

**NATIONAL HEALTH AND
NUTRITION EXAMINATION SURVEY III**

Electrocardiogram

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1. INTRODUCTION

1.1 General Overview of Electrocardiogram

The public health problems caused by cardiovascular disease are enormous. Cardiovascular disease is the leading cause of death and disability in the United States and a primary cause of acute hospital bed days and physician visits. The assessment of cardiovascular disease-related risk factors has been a central component of the NHANES. Data describing rates of morbidity and disability related to cardiovascular disease have provided important information to researchers, health providers and policymakers from the public and private sectors of the health field.

Data for the cardiovascular disease component for NHANES III will be collected by various methods. Questions will be asked about medical and familial history of cardiovascular disease, laboratory measurements and examination procedures including blood pressure measurements and an electrocardiogram. The electrocardiogram for NHANES III is a standard 12-lead electrocardiogram. All adult sampled persons (SP's) ages 40 and older are administered a resting electrocardiogram (ECG) as a routine component of their physical examination in the MEC.

The collection of electrocardiogram data in the NHANES III will provide a description of the age and sex-specific rates of ECG abnormalities in this nationally representative sample. Descriptions of national trends in age and sex-specific ECG abnormalities will also be provided. Collection of electrocardiogram data facilitates the conduct of longitudinal analyses to examine the relationship of specific ECG abnormalities to subsequent events of cardiovascular disease. In addition, data from NHANES III provide a unique opportunity to understand ECG abnormalities in high risk groups which could enhance future cardiovascular disease detection and prevention efforts.

2. EQUIPMENT

2.1 Description of Exam Room in MEC

The electrocardiogram equipment is located in the x-ray room in trailer #3 of the MEC. This room is shared with the x-ray and fundus photography components. The gurney which is secured by brake locks will function as the examination table for this component.

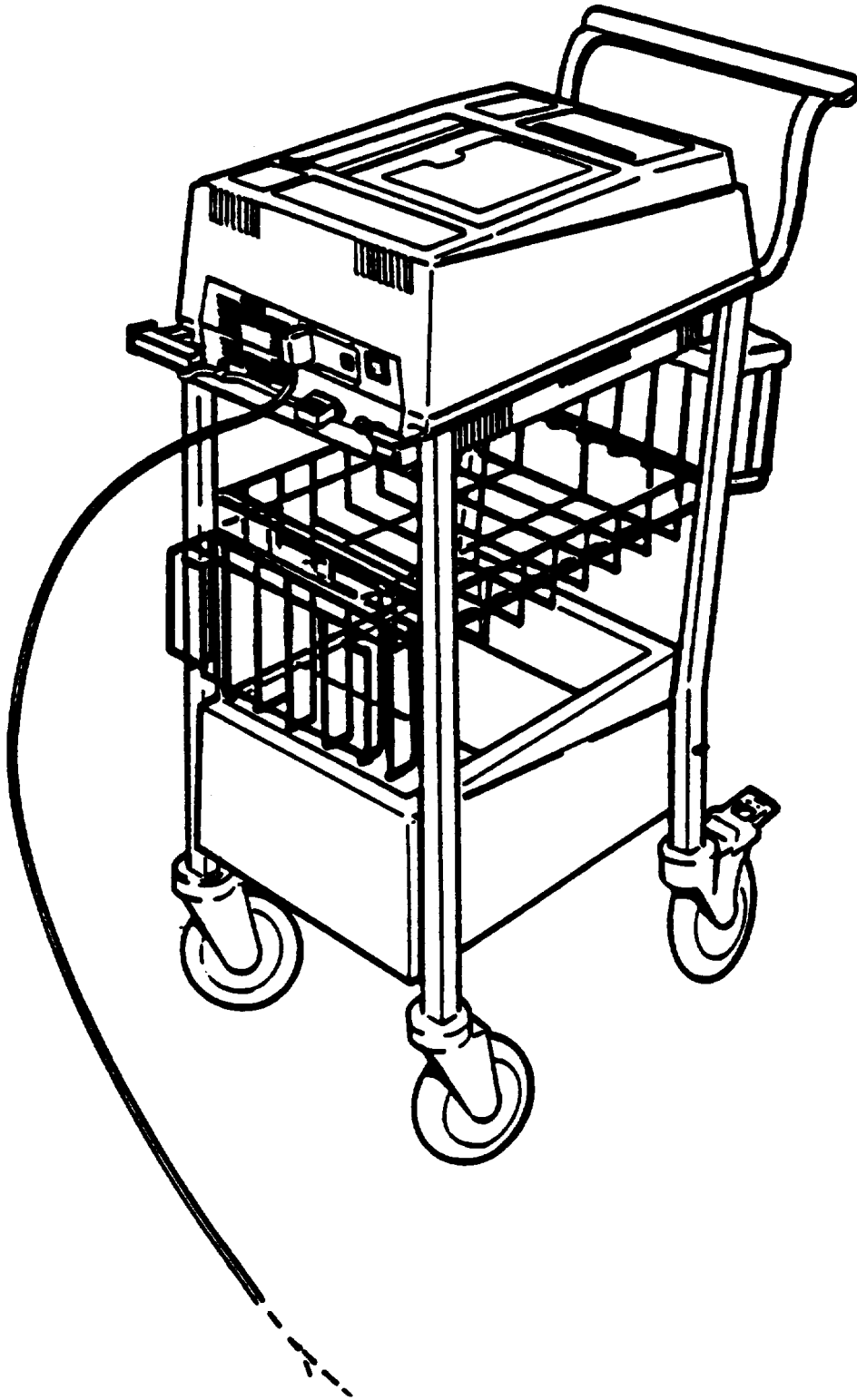
2.2 Description of Equipment and Supplies

- Marquette MAC 12 Unit
- Diskettes 3½"
- 10 lead wire patient cable
- ECG paper pressure-scribe
- Silver/silver chloride electrodes (10 per SP)
- Clip type connectors (10)
- Extra patient cable wires
- External calibrator unit
- Alcohol
- Baby oil
- Gauze Pads 4x4 or 2x2
- Table paper
- 2 Pillows
- Scissors
- Paper tape w/dispenser
- Wax cosmetic pencil
- 2 Dal-Squares
- Small pliers
- Basins
- Stool
- Box number (diskette) labels (preprinted)
- ECG Daily Logs

2.2.1 MAC 12 Unit (See Exhibit 2-1)

The Marquette MAC 12 unit represents the latest and most sophisticated technology in electrocardiography. An outgrowth of the earlier MAC I and MAC II units, this new instrument is designed to perform rapid, accurate analysis of both morphology and rhythm on 12-lead ECGs. The


Exhibit 2-1. Marquette MAC 12 Unit







MAC 12 is also capable of storing and/or transmitting these analyses and waveforms to central processors via telephone, cellular telephone, or satellite. For NHANES III, the function of the MAC 12 will be to obtain and store ECG data on 3½ inch, double-sided, double-density diskettes. All operating controls are on the keyboard on the top of the unit except for the power switch at the back of the unit. (See Exhibit 2-2.)



2.2.1.1 Keyboard Description

The LCD (Liquid Crystal Display) is on the top part of the MAC 12 keyboard and is used for entering information and displaying messages. The keyboard descriptions listed below correspond to the MAC 12 keyboard pictured in Exhibit 2-3.

 **Function keys select an LCD display function that is directly above the key. For example, in the LCD display below,**

 pressing the  key selects the **Delete** function,

 pressing the  key selects the **Format** function, and

 pressing the  key selects **More** which allows for reviewing more menu functions.



NOTE: As in the example above, LCD displays in this guide will show only those function keys that can actually be used to select a function.



OR



ENTER key. After typing information on the LCD display, it is usually necessary to press this key to enter or store what was typed.

Exhibit 2-2. Power Switch on the MAC 12 Unit

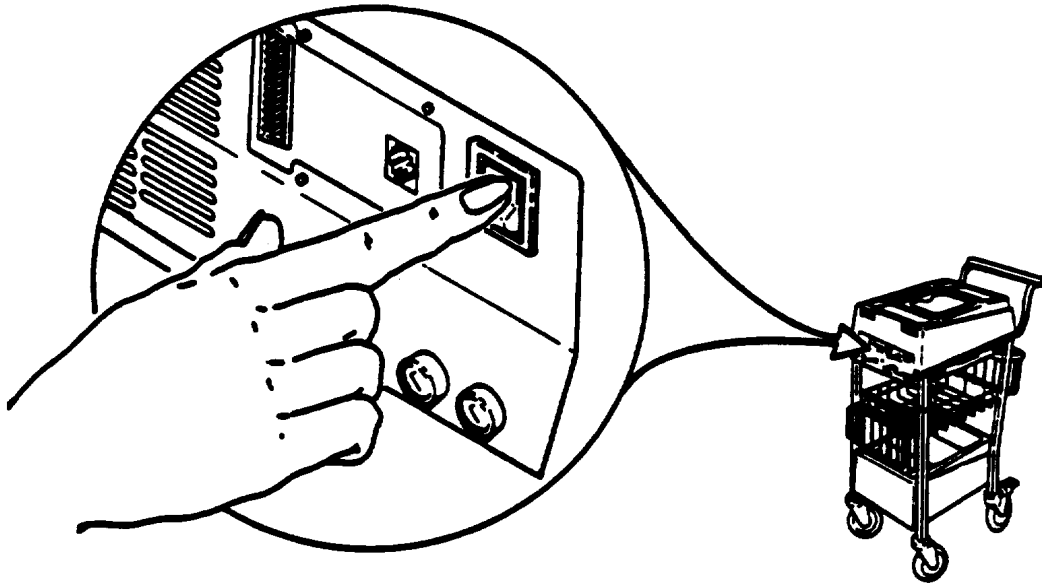
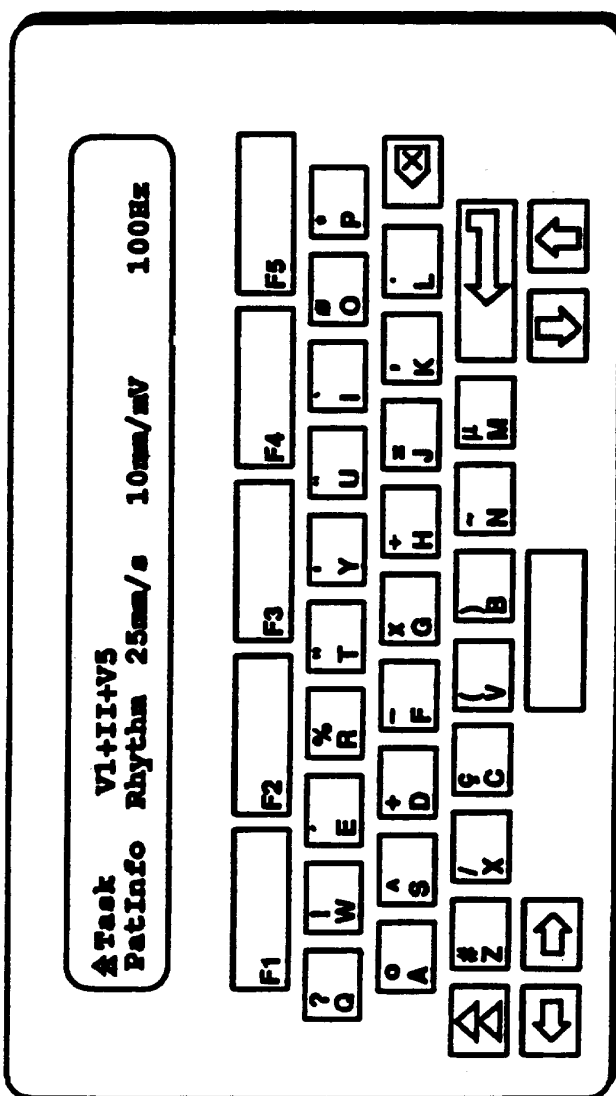
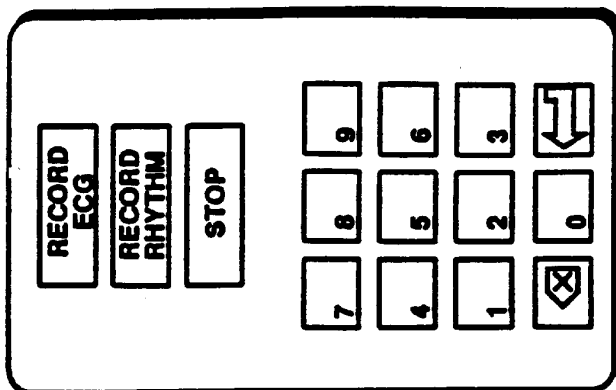


Exhibit 2-3. MAC 12 Keyboard





SHIFT key. Used to type shifted characters or to access special functions.



DELETE key. Press this key to erase a character that was typed on the LCD display.



SPACE BAR key. Press this key to create a space on the LCD display.



CURSOR LEFT key. Press this key to move the LCD cursor left.



CURSOR RIGHT key. Press this key to move the LCD cursor right.



BACK UP key. Pressing this key causes the prior LCD prompt to appear.



RECORD ECG key. Pressing this key acquires a 12-lead ECG from a patient and prints a 12-lead report. *The Main Menu must be displayed before you can record an ECG.*



RECORD RHYTHM key. Prints either a 3, 6, or 12-lead rhythm report depending on cart setup. *The Main Menu must be displayed before you can record a rhythm report.*

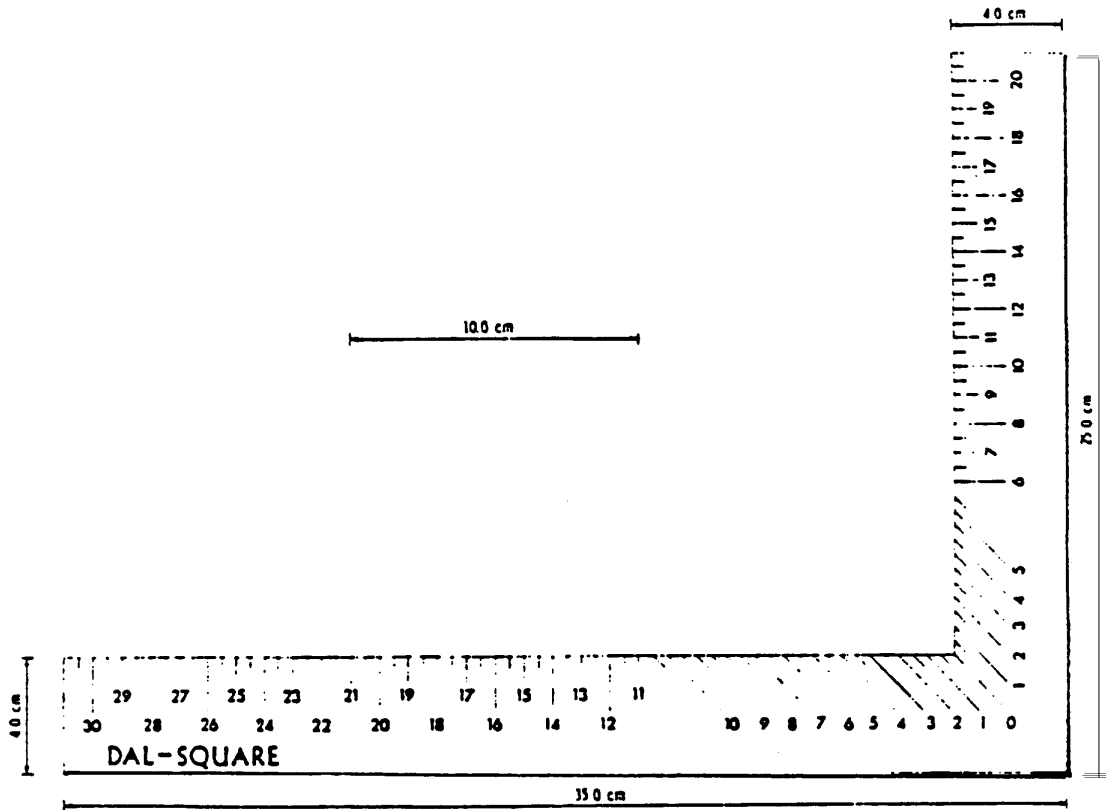


STOP key. Press this key to return to the *Main Menu*. Pressing this key also stops the printing of a report.

2.2.2 The Dal-Square

The Dal-Square (Exhibit 2-4) is an ECG electrode locator which reduces the uncertainty in the identification of the precordial leads. A particular problem in standard 12-lead electrocardiography

Exhibit 2-4. The Dal-Square



is accurate location of electrodes V_4 and V_5 . The Dal-Square simplifies positioning and provides a numeric record of the key precordial electrode positions, thereby facilitating more control over electrode placement errors.

The Dal-Square is a laminated vinyl locator in the form of a carpenter square with dual demarcations. This facilitates the accurate determination of the location of two points on the chest (the mid-sternum and left mid-axillary) in order to measure a 45° angle between them. This measurement is then identified as the location for the V_4 electrode. More detailed instructions for using the Dal-Square are described in Section 3 of this manual.

2.2.3 Inventory of Equipment and Supplies

At the beginning of each stand and at the end of each stand, the technicians take an inventory of the equipment used for the ECG exam component. Any pieces of equipment that are missing should be reported to the MEC manager. Supplies are also inventoried as discussed in Standardized Procedures.

2.3 Equipment Setup Procedures

2.3.1 Start of Stand Procedures

At the beginning of each stand, the following procedures are performed to prepare the ECG equipment for use.


1. Plug the power cord into the wall power outlet. Turn the machine on by pressing the power switch located on the back of the MAC unit.
2. Attach the ten-wire patient cable to the main body of the machine. Be careful that the connector on the cable is properly mated to the socket to avoid damaging any of the connector's prongs.
3. Rub the banana plug at the end of each lead wire with alcohol and gauze to remove any tarnish.

4. Make sure that supplies have been restocked. The room should have Dal-Squares, scissors, exam table paper, gauze pads, alcohol, baby oil, wax pencils, paper tape, silver/silver chloride electrodes, and clip type connectors. Always check to make sure there is an adequate supply of formatted diskettes.
5. The clipboard with the ECG Daily Log pages should be hung on the wall cuphook.
6. Clean the exam table with a mild detergent solution. Make sure that the exam table is positioned and that the wheels are locked in place. Place a pillow at the head of the exam table and cover it with clean examination paper.
7. Follow additional cleaning procedures for equipment as discussed in Section 2.4.1.

2.3.1.1 Formatting a Diskette

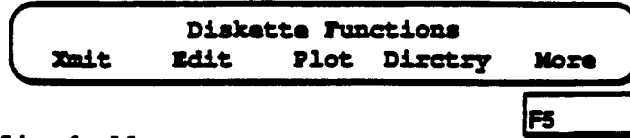
The MAC 12 stores ECGs on 3-1/2-inch diskettes. A diskette must be formatted before ECGs can be stored on it. Formatting simply prepares a diskette for first-time use. A diskette only needs to be formatted once. Since formatting erases everything on a diskette, be careful not to format the wrong diskette.

Formatting a diskette takes approximately 6-7 minutes per diskette. Therefore, it is recommended that all new diskettes be formatted at the beginning of the stand or when a shipment is received so that valuable time will not be lost during the stand.

1. If the *Main Menu* is not on the LCD display, press the **STOP** key to return to the *Main Menu*.
2. Press the  and the F1 keys at the same time to display the **System Functions** menu:

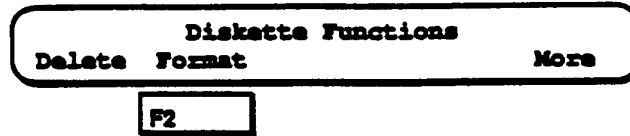


3. Then press the F2 key for Disk and the following will appear on the LCD display:



Press the F5 key for More.

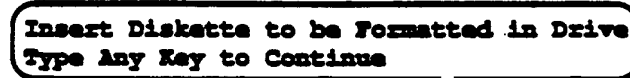
4. The following will appear on the LCD display:



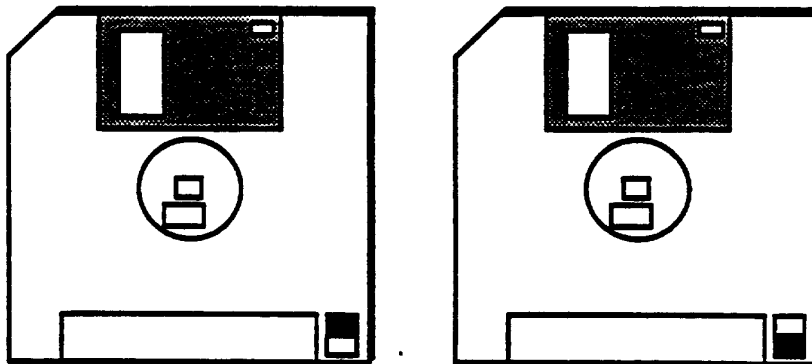
Press the F2 key for Format.

5. Then the password prompt will appear. Type in L1. Then press the ENTER key.

6. The following message will appear:



7. Make sure that the diskette you wish to format is NOT write protected. To do this, cover the write-protect hole (as shown below):



Not write protected (hole covered) Write protected (hole uncovered)

*** Back of Diskette ***

8. Insert the diskette - label side up - that you want to format into the diskette drive slot. If there already is a diskette in the diskette drive slot, remove it first by pressing the eject button.

9. After the diskette is inserted, press any key. Then one of the following two messages will appear:

**Diskette Error-Write Protected
Type Any Key to Continue**

OR

**** Looking for Bad Block Data ****

If the first message appears, remove the diskette from the disk drive, remove the write protection from the diskette, and restart this procedure.

If the second message appears, go to the next step.

10. One of the following two messages will appear:

**Bad block data found
Type Any Key to Continue**

OR

**No bad block data found
Type Any Key to Continue**

11. While the MAC 12 formats the diskette, the following series of messages will appear on the LCD display:

NOTE: The "XX" or "X"s in the following displays stand for numbers that will appear:

***** Writing the Tracks **
Track:XX Side:X**

THEN

**** Looking for Bad Sectors **
Track:XX Side:X Sector:XX**

2.3.3 Daily Procedures

1. Turn on the power to the MAC 12 by pressing the power switch on the back of the unit.
2. After the short self test, the LCD main menu will appear.
3. Prepare the ECG room for examinations. Make sure that adequate supplies are stocked.

2.4 Care and Maintenance

2.4.1 Cleaning of Equipment

1. At the beginning of each stand and during the stand as necessary, the MAC 12 unit may be cleaned with a clean, soft cloth and a solution consisting of mild dishwashing detergent diluted in water. (Before starting, turn the unit off.) However, avoid coming into contact with open vents, plugs and jacks of any kind, the keyboard and the writer. Thoroughly wipe the exterior of the unit and dry it with a clean, soft cloth or paper towel.
2. After each use, the Dal-Square should be cleaned off with alcohol and gauze.
3. The ends of the banana plugs should be rubbed with alcohol and gauze to clean them and to remove any tarnish.
4. At the beginning of each stand, the ECG/x-ray table should be wiped with a clean, soft cloth and a mild dishwashing solution. Dry the table with a clean, soft cloth.

2.4.2 Maintenance

At the beginning of each stand, inspect all cords on the MAC 12 unit for fraying or other damage. Inspect all plugs and connectors for bent prongs or pins. Verify that all cords and connectors are securely slated. Needed repairs or replacements should be reported to the MEC manager.

2.4.2.1 Replacing the ECG Paper

To replace the paper in the MAC 12's writer, follow these steps (see Exhibit 2-5):

1. Open the paper compartment lid by grasping it with the thumb and forefinger and lifting up.
2. Press the paper release lever outward and away from the MAC 12.
3. Insert the fanfold paper in the storage compartment.
4. Starting from the edge of the top sheet of paper, fold the paper over on an angle until the center of the paper is reached.
5. Insert the sheet which was just folded into the paper guide. Feed the paper through until it appears on top of the paper roller and underneath the paper carrier lock.
6. Pull the paper out and towards you until a full sheet of paper is exposed. Then push the paper release lever inward and towards you until the paper is secure. Finally, close the paper compartment lid.

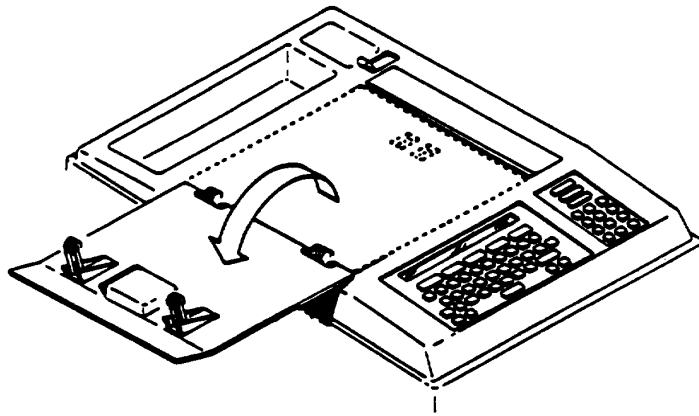
2.4.2.1.1 Storing the ECG Paper

The thermal paper used in the MAC 12 can be stored for an indefinite period of time as long as a few precautions are taken. The precautions apply to both unused paper and to paper that has already been run through the writer.

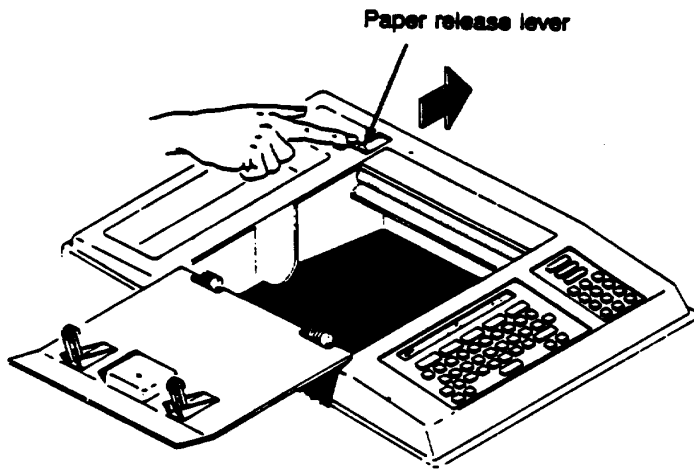
- Store the thermal paper in a cool, dry, and dark place. The paper should be stored in a location where the temperature is below 27.6 degrees Centigrade (80 degrees Fahrenheit) and where the relative humidity is between 40% and 65%.
- The thermal paper should NOT be in a location where it will be exposed to bright light or ultraviolet sources such as sunlight, fluorescent and similar lighting which cause yellowing of paper and fading of tracings.
- Avoid contact with cleaning fluids and solvents such as alcohols, ketones, esters, ether, etc.

Exhibit 2-5. Steps for Replacing ECG Paper

Step 1



Step 2



Step 3

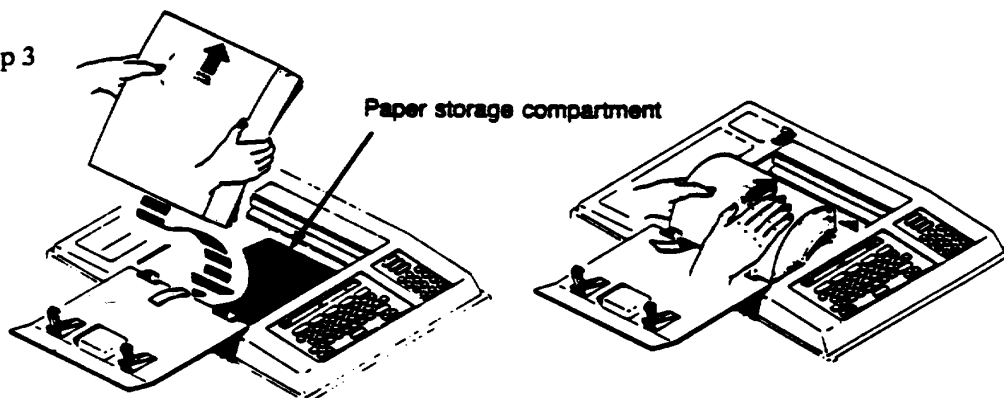
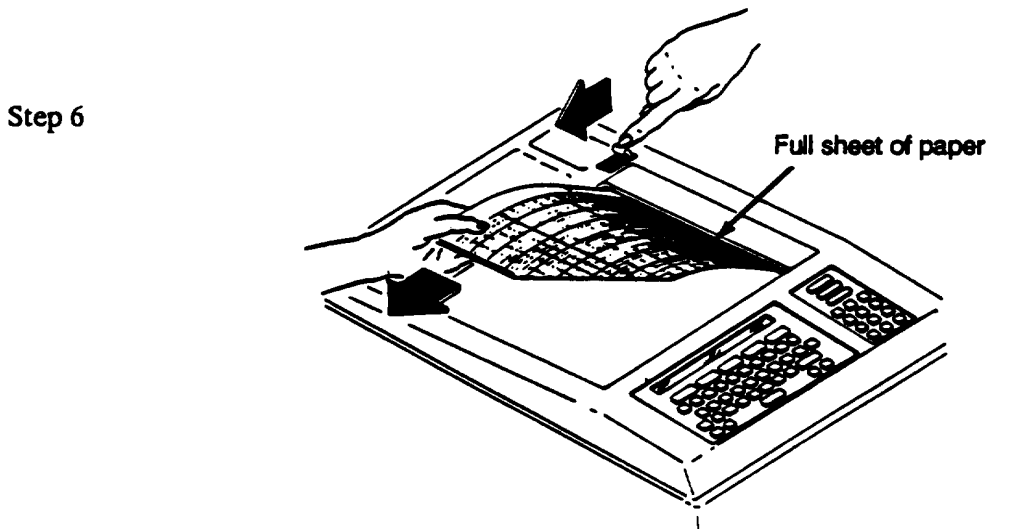
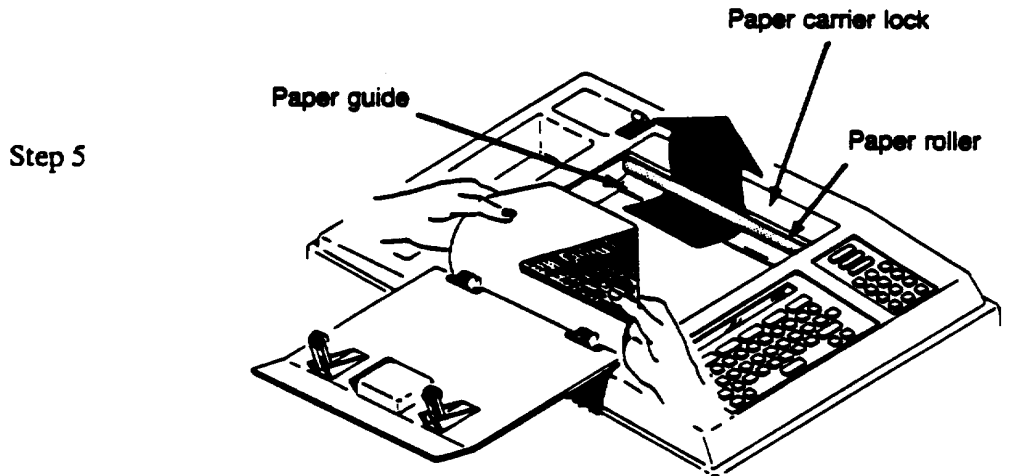
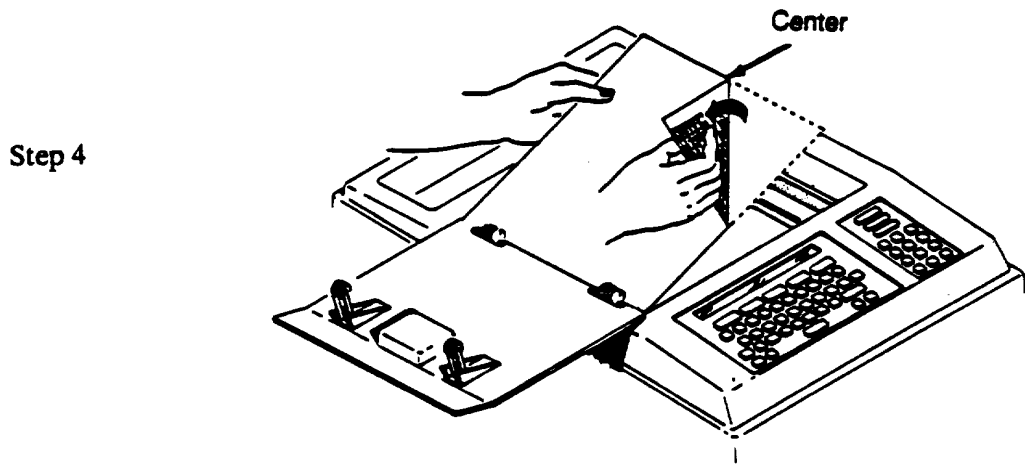


Exhibit 2-5. Steps for Replacing ECG Paper (continued)



2.4.2.2 Care of the Diskette

The 3½-inch diskettes used in the MAC 12 should be caRed for according to the following guidelines:

1. Do NOT attempt to move the protective cover nor take the diskette apart.
2. Store diskettes in the container specifically designed to hold 3-½-inch diskettes.
3. Do NOT attempt to clean the surface of a diskette, because cleaning fluid of any type can prevent the diskette drive from operating properly.
4. Prevent the diskette from being exposed to dust, fingerprints, direct sunlight, and extreme heat or cold.
5. Do NOT bend, drop, or twist a diskette.
6. Do NOT use an eraser on a diskette label or near a diskette. Eraser dust can easily get beneath the protective cover.
7. Keep diskettes away from all sources of magnetism, such as radio speakers, television sets, and motors.
8. Do NOT place heavy objects on a diskette.
9. Before moving the MAC 12, remove any diskette from the diskette drive.
10. Do NOT store full ECG data diskettes in the x-ray room.

2.4.2.3 Labeling Diskettes

Each 3½-inch inch formatted diskette must be labeled with a preprinted, self stick, numbered, barcoded label (format AA22222) before the disk is used to collect data. The label will be taken from the series of preprinted box number labels that are distributed to the staff by the MEC Manager at the beginning of each stand.

2.4.2.4 Storage of Silver/Silver Chloride Electrodes

The silver/silver chloride electrodes are made with a unique conductive adhesive hydrogel. Their performance may be adversely affected if individual cards of electrodes are exposed to air for long periods of time. Always store unused cards of electrodes in their pouch or in a sealable plastic bag. Store unopened product in a cool dry place.

2.4.3 Malfunctions

Report any malfunctions of the ECG equipment to the MEC manager. Back-up equipment will be provided, when available, until malfunctioning equipment can be repaired or replaced.

2.5 End of Stand Procedures

At the end of each stand, it is the responsibility of the technicians to prepare the ECG equipment for moving. The following procedures are to be followed:

1. Turn off the incoming power to the MAC unit by pressing the power switch located on the back of the unit.
2. Disconnect the power cord from the wall power outlet. Coil the cord and place it in the accessory basket attached to the front of the machine.
3. Remove any diskette from the diskette drive.
4. Disconnect the patient lead wire cable. Place it in protective covering and store it in the ECG cabinet.
5. Place all room supplies in the cabinet.
6. Make sure that the MAC 12 unit is secure for transit.

3. EXAMINATION PROTOCOL

3.1 Eligibility Criteria

All SP's 40 years of age and older are eligible for the electrocardiogram component. There are no automatic exclusions from the ECG. Cognitively impaired SPs should receive the ECG. For SPs in wheelchairs, the ECG should be done if the SP can self-transfer to the examining table or can be assisted in transferring by someone who has accompanied the SP and who usually lifts him/her.

3.2 Pre-examination Procedures

1. After the SP has entered the ECG room, have him/her sit on the ECG table with feet toward the bottom of the table in preparation for lying down. Ask the SP to remain in a sitting position temporarily.
2. Place the SP ID label, and record the SP age, sex, technician ID number, and beginning time on the ECG Daily Log.
3. Enter the technician ID number and the SP ID number into the automated system and verify the identifying information with the SP. If automated system is not functioning, use the hard copy data form.
4. If the SP is a male, have him remove the top of the examination gown to expose his chest. If the SP is a female have her remove her arms from her examination gown, but keep the gown draped over her chest.
5. Have the SP lie down carefully to avoid hitting the x-ray tube and place a pillow under the SP's head. The SP's arms should be positioned at the side of the body and legs should not be crossed.

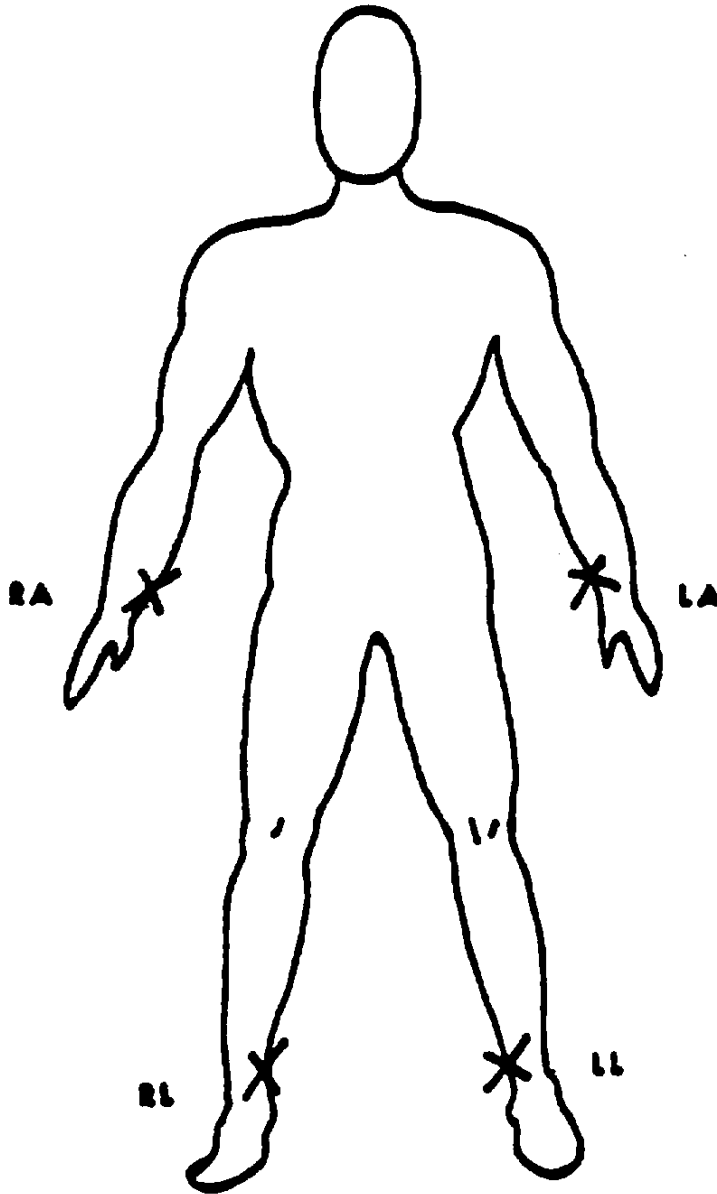
3.3 Examination Procedures

Ten leads must be placed at precise anatomical locations on the SP to obtain optimal quality data. Remember, before any lead can be placed, the electrode area of the SP's skin should be cleaned with alcohol (and gauze) to remove oil, sweat, or scaly skin. Failure to apply the electrodes to a clean surface could result in baseline drift.

1. Apply the four limb lead electrodes to the extremities (see Exhibit 3-1).

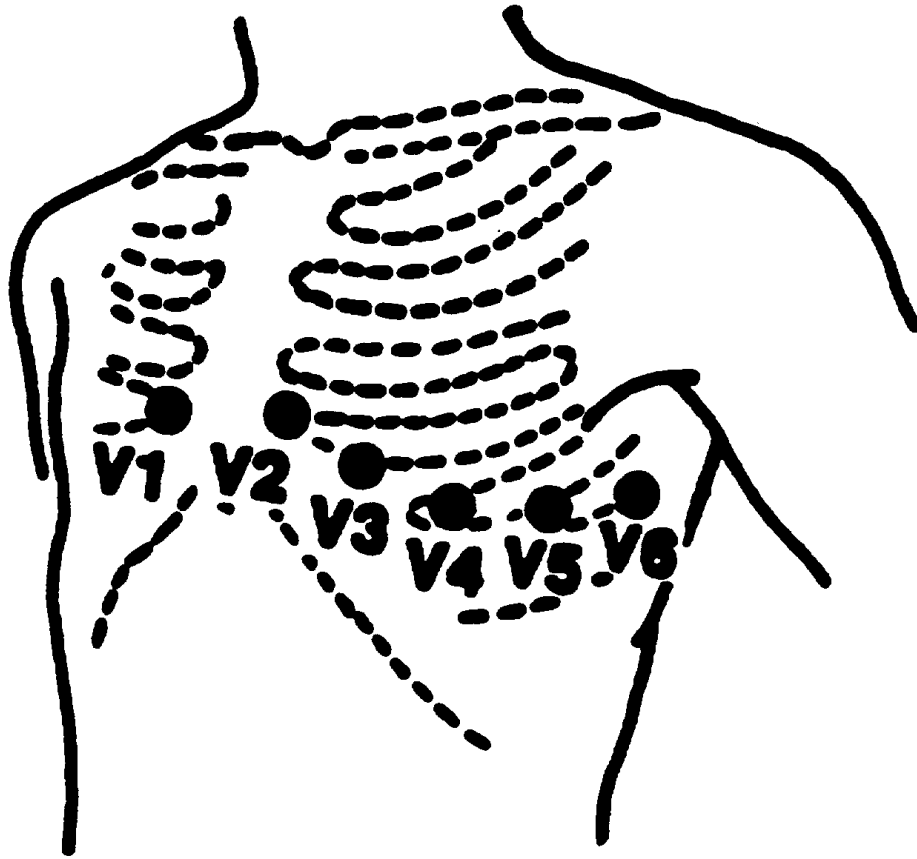
- a. Start with the right leg. The right leg electrode is to be applied to the inner leg about 4-5 cm. above the ankle.
 - b. Prepare the skin with alcohol and gauze and rub the area vigorously about ten times.
 - c. Peel an electrode from the carrier card and apply to the skin, pressing gently to ensure good adhesion. Parting the hair during applications helps adhesion.
 - d. The tab end of the electrode is pointed toward the upper leg.
 - e. Attach the clip type lead wire connector to the tab of the electrode.
 - f. Follow the same procedures (b-e) to apply the left leg electrode.
 - g. Next, go to the right arm. The inside of the lower arm has thinner skin and is the preferred electrode site.
 - h. Prepare the skin with alcohol and gauze and rub the area vigorously about ten times.
 - i. Place the electrode on the right arm so that the tab of the electrode is pointing up towards the arm.
 - j. Attach the clip type lead wire connector to the tab of the electrode.
 - k. Follow the same procedures (h-j) to apply the left arm electrode.
2. Attach the lead wires to the four extremities. Select the correct wire from the patient cable distribution block and pull it from the group. Attach the banana plug into the connector. (The top of the electrodes may have to be tightened for a firm connection with the banana plug.) The cable (lead) wires need to be as straight as possible. Loops in the lead wires can cause A-C interference.
 3. Double check that the right side (RA, RL) lead wires are on the SP's right side and the left side (LA, LL) lead wires are on the left and attached to the corresponding extremity.
 4. Palpate the SP's chest to locate the appropriate sites for the precordial leads (see Exhibit 3-2).
 - a. Locate the sternal angle with two fingers and move fingers towards the SP's right side to palpate the 1st and 2nd intercostal space. Keep moving down the intercostal spaces until the 4th intercostal space at the right border of the sternum is located.

Exhibit 3-1. Limb lead electrode locations



- b. Keep one finger (middle) on the 4th intercostal space and locate the same space on the left border of the sternum with the index finger.
- c. Then place a mark with the cosmetic pencil on the two landmarks. These are the locations of V_1 and V_2 . Check again to make sure that they are at the fourth intercostal spaces.
- d. From V_2 (fourth intercostal space at the left border of the sternum), palpate down to the fifth intercostal space (can be more easily palpated from under the nipple line). Draw an imaginary line at a horizontal line over from the 5th intercostal space to the middle of the sternum and mark this location. This is the location of the E orthogonal lead landmark which will be used only in these procedures for the Dal-Square measurement.
- e. Move the SP's left elbow out away from their body. Start in the left arm pit and move down to make a mid-axillary mark approximately horizontal to the E lead location line. This mid-axillary mark may have to be moved during the Dal-Square measurement which will provide a more accurate location for this landmark.
- f. The size of the SP's chest determines which size Dal-Square should fit firmly against the front of the SP's chest. If it does not, the SP may have to sit up to proceed with the Dal-Square measurements.
- g. The Dal-Square is placed firmly against the chest on a horizontal plane from the E mark to the mid-axillary point. The technician "spots" the level of the Dal-Square to make sure it is parallel. The mid-axillary mark previously made may have to be lowered. This mark now becomes the location for V_6 .
- h. The distance between the E mark and the point "0" on the Dal-Square is measured. The three digit number (i.e., 17.0 or 17.5) is recorded temporarily on paper to be later entered into the MAC 12.
- i. The distance from point "0" on the Dal-Square to the mid-axillary mark is measured. This is the 0- V_6 measurement and is recorded on paper to be later entered into the MAC 12. Keep the Dal-Square in place on the SP's chest.

Exhibit 3-2. Precordial electrode locations



- j. The difference between the 0-E and 0-V₆ measurements is calculated (the smaller measurement is always subtracted from the larger measurement, the 0-V₆ is usually the smaller measurement). The result of this calculation (or the difference between the two measurements) is then located on the Dal-Square from point "0" moving toward the E mark. Always move toward the E mark regardless of which number (0-E or 0-V₆) is larger. Follow the projection of the angled line on the Dal-Square to the chest surface with the pencil and mark. This is the location of the V₄ precordial electrode.

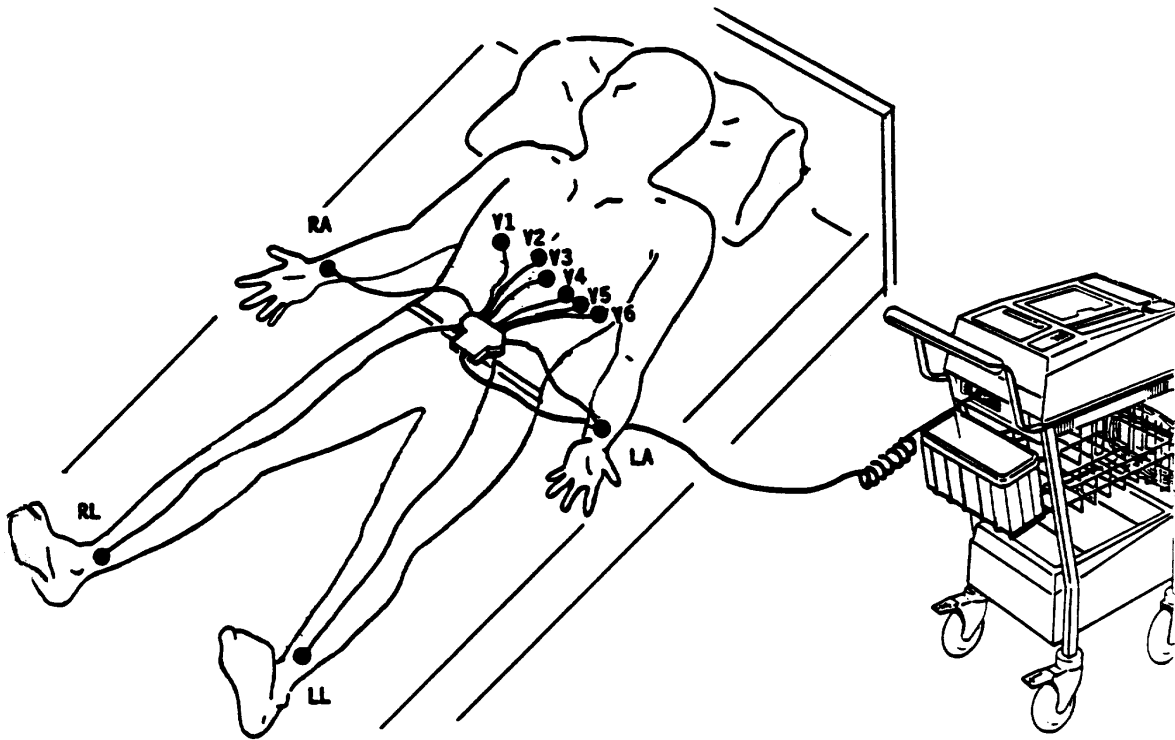
For example:

Mr. Smith is the SP. His 0-E measurement was 18.5. His 0-V₆ measurement was 11. The difference between 18.5 and 11 is 7.5 (i.e., 18.5 - 11 = 7.5). Therefore, the number 7.5 is found on the chest wall side of the Dal-Square (8 7 6) and this point is marked on Mr. Smith's chest. This is his V₄ location.

- k. V₃ is located directly between V₂ and V₄. Mark V₃. Use the straight edge of the Dal-Square to determine the linearity of the two points.
- l. V₅ is located directly between V₄ and V₆. Mark V₅. Again these points should be linear.
5. Briskly rub each chest location (V₁-V₆) with alcohol and gauze. The marks will rub off when rubbing the skin, but must be re-marked so as not to lose the location. It is recommended that the technician "spot" the area as they rub and clean the skin and re-mark immediately.
6. Attach electrodes to the chest in positions V₁-V₆. Remember, parting the hair during application helps adhesion.
7. The tabs of the electrodes should be pointed toward the patient cable yoke. Attach the clip type connectors to electrodes in positions V₁-V₆.
8. Attach the lead wires to the connectors in the corresponding chest positions. Be careful: it is very easy to connect the wrong lead to the wrong chest location.
9. Double-check to make sure all leads are correctly located and attached (see Exhibit 3-3).
10. Ask the SP to relax, breathe normally and to remain still (without talking) while the tracing is recorded. Reassure them that it will not hurt them.

Note: After placing the chest leads on the female SP, re-drape the top of the gown carefully over her chest. In addition, when *locating* precordial sites and when *placing* electrodes on female SP's, pendulous breasts should be allowed to distribute normally. Chest lead electrodes should be positioned even if the electrode is placed on top of the breast. It is more important that the electrodes

Exhibit 3-3. Correct position and attachment of all leads



be positioned correctly than it is for them to be close to the chest wall. However, the SP must remain very still so that the breast tissue doesn't move and "re-position" the electrodes.

3.3.1 Recording the ECG

Check the disk slot to see if it contains the diskette to be used, then follow these steps to enter SP information into the MAC 12:

1. If the Main Menu is not already displayed on the panel, then press the STOP key to return to it (as shown below):

Task	V1+II+V5			
PatInfo	Rhythm	25mm/s	10mm/mV	100Hz

2. Press the F1 key to select **PatInfo**. One of the two following displays will appear:

New Patient:
Yes No

OR

Patient Last Name:
A to Z, Space, ', - , .

If the New Patient display appears, select **Yes** by pressing the F1 key. Then press the **ENTER** key.

If the Patient Name display appears, do not enter any data, just press the **ENTER** key.

3. Do not enter any data for the Patient first name prompt. Press the **ENTER** key to pass this field.

4. Next, the following prompt will appear:

Patient ID:
Digits 0 to 9

Type in the SP's 7-digit identification number. Then press the **ENTER** key.

5. Press the **ENTER** key to pass the field for referring physician's name.

Referred By:
(Physician Name)

6. The location number prompt will be used to identify the last two numbers of the diskette number which will record the ECG. Then press the **ENTER** key.

Location Number:
0-99

7. The patient's room number prompt will be used to enter the technician ID number. Then press the **ENTER** key.

Room Number:
Any 5 characters

8. Press the **ENTER** key to pass this prompt.

Patient Over 1 Year Old:
Yes No

9. Type the age of the SP, then press the **ENTER** key.

Age:
0 to 127 yrs

10. The next two prompts are for Height and Weight data. However, since these data are already obtained during the MEC examination, these two fields will be used for the Dal-Square measurements. The O-E measurement will be recorded as three digits, i.e., 155 for 15.5 cm. in the height field. The OV-6 will be recorded likewise in the weight field, i.e., 140 for 14.0 cm. Press the **ENTER** key after typing each entry.

Height (in inches): 0 to 999

Weight (in lbs): 0 to 999

11. The Sex, Race, Medication, and Option Number prompts are also passed by just pressing the **ENTER** key for each prompt.

Sex: Male Female

Race: Cauc Black Oriental Hisp More
--

Medication: None Unknown Clear Add Scroll
--

Option Number: 0 to 99

12. The *Main Menu* will then reappear.

Task	V1+II+V5			
PatInfo	Rhythm	25mm/s	10mm/mV	100Hz

13. Press the **RECORD ECG** key. The following display will appear:

NOTE: The "XX" stands for numbers that may appear while the MAC 12 acquires data.

XX	** Acquiring Data **
----	----------------------

If no **Bad Lead** or other error message appears in the lower left side of the display, then go to the next step. However, if a Bad Lead message appears, you must correct the bad lead. When you correct the faulty lead, the MAC 12 will re-acquire the data.

14. When the MAC 12 has acquired the ECG, the following prompt will appear:

** ECG Acquisition Complete **

15. Next, the Mac 12 will process the ECG data and then begin printing reports:

NOTE: The "XX"s below represent numbers that will appear.

** Analyzing ECG **

THEN

** Printing Reports **

Page XX or XX

16. The following display will appear after all reports have been printed:

Number of Extras Copies:
0 to 99

Read the printed diagnosis on the first tracing for possible errors. If the quality of the first tracing is not good, press **STOP**, resolve problem and press **RECORD ECG** for a new tracing. If ECG quality is good, type in the number two for two extra copies. Then press the **ENTER** key.

17. Press the **ENTER** key to pass the Change Writer prompt.

Change Writer Setting for Reports?:
Yes No

18. After all reports have been printed, the following displays will appear:

** Processing ECG for Storage **

THEN

**** Write to Diskette ****

If NO diskette error occurs, the following will appear:

Storage to Diskette Complete
Type Any Key to Continue

Typing any key returns you to the *Main Menu*:

Task	V1+II+V5			
PatInfo	Rhythm	25mm/s	10mm/mV	100Hz

3.3.2 Examination Forms

3.3.2.1 Automated System

The automated system for the Electrocardiogram procedure consists of an introductory screen, one data collection screen, and exit screens.

Introductory Screen

Selecting "data collection" from the main menu will bring up the introductory screen and allow entry into the data collection forms. The purpose of the introductory screen is to establish the identity of both the technician and the SP and to establish examinations required of the SP for each MEC room. Only SP's 40 years of age and older will require an ECG procedure.

The Introductory Screen appears as follows:

Introduction

Technician		Examinee	
Tech# _____		Sample# _____	
Name _____		Name _____	
		Age ____	Years/Months _
		Sex _	

Procedures

Ecg _____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Data Collection Screen

After selecting the ECG procedures for the SP, the main data collection screen for ECG will appear.

Name _____ **Nchs#** 1234567

Electrocardiograph

Disk Number AA22222

Data recorded

1 1=Yes
2=No

Tracings Obtained

1 1=Yes
2=No

On the data collection screen, the technician records the number of the ECG diskette that collected the ECG data for this SP, and indicates whether the data were recorded and tracings obtained.

NOTE: Once the Shipping/Transmittal program is in use for the Automated System, the diskette number may already be programmed into the system. The technician would then verify the accuracy of the disk number on the screen with the diskette in the MAC 12. If the disk number is incorrect, the "previous field" key allows the technician to correct the disk number.

Exit Screen

When the screen is advanced, the exit screen will be displayed. The technician selects the most appropriate response to describe the results of the exam. An example of the exit screen and the definition of each result are given below:

```

Name SP 0788 _____ Sample# 1380788
Examination results
Select one
- ECG obtained _____
- Refused or uncooperative _____
- Out of time _____
- Physically unable to cooperate _____
- Unable to understand instructions _____
- Equipment problem _____
- Other reason _____
- _____
- _____
- _____
Comments:
. _____
. _____
. _____
Char Mode: Replace Page 1 Count: *7
  
```

<u>ECG Exit Result</u>	<u>Definition</u>
ECG obtained	ECG tracing obtained according to the protocol.
Refused/Uncooperative	SP initiated nonresponse. SP refused the exam for any reason and no tracing obtained (e.g., SP leaves early, SP or a family member sick, SP comes late, etc.)
Out of Time	SP comes on time; Adequate staff in MEC; It's the end of session and no time to do the exam.
Physically Unable to Cooperate	SP physically unable to cooperate with the exam and tracing not obtained (e.g., SP has back problems or SP cannot get on the table even with others' help, etc.).
SP Unable to Understand Instructions	SP unable to understand instruction and tracing not obtained, due to language, cognitive impairment or other communication problems.
Equipment/Supply	Hardware problems, out of paper or other supplies.
Other Reasons	Limit use of this code only to reasons that cannot be coded with above categories (e.g., SP sent home or excluded by the physician or inadequate staff to do the exam, etc.). Explain in comments.

3.3.2.2 Hard Copy Examination Form

If at any time the automated system is not properly functioning, the technician will record the results of the ECG exam on a hard copy data form (Exhibit 3-4).

The ECG exam form is divided into three sections, the I.D. section, the diskette number section, and results section.

- Enter the technician ID number and SP ID number or label in the first section.
- Enter the diskette number for the ECG.
- Select the final result of the examination. See the Exit Screen for a definition of each result. If "other" is selected, provide an explanation in the comments section.
- Provide any specific comments pertaining to the ECG procedure.

3.4 Postexamination Procedures

1. Remove the tracings from the MAC 12. Place the SP ID labels on all three tracings.
2. Carefully remove the lead wires from the electrodes, then remove the electrodes by gently pulling up on the tabs. Discard electrodes after one use.
3. Remove wax pencil marks with gauze and baby oil.
4. Have the SP put the examination gown back on to prepare for the next examination component.
5. Verify the diskette number used for recording the ECG and enter the result code into the automated system. Comments regarding the test should be noted in the comments section of the automated system.
6. Enter the time the SP left the ECG room and status code on the ECG Daily Log. Record any additional comments or unusual occurrences in the "Comments" section. The log MUST show the chronological sequence of data recorded. If an SP was examined with a status code of "PC" and then later reexamined, the log must include an entry for each time the SP was examined.

ECG AGES 40 AND OLDER	
STAFF NO. _____	NCHS ID NO. _____
Diskette No. _____	
RESULTS OF EXAMINATION:	010 <input type="checkbox"/> ECG obtained 013 <input type="checkbox"/> Refused/Uncooperative 014 <input type="checkbox"/> Out of Time 015 <input type="checkbox"/> Physically Unable to Cooperate 016 <input type="checkbox"/> SP Unable to Understand Instructions 017 <input type="checkbox"/> Equipment/Supply 018 <input type="checkbox"/> Other Reasons 7 Comments: _____

7. Place the two of the ECG tracings in the MEC physician's passbox. Place the third tracing in a file in the ECG room. The MEC physician will review the two tracings for technique and pathology in order to refer SPs with serious problems to their designated provider of medical care. If the quality of the ECG does not meet the standard evaluation criteria, the MEC physician will request that the ECG be repeated. If the ECG meets standard evaluation criteria the physician will initial one copy and return it to the ECG room. The initialed copy should be filed with the third copy in the ECG room. The physician will dispose of the second tracing. Both copies will be shipped weekly with the diskettes to NCHS.
8. Cover the ECG table with fresh tablepaper.
9. To protect the data from possible loss or damage, cover the MAC 12 with a leaded sheet when x-ray procedures are being conducted.

3.5 Recording Quality Electrocardiograms

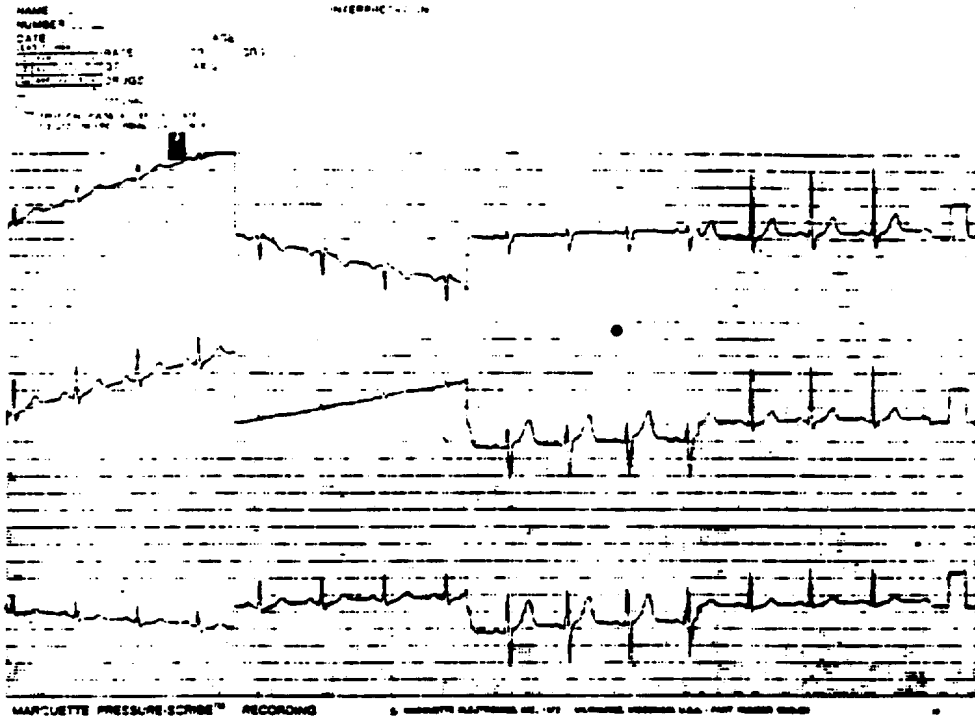
It is extremely important that the electrocardiograms submitted for NHANES III have a clean baseline, are free of drift, muscle tremor, and A-C interference. Enough variables influence the tracing without introducing unnecessary technical ones. It is the responsibility of the technician to produce high quality ECG's, using uniform techniques from tracing to tracing every day. Some of the most frequently found problems are discussed in this section. At the end of this section are the MAC 12 Error Display Codes and the Trouble Shooters Guide to assist the technicians when problems do occur.

3.5.1 Baseline Drift or Baseline Wander

Baseline drift is probably the most frequently encountered problem in learning the automatic ECG system. (See Exhibit 3-5.) An understanding of what actually causes drift will help explain why more precise technique is necessary with the MAC 12 system.

With a manually switched single-channel ECG system, the actual recording procedure takes as long as 3 to 4 minutes to complete. Therefore, there is plenty of time for the technician to correct for baseline drift problems each time leads are switched. Also, since the patient is connected for a longer period of time, the battery potentials created by the electrode-skin junction have a chance to stabilize with the elapsed time.

Exhibit 3-5. Baseline drift



For clear ECG's to be performed with the MAC 12 unit, baseline problems must be corrected before the procedure begins. This can only be accomplished with proper technique, clean skin, clean electrodes, and secure attachment of the electrode to the skin. Baseline drift is NOT caused by the ECG instrument. Unstable electrode contact is usually the prime suspect in baseline drift. Unstable electrode contact can be caused by:

1. Poor skin preparation (use more alcohol to clean the skin and gauze to dry the skin);
2. Poor technique (failure to securely attach electrode to skin and connector to electrode);
3. SP movement;
4. Tension on lead wires;
5. Faulty connection between electrode and lead wire; or
6. Dessicated electrodes.

3.5.1.1 Skin Variations

A very common and often misleading problem is that of skin resistance variations between one SP and another SP. Typically, a technician using only "fair" technique throughout the day will observe a mixture of good and poor quality tracings. Although the technician was using the same paste and the technique was consistent, SPs' skin was not the same. Baseline drift will occur in varying degrees, depending on the make-up of skin chemistry. Some skins are more sweaty and some more scaly. Each condition requires a different level of care in electrode application. Good technique compensates for even the most difficult SP skin conditions.

3.5.2 Muscle Tremor Interference

Muscle tremor is an artifact signal which is usually generated by the arm and leg muscles. These signals are present when the SP is tense, cold, or affected with muscle or nerve disorders. Some ECG machines are more accurate than others and have a greater capability of reproducing these smaller signals. This is not a fault of the machine. Actually it is an advantage, because with this capability also comes the ability to write small P and Q waves - signals which have sometimes been missed by less accurate machines.

Some suggestions for eliminating muscle tremor from the baseline:

1. Reassure and try to relax the SP.
2. Limb leads can be placed on the upper arms and thighs to eliminate muscle tremor caused by the arms and legs. This in no way affects the accuracy of the ECG.
3. Re-position or remove the pillow under the SP's head, causing hypertension of the neck. This often helps quiet muscle tremors.
4. Lay the SP's hands on his stomach or tuck them under the buttocks. Tucking the hands under the buttocks is usually more effective.
5. Place a pillow under the SP's knees to slightly elevate the legs.

3.5.3 A-C Interference

A-C interference is a common problem in a clinic or hospital setting. It can be caused by poor electrode contact or interference from nearby equipment. The technician should try different instructions from the Trouble-Shooting Guide to track down the source of the interference. Watches, glasses, rings or bracelets do not cause interference.

3.5.4 Electrodes Falling Off

Electrodes on hairy chests and loose skin can be a problem and certain precautions can save time in connecting an SP.

1. Establish a good connection by parting the hair before attaching the electrode.
2. Lay a towel across the wires to prevent the weight of the wire from tugging at the electrode. If the wire is twisted, it may also tend to pull at the electrode. If necessary, reposition the electrode by slightly adjusting the angle of the tab toward the patient-cable box.
3. It may be necessary to tape down the electrodes on SP's with extremely hairy chests.

3.5.5 Practical Points for the Technician

3.5.5.1 Placement of the Precordial Electrodes

The placement of the precordial electrode is often too casual. The placement should be as exact and constant as possible. For this reason only bony landmarks and the Dal-Square should be used in locating the precordial points. Even small displacements of the electrodes may produce considerable changes in the pattern.

3.5.5.2 Lead Patterns

Technicians are not expected to learn how to interpret the tracings, but they should watch the tracings come out of the machine with a trained, alert eye. Note carefully the pattern of the following leads:

1. Lead 1: If the complexes are all inverted, check the arm electrodes - they are almost certainly reversed. This is a very common problem which is not always identified by the technician. The MAC 12 display codes should help identify this error, also reversed leads sometimes cause an "A-C interference type" effect.
2. Standard Limb Leads: If the three main components (P, QRS and T) are virtually invisible in any one of these leads, the probability is that the two electrodes for that lead are attached to the two legs. Check the hook-up!

3. Lead V6: If the ventricular complex shows a deep downstroke (S wave) instead of the usual tall upright wave, take a lead further to the left (V7) to try and get a pattern with the major deflection upward.

To help identify lead problems from the ECG tracing, it may be useful for the technician to remember the relationship between the electrode placement (hooked to the corresponding lead wire) and the ECG tracing format.

Lead I = Left and right arm electrodes

Lead II = Right arm and left leg electrodes

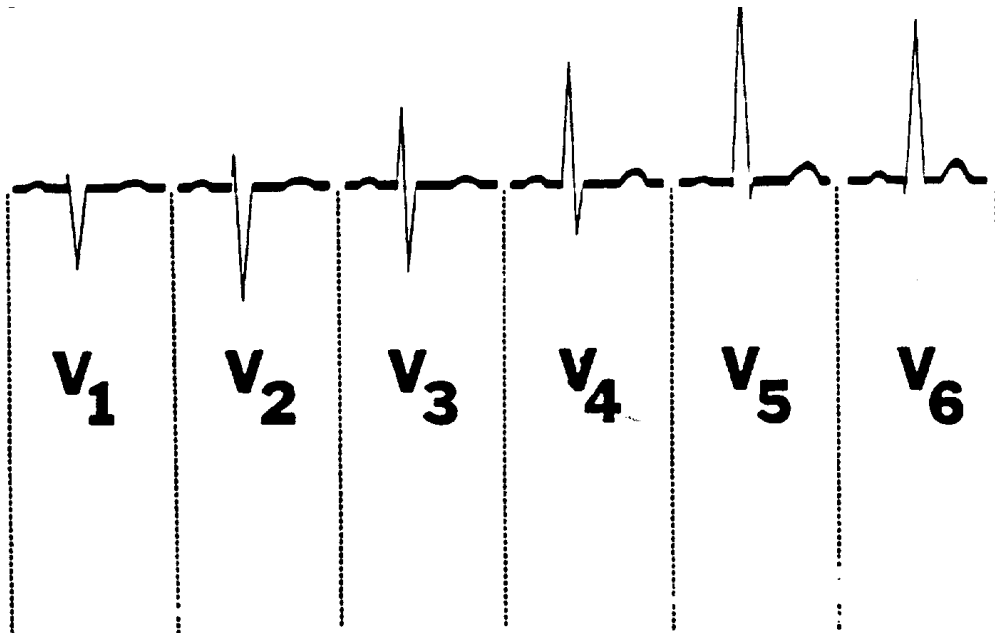
Lead III = Left arm and left leg

aVR = Right arm (+) and other limb electrodes as a common ground (-).

aVL = Left arm (+) and other limb electrodes as a common ground (-).

aVF = Left leg (+) and other limb electrodes as a common ground (-).

V₁-V₆ = The six chest leads monitor the heart from six progressively different positions on the chest. The ECG will thus show progressive changes from V₁ to V₆ as demonstrated below.



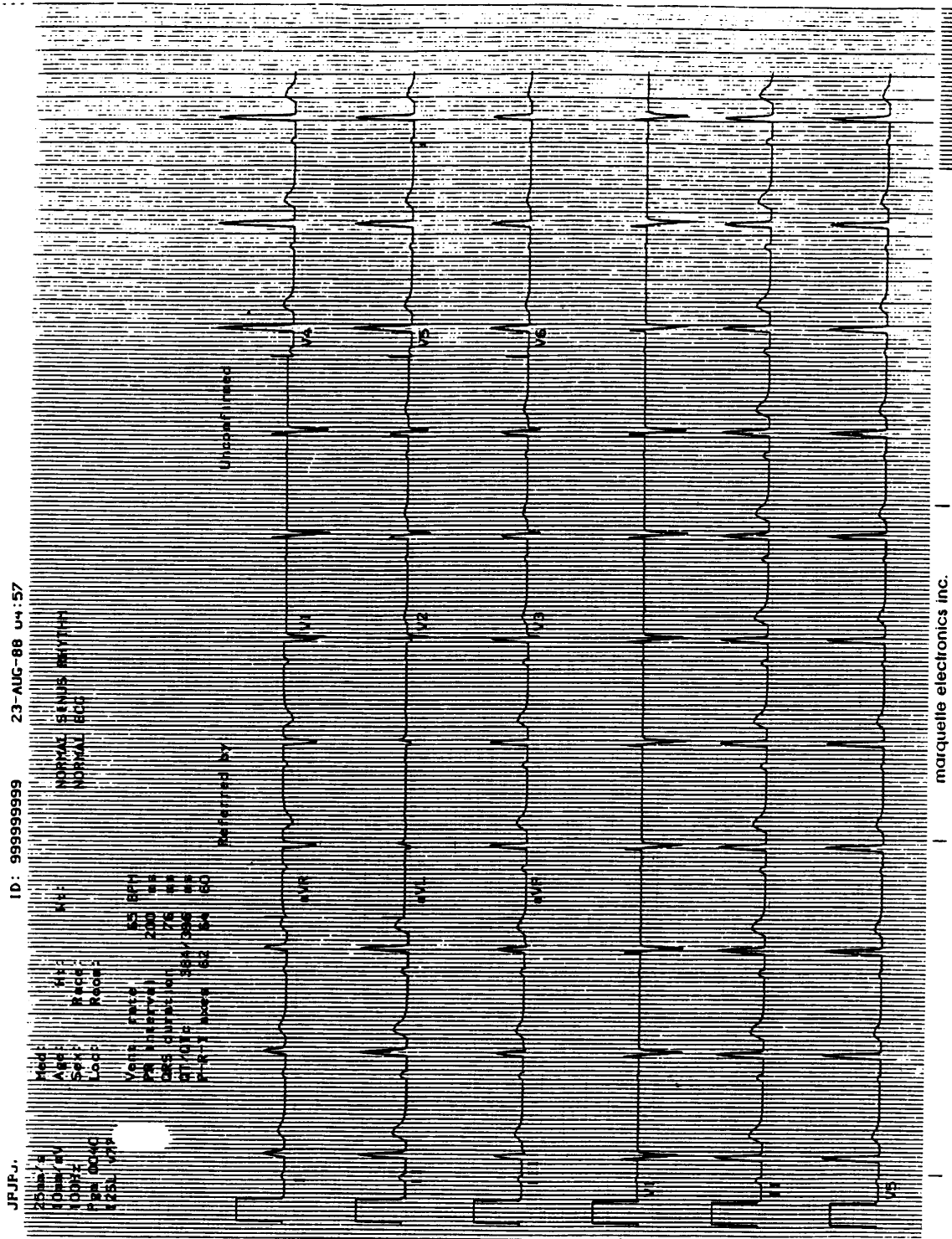
The ECG tracing paper is set up in six lines of graph or six channels. Four groups which include three leads each are displayed on the 12-Lead ECG. The rhythm tracings from leads V1, II, and V5 are displayed on the 4th, 5th and 6th channels. (See Exhibit 3-6.)

List of Leads for Lead Groups and Channels

Channel	Group			
	1	2	3	4
1	I	aVR	V ₁	V ₄
2	II	aVL	V ₂	V ₅
3	III	aVF	V ₃	V ₆
4	V ₁	V ₁	V ₁	V ₁
5	II	II	II	II
6	V ₅	V ₅	V ₅	V ₅

3.6 Error Messages

Observe the display panel on the MAC 12 for indication of an error, either a lead reversal or a poor quality/missing signal from a lead. The displays along with the associated problems are listed in this section. If any of the listed displays occurs, the problem should be corrected.



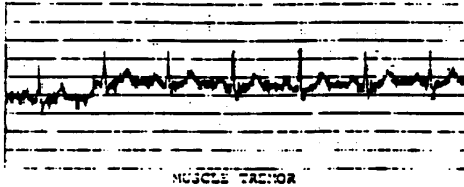
MAC 12 Error Messages

Error Message	Recommended Solution
Bad Lead or Bad Limb Lead	<ol style="list-style-type: none"> 1. Check the electrode site preparation and the electrode itself by replacing it with a new one if necessary. 2. If the "Bad Limb Lead" message appears, then check all the limb electrodes/leadwires. 3. If the "Bad Limb LL", "Bad Limb LA", or "Bad Limb RA" message appears, then check the specified electrode/leadwire. 4. If the "Bad Lead VI" (V2, V3, etc.) message appears, then check the specified electrode/leadwire. 5. Check for a defective leadwire by replacing the leadwire with a new one.
** No MAC Acquisition Module? **	Connect the acquisition module to the MAC 12.
Bad RAM Location	Inform the MEC manager to contact the biomedical engineer.
Checksum Error UX	Inform the MEC manager to contact the biomedical engineer.
Diskette Error - Bad Directory	Reinsert diskette into the disk drive slot and try to print or display the directory again. If the same message appears, then the diskette has become corrupted. If possible, use another diskette. Otherwise, inform the MEC manager.
Diskette Error - Not in Drive	Insert the diskette into the diskette drive slot.
Diskette Error - Write Protected	If data is to be saved on a diskette, the diskette must NOT be write protected. Refer to Description of Equipment for details.
Full	The diskette is full and cannot store any more files. Use another diskette.

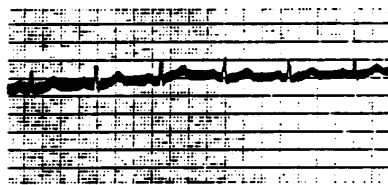
Error Message	Recommended Solution
No Data Storage - Plotter Output Only	* To record or save data on a diskette, remove the write protection from the diskette, and then insert it into the disk drive slot. If this message still appears, try using another diskette.
No such file	Check the directory to see if the ECG is on the diskette.
NoMem	Inform the MEC manager to contact the biomedical engineer.
Not Available	The feature, option, or function you were trying to access is not available at this time.
PANIC DUMP - VECTOR	This message will be present along with other letters and/or digits. If possible, copy them onto a piece of paper. Then turn the MAC 12 off and then on again. Then attempt to repeat what you were originally trying to do. If this message appears continuously, inform the MEC manager to contact the biomedical engineer.
XXXX of Bad Blocks Found	Format the diskette again. If this message still appears, then use a different diskette.
DOU, CRC, SNF, BBM, BIS, OFO, EOF, or DNM	Inform the MEC manager to contact the biomedical engineer.

3.7 Troubleshooting Guide for the Technician

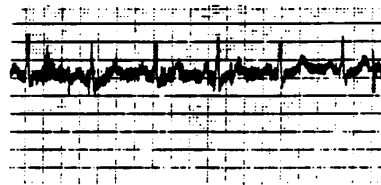
PROBLEM	CAUSE	SOLUTION
Baseline Drift.	Unstable electrode contact.	Make sure electrode is lying flat against the skin. The electrode should not be twisted or bunched. The clip connector should be securely fastened to the electrode tab.
	SP movement.	Relax the SP. Tuck hands under buttocks. Place pillow under knees. Wait 30 seconds and try again.
Muscle tremor interference.	Electrical signals being generated by the SP's arms and legs.	Place the arm and leg electrodes on the outside shoulders and thighs.
		Place a pillow under the knees.
		Tuck the SP's hands under the buttocks.
		Cover the SP if he is cold and attempt to relax him.
Electrodes keep falling off SP.	Hairy chest.	Part hair and reattach electrode. If necessary, replace the electrode.
	The electrode wires are pulling at the electrodes.	Reposition the electrodes. Lay a towel across the wires to hold them securely. Also make certain the wires are not twisted. Tape the electrodes on.
	Dried out electrode.	Replace electrode.
Clip connectors keep falling off wires.	Banana plugs have been smashed or worn small.	Pry the banana plugs open with a small object. Replace connectors.
No power light.	Defective power cord.	Contact Mec Manager.



PROBLEM	CAUSE	SOLUTION
One or more leads have straight lines or noise on all channels.	One ore more electrodes have fallen off.	Replace the electrodes.
	Loose connection in patient cable.	Replace patient cable.
A-C Interference	Poor electrode contact.	Re-rub the limb electrodes into the skin.
	Use of an adaptor without an external ground wire.	If the problem can be solved with the external ground wire, notify the MEC manager immediately as the outlet might be <u>unsafe</u> .
	The 3rd wire in the power cord is broken.	Replace the cord immediately as it might be <u>unsafe</u> .
	Interference being picked up from nearby faulty equipment.	Check other equipment which may be plugged into the same socket.
	Strong A-C field in the room.	Sometimes, there is an exceptionally strong A-C field in the room as the result of nearby electrical transformers and the like. About all you can do here is relocate the wires to reduce the wire loops.
Defective patient cable.	Try substituting a new patient cable.	



A-C INTERFERENCE



A-C INTERFERENCE PLUS MUSCLE TREMOR

4. LOGS AND RECORDS

This section describes additional procedures for the ECG component that are the responsibility of the health technicians. These procedures include completing records, logs, and transmittal forms for the recording and shipment of examination data. The accurate completion of these procedures help facilitate an organized data collection process.

4.1 Daily Appointment Schedule

The Daily Appointment Schedule will provide information for several uses. A copy of the schedule will be given by the coordinator to the health technicians for the next day. The form from the automated system will provide a copy with the name, age, and sample numbers for each SP scheduled for that day. This list can be used to verify the Daily Log Sheet and other forms. It also lists the number of SPs that are expected for the session.

4.2 Daily Log

The automated system serves as a daily log to record information about each SP. However, if the system is malfunctioning, hardcopy logs will be maintained.

Daily log sheets are to be completed in addition to the automated system until instructed otherwise by the MEC manager (see Exhibit 4-1). The daily log sheet is located on a clipboard in the X-Ray/ECG room. One page is used every session that examinations are being conducted during a stand. The technician completes the date, the session time, the stand number, and location.

For each SP examined, the technician records the SP's ID number, age and sex, technician ID number and the time the exam started, the time it was completed, the ECG diskette number and the assigned status code. Three status codes are used for the Status Code column. Code (C) indicates a "completed" exam, (PC) indicates a "partial complete" exam, and (NE) indicates "no exam." (PC) and (NE) both require reasons for the assigned codes. The comments section is used to note reasons why the examination was not completed (PE or NE), or any unusual occurrences, etc. The pages of the log

Exhibit 4-1.

National Health and Nutrition Examination Survey III
ECG DAILY LOG SHEET

Location _____ Date _____
Stand No. _____ Session: AM PM EVE

SP ID #	Age	Sex	Examiner ID #	Time In/Time Out	Diskette #	Status Code	Comments
1.				---/---			
2.				---/---			
3.				---/---			
4.				---/---			
5.				---/---			
6.				---/---			
7.				---/---			
8.				---/---			
9.				---/---			
10.				---/---			

are kept in a file until the end of the stand. At that time, the log pages are sent to Westat with the other end of stand materials.

4.3 Shipment of Forms and Data

4.3.1 Transmittal Forms

The automated system is designed to produce a computerized transmittal form which should accompany all shipments of ECG tracings and diskettes and other data items. A detailed discussion on generating transmittal forms and hard copy transmittal forms is provided in Standardized Procedures.

4.3.2 Shipment of ECG Tracings and Diskettes

The two ECG tracings for each SP and ECG diskettes with SP data should be labeled and stored to await shipment.

The diskettes and tracings that correspond with the diskette are shipped weekly to a designated evaluator at NCHS. Shipping instructions and destination for ECG data will be supplied by the MEC manager.

5. QUALITY CONTROL

Quality control procedures for electrocardiogram are extremely important and must be observed. As discussed in Section 3, the most common errors in ECG procedures are inadequate skin contact, wandering baseline, incorrect lead placement, reversed lead wires, and A-C interference. In order to minimize these errors, standard procedures for obtaining ECG's were described in this manual.

5.1 Examination Forms

5.1.1 Automated System

Each entry keyed into the system should be carefully reviewed before continuing on to the next screen. The diskette number on the screen should always be compared to the diskette in the MAC 12. If an entry error is noted after the transaction has been completed, record the error on the hard copy log and notify the MEC manager.

5.1.2 Hard Copy Exam Form

Hard copy exam forms when used must be carefully edited for complete, accurate and legible data.

5.2 Review, Observations, and Replication

The MEC physician is responsible for checking all ECG's for both technique and pathology in order to refer SP's with serious problems to their designated providers of medical care. An ECG tracing is acceptable to the MEC physician only if it meets all of the following minimum standards:

1. The ECG complex must be clearly defined with the P wave distinctly visible; no noise interference that would cause an obscured or obliterated P wave should be present.
2. The P wave, and except in rare instances, the QRS complex on lead 1 both must have positive deflections indicating that the limb leads have been applied properly.

3. The baseline must not "wander," that is, the vertical distance between adjacent complexes must not be greater than 5mm.
4. Four standard complexes must be present on the tracing.

Since the ECG's are checked before the SP leaves the MEC, the physician will request that an ECG be repeated if the quality does not meet the standard evaluation criteria.

During the pretest and field period, the ECG evaluator will make site visits to each MEC to ensure standardization. The key points which the evaluator will be checking for are:

1. Proper SP skin preparation;
2. Proper lead placement;
3. Adherence to the standardized guidelines;
4. Timing of procedure; and a
5. High quality ECG (no baseline drift, etc.).

The evaluator will review any deviations from the protocol with the technicians.

Different types of replicates will be utilized in NHANES III as a quality control measure. Complete Replicates - replicates who will be scheduled from a pool of volunteers for a complete reexamination at the MEC, will have another ECG taken when they are reexamined.

5.3 ECG Tracing Evaluations

During the study period 25-30% of the ECG's done by each technician are evaluated. A sample of the key criteria for ECG evaluation is listed on the Quality Control for ECG's form.

5.4 Refresher Sessions

Refresher sessions may be periodically scheduled to update the technicians on the ECG procedure or changes in protocol.

Exhibit 5-1

QUALITY CONTROL FOR ECG'S

Evaluator Name _____

Stand No. _____

Date Completed |__|_| |__|_| |__|_|
 Mo Day Yr

Location _____

Evaluation Criteria (25 to 30% Sample)	SP ID Number															Total Number
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Tech. ID number																
Acceptable																
Incorrect SP ID information																
Negative PQRS Lead I																
Noisy leads																
Wandering baseline																
Standard not adequate																
4 complexes not present																
Equipment problem																
A-C interference																
Unacceptable																

Comments:

6. SAFETY PROCEDURES

6.1 Equipment Precautions

The MAC 12 Unit is a widely used instrument approved by the Underwriter's Laboratory. This equipment is grounded so that the risk of electrical shock is highly unlikely. However, if at any time a "short" occurs or the technician discovers frayed wiring, etc., the equipment is NOT to be used. Do not attempt to remove the cover or back of the unit. The MEC manager is to be notified immediately of any equipment malfunctions or damage.

6.2 SP Movement and Positioning

The technician performing ECG's is responsible for the safety of the SP during this examination component. The main safety precaution is to make sure that the SP is helped on and off the ECG examination table and that the SP does not hit his/her head on the X-Ray tube. If an SP is experiencing any problems with his or her balance, there is a possibility that he or she may have difficulty staying centered on the ECG table and in sitting up after the exam is completed. The technician needs to be attentive to special disabilities of each individual SP. In addition, care should be taken when removing electrodes from the SP. This procedure can cause some discomfort and skin injury, especially on the elderly, if not performed carefully.

6.3 Precautions to Prevent Transmissions of Infections

The ECG equipment should be cleaned and disinfected at regular intervals. The exam table should be covered with clean examination paper after each SP is examined, and should be wiped down with a mild detergent at the beginning of each stand.

6.4 Emergency Procedures

There are no major risks associated with performing ECG's. Although technicians are not trained to interpret ECG's, in cases such as chest discomfort or ventricular tachycardia (which technicians would recognize on the tracing), the technician should call the MEC physician immediately to care for the SP. Procedures for medical emergencies and other types of emergency situations are discussed in the Standardized Procedures.