CardioScan 76a Overview

Diagnostic Monitoring Software

March 2012
Table of Contents

Introductory Note........................................................................................................................................3

New Software Features............................................................................................................................4

Advances in Template Editing................................................................................................................23

A-Fib Editing..............................................................................................................................................33

New Outputs and Interfaces.....................................................................................................................39
Introductory Note

About the Software

CardioScan (10, 11, and 12) has evolved into a significant upgrade with the introduction of version 76a. This document provides an overview of important new features.

About the Security Keys

CardioScan 76a is only compatible with the new HASP security keys.

For customers who recently purchased a previous version of CardioScan (54a) and who wish to upgrade to this version, Diagnostic Monitoring Software has established a trade-in program for older, non-HASP security keys. Please contact your DMS distributor for exchange details, as well as the nominal fees involved.

About DMS Holter Recorders

DMS 300-3A and 300-4A recorders now include a new HDMI ECG connector and ECG Cable.

Additional artifact rejection has been added to the 3A and 4A recorders. Double lead-wire isolation has been incorporated into the new ECG Cables.

The 3A recorders use the 7-electrode and 5-electrode ECG Cables.

The 4A recorders use the 4-electrode ECG Cable for 3-Lead ECG monitoring, and the 10-electrode ECG Cable for 12-Lead ECG monitoring. The 4A recorders automatically recognize the connection from either the 4 or 10 electrode ECG Cables, and then automatically adjust the 4A to either a 3-Lead or 12-Lead ECG recording.

Statement of Compliance / Quality Control

All software has been subject to the 2011 end-of-the-year Annual Audit for compliance with software quality control processes.
New Software Features

The following are software capabilities not found in CardioScan versions prior to 76a:

1. **AES-256 Encryption**: for safeguarding the privacy of medical facilities and their IT systems.

2. **HELP icon on Main Screen Display**
   
   a. **Feature**

   ![CardioScan Features](image)

Click on the various pages to view screenshots of the CardioScan features.
Double left click on any selected page-print to view an enlarged display.

b. Learning Center

Click on the “Select Topic” icon at upper-left to sequence through the ECG learning center.
c. **CE Info** (password is ce)

![CE Info window](image)

**d. Show Real-Time Holter ECG:** This is an important icon and will provide for three distinct functions.

- **Current.** Connect the Patient Isolation Test cable from the Holter recorder to the CardioScan PC to view the quality of the electrode application in real-time. If you tap each electrode gently, you should not see excessive artifact. If you see this artifact upon gently tapping an electrode site, this is an indication to clean the skin again at that electrode site.

- **Soon to be released.** The ANS Test (Autonomic Nervous System Test) can be performed by clicking on the ANS icon. The autonomic nervous system initiates the beginning of each heart beat. This is a 3-minute test. Minute 1 is 60-seconds of Deep Breathing with min and max HR analysis. Minute 2 is 60-seconds of Valsalva Ratio with min and max HR analysis. Minute 3 is 60-seconds of 30:15 Ratio (sitting down versus standing up) with min and max HR analysis. Then click on the Print icon for the ANS report.

- **Soon to be released.** Resting 12-Lead ECG test prior to the Holter ECG recording. The 300-4A recorder connected to the CardioScan PC performs the Resting 12-Lead ECG.
3. **System Setting icon on Main Screen Display**

   ![System Setting Icon]

   a. **ECG Strip Display:** with each R-R interval the heart rate, the ms interval, and arrhythmia label is displayed above the R-R interval. The ECG Strip Display allows you to center this data along three different horizontal locations.

   b. **Print Page Number:** allows each page in the Holter report to have its page number printed.

   c. **“Other A” Tab, Auto Fill Patient Info:**

   ![Auto Fill Patient Info]

   Use for setting up interface with GDT, SQL, HL7 databases.

   d. **“Other A” Tab, DICOM Server Setup:** use for interface with DICOM databases.
e. **“Other B” Tab:** **ECG STRIP COLOR MODE:** this allows the grid background for color ECG print-outs to be white or dark blue.

4. **EDIT Menu**

![Image](image.png)

a. When editing each beat template, the ECG Strip on the left side has been increased to 12-seconds of ECG data.

b. When using the 300-4A recorder, you can select either a 3-Lead or 12-Lead display on the Tools bar in the top left side of the screen display.

c. The shade-bar on the arrhythmia beat can be On-Off with the Tool bar icon.

d. The Gain of the ECG can be adjusted with the + or – with the Tool bar icon.

e. The percent (%) of prematurity above the VE beats has been enhanced.

f. The CAPS LOCK key is now active as a shortcut for turning on the All Templates Switch. You can use the power switch icon on the lower left or the CAPS LOCK key. When active, all the templates at the bottom section of the EDIT display can be edited with one command. For example, if you see the templates in the bottom section are artifact, you can press the CAPS LOCK and press the F key (or mouse click the F icon) and all beats are edited to Artifact.
g. **Note:** Additional artifact rejection has been added to both the 76a and the DMS 300-3A and 300-4A Holter recorders. This will allow Holter ECG recordings to be edited in less time.

h. **CATEGORY on right side of EDIT BEATS:** Auto sequence to next Category for all Categories.

![Screenshot of Edit Beats interface](image)

i. Click on Histogram icon on right side of above display, and double left click on R-R Interval. The following screenshot demonstrates the new display that you will see. The far right and left sides very often show interesting ECG events.
j. Within the Histogram display above, there is a new BBB beat classification. The BBB label is found in the lower right and is activated by the “U” key. If you want to, for example, change the BBB label to a Fusion label or a Ventricular Escape, you can do this. Find the BBB label at the bottom right, place the mouse arrow at BBB followed by U, and do a right mouse click. A window will open in the center of the display that will allow you to change and customize the beat label for this special abnormal Category.

k. In the EDIT menu, you can choose the large 8-second ECG display (see picture below).
Note the icons at bottom of the display that are for “QT” and “TWA.” Click on the QT icon to see vertical markers for QT interval. QTc measurements must be set up properly in the ST/QT Set-up menu (or Re-Analysis). Place the PR vertical marker at the beginning of an estimated Q-wave, and then use arrow key to move sample point one sample to the left.

If the QT markers are in an acceptable location, you could then access the RULER icon to verify the QT measurements at the bottom left of the ECG Strip. If the RULER measurement is close to the printed QT number, then the QT and QTc numbers are accurate.

Also note the TWA (T-Wave Alternans) icon. From this ECG Strip display in the EDIT menu, you can go into the TWA program by clicking on this TWA icon.
I. Below is the display when you click on the TWA icon.

The + key (in your keyboard’s number pad) increases the Gain of the ECG until the size of the T-waves shows the T-Wave Alternans.

The middle top section shows a 128 beat trend of the peak of the T-waves. The existence of a severe up-and-down trend shows a likely area of TWA.

Click on the PRINT icon to print the TWA Report.
5. PAGE SCAN Menu

a. There are many software additions in the Page Scan Menu.

b. You can select several Trends and Histograms for the top of the Page Scan display.

c. There is a Tool bar on the left side of the Page Scan display. You can select R-R Trend, or V, S, or P Histograms. \( V = \) green bars for quantity of VE beats and the yellow bars show the hours of V-Runs. In the above display, a left click on the yellow bar resulted in the Sustained V-Tach shown below the Histogram.

d. By selecting the S (for SVE beats) or the P (for Pause beats), similar results will be displayed.
e. The Tool bar also allows for the selection of Channel 1, 2, or 3 with the “CH” tool.

f. The next buttons are “+” and “-” for Gain adjust of the ECG display.

g. The next tool allows for the selection of the standard 60-second per line ECG display, or the enlarged 30-second new ECG display.

h. The next section of new tools are located on the left side of the larger ECG display found on the bottom of the screen.
   - The first tool is for keeping the red grid background, or removing it.
   - The next tool is for displaying the heart rate, or removing it.
   - The next tool is for displaying the ms of the R-R, or removing it.
   - The next tool is for displaying the V beat label, or removing it.
   - The next tool is for displaying the dot rectangular box around the selected beat.
   - The 8, 16, and 24 tools are the number of seconds in the rectangular dot box.

i. Additional new features at the bottom of the Page Scan display.

At the bottom of the 3-Lead ECG is a slide bar that allows you to move the 3-Lead ECG throughout the 24-hour time period.

There is also an ECG Strip icon. Clicking on this icon results in the display below appearing.
As you can see, a window opens up on the right side of the screen. This feature allows you to see the additional ECG Strips that are being added to the report.
6. A-FIB/FLU Menu

A-Fib algorithm changes have been added. A-Fib detection performs better at SVE Prematurity selections of 20% or 15%. For A-Fib patients, go to Settings menu, and select the 20% or 15% SVE Prematurity %. As shown above, the ECG Gain can be selected at Full Size or Half Size.

7. HRV Menu

a. You can select either HRV or Deceleration Capacity. Outside of USA and EU, you can access a HR Turbulence program.
b. Click on HRV.

c. There are four (4) Lorenz Plots across the top of the HRV display. You can click on any of the four plots. Double left click on the top-left Lorenz Plot.
d. The dots represent the ms R-R difference of the subject beat and the next beat. As the beats are located more towards the lower left corner, the less the Heart Rate Variability and the higher the Risk.

e. There are many options in viewing the locations of these dots. The dots are color-coded. VE beats are green dots, SVE beats are magenta dots, normal beats are white dots.

f. At the top-left, there is an “ALL” field. Click on the access arrow.

g. You can select the dots from the following options: All, Normal, VE, V-Pair, V-Run, SVE, SVE-Pair, SV-Run, or Artifact. For example, below shows V-Run.
h. There is a plot of only the beats that are in the V-Tach for this patient. If you do a point and drag to surround some beats, you can see the screen below.

![Plot of V-Tach beats]

i. The beginnings of each V-Tach are shown on the right side. You can double left click on any of these ECG Strips and see the enlarged ECG Strips in the same manner as you see them in other parts of the CardioScan program. You can edit the beats, if desired.

j. At the top of display, you see a field for Color Plan 1 and Color Plan 2. The picture in “f” above is Color Plan 2. Below is Color Plan 1. The difference is that the black dots to the far right are the beats that are the next beat after the green beats in “f” above.
k. Heart Rate Variability requires the deletion of Artifact beats. Artifact beats result in incorrect measurements of R-R intervals, and HRV is based on good Normal-to-Normal beats. Very often white dots that are in the lower left corner are artifact, and can be easily edited by a mouse point, drag, and surround. Then a right mouse click, and then click Artifact. You can verify the surrounded beats by verifying the ECG Strips on far right side.
8. DECELERATION CAPACITY

a. Click on Deceleration Capacity. Password is vec321.

b. The published medical literature suggests “Impaired heart rate deceleration capacity is a powerful predictor of mortality after myocardial infarction and is more accurate than LVEP and the conventional measures of heart rate variability.”

c. To obtain more information on Deceleration Capacity, we suggest an online search for “Deceleration Capacity of Heart Rate as a Predictor of Mortality.”

d. After typing in the password, the below is displayed.
e. The RULES icon allows for measurement of selected time periods, other than the default 24-hours.

f. Click on PRINT. The Deceleration Capacity report is completed.

g. Deceleration Capacity + Lorenz Plots + Autonomic Nervous System can be a strong predictor of patient risk.
Advances in Template Editing

With CardioScan 76a, Holter ECG editing can continue to be performed in the traditional manner, or you can select a new method of editing.

The purpose of this new method of editing is to provide a quicker and more accurate editing process. This new editing process will apply to most Holter ECG files, but not all.

The following is a description of this new method:

1. Go to System Setting. The below screen display will appear.

2. Select New Template at bottom right.

3. Also, select SVE Premature % at 30%; and select Manual Set ST at Yes.

4. Click on OK at bottom left to exit.
5. Select the “Tom Jones” patient file from Prior Holter menu. You can obtain this file by accessing the “Technical Support / Distributors” section of the DM Software website (www.holterdms.com). Click on the “Distributors” link, enter your username and password, and scroll down to “Sample Patient Holter ECG Files”. Follow the instructions to download the file.

6. From Data Access Choices menu, click on Edit to see the below screen display. This is the look of “New Templates.”

![Image of screen display]

7. Click on Close at bottom right to start the instructions for use of the New Templates.

8. After clicking on Close, you will see the below screen display.

![Image of screen display]
9. Click on Re-Analy at the bottom right to begin the re-analysis process.

Note that for QT analysis, we suggest that you move the PR baseline vertical marker one sample to the left (Tab key and left arrow key) for channels 1 and 3.

10. To begin the re-analysis, use the F10 key or click on the Accept icon (from 1 to 3 times). Depending on the speed of the PC, the re-analysis should take less than 20-seconds.
11. Click on the “Edit” icon at top left. This will take you to the New Templates. You are now ready to edit.

12. To begin the editing process, you want to edit in the opposite direction from the previous method. First edit the Normal beats, then the Artifact beats, then the SVE Template, then the BBB, then the Aberrant, and finally the VE Template.

The purpose of the above paragraph is to label all of the VE beats that may be in Normal, Artifact, etc. before beginning the New Template process.
13. Click on the Normal box.

VE beats would most likely be in first template at bottom left. There are no VE beats in the Normal templates, so click on Close at the bottom right.

14. Click on the Artifact box, and quickly see that there are no VE beats. Click Close.

15. Click on SVE Template, and see a new display of SVE beats prior to editing the SVE beats.
You will now see a 2-beat display. The second ECG beat is the SVE beat, or artifact. Above each 2-beat display is a horizontal yellow line with 2 small legs. The vertical legs represent where the beats were detected. When the vertical legs are directly above 2 good R-waves, then all is OK. However, when one of the vertical legs is lined up on something other than a real R-wave, then you need to edit as an Artifact or it could be a VE beat.

In the above, note that column 1 with rows 1 and 4 are artifact; column 2 with row 4 is artifact; column 3 with row 1 is artifact; column 4 with row 2 is artifact; and column 5 with rows 2 and 3 are artifact. You can use the mouse to select these artifact beats, and use the “F” key to change to Artifact.

Now you have edited your SVE beats.

Note: you may want to move the mouse arrow to column 1 and row 2, and do a double left click. You will see that the second beat of the SV Run needs to be changed to S.

Click on Close at bottom right to continue the editing process.

16. You are back to the New Template screen display. Click on the Aberrant box. There are 4 Aberrant beats. Change the first Aberrant beat to S for SVE, and change the remaining 3 beats to Artifact. Click on Close at bottom right.

17. Now click on Update Template icon on lower right side. If there had been any VE beats in the non-VE templates, they will now be moved to the VE Template box.

18. After clicking on Update Template, edit the VE Template. Click on the first VE Template box.
For all patients, the first template at the bottom is most likely to need editing. It is shown above surrounded in a small white box with a “21” at the top. This is the number of beats.

You will see that 12 beats need to be edited to Artifact. They are C1-R2&4, C3-all, C4-all, C5-R3, and C6-R1&3 (C=column and R=row). Use mouse arrow and F key to change to Artifact.

Quickly click on template boxes at bottom for 154, 29, 11, and 5 to visually verify that they are VE beats.

19. Now you want to move all of the good VE beats into the second template at the bottom of the display. This is the template with 154 beats.

You will see 5 template boxes at the bottom of the display. They need to all be moved into the second template.

You move the 4 other templates into the second template with a simple point and drag of the mouse. Place the mouse arrow on the first template, do a left click and hold, and then slide the first template on top of the second template and release the left click. Repeat this process for templates 3, 4, and 5.

You should see the below.

20. All of the VE beats are now in a single template at the bottom of the display. They are all in the second template box.

21. This is the focus of New Template editing. Get all of the good VE beats into the single template box, and the single template is to be located in the second template location.
22. Now we want to get the VE beats separated by foci. Essentially this is separating VE beats that are positive-going from those that are negative-going. And then, we want to print a new Report Page for Multi-focal Arrhythmias.

**Place the mouse arrow just below the second template box, and do a right mouse click.** The below screen display will appear.

The most common selections (from the right mouse click) are Auto Multifocal VE Sort (CH1) and Print Multifocal VE Report.
23. Click on the Auto Multifocal VE Sort (CH1) and the following display will appear.

24. In less than 3-seconds, there is a separation of positive-going VE beats and negative-going VE beats.

   The VE beats in the second template will automatically go to VE1 in the Category column of the EDIT screen display; and the VE beats in the third template will go to VE2 in the Category column. Thus, the different foci VE beats are prepared for the ECG Strip prints in the Holter report.

   It is important that all the VE beats first go into the second template, and then use the right mouse click to auto-sort the multi-focal beats. The second template will always be the VE1 beats, and the third template will always be the VE2 beats.

25. To print a multifocal report, click on Print Multifocal VE Report.

   The printed page gives you numerical data and a 24-hour histogram for each of the multi-focal VE beats. You can print up to 4 different types of multifocal beats on the one-page print-out.

   It is very seldom that you actually have more than 2 multifocal VE beats, but you can edit so that you could place additional VE beats in the fourth and fifth template locations. Usually, the difference in positive-going VE beats is caused by body position changes.

   The second template = the first 24-hour (minute-by-minute) histogram of VE beats.  
   The third template = the second 24-hour histogram print-out. 
   The fourth template = the third 24-hour histogram print-out.  
   He fifth template = the fourth 24-hour histogram print-out.
Note: There are three (3) other multi-focal sorts. This is for more difficult arrhythmias and requires more sophisticated editing. We recommend that you first get comfortable with the procedures outlined above.

Note: We recognize that this is a new editing process; however, we think that with a little practice, you will be able to process most Holter ECG files in a significantly shorter time period, and with more accuracy.

*********************************

In addition to the “Tom Jones” patient file referenced above, we encourage you to download a second demo Holter file (VT Morton).

As previously indicated, you can obtain this file by accessing the “Technical Support / Distributors” section of the DM Software website (www.holterdms.com). Click on the “Distributors” link, enter your username and password, and scroll down to “Sample Patient Holter ECG Files”. Follow the instructions to download the file.

First, go to PageScan. Go to the time of 23:16. The remaining several hours after 23:16 need to be changed completely to Artifact.

Use your mouse to select all the time from 23:17 to the end of the Holter. When done properly, this time period will be shaded gray. Then press the “F” key to change all of this time to Artifact.

Then process VT Morton per the above recommendations. Note how the Auto Multifocal Sort (CH1) generally separated the V-Tach beats from the other VE beats.
A-Fib Editing

This section highlights the dramatic improvements that have been made in A-Fib editing with CardioScan 76a. The result is the most accurate A-Fib report available from any Holter ECG system.

The A-Fib edit function has a new screen display, and is designed to make the editing process quicker and more accurate.

The description below is to be used in conjunction with the “AF Raponi” demo patient file. You can obtain this file by accessing the “Technical Support / Distributors” section of the DM Software website (www.holterdms.com). Click on the “Distributors” link, enter your username and password, and scroll down to “Sample Patient Holter ECG Files”. Follow the instructions to download the file.

Please note with respect to A-Fib that, at times, you may need to select SVE Prematurity at 15% or 20% in the System Setting menu. For this “Raponi” demo file, the SVE Prematurity was set at 30%.

The above is a screenshot of the new A-Fib editing. The top of the display shows the 24-hour heart rate. The light blue area equates to 1-hour of heart rate data. The red area is the A-Fib time period.
The 24-hour Heart Rate graph shows the heart rate on a minute-to-minute basis. Each minute the minimum and maximum heart rate is calculated. Typically, there is very little variation in heart rate during each minute. For those minutes that do display significant heart rate changes, you will see vertical green lines. The bottom of the vertical green line represents the minimum HR for the minute, and the top represents the maximum HR for the minute.

During A-Fib, the heart rate jumps up to a higher overall average. As you can see above, the heart rate trend line significantly increases to reflect this higher average.

A-Fib minutes are shown shaded in red. In addition to a higher heart rate average, notable immediate swings in low and high heart rates are also experienced during A-Fib. The vertical green lines become much longer because of these swings in heart rate.

The following is a description of the new A-Fib editing process. We will use the aforementioned “AF Raponi” demo patient file as reference. Analyze this file, and do NOT analyze channel 2.
Below the 24-hour heart rate trend are three (3) independent data displays. The top 1/3 are dot locations for each R-R interval. Those dots that are colored purple have been detected as SVE beats, and those dots that are colored green have been detected as VE beats. In the event of an R-R interval in excess of 2.0 seconds, you will see a red dot. For A-Fib patients you will see dots scattered in a chaotic manner.

The middle section shows P-wave changes. Imagine taking an ECG complex, and rotating it a quarter turn clockwise. This middle section shows each ECG complex for the selected 1-hour period in this rotated quarter turn. Starting at the top of this middle section, you can see the baseline ECG coming straight down in a vertical line. The P-wave is the dark black color. Below this, you can see the short green line. This is the baseline PR interval. The orange color is the QRS. If a patient entered into A-Fib, you would see the P-wave dark black color showing a chaotic mix of green colors because the P-wave no longer has a consistent PR interval.

The bottom section is the 3-channel ECG. You can do a left mouse point and click at any location in the top or middle sections, and you will see the corresponding 3-channel ECG here.

In the upper right, you can see the A-Fib data box. This allows you to access several edit functions directly.
Now let us see the ease with which CardioScan 76a allows you to recognize A-Fib time periods, and quickly add or delete A-Fib episodes.

With the mouse, select the first hour of A-Fib at the top of the screen (light blue).

The display shows the red color for the hour. The entire hour is detected as A-Fib. Note the many purple dots. These ECG beats were detected as SVE beats; however, you cannot have SVE beats during A-Fib rhythm. Thus, in the edit box at the top right, click on the icon “Remove SVE,” and the program will remove all SVE beats from all of the A-Fib time periods. In general, cardiologists prefer that VE beats in A-Fib minutes should be labeled as Aberrant beats. To accomplish this, click on the icon “Convert VE to Aberrant.”

Now click on the hour prior to the first hour of A-Fib.
The display shows all the sinus and A-Fib rhythm for this hour. You will see that the top 1/3 section and the middle section complement each other in showing the sinus and A-Fib time periods. You can use the mouse to quickly make the necessary edit changes.

Starting at about 17:40 (about the mid-point of the top 1/3 section), the rhythm appears to change from sinus to A-Fib. In this example the white background color indicates that the entire 1-hour of data is the sinus rhythm.

Take the mouse and do a point-and-drag across the first group of chaotic R-R intervals. After you do the point-and-drag, you need to click on the “Add” icon in the box at the right side. When you complete this process, the screen display will appear as follows.
Note that for the corresponding time period in the middle section, the P-wave display does not have the dark black color for the P-wave. This is caused by the chaotic PR interval that occurs during A-Fib.

To complete the editing process, do the point-and-drag edit for the remainder of the chaotic dot locations.

Click on the “Remove SVE” to remove the SVE beats from the new edited A-Fib minutes. Note again that the R-R interval section and the P-wave section complement each other in showing the chaotic heart rate changes and the chaotic PR interval changes. Accurate A-Fib editing is as simple as this.

If you see a red area that is not A-Fib rhythm, you can do the same point-and-drag, and then click on the “Delete” icon in the box at the right side. In order to verify that the red areas are A-Fib time periods, simply place the mouse arrow in the red area, and do a single left click. You will immediately see the A-Fib rhythm ECG strip at the bottom of the display.

When you are finished, click on the “Print Fib Report” to print.

For Multi-Day ECG reports, do the quick daily A-Fib edit process for each individual day.
New Outputs and Interfaces

Introduction

CardioScan 76a adds many significant data outputs that can be used for research studies and for databases such as HL7, DICOM, PDF, and SQL, among others.

These new outputs can be found in the ECG Strips menu, the HRV menu, and the Report menu. There will soon be similar outputs added to the A-Fib menu and the QT Validation menu.

This section will focus on the outputs and interfaces in the ECG Strip menu, the HRV menu, and the Report menu.

The ECG Strip menu provides outputs with buttons labeled “Output” and “Output Raw ECG Data”. The “Output” button is simply a traditional real-time ECG display for any selected time period. The “Output Raw ECG Data” button provides choices on how a user can select multiple formats to transfer raw ECG data for any selected time period into other programs, databases, or other medical analysis devices. For example, the ECG signal print-out consists of 128 sample points per second that are joined together to create a smooth and diagnostic ECG trace. The ASCII and HL7 FDA XML formats identify the exact position of each sample point for each channel of ECG data for a time period of 1 to 1440 minutes. (please refer to the DMS HL7 manual to review the details of the HL7 FDA XML format)

The HRV menu provides an output for HRV study projects. Many university hospitals have developed their own HRV computer algorithms for reporting on a wide spectrum of Heart Rate Variability activity. There are two general HRV outputs. The first output is of 5-minute HRV analysis data groups for both Time Domain and Frequency Analysis. The 5-minute data groups cover the entire length of the 24-hour Holter ECG. The second HRV output is the one most used by research study projects. It sends the R-R interval in ms to the C:\ for each ECG beat in the 24-hour Holter ECG. Each beat is annotated as (1) a qualified N-N beat, (2) a Ventricular Ectopic beat, (3) an Atrial Ectopic beat, and (4) an Artifact detected signal. The C:\ drive data can be instantly accessed from this HRV output menu.
A. CREATING RAW ECG DATA OUTPUT IN ASCII (TXT) OR XML FORMAT

1. Start the CardioScan Premier software, and access the desired patient file via the **Prior Holter** menu.

2. From the **Data Access Choices** menu, click on **ECG Strip**.
3. At the top-right of the window, select the ECG output start time. By default, it is 2 minutes after the start time of the recording.

4. Click on Output Raw ECG Data and select Save to ASCII File or Save ECG to HL7 FDA XML File depending on the desired output format. There is also an option to Save Raw Data to Binary Format.

5. The Output Duration window will appear. Select the number of minutes from the start time you would like to output. Click OK when done.
6. A new window will appear, displaying the location of the output file. By default, the file name is the last name of the patient, and it is saved to the root of the C: drive. Click OK to finish.

7. To access the file, close out of the CardioScan Premier software, and browse to the C: drive using Windows Explorer (right-click on the Start button and click on Explore or Open Windows Explorer). You will see the files located there.
8. Double-click on the TXT (ASCII) or XML file to open it, or right-click then **Open with** to specify which program you would like to view the file with. Samples of the output files can be found below.
XML (HL7 FDA XML)

```xml
<?xml version="1.0" encoding="UTF-8"?>
<AnnnotatedECG
 codeSystem="urn:hl7-org:v3/HL7/aECG/FDA/2003-12/schema/PORT_MT020001.xsd"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xmlns:voc="urn:hl7-org:v3/voc"
 xmlns:id="urn:hl7-org:v3">
 <id root="A0B0E0B-184F-4F42-B9CE-AD3DDESSE75F"/>
 <code display="Electrocardiogram" codeSystem="C1T4"
 codeSystem="2.16.840.1.113883.6.12" code="030000"/>
 <effectiveTime>
  <low value="20110406000200.000"/>
  <high value="20110406000210.000"/>
 </effectiveTime>
 <componentOf contextConductionInd="true" typeCode="COMP">
  <timePointEvent moodCode="EVN" classCode="CITTEVENT">
   <componentOf contextConductionInd="true" typeCode="COMP">
    <subjectAssignment moodCode="EVN" classCode="CLNTRL">
     <subject typeCode="SBJ" contextControlCode="OP">
      <trialSubject classCode="RESB3">
       <id extension="0001"/>
       <subjectDemographicPerson classCode="PSN"
 determinerCode="INSTANCE">
        <name>Doe John</name>
        <administrativeGenderCode display="Undefined"
 codeSystemName="AdministrativeGender"
 codeSystem="2.16.840.1.113883.5.1" code="UN"/>
        <birthTime value="2001-1-1-1-1-1-1.000"/>
     </trialSubject>
    </subject>
   </subjectAssignment>
  </timePointEvent>
 </componentOf>
</AnnnotatedECG>
```
XML (HL7 FDA XML) Cont.
B. CREATING HRV OUTPUT IN ASCII (TXT) OR XLS (EXCEL) FORMAT

1. Start the CardioScan Premier software, and access the desired patient file via the Prior Holter menu.

2. From the Data Access Choices menu, click on HRV and select HRV again.
3. At the bottom-right of the window, click on **Output HRV**.

4. The HRV output window will appear:

   - The time interval can be changed in the bottom-left corner, click **Refresh** to see the changes once the time is set.
   - Click on **Print** to print this chart using a printer.
   - Click on **Output** to view this chart as a text file using Notepad.
5. You can specify the output directory using the box in the bottom-right. It is set to C:\ by default. Click on **Output to Xls** to create the output files.

6. A new window will appear, displaying the location of the output files. By default, the file name includes the last name of the patient, the times of the interval, and is saved to the root of the C: drive. Click **OK** to finish.

![Output window](image)

7. To access the files, close out of the CardioScan Premier software, and browse to the C: drive using **Windows Explorer** (right-click on the Start button and click on **Explore** or **Open Windows Explorer**). You will see the files located there.
8. Double-click on the TXT (ASCII) or XLS (Excel) file to open it, or right-click then **Open with** to specify which program you would like to view the file with. Samples of the output files can be found on the next page.
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00</td>
<td>Qualified QRS</td>
</tr>
<tr>
<td>00:02</td>
<td>Atrial Ectopic</td>
</tr>
<tr>
<td>00:03</td>
<td>Ventricular Ectopic</td>
</tr>
<tr>
<td>00:04</td>
<td>Artifact</td>
</tr>
</tbody>
</table>

Start time: 00:00
First beat time: 00:02:01.15
End header
V963
Q100
Q1039
Q1023
Q1063
Q1054
Q1055
Q1070
Q1039
Q1047
Q1055
Q1047
Q1078
Q1062
Q1047
Q1071
Q1070
Q1070
Q1078
Q1086
Q1063
Q1078
Q1062
Q1039
Q1039
Q1070
Q1070
Q1035
Q1086
Q1047
Q1070
Q1078
<table>
<thead>
<tr>
<th>Time (s)</th>
<th>SDNN</th>
<th>SDANN</th>
<th>NIN50</th>
<th>pNN50</th>
<th>TOTAL PCVLF</th>
<th>LF</th>
<th>HF</th>
<th>LF/HF Ratio</th>
<th>HEART RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00</td>
<td>52</td>
<td>46</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>55 bpm</td>
</tr>
<tr>
<td>00:05</td>
<td>56</td>
<td>42</td>
<td>1</td>
<td>7</td>
<td>2651.2</td>
<td>770.7</td>
<td>1618.2</td>
<td>50.3</td>
<td>55 bpm</td>
</tr>
<tr>
<td>00:10</td>
<td>57</td>
<td>32</td>
<td>14</td>
<td>3</td>
<td>4678.4</td>
<td>4405.5</td>
<td>7716.0</td>
<td>50.0</td>
<td>54 bpm</td>
</tr>
<tr>
<td>00:15</td>
<td>60</td>
<td>44</td>
<td>14</td>
<td>5</td>
<td>4255.1</td>
<td>2934.9</td>
<td>3955.7</td>
<td>125.1</td>
<td>101.1 bpm</td>
</tr>
<tr>
<td>00:20</td>
<td>60</td>
<td>44</td>
<td>14</td>
<td>5</td>
<td>4255.1</td>
<td>2934.9</td>
<td>3955.7</td>
<td>125.1</td>
<td>101.1 bpm</td>
</tr>
<tr>
<td>00:25</td>
<td>56</td>
<td>42</td>
<td>11</td>
<td>5</td>
<td>2834.8</td>
<td>1722.2</td>
<td>3283.9</td>
<td>62.3</td>
<td>54 bpm</td>
</tr>
<tr>
<td>00:30</td>
<td>57</td>
<td>32</td>
<td>26</td>
<td>15</td>
<td>5353.1</td>
<td>1949.9</td>
<td>3158.3</td>
<td>219.5</td>
<td>54 bpm</td>
</tr>
<tr>
<td>00:35</td>
<td>47</td>
<td>22</td>
<td>22</td>
<td>14</td>
<td>3158.8</td>
<td>2080.6</td>
<td>8888.0</td>
<td>173.1</td>
<td>56 bpm</td>
</tr>
<tr>
<td>00:40</td>
<td>50</td>
<td>31</td>
<td>21</td>
<td>13</td>
<td>3417.2</td>
<td>1571.8</td>
<td>1601.9</td>
<td>158.0</td>
<td>55 bpm</td>
</tr>
<tr>
<td>00:45</td>
<td>60</td>
<td>30</td>
<td>21</td>
<td>14</td>
<td>7218.0</td>
<td>5544.0</td>
<td>1853.8</td>
<td>142.4</td>
<td>56 bpm</td>
</tr>
<tr>
<td>00:50</td>
<td>61</td>
<td>23</td>
<td>16</td>
<td>13</td>
<td>6666.6</td>
<td>5012.9</td>
<td>1850.5</td>
<td>97.9</td>
<td>54 bpm</td>
</tr>
<tr>
<td>00:55</td>
<td>73</td>
<td>35</td>
<td>13</td>
<td>15</td>
<td>5997.1</td>
<td>4128.6</td>
<td>1722.6</td>
<td>142.0</td>
<td>55 bpm</td>
</tr>
<tr>
<td>01:00</td>
<td>62</td>
<td>38</td>
<td>10</td>
<td>0</td>
<td>1361.7</td>
<td>832.6</td>
<td>519.0</td>
<td>25.8</td>
<td>71 bpm</td>
</tr>
<tr>
<td>01:05</td>
<td>51</td>
<td>33</td>
<td>2</td>
<td>7</td>
<td>4160.0</td>
<td>22702.2</td>
<td>2993.9</td>
<td>20.8</td>
<td>75 bpm</td>
</tr>
<tr>
<td>01:10</td>
<td>54</td>
<td>20</td>
<td>5</td>
<td>4</td>
<td>5755.4</td>
<td>3391.1</td>
<td>1475.0</td>
<td>40.0</td>
<td>80 bpm</td>
</tr>
<tr>
<td>01:15</td>
<td>47</td>
<td>16</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>01:20</td>
<td>79</td>
<td>33</td>
<td>11</td>
<td>7</td>
<td>4777.1</td>
<td>3400.0</td>
<td>5500.0</td>
<td>5.6</td>
<td>94 bpm</td>
</tr>
<tr>
<td>01:25</td>
<td>96</td>
<td>28</td>
<td>2</td>
<td>2</td>
<td>6166.6</td>
<td>6445.6</td>
<td>1459.4</td>
<td>22.5</td>
<td>80 bpm</td>
</tr>
</tbody>
</table>
C. CREATING REPORT SUMMARY OUTPUT IN ASCII (TXT) FORMAT

1. Start the CardioScan Premier software, and access the desired patient file via the Prior Holter menu.

2. From the Data Access Choices menu, click on Report.
3. On the right side of the window, click on ASCII.
4. All of the categories are selected by default. Uncheck the box for any you would like to omit, and then click Transfer to ASCII.

![Screenshot of CardioScan Premier software with Transfer to ASCII button highlighted]

5. A window will appear, letting you know the file creation is complete. Click OK to close it.

![Screenshot of window indicating file creation is complete]

6. To access the file, close out of the CardioScan Premier software, and browse to the folder where CardioScan is installed (typically C:\Carsc12) using Windows Explorer (right-click on the Start button and click on Explore or Open Windows Explorer). You will see the file named ASCII.txt located in there.

![Screenshot of Windows Explorer with ASCII.txt file highlighted]
7. Double-click on the file to open it.
D. CREATING REPORT OUTPUT IN PDF FORMAT

1. Start the CardioScan Premier software, and access the desired patient file via the Prior Holter menu.

2. From the Data Access Choices menu, click on Report.
3. On the left side of the window, check the boxes next to the reports you would like to save as a PDF file. On the right side of the window, click on PDF+DICOM.

4. In the bottom-left corner of the window, select Color or Black and White, and then click on the PDF File icon.
5. Select **Create PDF File** to create the PDF file. When it is finished, you will see the file appear in the box above the icons. At this point, you can select **Preview** to view the file, or **Send Email** to launch the computer’s default Email program.

6. Select the PDF file and click on Export.
7. You will now be able to specify the location where you wish to save the PDF report, as well as the file name. When ready, click **Save**.

![Save As dialog box](image1)

8. A window will appear, letting you know the file has been saved. Click **OK** to close it.

![Successful message](image2)
E. CREATING REPORT OUTPUT IN DICOM FORMAT

1. The first step is to input the DICOM server settings. Start the CardioScan Premier software, and click on System Setting. Select the Other A tab, and click on DICOM Server Setup.

2. Enter the correct DICOM server parameters (please consult your IT/EMR department), and click Close when finished. Then, click OK to close the System Setting menu.
3. Access the desired patient file via the **Prior Holter** menu.

4. From the **Data Access Choices** menu, click on **Report**.
5. On the left side of the window, check the boxes next to the reports you would like to save. On the right side of the window, click on PDF+DICOM.

6. Click on the DICOM File icon, and select Create DICOM File. When finished, the file will appear in the box above the icons.
7. Select the file and either click on (a) DICOM File, then Transfer to Server, or (b) Export.

8. If you select Export, you will now be able to specify the location where you wish to save the DICOM file, as well as the file name. When ready, click Save.
9. A window will appear, letting you know the file has been saved. Click **OK** to close it.
F. USING A BARCODE SCANNER TO INPUT PATIENT INFORMATION

1. To automatically input patient information by using a barcode scanner, run CardioScan Premier, go to System Settings -> Other A tab. Under “Auto Fill Patient Info”, there is a drop-down box that lets you select the desired method.

![System Settings](image)

2. After making your selection, click the OK button.

3. You can now go into the “New Patient” menu and scan the barcode, or manually enter the number under “Case #” and press Enter. The patient data will be filled in for you automatically.