HEWLETT
PACKARD

PageWriter XLi
User's Reference Guide

Notice

About This Edition

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The information in this guide applies to the PageWriter XLi cardiograph. This information is subject to change without notice. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

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WARNING

As with electronic equipment, **Radio Frequency** (RF) interference between the cardiograph and any existing RF transmitting or receiving equipment at the installation site, including electrosurgical equipment, should be evaluated carefully and any limitations noted before the equipment is placed in service.

Radio frequency generation from electrosurgical equipment and close proximity transmitters may seriously degrade performance.

Like all electronic devices, this cardiograph is susceptible to electrostatic discharge (ESD). Electrostatic discharge typically occurs when electrostatic energy is transferred to the patient, the electrodes, or the cardiograph. ESD may result in ECG artifact that may appear as narrow spikes on the cardiograph display or on the printed report. When ESD occurs, the cardiograph's ECG interpretation may be inconsistent with the physician's interpretation.

Hewlett-Packard assumes no liability for failures resulting from RF interference between HP medical electronics and any radio frequency generating equipment at levels exceeding those established by applicable standards.

CAUTION

Use of accessories other than those recommended by Hewlett-Packard may compromise product performance.

THIS PRODUCT IS NOT INTENDED FOR HOME USE.

IN THE U.S., FEDERAL LAW RESTRICTS THIS DEVICE TO SALE ON OR BY THE ORDER OF A PHYSICIAN.

Medical Device Directive

The PageWriter XLi Cardiograph complies with the requirements of the Medical Device Directive 93/42/EEC and carries the

$C\!\epsilon_{0123}$ mark accordingly.

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Safety Summary

Safety Symbols Marked on the Cardiograph

The following symbols are used on the cardiograph.

⚠	Caution - See operating instructions
❤	Type CF, defibrillation protected
∿	Alternating current
⏚	Equipotential (this is on the ground lug)

The following symbols appear on the cardiograph packaging.

☂	Keep dry
🌡	Temperature and relative humidity ranges
🍷	Fragile

Conventions Used in This Manual

WARNING	**Warning statements describe conditions or actions that can result in personal injury or loss of life.**

CAUTION	Caution statements describe conditions or actions that can result in damage to the equipment or software.

NOTE	Notes contain additional information on cardiograph usage.

Softkey represents the temporary key labels that appear on the keyboard display.

Key represents keys on the front panel.

Documentation Map

Documentation Map	
If you want to:	**Use this manual:**
Verify that all equipment is included	Packing List
Record ECG's	Operating Guide
Enter patient ID	
Make copies of ECG's	
Store ECG's	
Transmit or receive ECG's	
Troubleshoot problems	
Maintain the cardiograph	
Set up the cardiograph	
Install the battery	
Install the software	
Load paper	
Change applications	
Install or use Preview Plus	
Configure the cardiograph	User's Reference Guide
Prepare the patient	
Maintain the cardiograph	
Install and use the modem	

Documentation Map	
If you want to:	**Use this manual:**
Configure and use Special Applications	User's Reference Guide
Order supplies	
Use filters	
Understand analysis	Physician's Guide

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1 Introduction

About This Manual

This guide contains reference information and configuration instructions for experienced PageWriter XLi cardiograph users. If you are unfamiliar with using this cardiograph, please view the videotape tutorial *Using the Hewlett-Packard PageWriter XL Cardiographs*. For additional help on using your cardiograph refer to the *HP PageWriter XLi Operating Guide*.

2   Acquiring an ECG

One of the most important aspects of recording a clear ECG is good ECG technique. This chapter includes a review of recommended ECG technique as well as information about using the patient module.

NOTE   Computerized ECG analysis should always be reviewed by a qualified physician.

ECG Technique

ECG technique is very important, both to avoid difficulty when taking the ECG and to achieve the best quality result. There are three key aspects of good ECG technique:

- Helping the patient to relax.

- Preparing the patient for electrode connection.

- Using the patient module to check lead connections.

For best results, perform the following steps in the order given. More details on good technique follow this list.

- Check that the patient is comfortable and relaxed. Reassure the patient that the procedure is painless.

- If possible, place the patient away from electrical fixtures and their power cords, and away from the cardiograph's power cord if AC power is on.

- Expose the patient's forearms, lower legs, and chest.

- Beginning with the right leg position, apply electrolyte and attach electrodes.

NOTE	Disposable electrodes, when used properly, may be used for acceptable ECGs. For best results, prepare the skin and carefully follow manufacturer's usage instructions.

Relaxing the Patient

The more the patient relaxes, the less the ECG will be affected by noise. Your good technique helps the patient relax. You can help the patient to relax by the following:

- Make sure the patient is lying down and comfortable. The patient's arms and hands must be relaxed. If the table is too narrow, place the patient's hands under the buttocks to prevent muscle tension in the arms.

- When possible, take the ECG in a quiet room or area where others can't see the patient. Privacy is important to relaxation. Draw the curtains around the bed area when taking the ECG in a room with other people.

- Gain the patient's confidence by explaining the test and that it won't hurt.

- Your calm, relaxed attitude will help put the patient at ease.

- Don't let the patient move unnecessarily. It's also best to avoid all conversation during the actual ECG recording to keep the patient as still as possible.

Preparing the Patient

Selecting the **Electrode Positionsm,** Table 2-1**,** shows the proper electrode positions for taking an ECG. Put the electrodes in the correct anatomical locations according to information in Figure 2-1.Additional information concerning other lead systems may be found in Appendix A.

The tip of each lead wire is lettered and color coded for easy lead identification. For example, make sure that the RA lead wire and electrode connect to the right arm and the RL lead wire and electrode connect to the right leg.

Table 2-1 Standard 12-Lead Electrode Positions

Lead	Position
RL	On the right leg (inside calf, midway between knee and ankle)
LL	On the left leg (inside calf, midway between knee and ankle)
RA	On the right arm (on the inside)
LA	On the left arm (on the inside)
V1	Fourth intercostal space, at right sternal margin
V2	Fourth intercostal space, at left sternal margin
V3	Midway between V2 and V4
V4	Fifth intercostal space at left midclavicular line
V5	Same transverse level as V4, on anterior axillary line
V6	Same transverse level as V4, at left midaxillary line
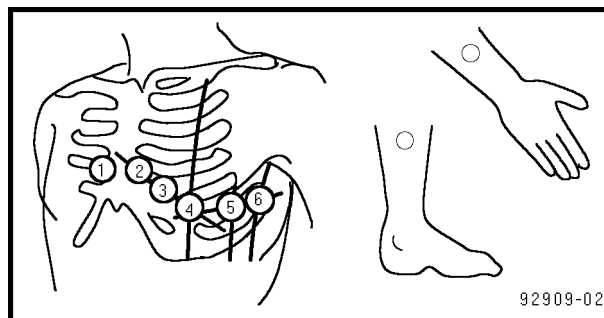
Figure 2-1 Standard 12-Lead Electrode Positions.

Preparing the Skin at the Electrode Positions

Since dry skin is a relatively poor electrical conductor, you must prepare the skin to assure good contact between the skin and the electrode. Before

securing the electrodes, you must lower the skin resistance at the electrode site by:

- Making sure that all electrodes are clean and bright. (Dirty or corroded electrodes prevent a good electrical connection.)

- Avoiding bony areas. Select flat, fleshy sites. You don't have to shave hair from the skin unless the hair is very thick.

- Rubbing the skin briskly with the edge of the electrode or a gauze pad until the skin is slightly red, but not bruised.

- Applying electrolyte to the prepared areas on the skin. Rub some electrolyte into the skin, but leave a slightly moist residue. **Do not spread electrolyte on the chest area between electrodes**. This will cause distorted waveforms on the ECG.

| NOTE | **Do not use alcohol or acetone pads** in place of the electrolyte because they impair the electrode contact with the skin. |

Securing the Electrodes

We have included two types of electrodes in the accessory box:

- Metal plate limb electrodes, held in place on the patient by rubber straps.

- Welsh cup chest electrodes, held in place by suction.

Securing the electrodes is a key part of good ECG technique and getting a good ECG trace. To avoid jittery waveforms, make sure that the electrodes are secure. Do not overtighten limb plate electrodes, since this might cause discomfort which results in muscle artifact on the waveforms.

Fasten the electrodes to the chest positions by squeezing the rubber bulb of the suction cup. See Figure 2-3. The bulb should be partially deflated when the electrode is firmly attached to the chest.

A good test for firm electrode contact is to grasp the electrode and try to move it. If it moves easily, the electrode connection is too loose. If it digs into the flesh, the electrode is too tight. Do not allow the chest electrodes to move in any way. Check the patient module display for indications that the connections are good. Ideally, the noise bar should remain in the green zone.

Do not leave suction electrodes connected to the chest for prolonged periods. The suction can cause intradermal hemorrhaging.
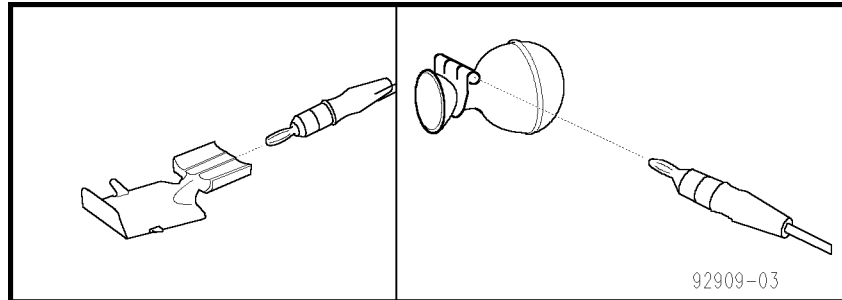
Figure 2-2 Connect Leadwires to Electrodes.
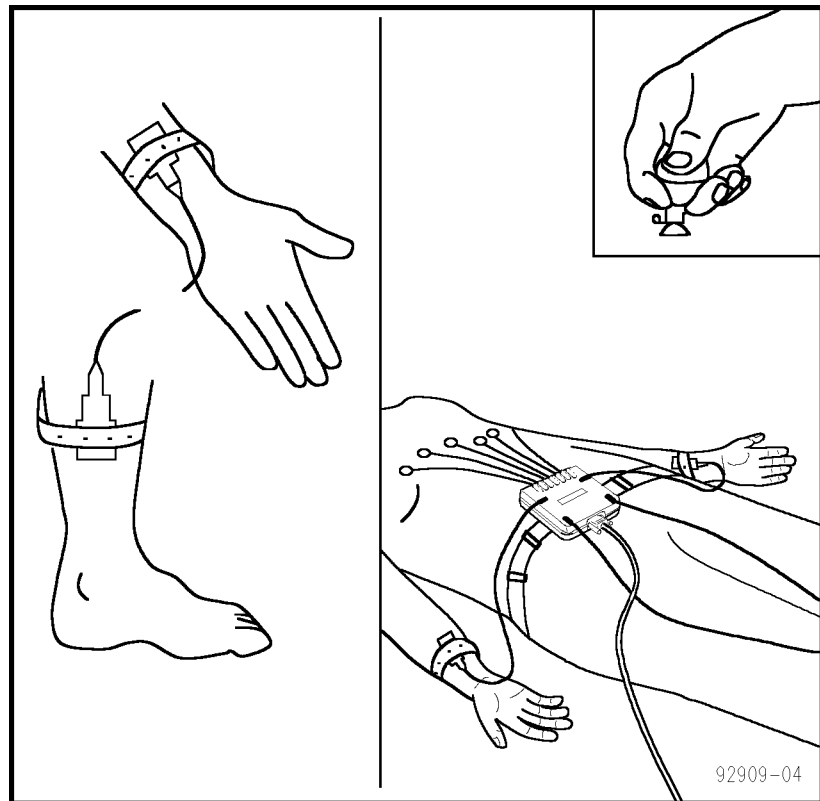
Figure 2-3 Fasten Electrodes.

Monitoring ECG Quality

There are three ways that the PageWriter XLi helps you monitor the quality of your ECG recordings.

- Using the patient module display
- Using the preview screen
- Observing quality messages on the cardiograph's display

You can stop the recording before or during printing if you see artifact or other ECG waveform problems on the screen. Modify lead placement or improve patient preparation and resume recording the ECG.

For further instructions on using the patient module display and the preview screen, refer to the *PageWriter XLi Operating Guide*.

Quality Messages on the Cardiograph's Display

After you start an Auto ECG recording, the cardiograph's display will show messages which indicate the quality of the recording. If there is minimal noise and all electrodes are securely attached, the message "'ECG ok" will appear.

Some messages indicate problems with the leads. They list the condition and the action to take. There are four conditions which affect the ECG:

- Leads off
- AC noise
- Artifact
- Baseline wander

If any of these conditions are severe, the message directs you to retry the recording. Correct the problem and then resume recording the ECG.

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3 Understanding the PageWriter XLi Special Applications

Overview

The ACI TIPI (Acute Cardiac Ischemia - Time Insensitive Predictive Instrument) and the TPI (Thrombolytic Predictive Instrument) are software products that enhance the computer-assisted ECG analysis capabilities of the PageWriter XLi Cardiograph. These "Predictive Instruments" generate 0-100% Predicted Probability scores of ACI (Acute Cardiac Ischemia) and patient outcome with and without thrombolytic therapy for acute myocardial infarction (AMI). These predicted probabilities are based on ECG features, patient age, gender, blood pressure, chest pain status and time since ischemic symptom onset. The cardiograph can be configured to automatically print these probabilities on the Auto ECG report.

Indications for Use

The ACI-TIPI is intended for use as an aid to clinicians in the diagnosis and triaging decision process of patients with ACI, which includes unstable angina pectoris and acute myocardial infarction (AMI).

The TPI is intended for use as an aid to clinicians identifying which patients with AMI are appropriate candidates for thrombolytic therapy. TPI is intended for adult patients, aged 35-75, diagnosed with symptoms of acute myocardial infarction.

These programs can be used in real-time and retrospective settings since they rely on information that is readily available in the emergency department (ED), or by retrospective review of the patient's medical record. The emergency physician's real-time decision making process is aided by having the predictive instruments incorporated into the electrocardiograph. The predictive scores, once acquired, can then be used along with actual patient outcome to help improve patient management practices retrospectively.

The predictive instruments provide the physician with tools to:

- Aid diagnosis and triage of some patients with symptoms suggestive of ACI
- Identify those patients most likely to benefit from thrombolytic therapy
- Facilitate the earliest possible administration of thrombolytic therapy

NOTE   For intended use and contraindication information, consult the *Predictive Instrument Physician's Guide* for important information.

Understanding TPI Variables

There are nine predictors of thrombolytic-related benefits and risks which include six clinical factors and detailed information on three ECG features.

The six clinical factors are:

- Time since ischemic onset
- Patient age
- Patient gender
- Patient Blood Pressure (systolic and diastolic)
- Patient's history of diabetes
- Patient's history of hypertension

NOTE   For each of the clinical factors listed above, patient data must be entered in order to produce a TPI report.

The three ECG features are:

- the presence or absence of pathological or significant Q waves
- the presence and degree of ST segment elevation or depression
- the presence and degree of T wave elevation or inversion

Understanding ACI TIPI Variables

Seven variables are used to predict Acute Cardiac Ischemia. These variables include four clinical factors and detailed information on three ECG features.

The four clinical factors are:

- the presence or absence of chest pain or pressure, or left arm pain
- whether chest pain or pressure, or left arm pain is the patient's most important presenting symptom
- patient age
- patient gender

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NOTE   For each of the clinical factors listed above, patient data must be entered in order to produce the ACI-TIPI report.

The three ECG features are:

- the presence or absence of pathological or significant Q waves
- the presence and degree of ST segment elevation or depression
- the presence and degree of T wave elevation or inversion

The exclusionary cases for both the TPI and ACI-TIPI applications are listed in the *Predictive Instrument Physician's Guide*. Please refer to this document for this information.

Using the TPI and ACI-TIPI Applications

To use the TPI and ACI-TIPI applications, you must configure the cardiograph and enable the applications. There are several types of reports that are produced by the cardiograph. These reports are summarized in Table 3-1.

Table 3-1 PageWriter XLi Reports

Report Type	Contents of Report	Notes
Standard 09 (Std 09)	ECG waveforms, measurements, ECL 09 Adult Interpretation	
Standard P4 (Std P4)	ECG waveforms, measurements, ECL P4 Pediatric Interpretation	
ACI-TIPI (T0)	ECG waveforms, TIPI Analysis, No Risk Management Report	
Risk Management	Risk Management Report —1 page summarizing clinical information and can be used by the Clinician to document clinical decisions	Only available when T0 is enabled The ACI-TIPI Report will also be printed.
TPI (H0)	ECG waveforms, TPI Analysis	

Analyzing an ECG with the Predictive Instruments

The flexibility of the PageWriter XLi allows you to configure the Predictive Instruments based on the type of patients presenting in your clinical setting. Using the Configuration Menu, you can set up your cardiograph to provide the desired analysis.

When first turned on the PageWriter XLi cardiograph will have the Special Applications turned off. The Special Application choices are part of the Global Configuration Menu and enable access to the following settings.

Table 3-2 Special Applications Settings

Parameter	Choices	Default value when Special Apps = off
Research Leads	Off/VX1-VX4/V4R-V8	Off
Default Adult Criteria	09/P4	09
Default Pediatric Criteria	09/P4	P4
Patient ID Criteria	On/Off	Off
ACI-TIPI	On/Off	Off
Risk Mgmt.	On/Off	Off
Risk Range	0%-100%	-
TPI	On/Off	Off
Screening	On/Off	Off
Leads	Normal/Cabrera	Normal
Storage Mode	Standard/Special	Normal
VCG	Off/vcg1/vcg2/vcg3/vcg4	Off
Default Storage Criteria	Def Adult/Ped, TIPI, TPI	Def Adult/Ped

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It is important to understand that it is possible to set the Default Adult Criteria and the Default Pediatric Criteria to be either 09 or P4. This flexibility is designed for unusual clinical settings, and you should always be aware of just how your cardiograph is set up.

Generating Reports with the Special Applications Off

This method of working enables any kind of report to be generated, however it does not allow for generation of multiple simultaneous reports. Through the top level "Auto Analysis" menu, you can specify the kind of report to be made. There are five choices available: Adult, Pediatric, TIPI, or TPI, or Default.

For each of these report options, here are the resulting reports given that Special Applications are Off and the Auto button has been pressed:

- Adult - The XLi will do an 09 report (regardless of patient age).

- Pediatric - The XLi will do a P4 report (regardless of patient age).

- TIPI - The XLi will do a TIPI report. A Risk Management report will not be generated.

- TPI - The XLi will do a TPI report. TPI screening will not occur.

- Default - The XLi will do an 09 report if the age is unspecified or above 15 years. The XLi will do a P4 report if the age is 15 years or less.

1. From the main display, press the $\boxed{\text{F1}}$ key until 'Auto Analysis' appears.

2. Press the $\boxed{\text{F3}}$ key to select the desired report format.

Generating Reports with the Special Applications On

It is possible to configure the PageWriter XLi to produce multiple reports. When the setting for Special Applications is turned to On, and the Auto button is pressed, there are five choices of reports available - Adult, Pediatric, ACI-TIPI, TPI or Default. The first four choices and their resulting outcomes are described below:

- Adult - The XLi will do the Default Adult Criteria Report (regardless of the patient's age).

- Pediatric - The XLi will do the Default Pediatric Criteria Report (regardless of the patient's age).

- ACI-TIPI - The XLI will do a TIPI report. Also, if the Risk Management Report is set to on in the Special Applications Menu and the ACI-TIPI Report risk factor falls within the limits set up, a Risk Management Report will be produced.

- TPI - The XLi will do a TPI report. TPI Screening will not occur.

Auto Analysis and the Default Choice

If the Default choice is selected from the Auto Analysis menu, multiple reports may be produced when the Auto button is pressed, depending on what has been enabled in the Special Applications in the Global Configuration Menu.

- TPI - If TPI is on and TPI Screening is off, a TPI report will be generated. If TPI is on and TPI Screening is On and the TPI Analysis Criteria are met, a TPI report will be generated. If both TPI and TPI Screening are on, but the TPI Analysis Criteria are not met, a TPI report will not be generated.

- ACI-TIPI - If ACI-TIPI is on, this will be the next report produced. If the Risk Management Report is also on and the ACI-TIPI calculated risk is between the low and high risk limits as set up in the Special Applications, then a Risk Management report will be produced.

- Standard ECG (consisting of one of the following):
  Patient ID Criteria Off - The XLi will do the Default Adult Report if the patient's age is specified as over 15. If the patient's age is 15 years or under, the Default Pediatric Report will be produced.
  Patient ID Criteria On and Patient ID Criteria Loaded - This custom interpretation report will be generated.
  Patient ID Criteria On but Patient ID Criteria Not Loaded - A Null report will be produced.
  Patient ID Criteria On but Patient ID Criteria Not Entered by the User - The XLi will do the Default Adult Report if the patient's age is specified as over 15. If the patient's age 15 years or under, the Default Pediatric Report will be produced.

- Vectorcardiography - If VCG is on and at least one of the X, Y or Z leads is included as a rhythm lead in the report type, and Research leads is set to off, then the XLi will produce a VCG report.

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Generating a STAT ECG Report

If your cardiograph has been configured with the Special Applications On, and with TPI and/or TIPI interpretations enabled, you may omit these interpretations by running a "STAT" ECG. A STAT ECG is guaranteed to generate a single standard report (typically 09 Adult Criteria or P4 Pediatric Criteria) without the need for Patient ID information. A STAT ECG is initiated by pressing the AUTO key twice in succession. A STAT report is produced even if "Print Auto = OFF" in the global configuration menu.

4   Choosing Report Features

This chapter describes the various ECG reports and how to print the Extended Measurements report.

ECG Formats

The Auto Report

Twelve-lead Auto reports display a ten second ECG in an Auto 3 x 4, Auto 3 x 5, Auto 4 x 4 or Auto 6 x 2 format. The Auto 3 x 4 format displays consecutive 2.5 second segments of 12 leads, three leads at a time. The Auto 3 x 5 format displays consecutive 2 second segments of 12 leads with the 5th lead column showing the extended pediatric leads, V3R, V4R, and V7. The Auto 4 x 4 format displays consecutive 2.5 second segments of 12 leads with the 4th row consisting of the extended research leads VX1-VX4 or V3R, V4R, V7, and V8. The Auto 6 x 2 format displays consecutive 5 second segments of 12 leads, six leads at a time. One or three leads can be displayed as rhythm strips at the bottom of Auto 3 x 4 and Auto 3 x 5 reports. The rhythm strips show the same 10 second segments as in the Auto 3 x 4 or Auto 3 x 5 section of the report. The Auto 4 x 4 report can show 1 rhythm strip.

Auto Report Information

The Auto report may be printed with patient ID information only or with various types of analysis information included. You can select which information appears on the printed report. See Chapter 6, **Configuring Your Cardiograph**, for information on choosing which features will be printed on the report.

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Basic Measurements Report. The Basic Measurements report has patient ID information and basic measurements for the ECG. These measurements, which include heart rate, interval and axis measurements, are in the table below with their abbreviations on the report.

Table 4-1 Basic Measurements

Symbol	Description	Units
Rate	heart rate	beats per minute
PR	PR interval	milliseconds
QRSD	QRS duration	milliseconds
QT	QT interval	milliseconds
QTc	QT interval corrected for rate	milliseconds
P	Frontal P axis	degrees
QRS	Frontal mean QRS axis	degrees
T	Frontal T axis	degrees

Severity Report. This report shows a summary statement of the severity derived from the ECG interpretation. There are five ECG severities:

- Normal

- Otherwise Normal

- Borderline

- Abnormal

- Defective Data

Interpretive Report. The Interpretive report includes basic measurement information as well as statements from the analysis of the extended measurements derived from medical and technical criteria. This report also shows a summary statement of the severity of the ECG interpretation.

Reasons Report. The Reasons report includes all of the features included on the Interpretive report as well as summarized reasons for each interpretative statement. The reason for each statement provides a summary of the criteria which were met in order to print the interpretive statement.

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Extended Measurements Report. The Extended Measurements report lists the measurements which determine a suggested interpretation. This two page report summarizes the morphology and rhythm characteristics for the individual lead waveforms and rhythm groups in the ECG.

To print the Extended Measurements report for a stored ECG:

1. Insert the disk with the ECG for which you want extended measurements.

2. Press Menu until the following display appears.

Transmit Store	Config	CheckDisk	Files

3. Press Files . The display becomes:

Delete	Log	Edit	Print	Files

4. Press Print . The display becomes:

123456	09-23-90	11:25:51 AM		
Select	Print	Next	Previous	More

5. Press Next or Previous until the correct patient ID number appears. Then press Select . Or:

- If you know the ID number of the ECG you want to print, press More , then Find .

- Type the patient ID number, then press Enter. The most recent ECG with that patient ID number appears. If you want a different ECG for that patient, you must scroll through the list by pressing Previous. Then press Select.

    Continue with the following steps.

6. Press Select and then Print. If your cardiograph has been configured to print "Choice", the following display appears.

Choose desired analysis for print.				
None	Measure	Interp.	Reasons	More

- Press More and the following display appears.

Choose desired analysis for print.		
Extended	Sev.only	More

See Chapter 6, **Configuring Your Cardiograph** for information on configuring your cardiograph to print the Extended Measurements report if it hasn't been set up to do so.

7. Press Extended.

8. The message, "Printing 1 of 1 ECG(s)" will appear and the two-page Extended Measurements report will be printed on the cardiograph.

You can also configure the cardiograph for "Choice" in order to print this report when copying an ECG.

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Manual Formats

Manual ECGs print continuously after you press $\boxed{\text{Manual}}$ until you press $\boxed{\text{Stop}}$. Manual ECGs are printed as the ECG waveform occurs.

The Manual Lead Sets

Manual mode is used for monitoring rhythm over an extended period. Besides standard lead combinations, you can configure your own lead combinations for Custom Manual 3 or 6 leads. See Chapter 6, **Configuring Your Cardiograph** for information about selecting different lead combinations in Manual mode. Besides the conventional 12 leads, you may use one of the following sets of supplemental leads:

pediatric leads	V4R, V3R, V7
or Frank leads	X, Y, Z
or generic research leads	VX1, VX2, VX3, VX4
or right chest / posterior research leads	V4R, V3R, V7, V8

The following tables show lead selection choices.

Table 4-2 Manual Standard Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	I, II, III aVR, aVL, aVF V1, V2, V3 V4, V5, V6	I, aVF, V2
6	I, II, III, aVR, aVL, aVF V1, V2, V3, V4, V5, V6	II, aVF, V1, V2, V4, V6
12	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6	

Table 4-3 Manual Standard + Pediatric Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	I, II, III aVR, aVL, aVF V1, V2, V3 V4, V5, V6 V3R, V4R, V7	I, aVF, V2
6	I, II, III, aVR, aVL, aVF V1, V2, V3, V4, V5, V6 I, aVF, V2, V3R, V4R, V7	II, aVF, V1, V2, V4, V6
12	|I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 I, II, aVF, V4R, V3R, V1, V2, V3, V4, V5, V6, V7	

Table 4-4 Manual Standard + Frank Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	I, II, III aVR, aVL, aVF V1, V2, V3 V4, V5, V6 X, Y, Z	I, aVF, V2
6	I, II, III, aVR, aVL, aVF V1, V2, V3, V4, V5, V6 I, aVF, V2, X, Y, Z	II, aVF, V1, V2, V4, V6
12	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 I, II, aVF, V1, V2, V3, V4, V5, V6, X, Y, Z	

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Table 4-5 Manual Standard + Generic Research Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	I, II, III aVR, aVL, aVF V1, V2, V3 V4, V5, V6 VX1, VX2, VX3	I, aVF, V2
6	I, II, III, aVR, aVL, aVF V1, V2, V3, V4, V5, V6 I, aVF, VX1, VX2, VX3, VX4	II, aVF, V1, V2, V4, V6
12	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 I, II, V1, V2, V3, V4, V5, V6, VX1, VX2, VX3, VX4	

Table 4-6 Manual Standard + Right Chest / Posterior Research Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	I, II, III aVR, aVL, aVF V1, V2, V3 V4, V5, V6 V4R, V3R, V1 V6, V7, V8	I, aVF, V2
6	I, II, III, aVR, aVL, aVF V1, V2, V3, V4, V5, V6 I, aVF, V4R, V3R, V7, V8 I, aVF, V2, V6, V7, V8	II, aVF, V1, V2, V4, V6
12	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6 I, II, V4R, V3R, V1, V2, V3, V4, V5, V6, V7, V8	

Table 4-7 Manual Cabrera Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	aVL, I, -aVR II, aVF, III V1, V2, V3 V4, V5, V6	I, aVF, V2
6	aVL, I, -aVR, II, aVF, III V1, V2, V3, V4, V5, V6	II, aVF, V1, V2, V4, V6
12	aVL, I, -aVR, II, aVF, III, V1, V2, V3, V4, V5, V6	

Table 4-8   Manual Cabrera + Pediatric Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	aVL, I, -aVR II, aVF, III V1, V2, V3 V4, V5, V6 V3R, V4R, V7	I, aVF, V2
6	aVL, I, -aVR, II, aVF, III V1, V2, V3, V4, V5, V6 I, aVF, V2, V3R, V4R, V7	II, aVF, V1, V2, V4, V6
12	aVL, I, -aVR, II, aVF, III, V1, V2, V3, V4, V5, V6 I, II, aVF, V4R, V3R, V1, V2, V3, V4, V5, V6, V7	

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Table 4-9 Manual Cabrera + Frank Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	aVL, I, -aVR II, aVF, III V1, V2, V3 V4, V5, V6 X, Y, Z	I, aVF, V2
6	aVL, I, -aVR, II, aVF, III V1, V2, V3, V4, V5, V6 I, aVF, V2, X, Y, Z	II, aVF, V1, V2, V4, V6
12	aVL, I, -aVR, II, aVF, III, V1, V2, V3, V4, V5, V6 I, II, aVF, V1, V2, V3, V4, V5, V6, X, Y, Z	

Table 4-10 Manual Cabrera + Generic Research Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	aVL, I, -aVR II, aVF, III V1, V2, V3 V4, V5, V6 VX1, VX2, VX3	I, aVF, V2
6	aVL, I, -aVR, II, aVF, III V1, V2, V3, V4, V5, V6 I, aVF, VX1, VX2, VX3, VX4	II, aVF, V1, V2, V4, V6
12	aVL, I, -aVR, II, aVF, III, V1, V2, V3, V4, V5, V6 I, II, V1, V2, V3, V4, V5, V6, VX1, VX2, VX3, VX4	

Table 4-11 Manual Cabrera + Right Chest / Posterior Research Leads

Number of Leads	Lead Choices	Default Custom Lead Choices
3	aVL, 1, -aVR II, aVF, III V1, V2, V3 V4, V5, V6 V4R, V3R, V1 V6, V7, V8	I, aVF, V2
6	aVL, I, -aVR, II, aVF, III V1, V2, V3, V4, V5, V6 I, aVF, V4R, V3R, V7, V8 I, aVF, V2, V6, V7, V8	II, aVF, V1, V2, V4, V6
12	aVL, I, _aVR, II, AVF, III, V1, V2, V3, V4, V5, V6 I, II, V4R, V3R, V1, V2, V3, V4, V5, V6, V7, V8	

4

ECG Formats

5   ECG Storage

This chapter contains information about storing ECGs on a flexible disk. Information about using and printing the ECG-Log and the Store-Log is also included.

Advantages of Disk Storage

Storing ECGs to disk allows you to recall the ECGs later as needed. Individual ECGs can be recalled for editing patient information, re-analyzing, or printing. Groups of ECGs can be recalled from disk for re-analyzing or printing.

ECGs are stored in two ways, Standard mode and Special mode. ECGs in Standard mode are stored at 250 samples per second; in Special mode they are stored at 500 samples per second. ECGs stored in Standard mode contain only the waveform segments printed on the Auto report; ECGs stored in Special mode contain a full ten seconds of information for all leads. More than 100 ECGs can be stored on a disk in Standard mode; approximately 35 ECGs can be stored on a disk in Special mode. Only ECGs stored in Special mode can be re-analyzed or re-formatted. Refer to the Global Configuration Fields table in Chapter 6, **Configuring Your Cardiograph** for information about how to configure the storage mode on your cardiograph.

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ECGs stored to disk on a PageWriter XLs cardiograph in Special mode, can be analyzed on a PageWriter XLi. To analyze the ECG from the disk, press

Files   from the main menu, then press   Analyze . You may then select the ECGs to analyze.

Storing Reports with the Special Applications Off

Should you decide to store the ECG report just taken, press Store. The report stored will always be the one just generated.

This will not change the global cardiograph configuration. The cardiograph will revert to the last saved storage/transmission configuration options if the cardiograph is powered off.

Storing Reports with the Special Applications On

For the report choices of, Adult, Pediatric, TIPI, and TPI, if you press Store, the report stored will always be the one just generated, with the exception that the Risk Management Report is never stored.

Storing Reports Using Auto Analysis and the Default Choice

If Auto Analysis is set to Default, and if the user presses Store, the report stored will be the Default Store report type that the user has previously defined in the Global Menu settings. In the case where a TPI report is not produced, and the choice for Default Store type is TPI, the "Standard" ECG report will be stored instead.

Automatically Storing Reports Using Forced Auto-Store

The PageWriter XLi may be configured, under the Global Configuration Menu, to store an ECG even if patient ID information has not been entered. If the answer to the Global Configuration question, "AutoStore?" [Yes | No | Force] is entered as "Force", the ECG will be stored with an ID of "Unknown".

Disk Handling and Maintenance Instructions

The following instructions will prevent ECG disk damage and data loss.

- Never manually open the silver shutter on the disk.

- Do not expose the disk to direct sunlight, extremes of temperature or humidity, magnetic fields or dust.

- Place the disk in a protective cover when the disk is not inside the drive.

- Store disks in a clean, dry place.

- Do not **eject** the disk, **move** the cardiograph or **turn off** the cardiograph when the disk is active in the drive. The disk is active when the drive access light is on.

- **Clean the disk drive with a wet-dry cleaning kit regularly**. Wet-dry cleaning kits are available from local computer stores.

- Clean the disk drive every six months unless the working environment is particularly dusty or dirty. Clean the drive more often in dusty or dirty environments.

TraceMaster ECG Management System users:

If you transfer ECGs to the TraceMaster System by disk, clean the TraceMaster drive every six months unless the working environment is particularly dusty or dirty. Clean the drive more often in dusty or dirty environments.

- Replace the disks regularly. The recommended interval is every three months. If the disks are used for more than 50 ECGs per day, replace the disks more frequently.

- For best results, **use only Hewlett-Packard recommended disks.** (HP part number M1700-89004)

- For more information, contact your Hewlett-Packard service representative.

5

Using the ECG-Log and Store-Log

The cardiograph automatically maintains two ECG logs. The ECG-Log is a list of the last 60 Manual and Auto ECGs recorded on the cardiograph. The latest ECG has the highest number. When more than 60 ECGs fill the list, the earliest ECGs disappear from the list.

The Store-Log lists all Auto ECGs stored on the flexible disk which is in the cardiograph's disk drive. The Store-Log is updated automatically when you store an ECG and when you delete a stored ECG from the flexible disk.

Figure 5-1 The ECG-Log

Table 5-1 The ECG-Log.

	Description
A	The last 60 ECGs which have been recorded.
B	Location number which includes the institution, department and cardiograph codes.
C	Date and time of the report.
D	Numerical order in which the ECG was recorded.
E	Date and time when the ECG was recorded.
F	Patient name and identification number.
G	ECG format and mode.
H	Initials of the person who recorded the ECG.
I	Department in which the ECG was recorded.
J	Institution, department and cardiograph identification number.
K	ECG storage indication.

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Figure 5-2 The Store-Log

Table 5-2 The Store-Log

	Description
A	The ECGs which are stored on the flexible disk which is in the cardiograph.
B	Number of ECGs stored on the flexible disk.
C	Percentage of space available on the disk
D	Date and time of the report.
E	Numerical order in which the ECG was stored.
F	Date and time when the ECG was recorded.
G	Patient name and identification number.
H	ECG format.
I	Initials of the person who recorded the ECG.
J	Department in which the ECG was recorded.
K	Institution, department and cardiograph identification number.
L	S - ECG storage mode. (Standard is 250, Special is 500; 3x5 and 4x4 Reports are 500; SAECG is SAE)
M	T - Indication that ECG was transmitted. For 3x5 and 4x4 Reports a "-" will appear.
N	E - Patient ID information edited, Yes or No.
O	A - Criteria used to interpret the ECG.

Printing ECG Logs

To print an ECG-Log or Store-Log:

1. Press Manual until the following display appears.

Transmit Store	Config	CheckDisk	Files

2. Press the Files softkey. The following display appears.

Delete	Log	Edit	Print	Exit

3. Press the Log softkey. The following display appears.

Log to Print		
ECG-Log	Store-Log	Exit

4. Press the ECG-Log softkey to print a list of recorded ECGs. Press the Store-Log softkey to print a list of stored ECGs.

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Using the ECG-Log and Store-Log

6   Configuring Your Cardiograph

6

Your cardiograph can be configured to meet the requirements of your institution. Typically the cardiograph is configured only during initial installation. This chapter describes overall (Global) configuration, patient ID entry configuration, and how to print and save the configuration information that you have selected.

NOTE   Before changing your cardiograph's configuration, you might want to print the current configuration settings. Refer to instructions on printing configuration at the end of this chapter.

Using Configuration Menus

This section describes how to configure the cardiograph's operating features. Each configuration menu choice is described briefly in a list, then in more detail in the section that follows the list.

1.   Press Menu until the following display appears:

Transmit Store	Config	CheckDisk	Files

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

		Configuration File Jobs		
Global	ID	Transmit	Files	Exit

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

Here are the basic descriptions for each softkey in this menu:

Global	Allows you to set the operating parameters for the cardiograph. The Global configuration affects all cardiograph operations.
ID	Allows you to choose which patient identification entries are requested before recording an ECG.
Transmit	Allows you to set the communication parameters required for transmitting and receiving ECGs.
Files	Allows you to store a copy of the cardiograph configuration and software to flexible disk, or to print the configuration settings.
Exit	Returns you to the main menu.

NOTE

When you make changes to the system configuration, it is recommended that you save the configuration on a flexible disk. If you must reload the configuration, restoring a custom configuration is much quicker and easier from a flexible disk than by re-entering the changes manually. Refer to "Storing the Configuration Information" later in this chapter for more information.

Two cases where you would need to use the configuration information from the disk are if you lose battery power or if different configurations are regularly used in your institution.

Selecting Configuration Parameters

When you select or change configuration parameters, the method is generally the same whether you are selecting Global, Transmit, or ID parameters. The display will be similar to this first parameter in the Global list:

Initial Interpretation? Reasons			
Enter	Choose	Previous	Exit

The message line on top displays the parameter and its current setting. The softkey labels are displayed on the bottom line.

Enter	Accepts current setting, then advances to the next parameter in the list; or returns to the menu if pressed when the last parameter in the list is displayed.
Choose	Advances through the list of choices for the specified parameter.
Tab	Appears only for the custom lead group parameters in the Global list. Used to select the leads for the custom format.
Leads	Used to select rhythm leads in "Default Auto?" parameter in Global configuration.
Previous	Returns to the previous display (does not appear on the first display).
Exit	Returns to the main menu.

Understanding Global Configuration

To change any configuration settings, follow these steps. Detailed information about the parameters follows these instructions in Table 5-1.

1. Press Menu until the following display appears:

Transmit Store	Config	CheckDisk	Files

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

		Configuration		
Global	ID	Transmit	Files	Exit

3. Press Global and the following display will appear.

Initial Interpretation? Reasons			
Enter	Choose	Previous	Exit

Table 6-1 lists each Global parameter and its choices. The factory default settings are shown in **boldface** type. There are explanations following the table for those parameters that cannot be fully explained in the table's Comments column.

Table 6-1 Global Configuration Fields

Parameter	Setting Choices	Comments
Initial Interpretation?	**Reasons** None Measure Interpret Severity only	See "Interpretation Parameters" section following table.
Copy Interpretation?	**Reasons** Extend Measure None Severity only Choice Measure Interpret	See "Interpretation Parameters" section following table.
AutoStore?	**Yes** No Force	Determines whether an Auto ECG is automatically stored without operator intervention.
Patient ID required?	**Yes** No	Appears only if AutoStore is "No". Determines whether the cardiograph will require patient ID information before recording an Auto ECG. If AutoStore is "Yes", this parameter is "Yes".
Auto Frequency Response?	**.15-150 Hz** .05-150 Hz .5-150 Hz W .15-40 Hz .5-40 Hz W .05-100 Hz .15-100 Hz .5-100 Hz W	W = Baseline Wander filter. See *Hewlett-Packard Interpretive Cardiograph Physician's Guide* for more information.

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Parameter	Setting Choices	Comments
Manual Frequency Response?	.5-40 Hz W **.05-40 Hz** .5-100 Hz W .05-100 Hz .5-150 Hz W .05-150 Hz	W = Baseline Wander filter. See *Hewlett-Packard Interpretive Cardiograph Physician's Guide* for more information
Line Power Filter?	Off **On**	A software filter that removes power line (AC) interference.
Line Power Frequency?	60 Hz 50 Hz	No default -- selected during software installation for use by line power filter.
Filter Key?	**BaselineWander & Artifact** BaselineWander Artifact	Determines which filter combinations are active when Filter key is "On"
Auto print speed?	**25 mm/sec** 50 mm/sec	Default Auto ECG print speed, can be overridden from the front key panel.
Default Auto?	**3 x 4** 3 x 4,1R (**I**) 3 x 4,3R (**I, II, III**) 6 x 2 3 x 5 3 x 5,1R (**I**) 3 x 5, 3R(**I, II, II**I) 4 x 4 4 x 4,1R (**I**)	Default format for Auto ECGs. H Plug Shorted Special Apps. = Yes, Research Set
Default Manual?	**3** 6 12	Default format for Manual ECGs.
Leads?	**AHA** IEC	Selects between two lead naming conventions. Affects lead labels on reports.

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Parameter	Setting Choices	Comments
Custom 3 lead group?	**I aVF V2**	You can set any combination of the available leads for routine usage. See explanations following table.
Custom Manual 6?	**II aVF V1 V2 V4 V6**	You can set any combination of the available leads for routine usage. See explanations following table.
Units of Measure?	**English (lb/in)** Metric (kg/cm)	Used for height and weight entry
Print Interpretation?	**Reasons** Extend Measure None Severity only Choice Measure Interpret	See "Interpretation Parameters" section following table.
Time format?	**AM/PM** 24 Hr	
Time separator?	**HH:MM:SS** HH.MM.SS	
Date format?	**MM/DD/YYYY** DD/MM/YYYY YYYY/MM/DD	
Date separator?	**MM/DD/YYY**Y MM.DD.YYYY MM-DD-YYYY MM DD YYYY	
Decimal format?	**XXX,XXX.XX** XXX.XXX,XX	
Paper size?	A (8.5 x 11 in) A4 (210 x 297 mm)	

Parameter	Setting Choices	Comments
Auto Print?	**Yes** No	Allows or suppresses the printing of an Auto ECG. If Auto Store = No, the Auto Print Choice of No is invalid.
AutoCopy?	Yes **No**	See explanation following table.
Copies? (1-5)	Type number between **1** and 5	If AutoCopy is "Yes", selects number of automatic copies after original recording.
Location code?	Type a 5-letter alphanumeric code.	See explanations following table.
Cart ID?	Type a 4-digit code.	See explanations following table.
Institution Name?	Type name, 40 characters maximum	See explanations following table.
Confirmation?	**PRELIMINARY - MD MUST REVIEW.** Type a label, 30 characters maximum	
User A label?	Type a label, 8 characters maximum	See explanations following table.
User B label?	Type a label, 8 characters maximum	See explanations following table.
Battery timeout?	Type minutes between **3** and 999.	See explanation following table.
Set keyboard?	**lower** case UPPER CASE	
Special applications?	**No** Yes	Allows configuration of research leads, ECG storage mode, and lead system.
Research leads? *	**No (= Frank Leads)** Yes (= Research Leads)	Used for four additional leads.

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Parameter	Setting Choices	Comments
Default Adult Criteria?*	**09** P4	
Default Pediatric Criteria?*	**P4** 09	
ID criteria version entry?*	**No** Yes	
Default ID criteria version?*	Type version, 2 character maximum	09, P4, T0, H0 or custom.
ECG storage mode?*	**Standard** (250 samples/second) Special (500 samples/second)	Special allows ECGs to be re-analyzed on a PageWriter XLi.
Lead system?*	**Standard** Cabrera	If available.
VCG?	**Off**	VCG1	VCG2	VCG3 | VCG4	
HP ACI-TIPI?	**Off**	On	
Risk Mgmt Report?	**Off**	On	
Low Limit for Risk Mgmt?	0-100	**10**	
High Limit for Risk Mgmt?	0-100	**90**	
HP TPI?	On	**Off**	
Auto-TPI Candidate Screen?	On	**Off**	
Store Analysis Type?	**Std Adult/Ped**	ACI-TIPI	 HP-TPI	
Power on application?	**XLi** Preview + SAECG	Allows your cardiograph to start up in the selected application.

Parameter	Setting Choices	Comments
Password?	Type a password, 8 characters maximum; no spaces	See explanation following table.

* This parameter appears only if "Special Applications" is set to "yes."

Interpretation Parameters.

These parameters determine which analysis information is included in an ECG report.

- **Initial Interpretation** controls the information that appears on the ECG when it is first taken.

- **Copy Interpretation** controls the information that appears on ECG copies. A copy may be made automatically or when the $\boxed{\text{Copy}}$ button is pressed.

- **Print Interpretation** controls the information that appears on a printout of a stored ECG.

The settings are:

None	Prints waveform and patient ID.
Severity only	Prints waveform and ID, severity.
Measure	Prints waveform and ID, basic measurements summary.
Interpret	Prints waveform and ID, basic measurements summary, ECG computer-generated interpretation.
Reasons	Prints waveform and ID, basic measurements summary, computer-generated ECG interpretation with interpretation reason statements.
Extend Measure	Prints a tabular summary of all measurements performed on ECG data.

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Choice   Allows the user to select the level of information
included when the copy is made without having
to change the overall instrument configuration.

Line Frequency

This parameter selects the frequency of the filter enabled by the line power
filter. The user usually selects the frequency during initial installation in
response to a prompt. However, the user will not be prompted when a custom
configuration is installed. Including this parameter in Global configuration
allows the user to change the frequency selection after initial software
installation.

Selecting Custom Lead Groups

Besides the pre-defined lead groups, you can configure one group of three
leads and one group of six leads that may be selected for Auto 3 x 4,3R,
Manual 3 or Manual 6 reports. These lead groups will appear and be recorded
when you select Custom 3-lead group and Custom Manual 6-lead group
reports from the main display.

1. Configure custom lead groups from global configuration when the display
    as shown below appears.

Custom 3 lead group		I	aVF	V2	
Enter	Choose	Tab	Previous		Exit

2. Press Choose to change leads.

3. Use Tab to move to the next lead field. In this case, the next lead field is
    aVF.

4. Press Enter to save the selections.

Selecting AutoCopy

When AutoCopy is set to Yes, the cardiograph automatically prints one or
more copies (depending on the "Copies" parameter setting) of the Auto ECG

after the original is recorded. You may choose interpretation features for the copies in the "Copy Interpretation" parameter. When AutoCopy is set to No, the user must press $\boxed{\text{Copy}}$ to receive each additional printed copy.

Selecting ECG Management Parameters

These parameters either trigger processing protocols on the ECG Management system and ECG WorkStation, or provide information for ECG tracking. These parameters include:

Location code	A 5-digit code. The first three digits represent the institution and the last two digits represent the department.
Cart ID	A 4-digit code identifying which cardiograph recorded the ECG.
Institution Name	Identifies the institution, such as "City General Hospital." Limited to 40 characters.
User A label	Label such as "Smoker?" or "Temp?" that appears in ID entry process. Limited to eight characters.
User B label	Label such as "Smoker?" or "Temp?" that appears in ID entry process. Limited to eight characters.

Selecting Battery Timeout Periods

To conserve battery power, the cardiograph turns off after the period specified by this parameter. The time is measured from the completion of the last operation, the last key press, or disconnection of all patient leads. The timeout function is disabled when the cardiograph is plugged into AC power and the AC switch is on. If the cardiograph turns off, current ID information and Copy memory are lost.

Setting a Password

To protect your configuration settings from casual changes, you can require password entry to access the configuration. This password is set in global configuration.

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CAUTION

If the password is set and forgotten, you will be unable to change the cardiograph configuration without re-installing the supplied software.

Turning Off Unused 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. To turn off ID fields:

1. Press Config from the main display. The following display appears.

		Configuration		
Global	ID	Transmit	Files	Exit

2. Press the ID softkey and the following display appears.

Allow NAME entry? Yes		
Enter	Choose	Exit

The following list presents each configuration option. You 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 except the last three items.

- Allow NAME entry?
- Allow AGE entry?
- Allow SEX entry?
- Allow CHEST PAIN entry?
- Allow HX DIABETES entry?

- Allow HX HYPERTENSION entry?
- Allow AC ISCHEMIC Sx TIME entry?
- Allow BP entry?
- Allow WEIGHT entry?
- Allow HEIGHT entry?
- Allow RACE entry?
- Allow DX entry?
- Allow RX entry?
- Allow OPERATOR entry?
- Allow DEPARTMENT entry?
- Allow ROOM entry?
- Allow REQUESTED BY entry?
- Allow USER A entry? ("USER A" is replaced by the label defined in global configuration.)
- Allow USER B entry? ("USER B" is replaced by the label defined in global configuration.)
- Allow ECG Mgr Priority entry? used to tell the ECG Management system to process this ECG first.

Storing the Configuration Information

When you press Files   from the main Configuration menu, the following menu appears on the display:

Configuration File Jobs		
Store	Print	Exit

Store Stores the cardiograph configuration on flexible disk.

Print Prints a copy of the cardiograph configuration.

| Exit | Returns to the main configuration menu. |

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NOTE | Store the cardiograph configuration each time it is changed. If the cardiograph's configuration is lost due to loss of battery power, you will be able to easily restore the cardiograph to its latest configuration.

Storing the configuration on a flexible disk allows you to load known configuration settings into the cardiograph.

To store the configuration:

1.   Insert a disk with no other information on it into the disk drive.

2.   Press Store , the prompt

Enter Disk Label: appears.
This optional label, can be up to 16 characters long and is displayed while the operating system is being installed. Examples of labels are "11/90 Config." or "Dr. Jones Disk."

3.   Type the label and press ⏎ . The cardiograph displays "Storing cardiograph 'configuration" until storing is complete.

NOTE | If the flexible disk you inserted in the disk drive is new and has not yet been formatted, a question will appear asking if you want the flexible disk formatted. Press Yes if you want the disk formatted. This will take about 90 seconds. You may also insert a formatted flexible disk at this time.

Using a Stored Configuration

To use a stored configuration on another PageWriter XLi cardiograph or if the configuration must be reloaded:

1.   Turn off the cardiograph.

2.   Insert the configuration disk.

3. Turn on the cardiograph. A display with a disk label similar to the following will appear. The disk label will vary.

```
              Load configuration?  11/90 config.
Yes                    No
```

4. Press Yes if the label displayed matches the configuration you want to load.

   Press Yes and the cardiograph configuration will not be altered. Find the configuration disk that you prefer and follow the instructions from step 1 again.

5. Remove the configuration disk.

The cardiograph will now operate with the configuration parameters from the disk.

Printing the Configuration

1. Press Config from the main display. The following display appears.

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

2. Press Files . The following display appears.

```
                    Configuration file jobs
Store              Print                              Exit
```

3. Press Print . The message "Printing cardiograph Configuration" appears on the display until the two page printout is complete.

   You then return to the Configuration Files menu.

7 Setting Up Your Cardiograph for Transmitting ECGs

This chapter describes how to set up your PageWriter XLi cardiograph for transmitting and receiving ECGs.

NOTE

Transmission of 3 x 5 and 4 x 4 ECG Reports to an HP TraceMaster ECG Management System is not possible. FAX transmission and LaserJet printing of 3 x 5 and 4 x 4 formats is allowed. The LaserJet printer must have a serial port.

For instructions on how to transmit an ECG, refer to the *PageWriter XLi Operating Guide*.

PageWriter XLi cardiographs can send ECGs to the following Hewlett-Packard products:

- Another PageWriter XLi cardiograph
- HP M1730A and M3700A TraceMaster ECG Management Systems
- Class III FAX Machines
- All PCL5 printers

The PageWriter XLi cardiograph can receive text reports from the HP M1730A and M3700A TraceMaster ECG Management Systems.

NOTE

- You will only be able to select from transmittable ECGs when you press Transmit. You cannot transmit Manual ECGs, ECGs recorded with research leads, or ECGs interpreted with a different criteria program version than on the transmitting cardiograph. The criteria program is the software used to interpret the ECG.
- The receiving instrument must have the same criteria version installed as the sending PageWriter XLi cardiograph.

When you configure your cardiograph for transmitting or receiving ECGs, you can configure four possible sites. This accommodates the various ways that ECGs can be managed. Three typical transmitting situations are:

- An ECG can be transmitted from the bedside to an HP ECG Management System for printing, analyzing, and storing.

- ECGs can be recorded on rounds and then transmitted to another area of the institution to a PageWriter XLi cardiograph or an HP TraceMaster ECG Management System.

- ECGs can be sent by modem to another institution for overreading or further analysis.

- ECGs can be sent by FAX/modem to a FAX machine for overreading or further analysis.

Transmitting ECGs Directly

You may transmit ECGs directly by cable to a Hewlett-Packard TraceMaster ECG Management System. Figure 7-1 shows how to connect the cables you need to connect the cardiograph directly.
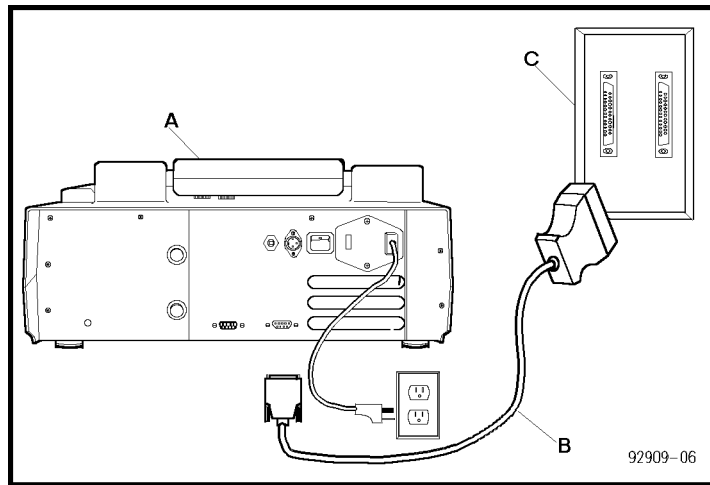
Figure 7-1 Connecting the Cables for Direct Transmission.

    A. PageWriter XLi Cardiograph

    B. Transmission Cable

    C. HP ECG Management System Connection

Configuring the Cardiograph to Transmit ECGs Directly

After connecting the cables, you must configure the cardiograph for direct transmission.

1. Press Menu until the following display appears:

Transmit Store	Config	CheckDisk	Files

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

		Configuration		
Global	ID	Transmit	Files	Exit

3. Press Transmit and the Transmit Configuration menu appears in the display.

	Configuration		
Transmit	Receive	AutoDial	Exit

4. Press Transmit to configure any of four transmission sites.The Configure Site menu will appear:

		Configuration Site		
#1	#2	#3	#4	Exit

5. Select a site number and the following display appears.

Connection? None		
Global	Choose	Exit

6. Press Choose until you see the choice Direct Connection, then press Enter. The next display will allow you to select the baud rate. When you choose direct connection, the default baud rate will be 9600.

Transmitting ECGs by Telephone to Another Site

You can also use a modem to transmit ECGs by telephone to another PageWriter XLi cardiograph or to a Hewlett-Packard Tracemaster ECG Management System.

Installing the Modem (For United States use only)

Before using the M1706B modem you must connect the cables. Figure 7-2 shows how to connect the cables for transmitting ECGs using a modem.
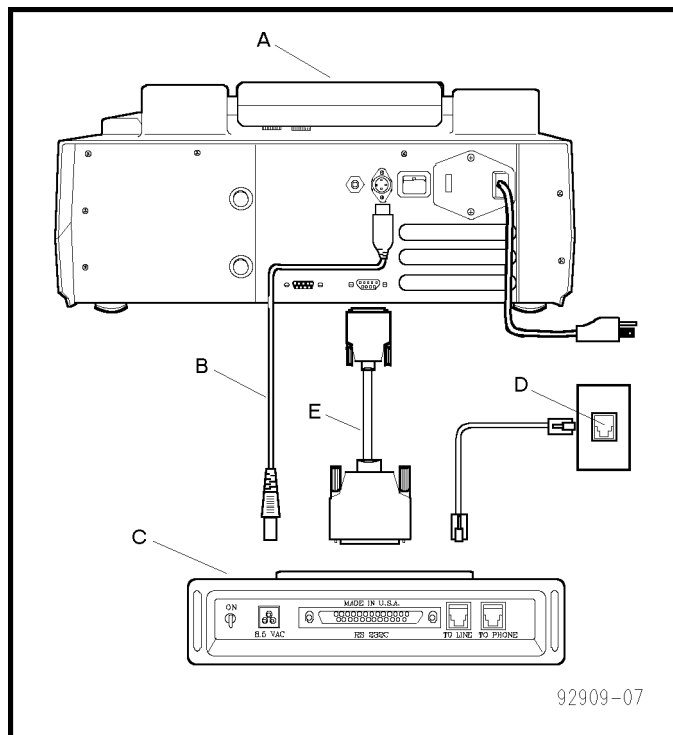
7
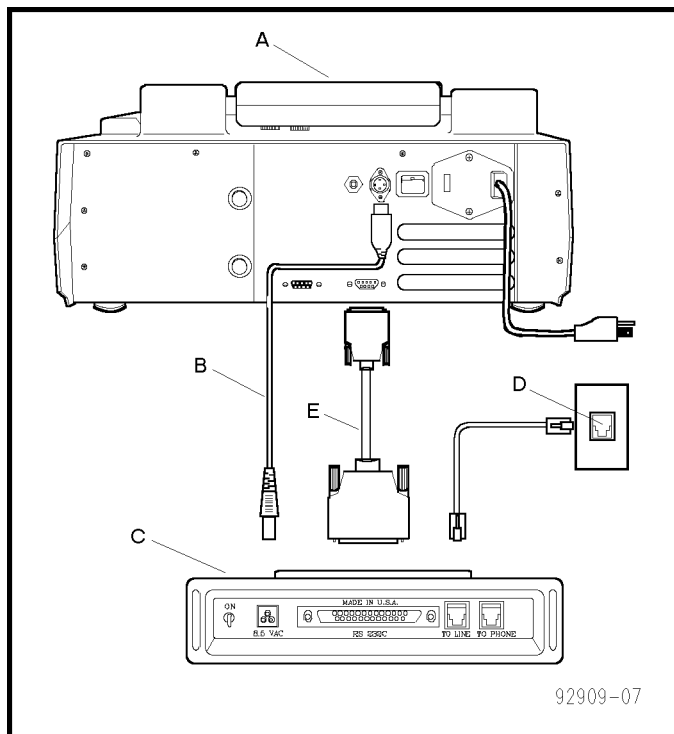
Figure 7-2 Connecting the Modem Cables.

A. PageWriter XLi Cardiograph

B. Modem Power Cord

C. Modem

D. Phone Line Connector

E. Modem Data Cable

Refer to Figure 7-2 and perform the following steps to install the modem.

1. Turn the cardiograph to **Standby**.

2. Turn the modem power switch off.

WARNING	**Equipment connected to the cardiograph's RS-232 connector can cause ground leakage current exceeding the maximum specified in UL544/IEC601-1 safety standards. Do not connect any equipment to the RS-232 connector during cardiograph operation when the patient cable is connected to a patient.**
NOTE	Make sure that the battery level is sufficient to prevent any loss of configuration settings and software in the cardiograph when AC power is removed. Check the "Battery Level" indicator lights on the cardiograph's key panel to ensure that they are all on.

3. Turn the cardiograph AC switch off.

4. Insert the larger connector end of the modem cable (24252M) into the RS-232C plug on the back of the modem. Tighten the retaining screws.

5. Insert the smaller end of the modem cable into the plug on the back of the cardiograph marked "Data Comm". Tighten the retaining screws.

NOTE	Connect the modem to the cardiograph and to the telephone line in the following order. This will avoid the possible electrical hazards from the outlet and telephone line.

6. Plug the modem power cable into the plug on the modem marked "9.0V ~AC".

7. Plug the other end of the modem power cable into the cardiograph.

8. Insert either end of the telephone cable into the connector on the back panel of the modem marked "To Line".

9. Insert the free end of the telephone cable into the telephone wall jack.

10. Plug the cardiograph power cable into the cardiograph and an AC outlet if they are not already plugged in.

11. Turn the cardiograph's AC power switch on.

12. Turn the modem on.

13. Turn the cardiograph on.

7

Connecting a Telephone to the Same Line as the Modem

To connect a telephone to the same line as the modem:

1. Connect one end of the telephone cable to the telephone.

2. Plug the free end of the cable into the modem connector marked "To Phone".

The modem is now installed and ready for use. You must configure the cardiograph for modem usage before transmitting ECGs.

Configuring the Cardiograph for Modem Usage

To transmit ECGs by telephone from the cardiograph, you must configure the cardiograph in the following way:

1. Press $\boxed{\text{Menu}}$ until the following display appears:

Transmit Score	Config	CheckDisk	Files

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

		Configuration		
Global	ID	Transmit	Files	Exit

3. Press Transmit and the Transmit Configuration menu appears on the display.

	Configuration Site		
Transmit	Receive	AutoDial	Exit

4. Press Transmit to configure any of four transmission sites. The Configure Site menu will appear:

		Configuration Site		
#1	#2	#3	#4	Exit

5. When you select a site number, the following display appears.

Connection? None		
Enter	Choose	Exit

The following table lists which settings to choose when using a modem. Each site may have different requirements.

Parameter	Choice
Baud Rate?	9600
Connection?	Programmable Modem
Phone #?	Type phone number, 36 characters max.
Dial Type?	**Tone**
	Pulse
Pause Length?	**2**, 4, 6, 8, 10 (secs)

Entering the Phone Number

When you enter the phone number for a site, there are three characters, Pause
",", Tone "w", and "X" you might need to use with the numbers. These
characters are inserted in the phone number by pressing Pause for "," and
Tone for "w".

Pause "," inserts a pause in the number dialing sequence to avoid dialing
errors if the number is sent too rapidly. An example would be
"1,234,567,8900." Select the length of the pause with the pause length
parameter.

Tone "w" instructs the modem to wait for a dial tone before completing the
dialing sequence. You will typically use this when you must dial for an
outside line before dialing the called number. For example, "9w567,8900"
instructs the modem to dial the "9," then wait for a dial tone before it dials the
rest of the number.

Entering an "X" from the keypanel instructs the modem not to wait for a dial
tone. This might be required when you dial through a PBX system or with
some non-U.S. modems. For example, "X567,8900" instructs the modem not
to wait for a dial tone before it dials the rest of the number.

Configuring the Cardiograph for AutoDial

AutoDial is for users who always transmit to the same site. To configure the
cardiograph for AutoDial:

1. Select AutoDial from the Transmit Configuration menu. The cardiograph
   displays the following menu:

	AutoDial Site? None	
Enter	Choose	Exit

2. Press Choose to select the site (#1, #2, #3, or #4) to which the
   cardiograph will automatically transmit when the operator presses
   Transmit .

3. Press Enter and the selected site will be set. The display will return to the transmission configuration menu. If you have not already configured the transmission site, you can configure it from this menu.

Installing the Modem on the Cart

After the M1706B modem is configured, you can install it on the cardiograph cart as shown in Figure 7-3.
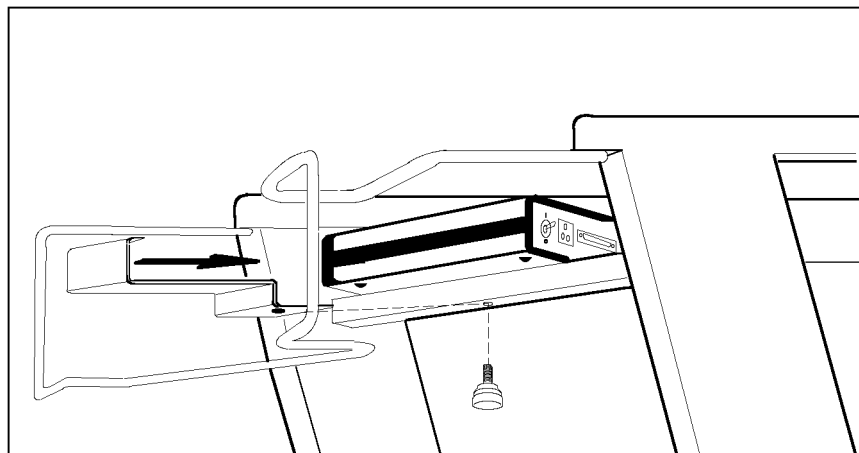
Figure 7-3 Attaching the Modem to the Cart.

To attach the modem to the cart:

1. Thread the knobscrew into the threaded hole on the underside of the crossbar on the cart but do not tighten it.

2. From the back of the cart, set the modem on top of the crossbar with the front of the modem (the display end) to your left. Make sure that it fits between the two guides molded into the paper tray on the cart.

3. Install the modem bracket and tighten the knobscrew.

Transmitting ECGs by FAX to Another Site

You can use the M1706B FAX/modem to transmit ECGs by telephone to another PageWriter XLi cardiograph or to any Class III FAX machine. The FAX/modem can be used for transmitting as a normal modem as well.

WARNING	Some Group III fax machines distort the received fax transmission by compressing the image to fit the viewing or printing device. This distortion can affect the amplitude and time scale of an ECG transmitted by fax.

For example, PC based fax/modems and fax cards will normally compress the received image when displaying the fax transmitted ECG on the PC monitor and can compress the image when the fax is printed.

To determine whether a fax machine distorts the received ECG fax, you will need to measure the ECG report's grid spacing or the calibration pulse and check these measurements against the printed scale factors shown at the bottom of a printed ECG report. The grid is nominally printed at 1 mm intervals in both the time and amplitude directions. The width of the calibration pulse is 200 msec and its height represents 1 mV. Therefore an ECG report with a 10 mm/mV amplitude scale and 25 mm/sec time scale should have a calibration pulse that is 10 mm tall and 5 mm wide. |

7

Installing the FAX/Modem

Before using the FAX/modem you must connect the cables as shown in Figure 7-4.

Figure 7-4 Connecting the Modem Cables.

A. PageWriter XLi Cardiograph

B. Modem Power Cord

C. Modem

D. Phone Line Connector

E. Modem Data Cable

Refer to Figure 7-4 and perform the following steps to install the modem.

1. Turn the cardiograph to **Standby**.

2. Turn the modem power switch off.

NOTE   Make sure that the battery level is sufficient to prevent any loss of
configuration settings and software in the cardiograph when AC power is
removed. Check the "Battery Level" indicator lights on the cardiograph's key
panel to ensure that they are all on.

---

3. Turn the cardiograph AC switch off.

4. Insert the larger connector end of the modem cable (24252M) into the RS-
    232C plug on the back of the modem. Tighten the retaining screws.

5. Insert the smaller end of the modem cable into the plug on the back of the
    cardiograph marked "Data Comm". Tighten the retaining screws.

CAUTION   Connect the modem to the cardiograph and to the telephone line in the
following order. This will avoid the possible electrical hazards from the outlet
and telephone line.

---

6. Plug the modem power cable into the plug on the modem marked "9.0 V
    ~ AC".

7. Plug the other end of the modem power cable into the cardiograph.

8. Insert either end of the telephone cable into the connector on the back
    panel of the modem marked "To Line".

9. Insert the free end of the telephone cable into the telephone wall jack.

10. Plug the cardiograph power cable into the cardiograph and an AC outlet if
    they are not already plugged in.

11. Turn the cardiograph's AC power switch on.

12. Turn the modem on.

13. Turn the cardiograph on.

Connecting a Telephone to the Same Line as the FAX/Modem

To connect a telephone to the same line as the FAX/modem:

1. Connect one end of the telephone cable to the telephone.

2. Plug the free end of the cable into the unused modem connector.

The FAX/modem is now installed and ready for use. You must configure the cardiograph for FAX/modem usage before FAXing ECGs.

Configuring the Cardiograph for FAX Usage

To FAX ECGs by telephone from the cardiograph, you must configure the cardiograph in the following way:

1. Press ⌐Menu⌐ until the following display appears:

Transmit Store	Config	CheckDisk	Files

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

		Configuration		
Global	ID	Transmit	Files	Exit

3. Press Transmit and the Transmit Configuration menu appears on the display.

	Configuration		
Transmit	Receive	AutoDial	Exit

4. Press Transmit to configure any of four transmission sites. The Configure Site menu will appear:

		Configuration Site		
#1	#2	#3	#4	Exit

5. When you select a site number, the following display appears.

```
Connection? None
Enter          Choose                          Exit
```

*   If you wish to step through setting choices, press Choose .
*   If you wish to select the displayed choice and move to the next field,
    press Enter .
*   If you wish to finish configuring and select the displayed choice,
    press Exit .

The following table lists which settings to choose when transmitting a FAX
using a FAX/modem. Each site may have different requirements.

Parameter	Choice
Connection?	FAX Programmable Modem
Baud Rate	9600
Phone #?	Type phone number, 36 characters max.
Dial Type?	**Tone** Pulse
Pause Length?	**2**, 4, 6, 8, 10 (secs)
Destination?	Type name, 22 characters max.
Print Grid on Report?	**Yes** No

Entering the Phone Number

When you enter the phone number for a site, there are three characters, Pause
",", Tone "w", and "X" you might need to use with the numbers. These

characters are inserted in the phone number by pressing `Pause` for "," and `Tone` for "w".

`Pause` "," inserts a pause in the number dialing sequence to avoid dialing errors if the number is sent too rapidly. An example would be "1,234,567,8900." Select the length of the pause with the pause length parameter.

`Tone` "w" instructs the modem to wait for a dial tone before completing the dialing sequence. You will typically use this when you must dial for an outside line before dialing the called number. For example, "9w567,8900" instructs the modem to dial the "9," then wait for a dial tone before it dials the rest of the number.

Entering an "X" from the keypanel instructs the modem not to wait for a dial tone. This might be required when you dial through a PBX system or with some non-U.S. modems. For example, "X567,8900" instructs the modem not to wait for a dial tone before it dials the rest of the number.

Transmitting an ECG via FAX

After a site has been configured on the cardiograph for FAX transmission, you can FAX an ECG to the site. The FAX/modem must also be installed to FAX to a FAX site. See Chapter 5 in the *PageWriter XLi Operating Guide* for the steps to FAX an ECG to the configured FAX site.

Printing an ECG on an HP LaserJet Printer

You can print stored ECGs on an HP PCL5 LaserJet printer. Figure 7-5 shows how to connect the cables between the cardiograph and the printer.
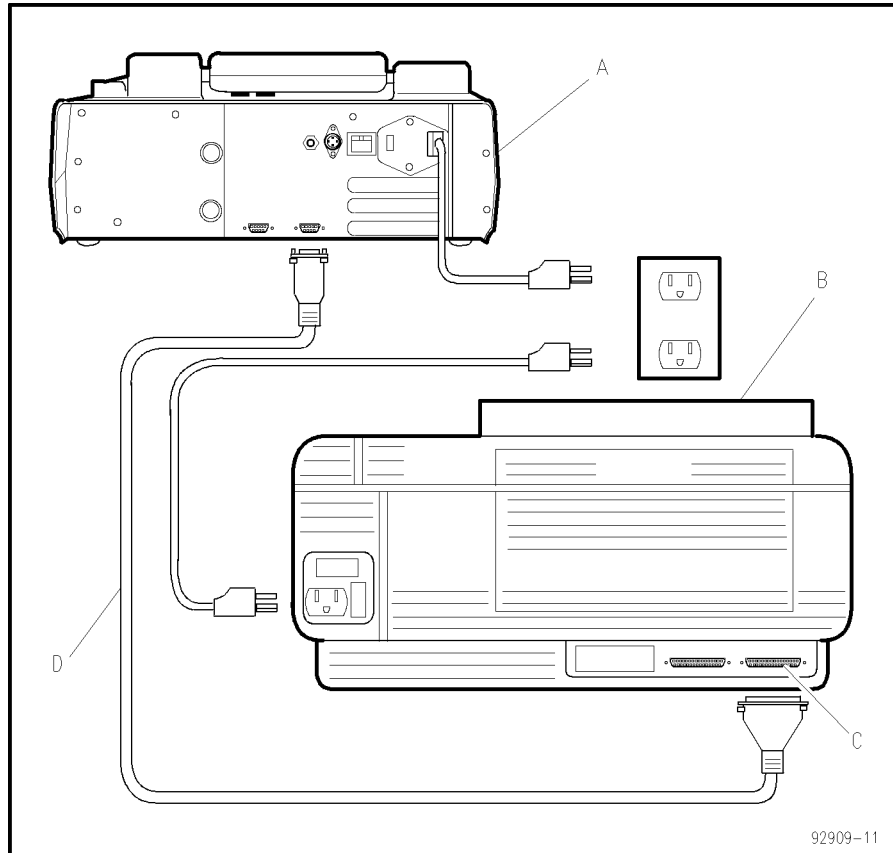
Figure 7-5 Connecting the Printer Cable.

    A. PageWriter XLi Cardiograph

    B. HP LaserJet Printer

    C. HP LaserJet Printer Serial Interface Port

    D. LaserJet Cable (HP 24542G)

WARNING	**The PageWriter XLi A.05.00 software allows you to print ECGs on a LaserJet. The LaserJet printer is NOT isolated to UL544/IEC-601-1 leakage current specifications. Be sure to disconnect the LaserJet from the cardiograph when you want to record ECGs.**

Setting up the LaserJet Printer

You must set up the LaserJet printer for serial printing before using it to print stored ECGs from the cardiograph. To configure the printer for serial printing, perform the following steps.

1. With the printer on, press the ON LINE key until the light is off.

2. Press the MENU key on the printer to step through the settings until I/O=PARALLEL* appears.

    If I/O=SERIAL* appears, the printer is already set for serial printing.

3. Press the + key until I/O=SERIAL appears.

4. Press the ENTER key on the printer. An asterisk will apear on the display: I/O=SERIAL*.

5. Press the MENU key and the BAUDRATE setting will appear.

6. Press the + key until BAUDRATE=19200 appears.

7. Press the ENTER key on the printer. An asterisk will appear on the display: BAUDRATE=19200*.

8. Press the ON LINE key.

    The printer is ready to use with your cardiograph.

Configuring the Cardiograph to Print ECGs on the HP LaserJet

After connecting the cables, you must configure the cardiograph for printing on the HP LaserJet.

1. Press ⎡Menu⎤ until the following display appears:

Transmit Store	Config	CheckDisk	Files

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

		Configuration		
Global	ID	Transmit	Files	Exit

3. Press Transmit and the Transmit Configuration menu appears in the display.

	Configuration		
Transmit	Receive	AutoDial	Exit

4. Press Transmit to configure any of four transmission sites.

		Configuration Site		
#1	#2	#3	#4	Exit

5. Select a site number and the following display appears.

Connection? None		
Enter	Choose	Exit

6. Press Choose until you see the choice "LaserJet", then press Enter . The baud rate display will appear.

7. Press Choose until you see the baud rate 19200, then press Enter .

8. Select whether to print a grid.

   If you have unlined paper in the printer, this selection will print the grid with the ECG.

7

Your cardiograph is now set up to print to an HP LaserJet when you select the configured site from the Transmit menu. See the *PageWriter XLi Operating Guide* for information about transmitting ECGs.

Receiving ECGs

When configured and connected for receiving, the cardiograph can receive ECGs whenever it is turned on. ECG reports are printed immediately when they are received. These reports cannot be copied or stored on the flexible disk.

Configuring the Cardiograph to Receive ECGs Directly

After connecting the cables, you must configure the receiving cardiograph for direct reception.

1. Press ⬚Menu until the following display appears:

Transmit Store	Config	CheckDisk	Files

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

		Configuration		
Global	ID	Transmit	Files	Exit

3. Press Transmit and the Transmit Configuration menu appears in the display.

	Configuration		
Transmit	Receive	AutoDial	Exit

4. When you press Receive the following display will appear.

Connection? None			
Enter	Choose		Exit

5. Choose Direct Connection, then press ⬚Transmit⬚ to proceed to baud rate selection. When you choose direct connection, the default baud rate will be 9600.

Configuring the Cardiograph to Receive ECGs via Modem

To configure the cardiograph for receiving ECGs by telephone:

1. Press ⬚Menu⬚ until the following display appears:

Transmit Store	Config		CheckDisk	Files

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

Configuration				
Global	ID	Transmit	Files	Exit

3. Press ⬚Transmit⬚ and the Transmit Configuration menu appears in the display..

Configuration			
Transmit	Receive	AutoDial	Exit

4. Press ⬚Receive⬚ . The following display will appear.

Connection? None		
Enter	Choose	Exit

Choose the programmable modem selection for connection type. The default baud rate for the programmable modem is 2400.

Receiving an ECG via FAX

The cardiograph is able to receive ECGs via the FAX/modem any time the cardiograph is configured for FAX/modem usage and idle.

Configuring the Cardiograph to Receive via FAX

To configure the cardiograph for receiving via FAX, perform the following steps.

1. Press Menu until the following display appears:

Transmit Store	Config	CheckDisk	Files

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

		Configuration		
Global	ID	Transmit	Files	Exit

3. Press Transmit and the Transmit Configuration menu appears in the display.

		Configuration	
Transmit	Receive	AutoDial	Exit

4. Press Receive . The following display will appear.

Connection? None		
Enter	Choose	Exit

Choose the FAX programmable modem selection for connection type. The default baud rate for the FAX programmable modem is 2400.

Receiving ECG Reports from an HP 5600C ECG Management System

After you have configured a site number for the HP 5600C ECG Management System with the appropriate connection parameters, you can receive reports from that system.

To receive reports from that system:

1. Press Menu until the following display appears.

Transmit Store	Config	CheckDisk	Files

2. Press Transmit . The following display appears.
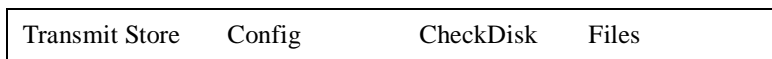
Selected	All	NewGroup Query	Files
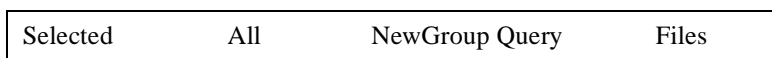
3. Press Query . You may then select the site number which is assigned to the 5600C ECG Management System.

4. After you press the site number, the cardiograph will call the system, ECGs will be transmitted from the ECG Management System to the cardiograph, and the cardiograph will print the reports as they are received.

Receiving ECGs from an HP M1730A or M3700A TraceMaster ECG Management System

PageWriter cardiograph users can receive ECGs from the M1730A and M3700A on request by using the Query function. The M1730A and M3700A will send the ECGs in batch or individually depending on how the cardiograph user responds to system questions on the cardiograph as shown in the instructions below.

There are two types of Query, standard query and interactive query.

In standard query, reports must be queued at the system for output to the cardiograph. Only diagnostic and extended measurements reports can be sent in standard query.

In interactive query, the cardiograph user selects the ECG to receive. A full ECG (report and waveform) can be received this way.

NOTE   Query will timeout after an idle period. The length of this period is determined by how the ECG Management system is configured.

From the cardiograph:

1. Press Menu until the following display appears.

Transmit Store	Config	CheckDisk	Files

2. Press Transmit . The following display appears.

		Transmit		
Selected	All	NewGroup	Query	Files

3. Press Query . If interactive query is configured on the system, the
    following display appears on the cardiograph. If interactive query is not
    configured on the system, consult the system administrator for the ECG
    Management system for assistance.

Select an online report?	
Yes	No

    a. Pressing No will start a batch query. All reports queued for your
        location will now be printed.

4. Press Yes to select interactive query. You will be asked for your ID
    number. Your ID number is the same as your password. See your system
    administrator if you do not know your ID number.

5. After you type a valid ID number and press Enter , you will be asked for
    an institution number.

    a. Type a three digit number for the desired institution or type "All".
        Typing "All" can result in an extended search if you do not specify a
        patient ID.

    b. Press ⏎ .

6. After you enter a valid institution number, you will be asked for patient
    ID. Type either a patient ID or a patient name no more than 16 characters
    long.

7. Press ⏎ . The message ''Searching database, please wait ...'' appears during a pause. The duration of the search depends on how many ECGs are stored on the database and how specific your search criteria are.

- If the search is unsuccessful, the following display appears and you can start a new search.

```
            No ECGs for this patient
New Inst                                   New ID
```

  ❑   Transmit returns you to step 5.

  ❑   New ID retains the institution you entered earlier, and returns you to step 6.

- If the search is successful, a display similar to the following appears.

```
  2 ECGs found for:  PATIENT IDNUMBER
Newest          Oldest          New Inst        New ID
```

  ❑   Newest shows the most recent stored ECG in the list.

  ❑   Oldest shows the oldest stored ECG in the list.

8. Press Newest or Oldest and a display similar to the following appears.

```
    III PATIENTID 01/26/91 06:21:52
Next          Previous          Select          More
```

From this display you can scroll through a list of selected ECGs. The top line contains:

- Institution number (III)
- Patient ID number or the first 16 characters of the patient name
- Date and time that this ECG was recorded

9. Press Select to receive and print the displayed ECG.

    Press Next or Previous to view other ECGs.

10. Press More and the softkey selections will change as shown below.

    +--+
    | III PATIENTID 01/26/91 06:21:52 |
    | Name   New Inst   New ID   More |
    +--+

    - If you wish to change the displayed ECGs from patient ID numbers to names, press Name. The display returns to the set of keys shown in step 8.

    - If names are already displayed, you will see ID instead of Name. If you wish to change the displayed ECGs from patient names to ID numbers, press ID.

    - If you wish to start a new search through another institution, press New Inst.

    - If you wish to start a new search for other patient ID numbers, press New ID.

    - If you wish to return to the set of keys shown in step 8, press More.

You may end the interactive query session any time by pressing the Stop key on the cardiograph. The transmission link will end immediately.

Consult your system administrator for more information about interactive query and how your system operates.

8 Troubleshooting

This chapter describes ways to improve ECG quality by correcting electrode contact problems as well as equipment problems. The tables in this chapter list possible actions to take for difficulties encountered when recording ECGs.

Troubleshooting Leads Off

You can identify which electrode is off by using the patient module as well as the preview screen. Poor electrode contact or a disconnected wire is shown on the patient module display by an X, on the preview screen by a flat dotted line, and on the printed report by a flat line.

Table 8-1 Leads Off Indications

Lead	Preview Screen	Patient Module	Printed Report
RL	Dotted line on all leads	X on all leads	Flat line on all leads
RA, LA, and/or LL	Dotted line on all leads	X on lead which is off and X on chest leads	Flat line on all leads
Chest lead(s)	Dotted line on lead(s) which is off	X on lead(s) which is off	Flat line on lead(s) which is off

Troubleshooting ECG Noise

Use the electrode status indicators (noise bars) on the patient module to check the quality of the ECG signal. The preview screen is another way to check the ECG signal quality before recording the ECG. Noise on the ECG recording is

often due to poor electrode contact or to environmental interference. Try improving the conditions surrounding the recording before using filters. As a last resort when you cannot eliminate or reduce noise at its source, use one or more of the configurable filters on your cardiograph.

There is some tradeoff between fidelity and clarity on the ECG trace when using any of the filters besides the line power (AC) filter.The more filters applied to the signal, the greater the possibility of removing details of the ECG signal besides removing noise. This is why filters should only be used as a last resort after attempting to improve the ECG technique.

Table 8-2 PageWriter XLi Cardiograph Filters

Filter Type	Configurable Settings	Interference Sources	In the Filter Box
Auto low frequency response	**0.15 Hz** 0.05 Hz 0.5 Hz W	Electrode movement, patient movement or respiration	.15 , .5 or .05
Auto high frequency response	**150 Hz** 100 Hz 40 Hz	Movement of skeletal muscles	150, 100, or 40
Manual low frequency response	**0.5 Hz** W 0.05 Hz	Electrode movement, patient movement or respiration	.5 or .05
Manual high frequency response	**40 Hz** 100 Hz 150 Hz	Movement of skeletal muscles	40, 100, or 150
Line Power (AC)	50 Hz 60 Hz	AC power lines, equipment operating near the patient	$\sim$
Baseline Wander	BaselineWander setting & press Filter	Electrode movement or poor contact and skin preparation.	W
Artifact	Artifact setting & press Filter	Muscle tremor.	F

Understanding Error Messages

The error messages that appear on the display will instruct you as to what action to take. If it is something that you can correct, the message will instruct you what to do.

If an error number appears, note the number and then perform the following steps.

1. Cycle the power — set the On-Standby button to **Standby** and back to **On**.

2. If the error reappears, re-install the System disk — see **Setting Up Your Cardiograph for the First Time** in the *PageWriter XLi Cardiograph Operating Guide*.

3. If the error continues, try another System disk.

4. If the error recurs, call your Hewlett-Packard service representative.

Calling for Assistance

Refer to **Calling for Service** in the *PageWriter XLi Cardiograph Operating Guide*.

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Solving Equipment Problems

The following tables list symptoms of equipment problems grouped by functions with suggested solutions. Many of the suggestions recommend that you try a sequence of actions until the problem is resolved. If the first action solves the problem, you do not need to try further actions.

Table 8-3 Battery Problems

Symptom	What to Do
Message: No battery. Load battery. Cardiograph won't turn on.	Install the battery, then try turning on the cardiograph.
AC indicator not lit	1. Plug in power cord. 2. Turn on AC switch. 3. Call your Hewlett-Packard service representative.
Cardiograph doesn't run on AC, but runs on battery	Call your Hewlett-Packard service representative.
Cardiograph doesn't run on battery, but runs on AC.	1. Charge battery for 24 hours. 2. Replace battery. 3. Call your Hewlett-Packard service representative.
Cardiograph won't power up on AC or battery	Call your Hewlett-Packard service representative.
Battery charge level indicator never indicates full capacity. Battery charge level indicator always indicates full capacity on AC power with battery.	1. With the cardiograph connected to AC power, turn on the cardiograph. If only a single battery level indicator is lit (other than the Battery Low Warning), reload the operating system, insuring the paper compartment door is closed. If the operating system is loaded with this door open, only a single indicator will light. 2. If after completing the step above, all battery level indicators are not lit, the battery requires further charging. When checking the battery level, always turn the cardiograph on while connected to AC power. 3. Replace battery. 4. Call your Hewlett-Packard service representative.

| NOTE | When dealing with noise problems, remember that most noise is the result of technique or poor electrode contact. If noise persists after checking the electrode placement and other elements of technique, the noise may be the result of faulty electrode wires. Only when you eliminate technique and electrode wires as the causes of the noise should you consider calling your Hewlett-Packard service representative. |

Table 8-4 Patient Module and Connecting Cable Problems

Symptom	What to Do
No display on patient module display.	1. Adjust contrast. 2. Call your Hewlett-Packard service representative.
"Leads off" displayed on preview screen, but patient module appears blank or shows stars, blanks, and boxes.||	Call your Hewlett-Packard service representative.
"Leads off" not indicated when wire is off.	1. Remove electrode wire from patient module. 2. Ensure the contacts on the patient module are clean and dry. 3. If "Leads off" is not indicated, call your Hewlett-Packard service representative.
"Leads off" indicated when wire is not off.	1. Remove electrode wire and install shorting plug. If "Leads off" is indicated, call your Hewlett-Packard service representative. 2. If "Leads off" is not indicated, replace electrode wire.
No response to start button.	1. Verify cardiograph not in configuration mode or busy. 2. Try pushing the button harder. 3. Suspect patient module if cardiograph starts from front panel but not from patient module button. 4. Call your Hewlett-Packard service representative.

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Table 8-4 Patient Module and Connecting Cable Problems (continued)

Symptom	What to Do
Bad ECG: Good calibration pulse in lead(s) where trace(s) is (are) not good. A lead is missing — On Auto reports: Electrode off on bottom of report. On Manual reports: "lead off" on trace.	1. See Table 6-1 in the *PageWriter XLi Cardiograph Operating Guide*. 2. Isolate defective wires and replace. 3. Call your Hewlett-Packard service representative.
Electrode off on ECG when no electrode is off.	1. Be sure STAT ECG is not taken within 15 seconds of cardiograph power-up.
Noisy lead(s): "AC" (regular pattern) — for 60 Hz, 12 peaks/5 mm at 25 mm/ sec; for 50 Hz, 10 peaks/5 mm	1. See Table 6-1 in the *PageWriter XLi Cardiograph Operating Guide*. 2. Reposition patient module cable away from AC power. 3. Try plugging cardiograph into AC outlet.
Noisy lead(s): Muscle artifact.	1. See Table 6-1 in the *PageWriter XLi Cardiograph Operating Guide*. 2. Replace disposable electrodes or lead adapters. 3. Call your Hewlett-Packard service representative.
Noisy lead(s): I, III, aVL	Replace LA leadwire.
Noisy lead(s): II, III, aVF	Replace LL leadwire.
Noisy lead(s): I, II, aVR	Replace RA leadwire.
Noise in only one V lead. Noise in general.	1. See Table 6-1 in the *PageWriter XLi Cardiograph Operating Guide*. 2. Isolate defective wires and replace.

Table 8-5 Printer Errors

Symptom	What to Do
Paper doesn't move; printer error message displayed Check paper supply.	1. Replace paper or clear paper jam. 2. Call your Hewlett-Packard service representative.
Paper moves then stops and displays an error message. Check paper supply.	1. Make sure cardiograph is loaded properly with approved thermal paper. 2. Clean paper sensor lens. See *PageWriter Cardiograph XLi Operating Guide* for instructions. 3. Call your Hewlett-Packard service representative.
Printer error message displayed; transient low battery status indication during printing (battery too low for good printing)	1. Charge battery. 2. Replace battery. 3. Call your Hewlett-Packard service representative.
Message: Printer door open.	1. Close door. 2. Call your Hewlett-Packard service representative.
Paper moves but nothing prints. Paper moves but printing is faint.	1. Make sure cardiograph is loaded with approved thermal paper. 2. Call your Hewlett-Packard service representative.
Paper stops in the wrong place after pressing ⌐Page Advance⌐ or ⌐Auto⌐. No error message.	1. Make sure cardiograph is loaded with approved thermal paper. 2. Clean sensor lens. 3. Call your Hewlett-Packard service representative.

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Table 8-5 Printer Errors (continued)

Symptom	What to Do
Printed data is garbled.	Call your Hewlett-Packard service representative.
Poor print quality or some dots not printing.	1. Clean printhead. See the *PageWriter XLi Cardiograph Operating Guide* for instructions. 2. Call your Hewlett-Packard service representative.
Some dots always on.	Call your Hewlett-Packard service representative.
Printing is dark on one side of page but faint on the other side.	Call your Hewlett-Packard service representative.

Table 8-6 Disk Drive Errors

Symptom	What to Do
Disk drive inoperative.	Call your Hewlett-Packard service representative.
Error message Try new disk appears.	1. Try known good disk. 2. Call your Hewlett-Packard service representative.
Error message Unrecognized file type appears.	1. Corrupt file, try known good file.

Table 8-7 Preview Screen Problems

Symptom	What to Do
Washed out display.	Adjust brightness and contrast controls for best display appearance.
All white screen. All black screen.	1. Adjust contrast or brightness or both. 2. Call your Hewlett-Packard service representative.
No brightness adjust. No contrast adjust. All blue screen. Garbled data on display.	Call your Hewlett-Packard service representative.
Backlight flickers. Half screen lit. No backlight but characters present.	1. Adjust brightness. 2. Call your Hewlett-Packard service representative.

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Table 8-8 Keyboard and Keyboard Display Problems

Symptom	What to Do
Display stays blank.	1. Adjust contrast or brightness. 2. Call your Hewlett-Packard service representative.
Keys won't work. Unable to enter data or operate controls.	Call your Hewlett-Packard service representative.

Table 8-9 Transmission Errors

Symptom	What to Do
1540, 1541	Call your Hewlett-Packard service representative.
Message ERROR 153X: Remote site failure.	This is a message from the remote site informing the user that the communication link has been terminated.
Unable to transmit or receive.	1. Check to see that modem is turned on and plugged in, if using a modem. 2. Call your Hewlett-Packard service representative.
Message No answer at site. Retry? when there is a dial tone. The cardiograph will not be able to start the transmission because the modem doesn't recognize the dial tone.	Type an "X" before typing the phone number. The modem will not wait for a dial tone.
3 x 5, 4 x 4 untransmittable, FAX only	This is a message to indicate that the user has attempted to transmit reports that are unrecognized by the remote site.

9 Supplies

Availability

Pricing and availability of the following and other supplies are available from Hewlett-Packard's Medical Supplies Centers.

- U.S.: 1-800-225-0230

- Outside the USA, contact your local Hewlett-Packard Sales Office, your authorized Hewlett-Packard Dealer or Distributor, or visit our Medical Supplies website at: www.healthcare.agilent.com/mpgsupplies/.

Paper

M1707A	Paper, 8.5" x 11", 1600 sheets, Header
M1708A	Paper, 8.5" x 11", 1600 sheets, No Header
M1709A	Paper, Metric, 1600 sheets, Header
M1710A	Paper, Metric, 1600 sheets, No Header
M2206A	Paper, 8.5" x 11", anti-fade, 1600 sheets, Header
M2207A	Paper, Metric, anti-fade, 1600 sheets, Header

Battery

M1721A	Battery assembly - lead acid type

Electrodes

40418A	Welsh electrode; 15mm base 5cc bulb; screw connect; 6/box
40421A	Welsh electrode; 15mm base 5cc bulb; push-in connect; 6/box (AHA Leads)
40490E	Welsh electrode; 4mm conn.(banana); 15mm cup; 2cc bulb (IEC Leads)
9301-0119	Large welsh electrode; 30mm dia cup; screw connect; 1/box
40420A	Disposable diagnostic pre-gelled electrode; 1000/case
13943B	Disposable diagnostic solid gel electrode; 1000/case, Tab Style
13944B	Disposable diagnostic wet gel electrode; 300/case, Snap Style
40423A	Reusable infant limb plate electrode; pk/4 (AHA Leads)
40424A	Reusable limb plate electrode; push-in connect; pk/4
40425A	Reusable limb plate electrode; screw connect; pk/4
40491E	Limb plate electrode; 4mm conn.(banana); 4 ea. (IEC Leads)
40494E	Limb clamp electrode; screw connect; 4/box
40493E	ECG adult foam electrode (Europe only); 300/case
40419A	Replacement bulb; 5cc for all 15mm dia. cups; 12/pk
40422A	Small replacement bulb; 2cc for all 15mm dia. cups; 12/pk

Lead Adapters

14282A	Lead adapter; converts post to spring clip
40475A	Lead adapter; from post to snap-on;10/pk. (AHA Leads)
40498E	Adapter; from banana plug to pincher;10/pk. (IEC Leads)
13946B	Tab electrode adapter; 10/pk.

Lead Adapters

40431B   Lead adapter from 1/8" post to alligator clip; 10/pk. (AHA Leads)

40432B   Lead adapter from 4mm post to alligator clip; 10/pk. (IEC Leads)

Patient Cables

M1719A   Data cable, 2.5M

M1720A   Data cable, 9M

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Replacement Leads

M1711A   AHA Limb Lead Replacement Kit; qty 2

M1712B   AHA Chest Lead Replacement Kit; 24", qty 3

M1712C   AHA Chest Lead Replacement Kit; 15", qty 3

M1713B   AHA Complete Lead Set; Chest leads, 24", limb leads 39"

M1714A   IEC Limb Lead Replacement Kit; qty 2

M1715B   IEC Chest Lead Replacement Kit; 60cm; qty 3

M1715C   IEC Chest Lead Replacement Kit, 38cm; qty 3

M1716B   IEC Complete Lead Set; chest leads 60 cm; limb leads 100 cm

M1717B   Extra Leads Set, AHA or IEC (Pediatric, Frank, & Research); 24"/60 cm (qty 4)

M1718A   Lead Support Kit; 4 shorting plugs, 10 banana adapters, 2 lead separators

Other

14030A   Rubber limb strap, 15 in.; 4/pk

14030B   Rubber limb strap, 30 in.; 4/pk, w/button

14030C   Rubber limb strap, 60 in.; 4/pk, w/button

9301-0119   Large Welsh electrode; 30 mm dia cup; screw connector; 1/box

9301-0120   Replaceable bulb for 30 mm dia cup Welsh electrode; 1/box

M1700-89004   Box of 10 High Density Disks (available from your Hewlett-Packard service office)

A Lead Systems

Frank Leads

Table A-1 Frank Lead Electrode Positions.

Lead	Color Code	Position
I	Orange/Red	At the right midaxillary line
E	Orange/Yellow	At the front midline
C (V4)	Orange/Green	Between front midline and left midaxillary line at 45 angle
A (V6)	Orange/Brown	At the midaxillary
M	Orange/Black	At the back midline
H	Orange/Violet	On the back of the neck or on the forehead
F	Red	On the left leg
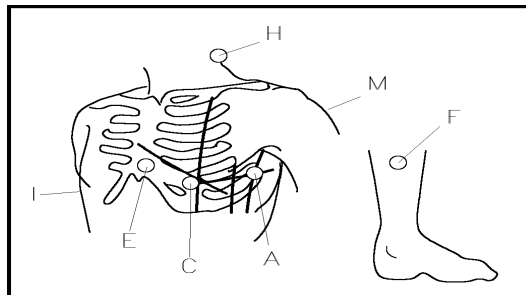
Figure A-1 Frank Lead Electrode Positions.

Special Lead Configurations

The PageWriter XLi provides great flexibility in the configuration and recording of ECG leads beyond the standard twelve by providing four additional leads. Please note that use of the additional leads does not affect the cardiograph's computerized ECG analysis. The analysis program uses only the standard 12 leads.

V3R, V4R, V7 and V8

Additional leads can be placed into the patient module. When the power to the cardiograph is turned ON, the additional leads will be recognized by the cardiograph. The cardiograph will identify the additional leads as V3R, V4R, V7 and V8. The V8 lead position on the module is labeled H.

These additional lead locations are positioned to investigate the right and posterior walls of the heart for both children and adults.
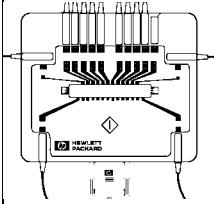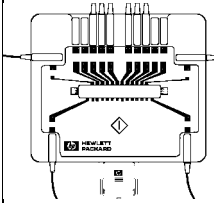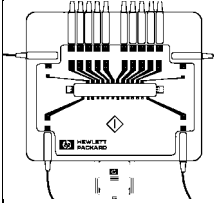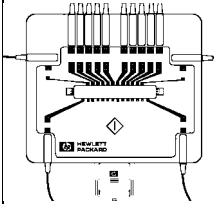
Children have a proportionately larger right heart mass than adults (hypertrophy of the left ventricle has not yet advanced). Therefore use of leads V3R, V4R, V7 and V8 provides desirable information about the electrical conduction on the right side of the heart that might not be seen in the standard 12 leads.

Leads V3R, V4R, V7 and V8 are also useful in evaluating adult patients suspected of having an inferior infarct involving the right or posterior wall of the heart. These additional leads may reveal changes indicative of injury that may be difficult to distinguish in the standard 12 leads.

VX1, VX2, VX3 and VX4

Researchers have the opportunity to label the four additional leads as VX1, VX2, VX3 and VX4. This selection is found in the Special Applications section of the cardiograph Global Configuration. The lead locations are determined entirely by the researcher. They will all be unipolar leads using the same Wilson pole as reference as used by the standard chest leads V1 through V6.
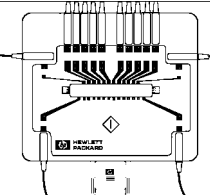
Table 6-2 Lead Configuration Choices

Global Configuration	Patient Module / Shorting Plug	Lead Type	Lead Set	Auto Report Format
		Pediatric	12 Leads + V4R, V3R, V7	3 x 4, 6 x 2, 3 x 5
		Standard	12 Leads	3 x 4, 6 x 2
Research Leads = Off		Frank	12 Leads + X, Y, Z	3 x 4, 6 x 2
Special Applications = On Research Leads = VX1, VX2, VX3, VX4		Generic Research	12 Leads + VX1, VX2, VX3, VX4	3 x 4, 6 x 2 4 x 4

A

Table 6-2 Lead Configuration Choices

Global Configuration	Patient Module / Shorting Plug	Lead Type	Lead Set	Auto Report Format
Special Applications = On Research Leads = V3R, V4R, V7, V8		Right Chest/ Posterior Research	12 Leads + V4R, V3R, V7, V8	3 x 4, 6 x 2 4 x 4

B Glossary

AC filter

The configurable filter which screens out ECG artifact caused by power line interference.

adult criteria

Interpretive rules used when analyzing ECGs if person's age is above 15 years. (See *ECG analysis, analysis criteria, and pediatric criteria*)

AHA leads

ECG lead names and identifying colors recommended by the American Heart Association. Limb leads are labelled RA, LA, LL, RL. Chest leads are labelled V1-V6. (See IEC leads)

alphanumeric

Composed of both letters and numbers. PageWriter XL has an alphanumeric keyboard.

alternating current (AC)

Electrical current provided by wall outlets. AC may be either 60 or 50 Hz depending on country.

analysis criteria

Rules used to interpret ECGs. (See *adult criteria, pediatric criteria*, and *ECG analysis*)

applications

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

artifact

ECG waveform distortion that may diminish ECG quality. ECG artifact (or noise) may be caused by electrical interference, poor electrode connections, or patient movement.

artifact filter

Hewlett-Packard term for filter which screens out noise on the ECG caused by muscle tremor. Operators turn on the artifact filter by pressing the ⌐Filter¬ key on the key panel.

Auto ECG

Twelve-lead ECG recorded and analyzed over a ten second period and printed in a preselected format.

AutoCopy

Hewlett-Packard term for user-configurable option which programs the cardiograph to automatically copy any Auto ECG recorded.

AutoDial

Hewlett-Packard term for user-configurable option which programs the cardiograph to transmit an ECG to a particular site when the operator presses Transmit .

AutoStore

Hewlett-Packard term for user-configurable option which programs the cardiograph to automatically store any Auto ECG recorded.

baseline wander

A slow upward or downward motion on the baseline of any ECG waveform.

baseline wander filter

The configurable filter which reduces baseline wander.

battery timeout

Hewlett-Packard term for process cardiograph uses to turn off automatically after a preset time period to conserve power. The number of minutes before battery timeout can be set in configuration mode.

baud rate

The speed at which data (ECGs) can be transmitted from one instrument to another.

Cabrera

An alternative limb lead order in which aVR is inverted and shown as -aVR. Lead order is aVL, I, -aVR, II, aVF, III, V1 - V6. (See *standard leads*. Also see **Questions and Answers** in the *PageWriter XLi Physician's Guide*.)

calibration pulse

A 200 ms, 1 mV square wave pulse which appears on the printed record. Calibration pulse shows the sensitivity at which the ECG was recorded and may show the effect of the filters.

CheckDisk

Hewlett-Packard term for softkey function which checks the percentage of flexible disk storage available for storing Auto ECGs.

configuration

The manner in which the cardiograph is programmed to function. When the software is installed, the cardiograph defaults to a preset configuration which may be changed at any time.

continuous preview

The Preview Plus application that allows you to view the ECG waveform on the preview screen without pauses when you print an ECG report.

cycle power

To press the $\boxed{\text{On-Standby}}$ button to **Standby** and then back to **On**.

Data Commport

The cardiograph connector into which the modem data cable or direct connection cable is inserted for ECG transmission.

delayed Manual

The Preview Plus application that allows you to capture and print ECG information that you see on the preview screen. Ordinarily the ECG information you see printed is what occurred after you pressed $\boxed{\text{Manual}}$.

ECG analysis

Computerized process for measuring and interpreting an Auto ECG.

ECG report

Paper copy produced by PageWriter XLi cardiographs when the operator presses one of the Auto start keys. This report includes a graphic representation of the heart's electrical activity (ECG waveforms) and identifying information and may also include interpretive information produced by the computerized analysis software. ECG reports must be overread by qualified physicians.

ECG-Log

Hewlett-Packard term for the softkey function which accesses the list of
the last 60 ECGs recorded on a cardiograph.

FAX

An image transmitted electronically.

FAX/modem

A device that allows the cardiograph to send and receive ECGs and
FAXes (Group III only).

file

Data such as an Auto ECG stored on a flexible disk.

flexible disk

A disk which can be inserted in the disk drive to store data such as Auto
ECGs or the system configuration. Flexible disks can also be used to load
software.

format

The manner in which ECG waveforms are presented on the printed ECG
report. ECG format is selected by the operator.

Frank leads

Lead system which obtains three dimensional ECG waveform
information. This information is presented using the three orthogonal
leads X, Y, and Z.

frequency response

The range of frequencies in which the cardiograph records ECG data.

front panel

Cardiograph area that includes the front panel display and the keyboard.

global configuration

Hewlett-Packard term for general cardiograph function settings. (See c*onfiguration*)

Hertz (Hz)

A unit of electrical frequency (cycles per second).

ID fields

Hewlett-Packard term for the areas where variable patient information can be entered. Using the ID fields, the operator can key in information such as patient identification number, name, and age.

IEC leads

Lead names and identifying colors recommended by the International Electrotechnical Commission standard. IEC limb leads are labelled R, L, F, and N. Chest leads are labelled C1-C6. (See *AHA leads*)

jittery waveform

Irregular up and down movement on the baseline of the ECG often caused by patient movement or muscle tremor.

Manual ECG

ECG report format which runs continuously until the operator stops the recording. The ECG may show three, six, or twelve lead waveforms. Many institutions and physicians may identify this format as a rhythm strip.

measurements

The amplitudes, durations, areas, and intervals which characterize the ECG waveform.

[Menu] key

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

modem

Device used to transmit data (ECGs) over phone lines.

morphology

Related to the shape of the ECG waveform.

operator

The person who records the ECG.

overread

To review an ECG report. This review must be completed by a qualified physician.

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.

patient module

Hewlett-Packard term for remote unit that contains all of the cardiograph's ECG data acquisition electronics, the display where electrode status appears, and a remote start/stop key. The patient module connects to the patient data cable and to the leads attached to the patient.

PCL printer language

Hewlett-Packard's page description language for printers. Used for defining a page, selecting fonts, and other formatting elements.

pediatric criteria

The interpretive rules used when analyzing ECGs if person's age is 15 years or less. (See *adult criteria, ECG analysis,* and *analysis criteria*)

preliminary report

An ECG report that has not been reviewed by a qualified physician. (See *overread*)

Preview Plus

The PageWriter XLi application that provides enhanced information on the preview screen. Preview Plus also allows you to reformat ECG reports, record timed Auto ECGs, record delayed Manual ECGs, and view a continuous ECG.

preview screen

Hewlett-Packard term for optional screen which, when installed on the cardiograph, shows the ECG traces as they will appear on the printed ECG report.

power on application

The configured setting that allows your cardiograph to start up in a particular application.

query

An operation mode that allows the cardiograph to call an HP ECG Management system and receive an ECG or reports for printing.

reformatted report

A printed report that is printed with a different lead presentation than the original ECG report. For example, you can reformat a 3 x 4 ECG and print it as a 6 x 2 ECG.

research lead set

Optional leads that can be positioned wherever needed in addition to standard, 12 lead set. Research leads are unipolar.

rhythm strip

Hewlett-Packard term for ten second recording of a particular lead that is printed at the bottom of an Auto ECG report. (See *Manual* and *Auto ECG*)

shorting plug

Small spacer plug inserted in patient module lead slot when lead is not in use.

softkeys

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.

standard leads

The conventional twelve lead order is I, II, III, aVR, aVL, aVF, V1 - V6. (See Cabrera)

Store-Log

Hewlett-Packard term for function which accesses a list of all ECGS stored on the flexible disk.

timed Auto ECG

The configured cardiograph setting that allows Auto ECGs to be recorded (and printed or stored on the selected option) at selected regular intervals.

transmission site

Hewlett-Packard term for four preset, configurable transmission selections. Operators may select connection type, baud rate (if appropriate), phone number (if appropriate), dialing type (if appropriate), and pausing length (if appropriate).

Welsh cups

Reusable electrodes held in place with suction cups.

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