
NorthEast Monitoring Inc. Holter LX Basic Software

Operator's Manual

NorthEast Monitoring Inc.
Two Clock Tower, Suite 360
Maynard, Massachusetts 01754
U.S.A.
www.nemon.com
June 30, 2004
Copyright 2004 NorthEast Monitoring Inc.

Part number: NEMM002 revision D
Software version: 5.2

Copyright 2004 NorthEast Monitoring Inc. All rights reserved.

**Microsoft Windows XP is a registered trademark of Microsoft Corp.
Java 2 Runtime Environment is a registered trademark of Sun
Microsystems.**

**Adobe Acrobat Reader is a registered trademark of Adobe Systems
Incorporated.**

**Special acknowledgement to Bruno Lowagie and Paulo Soares, the
authors of iText library. This open source library provided the ability
to generate Adobe Acrobat files. For more information, see
www.lowagie.com/iText.**

Table of contents

Chapter 1: Introduction to Holter LX Basic 1

Package contents	2
System requirements	2
Operator knowledge	2
Installation instructions	2
Launching LX Basic	4
Online help	4
Inserting a compact flashcard/SD card	4
Formatting an SD memory card	5
Formatting a compact flashcard	6
Erasing a compact flashcard	6
The Holter procedure	7

Chapter 2: Patient Information 9

Entering information for a new patient	9
Entering diary information	12
<i>Time-of-day</i>	12
<i>Symptom</i>	13
Changing Settings	13
Starting Holter analysis	15
Editing patient information for the “current” patient	15
Status window	16
Navigating the patient list	17
Previewing the data on the compact flashcard/SD card	18
Closing the Patient Information window	18

Chapter 3: Review Methods 19

Reviewing the Holter data	19
Color coding	19
Reviewing data in the Page window	20
<i>Single-channel page display</i>	21
<i>Relabeling a beat</i>	22
<i>Saving sample strips for the report</i>	22
<i>Disable/Enable SVPB</i>	23
<i>Expanded ECG display</i>	23
<i>Measuring in Expanded Page</i>	24
Reviewing the Trends window	25
<i>RR Trend</i>	25
<i>HR Trend</i>	25

<i>The blue marker</i>	26
<i>Amount of time displayed</i>	26
<i>Relabeling artifact</i>	26
Reviewing Saved Strips	26
<i>Changing the active strip</i>	27
<i>Editing a strip label</i>	27
<i>Deleting strips</i>	28
<i>Deleting channels from a strip</i>	28
<i>Replacing a strip with an alternative</i>	28
<i>Measuring</i>	29
<i>Printing the ECG now</i>	29
<i>Expanding the active strip</i>	29
Reviewing Tables	30
<i>Editing table entries</i>	30
<i>Printing the General table</i>	32
<i>Closing the Tables window</i>	32

Chapter 4: Printing 33

Final Report	33
<i>Choosing report modules</i>	33
<i>Including a heading on the front page of the report</i>	34
<i>Selecting which strips print in the report</i>	35
Full disclosure	35
Reviewing the Report Summary	36
Status indicators	38
Reviewing the report	38
Printing	38

Chapter 5: Preferences 41

<i>Draw grid</i>	41
<i>Use Control Panel vs. dd-mmm-yyyy date format</i>	41
<i>Assign date and time to Scan #</i>	42
<i>Use large fonts/Use large fonts in toolbar</i>	42
<i>Show additional fields in Patient Information</i>	42
<i>After analysis show</i>	42
<i>Annotation</i>	42
<i>Recorder types in use</i>	43
<i>Access advanced recorder settings</i>	43
<i>Entering physician names</i>	43
<i>Summary phrases</i>	43

Chapter 6: Managing Patient Reports 45

- Making room for new patients 45
- Backing up patient reports 46
 - What gets saved 46*
 - Automatic file name 47*
 - Assigning a backup file name 47*
 - The size of a backup file 47*
 - Customizing the Backup directory 47*
 - Where the backup file is saved 48*
- Retrieving a backed up patient report 48
- Additional features in the Backup window 49
- Using Roxio software to archive records on CD 49
 - Backing up a report on CD - single session 50*
 - Compressing Holter data for backup 50*
 - Copying to CD 50*
 - Deleting compressed files 54*
 - Backing up a Holter test on "direct" CD 54*
 - Formatting the CD 54*
 - Using the Holter LX Backup software 56*
 - Closing the CD session 57*
 - Adding patient reports to CD 58*
- Keeping track of archived data 58
 - Using the Backup log 58*
 - Using a simple spreadsheet list 59*
 - Creating a spreadsheet listing all archived patient names 59*
 - Locating a patient record in the spreadsheet 60*

Chapter 7: Configurations 61

- Running the Configuration program 61
 - Configuration folders 62
 - Saving a configuration 63
 - Exiting from the Configuration program 63
 - Using a configuration 63
-

Chapter 8: Utilities 65

- Setup window 65
- Batch print/view 66
- Delete patient data 67
- Add/remove patient directories 67
- Update software 68

Chapter 9: Using MagicVORTEX 69

Appendix A: Heart rate calculations 73

1 INTRODUCTION TO HOLTER LX BASIC

Welcome to NorthEast's Holter LX Basic Software. Used in conjunction with a NorthEast Monitoring digital recorder (either the DR180+ or the SD360), LX Basic allows you to print full disclosure of your patients' Holter recordings, to review all of the 3-channel recording on-screen, to confirm or correct all beat labels, to save particular ECG strips of interest, and to review the report information before it's printed. LX Basic automatically reads patient data from the recorder's compact flashcard/SD card - including entries made using the Event button - and saves sample strips of event markers, diary entries, and high and low heart rates. Backup features and the ability to send a report to another site are also included.

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

Note: This product, like all Holter monitoring products, should be used only under the direct supervision of a licensed physician.

NorthEast Monitoring is an FDA Registered Facility (1224919) that follows all FDA CGMP Manufacturing Practices. The DR180+ Digital Recorder with oximetry and the Holter LX oximetry software has FDA 510K Approved Product Certification (K004007). The Holter LX software has FDA 510K Approved Product Certification (K930564).

Package contents

Your Holter LX Basic package includes:

- NorthEast Monitoring Holter LX software CD
- NorthEast Monitoring Holter LX Basic Operator's Manual
- NorthEast Monitoring Software Protection Key
- Installation instructions

System requirements

This software can only be used in conjunction with a NorthEast Monitoring digital recorder - either the DR180+ or the SD360. It is not compatible with the Holter monitor of any other manufacturer. To run the Holter LX Basic software, your personal computer must include:

- Microsoft Windows XP
- a processor with a speed of 1 GHz or faster
- at least 256 MB of memory; 512 MB is recommended
- a disk drive of at least 10 GB
- a monitor with a resolution of at least 1024 by 768
- a USB compact flashcard/SD card reader or a laptop PC card slot
- a laser printer is recommended

Operator knowledge

To use NorthEast Monitoring Holter LX Basic Software, you must have extensive Holter knowledge that allows you to properly identify sinus and paced rhythms, abnormal rhythms, supraventricular and ventricular arrhythmias, artifact, ST segment changes, and pacemaker failures. In addition, all instructions assume a working knowledge of computers and, specifically, Windows XP software.

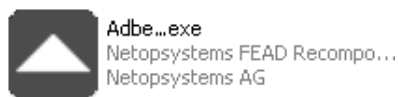
Installation instructions

To run, Holter LX Basic software must be installed on your hard disk. We recommend that no other Windows programs be running when you install the Holter LX software. To install the Holter LX Basic software:

1. Insert the NorthEast Holter LX Software CD into your computer's CD drive. A window opens on your monitor acknowledging the CD and displaying icons indicating what is present on the CD. They include one for Adobe Acrobat Reader (its label starts "Adbe"), one for Java 2 Runtime Environment (its label starts "j2re"), one for the Rainbow that is specific to your system (its label starts "rainbow") and one for NorthEast Holter LX (its label starts "nem"). In addition, there are document files containing a copy of this and other NorthEast product operator's manuals, and a "readme" text file. (We recommend that you

print and read the readme file as soon as installation is complete.)

2. Double click on the Adobe Acrobat Reader icon and follow the installation instructions as they appear on the screen, pressing the Enter key whenever prompted to go to the Next window. When completed, the CD window re-appears.



Acrobat Reader icon

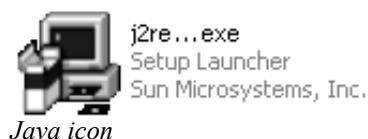
3. If your NorthEast software key (a.k.a. dongle) is already plugged into one of the ports on your computer, remove it. A software key for a parallel port is putty-colored, and one for a USB port is purple.



Rainbow icon

With the software key removed, double click on the Rainbow icon and follow the installation instructions as they appear on the screen, pressing the Enter key whenever prompted to go to the Next window. When completed, the CD window re-appears. Plug the software key into the appropriate port.

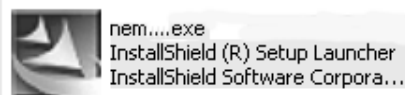
4. Double click on the Java icon and



follow the installation instructions as they appear on the screen, pressing the Enter key whenever prompted to go to the Next window. When completed, the CD window re-appears.

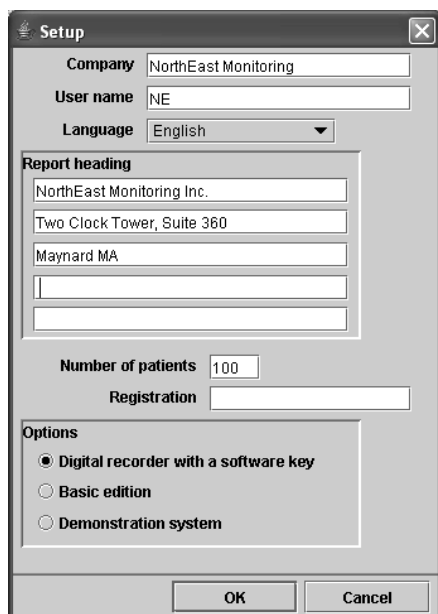
Note: If you are asked to reboot after Java installation, please reboot and continue with step 4.

5. Double click on the NorthEast icon and follow the installations instructions as they appear on the screen. Each time you are prompted to go to



NorthEast Monitoring icon

the Next instruction window, press the Enter key to do so. When you are prompted to select Finish, press the Enter key to do so. After a short delay, the Setup window opens.



Setup window

6. Type appropriate information in each of the fields, including your name and the name of your facility. In the five fields for the Report Heading, type the five lines you want to appear at the top of the front page of each Holter report. Leave the Number of patients set to 30. Click on the radio button next to "Basic edition." When the information is complete, click OK to close the Setup window.
7. Close the CD window. The Holter LX Basic software launches and then is ready to be used. To exit the LX Basic software, select Patient > Exit or click the red Close button in the upper right corner.

Launching LX Basic

Once the programs are installed, you start the Holter LX Basic software by selecting Programs > Holter 5 > Holter 5 from the Start menu.

If you use the LX Basic software often enough, Windows XP may add Holter 5 to the Start menu, and you can then start the Holter LX Basic software by selecting Start > Holter 5.

Online help

In addition to the information in this manual and the on-screen help messages that appear within the LX Basic software, help is also available online at our web site www.nemon.com.

Inserting a compact flashcard/SD card

All ECG recorded during the Holter period is saved on a removable memory card. The DR180+ recorder uses a compact flashcard, while the SD360 recorder uses an SD memory card. To input the data from the card to the computer system, first remove the card from the recorder, and then insert it into your computer system's card reader.

Into a USB SD memory card reader

To insert an SD memory card into the drive, hold the card right-side up, with the missing corner away from you and to the right. Insert the opposite edge into the opening of the SD card reader.

Push the card in gently until it is fully plugged in. Some card readers have a light indicating when a flashcard is properly inserted; if yours does, make sure the light comes on.

Depending on your computer and your card reader, a window may appear acknowledging that a card has been newly inserted and listing what files are present on the card. A recording saved by an SD360 Digital Recorder is named “flash.dat.” If the window appears, close it.

Into a USB compact flashcard reader

To insert the compact flashcard into the flashcard drive, hold onto the card by the edge with the ridge and insert the opposite edge into the opening of the flashcard reader. Push the card in gently until it is fully plugged in. Some card readers have a light indicating when a flashcard is properly inserted; if yours does, make sure the light comes on.

Depending on your computer and your card reader, a window may appear acknowledging that a card has been newly inserted and listing what files are present on the card. A recording saved by a DR180+ Digital Recorder is named “flash.dat.” If the window appears, close it.

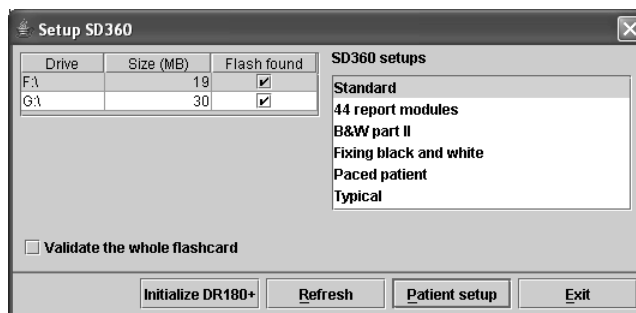
Into a laptop PC card slot

First insert the compact flashcard into a compact flashcard adaptor; to do so, hold onto the card by the edge with the ridge and insert the opposite edge into

the adaptor. Then insert the adaptor, right side up into the laptop’s card slot. If a window appears listing what files are on the flashcard, close it.

Formatting an SD memory card

To use an SD memory card with North-East Monitoring’s SD360 recorder, it must be initialized using the LX Holter software. To do so, insert the SD card into the card reader, close the Windows Explorer window that opens, and using the Holter software, select Patient > Flashcard > Initialize. The Setup SD360 window opens. It displays every drive that holds a memory card and a list of configurations (SD360 settings).



Setup SD360 window

Note: *If your system allows both SD360 and DR180+ recorders, and the Initialize DR180+ window opens, click the Initialize SD360 button to switch to the Setup SD360 window.*

Select the appropriate configuration corresponding to the patient to be hooked up (in the SD360 settings field at the right), then click Patient setup. The Patient setup window allows you

to enter clerical information about the patient to be saved on the SD card before the Holter test begins. See Chapter 2: Patient Information for details about data entry in this window.

SD360 Patient setup window

Once the window contains the correct patient information, click the Copy to SD360 button. The card will be initialized and the patient data will be copied onto it.

For details about the settings available using the SD360 settings button, please refer to your SD360 Holter Recorder Operator's Manual.

Formatting a compact flashcard

To use a compact flashcard with NorthEast Monitoring's DR180+ and LX Basic software, it must be formatted properly before recording the patient data. Flashcards that come with the DR180+ Digital Holter Recorder are already formatted properly and need only to be erased before re-use. A flashcard from a different source, though, must first be formatted using

the FAT file system (not FAT 32) and then erased using NorthEast's software.

To format a compact flashcard, insert the card into your computer's card reader, then select My Computer. In the My Computer window, click on the icon designating your compact flashcard reader, then select File > Format. When the window opens, set the File system to FAT, then click Start. Click Close when formatting is complete.

Erasing a compact flashcard

To erase and initialize a compact flashcard for re-use in the DR180+, insert the flashcard in your computer's flashcard reader and launch the Holter LX Pro software. Then select Patient > Flashcard > Initialize.

Note: If your system allows both SD360 and DR180+ recorders, and the Setup SD360 window opens, click the Initialize DR180+ button to switch to the Initialize DR180+ window instead.

In the Initialize DR180+ window, highlight the Standard selection and then click the Erase button. When the erase is completed, the flashcard will contain a blank flash.dat file that will allow it to be used in the DR180+.

Note: If you insert a flashcard into the recorder and get a message that the “Memory card is missing,” the flashcard is not formatted or erased properly.

Note: Note: If other files are present on the compact flashcard, they must be removed (either deleted or moved using Explorer) before you can erase the card for use in the DR180+ Digital Recorder. This may include a bootex.log file of 0 length that was installed by Windows XP if the flashcard is in your computer’s flashcard reader when the computer boots up. We recommend that you not leave flashcards inserted in the reader when you turn your computer on.

NorthEast Monitoring Holter LX Basic software is used in conjunction with data from the NorthEast Monitoring DR180+ and/or SD360 Digital Recorders. After a patient has worn the recorder, you take the compact flashcard or SD card from it and insert the card in your computer system’s compact card reader and the Holter signal is loaded onto your system. While the signal is being transferred, the LX Basic software processes it, then you

review the results, edit as needed, and print the report.

An overview of the process is covered in this chapter, and details are covered in subsequent chapters.

The Holter procedure

The Holter procedure typically includes the following steps:

- Holter the patient using a DR180+ or an SD360 Digital Recorder.
- Remove the recorder from the patient and remove the compact flashcard or the SD card from the recorder.
- Insert the card into the computer’s card reader.
- Start the Holter LX Basic software.
- Review/enter information about the patient and the recording.
- Let the software analyze the Holter data.
- Review the 24 hours (or longer) of data by moving through the Page display, from the beginning of the recording to the end. Relabel beats and all matches as appropriate. Make measurements as necessary. Save strips to document significant events for the final report.
- Review the Saved Strips, making sure that all significant events are documented and labeled properly.

- Type your comments about the Holter test in the Report Summary.
- Print the final report to be reviewed by a physician.

Detailed information about the steps outlined above appears in subsequent chapters in this manual.

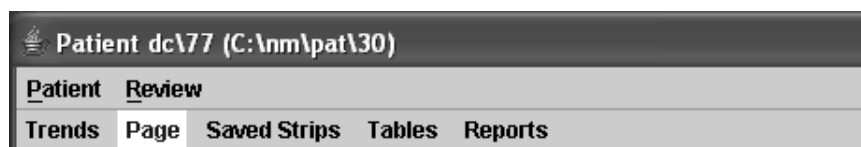
2 PATIENT INFORMATION

The Patient Information window contains important information about the patient who wore the DR180+ or SD360 recorder. The software automatically retrieves patient data from the recorder's memory card, along with the Holter signal, but you are responsible for entering the remaining data. The data saved by the DR180+ recorder includes an ID number, the recorder number, the date, the start time, and whenever the patient pressed the Event button. The SD360 saves all that information plus whatever clerical information was entered when the SD card was initialized for the recording. All entries in the Patient Information window can be edited.

While running the LX Basic software, you have the choice of opening the Patient Information window for (1) the last patient whose Holter test was accessed (that is, the “current” patient), (2) a previous patient whose Holter test has already been analyzed, or (3) a new patient whose Holter test has not yet been analyzed. In the first two cases, a patient record has already been created for the patient and the Holter data for the patient has already been downloaded from the flashcard of the recorder onto the hard disk of your computer. In the case of a new patient, a new record must be created and the Holter information downloaded from the flashcard/SD card. This chapter covers creating a new patient record first.

Entering information for a new patient

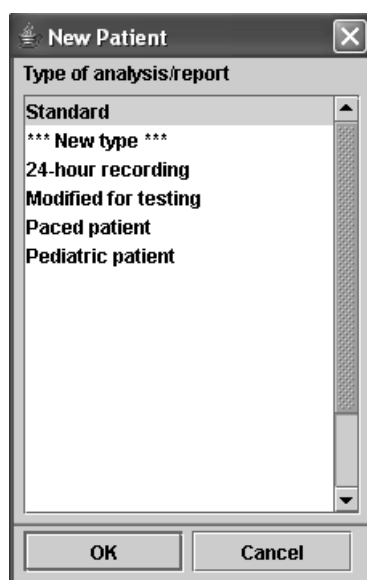
To enter information about a new patient's Holter recording, the LX software must be running. When the program appears, it displays a blank screen with the standard toolbars. To start a new patient, first insert the patient's compact flashcard/SD card into the card reader and then select Patient > New.



Standard Holter toolbars

Note: If you select **Patient > New** before inserting the flashcard/SD card, you will see a **Confirm** window that explains that there is no flashcard in the drive. If this happens, insert the correct card into the drive and click **Retry**.

After you select **Patient > New**, a **Type of analysis/report** window opens. Select **Standard** from the list and click **OK**.



Type of analysis/report window

Note: For more information about types of analysis/reports, see the **Chapter 7: Configurations**.

Note: If you see a message that says, “There are no empty patient...” instead of the window above, see “Making room for new patients” in **Chapter 6: Managing Patient Reports**.

When the Patient Information window opens for a new patient, the data on the flashcard/SD card is immediately read from the card reader. As the Holter data from the card loads onto your computer hard drive, you can start entering patient information.

Note: Once the flash.dat has loaded, the flashcard button label in the Patient Information window changes to “Copy different flashcard.” If the patient information displayed does not match the correct patient, remove the card, insert the correct one and click “Copy different flashcard.”

To enter patient information:

1. Type the patient name using the Last name, First name, and Middle initial (MI) fields appropriately. Use your pointing device (mouse) to click on the next field you want to fill in, or press the Tab key to move to the next field. The name in the printed report appears as entered in this window.

New Patient Information window

2. Fill in any of the remaining data fields. There are six types of data fields:

- **Freeform:** These allow you to type alphanumeric characters, limited by the space constraints displayed, e.g., patient name.
- **Radio buttons:** The Sex entry appears as this type. Circles represent the choices. Click on a circle to select it. Only one choice can be selected.



Example of radio button

- **Formatted:** The entry must be in a specific format. For example, the D.O.B. (date of birth) field must be entered as one of the valid formats; which one depends on the settings of your system. If the D.O.B. field reads MM/DD/YYYY, the entry must be typed with the first two digits representing the month, the second two digits representing the day, and the final four digits representing the year. If the D.O.B. field reads DD-MON-YYYY, the entry must be typed with two digits representing the day, three letters representing the abbreviation for the month, and four digits representing the year. (To change the D.O.B. format, see Chapter 5: Preferences.)
- **Automatic:** These are filled in automatically from the flashcard.

- **Check box:** The fields with an empty square can be clicked on to display a check mark. Click again to remove the mark.
- **Combination:** In these, you can either type a freeform entry or make a selection from a predetermined list of choices. To display the list of choices, click on the scroll arrow to the right of the field. In the Indication and Medication fields, the scroll arrow does not appear until you click on the field itself. To select a choice from the list, click on it.

Some combination boxes have an auto-fill feature. When you start typing an entry, the software will automatically finish typing for you from its list of choices; if the word taken from its list is incorrect, simply keep typing until the correct one appears. If the correct one is not on the list, type the complete entry. These fields have the auto-fill feature: Indication, Medication, Physician, Interpreting physician (optional), and Strip label.

Note: The D.O.B. and Age fields work together. If you know the patient's date of birth, enter it, and the software automatically calculates the patient's age based on the D.O.B. and the recording date. If you do not know the date of birth, but know the age, type a numeric entry in the Age field, and select the appropriate unit (e.g., years) in the Age Unit field. If you know neither, leave the fields blank. The software does not allow an inconsistent D.O.B. and age; if you enter inconsistent data, it will leave the age and remove the D.O.B.

Note: *The Notes field allows an alphanumeric entry that can be used to record information that might be helpful about the Holter test or the patient. It is not printed in the final report. To enter notes to be printed in the final report, use the Comments section of the Report summary.*

Entering diary information

While wearing the DR 180+ or SD360, the patient can identify symptoms and activities in two ways:

(1) by pressing the Event button on the recorder and, possibly, entering a pre-coded symptom or activity (DR180+ only), or

	Time	Symptom
1	10:45:00am-1	Palpitations
2	12:10:00pm-1	Dizzy
3	03:30:00pm-1	Palpitations while walking
4	HH:MM:00am-1	
5	HH:MM:00am-1	
6	HH:MM:00am-1	
7	HH:MM:00am-1	
8	HH:MM:00am-1	
9	HH:MM:00am-1	
10	HH:MM:00am-1	

Buttons: Delete, Done

Diary symptoms window

(2) by keeping a written record of times and symptoms or activities.

The software reads the Event button information directly from the flash-card/SD card and enters it automatically. You must type any significant information from the written record

manually into the Diary Symptoms window.

To open the Diary Symptoms window, click the Diary button in the Patient Information window. The Diary Symptoms window contains two types of fields: time and symptom. Any entries that are already present when you first open a patient's Diary Symptoms window were those automatically read from the compact flashcard.

Enter the time-of-day and symptom for each diary event recorded.

Note: *Whether the software uses a 12- or 24-hour clock is determined by your computer's setting in the Control Panel.*

Time-of-day

To enter the time-of-day of a written symptom or activity, click on the text in the time field. Type over the existing characters, using the format indicated, with either a 12- or 24-hour clock:

- HH stands for a two-digit hour.
- MM stands for a two-digit minute.
- 00 stands for a two-digit second; this is automatically filled in with 00 so that you do not have to type the seconds.
- using a 12-hour clock format, am stands for the morning and pm stands for the afternoon; change the "a" to "p" if necessary.
- 1, 2 or 3 at the end indicates Day 1, Day 2, or Day 3.

Symptom

To enter a symptom, first click on the Symptom field next to the appropriate time-of-day. Then enter the text either by typing a freeform entry or by clicking on the arrow to display a scrolling list of pre-typed entries. To enter a selection from the list, click on it; the list window closes and the entry appears in the Symptom field. You can also add freeform information after selecting a pre-typed entry. To do so, make your selection, then click at the end of the text and type the additional information, followed by the Enter key.

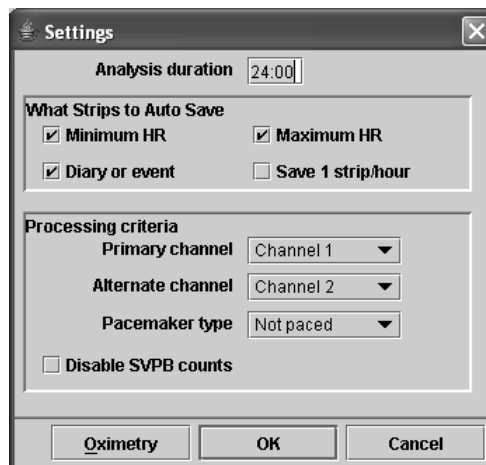
To delete a diary entry, click the time-of-day field of the entry and then click the Delete button. The time-of-day will revert to HH:MM:00-1 or HH:MM:00am1 and no entry will be saved. To select multiple entries to be deleted, select one and then hold the Shift key down while you select subsequent entries; when all entries that you want deleted are highlighted, click Delete.

When you have finished entering all written diary events, click the Done button to save your entries and return to the Patient Information window.

Changing Settings

During Holter analysis, the LX Basic software makes decisions about the

Holter signal based on some pre-defined settings.



Settings window

You can change any of the criteria in the Settings window; click the Settings button in the Patient Information window to display the Settings window.

The Settings window allows control over the following:

- **Analysis duration** determines how many hours of data are analyzed. All the ECG loads in from the compact flashcard/SD card, but analysis stops after the amount of time indicated here or at the end of the Holter recording, whichever comes first. It uses the HH:MM format, with the first two digits indicating how many hours and the second two indicating how many minutes.
- **Minimum HR** indicates whether to automatically save a sample strip of the lowest heart rate (typically based on a four-beat running average) observed during the recording.

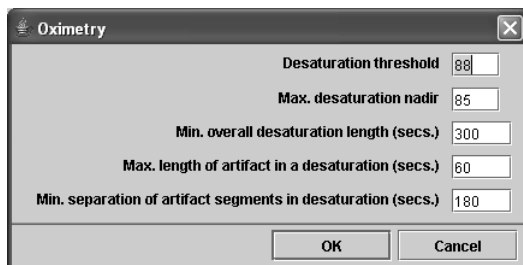
- **Maximum HR** indicates whether to automatically save a sample strip of the fastest heart rate (typically based on a four-beat running average and excluding ectopy) observed during the recording.
- **Diary or event** indicates whether to automatically save a sample strip at the time-of-day when either (1) the event button on the recorder was pushed or (2) an entry was manually typed into the Diary Symptoms window.
- **Save 1 strip/hour** indicates whether to automatically save a sample strip at the beginning of each hour of the recording.
- **Primary channel** determines which channel is used first to locate R-waves and do template matching.
- **Alternate channel** determines which channel is used to do template matching and also to locate R-waves if one is not found in the primary channel.
- **Pacemaker type** contains four settings that allow the software to expect certain behavior:
 1. **Not paced** means that the software will not look for any pacemaker spikes, beats or failures.
 2. **VVI** means that each paced beat will be preceded by a single spike.
 3. **AV sequential** means that paced beats will be preceded by two spikes, one atrial and one ventricular.
 4. **DDD** means that paced beats can be preceded by either one or two spikes.
- **Disable SVPB counts** is a setting that allows you to turn off the identification and counting of SVPBs. Use it when the patient exhibits atrial fibrillation or any other time the SVPB label is not appropriate.

Within the Settings window, there are three types of fields. For a numeric entry, click on the field and type over the existing entry. For a check box associated with a setting, click to turn it on or off; a check mark indicates that the setting is turned on. For fields with an arrow to the right, click on the arrow to list the other possible settings, then click on the new choice.

When you have finished making changes, click OK to save those changes and close the window, and click Cancel to close the window without saving changes.

Note: *Be sure to make any changes in the Settings window before you work on the final report. Manually saved sample strips and typed comments will be lost after some changes in the Settings window.*

For any patients with oximetry data, the Settings window also contains an Oximetry button, which opens the Oximetry window that allows settings to be reviewed and adjusted.



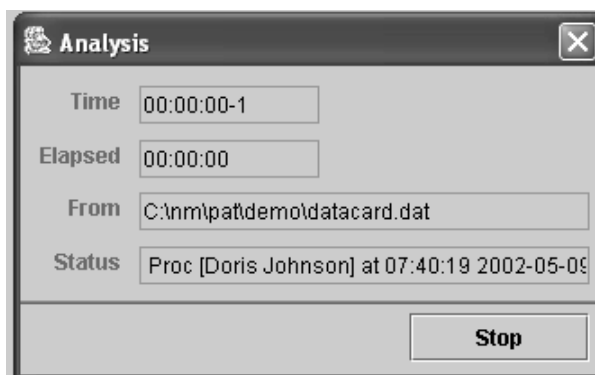
Oximetry settings

The settings include:

- **Desaturation threshold** (percent) defines the oxygen level (SpO₂ value) that every reading during a desaturation event must be below. The duration of an event is defined as a time period during which no reading was above this level.
- **Max. desaturation nadir** defines the SpO₂ level that must be met for an event to be identified as a desaturation event. During the event, at least one reading must drop to this level.
- **Min. overall desaturation length** (in seconds) determines how long the readings must remain at or below the Desaturation threshold to be considered a desaturation event.
- **Max. length of artifact in a desaturation** (in seconds) defines the maximum amount of sequential artifact that can occur during a desaturation event and still have it reported as an event.
- **Min. separation of artifact segments in desaturation** (in seconds) defines how close periods of artifact can be within a desaturation event and still have it reported as an event.

Starting Holter analysis

To start Holter analysis after entering patient data, click the Start button at the bottom of the Patient Information window. The Analysis window appears. When analysis is complete, the Analysis window closes automatically.



Analysis window

To interrupt analysis, click the Stop button. The analysis ends immediately, with data only for the portion that was complete. The unanalyzed ECG can be reviewed in Page and printed in full disclosure.

After analysis is complete, proceed with your review of the Holter recording. See Chapter 3: Review Methods for details.

Editing patient information for the “current” patient

After analysis is completed for a patient’s Holter data, you can re-open the Patient Information window and edit the information in it. To open the

Patient Information window for the current patient, select Patient > Patient Information.

Patient Information window for analyzed (not new) patient

While most of the Patient Information window is the same as that of a new patient, there are significant differences:

- The addition of the Status button (see the “Status window” section for details).
- The Re-analyze button replaces the Start button because the Holter signal has already been analyzed. Use this button to start analysis over from the beginning.
- The absence of the Copy different

Status window

flashcard button. To copy the Holter data from a flashcard/SD card, you must use Patient > New.

Status window

After a patient’s Holter signal has been analyzed, the Patient Information window also includes a Status button that opens the Status window. The Status window helps you keep track of the status of each patient’s Holter test. As you complete each step, you can click on the check box next to each field in the Status window to indicate that the step has been completed. The Status fields include:

- **Edited** indicates the Holter signal was reviewed and edited as needed;
- **Printed** means the report was printed;
- **Verified** means the report was reviewed/approved by a physician;
- **Locked** removes all editing capabilities from the Patient Information and Review windows. No changes are allowed.

In addition, one other Status field appears - Backup. That field is filled in automatically when you use the Backup program to save a patient’s Holter information; it contains either “Full” to indicate that all Holter data is backed up with the patient report or “Report” to indicate that just the compiled report is backed up for this patient.

Navigating the patient list

You can keep multiple patient Holter recordings and reports on your computer system. All of the patients currently saved in the software appear when you select Patient > Open from the toolbar.

The list of patients in the Open Patient window

includes information regarding each report. Although the particular fields are customizable in the Backup program, the fields included in the standard release of the LX Basic software are: the name of the directory in

which the patient's report is stored, the patient name, the I.D. number, the Scan #, and the analysis date. The Backup field displays the date that the report was backed up on your system; Type indicates what is backed up - either the report, including strips (indicated by "Report"), or the full report (indicated by "Full"), consisting of the report plus the entire Holter recording.

At any one time, only one patient is the current patient - the patient whose

information appears when you select Patient > Patient Information, the patient whose ECG appears in the screen displays, the patient whose report prints when you make the request. To change the current patient to a different one, either click on the appropriate name on the list and click Open, or double-click on the appropriate line.

#	Directory	Name	I.D.	Scan #	Analyzed	Length	E	P	V	L	Backup	Type
170	nmpatdata6205	620...			2003-06-13	00:35:58					2003-06-12 08:04	Full
171	nmpatdata6206	620...			2003-06-11	00:35:58					2003-06-12 08:04	Full
172	nmpatdata6207	620...			2003-06-11	00:35:58					2003-06-12 08:04	Full
173	nmpatdata6208	620...			2003-06-11	00:35:58					2003-06-12 08:04	Full
174	nmpatdata6209	620...			2003-06-11	00:35:58					2003-06-12 08:04	Full
175	nmpatdata6210	621...			2003-06-11	00:35:58					2003-06-12 08:04	Full
176	nmpatdata6201	720...			2003-06-13	00:35:59					2003-06-12 08:04	Full
177	nmpatdata6202	720...			2003-06-11	00:35:58					2003-06-12 08:04	Full
178	nmpatdata6203	720...			2003-06-11	00:35:58					2003-06-12 08:04	Full
179	nmpatdata6204	720...			2003-06-13	00:35:59					2003-06-12 08:04	Full
180	nmpatdata6205	720...			2003-06-11	00:35:58					2003-06-12 08:04	Full
181	nmpatdata6206	720...			2003-06-11	00:35:58					2003-06-12 08:04	Full
182	nmpatdata6207	720...			2003-06-11	00:35:58					2003-06-12 08:04	Full
183	nmpatdata6208	720...			2003-06-13	00:35:58					2003-06-12 08:04	Full
184	nmpatdata6209	720...			2003-06-11	00:35:58					2003-06-12 08:04	Full
185	nmpatdata6210	721...			2003-06-11	00:35:59					2003-06-12 08:04	Full
186	nmpatdata6201	820...			2003-06-11	00:35:58					2003-06-12 08:04	Full
187	nmpatdata6202	820...			2003-06-18	00:35:59					2003-06-12 08:04	Full
188	nmpatdata6203	820...			2003-06-19	00:35:59					2003-06-12 08:04	Full
189	nmpatdata6204	820...			2003-06-13	00:35:58					2003-06-12 08:04	Full
190	nmpatdata6205	820...			2003-06-11	00:35:58					2003-06-12 08:04	Full
191	nmpatdata6206	820...			2003-06-19	00:35:58					2003-06-12 08:04	Full
192	nmpatdata6207	820...			2003-06-11	00:35:58					2003-06-12 08:04	Full
193	nmpatdata6208	820...			2003-06-11	00:35:58					2003-06-12 08:04	Full
194	nmpatdata6209	820...			2003-06-25	00:35:59					2003-06-12 08:04	Full
195	nmpatdata6210	821...			2003-06-11	00:35:58					2003-06-12 08:04	Full
196	C:\nmpat12lea...	12L...	360		2003-09-02	10:33:02					2003-09-02 09:40	Full
197	C:\nmpatbug445	000...	123456...		2003-09-12	39:58:49						
198	C:\nmpatcan0...	Too...	947605...		2003-09-17	24:17:12						
199	C:\nmpatcan0...	Too...	135		2003-09-18	18:20:50						
200	C:\nmpatdemo	Dori...	123456...00		2003-09-17	03:58:52						

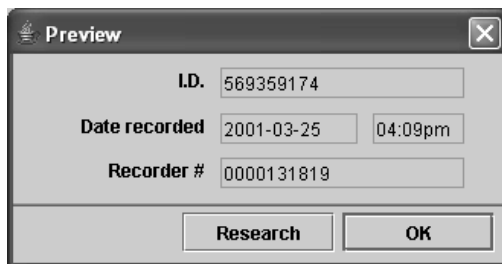
An example of the Open Patient window

Also, you can change the current patient using the << and >> buttons in the bottom of the Holter LX window. << changes the current patient to the previous one on the patient list. >> changes the current patient to the next one on the patient list. Click each button repeatedly to move backward or forward through the list. To display a combo box listing all patients on the system, click the arrow to the left of the << and >> buttons.

For more information about managing and backing up the patient records saved on the system, see Chapter 6: Managing Patient Reports.

Previewing the data on the compact flashcard/SD card

If you would like to review the clerical information on a flashcard/SD card before creating a new patient record, you can insert the card into the drive and then select Patient > Preview from the main toolbar. This opens the Preview window, which displays the identification and recorder numbers, along with the date recorded and the start time, directly off the card without loading the information onto your computer's hard disk. Use this feature to verify which flashcard contains a particular patient's Holter data.



Preview window

After verifying that the card is the correct one, click OK to close the window. If the information in the Preview window does not match the information you have, do not proceed without clearing up the discrepancy.

After verifying that the card is from the correct patient, select Patient > New and follow the normal procedure described at the beginning of this chapter.

Closing the Patient Information window

To save your data and close the Patient Information window without starting analysis, click OK. To close it without saving any changes, click Cancel.

3 REVIEW METHODS

After loading the Holter signal from the compact flashcard/SD card to the hard disk of your computer, the LX software analyzes the signal and then displays it for your review. You can review an on-screen, color-coded full disclosure of all the ECG, an interval table summarizing the heart rates and ectopy counts, graphs showing the heart rate and RR interval data, selected strips saved for the final report, and a report summary that describes the heart rates measured during the recorded period, along with any typed comments you enter.

Reviewing the Holter data

Note: NorthEast Monitoring recommends that the entire Holter recording for each patient be carefully reviewed by a physician or other qualified person who knows how to interpret Holter waveforms. This review can be done page-by-page using either the Page window or the printed full disclosure.

Details of using the Page window are included in this chapter, while printing full disclosure is covered in Chapter 4: Printing.

Color coding

Throughout the LX Basic software, the ECG is color-coded based on what the system has labeled each beat:

- **Green:** Beats the software has identified as normal.
- **Yellow:** Beats identified as supraventricular premature beats (SVPBs). They have a normal morphology, but fall at least 20% early compared to the normal.
- **Red:** Beats identified as ventricular premature beats (VPBs). They differ significantly from the normal; they are not necessarily premature.
- **White:** Beats identified as pauses, defined as RR intervals at least 2.5 seconds or longer. White overrides any other color that the beat also qualifies for (e.g., red because it's a VPB).
- **Light blue (cyan):** Signal that appears to be contaminated by artifact.
- **Cobalt blue:** Beats identified as paced.

All data must be reviewed carefully to ensure that you agree with the beat labels the software has selected; if you do not agree, you can change a beat label and its color will change appropriately.

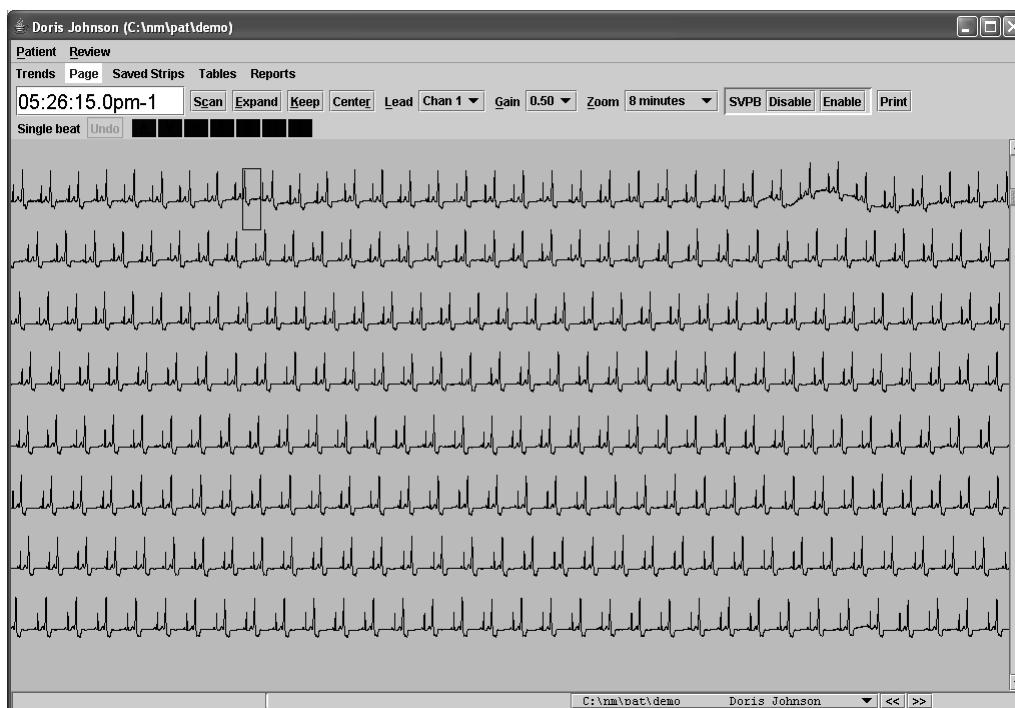
In addition to the labels the software can provide for each beat, there are some labels only you can use to relabel beats. These are:

- **Aberrant:** Use this label to identify and count beats as aberrantly conducted SVPBs.
- **Questionable (Unknown):** Use this label to separate out beats you cannot identify and keep them from being included in another category. They are colored green, like normals.

- **T-wave:** Use this label if the software has identified a portion of the signal as a QRS, but it is not. This will merge its RR interval with the preceding RR interval. The signal will take the color of whatever beat precedes it.

Reviewing data in the Page window

The Page window allows you to review all of the ECG stored during the Holter recording, like an electronic full disclosure. The Page window is divided into two displays: a miniature, single-channel presentation of the ECG and an expanded 3-channel display with a background grid.



Page window - full screen

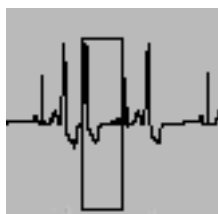
You can toggle the Page window format back and forth between (1) only the miniaturized ECG and (2) a combination screen (that shows the single-channel display on the top half and the expanded strip on the bottom half) using the Full Screen/Expand button.

Note: *On screen, the ECG is displayed in color as explained previously. As you page through the ECG, first determine what the patient's underlying rhythm is. If the patient displays normal sinus rhythm, then pay particular attention to any signal, regardless of color, that appears different from the patient's normal rhythm.*

Single-channel page display

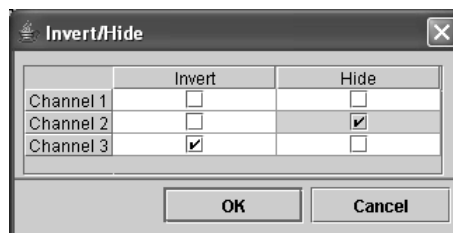
The single-channel page display contains a blue highlight box surrounding one of the QRS complexes. The time-of-day at that beat is displayed in the time field in the upper left corner of the window. The displayed ECG can be adjusted in these ways:

- To adjust the ECG so that the highlighted beat appears in the center of the page, click Center.
- To move the highlight box to a different beat, click on the beat.
- To change the channel displayed, click on the Lead field and select a different channel from the list.



A highlighted beat

- To change the amplitude of the displayed signal, click on the Gain field and select a different size from the list.
- To change the amount of time displayed on each page, click on the Zoom field and select a different amount of time.
- To invert the signal in a channel or to completely eliminate a channel from any display and the report, go to Review > Invert/Hide to open the Invert/Hide window. Click on the check box for each channel to be inverted or hidden; click on the check box again to return the signal to normal. Click OK to save any changes and exit. To close the window without saving changes, click Cancel.

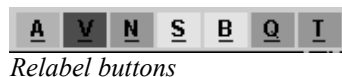


Invert/Hide window

In the single-channel display, you can visually review pages of ECG by using the PageUp and PageDown keys, by clicking on the down arrow of the scroll bar, or by clicking the Scan button. Turn the Scan button off by clicking it again. While scanning, use the + key to increase the speed of the display, and use the - key to decrease it.

Relabeling a beat

If you determine that a particular beat is not labeled appropriately, you can use the relabel buttons to change the beat label. To relabel, click on the beat to highlight it, then click the appropriate relabel button.



The relabel buttons correspond to the beat labels explained in the “Color coding” section on the first page of this chapter, with:

- **A** for artifact
- **V** for ventricular (VPB)
- **N** for normal
- **P** for paced (only if pacemaker type is on)
- **S** for supraventricular (SVPB)
- **B** for aberrant SVPB
- **Q** for questionable/unknown
- **T** for T-wave

In addition, combinations of abnormal beats can result in these beat labels, which you see when the beat is highlighted in the Expanded Page display described on the next page:

- **VPB Pair** - two VPBs in a row
- **VTAC** - three or more VPBs in a row, regardless of heart rate
- **Bigeminy/Trigeminy/Quadrigeminy** - a pattern of VPBs

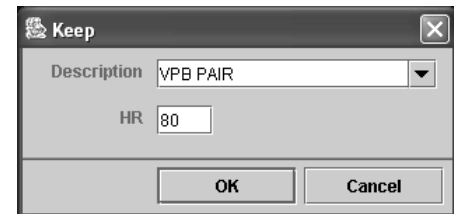
alternating with normals at a 1:1 ratio, a 1:2 ratio, and a 1:3 ratio, respectively

- **R on T** - a VPB that occurs so early it may fall on the T-wave of the preceding beat
- **SVPB Pair** - two SVPBs in a row
- **SVT** - three or more SVPBs in a row, regardless of heart rate
- **Tachycardia** - normal beats at a rate that equals or exceeds the Tachycardia setting in the Settings window
- **Bradycardia** - normal beats at a rate equal to or less than the Bradycardia setting in the Settings window
- **Pause** - an RR interval longer than 2.5 seconds

Note: *If you relabel one or more beats, when you exit from the Page window, the software automatically updates all results to reflect your changes.*

Saving sample strips for the report

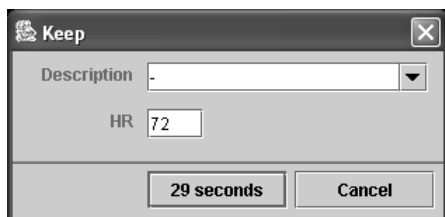
As you page through the ECG, you can choose to manually save sample strips for the report. The 7.5-second sample strips are printed as full-sized, 25 mm/second ECG on a background grid. To save a strip, click on the beat you want at the center of the strip to move the highlight box there, and then



Keep window with OK button

click Keep; the Keep window opens. To label the strip, either type the label in the Description field or select a label from the scrolling list; then click OK to save the strip. If you decide to close the Keep window without saving the strip, click Cancel.

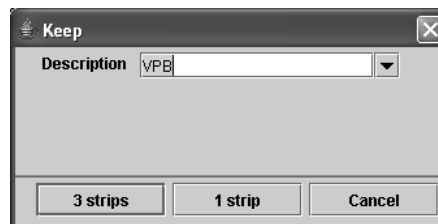
To save strips of an event longer than 7.5 seconds, drag the cursor across the ECG to be saved (the selected ECG will turn purple) and then click Keep. In the Keep window, you can enter the label of the first strip in the series and then click the left button, which indicates how long a time period to be saved. Subsequent strips in the series will be labeled “Continuous (x/n)” (meaning strip number x out of a total of n strips in the series).



Keep window with continuous button

To save multiple strips, all with the same label, click on a beat at the center of the ECG to be saved, then hold the Shift key down and click on another beat. Then click Keep. In the Keep window, click the button labeled “n strips” to save all the selected examples; click the button labeled “1 strip” to save just the first. All strips will have the label in the Description field; change it when appropriate. Because the strips are likely to have different

heart rates, no heart rate fields are presented.



Keep window with multiple strips button

Disable/Enable SVPB

If a patient is in intermittent atrial fibrillation or flutter, you can disable the SVPB counts for those periods. To do so, select the ECG by dragging across it (it turns magenta), then click the SVPB Disable button.



All the selected beats turn green, indicating that none of them are called SVPBs. To undo the change, select the ECG again and click SVPB Enable.

Expanded ECG display

The Expanded display shows three channels of ECG in the bottom of the Page window. To display the expanded ECG, click Expand.

Note: *Throughout the Holter LX software, if oximetry data is present, oximetry information appears where channel 3 would normally be. In expanded Page, the oximetry value is displayed as a green trend line, while the pulse waveform is displayed in white; if hash marks appear, the data contained too much artifact.*



Expanded portion of Page window with data fields

The expanded display includes a beat label in the upper left corner and beat-by-beat annotation of either heart rate or RR interval.

The expanded ECG in the bottom half of the window and the single-channel display in the top half of the window are linked. The Expanded strip is centered on the highlight box in the top half. If you move the highlight box, the ECG displayed in the bottom half changes appropriately.

To change the amount of time that appears in the expanded mode, click in the Display field in the toolbar at the center of the window and select the amount of time to be displayed.

To print a strip of ECG centered on a displayed beat, along with a page of full disclosure of the surrounding rhythm, use the Print button. When the Print window opens, click the left button to print the current beat centered on

the page of full disclosure, or click the middle button to print with the beat on the first line. Click Cancel to close the window without printing.

Measuring in Expanded Page

The two blue vertical calipers can be used to make a variety of measurements. The calipers can be dragged to specific locations on the ECG; clicking on the ECG will also move the closer caliper to the location of the cursor. To move both calipers while keeping them the same distance apart, click on the Both check box in the center toolbar, and then drag them where you want them; click Both again to move each caliper separately.

To keep the calipers in the same locations as you move through different screens of ECG, click the check box next to Lock; the calipers will stay in the indicated locations unless you move them again. Click again to turn off.

To measure the heart rate on the strip, place the calipers two RR intervals apart; the heart rate appears in the HR (2 RR) field. To measure an RR or a PR interval, place the left caliper at the start of the interval and the right caliper at the end of the interval; the time between them appears in the Time field.

To make ST measurements, place the left caliper in the isoelectric portion of the PR interval, and place the right caliper where you want the ST segment measurement to be made; the vertical distance between where the left caliper intersects the ECG and where the right caliper intersects the ECG will appear in the ST field for each channel (labeled ST 1, 2, 3).

If oximetry data is present, it appears in SpO2 data fields to the right of the Display field.

Reviewing the Trends window

Open the Trends window by clicking Trends in the Review toolbar or by selecting Review > Trends in the primary Holter toolbar. The display includes two trend graphs of information from the recording.

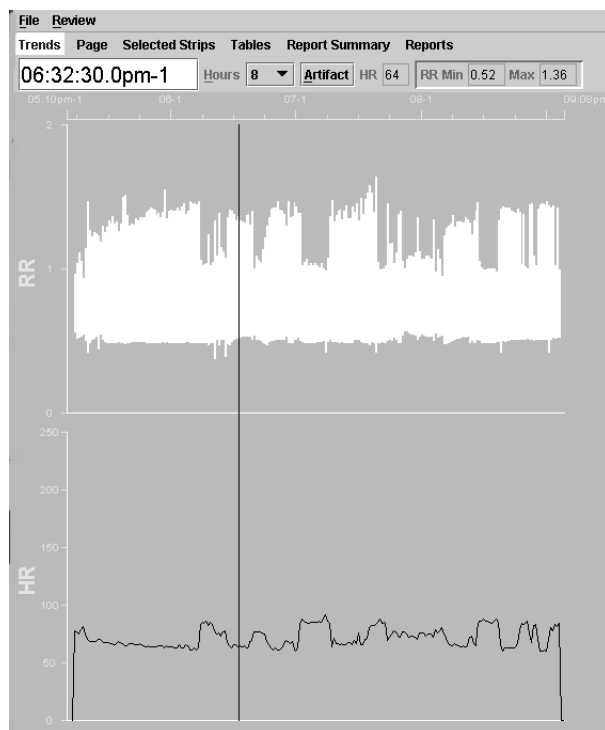
RR Trend

The RR trend shows the range of RR interval measurements throughout the Holter period in one-minute increments. Time-of-day appears on the

horizontal axis, and RR interval length (in seconds) is on the vertical axis. RR intervals are plotted so that the range within each minute appears as a vertical line; the top end of the line indicates the longest RR interval within that minute, and the bottom of the line indicates the shortest RR interval within it.

HR Trend

The HR trend shows heart rate data throughout the Holter period in one-minute increments. Like in the RR trend, time-of-day appears on the horizontal axis. On the vertical axis is heart rate in beats per minute. The information plotted is the average heart rate for each minute.



Trends window

The blue marker

The blue vertical marker is located at the time-of-day of a particular 30-second segment. Click on either trend to move the marker to a different time-of-day. The time-of-day that appears in the large data box indicates the time-of-day at the marker. The data boxes at the top of the display indicate the heart rate (HR), the shortest RR interval (RR Min), and the longest RR interval (Max) in the minute where the marker is located.

Amount of time displayed

You can expand the trends by decreasing the amount of time displayed across a single page. To change the amount of time displayed, click on the arrow in the Hours field and select the number of hours you want displayed per page.

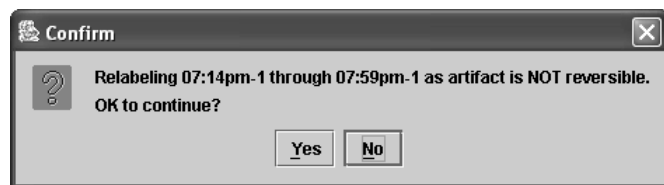
When Hours is set to less than 24 for a 24-hour recording, there are multiple pages of data. To move from one page of data to the next, use either the PageUp and PageDown keys on your keyboard, or the scroll bar at the right edge of the window.

Relabeling artifact

If, after looking at the Holter signal on the screen or on the full disclosure printout, you see that the signal contains long periods of artifact that might be included in the heart rate measurements, then you can relabel those periods as artifact in the Trends window.

Once relabeled as artifact, any signals that the software identified as QRS complexes within that time period will no longer be included in the heart rate calculations or the arrhythmia counts.

To relabel a section as artifact, open the Trends window and, using the mouse to drag from the time-of-day at the start of the artifact to the time-of-day where it ends, select the period you want to relabel artifact. It will turn pink. Then press the Artifact button. When the confirmation window appears, click Yes to relabel it artifact.



Confirm window

To close the confirmation window and cancel the relabel, click No.

Reviewing Saved Strips

In addition to printing out full disclosure, the report can include full-size, 7.5-second, 25 mm/sec strips on a background grid. Four types can be saved automatically: Minimum HR, Maximum HR, Event/Diary entries, and a sample strip for each hour of the recording. You can also manually save strips while reviewing the Holter in the Page window (see “Saving sample

strips for the report” earlier in this chapter).

To review the saved strips before printing the report, click Saved Strips in the Holter menu.



Two strips in Saved Strips window

The Saved Strips window displays a miniature version of the strips 12 at a time. Each is labeled with its strip label and the time-of-day at which it occurred. If you have saved lots of strips manually in the Page window, you can page through them using either the PageUp and PageDown keys or clicking on the up and down arrows of the scroll bar.

The strips are initially sorted by strip label. If you would rather review them ordered by time-of-day, select Time from the choices in the Sort field.

Changing the active strip

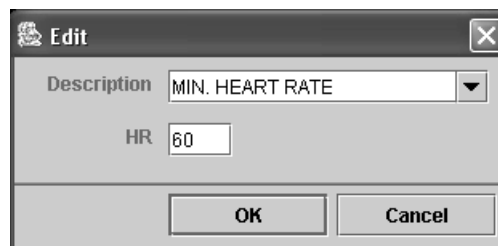
At any time, there is only one active strip, the strip outlined in blue. Three fields above the strips refer specifically to the active strip and cannot be changed. Those fields include time-of-day, a strip number, and heart rate.

To change the active strip, click on the one you want so that the outline surrounds that one. You can also change the active strip by clicking the List button in the toolbar to open the List window. The List window lists each strip label and corresponding heart rate in order of time-of-day. To display a particular strip from the list, click on the appropriate entry on the list and press OK, or double-click on the entry. To

exit without changing the active strip, press Cancel.

Editing a strip label

To change the label of the active strip, click on Edit in the toolbar. The Edit window opens; it includes a field with the current label of the strip and the heart rate of the ECG in the strip.



Edit window in Saved Strips

You can either type over the existing strip label in the Description field or select an alternate label by clicking on the arrow at the right end of the Description field and selecting a label from the displayed list.

To change the heart rate on the strip, click on the HR field and type over the existing entry.

When you have completed your changes, click OK to save those

changes and exit; click Cancel to exit without saving any changes.

Deleting strips

If you decide to delete one or more of the strips from the final report, you can do that in the Saved Strips window. To delete one strip in the Multiple strip display, click on it to make that strip the active one, then click Delete in the toolbar. To delete more than one strip, click on the first strip to make it the active strip; in addition to the blue highlight around the strip, there is also a yellow highlight around the time-of-day, indicating that the strip is selected. Click on any additional strips you want to delete, then click Delete in the toolbar. All of the selected strips (as indicated by the yellow highlights) are now deleted.

When you delete a strip, its label becomes red; strips with red labels are not included in the printed report. To retrieve a deleted strip, click on it and then click Delete in the toolbar again; the label text changes back to yellow.

To delete all of the strips displayed, click the button labeled Del/Undel All. All of the strip labels turn red. To retrieve all of the strips displayed, click the button again.

Deleting channels from a strip

To delete one or more channels of a strip, but not the entire strip, click on

the strip to make it active. Then, click on one of the check boxes labeled Channel 1, 2 and 3. For a particular strip, if a check is present, the channel will be included; if a box is not checked, the channel will be deleted.

To delete the same channel from all strips, delete the channel from the active strip, then click All. When the Confirm window appears, click Yes to delete the channel(s) from all strips. Click No to cancel the All command.

Replacing a strip with an alternative

The maximum and minimum heart rate strips that are saved automatically by the software can be replaced by an alternative. The software selects sample strips for those types automatically. If you would prefer to select a different one (perhaps because the selected one contains artifact), click on the strip to make it active; the Alternatives button appears.

When you click Alternatives, the Alternatives window opens, displaying other choices for that label. The strips are sorted by heart rate, with the current selection the first one, in the upper left corner.

To select a different strip, click on the strip and then the Select new Alternative button. The window closes and the new strip appears in the Saved Strips

window. To exit from the Alternatives window without changing the strip, click the Back to Saved Strips button.

Measuring

The data fields in the center of the toolbar - HR (2 RR), Time, and the ST indicators for each channel - contain data calculated based on the two blue calipers in the active strip, just as they do in the Page window. As you drag the blue calipers, those fields change, reflecting the new caliper positions.

To measure a two-beat heart rate, place the calipers two RR intervals apart; the measurement appears in the HR (2 RR) field. To measure ST in any of the channels, position the left caliper in the isoelectric area of the PR interval and the right caliper where you want to make the ST measurement; the measurements for each channel appear in the appropriate fields.

To move the calipers keeping them the same distance apart, click the check box next to Both and then drag the calipers. Click Both again to remove the mark and move them separately.

To keep the calipers in the same locations as you move through different screens of ECG, click the check box next to Lock; the calipers will stay in the indicated locations until you move them again. Click again to turn off.

Printing the ECG now

To print a strip of ECG centered on a displayed beat, along with a page of

full disclosure of the surrounding rhythm, use the Print button. When the Print window opens, click the left button to print the current beat centered on the page of full disclosure, or click the middle button to print with the beat on the first line. Click Cancel to close the window without printing.



Print choices

Expanding the active strip

To view a strip more closely, either click Single in the toolbar or double-click on the strip. It then fills the Saved Strips window. Each beat is labeled with either the heart rate (BPM) or the length (in milliseconds) of the RR interval following the beat.

The blue measurement calipers and the related data fields work in this window as described in the previous section, “Measuring.”

All other buttons and fields work in the Expanded display just as they do in the Multiple strip display. Use PageUp and PageDown to display the other strips. To return to the Multiple strip display, click Multiple in the toolbar.

Note: Saved Strips are re-compiled after every update or re-analysis, so be sure to make changes to the automatically saved strips only after you have completed all other editing. Any editing of strips that occurs before an update or re-analysis will be lost.

Reviewing Tables

The Tables window consists of a General table and optional Oximetry tables (the Oximetry tables appear only for recordings with oximetry data):

- **General** - This is an interval table that lists the time-of-day at the start of the interval; the low, mean and high heart rates calculated during the interval (see the appendix for details of heart rate calculations); the total number of beats identified and counted in the interval (this excludes periods of artifact); the amount of time analyzed (this also excludes artifact); the total number of SVPBs; and the total number of VPBs.

(and percentage of the monitored period) was spent with certain heart rate ranges.

- **Desaturation table (optional)** - The table indicates the start time, end time and duration of each detected desaturation event. The parameters defining desaturation events are determined by the oximetry settings accessible in Patient > Patient Information > Settings > Oximetry.

Editing table entries

To edit information in the General table, you can use either the Edit or the Zero button; the Oximetry tables cannot be edited. In the General table, the

Edit button opens the Interval Table Edit window that allows you to change information within the

data fields for a particular interval. To

	Low HR	Mean HR	High HR	Total Beats	Time Analyzed	SVPB Total	VPB Total
1 05:10pm-1	60	68	75	3147	00:45:51	2	1577
2 06:00pm-1	69	69	103	4194	00:59:59	1	1994
3 07:00pm-1	77	77	103	4626	01:00:00	1	1971
4 08:00pm-1	74	74	104	4447	00:59:54	1	1957
5 09:00pm-1	76	76	100	647	00:08:27	0	254
Total	60	72	104	17061	03:54:13	5	7753

General table in Tables window

- **SpO2/HR summary (optional)** - The table lists minimum, maximum and mean SpO2 and heart rate values for the monitored period.
- **SpO2 summary (optional)** - The table indicates how much time (and percentage of the monitored period) was spent within certain SpO2 ranges.
- **Heart rate summary (optional)** - The table indicates how much time

Interval Table Edit window

use the Edit button, click on an interval to highlight it, then click Edit.

Within the Interval Table Edit window, you can click in any data field to type in your changes. Highlight an existing entry and type over it, or click to the right of the entry and backspace to eliminate it and then type your entry.

Editable fields appear with data against a white background. Those you cannot edit have a blue background; these include time-of-day at the start of the interval, time analyzed, total number of beats, total paced beats, total VPB count, total VTAC runs, total VTAC beats, total SVPB count, total SVT runs, total SVT beats, and the VTAC and SVT heart rates. The total beat

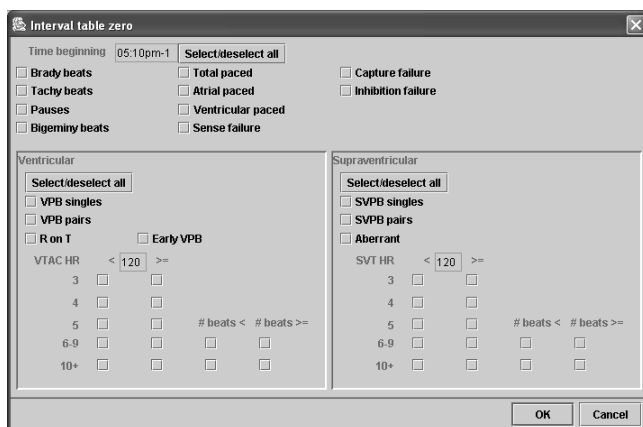
To save your changes and exit, click OK. To exit without saving changes, click Cancel.

Note: *The VPB and SVPB total beat counts are the only ectopy data that appear in the General table in the Tables window. To change those totals, you must enter new data in the singles, pairs or runs fields.*

To completely eliminate all information within an interval, use the Zero button, which opens the Interval Table Zero window. In that window, each data field has an associated check box that determines whether to include or exclude the data for that field in the table. To zero data for a particular field, click on the check box so that a check mark appears. Click again to remove the check mark.

Click on as many data fields as you want zeroed out, then click OK to exit. Click Cancel to exit without saving any changes.

Select/deselect all buttons are available for each section. Use them to turn on or off all data fields within a section - general information, ventricular or supraventricular.



Interval Table Zero window

counts are not editable because they are calculated from other field data present in the table; as you make changes to the other fields, the total counts change appropriately.

Note: *Be sure to make any changes to the tables carefully. Incorrect information entered in this window can cause inconsistencies in the printed report.*

Printing the General table

To print the table, click Print to open the Print window, which should list your printer type and default to one copy. Click OK to print. Click Cancel to close the window without printing.

Closing the Tables window

Click OK to close the Tables window.

4 PRINTING

The Holter LX Basic software generates printed reports composed of report modules that can be included or excluded, along with full disclosure of all or part of the Holter data. Modules can be selected individually, and include the first page with clerical information, the second page containing typed comments, and a list of diary entries for the patient, along with sample strips in either standard 25 mm/second format or half that size. Full disclosure of any interval can also be included. If oximetry data was recorded for the patient, oximetry modules can also be included in the printed report.

Final Report

Choosing report modules

To access the report modules that can be included in the final printed report, select Reports from the Review toolbar to open the Reports window. The modules that are available for the current patient are listed in the right half of the Reports window; if the optional Oximetry modules appear, oximetry data was saved during the recording. The modules include:

- **Patient Information.** This is the standard front page, with a report heading, the information entered in the Patient Information window, and the Report Summary.
- **Comments Page.** This also contains some clerical information about the patient, along with a large area for comments that were typed in the Comment window of the Report Summary.
- **List of Diary Events.** This lists the time-of-day and symptom for each entry in the Diary Symptoms window accessible from the Patient Information window.

	Reports
Patient Information	<input checked="" type="checkbox"/>
Comments Page	<input type="checkbox"/>
List of Diary Events	<input type="checkbox"/>
Half-Sized Strips	<input type="checkbox"/>
Full-Sized Strips	<input type="checkbox"/>
SPO2 Trend 24 HR	<input type="checkbox"/>
SPO2 Trend 2 HR	<input type="checkbox"/>
SPO2 and HR Summary	<input type="checkbox"/>
SPO2 Values and Full Disclosure	<input type="checkbox"/>
SPO2 Trend and Full Disclosure	<input type="checkbox"/>

☐ All on/off

Report module list in Reports window

- **Half-Sized Strips.** This presents the sample strips in a 50 mm/second format that allows 14 strips per page.
- **Full-Sized Strips.** This presents the sample strips in a 25 mm/second format, with three strips per page.
- **SpO2 trend 24 hours (optional).** This prints a compressed trend of oximetry and heart rate data, with 24 hours across one page.
- **SpO2 trend 2 hours (optional).** This prints an expanded trend of oximetry and heart rate data, with 2 hours across each page.
- **SpO2 and heart rate summary (optional).** This table presents the minimum, maximum and mean SpO2 and heart rate values for the monitored period.
- **SpO2 values and Full Disclosure (optional).** This prints two-channel full disclosure of the ECG annotated with SpO2 values.
- **SpO2 trend and Full Disclosure (optional).** This prints full disclosure of the ECG, along with a trend of the SpO2 data at that time.

To include a module in the report, the check box next to the module name in the Reports window must contain a check mark. Click an empty box to add a check mark, and click a check mark to remove it. To turn all of the modules on or off, click the All On/Off check box under the report module list; to change them all again, click the All On/Off check box again.

Including a heading on the front page of the report

The Patient Information module of the report includes a report heading so that you can customize the report for your facility. The heading consists of five lines of freeform text, with up to 34 characters per line. To enter text in a line, click on the field and type your entry. Click on each field in turn and type. You can leave any line blank.

The screenshot shows a window titled "Report heading" with a "List" button. Below the button is a list of five text fields containing the following text:

NORTHEAST MONITORING
Two Clock Tower
Suite 360
Maynard MA

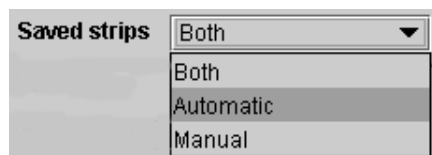
Report heading in Reports window

If your address comes up automatically, but you would like to change it for a particular patient, click on the field, use the Delete/Backspace keys to clear what is there, and then type your entry.

To select an address from a different configuration (i.e., one you entered previously, but did not select when you started this new patient), click the List button. That opens the Report Headings window listing your options. Click your choice to highlight it, then click Copy to close the window and replace the address.

Selecting which strips print in the report

Although both manually saved (those saved using the Keep button in the Review windows) and automatically saved strips appear in the Saved Strips window, they do not all need to be included in the final report. To include just the automatically saved strips, open the Reports window and select Automatic in the Saved strips field. To include just the manually saved strips, select Manual for that field. To include both types, select Both.



Choices for Saved strips

If the final report is printed including either the half-sized or the full-sized strip module, it will include only those strips designated in the Saved strips field of the Reports window.

Full disclosure

Full disclosure is a printout of all the ECG recorded during the Holter monitoring period, in a miniaturized format. Each page is annotated with time-of-day along the left margin.

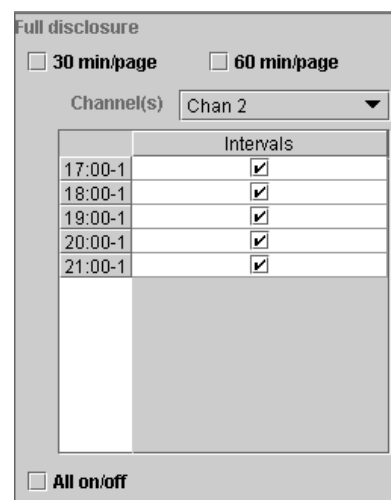
You can print full disclosure in a variety of formats based on the channels printed and the amount of time printed on each page. Full disclosure can be

printed for a single channel (channel 1 or 2 or 3) or for two channels together on a page (channels 1 and 2, or channels 1 and 3, or channels 2 and 3). It can be printed with 30 minutes of ECG per page or 60 minutes.

Determining what to print in full disclosure

To request a full disclosure printout, select Reports from the Review toolbar. In the Reports window, there is a section with settings that control full disclosure. It includes three fields:

- Time per page check boxes.** At the top of the section are two check boxes labeled 30 min/page and 60 min/page. To print full disclosure, there must be a check mark in one of these check boxes. Click on the check box to make a check mark appear in it; click on the other check box to put the check mark there and remove it from the first check box. To eliminate a check mark, click again on the check box.



Full disclosure area in Reports window

- **Channel(s) field.** To indicate what channel(s) to print in full disclosure, select an entry from the Channel field. Click on the arrow to display your choices, and then click on your selection.
- **Intervals to include.** Full disclosure can be printed for each hourly interval, all of the hourly intervals, or whatever combination you select. For each Holter test, the Intervals field lists all hourly intervals in the recording. To include an interval in the full disclosure printout, click on the check box next to the time-of-day at the beginning of the interval. Click on as many intervals as you would like to print. To eliminate an interval from the printout, click on the check box to get rid of the check mark. To check all intervals on or off, click on the All On/Off check box below the interval list.

Note: *The time per page check boxes control how much total ECG is printed per page. If you choose to print two channels of ECG, the 30 min/page setting will print both channels during a 15-minute time period, and the 60 min/page setting will print both channels of a 30-minute time period.*

Reviewing the Report Summary

A report summary is printed on the front page of the printed report. An optional comment page can be printed as the second page. To review and edit the information that appears on those pages, select Reports > View Summary. Unless there is oximetry data recorded for the patient, the standard Report Summary appears.

Report Summary			
Monitored time:	3:58 hours		
Start time:	5:10PM1		
Mean Heart Rate:	73		
Maximum Heart Rate:	104 at	8:30:53PM1	
Minimum Heart Rate:	60 at	5:15:28PM1	

COMMENTS:			

Standard Report Summary

Information in the standard Report Summary includes:

- the length of time the patient wore the Holter recorder
- start time
- mean heart rate, calculated by dividing the total number of beats by the time analyzed
- maximum heart rate measured, based on a four-beat running average
- time-of-day at which the maximum heart rate was observed
- minimum heart rate measured, based on a four-beat running average

- time-of-day at which the minimum heart rate was observed

If oximetry data was recorded for the patient, the oximetry Report Summary appears.

Report Summary

START TIME: 9:13AM TOTAL TIME: 16:01 hrs. TIME ANALYZED: 15:39 hrs.

SUMMARY TABLE			
SpO2 Level (%)		Heart Rate (BPM)	
Minimum	78	50	
Mean	92	76	
Maximum	100	121	

SATURATION PROFILE			HEART RATE PROFILE		
SpO2 Level	Time	Percentage	Heart Rate	Time	Percentage
100 - 95%	6:29:30	44.17	> 160	0:00:00	0.00
95 - 90%	4:10:48	28.44	160 - 140	0:00:00	0.00
90 - 85%	1:05:30	7.42	140 - 120	1:59:36	12.73
85 - 80%	2:53:12	19.64	120 - 100	0:00:03	0.01
80 - 75%	0:02:42	0.30	100 - 80	4:38:34	29.64
75 - 70%	0:00:00	0.00	80 - 60	7:00:01	44.71
< 70%	0:00:00	0.00	60 - 40	2:01:19	12.91
< 90%	4:01:24	27.37	< 40	0:00:00	0.00
< 89%	4:00:24	27.26			
< 88%	4:00:06	27.23			
< 87%	4:00:00	27.21			
< 86%	3:58:00	26.98			

Comments:

Oximetry Report Summary

Editing the Report summary

The Report Summary window displays the information exactly as it will appear on the front page of the report. Every character can be edited, if you choose to do so. You can select the text and then delete it or type over it, or you can simply add to the information that is already there.

Phrases

This patient exhibited first
This patient exhibited inter
This patient exhibited nor
This patient exhibited sec
This patient has a pacema

◀ ▶

Add

Summary phrases

To add comments to the end of the summary, click after **Comments:** and then either type the comment or select a line from the Phrases window in the left portion

of the window; after selecting the phrase, click Add to copy it over into the Comments area.

The Phrases list appears only if you entered at least one sentence in Patient > Preferences > Summary phrases.

Note: Because the printed report includes the information from the Report summary exactly as it appears here in the Report Summary window, be sure to make changes carefully.

To access the additional Comment window, click the Comment button, then type the information you would like to appear on the Comments page of the report (typically page 2).

Click Front page to return to the previous Report Summary window, the one that appears on the front page.

If you start making changes to the text in the Report Summary window, but then decide you would like to revert to the original information, click the Redo button; your changes to the Report Summary window will be deleted and the text will return to the original.

To print the Report Summary before inclusion in the final report, click Print to open the Print window, and then click OK to print it. Click Cancel to close without printing.

When the information in the window appears as you would like it, click OK

to save your changes and exit. Click Cancel to exit without saving your changes.

Note: *The Report Summary is newly compiled after any update or re-analysis, so do not make changes here until all other editing is complete. If you make changes and then update or re-analyze, you will have to re-enter your changes.*

Status indicators

Note that the Status indicators from the Patient Information window also appear here in the Reports window. Use them to keep track of whether a patient's Holter has been edited, printed, and/or verified already. Click the check box to add or remove a check mark.

Reviewing the report

To review the report on-screen before printing it, click Review at the bottom of the Reports window. The report compiles and then is displayed using Adobe Acrobat, starting with page 1. To view more pages of the report, use the scroll bar or use the PageUp and PageDown keys.

Note: *The report cannot be edited or changed in any way in this display mode, but you can go back to the Review methods (Saved Strips, Page, or Trends) or to the Patient Information or Report Summary windows to make changes before printing the final report.*

Note: *Although you can choose to print the report from the Acrobat file displayed using the Review button, you must ensure that the Adobe Acrobat settings are appropriate for the Holter report. In File > Print, (1) Print as Image must be turned on and (2) Expand small pages to paper size (version 5) or Fit on page (version 6) must be turned off. Printing the report without the proper settings will result in a non-diagnostic-quality printout.*

You can also use Adobe Acrobat to create the report if you want to send an electronic version of the report to a different site that has no Holter LX software. By sending the pdf file created by Adobe, the other site can use Acrobat Reader software to print the report. Again, be sure to use the appropriate Adobe Acrobat settings described above before creating the report.

Printing

When the fields within the Reports window are set properly for a patient, click the green Print button at the bottom of the window to compile and print the report. If you turned on some of the report modules, those print first, followed by any full disclosure you have selected.

To cancel printing after clicking the Print button, click Cancel. Whatever portion of the report that has been compiled prints, and then the rest of the report is canceled.

Note: Sometimes when you click the Print or Review buttons in the bottom of the Reports window, a confirmation window appears asking, “OK to review the previously compiled report?” That means that a report has already been compiled for this patient’s Holter test. If you are sure that no changes have been made to any Holter setting or any information in the report, click Yes to print a report identical to the previously compiled one. If you are unsure whether any changes have been made, click No; a new report will compile and then print.

At any point after printing the report, you can still edit the information and retrieve additional strips, and then print out the report again.

5 PREFERENCES

You can customize certain parts of the Holter LX Basic software to better suit the needs of your facility. The customization options range from entering the names of physicians who order Holter tests - so that you don't have to type them in each time - to which Review window you want to come up automatically at the end of analysis.

Preferences window

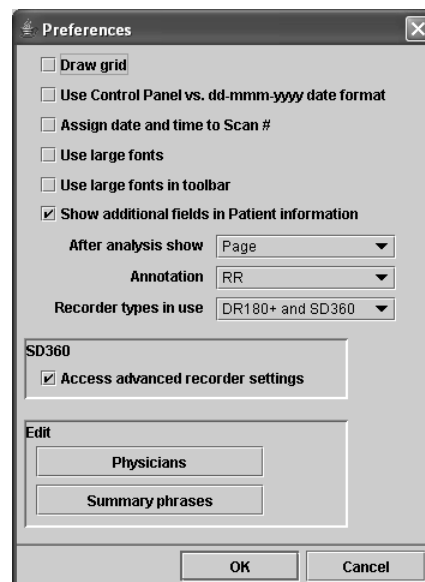
To open the Preferences window, select Patient > Preferences.
These customization options are available:

Draw grid

You can choose whether or not there is a background grid behind the Expanded strip displayed in the Page window. Click on the Draw grid check box to change the setting. A check mark indicates that a light grid will appear. No check mark means that the grid will not appear.

Use Control Panel vs. dd-mmm-yyyy date format

To use the date format used throughout your computer system instead of the format provided by Northeast Monitoring, put a check in this check box.



Preferences window

To change the date and time format used by your computer system, select either: (1) Start > Settings > Control Panel > Regional and Language Options or (2) My Computer > Control Panel > Regional and Language Options. Use the Customize button and the

12-Feb-1900

NorthEast date format

Assign date and time to Scan

This indicates whether a Scan # is automatically assigned to a patient record. When this feature is turned on, a date-and-time stamp is entered in the Scan # field whenever a New patient is created.

This setting also allows an auto sequencing feature that includes a combination of the date/time stamp plus an assigned number (starting at 00001) in the Scan # field. To implement the auto sequencing feature, you must change the entry in the Scan # field in the Configuration program. For details, see Chapter 7: Configurations.

Use large fonts

This determines the size of the font used throughout the software. A check mark indicates that a large font is used for all menu items, selections and text.

Use large fonts in toolbar

This determines the size of the font used in the Holter Review toolbar. A check mark indicates that a large font is used for the Review items.

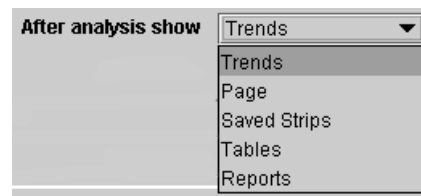
Show additional fields in Patient Information

The two fields Interpreting physician and Analyst in the Patient Information window are optional. If you want them to appear in the Patient Information window and on the front page of the final report, this setting should be on. If

you do not want them, this setting should be off.

After analysis show

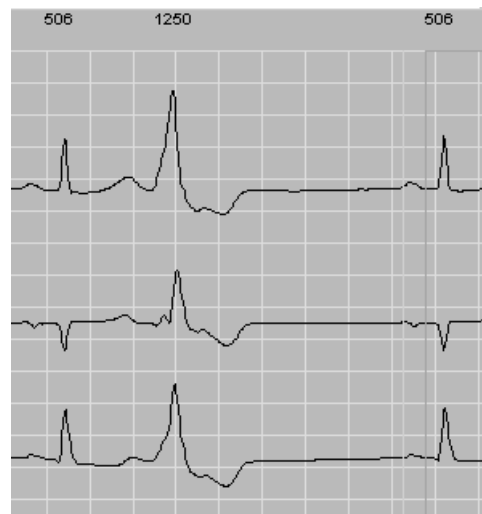
This field allows you to determine which window is displayed upon the completion of analysis. Your choices include any of the Review windows and the Reports window. To change the setting, click on the arrow in the field to display the list of choices, then click on your selection.



Choices for display after analysis

Annotation

Indicate here whether the beats in any on-screen, expanded strip should be labeled with a beat-by-beat heart rate or RR interval length. The annotation



Beats with RR interval annotation (in milliseconds)

refers to the RR interval starting at the R-wave under the label.

Click on the arrow in the field to display your choices. Click on your choice to select it.

Recorder types in use

This should be set based on whether you use DR180+ or SD360 recorders, or both. Select one of the following: DR180+ and SD360, DR180+ only, or SD360 only. This setting determines what your choices are when you go to format a flashcard/SD card before recording a new patient.

Access advanced recorder settings

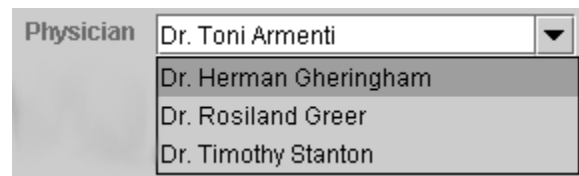
This should be on (with a check mark) so that you can make changes to how the SD cards are formatted for use in the SD360 recorder. If you want to not allow changes to the format used, turn this setting off (no check mark).

Entering physician names

You are able to customize the entries for the Physician field in the Patient Information window that appear in the patient information area of the printed report. Entries in that field can be preset so that you can make a selection from a list instead of typing the physician name in for each Holter test.

To add a name to the list in the Physician field of the Patient window, go to

Patient > Preferences > Physicians. In the Edit physician name window, click on the first line and type the name as you want it to appear in the report. To enter another name, click on the line below the first and type that name. Use the scroll bar to access additional lines. When you have entered as many names as you need, click OK to close the Edit physician names window.



Physician list in Patient Information

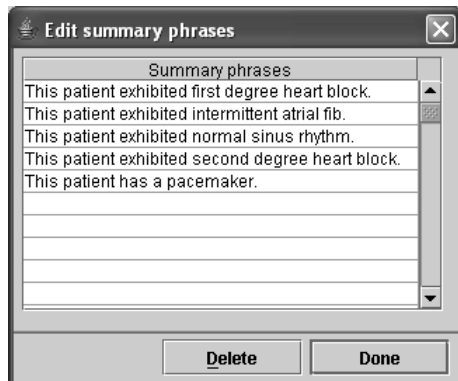
To exit without saving changes, click Cancel. To delete an entry, click on the line so that the field is outlined and then click Delete.

Summary phrases

You are able to customize entries for the Comments area of the Report Summary section of the printed report using this button.

To add a sentence, select Patient > Preferences > Summary phrases. Click on a field and type a sentence as you want it to appear in the Report Summary. When all sentences are complete,

click Done. To delete a line, highlight it and then click Delete.



Edit summary phrases window

The sentences will be available for you to select when you display Reports > View Summary, so that you don't need to re-type common phrases.

6 MANAGING PATIENT REPORTS

Making room for new patients

When the software has saved the maximum number of patients allowed by your system, you must delete old patient reports to make room for new ones. If you want to archive an electronic version of each report, make sure you back up a patient report before you delete it.

To delete a patient report from the patient list, go to Patient > Open to display the list of patient records currently in the Holter LX software. In the Open Patient window, click on a patient name to highlight it and click the Delete button. When the Confirmation window appears, click Yes. That slot in the list will now be available the next time you select Patient > New.

To delete multiple sequential patient reports in the Open Patient window, click on the first report to be deleted, then drag down to the last one you want deleted. With multiple patient names highlighted, click the Delete button. When the Confirmation window appears, click Yes.

To close the Confirmation window without deleting any patient reports, click No.

Backing up patient reports

To back up patient reports in the directory before deleting them to make room for new patient reports, go to Patient > Open and click the Backup button to open the Backup window, which displays the Backup tab.

From the list of patients in the top half of the Backup window, click on the patient report you want to back up; if your patient list is longer than the window display, use the scroll bar to display additional patient reports. To back up multiple sequential patient reports, click on the first report to be backed up, then drag down to the last one you want backed up. With the appropriate patient(s) selected (that is, highlighted), click Backup again. A condensed version of the report is created and saved.

What gets saved

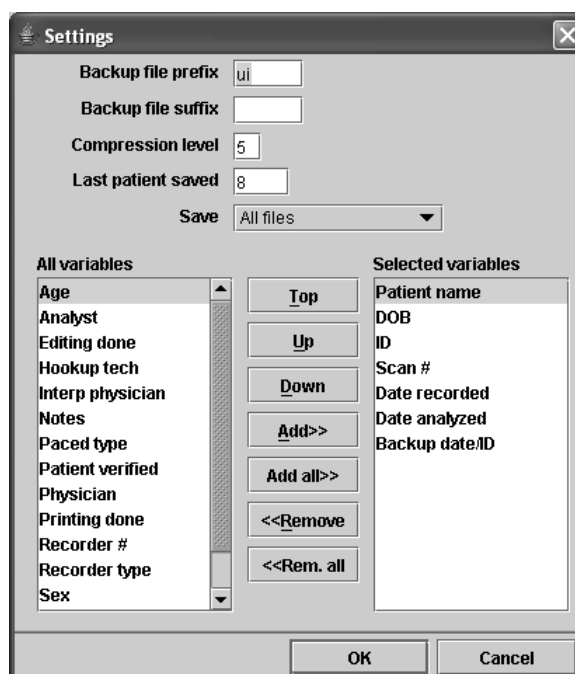
To determine how much of the patient data is saved in the backed up report, the program refers to the entry in the Save field of Backup > File > Settings.

The Save field in the Backup Settings window contains two choices: (1) “All files” will compress all patient data, including the entire Holter recording; and (2) “Reports only” will save an electronic version of the patient’s printed Holter report, including ECG strips, but not the entire recording. By doing an “All files” (full) backup, the

patient’s Holter data can be re-analyzed at a later date.

To change the entry, click on the arrow to the right of the field and then click on your choice. Click OK to close the Settings window. The type of backup report to be saved appears in the Save field of the Backup tab.

Once a patient report has been backed up, the type of backup is indicated in both the Open Patient window and in the Status window within the Patient Information window. In the Open Patient window, a full backup is indicated as “Full” in the Type column; a backed up report is indicated as “Report.” In the patient’s Status window, the Backup field displays either “Full” or “Report.”



Settings window in Backup

Automatic file name

The file name of the backed up report is automatically assigned as a number followed by the “zip” extension. The assigned number is the one following the entry in the Last patient saved field of the Backup Settings window. The software automatically keeps track of the numbers it assigns and updates this field, but you can over-ride it by entering a different number and clicking OK.

Note: Make changes here carefully. If you enter a new number that is smaller than the number listed, the backup process will reuse a file name and overwrite the previously saved patient report. The previously saved patient report will be permanently lost.

Assigning a backup file name

The Settings window in the Backup program allows you to include a prefix or suffix on the numeric file name given to a backup report. If you assign a prefix or suffix to a particular patient group (for example, all the patients of a particular physician) this feature means that later you can easily identify which reports are in that group.

To include a prefix or suffix to the backup file name, enter up to four characters in the appropriate field of the Settings window before saving the patient report. If no prefix or suffix is specified in the Settings window, the backup file name will be the next sequential number in the backup series, with the extension “zip.”

The size of a backup file

The Compression level field of the Settings window in Backup allows you to control the amount of compression performed when saving the backup file. The range is from 1 to 9, with 1 being the least compressed and 9 the most compressed. That makes 1 the quickest backup process, and 9 the longest.

Customizing the Backup directory

The Backup directory (on the Backup tab of the Backup program) can be customized to include only those fields you need to track your patients’ backed up records. Use the fields and buttons in the bottom half of the Settings window to establish which fields appear as column headings in the Backup directory. Those variables (headings) in the left-hand column will not be included; those in the right-hand column will be included. Use the buttons in the center - Add, Add all, Remove, and Remove all - to move variables (headings) from one column to the other. Rearrange those in the right-hand column using the other buttons in the center - Top, Up, and Down.

Note: We recommend that if you customize the Backup directory, you do so only before backing up any patient records. Inconsistencies will result if you back up some reports using one set of headings and other reports with a different set of headings.

Where the backup file is saved

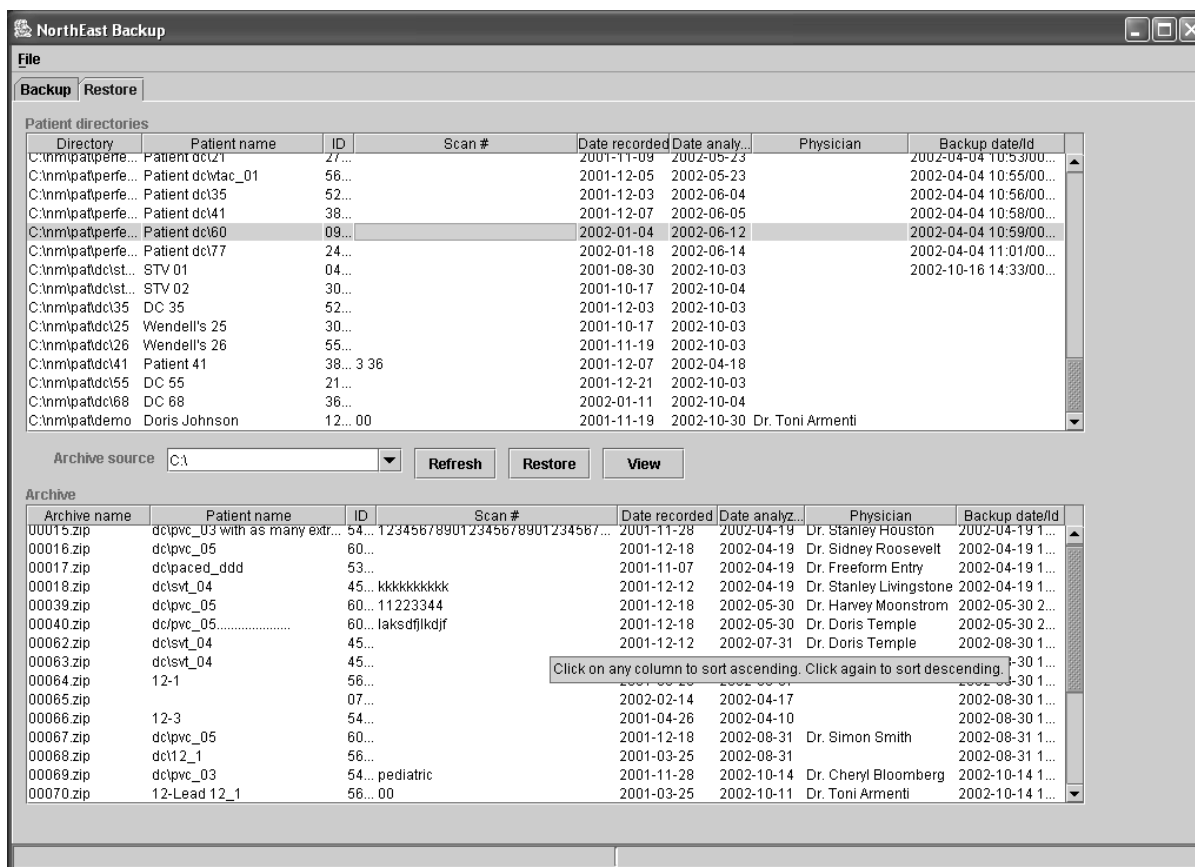
In the Backup window, the Archive destination directory field indicates what device and directory will store the backup file. The setting defaults to \nm\backup on your hard drive. To save the backed up report elsewhere, select a device from the list associated with the Archive destination directory field and type in the appropriate directory name before clicking on the Backup button.

See the sections about archiving reports on CD using Roxio Easy CD Creator later in this chapter for details about moving the files in the backup directory to permanent storage.

Retrieving a backed up patient report

To retrieve a patient report that has been backed up, go to Patient > Open, then click on the Backup button. The Backup window opens, with two tabs at the top. Click on the Restore tab to open the Restore window.

In the Archive source field, select the drive on which the patient reports are backed up. Any reports the software finds on that drive will be listed in the bottom portion of the window. In that bottom portion, click on the patient report you want to retrieve; in the top portion, click on the patient slot where



Restore tab in Backup window

you want the retrieved report to go. The patient report in that slot will be over-written, so be sure to select the slot carefully. Then click Restore. When the Confirmation window appears, click Yes to retrieve the backed up report. Click No to close the Confirmation window without retrieving the report.

Click on the X in the red button at the top right of the Backup window to close it.

Note: *You can retrieve only the same type of report you backed up. If you backed up a Full report, all the Holter data is there for you to re-analyze, if necessary. If you backed up a Report, only an electronic version of the printed report is available, and re-analysis is not possible.*

Additional features in the Backup window

The Backup and the Restore tabs of the Backup window also include these buttons, which function as indicated:

Refresh: Redisplays patient report lists, reflecting any changes.

View: Allows you to select a backed up report and view it on-screen without restoring it onto the current Patient List. Once it's displayed, you can also print the report.

Copy to clipboard: Allows you to export a patient's backed up report to a spreadsheet. For details, see the section "Using a spreadsheet to keep track of archived data," later in this chapter.

Using Roxio software to archive records on CD

The Backup program built into the Holter LX software can be used to archive patient reports onto a compact disk using Roxio Easy CD Creator software. During the procedure, the patient files are copied from the system's hard disk, compressed, and saved to CD. There are two requirements: (1) the Roxio software must be installed on your system's hard disk and (2) your system must have CD drive that can write to CD.

As a general rule, each 700-MB CD can hold about 10 to 15 full patient reports (called "Full" in the Backup Settings), including 24 hours of editable ECG, or between 200 and 300 partial records (called "Reports" in the Backup Settings) that include the entire Holter report, but not the full editable ECG.

You have two options for backing up:

- copying a group of zipped patient files at a single session onto a CD, using a format that is more likely to be accessible by any computer system; or
- copying zipped patient files at multiple sessions to a CD that is considered a direct device, using a format that perhaps will not be supported in the future.

Note: *We recommend that the former approach be used when backing up patient reports for permanent archival. That approach is described first in the following documentation.*

Backing up a report on CD - single session

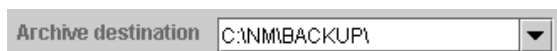
The procedure consists of three steps:

1. using the Holter LX Backup software to compress patient files and save them in a temporary location (this step was already covered in a previous section, but is also included in the following instructions),
2. using Roxio software to copy the compressed files to CD, and
3. deleting the compressed patient files from the temporary location.

Compressing Holter data for backup

To start the backup procedure:

1. Launch the Holter LX software.
2. Select Patient >Open.
3. Click Backup to open the Backup window, which displays the Backup tab.
4. In the Destination field, enter the device and directory in which backed-up files will be stored temporarily. Use c:\nm\backup.



Archive destination field in Backup window

5. In the list of patients, click on the patient report you want to back up; if your patient list is longer than the window display, use the scroll bar to display additional patient reports. To back up multiple sequential patient reports, click on the first report to be

backed up, then drag down to the last one you want backed up.

6. With the appropriate patient(s) selected (that is, highlighted), click Backup again. A small Backup status window opens, displaying the current compression step.



Backup window displayed during compression

7. When compression is complete and the files have been transferred to the \nm\backup directory, the status window closes. You can continue with formatting the CD.

Note: For details about what files get compressed and assigned file names, refer to the “Backing Up Patient Reports” section earlier in this manual.

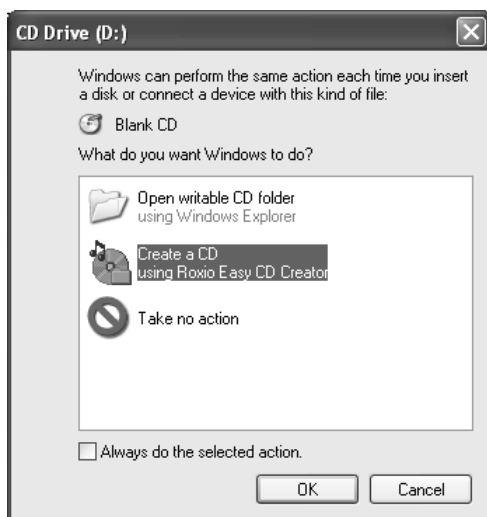
Copying to CD

To copy the zipped files produced by the backup program onto CD:

1. Insert a blank, writable CD-R (not CD-RW) into the drive. Explorer opens a CD Drive window asking how to proceed.

Note: Although it is possible to use a CD-RW for backup, it requires a prolonged formatting period and is more expensive. Because the backup procedure is intended to be permanent storage of patient records, there is no advantage to using CD-RWs.

2. If an Explorer window opens asking how to proceed, select the choice “Create a CD using Roxio Easy CD Creator” to launch the Roxio Easy CD Creator software. If an Explorer
4. The middle menu choice is “data CD project.” Click that. The Data CD Project window opens, as shown below.

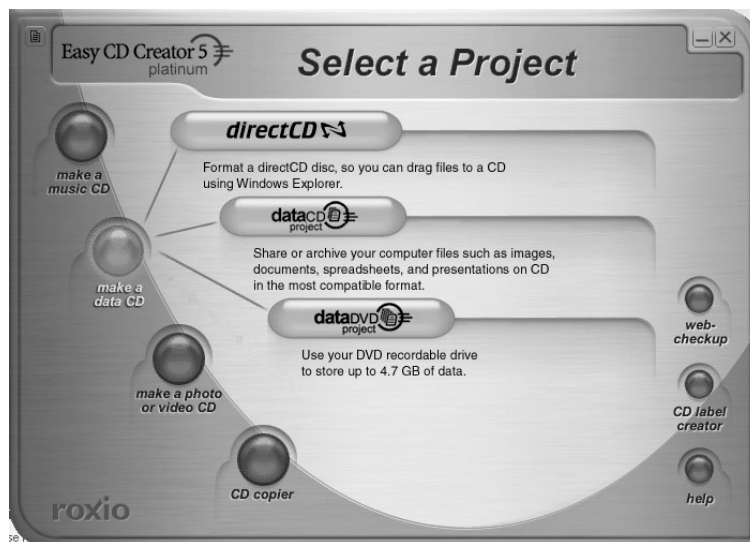


Explorer's CD Drive window

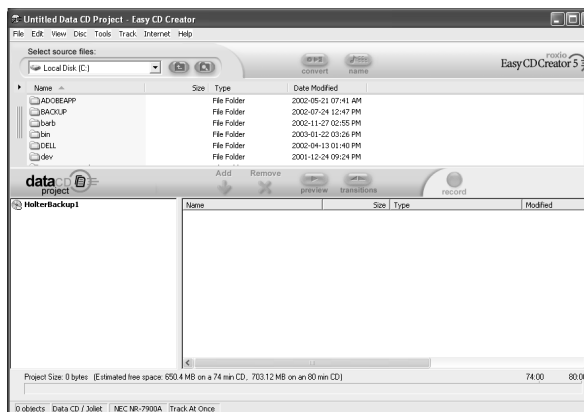
window does not open, launch the Roxio Easy CD Creator from your Start > Programs menu.

3. The Roxio main menu appears.

Place the cursor over the button labeled “make a data CD” so that additional menu choices appear as shown to the right.

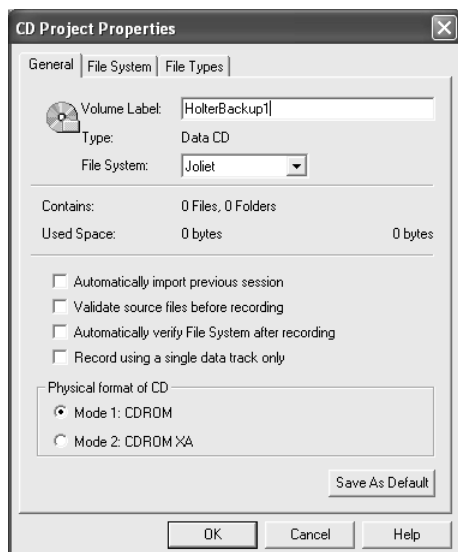


Main menu of Roxio Easy CD Creator



Data CD Project window

5. Select File > CD Project Properties to open the properties window as shown below. Type the label you want for the CD in the Volume Label field.

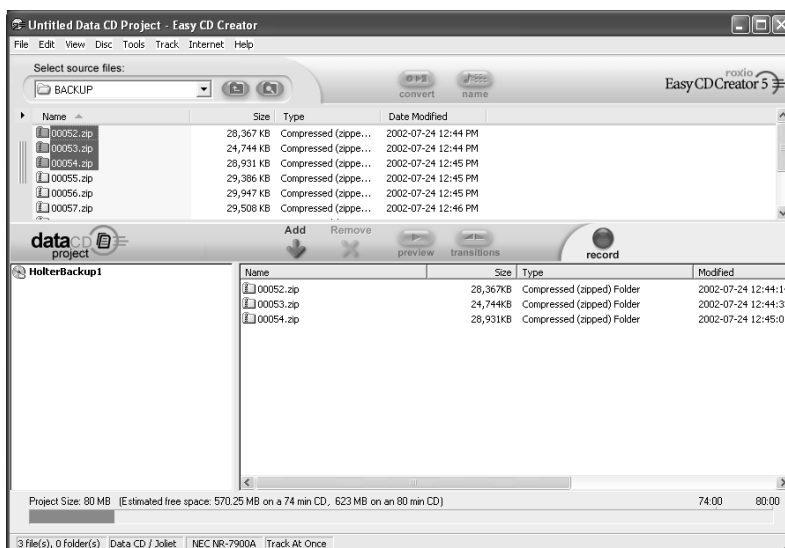


CD Project Properties window

6. Make sure that "Joliet" is listed in the File System field. If it is not, select it from the list of choices.
7. Click the radio button labeled "Mode 1: CDRROM."
8. Press OK to close the window.
9. Within the Data CD Project window, the "Select source files" field should read "Local Disk (C:)" and should list directories/folders below it. One of the directories is named "nm" - for NorthEast Monitoring. Double-click that folder so that

"nm" appears in the Select source files field and additional directories are listed below it. In that list of directories, double-click on "backup" to select it; "backup" appears in the Select source files field, and the compressed files (named *.zip) are listed below that.

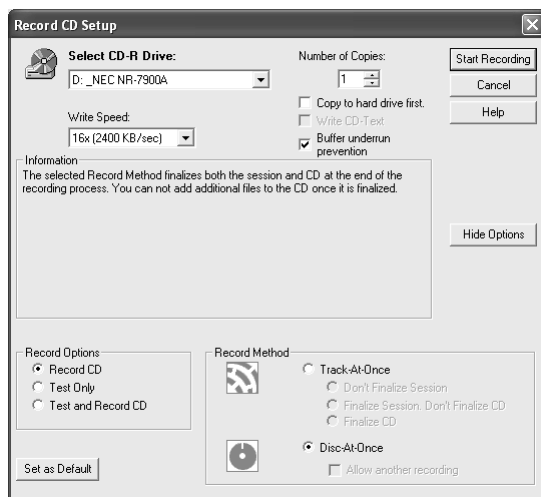
10. From the list, select the patient records to be backed up, which will typically be all the files listed. Click on a file name to select it; to select multiple sequential files, click on the file name, press the Shift key and drag to the last file name. To select all files, hold down the Ctrl key and press A.
11. With the files you want highlighted, click the Add arrow near the center of the window. The selected file names appear below the Add arrow. You can also choose to drag the highlighted file names from the top of the window to the space below the Add arrow. Files can also be



Data CD Project window with selected files in Add list

selected individually and added to the Add list one at a time.

12. When all of the files you want copied to the CD appear in the Add list, press the red record button. The Record CD Setup window opens.

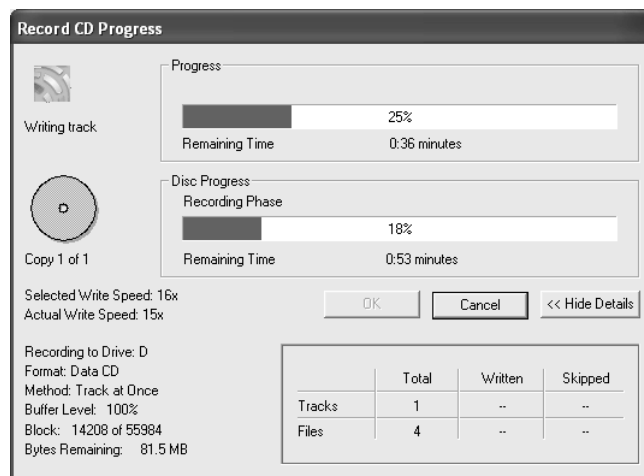


Record CD Setup window

Note: If the record button is dim, you have not yet moved files to the Add list. You must have selected at least one file and moved it to the Add list for the record button to turn red.

13. When the Record CD Setup window opens, if the Options button appears, click it to include the record options at the bottom of the window, as shown in the figure above. If the Hide Options button appears when the Record CD Setup window opens, the options are already displayed.
14. In the Record Options area, "Record CD" should be selected. In the Record Method area, click on "Disc-At-Once." This will allow you to copy files to the CD and then close the session to future additions.

15. Click the Start Recording button.
16. The Record CD Progress window shown below appears as the files are copied to CD.
17. When copying is complete, a query about launching CD Label Creator opens. To Close the current CD session, click Close.
18. In the Record CD Progress window, click OK.
19. If a query window appears asking you whether you should save the project, click Yes.
20. The Explorer window for the CD drive appears with the compressed files listed as "Files Currently on the CD." Close the window.
21. Eject the CD from the drive and label it appropriately, with a unique name that will distinguish this CD from other backup CD.



Record CD Progress window

Note: Do not remove the CD from the drive while it is still being written to. Wait for the spinning sound to stop before removing the CD.

Deleting compressed files

22. To delete the compressed files from their temporary location, go to My Computer and double-click Local Disk.
23. Double-click the nm folder to open it.
24. Double-click the backup folder to open it, displaying the compressed files (*.zip) currently in the folder.
25. To delete the files one-by-one, right-click on each file you have backed up and select Delete. To delete all files, select one of them, then hold down the Ctrl key and press A to select all, then press Delete.

Note: If you do not delete files from the \nm\backup directory, they will accumulate and you will have to keep track of which ones have been copied to CD and which ones have not. Instead, we recommend that you routinely delete all files after copying to CD so that when you are backing up, you know that any files in the \nm\backup directory have not yet been copied to CD.

Backing up a Holter test on “direct” CD

The procedure consists of three steps:

1. properly formatting the CD,
2. using the Holter LX Backup software, and
3. closing the CD session.

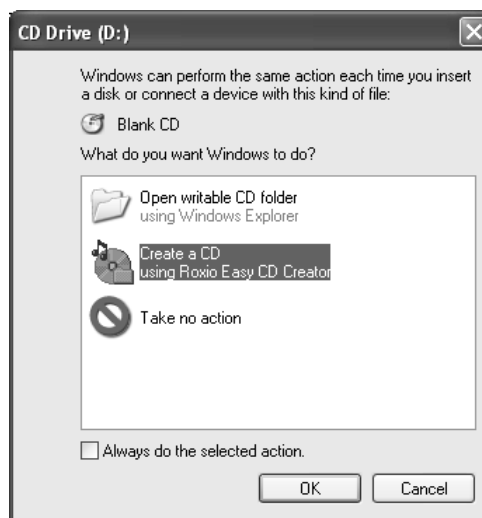
Formatting the CD

To format the CD to accept the zipped files produced by the backup program:

1. Insert a blank, writable CD-R (not CD-RW) into the drive.

Note: Although it is possible to use a CD-RW for backup, it requires a prolonged formatting period and is more expensive. Because this procedure allows you to periodically copy patient records to the same CD until it is full and because the backup procedure is intended to be permanent storage of patient records, there is no advantage to using CD-RWs.

2. If an Explorer window opens asking how to proceed, select the choice “Create a CD using Roxio Easy CD Creator” to launch the Roxio Easy CD Creator software. If an Explorer



CD Drive window with Roxio selection

window does not open, launch the Roxio Easy CD Creator from your Start > Programs menu.

3. The Roxio main menu appears.
4. Place the cursor over the button labeled “make a data CD” so that additional menu choices appear as shown at right.
5. The top menu choice is “direct CD.” Click that. The Roxio format utility opens.



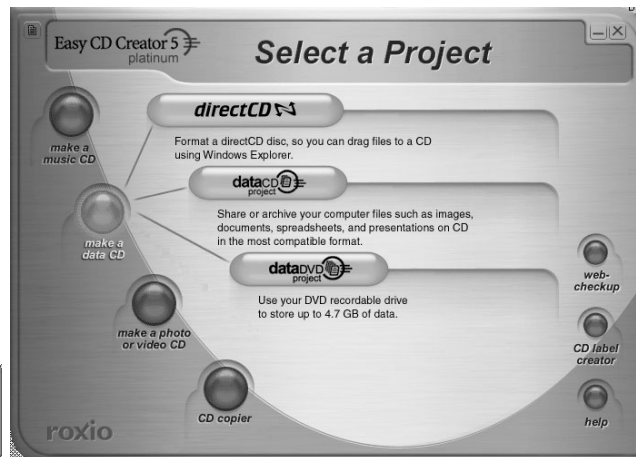
Roxio format utility

6. Make sure the correct drive name is listed in the select CD field as shown in the figure above. Then click the Format CD button in the center of the display. The Format window opens.



Direct CD Format window

7. Type a label name for the CD (choose a unique name that will dis-



Roxio main menu with “make a data CD” choices

tinguish this CD from other backup CDs) in the field indicated in the Format window. If you have inserted a new blank CD-R, the Quick Format and Full Format selections will be dim; the Quick Format will be done.

Note: If the **Quick Format** selection is dim and the **Full Format** selected, and you cannot click the **Quick Format** radio button on, you probably have a **CD-RW** in the drive. We recommend that you use a **CD-R** instead.

8. Click the Start Format button. Several windows open in sequence. When formatting is complete, Explorer opens an empty window for the indicated drive.
9. Close the Explorer window to reveal a CD Ready window; click OK to close that; and then close the Roxio format utility display.
10. Launch the Holter LX software and continue with the steps in the next section.

Using the Holter LX Backup software

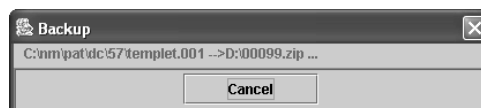
11. After launching the Holter LX program, go to Patient > Open, then click the Backup button.
12. In the Backup window, the Backup tab should be displayed. From the list of patients in the Backup window, click on the patient report you want to back up. To back up multiple sequential patient reports at one time, click on the first one to be backed up, then drag down to the last one you want backed up. Or click on the patient report you want to back up and then press the Shift key and click on additional patients.
13. In the Archive destination field under the patient list, select the appropriate drive name for your system's CD drive. Click on the arrow

at the right of the field to display the drive choices; click on your choice to change the setting.



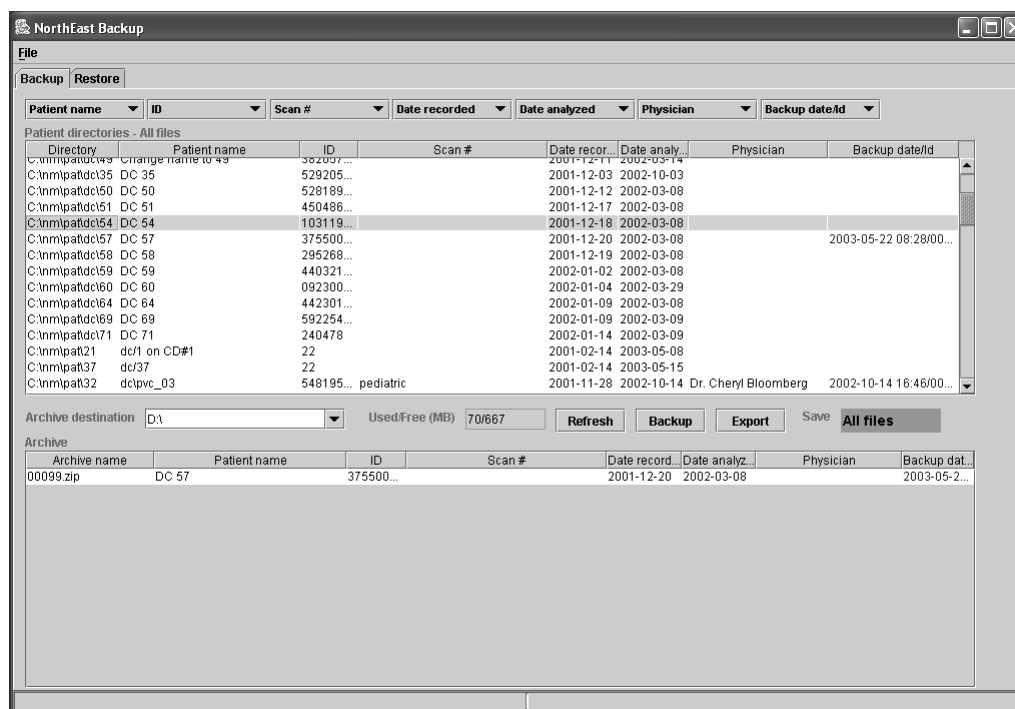
Archive destination field in Backup window

14. With the appropriate patient(s) selected (that is, highlighted), click Backup again. The report for each patient is compressed into a zip file and transferred to the CD.



Backup window displayed during compression

15. When the procedure is complete, the Backup window reappears, with the list of backed up patients in the bottom half of it.



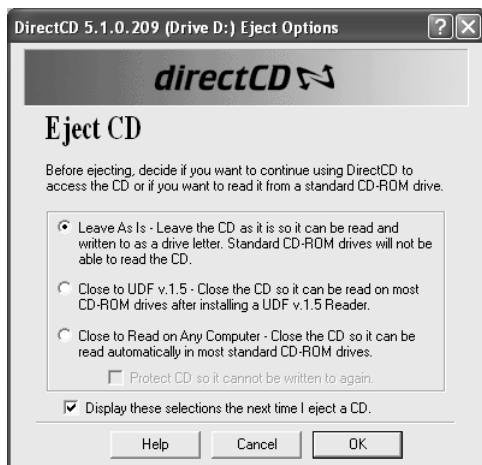
Backup window with Backup tab displayed

16. Click the red close button in the upper right corner to exit the Backup window and return to the Open patient window.
17. To remove the CD from the drive, follow the directions in the next section.

***Note:** Details of what gets saved for each patient report and how to retrieve a patient report from archived files are covered in the early sections of this chapter.*

Closing the CD session

18. Once you have backed up patient files on CD, to remove the CD, you must first indicate how to save the CD. To do so, select the Roxio software so that the format utility is displayed.
19. Click the Eject button in the center of the display. The Eject Options window opens with the following choices:



Eject Options window

- **Leave As Is** - This leaves the CD in a state so that you can continue to add patient reports to it. In this state it is only readable by a system running Roxio Easy CD Creator Software.
 - **Close to UDF v.1.5** - This saves the information on CD, but will not allow additional patients to be added. It can only be read by a system running UDF v.1.5.
 - **Close to Read on Any Computer** - This saves the information on CD, but will not allow additional patients to be added. It can be read on most standard CD-ROM drives, without Roxio software.
20. To save to the CD, but allow additional patients to be added in the future (up to the storage limit of the CD), click “Leave As Is” to select it, then click OK. The CD drive opens and the following window appears.



Ejected CD window

21. Click OK.
22. Remove the CD and label it appropriately.
23. If the Roxio format utility is still displayed, click the close button in the upper right corner to close it.

Adding patient reports to CD

To copy additional patient reports onto a directCD that already contains some:

1. Insert the CD into the drive. If a window opens displaying what is on the CD, close it.
2. Launch the Holter LX software and follow steps 10 through 19 listed above.
3. If the CD is not yet full, you can proceed with steps 20 and 21, and then remove the CD from the drive. If the CD is full, (1) select the “Close to Read on Any Computer” choice in the Eject Options window in step 20 so that the information is permanently archived in a format that is accessible by most CD-ROM drives without Roxio software and (2) click to turn on “Protect CD so it cannot be written to again;” then click OK and remove the CD from the drive.

Keeping track of archived data

Once you have backed up patient reports (either Full reports including all the recorded ECG or Reports including just the information in the printed report) onto CD, you need to keep track of which CD holds which patient reports. You can do this using either (1) the Backup Log in the Holter LX software or (2) a spreadsheet program like Microsoft Works Spreadsheet.

Using the Backup log

To view a list of the patient reports you have backed up using the Holter LX software:

1. Select Patient > Open.
2. Click the Backup button.
3. Select File > Backup log.

The Backup log lists the archived names of the backed up files, then any column headings (variables) you selected in the Backup Settings window.

To add the name you gave to the CD on which reports were backed up:

1. Click on the individual patients you backed up. To select multiple sequential patients, hold down the Shift key as you click.
2. Click the Set volume name button.
3. Type the unique name you gave to the CD holding the backed-up reports. Then click OK.

The Backup log now contains the name of the CD on which the backup file is saved. It appears in the Backup Date/ I.D. field.

To print the Backup log, select the rows to be printed, then click the Copy to clipboard button. Using a spreadsheet program, paste the information into a new spreadsheet and print as instructed by the spreadsheet program. For details about using the MicroSoft Works Spreadsheet to track patient data, see

the instructions in the following section.

Using a simple spreadsheet list

The simplest way to use a spreadsheet program is to create a spreadsheet that lists all the patients on a particular CD and print that list to archive with the CD. Alternatively, you can create one large spreadsheet listing all archived patients and the CD label on which they are saved; this spreadsheet can later be used to locate a patient name and then obtain the CD label.

To create a printout listing the patient reports on a particular CD:

1. Launch the Holter LX program.
2. Select Patient > Open.
3. In the Open Patient window, click Backup.
4. In the Backup window, in the bottom half of the window, select the Archive destination where the patient records were stored. If you backed up using the dataCD method described earlier, the Archive destination was c:\nm\backup\. If you used the directCD method, the Archive destination was originally your CD drive (often d:); make sure you have the CD in the drive when you select the drive. The patient records you just backed up will appear in the bottom half of the Backup window.
5. Press the Copy to clipboard button.

6. Launch the Microsoft Works Spreadsheet. An empty spreadsheet opens.
7. Select Edit > Paste. The data selected in the Backup program is entered in the data fields of the spreadsheet.
8. Select File > Save As. Select an appropriate folder/directory in which to save the document and type an appropriate name (for example, the Volume Label you assigned the CD).
9. To print the spreadsheet to keep with the CD or to file, use File > Print.
10. Use File > Exit to close the spreadsheet program.

Creating a spreadsheet listing all archived patient names

If you create a single spreadsheet listing all archived patient names, you can more easily locate the particular CD on which a patient record is archived. To create the spreadsheet:

1. Follow steps 1 through 8 above.
2. Create a new column by clicking in the spreadsheet in the field to the right of "Volume" and selecting Insert > Insert column.
3. Type a label for the column; call it "CD Label."
4. Click on the first field below CD Label and type the label of the CD on which the patients were archived.
5. Drag across the label you have typed to select it and select Edit >

Copy to make a copy of the text.
Paste the copy into each of the CD
Label fields of the other patients
backed up on that CD.

6. Follow steps 9 through 11 above.
7. Whenever you want to add patients to the spreadsheet, launch the Holter Backup program, select the appropriate archive destination and click Copy to clipboard. Then open the spreadsheet file, click on the row below the last used row and select Edit > Paste.
8. To eliminate the extra row of labels at the top of the new list, use Insert > Delete row.
9. Add the appropriate CD label in the CD Label column.
10. Select File > Save, then File > Exit.

Locating a patient record in the spreadsheet

To find a particular patient in the spreadsheet, sort (using Tools > Sort...) by the name or scan number column, locate the match, then refer to the CD Label field to see which backup CD holds that patient record.

7 CONFIGURATIONS

The Configuration program allows you to customize certain aspects of the software, including diary entry text and the report heading that appears on the first page of the printed report. In addition, with careful attention to detail, you can establish report formats that are specific to a physician. Each separate customized format is called a configuration.

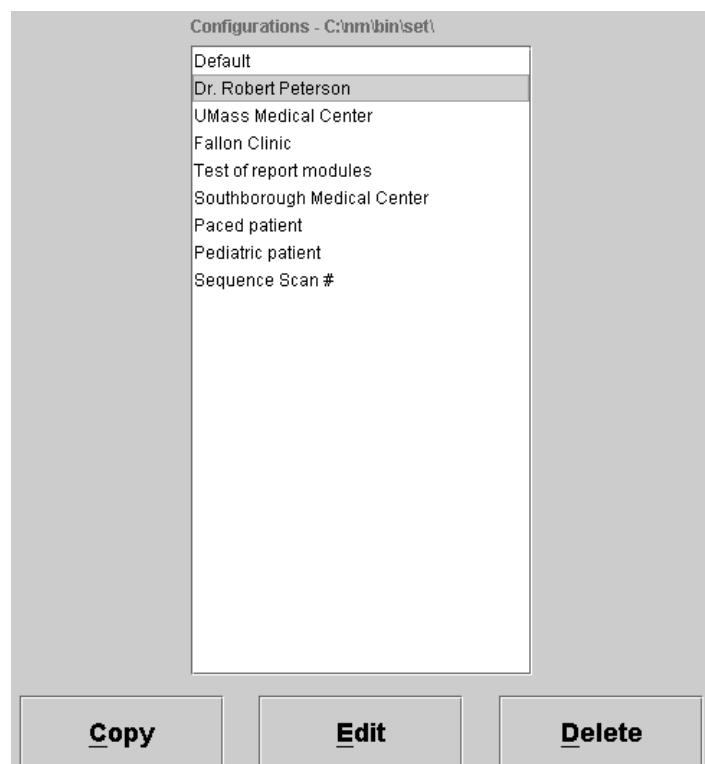
Running the Configuration program

You access the Configuration program outside of the Holter LX Basic software when the Holter program is not running.

With the Holter program not running, select Start > Programs. From the Programs menu, select Holter 5. From the Holter 5 menu, select Configure. The main Configuration window opens.

Configuration window

The main Configuration window opens with a listing of all current configurations of your software. Each should have a unique name. To make changes, you can either edit an existing configuration or create a new one. You can also delete a configuration if you no longer need it.



Main Configuration window

To edit an existing configuration, click on the name associated with the configuration you want to change, and then click Edit.

To create a new configuration, click on the name associated with a configuration similar to the one you want to create, and then click Copy.

To delete a configuration, click on the name associated with the configuration you want to eliminate, and then click the Delete button.

Configuration folders

The window for a specific configuration consists of a pile of folders with tabs. Each folder contains the controls for a particular window or portion of the Holter LX Basic software. Within the folders for a configuration, any entry in any of the fields automatically

appears whenever you create a new patient using that configuration.

To display the fields in a particular folder, click on the tab for that folder.

The folders contain the controls indicated:

- **Main** - This includes fields indicating the name (description) of the configuration, which appears in the list whenever you start a new patient; the physician's and interpreting physician's names associated with the configuration; the scan number; hookup technician; and analyst.

*Note: When you create a new configuration by using the Copy button, the Description field in the Main folder reads ***New***. Be sure to type a new name for the configuration in the Description field to differentiate it from others you create.*

Configuration folders

***Note:** The Main folder contains the Scan # field which controls the auto-sequencing of the Scan number in the Patient window. To have the system automatically increment the scan number for each patient, enter \$seq in the Scan # field; to include the date and/or time-of-day in the Scan # field, enter \$date or \$time, respectively. Use whatever order you want the scan number to follow. Also, be sure to turn the “Assign date and time to Scan #” feature on in the Preferences window.*

- **Diary** - Different diary entries can be added, and diary entries can be replaced with other text or deleted singly or all together. The diary entries then appear in the drop-down list of choices in the Symptom field in Patient Information > Diary.
- **Oximetry** - This controls the settings that come up automatically in the window accessed by selecting Settings > Oximetry.
- **Report** - This allows you to have a configuration with a different report heading and/or a different selection of report modules.

Saving a configuration

For each configuration you create or edit, make changes in as many folders as you need to. When all folders reflect what you want to associate with that configuration, click the OK button at the bottom of the window. Your new configuration will be saved and the

window closed; the main Configuration window then appears.

Canceling a configuration

To exit from the Configuration folders without saving the new configuration, click Cancel. The window closes and the main Configuration window appears.

To create or edit another configuration, use the Copy or Edit button again.

Exiting from the Configuration program

To exit from the Configuration program, click the red Close button in the upper right corner of the window.

Using a configuration

The configurations created or edited using the Configurator appear when you start a new Holter test and when you initialize an SD card. When you select Patient > New to open the Patient Information window for a new Holter test, a list of the Configuration descriptions appears in the Type of analysis/report field; select your choice from that list. When you initialize an SD card before a recording, the list of Configurations appears in the SD360 settings field of the Setup SD360 settings window; select your choice from that list.

For example, a configuration called “Oximetry” can be set up so that the Reports window opens with the oximetry modules already checked. When you start the Holter test for a patient with oximetry data, you could select Patient > New, then select the Oximetry configuration. That would mean that you would not have to check off each report module you want to include in the report.

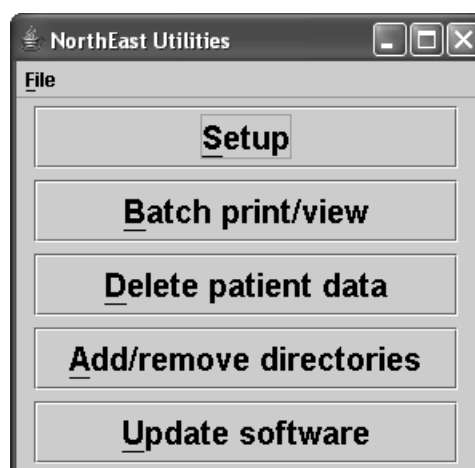
Of course, if you use an inappropriate configuration for a patient, after analysis, you can always go to the appropriate windows and make necessary changes.

8 UTILITIES

The LX Basic Utilities allow you additional control over some of the technical aspects of your software, including the restructuring of your system to hold more patient Holter tests within the program, updating your software, and accessing additional directories on your hard drive.

Running the Utilities program

You should access the Utilities when the Holter LX program is not running. To run Utilities, select Start > Programs > Holter 5 > Utilities. The Utilities window appears. The buttons in the Utilities window allow you access to the Setup window you saw during the software installation process, to print or view on-screen batches of patient reports, to add and remove patient directories and patient data, and to update the LX Basic software to the latest release.



Utilities window

Click the buttons to open the following windows:

Setup window

The Setup window contains information specific to your facility and Holter LX software. This includes the names of both your facility and the primary user of your Holter software, along with five lines for the name and address that appear in the Reports window when you go to print a Holter report. To change the entries in those fields, select the characters to be replaced and type the text you want in the appropriate locations.

To change the language used throughout the Holter LX software, make your selection from the drop-down menu associated with the Language field.

To change the number of patient reports stored on the hard disk of your computer, you can either enter a different number in the Number of patients field in this window or use the Add/remove directories accessible from the Utilities menu. If you choose to change the number here in the Setup window, all patient directory slots will be overwritten with empty new patient slots, so be sure any patients whose reports will be overwritten are already backed up before you proceed.

The Registration number is one assigned specifically to each NorthEast Monitoring

Setup window

customer except for those who use the LX Basic software. Basic users should not type a number in this field unless you upgrade your software to include additional features. This field works in conjunction with the “Digital recorder with a software key” radio button in the Options area. If the Basic edition radio button is checked, there is no need for a registration number.

Batch print/view

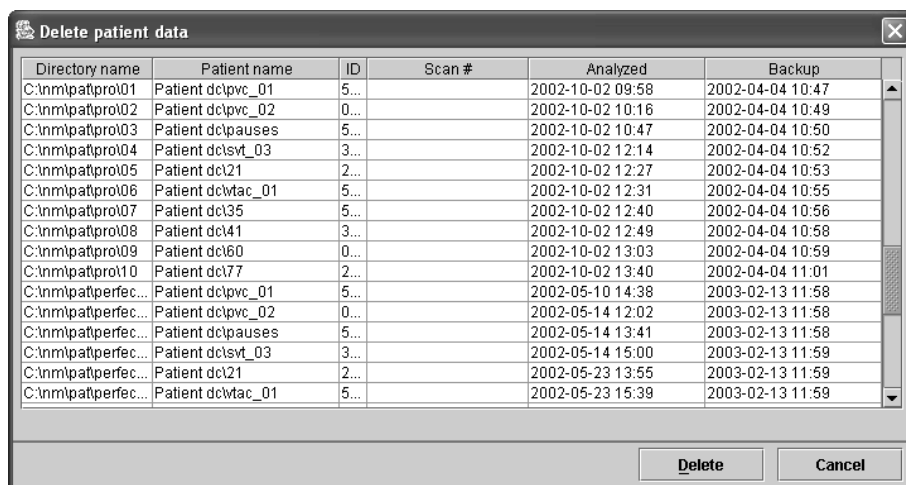
Use this utility to list all the patient reports currently on your computer’s hard disk and then choose to either print the report or review it on-screen. To select a particular patient report, click on the appropriate line to highlight it. To review the patient report on-screen, click View. To print the report, click Print. To exit from the window, click Cancel.

Directory name	Pa...	ID	Scan #	Analyzed	Backup
C:\nm\pat33	dc...	5362...		2002-10-16 11:48	2003-09-02 10:30
C:\nm\pat34	ddd	5362...		2002-10-16 12:16	2003-09-02 10:31
C:\nm\pat35	dc...	6082...		2002-10-16 13:51	2003-09-02 10:31
C:\nm\pat36	dc...	4516...	4515155151515151515...	2002-10-16 13:59	2003-09-02 10:32
C:\nm\pat37	dc...	22		2003-05-15 16:26	2003-09-02 10:32
C:\nm\pat38	La...	2720...		2003-09-18 10:00	2003-09-02 10:33
C:\nm\pat39	te...	2720...		2003-09-11 08:08	2003-09-10 10:24
C:\nm\pat40	Fr...	123	03--1551	2003-07-02 09:31	2003-09-02 10:33
C:\nm\pat41	no...	2720...		2003-09-01 11:14	2003-09-02 10:34
C:\nm\pat46	Mi...			2003-11-20 19:56	
C:\nm\pat47	00...	5693...		2003-10-08 12:10	
C:\nm\pat48	Kl...	0626...	162	2003-09-05 12:44	
C:\nm\pat49	Mc...	4141...		2003-10-14 09:24	
C:\nm\patdc101	do...	22	123456	2003-08-20 11:41	2003-09-02 10:35
C:\nm\patdc102	do...	5477...		2003-05-09 08:28	2003-09-16 13:05

Batch print/view window

Delete patient data

This window displays a listing of the patient records currently included in the Holter LX software. To eliminate patients from the listing, select the one(s) to be deleted and click the Delete button. To close the window without deleting any patient records, click Cancel.



The 'Delete patient data' window contains a table with the following data:

Directory name	Patient name	ID	Scan #	Analyzed	Backup
C:\nm\pat\prol01	Patient dclpvc_01	5...		2002-10-02 09:58	2002-04-04 10:47
C:\nm\pat\prol02	Patient dclpvc_02	0...		2002-10-02 10:16	2002-04-04 10:49
C:\nm\pat\prol03	Patient dclpauses	5...		2002-10-02 10:47	2002-04-04 10:50
C:\nm\pat\prol04	Patient dclsvt_03	3...		2002-10-02 12:14	2002-04-04 10:52
C:\nm\pat\prol05	Patient dcl21	2...		2002-10-02 12:27	2002-04-04 10:53
C:\nm\pat\prol06	Patient dclwtac_01	5...		2002-10-02 12:31	2002-04-04 10:55
C:\nm\pat\prol07	Patient dcl35	5...		2002-10-02 12:40	2002-04-04 10:56
C:\nm\pat\prol08	Patient dcl41	3...		2002-10-02 12:49	2002-04-04 10:58
C:\nm\pat\prol09	Patient dcl60	0...		2002-10-02 13:03	2002-04-04 10:59
C:\nm\pat\prol10	Patient dcl77	2...		2002-10-02 13:40	2002-04-04 11:01
C:\nm\pat\perf...	Patient dclpvc_01	5...		2002-05-10 14:38	2003-02-13 11:58
C:\nm\pat\perfec...	Patient dclpvc_02	0...		2002-05-14 12:02	2003-02-13 11:58
C:\nm\pat\perfec...	Patient dclpauses	5...		2002-05-14 13:41	2003-02-13 11:58
C:\nm\pat\perfec...	Patient dclsvt_03	3...		2002-05-14 15:00	2003-02-13 11:59
C:\nm\pat\perfec...	Patient dcl21	2...		2002-05-23 13:55	2003-02-13 11:59
C:\nm\pat\perfec...	Patient dclwtac_01	5...		2002-05-23 15:39	2003-02-13 11:59

Buttons: Delete, Cancel

Delete patient data window

Be sure that you have performed any required backing up of patient records before you delete them here.

Add/remove patient directories

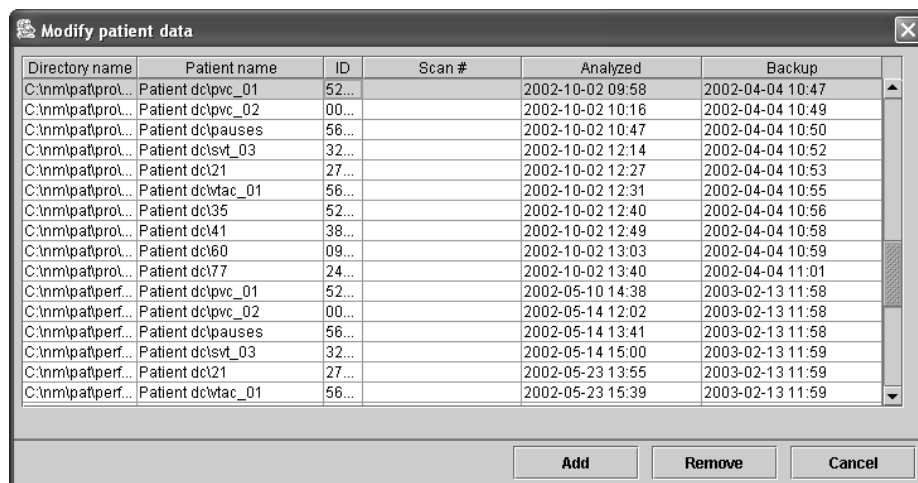
This button opens the Modify patient data window that allows you to

add a specific directory to the list of patients accessible through the LX software without creating the slot as an empty new patient, or to remove a specific directory from the list of patients without actually deleting the patient from the hard drive. It allows you to access additional patient records that were not previously accessible and

allows you to ignore other records.

Click the Add/remove button to open the Modify patient data window; it displays all the patient directories currently on your hard drive. To allow access to additional

patient record(s), select the patient record(s) to be added, then click the Add button. To delete patient record(s),



The 'Modify patient data' window contains a table with the following data:

Directory name	Patient name	ID	Scan #	Analyzed	Backup
C:\nm\pat\prol...	Patient dclpvc_01	52...		2002-10-02 09:58	2002-04-04 10:47
C:\nm\pat\prol...	Patient dclpvc_02	00...		2002-10-02 10:16	2002-04-04 10:49
C:\nm\pat\prol...	Patient dclpauses	56...		2002-10-02 10:47	2002-04-04 10:50
C:\nm\pat\prol...	Patient dclsvt_03	32...		2002-10-02 12:14	2002-04-04 10:52
C:\nm\pat\prol...	Patient dcl21	27...		2002-10-02 12:27	2002-04-04 10:53
C:\nm\pat\prol...	Patient dclwtac_01	56...		2002-10-02 12:31	2002-04-04 10:55
C:\nm\pat\prol...	Patient dcl35	52...		2002-10-02 12:40	2002-04-04 10:56
C:\nm\pat\prol...	Patient dcl41	38...		2002-10-02 12:49	2002-04-04 10:58
C:\nm\pat\prol...	Patient dcl60	09...		2002-10-02 13:03	2002-04-04 10:59
C:\nm\pat\prol...	Patient dcl77	24...		2002-10-02 13:40	2002-04-04 11:01
C:\nm\pat\perf...	Patient dclpvc_01	52...		2002-05-10 14:38	2003-02-13 11:58
C:\nm\pat\perf...	Patient dclpvc_02	00...		2002-05-14 12:02	2003-02-13 11:58
C:\nm\pat\perf...	Patient dclpauses	56...		2002-05-14 13:41	2003-02-13 11:58
C:\nm\pat\perf...	Patient dclsvt_03	32...		2002-05-14 15:00	2003-02-13 11:59
C:\nm\pat\perf...	Patient dcl21	27...		2002-05-23 13:55	2003-02-13 11:59
C:\nm\pat\perf...	Patient dclwtac_01	56...		2002-05-23 15:39	2003-02-13 11:59

Buttons: Add, Remove, Cancel

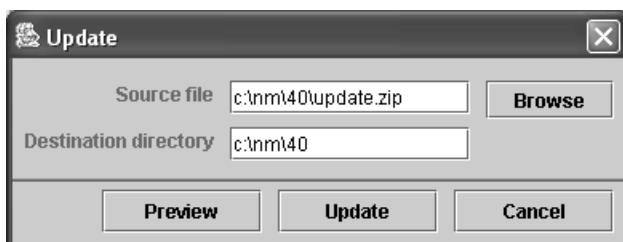
Modify patient data window

select the patient record(s) to be deleted, then click the Delete button.

Update software

To update your LX software to a newer version, click the Update button to open the Update window. The Source file should contain the directory and file name of the NorthEast Monitoring software update you received. If the Source file is not correct, use the browse button to access other folders to locate the file, or type the correct complete file name including all directories.

To run the NorthEast Monitoring LX software as designed, the destination directory should read “C:\nm\bin”. If it does not, type that now.



Update software window

To view information about the update file without installing it, click Preview.

To install the update file specified in the Source file field into the Destination directory, click Update and follow the instructions.

To exit the Update window without installing new software, click Cancel.

9 USING MAGICVORTEX

To use NorthEast Monitoring software to send a patient's Holter data to another site for analysis, you must be a MagicVortex customer. To sign up for MagicVortex, visit their web site at www.MagicVortex.com and select Sign up from the menu on the home page. Once you are a MagicVortex customer, you can follow these instructions both (1) to send out the patient data to a receiving site that has agreed to analyze it and (2) to receive a completed report back.

Sending patient data

1. From the Start menu, select Programs > Holter 5 > Remote Setup to open the Patient menu item in the remote reporting software.
2. Select Patient > New to open a patient slot for the patient to be sent. If no empty slot is available, the Open Patient window

The screenshot shows a 'Patient Information' dialog box. It has a title bar with a close button. The form is divided into two main columns. The left column contains: 'Patient name' (text box), 'Sex' (radio buttons for M and F), 'D.O.B.' (text box with format YYYY-MM-DD, a 'Years' dropdown, and a separator), 'I.D.' (text box), 'Scan #' (text box), 'Hookup tech/analyst' (text box), 'Physician' (dropdown), 'Interpreting physician' (dropdown), 'Date recorded' (text box with format YYYY-MM-DD, a time dropdown set to 08:00am, and a separator), and 'Recorder #' (text box). The right column contains: 'Indication' (three stacked dropdown menus), 'Medication' (three stacked dropdown menus), and a 'Copy flashcard' button. At the bottom of the window are five buttons: 'Remote', 'MagicVortex', 'Settings', 'OK', and 'Cancel'.

Patient Information window in Remote Setup

opens and you must delete one of the patients on the list; then close the Open Patient window and select New again.

3. Insert the compact flashcard from the recorder into the compact flashcard reader.
4. Click the Copy flashcard button in the Patient window. This copies the Holter data from the flashcard onto your computer's hard drive. Some of that data appears in the Patient window; verify that the data from the flashcard is for the correct patient.
5. Enter as much additional patient information as you want included in the final Holter report, including any written diary entries, indications and medications. See Chapter 2: Patient Information for details about entering patient information.
6. When data entry is complete, click the MagicVortex button in the Patient Information window. This opens the MagicVortex Setup window. The Enable MagicVORTEX field should have a check mark. The MagicVortex icon on your desktop

should contain a blue center indicating that you are currently connected to the MagicVortex.

Note: *If the center of the MagicVortex icon is gray, you are not currently connected to MagicVortex via the Internet and you will not be able to send patient data until the connection is established.*

7. The FTP directory field should read c:\nm\ftp; if it does not, click on that field and type that now.
8. Click on the Destination email field and type the e-mail address where you are sending the Holter data for analysis.
9. Leaving the Options field blank, click on the Location field. This entry will be used to rename the patient files you send so that there is a unique filename at the receiving site. If you have been assigned a location name by the receiving site, type that. If not, type something to identify your location.
10. Click on the Initials field. Type your initials.
11. When you have completed the fields, click Send. The two files for this patient will be sent to the receiving site. To exit without sending the data now, but saving your entries, click OK. To exit without sending or saving, click Cancel.

MagicVORTEX Setup window

Receiving a patient report

To receive a Holter report via MagicVortex, you do not have to be a MagicVortex customer. If you are a MagicVortex customer, the report returned will be automatically downloaded to your computer when the analysis site sends it; if you are not, you must retrieve the Holter report via e-mail.

As a MagicVortex customer

After the analysis site has sent you a Holter report via MagicVortex, the report automatically downloads to your computer. To retrieve the report, open the MagicVortex window (using the icon that looks like the eye of a storm) and it displays the file and its status. Once the download is complete, the status reads “Ready to save.” To save the file, select File > Save from the toolbar, and use the Browser to indicate what folder you’d like to save the report in and what filename to use; then click Save.

To print the report, open the file in the folder where you saved it, and use File > Print to print the report.

Without being a MagicVortex customer

After the analysis site has sent you a Holter report via MagicVortex, you will receive a notice via e-mail that there is a file for you. The e-mail notice will include a link to the site. To retrieve the report:

1. Click on the link and you will be connected to the MagicVortex site, which will request that you log in.
2. Enter the password for your e-mail address and click the Login button. MagicVortex displays your account folder, which contains information about the file that was sent to you, including its name at the top.
3. To retrieve the file, click the Download File button. The File Download window opens.
4. In the File Download window, indicate what you would like to do with the file. We recommend that you Save it using the Save button and using the Browser to indicate the folder where you’d like it saved. The report is now downloaded to your computer.
5. When the download is complete, you can choose to immediately print the report by selecting Open to display the report, and then using File > Print. The Holter report prints, and you have a saved electronic copy of it on your computer in the folder you indicated in Step 4.

APPENDIX A

Calculation of Heart Rate

Types of heart rates

A variety of heart rate calculations are made by NorthEast Monitoring Holter LX software. They include:

- Current heart rate
- Minute-by-minute heart rate
- Beat-by-beat heart rate
- Mean heart rate in intervals
- Mean heart rate for Holtered period
- Second heart rate
- Heart rate strips

Current heart rate

This is a complex function that takes the current beat and the beats preceding it into account. This weighted average follows these rules:

1. If the differences between the adjacent beats of the preceding four RR intervals are no more than 12 percent of the average RR interval for the previous beat and the beats are all normal, then the new average RR interval is the simple average of the previous four RR intervals.
2. If the previous four RR intervals were NOT bigeminy, VTAC or SVT AND the current RR interval is within 25 percent of the previous average AND the previous two beats were not ventricular AND the previous 10 beats were not supraventricular, then the new average RR interval is 1/8 of the current RR interval plus 7/8 of the previous average.
3. If the previous four RR intervals were NOT bigeminy, VTAC or SVT AND the current RR interval is not within 25 percent of the previous average OR any of the previous two beats were ventricular OR any of the previous 10

beats were supraventricular, then the new average is $1/32$ of the current RR interval plus $31/32$ of the previous average.

4. If the previous four RR intervals were bigeminy, VTAC or SVT, then the average RR interval is changed by 0.000087 seconds. It is increased if the current interval is longer than the previous interval, otherwise it is decreased.

Once the current average RR interval is determined, the current heart rate is calculated as 60 divided by the current average RR interval, that is, $\text{current HR} = 60/(\text{current RR interval})$.

The current heart rate is used as the heart rate that appears in the heart rate data field for any displayed strip. This includes the heart rate associated with any strip in the Selected Strips window and in the printed report.

The current heart rate is also used to detect tachycardia and bradycardia. The onset of either is determined to be when the current heart rate reaches the tachycardia or bradycardia settings in the Scanning Criteria window.

The low and high heart rates reported in the Tables window and in the tables of the printed report refer to the lowest and highest current heart rate calculated during the interval.

Minute-by-minute heart rate

The heart rate plotted in the Trends window is a minute-by-minute heart rate. It is calculated as 60 times the number of beats processed in the minute divided by the sum of all RR intervals of beats processed in the minute (in seconds).

Beat-by-beat heart rate

The heart rate associated with each beat in expanded displays whenever the Annotation field in the Preferences window is set to Heart Rate is the beat-by-beat heart rate. It is calculated based on the RR interval following the labeled beat. Beat-by-beat heart rate equals 60 divided by RR interval, that is, $\text{HR} = 60/(\text{RR})$.

Mean heart rate in intervals

In the tables (in Tables window and printed report), the mean heart rate within each interval is calculated by dividing the number of beats in that interval by the amount of time processed within the interval.

Mean heart rate for Holtered period

In the Report Summary (in the Report Summary window and printed report), the mean heart rate during the Holter test is the number of beats counted divided by the amount of time processed.

Second heart rate

The second heart rate is the heart rate associated with a run of VTAC or SVT. It is calculated as 120 divided by the sum of the current RR interval and the previous RR interval. The second heart rate appears in strips with VTAC or SVT in Selected Strips, the printed report, and the strip list, labeled HR2.

The second heart rate is used to determine where in the ventricular and supraventricular run tables a run of VTAC or SVT appears. The heart rate separating fast from slow runs is determined by the VTAC and SVT settings in Scanning Criteria, but the rate of each event is considered to be the second heart rate.

The second heart rate is also used to determine which run is identified as the fastest run of VTAC and SVT.

Heart rate strips

In the Critical Events window, there is a choice in the Type field called "HR strips." This displays all ECG from the Holter test divided into 7.5-second strips. Each strip includes a time-of-day and a Strip HR. That Strip heart rate is the total number of RR intervals (including partial ones, but excluding artifact) within the strip divided by the sum of the RR intervals.

Defining dead-time and RonTs

Dead-time is the amount of time (in seconds) after a detected QRS complex during which the software will not look for another QRS complex. Generally, this helps to prevent the misidentification of tall T-waves as QRS complexes.

The operator can add more time to the tail end of the dead-time using the Extra dead-time setting in the Scanning Criteria window. An increase in the Extra dead-time should be done judiciously so that very early VPBs do not fall within it.

Because the recovery time (i.e., the width of the T-wave) varies with heart rate, the dead-time built into the software adjusts based on the current heart rate. At higher rates, the dead-time decreases, and at lower rates, the dead-time increases.

Likewise, the definition of an R on T, which is a VPB falling on the T-wave of the preceding beat, varies with heart rate. Since the software does not identify T-waves, it cannot determine whether a VPB is actually falling on the T-wave of the preceding beat. But the software can calculate where the T-wave for a beat should be and then alert the operator regarding any VPBs that fall within that hypothetical area.

The heart rate determines the dead-time and R on T period definitions as shown in the following table:

TABLE 1. How heart rate determines dead-time and R on T

Heart rate	Dead-time	R on T
50	0.43500	0.440
55	0.38727	0.418
60	0.34750	0.400
65	0.31384	0.384
70	0.28500	0.371
75	0.26000	0.360
80	0.23812	0.350
85	0.22000	0.341
90	0.22000	0.333
95	0.22000	0.326
100	0.22000	0.320
105	0.22000	0.314
110	0.22000	0.309
115	0.22000	0.304
120	0.22000	0.300
125	0.22000	0.296
130	0.22000	0.292
135	0.22000	0.288
140	0.21428	0.285
145	0.20689	0.282
150	0.20000	0.280
155	0.19354	0.270
160	0.18750	0.265
165	0.18181	0.261
170	0.17647	0.257
175	0.17142	0.253

TABLE 1. How heart rate determines dead-time and R on T

Heart rate	Dead-time	R on T
30	0.50000	0.600
35	0.50000	0.542
40	0.50000	0.500
45	0.50000	0.466

Index

Numerics

12- or 24-hour clock 12

A

Acrobat file (pdf) 38
Add/remove button 67
Add/remove directories 66
Adding patient directories 67
Adobe Acrobat 3, 38
After analysis, show 42
Alternate channel 14
Alternatives 28
Analysis duration 13
Analysis window 15
Annotation 42
Archive source field 48
Assign date and time to Scan number 42
auto sequencing 42
Auto-fill feature 11
auto-sequencing of the Scan number 63

B

Back to Saved Strips button 29
Backing up patient reports 46
Backup
 file names 47
 what gets saved 46
 where file is saved 48
Backup field 17
backup file name 47
Backup status field 16
bootex.log 7
Both 24, 29

C

calipers for measuring 24, 29
check box 11
color-coding 19, 21
Comments 33, 37
Compact flashcard 4, 7
 erasing/initializing 6
 formatting 6
 inserting 4

Preview button 18

Compression level 47
Configurations 61, 62
Continuous 23
Copy different flashcard button 16
Copy to clipboard 49
Copy to SD360 button 6
current patient 17
Customizing the Backup directory 47

D

D.O.B. 11
data entry types 11
data fields 11
date format 11
date/time stamp 42
definitions, beat labels 22
delete a patient report 45
Delete button 67
deleting a patient record 45
deleting all strips 28
deleting channels from strip 28
deleting patient data 66
deleting strips 28
Destination directory 48
Diary 63
Diary entries 12, 13, 17, 33
Diary or event 14
Disable SVPB counts 14
Display field 24
dongle 3
DR180+ 4, 6, 9, 12
Draw grid 41

E

Edit button 30
Edit physician name 43
Edit window 27
event button 9, 12
event marker 12
expanded strip 21

F

File Download 71
flash.dat 5
Full 46, 49
Full disclosure 35
Full report 49
Full Screen/Expand button 21
Full-Sized Strips 34

G

General table 30

H

help 4
highlight 21
Holter procedure 7
HR (2 RR) 29

I

Indication 11
Initialize 5
Inserting 4
Installation instructions 2
Interpreting physician name 41
Interval table edit window 31
Interval table zero window 31
Invert/Hide 21

J

Java 2 Runtime Environment 2

K

Keep button 35

L

Language change 66
large fonts 42
Last patient saved field 47
Launching LX Pro 4
Lead field 21
List
 in Patient window 17
 saved strips 34

Lock 24, 29

M

MagicVortex 69
marker 26, 29
Maximum HR 14
measuring heart rate 25
measuring intervals 25
measuring ST segment 25
Medication 11
memory card 18
Minimum HR 13
multiple strips 23

N

New 69
new patient 9, 10
Next button 17
Notes field 12
Number of patients stored 66

O

Open Patient window 17, 45, 69
operator knowledge 2
Oximetry 23, 30, 37, 63
 report modules 34
 tables 30
 window 14

P

Pacemaker type 14
Page 19, 20, 21
 center 21
 expanded 23
 expanded strip 20
 gain field 21
 keep 23
 scan button 21
 zoom field 21
Patient information 9, 10, 16, 17, 33, 42
 age 11
 D.O.B. 11
 gender 11

- patient name 10
- Patient setup window 5
- Phrases 37
- Physician name 41, 43
- Preferences window 41
- Preview 18
- Previous button 17
- Primary channel 14
- Print button 24, 29, 38
- Print countdown 43
- Printing report 33

Q

- Questionable 20

R

- Radio buttons 11
- Re-analysis 29
- Re-analyze button 16
- Redo button 37
- Refresh 49
- Registration number 66
- relabel 20, 22
- relabeling artifact 26, 38
- Remote Setup 69
- Removing patient directories 67
- Report 46, 63
- Report heading 4, 34
- Report modules 33
- Report Summary 8, 36, 37
- Reports 49
- Restore 48
- Retrieving a backed up patient report 48
- Review 38
- Reviewing the Holter data 19
- Roxio Easy CD Creator 48, 49

S

- Save 1 strip/hour 14
- Saving sample strips 22, 23
- Scan # field 63
- Scan number 42
- SD card 7

- SD memory card 4, 5
- SD360 4, 9, 12
- SD360 settings 6
- Select new Alternative button 28
- Saved Strips 7
 - active strip 27
 - alternatives 28
 - deleting 28
 - deleting strips 28
 - editing labels 27
 - expanded 29
 - list of strips 27
 - sort 27
 - which print 35
- Saved strips field 35
- Saved Strips window 26, 35
- Settings 13
- Setup SD360 window 5
- Setup window 3, 65
- software key 3
- ST measurement 25, 29
- start analysis 15
- Start button 15
- Status button 16
- Status field 16
- Status window 16
- Strips
 - full-sized 34
 - half-sized 34
- Summary phrases 37, 43
- SVPB Disable 23
- System requirements 2

T

- Tables window 30
- time-of-day format 12
- Trends
 - hours field 26
 - heart rate 25
 - RR interval 25
- T-wave 20

U

Update 29

Updating software version 68

Utilities 65

V

View 66

 backed up report 49

View Summary 36

Z

Zero button 30, 31