Cardiograph

Signal-Averaged ECG

M1754A

INSTRUCTIONS FOR USE

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M1754A Signal-Averaged ECG (SAECG) Instructions for Use

Philips Cardiograph

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Notice

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the instrument is used according to the instructions for use presented in this manual.

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Safety Summary

Safety Symbols Marked on the Cardiograph

The following symbols are used on the cardiograph or the cart.

Caution - See operating instructions
Type CF, defibrillation protected
Alternating current
Equipotential (this is on the ground lug)
The maximum weight that the cart can hold.

Conventions Used in This Manual

NOTE

Notes contain additional information on M1754A usage.

softkeys represents the temporary key labels that appear on the display.

Key represents keys on the front panel.

Contents

Figures

Tables

Getting Started

Introduction

This guide contains information about using the M1754A Signal-Averaged ECG (SAECG) cardiograph application to acquire a Signal-Averaged ECG for use in the detection of late potentials. There are also instructions on configuring the cardiograph for M1754A SAECG application operation.
Refer to the *Page Writer XLi Cardiograph Operating Guide* for operating and installation instructions for your cardiograph.

Installing M1754A SAECG Software

Be sure that the M1700A XLi software has been installed before installing any other applications in your cardiograph. To install the M1754A SAECG software, perform the following steps.

1. Turn the cardiograph to **Standby** from the front panel.
2. Insert the M1754A SAECG application disk in the disk drive in the front of the cardiograph.
3. Prepare the SAECG patient module and attach it to the cardiograph.
a. Put shorting plugs in the LA and LL positions.
b. Attach lead wires to the remaining positions on the SAECG patient module.

NOTE

The SAECG patient module can also be used for XLi applications. If you wish to routinely acquire XLi ECGs as well as SAECGs, you may attach lead wires in place of the shorting plugs for the LA and LL leads on the SAECG patient module. Then attach the LA and LL electrodes on the normal positions.

You will achieve shorter averaging times if you use shorting plugs in the LA and LL lead positions.

4. Turn the cardiograph on. The message **Load SAECG application?** appears.
5. Press Yes. The copyright display appears briefly.

```
      (c) 1991 Hewlett-Packard, Corazonix Corp
            SAECG (M1754A - A.01.00)
```

Then the following display appears.

```
******
            SAECG (M1754A - A.01.00)
```

The asterisks gradually extend across the display until the software installation is complete. The following display appears.

```
Auto     3x4
Report   Format          01/26/92     01:23AM
```

You can now select the SAECG application as described in the next section.

To configure your cardiograph for your requirements, refer to Chapter 4.

Selecting the SAECG Application

When the SAECG application is installed, you can either use your cardiograph to acquire a standard (XLi) ECG or you can acquire Signal-Averaged ECGs. To select SAECG operation from the Preview Plus application, perform the following steps.

1. Press Menu until you see the following display.

```
                        Prev+
Reformat     Timed      Cont Prev     Delayed   Exit
```

2. Press Exit.

3. In the Applications menu, press SAECG.

- If you haven't already attached the SAECG patient module, you will be instructed to do so.

The following display appears.

```
                       SAECG
Start                              01/26/92     01:23AM
```

4. Attach the electrodes to the patient as described in the next section.
5. Check the signal quality by viewing the preview screen and the SAECG patient module display.

The next chapter, Chapter 2, describes how to acquire the ECG and create the final SAECG report.

Preparing the Patient and Applying Electrodes

To prepare the patient and apply the electrodes, perform the following steps.

1. Relax the patient.

- Check that the patient is comfortable.
- Reassure the patient that the procedure is safe.

NOTE

It is essential to relax the patient as much as possible during the procedure. This is because the quality of the ECG signal depends on reducing tension in the patient.

2. Prepare the electrode positions.

- Shave the electrode positions if necessary.
- Cleanse the skin with your institution's cleansing solution.
- Rub the skin gently with a gauze pad until the skin is slightly red.

NOTE

Electrode site preparation is especially important for the detection of the low level signals involved in late potentials.

3. Place the electrodes as shown in Figure 1-1.

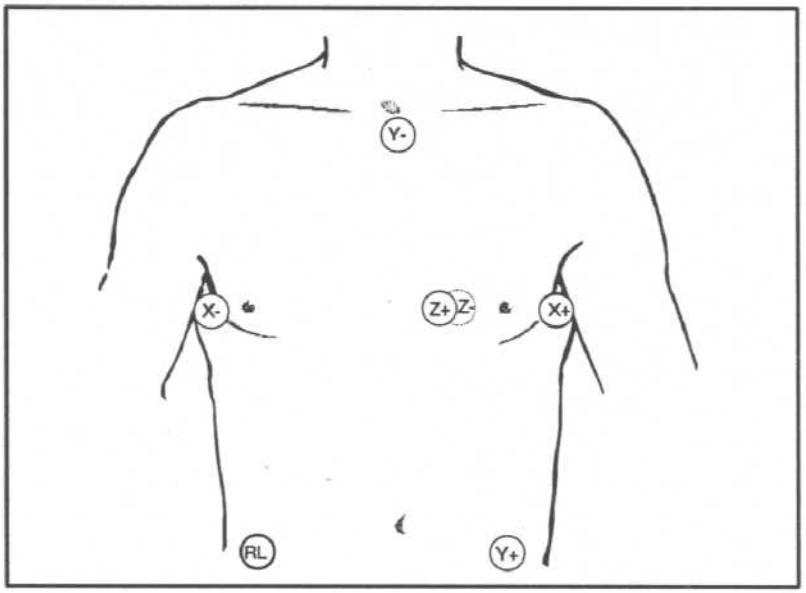


Figure 1-1. Placing Electrodes for an SAECG.

Table 1-1. SAECG Electrode Positions

AHA	IEC	Position
Y+	Y+	In the lower, left abdominal region on the left iliac crest
Y-	Y-	On the superior aspect of the manubrium.
Z+	Z+	At the fourth intercostal space, at the left sternal margin (V2 position)
Z-	Z-	On the back, directly opposite the Z+ electrode
X+	X+	At the same level as the Z axis along the mid-axillary line on the patient's left side
X-	X-	At the same level as the Z axis along the mid-axillary line but on the patient's right side
RL	N	Opposite the Y+ electrode on the right iliac crest
LA	L	On the left forearm (if used)
LL	F	On the left leg (if used)

Acquiring a Signal - Averaged ECG

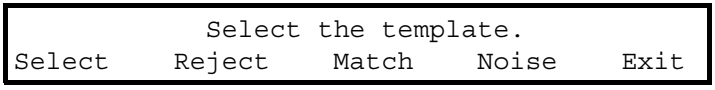
This chapter contains information on how to acquire a Signal-Averaged ECG. There are three steps to acquiring a Signal-Averaged ECG.
1. Selecting a template beat.
2. Acquiring and averaging ECG data.
3. Verifying the onset and offset of the QRS complex.

Selecting the Template Beat

You must confirm the template beat to start the signal averaging process. Perform the following steps to select a template beat.

1. Press Menu until the following menu is displayed.

2. Press Start . The message **Determining template beat...** appears. Then the following display appears.



The template beat with the matching and noise windows appears on the preview screen as shown in Figure 2-1.

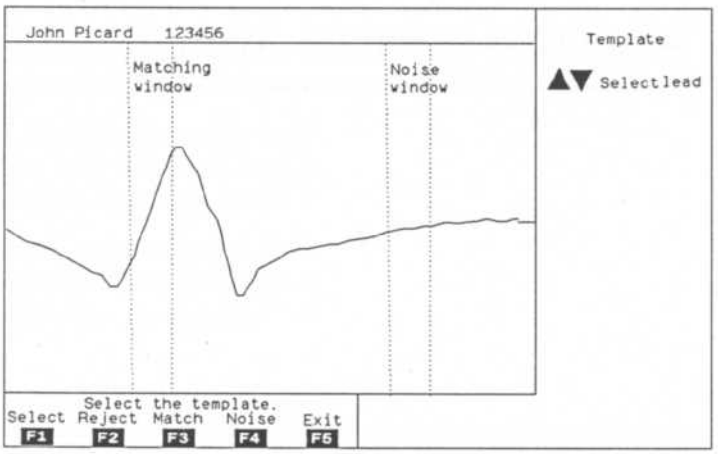


Figure 2-1. A Template Screen.

3. To confirm the template beat, press Select .

• If you wish to place the template on another lead, use the ▲ and ▼ keys.

• If you wish to acquire a new template beat, press Reject .

• If you wish to adjust the matching window, press Match .

You can obtain best results when the matching window contains the fast rising portion of the R wave.

If you wish to adjust the noise window, press Noise .

Be sure that the noise window is on a flat part of the signal and that the T wave is not inside the window.

When you press Match or Noise , perform the following steps to adjust the windows.

a. Use ◄ and ► keys to adjust the position of the windows.

b. Press Done . The following display returns.

```
                Select the template.
Select     Reject     Match     Noise     Exit
```

After you have selected the template beat, the message **Averaging...** appears and the preview screen displays a continuous ECG signal for leads X, Y, and Z as shown in Figure 2-2. The message remains on the screen until the end condition is met.

The end condition is configured on your cardiograph. The default end condition is a noise level of less than 0.3 μV, but the end condition could be configured to a specified number of beats or a selected noise level. The number of beats and the noise level are displayed on the preview screen during averaging.

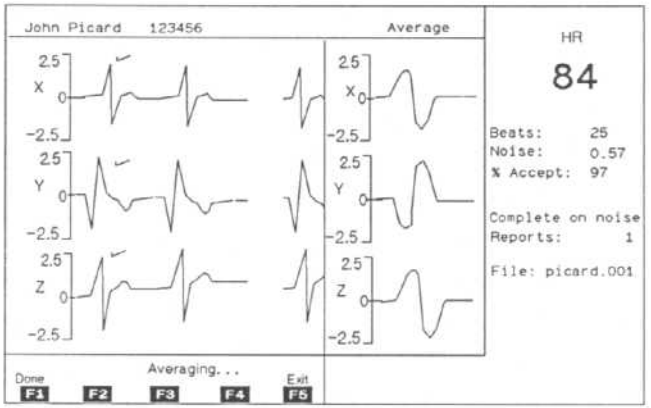


Figure 2-2. An Averaging Screen.

NOTE

You can press Done at any time to end the averaging process before it meets the configured end condition.

Once the averaging process is complete, the message **Filtering averaged beats...** appears.

Editing the Final Report

After the ECG signals are averaged and filtered, the final SAECG information is displayed on the preview screen. You can adjust the QRS onset and offset before printing and storing the SAECG report.

Adjusting the QRS Onset and Offset

The QRS complex on the final report has its onset and offset marked for signal averaging measurements. It is essential that the onset and offset in any individual lead or in the vector are properly placed to produce accurate measurements. If you must adjust the QRS onset and offset on the final report, perform the following steps.

1. When averaging is finished, the following message appears on the display.

```
        Adjust the onset and offset.
Print     Onset     Offset     Lead     Exit
```

At the same time the Measurements screen, as shown in Figure 2-3, appears on the preview screen.

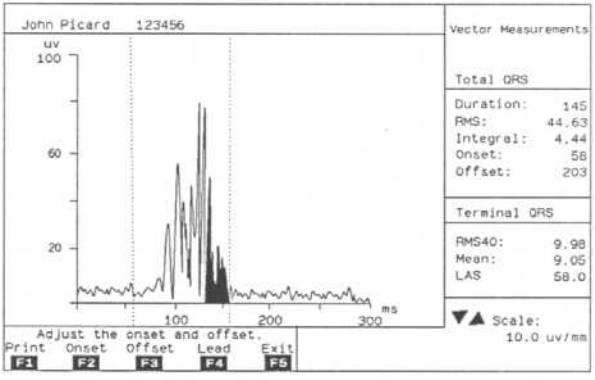


Figure 2-3. A Measurements Screen.

2. Ensure that a flexible disk for storage is in the cardiograph's disk drive.
3. If the QRS complex's onset and offset are correctly placed by default and you want a printed report, press Print. The message **Printing report ...** appears before the report is stored.

• If you wish to change the waveform's scale, use the ▲ and ▼ keys.

• If you wish to move the onset, press Onset.

• If you wish to move the offset, press Offset.
The following display appears.

```
                Adjust the onset
Done                                          Exit
```

a. Use the ◄ and ► keys to move the onset or offset windows left or right.

b. Press Done when the QRS onset and offset are correctly placed.

• If you wish to view another lead, press Lead. The following display appears.

```
          Choose another lead
Vector     X        Y       Z                 Exit
```

- If you wish to view the X, Y, or Z lead, press X, Y, or Z respectively. You can then change the onset and offset on the leads if desired.
- If you wish to display the combined vector lead on the preview screen for editing or viewing, press Vector.

After selecting a lead you can adjust the onset and offset independently for all leads plus the combined vector lead.

After printing, the report will be stored. If your application is configured for manual file naming, you will be prompted to provide a file name.
a. To store a report with a specified file name, type a name with up to eight characters and with a three-digit extension; for example, Wenworth.001. You can also use the patient ID for a file name if the ID is under eight characters.

NOTE

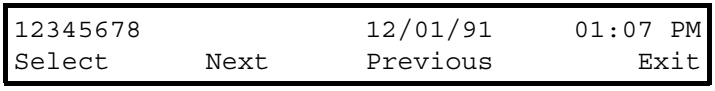
Manually enter the file name if you intend to use this file on a Corazonix Predictor ® for additional study.

b. Press Done . The message **Storing report...** appears, then the display returns to the SAECG display.

Editing and Printing a Stored SAECG

You can edit and print a stored SAECG report. To retrieve a stored SAECG report so you can edit and print the report, perform the following steps from the SAECG application.
1. Insert the storage disk that has the SAECG report you wish to edit or print into the cardiograph disk drive.
2. Press Menu until the following display appears.

3. Press Exit . The following display appears.



4. Press Next or Previous until the correct patient ID number appears.
5. Press Previous. The following display appears.

```
        Adjust the onset and offset.
Print    Onset    Offset    Lead    Exit
```

You can now adjust the onset and offset and print the SAECG report as described earlier in *Editing the Final Report*. If you wish, you can also print the SAECG report without editing it.

You can delete stored SAECGs from the Preview + or XLi menus the same way ECGs are deleted.

Understanding the Printed SAECG Report

This chapter contains information about the printed SAECG report. The report is printed on the PageWriter XLi printer. The SAECG report gives a concise summary of the SAECG test.

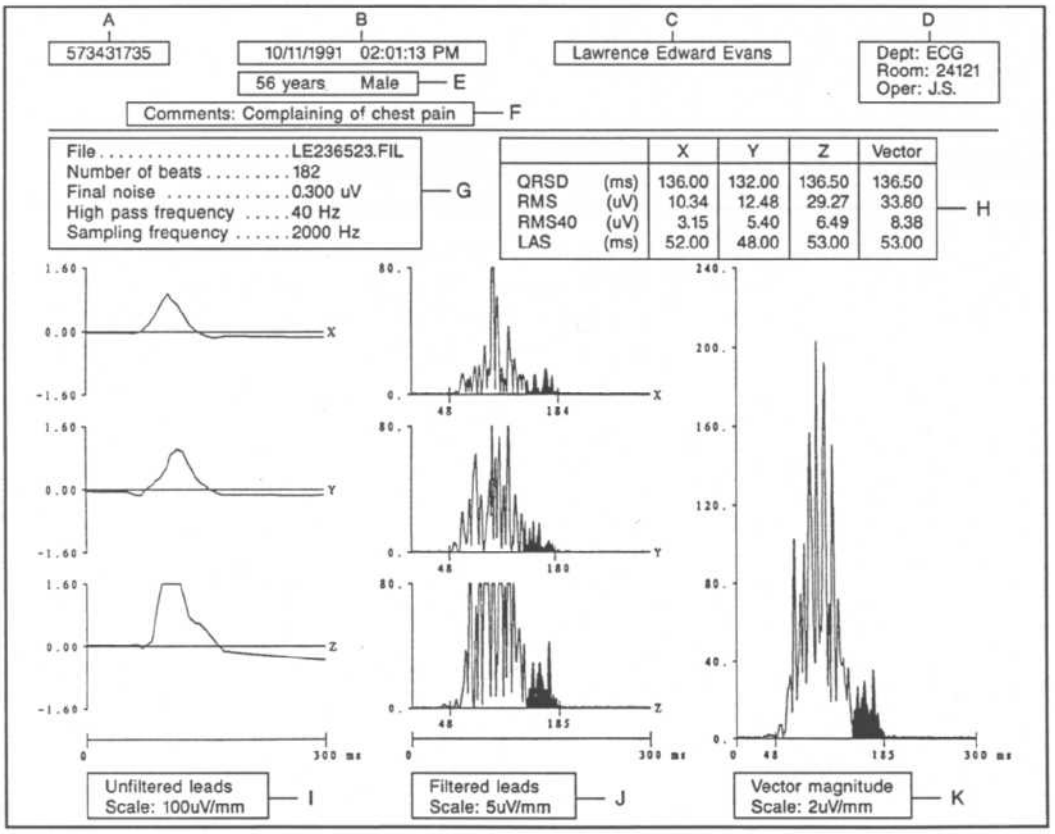


Figure 3-1. The SAECG Report.

Table 3-1. SAECG Report Annotations

	Description
A	Patient ID number
B	Date and Time
C	Patient Name
D	Department, Room number, Operator
E	Age and Sex
F	Comments
G	Configured Settings
H	Measurements
I	Unfiltered Lead Waveforms
J	Absolute Filtered Lead Waveforms
K	Vector Size

Configuring the M1754A SAECG Application

This chapter describes how to configure your cardiograph for use with the M1754A SAECG application. Tables at the end of this chapter show which operating parameters are configurable.

Configuring Your Cardiograph to Start Up in the SAECG Application

If you wish to configure your cardiograph to start up in the SAECG application, perform the following steps from the main XLi application.

1. Press Menu until the following display appears

2. Press Config . The main configuration menu will appear:

```
                Configuration
Global      ID     Transmit     Files     Exit
```

NOTE

If this is not the initial configuration, you might need to type the configured password before you can make any changes to the configuration.

3. Press Global and the following display appears.

```
Initial Interpretation? Reasons
Enter      Choose           Previous      Exit
```

4. Press Enter to step through the global configuration fields until the following field appears.

```
Power on application? XLi
Enter     Choose           Previous      Exit
```

5. Press Choose until SAECG appears on the display.

6. Press Enter and the SAECG setting will be accepted. The next configuration parameter will appear.

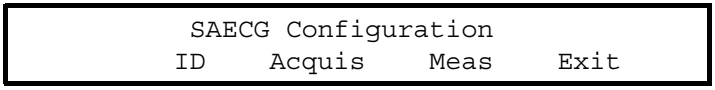
7. Press Exit when you have finished changing the main configuration settings. Your cardiograph will now start up in the SAECG application when you turn it on.

Configuring the SAECG Application

The M1754A SAECG application has default operating parameters when it is installed on your cardiograph. To customize the SAECG operating parameters, perform the following steps from the SAECG application.

1. From the main SAECG menu, press Menu until the following menu is displayed.

2. Press Config . The SAECG Configuration menu is displayed.



3. Press one of the softkeys on the SAECG configuration menu to configure the SAECG application for your institution.

- If you wish to determine which ID parameters are requested each time you enter patient information, press IDs .
- If you wish to choose Acquisition parameters, press Acquis .
- If you wish to choose Measurements parameters, press Meas .

The following sections describe how to configure ID, Acquisition, and Measurements operating parameters.

Patient ID Fields

You don't have to step through all the possible patient ID information each time you enter patient ID. You can turn off the ID fields that you don't use. The only information you must include for storage is the patient ID number.

The following list shows each patient ID configuration option. You can choose either **Yes** to include or **No** to exclude that item from the patient ID information printed on the ECG. Yes is the default choice for all.

- Allow NAME entry?
- Allow AGE entry?
- Allow SEX entry?
- Allow OPERATOR entry?
- Allow DEPARTMENT entry?
- Allow ROOM entry?
- Allow COMMENTS entry?

Configuration Tables

Table 4-1 and Table 4-2 show configurable operations on the M1754A SAECG application. The setting choices that are shown in bold type are the default settings. These settings are adequate for most applications.

Acquisition Fields

Table 4-1 shows Acquisition configuration choices.

Table 4-1. Acquisition Configuration Fields

Parameter	Set ting Choices	Comments
Fiducial point?	Left Center Right	The peak of the QRS can be moved from the center to either the right or left third of the display and printed report. The noise window is moved by the same amount as the fiducial point.
Correlation coefficient? (0.01- 0.99)	**0.99** Type a number between 0.01 and 0.99	This sets how closely the acquired beats must match the template. A value of 0.99 is as close as possible.
Average to?	**Noise level** Beats	The end of the averaging process is controlled by either a total number of accepted beats, or an average noise level of the three leads.
Noise level? (0 - 100 μV)*	**0.3 μV** Type a number between 0.0 and 100.0	The noise level required before the process completes. * This field appears only if *Noise level is* selected in the *Average to?* field.
Number of beats? (1 - 9999)*	**200** Type a number between 1 and 9999	The total beats that must be collected before the process completes. * This field appears only if *Beats is* selected in *Average to?* field.

Measurement Fields

Table 4-2 shows Measurement configuration choices.

Table 4-2. Measurements/Processing Configuration Fields

Parameter	Setting Choices	Comments
Filter frequency?	**40** 80 25	This sets the frequency of the high pass filter.
Unfilt. lead scaling?	**Auto** Manual	This sets the automatic scaling of the unfiltered leads on the printed report.
Unfilt. lead scale? *	**100 μV/mm** Type a number between 1 and 1000 μV/mm	
Filt. lead scaling?	**Auto** Manual	This sets the automatic scaling of the filtered leads on the printed report.
Filt. lead scale? *	**5 μV/mm** Type a number between 1 and 20 μV/mm	
Vector scaling?	**Auto** Manual	This sets the vector scaling on the printed report.
Vector scale? *	**2 μV/mm** Type a number between 1 and 20 μV/mm	The vector scaling can also be changed during editing.
Automatic file naming?	**Yes** No	The file name is automatically specified. Manual file naming is used for easier file exchange with the Corazonix Predictor®

* This appears only if Manual is selected in the previous setting.

Troubleshooting

This chapter contains information about troubleshooting the M1754A operation. Cardiograph troubleshooting is covered in more detail in the *PageWriter XLi Cardiograph Operating Guide* and the *PageWriter XLi Cardiograph Instructions for Use.*

NOTE

Be sure that you have the SAECG patient module attached to the cardiograph for use with the M1754A application.

ECG technique is particularly important for ensuring a good recording. An extremely noisy ECG signal can take too long to average. Three problems that could prevent you from acquiring an SAECG include:

- Muscle artifact
- Bad lead contact
- Electrical interference

Chapter 1 includes more information on ECG technique.

Error Messages

Error messages appearing on the display instruct you as to what action to take. If the error is something that you can correct, the message instructs you what to do.

Table 5-1. SAECG Testing Problems

Symptom	What to Do
Message: `6503` appears.	The XLi cardiograph software has not yet been installed. Install the XLi software before installing the SAECG software.
Message: `No room to load application.` appears.	Delete another application such as Preview Plus, before installing the SAECG application.
Message: `Attach SAECG patient module.`	Attach the SAECG patient module before attempting to use the SAECG application.
Message: `No heartbeat. Check connections.` appears.	A lead might not be connected. Refer to Chapter 1 for information on how to apply electrodes for an SAECG.
The noise stops decreasing during averaging.	A lead might be off. Check the leads and continue or restart the SAECG test.
The application does not average to the preset level of noise.	The ECG signal is too noisy. See the section on *Preparing the Patient and Applying Electrodes* in Chapter 1.

Glossary

applications

Software used for a specific task. The PageWriter XLi has the SAECG application and the Preview Plus application.

combined vector lead

A combination of three orthogonal leads. It is derived from the sum of the squares of the three leads, and then the square root of that sum.

$$\sqrt{x^2 + y^2 + z^2}$$

configuration

The preset operating parameters for the cardiograph. When the software is installed, the cardiograph defaults to a preset configuration which may be customized any time.

correlation coefficient

A number that shows how closely that the acquired beats must match the template beat. O indicates the least close match; 1 indicates the closest match.

end condition

The point when the designated number of beats are acquired or the level of noise is reached in order to have enough clear ECG data to average.

fiducial point

A reference point based on the peak of the QRS complex. This adjustment enables you to average on different parts of the waveform.

filtered lead scaling

The size at which the filtered leads are displayed.

filter frequency

Frequency on the high pass filter above which an ECG signal is recorded. For example, a filter frequency of 80 1Iz means that frequency components below 80 Hz are removed.

flexible disk

A disk which can be inserted in the disk drive to store data such as ECG and SAECG reports or the configuration. Software is installed from a flexible disk.

function keys

The line of keys lettered F1 to F5 at the top of the keyboard that correspond to the labels displayed at the bottom of the screen.

matching window

The area of the template beat that will be correlated to each new beat.

Menu **key**

Cardiograph key that changes the menu selections displayed on the cardiograph's front panel display.

noise window

The area of the template beat used to determine the amount of noise in the signal. This should be the smoothest part of the beat.

operating parameters

Configured settings that permit the SAECG application to function in a desired manner.

password

Private code word that limits access to the cardiograph's configuration software to those persons knowing the code word. Passwords prevent accidental or unauthorized changes to cardiograph configuration.

Preview Plus

Philips name for optional software application which enhances the standard preview screen.

preview screen

Philips term for the screen which, when installed on the cardiograph, shows the ECG traces as they will appear on the printed ECG report. The preview screen is required for the SAECG application.

QRS onset and offset

The beginning and end of the QRS complex.

SAECG patient module

The remote patient unit that contains all of the cardiograph's SAECG data acquisition electronics. The patient module connects to the patient data cable and to the leads attached to the patient.

signal averaging

Averaging performed on an ECG waveform to reduce random noise.

Signal-Averaged ECG (SAECG)

A report produced by the M1754A to aid in the detection of late potentials.

softkeys

The function keys labelled in the lower portion of the cardiograph's front panel display and physically positioned underneath the display. These keys change functions when they are pressed. The matching display label also changes.

template beat

A typical beat used to match other beats during averaging. When selecting a template beat, choose a clean beat without a lot of noise.

vector scaling

The size at which the combined leads are displayed.

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