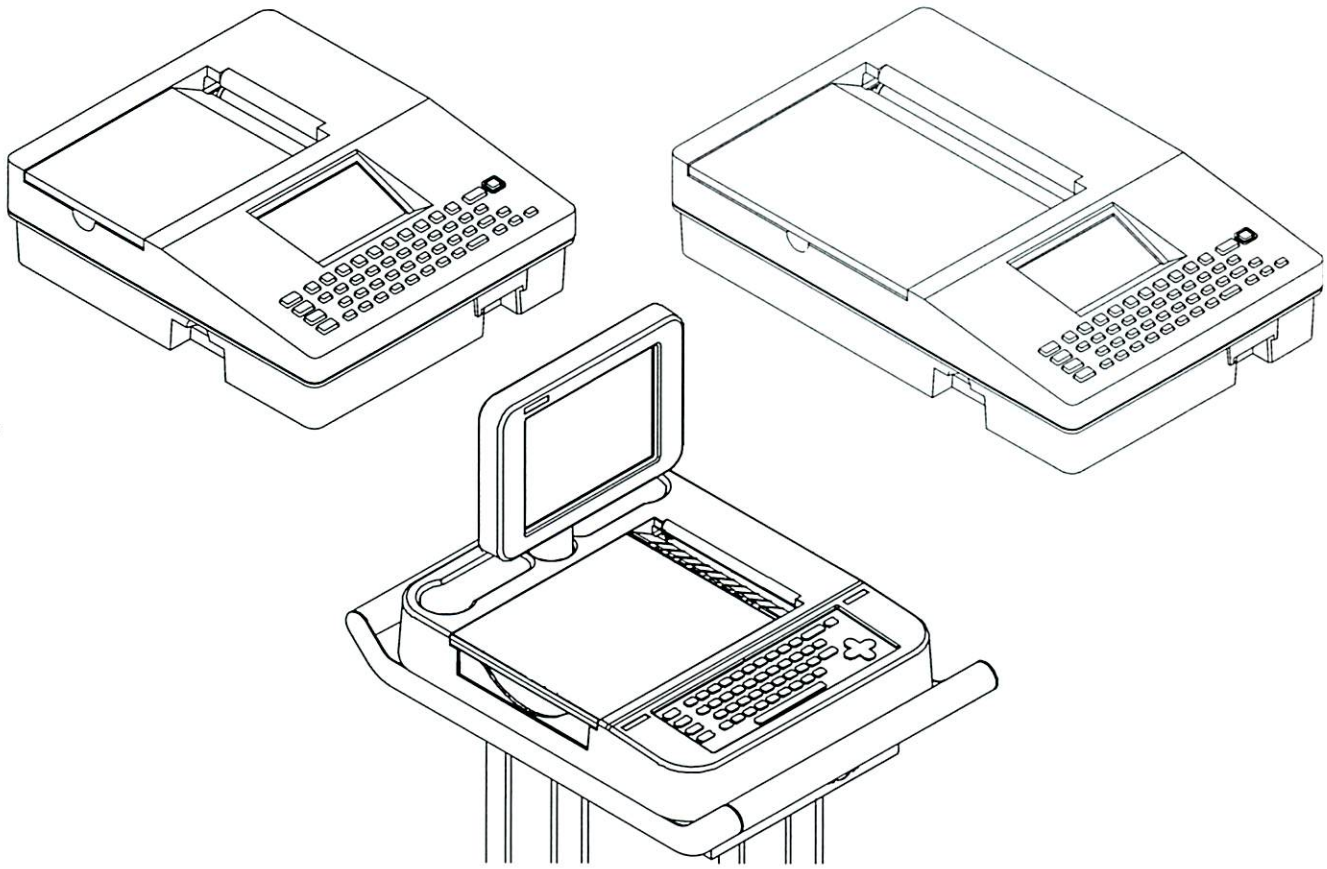
Operating Instructions



Eclipse Electrocardiographs

Operating Instructions Part No. 086425
Issued: 0997

Burdick, Inc. 15 Plumb Street Milton, WI 53563 U.S.A. (608) 868-6000

OPERATOR COMMENTS

We are constantly striving to make our products and our documentation easier to use. You can help by sharing your comments with us. If you have any suggestions, or if you would like to notify us regarding an inaccuracy, please photocopy, fill out and mail the Operator's Comments form located at the back of this manual. Your input will be sincerely appreciated.

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Burdick, Inc.
15 Plumb Street
Milton, Wisconsin 53563 U.S.A.

Acquiring ECG Reports

1. Prepare patient according to guidelines in Chapter 5, "Patient Preparation."

2. Plug Eclipse into a properly grounded, AC power outlet (if battery is not charged).
See "Connecting Power" on pg. 2-3

3. From Standby mode, press 

to power up to the PREVIEW screen.

For a Stat ECG...

4. Press 

to acquire an Auto ECG report.
See "Acquiring an Auto ECG" on pg. 6-10.

For an ECG with demographics...

4. Press 

to go to the EDIT ID menu.

5. If a System Note box appears with the message "**NEW Patient?**" press 

.

6. Type the patient's ID and press 

.

7. Type the patient's last name and press 

.

8. Type the patient's first name and press 

.

9. Type the patient's date of birth and press 

.

10. Select the appropriate gender in the ***Sex** field by pressing either 

or 

.

11. Fill in remaining fields as thoroughly as possible. Skip fields if necessary. Exit menu or acquire a report at any time.
See "Entering Patient Demographics" on pg. 6-4

12. Press 

to acquire an Auto ECG report.
See "Acquiring an Auto ECG" on pg. 6-10.

Table of Contents

Intended Use

The Eclipse models discussed in this manual are the Eclipse 4, Eclipse 400, Eclipse 8, Eclipse 800, Eclipse 850 and the Eclipse Plus. All of these electrocardiographs are intended to be used for obtaining 12-lead tracings of the electronic potentials associated with the heart. These electrocardiographs are available with automated analysis capability, Fax capability and SCP-ECG communication capability. Instructions for using all of the capabilities of the Eclipse electrocardiographs are contained in this manual.

Warnings, Cautions & Notices

Warnings

WARNING: This device is NOT intended for unattended or continuous patient monitoring. It is intended for short-term ECG waveform acquisition. There are no audible or visible alarms.

WARNING: Never remove the battery pack and attempt to recharge it using an external battery charger. Fire or explosion may result.

WARNING: Explosion hazard. Do NOT use in the presence of flammable anesthetics.

WARNING: Electrical shock hazard. Do NOT contact unit or patient during defibrillation. Otherwise, serious injury or death could result.

WARNING: NEVER position defibrillator paddles very close to or over ECG sensors. Remove all chest sensors (V-Leads/C-Leads) from a patient before defibrillation to allow proper paddle placement. Severe burns may result from improper placement of defibrillator paddles. Before using any defibrillator, consult the operating instructions for that equipment.

WARNING: Electrical shock hazard. Operate the unit from its battery supply if the integrity of the protective earth conductor is in doubt. Otherwise, serious injury or death could result.

WARNING: Hazardous voltage. To reduce the risk of electrical shock, do not attempt to remove the cover under any circumstances. Refer servicing to a qualified technician.

Cautions

CAUTION: Federal law restricts this device to sale by or on the order of a physician.

CAUTION: The unit must be operated only at the line voltage and frequency specified on the rating plate.

CAUTION: Although the Eclipse is designed to meet IEC 601-1-2 EMC immunity requirements, the presence of strong EMI fields generated by electronic, surgical or diathermy instruments in close proximity to the unit may cause trace noise or input overload conditions.

CAUTION: Fire hazard. Use only Burdick battery pack. Replace Eclipse 4, 400, 8, 800 or 850 battery pack with the battery specified on the label inside the battery compartment.

Notices

NOTICE: Do not place used battery pack in your regular trash. The incineration, landfilling, or mixing of NiCd batteries with municipal waste is PROHIBITED BY LAW in most areas. Return this battery pack to a government-approved battery recycler. Contact your local waste management officials for more information.

NOTICE: Computer assisted interpretation is a valuable tool when used properly. However, no automated interpretation is completely reliable and interpretations should be reviewed by a qualified physician before treatment, or non-treatment, of any patient.

NOTICE: Because the Burdick Eclipse offers different lead configurations, always ensure that the appropriate lead placement is employed for the lead configuration selected.

NOTICE: Waveforms displayed on the Eclipse screen are not intended to be used for diagnostic purposes. Use displayed waveforms to assess signal quality only.

Definitions of Symbols Used

Safety Symbols

Attention. Consult accompanying documents.

Danger! High voltage.

Hazardous voltage.

Defibrillation-Protected Type CF Equipment.

Equipotentiality (used to label the grounding lug).

CE

Complies with the requirements of the EMC directive.

Labelling Symbols


Alternating Current (AC)


Automatic Operation


Custom Lead Triplet


Frequency Response


Heart Rate


Input/Output Connection

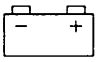

LCD Screen Contrast


Manual Operation


On/Standby


Stop Function

Serial port



Battery Compartment


Battery Charge Status

Chapter 1 *General Information*

Congratulations on your purchase of a top quality Burdick ECG machine.

By listening to our customers, we have designed the Eclipse to suit your specific needs, incorporating features that people like yourself have requested.

Your business is important to us. If you would like more information or if you have any questions, please contact your Burdick dealer or call Burdick Inc., Customer Service Department at **(800) 777-1777** or **(608) 868-6000**.

> *CAUTION: Federal law restricts this device to sale by or on the order of a physician.*

Inspection Upon Delivery

Your new Burdick Eclipse was carefully inspected before shipment. Please inspect your unit upon delivery for any damage which may have occurred in transit. If you notice any damage, please contact your shipping agent.

Check the enclosed accessories against the included list of standard accessories. If items are missing, contact your Burdick dealer or call Burdick Inc., Customer Service Department at **(800) 777-1777** or **(608) 868-6000**.

> **NOTE:** Your Burdick Eclipse Electrocardiograph is intended for use with approved ECG supplies; its reliability and performance are directly affected by the supplies you use.

General Description

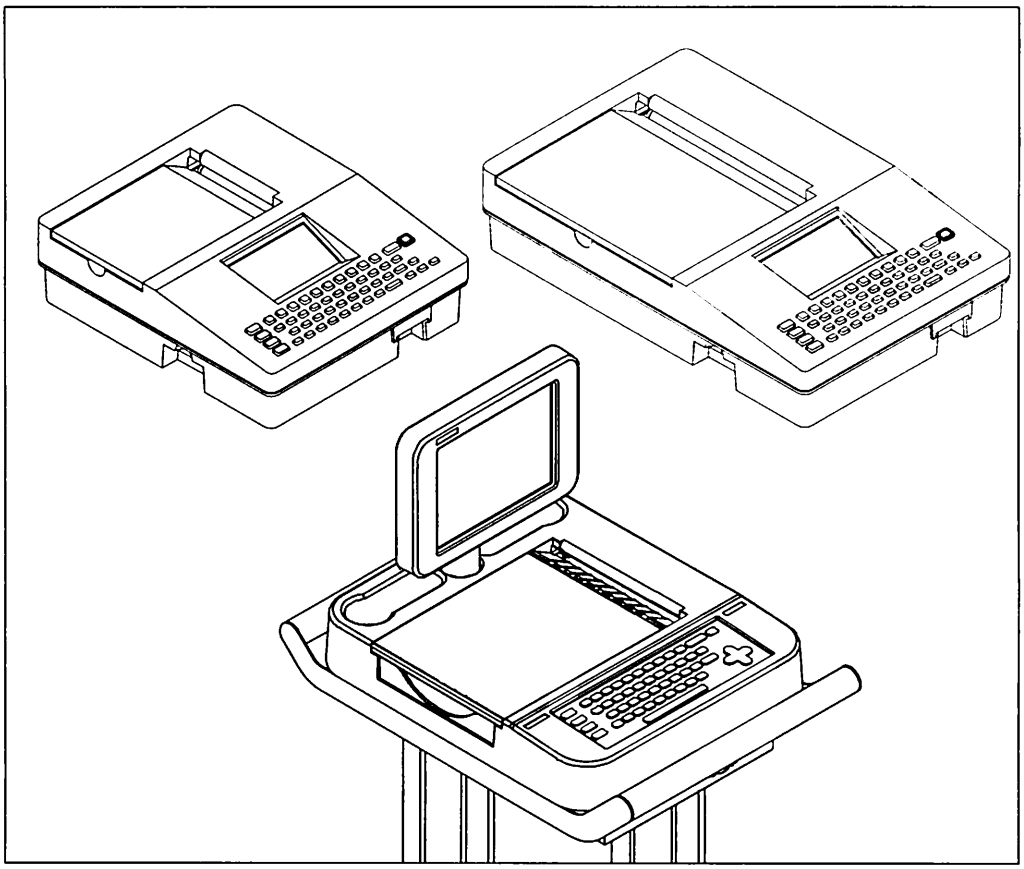


Figure 1-1
Burdick Eclipse 4, Eclipse 8 and Eclipse Plus

- Portable; may be operated from battery or AC line power.
- Eclipse Plus features an active-matrix color LCD.
- Eclipse 4, 8, 400 and 800 utilize a high resolution, grayscale LCD.
- Eclipse 850 features a backlit, grayscale LCD.
- Prints using a thermal printer and thermosensitive, Z-fold paper.
- Operates in manual and automatic modes.
- Records in either standard or Cabrera lead formats.
- Stores and, with interpretive models, analyzes waveforms acquired in automatic mode.
- Prints at least 200 pages at 25 mm/s recording speed when the internal battery is fully charged.
- Continuously recharges the battery whenever the unit is connected to AC line power.
- Enhanceable. Software enhancements are quickly and easily introduced.
- Allows you to preview waveforms before you print, saving time and supplies.
- Features selectable patient demographic fields that you may use to suit your needs.

Burdick's Analysis Program

About the program

The Eclipse is available with Burdick's interpretive analysis program. This program is widely respected as one of the most accurate available today. It was developed by Prof. Peter MacFarlane of the Glasgow Royal Infirmary who has been involved in computerized ECG interpretation since its inception in the 1960s.

The ECG Interpretation Criteria Physician's Guide is included with the Operating Instructions. This guide outlines the criteria used by Burdick's analysis program.

Features of Burdick's analysis program

- DEVELOPED IN A HOSPITAL ENVIRONMENT
  The interpretive program was developed in the University Department of Medical Cardiology in the Glasgow Royal Infirmary. Unlike many products which are developed with the aid of outside consultants, this program was developed in the environment for which it is intended.
- USES AGE, SEX AND RACE DATA EXTENSIVELY
  More than 500 measurements, plus the patient's age, sex, clinical classification and medications are factored into each analysis. Several criteria for abnormalities are age, race and sex dependent. Race, for example is key in identifying hypertrophy and T-wave abnormalities.
- PRODUCES CLEAR REASON STATEMENTS
  Reasons appending abnormalities are given in conversational language. For example, wording like, "High voltages in limb leads," is used rather than, "R in I > 1.4 mV."
- USES CLINICAL HISTORY
  The program is the first to use clinical class as an integral part of analysis just as a physician would consider clinical class in his or her evaluation.
- UNDER CONTINUOUS DEVELOPMENT & ENHANCEMENT
  The program has been clinically tested against more than 80,000 ECGs and is continuously under development.
- ACCURATELY DETECTS NORMAL ECGs
  Normal ECGs are easily identified and sorted so the physician may quickly verify results.

Safety Features

WARNING: Electrical shock hazard. Do NOT contact unit or patient during defibrillation. Otherwise, serious injury or death could result.

WARNING: NEVER position defibrillator paddles very close to or over ECG sensors. Remove all chest sensors (V-Leads/ C-Leads) from a patient before defibrillation to allow proper paddle placement. Severe burns may result from improper placement of defibrillator paddles. Before using any defibrillator, consult the operating instructions for that equipment.

Complies with IEC 601-1 and 601-2-25 safety standards.

Includes a 3-conductor, hospital-grade power cable. Includes an electrically isolated, DB-15 style patient cable. This conforms to IEC safety, pinout and mechanical requirements.

CE This symbol on the rear panel indicates this equipment meets the requirements of the EMC directive.

This symbol next to the patient cable connector indicates this equipment is classified as defibrillation-protected, Type CF equipment. The patient cable and input circuits are designed to prevent damage to the recorder if the unit is connected to a patient during defibrillation.

Using Multiple Electrical Apparatus

Use caution when monitoring patients who must be protected from very small electrical currents. Susceptible patients include patients with cardiac catheters or pacemakers. Consult a qualified technician before using multiple electrical apparatus in this patient environment.

The Eclipse patient leads are electrically isolated from ground and the device meets the most stringent IEC and ANSI/AAMI medical standards for leakage currents.

However, a potential hazard may occur if the enclosure leakage currents from multiple pieces of equipment combine and are inadvertently routed directly to a patient's heart via a catheter or pacemaker lead. Only equipment which is certified to IEC and ANSI/AAMI medical standards should be used in this environment. Use of certified equipment does not, however, completely eliminate this possible hazard.

Another potential hazard may occur if two devices near a patient are powered from different circuits. If the grounds of the two circuits are at different potentials, which can occur under certain fault conditions, then a ground loop can exist between the enclosures of the two devices. If devices must be powered from separate circuits in the vicinity of a susceptible patient, then the grounding lugs on the devices should be electrically connected via an equipotential cable. Please also consult Chapter 2, "Equipment Setup."

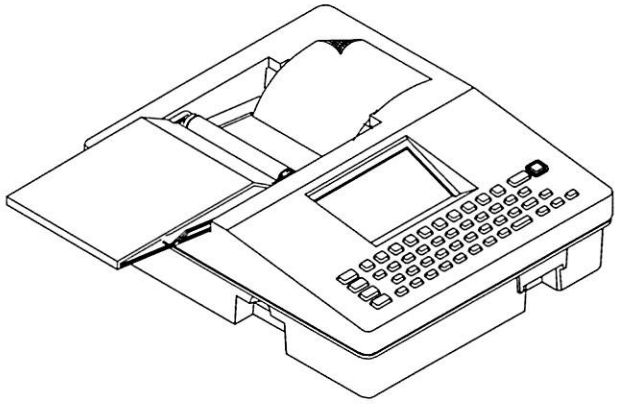
Chapter 2 *Equipment Setup*

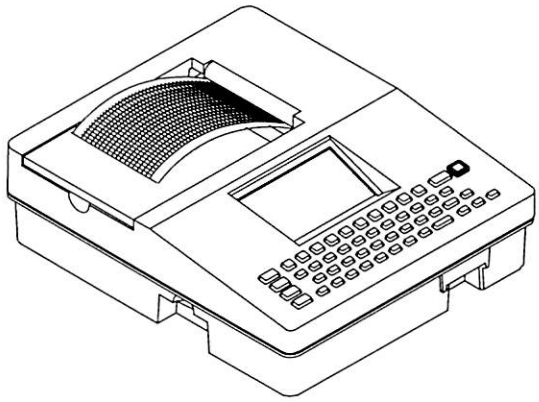
This chapter covers:

- Loading recording paper.
- Turning the unit on and off.
- Connecting AC line power to the unit.
- Calibrating the Battery Status gauge.
- Connecting external equipment.
- Connecting the patient cable to the unit.
- Enhancing software.

Quick Reference-Loading Recording Paper

1. Turn the Eclipse on.
2. Open the paper compartment door by lifting and sliding it out to the left.
3. Remove any remaining paper from the paperwell.
4. Lift the top sheet of the new stack of paper and pull it to the right.
5. Place the paper into the compartment.
6. Slide the compartment cover back into place until you notice a definite click as it snaps into the feed rollers.
7. Press the "P" key to advance the paper the next sheet.





***Eclipse 4 is shown. The procedure is the same for all Eclipse models.**

NOTE: Damage caused by using unapproved recording paper may void your warranty.

Use only Burdick, thermally responsive ECG paper. The following Burdick ECG papers are recommended:

1. Assurance 50™. Permanent trace, Z-fold. Thermal image integrity guaranteed for 50 years.
2. Standard trace, Z-fold. Thermal image integrity guaranteed for 5 years when stored in accordance with manufacturer's specifications.

The printer is pre-adjusted at the factory. Do not try to make adjustments.

Connecting Power

⚠ *WARNING: Electrical shock hazard. Operate the unit from its battery supply if the integrity of the protective earth conductor is in doubt. Otherwise, serious injury or death could result.*

⚠ *CAUTION: The unit must be operated only at the line voltage and frequency specified on the rating plate.*

Maximum patient and operator safety is ensured only when the Eclipse is properly grounded. To do this, connect the power cable to the AC Power connector (see Figure 2-2 on pg. 2-5) and connect the other end to a properly grounded, AC line outlet.

There is no switch to disconnect AC line power. To do this you must unplug the unit. The battery is automatically charged whenever the unit is connected to AC line power.

NOTE: The battery that is shipped with your new Eclipse is not charged. To charge the battery and prepare the Eclipse for normal use, follow the procedure below to calibrate the Battery Status gauge.

Calibrating the Battery Status Gauge

Whenever a new battery is placed in the Eclipse or whenever the battery is removed and re-installed, the Battery Status gauge in the PREVIEW screen should be calibrated. In addition, Burdick recommends that you follow this procedure every 60 days to maintain maximum battery capacity. This is especially important if the unit is infrequently operated with battery power. The Eclipse 400, Eclipse 800 and Eclipse 850 do not have a Battery Status gauge, however it is still a good idea to perform this procedure to condition the battery and maintain maximum capacity.

1. Unplug the Eclipse from AC line power.
2. Press ON/STBY to turn the Eclipse on. Press M to go to the Main menu. Press B, then press Enter to turn on the Battery Exercise Mode.
3. Fully discharge the battery by operating the unplugged unit until the unit powers down from lack of power.
4. Ensure that the battery is discharged by pressing the On/Standby key. If the unit does not turn on or if it powers down within a few seconds, the battery is discharged.
5. Reconnect AC power to fully recharge the battery in about 5 hours.

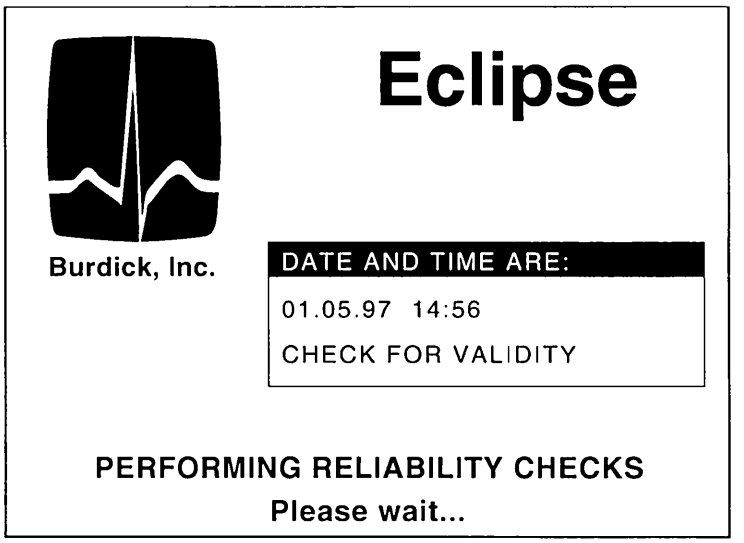
NOTE: You may operate the Eclipse from AC line power while the battery is charging. However, this will increase charging time.

Turning the Unit On and Off

Press the On/Standby key to turn the Eclipse on. The unit performs self-tests and displays the following (see Figure 2-1):

- Current date and time
- A message prompting you to check date and time accuracy
- Any error detected during the self-tests

Figure 2-1
The Power Up Screen



After completing self-tests, the unit displays the PREVIEW screen.

Press the On/Standby key to return the Eclipse to Standby mode at any time during operation.

The Eclipse will automatically power down to Standby mode after 15 minutes of inactivity. The auto power down timer is automatically reset when any of the following occur:

- ✔ a keyboard key is pressed
- ✔ a communications function is active
- ✔ patient waveforms are displayed on the Preview screen
- ✔ the AC line cord is connected or disconnected.

The Auto Power Down feature may be temporarily turned off by putting the unit in Battery Exercise Mode.

The unit is not operational in Standby mode but it charges the internal battery whenever it is plugged in. There is no switch to disconnect power. A symbol displayed on the screen of the Eclipse 4, Eclipse 8 and Eclipse Plus tracks battery charging status.

POWER INDICATOR

This green light on the back of the unit (see Figure 2-2) is on whenever the unit is receiving AC line power.

Equipment Connections

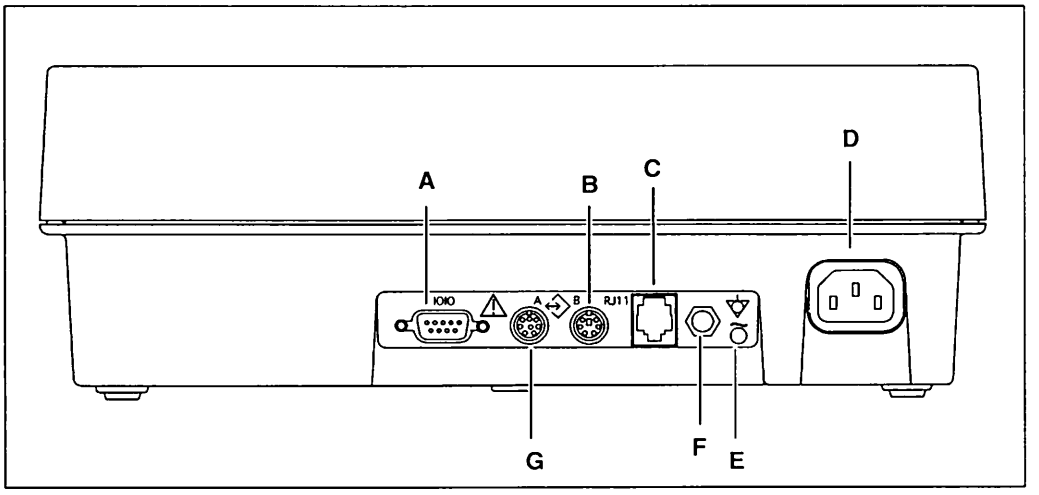
Connecting power cord and peripheral equipment

⚠ *CAUTION: The unit must be operated only at the line voltage and frequency specified on the rating plate.*

Connect AC line power and external equipment via the connectors on the back panel (see Figure 2-2).

For patient safety, all equipment in patient environment should be IEC 601-1 approved. All connected equipment should be IEC 950 approved or equivalent. Consult a qualified technician to verify equipment compatibility.

Figure 2-2
Eclipse Back Panel



IOIO **(A) SERIAL PORT (ECLIPSE 4, 8, PLUS & 850 WITH COMMUNICATIONS)**

Connect compatible fax/modems to this serial connector using Burdick modem cable, part number 007734. You must have the fax or SCP-ECG software installed to use this function.

Most Hayes-compatible modems supporting Fax Service Class 2 commands will work with the Eclipse.

This connector is also used for direct connection of the unit to a compatible management system. Use Burdick Direct Connect cable, part number 882029.

(B) EXPANSION (ECLIPSE 4, 8 & PLUS)

This connector is reserved for future expansion.

RJ11 **(C) INTERNAL MODEM (ECLIPSE 4, 8, PLUS & 850 WITH COMMUNICATIONS)**

Connect the phone line you will be using for faxing or sending records into this **RJ11** connector if your unit is equipped with an internal fax/modem.

(D) AC POWER

Use the Burdick power cord to connect the unit to AC line power here.

(E) POWER INDICATOR

Verify that the unit is receiving AC line power when this green light is on.

(F) EQUIPOTENTIAL GROUNDING

Connect peripheral equipment directly to the Eclipse protective earth ground via this jack. This is necessary only if peripheral equipment requires equipotential grounding.

(G) ANALOG OUTPUT (ECLIPSE 4, 8, PLUS & 850 WITH COMMUNICATIONS)

Use Burdick monitor cable, part number 007730, to connect a monitor via this **8-Pin Mini-DIN** jack.

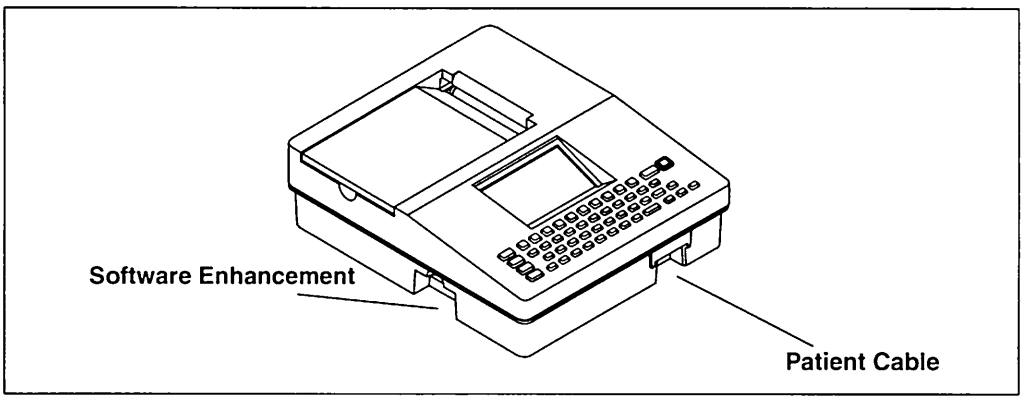
On the Eclipse 4, 8 and 850, this analog output provides the same 3 channels of waveforms which are currently displayed on the PREVIEW screen. Frank and Nehb are not supported.

On the Eclipse Plus, this analog output provides one channel waveform which is the first channel which is currently displayed on the PREVIEW screen, unless the PREVIEW screen is displaying all 12 leads. In this case, channel II is output.

Connecting the Patient Cable and Enhancing Software

Enhance software and connect the Patient Cable via connectors on the side and front of the unit (see Figure 2-3).

Figure 2-3
Patient Cable Connector and PC Card Slot (Eclipse 4 shown)



PATIENT CABLE

Connect the Patient Cable here. Make sure the connector on the cable is arrow-side-up then firmly push the connector until the arrow point is aligned with the edge of the Eclipse.

SOFTWARE ENHANCEMENT (ECLIPSE 4, 8 AND PLUS)

Consult the software installation instructions that accompany the PC Card and insert the card into this slot. Use only Burdick approved cards in your Eclipse. Unapproved cards do not work.

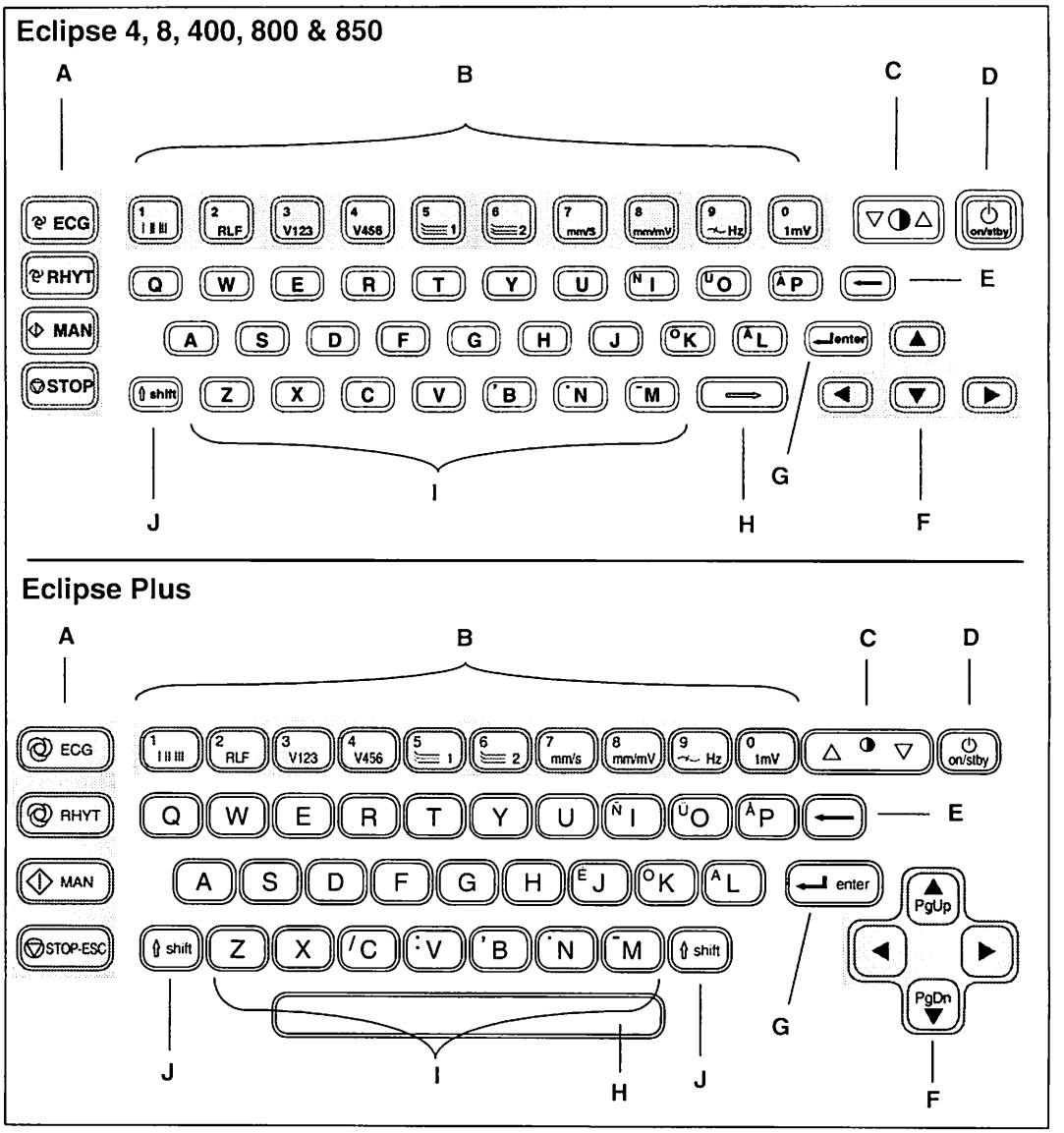
Chapter 3 *Keyboard and Displays*

This chapter provides a brief overview on how to operate the Eclipse electrocardiograph. This chapter describes:

- The keyboard.
- Common uses for specialized keys.
- The PREVIEW screen.
- Common menu features and options.

Understanding the Keyboard

Figure 3-1
The Keyboard and Key Types



(A) FUNCTION

Provide 1-key printing operations and PREVIEW screen access.

The "ECG" key acquires and prints a 12-lead Auto ECG. This is a series of reports using pre-programmed lead sequences and settings.

The "RHYT" key acquires an Auto Rhythm report. This rhythm strip is a pre-selected number of pages and uses the leads currently selected in the PREVIEW screen.

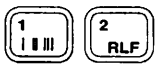
The "MAN" key acquires a Manual Rhythm report. This is a continuous rhythm strip of the leads currently selected in the PREVIEW screen.

The "STOP" key halts any of the above functions. Also returns the display to the PREVIEW screen without saving changes from most other menus.

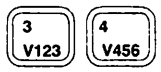
(B) NUMERIC/ MACHINE CONTROL

When entering data, these keys are used to enter numbers.

These keys may also be used as hot keys and for specific operations. Many of these operations change settings also defined in the USER SETUP menu. When these keys are used, the settings are in effect for the current ECG only.



The "1" and "2" keys select pre-programmed lead triplets for the display. Manual Rhythm and Auto Rhythm reports print the currently displayed lead triplets. On the Eclipse 4, 8, 850 and Eclipse Plus, when used with Shift key in the PREVIEW screen, they select either User 1 or User 2. This would otherwise have to be done in the SYSTEM SETUP menu.



The "3" and "4" keys select pre-programmed lead triplets for the display. Manual Rhythm and Auto Rhythm reports print the currently displayed lead triplets.

The "5" and "6" keys select user-defined leads for the display. Manual Rhythm and Auto Rhythm reports print the currently displayed leads.

The "7" key toggles the Paper Speed between 10, 25 and 50 mm/sec.

The "8" key toggles the ECG Gain between 5 mm/mV, 10 mm/mV, 20 mm/mV, L10,C5 mm/mV and L20, C10 mm/mV.

The "9" key toggles the ECG Filter Frequency between 40 and 150 Hz.

The "0" key produces a 1 mV Calibration Pulse on the display and printouts.

(C) BRIGHTNESS

Adjusts the display brightness.

(D) ON/STANDBY

Turns the unit on and returns the unit to standby mode.

May also be used if the Eclipse "freezes." If the unit is unresponsive to key strokes and the LCD display is not changing, press and hold the On/Standby key for at least 5 seconds then release. The unit shuts off. To continue with normal operation, press the On/Standby key again and the unit will turn on.

(E) BACKSPACE

Deletes a character behind the cursor.

(F) ARROW

Used to move around in Eclipse displays.

The Up and Down arrows allow movement within menus, fields and lists. Hold down the shift key and press the arrows to page up and down in the directory.

The Left and Right arrows allow movement to and from menus and lists.

(G) ENTER

Accepts current selection.

(H) SPACE

Inserts a space.

THROUGH

(I) ALPHABETIC

Provide letters when entering data. With the Shift key held down, they provide the following punctuation and characters: [,], [.], [-], Ñ, Ü, Ö, Å and Ä. At other times may be used as hot keys (see "HOT KEYs" on pg. 3-10).

If the "P" key is pressed while the Preview screen is displayed, the paper will advance to the beginning of the next sheet.

(J) SHIFT

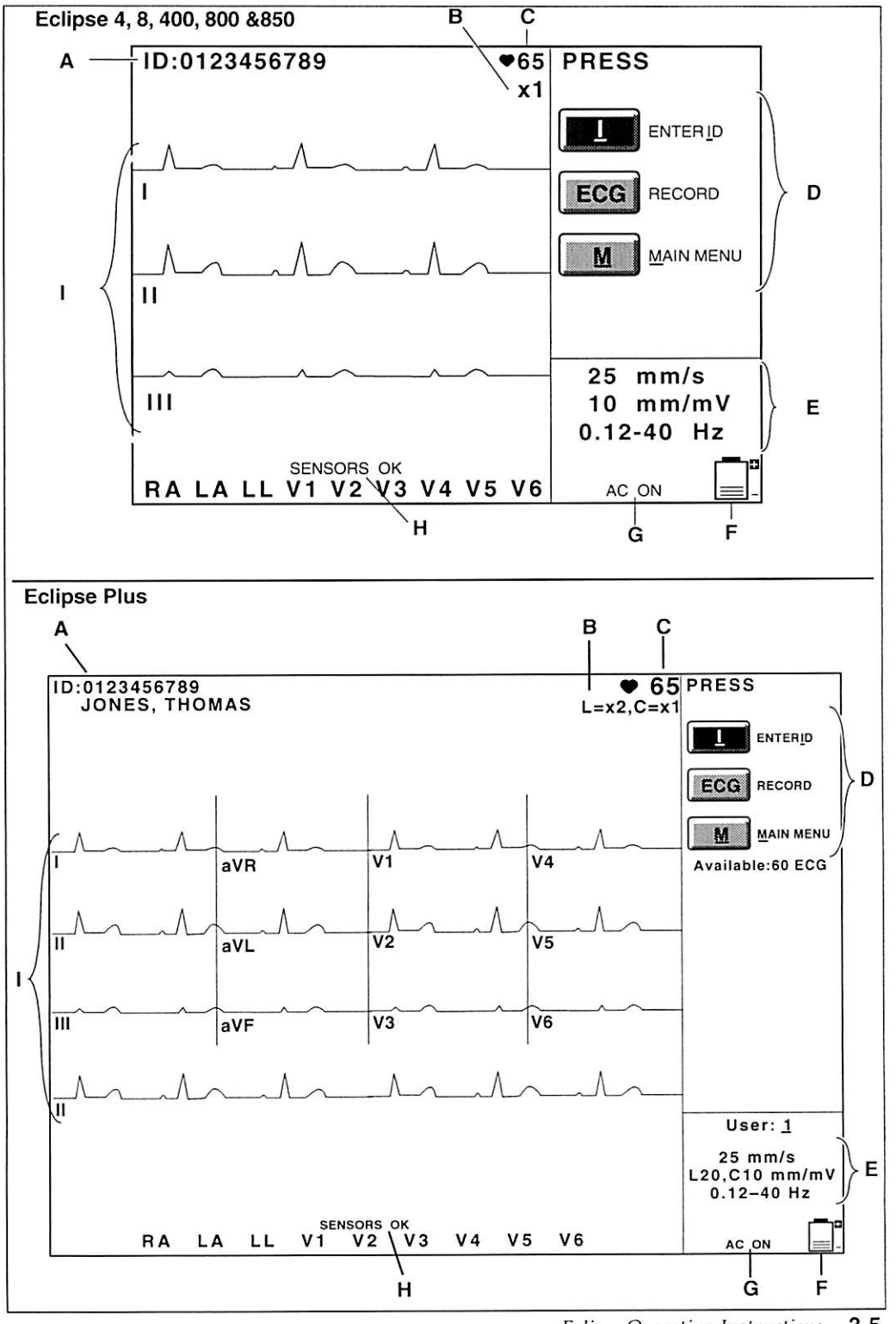
Provides access to special characters on some alphabetic keys. Provides additional machine control capabilities for the "1" and"2"keys on Eclipse 4, 8, 850 and Plus.

Understanding the Displays

The PREVIEW Screen

After the Eclipse has been turned on and performs self-tests, the PREVIEW screen is displayed (see Figure 3-2). Its features are described below.

Figure 3-2
The Preview Screen



(A) PATIENT ID

Identification number of the current patient. On the Eclipse Plus, this field also displays the patient's name.

(B) RELATIVE GAIN

Tracks the amplitudes of the displayed waveforms. This corresponds to the Recorder Gain setting as follows:

Recorder Gain	Relative Gain
5 mm/mV	x1/2
10 mm/mV	x1
20 mm/mV	x2
L=10, C=5 mm/mV	L=x1, C=x1/2
L=20, C=10 mm/mV	L=x2, C=x1

(C) HEART RATE

Displays the patient's heart rate.

The Eclipse heart rate meter is specified to function in the range of 30 to 250 bpm with a tolerance of ±10% or ±5 bpm, whichever is greater. The meter functions with a tolerance of ±10% in the range of 251 to 295 bpm. The meter has no specification for heart rates greater than 295 bpm.

(D) FUNCTIONS LIST

Displays available functions and menus.

(E) RECORDER SPEED, GAIN AND FREQUENCY RESPONSE

Displays settings for current ECG reports.

(F) BATTERY STATUS GAUGE

Tracks battery charge level on the Eclipse 4, 8 & Plus.

When all 8 bars are lit, the battery is fully charged. When battery power is being used, the minus sign (-) is highlighted indicating that charge is being drained. When the unit is connected to AC line power, the plus sign (+) is highlighted indicating the battery is charging.

When fewer than 15 minutes of operating time remain, the message "LOW BATTERY" flashes and the unit beeps every 30 seconds.

If the charge level drops too low, the unit displays the message, "POWERING DOWN." Then, after 5 seconds, the unit shuts off. Connect the unit to AC line power at this point to operate the unit and recharge the battery.

(G) POWER STATUS

Indicates the power source, AC line power or battery.

(H) SENSOR STATUS

Indicates signal quality.

If all sensors are producing good signals, the display reads:

SENSORS OK

If one or more sensors produce a poor signal, the labels for the affected sensors are highlighted and the problem is indicated by one of the following messages:

FAIL
DRIFT
NOISE

NOTE: To ensure accurate sensor status indication, the RL electrode must be connected.

NOTE: Refer to Chapter 9, "Troubleshooting" for information on correcting signal problems.

(I) ECG WAVEFORMS

NOTICE: Waveforms displayed on the Eclipse screen are not intended to be used for diagnostic purposes. Use displayed waveforms to assess signal quality only.

This area of the screen displays waveforms for the selected lead group. Until leads are properly connected to a patient, only "flatlines" are displayed.

NOTE: When you select a 6-channel customized lead group on the Eclipse 8, 800 and 850, only the first three channels are displayed. However, the "MAN" and "RHYT" keys acquire printouts of all six leads.

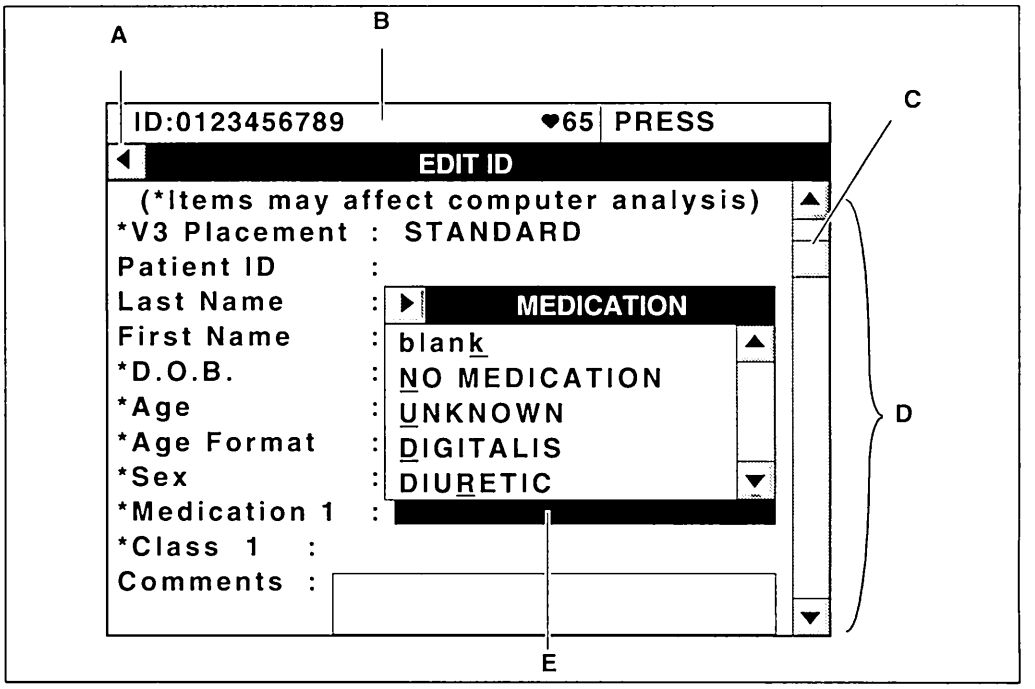
A sample menu—the EDIT ID menu

Most of the Eclipse displays are menus. For example, the EDIT ID menu is used to enter patient demographics.

The "EDIT ID" choice is highlighted in the PREVIEW screen Functions list. You may use the Up and Down Arrow keys to highlight other choices and move around in the Functions List.

To go to the EDIT ID menu, highlight "EDIT ID" and press the Enter key. The new menu will be displayed (see Figure 3-3). Following is a description of basic menu features.

Figure 3-3
A Sample Menu-The EDIT ID Menu



(A) RETURN TO PREVIOUS SCREEN

The arrow in the upper left corner reminds you that you may return to the previous screen by pressing the Left Arrow key.

(B) PREVIOUS SCREEN

The top of the last screen that was displayed shows above all menus.

(C) SCROLLING BOX

Located in the Scroll bar, this shows you when the menu continues beyond the current view. The box is at the top when the top field shows. It moves down as you scroll through the menu until the last field shows.

(D) SCROLL BAR

Located on the right side of the menu.

(E) ACTIVE FIELD

When a field is highlighted you may edit the contents of that field.

Using Menus

The Up and Down Arrow keys are used to scroll within menus.

Menus are composed of fields. There are three kinds of fields:

1. Alphanumeric
2. Numeric
3. List

ALPHANUMERIC FIELDS

When active, alphanumeric fields may be filled by typing alphabetic or numeric keys. You may also type spaces, punctuation, and non-English characters.

For example, to type the character "Ñ" in the **Last Name** field:

1. Scroll to the **Last Name** field.
2. Hold down the Shift key.
3. Simultaneously press the "I" key.

Press the Enter key after filling fields to accept data and move to the next field.

NUMERIC FIELDS

When active, numeric fields may be filled by typing numeric keys only. The Eclipse will produce a "beep" sound if you try to type letters or other inappropriate data into a numeric field.

Press the Enter key after filling fields to accept data and move to the next field.

LIST FIELDS

When active, list fields display a box with a list of choices. These are described in the next section.

DEFAULTS

Every field has a default setting.

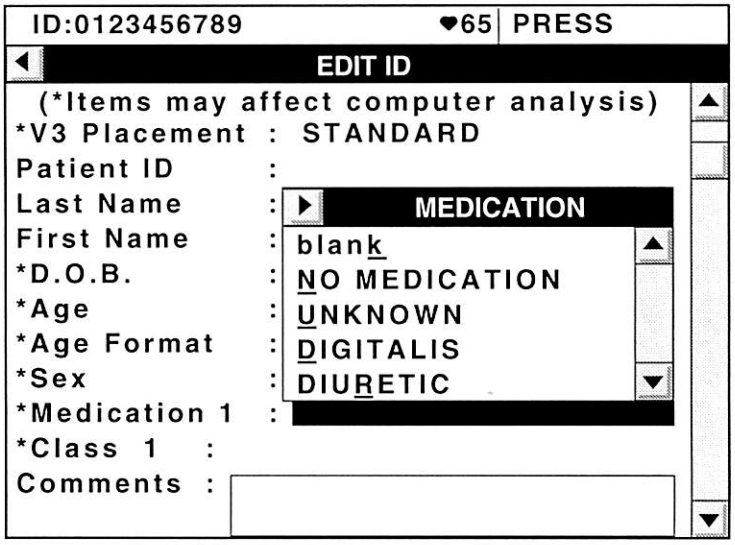
For example, if you skip the ***Age Format** field it will be filled in with "YEARS." Unless you make another choice, the Eclipse always uses defaults. Most often, fields are left blank.

Lists and System Notes

LISTS

Lists give you all the choices for a particular field. For example, scroll to **Medication 1.** A list appears (see Figure 3-4). The field may be filled with any choice from this list. After you make a selection, the next field becomes active.

Figure 3-4
A Sample List - The Medication List



HOT KEYS

All list items have hot keys to select them.

For example, the letter "D" is underlined in the choice, "DIGITALIS." This is a hot key; it is temporarily specialized to select this choice. Press the "D" key to select "DIGITALIS".

Another way to select items is from within the list. You may gain access to the list by pressing the Right Arrow key.

Scroll within the list using the Up and Down Arrow keys. When your choice is highlighted, choose it by pressing the Enter key.

To exit the list without selecting anything, press the Left Arrow key.

SYSTEM NOTES

System notes give you additional information as needed. For example, a system note appears if you enter data that exceeds an allowed range.

To see a system note, scroll to the ***Age** field. This is a numeric field that accepts only data between 0 and 364. Try typing a larger number such as 500. A system note box appears.

Press the hot key, "O," to acknowledge the note and continue.

You have just practiced the basics of using the Eclipse. More information accompanies sections for specific functions such as acquiring an Auto ECG.

Press the Left Arrow key to return to the PREVIEW screen and continue working.

Chapter 4 *Program Setup*

This chapter covers the SYSTEM SETUP and USER SETUP menus.

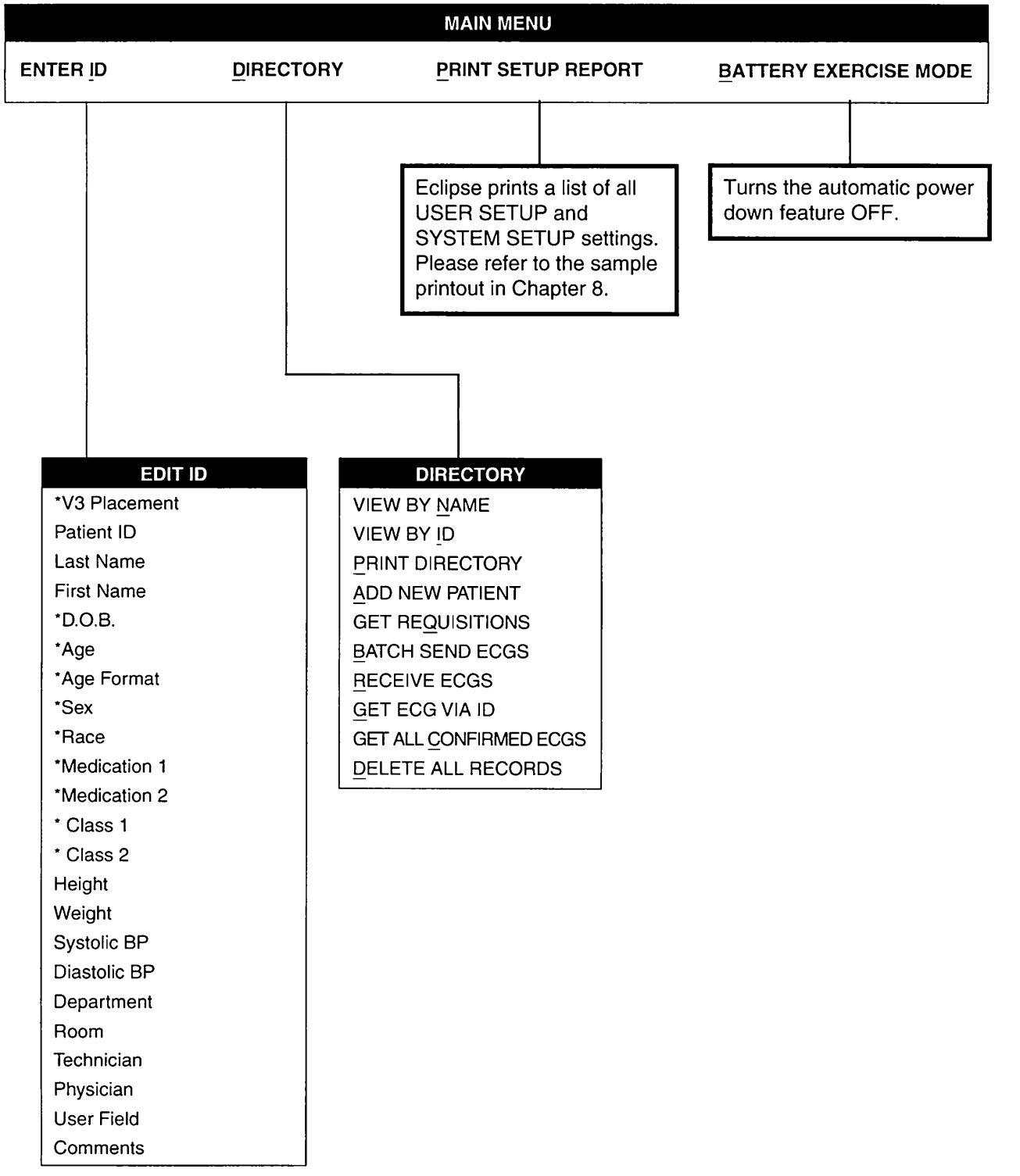
Use the SYSTEM SETUP menu to:

- Select User 1 or User 2. (Eclipse 4, 8, 850 & Plus)
- Format Eclipse general settings.
- Set the internal calendar & clock.

There are 7 USER SETUP menus. Use these to:

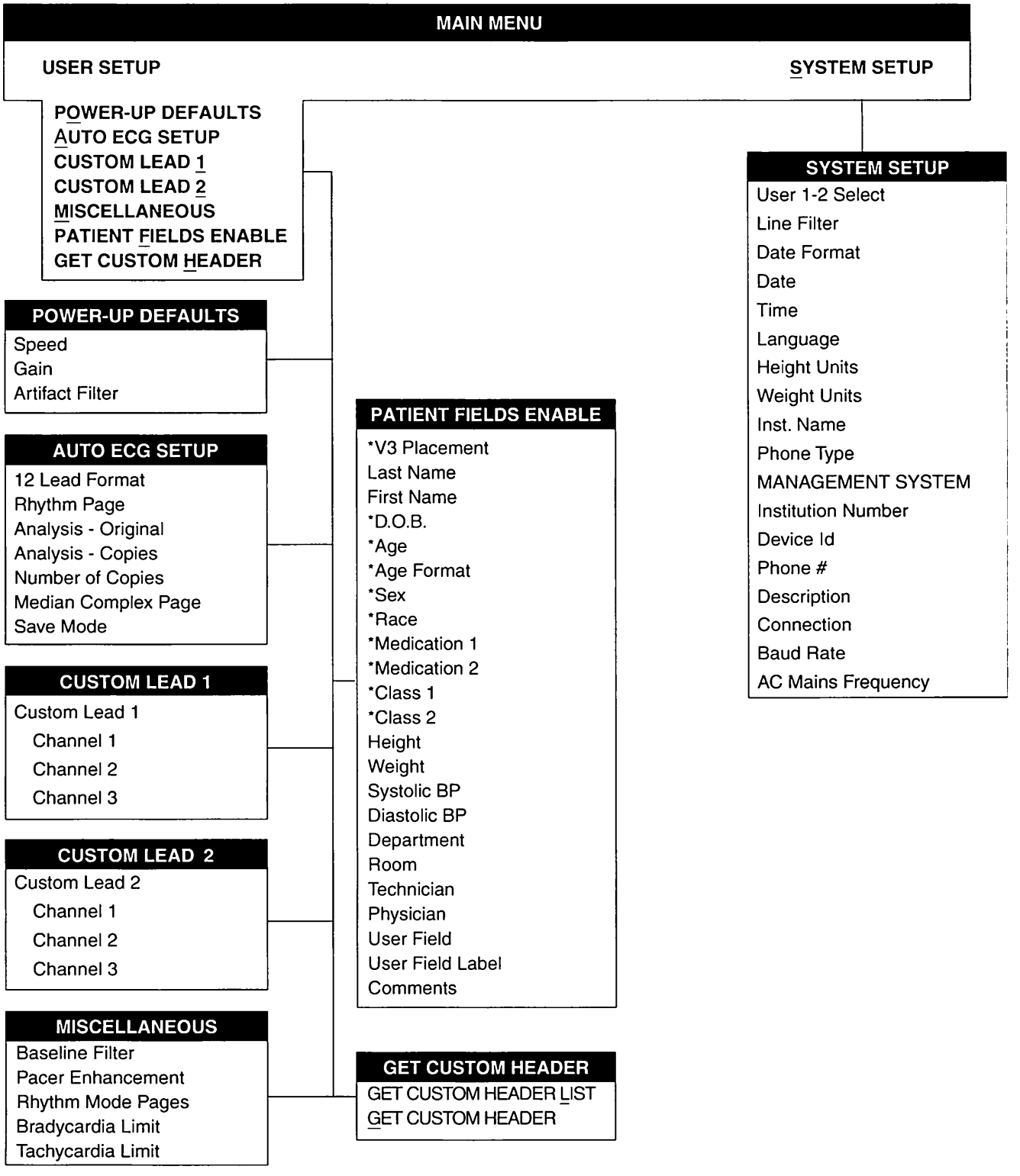
- Customize 2 sets of configurations referred to as User 1 and User 2. (Eclipse 4, 8, 850 & Plus)
- Determine the default power-up values for Recorder Speed, Gain and Frequency Response.
- Format printouts.
- Format Auto ECG and Auto Rhythm reports.
- Determine information fields to appear in the EDIT ID menu and on printouts.
- Customize lead groups.
- Get Custom Header information from an ECG Data Management System like the PYRAMIS system. (Eclipse w/SCP-ECG capability only.)

Quick Reference-Basic Menu Structure (Eclipse 4 & 400)

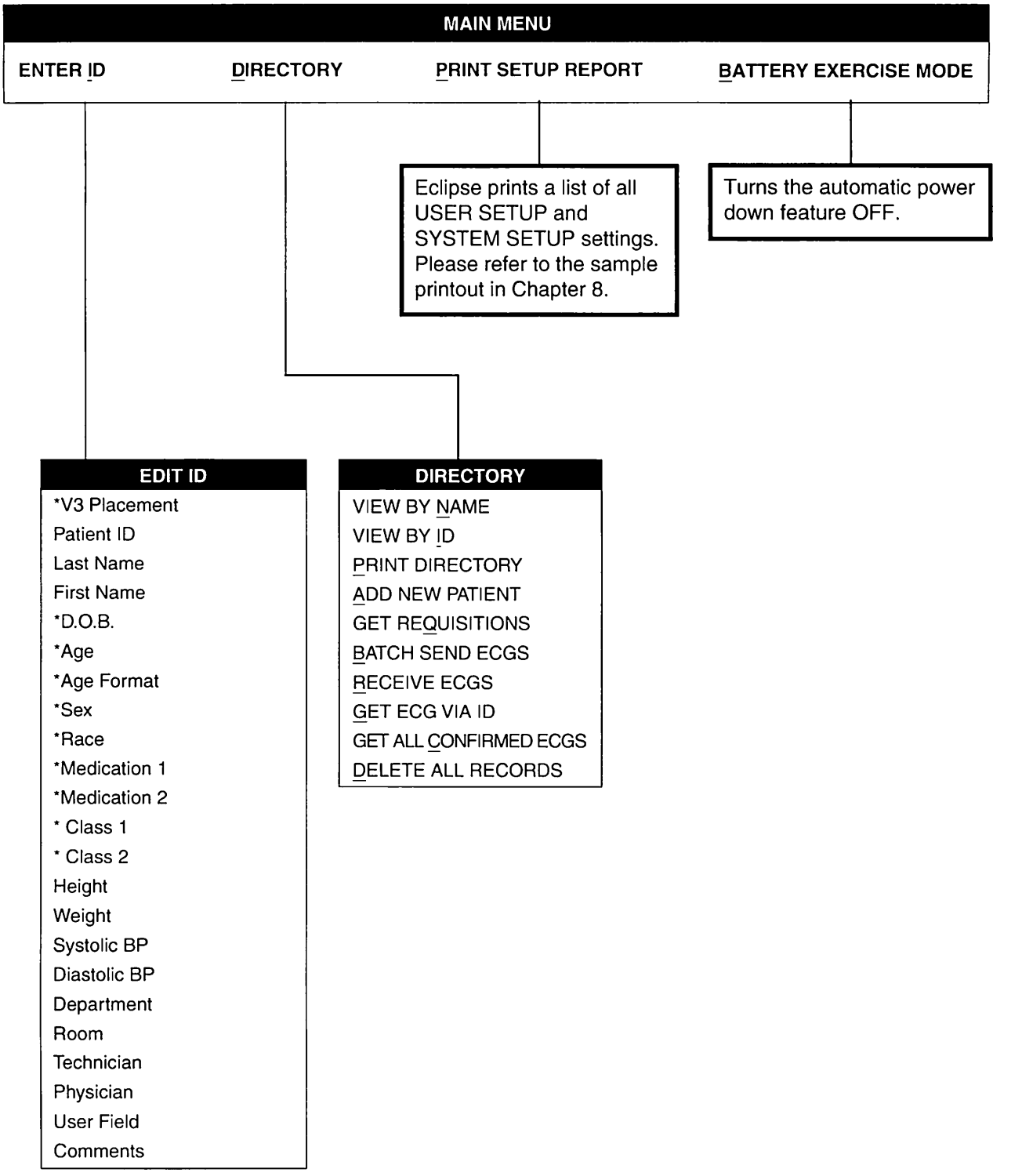


Note: Fields marked with an asterisk (*) affect ECG analysis.

[Basic Menu Structure (Eclipse 4 & 400) continued]

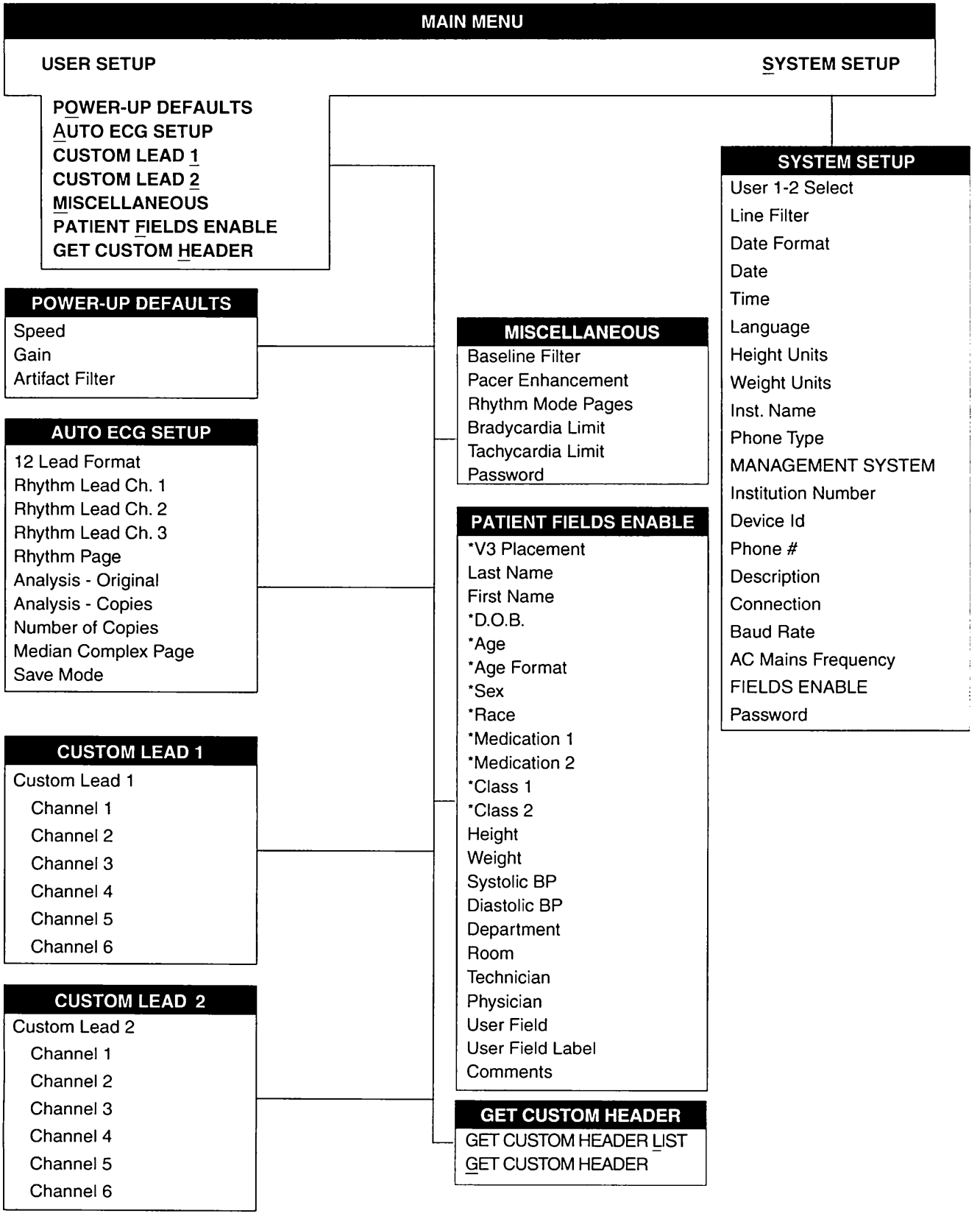


Quick Reference-Basic Menu Structure (Eclipse 8, 800 & 850)

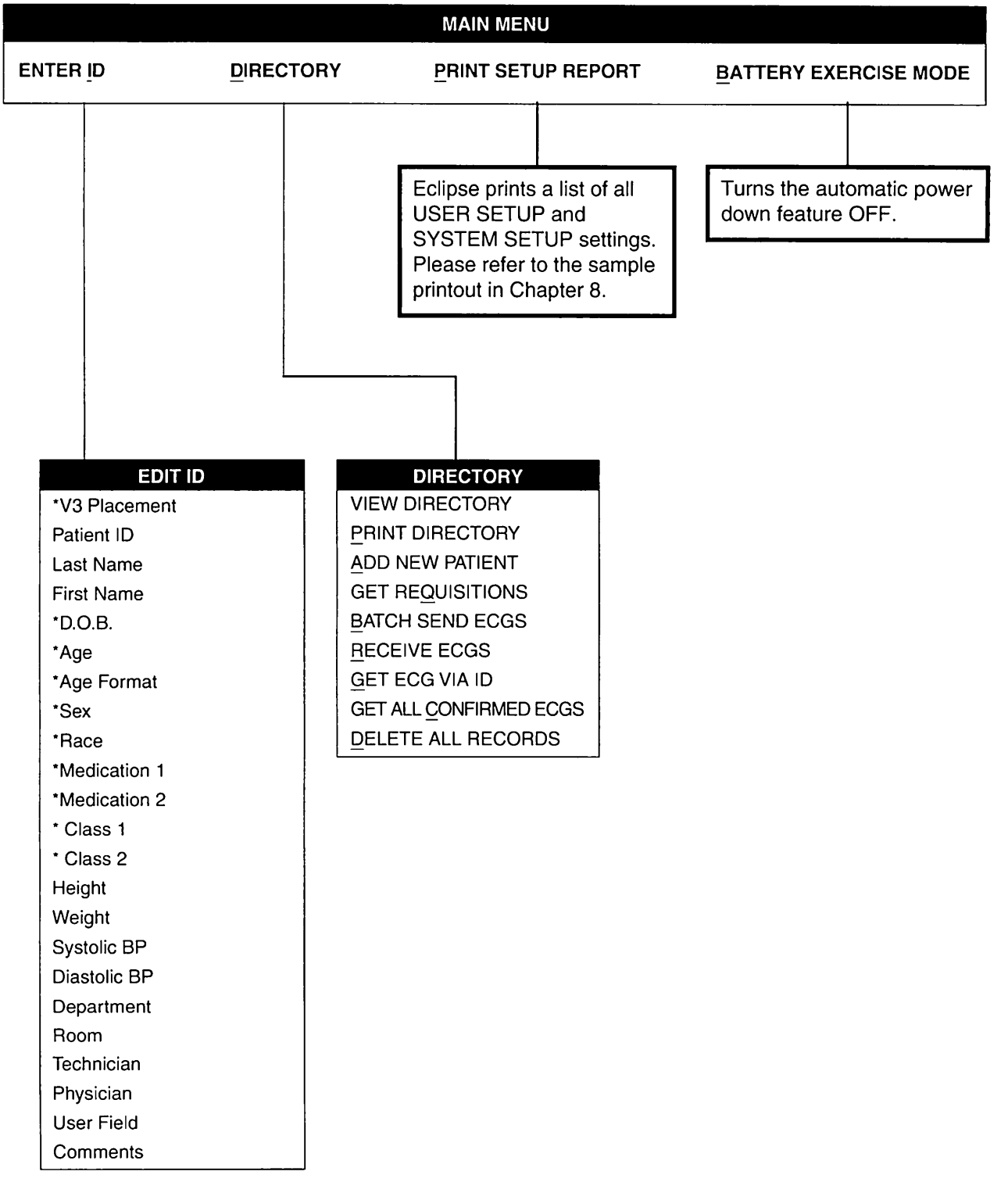


Note: Fields marked with an asterisk (*) affect ECG analysis.

[Basic Menu Structure (Eclipse 8, 800 & 850) continued]

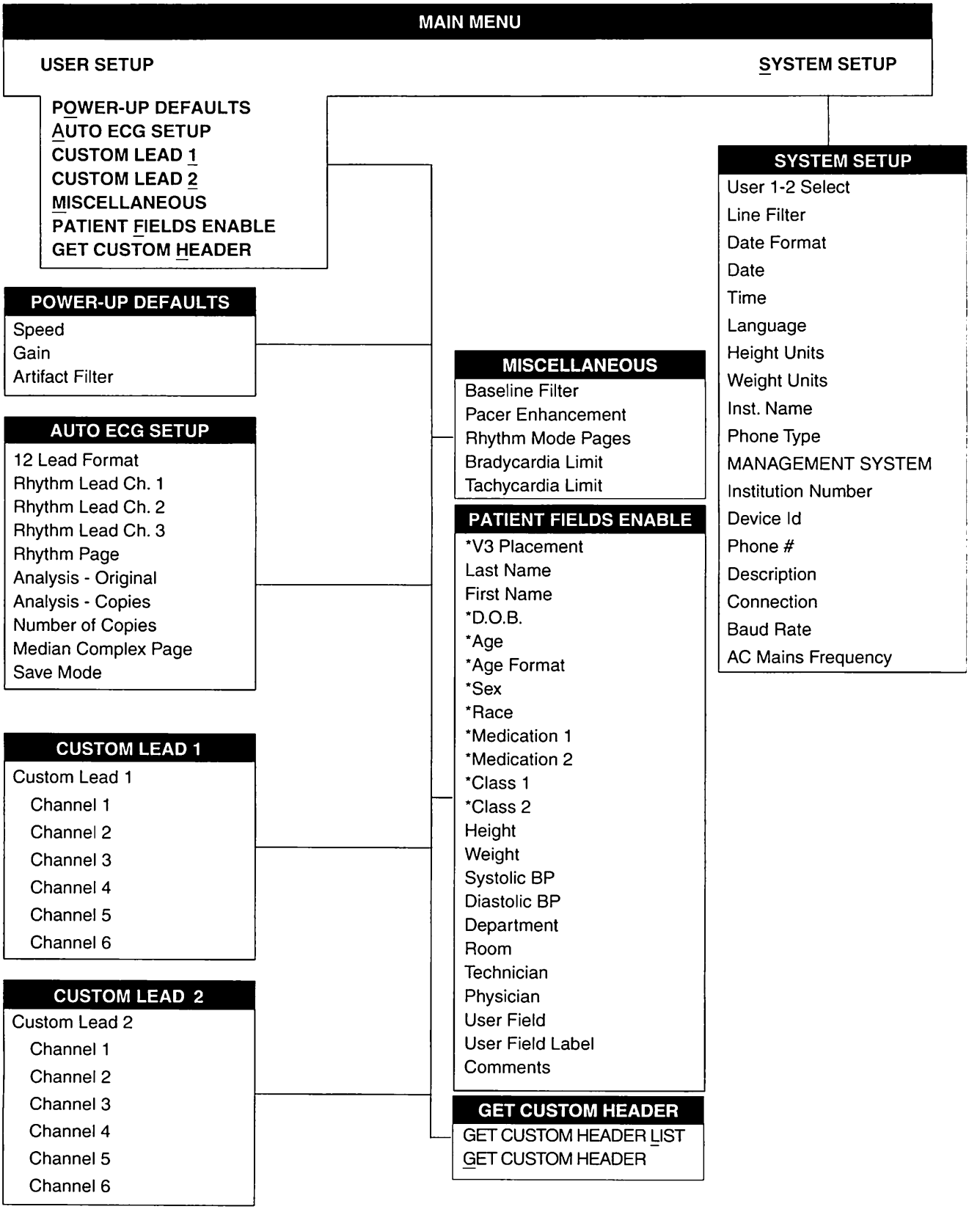


Quick Reference-Basic Menu Structure (Eclipse Plus)

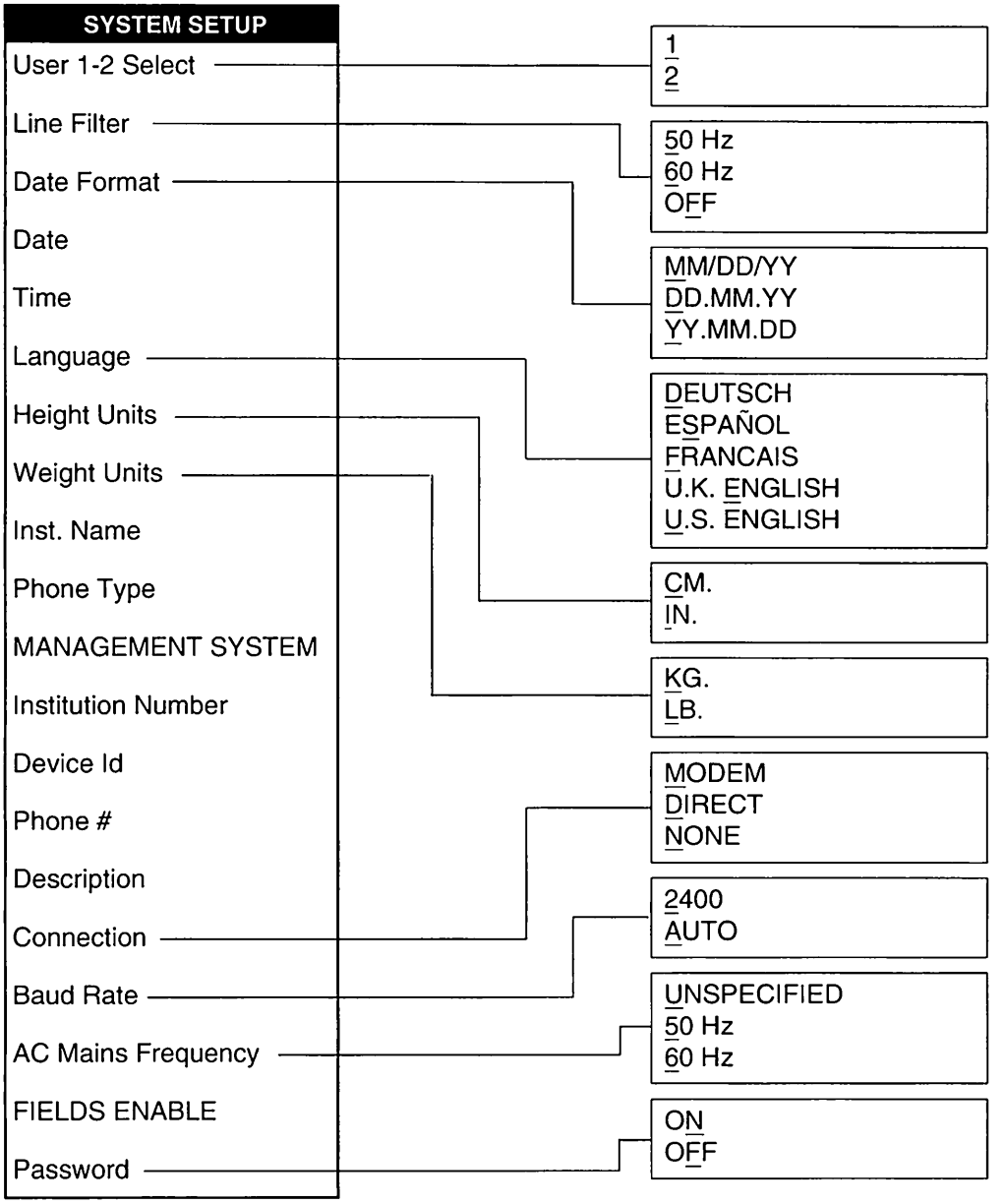


Note: Fields marked with an asterisk (*) affect ECG analysis.

[Basic Menu Structure (Eclipse Plus) continued]

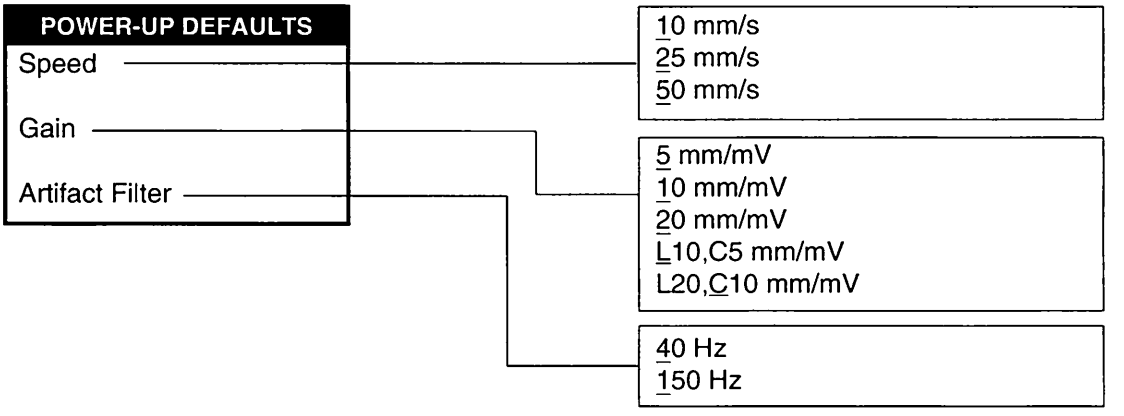


Quick Reference-Configuring System Setup

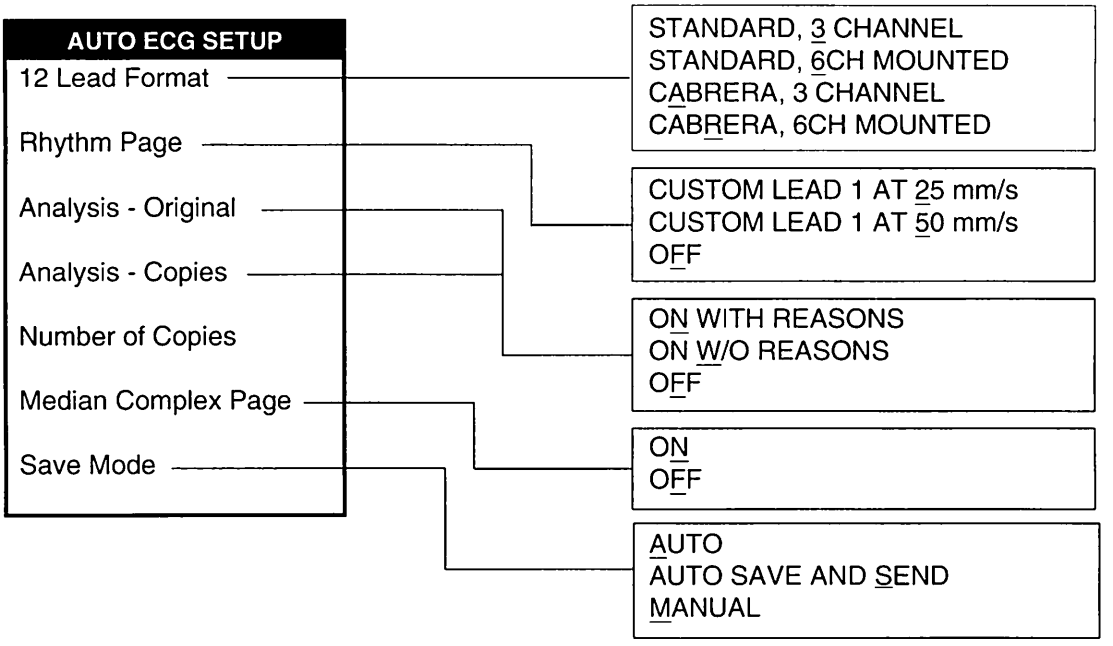


For any field that does not have a list, you may type in the appropriate information from the keyboard.

Quick Reference-Power-Up Defaults

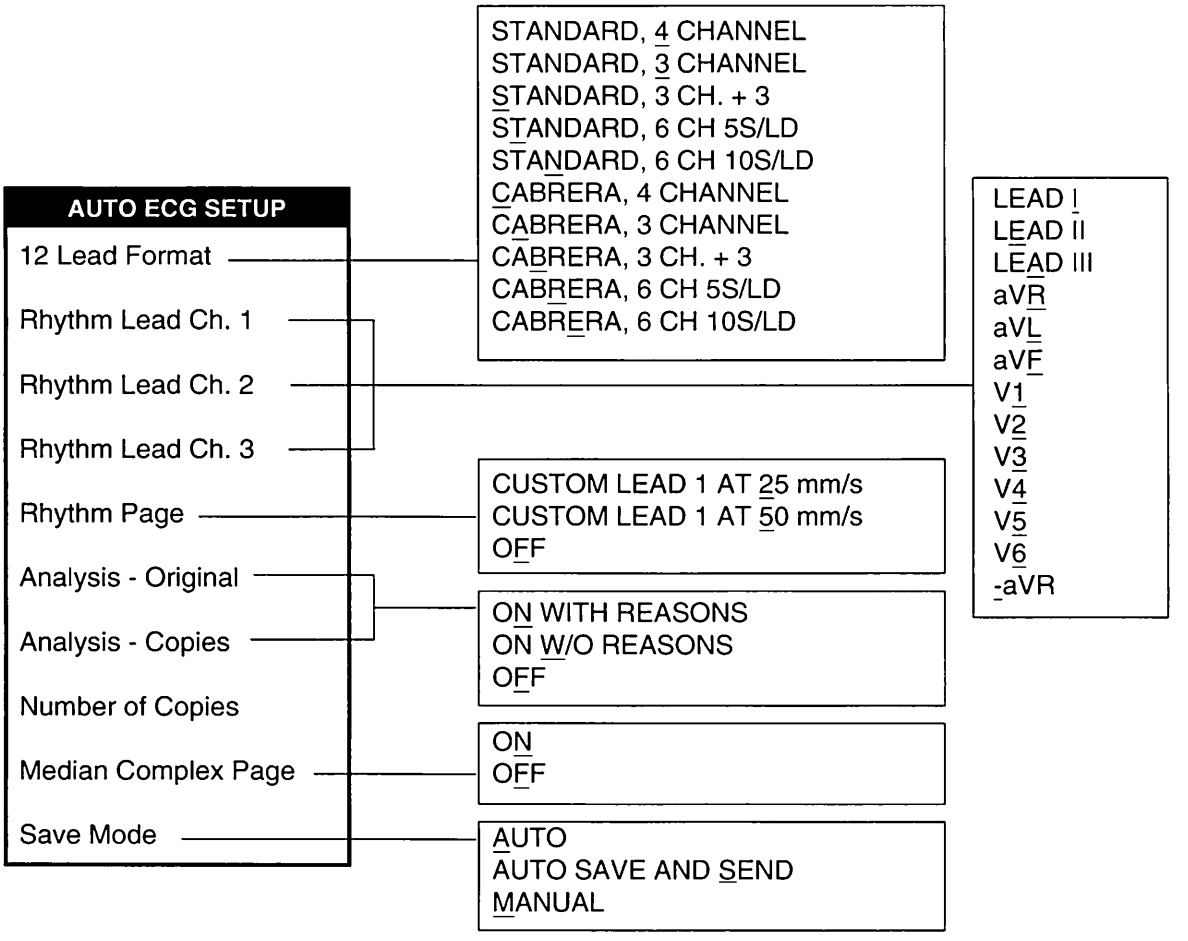


Quick Reference-Auto ECG Setup (Eclipse 4 & 400)



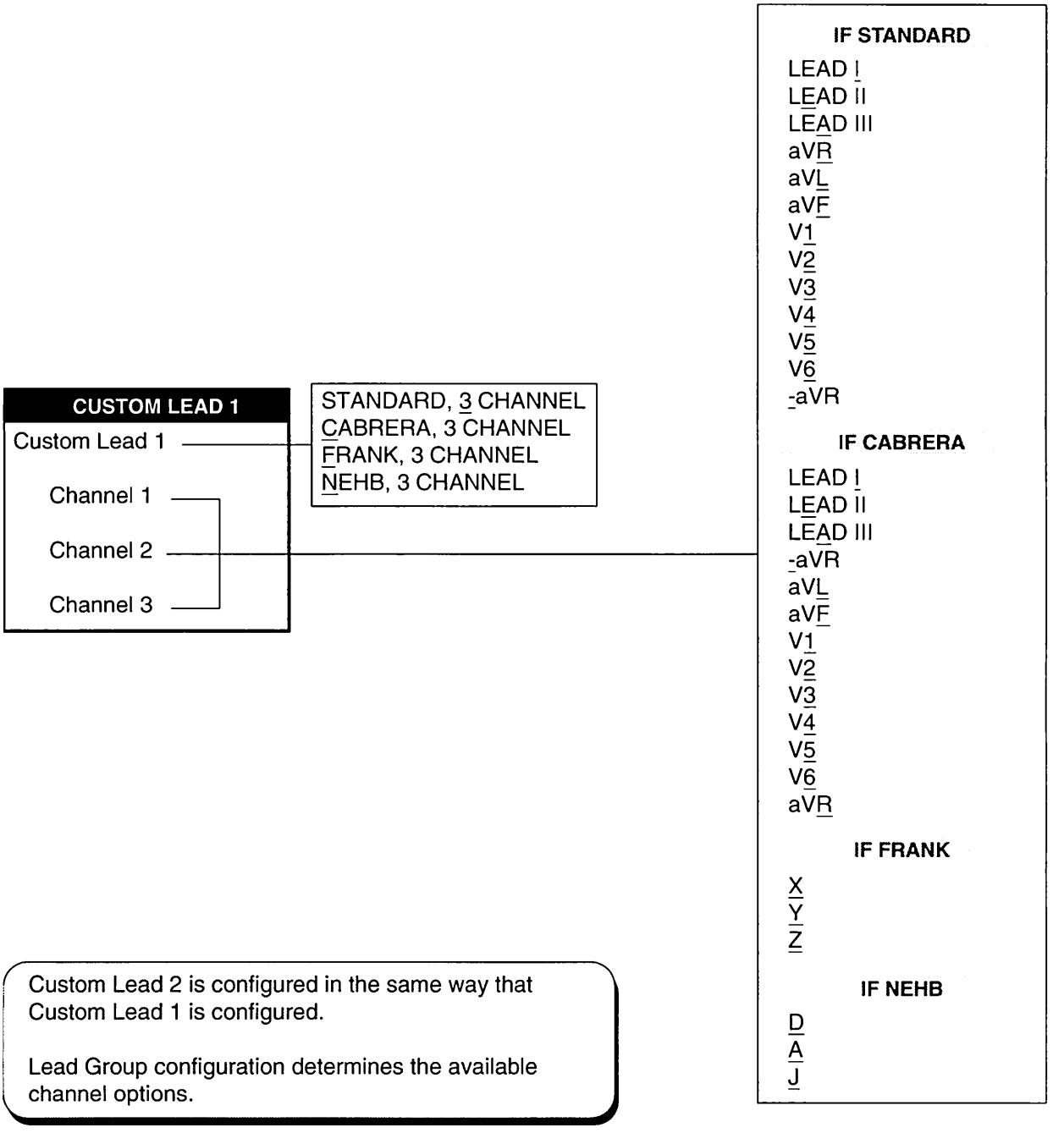
For any field that does not have a list, you may type in the appropriate information from the keyboard.

Quick Reference-Auto ECG Setup (Eclipse 8, 800, 850 & Plus)



For any field that does not have a list, you may type in the appropriate information from the keyboard.

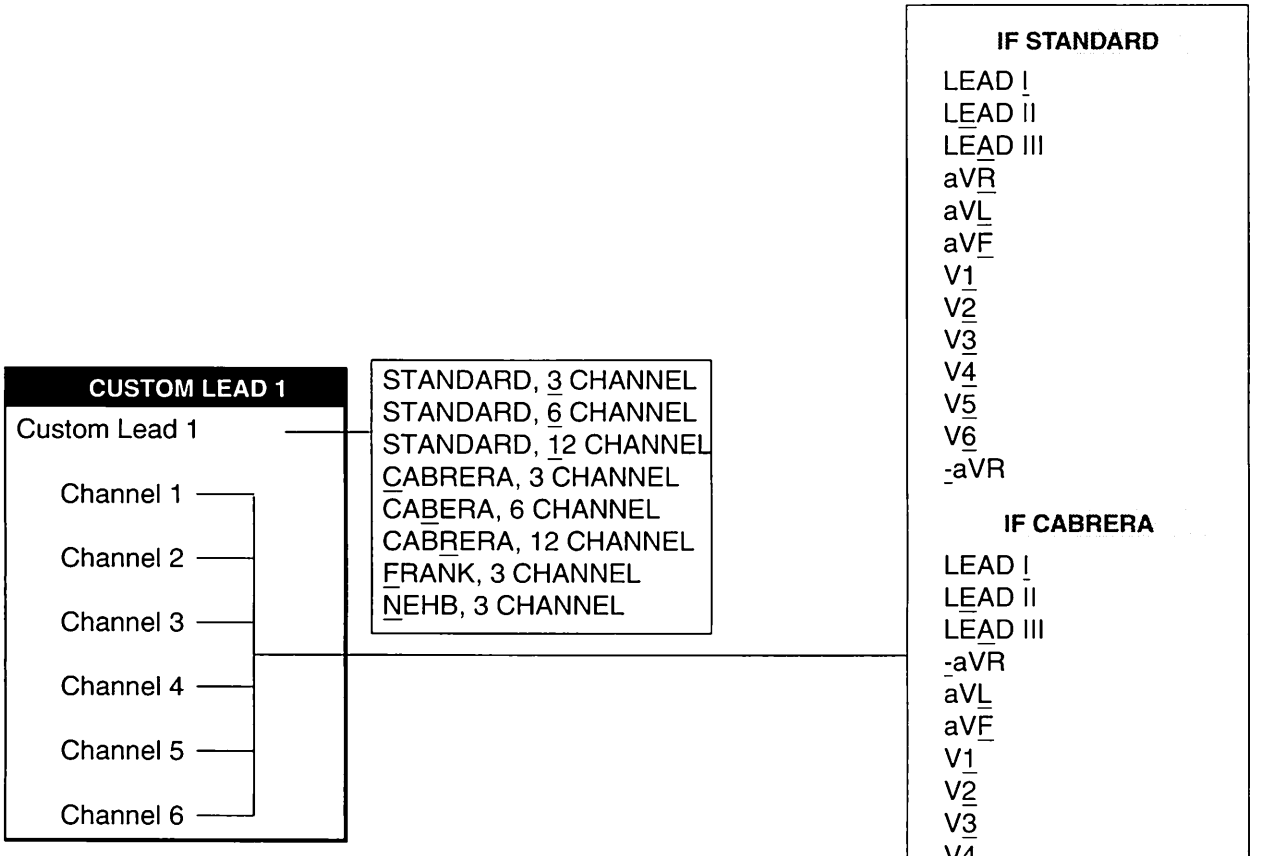
Quick Reference-Customizing Lead Groups (Eclipse 4 & 400)



Custom Lead 2 is configured in the same way that Custom Lead 1 is configured.

Lead Group configuration determines the available channel options.

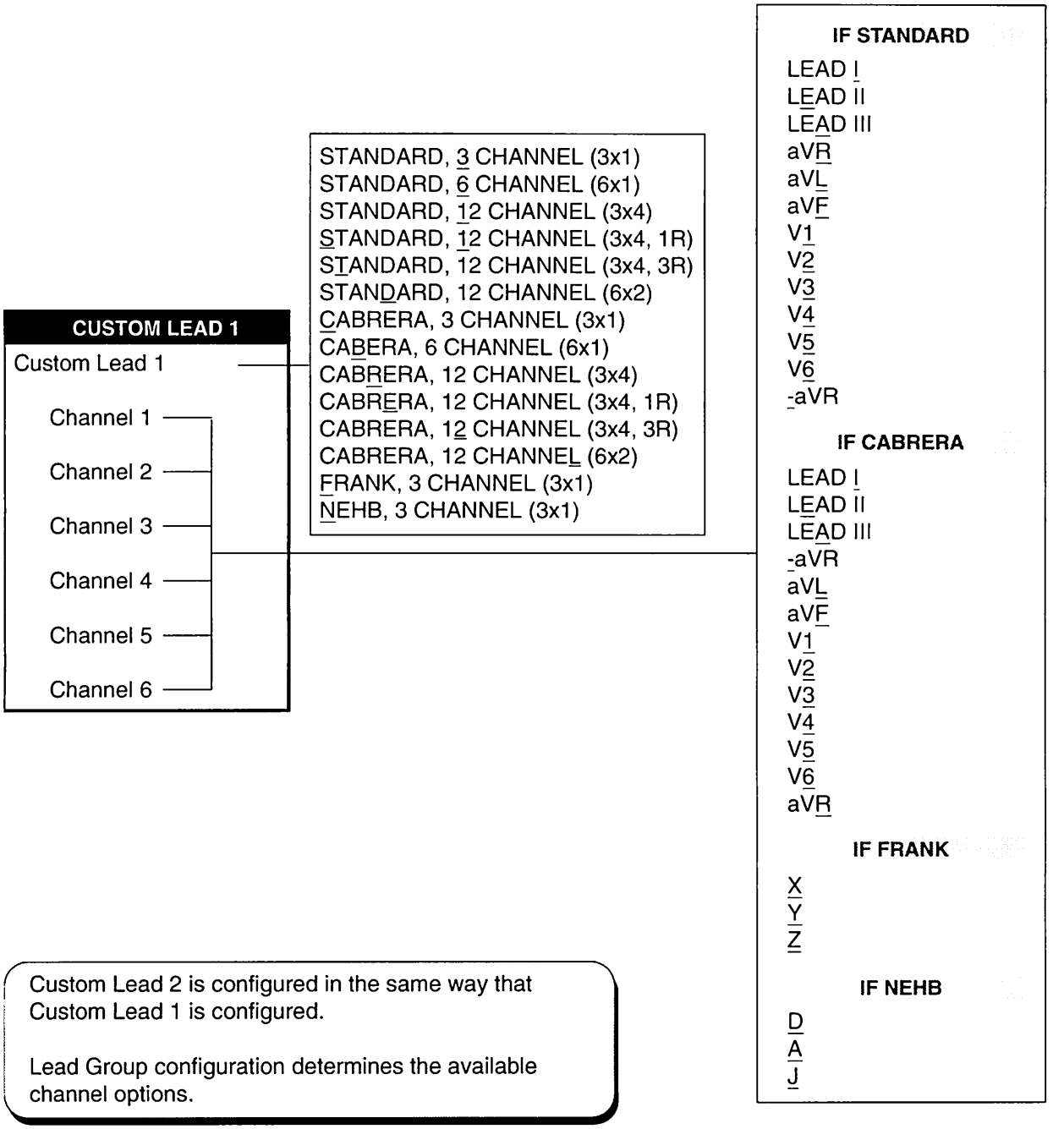
Quick Reference-Customizing Lead Groups (Eclipse 8, 800 & 850)



Custom Lead 2 is configured in the same way that Custom Lead 1 is configured.

Lead Group configuration determines the available channel options.

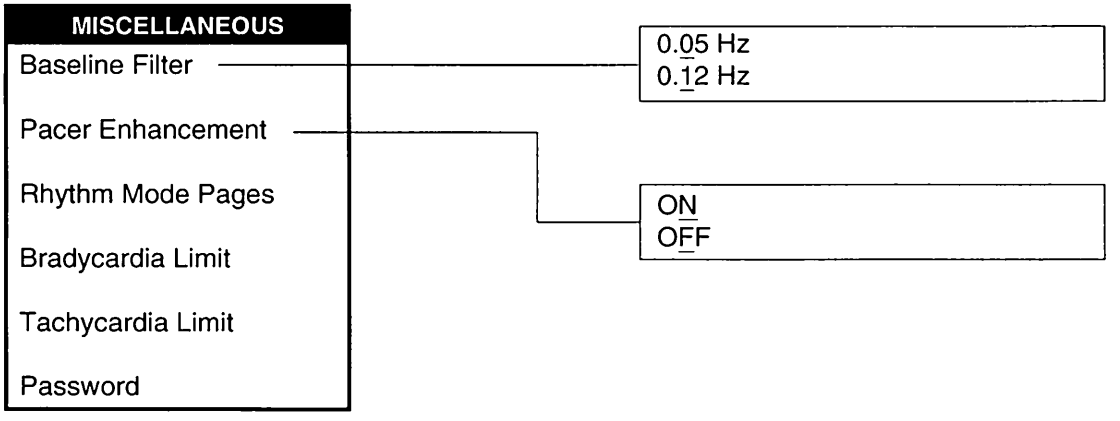
Quick Reference-Customizing Lead Groups (Eclipse Plus)



Custom Lead 2 is configured in the same way that Custom Lead 1 is configured.

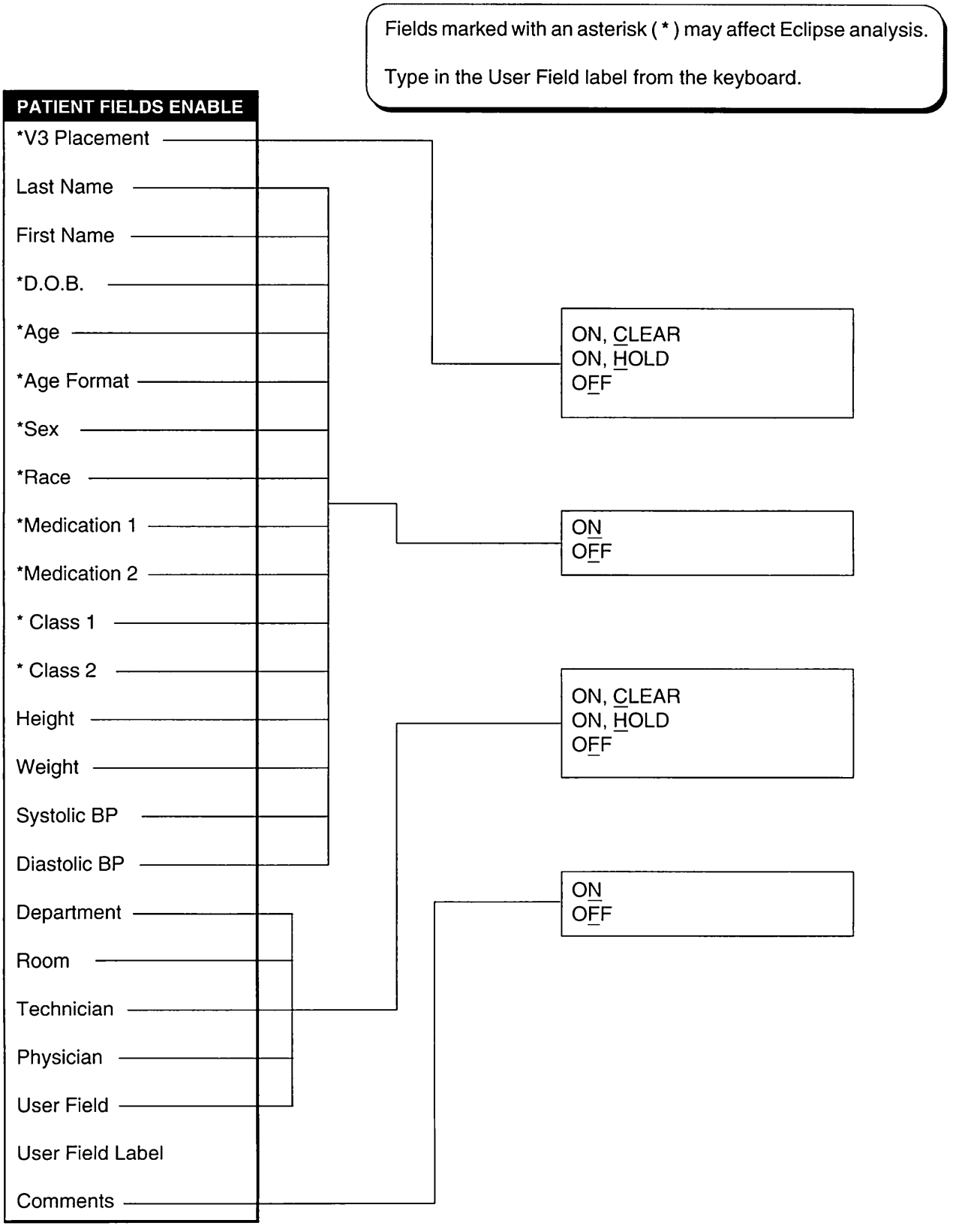
Lead Group configuration determines the available channel options.

Quick Reference-Configuring the MISCELLANEOUS menu



For any field that does not have a list, you may type in the appropriate information from the keyboard.

Quick Reference-Selecting Patient Fields



Configuring SYSTEM SETUP Menu

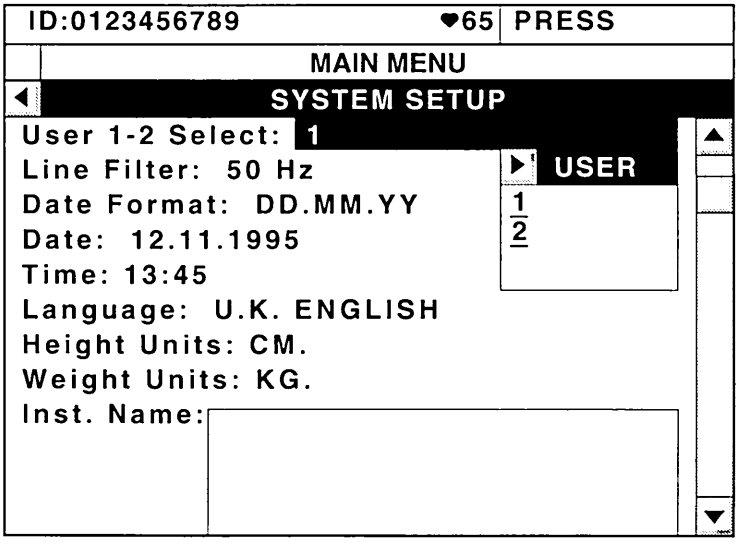
Go to SYSTEM SETUP menu

Press the On/Standby key to power up to the PREVIEW screen.

Press the "M" key to go to the MAIN MENU.

Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1).

Figure 4-1
The SYSTEM SETUP Menu
(Eclipse 4 shown)



Configure SYSTEM SETUP menu

Following is a description of the SYSTEM SETUP menu fields.

As you scroll through this menu, some fields have lists. Select the appropriate item from a list by pressing the hot key indicated by the underlined letter. In this chapter, the available choices are listed next to the field name.

When you scroll to other fields in this menu, the cursor blinks. In these fields, type the appropriate information from the keyboard. In this chapter, the type of information and the number of characters allowed are listed in brackets next to the field name.

USER 1-2 SELECT (ECLIPSE 4, 8, 850 & PLUS)

1
2

For each "User," there is a customized group of formats. For more information on User 1 and User 2, see "Configuring the USER SETUP Menus" on pg. 4-22.

> **NOTE:** The unit automatically turns off and on again whenever you change the User selection. This ensures that all changes take effect.

LINE FILTER

50 Hz
60 Hz
OFF

Filters electrical interference from AC line voltage.

DATE FORMAT

MM/DD/YY
DD.MM.YY
YY.MM.DD

DATE

[Up to 20 alphanumeric characters]

Use spaces, hyphens or periods to separate the day, month and year. Some acceptable ways to type the date are:

1. 10 10 1997
2. 10–10–1997
3. 10.10.1997

> **NOTE:** Remember that the period character (.) is typed by holding down the Shift key and pressing the "N" key. The hyphen character (-) is typed by holding down the Shift key and pressing the "M" key.

TIME

[Alphanumeric field displayed in 24-hour format]

Use a space to separate the hour from the minutes.

LANGUAGE (ECLIPSE 4, 8, 850 & PLUS)

DEUTSCH
ESPAÑOL
FRANCAIS
ITALIANO
U.K. ENGLISH
U.S. ENGLISH

Selects language for printed and displayed text. You should not have to adjust this field.

> **NOTE:** The unit automatically turns off and on again whenever you change the Language selection. This ensures that all changes take effect.

HEIGHT UNITS

CM.
IN.

Selects units for expressing patient height.

> **NOTE:** The unit automatically turns off and on again whenever you change the Units selection. This ensures that all changes take effect.

WEIGHT UNITS

KG.
LB.

Selects units for expressing patient weight.

> **NOTE:** The unit automatically turns off and on again whenever you change the Units selection. This ensures that all changes take effect.

INST. NAME

[Up to 30 alphanumeric characters]

Refers to the institution.

PHONE TYPE

TOUCH TONE

PULSE

NOTE: Eclipse electrocardiographs equipped with SCP-ECG capability can send and receive ECG records. The items under MANAGEMENT SYSTEM refer primarily to the use of an ECG Data Management System such as the Burdick PYRAMIS System. The **Phone #, Description, Connection** and **Baud Rate** fields are also used when sending records between two Eclipse units. If you are using a management system, be sure to consult your System Administrator so that you can setup your Eclipse to be compatible with the management system. For more information on sending and receiving records, see "Sending and Receiving Records" on pg. 7-9.

INSTITUTION NUMBER

[Up to 5 numeric characters]

Refers to the institution. This is extremely important when two or more institutions share a PYRAMIS System.

DEVICE ID

[Up to 5 numeric characters]

Identifies the Eclipse unit with a unique number. The Device Id is used by the PYRAMIS system to identify which electrocardiograph acquired each ECG record.

PHONE

[Up to 25 numeric characters. The comma character (,) inserts a pause during dialing]

Provides a phone number to reach the management system or another Eclipse electrocardiograph with modem. If MODEM is selected for the **Connection** field, make sure to include a phone number to enable the sending and receiving functions on the Eclipse.

Include a comma to insert a pause while dialing. A pause may be used if you need to access an "outside line." For example, this is often used after dialing a "9" prefix before the rest of the phone number.

DESCRIPTION

[Up to 20 alphanumeric characters]

Identifies what management system or electrocardiograph is reached at the phone number in the above field.

CONNECTION

MODEM
DIRECT
NONE

Determines what type of connection is used when sending or receiving records. Selecting NONE disables any sending or receiving functions on the Eclipse. This will also allow the Eclipse to automatically delete records that do not have the **St** status (see "Record Status" on pg. 7-7).

BAUD RATE

2400
AUTO

Determines the rate at which the modem will send or receive records. Selecting AUTO allows the modem to send or receive records at the fastest rate depending on the speed of the modem on the connecting equipment.

AC MAINS FREQUENCY

UNSPECIFIED
50 Hz
60 Hz

Labels ECG records with the frequency of the AC line power which is connected to the Eclipse unit. This is used by the PYRAMIS System to identify the line frequency in the area where the records are acquired.

PASSWORD (if available)

Determines whether a password is required to access the USER SETUP menus and the SYSTEM SETUP menu. The password is set in the MISCELLANEOUS menu (see "Password (if available)" on pg. 4-29).

Return to PREVIEW screen

Press the Left Arrow key to return to MAIN MENU.

Press the Left Arrow key again to return to the PREVIEW screen.

Verify calendar & clock settings

To verify the date and time, press the On/Standby key to put the unit in Standby mode. Then press the On/Standby key again to turn the unit on.

Check the date and time on the POWER-UP screen.

Configuring the USER SETUP Menus

There are 7 USER SETUP menus. On the Eclipse 4, 8, 850 & Plus, these menus are used to format two *sets* of configurations; one for each of two "Users." The **User 1-2 Select** option is located in the SYSTEM SETUP menu. However, you can select the desired User from the PREVIEW screen by holding down the shift key and pressing either the "1" or the "2" key.

Following is a description of the USER SETUP menus:

POWER-UP DEFAULTS
AUTO ECG SETUP
CUSTOM LEAD 1
CUSTOM LEAD 2
MISCELLANEOUS
PATIENT FIELDS ENABLE
GET CUSTOM HEADER

As you scroll through these menus, some fields have lists. Select the appropriate item from a list by pressing the hot key indicated by the underlined letter. In this chapter, the available choices are listed under the field name.

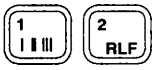
When you scroll to other fields in these menus, the cursor blinks. In these fields, type the appropriate information from the keyboard. In this chapter, the type of information and the number of characters allowed are listed in brackets under the field name.

Activate the desired User and go to a USER SETUP menu

Press this key to power up to the PREVIEW screen.

On the Eclipse 4, 8, 850 & Plus, select the set of formats you want to edit by:

1. Holding down the Shift key.



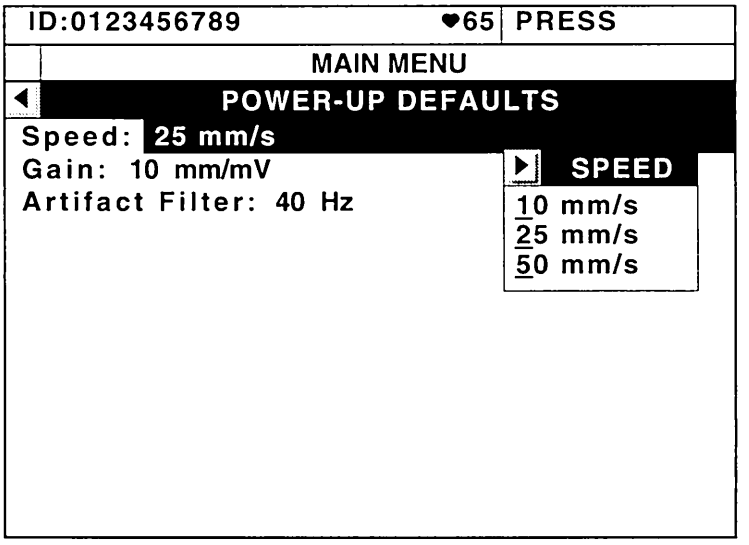
2. Simultaneously pressing either the "1" key or "2" key for User 1 or User 2 respectively.

   NOTE: The unit automatically turns off and on again whenever you change the User selection.

In the PREVIEW screen, press "M" to go to the MAIN MENU.

In the MAIN MENU, select the desired USER SETUP menu such as POWER-UP DEFAULTS. The new menu will appear (see Figure 4-2).

Figure 4-2
A USER SETUP Menu—
The POWER-UP
DEFAULTS Menu



Configuring the POWER-UP DEFAULTS menu

The fields in this menu affect paper speed and waveform printing. The settings in this menu are in effect whenever the Eclipse is powered on with the On/Standby key. Settings in this menu are different from the temporary changes made by pressing machine control keys (see "Understanding the Keyboard" on pg. 3-2). When the "7," "8" and "9" keys are used to change the settings for Speed, Gain and Filter, the changes are not saved when the unit powers down.

To save changes in the POWER-UP DEFAULTS menu, press the Left Arrow key. The changes go into effect the next time the Eclipse is powered on.

SPEED

10 mm/s
25 mm/s
50 mm/s

Refers to chart paper speed.

GAIN

5 mm/mV
10 mm/mV
20 mm/mV
L10,C5 mm/mV
L20,C10 mm/mV

Determines the amplitude of printed and displayed waveforms.

ARTIFACT FILTER

40 Hz
150 Hz

Sets the upper frequency response.

Selecting 40 Hz will reduce muscle tremor and patient movement artifacts.

Configuring the AUTO ECG SETUP menu

NOTE: The ANALYSIS-ORIGINAL and ANALYSIS COPIES fields are available only on units with interpretive capabilities. The MEDIAN COMPLEX PAGE is available on all units with measurement capabilities.

12 LEAD FORMAT (ECLIPSE 4 & 400)

STANDARD, 3 CHANNEL
STANDARD, 6CH MOUNTED
CABRERA, 3 CHANNEL
CABRERA, 6CH MOUNTED

Sets printout format. For sample printouts, see Chapter 8.

12 LEAD FORMAT (ECLIPSE 8, 800, 850 & PLUS)

STANDARD, 4 CHANNEL
STANDARD, 3 CHANNEL
STANDARD, 3 CH. + 3
STANDARD, 6 CH 5S/LD
STANDARD, 6 CH 10S/LD
CABRERA, 4 CHANNEL
CABRERA, 3 CHANNEL
CABRERA, 3 CH. + 3
CABRERA, 6 CH 5S/LD
CABRERA, 6 CH 10S/LD

Sets printout format. For sample printouts, see Chapter 8.

NOTE: If you select a 4-channel or a 3-channel plus 3 rhythm format, select a lead or leads for the rhythm printout.

RHYTHM LEADS CH. 1 (ECLIPSE 8, 800, 850 & PLUS)

LEAD I
LEAD II
LEAD III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
-aVR

Selects leads used if a rhythm printout is selected for **12 Lead Format** above.

RHYTHM LEADS CH. 2 (ECLIPSE 8, 800, 850 & PLUS)

Same as Channel 1

RHYTHM LEADS CH. 3 (ECLIPSE 8, 800, 850 & PLUS)

Same as Channel 1

RHYTHM PAGE

CUSTOM LEAD 1 AT 25 mm/s
CUSTOM LEAD 1 AT 50 mm/s
OFF

Enables a separate 10-second rhythm report as part of an Auto ECG report. This is not available if Custom Lead 1 is set to Frank or Nehb.

ANALYSIS-ORIGINAL

ON WITH REASONS
ON W/O REASONS
OFF

Determines whether analysis statements appear on Auto ECG reports. If analysis statements are printed, this field also determines whether the supporting reason statements are printed.

ANALYSIS-COPIES

ON WITH REASONS
ON W/O REASONS
OFF

Determines whether analysis statements appear on copies of Auto ECG reports. If analysis statements are printed, this field also determines whether the supporting reason statements are printed.

NUMBER OF COPIES

[Numeric. Range = 0-5]

Sets the number of ECG report copies that are printed.

MEDIAN COMPLEX PAGE

ON
OFF

Enables Median Complex printout as part of an Auto ECG report.

SAVE MODE

AUTO
AUTO SAVE AND SEND
MANUAL

Determines how Auto ECG reports are saved. If manual save is selected, the PREVIEW screen is displayed at the end of an Auto ECG sequence. You may save the report at this time. After saving an Auto ECG, either manually or automatically, the DIRECTORY menu is displayed.

Configuring CUSTOM LEAD 1 & CUSTOM LEAD 2 menus

These two menus each format a group of leads. These groups can later be selected by pressing the "5" or "6" machine control keys (see "Understanding the Keyboard" on pg. 3-2).

Custom Lead Group 1 is also used for the rhythm page of an Auto ECG report. Only Standard or Cabrera configurations are acceptable for this purpose. Do not select Frank or Nehb if you want a rhythm page as part of an Auto ECG.

NOTICE: Because the Burdick Eclipse offers different lead configurations, always ensure that the appropriate lead placement is employed for the lead configuration selected.

CUSTOM LEAD 1 (ECLIPSE 4 & 400)

STANDARD, 3 CHANNEL
CABRERA, 3 CHANNEL
FRANK, 3 CHANNEL
NEHB, 3 CHANNEL

Format Custom Lead 1 to suit your needs.

If you have selected Standard or Cabrera, select leads for CHANNEL 1, CHANNEL 2 and CHANNEL 3. Lead availability is affected by the selected lead format.

CUSTOM LEAD 1 (ECLIPSE 8, 800 & 850)

STANDARD, 3 CHANNEL
STANDARD, 6 CHANNEL
STANDARD, 12 CHANNEL
CABRERA, 3 CHANNEL
CABRERA, 6 CHANNEL
CABRERA, 12 CHANNEL
FRANK, 3 CHANNEL
NEHB, 3 CHANNEL

Format Custom Lead 1 to suit your needs.

If you have selected Standard or Cabrera, select leads for the appropriate channels. Lead availability is affected by the selected lead configuration.

CUSTOM LEAD 1 (ECLIPSE PLUS)

STANDARD, 3 CHANNEL (3x1)
STANDARD, 6 CHANNEL (6x1)
STANDARD, 12 CHANNEL (3x4)
STANDARD, 12 CHANNEL (3x4, 1R)
STANDARD, 12 CHANNEL (3x4, 3R)
STANDARD, 12 CHANNEL (6x2)
CABRERA, 3 CHANNEL (3x1)
CABRERA, 6 CHANNEL (6x1)
CABRERA, 12 CHANNEL (3x4)
CABRERA, 12 CHANNEL (3x4, 1R)
CABRERA, 12 CHANNEL (3x4, 3R)
CABRERA, 12 CHANNEL (6x2)
FRANK, 3 CHANNEL (3x1)
NEHB, 3 CHANNEL (3x1)

Format Custom Lead 1 to suit your needs. The numbers in parentheses indicate how the selected lead group will be displayed on the screen. If you select a display that includes rhythm leads, the rhythm leads displayed are the same ones that have been selected for printing in the Auto ECG Setup menu. (See "Configuring the AUTO ECG SETUP menu" on pg. 4-24.)

If you have selected a non-12 lead Standard or Cabrera format, select leads for the appropriate channels. Lead availability is affected by the selected lead configuration.

CHANNEL 1

Standard

LEAD I
LEAD II
LEAD III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
-aVR

Cabrera

LEAD I
LEAD II
LEAD III
-aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
aVR

Frank

X
Y
Z

Nehb

D
A
I

CHANNEL 2

Same as Channel 1

CHANNEL 3

Same as Channel 1

CHANNEL 4 (ECLIPSE 8, 800, 850 & PLUS)

Same as Channel 1

CHANNEL 5 (ECLIPSE 8, 800, 850 & PLUS)

Same as Channel 1

CHANNEL 6 (ECLIPSE 8, 800, 850 & PLUS)

Same as Channel 1

CUSTOM LEAD 2

Custom Lead Group 2 is similar to Custom Lead Group 1. It is set up in the same manner. It is then accessed by pressing the number "6" on the keyboard.

Configuring the MISCELLANEOUS menu

NOTE: The BRADYCARDIA LIMIT and TACHYCARDIA LIMIT fields are available only on units with interpretive or measurement capabilities.

BASELINE FILTER

.05 Hz
.12 Hz

Sets the low frequency response.

Selecting .12 Hz will reduce baseline wander artifacts.

PACER ENHANCEMENT

ON
OFF

Enables pacemaker enhancement. This feature makes pacemaker signals show up as prominent spikes on the display and on printouts. An enhanced pacer is printed as a spike that is at least 10 mm tall and of positive polarity.

RHYTHM MODE PAGES

[Numeric. Range = 1-10]

Sets the number of pages printed during an Auto Rhythm.

BRADYCARDIA LIMIT

[Numeric. Range = 41-69]

Reports for adult patients with heart rates below this limit are labelled "BRADYCARDIA." For more information on heart rate limits refer to the Physician's Guide.

TACHYCARDIA LIMIT

[Numeric. Range = 81-129]

Reports for adult patients with heart rates above this limit are labelled "TACHYCARDIA." For more information on heart rate limits refer to the Physician's Guide

PASSWORD (if available)

[Up to 15 alphanumeric characters]

NOTE: Write down the password and keep it in a secure place. You will be able to change or remove the password protection only after you have entered the correct password.

Determines the password required to access the USER SETUP menus and the SYSTEM SETUP menu. You can set a different password for both User 1 and User 2. This field is enabled in the SYSTEM SETUP menu (see "password (if available)" on pg. 4-21).

Enabling patient demographic fields

> **NOTE:** This menu will not be available if the Eclipse is configured to use Custom Header in conjunction with an ECG data management system like the PYRAMIS system.

The last USER SETUP menu determines which patient demographic fields are used. An asterisk (*) indicates that information in these fields directly affects Eclipse analysis.

Select "**ON**," "**ON, CLEAR**" or "**ON, HOLD**" to make each demographic field appear in the EDIT ID menu. These fields also appear on printouts.

Select **ON, HOLD** if you want every patient file to have the same information in this field. Until the information is typed over, the EDIT ID menu will keep the information in these fields even if the Eclipse is turned off. For example, you may want every patient record to be labelled with the same Department name.

"**ON**" and "**ON, CLEAR**" act the same. Fields that are enabled with these are cleared for every new patient or when the unit returns to Standby mode.

***V3 PLACEMENT**

ON, CLEAR
ON, HOLD
OFF

Used for pediatric recording only.

LAST NAME

ON
OFF

FIRST NAME

ON
OFF

***D.O.B.**

ON
OFF

***AGE**

ON
OFF

***AGE FORMAT**

ON
OFF

***SEX**

ON
OFF

***RACE**

ON
OFF

***MEDICATION 1**

ON
OFF

***MEDICATION 2**

ON
OFF

*** CLASS 1**

ON
OFF

*** CLASS 2**

ON
OFF

HEIGHT

ON
OFF

WEIGHT

ON
OFF

SYSTOLIC BP

ON
OFF

DIASTOLIC BP

ON
OFF

DEPARTMENT

ON, CLEAR
ON, HOLD
OFF

ROOM

ON, CLEAR
ON, HOLD
OFF

TECHNICIAN

ON, CLEAR
ON, HOLD
OFF

PHYSICIAN

ON, CLEAR
ON, HOLD
OFF

USER FIELD

ON, CLEAR
ON, HOLD
OFF

USER FIELD LABEL

[Up to 15 alphanumeric characters]

Renames the above field. The new name is displayed in the EDIT ID menu and printed on patient demographics reports. The User Field may be used for anything. For example, you may want to use the field for the referring physician's name.

COMMENTS

ON
OFF

Press the Left arrow key to return to the MAIN MENU.

Press the Left arrow key again to return to the PREVIEW screen.

Getting Custom Header Information (Eclipse w/SCP-ECG)

The Get Custom Header function is available for Eclipse electrocardiographs that are used with an ECG data management system like the PYRAMIS system.

Custom Header information is a list of patient demographic items to be used in the EDIT ID menu and to be printed on ECG reports. This list is maintained on the ECG data management system. By connecting to the management system, the Eclipse can be programmed to use the Custom Header.

You can connect to the PYRAMIS ECG Data Management System in two ways:

1. Direct Connection
2. Remote Connection

USING A DIRECT CONNECTION

1. Connect the Burdick Interconnect Cable #882029 to the connector labeled "DECG-SCP" on the PYRAMIS back panel and to the connector labeled "**IOIO**" on the Eclipse back panel.
2. Press the On/Standby key to power up to the PREVIEW screen.
3. Press the "M" key to go to the MAIN MENU.
4. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).
5. Press the Down Arrow key to highlight the **Connection** field and select **DIRECT.**
6. Press the Left Arrow key to return to the MAIN MENU.
7. Press the "H" key to go to the GET CUSTOM HEADER menu.
8. Receive a list of available Custom Headers by selecting **GET CUSTOM HEADER LIST.**
9. Highlight the desired Custom Header and press the Enter key to select it. The word "SELECT" is displayed.
10. Press the Left Arrow key to return to the GET CUSTOM HEADER menu.
11. Press the "G" key to receive the Custom Header list and automatically configure the Eclipse to use those patient demographic fields.

USING A REMOTE CONNECTION

NOTE: This requires an Eclipse with either an internal or external modem.

1. Press the On/Standby key to power up to the PREVIEW screen.
2. Press the "M" key to go to the MAIN MENU.
3. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).
4. Press the Down Arrow key to highlight the **Connection** field and select **MODEM.**

5. Verify that the **Phone #** and **Description** fields are correctly filled in.

6. Press the Left Arrow key to return to the MAIN MENU.

7. Press the "H" key to go to the GET CUSTOM HEADER menu.

8. Receive a list of available Custom Headers by selecting **GET CUSTOM HEADER LIST.**

9. Highlight the desired Custom Header and press the Enter key to select it. The word "SELECT" is displayed.

10. Press the Left Arrow key to return to the GET CUSTOM HEADER menu.

11. Press the "G" key to receive the Custom Header list and automatically configure the Eclipse to use those patient demographic fields.

Acquiring a Printout of Eclipse Settings

You may print a list of all current Eclipse settings. Please see "Print Setup Report" on pg. 8-2 for examples which were printed using settings configured at the factory.

Press the On/Standby key to power up to the PREVIEW screen.

Press the "M" key to go to the MAIN MENU.

Press the "P" key to print the list.

Press the Left arrow key to return to the PREVIEW screen.

Chapter 5 *Patient Preparation*

This chapter covers patient preparation, and lead arrangement.

The following lead arrangements are covered:

- Standard and Cabrera
- Exercise Stress
- Pediatric
- Frank
- Nehb

Resting ECG Lead Placement & Coding Chart

LEAD CODING AND MEASUREMENTS

AHA

STANDARD LIMB LEADS

LEAD	SENSORS CONNECTED / MEASURED
LEAD I	LA-RA
LEAD II	LL-RA
LEAD III	LL-LA

AUGMENTED LIMB LEADS

LEAD	SENSORS CONNECTED / MEASURED
aVR	RA and (LA-LL)
aVL	LA and (RA-LL)
aVF	LL and (RA-LA)

CHEST LEADS

LEAD	SENSORS CONNECTED / MEASURED
V_1	V_1 and (LA-RA-LL)
V_2	V_2 and (LA-RA-LL)
V_3	V_3 and (LA-RA-LL)
V_4	V_4 and (LA-RA-LL)
V_5	V_5 and (LA-RA-LL)
V_6	V_6 and (LA-RA-LL)

AHA COLOR CODE

LEAD	LOCATION	BAND	LABEL
RL	RIGHT LEG	GREEN	
LL	LEFT LEG	RED	
RA	RIGHT ARM	WHITE	
LA	LEFT ARM	BLACK	
V_1	CHEST	BROWN	RED
V_2	CHEST	BROWN	YELLOW
V_3	CHEST	BROWN	GREEN
V_4	CHEST	BROWN	BLUE
V_5	CHEST	BROWN	ORANGE
V_6	CHEST	BROWN	VIOLET

IEC COLOR CODE

LEAD	LOCATION	BAND	LABEL
N	RIGHT LEG	BLACK	
F	LEFT LEG	GREEN	
R	RIGHT ARM	RED	
L	LEFT ARM	YELLOW	
C_1	CHEST	WHITE	RED
C_2	CHEST	WHITE	YELLOW
C_3	CHEST	WHITE	GREEN
C_4	CHEST	WHITE	BROWN
C_5	CHEST	WHITE	BLACK
C_6	CHEST	WHITE	VIOLET

IEC

STANDARD LIMB LEADS

LEAD	SENSORS CONNECTED / MEASURED
LEAD I	L-R
LEAD II	F-R
LEAD III	F-L

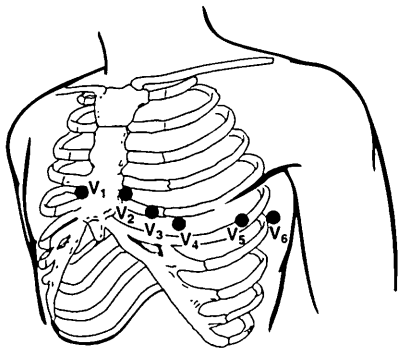
AUGMENTED LIMB LEADS

LEAD	SENSORS CONNECTED / MEASURED
aVR	R and (L-F)
aVL	L and (R-F)
aVF	F and (R-L)

CHEST LEADS

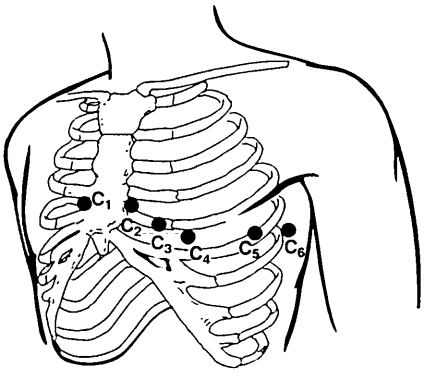
LEAD	SENSORS CONNECTED / MEASURED
C_1	C_1 and (L-R-F)
C_2	C_2 and (L-R-F)
C_3	C_3 and (L-R-F)
C_4	C_4 and (L-R-F)
C_5	C_5 and (L-R-F)
C_6	C_6 and (L-R-F)

PLACEMENT OF THE CHEST SENSORS



AHA

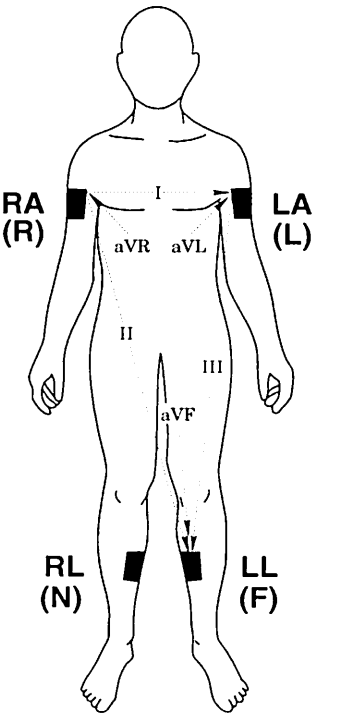
- **V_1** Fourth intercostal space at right margin of sternum
- **V_2** Fourth intercostal space at left margin of sternum
- **V_4** Fifth intercostal space at junction of left midclavicular line
- **V_3** Midway between position V_2 and position V_4
- **V_5** At horizontal level of position V_4 at left anterior axillary line
- **V_6** At horizontal level of position V_4 at left midaxillary line



IEC

- **C_1** Fourth intercostal space at right margin of sternum
- **C_2** Fourth intercostal space at left margin of sternum
- **C_4** Fifth intercostal space at junction of left midclavicular line
- **C_3** Midway between position C_2 and position C_4
- **C_5** At horizontal level of position C_4 at left anterior axillary line
- **C_6** At horizontal level of position C_4 at left midaxillary line

PLACEMENT OF THE LIMB SENSORS



Preparing Patients for ECGs

You will obtain high quality ECGs when your patient is relaxed. Assure your patient that there is no danger or pain involved, and that his or her cooperation will assist in producing a valuable diagnostic record.

Make the patient comfortable on a cot or padded table which is large enough to support arms and legs. The patient's arms should rest at his or her sides and the legs should lie flat, not touching one another. Use a pillow to support the patient's head. Also, try to avoid factors like cold drafts which could cause discomfort. Leaving the chest and sensor sites exposed, cover your patient with a blanket to prevent shivering.

Choosing the environment

WARNING: Explosion hazard. Do NOT use in the presence of flammable anesthetics.

CAUTION: Although the Eclipse is designed to meet IEC 601-1-2 EMC immunity requirements, the presence of strong EMI fields generated by electronic, surgical or diathermy instruments close to the unit, may cause trace noise or input overload conditions.

The Eclipse is a high fidelity instrument which responds to the minute voltages of the heart. Since it is such a sensitive instrument, take care to avoid interference which can be produced by muscle tremor and AC signals. To minimize interference, locate the electrocardiograph and patient away from power cords and other electrical devices.

Preparing the skin

You are more likely to get a stable baseline and clean trace if you prepare your patient's skin properly at sensor sites.

For the best contact:

1. Clean the skin with alcohol or acetone and let dry completely.
2. Abrade the skin slightly with a dry, heavy gauze or similar alternative.

Applying ECG Sensors

Apply sensors before entering patient information into the Eclipse. This allows time for the sensors to adhere and improves conductivity.

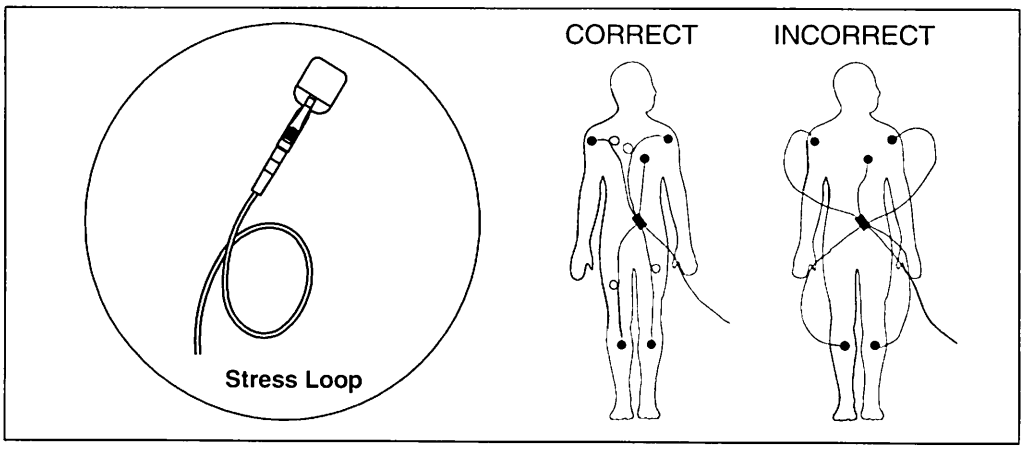
After applying sensors, connect the patient cable to them. Make sure the lead cables follow the contours of the patient's body and lie flat. If any lead wire is too long, as with a short patient or child, take up the length by making a small "stress loop" (see Figure 5-1).

Refer to the "Resting ECG Lead Placement & Coding Chart" on pg. 5-2 for details on lead groups and sensor locations.

When applying sensors to sites with a lot of hair, the following techniques may improve contact:

1. Use the thumb and forefinger to spread the hair before applying the sensor to the skin.
2. Abrade the skin slightly with a dry, heavy gauze or similar alternative.
3. If the sensor does not adhere well, it may be necessary to shave the site.

Figure 5-1
Lead Cable Arrangement



Using Disposable ECG Sensors

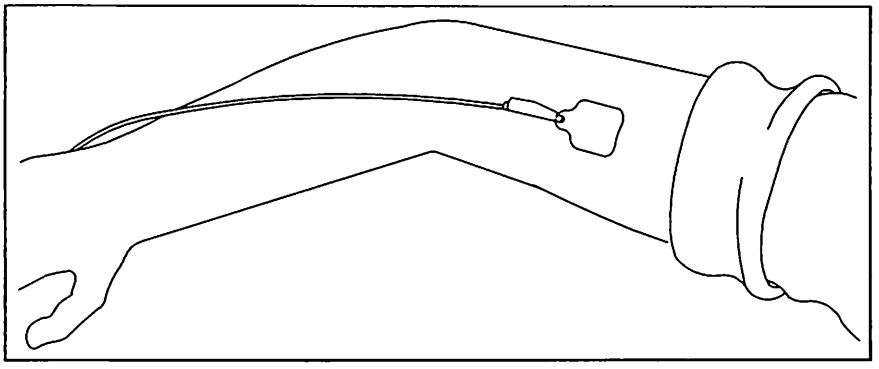
Disposable sensors from Burdick save time and are an affordable alternative to bulbs, plates, straps, creams, and gels. Disposable sensors utilize a highly conductive, natural adhesive for good results.

Disposable sensors should be stored according to the guidelines on the packaging and should not be used after the expiration date. Never mix sensor types or brands. Incompatibilities can cause baseline drift and can increase trace recovery time after defibrillation.

Applying limb sensors

1. Expose the arms and legs.
2. Place sensors firmly on the limb sites. Choose fleshy areas, not ankles or wrists (see Figure 5-2).
3. Clip leads to the sensors. Leads on arm sensors should point downward toward feet. Leads on legs should point upward toward chest.

Figure 5-2
Disposable Limb Sensor on Arm



Applying chest sensors

1. Expose the chest.
2. Locate the 6 C-lead (V-lead) positions on the patient's chest.
3. Apply the sensors.
4. Ensure that the leads conform to body contours and that no strain is placed on the sensors.

Using Reusable ECG Sensors

Never mix sensor types or brands. Dissimilar metals or other incompatibilities may cause considerable baseline drift and may increase trace recovery time after defibrillation. Do not use corroded sensors, they may give poor results.

Electrolyte

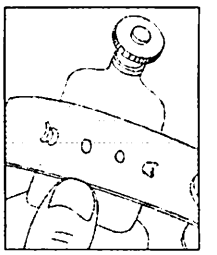
> **NOTE:** Watches and jewelry which could come in contact with electrolyte should be removed to avoid damage.

Burdick recommends Liqui-cor® and Lectro-pads® for use with reusable sensors. Both provide excellent conductivity between the skin and sensor; both are hypoallergenic, nonabrasive, and water soluble for easy cleanup.

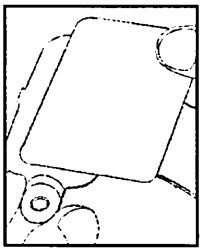
Reusable sensors (Welsh bulbs, limb plates) should be kept clean. They should be washed after each use and scoured frequently with a light-duty kitchen cleanser. Never use a metallic pad to clean the sensors. Accumulation of electrolyte may cause drifting and degrade ECG quality.

Applying limb plates

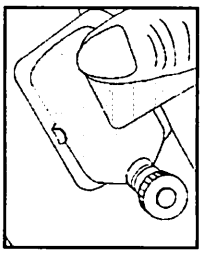
1. Expose the arms and legs.



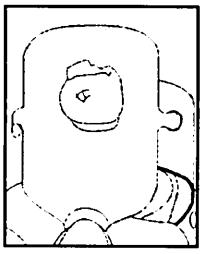
2. Connect sensor straps to the "ears" of the sensors.



3. If using Lectro-pads®, the pad extends slightly beyond the edge of the sensor.



4. Firmly stroke the skin in the application area with this overlapping edge. This squeezes some electrolyte from the edge of the pad and helps clean the skin.



5. If you use Liqui-cor®, squeeze out a small amount as illustrated. Spread it evenly over the sensor surface. Always apply the same amount of electrolyte to each sensor.

6. Place sensors firmly on the limb sites. Position them so that the sensor will not press against the body or table when the patient is relaxed. On arms, the screws should point downward toward the feet. On legs, the screws should point upward, toward chest.
7. Without stretching the strap, wrap it around the limb until a hole lines up with a sensor "ear." Then stretch the strap and fasten it with the next hole.
8. Connect the limb leads to the four sensors.

Applying Welsh bulb chest sensors

1. Connect the 6 Welsh bulb sensors to the C-leads (V-leads) on the patient cable.
2. Locate the 6 C-lead (V-lead) positions on the patient's chest (see "Resting ECG Lead Placement & Coding Chart" on pg. 5-2).
3. Squeeze out a drop of Liqui-cor® electrolyte at each sensor site. Use a tongue depressor to spread the electrolyte taking care that it does not touch the electrolyte from another site.
4. Apply the sensors by squeezing the rubber bulb and allowing suction to hold the sensor in place. Only a small dimple should remain on the bulb when it is released.
5. Ensure that the leads conform to the body contours and that no strain is placed on the sensors.

Resting ECG Lead Placement

Refer to "Resting ECG Lead Placement & Coding Chart" on pg. 5-2 to place all limb and chest sensors.

Lead Placement for Exercise Stress Testing

Use a similar technique when preparing for an Exercise Stress test as you use when taking a resting ECG. The following exceptions apply:

1. Place limb leads where movement is not a factor (see Figure 5-3).
2. Take special care with skin preparation.
   - ✔ Cleanse sensor sites with alcohol or acetone swab.
   - ✔ Use a Burdick Skin Rasp. Applying moderate pressure, stroke the skin 2 or 3 times at each site with the rough side of the rasp.
3. Secure dangling wires with tape to the patient's abdomen.

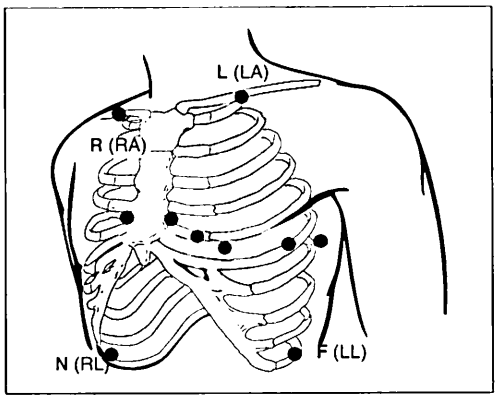


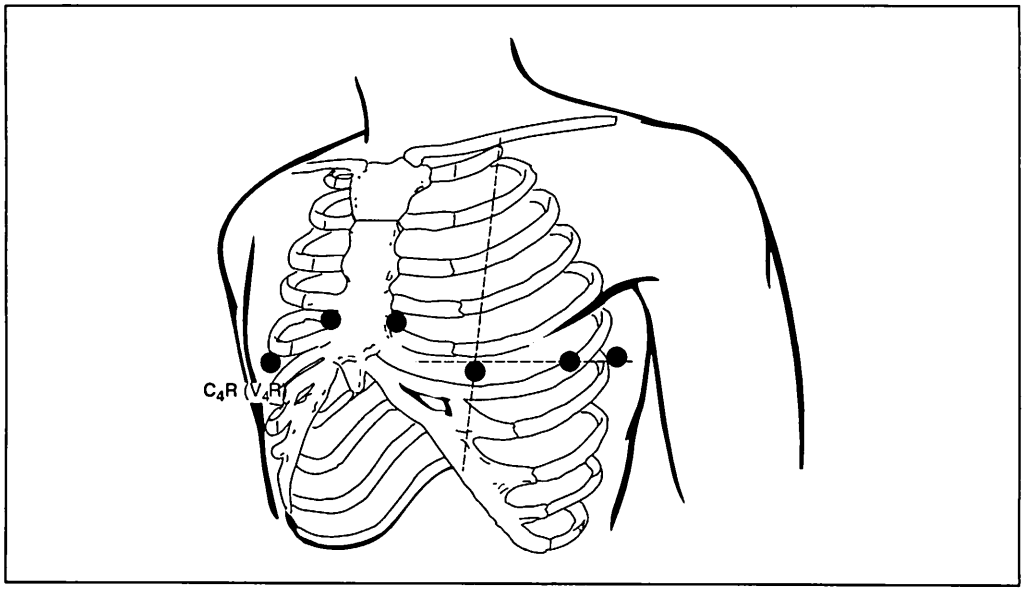
Figure 5-3
Exercise Stress Lead Placement

Pediatric Lead Placement

When acquiring a pediatric ECG, you may use an alternative C_3 (V_3) placement. Place the sensor in the C_4R (V_4R) position. This is across the sternum from C_4 (V_4). See Figure 5-4 for location. Improper placement will result in inaccurate waveform labelling.

You must select the corrected C_3 (V_3) placement in the EDIT ID menu (see "Entering Patient Demographics" on pg. 6-4). If you place C_3 (V_3) in the C_4R (V_4R) position, select "V4R" in the ***V3 Placement** field located in the ENTER ID menu for proper printout labelling.

Figure 5-4
Pediatric Chest Lead Placement



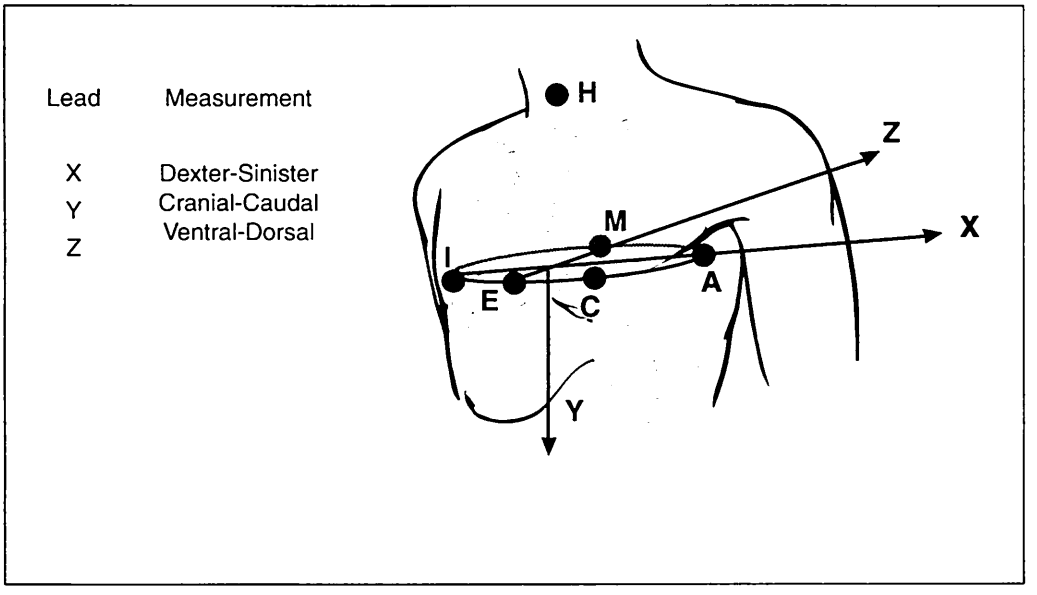
Frank: Corrected Orthogonal Leads

Attach all the limb sensors, R, L, F, and N (RA, LA, LL and RL). Please see "Resting ECG Lead Placement & Coding Chart" on pg. 5-2 for diagram.

Attach the chest sensors according to the following table. I, E, C, M and A should all be in the same horizontal plane level with the fifth intercostal space (see Figure 5-5).

C_1 (V_1)	Chest - right midaxillary line	I
C_2 (V_2)	Chest - midsternum	E
C_3 (V_3)	Chest - midclavicular line	C
C_4 (V_4)	Chest - left midaxillary line	A
C_5 (V_5)	Back - spine, opposite E	M
C_6 (V_6)	Throat or back of neck	H

Figure 5-5
Frank Lead Placement



Nehb: Bipolar Leads

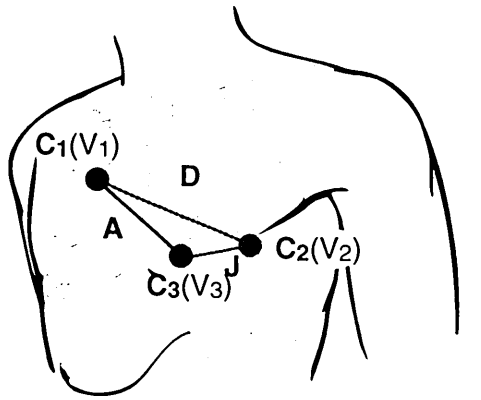
Attach all the limb sensors, R, L, N, and F (RA, LA, LL and RL). Please see "Resting ECG Lead Placement & Coding Chart" on pg. 5-2 for diagram.

Attach the chest sensors according to the following table (see Figure 5-6).

C_1 (V_1)	Chest - second rib at right sternal border	N_{st}
C_2 (V_2)	Back - left posterior axillary line on level with the bottom tip of the scapula.	N_{ax}
C_3 (V_3)	Chest - opposite the scapular apex at the same level as V_2 above.	N_{ap}

Figure 5-6
Nehb Lead Placement

Lead	Measurement
D	N_{ax} - N_{st}
A	N_{ap} - N_{st}
J	N_{ap} - N_{ax}



Connecting the Patient Cable to the Eclipse

Plug the patient cable into the connector on the front of the unit. This is located under the keyboard (see "Connecting the Patient Cable and Enhancing Software" on pg. 2-6).

Chapter 6 *Acquiring ECG Reports*

This chapter covers:

- Entering patient information in the EDIT ID menu.
- Acquiring Stat ECG reports.
- Acquiring Auto ECG reports.
- Acquiring Auto and Manual Rhythm reports.

If you are not familiar with using the Eclipse , you may wish to read Chapter 3, "Keyboard and Displays," before proceeding.

If you have not yet configured User Setup, you will obtain reports in default formats. Please see Chapter 4, "Program Setup," for more information.

Quick Reference-Acquiring ECG Reports

1. Prepare patient according to guidelines in Chapter 5, "Patient Preparation."
2. From Standby mode, press on/stby to power up to the PREVIEW screen.

For a Stat ECG...

3. Press ECG to acquire an Auto ECG report.

See "Acquiring an Auto ECG" on pg. 6-10.

For an ECG with demographics...

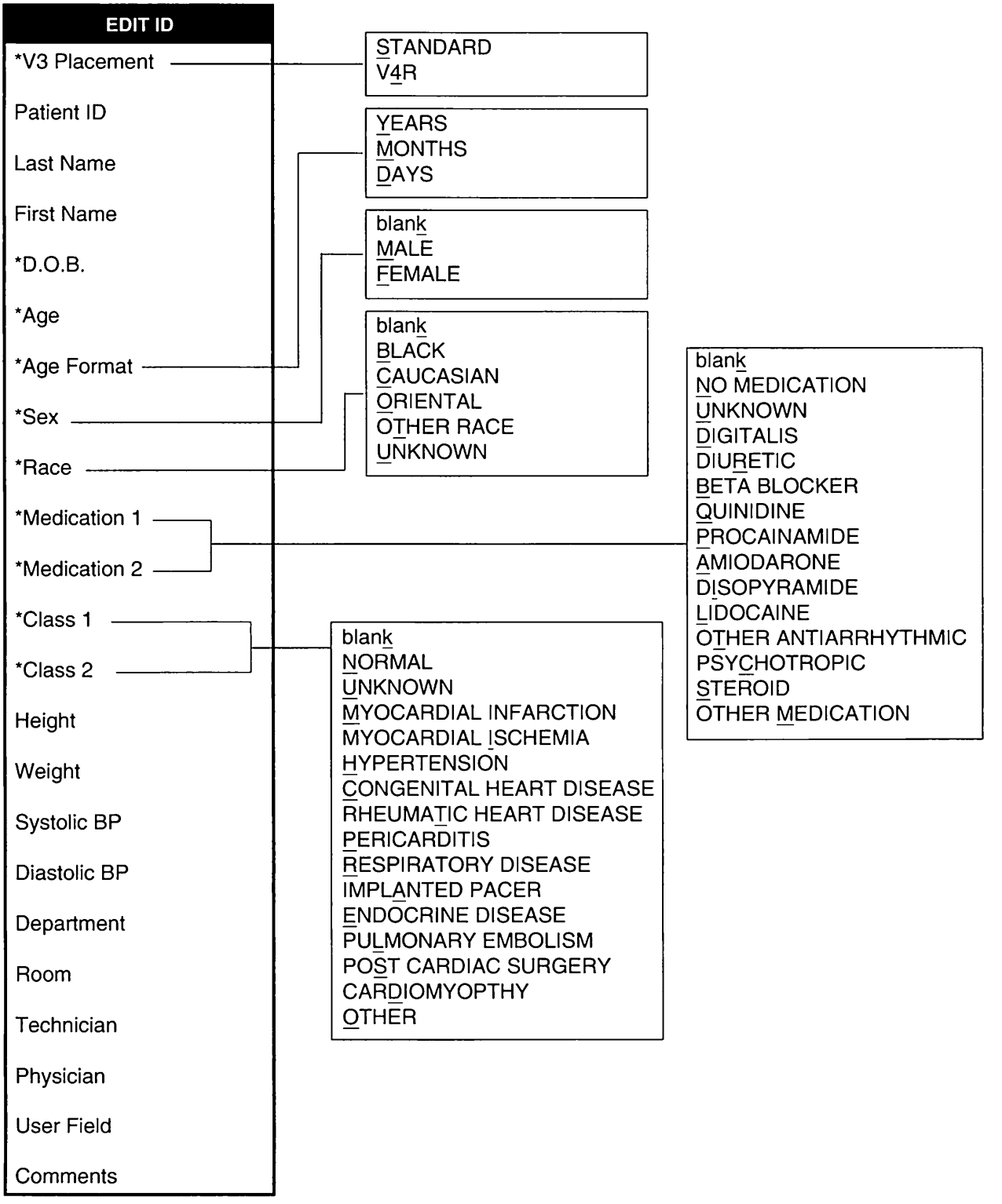
3. Press N I to go to the EDIT ID menu.
4. If a System Note box appears with the message "**NEW Patient?**" press Y.
5. Type the patient's ID and press enter.
6. Type the patient's last name and press enter.
7. Type the patient's first name and press enter.
8. Type the patient's date of birth and press enter.
9. Select the appropriate gender in the ***Sex** field by pressing either F or M.
10. Fill in remaining fields as thoroughly as possible. Skip fields if necessary. Exit menu or acquire a report at any time.

See "Entering Patient Demographics" on pg. 6-4

11. Press ECG to acquire an Auto ECG report.

See "Acquiring an Auto ECG" on pg. 6-10.

Quick Reference-Entering Patient Information



For any field that does not have a list, you may type in the appropriate information from the keyboard.

Acquiring a Stat ECG

Press the "ECG" function key on the left side of the keyboard to acquire an Auto ECG report. This key is active in the PREVIEW screen and most menus including the EDIT ID menu.

If there is no Patient ID when you press this key, the Eclipse prints a Stat ID in the **Patient ID** field. This consists of "#STAT#" followed by the date and time (24-hour format).

Entering Patient Demographics

Some patient information directly affects ECG analysis. Your patient's physician uses this information when interpreting ECG reports. Likewise, interpretive Eclipse units provide more accurate and complete analysis statements when you enter patient information thoroughly.

Fields which directly affect Eclipse analysis, such as the ***D.O.B.** (date of birth) field, are marked with an asterisk (*).

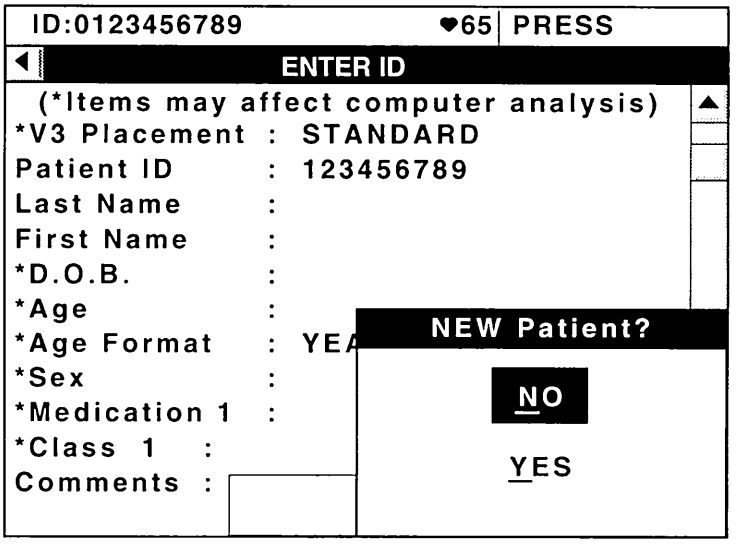
From the PREVIEW screen, press the "I" key to go to the EDIT ID menu. You may also go to the EDIT ID menu from the MAIN MENU. If you want to create a file for this patient in the Directory, select **ADD NEW PATIENT** in the DIRECTORY menu (see "Using the DIRECTORY Menu" on pg. 7-4).

You may exit the EDIT ID menu at any time by pressing the Left arrow key. Information entered here will be used to label all ECG reports until you begin a new patient file or return the unit to Standby mode.

NEW PATIENT?

If demographics have been entered already, a message appears which reads, "**NEW Patient?**" (see Figure 6-1). Selecting YES begins a new file. Selecting NO uses the current patient information.

Figure 6-1
The EDIT ID Menu



The EDIT ID fields are described below.

As you scroll through this menu, some fields have lists. Select the appropriate item from a list by pressing the hot key indicated by the underlined letter. In this chapter, the available choices are listed next to the field name.

When you scroll to other fields in this menu, the cursor blinks. In these fields, type the appropriate information from the keyboard. In this chapter, the type of information and the number of characters allowed are listed in brackets next to the field name.

> **NOTE:** Some of the fields described here may not appear because they have been disabled in the PATIENT FIELDS ENABLE menu (see "Enabling patient demographic fields" on pg. 4-30) or because the Eclipse is configured to use a Custom Header (see "Getting Custom Header Information (Eclipse w/SCP-ECG)" on pg. 4-32).

***V3 PLACEMENT**

STANDARD
V4R

Use only for pediatric reports. For more information on pediatric lead placement, see "Pediatric Lead Placement" on pg. 5-8.

PATIENT ID

[Up to 20 alphanumeric characters]

LAST NAME

[Up to 20 alphanumeric characters]

FIRST NAME

[Up to 20 alphanumeric characters]

***D.O.B**
(DATE OF BIRTH)

[Up to 20 alphanumeric characters]

Use spaces, hyphens or periods to separate the day, month and year. Some acceptable ways to type the date are:

1. 10 10 1950
2. 10–10–1950
3. 10.10.1950

> **NOTE:** Remember that the period character (.) is typed by holding down the Shift key and pressing the "N" key. The hyphen character (-) is typed by holding down the Shift key and pressing the "M" key.

***D.O.B.** is used to automatically fill in ***Age** and ***Age Format**. For accuracy and convenience, you may wish to use this field rather than fill in ***Age** manually.

***AGE**

[Up to 3 numeric characters. Range = 0-364]

Not editable if ***D.O.B.** was entered.

***AGE FORMAT**

YEARS
MONTHS
DAYS.

Not editable if ***D.O.B.** was entered.

***SEX**

blank
MALE
FEMALE

***RACE**

blank
BLACK
CAUCASIAN
ORIENTAL
OTHER RACE
UNKNOWN

NOTE: If you typically use just the ***Medication 1** and ***Class 1** fields, use the PATIENT FIELDS ENABLE menu to select the **OFF** setting for the ***Medication 2** and ***Class 2** fields (see "Enabling patient demographic fields" on pg. 4-30).

***MEDICATION 1**

blank
NO MEDICATION
UNKNOWN
DIGITALIS
DIURETIC
BETA BLOCKER
QUINIDINE
PROCAINAMIDE
AMIODARONE
DISOPYRAMIDE
LIDOCAINE
OTHER ANTIARRHYTHMIC
PSYCHOTROPIC
STEROID
OTHER MEDICATION

Select a medication type if you know the category of medication your patient is taking. For Eclipse analysis, it is better to select NO MEDICATION or UNKNOWN than to leave this field blank.

***MEDICATION 2**

NOTE: Do not use this field if blank, NO MEDICATION or UNKNOWN is selected for ***Medication 1**. These entries for ***Medication 1** cause the analysis program in interpretive Eclipse units to ignore the ***Medication 2** field.

See ***MEDICATION** 1, above

***CLASS 1**

blank
NORMAL
UNKNOWN
MYOCARDIAL INFARCTION
MYOCARDIAL ISCHEMIA
HYPERTENSION
CONGENITAL HEART DISEASE
RHEUMATIC HEART DISEASE
PERICARDITIS
RESPIRATORY DISEASE
IMPLANTED PACER
ENDOCRINE DISEASE
PULMONARY EMBOLISM
POST CARDIAC SURGERY
CARDIOMYOPTHY
OTHER

Refers to the patient's cardiac diagnosis. Select the appropriate diagnosis from the list if you know your patient's condition. For Eclipse analysis, it is better to select NORMAL or UNKNOWN than to leave this field blank.

***CLASS 2**

NOTE: Do not use this field if blank, NORMAL or UNKNOWN is selected for ***Class 1**. These entries for ***Class 1** cause the analysis program in interpretive Eclipse units to ignore the ***Class 2** field.

See ***CLASS 1**, above

HEIGHT

[Up to 3 numeric characters. Range = 0-96 in. or 0-244 cm.]

Measured in either inches or centimeters as determined in the SYSTEM SETUP menu.

WEIGHT

[Up to 3 numeric characters. Range = 0- 500 lb. or 0-227 kg.]

Measured in either pounds or kilograms as determined in the SYSTEM SETUP menu.

SYSTOLIC BP (BLOOD PRESSURE)

[Up to 3 numeric characters. Range = 0 – 250]

DIASTOLIC BP (BLOOD PRESSURE)

[Up to 3 numeric characters. Range = 0 – 250]

DEPARTMENT

[Up to 5 numeric characters. Range 1 – 32000]

Identifies your department in the facility. A list of the allowable selections is displayed if one has been downloaded from a management system.

ROOM

[Up to 7 alphanumeric characters]

Identifies your location within the facility.

TECHNICIAN

[Up to 20 alphanumeric characters]

Identifies the person acquiring the ECG.

PHYSICIAN

[Up to 20 alphanumeric characters]

Identifies the patient's physician

USER FIELD

[Up to 15 alphanumeric characters]

Use this field to suit your needs. A possible use might be to identify the referring physician. You may label this field in the USER SETUP menu (see "Configuring the USER SETUP Menus" on pg. 4-22).

COMMENTS

[Up to 120 alphanumeric characters]

Use this field to input additional patient information as needed.

Printing Reports

Use the "STOP" key to halt any printout. The Eclipse advances the chart paper to the next page and returns to the PREVIEW screen.

If the unit runs out of paper or if the paper jams, you are given the option to reload the paper and continue printing (see Figure 6-2). Alternatively, you may stop the function and return to the PREVIEW screen. For paper loading instructions see "Loading Recording Paper" on pg. 2-2.

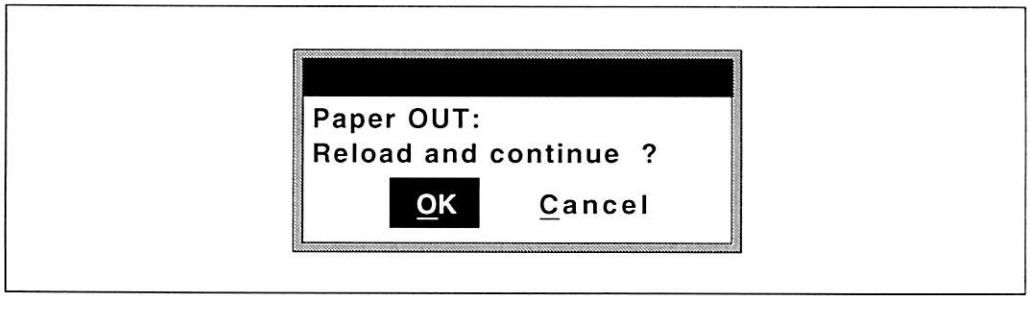


Figure 6-2
System Note Regarding a Printing Problem

Acquiring an Auto ECG

Press the "ECG" function key to begin an Auto ECG. This key is active in most menus but you may verify waveforms before printing when you use the PREVIEW screen. Please refer to the sample printout in Chapter 8.

- Before printing, you may adjust Recorder Speed, Gain or Frequency Response using the machine control keys "7" through "9." These settings will stay in effect until you change them or return the unit to Standby mode.
- The Eclipse checks lead status and data quality. An error message notifies you of a problem. You may override an error message and continue recording by pressing the ECG key again.
- If no Patient ID information was entered, an ID is entered automatically. This ID will consist of "STAT" followed by the date and time.

- Press the "STOP" function key at any time to halt the Auto ECG. This is the only function key which is available during printing.
- During an Auto ECG, the Eclipse prints some or all of the following reports:

    1. Formatted, 12-lead Report (always printed)
    2. Rhythm Report
    3. Median Report
    4. Analysis and Demographics Report

    NOTE: The Demographics report is always printed. Analysis, however, is available only on interpretive units. On interpretive units, analysis may be disabled in the USER SETUP menu.

    The Auto ECG sequence is determined in the AUTO ECG SETUP menu (see "Configuring the USER SETUP Menus" on pg. 4-22).

- The Eclipse returns to either the PREVIEW screen or the DIRECTORY menu after an Auto ECG. This is determined in the USER SETUP menu (see SAVE MODE in "Configuring the USER SETUP Menus" on pg. 4-22).
- Saving an Auto ECG creates a file in the Directory. From the DIRECTORY menu, you may access this file in the future. You may wish to access the file to:

    1. Reprint the ECG report.
    2. Reprint the ECG report at a different Chart Speed, Frequency Response, or Gain setting.
    3. Use the patient demographics to acquire new ECG reports.

Acquiring an Auto Rhythm

NOTE: REDUCED PERFORMANCE MODE. Printing performance of an Auto Rhythm may be reduced when the current Custom Lead format is Frank and when the printing speed is set to 50 mm/s.

An Auto Rhythm is a rhythm strip that prints for a set number of pages. The number of pages is determined in the MISCELLANEOUS menu.

Press the "RHYT" function key to begin an Auto Rhythm. This key is active in most menus but you may verify waveforms before printing when you use the PREVIEW screen. Please refer to the sample printout in Chapter 8.

- The Eclipse prints the report using the channels displayed in the PREVIEW screen. Before printing, select the desired leads using the machine control keys "1" through "6."
- The Eclipse prints the report using the Recorder Speed, Gain and Frequency Response settings displayed in the PREVIEW screen. You may toggle these settings using the machine control keys "7" through "9" before printing only.

- Press the "STOP" function key to halt an Auto Rhythm. You may also interrupt printing and begin another report with any of the other function keys to the left of the keyboard.
- No saving is possible with Auto Rhythm data.

Acquiring a Manual ECG

NOTE: REDUCED PERFORMANCE MODE. Printing performance of a Rhythm may be reduced when the current Custom Lead format is Frank and when the printing speed is set to 50 mm/s.

Press the "MAN" function key to print a continuous rhythm strip. This key will print a Manual ECG from most menus but you may verify waveforms before printing when you use the PREVIEW screen. Please refer to the sample printout in Chapter 8.

- The Eclipse prints the report using the channels displayed in the PREVIEW screen. You may choose different leads using the machine control keys "1" through "6" before or during printing.

- While printing, you may place a 1 mV simulated calibration pulse on the printout and display by pressing the "0" key.
- The Eclipse prints the report using the Recorder Speed, Gain and Frequency Response settings displayed in the PREVIEW screen.

You may toggle these settings using the machine control keys "7" through "9" before or during printing.

- Press the "STOP" key to halt printing. You may also interrupt printing and begin another report with any of the other function keys to the left of the keyboard. The Manual ECG does not stop automatically.
- No saving is possible with Manual ECG data.

Chapter 7 *Directory of Existing Files*

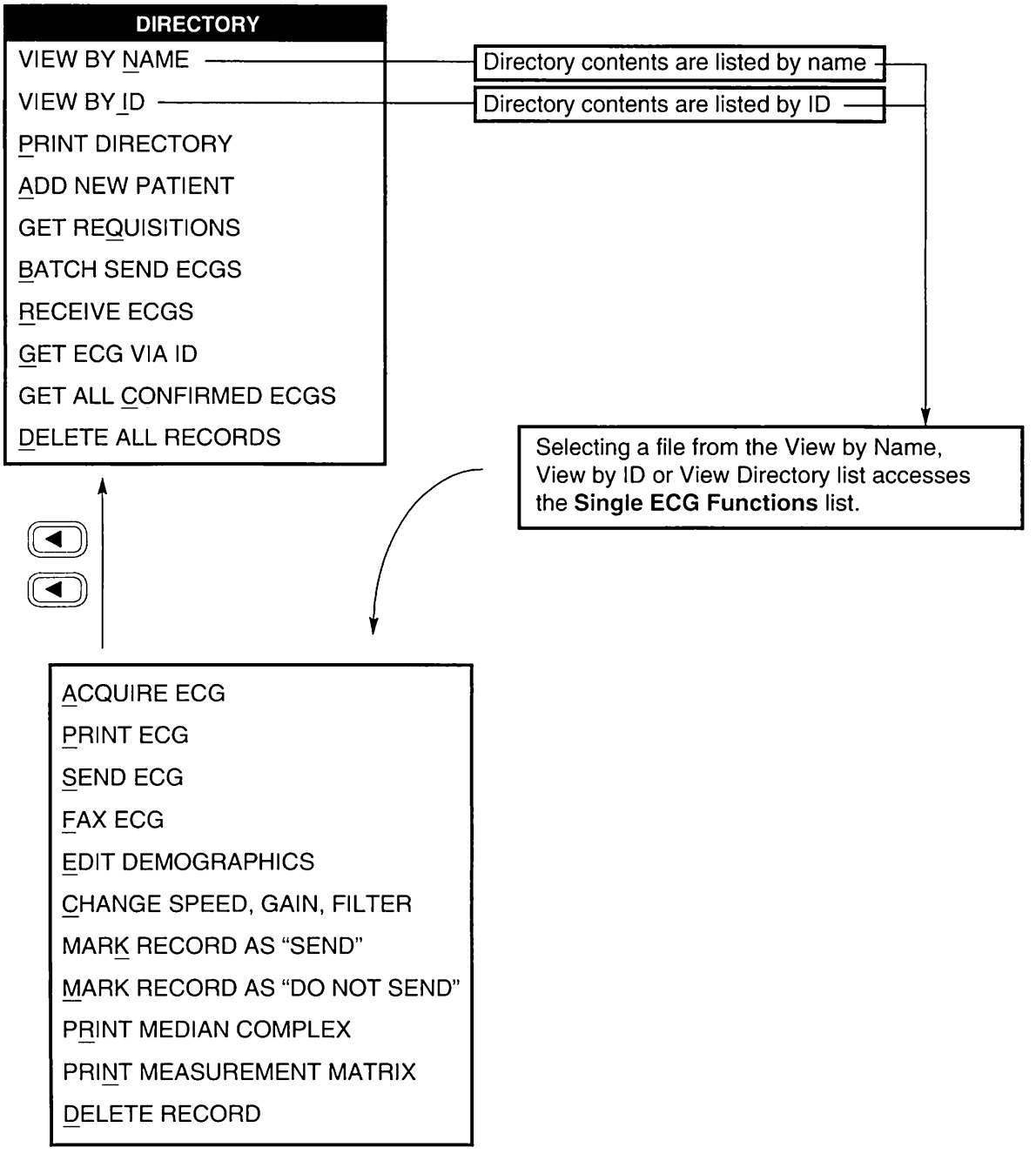
This chapter covers the DIRECTORY menu. From this menu you may:

- Locate and retrieve patient files.
- Edit patient demographics in an existing file.
- Reprint reports.
- Fax reports.
- Send and Receive reports.

If you are not familiar with using the Eclipse, you may wish to read Chapter 3, "Keyboard and Displays," before proceeding.

If you have not yet configured User Setup, you will obtain reports in default formats. Please see Chapter 4, "Program Setup," for more information.

Quick Reference-The DIRECTORY Menu and Single ECG Functions List



*VIEW BY NAME and VIEW BY ID are combined into VIEW DIRECTORY on the Eclipse Plus.

How to Print a Copy of an Auto ECG Report

1. In the DIRECTORY menu, scroll to and select the **VIEW BY NAME** or **VIEW BY ID** field.
2. Locate the desired patient file, highlight it, and press the Enter key. The Single ECG Functions list is displayed.
3. Press the "P" key to reprint a copy of the report.

How to Fax a Copy of an Auto ECG Report

NOTE: To use the Fax function, your Eclipse must be equipped with either an internal or an external modem.

1. In the DIRECTORY menu, scroll to and select the **VIEW BY NAME** or **VIEW BY ID** field.
2. Locate the desired patient file, highlight it and press the Enter key. The Single ECG Functions list is displayed.
3. Press the "F" key to access the FAX ECG menu.
4. Select the destination for the fax by pressing the corresponding hot key: "1," "2," "3" or "4." Eclipse faxes the report.

How to Edit Patient Demographics

1. In the DIRECTORY menu, scroll to and select the **VIEW BY NAME** or **VIEW BY ID** field.
2. Locate the desired patient file, highlight it and press the Enter key. The Single ECG Functions list is displayed.
3. Press the "E" key to access the EDIT ID menu.
4. Edit patient demographics as desired. These changes are saved when you press the Left Arrow key to exit this menu.

How to Delete a Patient File

1. In the DIRECTORY menu, scroll to and select the **VIEW BY NAME** or **VIEW BY ID** field.
2. Locate the desired patient file, highlight it and press the Enter key. The Single ECG Functions list is displayed.
3. Press the "D" key to permanently delete the file.
4. Press the "O" key to confirm deletion.

Using the DIRECTORY Menu

About the Directory

Eclipse electrocardiographs have a directory for storage of ECG records. The Eclipse Plus can store 60 records. The Eclipse 4 and 8 can store 40 records. The Eclipse 400, 800 and 850 store 1 record. Storage of more records is an available option with the Eclipse 850. Records are created by:

- Saving an Auto ECG report.
- Selecting the **ADD NEW PATIENT** field in the DIRECTORY menu.

There are two kinds of records stored in the Directory:

1. Records containing Auto ECG reports.
2. Records without Auto ECG reports; "Demographics only"

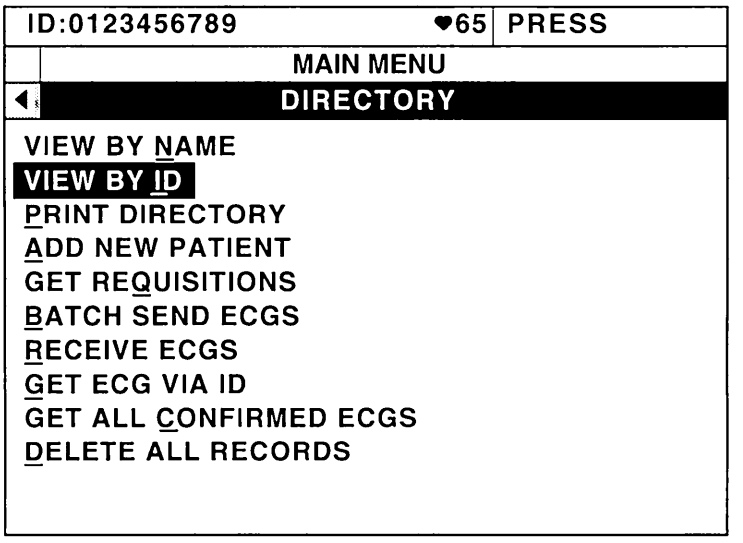
Demographics only records are created both when **ADD NEW PATIENT** is selected in the DIRECTORY menu and when a requisition is downloaded from an ECG data management system like PYRAMIS. A record is a demographics only record until an ECG is taken for that patient (see "ADD NEW PATIENT" on pg. 7-6 and "Receiving requisitions from PYRAMIS" on pg. 7-10).

If the Directory is full, creating a new record will usually result in the deletion of an older record. The rules for record deletion are explained in the section, "Record Status" on pg. 7-7.

Go to the DIRECTORY menu

1. Press the On/Standby key to power up to the PREVIEW screen.
2. Press the "M" key to go to the MAIN MENU.
3. Press the "D" key to go to the DIRECTORY menu (see Figure 7-1).

Figure 7-1
The DIRECTORY Menu



The DIRECTORY menu items

Following is a description of the DIRECTORY menu.

The fields in this menu all have hot keys to select them. These fields initiate operations which are described next to the field name below.

> **NOTE:** Because of the larger display, the VIEW BY NAME and VIEW BY ID fields are combined on the Eclipse Plus. The VIEW DIRECTORY field shows both Name and ID.

VIEW BY NAME

Accesses a complete list of the Directory contents. Records are listed in the format:

> LAST NAME, FIRST NAME (may be shortened to fit)
> Acquisition date
> Acquisition time
> Record status

Select a file by highlighting it and pressing the ENTER key. The Single ECG Functions List is displayed.

VIEW BY ID

Accesses a complete list of the Directory contents. Records are listed in the format:

> Patient ID
> Acquisition date
> Acquisition time
> Record status

Select a file by highlighting it and pressing the ENTER key. The Single ECG Functions List is displayed.

VIEW DIRECTORY

Accesses a complete list of the Directory contents. Records are listed in the format:

> LAST NAME, FIRST NAME (may be shortened to fit)
> Patient ID
> Acquisition date and time
> Record status

Select a file by highlighting it and pressing the ENTER key. The Single ECG Functions List is displayed.

PRINT DIRECTORY

Prints a complete list of the Directory contents (see sample printout in Chapter 8).

ADD NEW PATIENT

Creates a new patient file and displays the EDIT ID menu (see "Entering Patient Demographics" on pg. 6-4). This allows you to input demographics into the Directory in advance of taking an ECG. This reduces the time required to acquire the report.

Enter patient ID and other demographics as needed. Changes are saved when you press the Left Arrow key to exit the EDIT ID menu.

> **NOTE:** GET REQUISITIONS, BATCH SEND ECGS, RECEIVE ECGS, GET ECG VIA ID and GET ALL CONFIRMED ECGS are available only on Eclipse electrocardiographs that are equipped with SCP-ECG capability. For more information on these functions see "Sending and Receiving Records" on pg. 7-9.

GET REQUISITIONS

Accesses the GET REQUISITIONS menu. This is used when retrieving a list of requisitions from an ECG data management system like the PYRAMIS system. A requisition is a request for an ECG report. Requisitions are used to organize the schedule of the person acquiring ECG records.

BATCH SEND ECGS

Sends all Auto ECG records stored in the Directory that have the appropriate status (see "How record status affects the sending operations" on pg. 7-9).

RECEIVE ECGS

Places the Eclipse into a waiting mode so that records can be sent to the electrocardiograph.

GET ECG VIA ID

Accesses the GET ECG VIA ID menu. This is used when retrieving a specific record from an ECG data management system.

GET ALL CONFIRMED ECGS

Requests that the ECG data management system send all recently confirmed ECG records to the Eclipse.

PYRAMIS sends all confirmed records that match the current Institution Number and Department that are set on the Eclipse.

> **NOTE:** The Institution Number is set in the SYSTEM SETUP menu. The Department is determined in the EDIT ID menu but may be equal to 1 (the default) if the Department field is set to ON, CLEAR or OFF in the PATIENT FIELDS ENABLE menu.

DELETE ALL RECORDS

Deletes entire Directory contents. A System Note box appears.

Proceed with caution; answering Ok to the next two questions will permanently erase every record in the Directory. It is not possible to recover erased records. To cancel the request, select Cancel.

Record Status

When you access a complete list of the Directory contents, the status of each record can be seen in the last column of the list. To save space, a short code is used to tell you the status of the record:

Code	Record Status	Explanation of Status
Pr	Printed	The record contains an Auto ECG record that has been printed by the Eclipse electrocardiograph.
Dm	Demographics Only	The record contains only patient demographic information. The record does not contain an ECG report.
St	Sent	The record has been sent to another electrocardiograph or to an ECG data management system such as the Burdick PYRAMIS System.
No	Do Not Send	The record was manually marked so that the record will not be sent the next time that **BATCH SEND ECGS** is selected in the DIRECTORY menu.
Rv	Received	The record was received from another electrocardiograph or from an ECG data management system such as the Burdick PYRAMIS System.
Rq	Requisition	The record contains only patient demographic information. An ECG report is being requested for this patient by the ECG data management system.

Automatic deletion when the Directory is full

If you create a new record when the Directory is full, the Eclipse deletes an older record to make room for the new record. There are rules based on record status which determine which records are automatically deleted. The oldest record with the proper status is deleted.

- Records with status **Dm** or **Rq** are never deleted. However, a record with both **Rq** and **St** will be deleted.
- If, in the SYSTEM SETUP menu, the **Connection** field is set to **MODEM** or **DIRECT**, a record with status **Pr** and **St** may be deleted.
- If, in the SYSTEM SETUP menu, the **Connection** field is set to **MODEM** or **DIRECT**, a record with status **Rv** and **Pr** may be deleted.
- If, in the SYSTEM SETUP menu, the **Connection** field is set to **NONE**, any record with status **Pr** will be deleted.

If the Directory is full of records that don't meet any of the automatic deletion criteria, you will not be able to create new records unless you manually delete records from the Directory. The **Directory Full** message is displayed. You may, however, obtain Auto ECG printouts. These will not be stored in the Directory unless storage space is made available.

The Single ECG Functions List

This is a list of operations which may be carried out with an existing file. The list appears when you select a file from the Directory list.

> **NOTE:** PRINT MEDIAN COMPLEX and PRINT MEASUREMENT MATRIX are available only on units with interpretation or measurement capabilities.

> **NOTE:** SEND, MARK RECORD AS "SEND" and MARK RECORD AS "DO NOT SEND" are available only on Eclipse electrocardiographs equipped with SCP-ECG capability. For more information on these functions see "Sending and Receiving Records" on pg. 7-9.

ACQUIRE ECG

Returns to the EDIT ID menu so that you may make changes to the patient demographic information in the selected file as needed.

When the patient demographic information is correct, press the "ECG" key to acquire an Auto ECG.

PRINT ECG

Reprints the ECG report from the selected record.

SEND ECG

Sends the selected record to the data management system or connected electrocardiograph.

FAX ECG

Accesses the FAX ECG menu (see "The FAX ECG Menus" on pg. 7-18). To use the Fax function, your electrocardiograph must be equipped with fax software and either an internal or an external modem.

EDIT DEMOGRAPHICS

Opens the EDIT ID menu so that you may make changes to the patient demographics for the saved record.

CHANGE SPEED, GAIN, FILTER

Accesses the CHANGE SPEED, GAIN, FILTER menu. This menu, which is similar to the POWER-UP DEFAULTS menu, is used to adjust the format for reprinting the record.

MARK RECORD AS "SEND"

Changes the status of the record so that it will be sent the next time that BATCH SEND ECGS is selected. The status of **St** is removed from that record.

MARK RECORD AS "DO NOT SEND"

Changes the status of the record so that it will not be sent the next time that BATCH SEND ECGS is selected. The record is marked with the **No** status.

PRINT MEDIAN COMPLEX

Prints a copy of the median complexes for the selected record.

Chart speed is fixed at 50 mm/s.

PRINT MEASUREMENT MATRIX

Prints a copy of the matrix for the selected record.

DELETE ECG

Permanently removes the selected record. A message box will appear.

Proceed with caution; choosing Ok will permanently erase the record. To cancel the request, select Cancel.

Sending and Receiving Records

NOTE: Sending and receiving functions are available on Eclipse units equipped with SCP-ECG capability. You may use a remote connection with either an internal or an external modem or a direct connection with another Eclipse or a compatible ECG management system.

How record status affects the sending operations

Record status (see "Record Status" on pg. 7-7) affects whether records can be sent from the Eclipse. The status of some records can be changed in the Single ECG Functions list (see"The Single ECG Functions List" on pg. 7-8). There are rules based on record status which determine which records can be sent and when:

- Records with status **Dm** can not be sent.
- Records with status **Rv** can not be sent.
- Records with status **St** or **Rq** will not be sent when **BATCH SEND ECGS** is selected in the DIRECTORY menu. These records may be sent individually from the Single ECG Functions list.
- Records with status, **No**, will not be sent when **BATCH SEND ECGS** is selected in the DIRECTORY menu. These records may be sent individually from the Single ECG Functions list.

Receiving requisitions from PYRAMIS

A requisition is a demographics only record. These records are received from the ECG management system to indicate that an ECG report is needed for the patient.

You can receive requisitions from the PYRAMIS ECG Data Management System in two ways:

1. Direct Connection
2. Remote Connection

USING A DIRECT CONNECTION

1. Connect the Burdick Interconnect Cable #882029 to the connector labeled "DECG-SCP" on the PYRAMIS back panel and to the connector labeled "**IOIO**" on the Eclipse back panel.

2. Press the On/Standby key to power up to the PREVIEW screen.

3. Press the "M" key to go to the MAIN MENU.

4. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).

5. Press the Down Arrow key to highlight the **Connection** field and select **DIRECT**.

6. Press the Left Arrow key to return to the MAIN MENU.

7. Press the "D" key to go to the DIRECTORY menu.

8. Press the "Q" key to go to the GET REQUISITIONS menu.

9. Select **ENTER CRITERIA**. The Get Requisitions menu is displayed.

10. The **Department** field will display the default Department number as set in the PATIENT FIELDS ENABLE menu. This will limit the search to requisitions targeted at the selected department. You may change this to receive requisitions for a different department. You can also delete this to receive all requisitions currently on the PYRAMIS system.

11. To limit the request to requisitions targeted at you or your area, type your code into the **Group Code** field.

    The Group Code is maintained on the PYRAMIS system. Contact your System Administrator to verify your Group Code.

12. If you want to receive a specific requisition and you know the number, type this number into the **Req. Number (Requisition Number)** field.

13. Press the Left Arrow key to return to the GET REQUISITIONS menu.

14. Select **GET REQUISITIONS** to receive all requisitions that match the criteria you have entered.

USING A REMOTE CONNECTION

NOTE: This requires an Eclipse with either an internal or external modem.

1. Press the On/Standby key to power up to the PREVIEW screen.

2. Press the "M" key to go to the MAIN MENU.

3. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).

4. Press the Down Arrow key to highlight the **Connection** field and select **MODEM.**

5. Verify that the **Phone #** and **Description** fields are correctly filled in.

6. Press the Left Arrow key to return to the MAIN MENU.

7. Press the "D" key to go to the DIRECTORY menu.

8. Press the "Q" key to go to the GET REQUISITIONS menu.

9. Select **ENTER CRITERIA**. The Get Requisitions menu is displayed.

10. The **Department** field will display the default Department number as set in the PATIENT FIELDS ENABLE menu. This will limit the search to requisitions targeted at the selected department. You may change this to receive requisitions for a different department. You can also delete this to receive all requisitions currently on the PYRAMIS system.

11. To limit the request to requisitions targeted at you or your area, type your code into the **Group Code** field.

    The Group Code is maintained on the PYRAMIS system. Contact your System Administrator to verify your Group Code.

12. If you want to receive a specific requisition and you know the number, type this number into the **Req. Number (Requisition Number)** field.

13. Press the Left Arrow key to return to the GET REQUISITIONS menu.

14. Select **GET REQUISITIONS** to receive all requisitions that match the criteria you have entered.

Sending records to PYRAMIS

You can send records to the PYRAMIS ECG Data Management System in two ways:

1. Direct Connection
2. Remote Connection

USING A DIRECT CONNECTION

1. Connect the Burdick Interconnect Cable #882029 to the connector labeled "DECG-SCP" on the PYRAMIS back panel and to the connector labeled "**IOIO**" on the Eclipse back panel.

2. Press the On/Standby key to power up to the PREVIEW screen.

3. Press the "M" key to go to the MAIN MENU.

4. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).

5. Press the Down Arrow key to highlight the **Connection** field and select **DIRECT**.

6. Press the Left Arrow key to return to the MAIN MENU.

7. Press the "D" key to go to the DIRECTORY menu.

8. Send all records by selecting **BATCH SEND ECGS** or select a single record and select **SEND ECG** from the Single ECG Functions list.

USING A REMOTE CONNECTION

NOTE: This requires an Eclipse with either an internal or external modem connected to a phone line.

1. Press the On/Standby key to power up to the PREVIEW screen.

2. Press the "M" key to go to the MAIN MENU.

3. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).

4. Press the Down Arrow key to highlight the **Connection** field and select **MODEM**.

5. Verify that the **Phone #** and **Description** fields are correctly filled in.

6. Press the Left Arrow key to return to the MAIN MENU.

7. Press the "D" key to go to the DIRECTORY menu.

8. Send all records by selecting **BATCH SEND ECGS** or select a single record and select **SEND ECG** from the Single ECG Functions list.

Sending records to an Eclipse

You can send records to another Eclipse in two ways:

1. Direct Connection
2. Remote Connection

USING A DIRECT CONNECTION

1. Connect the Eclipse Direct Connect Cable #007796 to the connectors labeled "**IOIO**" on the back panel of each Eclipse.

NOTE: Follow steps 2 through 7 on both Eclipse units.

2. Press the On/Standby key to power up to the PREVIEW screen.

3. Press the "M" key to go to the MAIN MENU.

4. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).

5. Press the Down Arrow key to highlight the **Connection** field and select **DIRECT**.

6. Press the Left Arrow key to return to the MAIN MENU.

7. Press the "D" key to go to the DIRECTORY menu.

8. On the Eclipse that will be receiving the records, press the "R" key to put the electrocardiograph into waiting mode.

9. On the Eclipse that will be sending the records, send all records by selecting **BATCH SEND ECGS** or select a single record and select **SEND ECG** from the Single ECG Functions list.

USING A REMOTE CONNECTION

NOTE: This requires two Eclipse units with either an internal or external modem connected to a phone line.

NOTE: Follow steps 1 through 3 and steps 5 and 7 on both Eclipse units.

1. Press the On/Standby key to power up to the PREVIEW screen.

2. Press the "M" key to go to the MAIN MENU.

3. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).

4. On the Eclipse that will be sending records, press the Down Arrow key to highlight the **Description** field and verify that the description and phone number are correct for the electrocardiograph that will be receiving records.

5. On both Eclipse units, press the Down Arrow key to highlight the **Connection** field and select **MODEM**.

6. Press the Left Arrow key to return to the MAIN MENU.

7. Press the "D" key to go to the DIRECTORY menu.

8. On the Eclipse that will be receiving the records, press the "R" key to put the electrocardiograph into waiting mode.

9. On the Eclipse that will be sending the records, send all records by selecting **BATCH SEND ECGS** or select a single record and select **SEND ECG** from the Single ECG Functions list.

Receiving records from PYRAMIS

You can receive records from the PYRAMIS ECG Data Management System in two ways:

1. Direct Connection
2. Remote Connection

USING A DIRECT CONNECTION

1. Connect the Burdick Interconnect Cable #882029 to the connector labeled "DECG-SCP" on the PYRAMIS back panel and to the connector labeled "**IOIO**" on the Eclipse back panel.

2. Press the On/Standby key to power up to the PREVIEW screen.

3. Press the "M" key to go to the MAIN MENU.

4. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).

5. Press the Down Arrow key to highlight the **Connection** field and select **DIRECT**.

6. Press the Left Arrow key to return to the MAIN MENU.

7. Press the "D" key to go to the DIRECTORY menu.
8. Receive all confirmed records by selecting **GET ALL CONFIRMED ECGS** or receive records of a particular patient by selecting **GET ECG VIA ID** (see "Using GET ECG VIA ID" on pg. 7-16).

USING A REMOTE CONNECTION

NOTE: This requires an Eclipse with either an internal or external modem.

1. Press the On/Standby key to power up to the PREVIEW screen.

2. Press the "M" key to go to the MAIN MENU.

3. Select SYSTEM SETUP by pressing the "S" key. The SYSTEM SETUP menu will appear (see Figure 4-1 on pg. 4-17).

4. Press the Down Arrow key to highlight the **Connection** field and select **MODEM**.
5. Verify that the **Phone #** and **Description** fields are correctly filled in.

6. Press the Left Arrow key to return to the MAIN MENU.

7. Press the "D" key to go to the DIRECTORY menu.

8. Receive all confirmed records by selecting **GET ALL CONFIRMED ECGS** or receive records of a particular patient by selecting **GET ECG VIA ID** (see "Using GET ECG VIA ID" below).

Using GET ECG VIA ID

When you select **GET ECG VIA ID** you can search the PYRAMIS database for all the records for a particular patient. You can do this using:

1. The patient's ID
2. The patient's name

USING THE PATIENT'S ID

1. From the DIRECTORY menu, select **GET ECG VIA ID**. The GET ECG VIA ID menu is displayed.
2. The only option available at first is **ENTER ID**. Select this option. The GET VIA ID menu is displayed.
3. Type the patient's ID in to the **ID** field.

4. Press the Left Arrow key to return to GET ECG VIA ID.
5. Select **GET ECG LIST** to view a list of all the records stored on PYRAMIS with that ID.
6. When the list has downloaded, highlight each record that you want to receive and press enter to select the record. The word, "**SELECT**" appears on the right side of the display.

7. Press the Left Arrow key to return to GET ECG VIA ID.
8. Select **GET ECG(S)** to begin receiving all the selected records.

USING THE PATIENT'S NAME

1. From the DIRECTORY menu, select **GET ECG VIA ID**. The GET ECG VIA ID menu is displayed.
2. The only option available at first is **ENTER ID**. Select this option. The GET VIA ID menu is displayed.
3. Type at least the first letter of the patient's last name (see "How PYRAMIS Searches Using the Patient's Name").

4. Press the Left Arrow key to return to GET ECG VIA ID.
5. Select **GET ECG LIST** to view a list of all the records stored on PYRAMIS with that ID.
6. When the list has downloaded, highlight each record that you want to receive and press enter to select the record. The word, "SELECT" appears on the right side of the display.

7. Press the Left Arrow key to return to GET ECG VIA ID.
8. Select **GET ECG(S)** to begin receiving all the selected records.

HOW PYRAMIS SEARCHES USING THE PATIENT'S NAME

PYRAMIS can search using just the **Last Name** field. All the files with the entered last name are retrieved. If there are no files with exactly the same last name, then PYRAMIS locates all the files with last names that are *similar* to the one entered.

When you search using **First Name** in addition to the **Last Name** field, PYRAMIS searches for files with a first name that matches exactly. First, PYRAMIS searches for an exactly matching last name. If no exact matches are found, PYRAMIS searches for similar last names. Once a last name is found, either matching or similar, PYRAMIS displays only the records in which the first name matches exactly.

For example:

The database has 4 records:

Stork, Blanche
Smythe, John
Smythe, Blanche
Smith, Blanche

Search for :

Last Name:	Smi
First Name:	Blanche

PYRAMIS displays 2 records in the ***List of Patients*** window:

Smythe, Blanche
Smith, Blanche

No exact match was found for the last name so all names similar to "Smi" were located. Of these, only files with an exactly matching first name were displayed.

The FAX ECG Menus

NOTE: To use the Fax function, the Eclipse must be equipped with fax software and either an internal or an external modem.

From the Single ECG Functions list, press "F" to access the FAX ECG menu.

The FAX ECG menu items

Eclipse stores up to 4 phone numbers which are listed by their descriptions. Where the fields are described below, "X" is a number from 1 to 4 corresponding to each phone number.

X: DESCRIPTION #X

Press the hot key to begin faxing to the destination described.

EDIT PHONE NUMBER

Press "E" to enter new phone numbers or correct existing numbers in the EDIT PHONE NUMBER menu.

The EDIT PHONE NUMBER menu items

Eclipse stores up to 4 phone numbers along with their descriptions. Where the fields are described below, "X" is a number from 1 to 4 corresponding to each phone number.

PHONE #X

[Up to 20 numeric characters. The comma character (,) inserts a pause during dialing]

Type a phone number to reach the destination described in the **DESCRIPTION #X** field. Include a comma to insert a pause while dialing. A pause may be used if you need to access an "outside line." For example, this is often used after dialing a "9" prefix before the rest of the phone number.

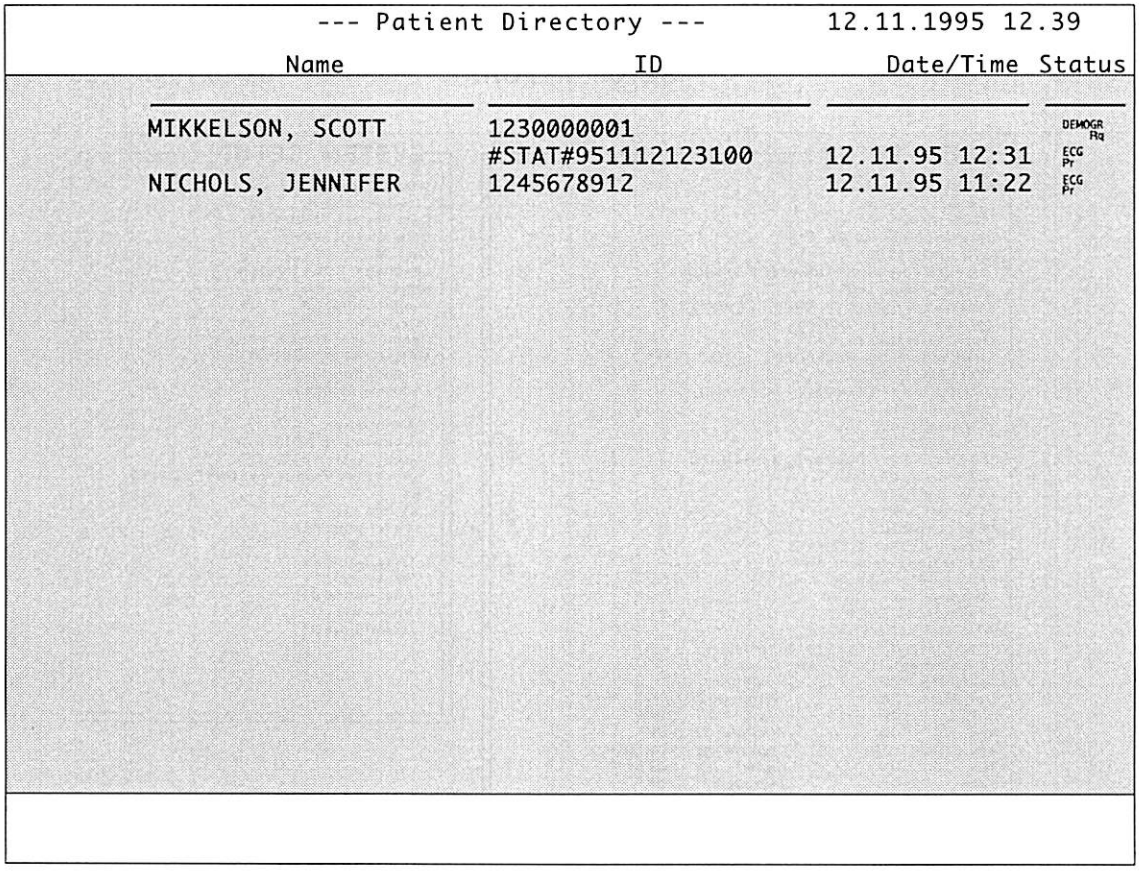
DESCRIPTION #X

[Up to 20 alphanumeric characters]

Describe the destination that is reached when reports are faxed to **PHONE #X**. This is displayed in the FAX ECG menu.

Chapter 8 *Sample Printouts*

Print Directory Report



Print Setup Report

The Print Setup Report is a list of all current settings (see "Acquiring a Printout of Eclipse Settings" on pg. 4-34).

The example printouts below list the settings as they are set at the factory. The top example is from an Eclipse that is configured to be used in the United States. Below that is the SYSTEM SETUP for an Eclipse configured for use in Europe.

Eclipse 4

SETUP REPORT 03/10/1997 9:20

USER SETUP

POWER UP DEFAULTS
- Speed: 25 mm/s
- Gain: 10 mm/mV
- Artifact Filter: 40 Hz

AUTO ECG SETUP
- 12 Lead Format: STANDARD, 3 CHANNEL
- Rhythm Page: OFF
- Analysis Original: ON WITH REASONS
- Analysis Copies: OFF
- Number of Copies: 0
- Median Complex Page: OFF
- Save Mode: AUTO

Custom Lead 1: STANDARD, 3CHANNEL
- Channel 1: LEAD II
- Channel 2: aVF
- Channel 3: V5

Custom Lead 2: STANDARD, 3 CHANNEL
- Channel 1: LEAD II
- Channel 2: aVF
- Channel 3: V5

MISCELLANEOUS
- Baseline Filter: 0.12 Hz
- Pacer Enhancement: OFF
- Rhythm Mode Pages: 1
- Bradycardia Limit: 60
- Tachycardia Limit: 100

PATIENT FIELDS ENABLE
(*Items may affect computer analysis)

*V3 Placement: ON, CLEAR		*Class 2: OFF	
Last Name	: ON	Height (in): OFF	
First Name	: ON	Weight (lbs): OFF	
*D.O.B.	: ON	Systolic BP	: OFF
*Age	: ON	Diastolic BP	: OFF
*Age Format	: ON	Department	: ON, HOLD
*Sex	: ON	Room	: OFF
*Race	: OFF	Technician	: OFF
*Medication 1	: ON	Physician	: OFF
*Medication 2	: OFF	User Field	: OFF
*Class 1: ON		User Field Label: User Field:	
		Comments: ON	

SYSTEM SETUP

User 1-2 Select: 1
Line Filter: 60 Hz
Date Format: MM/DD/YY
Date: 03/10/1997
Time: 9:20
Language: U.S. ENGLISH
Height Units: IN.
Weight Units: LB.
Inst. Name:
Phone Type: TOUCH TONE
MANAGEMENT SYSTEM
- Institution Number: 1
- Device Id: 00000
- Phone #:
- Description:
- Connection: NONE
- Baud Rate: AUTO
- AC MAINS Frequency: UNSPECIFIED

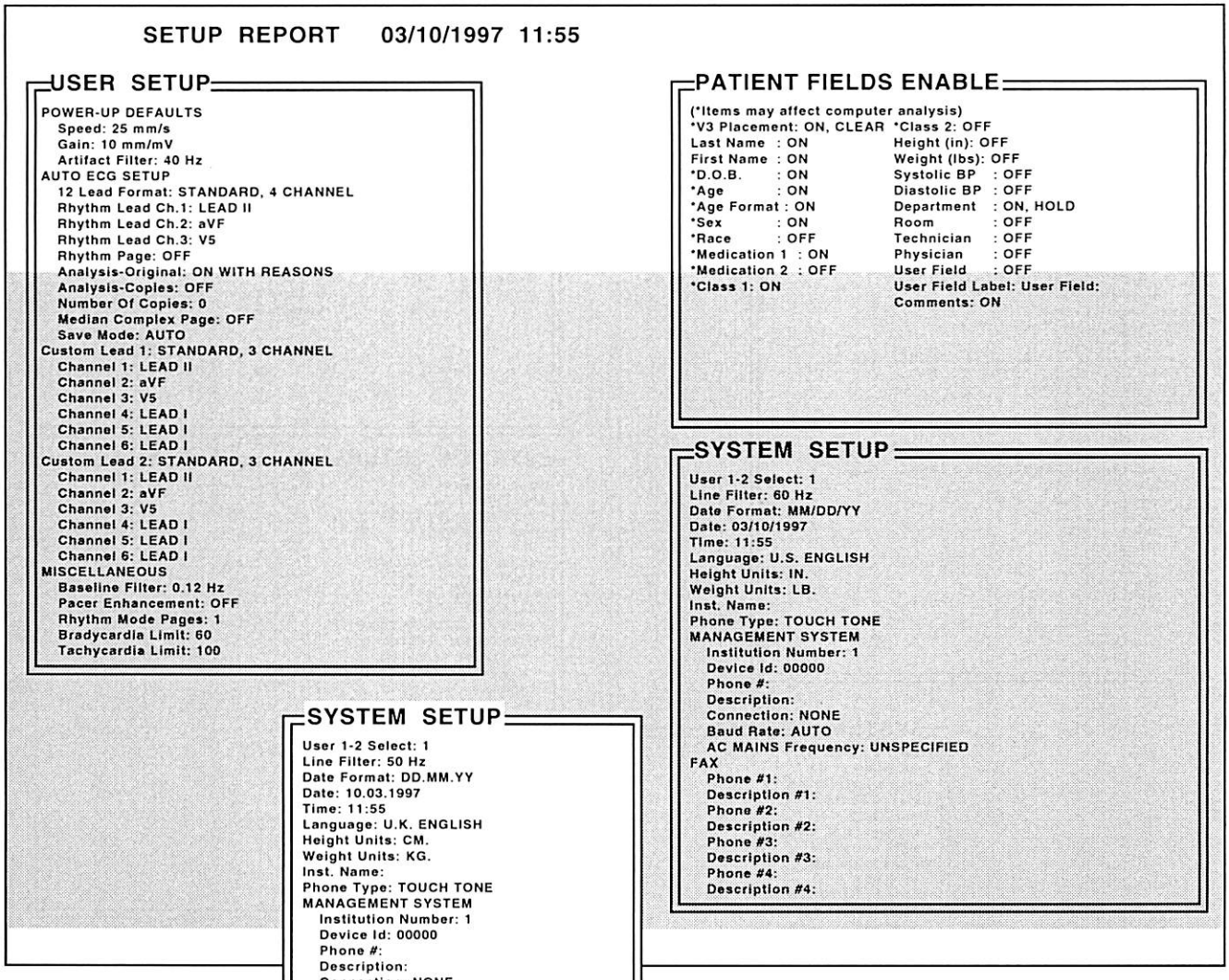
FAX
- Phone #1:
- Description #1:
- Phone #2:
- Description #2:
- Phone #3:
- Description #3:
- Phone #4:
- Description #4:

SYSTEM SETUP

User 1-2 Select: 1
Line Filter: 50 Hz
Date Format: DD.MM.YY
Date: 10.03.1997
Time: 9:20
Language: U.K. ENGLISH
Height Units: CM.
Weight Units: KG.
Inst. Name:
Phone Type: TOUCH TONE
MANAGEMENT SYSTEM
- Institution Number: 1
- Device Id: 00000
- Phone #:
- Description:
- Connection: NONE
- Baud Rate: AUTO
- AC MAINS Frequency: UNSPECIFIED

FAX
- Phone #1:
- Description #1:
- Phone #2:
- Description #2:
- Phone #3:
- Description #3:
- Phone #4:
- Description #4:

Eclipse 850



SETUP REPORT 03/10/1997 11:55

USER SETUP

POWER-UP DEFAULTS
- Speed: 25 mm/s
- Gain: 10 mm/mV
- Artifact Filter: 40 Hz

AUTO ECG SETUP
- 12 Lead Format: STANDARD, 4 CHANNEL
- Rhythm Lead Ch.1: LEAD II
- Rhythm Lead Ch.2: aVF
- Rhythm Lead Ch.3: V5
- Rhythm Page: OFF
- Analysis-Original: ON WITH REASONS
- Analysis-Copies: OFF
- Number Of Copies: 0
- Median Complex Page: OFF
- Save Mode: AUTO

Custom Lead 1: STANDARD, 3 CHANNEL
- Channel 1: LEAD II
- Channel 2: aVF
- Channel 3: V5
- Channel 4: LEAD I
- Channel 5: LEAD I
- Channel 6: LEAD I

Custom Lead 2: STANDARD, 3 CHANNEL
- Channel 1: LEAD II
- Channel 2: aVF
- Channel 3: V5
- Channel 4: LEAD I
- Channel 5: LEAD I
- Channel 6: LEAD I

MISCELLANEOUS
- Baseline Filter: 0.12 Hz
- Pacer Enhancement: OFF
- Rhythm Mode Pages: 1
- Bradycardia Limit: 60
- Tachycardia Limit: 100

PATIENT FIELDS ENABLE

(*Items may affect computer analysis)

*V3 Placement: ON, CLEAR		*Class 2: OFF	
Last Name	: ON	Height (in): OFF	
First Name	: ON	Weight (lbs): OFF	
*D.O.B.	: ON	Systolic BP	: OFF
*Age	: ON	Diastolic BP	: OFF
*Age Format	: ON	Department	: ON, HOLD
*Sex	: ON	Room	: OFF
*Race	: OFF	Technician	: OFF
*Medication 1	: ON	Physician	: OFF
*Medication 2	: OFF	User Field	: OFF
*Class 1: ON		User Field Label: User Field:	
		Comments: ON	

SYSTEM SETUP

User 1-2 Select: 1
Line Filter: 60 Hz
Date Format: MM/DD/YY
Date: 03/10/1997
Time: 11:55
Language: U.S. ENGLISH
Height Units: IN.
Weight Units: LB.
Inst. Name:
Phone Type: TOUCH TONE
MANAGEMENT SYSTEM
- Institution Number: 1
- Device Id: 00000
- Phone #:
- Description:
- Connection: NONE
- Baud Rate: AUTO
- AC MAINS Frequency: UNSPECIFIED

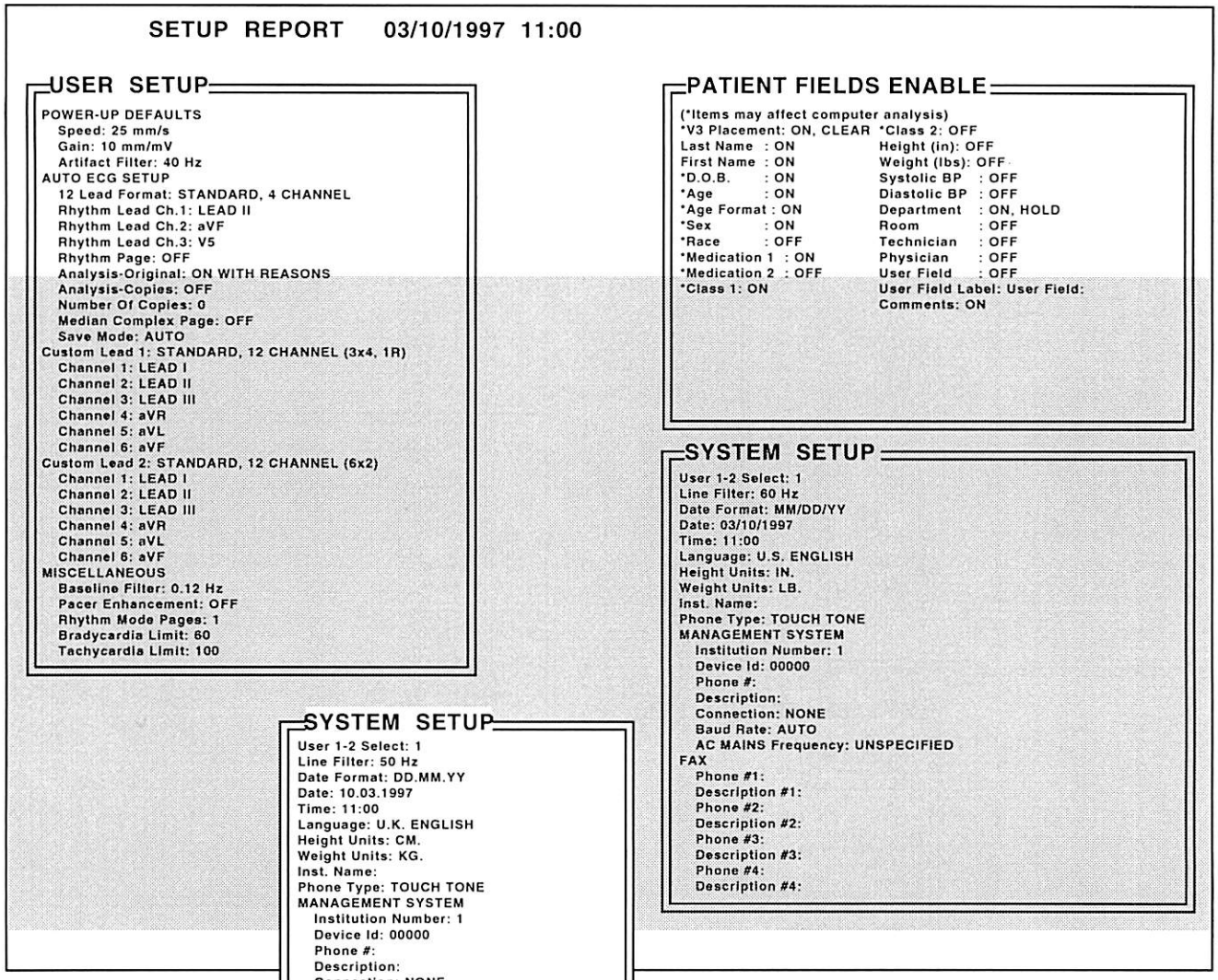
FAX
- Phone #1:
- Description #1:
- Phone #2:
- Description #2:
- Phone #3:
- Description #3:
- Phone #4:
- Description #4:

SYSTEM SETUP

User 1-2 Select: 1
Line Filter: 50 Hz
Date Format: DD.MM.YY
Date: 10.03.1997
Time: 11:55
Language: U.K. ENGLISH
Height Units: CM.
Weight Units: KG.
Inst. Name:
Phone Type: TOUCH TONE
MANAGEMENT SYSTEM
- Institution Number: 1
- Device Id: 00000
- Phone #:
- Description:
- Connection: NONE
- Baud Rate: AUTO
- AC MAINS Frequency: UNSPECIFIED

FAX
- Phone #1:
- Description #1:
- Phone #2:
- Description #2:
- Phone #3:
- Description #3:
- Phone #4:
- Description #4:

Eclipse Plus



SETUP REPORT 03/10/1997 11:00

USER SETUP

POWER-UP DEFAULTS
Speed: 25 mm/s
Gain: 10 mm/mV
Artifact Filter: 40 Hz
AUTO ECG SETUP
12 Lead Format: STANDARD, 4 CHANNEL
Rhythm Lead Ch.1: LEAD II
Rhythm Lead Ch.2: aVF
Rhythm Lead Ch.3: V5
Rhythm Page: OFF
Analysis-Original: ON WITH REASONS
Analysis-Copies: OFF
Number Of Copies: 0
Median Complex Page: OFF
Save Mode: AUTO
Custom Lead 1: STANDARD, 12 CHANNEL (3x4, 1R)
Channel 1: LEAD I
Channel 2: LEAD II
Channel 3: LEAD III
Channel 4: aVR
Channel 5: aVL
Channel 6: aVF
Custom Lead 2: STANDARD, 12 CHANNEL (6x2)
Channel 1: LEAD I
Channel 2: LEAD II
Channel 3: LEAD III
Channel 4: aVR
Channel 5: aVL
Channel 6: aVF
MISCELLANEOUS
Baseline Filter: 0.12 Hz
Pacer Enhancement: OFF
Rhythm Mode Pages: 1
Bradycardia Limit: 60
Tachycardia Limit: 100

PATIENT FIELDS ENABLE

(*Items may affect computer analysis)

*V3 Placement: ON, CLEAR	*Class 2: OFF
Last Name : ON	Height (in): OFF
First Name : ON	Weight (lbs): OFF
*D.O.B. : ON	Systolic BP : OFF
*Age : ON	Diastolic BP : OFF
*Age Format : ON	Department : ON, HOLD
*Sex : ON	Room : OFF
*Race : OFF	Technician : OFF
*Medication 1 : ON	Physician : OFF
*Medication 2 : OFF	User Field : OFF
*Class 1: ON	User Field Label: User Field:
	Comments: ON

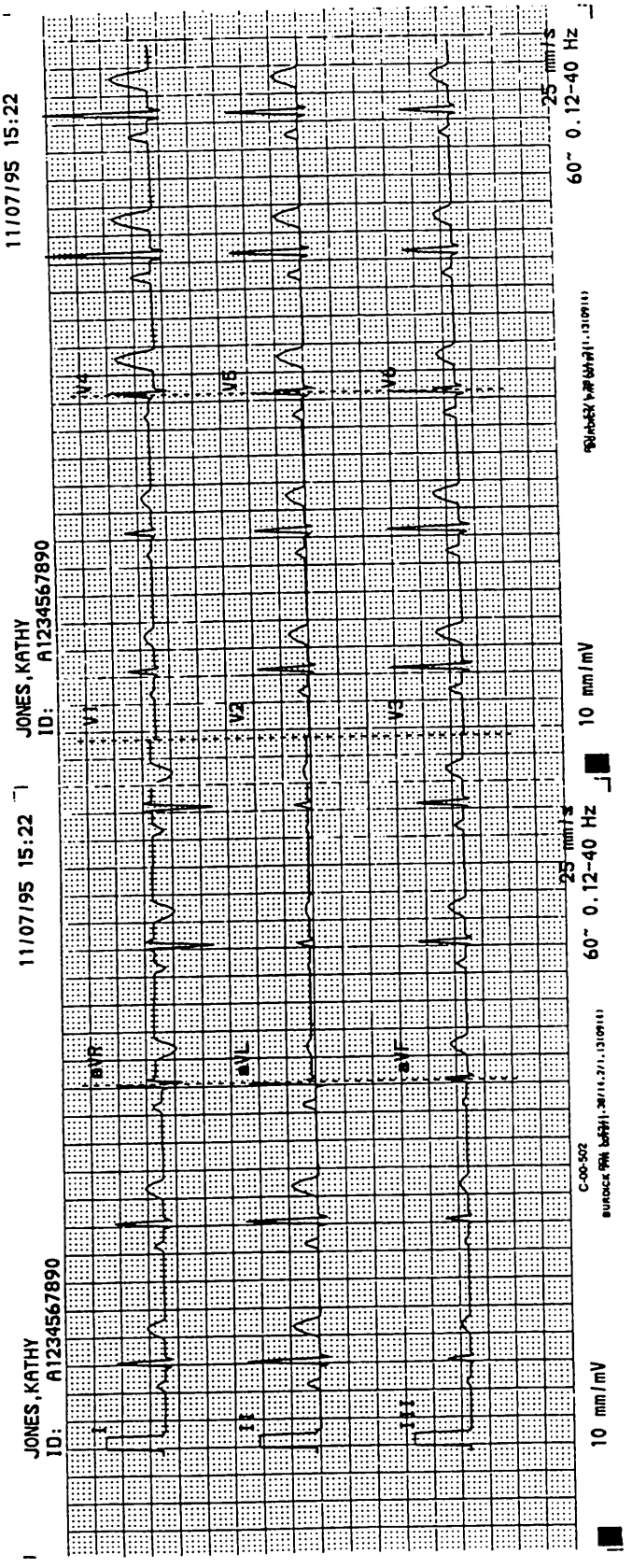
SYSTEM SETUP

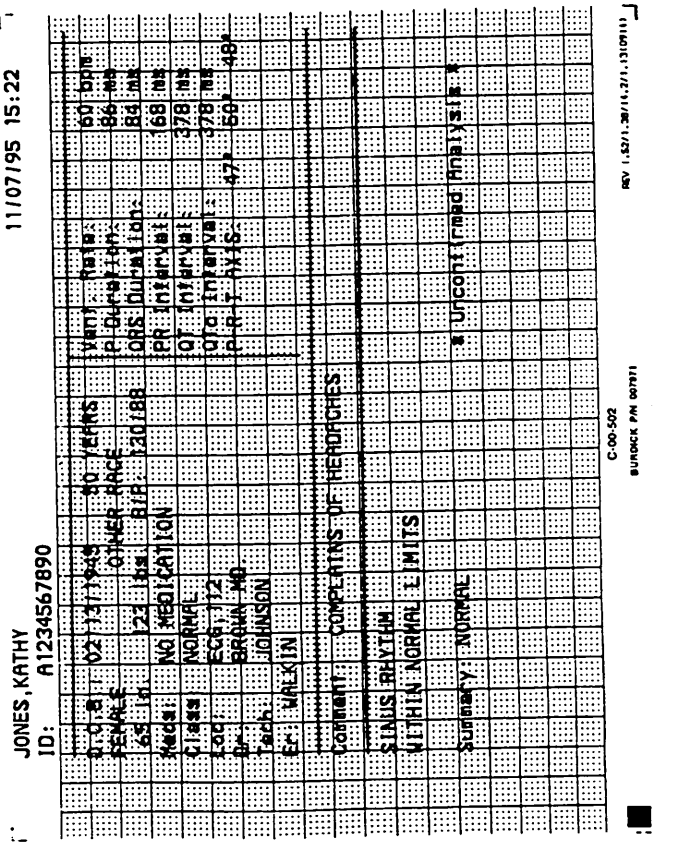
User 1-2 Select: 1
Line Filter: 60 Hz
Date Format: MM/DD/YY
Date: 03/10/1997
Time: 11:00
Language: U.S. ENGLISH
Height Units: IN.
Weight Units: LB.
Inst. Name:
Phone Type: TOUCH TONE
MANAGEMENT SYSTEM
Institution Number: 1
Device Id: 00000
Phone #:
Description:
Connection: NONE
Baud Rate: AUTO
AC MAINS Frequency: UNSPECIFIED
FAX
Phone #1:
Description #1:
Phone #2:
Description #2:
Phone #3:
Description #3:
Phone #4:
Description #4:

SYSTEM SETUP

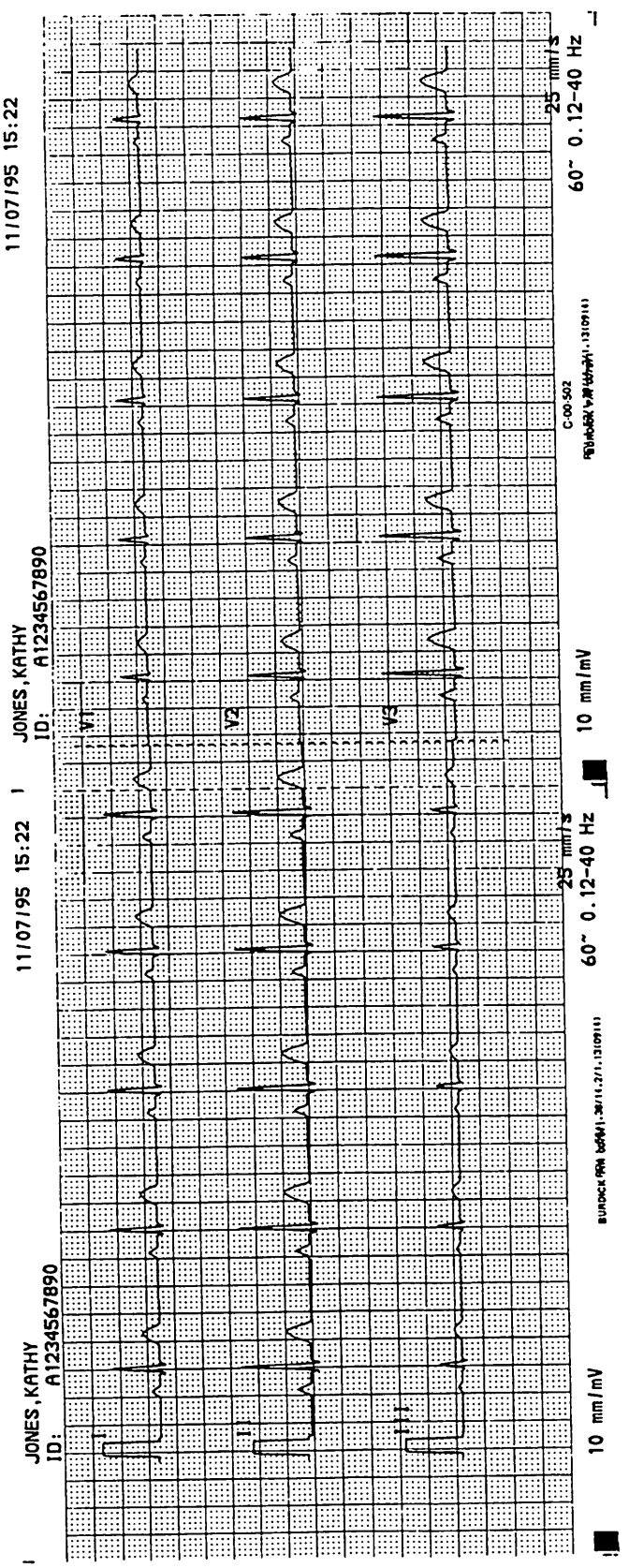
User 1-2 Select: 1
Line Filter: 50 Hz
Date Format: DD.MM.YY
Date: 10.03.1997
Time: 11:00
Language: U.K. ENGLISH
Height Units: CM.
Weight Units: KG.
Inst. Name:
Phone Type: TOUCH TONE
MANAGEMENT SYSTEM
Institution Number: 1
Device Id: 00000
Phone #:
Description:
Connection: NONE
Baud Rate: AUTO
AC MAINS Frequency: UNSPECIFIED
FAX
Phone #1:
Description #1:
Phone #2:
Description #2:
Phone #3:
Description #3:
Phone #4:
Description #4:

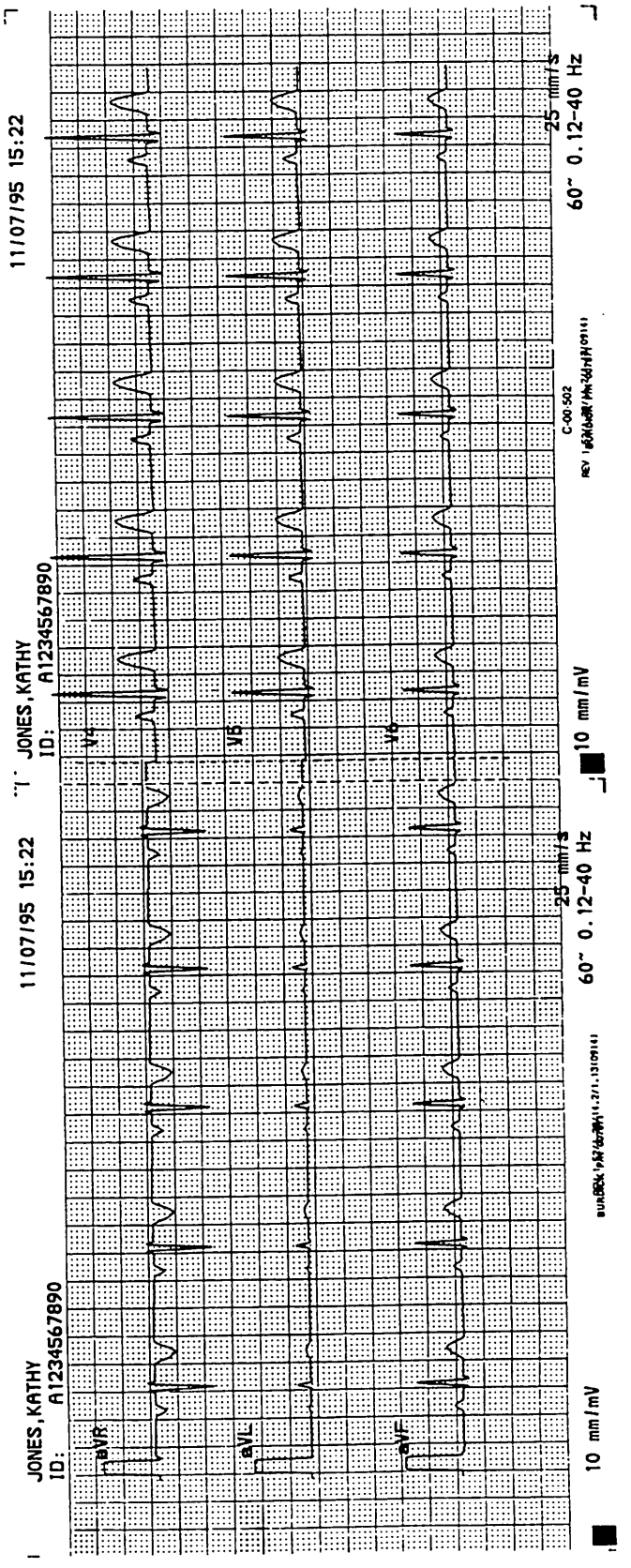
Standard 12-Lead, 3-Channel Auto ECG (Eclipse 4 & 400)



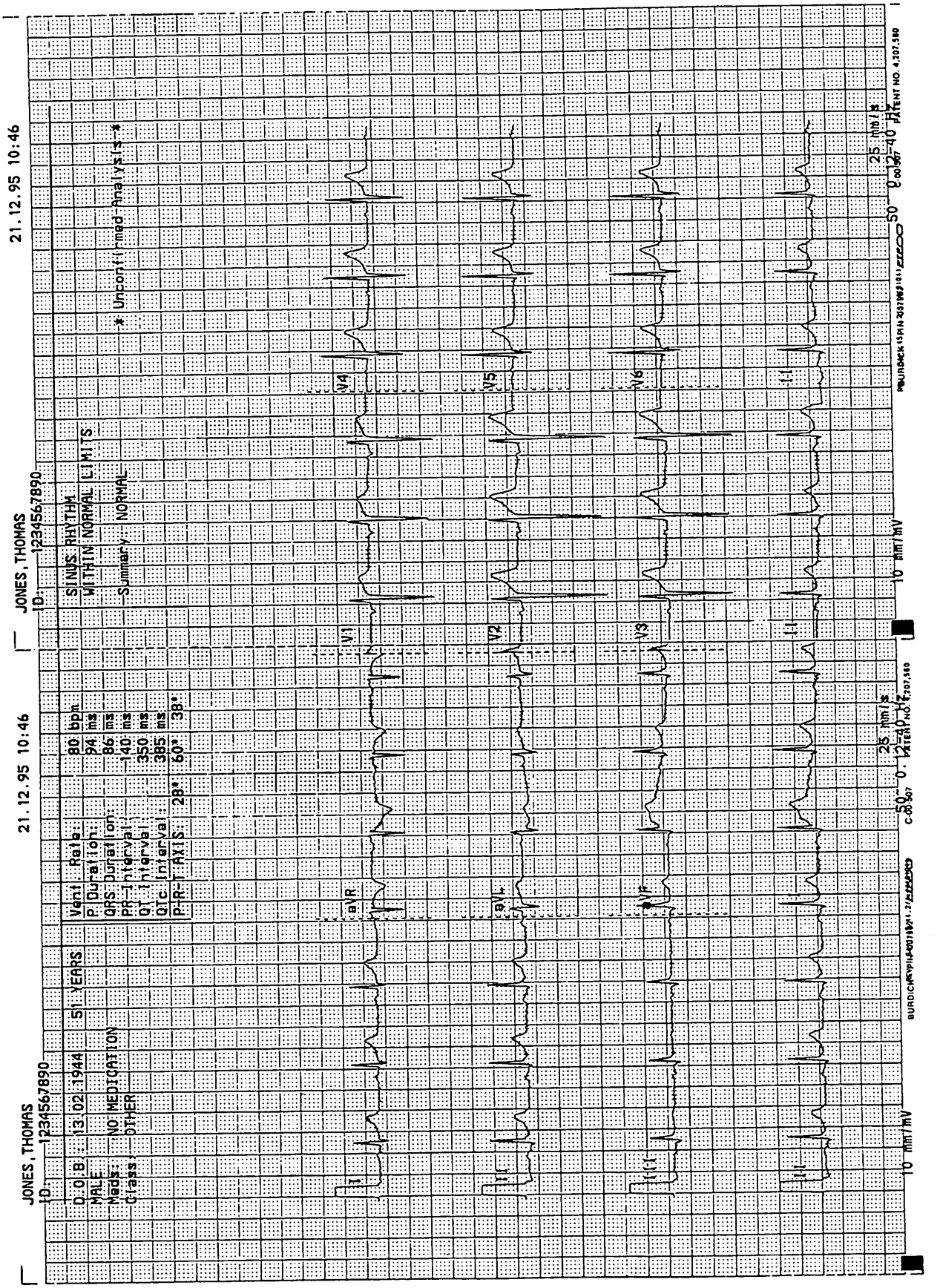


Standard 12-Lead, 6-Channel Auto ECG (Eclipse 4 & 400)

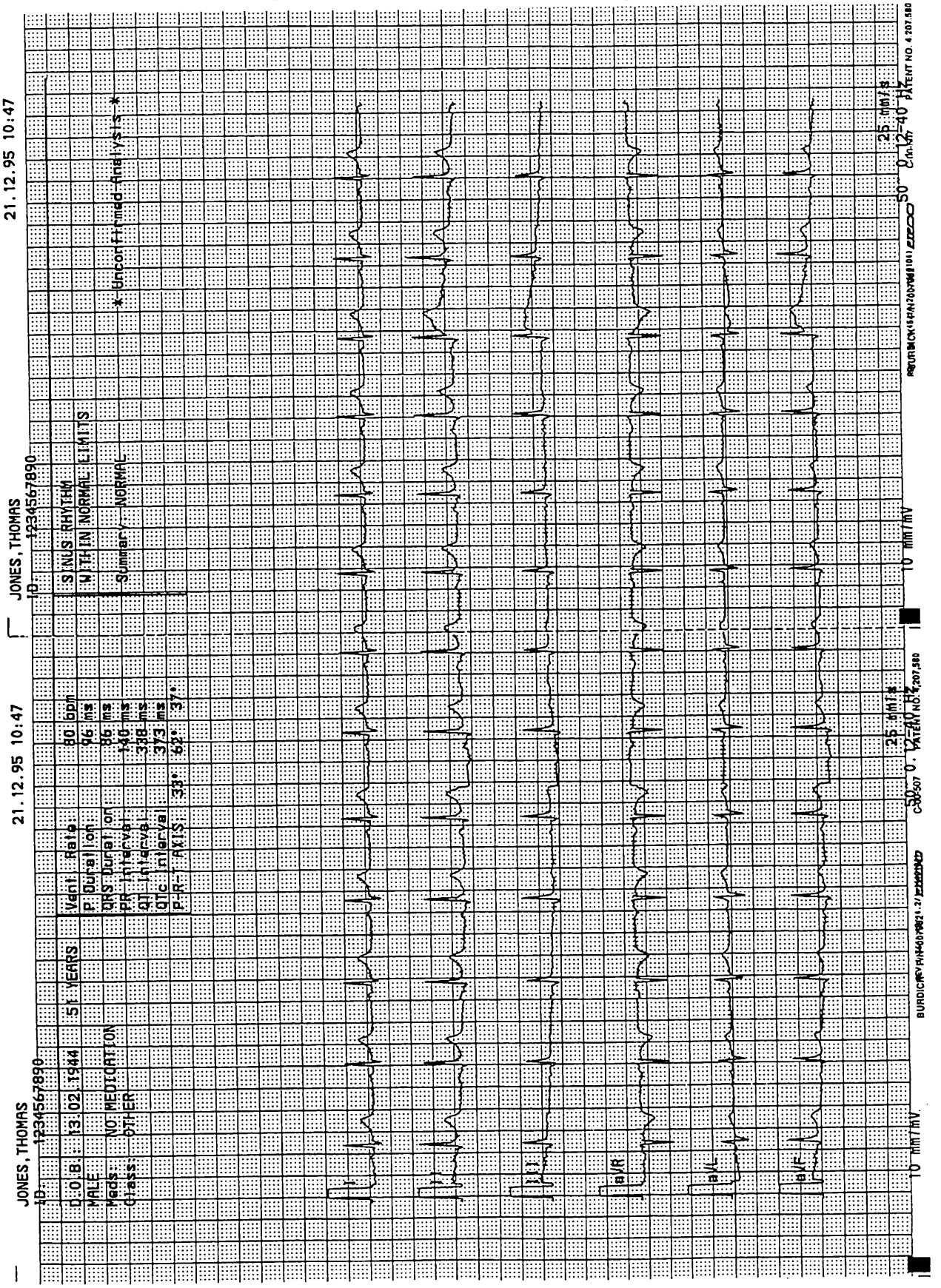




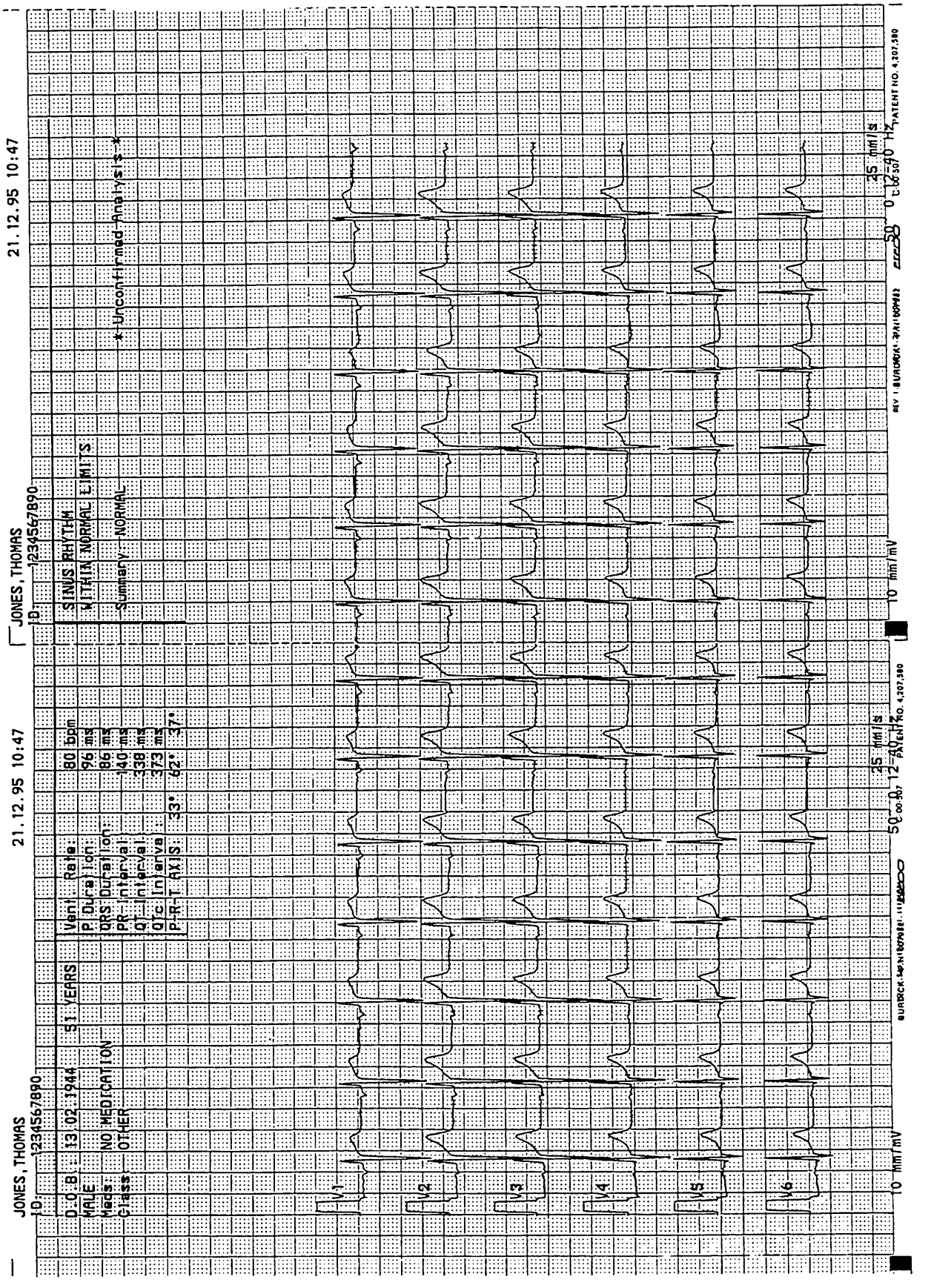
Standard 12-Lead, 4-Channel Auto ECG (Eclipse 8, 800 & 850)



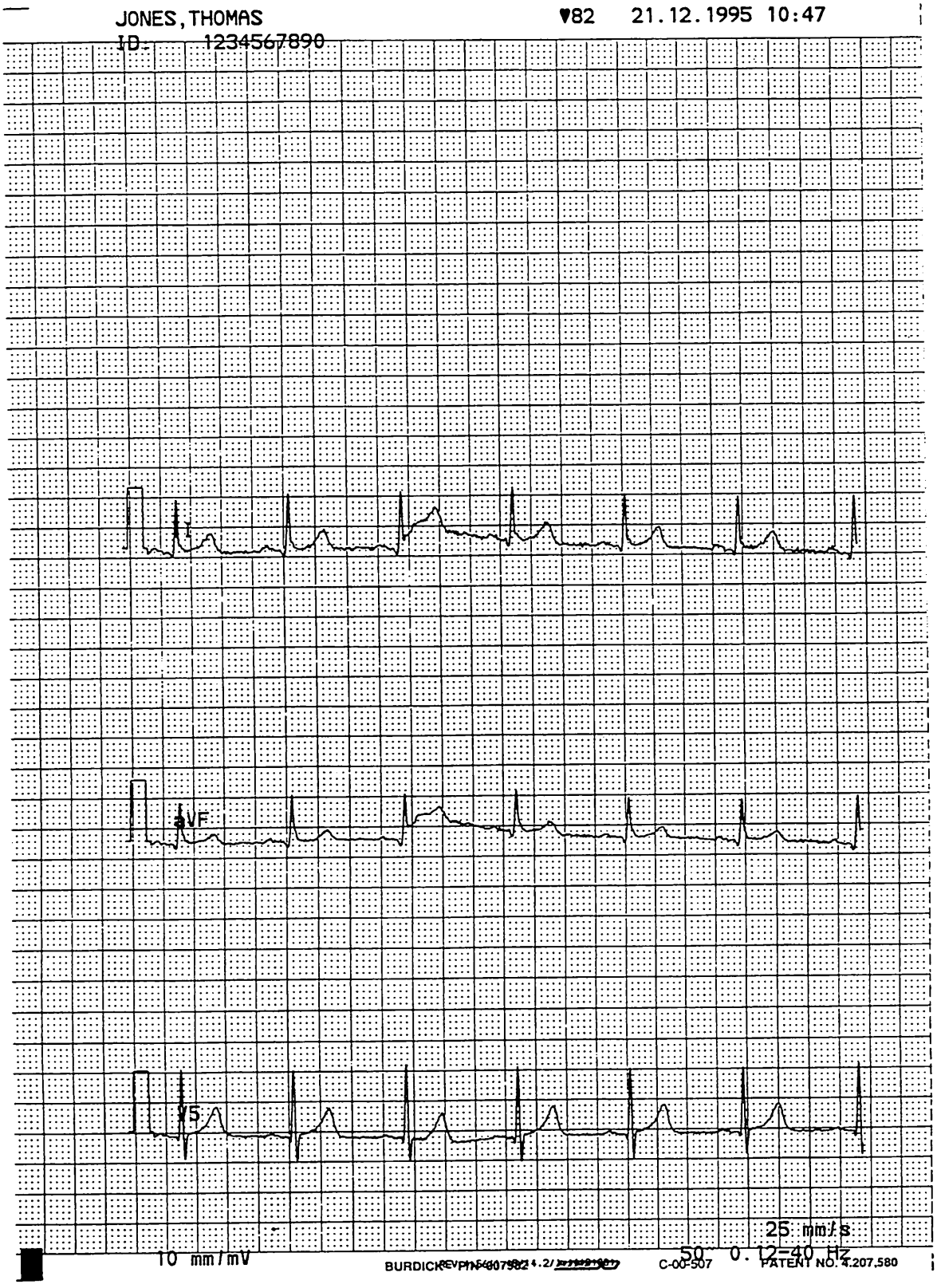
Standard 12-Lead, 6-Channel Auto ECG (Eclipse 8, 800 & 850)



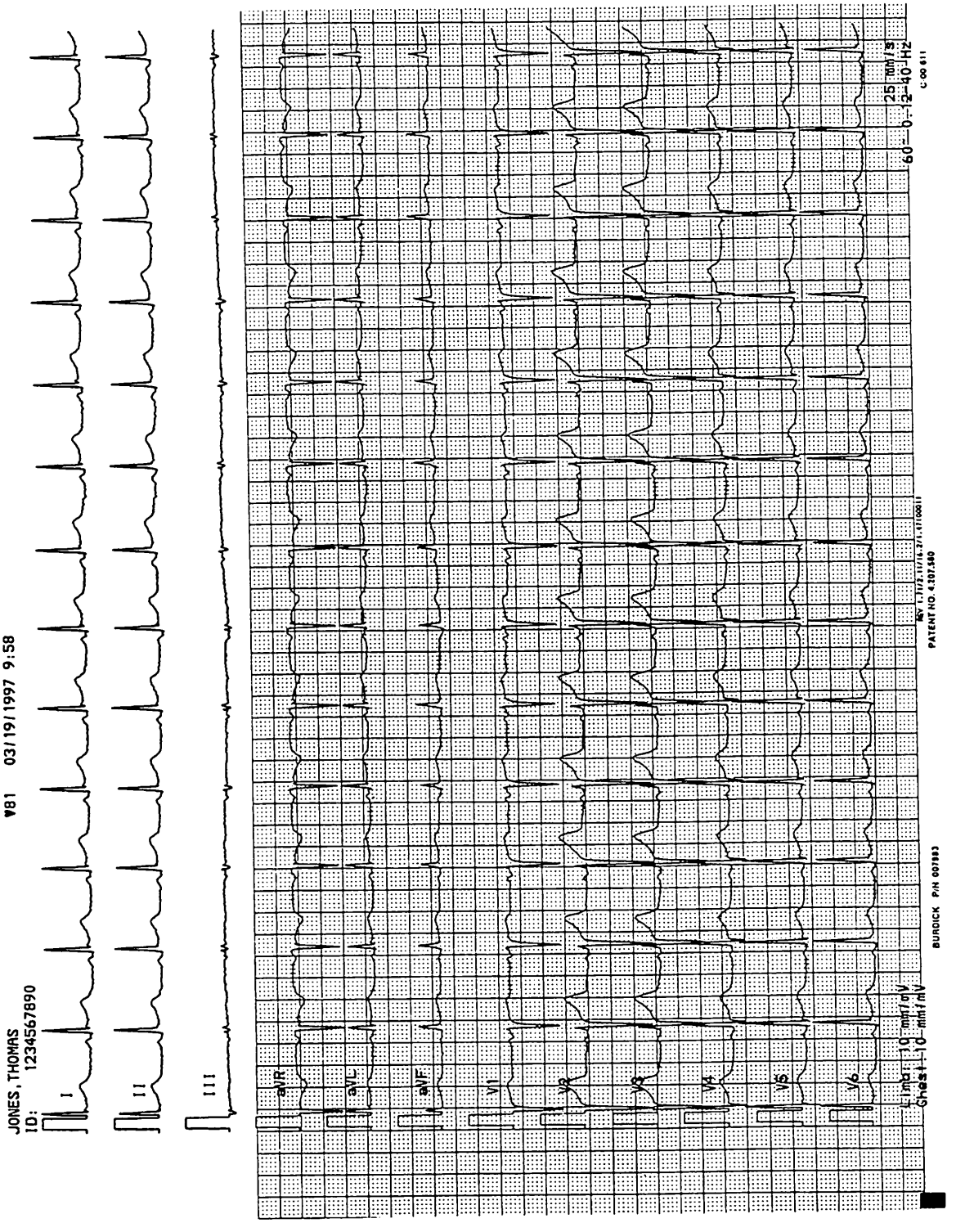
[Standard 12-Lead, 6-Channel Auto ECG (continued)]



Standard 3-Channel Rhythm & Manual ECG (Eclipse 8, 800 & 850)



Standard 12 Channel Rhythm & Manual ECG (Eclipse Plus)



Chapter 9 *Troubleshooting*

Troubleshooting Basic Unit Problems

PROBLEM	PROBABLE CAUSE
Unit will not turn on.	- Unit not connected to AC line voltage. - Battery is not installed or has no charge. - Faulty power cord. - AC outlet not functional.
After the battery has been fully charged, the battery status gauge indicates low battery within 30 minutes of operation.	- Battery pack may be worn out. - Battery status gauge is not calibrated (see "Calibrating the Battery Status Gauge" on pg. 2-3).
Unit has "frozen." The unit does not respond to key strokes and the display does not change.	- Press the On/Standby key. After a possible delay of up to 5 seconds, the unit shuts off. To continue with normal operation, press On/Standby again to restart the Eclipse.
Unit displays a completely blank screen.	- Press the On/Standby key to restart the Eclipse.
Unit will not send or receive records via modem.	- Verify that the phone number and description fields are correctly filled in. These are found in the SYSTEM SETUP menu. - Verify that the correct phone type and connection type are selected in the SYSTEM SETUP menu.
Fax function is not working.	- Verify that the phone number and description fields are correctly filled in. These are accessed through the FAX ECG menu.
Several functions in the DIRECTORY menu are unavailable and appear gray.	- Verify that the correct connection type is selected in the SYSTEM SETUP menu. - If MODEM is selected for the **Connection** field, verify that the **Phone #** field is correctly filled in. These are found in the SYSTEM SETUP menu.

Troubleshooting Trace Problems

PROBLEM	PROBABLE CAUSE
Waveforms are flat for all leads	- Patient cable not properly connected to unit.
Waveform is flat for one or more leads. All others are OK.	- Lead wire(s) disconnected from patient. - Damaged lead wire(s).
Baseline is drifting in waveform for one or more leads.	- Poor patient preparation. - Use of dissimilar sensors or sensors not recommended for use with Eclipse . - Sensors need to sit longer on skin. - Poor sensor contact with skin.
Trace is "noisy." The waveform is not a single, clean line.	- AC interference from lighting, cables, or equipment near patient. - Improper line filter setting in SYSTEM SETUP menu.
Occasional noise or artifact in the waveform for one or more leads.	- Patient movement. - Muscle tremor noise. - Improperly applied sensors. - Electrical interference. - Sensors need to sit longer on skin. - Poor sensor contact with skin. - Ineffective baseline filter setting.
"OVERLOAD" message will not clear.	- The sensor is not applied correctly. - The lead cable has a broken wire. This cable should be replaced.
Incorrect heart rate printed and/or displayed.	- Waveform is a bigeminal rhythm. - Poor data quality. Ensure that the sensors and leads are attached properly.
Incorrect or missing measurements on the printout.	- Undetermined P-wave or P-T coupling. - Poor data quality. Ensure that the sensors and leads are attached properly. - Unusual waveform pattern.

Troubleshooting Printer Problems

PROBLEM	PROBABLE CAUSE
Paper jammed	- Unit not used for extended period of time with paper installed.

PROBLEM	PROBABLE CAUSE
REDUCED PERFORMANCE MODE Paper speed erratic. ECG printouts have unexpected breaks in the waveforms at random intervals. Breaks are accompanied by vertical dashed lines, header/footer information and lead designators.	- 50 mm/s paper speed selected. Reduce paper speed to 25 mm/s. - Artifact filter is set to 40 Hz (on). Change setting to 150 Hz. - Current Custom Lead setting is Frank. Use another Custom Lead setting or reduce paper speed and turn off Artifact Filter.

Recognizing and Reducing ECG Artifacts

"OVERLOAD" message

Defibrillating the patient will interfere with the Eclipse sensors. This may result in loss of the trace or erratic trace deflections. An "OVERLOAD" message alerts you that waveforms may not be accurate. To speed recovery time after defibrillation press the "B" key to activate the Defibrillation Recovery filter (see "The Defibrillation Recovery filter" on pg. 9-5).

A broken wire in a patient lead or a poorly applied sensor may also cause an "OVERLOAD" message. This condition must be corrected before the overload condition clears.

Rapid, large and erratic deflections

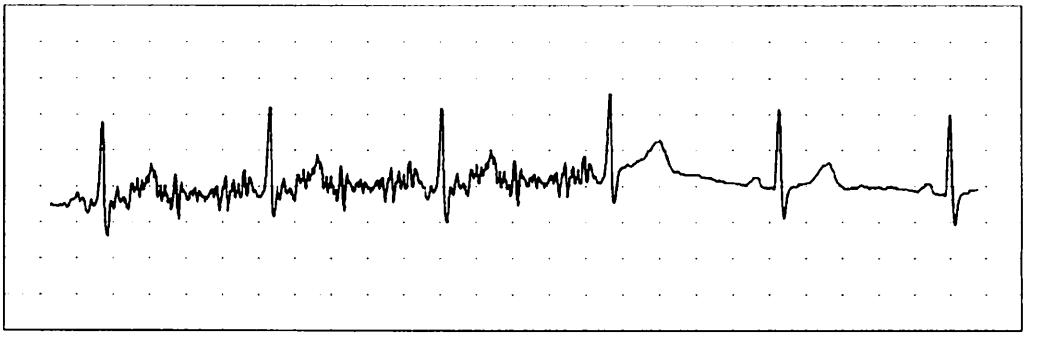
A broken wire in the patient lead or a poorly applied sensor may cause rapid, large and erratic trace deflections.

Irregular frequency or amplitude

Patient movement and muscle tremor may result in abnormal traces. To minimize this artifact, toggle the artifact filter to 40 Hz with the "9" machine control key.

In addition, try to gain the patient's cooperation in staying very relaxed and still. Sometimes, somatic tremor is unavoidable but its effects may be minimized by having the patient place his/her hands under the buttocks.

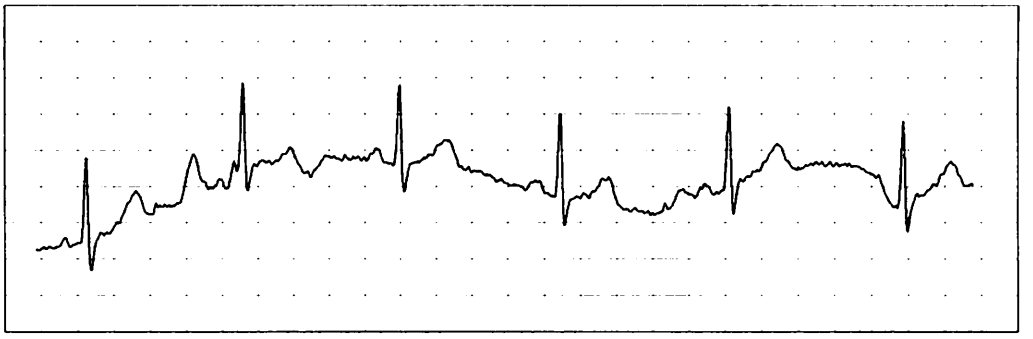
Figure 9-1
Somatic Tremor and Patient Movement Artifact



Baseline wander

Poorly affixed sensors may cause the baseline to wander. Normally, the baseline will stabilize within a few seconds. If the baseline shifts up and down, it may be due to the patient's breathing or to loose or corroded sensors.

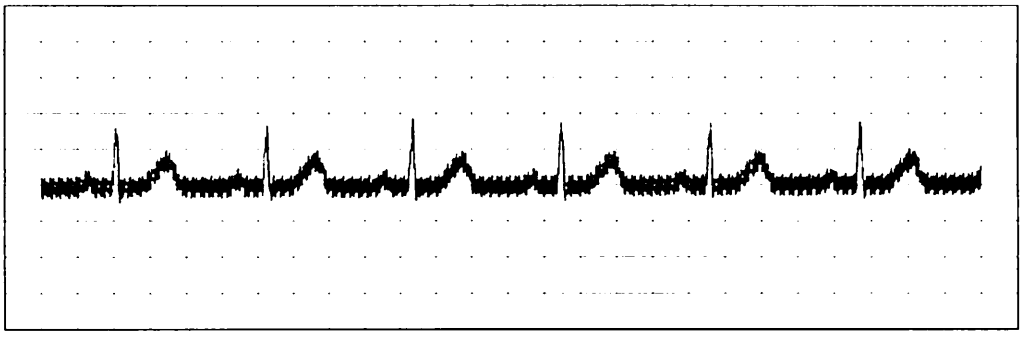
Figure 9-2
Poorly Affixed Sensor Artifact



Wide baseline

Electrical interference may produce a wide baseline. Its amplitude depends on the strength of the current source and the lead being recorded. In any one lead, the amplitude of the interfering signal is uniform.

Figure 9-3
Electrical Interference Artifact



To reduce electrical interference:

- ✔ Keep the power cord away from the patient and patient cable.
- ✔ Connect the unit to a properly grounded wall outlet.
- ✔ Arrange the patient cable leads together, closely following the body contour.
- ✔ Check the line filter setting in the SYSTEM SETUP menu. For more information, see "Configuring SYSTEM SETUP Menu" on pg. 4-17.
- ✔ Ensure that Diathermy or X-ray equipment in adjacent rooms is not operating. Other electrical equipment including electric beds and lighting fixtures may also generate interference (even when not in use).

- ✔ Try moving the patient to another place in the room. Sometimes, electrical wiring in walls and ceilings causes interference.
- ✔ Operate the Eclipse from battery power.

The Defibrillation Recovery filter

NOTE: The Defibrillation Recovery filter should be used only for enhanced recovery time after defibrillation to confirm the presence of cardiac activity. While this filter is enabled, waveforms printed are not of diagnostic quality. Care must be taken by the operator to not misinterpret the patient's condition during an "OVERLOAD" condition.

The Eclipse provides a Defibrillation Recovery filter for faster recovery time from an "OVERLOAD" condition caused by defibrillation (see ""OVERLOAD" message" on pg. 9-3).

This filter is enabled by pressing the "B" key. Do this only after defibrillation and only if the trace does not recover. When the filter is enabled, the Sensor Status message in the PREVIEW screen displays "FAIL" and "OVERLOAD" is printed on the report. After approximately 30 seconds, the filter clears and the Eclipse returns to normal operation.

Chapter 10 *Maintenance and Service*

This chapter covers:

- Installing or replacing the battery.
- Eclipse Maintenance.
- Performance Disclosures.
- Technical Data.

Quick Reference-Replacing the Battery (Eclipse 4, 8, 400, 800, 850)

⚠ *WARNING: Never remove the battery pack and attempt to recharge it using an external battery charger. Fire or explosion may result.*

CAUTION: Fire hazard. Use only Burdick battery pack. Replace Eclipse 4, 400, 8, 800 or 850 battery pack with the battery specified on the label inside the battery compartment.

⚠ **NOTICE:** Do not place used battery pack in your regular trash. The incineration, landfilling, or mixing of NiCd batteries with municipal waste is PROHIBITED BY LAW in most areas. Return this battery pack to a government-approved battery recycler. Contact your local waste management officials for more information.

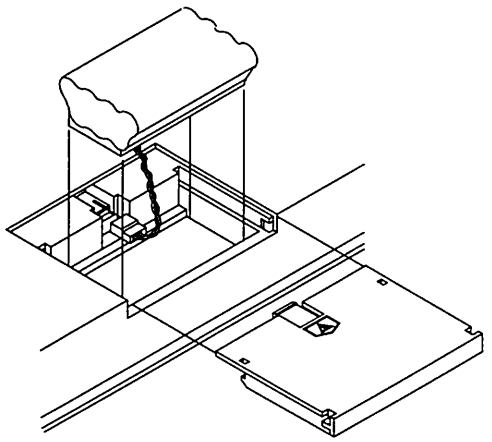
Removal

1. Turn unit over to expose battery cover.
2. Depress battery cover latch and slide cover out.
3. Lift battery pack and disconnect battery by grasping the connector and sliding it straight out.

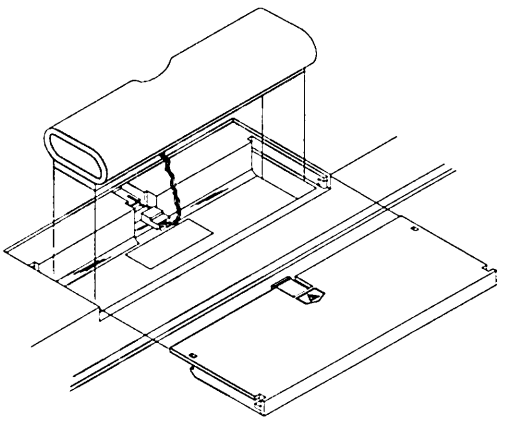
DO NOT PULL ON WIRES!

Installation

1. Slide battery connector on to PC board. (Battery connector is polarized and made to fit only one way; Do not force connector into slot.)
2. Place battery pack into battery compartment:



Eclipse 4 and 400



Eclipse 8, 800 & 850

3. Arrange battery connector wires so that they will not interfere with battery cover.
4. Position battery cover over battery compartment and slide forward until it snaps into place.
5. Calibrate the Battery Status Gauge on the Eclipse 4 and 8 whenever you remove and replace the battery (see "Calibrating the Battery Status Gauge" on pg. 2-3).

Inspecting for Damage

WARNING: Hazardous voltage. To reduce the risk of electrical shock, do not attempt to remove the cover under any circumstances. Refer servicing to a qualified technician.

Before using the Eclipse, always check the power cord, power plug, power connector, and power input jack for signs of damage.

Immediate service is required if:

- ✔ The equipment falls from the cart or is subjected to some other extreme mechanical stress.
- ✔ Liquid is spilled on the equipment.
- ✔ The equipment is not functioning properly.
- ✔ Parts of the enclosure are cracked, removed or lost.
- ✔ Any connector or cord shows signs of deterioration such as cracking.

Cleaning and Disinfecting the Eclipse

The housing

NEVER use ether, benzene or similar solvents.

CLEANING

Gently rub the housing with a clean, damp cloth. If necessary, a mild household detergent may be used.

DISINFECTION

Spray the housing with INCIDIN or similar product.

The patient cable and reusable sensors

NEVER immerse cables in fluid, or use hot sterilization. Do not use ether. Do not use bleach, acetone or similar harsh chemicals or solvents.

CLEANING AND DISINFECTION

Rub with a clean cloth moistened with a formaldehyde solution such as CIDEX, SONACIDE, LYSOFORM 5% or INCIDIN 1.5%.

Testing Equipment

The Eclipse performs a self-test every time it is powered up. It is not necessary for you to perform any other tests on the unit.

Testing the Patient cable

- Disconnect the Patient cable
- Check for a short, broken wire, or poor contact by measuring the resistance of each lead in the cable. Each lead is equipped with a protective resistor of 10,000 ohm.

Testing the battery

The Eclipse monitors battery status. It is not necessary for you to perform any tests on the battery. However, if the battery does not retain a charge for more than 30 minutes of operation, you may need to condition or replace the battery pack. To condition the battery pack, perform the steps outlined in "Calibrating the Battery Status Gauge" on pg. 2-3. Even though the Eclipse 400, 800 and 850 do not have a battery status gauge, it is still recommended that you perform the calibration procedure to condition the battery. Battery replacement is described earlier in this chapter. The battery pack in the Eclipse Plus is not user replaceable. It must be replaced by an authorized service representative.

WARNING: Never remove the battery pack and attempt to recharge it using an external battery charger. Fire or explosion may result.

- During operation, the Battery Status gauge in the PREVIEW screen tracks battery charge status (Eclipse 4, 8 and Plus only).
- The message, "LOW BATTERY" flashes when fewer than 15 minutes of operating time remain. The unit will also "beep" every 30 seconds to remind you.
- If the charge level drops too low, the unit displays the message, "POWERING DOWN." Then, after 5 seconds, the unit shuts off. Connect the unit to AC line voltage at this point to operate the unit and recharge the battery.

Voltages and fuses

The Eclipse is internally configured to use either 115VAC or 230VAC. The AC line power fuse is mounted internally and should be replaced only by an authorized service representative.

Restricted environment

The Eclipse must be stored in an environment with a temperature of -20° C to 55° C and relative humidity of 25% to 95% non-condensing.

Available documentation

The following documentation is available for this product:

- Operating Instructions (supplied with product)
- List of Accessories and Supplies (supplied with product)
- Service Manual (available upon request)

Notice to responsible service personnel

The contents of this document are not binding. If you find a significant difference between this service information and your unit, please consult Burdick. We reserve the right to improve or modify products without amending this document or advising the user.

We recommend consulting authorized Burdick personnel for all service and repairs, and using genuine Burdick parts, exclusively. Burdick will not otherwise assume responsibility for material quality, workmanship or any consequences thereof.

This product has been carefully designed and manufactured to provide a high degree of safety and dependability. However, we can not guarantee against the failure or deterioration of components due to aging and normal use.

Performance Disclosures

⚠ *WARNING: Explosion hazard. Do NOT use in the presence of flammable anesthetics.*

⚠ *WARNING: This device is NOT intended for unattended or continuous patient monitoring. It is intended for short-term ECG waveform acquisition. There are no audible or visible alarms.*

CAUTION: Although the Eclipse is designed to meet IEC 601-1-2 EMC immunity requirements, the presence of strong EMI fields generated by electronic, surgical or diathermy instruments in close proximity to the unit may cause trace noise or input overload conditions.

NOTICE: Computer assisted interpretation is a valuable tool when used properly. However, no automated interpretation is completely reliable and interpretations should be reviewed by a qualified physician before treatment, or non-treatment, of any patient.

NOTICE: Because the Burdick Eclipse offers several different lead configurations, always ensure that the appropriate lead placement is employed for the lead configuration selected.

CE This symbol which appears on the rear panel of some units, indicates this equipment meets the requirements of the EMC directive.

These units have been tested for electromagnetic compatibility in accordance with IEC 601-1-2. The failure criterion for the device is, "undetectable interference with the ECG trace which could result in misdiagnosis." While the device passes the relevant standards, it may exhibit evidence of interference when subjected to electrostatic discharges, high voltage transients or high voltage surges, as defined in IEC 801-2, IEC 801-4 and IEC 801-5. The interference from a single event will demonstrate as a sharp noise spike on the ECG trace. The clinician will not confuse such a noise spike with the heart beat waveforms and there is no hazard of misdiagnosis. In the unlikely situation that the equipment is placed in an environment where such interference events are common, either the equipment or the interference source may be moved.

Battery pack

Under normal conditions, a fully charged battery pack provides adequate power to print a minimum of 200 pages of data at paper speed of 25 mm/sec; or a minimum of 20 minutes of continuous acquisition and printing.

A fully discharged battery pack will completely recharge in approximately 5 hours.

Heart rate detection

The Eclipse heart rate meter is specified to function in the range of 30 to 250 bpm with a tolerance of ±10% or ±5 bpm, whichever is greater. The meter functions with a tolerance of ±10% in the 251 to 295 bpm range. The meter has no specification for heart rates greater than 295 bpm.

Frequency response

The Eclipse uses digital electronic circuitry to reproduce the ECG trace. Because of sampling characteristics and the asynchronism between sample rate and signal rate, a modulating effect from one cycle to the next **may** be produced, particularly in high heart rate (i.e. pediatric) recordings. This phenomenon is inherent to digital systems and should not be interpreted as a physiological condition.

The frequency response is tested using the following methods:

Method	Nominal input amplitude (mV p-p)	Input frequency and waveform	Output response (mm) relative to 10Hz output
A	1.0	0.67 to 40 Hz, sinusoidal	±10%
B	1.5	< 1 Hz 20 ms, triangular	+0%, - 10%

Assessing overall system error

- At all available sensitivity settings, apply a 5 Hz signal to the appropriate patient sensor connection to obtain a full scale deflection of 50 mm.
- Measure the input signal and compute the gain as output/input. Repeat this procedure for output deflections of 40, 30, 20, 10, and 5 mm.
- The computed gain in each instance must be within ±5 percent or ±40 µV of the nominal value, whichever is greater.

Technical Data (Eclipse 4 & Eclipse 400)

Dimensions:	299mm x 349mm x 105mm (11.75" x 13.75" x 4.14")
Weight (unit only):	4.32 kg (9.5 lbs)
Power Requirements:	
mains power requirement	115/230 VAC, 0.48/0.24 A, 50/60 Hz
battery operation	16.8 VDC NiCd battery pack
Fuses:	
F1 and F2 mains	for 115 V, 0.63 A 250 V type T for 230 V, 0.315 A 250 V type T
Environmental:	
operating temperature	10° C to 40° C
storage temperature	-20° C to 55° C
relative humidity	25% to 95% non-condensing
atmospheric pressure	7×10^4 to 10.6×10^4 Pa
Acquisition:	
lead selection	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 Supports Frank X,Y,Z and Nehb D,A,J
interpretation (if equipped)	diagnosis, measurements, reasons statements
modes	auto, rhythm, manual
frequency response	meets or exceeds ANSI/AAMI EC11-1991 standard
input impedance	meets or exceeds ANSI/AAMI EC11-1991 standard
electrode offset tolerance	±300 mV
a/d conversion	5µV LSB
Storage Resolution:	500 samples/sec, 5µV resolution
Artifact Filter Response:	40 Hz, -3dB
Display:	320 x 240 pixel Liquid Crystal Display (LCD)
Printout:	
paper type	thermal sensitive
chart speeds	10, 25, 50 mm/sec
gain	5, 10, 20 mm/mV
printout formats	3 channels; additional rhythm formats
printout device	104mm thermal dot array
paper dimension	106mm x 140mm Z-fold

Input/Output: (Eclipse 4)

standard RS-232 (9 pin "D")

analog output (8 pin DIN)

expansion connector (6 pin DIN)

telephone line interface (RJ11C)

PCMCIA slot (type 3)

Conforms to Standards:

IEC 601-1/CSA C22.2 no. 601-1-M90

IEC 601-2-25/CSA C22.2 no. 601-2-25

IEC 601-1-2
And, by reference of IEC 601-1-2, conforms to EN 55011-Class A, IEC 801-2, IEC 801-3, IEC 801-4 and IEC 801-5.

Safety:

leakage current	patient <10µA, chassis <100µA
defibrillator protection	to 5000V, 400J

Technical Data (Eclipse 8 & Eclipse 800)

Dimensions:	299mm x 462mm x 105mm (11.75" x 18.16" x 4.14")
Weight (unit only):	6.45 kg (14.2 lbs)
Power Requirements:	
mains power requirement	115/230 VAC, 0.80/0.40 A, 50/60 Hz
battery operation	16.8 VDC NiCd battery pack
Fuses:	
F1 and F2 mains	for 115 V, 1.0 A 250 V type T for 230 V, 0.500 A 250 V type T
Environmental:	
operating temperature	10° C to 40° C
storage temperature	-20° C to 55° C
relative humidity	25% to 95% non-condensing
atmospheric pressure	7×10^4 to 10.6×10^4 Pa
Acquisition:	
lead selection	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 Supports Frank X,Y,Z and Nehb D,A,J
interpretation (if equipped)	diagnosis, measurements, reasons statements
modes	auto, rhythm, manual
frequency response	meets or exceeds ANSI/AAMI EC11-1991 standard
input impedance	meets or exceeds ANSI/AAMI EC11-1991 standard
electrode offset tolerance	±300 mV
a/d conversion	5µV LSB
Storage Resolution:	500 samples/sec, 5µV resolution
Artifact Filter Response:	40 Hz, -3dB
Display:	320 x 240 pixel Liquid Crystal Display (LCD)
Printout:	
paper type	thermal sensitive
chart speeds	10, 25, 50 mm/sec
gain	5, 10, 20 mm/mV
printout formats	3, 4 or 6 channels; additional rhythm formats
printout device	216mm thermal dot array
paper dimension	8.5" x 5.5" Z-fold 210mm x 150mm (A4) Z-fold

Input/Output: (Eclipse 8)

standard RS-232 (9 pin "D")

analog output (8 pin DIN)

expansion connector (6 pin DIN)

telephone line interface (RJ11C)

PCMCIA slot (type 3)

Conforms to Standards:

IEC 601-1/CSA C22.2 no. 601-1-M90

IEC 601-2-25/CSA C22.2 no. 601-2-25

IEC 601-1-2
And, by reference of IEC 601-1-2, conforms to EN 55011-Class A, IEC 801-2, IEC 801-3, IEC 801-4 and IEC 801-5.

Safety:

leakage current	patient <10µA, chassis <100µA
defibrillator protection	to 5000V, 400J

Equipment Type:

class I (per IEC 601-1)

Technical Data (Eclipse 850)

Dimensions:	299mm x 462mm x 105mm (11.75" x 18.16" x 4.14")
Weight (unit only):	6.45 kg (14.2 lbs)
Power Requirements:	
mains power requirement	115/230 VAC, 0.80/0.40 A, 50/60 Hz
battery operation	16.8 VDC NiCd battery pack
Fuses:	
F1 and F2 mains	for 115 V, 1.0 A 250 V type T for 230 V, 0.500 A 250 V type T
Environmental:	
operating temperature	10° C to 40° C
storage temperature	-20° C to 55° C
relative humidity	25% to 95% non-condensing
atmospheric pressure	7×10^4 to 10.6×10^4 Pa
Acquisition:	
lead selection	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 Supports Frank X,Y,Z and Nehb D,A,J
interpretation (if equipped)	diagnosis, measurements, reasons statements
modes	auto, rhythm, manual
frequency response	meets or exceeds ANSI/AAMI EC11-1991 standard
input impedance	meets or exceeds ANSI/AAMI EC11-1991 standard
electrode offset tolerance	±300 mV
a/d conversion	5µV LSB
Storage Resolution:	500 samples/sec, 5µV resolution
Artifact Filter Response:	40 Hz, -3dB
Display:	320 x 240 pixel, backlit Liquid Crystal Display (LCD)
Printout:	
paper type	thermal sensitive
chart speeds	10, 25, 50 mm/sec
gain	5, 10, 20 mm/mV
printout formats	3, 4 or 6 channels; additional rhythm formats
printout device	216mm thermal dot array
paper dimension	8.5" x 11" Center-folded 210mm x 300mm (A4) Center-folded

Input/Output:

(units with communications)	standard RS-232 (9 pin "D")
	analog output (8 pin DIN)
	telephone line interface (RJ11C)

Conforms to Standards:

IEC 601-1/CSA C22.2 no. 601-1-M90

IEC 601-2-25/CSA C22.2 no. 601-2-25

IEC 601-1-2
And, by reference of IEC 601-1-2, conforms to EN 55011-Class A, IEC 801-2, IEC 801-3, IEC 801-4 and IEC 801-5.

Safety:

leakage current	patient <10µA, chassis <100µA
defibrillator protection	to 5000V, 400J

Equipment Type:

class I (per IEC 601-1)

Technical Data (Eclipse Plus)

Dimensions (with cart):	43.5cm x 65.1cm x 125.7cm (17.125" x 25.625" x 49.5")
Weight (with cart):	39.5 kg (87 lbs)
Power Requirements:	
mains power requirement	115/230 VAC, 0.80/0.40 A, 50/60 Hz
battery operation	16.8 VDC NiCd battery pack
Fuses:	
F1 and F2 mains	for 115 V, 1.0 A 250 V type T for 230 V, 0.500 A 250 V type T
Environmental:	
operating temperature	10° C to 40° C
storage temperature	-20° C to 55° C
relative humidity	25% to 95% non-condensing
Acquisition:	
atmospheric pressure	7×10^4 to 10.6×10^4 Pa
lead selection	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 Supports Frank X,Y,Z and Nehb D,A,J
interpretation	diagnosis, measurements, reasons statements
modes	auto, rhythm, manual
frequency response	meets or exceeds ANSI/AAMI EC11-1991 standard
input impedance	meets or exceeds ANSI/AAMI EC11-1991 standard
electrode offset tolerance	±300 mV
a/d conversion	5µV LSB
Storage Resolution:	500 samples/sec, 5µV resolution
Artifact Filter Response:	40 Hz, -3dB
Display:	640 x 480 pixel Active-Matrix, Color, Liquid Crystal Display (LCD)
Printout:	
paper type	thermal sensitive
chart speeds	10, 25, 50 mm/sec
gain	5, 10, 20 mm/mV
printout formats	3, 4, 6 or 12 channels; additional rhythm formats
printout device	216mm thermal dot array
paper dimension	8.5" x 11" Z-fold or 210mm x 300mm (A4) Z-fold

Input/Output:

standard RS-232 (9 pin "D")

analog output (8 pin DIN)

expansion connector (6 pin DIN)

telephone line interface (RJ11C)

PCMCIA slot (type 3)

Conforms to Standards:

IEC 601-1/CSA C22.2 no. 601-1-M90

IEC 601-2-25/CSA C22.2 no. 601-2-25

IEC 601-1-2
And, by reference of IEC 601-1-2, conforms to EN 55011-Class A, IEC 801-2, IEC 801-3, IEC 801-4 and IEC 801-5.

Safety:

leakage current	patient <10µA, chassis <100µA
defibrillator protection	to 5000V, 400J

Equipment Type:

class I (per IEC 601-1)

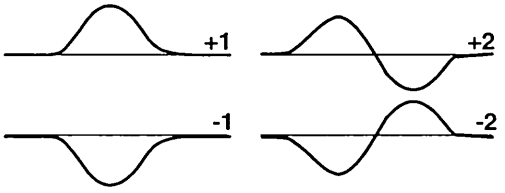
Chapter 11 *Measurement Matrix*

Eclipse models with interpretation or measurement capabilities can be programmed to print the Measurement Matrix after the analysis report.

The Measurement Matrix consists of 12 columns which contain measurements for the twelve standard leads. These columns are labelled I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6.

The following table explains the numerical values in the Measurement Matrix.

MEASUREMENT	DESCRIPTION
PON	Time in milliseconds from the beginning of recording to the beginning of the first P wave.
PDUR	P wave duration in milliseconds.
QRSON	Time in milliseconds from the beginning of recording to the beginning of the QRS complex.
QRSDUR	QRS duration in milliseconds.
QDUR	Q wave duration in milliseconds.
RDUR	R wave duration in milliseconds.
SDUR	S wave duration in milliseconds.
R'DUR	R' wave duration in milliseconds.
S'DUR	S' wave duration in milliseconds.
P+DUR	P+ wave duration in milliseconds.
QRSDEF	Intrinsicoid deflection time.
P+AMP	P+ wave amplitude in microvolts.
P-AMP	P- wave amplitude in microvolts.
QRSP2P	Peak to peak amplitude of the QRS complex.
QAMP	Q wave amplitude in microvolts.
R'AMP	R wave amplitude in microvolts.
S'AMP	S wave amplitude in microvolts.
RPAMP	R' wave amplitude in microvolts.
SPAMP	S' wave amplitude in microvolts.

MEASUREMENT	DESCRIPTION
STAMP	ST wave amplitude in microvolts.
2/8STT	Amplitude in microvolts at a point which is 2/8 of the ST-T interval.
3/8STT	Amplitude in microvolts at a point which is 3/8 of the ST-T interval.
T+AMP	T+ wave amplitude in microvolts.
T-AMP	T- wave amplitude in microvolts.
QRSAR	Total area of the QRS complex in microvolts/millisecond.
TMORPH	T wave morphology. 
RWNCH	R wave notch count.
DWCON	Probability (in %) of the presence of a delta wave.
STSLOP	ST slope in degrees.
TON	Time in milliseconds from the beginning of the recording to the beginning of the T wave.
TDUR	T wave duration in milliseconds.
T+DUR	T+ wave duration in milliseconds.

Burdick, Inc.
15 Plumb Street • Milton, WI 53563, USA. • Phone: 1-608-868-6000 • Fax: 1-608-868-1392

Fax Cover Sheet

Date: _____ **page 1 of** _____

To: **Burdick, Inc.** (608) 868-1392
Attn: Technical Documentation

From: _____

Facility: _____

Physician's Name: _____

Street Address: _____

City: _____

State: _____ Zip: _____

Phone: ( ) _____

Fax: ( ) _____

Operator's Comments

We are constantly striving to make our products and our documentation easier to use. You can help by sharing your comments with us. If you have any suggestions, or if you would like to notify us regarding an inaccuracy, please photocopy, fill out and complete this form and fax it back to Burdick, Inc. or mail it to the address at the top of the page.

COMMENTS OR SUGGESTIONS:

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Limited Warranty and Service

BURDICK, INC. MAKES NO WARRANTY OTHER THAN THE ONE SET FORTH HEREIN. WHICH LIMITED WARRANTY IS IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

YOUR BURDICK, INC. LIMITED 3 YEAR WARRANTY:

Burdick, Inc. warrants to the original purchaser, for a period of three (3) years from the purchase date, that all equipment components (consisting of the main electronic assembly, and not including accessories) which fail to operate as provided in the equipment specifications, will be repaired or replaced, at Burdick, Inc.'s option, without charge to the customer. However, the customer assumes all responsibility for shipping charges.

Equipment returned to the Burdick Repair Center, Milton, WI during the first year after purchase will be serviced at no charge to include parts, labor and return transportation. However, the customer assumes all responsibility for incoming shipping charges. Any equipment* component which fails to operate in normal use during the subsequent two (2) years will be repaired or replaced, at Burdick, Inc.'s option, without charge. The customer assumes all responsibility for shipping and labor repair charges.

All accessories and main battery supplied with the new equipment (with the exception of non-replaceable-lead patient cables) are warranted for one (1) year from the purchase date and will be repaired or replaced at Burdick, Inc.'s option, without charge to the customer, with the exception of shipping charges. Non-replaceable-lead patient cables are warranted for a period of ninety (90) days from the date of original purchase. Accessories and parts sold separately are warranted for a period of ninety (90) days from the date of original purchase.

This Warranty gives you specific legal rights which may vary from state to state. This Warranty does not apply to equipment damaged by shipping, accident, misuse, theft, neglect, fire or other Acts of God, deterioration caused by use of chemicals not encountered during normal operation, equipment failures due to the use of paper or other supplies not conforming to Burdick-approved specifications and standards, power surges or unauthorized modifications. This Warranty also will not apply if the serial number has been altered or defaced, or if the equipment has been modified or serviced by anyone other than an authorized agent of Burdick, Inc. No representative or employee of Burdick, Inc. is authorized to assume any further liability or grant any further warranty beyond the Warranty set forth herein.

Authorized Burdick dealers are approved to maintain the Burdick, Inc. equipment they sell. They are equipped to provide on site field service whenever it is practical. If trouble occurs, contact the Burdick dealer from whom the products were originally purchased to arrange for service. The engineering and service specialists of Burdick, Inc. stand ready to assist customers and dealers, and repair information can be supplied by telephone or mail.

In order for this Warranty to apply, THE PURCHASER MUST COMPLETE THE WARRANTY CARD and mail it directly to Burdick, Inc. Postage has been prepaid for your convenience. Failure to complete your Warranty Card could result in delays in repair and/or service, or a denial of the Warranty.

Important Note: Current FDA Regulations require that some medical devices and their locations be registered. Your completed Warranty Card automatically registers your product.

In the event a Warranty Card is/was not returned, the following information must be supplied to Burdick, Inc. before warranty support can be provided:

1. Customer name, address and telephone/fax numbers;
2. Equipment model, serial number and date of installation;
3. Installation date of new part, new accessory or new unit;
4. Name of dealer from whom equipment was purchased;
5. Complete description of unit's condition (please state if symptoms are constant or intermittent);
6. Complete list of all steps taken in attempts to remedy the problem.

SERVICE:

Burdick, Inc. products are sold and serviced through a nationwide network of medical equipment distributors who have been carefully selected for their proven ability to serve the medical profession. All of these Authorized Service Agents participate in an ongoing certification program and must demonstrate a high caliber of technical expertise. Service, parts and accessories for Burdick, Inc. equipment are available from your authorized dealer. For more information or special assistance, contact Burdick, Inc. at **(800)-333-7770** or **(608)-868-4678**.

RETURNING EQUIPMENT FOR SERVICE:

If equipment is being returned for repair, prior authorization must first be obtained by phone or mail. Always include a detailed list of symptoms, and if applicable, a sample trace recording. Please include your name and phone number. This will assure you are provided with the fastest and most efficient service possible. If circuit boards are shipped to a service center, always ensure they are adequately protected and enclosed in an antistatic bag.

If a unit must be returned to the Burdick, Inc. factory for repair, the unit and accessories should be carefully packed in a strong carton, preferably the one specifically designed for that unit. Shipping containers are available from your Burdick dealer, however, the customer is responsible for and assumes all risks associated with shipment of the unit. Ensure that the package is clearly marked for protection against rough handling.

Example: "DELICATE ELECTRONIC EQUIPMENT - HANDLE WITH CARE".

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*Equipment is considered to be the main electronic assembly, and by definition does not include any accessories.

FCC CONNECTION INFORMATION

This equipment complies with Part 68 of the FCC Rules. On the bottom of this equipment is a label that contains, among other information, the FCC Registration Number and ringer equivalence number (REN) for this equipment. If requested, this information must be provided to the telephone company.

The REN is used to determine the quantity of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in devices not ringing in response to an incoming call. In most, but not all areas, the sum of the RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total RENs, contact the telephone company to determine the total REN for the calling area.

If your *BURDICK* Eclipse causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, you will be notified as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could effect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications in order to maintain uninterrupted service.

If you experience trouble with your BURDICK Eclipse, please contact Burdick, Inc., 15 Plumb Street, Milton, WI 53563, U.S.A., phone: (800) 333-7770 or (608) 868-6000 for repair/warranty information. If the trouble is causing harm to the telephone network, the telephone company may request you remove the equipment from the network until the problem is solved.

This equipment may not be used on coin service provided by the telephone company. Connection to Party Line Service is subject to state tariffs. (Contact the state public utility commission, public service commission, or corporation commission for information.)

This device is equipped with a USOC RJ11C connector

EQUIPMENT ATTACHMENT LIMITATIONS

NOTICE: The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, user's should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single-line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

User's should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The LOAD NUMBER (5) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop, which is used by the device to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all of the devices does not exceed 100.

SERVICE STATION: If you have any questions or trouble, please contact Burdick, Inc., 15 Plumb Street, Milton, WI 53563, U.S.A., phone: (608) 868-6000 or (800) 777-1777.

Service: (800) 333-7770 • Orders: (800) 777-1777

Burdick, Inc. 15 Plumb Street Milton, WI 53563 U.S.A. (608) 868-6000

Burdick, Inc.

ECG INTERPRETATION CRITERIA

Physician's Guide

Burdick Manual Number 086533
Revision 1196

USER COMMENTS

We are constantly striving to make our products and our documentation easier to use. You can help by sharing your comments with us. If you have any suggestions, or if you would like to notify us regarding an inaccuracy, please photocopy, fill out, and mail the User Comments form located at the back of this manual. Your input will be sincerely appreciated.

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Burdick, Inc.
15 Plumb Street
Milton, Wisconsin 53563 U.S.A.

TABLE OF CONTENTS

Chapter 1 INTRODUCTION

Welcome to the latest edition of the Burdick Inc. criteria handbook which accompanies the ECG interpretative program. The aim of this handbook is to provide a list of the criteria currently used for ECG interpretation in Burdick Electrocardiographs. They have evolved over many years of developing a program[1] for ECG analysis in the University of Glasgow Department of Medical Cardiology based in the Royal Infirmary, Glasgow, Scotland. While some criteria are traditional, others have been developed through research studies and the need to quantitate what, for many ECG abnormalities, has essentially been a subjective analysis of waveforms.

The major addition to this version of the handbook is the inclusion of pediatric criteria, which are automatically invoked when age is less than 16 to 18 years depending on the particular measurement being checked. The reason for this is a unique feature of the Glasgow criteria in that continuous equations of upper limits of normal measurements are used. In general, such measurements will increase linearly from birth to adolescence, an example being QRS duration which has an upper limit of 80 milliseconds at birth increasing to approximately 115 milliseconds at 18 years of age. However, some measurements may reach their adult value at less than 18 years of age. The pediatric criteria are based on a large study of over 1,750 neonates, infants and children conducted by this laboratory[2,3].

The pediatric criteria can make use of lead V4R when it is available. While this enhances the accuracy of ECG interpretation in this age group, the program will still function when the conventional 12-lead recording positions are used in children although the use of V4R to the exclusion of V3 is to be preferred. Full details of how to select the appropriate lead configuration for input to the electrocardiograph can be found in the relevant Burdick electrocardiograph operator manual. Similarly, the mechanism for inputting the age of a patient can also be found in the operator manual. In the case of neonates and infants, the age will be calculated in days if the date of birth is input. If an age is input in years only, the criteria will be less efficiently used because the continuous equations employed allow the advantage of utilizing the age in days. In other words, if a patient aged 1 year 11 months has an age of 1 year inserted, this will result in an age in days of 365 being used compared to a much more accurate age of approximately 700 days. Clearly, there will then be significant differences in the upper limit of normal using continuous equations based on the age in days compared to using an age in years.

A principal aim in preparing this manual was that the criteria should, wherever possible, be presented in a relatively straightforward form. At the same time, it was intended that the text should convey the unique flavor of the approach used for ECG analysis within Burdick machines. For this reason, a compromise has been adopted where, for some criteria, a generalized statement has been made rather than a precise quantification of numerical data being listed. Even so, the list of criteria is somewhat detailed but it should be appreciated that computers do require a certain amount of precision!

The layout of the criteria should be self-explanatory. In general terms, the wave amplitudes have positive or negative amplitudes in the conventional sense, e.g. the S wave is regarded as having a negative amplitude. Similarly, a criterion which requires that T- < -0.1mV means that the negative T wave amplitude (see Figure 1) should be in excess of -0.1 millivolts, e.g. this would be true if T- = -0.2mV. Occasionally, the absolute value of a negative wave or ratio is denoted by | |.

Criteria for serial change have been omitted from this handbook for the present since they do not form part of the stand alone analysis. They are however incorporated in the program and if an electrocardiograph is linked to a central facility at some time in the future in order to retrieve earlier reports, serial comparison can be undertaken at the bedside on that machine. Likewise, detailed criteria for arrhythmias are not listed although the various statements which can be produced by the program are presented.

The general form of an output statement from the Burdick program series is as follows:

Reason 1
Reason 2
Reason 3
Diagnostic Statement 1
Diagnostic Statement 2
Diagnostic Statement 3 / Additional Statement

Not all reasons or statements are printed for each output.

The criteria listed in the manual relate to the diagnostic statements together with a limited number of additional statements. The various reasons are not listed in detail, except in the sections dealing with ST-T abnormalities where they are essentially integral to the diagnostic statement as explained in the manual.

A unique feature of the Burdick Program is the ability to make use of age, sex, drug therapy and clinical classification of the patient. The full list of clinical classifications used is as follows:

Normal
Myocardial Infarction
Myocardial Ischemia
Hypertension
Congenital Heart Disease
Rheumatic Heart Disease
Pericarditis
Respiratory Disease
Endocrine Disease
Pulmonary Embolism
Post Cardiac Surgery
Cardiomyopathy
Other
Unknown

The list of drug therapies accepted is as follows:

Digitalis
Diuretic
Beta Blocker
Quinidine
Procainamide
Amiodarone
Disopyramide
Lidocaine
Other antiarrhythmic
Psychotropic
Steroid
No medication
Unknown
Other medication

The manner in which the clinical information is used will be apparent from a study of the criteria presented in this manual. It should be stressed that this approach is optional and in the event that the user does not wish to use clinical data, an interpretation will still be produced. It is however our strong belief that the ECG should be interpreted on the basis of a knowledge of the patient's clinical condition and for that reason it is recommended that the clinical information is input to the electrocardiograph to enhance the quality of the diagnostic statement.

Full details of the operation and programming of the electrocardiograph can be found in the relevant manual.

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University of Glasgow,
Scotland.

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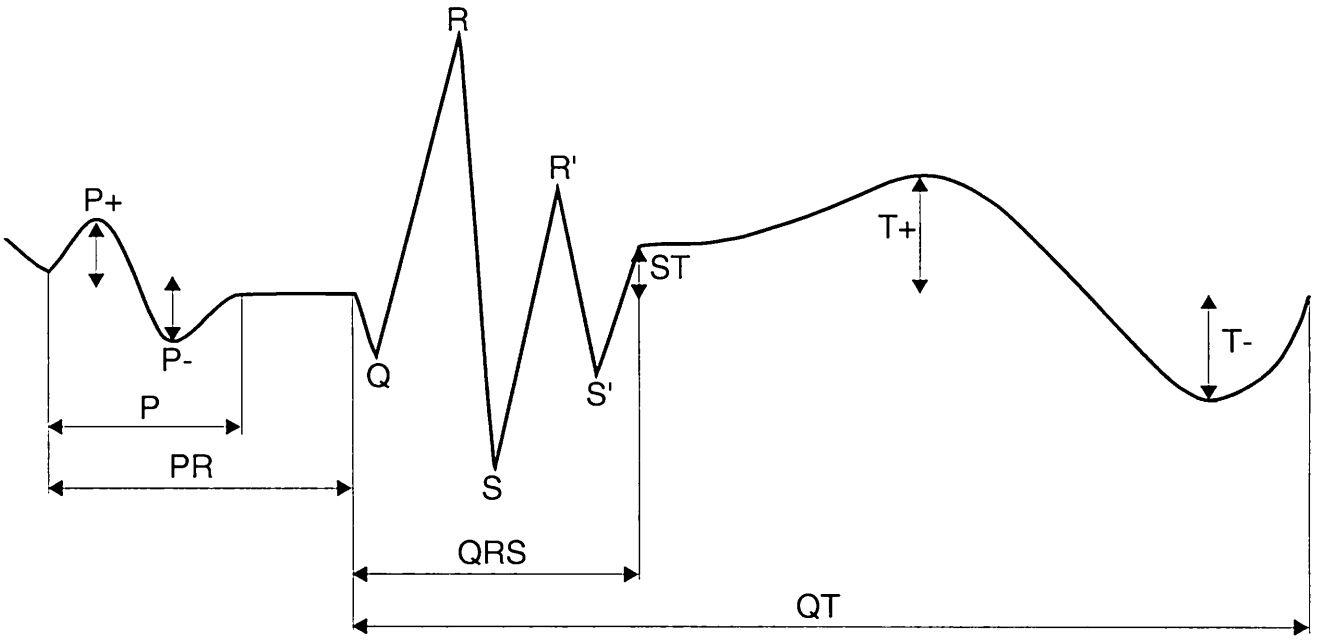

Figure 1 - Measurement Reference

Overall P onset, P offset, QRS onset, QRS offset and T termination are determined from all 12 leads. Individual lead wave amplitudes are then obtained.

P+ and P- are measured with respect to a straight line fitted between overall P onset and offset.

Q, R, S, R', S', T+ and T- amplitudes are measured with respect to a horizontal line through the lead QRS onset.

Durations are measured between relevant points.

Isoelectric components between the overall QRS onset and an individual lead onset are not included in a Q or R duration.

> **NOTE:** Computer assisted interpretation is a valuable tool when used properly. No automated analysis system is completely reliable, however, and interpretations should be reviewed by a qualified physician before treatment, or non-treatment, of any patient.

Chapter 2 PRELIMINARY COMMENTS

This introductory section of the diagnostic software checks the validity of the leads. The criteria apply to ECGs recorded from patients of all ages.

STATEMENTS

1. ? FAULTY Vn - OMITTED FROM ANALYSIS

For leads V2-V5:

(a) i. peak-peak QRS in any one of V2 to V5 < 0.35mV and < 1/3 peak-peak QRS of the leads on either side
or ii. if the peak to peak QRS in any one of V2 to V5 < 0.5 mV and < 1/5 peak-peak QRS of the leads on either side
and (b) T+ < 0.10mV with T- > -0.10mV in that lead

2. ? FAULTY V6 - OMITTED FROM ANALYSIS

(a) peak-peak QRS in V6 < 0.3mV, and < 1/3 peak-peak QRS in V5
or (b) peak-peak QRS in V6 < 0.5mV, and < 1/6 peak-peak QRS in V5
or (c) if P+ = 0 in V6 with QRS area in V6 < -200 and QRS area in V5 > 200

3. SEQUENCE ERROR: Vn, Vn+1 THEREFORE OMITTED

For leads V2-V5

(a) i. the QRS area in Vn is negative, and the QRS area in the leads on either side is positive
or ii. the QRS area in Vn < 25% of the area for Vn-1 and Vn+1, and all areas have the same sign
and (b) | QRS area | > 500 in Vn-1, Vn, and Vn+1

4. LEAD(S) ..... UNAVAILABLE

If any of the leads is not present, the above statement is printed with the appropriate lead identified.

5. POSSIBLE MEASUREMENT ERROR - CHECK DATA

The maximum absolute value of the P+ or P- wave in any lead exceeds 1.0mV.

LEAD REVERSAL/DEXTROCARDIA

This section of the program aims to detect the faulty application of the arm leads and to differentiate it from dextrocardia. In this case, the criteria are age dependent and allowance has to be made for the fact that Lead V3 may not be available in children.

CRITERIA

A. the P wave flag is set
B. $100° < P \text{ axis} \leq 180°$ or $-180° < P \text{ axis} < -100°$
C. $90° < QRS \text{ axis} \leq 180°$, or $-180° < QRS \text{ axis} < -90°$ and the QRS area in Lead I is negative
D. in V6, the peak to peak QRS > 0.5mV, with the QRS area > 0 and P+ > P-
E. i. $0 \leq R(n+1) \leq R(n)$ for n = V3, V4, V5 or $R \leq 0.1$mV for all of V3, V4, V5, V6
and ii. 100 > QRS area (n+1) > QRS area(n) for n = V3, V4, V5, and in V6, peak to peak QRS < 0.8mV, with R < 0.1mV, and QRS axis > 60°
F. i. in I, $|Q| > R \geq R'$, or ($|S| > R'$, with $Q = 0$ and $r'_I \neq 0$)
and ii. in V6, $S > 0.25$mV or $|R/S| \geq 2$
and iii. ST polarities are opposite in I and V6 as are T wave amplitudes

STATEMENTS

1. APPEARANCES SUGGEST ARM LEAD REVERSAL - ONLY LEADS aVF, V1-V6 ANALYZED

(a) A and B and C and (D or F) true and age > 180 days
or (b) C and F true and (not A) and age > 180 days
or (c) A and B and $\{ \Sigma T_I \times \Sigma T_{V6} < 0 \}$ and age ≤ 180 days
where $\Sigma T_I = T_I+ - |T_I-|$ and T+ is the amplitude of the positive component of the T wave and T- is the amplitude of the negative component of the T wave.

2. APPEARANCES SUGGEST DEXTROCARDIA: REPEAT WITH REVERSED LEADS. NO FURTHER ANALYSIS.

(a) 1 is not true
and (b) i. A and B and E are true
or ii. (not A) and C and E are true

RESTRICTED ANALYSIS

If it is not meaningful to interpret the QRS-T morphology for whatever reason, one of the following statements will be printed.

1. **NO FURTHER ANALYSIS MADE BECAUSE OF PACEMAKER RHYTHM**

2. **NO FURTHER ANALYSIS MADE - DOUBT AS TO SUITABLE BEAT(S). DOMINANT GROUP PRINTED**

3. **NO FURTHER ANALYSIS MADE - DOUBT OVER CHOICE OF CYCLE. DOMINANT GROUP PRINTED**

4. **SIMILAR QRS IN PRECORDIAL LEADS: ? SIMULATED ECG. NO FURTHER ANALYSIS**

MISCELLANEOUS PRELIMINARY STATEMENTS

The following statements can be printed in the event of faulty input of clinical data. The analysis continues with default values chosen.

1. INPUT CONTAINS INCOMPATIBLE CLINICAL DATA. THESE HAVE BEEN RESET AS UNKNOWN.

(a) clinical classifications are normal + any other
or (b) clinical classifications are unknown + any other

2. INPUT CONTAINS INCOMPATIBLE DRUGS. THESE HAVE BEEN RESET AS UNKNOWN

(a) drugs are unknown + any other

3. INTERPRETATION MADE WITHOUT KNOWLEDGE OF PATIENT'S SEX

4. INTERPRETATION MADE WITHOUT KNOWLEDGE OF PATIENT'S AGE

5. INTERPRETATION MADE WITHOUT KNOWLEDGE OF PATIENT'S SEX AND AGE

Chapter 3 *HEART RATE*

The limits for tachycardia and bradycardia are clearly age related in the neonatal and pediatric age range. In the Burdick program, a continuous limit of normality is used for certain age ranges such as from birth to 28 days (see example below). These data were obtained from a study of over 1,750 healthy neonates, infants and children.

TACHYCARDIA

Age Range	Rate in beats/min.
Birth - 28 days	163 → 180
29 days - 180 days	180
181 days - 17 years	180 → 100
≥18 years	100

BRADYCARDIA

Age Range	Rate in beats/min.
Birth - 28 days	88 → 105
29 days - 365days	105
1 year - 12.5 years	105 → 60
≥12.5 years	60

NOTE: The final limits of 100 and 60 are user programmable.

Example: For a neonate of 14 days of age, the tachycardia limit is 172/min and the bradycardia limit is 96/min.

Chapter 4 *INTERVALS*

The normal limit of PR interval is age dependent and the appropriate continuous equation is utilized in the software. To control specificity, it was decided to maintain the upper limit of normal for adolescents and adults at 0.20 seconds although there is evidence that it may be slightly less than this value particularly in the younger of these age ranges.

Since QT interval is essentially heart rate related, an age dependent equation has not been utilized. However, if the heart rate exceeds 125 per minute, no statement on corrected QT interval is printed. This approach also applies if the QRS duration is in excess of 120 milliseconds.

PR INTERVAL

Omit this section if:

(a) the P wave flag (from rhythm analysis) is not set,
or (b) the rhythm is not SINUS RHYTHM,
or (c) WPW pattern is present

STATEMENT

1. SHORT PR: POSSIBLE VENTRICULAR PREEXCITATION

(a) the PR interval is less than the lower limit for age as specified in the table:

Age range (years) :	limit (msecs)
0-11 :	[74 + 0.006*age(days)]
12+ :	10

2. SHORT PR INTERVAL

(a) age < 12 years Limit < overall PR interval < [limit = 10] msecs
or (b) age ≥ 12 years 100 < overall PR interval < 110 msecs

3. FIRST DEGREE A-V BLOCK

(a) The PR interval ≥ the age dependent limit as specified in the following table.

Age	Limit in msecs
≤ 18 years	[163 + 0.0087 Age(days)]
> 18 years	220

4. BORDERLINE FIRST DEGREE A-V BLOCK

(a) 3(a) is not true.

(b) The PR interval ≥ the age dependent limit as specified in the following table.

Age	Limit in msecs
≤ 18 years	[143+ 0.0087 Age(days)]
> 18 years	200

NOTE: Statements 3 and 4 are determined by the rhythm analysis.

QT INTERVAL

If the QRS duration ≥ 0.12s, or if the heart rate exceeds 125/minute, omit this section. The criteria in this section use the corrected QT interval denoted QTc. This is calculated from the following equation*:

$$QTc = QT + 1.75 \times (\text{heart rate} - 60)$$

STATEMENTS

1. LONG QTc: POSSIBLE HYPOCALCEMIA OR T-U FUSION

(a) i. QTc ≥ 0.46s for males or (females < 50 years)
or ii. QTc ≥ 0.47s for females ≥ 50 years
and (b) the heart rate < 110

2. LONG QTc: POSSIBLE HYPOCALCEMIA, T-U OR T-P FUSION

(a) i. QTc ≥ 0.46s for males
or ii. QTc ≥ 0.47s for females
and (b) the heart rate ≥ 110

3. LONG QTc - PROBABLY DUE TO DRUG THERAPY

(a) 1 or 2 above is true
and (b) drug therapy is beta blocker, quinidine, procainamide, amiodarone, dysopyramide or steroid.

This statement replaces 1 or 2 if true.

4. SHORT QTc: POSSIBLE HYPERCALCEMIA

(a) QTc ≤ 0.35s

5. SHORT QTc: POSSIBLE HYPERCALCEMIA, DIGITALIS EFFECT

(a) QTc ≤ 0.35s
and (b) drug therapy includes digitalis

*Hodges et al. J.A.C.C. 1983, 1(2):694.

Chapter 5 CONDUCTION DEFECTS

The duration criteria for conduction defects are now age dependent. As indicated in the Introduction, it is possible to utilize an equation to calculate the upper limit of QRS duration from birth to adolescence and a similar concept can be applied to determine the normal limits of the duration of Q, R, S waves individually. In order not to complicate the criteria listing, certain duration values are listed as a constant value plus an age dependent variable denoted by LIM1 or LIM2 or LIM3. The following table lists the values of these three variables at birth and in adolescence. Adult criteria are obtained by using the higher of the values while pediatric criteria are derived from an age dependent value intermediate to the two limits.

	Birth	Adolescence
LIM1	0	32msecs
LIM2	29	35msecs
LIM3	40	45msecs

As an example, Criterion 1a indicates that the R or R' duration in Lead I has to exceed 68msecs at birth or 100msecs in adulthood for the criterion to be met, while at age 10, the critical duration would be approximately 85msecs.

1. EXTENSIVE I.V. CONDUCTION DEFECT

(a) in Lead I, R or R' > LIM1 + 68
and (b) in Lead I, T+ < 0.1mV and T- < -0.1mV
and (c) in V1, R or R' > LIM3
and (d) the QRS spatial velocity at 4/8 or 5/8 < 40mV/sec
and (e) in V1, both Q and S have duration ≤ LIM1 + 68 or amplitude ≥ -1mV

2. LEFT BUNDLE BRANCH BLOCK

(a) the QRS spatial velocities at any two of 4/8, 5/8 and 6/8 < 100mV/sec
and (b) i. in Lead I, V5 or V6: R > LIM1 + 68, with Q > -0.02mV
or ii. in Lead I, V5 or V6: R' > LIM1 + 68, with S > -0.02mV
and (c) in V1, either Q or S ≥ LIM1 + 58 with amplitude < -1mV
and (d) (R+R') duration summed over I, V5 and V6 > 3*(LIM1 + 58)
and (e) R amplitude/R duration < 20 in I and (V5 or V6) with |R/S| > 4
and (f) QRS duration ≥ LIM1 + 88 in any two leads
and (g) in V2, sum of R+R' < 0.3mV

3. I.V. CONDUCTION DEFECT OF LEFT BUNDLE BRANCH BLOCK TYPE

None of the previous statements is true and from the following criteria either:
(a and b and c and d and f) is true
or (b and d and e and f) is true

(a) QRS duration > LIM1 + 88 in any two leads
(b) i. in Lead I, V5 or V6: R > LIM1 + 68, with Q > -0.02mV
or ii. in Lead I, V5 or V6: R' > LIM1 + 68, with S > -0.02mV
(c) i. in Lead I, S ≤ LIM2, or S ≥ -0.15mV, or |R/S| ≥ 4
and ii. in Lead I, S' ≤ LIM2, or S' ≥ -0.15mV, or |R'/S'| ≥ 4
(d) in V1 or V2, either Q or S > LIM1 + 68, with corresponding amplitude < -1.0mV
(e) the QRS spatial velocity at 4/8 and 5/8 < 100mV/sec
(f) (R+R') duration summed over I, V5 and V6 > 3*(LIM1 + 58)

4. INCOMPLETE LEFT BUNDLE BRANCH BLOCK

(a) i. in V5 or V6, R > LIM1 + 38, with Q > -0.02mV
or ii. in V5 or V6, R' > LIM1 + 38, with S > -0.02mV
and (b) i. in V5 or V6, 0.10s < QRS < 0.13 secs
and ii. in V1 or V2, 0.10s < QRS < 0.13 secs
and (c) the QRS spatial velocities at 4/8 and 5/8 < 100mV/sec
and (d) i. in I, S ≤ LIM2, or S ≥ -0.15mV or |R/S| > 4
and ii. in I, S' ≤ LIM2 or S' ≥ -0.15mV or |R'/S'| > 4

5. RIGHT BUNDLE BRANCH BLOCK

(a) QRS duration in V5 or V6 > LIM1 + 68, and QRS duration in V1 or V2 > LIM1 + 68
and (b) i. in I, V5 or V6, S > LIM2, and S < -0.14mV, and |R/S| < 4
or ii. in I, V5 or V6, S' > LIM2, and S' < -0.14mV, and |R'/S'| < 4
and (c) in V1 or V2, R or R' > 0.045 secs
and (d) i. the QRS spatial velocity at 4/8 or 5/8 < 40mV/sec
or ii. the QRS spatial velocity at 6/8 < 40mV/sec with the QRS spatial velocity at 6/8 less than at 7/8
and (e) in V1, T- < -0.1mV
and (f) QRS axis is not between -30° and -120° or R > |S| in II
and (g) i. QRS axis is not between 100° and 135° and age > 6 months
or ii. R and R' in Lead II < 0.8mV
or iii. R and R' in Lead III < 1mV
or iv. RVH is present
and (h) QRS duration > LIM1 + 78 in any two leads
and (i) WPW type A is not present

6. RIGHT BUNDLE BRANCH BLOCK WITH LEFT ANTERIOR FASCICULAR BLOCK

Test (a) below replaces tests (f), (g), (h) in RBBB above
or Test (a) below replaces tests (f) in IVCD of RBBB type

(a) i. -120° < overall QRS axis < -30° and R > |S| in II
and ii. Inferior myocardial infarction is not present

7. RIGHT BUNDLE BRANCH BLOCK WITH LEFT POSTERIOR FASCICULAR BLOCK

Test (a) below replaces (f), (g), (h) in RBBB
or Test (a) below replaces (f) in IVCD of RBBB type

(a) i. 100° ≤ overall QRS axis ≤ 135° and age > 6 months
and ii. R or R' in Lead II ≥ 0.8mV
and iii. R or R' in Lead III ≥ 1mV
and iv. RVH is not present

8. I.V. CONDUCTION DEFECT OF RIGHT BUNDLE BRANCH BLOCK TYPE

None of the previous statements is true and from the following criteria either:

i. (a and b and c) or (d and e)
and ii. (f) is true

(a) i. QRS > LIM1 + 78 in any two leads
and ii. QRS duration > LIM1 + 83 or RVH is not present
(b) in Lead V1 or V2, R > LIM3 with S = 0, or R' > LIM3
(c) i. in Lead I, S, S' and R all have 0 amplitude, and Q is not 0
or ii. in Lead I, V5 or V6, S > LIM2, and S < -0.14mV or |R/S| < 4
or iii. in Lead I, V5 or V6, S' > LIM2, and S' < -0.14mV or |R'/S'| < 4
(d) R or R' in Lead V1 > LIM1 + 88
(e) delta confidence value in Lead V1 is 0
(f) i. Overall QRS axis is not between -30° and -120°
and ii. R and R' in lead II < 0.8mV
or iii. R and R' in lead III < 1mV
or iv. RVH is present

9. I.V. CONDUCTION DEFECT

None of the previous statements is true and from the following criteria either:

(a) is true
or (b and c) is true.

(a) QRS duration ≥ LIM1 + 88 in any two leads
(b) in V1 or V2, Q or S > LIM1 + 68
(c) i. in lead I or V5, R > LIM1 + 68, and Q > -0.02mV
or ii in lead I or V5, R' > LIM1 + 68, and S > -0.02mV

10. INCOMPLETE RIGHT BUNDLE BRANCH BLOCK

(a) i. in V1 or V2, R' ≥ 0.2mV and, in the same lead,
R' -ST amplitude > 0.05mV and S' > 0.2mV, and R' > R
and ii. QRS duration < LIM1 + 88msecs.
and (b) i. there is no atrial fibrillation or flutter
or ii. there is atrial fibrillation or flutter
and R' amplitude > 3*max (P+, P-)

11. PROBABLE NORMAL VARIANT

(a) i. in V1 or V2, 0.15mV < R' < 0.2mV and, in the same lead,
R' -ST amplitude > 0.05mV and S' > 0.2mV and R' > R
and ii. QRS duration < LIM1 + 88msecs.
and (b) i. there is no atrial fibrillation or flutter
or ii. there is atrial fibrillation or flutter
and R' amplitude > 3*max (P+, P-)

12. POSSIBLE R.V. CONDUCTION DELAY

(a) i. in lead I, S > LIM2, and S < -0.15mV, and |R/S| < 4
or ii. in lead I, S' > LIM2, and S' < -0.15mV and |R'/S'| < 4
and (b) in lead V6, S > LIM2, and S < -0.2mV, and |R/S| < 4
and (c) the QRS spatial velocity at 5/8, 6/8 and 7/8 < 40mV/sec
and (d) QRS > LIM3 + 68

13. MINOR I.V. CONDUCTION DEFECT

(a) the R wave notch count is 1 or more in any lead I,II, III
and (b) the R wave notch count is 1 or more in any lead V4, V5 or V6

WPW PATTERN

In order to keep the criteria as sensitive as possible, the age dependence of the criteria in this section is extremely limited. The variable LIM1 is defined on page 5-1.

CRITERIA

A. there is a 70% confidence of Delta Waves in any two of V1-V6

B. i. PR + QRS < 0.30 secs
and ii. PR < 0.12 secs

C. i. PR < 0.17 secs
and ii. PR + QRS < 0.32 secs

D. there is a 90% confidence of Delta Waves in any two of Leads I, II, III, aVR, aVL, aVF

E. there is a 70% confidence of a Delta Wave in V1, and R in V1 > 0.5mV, and S in V1 > -0.5mV

F. there is a 70% confidence of a Delta Wave in V4 or V5 or V6, and R in V1 ≤ 0.5mV and R in V5 ≥ 0.5mV and Q in V4 and V5 > -0.05mV

G. there is 90% confidence of a Delta Wave in V1 and R in V1 > 0.5mV, and S in V1 > -0.5mV

H. there is 90% confidence of a Delta Wave in V4 or V5 or V6 and R in V1 ≤ 0.5mV and R in V5 ≥ 0.5mV and Q in V4 and V5 > -0.05mV

J. R wave in V5 or V6 > 3mV and the R in V1 ≤ 0.5mV and there is a 30% confidence of a Delta Wave in I, V5 or V6

K. QRS > LIM1 + 88msecs

L. R in V1 > 0.5mV and there is a 30% confidence of a Delta Wave in V1

M. in V1, the QRS area > 0

N. in V5, the QRS area > 0 and M is not true

STATEMENTS

1. WPW PATTERN TYPE A

i. A is true
and ii. (B and E) or (C and G) are true

2. WPW PATTERN TYPE B

i. A is true
and ii. (B and F) or (C and H) are true

3. POSSIBLE WPW PATTERN TYPE A

i. 1 and 2 are false
and ii. (B and L) or (C and E) are true
and iii. K is false

4. POSSIBLE WPW PATTERN TYPE B

i. 1 and 2 are false
and ii. (B and J) or (C and F) are true
and iii. K is false

5. CONSIDER WPW PATTERN TYPE A

i. None of 1 to 4 is true
and ii. A or D is true
and iii. C is true
and iv. M is true

6. CONSIDER WPW PATTERN TYPE B

i. None of 1 to 4 is true
and ii. A or D is true
and iii. C is true
and iv. N is true

Chapter 6 *HYPERTROPHY*

LEFT VENTRICULAR HYPERTROPHY

If WPW or LBBB or IVCD of LBBB type has been detected, this section is omitted.

The criteria for LVH are in the form of points awarded for each test with the points being totalled to give a final score. In a fashion similar to the use of a continuous equation for a normal limit of duration, it is feasible to use such an equation for upper limits of normal voltage of Q, R and S amplitudes. Such equations are used for diagnosing LVH in children in which case the continuous equations are on occasions split into two with one equation being from birth to one month of age and the other being from one month until adolescence. It is also worth noting that equations are dependent on race and at the present time, separate equations are available for Caucasian and Oriental adults.

For convenience, a short table of significant limits is presented below. Limits for children are intermediate to those for birth and 17 years.

CRITERIA

A. Amplitude (use only the maximum score from criteria i-v). Each part scores 2 points. In addition, Part i, scores 1 extra point for each 0.3mV over the limit. Parts ii, iii and v score 1 extra point for every 0.5mV over the limit for patients aged 17 and over. Also, 1 point is deducted from i-v if there are Q waves or low R waves in the anterior leads.

i. the largest R in I or aVL ≥ an age and sex dependent limit (LIM1 and LIM2 respectively)
ii. |S| in V1 or V2 ≥ an age and sex dependent limit (LIM3)
iii. R in V5 or V6 ≥ an age and sex dependent limit (LIM4)
iv. the Lewis Index (RI + |S|III) - (RIII+ |S|I) > an age and sex dependent limit (for age 17 and over only) (LIM5)
v. the Sokolow Lyon Index |SV1| + RV5 > an age and sex dependent limit (for age 17 and over only) (LIM6)

Table of sex and age dependent limits for criterion A.
All figures are in millivolts.

	Birth	17 years		50 years	
		Male	Female	Male	Female
LIM1	1.3	1.5	1.5	1.6	1.4
LIM2	0.9	1.1	0.9	1.3	1.2
LIM3	3.0	4.0	3.5	2.5	2.0
LIM4	3.25	4.0	2.5	2.5	2.2
LIM5	-	2.5	2.0	2.0	1.8
LIM6	-	5.0	4.25	4.5	3.75

A complete table is too detailed to print. The adult age ranges currently used are 17-29, 30-39, 40-49, 50 and over.

B. (1-4 points)

(a) In any of I, aVL, V5 or V6

i. ST ≤ -0.02mV and ST slope is downward sloping
ST ≤ -0.05mV and ST slope is flat or downward sloping
ii. ST - T- > 0.1mV
iii. T- < -0.2mV with T+ < 0.15mV
iv. R or R' > 1.0mV
v. There are no pathological Q waves in the lateral leads
vi. QRS < 0.12secs.

Score 4 points if i-vi are true
Score 2 points if i, ii, iii, v, vi are true

(b) If (a) is not true then consider:

i. ST or T changes in the lateral leads
ii. A (i or iv is true)
iii. A (ii, iii or v) is true and not anterior infarction
iv. A (ii, iii or v) is true and anterior infarction
v. QRS < 0.12secs.

Score 2 points if i, v and (ii or iii)
Score 1 point if i, iv and v.

NOTE: If B(a) or B(b) is true, deduct 2 points if there is inferior infarction with T- aVF < -0.05mV.

C. (2 points).

i. the P wave flag is set
and ii. the terminal amplitude of P in V1 < -0.1mV
and iii. the terminal duration of P in V1 ≥ 0.04 seconds

If C is not true, score 1 if atrial fibrillation or atrial flutter is present.

D. (2 points).

i. inferior infarction has not been detected
and ii. -120° < frontal QRS axis < -30°

E. (1 point).

i. the QRS duration in lead V5 or V6 ≥ 0.10 seconds
ii. RBBB of any type is not present

F. (1 point).

i. the intrinsicoid deflection in V5 or V6 ≥ 60ms
and ii. there are no pathological Q waves (see Myocardial Infarction section) in the corresponding lead.

STATEMENTS

1. LEFT VENTRICULAR HYPERTROPHY

(a) score ≥ 6 points

2. PROBABLE LEFT VENTRICULAR HYPERTROPHY

(a) score = 5 points

3. POSSIBLE LEFT VENTRICULAR HYPERTROPHY

(a) score = 4 points and there are ST or T abnormalities in the lateral leads.

4. WITH SECONDARY ST-T CHANGES

This statement is added to 1, 2 or 3 if B(a) is true

5. WITH ST-T CHANGES LIKELY TO BE DUE IN PART TO MYOCARDIAL ISCHEMIA

This statement is added to 1, 2 or 3 if the following are true:

i. 4 is not true
and ii. there are no anteroseptal ST-T abnormalities
and iii. T < -0.2mV in aVF with no inferior infarction or
T < -0.2mV in I or V5 or V6 with no lateral infarction
and iv. age ≥ 30 if male and age ≥ 40 if female

6. WITH ST-T CHANGES PARTLY DUE TO MYOCARDIAL ISCHEMIA/DIGITALIS EFFECT

This statement is added to 1, 2 or 3 if the following are true:

i. 5 is true
ii. patient is receiving digitalis

7. WITH SECONDARY ST-T CHANGES WHICH MAY BE DUE IN PART TO DIGITALIS EFFECT

This statement is added to 1, 2 or 3 if the following are true:

i. B(a) is true
ii. Patient is on digitalis

8. CONSIDER LEFT VENTRICULAR HYPERTROPHY SUGGESTED BY VOLTAGE CRITERIA ONLY

i. LVH score ≥ 4
and ii. criteria B-F are false
and iii. there are no lateral ST-T changes

9. MAY BE NORMAL VARIANT CONSISTENT WITH CLINICAL FINDINGS

This statement replaces 2 or 3 if the following are true:

i. the LVH score ≤ 5
and ii. any part of A is true
and iii. there is no BVH
and iv. the patient is less than 35 years old
and v. there are no ST-T changes
and vi. there are no ST-T reasons for LVH set
and vii. clinical classification is normal

10. MAY BE NORMAL VARIANT IF NO CLINICAL ABNORMALITY FOUND

This statement replaces 2 or 3 if the following are true:

i. if 9 i-vi are true
and ii. clinical classification is not normal, hypertension, congenital heart disease, rheumatic heart disease or cardiomyopathy.

RIGHT VENTRICULAR HYPERTROPHY

If WPW has been detected, this section is omitted.

The criteria for RVH are in the form of points awarded for each test. The points are totalled to give a final score.

The upper limits of normal voltage used for R and S amplitudes in the diagnosis of right ventricular hypertrophy are age dependent and can be made available in the form of continuous equations. A complete set of equations is too complex to include but as an example, the upper limit of S wave amplitude in Lead I is presented. The equation is valid from birth to 30 days.

$$LIM1 = \{40 - 0.267 \times Age(days)\}^2 \mu V$$

The following table is a guide to the various limits used in this section. Adult criteria are obtained using the higher values while pediatric criteria are derived from an age dependent value intermediate to the two lower limits.

Table of age dependent limits for criteria below.

	Birth	Adolescence	Age 60
LIM1	1.6 mv	0.482	0.36
LIM2	2.5 mv	1.5	
LIM3	3.14 mv	0.78	0.56
LIM4	2.17 mv	1.6	
LIM5	10.9	1.1	
LIM6	204°	90°	

CRITERIA

A. (2 points).

i. in lead I, either S or S' > LIM1
and ii. in lead I, R > 0.1mV
and iii. in Lead I, |S| > R or |S'| > R'

B. (3 points).

i. in lead I, either S or S' > 2.5*LIM1
with R > 0.1mV(2.723mV→1.0mV)
or ii. in V5, either S or S' > 1.5*LIM2

NOTE: If both A and B are true, count only B.

C. (2 points).

i. in lead V1, the R > LIM3 or R' amplitude > 0.7mV
and ii. T+ in V1 ≤ 0.7mV (age 12-30), or 0.5mV (age ≥ 30)
or iii. In V4R, R > LIM4 or R' > 0.7mV
and iv. T+ in V4R ≤ 0.7mV

D. (1 point).

R' > 0.1mV and R' > R in lead V1

E. (2 points).

i. in V1, the R/ | S | amplitude ratio ≥ LIM5 with S not equal to 0
or ii. in V1, Q and S = 0mV
and iii. in V1, either R or R' > 0.4mV
and iv. T+ amplitude in V1 ≤ 0.5mV

F. (3 points).

i. in V1, | Q | > 0.1mV and Q ≥ 0.025 secs., and R ≥ 0.25mV with R-ST_j ≥ 0.04mV and S = 0mV
or ii. in V1, | S | > 0.1mV and S > 0.025 secs, and R' > 0.25mV with R'-ST_j > 0.04mV, and R < 0.075mV

G. (1 point).

in aVF, the P+ amplitude ≥ 0.3mV

H. (1 point).

i. in aVF, the ST junction is negative
or ii. in aVF, T- < -0.1mV, and the T wave is not (biphasic, starting positive)

J. (3 points).

i. in V2, ST_j < 0.02mV with downward slope < -10 and age > 5 years
or ii. in V2, T- < -0.1mV

K. (1 point)

LIM6 < QRS axis < 270°

L. (1 point).

i. in all the leads I, II, and III, | S | > 0.2mV
and ii. QRS axis > 0°.

STATEMENTS

1. RIGHT VENTRICULAR HYPERTROPHY

(a) Score ≥ 6 points

2. PROBABLE RIGHT VENTRICULAR HYPERTROPHY

(a) Score = 5 points

3. POSSIBLE RIGHT VENTRICULAR HYPERTROPHY

(a) Score = 4 points

4. WITH SECONDARY ST-T CHANGES

This statement is added to 1, 2 or 3 if the following is true in V1 or V2 or aVF, the latter if 75° < QRS axis ≤ 180°.

(a) Marked downward ST slope
and (b) ST < -0.05mV
and (c) T- < -0.2mV

5. WITH SECONDARY ST-T CHANGES WHICH MAY BE DUE IN PART TO DIGITALIS EFFECT

i. 4 is true
and ii. patient is on digitalis

BIVENTRICULAR HYPERTROPHY

STATEMENTS

If LBBB, or IVCD of LBBB type, or WPW is set true, omit this section.

1. BIVENTRICULAR HYPERTROPHY

(a) i. LV hypertrophy score ≥ 6 points
and ii. RV hypertrophy score ≥ 6 points
or (b) the maximum QRS vector > an age dependent limit (see table below)

2. PROBABLE BIVENTRICULAR HYPERTROPHY

(a) statement 1 is not true
and (b) i. LV hypertrophy score ≥ 5 points
and ii. RV hypertrophy score ≥ 5 points
or (c) i. LV hypertrophy score ≥ 11
and ii. the maximum QRS vector (in I, aVF, V2) > age dependent limit (see table below).

3. POSSIBLE BIVENTRICULAR HYPERTROPHY

(a) statements 1 and 2 are not true
and (b) i. LV hypertrophy score ≥ 4
and ii. RV hypertrophy score ≥ 4

4. WITH SECONDARY ST-T CHANGES

This statement is added to 1, 2 or 3 if

(a) LVH criterion B(a) is true
or (b) RVH statement 4 is true

Table of age dependent limits for max QRS vector

	Age < 30	30<Age<39	Age ≥ 40
BVH	6.0mV	5.0mV	4.5mV
PROBABLE BVH	5.5mV	4.5mV	4.0mV

5. WITH ST-T CHANGES WHICH MAY BE DUE IN PART TO MYOCARDIAL ISCHEMIA

(a) 4 is not true
and (b) i. T- aVF < 0.2mV and there is not inferior infarction
or ii. T- < -0.2mV in I, V5 or V6 and there is not lateral myocardial infarction
and (c) iii. age ≥ 30 if male and age ≥ 40 if female

6. WITH ST-T CHANGES WHICH MAY BE DUE IN PART TO MYOCARDIAL ISCHEMIA/DIGITALIS EFFECT

(a) 4 or 5 is true
and (b) Patient is on digitalis
and (c) age ≥ 30 if male and age ≥ 40 if female

Chapter 7 MYOCARDIAL INFARCTION

Omit this section if WPW is present.

Omit leads V2-V4 if LBBB is present.

CRITERIA: Q WAVES IN INFERIOR AND LATERAL LEADS

Q1 (a) i. Q > 0.035 secs and |Q/R| > 1/5
or ii. Q > 0.04secs
or iii. T axis < 0, and Q > 0.028 secs, and |Q/R| > 1/4 in aVF
and (b) |Q| > 0.09mV
and (c) peak to peak QRS > 0.15mV

Q2 (a) i. Q > 0.035 secs
or ii. Q > 0.030 secs and |Q/R| ≥ 1/3
and (b) |Q| > 0.2mV
and (c) peak to peak QRS > 0.15mV

Q3 (a) Q > 0.026 secs or |Q/R| > 1/5
and (b) |Q| > 0.11mV
and (c) peak to peak QRS > 0.15mV

Q4 (a) i. Q ≥ 0.03 secs and T- < -0.1mV
or ii. |Q/R| > 1/3 and Q > 0.02 secs and age > 20
and (b) |Q| > 0.075mV
and (c) peak to peak QRS > 0.2mV
and (d) i. T- < -0.05mV
or ii. ST > 0.06mV

Q5 (a) |Q/R| > 1/4 in II and |Q| > 0.1mV
(b) QRS axis < 0
(c) Age > 20 years

Q6 (a) i. R amplitude in II < R amplitude in III
and ii. QRS axis ≤ -30
and iii. R < 0.20mV in III.
or (b) i. Q ≥ 0.015 secs and R < 0.1mV and S > 0.02 secs in aVF
and ii. peak-peak QRS > 0.15mV in aVF

Q7 (a) T axis < -10
(b) R < 0.90mV in II
(c) |Q/R| > 1/5 in any 2 of II, III, or aVF

Similar criteria apply when a small primary r is present. In this case, S replaces Q and R' replaces R.

INFERIOR INFARCTION

STATEMENTS

The tests for Q1 to Q4 are carried out on II, III, and aVF. The following statements therefore refer to findings in these leads.

1. ACUTE INFERIOR INFARCTION

(a) i. there are two or more Q1
or ii. there is at least one Q1 and one Q2
and (b) ST ≥ 0.1mV in II or aVF
and (c) -10° < slope of ST segment
and (d) T- ≥ -0.05mV in inferior leads

2. RECENT INFERIOR INFARCTION

(a) i. there are two or more Q1
or ii. there is at least one Q1 and one Q2
and (b) ST elevation ≥ 0.06mV in II or aVF
and (c) T- < -0.1mV in II or aVF

3. OLD INFERIOR INFARCTION

(a) i. there are two or more Q1
or ii. there is at least one Q1 and one Q2
(b) there is no ST elevation in II or aVF
(c) there are no T wave abnormalities in the inferior leads

4. INFERIOR INFARCTION, PROBABLY ACUTE

(a) i. there are two or more Q1
or ii. there is at least one Q1 and one Q2
and (b) ST ≥ 0.06mV in II or aVF
and (c) 0° < ST slope in aVF < 25°
and (d) T- ≥ -0.05mV in II or aVF

5. INFERIOR INFARCTION, POSSIBLY ACUTE

(a) i. there are two or more Q1
or ii. there is at least one Q1 and one Q2
and (b) ST ≥ 0.06mV in II or aVF
and (c) ST slope in aVF ≤ 0°
and (d) T- ≥ -0.05mV in II or aVF

6. INFERIOR INFARCTION - AGE UNDETERMINED

(a) i. there are two or more Q1
or ii. there is at least one Q1 and one Q2
and (b) the infarct is not **ACUTE, PROBABLY ACUTE, POSSIBLE ACUTE, RECENT,** or **OLD**

7. PROBABLE ACUTE INFERIOR INFARCTION

(a) i. there is one Q1 and at least one Q3 or Q4
or ii. there are two or more Q2
or iii. there is one Q2 and one Q3
or iv. there is one Q1 from II or aVF
or v. there is one Q5
and (b) ST ≥ 0.06mV in II or aVF
and (c) T- ≥ -0.05mV in II or aVF

NOTE: Statements 2, 3 and 6 are preceded by PROBABLE if:
(a) 7(a) is true and 2(a) is not true
and (b) corresponding parts of 2, 3, 6 are true

8. POSSIBLE ACUTE INFERIOR INFARCTION

(a) i. there is one Q2 and one Q4
or ii. there are two or more Q3 with |Q/R| > 1/4
or iii. there is one Q6 or one Q7
and (b) ST ≥ 0.06mV in II or aVF
and (c) T- ≥ -0.05mV in II or aVF

NOTE: Statements 2, 3 and 6 are preceded by POSSIBLE if:
(a) 8(a) is true and 2(a) and 7(a) are not true
and (b) corresponding parts of 2, 3, 6 are true

9. INFERIOR INFARCTION

(a) 1(a), 7(a) or 8(a) is true
and (b) none of the preceding statements is true

10. ABNORMAL VENTRICULAR CONDUCTION PATHWAYS

(a) if any of the previous statements is true
and (b) the age of the patient is less than 20 years

Replace the previous statement with this one.

INFERIOR INFARCTION STATEMENT ADDITION

11. CARDIOMYOPATHY ALONE MAY CAUSE Q WAVES

(a) any of the inferior infarction statements is set
and (b) there is a clinical classification of cardiomyopathy
and (c) T+ ≥ 0.05mV in II and aVF

LATERAL INFARCTION

STATEMENTS

The tests for Q1 to Q4 are carried out on I, aVL, V5, V6.
The following statements therefore refer to findings in these leads.

1. ACUTE LATERAL INFARCTION

(a) i. there are two or more Q1
or ii. there is one Q1 and at least one Q2
and (b) ST ≥ 0.1mV in I, V5 or V6
and (c) -10° < ST slope in I, or V5
and (d) T- ≥ 0mV in I, V5, V6

2. RECENT LATERAL INFARCTION

(a) i. there are two or more Q1
or ii. there is one Q1 and at least one Q2
and (b) ST ≥ 0.06mV in I, V5 or V6
and (c) T- < -0.05mV in I, V5 or V6

3. OLD LATERAL INFARCTION

(a) i. there are two or more Q1
or ii. there is one Q1 and at least one Q2
and (b) there are no ST-T abnormalities in I, V5 or V6

4. LATERAL INFARCTION, PROBABLY ACUTE

(a) i. there are two or more Q1
or ii. there is one Q1 and at least one Q2
and (b) ST ≥ 0.06mV in I, V5 or V6
and (c) 0° < ST slope in I, or V5 < 25°
and (d) T- ≥ -0.05mV in I, V5 or V6

5. LATERAL INFARCTION, POSSIBLY ACUTE

(a) i. there are two or more Q1
or ii. there is one Q1 and at least one Q2
and (b) ST ≥ 0.06mV in I, V5 or V6
and (c) ST slope in I or V5 ≤ 0°
and (d) T- ≥ -0.05mV in I, V5 or V6

6. LATERAL INFARCTION - AGE UNDETERMINED

(a) i. there are two or more Q1
or ii. there is one Q1 and at least one Q2
and (b) none of ACUTE, PROBABLY ACUTE, POSSIBLE ACUTE, RECENT or OLD is true

7. PROBABLE ACUTE LATERAL INFARCTION

(a) i. there is one Q1 and at least one Q3 or Q4
or ii. there are two or more Q2
or iii. there is one Q2 and one Q3
and (b) ST ≥ 0.06mV in I, V5 or V6
and (c) T- > -0.05mV in I, V5 or V6

NOTE: Statements 2, 3 and 6 are preceded by PROBABLE if:
(a) 7(a) is true and 2(a) is not true
and (b) corresponding parts of 2, 3, 6 are true

8. POSSIBLE ACUTE LATERAL INFARCTION

(a) i. there is one Q2 and one Q4
or ii. there are two or more Q3 with |Q/R| > 1/4
or iii. there is one or more Q1 from I, V5 or V6
and (b) ST ≥ 0.06mV in I, V5 or V6
and (c) T- ≥ -0.05mV in I, V5 or V6

NOTE: Statements 2, 3 and 6 are preceded by POSSIBLE if:
(a) 8(a) is true and 2(a) and 7(a) are not true
and (b) corresponding parts of 2, 3, 6 are true

9. LATERAL INFARCTION

(a) 1(a), 7(a) or 8(a) is true
and (b) none of the above statements is true

10. ABNORMAL VENTRICULAR CONDUCTION PATHWAYS

(a) if any of the previous statements is set true
and (b) the age of the patient is less than 20 years

Replace the previous statement with this one.

LATERAL INFARCTION STATEMENT ADDITION

11. CARDIOMYOPATHY ALONE MAY CAUSE Q WAVES

(a) any of the lateral infarction statements is set
and (b) there is a clinical classification of cardiomyopathy
and (c) T+ ≥ 0.05mV in I, V5 and V6
there are no sequential changes or T wave improvements in lateral leads

CRITERIA: Q WAVES IN ANTEROSEPTAL, ANTERIOR OR SEPTAL LEADS

VQ1

(a) i. |Q| > 0.2mV
and ii. Q > 0.03 secs
and iii. peak to peak amplitude > 0.2mV

or (b) i. R = 0
and ii. |S| > 0.2mV
and iii. S > 0.03secs
and iv. peak to peak amplitude > 0.2mV

VQ2

(a) i. |Q| > 0.14mV
and ii. Q > 0.015 secs
and iii. |Q/R| > 1/4
and iv. peak to peak amplitude > 0.2mV

or (b) i. R < 0.065mV
and ii. |S| > 0.14mV
and iii. S > 0.015 secs
and iv. |S/R'| > 1/4

VQ3

(a) i. R < 0.11mV
and ii. R' < 2R amplitude, or RBBB or IVCD of RBBB type is present
and iii. |R/S| < 0.125
and iv. the peak to peak amplitude > 0.2mV
and v. RVH is not present

VQ4

(a) i. R in V(n) - R in V(n+1) > 0.02mV in the adjacent precordial lead, (e.g. RV3 < RV2)
ii. R < 0.3mV in those two leads
iii. R' < R in those two leads

QRVH

(a) i. R > 0.3mV with S = 0mV or R < 0.1mV with R' > 0.3mV
and ii. RBBB or IVCD or IVCD of RBBB type are not present
and iii. ST in V2 ≤ 0.12mV or ST < 1/2 T+

or (b) i. R < 0.3mV or S is not 0mV
and ii. in lead I, S or S' < -0.5mV
and iii. there is a clinical classification of congenital heart disease, rheumatic heart disease, pericarditis, respiratory disease, pulmonary embolism, post cardiac surgery, cardiomyopathy or other/not known
and iv. RBBB or IVCD or IVCD of RBBB type are not present

PRWP

(a) i. R V3 < 0.3mV and R' V3 < 0.3mV
and ii. None of VQ1-VQ4 is true

ANTEROSEPTAL MYOCARDIAL INFARCTION

STATEMENTS

The tests for VQ1 - VQ4 are applied to V2 - V4.
The following statements therefore apply to findings in these leads.

1. ACUTE ANTEROSEPTAL INFARCTION

(a) VQ1 is true for V2 and one of V3, V4 with QRVH false in V1
and (b) ST ≥ 0.2mV in one lead
and (c) ST slope > 0° in V2
and (d) T- ≥ -0.10mV in both leads
and (e) ST ≥ 1/2 T+ in V2 or V3

2. RECENT ANTEROSEPTAL INFARCTION

(a) VQ1 is true for V2 and one of V3, V4 with QRVH false in V1
and (b) ST ≥ 0.12mV in two leads
and (c) T- < -0.1mV in V2 or V3

3. OLD ANTEROSEPTAL INFARCTION

(a) VQ1 is true for V2 and one of V3, V4 with QRVH false in V1
and (b) ST < 0.12mV in V2-V4 and T > 0.1mV in V2-V4

4. ANTEROSEPTAL INFARCTION, PROBABLY ACUTE

(a) VQ1 is true for V2 and one of V3, V4 with QRVH false in V1
and (b) ST ≥ 0.12mV in two leads
and (c) 0° < ST slope in V2 < 25°
and (d) T- ≥ -0.10mV in all leads
and (e) ST ≥ 1/2 T+ in V2 or V3

5. ANTEROSEPTAL INFARCTION, POSSIBLY ACUTE

(a) VQ1 is true for V2 and one of V3, V4 with QRVH false in V1
and (b) ST ≥ 0.12mV in two leads
and (c) ST slope ≤ 0°
and (d) T- ≥ -0.10mV in all leads
and (e) ST ≥ 1/2 T+ in V2 or V3

6. ANTEROSEPTAL INFARCTION - AGE UNDETERMINED

(a) VQ1 is true for V2 and one of V3, V4 with QRVH false in V1
and (b) none of ACUTE, PROBABLY ACUTE, POSSIBLY ACUTE, RECENT, OLD is set true
and (c) T- < -0.10mV in one lead and T < 0.1mV in V2-V4

7. PROBABLE ACUTE ANTEROSEPTAL INFARCTION

(a) one VQ1 is true, and there is a VQ in V2 and in V3 or V4 with QRVH false in V1
and (b) ST ≥ 0.12mV in two leads
and (c) T- ≥ -0.10mV in all leads
and (d) ST ≥ 1/2 T+ amplitude in V2 or V3

NOTE: Statements, 2, 3 and 6 are preceded by PROBABLE if:
(a) 7(a) is true and 2(a) is not
and (b) corresponding parts of 2, 3, 6 are true except 6(c)

8. POSSIBLE ACUTE ANTEROSEPTAL INFARCTION

(a) i. VQ2(a) is true in V2 and one of V3, V4 with QRVH false in V1
or ii. VQ2(b) is true in V2 and one of V3, V4
and (b) ST ≥ 0.12mV in two leads
and (c) T- ≥ -0.10mV in all leads
and (d) ST ≥ 1/2 T+ in V2 or V3

NOTE: Statements 2, 3 and 6 are preceded by POSSIBLE if:
(a) 8(a) is true and 1(a), 7(a) are not
and (b) corresponding parts of 2, 3, 6 are true except 6(c)

9. ANTEROSEPTAL INFARCTION

(a) any of 1(a), 8(a) is true
and (b) none of the above statements is true

10. ABNORMAL VENTRICULAR CONDUCTION PATHWAYS

(a) any of the above statements is true,
and (b) the age of the patient is less than 20 years

This statement replaces any of 1-9, if true.

11. IN VIEW OF VALVULAR HEART DISEASE, ANTEROSEPTAL CHANGES MAY BE DUE TO VENTRICULAR HYPERTROPHY

(a) any of the above statements is true
and (b) T+ ≥ 0.10mV in V2-V4
and (c) ST < 1/2 T+ in V2, V3
and (d) RECENT ASMI is not true
and (e) there is not a clinical classification of myocardial infarction but there is of rheumatic heart disease

This statement replaces any previous one, if true.

12. IN VIEW OF CONGENITAL HEART DISEASE, ANTEROSEPTAL CHANGES MAY BE DUE TO CORRECTED TRANSPOSITION

(a) if any of the statements 1-9 is set true
and (b) T+ ≥ 0.10mV in V2-V4
ST < 1/2 T+ in V2 and V3, and not RECENT ASMI
and (c) there is not a clinical classification of myocardial infarction but there is of congenital heart disease

13. CONSIDER ANTEROSEPTAL INFARCT - ALTHOUGH CHANGES V2-V4 MAY BE DUE TO LEFT VENTRICULAR HYPERTROPHY ALSO PRESENT

(a) if any of the statements 1-9 is set true
and (b) LVH is present
and (c) ST < 1/2 T+ in V2 and V3, and there is not RECENT ASMI
and (d) there is not a clinical classification of either congenital heart disease or rheumatic heart disease
and (e) the age of the patient is 20 years or over
and (f) VQ1 is false in both V3 and V4
and (g) there is not clockwise cardiac rotation

This statement replaces any of 1-9, if true.

14. CONSIDER ANTEROSEPTAL INFARCT - THOUGH CHANGES V2-V4 MAY BE DUE TO LEFT VENTRICULAR HYPERTROPHY. REPEAT ADVISED.

(a) 13(a) to (g) are true
and (b) clinical classification is myocardial infarction

This statement replaces any of 1-9, if true.

15. CHANGES V2-V4 ARE PROBABLY DUE TO LEFT VENTRICULAR HYPERTROPHY BUT CONSIDER ANTEROSEPTAL INFARCTION

(a) if any of the statements 1-9 is set true
and (b) LVH is present with secondary ST-T changes and |S|
in V2 > 2.0mV
and (c) ST < 1/2 T+ in V2 and V3, and there is not RECENT ASMI
and (d) there is not a clinical classification of either congenital heart disease or rheumatic heart disease
and (e) the age of the patient is 20 years or over
and (f) there is not clockwise cardiac rotation and VQ1 is false in V4

This statement replaces any of 1-9, if true.

16. CHANGES V2-V4 ARE PROBABLY DUE TO LEFT VENTRICULAR HYPERTROPHY BUT CONSIDER ANTEROSEPTAL INFARCTION. REPEAT ADVISED.

(a) 15(a) to (f) are true
and (b) clinical classification is myocardial infarction

17. CHANGES V2-V4 ARE PROBABLY RELATED TO POOR R WAVE PROGRESSION BUT ANTEROSEPTAL INFARCTION CANNOT BE EXCLUDED

(a) if any of the statements 1-9 is set true
and (b) ST < 1/2 T+ in V2 and V3, and there is not RECENT ASMI
and (c) clockwise cardiac rotation is true, and VQ1 false in V4

This statement replaces any of 1-9, if true.

18. ANTEROSEPTAL CHANGES ARE PROBABLY RELATED TO POOR R WAVE PROGRESSION CONSISTENT WITH PULMONARY DISEASE

(a) 17(a) to (c) are true
and (b) there is a clinical classification of respiratory disease but not of myocardial infarction

This statement replaces 1-9, if true.

ANTEROSEPTAL INFARCTION STATEMENT ADDITION

1. CARDIOMYOPATHY ALONE MAY CAUSE Q WAVES

(a) any of the anteroseptal infarction statements is set
and (b) there is a clinical classification of cardiomyopathy
and (c) T+ > 0.10mV in V2-V4

ANTERIOR MYOCARDIAL INFARCTION

STATEMENTS

The tests for VQ1-VQ4 are applied to V3, V4. The following statements therefore apply to findings in these leads.

1. ACUTE ANTERIOR INFARCTION

(a) VQ1 is true for V3 and V4 with QRVH false in V1
and (b) ST ≥ 0.2mV in one lead
and (c) ST slope > 0° in V3
and (d) T- ≥ -0.10mV in both leads
and (e) ST ≥ 1/2 T+ in V3 or V4

2. RECENT ANTERIOR INFARCTION

(a) VQ1 is true for V3 and V4 with QRVH false in V1
and (b) ST ≥ 0.12mV in both leads
and (c) T- < -0.1mV in V3 or V4

3. OLD ANTERIOR INFARCTION

(a) VQ1 is true for V3 and V4 with QRVH false in V1
and (b) ST < 0.12mV in V3, V4 and T+ ≥ 0.1mV in V3, V4

4. ANTERIOR INFARCTION, PROBABLY ACUTE

(a) VQ1 is true for V3 and V4 with QRVH false in V1
and (b) ST ≥ 0.12mV in both leads
and (c) 0° < ST slope in V2 < 25°
and (d) T- ≥ -0.10mV in both leads
and (e) ST ≥ 1/2 T+ in V3 or V4

5. ANTERIOR INFARCTION, POSSIBLY ACUTE

(a) VQ1 is true for V3 and V4 with QRVH false in V1
and (b) ST ≥ 0.12mV in both leads
and (c) ST slope ≤ 0°
and (d) T- ≥ -0.10mV in both leads
and (e) ST ≥ 1/2 T+ in V3 or V4

6. ANTERIOR INFARCTION - AGE UNDETERMINED

(a) VQ1 is true for V3 and V4 with QRVH false in V1
and (b) none of ACUTE, PROBABLY ACUTE, POSSIBLY ACUTE, RECENT, OLD is set true
and (c) T- < -0.10mV in V3 or V4

7. PROBABLE ACUTE ANTERIOR INFARCTION

(a) i. VQ1 is true for V3 or V4 with QRVH false in V1
or ii. VQ4 is true for V2, V3 or V3, V4
and (b) ST ≥ 0.12mV in V3 and V4
and (c) T- ≥ -0.10mV in V3 and V4
and (d) ST ≥ 1/2 T+ amplitude in V3 or V4

NOTE: Statements 2, 3 and 6 are preceded by PROBABLE if:
(a) 7(a) is true and 1(a) is not
(b) corresponding parts of 2, 3, 6 are true except 6(c)

8. POSSIBLE ACUTE ANTERIOR INFARCTION

(a) i. VQ2(a) is true in V3 or V4 with QRVH false in V1
or ii. VQ2(b) or VQ3 is true in V3 or V4
or iii. VQ4 is true for V2, V3 or V3, V4 except for females < 50
or iv. PRWP is true and R < 0.4mV in I and not RVH and
(|S| < 0.15mV in I or R > 0.4mV in V4 or T+ < 0.05mV in V2-V4)
or v. PRWP is true and R > 0.4mV in I and
[(ST > 0.05mV and ST > T+/2 in V3 or V4) or
(LVH is present and R < 0.15mV in V4)]
and (b) ST ≥ 0.12mV in V3 and V4
and (c) T- ≥ -0.10mV in V3 and V4
and (d) ST ≥ 1/2 T+ in V3 or V4

NOTE: Statements 2, 3 and 6 are preceded by POSSIBLE if:
(a) 8(a) is true and 1(a), 7(a) are not
(b) corresponding parts of 2, 3, 6 are true except 6(c)

9. ANTERIOR INFARCTION

(a) any of 1(a), 7(a), 8(a) is true
(b) none of the above statements is true

10. ABNORMAL VENTRICULAR CONDUCTION PATHWAYS

(a) any of the above statements is true,
and (b) the age of the patient is less than 20 years

This statement replaces any of 1-9, if true.

11. IN VIEW OF VALVULAR HEART DISEASE, ANTERIOR CHANGES MAY BE DUE TO VENTRICULAR HYPERTROPHY

(a) any of the above statements is true
and (b) T+ ≥ 0.10mV in V3, V4
and (c) ST < 1/2 T+ in V3 and V4
and (d) RECENT ANTERIOR MI is not true
and (e) there is not a clinical classification of myocardial infarction but there is of rheumatic heart disease.

This statement replaces any previous one, if true.

12. IN VIEW OF CONGENITAL HEART DISEASE, ANTERIOR CHANGES MAY BE DUE TO CORRECTED TRANSPOSITION

(a) if any of the statements 1-9 is set true
and (b) T+ ≥ 0.10mV in V3 and V4
and (c) ST < 1/2 T+ in V3, V4 and not RECENT ANTERIOR M.I.
and (d) there is not a clinical classification of myocardial infarction but there is of congenital heart disease

13. CONSIDER ANTERIOR INFARCTION - ALTHOUGH CHANGES V3-V4 MAY BE DUE TO LEFT VENTRICULAR HYPERTROPHY ALSO PRESENT

(a) if any of the statements 1-9 is set true
and (b) LVH is present
and (c) ST < 1/2 T+ in V3 and V4, and there is not RECENT ANTERIOR M.I.
and (d) there is not a clinical classification of either congenital heart disease or rheumatic heart disease
and (e) the age of the patient is 20 years or over
and (f) VQ1 is false in both V3 and V4
and (g) there is not clockwise cardiac rotation
and (h) VQ2 or VQ4 is true for V3

This statement replaces any of 1-9, if true.

14. CONSIDER ANTERIOR INFARCTION - THOUGH CHANGES V3-V4 MAY BE RELATED TO LEFT VENTRICULAR HYPERTROPHY. REPEAT ADVISED.

(a) 13(a) to (h) are true
(b) clinical classification is myocardial infarction

This statement replaces any of 1-9, if true.

15. CHANGES V3-V4 ARE PROBABLY DUE TO LEFT VENTRICULAR HYPERTROPHY BUT CONSIDER ANTERIOR INFARCTION

(a) if any of the statements 1-9 is set true
and (b) LVH is present with secondary ST-T changes and |S| in V2 > 2.0mV
and (c) ST < 1/2 T+ in V3 and V4, and there is not RECENT ANTERIOR M.I.
and (d) there is not a clinical classification of either congenital heart disease or of rheumatic heart disease
and (e) the age of the patient is 20 years or over
and (f) there is not clockwise cardiac rotation, and VQ1 is false in V3 and V4

This statement replaces any of 1-9, if true.

16. CHANGES V3-V4 ARE PROBABLY DUE TO LEFT VENTRICULAR HYPERTROPHY BUT CONSIDER ANTERIOR INFARCTION. REPEAT ADVISED.

(a) 15(a) to (f) are true
(b) clinical classification is myocardial infarction

17. CHANGES V3-V4 ARE PROBABLY RELATED TO POOR R WAVE PROGRESSION BUT ANTERIOR INFARCTION CANNOT BE EXCLUDED

(a) if any of the statements 1-9 is set true, and
(b) ST < 1/2 T+ in V3 and V4, and there is not RECENT ANTERIOR M.I.
and (c) clockwise cardiac rotation is true, and VQ1 false in V4

This statement replaces any of 1-9, if true.

18. ANTERIOR CHANGES ARE PROBABLY RELATED TO POOR R WAVE PROGRESSION CONSISTENT WITH PULMONARY DISEASE

(a) 17(a) to (c) are true
(b) there is a clinical classification of respiratory disease but not of myocardial infarction

This statement replaces 1-9, if true.

19. PROBABLE NORMAL VARIANT

i. VQ4 or PRWP is true
ii. R or R' in I > 0.4mV
iii. T+ > 0.05mV in V2-V4
iv. there is no significant ST elevation V2-V4
v. R > 0.6mV in V4 for males or R > 0.4mV in V4 for females
vi. there is not LVH
vii. there is no inferior or lateral infarction

20. CHANGES ARE POSSIBLY DUE TO RIGHT VENTRICULAR HYPERTROPHY

i. VQ4 or PRWP is true
ii. R or R' in I < 0.4mV
iii (RVH is present) or [S < -0.15mV in I and (Tmorph = -2 in V2 or T+ > 0.05 in V2-V4)]

ANTERIOR INFARCTION STATEMENT ADDITION

1. CARDIOMYOPATHY ALONE MAY CAUSE Q WAVES

(a) any of the Anterior Infarction statements is set
and (b) there is a clinical classification of cardiomyopathy
and (c) T+ > 0.10mV in V3, V4

SEPTAL INFARCTION

STATEMENTS

The tests for VQ1 and VQ2a are applied to V1, V2.
The following statements therefore apply to findings in these leads.

1. ACUTE SEPTAL INFARCTION

(a) VQ1 is true for V2 with QRVH false in V1
and (b) ST ≥ 0.2mV in V2
and (c) ST slope > 0° in V2
and (d) T- ≥ -0.10mV in V2
and (e) ST ≥ 1/2 T+ in V2

2. PROBABLE ACUTE SEPTAL INFARCTION

(a) VQ1 is true for V2, with QRVH false in V1
and (b) ST ≥ 0.12mV in V2
and (c) T- ≥ -0.10mV in V2
and (d) ST ≥ 1/2 T+ amplitude in V2

3. PROBABLE RECENT SEPTAL INFARCTION

(a) VQ1 is true for V2, with QRVH false in V1
and (b) T- < 0.10mV in V2
and (c) ST ≥ 0.12mV in V2

4. PROBABLE OLD SEPTAL INFARCTION

(a) VQ1 is true for V2, with QRVH false in V1
and (b) T+ ≥ 0.10mV in V2
and (c) ST < -0.12mV in V1

5. PROBABLE SEPTAL INFARCTION - AGE UNDETERMINED

(a) VQ1 is true for V2, with QRVH false in V1
and (b) none of ACUTE, RECENT, OLD is set true

6. POSSIBLE ACUTE SEPTAL INFARCTION

(a) There is VQ2a in V2 with QRVH false in V1
and (b) ST ≥ 0.12mV in V2
and (c) T- ≥ -0.10mV in V2
and (d) ST ≥ 1/2 T+ amplitude in V2

7. POSSIBLE RECENT SEPTAL INFARCTION

(a) there is VQ2a in V2 with QRVH false in V1
and (b) T- < 0.10mV in V2
and (c) ST ≥ 0.12mV in V2

8. POSSIBLE OLD SEPTAL INFARCTION

(a) there is VQ2a in V2 with QRVH false in V1
and (b) T+ ≥ 0.10mV in V2
and (c) ST < 0.12mV in V2

9. POSSIBLE SEPTAL INFARCTION - AGE UNDETERMINED

(a) there is VQ2a in V2 with QRVH false in V1
and (b) none of ACUTE, RECENT, OLD is set true

10. ABNORMAL VENTRICULAR CONDUCTION PATHWAYS

(a) any of the statements 1-9 is true
and (b) the age of the patient is less than 20 years

11. IN VIEW OF VALVULAR HEART DISEASE, SEPTAL CHANGES MAY BE DUE TO VENTRICULAR HYPERTROPHY

(a) any of the above statements is true
and (b) T+ ≥ 0.10mV in V2
and (c) ST < 1/2 T+ in V2
and (d) RECENT SEPTAL MI is not true
and (e) there is not a clinical classification of myocardial infarction but there is of rheumatic heart disease

This statement replaces any previous one, if true.

12. IN VIEW OF CONGENITAL HEART DISEASE, SEPTAL CHANGES MAY BE DUE TO CORRECTED TRANSPOSITION

(a) if any of the statements 1-9 is set true
and (b) T+ ≥ 0.10mV in V2
and (c) ST < 1/2 T+ in V2 and not RECENT SEPTAL M.I.
and (d) there is not a clinical classification of myocardial infarction but there is of congenital heart disease

13. CONSIDER SEPTAL INFARCT THOUGH CHANGES IN V2 MAY BE RELATED TO LEFT VENTRICULAR HYPERTROPHY WHICH IS ALSO PRESENT

(a) if any of the statements 1-9 is set true
and (b) LVH is present
and (c) ST < 1/2 T+ in V2 and there is not RECENT SEPTAL M.I.
and (d) there is not a clinical classification of either congenital heart disease or rheumatic heart disease
and (e) the age of the patient is 20 years or over

This statement replaces any of 1-9, if true.

14. CONSIDER SEPTAL INFARCT THOUGH CHANGES IN V2 MAY BE RELATED TO LEFT VENTRICULAR HYPERTROPHY ALSO PRESENT. REPEAT ADVISED

(a) 12(a) to (c) are true
(b) clinical classification is myocardial infarction

This statement replaces any of 1-9, if true.

15. CHANGES IN V2 ARE PROBABLY DUE TO LEFT VENTRICULAR HYPERTROPHY BUT CONSIDER SEPTAL INFARCTION

(a) if any of the statements 1-9 is set true
and (b) LVH is present with secondary ST-T changes and |S| in V2 > 2.0mV
and (c) ST < 1/2 T+ in V2 and there is not RECENT SEPTAL M.I.
(d) there is not a clinical classification of either congenital heart disease or rheumatic heart disease
and (e) the age of the patient is 20 years or over

This statement replaces any of 1-9, if true.

16. CHANGES IN V2 ARE PROBABLY DUE TO LEFT VENTRICULAR HYPERTROPHY BUT CONSIDER SEPTAL INFARCTION. REPEAT ADVISED.

(a) 15(a) to (e) are true
and (b) clinical classification is myocardial infarction

17. CHANGES IN V2 ARE PROBABLY RELATED TO POOR R WAVE PROGRESSION BUT SEPTAL INFARCTION CANNOT BE EXCLUDED

(a) if any of the statements 1-9 is set true
and (b) ST < 1/2 T+ in V3 and V4, and there is not RECENT SEPTAL M.I.
and (c) clockwise cardiac rotation is true, and VQ1 false in V4

This statement replaces any of 1-9, if true.

18. SEPTAL CHANGES ARE PROBABLY RELATED TO POOR R WAVE PROGRESSION CONSISTENT WITH PULMONARY DISEASE

(a) 17(a) to (c) are true
and (b) there is a clinical classification of respiratory disease but not of myocardial infarction

This statement replaces any of 1-9, if true.

SEPTAL INFARCTION STATEMENT ADDITION

1. CARDIOMYOPATHY ALONE MAY CAUSE Q WAVES

(a) any of the septal infarction statements are set
and (b) there is a clinical classification of cardiomyopathy
and (c) T+ ≥ 0.10mV in V2

POSTERIOR MYOCARDIAL INFARCTION

CRITERIA:

PMI1:

(a) i. R in V1 > 0.04secs
and ii. R in V1 > 0.8mV
and iii. T+ in V1 > 0.5mV
and (b) i. R in V2 > 0.04secs
and ii. R in V2 > 1mV
and iii. T+ in V2 > 0.8mV

PMI2:

The S-T junction < 0mV in V1 or V2

STATEMENTS

If there are inferior or lateral infarct statements or RBBB or RVH, omit tests 1 and 2.

1. POSSIBLE RECENT TRUE POSTERIOR INFARCT

(a) PMI1 is true
and (b) PMI2 is true

2. POSSIBLE TRUE POSTERIOR INFARCT - AGE UNDETERMINED

(a) PMI1 is true
and (b) PMI2 is not true

POSTERIOR INFARCTION STATEMENT ADDITIONS

3 and 4 are additions to any inferior or lateral infarction statement only.

3. V1, V2 SUGGEST POSTERIOR EXTENSION

(a) PMI1 is set true
and (b) there is inferior or lateral myocardial infarction

4. TALL R V1/V2 CONSISTENT WITH THE INFARCT

(a) RVH is true, with tall R in V1
and (b) there is inferior or lateral myocardial infarction
and (c) RBBB and IVCD of RBBB type are not present

If 4 is true, then RVH is set false.

ANTEROLATERAL MYOCARDIAL INFARCTION

This section is entered if the following criteria are met.

CRITERIA

(a) i. there is a Q1 in V5
or ii. there is a Q2 in V5 with lateral myocardial infarction true
and (b) i. there is a VQ1 or VQ2 in V4
or ii. there is a VQ3 in V4 or VQ4 in V3, V4

Any anterolateral statement will suppress the separate lateral, anteroseptal, and anterior statements.

STATEMENTS

1. ACUTE ANTEROLATERAL INFARCTION

(a) i. in I, aVL, V5, V6 there are two or more Q1 or at least one Q1 and Q2
or ii. in V2, V3, V4, there are at least two VQ2
and (b) i. ST ≥ 0.1mV and T- > -0.05mV in lateral leads
or ii. ST ≥ 0.1mV and T > -0.10mV in anteroseptal leads
or iii. ST ≥ 0.1mV and T- > -0.10mV in anterior leads

2. RECENT ANTEROLATERAL INFARCTION

(a) i. in I, aVL, V5, V6 there are two or more Q1
or ii. in V2, V3, V4, there are at least two VQ2
and (b) i. ST ≥ 0.06mV and T < -0.05mV in lateral leads
or ii. ST ≥ 0.12mV and T < -0.10mV in anteroseptal leads
or iii. ST ≥ 0.12mV and T < -0.10mV in anterior leads

3. OLD ANTEROLATERAL INFARCTION

(a) i. in I, aVL, V5, V6 there are two or more Q1 or at least one Q1 and Q2
or ii. in V2, V3, V4, there are at least two VQ2
and (b) i. ST < 0.12mV and T ≥ 0.10mV in lateral leads
and ii. ST < 0.12mV and T ≥ 0.10mV in anteroseptal leads
or iii. ST < 0.12mV and T ≥ 0.10mV in anterior leads

4. ANTEROLATERAL INFARCTION, PROBABLY ACUTE

(a) i. in I, aVL, V5, V6 there are two or more Q1 or at least one Q1 and Q2
or ii. in V2, V3, V4, there are at least two VQ2
and (b) ACUTE ALMI is not set
and (c) i. ST ≥ 0.06mV and ST slope in I or V5 > 0° and T- > -0.05mV in lateral leads
or ii. ST ≥ 0.12mV and ST slope in V2, V3, V4 > 0° and T- > -0.10mV in anteroseptal leads
or iii. ST ≥ 0.12mV, ST slope > 0° and T- > -0.10mV in anterior leads

5. ANTEROLATERAL INFARCTION, POSSIBLY ACUTE

(a) i. in I, aVL, V5, V6 there are two or more Q1 or at least one Q1 and Q2
or ii. in V2, V3, V4, there are at least two VQ2
and (b) ACUTE ALMI is not set
and (c) i. ST ≥ 0.06mV and ST slope in I or V5 < 0° and T- > 0.10mV in the lateral leads
or ii. ST ≥ 0.12mV and ST slope in V2, V3, or V4 < 0° and T- > -0.10mV in the anteroseptal leads
or iii. ST ≥ 0.12mV and ST slope in V3 < 0° and T- > -0.10mV in anterior leads

6. ANTEROLATERAL INFARCTION - AGE UNDETERMINED

(a) i. in I, aVL, V5, V6 there are two or more Q1 or at least one Q1 and Q2
or ii. in V2, V3, V4, there are at least two VQ2
and (b) ACUTE, PROBABLY ACUTE, POSSIBLY ACUTE, RECENT or OLD ANTEROLATERAL M.I. are not true

7. PROBABLE ACUTE ANTEROLATERAL INFARCTION

(a) i. in I, aVL, V5, V6 there is one Q1 and at least one Q3 or Q4
or ii. there is a Q2 and a Q3
or iii. VQ1 is true for (V2 and V3 or V4) or (V3 and V4) with QRVH false for V1
and (b) i. ST ≥ 0.1mV and T- ≥ -0.05mV in lateral leads
or ii. ST ≥ 0.12mV and T- ≥ -0.10mV in anteroseptal leads

NOTE: Statements 2, 3 and 6 are preceded by PROBABLE if:
(a) 7(a) is true and 1(a) is not true
and (b) corresponding parts of 2, 3 and 6 are true

8. POSSIBLE ACUTE ANTEROLATERAL INFARCTION

(a) Criterion A is true
and (b) i. ST ≥ 0.10mV and T- ≥ 0.05mV in lateral leads
ii. ST ≥ 0.12mV and T- ≥ -0.10mV in anteroseptal leads
iii. ST ≥ 0.12mV and T- ≥ -0.10mV in anterior leads

NOTE: Statements 2, 3, 6 are preceded by POSSIBLE if:
(a) 8(a) is true and 1(a), 7(a) are not true
and (b) Corresponding parts of 2, 3 and 6 are true

9. ANTEROLATERAL INFARCTION

(a) any of 1(a), 7(a), 8(a) is true
and (b) none of the above statements is true

10. ABNORMAL VENTRICULAR CONDUCTION PATHWAYS

(a) if any of the previous is set true
and (b) the age of the patient is less than 20 years

ANTEROLATERAL INFARCTION STATEMENT ADDITION

1. CARDIOMYOPATHY ALONE MAY CAUSE Q WAVES

(a) any of the anterolateral infarction statements is set
and (b) there is a clinical classification of cardiomyopathy
and (c) T ≥ 0.05mV in anterolateral leads

EXTENSIVE MYOCARDIAL INFARCTION

This section is entered if the following criteria are met.

(a) there is inferior infarction
and (b) there is lateral infarction
and (c) there is anterior or anteroseptal infarction

STATEMENTS

1. ACUTE EXTENSIVE INFARCTION

(a) i. there is inferior or lateral infarction
and ii. there is anteroseptal infarction
and (b) there is ST elevation in the inferior, lateral and anteroseptal leads. (See criteria for ACUTE ST change in the relevant infarction section)

2. RECENT EXTENSIVE INFARCTION

(a) i. there is inferior or lateral infarction
and ii. there is anteroseptal infarction
and (b) there is ST elevation and T wave inversion in the inferior, lateral and anteroseptal leads. (See criteria for RECENT ST change in the relevant infarct section)

3. OLD EXTENSIVE INFARCTION

(a) i. there is inferior or lateral infarction
and ii. there is anteroseptal infarction
and (b) there is no ST elevation or T wave inversion in the inferior, lateral or anteroseptal leads. (See criteria for OLD ST change in the relevant infarct section)

4. EXTENSIVE INFARCTION, PROBABLY ACUTE

(a) i. there is inferior or lateral infarction
and ii. there is anteroseptal infarction
and (b) there is minimal ST elevation and limited T wave changes in the inferior, lateral and anteroseptal leads. (See criteria for PROBABLE ACUTE ST change in the relevant infarct section)

5. EXTENSIVE INFARCTION, POSSIBLY ACUTE

(a) i. there is inferior or lateral infarction
and ii. there is anteroseptal infarction
and (b) there is minimal ST elevation and limited T wave changes in one of the inferior, lateral or anteroseptal groups of leads. (See criteria for POSSIBLE ACUTE ST change in the relevant infarct section)

6. EXTENSIVE INFARCTION - AGE UNDETERMINED

(a) i. there is inferior or lateral infarction
and ii. there is anteroseptal infarction
and (b) ACUTE, OLD, PROBABLY ACUTE, widespread infarction are not true

7. EXTENSIVE INFARCTION

(a) 1(a) is true
and (b) none of the above statements is true

NOTE: Statements 1 to 7 can be preceded by PROBABLE if:
(a) weaker Q wave criteria are met in the inferior and anteroseptal leads
and (b) corresponding parts of 1 to 7 are true

The next six statements are optional additions to statement 7, whether or not it is preceded by PROBABLE.

WITH ACUTE CHANGES IN THE ANTEROLATERAL LEADS

(a) ST ≥ 0.06mV in the anterolateral leads only

WITH ACUTE CHANGES IN THE INFERIOR AND ANTEROSEPTAL LEADS

(a) ST ≥ 0.06mV in inferior leads and ST > 0.12mV in anteroseptal leads only

WITH ACUTE CHANGES IN THE INFERIOR AND LATERAL LEADS

(a) ST ≥ 0.06mV in inferior and lateral leads only

WITH ACUTE CHANGES IN THE LATERAL LEADS

(a) ST ≥ 0.06mV in lateral leads only

WITH ACUTE CHANGES IN THE INFERIOR LEADS

(a) ST ≥ 0.06mV in inferior leads only

WITH ACUTE CHANGES IN THE ANTEROSEPTAL LEADS

(a) ST ≥ 0.12mV in anteroseptal leads only

EXTENSIVE INFARCTION STATEMENT ADDITION

1. CARDIOMYOPATHY ALONE MAY CAUSE Q WAVES

(a) any of the Extensive Infarction statements is set
and (b) there is a clinical classification of cardiomyopathy
and (c) T waves are not inverted.

COMBINATIONS

In addition to the above, it is possible to combine abnormalities in different groups of leads, assuming that criteria for extensive infarction are not set. As an example, the following statement can be printed.

INFERIOR AND ANTERIOR INFARCTION

Chapter 8 *ST ABNORMALITIES*

CRITERIA:

A. In leads I, II, III, aVL, aVF, V5, V6

1. (a) ST slope is positive
   and (b) ST ≥ 0.06mV
   and (c) ST ≥ 1/2 T+

or 2. (a) ST ≥ 0.06mV
   and (b) T+ ≤ 0.05mV
   and (c) ST ≥ 1/5 R or R'

or 3. (a) ST > 0.2mV

Omit B below if any of LBBB, anteroseptal, anterior, septal, anterolateral or widespread myocardial infarction or incomplete RBBB is present.

B. In leads V2, V3, V4

1. (a) i. ST slope > 0° and ST ≥ 0.12mV and age ≥ 30
   or ii. ST ≥ 0.2mV and age < 30
   and (b) ST ≥ 1/2 T+

or 2. i. ST > 0.45mV in V2 or ST > 0.35mV in V3 or ST > 0.25mV in V4 and male
   or ii. ST > 0.26mV in V2 or ST > 0.20mV in V3 or ST > 0.14mV in V4 and female

Omit C and D below if LBBB, RBBB or any myocardial infarction is present or if A or B is true.

C. (a) i. ST ≥ 0.1mV in any of I, II, III, aVF, V5 or V6
   or ii. ST ≥ 0.2mV in all of V2-V4

D. (a) i. ST ≥ 0.08mV and ST slope > 0° in any of I, II, III, aVF, V5 or V6
   ii. ST ≥ 0.15mV in all of V2-V4

E. (a) ST_j < -0.1mV and ST_j ≤ T- + 0.05mV in all of V2-V4

F. (a) ST junction < -0.3mV in any of V1-V4

STATEMENTS (REASONS)

In the diagnostic output relating to ST abnormalities, there is a "reason" statement printed above the diagnostic statement, e.g.

INFERIOR AND ANTERIOR ST ELEVATION

This is essentially integral to the diagnostic statement that follows, i.e. this latter statement would be meaningless if not preceded by a reason.

1. INFERIOR ST ELEVATION

(a) inferior infarction is not true
and (b) A is true for II, III or aVF

2. LATERAL ST ELEVATION

(a) lateral and anterolateral infarction are not true
and (b) A is true for I, aVL, V5 or V6

3. ANTEROSEPTAL ST ELEVATION

(a) B is true for V2 and (V3 or V4)

4. ANTERIOR ST ELEVATION

(a) 3 is not true
and (b) B is true for V3 or V4

5. SEPTAL ST ELEVATION

(a) 3 is not true
and (b) B is true for V2

6. EXTENSIVE ST ELEVATION

(a) A is true for inferior and lateral leads
and (b) B is true for anteroseptal or anterior or septal leads

7. ANTEROLATERAL ST ELEVATION

(a) A is true for V5 or V6
and (b) B is true for anteroseptal or anterior leads

Combinations of the above are possible, e.g.

INFERIOR AND LATERAL ST ELEVATION

8. MARKED ANT/SEPTAL STj DEPRESSION

(a) E is true

9. MARKED ST DEPRESSION IN V LEAD

(a) F is true.

STATEMENTS

If any of 1 to 7 (or combinations) above is true, print one of the following.

1. CONSIDER RECENT * INFARCTION

(a) age ≥ 20 years and there is a clinical classification of myocardial infarction

or (b) A and/or B is true

In this statement * can represent

EXTENSIVE	INFERIOR
ANTEROLATERAL	LATERAL
ANTEROSEPTAL	SEPTAL
ANTERIOR	

and various combinations.

2. POST OPERATIVE PERICARDITIS

(a) Clinical classification includes post cardiac surgery

and (b) Extensive ST elevation (A or B or C is true)

3. STRONGLY SUGGESTS PERICARDITIS

(a) 2(b) is true

4. CONSIDER PERICARDITIS

(a) Extensive ST elevation (D is true)

5. CONSISTENT WITH KNOWN PERICARDITIS

(a) there is a clinical classification of pericarditis

and (b) A or B or C or D is true

6. PROBABLE POST OPERATIVE CHANGES

(a) there is a clinical classification of post cardiac surgery

and (b) A or B or C or D is true

7. REPEAT TO CHECK FOR SEQUENTIAL CHANGES

(a) there is a clinical classification of myocardial infarction and age ≥ 20 years

and (b) C or D is true

8. POSSIBLY ABNORMAL CONSIDERING THE CLINICAL FINDINGS

(a) age < 20 years
and (b) there is a clinical classification of congenital heart disease or of rheumatic heart disease
and (c) A or B is true

9. POSSIBLY NORMAL VARIANT IN VIEW OF AGE

(a) age < 20 years
and (b) there is not a clinical classification of congenital heart disease or of rheumatic heart disease or of pericarditis
and (c) A or B is true

10. REPEAT IF MYOCARDIAL INJURY IS SUSPECTED

(a) age ≥ 20 years
and (b) there is not a clinical classification of myocardial infarction

11. PROBABLE LATERAL EXTENSION OF INFARCTION

(a) there is ST elevation in lateral leads
and (b) there is recent or acute inferior, anteroseptal or anterior infarction present
and (c) there is not lateral or anterolateral infarction

12. EARLY REPOLARIZATION

(a) C is true
and (b) i. LVH is not present
or ii. there is not a clinical classification of myocardial infarction or of pericarditis
and (c) neither 1 nor 9 is set true

13. POSSIBLE EARLY REPOLARIZATION

(a) D is true
and (b) i. LVH is not present
or ii. there is not a clinical classification of myocardial infarction or pericarditis
and (c) 10 above is not true

ST DEPRESSION

If either of the following sets of criteria is true, then reason 8 or 9 is printed together with the appropriate statement 14 or 15 respectively.

14. PROBABLY RECIPROCAL TO INFERIOR INFARCT

(a) i. statement 1 above is set true for INFERIOR leads
or ii. there is ACUTE, PROBABLY ACUTE, POSSIBLE ACUTE or RECENT INFERIOR M.I.
and (b) in V1, V2, V3 ST < -0.1mV and ST ≤ T- + 0.05mV
and (c) there is not RBBB or IVCD of RBBB type

15. CONSIDER RECENT INFARCTION

(a) ST < -0.3mV in any of V1 - V4 with corresponding ST slope negative, and RBBB, IVCD of RBBB type are false
or (b) ST < -0.3mV in V5 or V6 with corresponding ST slope negative, and LVH with ST-T changes, LBBB and IVCD of LBBB type are false

Chapter 9 ST-T CHANGES

CRITERIA

The criteria for ST-T changes are essentially classical in nature relating to ST depression or T wave inversion. In practice, however, their logical relationship to diagnostic statements is somewhat involved. For this reason, a simplified version is set out below.
Define ST-T changes in the lead combinations as follows:

INFERIOR LEADS
- (a) there is ST depression or T wave inversion in inferior leads
- (b) there is not inferior myocardial infarction or LVH or RVH
- (c) none of WPW, LBBB, or IVCD of LBBB TYPE is true

LATERAL LEADS
- (a) there is ST depression or T wave inversion in lateral leads
- (b) there is not lateral infarction or LVH
- (c) none of WPW, LBBB, or IVCD of LBBB TYPE is true

ANTEROSEPTAL LEADS
- (a) there is ST depression or T wave inversion in anteroseptal leads
- (b) there is not (anterior) septal or anterior infarction
- (c) there is not RVH or some types of LVH
- (d) none of WPW, RBBB, RBBB + LAFB, RBBB + LPFB, IVCD OF RBBB TYPE or EXTENSIVE IV CONDUCTION DEFECT is true

ANTERIOR LEADS
- (a) there are not ST-T changes in the anteroseptal leads
- (b) there is ST depression or T wave inversion in the anterior leads
- (c) there are not some types of LVH or RVH
- (d) none of WPW, RBBB, RBBB + LAFB, RBBB + LPFB, IVCD OF RBBB TYPE, EXTENSIVE IV CONDUCTION DEFECT, LBBB, or IVCD OF LBBB TYPE is true

SEPTAL LEADS
- (a) there are not ST-T changes in the anteroseptal or anterior leads
- (b) there is ST depression or T wave inversion in the septal leads
- (c) there is not anteroseptal or anterior or septal infarction
- (d) there is no RVH
- (e) none of WPW, RBBB, RBBB + LAFB, RBBB + LPFB, IVCD OF RBBB TYPE, or EXTENSIVE IV CONDUCTION DEFECT is true

ANTEROLATERAL LEADS
- (a) there are ST and/or T wave changes in both anterior and lateral leads as defined above

EXTENSIVE
- (a) there are ST and/or T wave changes in the inferior leads and either the anterolateral or lateral leads together with septal, anteroseptal or anterior leads

STATEMENTS (REASONS)

There are several possible 'reason' statements that can be produced, namely:

ST CHANGES IN THE * LEADS

ST JUNCTIONAL DEPRESSION

EXTENSIVE ST CHANGES

T WAVE CHANGES IN * LEADS

EXTENSIVE T WAVE CHANGES

ST-T CHANGES IN * LEADS

EXTENSIVE ST-T CHANGES

The location of the abnormality, denoted *, can be chosen from the following:

INFERIOR
LATERAL
ANTEROSEPTAL
ANTERIOR
SEPTAL
ANTEROLATERAL

Various combinations can be selected, e.g. INFERIOR AND LATERAL.

> NOTE: The 'reason' statements are essentially integral to the main diagnostic statement which would be meaningless if not preceded by a reason.

STATEMENTS:

If any of the above statements is true, it is printed together with one of the following statements, which are presented here in almost a hierarchical form, i.e. a statement towards the end of the list would only be printed if those near the top were not relevant. In the interest of brevity there are marked simplifications in presenting the list.

In the pediatric age range, statements involving 'Myocardial Ischemia' are suppressed and replaced by a more appropriate statement.

1. MAY BE RELATED TO THE ELECTRONIC PACEMAKER ACTIVITY

(a) there are T wave changes in any lead group
and (b) there is demand pacemaker activity

2. ADDITIONAL EVIDENCE OF MYOCARDIAL ISCHEMIA

(a) there are ST-T changes in the lateral leads
and (b) i. there is evidence of anterior or anteroseptal infarction with T wave inversion in the relevant leads
or ii. there is inferior infarction with inferior T wave changes

3. STRONGLY SUGGESTS MYOCARDIAL INFARCTION CONSISTENT WITH THE CLINICAL FINDINGS

(a) there is marked ST depression
and (b) patient is not on digitalis
and (c) there is not atrial flutter or atrial fibrillation,
and (d) there is a clinical classification of myocardial infarction

4. CONSISTENT WITH THE HISTORY OF PULMONARY EMBOLISM

(a) clinical classification is pulmonary embolism
and (b) patient is not on digitalis
and (c) i. 3(a), (c) are true and there are ST-T changes in the (antero) septal leads
or ii. there are moderate ST-T changes in certain combinations of leads

5. STRONGLY SUGGESTS MYOCARDIAL INJURY/ISCHEMIA

(a) 3(a)(b)(c) are true
and (b) clinical classification is not myocardial infarction, pulmonary embolism or post cardiac surgery in the presence of certain groups of ST-T changes

6. PROBABLE POST OPERATIVE CHANGES

(a) clinical classification is post cardiac surgery
and (b) i. there is widespread T wave inversion
or ii. there are T wave changes in at least two groups of leads

7. CHANGES POSSIBLY DUE TO MYOCARDIAL INFARCTION OR CEREBROVASCULAR ACCIDENT

(a) there is T wave inversion in the lateral or anteroseptal leads
and (b) T- < -1.0mV in V3, V4 or V5

8. STRONGLY SUGGESTS MYOCARDIAL INFARCTION

(a) T- < -0.5mV in V2 or V3 or V4
or (b) T- < -0.35mV in aVF

9. NON SPECIFIC CHANGES CONSISTENT WITH HYPOTHYROIDISM OR HYPOPITUITISM

(a) T wave abnormalities (but not in anteroseptal leads only)
and (b) clinical classification is endocrine disease
and (c) the heart rate < 60
and (d) the patient is not on digitalis

10. NON SPECIFIC CHANGES POSSIBLY SECONDARY TO THE CLINICAL FINDING OF HYPERTENSION

(a) T wave abnormalities in the inferior and/or lateral leads
and (b) clinical classification is hypertension
and (c) patient is not on digitalis

11. NON SPECIFIC CHANGES POSSIBLY DUE TO DIGITALIS OR SECONDARY TO HYPERTENSION

(a) 10(a) and 10(b) are true
and (b) patient is on digitalis

12. CHANGES MAY BE DUE IN PART TO MYOCARDIAL ISCHEMIA AND SECONDARY TO HYPERTENSION

(a) T wave abnormalities including inferior and lateral leads in addition to T wave changes in other leads
and (b) clinical classification is hypertension
and (c) patient is not on digitalis

13. CHANGES MAY BE DUE TO ISCHEMIA/DIGITALIS EFFECT AND SECONDARY TO HYPERTENSION

(a) 12(a) and (b) are true
and (b) patient is on digitalis

14. NON SPECIFIC CHANGES POSSIBLY SECONDARY TO CONGENITAL HEART DISEASE

(a) there are ST and/or T wave abnormalities
and (b) clinical classification is congenital heart disease
and (c) patient is not on digitalis

15. NON SPECIFIC CHANGES POSSIBLY SECONDARY TO VALVULAR HEART DISEASE

(a) there are ST and/or T wave abnormalities
and (b) clinical classification is rheumatic heart disease
and (c) patient is not on digitalis

16. NON SPECIFIC CHANGES POSSIBLY SECONDARY TO VALVULAR HEART DISEASE/DIGITALIS

(a) 15(a) and (b) are true
and (b) patient is on digitalis

17. NON SPECIFIC CHANGES POSSIBLY SECONDARY TO RESPIRATORY DISEASE

(a) there are ST or T wave changes in the inferior leads with or without other ST-T changes
and (b) clinical classification is respiratory disease
and (c) P+ amplitude in aVF > 0.3mV
and (d) QRS axis > 60° if ST-T changes other than inferior are present
and (e) patient is not on digitalis

18. CONSISTENT WITH NORMAL JUVENILE T WAVES

(a) T wave changes in (anterior) septal leads
and (b) age < 20 years

19. NORMAL FOR AGE AND RACE

(a) 18(a) is true
and (b) negro with age < 40 years

20. THESE CHANGES COULD BE A NORMAL VARIANT IN YOUNG WOMEN

(a) T wave changes in the inferior leads with or without changes in the lateral leads
and (b) the patient is female with age < 35 years
and (c) patient is not on digitalis
and (d) no previous statement is true and clinical classification is not myocardial infarction or ischemia

21. THESE CHANGES ARE UNUSUAL FOR A MALE OF THIS AGE BUT COULD BE A NORMAL VARIANT

(a) T wave changes in the inferior leads
and (b) the patient is male with age < 30 years
and (c) patient is not on digitalis
and (d) no previous statement is true and clinical classification is not myocardial infarction or ischemia

22. DIGITALIS EFFECT IS THE PROBABLE CAUSE

(a) female with age < 35 years or male with age < 30 years
and (b) no previous statement is true and clinical classification is not myocardial infarction or ischemia
and (c) patient is on digitalis
and (d) clinical classification is not pulmonary embolism or post cardiac surgery with certain groups of ST-T changes

23. STRONGLY SUGGESTS MYOCARDIAL ISCHEMIA CONSISTENT WITH THE CLINICAL FINDINGS

(a) marked T wave abnormalities in any group or groups of leads
and (b) clinical classification is myocardial infarction or myocardial ischemia
and (c) patient is not on digitalis

24. STRONGLY SUGGESTS MYOCARDIAL ISCHEMIA/ DIGITALIS EFFECT CONSISTENT WITH THE CLINICAL FINDINGS

(a) 23(a) and (b) are true
and (b) patient is on digitalis

25. ABNORMAL CHANGES POSSIBLY DUE TO MYOCARDIAL ISCHEMIA

(a) ST-T abnormalities in any group of leads
and (b) no previous statement true
and (c) patient is not on digitalis
and (d) clinical classification is not myocardial infarction or ischemia
and (e) age > 30 years if male or age > 40 years if female

26. ABNORMAL CHANGES POSSIBLY DUE TO MYOCARDIAL ISCHEMIA/DIGITALIS EFFECT

(a) 25(a)(b)(d)(e) are true
and (b) patient is on digitalis

27. CHANGES ARE ABNORMAL FOR AGE AND SEX. INTERPRET TOGETHER WITH CLINICAL DATA.

(a) 25(a) to (d) are true
and (b) Age ≤ 30 years if male or age ≤ 40 years if female

28. ABNORMAL FOR AGE AND SEX. POSSIBLE DIGITALIS EFFECT. INTERPRET TOGETHER WITH CLINICAL DATA.

(a) 27(a)(b) are true
and (b) patient is on digitalis

29. POSSIBLE MYOCARDIAL ISCHEMIA CONSISTENT WITH CLINICAL FINDINGS

(a) moderate ST and/or T wave abnormalities in any group or group of leads
and (b) clinical classification of myocardial infarction or myocardial ischemia
and (c) patient is not on digitalis

30. POSSIBLE MYOCARDIAL ISCHEMIA/ DIGITALIS EFFECT CONSISTENT WITH CLINICAL FINDINGS

(a) 29(a)(b) is true
and (b) patient is on digitalis

31. BORDERLINE ABNORMAL CHANGES POSSIBLY DUE TO MYOCARDIAL ISCHEMIA

(a) 29(a) is true
and (b) 29(b) is false and clinical classification is not normal
and (c) patient is not on digitalis
and (d) age > 30 years if male or age > 40 years if female

32. BORDERLINE ABNORMAL CHANGES POSSIBLY DUE TO MYOCARDIAL ISCHEMIA/DIGITALIS EFFECT

(a) 29(a) is true
and (b) 29(b) is false and clinical classification is not normal
and (c) patient is on digitalis
and (d) age > 30 years if male or age > 40 years if female

33. REGARD AS BORDERLINE CHANGE IN VIEW OF CLINICAL FINDINGS

(a) 29(a) is true
and (b) clinical classification is normal
and (c) patient is not on digitalis
and (d) age > 30 years if male or age > 40 years if female

34. BORDERLINE ABNORMAL FOR AGE AND SEX. INTERPRET TOGETHER WITH CLINICAL DATA.

(a) 29(a) is true
and (b) clinical classification is not normal or unknown
and (c) patient is not on digitalis
and (d) age ≤ 30 years if male or age ≤ 40 years if female

35. BORDERLINE ABNORMAL FOR AGE AND SEX - POSSIBLE DIGITALIS EFFECT. INTERPRET TOGETHER WITH CLINICAL DATA.

(a) 34(a)(b)(d) are true
and (b) patient is on digitalis

36. THESE CHANGES REPRESENT EQUIVOCAL EVIDENCE OF MYOCARDIAL ISCHEMIA

(a) none of the previous statements is true
and (b) there are widespread borderline ST and/or T wave changes
and (c) patient is not on digitalis

37. EQUIVOCAL EVIDENCE OF MYOCARDIAL ISCHEMIA/DIGITALIS EFFECT

(a) 36(a)(b) are true
and (b) patient is on digitalis

38. THESE MINOR CHANGES ARE OF EQUIVOCAL SIGNIFICANCE ONLY

(a) there are borderline ST and/or T wave changes in any group of leads
and (b) patient is not on digitalis

39. THESE MINOR CHANGES ARE PROBABLY DUE TO DIGITALIS EFFECT

(a) 38(a) is true
and (b) patient is on digitalis

40. POSSIBLE DIGITALIS EFFECT/ MYOCARDIAL ISCHEMIA

(a) none of the previous statements is true
and (b) patient is on digitalis
and (c) age ≥ 35 years if female or age ≥ 30 years if male

41. NON SPECIFIC CHANGES

(a) there are borderline ST and/or T wave changes
and (b) none of the previous statements is true

42. NO INTERPRETATION OFFERED BECAUSE OF UNKNOWN AGE AND/OR SEX

(a) age is unknown, or sex is unknown
and (b) none of the previous statements has been set

43. NON SPECIFIC ST CHANGES

(a) there is no T wave abnormality or ST segment depression but there is junctional ST depression
and (b) there is no myocardial infarction, conduction defect or WPW syndrome result
and (c) there is not LVH with ST/T reasons,
and (d) the ST slope > 0° with the ST amplitude ≤ -0.02mV for any TWO leads (excluding aVR)

ADDITIONAL STATEMENTS

The following statements may be added, if applicable, after any of the above statements.

44. CHANGES MAY ALSO BE DUE IN PART TO RATE

(a) heart rate > 120

45. CHANGES MAY ALSO PARTLY BE DUE TO RHYTHM

(a) the rhythm is atrial fibrillation or atrial flutter

46. CHANGES MAY BE DUE PARTLY TO RATE/RHYTHM

(a) heart rate > 120
and (b) rhythm is atrial fibrillation or atrial flutter

Chapter 10 MISCELLANEOUS

ATRIAL ABNORMALITIES

If the P wave flag is not set, or rhythm is not sinus, omit this section.

CRITERIA

A.			P duration ≥ 0.14 seconds.
B.			P+ amplitude > 0.3mV in any one of II, III, aVF.
C.		i.	P- amplitude in V1 ≤ -0.15mV
	and	ii.	P terminal duration in V1 ≥ 0.04 seconds
D.		i.	P+ in V1 > 0.20mV
	or	ii.	P+ in V2 > 0.25mV

STATEMENTS

1. NON SPECIFIC P WAVE ABNORMALITIES

(a) B is true

2. POSSIBLE LEFT ATRIAL ENLARGEMENT

(a) A is true
and (b) D is false

3. POSSIBLE RIGHT ATRIAL ENLARGEMENT

(a) D is true
and (b) A is false
and (c) clinical classification is not respiratory disease

4. POSSIBLE RIGHT ATRIAL ENLARGEMENT IN KEEPING WITH RESPIRATORY DISEASE

(a) D is true
and (b) A is false
and (c) clinical classification is respiratory disease

5. POSSIBLE BIATRIAL ENLARGEMENT

(a) D is true
and (b) A or C is true

QRS AXIS DEVIATION

The section on frontal plane abnormalities is omitted if Leads I, II, III are not available. The following age dependent equation is used to calculate the upper limit of normal QRS axis for patients with an age ≤ 6 months.

LIM = [230 - 0.66*age (days)].

The maximum value of LIM is set at 110° for patients over the age of 6 months.

STATEMENTS

1. INDETERMINATE FRONTAL QRS AXIS

(a) The (algebraic) sum of the amplitudes of Q, R and S < 0.15mV in Leads I, II and III.

If this statement is true, omit the remainder of this section.

2. L.A.D.

(a) Age > 30 years
  i. -45° < overall QRS axis ≤ -30°
and ii. QRS area in aVF < 0
(b) 15 ≤ age ≤ 30 years
  i. QRS axis < (15 - age years) * 2

3. QRS AXIS LEFTWARD (SUPERIOR) FOR AGE

(a) Age < 7 days
  i. -120 < QRS axis < 75
and ii. .NOT. (QRS axis < 0 .and. QRS area aVF > 0)
(b) 7 days ≤ age ≤ 182 days
  i. QRS < 78 -(78*Agedys)/182
(c) 183 days ≤ age ≤ 15 years
  i. QRS < 0

4. MARKED L.A.D.

(a) -120° ≤ overall QRS axis ≤ -45°
and (b) QRS area in aVF < 0
and (c) Age ≥ 15 years

5. MARKED L.A.D. - CONSIDER CONGENITAL HEART DISEASE

(a) -120° ≤ overall QRS axis ≤ -45°
and (b) QRS area in aVF < 0
and (c) Age < 15 years

6. R.A.D.

(a) LIM ≤ overall QRS axis < LIM + 10°
(usually 110° →120° for age > 6 months)

7. MARKED R.A.D.

(a) LIM + 10 ≤ overall QRS axis ≤ max (LIM + 20, 180°)
(usually 120 →180 for age > 6 months)

8. L.A.D. - LEFT ANTERIOR FASCICULAR BLOCK

(If all the following criteria are met, this statement replaces No. 2 or 4)

(a) LBBB, IVCD of LBBB type, RBBB WITH POSSIBLE LEFT ANTERIOR FASCICULAR BLOCK are not present
and (b) QRS duration < 0.12 secs
and (c) |S| > R amplitude in Lead II
and (d) in aVL, Q ≤ 0.02mV, with |R/Q| > 3
and (e) i. intrinsicoid deflection in aVL exceeds 0.042 secs
or ii. 6/8 spatial velocity < 50mV/sec and S < -0.1mV in V5
and (f) -120° < QRS axis ≤ -45°

9. L.A.D. - POSSIBLE LEFT ANTERIOR FASCICULAR BLOCK

(a) 8(a) to 8(e) are true
and (b) -45° < QRS axis < -30°

10. R.A.D. - LEFT POSTERIOR FASCICULAR BLOCK

(If all the following criteria are met, this statement replaces No. 6 or 7).

(a) RVH is not present and age ≥ 30
(b) i. 90° < QRS axis < 180° and age ≥ 30
or ii. 105° < QRS axis < 180° and age < 30
and (c) QRS duration < 0.12 secs
and (d) R or R' in lead II > 0.8mV
and (e) R or R' in lead III > 1mV
and (f) Q ≤ -0.02mV in leads II and III

11. ABNORMAL EXTREME QRS AXIS DEVIATION

(a) max(LIM + 20, 180°) < overall QRS axis < 240°
(usually 180 →240 for age > 6 months)

LOW QRS VOLTAGES

STATEMENTS

1. LOW QRS VOLTAGES IN STANDARD LIMB LEADS

(a) peak to peak voltage < 0.5mV for all of Leads I, II and III

2. LOW QRS VOLTAGES IN PRECORDIAL LEADS

(a) i. peak to peak voltage < 1mV for all of leads V1, V2, V3, V4, V5 and V6,

or ii. peak to peak < 0.5mV for all of V4, V5 and V6

3. GENERALIZED LOW QRS VOLTAGES

(a) both 1 and 2 are true

TALL T WAVES

STATEMENTS

1. TALL T WAVES - CONSIDER HYPERKALEMIA

(a) T+ amplitude > an age and sex dependent limit in all leads V3 to V5, as detailed in the table below

and (b) clinical classification is not myocardial infarction

2. TALL T WAVES - POSSIBLY DUE TO INFARCTION

(a) T+ amplitude > an age and sex dependent limit in all leads V3 to V5 as detailed in the table below

(b) there is a clinical classification of myocardial infarction

Table of age and sex dependent limits:

	Age < 30	Age ≥ 30
Female	0.9mV	0.75mV
Male	1.6mV	1.2mV

RHYTHM STATEMENTS

The rhythm section of the program will always select one statement (only) from the list of dominant rhythms and if appropriate will select up to three additional statements from the list of supplementary statements.

DOMINANT RHYTHM STATEMENTS

SINUS RHYTHM

SINUS TACHYCARDIA

SINUS BRADYCARDIA

SINUS ARRHYTHMIA

IRREGULAR SINUS TACHYCARDIA

IRREGULAR SINUS BRADYCARDIA

ATRIAL FLUTTER

ATRIAL FIBRILLATION

REGULAR ATRIAL PACING

REGULAR VENTRICULAR PACING

REGULAR A-V SEQUENTIAL PACING

A-V SEQUENTIAL AND VENTRICULAR PACING

ECTOPIC ATRIAL RHYTHM

ECTOPIC ATRIAL TACHYCARDIA

ECTOPIC ATRIAL BRADYCARDIA

IRREGULAR ECTOPIC ATRIAL RHYTHM

IRREGULAR ECTOPIC ATRIAL TACHYCARDIA

IRREGULAR ECTOPIC ATRIAL BRADYCARDIA

PROBABLE SINUS (? ATRIAL) TACHYCARDIA

PROBABLE SINUS TACHYCARDIA. ? ATRIAL TACHYCARDIA OR FLUTTER + 2:1 A-V BLOCK

PROBABLE SUPRAVENTRICULAR TACHYCARDIA

PROBABLE SVT, BUT CONSIDER SINUS OR PAROXYSMAL ATRIAL TACHYCARDIA

SINUS BRADYCARDIA. CONSIDER SINUS RHYTHM WITH 2:1 SINO-ATRIAL BLOCK

PROBABLE ATRIAL FIBRILLATION

PROBABLE A-V JUNCTIONAL RHYTHM

PROBABLE ACCELERATED JUNCTIONAL RHYTHM

WIDE COMPLEX TACHYCARDIA - PROBABLE VT

ACCELERATED IDIOVENTRICULAR RHYTHM

POSSIBLE IDIOVENTRICULAR RHYTHM

POSSIBLE ATRIAL FLUTTER

POSSIBLE A-V JUNCTIONAL RHYTHM

POSSIBLE ACCELERATED JUNCTIONAL RHYTHM
WIDE COMPLEX TACHYCARDIA - POSSIBLE SVT
WIDE COMPLEX TACHYCARDIA - POSSIBLE VT
A-V DISSOCIATION
REGULAR RHYTHM
REGULAR SUPRAVENTRICULAR RHYTHM
UNDETERMINED RHYTHM
IRREGULAR RHYTHM
IRREGULAR SUPRAVENTRICULAR RHYTHM

SUPPLEMENTARY RHYTHM STATEMENTS

PREMATURE VENTRICULAR CONTRACTIONS
FREQUENT PVCs
MULTIFORM PVCs
FREQUENT MULTIFORM PVCs
INTERPOLATED PVCs
MULTIFORM INTERPOLATED PVCs
MULTIFOCAL PVCs
MULTIFOCAL INTERPOLATED PVCs
FREQUENT MULTIFOCAL PVCs
VENTRICULAR COUPLETS
PREMATURE ATRIAL CONTRACTIONS
SUPRAVENTRICULAR EXTRASYSTOLES
FREQUENT SUPRAVENTRICULAR EXTRASYSTOLES
FIRST DEGREE A-V BLOCK
BORDERLINE FIRST DEGREE A-V BLOCK
WENCKEBACH (MOBITZ I) 2nd DEGREE A-V BLOCK
MOBITZ TYPE II 2nd DEGREE A-V BLOCK
2:1 A-V BLOCK
3:1 A-V BLOCK
4:1 A-V BLOCK
HIGH DEGREE A-V BLOCK
COMPLETE A-V BLOCK
SINO-ATRIAL 2nd DEGREE MOBITZ II BLOCK
BIGEMINAL PACs
BIGEMINAL PVCs
DEMAND ATRIAL PACING
DEMAND ATRIAL PACING AND INEFFECTIVE STIMULI

DEMAND VENTRICULAR PACING

DEMAND VENTRICULAR PACING AND INEFFECTIVE STIMULI

DEMAND A-V SEQUENTIAL PACING

DEMAND A-V SEQUENTIAL PACING AND INEFFECTIVE STIMULI

DEMAND A-V SEQUENTIAL AND VENTRICULAR PACING

DEMAND A-V SEQUENTIAL AND VENTRICULAR PACING AND INEFFECTIVE STIMULI

ABERRANT VENTRICULAR CONDUCTION

RAPID VENTRICULAR RESPONSE

UNCONTROLLED VENTRICULAR RESPONSE

SLOW VENTRICULAR RESPONSE

NON-SUSTAINED VENTRICULAR TACHYCARDIA

INTERMITTENT CONDUCTION DEFECT

PAROXYSMAL IDIOVENTRICULAR RHYTHM

UNDETERMINED ECTOPIC COMPLEXES

UNDETERMINED IRREGULARITY

NORMAL

There are only two statements available for use when all of the preceding tests have proved negative.

1. WITHIN NORMAL LIMITS

(a) there is sinus rhythm at a rate within the limits set for bradycardia and tachycardia
and (b) none of the diagnostic statements is true
and (c) the patient's age is ≥ 17 years

2. WITHIN NORMAL LIMITS FOR AGE

(a) there is sinus rhythm at a rate within the limits set for bradycardia and tachycardia
and (b) none of the diagnostic statements is true
and (c) the patient's age is < 17 years

3. NO OTHER FINDING

(a) 1(a) is not true
and (b) none of the diagnostic statements is true

NOTE: Serial comparison statements are excluded from this manual.

SUMMARY CODES

There are ten summary codes available. Each diagnostic statement and dominant or supplementary rhythm statement is assigned a summary code and the highest code present in an interpretation is then printed. The various codes in ascending order are as follows:

1. NORMAL
2. TACHYCARDIA - OTHERWISE NORMAL
3. BRADYCARDIA - OTHERWISE NORMAL
4. PVCs - OTHERWISE NORMAL
5. PACs - OTHERWISE NORMAL
6. AVAILABLE LEADS NORMAL
7. BORDERLINE NORMAL
8. BORDERLINE ABNORMAL
9. ABNORMAL
10. TECHNICAL ERROR

Chapter 11 *APPENDIX A*

GUIDELINES ON ACCURACY

> **NOTE:** Computer assisted interpretation is a valuable tool when used properly. No automated analysis system is completely reliable, however, and interpretations should be reviewed by a qualified physician before any decision is made regarding treatment.

In this appendix you will find a scoring methodology that advises users of the sensitivity, specificity, and predictive value of the criteria used in this handbook whenever possible. In addition, the type of database from which these values have been derived will be described and an estimate of the prevalence of abnormalities given.

The so-called Bethesda Conference on optimal electrocardiography (Am J. Cardiology, 1978; 41:158-70) recommended that ECG abnormalities be classed into three types, namely:

Type A — Statements which describe lesions or cardiac abnormalities which can be determined by non-ECG methods such as echocardiography or cardiac catheterization, e.g. ventricular hypertrophy.

Type B — Statements which refer to abnormalities detected primarily by the ECG itself, e.g. left bundle branch block or cardiac arrhythmias.

Type C — Statements which are essentially descriptive or which cannot easily be confirmed by non-ECG methods, e.g. left axis deviation, non specific ST-T changes.

With respect to the data provided for Type A abnormalities in adults, the CSE database has been used. This database contains 1220 cases documented by non-ECG methods (New England Journal of Medicine, 1991; 325:1767-73). The data for the Type A statements were obtained from a test submission made in the spring of 1992. For Type B abnormalities, 204 ECGs were selected from a larger database of 500 highly abnormal ECGs. None of these 204 ECGs had pure sinus rhythm. These ECGs were obtained from a large, 1000 bed, university teaching hospital. In order to obtain examples of other selected rhythm abnormalities such as interpolated VES, a database of volunteers in a pharmaceutical trial was examined from which a further 196 ECGs, all with rhythm abnormalities, were obtained. The prevalence figures detail the frequency of occurrence of various statements within each individual study group and not within a total hospital or study population.

Type A, B and C abnormalities in ECGs from children were investigated in two separate groups. A large group of healthy children were screened either in hospitals (neonates mainly), postnatal clinics, playgroups, junior schools and

high schools. Parental permission was obtained on every occasion. A total of 2015 ECGs from such apparently healthy children were reviewed in order to address the specificity of the pediatric criteria. On the other hand, there is no large internationally available database of ECGs from children with congenital heart disease. In order to assess the sensitivity of the diagnostic criteria in such children, ECGs from 181 children referred for investigation of suspected cardiac abnormalities were reviewed by experienced electrocardiographers. Data on sensitivity of various abnormalities are based on this group. It should be noted that a number of children with cardiac murmurs did not demonstrate any significant abnormalities on their ECGs. The incidence of arrhythmias in the total group of children was negligible and could not be commented on in this study.

Estimates of sensitivity and specificity relate to the combination of all categories within a single abnormality; e.g. statements on "possible," "probable" and "definite" left ventricular hypertrophy are combined, while some infarct locations such as septal, anteroseptal and anterior have results grouped together under "anterior" in view of the way that results from the CSE database were made available. To a certain extent, this latter point pertains to statements on "probable" and "possible."

Whenever possible, comments on results are cross-referenced with the relevant pages of the criteria handbook where the mechanism for grading statements into "possible," "probable," etc. can be found.

DEFINITIONS

The following definitions have been used in compiling tables of diagnostic accuracy:

$$\text{Sensitivity} = \frac{TP}{TP + FN}$$

$$\text{Specificity} = \frac{TN}{TN + FP}$$

$$\text{Positive Predictive Value} = \frac{TP}{TP + FP}$$

$$\text{Negative Predictive Value} = \frac{TN}{TN + FN}$$

$$\text{Prevalence} = \frac{\text{Number of Cases with the Abnormality}}{\text{Total Number of Cases on the Database}}$$

TP = True positive statement made by computer program, i.e. correct diagnosis of an abnormality

TN =True negative statement, i.e. the computer program correctly did not report an abnormality which was not present

FP = Incorrect positive statement made by computer program, i.e. the computer program wrongly reported an abnormality which was not present

FN =Incorrect negative statements, i.e. the computer program incorrectly failed to report an abnormality which was present

TYPE A STATEMENTS — DIAGNOSTIC CATEGORY*

DIAGNOSTIC CATEGORY	SENSITIVITY	SPECIFICITY	POSITIVE PRED. VALUE	NEGATIVE PRED. VALUE	PREVALENCE	NOTES
Normal	97%	76%	65%	98%	382/1220	'Sensitivity' in normal is essentially the percentage of ECGs reported as normal in healthy persons.†
LVH	51%	99%	88%	92%	183/1220	A scoring system is used for diagnosing LVH. The methodology for 'probable LVH' etc. is discussed on page 6-1 of this guide.
RVH	46%	100%	86%	98%	55/1220	Same as above for LVH, but methods are on page 6-5 of this guide.
BVH	30%	99%	64%	97%	52/1220	See page 6-7 of this guide for details of the scoring methodology for 'possible BVH' etc.
AMI*	73%	98%	85%	97%	170/1220	'Anterior' infarction (AMI) includes septal, anteroseptal, anterior, lateral, and anterolateral. The qualifiers 'possible, probable' depend on Q-wave duration etc. as detailed beginning on page 7-1 of this guide.
IMI*	66%	98%	92%	91%	273/1220	Inferior infarction criteria are detailed on page 7-2 of this guide
MIX*	68%	97%	59%	98%	73/1220	MIX refers to combinations of anterior and inferior infarction and includes 'widespread' infarction.

†Specificity and positive predictive value for 'NORMAL' should be interpreted carefully. A report of 'NORMAL' in a case of 'MYOCARDIAL INFARCTION' or 'HYPERTROPHY' contributes to decreased specificity for 'NORMAL' (even though the ECG may appear 'NORMAL'). In the CSE study, an ECG report stating only 'myocardial ischemia' was mapped to 'NORMAL' even if the true answer was 'INFARCTION', thereby also contributing to decreased specificity for 'NORMAL'.

*The accuracy of the program in dealing with acute myocardial infarction was assessed with respect to interpretation of ECGs by cardiologists. 100 ECGs with a mixture of inferior and anterior myocardial infarction and thought to show evidence of acute myocardial infarction according to experienced cardiologists, were used to assess the sensitivity of the program. On the other hand, to assess specificity, 144 ECGs from patients with proven left ventricular hypertrophy but not with any evidence of acute myocardial infarction were used. The results were as follows:

Sensitivity for acute MI = 95/100 = 95%. (CI = 90.7%, 99.3%)

Statements were of the type "Acute MI" or "MI Possibly Acute" or "MI Probably Acute".

Specificity for acute MI = 138/144 = 96%. (CI = 92.6%, 99.1%)

There were two statements of "Acute Myocardial Infarction" and four false positive statements of the type "Consider Recent Myocardial Infarction".

*The above data were obtained from an assessment of the program in May 1992 and supersede the data published in the New England Journal of Medicine (1991; 325:1767-73).

TYPE B STATEMENTS — CONDUCTION DEFECTS

CONDUCTION DEFECTS	SENSITIVITY	SPECIFICITY	POSITIVE PRED. VALUE	NEGATIVE PRED. VALUE	PREVALENCE	NOTES†
R.B.B.B.	100%	100%	100%	100%	11/204	Includes 'IVCD of RBBB type'.
L.B.B.B.	100%	100%	100%	100%	9/204	Includes 'IVCD of LBBB type'.
R.B.B.B. w/ Left Anterior Fascicular Block	100%	100%	100%	100%	6/204	
Incomplete R.B.B.B.	100%	100%	100%	100%	9/204	
I.V. Conduction Defect	93%	99%	93%	99%	15/204	
Minor I.V. Conduction Defect	100%	99%	83%	99%	5/204	
WPW Pattern	100%	100%	100%	100%	3/204	Includes type A and B pattern
Fascicular Block	100%	100%	100%	100%	6/204	Includes Anterior (5) and Posterior (1) Fascicular Block

†1) Incomplete LBBB and possible RV conduction delay did not occur in the database studied. 2) A database of 204 ECGs with Type B statements was used.

TYPE B STATEMENTS — DOMINANT RHYTHM STATEMENTS

DOMINANT RHYTHM STATEMENTS	SENSITIVITY	SPECIFICITY	POSITIVE PRED. VALUE	NEGATIVE PRED. VALUE	PREVALENCE	NOTES†
SINUS RHYTHM	99%	99%	99%	99%	100/400	
SINUS TACHYCARDIA	100%	100%	100%	100%	29/400	
SINUS BRADYCARDIA	100%	100%	100%	100%	65/400	
SINUS ARRYTHMIA	100%	100%	100%	100%	7/400	
IRREGULAR SINUS TACHYCARDIA	100%	99%	50%	100%	1/400*	
IRREGULAR SINUS BRADYCARDIA	100%	100%	100%	100%	13/400	
ATRIAL FLUTTER	100%	100%	100%	100%	9/400	
ATRIAL FIBRILLATION	95%	98%	92%	99%	38/400	
REGULAR ATRIAL PACING	100%	100%	100%	100%	2/400	
REGULAR VENTRICULAR PACING	100%	100%	100%	100%	4/400	
REGULAR A-V SEQUENTIAL PACING	100%	100%	100%	100%	2/400	
A-V SEQUENTIAL AND VENTRICULAR PACING	100%	100%	100%	100%	1/400	
ECTOPIC ATRIAL RHYTHM ECTOPIC ATRIAL TACHYCARDIA ECTOPIC ATRIAL BRADYCARDIA	100%	100%	100%	100%	6/400	
IRREGULAR ECTOPIC ATRIAL RHYTHM	100%	100%	67%	99%	2/400	
IRREGULAR ECTOPIC ATRIAL TACHYCARDIA	100%	100%	100%	100%	1/400	
IRREGULAR ECTOPIC ATRIAL BRADYCARDIA	100%	100%	100%	100%	2/400	
PROBABLE SINUS (? ATRIAL) TACHYCARDIA	100%	100%	100%	100%	2/400	
PROBABLE SINUS TACHYCARDIA. ? ATRIAL TACHYCARDIA OR FLUTTER AND 2:1 A-V BLOCK	100%	100%	100%	100%	3/400	
PROBABLE SVT PROBABLE SVT, BUT CONSIDER SINUS OR PAROXYSMAL ATRIAL TACHYCARDIA	100%	100%	100%	100%	1/400	

DOMINANT RHYTHM STATEMENTS	SENSITIVITY	SPECIFICITY	POSITIVE PRED. VALUE	NEGATIVE PRED. VALUE	PREVALENCE	NOTES[†]
SINUS BRADYCARDIA CONSIDER SINUS RHYTHM WITH 2:1 SINOATRIAL BLOCK	100%	100%	100%	100%	42/400	
PROBABLE ATRIAL FIBRILLATION	97%	98%	92%	99%	37/400	
PROBABLE ACCELERATED JUNCTIONAL RHYTHM	100%	100%	100%	100%	2/400	
WIDE COMPLEX TACHYCARDIA - PROBABLE VT	100%	100%	100%	100%	3/400	
ACCELERATED IDIOVENTRICULAR RHYTHM	0%	100%	0%	100%	1/400	
POSSIBLE IDIOVENTRICULAR RHYTHM	100%	100%	100%	100%	1/400	
POSSIBLE ATRIAL FLUTTER	100%	100%	100%	100%	6/400	
POSSIBLE A-V JUNCTIONAL RHYTHM	100%	100%	100%	100%	1/400	
POSSIBLE ACCELERATED JUNCTIONAL RHYTHM	100%	100%	100%	100%	2/400	
WIDE COMPLEX TACHY-CARDIA POSSIBLE SVT	100%	100%	100%	100%	1/400	
WIDE COMPLEX TACHY-CARDIA POSSIBLE VT	100%	100%	100%	100%	3/400	
A-V DISSOCIATION	50%	100%	100%	98%	9/400[††]	
REGULAR RHYTHM	100%	100%	100%	100%	1/400	
REGULAR SUPRAVENTRICULAR RHYTHM	100%	100%	100%	100%	1/400	
UNDETERMINED RHYTHM	100%	100%	100%	100%	2/400	
IRREGULAR RHYTHM	100%	100%	100%	100%	1/400	
IRREGULAR SV RHYTHM	100%	100%	100%	100%	1/400	

[†]1) Values of sensitivity and specificity etc. on arrhythmias occurring very rarely e.g. 1/400 are clearly subject to variation on a larger database. This is a reflection of their overall prevalence. 2) Some cases may appear twice under 'PREVALENCE'. For example 'AV DISSOCIATION' was reported as 'REGULAR SUPRAVENTRICULAR RHYTHM' in one case.

[*]One 'SINUS TACHYCARDIA + SVES' was reported as IRREGULAR SINUS TACHYCARDIA. This was regarded as 50% correct. There was one other false positive case.

[††]One case was reported as POSSIBLE A-V JUNCTIONAL RHYTHM (regarded as partly correct).

TYPE B STATEMENTS — SUPPLEMENTARY RHYTHM STATEMENTS

SUPPLEMENTARY RHYTHM STATEMENTS	SENSITIVITY	SPECIFICITY	POSITIVE PRED. VALUE	NEGATIVE PRED. VALUE	PREVALENCE	NOTES‡
PREMATURE VENTRICULAR CONTRACTIONS	94%	100%	100%	99%	18/400	
FREQUENT PVCs	100%	100%	100%	100%	4/400	
MULTIFORM PVCs	100%	99%	89%	100%	8/400	
FREQUENT MULTIFORM PVCs	100%	99%	80%	100%	4/400	
INTERPOLATED PVCs	100%	100%	100%	100%	35/400	
MULTIFOCAL PVCs	100%	100%	100%	100%	2/400	
MULTIFOCAL INTERPOLATED PVCs	100%	100%	100%	100%	3/400	
FREQUENT MULTIFOCAL PVCs	100%	99%	82%	100%	9/400	
PREMATURE ATRIAL CONTRACTIONS SUPRAVENTRICULAR EXTRASYSTOLES	89%	99%	100%	99%	27/400	
FREQUENT SUPRAVENTRICULAR EXTRASYSTOLES	100%	100%	100%	100%	1/400	
FIRST DEGREE A-V BLOCK	100%	100%	100%	100%	5/400	
BORDERLINE FIRST DEGREE A-V BLOCK	100%	100%	100%	100%	16/400	
WENCKEBACH (MOBITZ I) 2nd DEGREE A-V BLOCK	50%	100%	50%	100%	2/400	
MOBITZ TYPE II 2nd DEGREE A-V BLOCK	100%	100%	100%	100%	2/400	
2:1 A-V BLOCK	100%	100%	100%	100%	7/400	
3:1 A-V BLOCK	100%	100%	100%	100%	1/400	
4:1 A-V BLOCK	100%	100%	100%	100%	2/400	
HIGH DEGREE A-V BLOCK	100%	100%	100%	100%	1/400	
COMPLETE A-V BLOCK	0%	100%	0%	100%	1/400	
SINOATRIAL 2nd DEGREE MOBITZ II BLOCK	100%	100%	100%	100%	1/400	
BIGEMINAL PACs	100%	100%	100%	100%	8/400	
BIGEMINAL PVCs	100%	100%	100%	100%	2/400	
DEMAND ATRIAL PACING	100%	100%	100%	100%	1/400	
DEMAND ATRIAL PACING AND INEFFECTIVE STIMULI	100%	100%	100%	100%	1/400	
DEMAND VENTRICULAR PACING	100%	100%	100%	100%	2/400	

SUPPLEMENTARY RHYTHM STATEMENTS	SENSITIVITY	SPECIFICITY	POSITIVE PRED. VALUE	NEGATIVE PRED. VALUE	PREVALENCE	NOTES†
DEMAND A-V SEQUENTIAL PACING	100%	100%	100%	100%	1/400	
DEMAND A-V SEQUENTIAL PACING AND INEFFECTIVE STIMULI	100%	100%	100%	100%	2/400	
DEMAND A-V SEQUENTIAL AND VENTRICULAR PACING	100%	100%	100%	100%	1/400	
RAPID VENTRICULAR RESPONSE	100%	100%	100%	100%	9/400	
UNCONTROLLED VENTRICULAR RESPONSE	100%	100%	100%	100%	6/400	
SLOW VENTRICULAR RESPONSE	100%	100%	100%	100%	4/400	
NON-SUSTAINED VENTRICULAR TACHYCARDIA	100%	100%	100%	100%	1/400	
INTERMITTENT CONDUCTION DEFECT	100%	100%	100%	100%	1/400	
PAROXYSMAL IDIOVENTRICULAR RHYTHM	100%	100%	67%	100%	2/400	

†1) Values of sensitivity and specificity etc. on arrhythmias occurring very rarely e.g. 1/400 are clearly subject to variation on a larger database. This is a reflection of their overall prevalence. 2) Physicians should be aware that arrhythmias with a low prevalence are likely to have a low sensitivity in computer reporting. They should always be carefully reviewed.

TYPE A, B, C ABNORMALITIES IN CHILDREN

	SENSITIVITY	SPECIFICITY	POSITIVE PRED. VALUE	NEGATIVE PRED. VALUE	PREVALENCE	NOTES†
Normal	95%	86%	99%	47%	2111/2196	
RVH	76%	99%	61%	99%	29/2196	
LVH	78%	99%	70%	99%	9/2196	
BVH	80%	100%	100%	100%	5/2196	
RBBB	86%	99%	50%	100%	14/2196	
IVCD	100%	99%	46%	100%	3/2196	
Right Atrial Enlargement	100%	99%	28%	100%	5/2196	
Left Atrial Enlargement	100%	99%	43%	100%	6/2196	
BiAtrial Enlargement	100%	100%	100%	100%	4/2196	
Nonspecific P wave changes	100%	99%	36%	100%	4/2196	
Borderline ST-T changes	100%	99%	15%	100%	5/2196	
RAD	100%	100%	100%	100%	9/2196	
Inferior QRS Axis	100%	100%	100%	100%	7/2196	
LAD	100%	100%	100%	100%	5/2196	
Leftward QRS Axis	100%	100%	100%	100%	7/2196	
Abnormal Q waves	78%	100%	100%	99%	9/2196	
Tall R waves-consider as normal	100%	100%	100%	100%	4/2196	

†The entries for predictive values are somewhat skewed by the large numbers of normal children who constituted approximately 95% of the database. In contrast, in the CSE Database of adult ECGs, the number of normals was approximately one-third of the database.

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