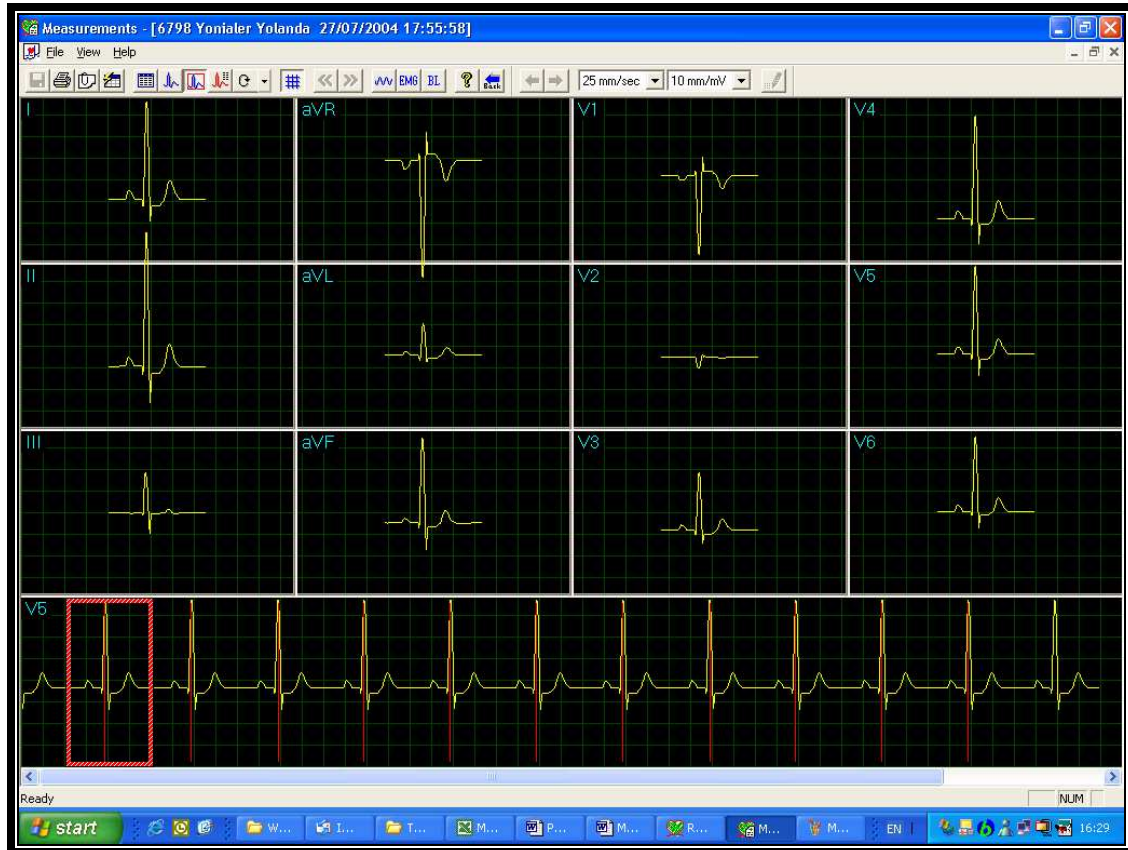


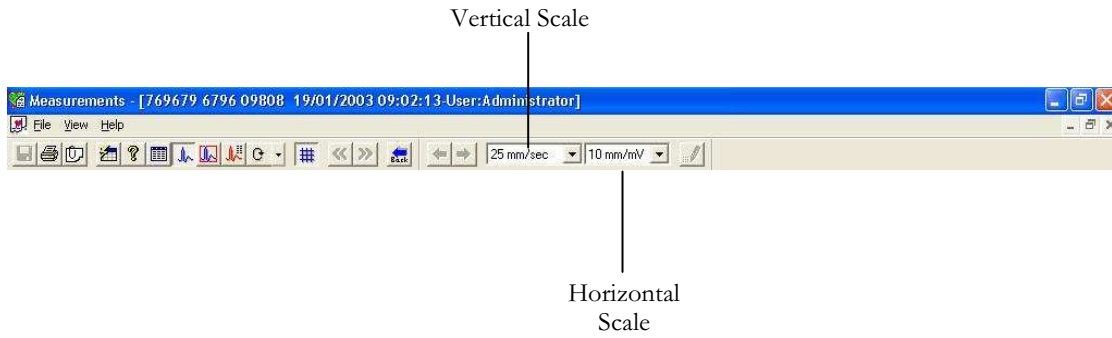
## QRS Display



**Figure 22: Measurements—QRS display**

The QRS screen displays the QRS in each of the leads and a strip lead of a default lead (defined in the setup of the application from which Measurements was accessed). The QRS displayed in each of the leads is marked by a red rectangle in the strip lead. To view a different QRS in all the leads, drag and drop the square by to a different QRS. The QRS markers can be moved to the left and right (between the previous and the next marker). Changes in marker positions are recalculated and displayed in the tabular screen and the Averages screen.

## Toolbar of Averages/QRS Displays



**Figure 23: Toolbar of Averages/QRS**

## Caliper Display

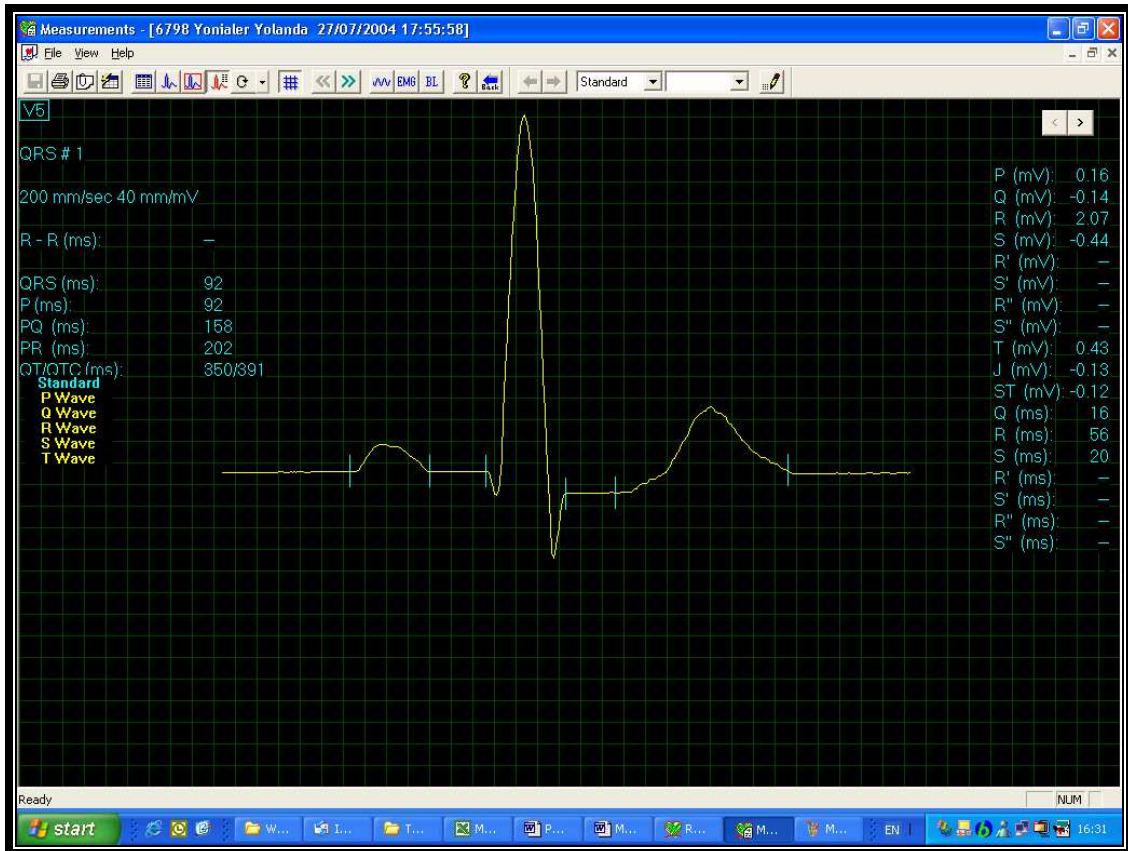


Figure 24: Measurements—Caliper

## Toolbar of Caliper Display

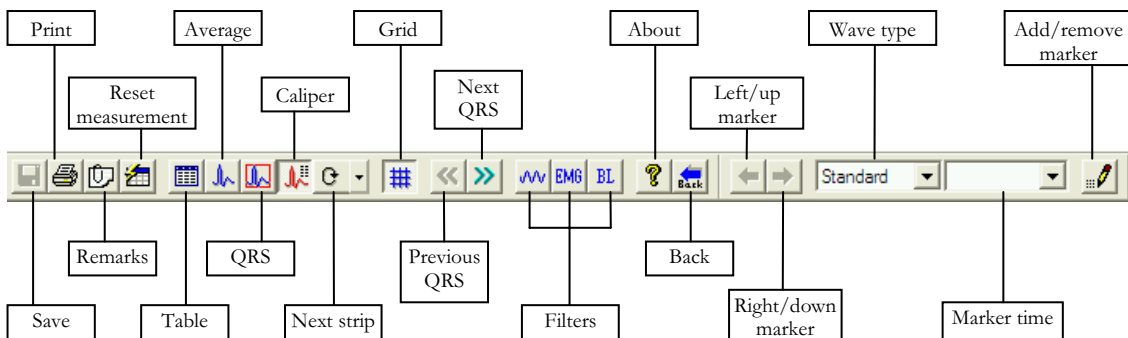

























Figure 25: Toolbar of Caliper

The Caliper screen (above) is opened via the menu, the toolbar, or by double clicking a lead in the QRS or Averages screens. It displays one QRS with its values. The user can edit locations of wave markers, display different QRS in the same lead, or navigate through leads and display QRS in different leads. Changes in wave marker positions are recalculated and displayed in the tabular screen.

## Toolbar and Menus

To do this	Click this icon	Or use this short-cut key	Or select this menu	Description
Save Measurements		Ctrl+S	File > Save	Saves measurements to test file on disk.
Print ECG		F6	File > Print ECG	Off line printing. The ECG is printed in miniature format. Horizontal: 6.25 mm/sec, vertical: 2.5 mm/mV.
Add/View Remarks		Alt+V+R	View > Remarks	Lets you enter free text during or after the ECG recording. This is printed and saved together with ECG traces.
Reset Measurements		Alt+F+M	File > Reset Measurements	Reset measurements to those calculated by the application. This option will eliminate all the modification performed manually in the measurements.
To Open Measurements in Table Format			View > View Format > Measurements table	Displays the measurements in a table format.
To Display QRS Averages			View > View Format > Averages	Displays the QRS averages on screen.
To Display QRSs in All the Channels			View > View Format > QRS	Displays the QRSs in all the channels on screen .
Display Caliper			View > View Format > Caliper	Displays the Caliper.
Display the Next Leads		Ctrl+0	View > View Format > Next strip	Lets you scroll through all leads in the 3X1 display.
Display/Hide the Grid			View > Grid	Optional display of 5mm raster.

To do this	Click this icon	Or use this short-cut key	Or select this menu	Description
To Display Information			Help > About...	Displays software version number. Quote this for any software inquiry. Also shows memory size and free disk space. The HASP ID number is the ID of existing software keys. This ID number is used for adding software options.
Previous QRS			View > View Format > Previous QRS	Moves to previous QRS on the same channel.
Next QRS			View > View Format > Next QRS	Moves to next QRS on the same channel.
Set 50/60 Hz Filter			ECG > Filters > 50/60 Hz	ON/OFF for line interference filter. Set OPTIONS for 50 or 60 Hz prior to operation.
Set EMG Filter			ECG > Filters > EMG	ON/OFF for muscle noise filter.
Set Base Line Filter			ECG > Filters > BaseLine	ON/OFF for baseline filter on ECG data.
Move Marker to Right/Bottom	 		-----	Enabled in Caliper screen when a wave type and marker name are selected. Click to move the marker right or down (according to the marker selected).  Disabled when no wave marker is selected or the Caliper screen is not displayed.
Horizontal Resolution			-----	(Averages and QRS screens)  Lets you choose between horizontal displays of 12.5, 25, 50, and 100 mm/sec.  (Default: 25 mm/sec)
Select QRS Wave Type			-----	In Caliper, lets you select the QRS wave type from the list to view its markers. After selecting the wave type, select a marker name to move it.
Vertical Resolution			-----	(Averages and QRS screens)  Lets you choose between vertical displays of 5, 10, 20, and 40 mm/mV.  (Default: 10 mm/mV)

To do this	Click this icon	Or use this short-cut key	Or select this menu	Description
Select Name of QRS Marker			-----	In Caliper, lets you select the name of a marker to edit it (move it up/down/left/right).
Add/Remove ECG Wave Marker			File > Add/Remove ECG Wave Marker	(Caliper screen only) Opens a dialog box and lets you check/clear the wave markers to be displayed and calculated.
Print Reports	-----		File > Print Reports	Lets you choose the report to be printed from the sub-menu: Single QRS/QT Report, Multiple QRS Report, or All Reports.

**Table 26: Measurements Toolbar and Menus**

# CHAPTER 13: DATABASE APPLICATION

(This option is available with the D1\D2 license)

Database application is an optional package requiring a D1 or D2 permission license. Install Database from the PC-ECG1200 package.

Keep and manage ECG studies in a catalog organized according to patient name or ID. In a network, users can share the database (save it in the server). Data acquisition for all applications can be initiated either in the application itself or from the database main screen.

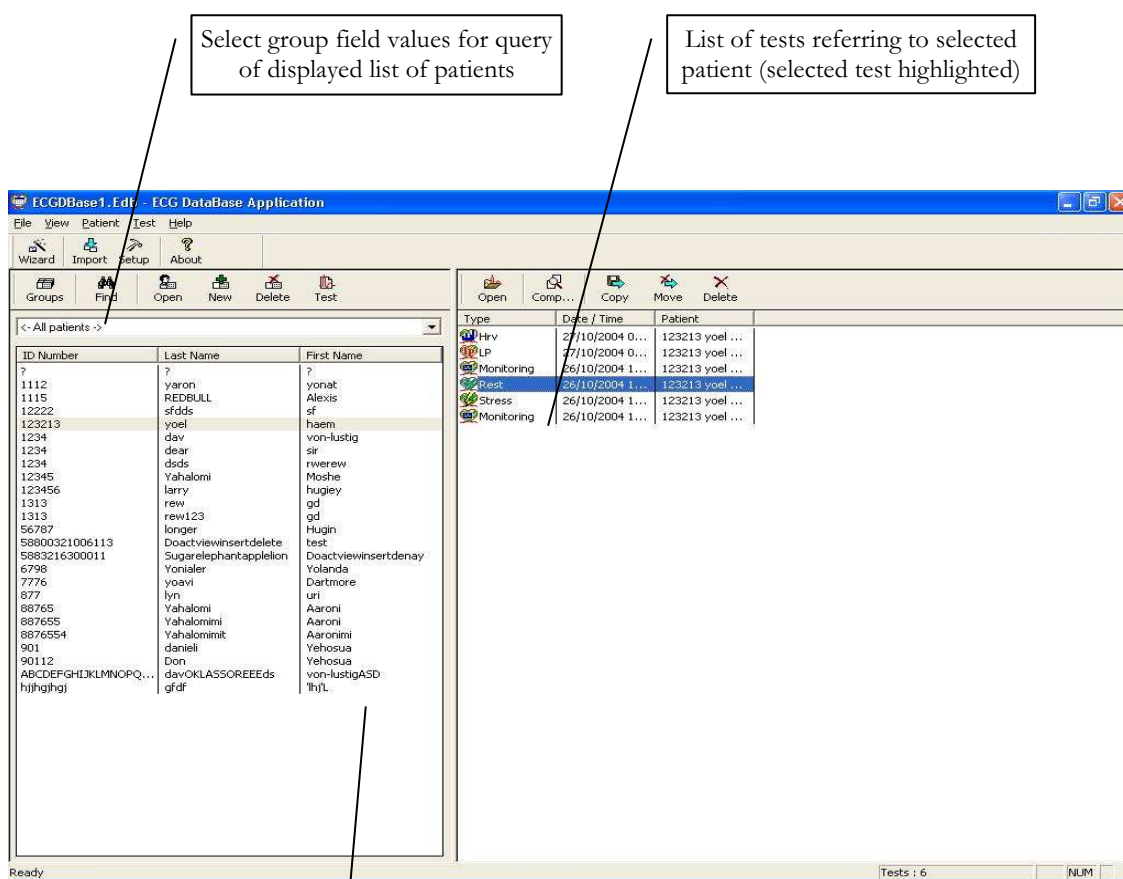


Figure 26: Database Main Screen

List of patients in database (or in selected group)

## First Time Use

When you first start Database application, you are prompted to confirm the location of the database.

- Choose **New** if no database exists
- Choose **Open** to work with an existing database

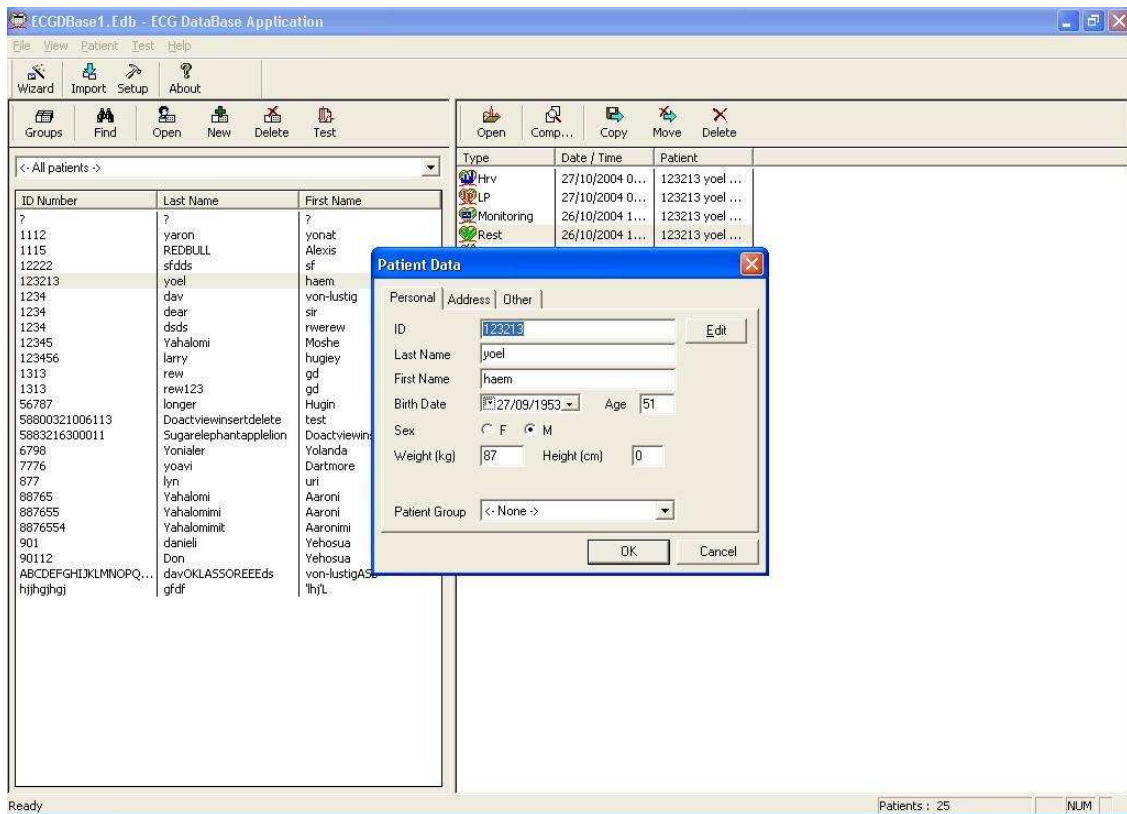


Figure 27: Database Patient Query



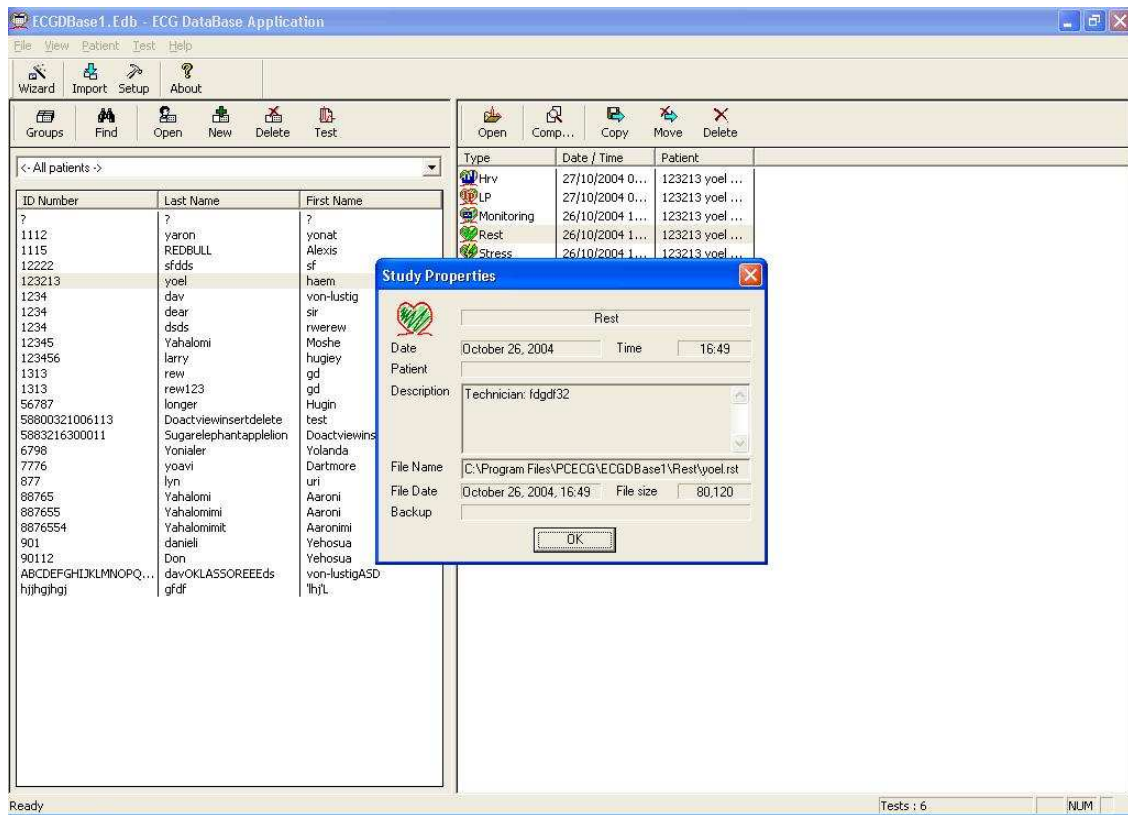


Figure 28: Database Properties of Selected test

## Comparing Rest Tests

Database application allows the user to compare rest tests on 1 or 12 channels.

### To Compare Rest Tests

1. Select two or more Rest tests from the Database interface
2. Click **Compare**





## Database Setup



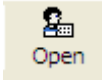


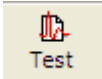

Click Setup on the Toolbar to access the following parameters:

Tab	Description
<b>Default Workspace</b>	Select the default workspace.
<b>Choose Data Directory</b>	Input data directory (with browsing option).
<b>External Patient Data file</b>	Input the location of the external patient data file (with browsing option for PatientFile.INI file).
<b>Delete with Password</b>	Check this option to require a password for DELETE (default: unchecked).

**Table 27: Database Setup Options**

## Toolbar and Menus

To do this	Click this icon	Or use this short-cut key	Or select this menu	Description
<b>Main Toolbar</b>				
<b>Connect to Database</b>		Ctrl+W	File > Database Connection Wizard	Creates a new database or retrieve path for an existing one.
<b>Import tests to database</b>		Ctrl+I	File > Import ECG Data File	Adds studies recorded and saved outside the database. To select all patient data files within a directory, press CTRL + A and verify that all files are checked.
<b>Define Workspace Preferences</b>		Ctrl+T	View > Setup	Defines the location of default workspace, patient identification, and a special file called External File. This file (Windows.INI format) allows the user to prepare a list of patients that can be read by PC-ECG 1200 applications. Note: This feature does not require the D3 software key.
<b>Edit Groups</b>			File > Groups	Defines different patient groups, such as Private, HMO, Military, etc.

To do this	Click this icon	Or use this short-cut key	Or select this menu	Description
<b>View Application Information</b>			Help > About	Displays version number, communication and web information, and disk and RAM memory size. The HASP ID number is used for identification of the software key for adding software options.
<b>Patient Toolbar</b>				
<b>Find a Patient</b>			Patient > Find	Allows the user to find a patient by entering a string in any or all of ID, Last Name, and First Name fields.
<b>Open Patient Detail</b>			Patient > Open Patient	Allows the user to check for patient information before performing a study on a patient.
<b>Add New Patient to Database</b>			Patient > New Patient	Inserts a new patient. You are prompted to enter partial or complete patient details. Enter ID, Last, and First Name at least. If patient details match an existing one you cannot add this patient to the list. The existing patient matching the details will be checked to allow the user to add a study.
<b>Delete a Patient</b>			Patient > Delete Patient	Deletes an entry. If the entry is not empty of studies, you will be asked to confirm deletion.
<b>Perform a New Test</b>			Patient > New Test	Starts the application and starts recording.
<b>Test Toolbar</b>				
<b>Open a Test</b>			Test > Open Test	Allows the user to view a study. You must first select a study to activate OPEN.





To do this	Click this icon	Or use this short-cut key	Or select this menu	Description
Compare Rest tests	 Comp...		Test > Compare	Select two or more Rest tests from the Database interface and click <b>Compare</b> . This option is only available when you check <b>Setup &gt; ECG Recording &gt; Use ECG Database</b> .  Click <b>Compare</b> again to end Compare mode and display the Rest test.
Copy a Test	 Copy		Test > Copy Test	Copies a study.
Move a Test	 Move		Test > Move Test	Moves a study and deletes it from the database. The default option is to leave the study's properties in the database: upon completion of the operation. The study remains in the list with an X sign. You can choose to remove the entire study instead.
Delete a Test	 Delete		Test > Delete Test	Deletes a study from the database. The default option is to leave the study's property in the database: upon completion of the operation, the study remains in the list with an X sign. You can choose to delete the entire study instead.
Update Database			File > Update Database	Updates the database.
Print Setup			File > Print Setup	Opens the <b>Print Setup</b> dialog box to set printing preferences.
View Test Properties			Test > Test Properties	Displays study properties.

Table 28: Database Toolbar and Menus

---

## APPENDIX A: INTERFACING WITH INFORMATION SYSTEMS

There are several ways to exchange information between PC-ECG 1200 and Hospital Information System (HIS). These are described below:

### Demographic Data

#### Information System Prepares Patient Demographic Data for PC-ECG 1200:

This uses a text file called PatientFile.ini. The location is defined in Database setup.

**File Name: PatientFile.ini**

**File Format:**

[PATIENTDATAXXX]

ID=

LastName=

FirstName=

BirthDay=

BirthMonth=

BirthYear=

Sex=

Weight=

Height=

Address=

Phone1=

Phone2=

Fax=

E-Mail=

Medications=

Other=

[PatientDataXXX]—Section name. XXX—number from 000 to 200.

At least one of the keys **ID**, **LastName**, or **FirstName** must be completed. If all these keys are empty, section of this patient will be ignored.

The keys **Height**, **Address**, **Phone1**, **Phone2**, **Fax**, **Email**, **Medications** and **Other** appear only with Database.

**Example:**

[PatientData001]

ID=1234567890

LastName=Smith

FirstName=Worker

BirthDay=11

BirthMonth=6

BirthYear=1959

Sex=1

Weight=59

Height=170

Address=523 Main st. Tacoma Mexico

Phone1=702-8765643

Phone2=702-8743031

Fax=702-8743032

E-Mail=nkir@sympo.ca

Medications=none

Other=none

[PatientData003]

ID=123456789

LastName=Smith

FirstName=Worker3

---

## HL7 Format File

### PC-ECG Prepares HL7 Format File with Stress Test Results

This file is created upon demand in the study review screen.

The file of Stress test in Format HL7 includes:

#### 1. Patient Information:

Name: John  
Last Name: Smith  
Id Number: 12345678  
Birth Date: 24/1/1955  
Sex: M  
Weight: 80 kg

#### 2. Hospital and Physician Information:

Hospital Name: General Hospital  
Hospital Address: Megapolis  
Physician Name: Dr. Stern

#### 3. Test Date and Time:

Test Date: 18/09/1999  
Test Time: 12:41:51

#### 4. Test Results:

Protocol: Bruce  
  
Target HR: 183  
Max HR: 175 (95%)  
  
Max. SBP: 200  
Max. DBP: 100  
  
Max. METS: 8.8  
Max. VO2: 30.9  
  
ST = J+60

**5. Results of Blood Pressure, HR, Double Product (HRXBP sys.), ST level (mm) and ST Slope (mV/sec) for the Most Important Stages of Stress Test:**

*Rest:* BP: 150/100, HR: 79, Product: 11850, ST Level (mm), Slope (mV/sec) (-1.2/0.7, 0.2/1.8, 1.9/-0.5, -2.0/0.4, -2.9/3.3, -1.1/2.6, -1.4/2.2, -1.6/1.8, -1.3/6.1, -1.8/2.5, -1.7/1.5)

*Max HR:* Time: 7:05, BP: 200/100, HR: 175, Product: 35000, ST Level (mm), Slope (mV/sec) (-1.2/0.7, 0.2/1.5, 1.9/-0.5, -2.0/0.1, -2.9/3.3, -2.1/2.6, -1.4/2.2, -1.4/1.8, -1.7/6.1, -1.2/2.4, -1.7/1.5)

*Worst ST:* Lead aVF:-1.2 mm, Time:4:15, BP:200/100, HR:137, Product: 27400, ST Level (mm), Slope (mV/sec) (-1.3/0.4, 0.2/1.5, 1.2/-0.5, -2.0/0.1, -2.5/3.3, -2.1/2.6, -1.7/2.2, -1.4/1.8, -1.3/2.1, -1.2/2.4, -1.7/1.5)

*Recovery:* Time: 10:59, BP: 170/80, HR: 127, Product: 21590, ST Level (mm), Slope (mV/sec) (-1.3/0.4, 0.6/1.5, 1.3/-0.5, -2.0/0.1, -1.5/3.3, -2.1/2.6, -1.5/2.2, -1.4/1.9, -1.3/2.1, -1.2/2.3, -1.7/1.5)

**6. Physician Remarks and Conclusions:**

Reason for Test:	Chest pressure
Reason for Ending Test:	Fatigue
Conclusions:	Normal blood pressure



## GDT/BDT Type Communication

### PC-ECG and HIS (Hospital Information System) Maintain Bi-Directional GDT/BDT Type Communication

1. Import demographic data from HIS to PC-ECG
  - a. In setup, select **GDT/BDT**.
  - b. Check **Import from GDT/BDT**.
  - c. Define the GDT/BDT directory (in which the HIS file will be ready).
  - d. Define the first four characters of the “Token for PC-ECG” file.  
This file always contains the last patient data.
  
2. Export the GDT/BDT file from PC-ECG to HIS.
  - a. In setup, select **GDT/BDT**.
  - b. Check **Save Test in GDT/BDT**.
  - c. Define the GDT/BDT directory (in which PC-ECG file will be ready). It can be the same as in 1.
  - d. Define the first four characters of the “Token for Practice EDP” file.  
This file always contains the last patient data.

## Saving the Stress Test as a RAW Data (“native binary”) Format File

1. Record a stress study
2. Under File menu, create a RAW Data File.  
A file with extension RDT is created, with the following structure:  
**(low byte, high byte) x 12 Leads x n samples** (1sec = 500 samples).

Leads sentence - *I, II, III, AVR, AVL, AVF, V1, V2, V3, V4, V5, V6.*

Byte Number	Byte Type	Lead Number	Sample Number	Second Number			
1	Lb	I	1	1			
2	Hb						
3	Lb	II					
4	Hb						
...	...	...					
21	Lb	V5					
22	Hb						
23	Lb	V6					
24	Hb						
25	Lb	I			2		
26	Hb						
27	Lb	II					
28	Hb						
...	...	...					
45	Lb	V5					
46	Hb						
47	Lb	V6					
48	Hb						
...	...	...				...	...
$1+(n-1)*24$	Lb	I				n	n/500
$2+(n-1)*24$	Hb						
$3+(n-1)*24$	Lb	II					
$4+(n-1)*24$	Hb						
...	...	...					
$21+(n-1)*24$	Lb	V5					
$22+(n-1)*24$	Hb						
$23+(n-1)*24$	Lb	V6					
$n * 24$	Hb						

Table 29: Stress Raw Data File Format

## Saving the Monitor Test as a Raw Data (“Native Binary”) Format File

1. Record a Monitor study.
2. Under File menu, create a RAW Data File.  
A file with extension RDT is created, with the following structure:  
**Number Leads** (low byte, high byte) + **Sample Rate** (low byte, high byte) + **(low byte, high byte) x Number Leads x n samples** (1sec = (sample rate)).

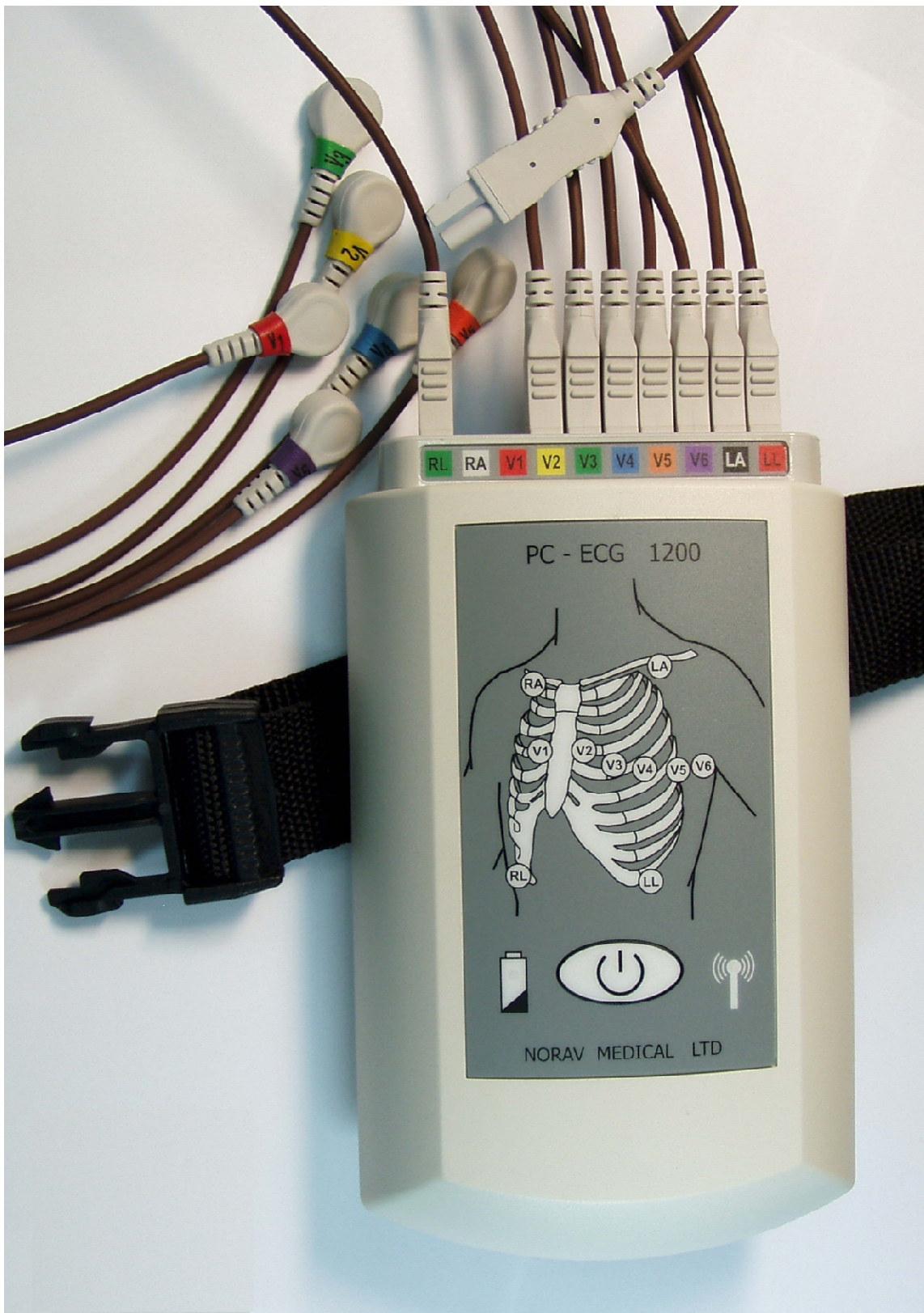
Byte Number	Byte Type	Lead Number	Sample Number	Second Number
1	Lb	1	1	1
2	Hb			
3	Lb	2		
4	Hb			
...	...	...		
2N -1	Lb	N		
2N	Hb			
2N +1	Lb	1	2	n/ (sample rate)
2N +2	Hb			
2N +3	Lb	2		
2N +4	Hb			
...	...	...		
2N*2-1	Lb	N		
2N*2	Hb			
...	...	...	...	...
1+(n-1)*2N	Lb	1	n	n/ (sample rate)
2+(n-1)*2N	Hb			
3+(n-1)*2N	Lb	2		
4+(n-1)*2N	Hb			
...	...	...		
2N*n-1	Lb	N		
2N*n	Hb			

Table 30: Monitor Raw Data file format

## APPENDIX B: TECHNICAL SPECIFICATIONS

### 1200W (Transmitter)

<b>ECG</b>	
Patient Leads	Detachable 10 lead wires conform to AAMI
Lead Standards	AHA or IEC
Defibrillator Protection:	Protected against 360 J discharge
Patient Leakage current	<10 $\mu$ A
Input Impedance	>100 Mohm
CMRR	>100 db
DC max. input	+/- 300 mv
Frequency Range (-3db)	0.05 –150 Hz
Signal dynamic range	20 mV
Battery	4 - AA alkaline or NIMH rechargeable
Operation Time	Up to 40 hours with 4 AA alkaline battery
<b>A2D</b>	
A2D resolution	16 bit, 2 <sup>i</sup> complement
Full scale range	+/- 10 mV
LSB weight	0.3 $\mu$ V
Full scale +	+10 mV (Digital value = 7FFF hex )
Midscale	0 mV (Digital value = 0000 hex )
Midscale – LSB	-0.3 $\mu$ V (Digital value = FFFF hex )
Full scale -	-10 mV (Digital value = 8000 hex )
Sample Rate	500
<b>Communication</b>	
Frequency Range	2400-2483.5 Mhz
Output Power	0.4mW, conform to FCC part 15.249
<b>Mechanical</b>	
Weight [g]	350
Size [mm]	160x100x45
<b>Environmental</b>	
Operating Temperature Range	0°C to 50°C
Storage Temperature Range:	-40°C to 70°C
Relative Humidity	0-85% non-condensing
<b>Regulatory</b>	
Safety Standards	IEC60601-1; IEC60601-2-25; IEC60601-2-27; IEC60601-2-51; EN301 489-1; EN301 489-3; EN300 440
Device Classification	Type CF, battery operated



NV-54/PCECG1200W

## 1200WR (Receiver)

Communication	
Frequency Range	2400-2483.5 Mhz
Output Power	0.4mW, conform to FCC part 15.249
USB 2.0 compliant, Full Speed Device	Control, Isochronous Transfer Types
Power In	5v, 40mA
Mechanical	
Weight[g]	50
Size [mm]	103x30x30
Environmental	
Operating Temperature Range	0°C to 50°C
Storage Temperature Range:	-40°C to 70°C
Relative Humidity	0-85% non-condensing

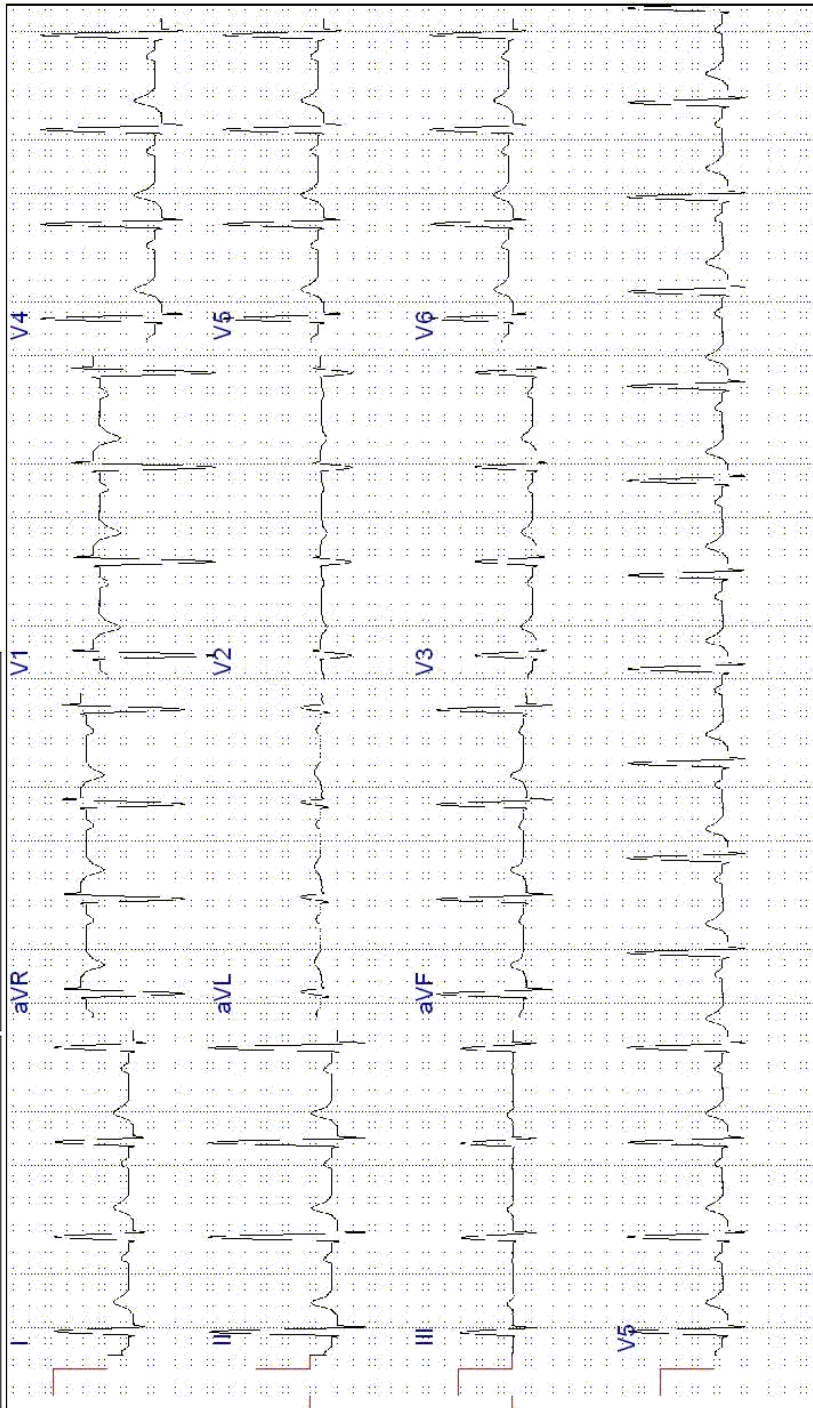


# APPENDIX C: REPORT SAMPLES

BP: 80/120

HR: 86

Signature: _____	
ID:	I2
Last Name:	Wortenberg
First Name:	Hans
Birth Date:	05/01/1977
Age:	27
Sex:	M
Weight (kg):	78.00



Novus Medical Ltd. rev. 4.6.0

January 06, 2004 10:27

25 mm/sec 10 mm/mV Filters: 50 Hz -off; BL -off; 0.05 -150 Hz

Figure 29: Rest Report

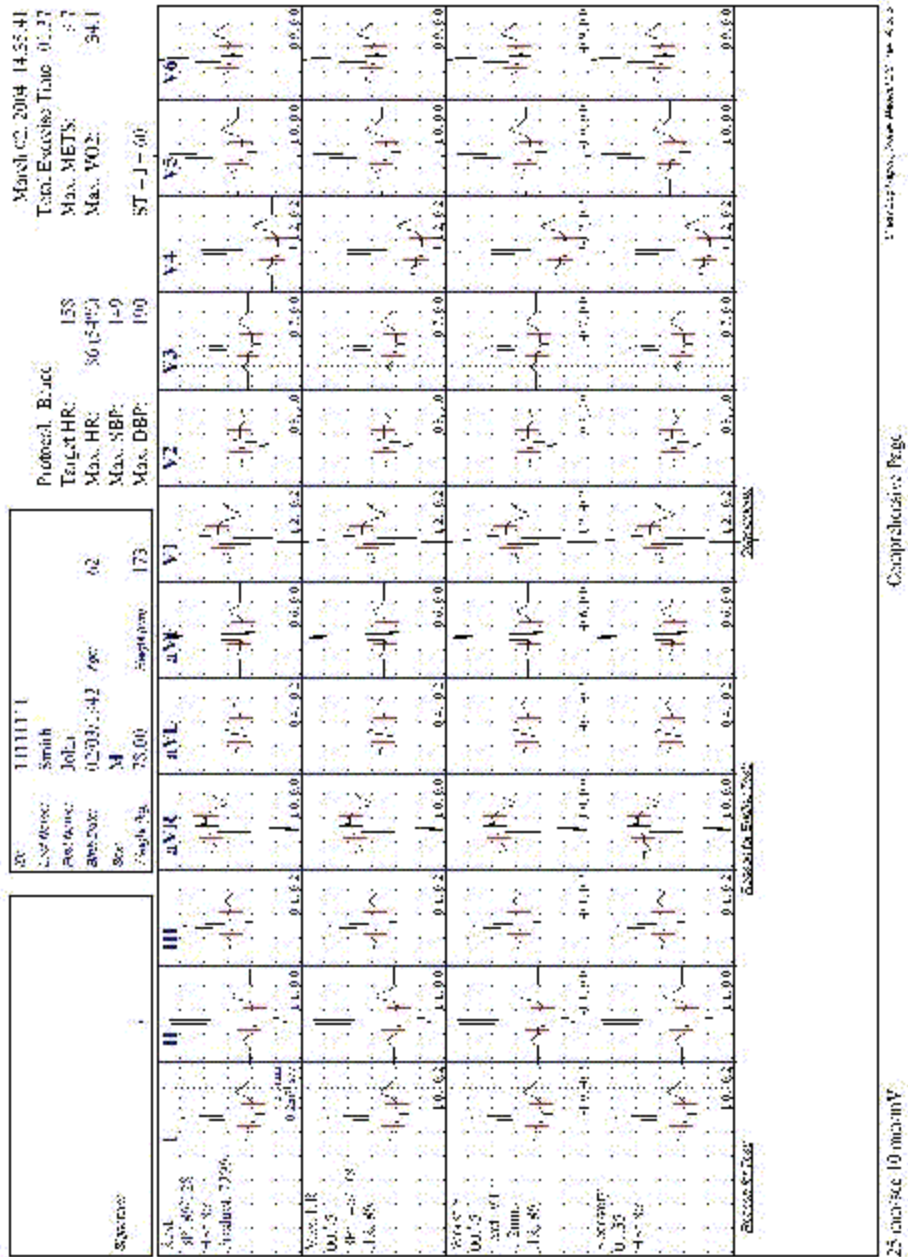


Figure 30: Stress Applications - Comprehensive Report



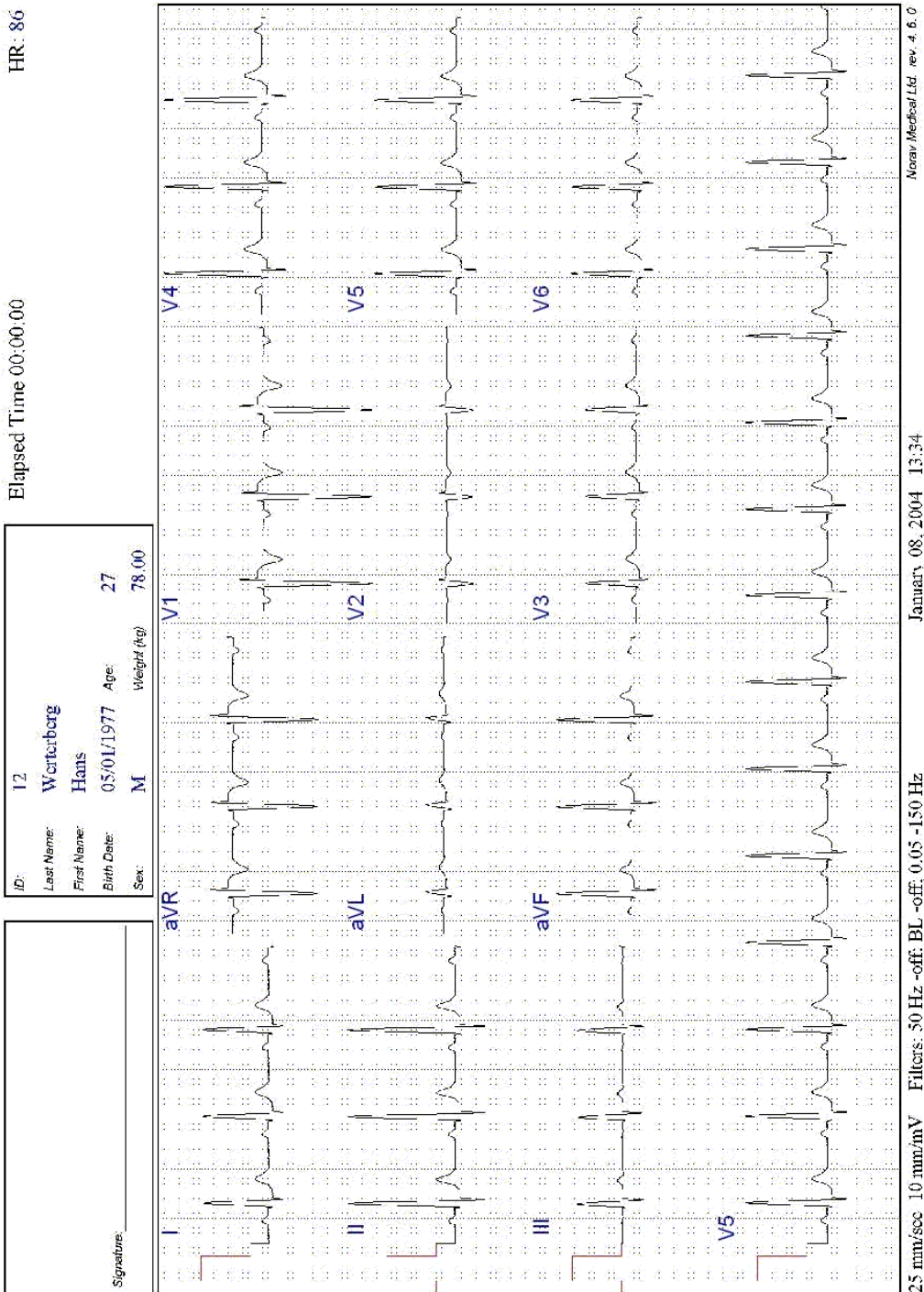


Figure 31: ECG Monitoring Report

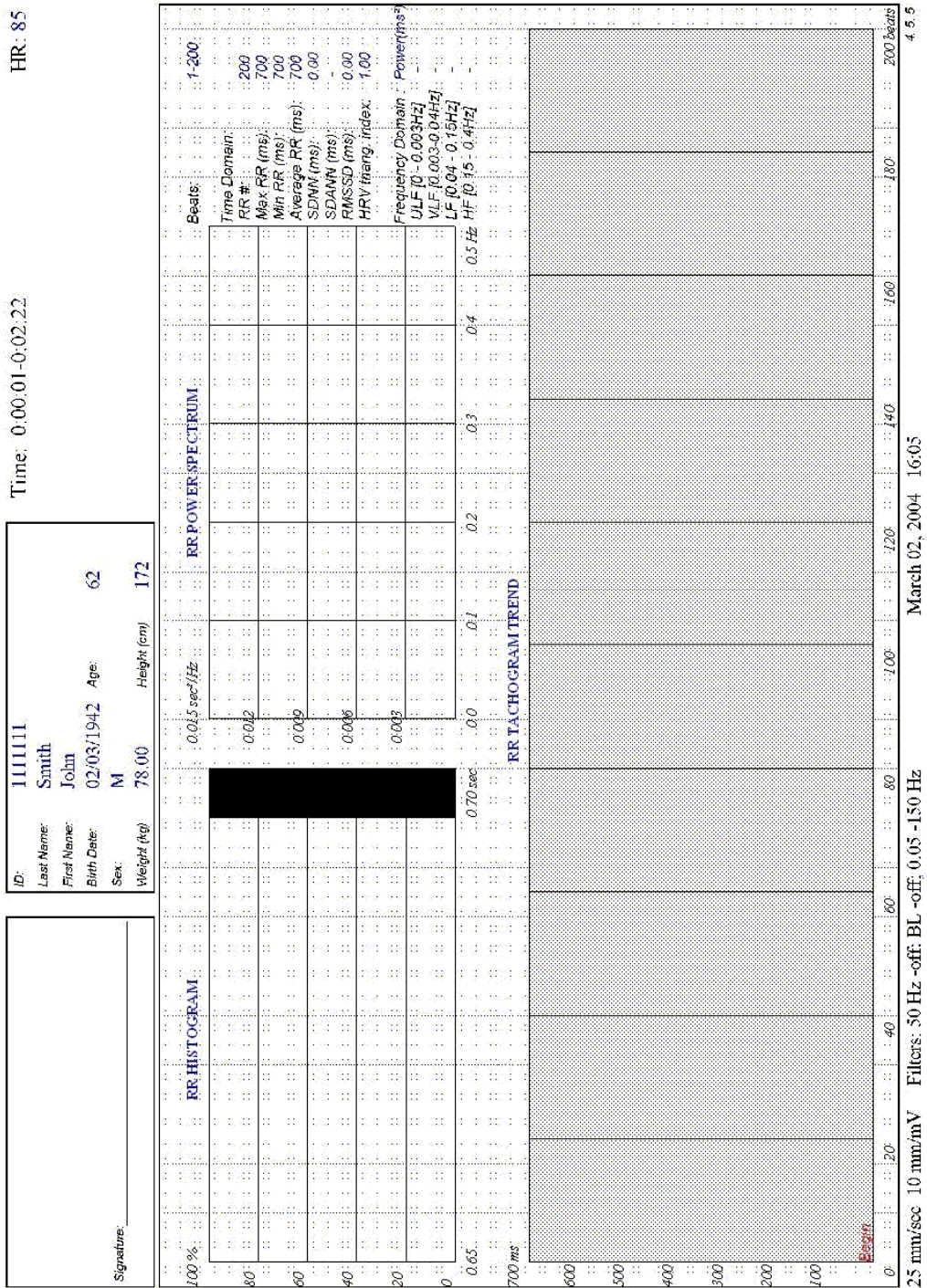


Figure 32: Heart Rate Variability Report

HR (bpm): 86

January 06, 2004 10:33

ID: 12  
 Last Name: Wertberg  
 First Name: Hans  
 Birth Date: 05/01/1977 Age: 27  
 Sex: M Weight (kg): 78.00

Signature: \_\_\_\_\_

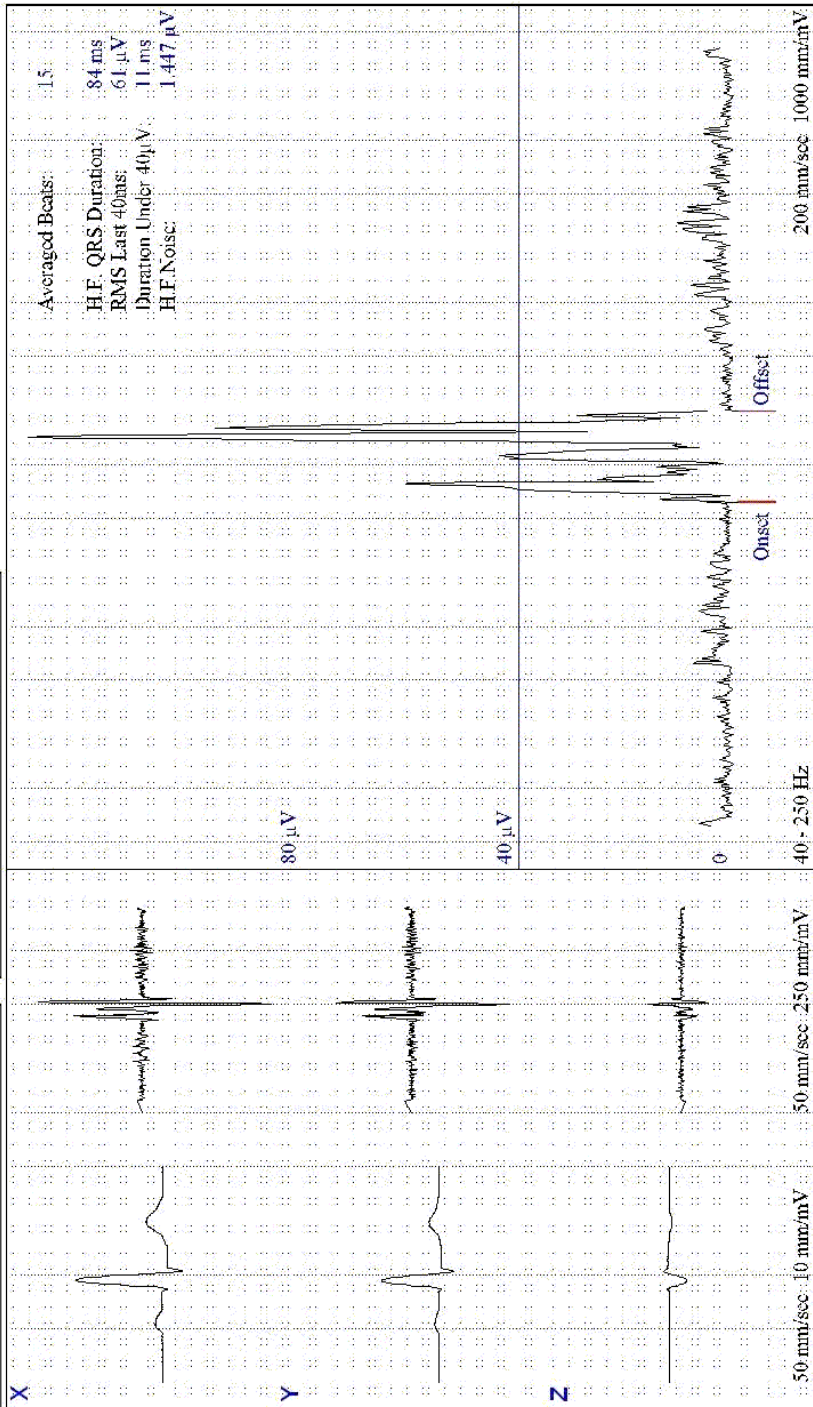


Figure 33: Late Potential Report

## APPENDIX D: TROUBLESHOOTING

### USB Driver is not Installed Properly on Windows XP During PC-ECG Installation

#### Problem

If you connect the device to the PC via the USB before installing PC-ECG 1200 (including the USB driver), the USB driver is not installed. The Windows operating system identifies new hardware and starts the hardware installation wizard. If you complete the wizard, the driver is not found and the hardware is defined in the Device Manager as “USB device” with an icon ‘?’ indicating that the driver is not correctly installed.

If the USB cable is left connected while trying to install the driver from the PC-ECG1200 installation CD—a message regarding Win XP signature does not appear and the driver is not installed.

#### Solution

1. Disconnect the USB cable.
2. Install the PCECG software from the CD-ROM.  
During installation a message should appear about the Windows XP signature. If the message does not appear during the installation of PC-ECG, then the driver is not installed. If working under Windows XP press “Continue anyway” on message regarding the digital signature.
3. Check if the driver is now installed correctly (there is no question mark icon next to the USB driver in the device manager and the LED on the USB adaptor is on).

If the device is still not correctly installed, then complete the following steps:

4. uninstall the unidentified USB driver as follows:
  - a. While still connected to the USB, right click **My Computer**.
  - b. Select **Properties** from the pop-up menu.
  - c. Click **Device Manager** on the Hardware tab.
  - d. Double click the USB Device with the ? icon in the list of devices.
  - e. Select **Driver** tab.
  - f. Click **Uninstall** and then **OK**.
5. After the driver is deleted, disconnect the USB cable from the PC.
6. Install the PC-ECG software and continue to the next step.
7. Reconnect the USB cable to the computer connector.  
Windows XP identifies the new hardware automatically and the new hardware wizard opens.
8. Follow the instructions on screen. If working under Windows XP press “Continue anyway” on message regarding the digital signature. After the driver is installed make sure the green light is illuminated on the 1200 USB adaptor

## Recovering ECG Data after Unexpected Shutdown of the Stress Application

### Problem

If the application terminates unexpectedly before the ECG test is completed and saved, it may be possible to recover the ECG data of the (exhausted [??]) patient.

### Solution

Stress ECG application stores native ECG data in the temporary file. You can convert this data into Monitoring ECG application file format as follows:

1. Start the Stress ECG application.
2. Click **Recovery File to Monitoring Format...** in the **File** main menu. The **Choose files for conversion...** dialog box is displayed.
3. Select the Windows\Temp folder.
4. Select **strXX.tmp** last created temporary file and click **Open**.
5. Select the Monitoring ECG files folder.
6. Insert monitoring ECG file name according to patient ID or last name and click **Save**.
7. Close the Stress ECG application.
8. Open the Monitoring ECG files folder and double click on the last stored file.  
The monitoring ECG application opens.
9. Click the **Patient** main menu button and insert patient data.
10. Save the updated Monitoring ECG file.  
You can now inspect and print ECG strip from the Monitoring ECG application.

## Working in AutoSave Mode Without Saving Modifications

If you perform modifications (adds/edit remarks, measurements, recalculations, etc...) while in AutoSave mode, but do not wish to save the modifications, do the following:

1. Click **Setup**.
2. Uncheck the **Auto Save** option and click **OK**.
3. Close the application (or the file) with the X button.  
A dialog box is displayed requesting acknowledgement for the save.
4. Click **No**.
5. Reopen the application and the file.
6. Check that the modifications were not saved.
7. It is now safe to re-enable the Auto Save mode (if required).

## **A Thick Straight Line is Displayed For All Leads**

### **Problem**

A thick straight line appears on screen for all leads when the connection to the acquisition box fails.

### **Solution**

When using USB connection, check that the led on the 1200USB adapter is illuminated.

If the led on USB adapter is not illuminated, check connections to the USB port and to the adapter.

If the led on the USB adapter is illuminated or if connected through RS232, check the connection to the acquisition box and make sure the box is switched on.

## **Noisy ECG Signal on Leads**

### **Problem**

A noisy ECG signal on one or more of the leads may be caused due to poor connection of the appropriate electrodes or leads on the patient.

### **Solution**

Check the connection of the appropriate leads on the patient. Make sure the electrodes are applied OK on the patient.

## Missing data after a thick line

### Problem

On the screen and in printouts of the ECG, appears for a few seconds a thick straight line and after that there is missing data for a period of time. The ECG traces resume after this random period of time. This problem may be caused due to sleep mode or hibernation mode the PC entered while the ECG test was running.

### Solution

Any settings related to the power management should be disabled: no standby, no stop HD, no hibernation, etc... on the laptop during the Stress test.

To set the power management do the following:

1. right click on the desktop.
2. select PROPERTIES from the pop-up menu.
3. Select SCREENSAVER tab.
4. Press on POWER button in the Monitor Power frame.
5. Select Power Schemes as either PRESENTATION or HOME\OFFICE DESK.
6. Set NEVER to "Turn off Hard Disk", "System Standby" and "System Hibernates".
7. Press OK to apply this configuration.