    - ***Baud Rate*** – 115200
    - ***Destination Directory*** for the shared folder.
11. Click ***OK*** to add the selected inbound connection.

    You are returned to the ***Connectivity Server*** window.
12. Click ***Restart Service*** to start the ***Connectivity Server*** service.

    The LED must be green to indicate the service has been started.
13. Click ***OK*** to exit the ***System Configuration*** window and return to the CardioSoft home window.

Deleting Stored ECGs

1. Press ***Select***.
2. Select one or more ECGs.
3. Select ***Delete***.

   You will be prompted to enter the password.
4. Type the user password and press the ***Enter*** key.

   The selected file(s) will be deleted from the SD card.

NOTE:
Deleting stored ECGs will not delete the corresponding ECGs stored in PDF format.

Storing ECGs in XML Format

1. Press ***Select***.
2. Select one or more ECGs.
3. Select ***Save XML*** to generate the XML data.

   The resulting XML file(s) will be stored onto the SD card in the XML folder.

Storing ECGs in PDF Format

NOTE:
Before you store an ECG in PDF format, choose the report format for the PDF file by selecting ***Setup***>***PDF Configuration***>***PDF Format***.

To save the stored ECG reports in PDF format on the SD card:

1. Select ***File Manager***>***Report Setup***.
2. If desired, change the filter and gain settings. For more information see "Report Setup" on page 78.
3. Press ***Select***.

4. Select one or more ECGs.
5. Select ***Save PDF***.

   The resulting PDF file(s) will be stored on to the SD card in the PDF folder.

Using the SD (Secure Digital) Card

GE Healthcare recommends using a 2 GB SanDisk or Transcend SD card.

NOTE:
Use an SD card exclusively to store ECGs. Do not use this SD card for any other purpose. The SD card should be formatted for FAT16 file system. Perform regular backups by copying the entire content present on the SD card.

NOTE:
The ECG files stored in SD card are encrypted except XML and PDF file. SD card used in a specific device can not be used in another MAC600 device.

Locking and Unlocking

To prevent accidental deletion of data, protect the SD card by moving the lock panel to the locked position. Move the lock panel back to the unlocked position to store data to the SD card or to delete data from the SD card.

Formatting the SD Card

Most SD cards do not require formatting. If an unformatted SD card is used with the system, the following message will be displayed:

"This SD Card cannot be read and requires formatting. Formatting will destroy all data on this SD Card. Are you sure you want to format?"

Select ***Yes*** to format the SD card.

Ejecting an SD Card from the Drive Slot

Press the SD card into the drive slot to eject it. The drive slot is spring loaded, and it will eject the SD card.

6

System Setup

Introduction

System Setup provides access to functions that allow you to customized the system settings and utilities to help you manage those settings.

Accessing the Setup Function

1. From the startup screen select the ***More*** option.
2. Select ***Setup*** to access the ***System Setup*** function.
3. Enter the ***System Setup*** password.

   The default password is `11112222`.

The ***System Setup*** menu opens.

ECG

On the ***System Setup*** menu, verify the ECG is selected and press the ***Enter*** key to enter the ECG function. The ECG window opens.

The ECG function allows you to define the following information:

- Number of reports printed for the available report formats
- Auto gain and Auto shift
- Lead Sequence and Lead Groups
- Writer settings
- Parameters for ECG Analysis and ECG Acquisition

Resting ECG Reports

With ***Resting ECG Reports*** highlighted, press the ***Enter*** key. The following window opens.

The ***Resting ECG Reports*** window setup options are defined in the following table.

Function	Description
Normal ECG Reports	Choose the report formats your system automatically prints after you press the **ECG** key ● Select whether you want the report to print with or without interpretation (12SL analysis statements). ● Enter the number of copies you want to print for each report (0 - 10 copies). The available report formats are: ■ ***4 by 2.5s*** ■ ***4 by 2.5s + 1 rhythm ld*** ■ ***4 by 2.5s + 1 rhythm ld*** ■ ***4 by 10s*** ■ ***Autorhythm*** **NOTE:** The default report format is one copy with interpretation for 4 by 2.5.
Abnormal ECG Reports	Choose the report formats your system automatically prints when an ECG is interpreted as abnormal. ● Select whether you want the report to print with or without interpretation (12SL analysis statements). ● Enter the number of copies you want to print for each report (0 - 10 copies). The available report formats are: ■ ***4 by 10s*** ■ ***Autorhythm*** By default, no extra report is printed.

Function	Description
Auto gain	Select ***Yes*** to enable ***Auto gain***. The ***Auto gain*** feature adjust the gain to minimize waveform overlap. Depending on the amount of overlap, the ***Auto gain*** may be applied to all leads or only the chest leads. The default is ***No***.
Auto shift	Select ***Yes*** to enable ***Auto shift***. The ***Auto shift*** feature automatically shifts the waveforms vertically to avoid (or minimize) waveform overlap between rows. The default is ***Yes***.

Lead Sequence

With ***Lead Sequence*** highlighted, press the ***Enter*** key. The ***Lead Sequence*** window opens.

Select ***Standard*** lead sequence or ***Cabrera*** lead sequence. Depending on the lead sequence selected, the leads defined under the ***Lead Groups*** will change to the respective lead sequence. The default lead sequence is ***Standard***.

Lead Groups

With ***Lead Groups*** highlighted, press the **Enter** key. The ***Lead Groups*** window opens.

The following table describes how to define the lead groups, extra rhythm lead, and lead group for autorhythm.

Function	Description
Group 1 – Group 3	These groups are only displayed on the screen. The options available under the leads displayed are: ***All Leads*** and ***6 leads***. The default is ***All leads*** for ***Group 1*** and ***6*** leads for ***Group 2*** and ***Group 3***.
Group 4 – Group 7	These groups are for rhythm printing and display. The number of leads that can be selected is three.
Extra rhythm lead	Select the rhythm lead for the ***4 by 2.5 + 1 rhythm ld*** report format. The default is lead ***V1***.
Autorhythm	Select the group (from Group 4 to Group 7) to be printed in the Autorhythm report.

Writer Setup

With ***Writer Setup*** highlighted, press the **Enter** key. The ***Writer Setup*** window opens.

The ***Writer Setup*** window setup options are defined in the following table.

Function	Description
Speed[1]	Select the writer's speed setting in millimeters per second. The default is ***25 mm/s***.
Gain[1]	Select the writer's gain setting. The default is ***10 mm/mV***.
Filter[1]	Select the writer's filter setting. The default is ***150 Hz***.
Paper	Select the kind of paper, ***Z-Fold/Roll***. The default is ***Z-Fold***.
[1]The setting is valid for PDF formats too.	

ECG Analysis

With ***ECG Analysis*** highlighted, press the **Enter** key. The ***ECG Analysis*** window opens.

The ***ECG Analysis*** window setup options are defined in the following table.

Function	Description
Preview before print	Displays acquired 10 second ECG and 12SL analysis. The default is ***Yes***.
Screening criteria	Select ***Yes*** to prevent specific 12SL analysis statements from appearing in the reports. The default is ***No***.See "12SL Statements" on page 141.for a list of these statements.
Reason Statements	Select ***Yes*** to enable the inclusion of reason statements in the report. The default is ***No***.

Function	Description
Suppress NORMAL statements	Select ***Yes*** to prevent the Normal ECG 12SL analysis statement from appearing in the report. The default is ***No***.
Suppress ABNORMAL and BORDERLINE statements	Select ***Yes*** to prevent the Abnormal ECG and Borderline ECG 12SL analysis statements from appearing in the report. The default is ***No***.

ECG Acquisition

With ***ECG Acquisition*** highlighted, press the **Enter** key. The ***ECG Acquisition*** window opens.

The ***ECG Acquisition*** window setup options are defined in the following table.

Function	Description
Baseline roll filter	Use this filter to remove baseline sway. The higher the setting, the more the filter smooths out a wandering baseline. This filter does NOT distort the ST segment displayed on the ECG reports. The default is ***0.16 Hz***.
Disable auto gain check	Select ***No*** to display a prompt after the user presses the **ECG** key if the gain of the recorded ECG data is either too high or too low. The user can then manually adjust the gain. The default is ***No***.
Disable lead off check[1]	Select ***No*** to display a screen message when the system detects a disconnected lead wire. The default is ***No***.
Baseline wander warning[1]	Select ***Yes*** to display a screen message when the system detects a wandering baseline. The default is ***No***.
Muscle tremor warning[1]	Select ***Yes*** to display a screen message when the system detects muscle tremor. The default is ***No***.
AC noise level warning[1]	Select ***Yes*** to program the system to check for powerline interference when recording an ECG. The default is ***Yes***.

Function	Description
Hookup Advisor	Select ***Yes*** to enable the ***Hookup Advisor*** option, which monitors the quality of resting ECG. The default is ***Yes***.
Prompt level	Select the level at which the system acknowledges poor signal quality. See "Hookup Advisor" on page 68 for information on setting up this option. The default is ***Red***.
Pre-acquisition	Select ***Yes*** to begin acquiring ECG data as soon as the system is in Resting ECG mode. The system does not wait until the user presses the **ECG** key before it starts acquiring ECG data. The latest 10 seconds of ECG data is ready for analysis when ***Pre-acquisition*** is turned on. The default is ***No***.
[1]If ***Hookup Advisor*** is enabled, this option is overridden by ***Hookup Advisor***.	

Basic System

On the ***System Setup*** menu, use the arrow pad to scroll to ***Basic System*** until it is highlighted and press the **Enter** key. The ***Basic System*** window opens

The functions under ***Basic System*** allow you to perform the following

- Set up patient questions
- Set screen colors
- Activate an option
- Change settings for miscellaneous parameters.

Patient Questions

On the ***Basic Setup*** menu, highlight ***Patient Questions*** and press the **Enter** key. The ***Patient Questions*** window opens.

The ***Patient Questions*** window setup options are defined in the following table:

Function	Description
Patient Info required	Select ***Yes*** to display a prompt to enter the patient information after the user presses the **ECG** key. The default is ***No***.
ID required	Select ***Yes*** to mandate the entry of a patient's identification number before an **ECG** can be recorded. The default is ***No***.
ID length	Type the number of characters used in the patient identification number. Choose from ***3*** to ***16*** characters. Use a format that is compatible with the MUSE system to which the system is communicating. This is for devices in which transmission or storage options are enabled. The default is ***16***.
Age	Select ***Yes*** to add the field ***Age*** in ***Patient Data*** window. The default is ***Yes***.

Function	Description
Method of entering age	Choose the method to enter the patient's age: ● Select ***Date of birth*** to enter a patient's age in day-month-year format. With this setting, the patient's date of birth will appear on the printed ECG. ● Select ***Age*** in years to enter the patient's age in years, months, weeks, days, or hours. With this setting, the patient's age in years, months, weeks, days, or hours will appear on the printed ECG. The default is ***Date of birth***.
Gender	Select ***Yes*** to add the field ***Gender*** in the ***Patient Data*** window. The default is ***Yes***.
Secondary ID	Select ***Yes*** to add the field ***Secondary ID*** in the ***Patient Data*** window. The default is ***No***.
Text entry	● Select ***Numbers and letters*** if the patient ID and secondary ID are to be entered in alpha-numeric format. ● Select ***Numbers*** only if the patient ID and secondary ID are to be entered in numeric format. 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, ACE200 is entered by pressing 22 **Enter** 2222 **Enter** 333 **Enter** 2 **Enter** 0 0 **Enter**. OR 22 **Enter** 2222 333 2 0 0 **Enter** The default is ***Numbers only***.

Screen Colors

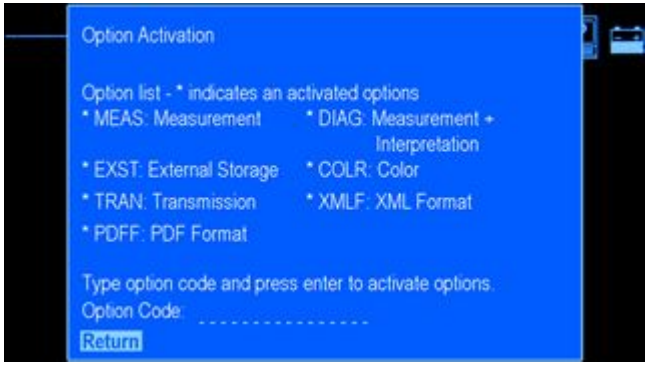
On the ***Basic Setup*** menu, highlight ***Screen colors*** and press the **Enter** key. The ***Screen colors*** window opens.

The ***Screen colors*** window setup options are defined in the following table:

Function	Description
Monochrome	Select ***Monochrome*** to view white screen elements.
Option 1	Select ***Option 1*** to view white, green, yellow, and red screen elements. The default is ***Option 1***.
Option 2	Select ***Option 2*** to view white, yellow, and red screen elements.

Option Activation

On the ***Basic Setup*** menu, highlight ***Option Activation*** and press the **Enter** key. The ***Option Activation*** window opens.



This window will display the options available. An asterisk (*) appears next to each option which is currently activated on the system. Use the following instructions to activate an option on your system,

1. At the ***Option Code*** field, type the 12-digit option activation code and press the **Enter** key.

   If you typed the code for an option which has been purchased for the system, an asterisk will appear next to that option in the list.

2. Repeat step 1 for each option to be activated.
3. Highlight ***Return*** and press **Enter** to return to the ***Basic System*** menu.

Miscellaneous Setup

On the ***Basic Setup*** menu, highlight ***Miscellaneous Setup*** and press the **Enter** key. The ***Miscellaneous Setup*** window opens.

The ***Miscellaneous Setup*** window setup options are defined in the following table:

Function	Description
Buzzer	Select ***On*** to turn on the system's buzzer. Select ***Off*** to turn off the system's buzzer. The default is ***On***.
Information line	Select ***Yes*** to enable the help information line on the screen. The default is ***Yes***.
Cart number	Type a number that uniquely identifies this system.
Site number	Type a number from 1-32 to identify where the data will be stored in the MUSE system. The ***Site number*** used must match the site number on the MUSE system to which the system is communicating.

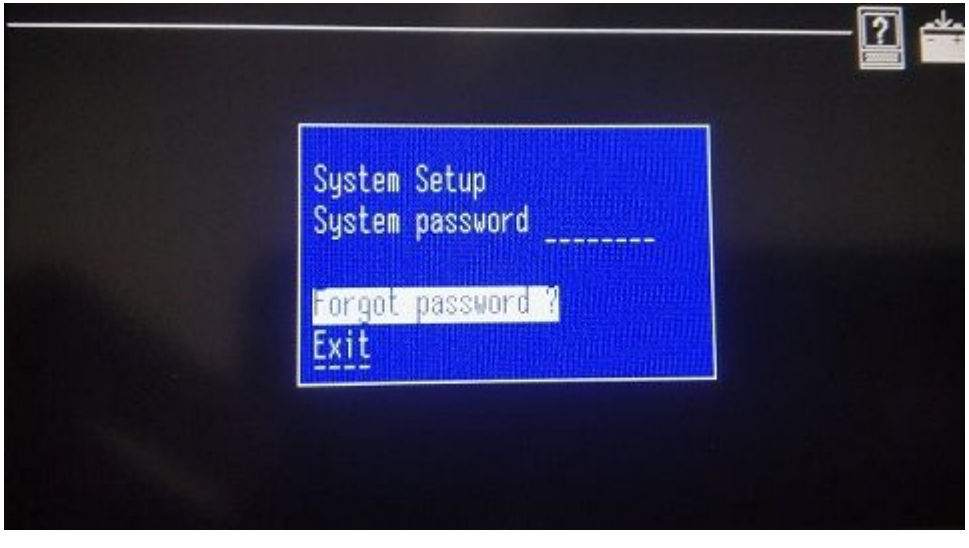
Function	Description
Location number	Type a number to identify the location of this system to a MUSE system. Use a value from 0-9999 for a MUSE system using software version 7 or later. The ***Location number*** used must match the location number on the MUSE system to which the system is communicating
File Manager sort	Select the sorting method ***File Manager*** uses to display stored ECGs. The default is ***By ID***.
Automatic Shutdown	Type the number of minutes (x) greater than zero to enable the battery conservation mode. If a key is not pressed within (x) minutes, your system will automatically power off. This does not happen if the system is connected to DC power. The default is 0 (zero) which indicates that ***Automatic Shutdown*** is disabled.
Change Password	Type a numeric password (eight digits) that allows you to access the ***System Setup*** functions. The default system password is 11112222. Keep track of the assigned password. **NOTE:** The user should regularly take the backup of the assigned password.
Demo Mode	Select ***Yes*** to turn on the ***Demo Mode***. The default is ***No***. The ***Demo Mode*** is provided for the convenience of demonstration only.

Reset Password

If you forget your password you can reset the password using the below steps.

1. On ***System Setup Password***, highlight ***Forget Password*** and press the **Enter** key.

   NOTE:
   Forgot password will reset to factory default settings including the encryption key and stored ECG Files will not be assessable.



2. In the ***Forget Password*** window, the below message appears:
   This will restore system setup to default factory settings and stored ECG Files will not be assessable.

Press Lead + **F3 keys** to continue.

3. **Enter** the **New Password**.

4. **Confirm** the **New Password**.

The settings are restored to default, the existing encryption key is erased and the new key is generated.

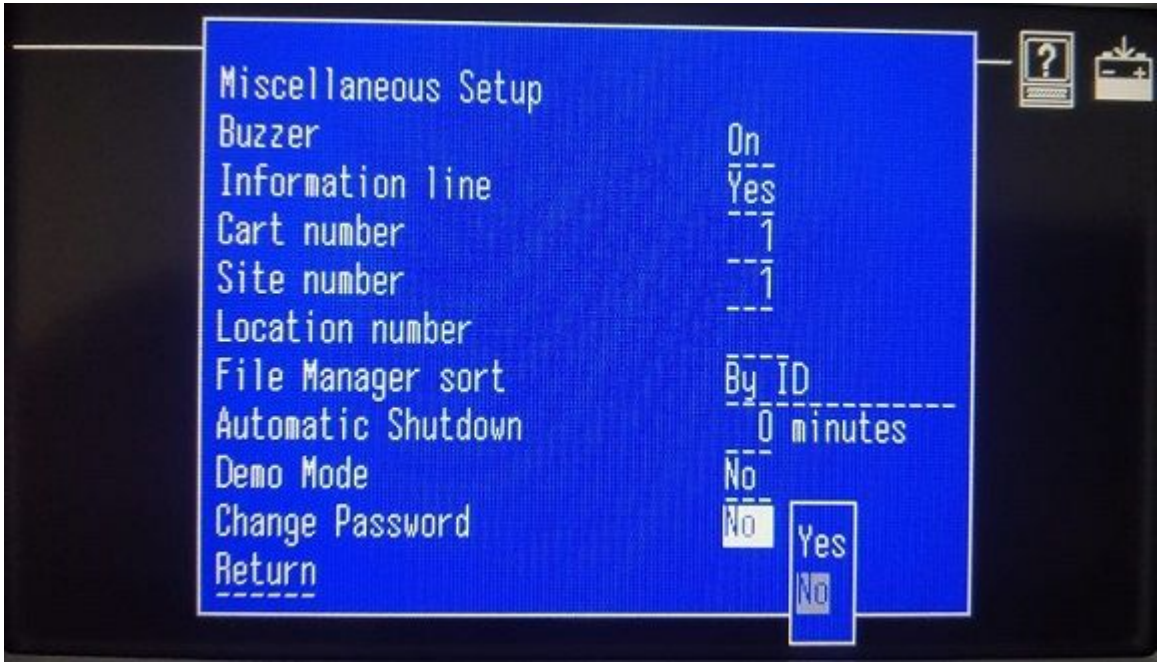
NOTE:

The password is not exported to SD card in save set up.

Change Password

Change the password using the below steps.

1. On the ***Basic Setup*** menu, highlight ***Miscellaneous Setup*** and press the **Enter** key.
   The ***Miscellaneous Setup*** window opens.
2. In ***Miscellaneous Setup*** menu, highlight ***Change Password*** and press the **Enter** key.
   The ***Change Password*** menu opens.
3. In the ***Change Password*** menu, highlight ***Yes*** and press the **Enter** key.
   The ***Change Password*** window opens.



4. **Enter** the **New Password**.

5. **Confirm** the **New Password**.

NOTE:
The password is not exported to SD card in save set up.

6. Select **Return** and press the **Enter** key to exit.

Country Setup

On the ***Basic Setup*** menu, highlight ***Country Setup*** and press the **Enter** key. The ***Country Setup*** window opens.

The options under ***Country Setup*** allow you to perform the following:

- Set the language of the device.
- Set the date and time.
- Set AC filter parameters.
- Set the lead notation.

Language

On the ***Country Setup*** menu, select and set the language:

1. Highlight ***Language*** and press the **Enter** key.

   The ***Select new language*** window opens.

2. Highlight a language of your choice and press the **Enter** key.
3. Save and exit from the ***System Setup*** to view the new language.
   a. Press the **esc** key until you reach ***System Setup*** menu.
   b. Scroll and highlight ***Exit*** and press the **Enter** key.
   c. At the ***Save Setup*** menu, select whether you would like to save to the system, to an SD Card or do not save the setup

Date and Time

On the ***Country Setup*** menu, highlight ***Date and Time*** and press the **Enter** key. The ***Date and Time*** window opens.

The ***Date and Time*** window setup options are defined in the following table:

Function	Description
Current Date	Enter the current date in DD-MMM-YYYY format.
Current time	Enter the current time in 24 hour format.

AC Filter

On the ***Country Setup*** menu, set the AC filter parameters.

1. Select the ***AC filter*** and press **Enter** key.

   The ***AC filter*** window opens.

2. Select the value for the ***AC filter***.

   The default is ***Off***.

3. Select the setting for the ***Adaptive AC filter***.

   The default is ***Yes***.

4. Select ***Return*** and press the **Enter** key to return to the ***Country Setup*** menu.

Notation

On the ***System Setup*** menu, set the lead notation.

1. Select ***Notation*** and press the **Enter** key.

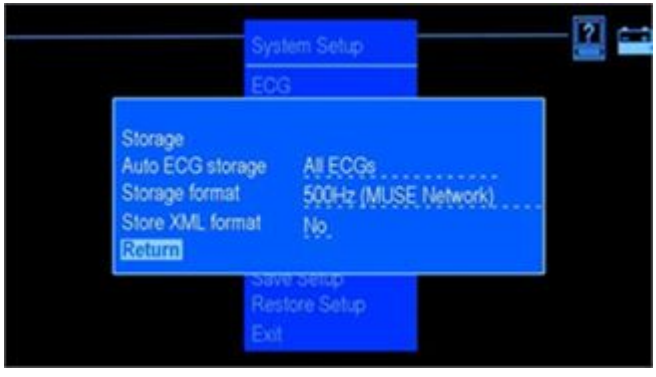
   The ***Notation*** window opens.

2. Select the value for the lead ***Notation*** (AHA or IEC).

3. Select ***Return*** and press the **Enter** key to return to the ***Country Setup*** menu.

Storage

On the ***System Setup*** menu, highlight ***Storage*** and press the **Enter** key. The ***Storage*** window opens.



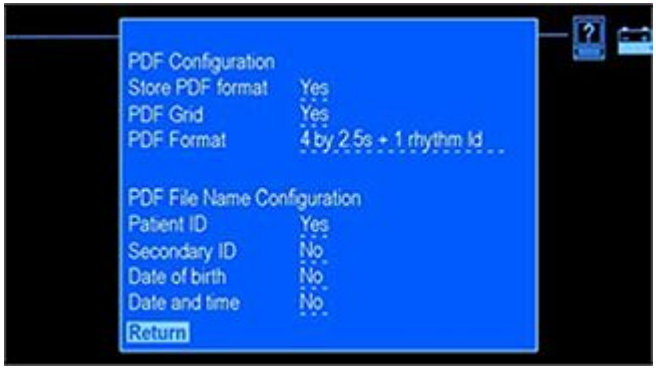
This function helps you to define the type and format of the ECG to be stored.

The ***Storage*** window setup options are defined in the following table:

Function	Description
Auto ECG Storage	Select the type of ECGs you want your system to automatically store. The default is ***No ECGs***.
Storage format	Select the type of storage format for the recorded ECG. The default is ***500Hz (Muse Network)***. **NOTE:** The recorded ECG is encrypted. • Select ***500Hz (MUSE Network)*** if sending ECGs to a MUSE system using MUSE software versions 004A or later • Select ***500Hz DVS (MUSE Network)*** to store ECGs so that they can be reprinted at the same full original resolution by the receiving device. The MUSE system must be using software version 5D.04 or later.
Store XML format	Select ***Yes*** to automatically save each ECG in XML format in addition to the standard GE Healthcare proprietary format. The default is ***No***.

PDF Configuration

On the ***System Setup*** menu, highlight ***PDF Configuration*** and press the **Enter** key. The ***PDF Configuration*** window opens.



This function helps you define the PDF settings for ECGs stored in PDF format.

The ***PDF Configuration*** window setup options are defined in the following table:

Function	Description
Store PDF format	Select ***Yes*** to automatically save each ECG in PDF format in addition to the standard GE Healthcare proprietary format. The default is ***No***.
PDF Grid	Select ***Yes*** to enable the grid lines to appear in the PDF file. The default is ***Yes***.

Function	Description
PDF Format	Select report format for the ECG stored in PDF format. The default is ***4 by 2.5s + 1rhythm ld***.
PDF File Format Configuration	Select how the PDF file will be named. The PDF file name can include all or any of the following: • ***Patient ID*** Choose ***Yes*** to include the patient ID in the file name. The default is ***Yes***. • ***Secondary ID*** Choose ***Yes*** to include the patient's secondary ID in the file name. The default is ***Yes***. • ***Date of birth*** Choose ***Yes*** to include the patient's date of birth in the file name. The default is ***Yes***. • ***Date and Time*** Choose ***Yes*** to include the date and time (of the recorded ECG) in the file name. The default is ***Yes***. The default naming convention for the file is: ***PatientID_DateOfbirth_Date_Time.pdf*** **NOTE:** If all parameters above are set to ***No***, the PDF file will be named ***Date_Time.pdf***.

Transmission

On the ***System Setup*** menu, highlight ***Transmission*** and press the **Enter** key. The ***Transmission*** window opens.

This function lets you define the type of ECGs to be transmitted, the default location where the ECG is to be transmitted, and the baud rate of the serial line.

NOTE:

If the baud rate of the MAC 600 is changed, the setting of the PC or the MUSE Server/Client must be updated accordingly.

The ***Transmission*** window setup options are defined in the following table:

Function	Description
Auto ECG Transmission	Select the type of ECGs that will be automatically transmitted to an external device. The default is ***No ECGs***.
Delete after transmit	Select whether the ECG will be deleted from the SD Card after it is transmitted to an external device. The default is ***Yes***.

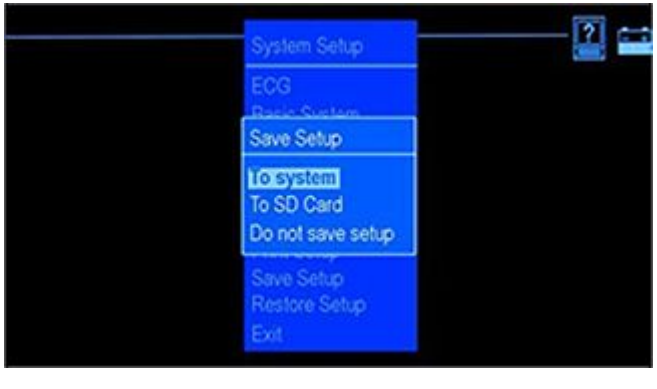
Function	Description
Serial line baud rate	Select the baud rate of the serial line. The default is ***115.2k***.
Default Location	Select the default location where the file is to be transmitted. The default is ***None***.

Print Setup

On the ***System Setup*** menu, highlight ***Print Setup*** and press the **Enter** key to print a report of the ***System Setup*** parameters defined for your device.

Save Setup

On the ***System Setup*** menu, highlight ***Save Setup*** and press the **Enter** key. The ***Save Setup*** window opens.



The ***Save Setup*** window setup options are defined in the following table:

Function	Description
To system	Saves the changes to the system.
To SD Card	Saves the changes to an SD card.
Do not save setup	Exits the ***Save Setup*** menu without saving the changes made to ***Setup***.

Restore Setup

On the ***System Setup*** menu, highlight ***Restore Setup*** and press the **Enter** key. The ***Restore Setup*** window opens.

The ***Restore Setup*** window setup options are defined in the following table:

Function	Description
To Original Factory Settings	Select to restore the system to the default factory settings.
From SD Card	Select to restore the system setup parameters from an SD card.
Do Not Restore Setup	Select to exit this function.

A

Maintenance

Regular maintenance, irrespective of usage, is essential to ensure that the equipment functions as required. This chapter provides basic maintenance information for the following components:

- The device
- Paper
- Battery

WARNING:

MAINTENANCE Failure on the part of all responsible individuals, hospitals, or institutions using 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.

Device Maintenance

CAUTION:

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

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

- Before inspecting or cleaning the 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 Device

Perform a visual inspection daily, preferably before the system's first use everyday. 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 are secured on the keypad 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 and Disinfecting Exterior Surfaces

Clean and disinfect exterior surfaces monthly or more often as needed.

To clean the exterior surfaces:

1. Use a clean, soft cloth and an agent or disinfectant that contains alcohol and is commonly used in hospitals.

   NOTE:
   Do not use disinfectants with a phenol base or peroxide compounds.

2. Wring excess water/solution from the cloth. Do NOT drip water or any liquid on the system and avoid open vents, plugs, or connectors.
3. Dry surfaces with a clean cloth or paper towel.

Cleaning Materials to Use

Use the following materials to clean the device:

- Mild dishwashing detergent
- Clean, soft cloth
- Water

The device is compatible with cleaning agents that contain chemicals listed below, either individually or as a combination with respective concentration:

- 50% PROPYL ALCOHOL (50% propan-1-ol)
- 25% ISO PROPYL ALCOHOL (25% propan-2-ol)
- 25% ETHANOL

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

Precautions

Observe the following precautions when cleaning cables:

- Never immerse cables in any liquid.
- Never pour or spray any liquid directly onto cables.
- Never permit fluid to seep into connections or openings.
- Never autoclave or steam clean cables or dip them in CIDEX solution.
- Always wipe gently to avoid pulling long wires from the connectors.
- Always remove cables from the device before cleaning.
- The metal parts may get corroded if they come into contact with disinfectant solutions. Avoid using disinfectant solution around the metal parts.

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

Cleaning the Printhead

If the printer does not function, you may need to clean dust and foreign particles from the printhead. To clean the printhead, do the following:

1. Dip cotton swabs in ethyl alcohol and wring out the excess solution.
2. Open the printer door.

3. Gently wipe the heating element with the cotton swabs.
4. Close the printer door when it is completely dry.

CAUTION:
Do not use products that can harm the heating element, such as sandpaper. Avoid unnecessary force when handling the printhead.

CAUTION:
RISK OF SKIN BURNS The printhead gets hot when recording.

Do not to touch the thermal printhead when inserting the paper.

NOTE:
Use only original GE Healthcare Writer paper. This paper has a special coating that prevents contamination and debris collection on the printhead, and electrostatic buildup. Using other paper may result in recordings of poor quality. The printhead may wear out prematurely, and use of other paper may void the warranty.

Calibration Check

A regular calibration check of the system is recommended once a year. To check calibration of the system:

1. Switch on the system.
2. Connect the patient cable to the system.
3. Change the report format to print 1 copy of an ECG for 4 by 3 report format (with/without interpretation). See "Report Setup" on page 78.
4. Set the speed to 25 mm/sec and gain to 10 mm/mV.
5. Press the **ECG** key to print an ECG report.
6. Ensure that each calibration pulse is 5mm ±5% in width and 10mm ± 5% in height.

Preventive Maintenance

GE Healthcare does not recommend any preventive maintenance for this system. However preventive maintenance may be performed by the user. Refer to *MAC 600 Service Manual* for details on how to perform preventive maintenance. If further technical assistance is required, contact the nearest GE Healthcare Service Centre.

Storing Thermal Paper

NOTE:
To ensure maximum image life, store thermal paper separately in manila folders or polyester/polymide protectors.

To avoid deterioration or fading, follow these precautions:

1. Store in cool, dark, and dry locations.

   Temperature must be below 86°F (30°C). Relative humidity must be less than (<) 65%.

2. Avoid exposure to bright light or ultraviolet sources such as sunlight, fluorescent, and similar lighting which causes yellowing and fading.

3. Do NOT store thermal papers with any of the following:

   - Carbon and carbonless forms.
   - Non-thermal papers or any products containing tributyl phosphate, dibutyl phthalate, or other organic solvents. Many medical and industrial writer papers contain these chemicals.
   - Document protectors, envelopes, and sheet separators containing polyvinyl chloride or other vinyl chlorides.

4. Avoid contact with: cleaning fluids and solvents such as alcohols, ketones, esters, ether, and so on.

5. Do NOT use mounting forms, pressure-sensitive tapes, or labels containing solvent-based adhesives.

Battery Maintenance

The system uses a rechargeable battery containing Lithium-Ion cells. The battery contains an integrated safety protection circuit.

The system battery has a shelf life of six months. Recharge the battery once every six months when stored for a long period of time. The system switches off when the battery is completely discharged. Charge battery regularly to maximize battery life.

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.

To print an ECG after low battery shutdown do the following:

1. Connect the system to an AC power supply.
2. Recharge the battery for 20 minutes.
   The system is ready to print an ECG.

To print an ECG after a battery is fully discharged do the following:

1. Connect the system to an AC power supply.
2. Recharge the battery for 90 minutes.
   The system is ready to print an ECG.

NOTE:
The system does not print an ECG without a working battery.

Periodic Maintenance

In addition to normal system use, periodic deep discharge cycles may be required to ensure consistent battery performance. A deep discharge cycle occurs when the battery is discharged until the system shuts down and the battery is charged until it is full.

NOTE:
For optimal battery life, GE Healthcare recommends one deep discharge cycle every three months, but does not recommend over-exercising the battery with multiple deep discharge cycles.

Battery Safety

Observe the following warnings whenever handling the system battery:

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

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 device for an adequate length of time, use the following instructions to replace the battery.

1. Remove the cover of the battery compartment by pulling it along the direction of the arrow etched on the cover of the battery compartment.
2. Remove the old battery.

3. Insert a new battery as shown in the figure.
4. Replace the cover of the battery compartment.

Connecting the ACDC Power Adapter

The 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.

To connect the system to an AC power outlet:

1. Connect the female end of the ACDC power adapter to the power connector on the back of the unit (A).
2. Plug the male end of the power cord in the ACDC power adapter to the AC outlet.
3. Check the power LED to make sure the unit is receiving power from the AC outlet.

NOTE:

Use only the GE Healthcare recommended ACDC power adapters. The system requires a working battery for printing ECG reports.

Charging the Battery

To fully charge the system battery:

1. Connect the system to an AC wall outlet.
2. Charge the system's battery 2–3 hours or until the battery LED switches off.

NOTE:
If the battery is deeply discharged, you may have to charge the battery for 6 to 7 hours.

Is the Battery Charging?

The following are indications show that your device is being charged.

- the amber battery light glows
- the battery gauge icon shows the battery charging icon

NOTE:
If the battery is fully charged or exceeds safe charging temperature, the system will not charge the battery.

When Should You Charge the Battery?

- **Before Initial Use**
  To ensure a fully charged battery, charge the system before you use it for the first time.
- **Between Acquisitions**
  To ensure a fully charged battery, power off the system and connect it to an AC wall outlet until you use the system again. This prolongs battery runtime.
- **When the Battery is Low**
  The amber light on the keypad flashes intermittently.
- **When the Battery is Completely Discharged**
  Your system powers off when the battery is completely discharged. To operate your system, you must connect the system to an AC wall outlet.

B

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, see "Inspecting the Device" on page 126.
- 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 Healthcare 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 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 Healthcare Technical Support.

Equipment Problems

This section lists the problems that are likely to occur and their solutions.

System Does Not Power Up

- Verify the unit is turned on.
- If it is not, turn on the unit. See "Turning on the System" on page 51.
- Verify the battery is installed and charged.
  See "System Errors" on page 138, for instructions on verifying whether the battery is installed and charged.
  See "Replacing the Battery" on page 132for instructions on installing the battery.
- Verify the unit is connected to an AC power outlet.
- Verify the equipment is receiving power from the AC power outlet.
  If the unit is receiving power, the Power LED will be lit.

Acquired ECG Data Displays Unacceptable Noise

- Check the patient's position.
  The patient should remain motionless during the acquisition of a resting ECG.
- Use the Hookup Advisor indicator to help determine the cause of the noise.
  For more information, see "Hookup Advisor" on page 68.
- Verify the electrodes are placed properly.
  See "Standard 12 Lead Placement" on page 57.
- Verify the electrodes have been applied correctly.
  Perspiration, excessive hair, lotions, and dead skin cells must be removed from the electrode site.
  See "Preparing the Patient" on page 55.
- Check for defective or expired electrodes.

Replace the electrodes if there are any questions about their effectiveness.

- Check for defective, broken, or disconnected patient cable.
  Replace the lead wires if you see that they are not effective. See "Connecting the Patient Cable" on page 49.

Paper Jams

If the paper jams while printing, verify the paper was inserted correctly. See "Loading the Paper" on page 49.

SD Card Error

If you see an error message stating that the SD card is not present or cannot be found, or that the ***SD Card Cannot Be initialized***, do the following:

- 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 system.
  To verify an SD card is formatted for the correct file system, do the following:

  a. Insert the card into an SD card reader attached to a PC.

  b. Copy any files you want to save from the SD card to a folder on the PC.

  c. Using the Windows Format command, specify either FAT or FAT16 for the file system and format the card.

  NOTE:
  Formatting the SD card will erase any existing files on the card.

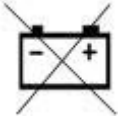
  d. Copy the files from the folder on the PC to the newly formatted SD card.

NOTE:
If the file system of the SD card is corrupted, you will be prompted to recover the file system by formatting the SD card. System recovery from corruption of SD card file system will destroy the ECGs stored on the SD card.

System Errors

The following table identifies some potential errors that may occur while you are operating the system, the possible causes, and a recommended action to resolve the error.

If performing the recommended actions does not resolve the problem, contact authorized service personnel.

Problem	Cause	Solution
 appears on the screen.	No battery is installed in the system.	Install a battery and connect the system to an AC wall outlet to charge the battery
Amber LED on the key pad flashes intermittently.	The battery charge is low.	Connect the system to an AC wall outlet to charge the battery.
 appears on the screen.	The writer door is open.	Close the writer door.
The writer printhead is too hot appears on the screen	The Writer mechanism has heated up due to heavy use.	Turn off the system and power on after 3 to 4 minutes. If problem recurs with normal use, inform service.
The system does not power up when operating from battery power	The battery is fully discharged.	Connect the system to an AC wall outlet to charge the battery.

Problem	Cause	Solution
The system shuts down when operating from battery power.	Low battery, or the ***Automatic Shutdown*** feature is enabled	Connect the system to an AC wall outlet to charge the battery. Check the setting for ***Automatic Shutdown***.
"...." Lead disconnected message appears.	Electrode(s) disconnected.	Reconnect the electrode(s).

C

12SL Statements

Introduction

The statements given in the following table do not appear on ECG reports when the ***Screening criteria*** option is enabled in ***System Setup***.re

Statement
Aberrant conduction
Abnormal QRS-T angel, consider primary T wave abnormality
Cannot rule out
Deep Q wave in lead V6
Early repolarization
Incomplete right bundle branch block
Junctional ST depression, probably abnormal
Junctional ST depression, probably normal
(masked by fascicular black?)

Statement
Minimal voltage criteria for LVH, may be normal variant
Moderate voltage criteria for LVH, may be normal variant
Nonspecific intraventricular conduction delay
Northwest axis
, plus right ventricular enlargement
Possible
Prominent mid-precordial voltage.
Pulmonary disease pattern
Right axis deviation
Right superior axis deviation
Rightward axis
RST’ or QR pattern in V1 suggests right ventricular conduction delay
S1–S2–S3 pattern, consider pulmonary disease, RVH, or normal variant
ST elevation, consider early repolorization, pericarditis, or injury
ST elevation, probably due to early repolorization
with 2:1 AV conduction
with 3:1 AV conduction
with 4:1 AV conduction
with 5:1 AV conduction
with a competing junctional pacemaker
with rapid ventricular response

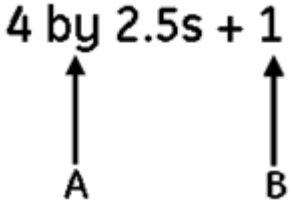
Statement
with retrograde conduction
with slow ventricular response
with undetermined rhythm irregularity

D

Report Formats

Format Description

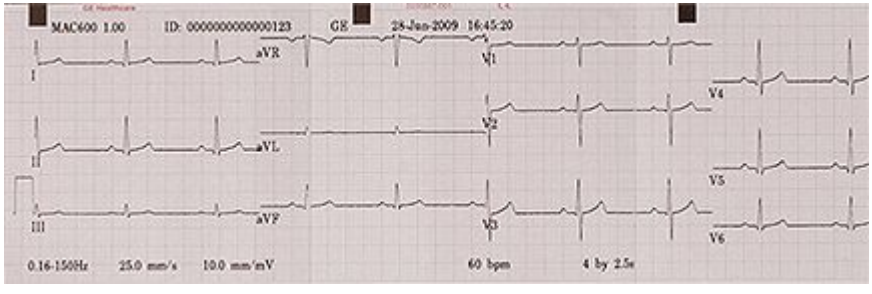
Numeric report names are used to describe how the ECG data is displayed.

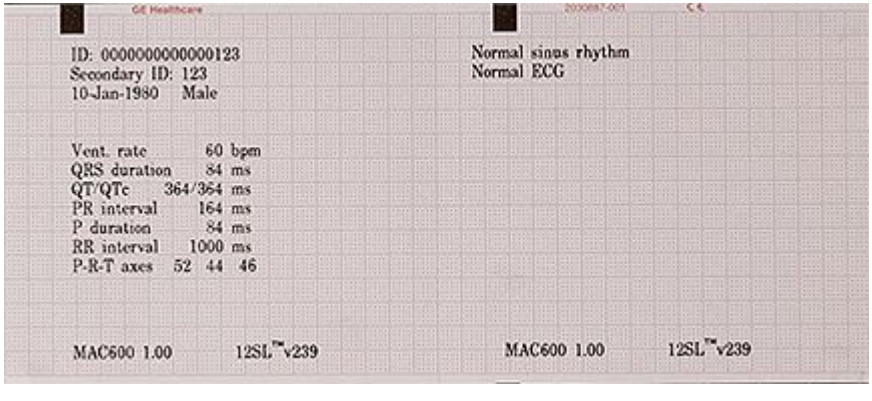


Label	Description
A	Four columns of data containing 3 leads with 2.5 seconds of data in each lead.
B	One 10 second rhythm lead.

Sample Reports

Following is a sample report format for ***4 by 2.5s*** Lead:





Index

D

E

F

G

H

I

K

L

M

O

P

R

S

T

W

Z

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