

**CARDY®Ergo PC program  
Operation Manual**

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# 1 CardyMed: PC ECG

## 1.1 Introduction

### ***CARDY® MED: PC-based ECG diagnostic system, version 2.0.0.\**** **Operational Manual**

#### **Introduction**

Your **CARDY® MED** intelligent ECG system provides a triple way of usage:

- when connecting to a PC, it carries out traditional, laboratory ECG tasks: measurement, analysis, data storing, comparing, printing out of findings
- as bedside ECG, operates as usual stand-alone ECG equipment: measures and analyses ECG
- you can program it for home usage, and download data from its memory

#### **1. Functions of the Cardy system**

##### **As a stand-alone equipment:**

- Monitoring of 12 standard leads (CardyHome: 8 leads)
- Storage: raw or processed curves
- Analysis

##### **Connected to PC:**

- Monitoring of 12 standard leads on PC screen (CardyHome: 8 leads)
- Storage of patients' data and ECG records on hard drive in compressed form.  
(On hard drive of 20 Gbyte 1.7 million ECG can be stored)
- Automatic parameter computation and diagnosing of ECG
- Visual comparison of ECG measured on different time
- Editing and storage of comment to ECG record by built-in editor
- Printing of findings
- Archiving and recovering data base
- Export and import function for data exchange
- Built-in e-mail sending of ECG record
- Local network supporting
- Easy-to integrate to praxis software
- Windows 2000, XP, Vista compatible

#### **1.2 Elements of the system:**

- Cardy ECG unit
- PC, infra-cable, software
- Patient cable, electrodes
- Cardy holder (option)

Minimal requirements:

- Pentium CPU, 64MB RAM

- SVGA Monitor, 1 GB HDD

### **1.3 General requirements**

Before starting read this manual carefully. The manufacturer can only be held responsibility for the safety, reliability, and performance of the apparatus, if:

- The electrical installation of the relevant room complies with IEC requirements
- The Cardy is used in accordance with the operating instruction

### **1.4. Location**

Do not keep or operate the apparatus in a wet, moist or dusty environment. Also, avoid exposure to direct sunlight or heat from other sources. Do not allow the unit to come into contact with acidic vapours or liquids, as such contact cause irreparable damage.

The unit should not be placed near X-ray or diathermy units, large transformer or motors. In some cases the switching power supply unit of notebooks and displays can cause 50Hz noise on ECG signal. If it happens, ask assistance from experts.

The Cardy is battery operated, use always 2 pieces of AA type alkaline batteries or compatible accumulators. Take care of polarity when changing the batteries.

**Usage of any kind of power supply is dangerous and prohibited.**

The patient's pacemaker or other stimulator can simultaneously used with Cardy, the do not interfere each other. However the doctor must know the presence of these equipments and he/she should evaluate the ECG in the awareness of this.

The Cardy can not be applied to ECG leads measured directly on the surface of the heart.

### **1.5. Usage of defibrillator**

1.5.1 The input of the Cardy is not protected against defibrillator spike, so during defibrillation the patient cable should be pulled from the Cardy or defibrillation-protected patient cable should be used.

During measurement the patient's bed, the patient him/herself, and the equipment applied on patient should not be touched as this can lead to injury.

Avoid touching the Cardy, patient or patient cable during measurement, as it can cause noisy ECG.

### **1.6. A Cardy can not be used during applying high-frequency surgical equipment.**

### **1.7. Before operation**

Check if the system is in proper condition with special regard to the connection of the patient cable

Polarization voltage and due to it base line wandering may occur if old and new electrodes are used simultaneously. The same can happen if disposable electrodes are used together with non-disposable electrodes.

### 1.8. During operation

If the safety of the patient requires, switch off the system or remove the electrodes. Do not touch the electrodes and the patient. Do not let the patient or the electrodes contact electrically leading units such as metal parts of examining bed, metal stand etc. During measurement the patient should locate at least 2-3 m from transformer (TV, PC, mobile phone) as these can disturb the measurement. Special attention should be taken on power supply unit of the notebooks: if the ECG is comprises noise try to pull out the power supply unit from the mains.

### 1.9. After operation

Detach the electrodes first. The PC must be switched off only if the system will not be used for a longer period of time (some hours)  
Clean the non-disposable electrodes after every examination. Use alcohol or other special electrode cleaning liquid for this.

### 1.10. Maintenance and checking

The system and accessories should be checked regularly by authorized people.

## 1.2 Specification

### 1.11. Specification

Power supply:	3 Volt, battery (2 pieces, AA tip.)
Current consumption:	40mA
Patient protection:	floating ground (IEC-601, BF type)
Input range:	+/- 5 mV
Sampling:	500Hz, 10 uV/bit (A/D of 10-bit)
Input resistance:	10 MOhm
CMRR:	100 dB
Filters:	100 Hz low pass (hardware, constantly used ), 50 Hz (mains, software, switchable), 30Hz (muscle tremor – myogram - , software, switchable),
Frequency range:	0.05-100Hz
Error of linearity:	< 0.5 %
DC tolerance on input:	400 mV
Lead system:	12 Standard

## 1.3 Installation in Win XP, WIN 7. CardyMed with Bluetooth

### Installation of the **CARDY® MED** (or optionally **CARDY® Ergo PC software**)

a.) Download the installation program from:

[http://wolfmedical.hu/Fb/Cardy\\_Infra/CardyMed\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Infra/CardyMed_e.exe) for Cardy with infra, or

[http://wolfmedical.hu/Fb/Cardy\\_Bt/CardyMed\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Bt/CardyMed_e.exe) for Cardy with

bluetooth

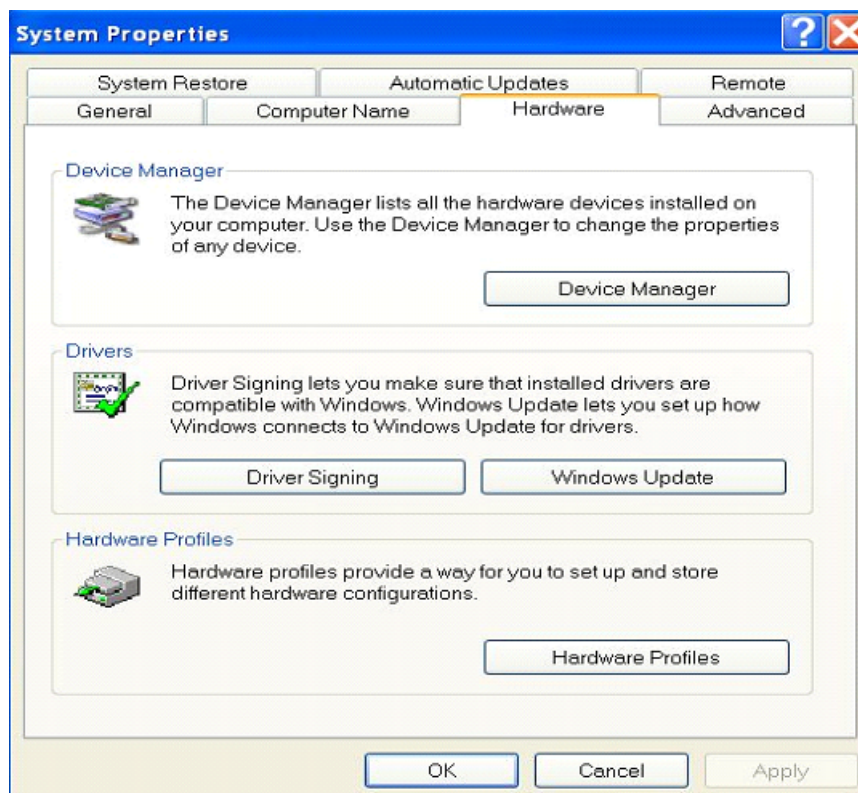
If you have CardyErgo unit, download the installation program from:

[http://wolfmedical.hu/Fb/Cardy\\_Infra/CardyErgo\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Infra/CardyErgo_e.exe) for Cardy with infra, or

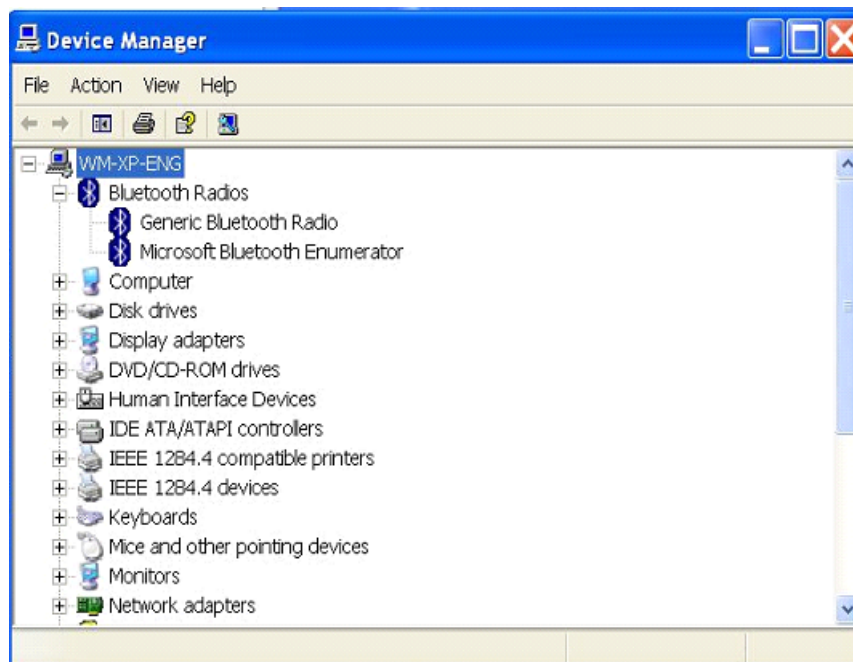
[http://wolfmedical.hu/Fb/Cardy\\_Bt/CardyErgo\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Bt/CardyErgo_e.exe) for Cardy with bluetooth

- b.) Run **CardyMed\_e.exe** or **CardyErgo\_e.exe** to install the Cardy system on your PC
- c.) Set the language in setup menu ("hammer icon")
- d.) **1. Installing Bluetooth USB dongle in Windows XP, or Vista or Windows7**  
**Important: the bluetooth communication works with the bluetooth USB dongle attached to the Cardy.** If any other bluetooth is installed on your PC – Bluesoleil or WidCom or whatever – remove it from the PC, as only a bluetooth module using the Microsoft driver works properly.  
(The built-in driver of Windows is used)
  - 1. Start Windows XP
  - 2. Insert the USB bluetooth dongle into a vacant USB port of your system
  - 3. Windows should automatically detect the USB bluetooth dongle
  - 4. Windows will automatically install its built-in driver

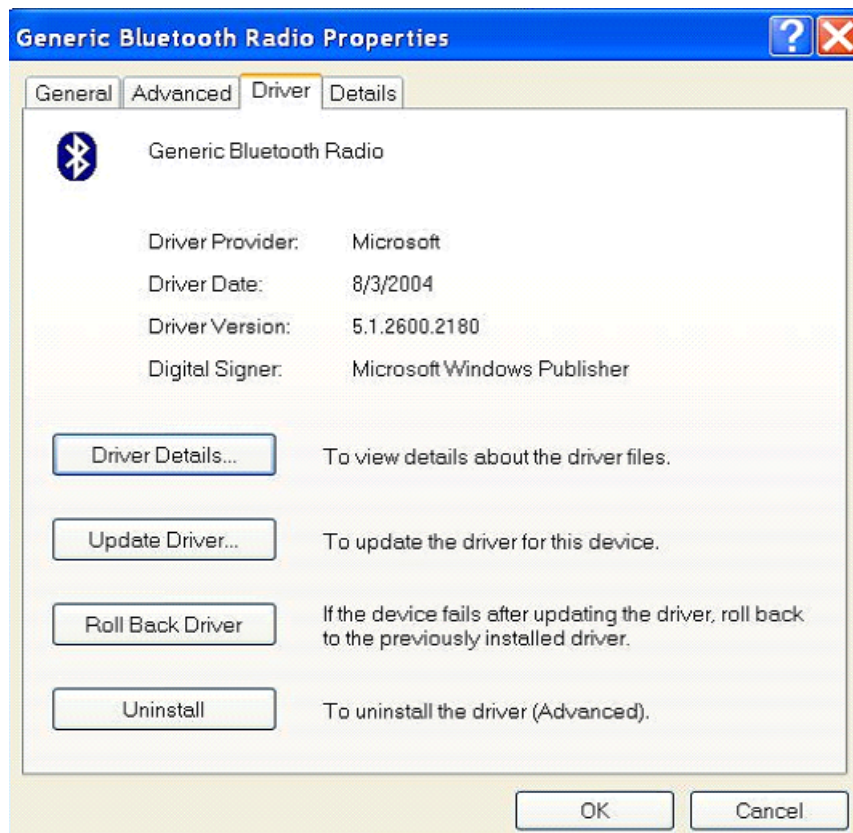
If any problem occurs with BT communication, check the driver the Windows automatically installed. Ask help from computer expert or follow the steps bellow:  
Display System Properties window



Click Device Manager menu



Double click Generic Bluetooth Radio and then select the "Driver"





As it can be seen, the "Driver provider" should be Microsoft.

## 1.4 Installation in Win XP, WIN 7. CardyMed with infra

If you have USB infra instead of bluetooth, - and also in the Cardy purchased – install the USB infra stick as written here:

a.) **1. Installing Sigmatel\_type USB IrDA adapter (INFRA port) in Windows XP or Vista** (The built-in driver of Windows is used)

1. Start Windows XP
2. Insert the USB IrDA adapter into a vacant USB port of your system
3. Windows should automatically detect the USB IrDA adapter
4. Windows will automatically install its built-in driver

d.) **Installing MosChip MCS 7780 type infra unit:**

**IMPORTANT! Do not connect the infra unit to your PC, before you install the driver for it!**

1. Install the CardyMed or CardyErgo PC software from the downloaded file
2. Install the infra driver from the working directory of Cardy. If you have accepted the default directory during the installation, the infra driver is found in c:\Cardy\ directory. Select the directory which fits your operating system and double click on setup.exe in it.

The infra driver for different operation system can be found in 4 directories:

MCS7780\_Vista\_Win7\_64  
MosChip7780\_WinXP\_32bit  
MosChip7780\_WinXP\_64  
MCS7780\_Vista\_Win7\_32

(For example, if you have Win XP, 32 bit, select MosChip7780\_WinXP\_32bit directory)

After successful installation you may connect the infra unit to PC. This unit connects your CARDY® Med with your PC. During ECG measurements, this infrared connector is used to send ECG data from CARDY to the PC. The infrared connector works best if you place CARDY® about 5-10 cms (4-8 inches) in front of the upper infrared window of CARDY®.

Cardy holder is automatically ensures the proper positioning of the infra unit. The cable of the infra can be lengthening up to 5 meters with passive cable or more with active USB lengthening cable.

After successful installation of infra driver, switch on the Cardy and put in front of the infra unit.

Windows will recognize the new hardware and offers the installation of a "modem driver". Accept it and let the Windows install the suitable software automatically.

## 1.5 Installation of CardyMed/Bt in WIN8

If your notebook has a bluetooth, check it, if the driver provider is Microsoft (MS).  
(See in *Installation. CardyMed with Bluetooth* **chapter**.)

If the driver provider is MS, you can use the Cardy with the built-in bluetooth.

If the driver provider is not MS, follow the steps:

1. Disable the „Generic bluetooth adapter“

Control panel

Device manager

Disable the „Generic bluetooth adapter“ (Right click on it.)

2. Install the bluetooth attached to Cardy.

Connect it to any of the USB connector and let the Windows automatically install the driver for it.

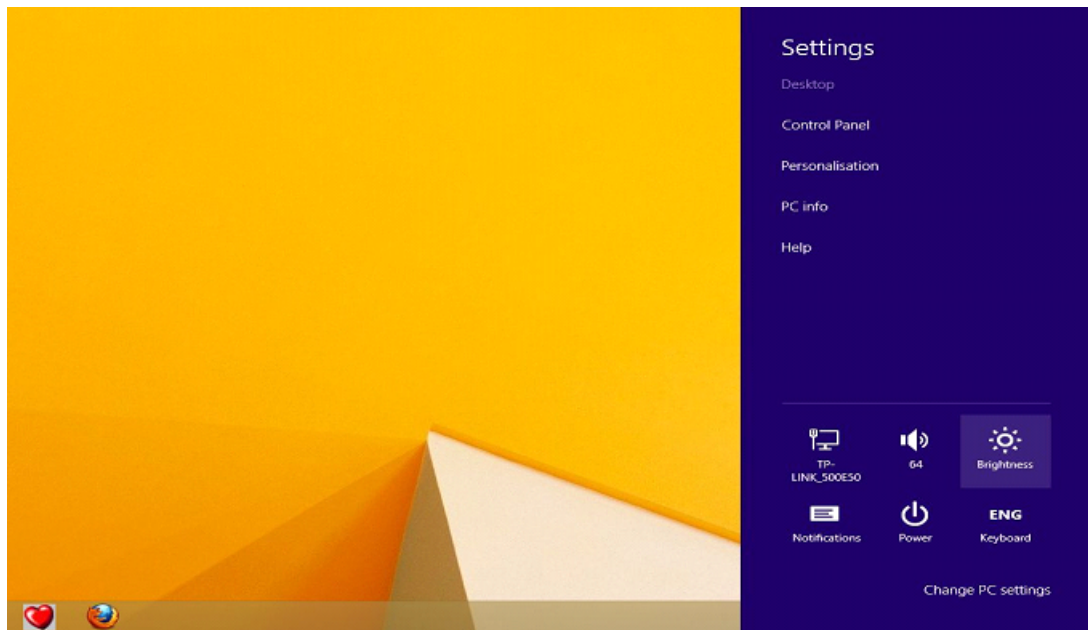
Usage of the Cardy in Win 8

1. Pair the Cardy in Windows

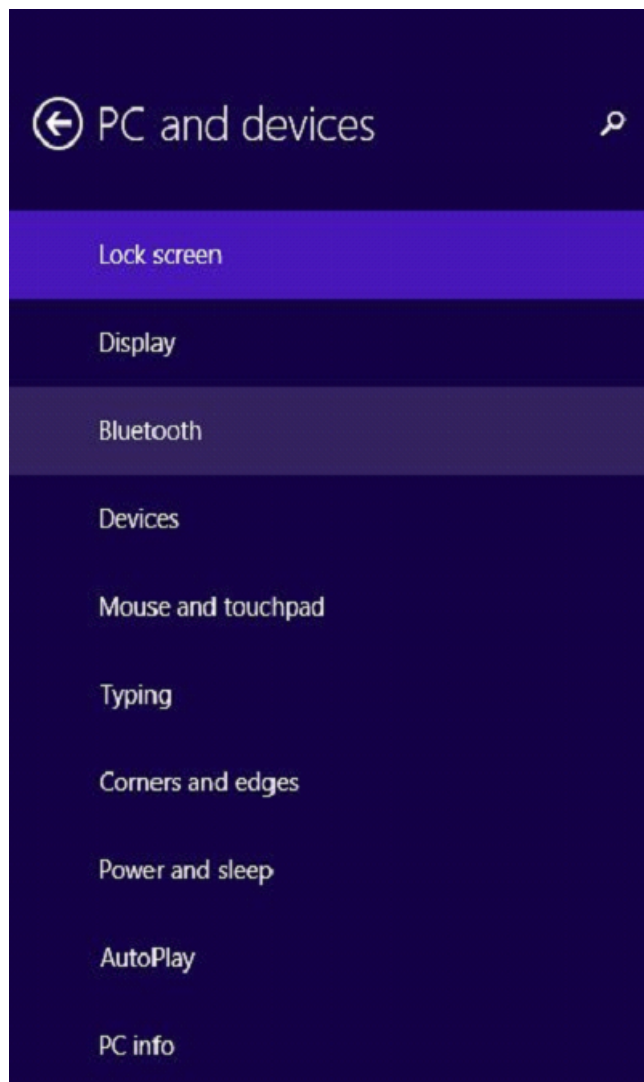
- Click the setting icon



Select "PC settings"



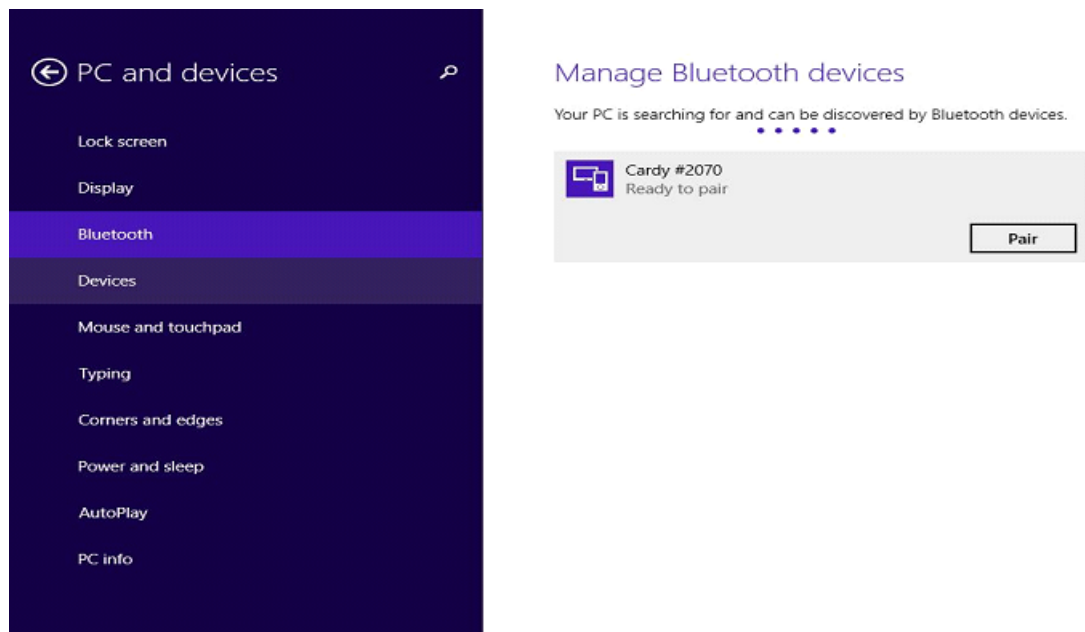
Select "PC and devices"



- Switch on Cardy and wait appr. 15 sec. (this is needed for the Windows to find Cardy bluetooth.)

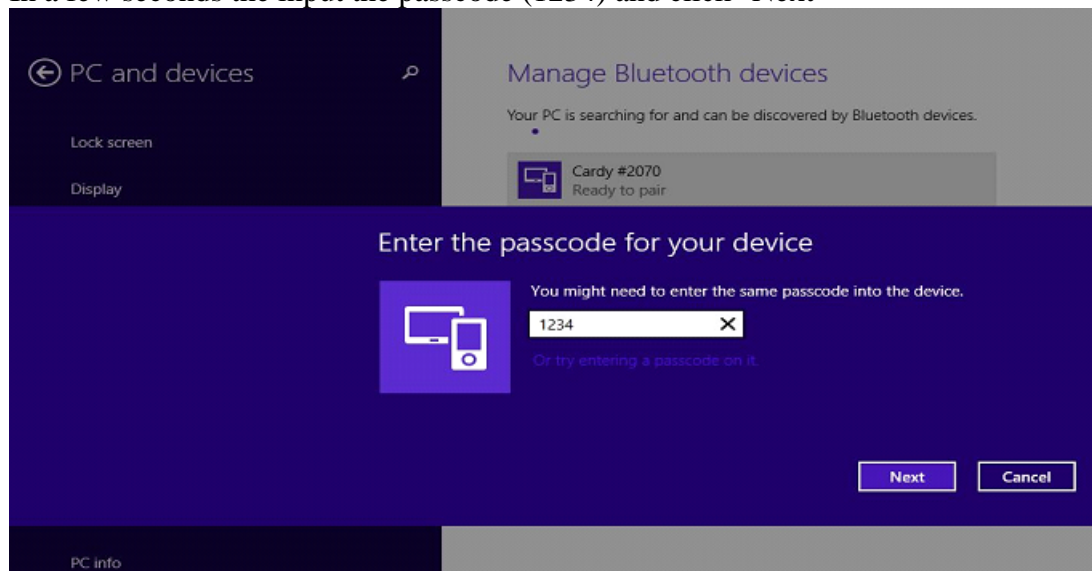
- Click "Bluetooth"

>> Pairing of Cardy is started and the Cardy with serial No. is displayed:

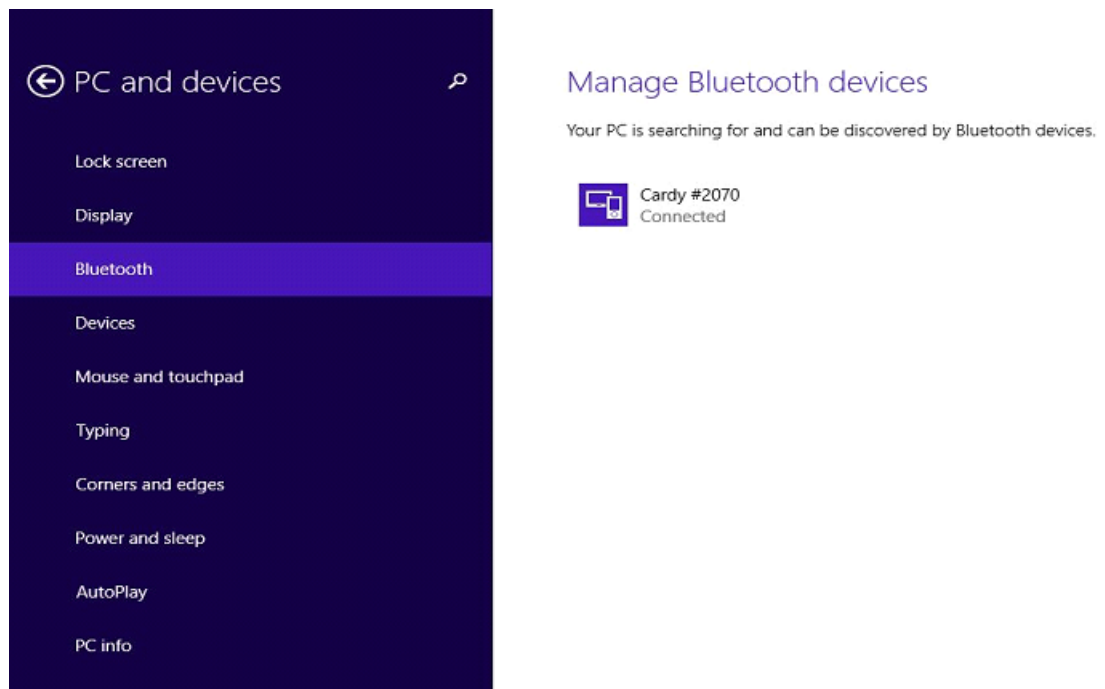


- Click "Pair" to pair.

In a few seconds the input the passcode (1234) and click "Next"



The successful pairing is displayed on the screen:

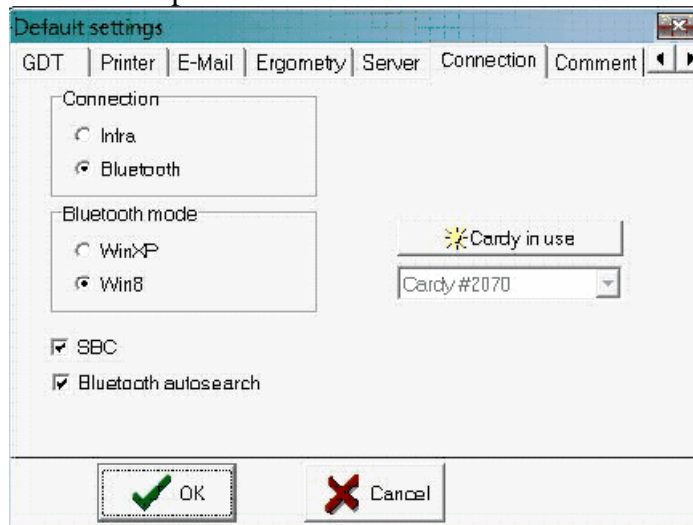


2. Pair the Cardy in Cardy PC program:

- Switch on Cardy and wait appr. 15 sec. (this is needed for the Windows to find Cardy bluetooth.)

- Start Cardy program

- Select Setup/Connection menu



- Click on "Cardy in use. >>The program searches for your Cardy.
- Select the down-rolling menu the proper serial No. and click "OK"

2. Record the patient name>>"Hear icon" becomes active

3. Click on heart icon>>the monitoring window is displayed

4. Click "green lamp">>monitoring starts in 10-20 sec.

Now the Cardy pairing is finished. After this the program finds the Cardy automatically if it is switched on at least 15s prior to the program starting.

## 1.6 Operation of the PC program

### Operation of the Program

Run "CARDY® Program" by double clicking on its icon. (If there is no icon after installation, you may generate icon when running the program 1<sup>st</sup> time from windows Start /Programs menu in the regular way.) The Main Menu will be displayed.

The program functions can be found in the main menu: as text in the top row, and as icons below.

**Program** menu serves for settings and program exit. **The patient** menu serves to create new patient file or modify the existing one. The archive or recover the data base and export/import function can be made here, too. **Cardy** menu handles the Cardy: it reads the ECG files from Cardy in and switches the Cardy off.

The right side text fields correspond to the selected patient. The icons below can be used to erase or modify patient data or to record a new patient.

Most of the program function can be run by hot key (See online help for details)

**Press F1 for help.**

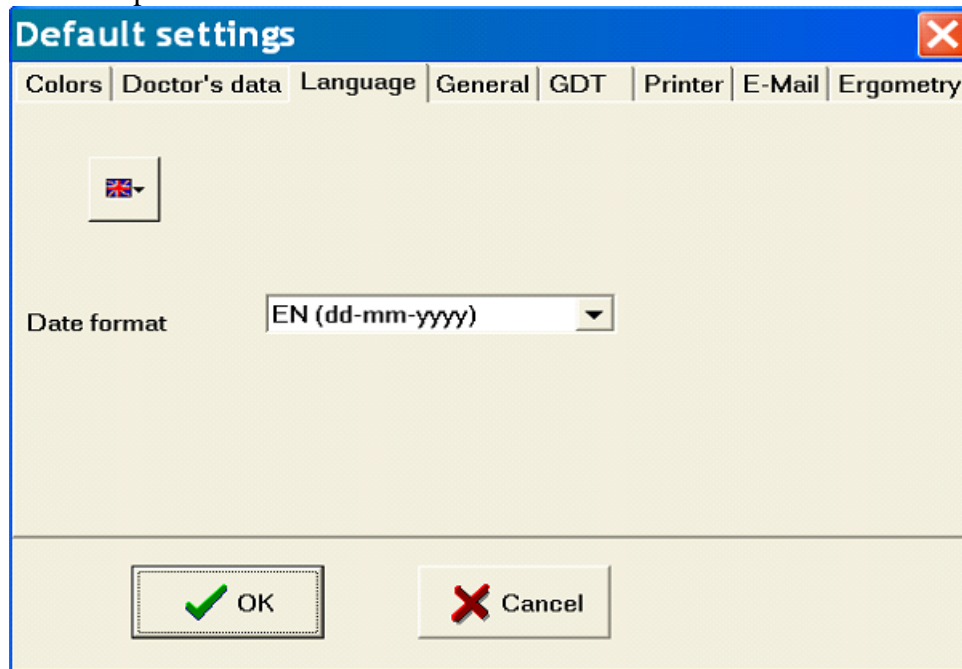


## 1.7 Settings

When you run this program for the first time, start with **settings** (the Hammer icon)



The program can work with default settings, so there is no need to change them, but some possibilities serve as comfort for the user.



### Settings:

#### Colors:

**Drawings:** colors of visualization on display

**Printer:** to set colors on color printer (default: black and white), and the printing position.

**PDF:** the settings is referred to the colors of the ECG findings, when it is sending by e-mail in pdf format,

**Doctor's data:** printed on every printout

**Language:** select English, German or Hungarian

**GDT:** when Cardy program cooperates with praxis program, the work directory can be set

**Printer:** select the printer you want to use with Cardy program

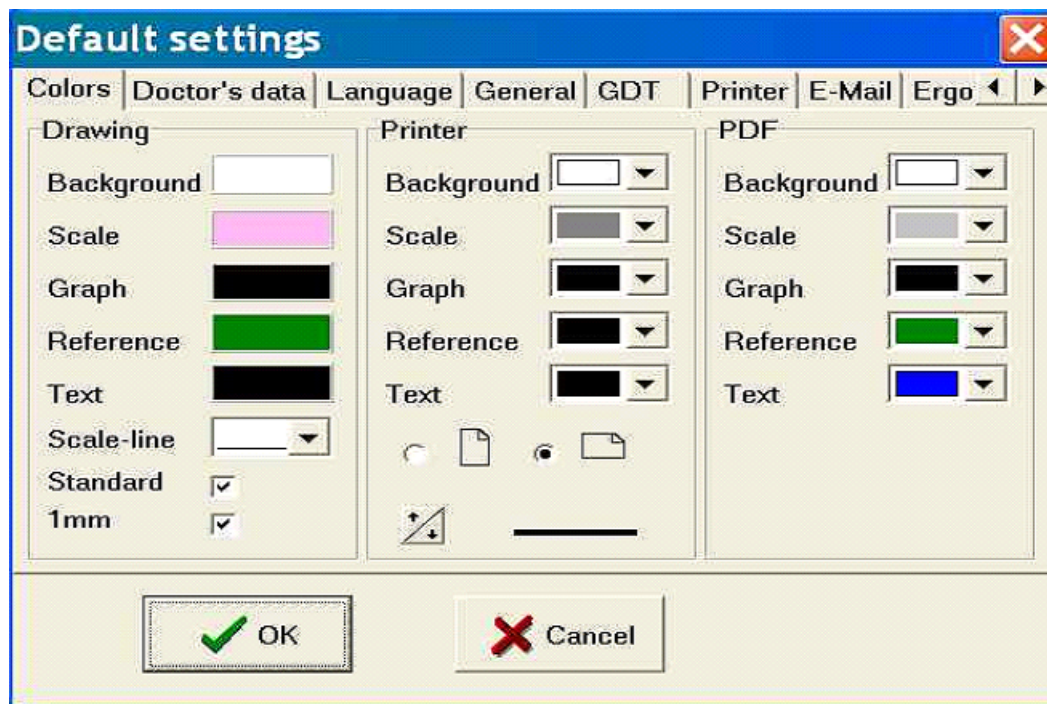
**E-mail:** the measurements can be sent by e-mail. The address can be set here.

**Ergometry:** Set the type of ergometer you have and the serial port you use. (This option can be used with CardyErgo model)

### Color settings:

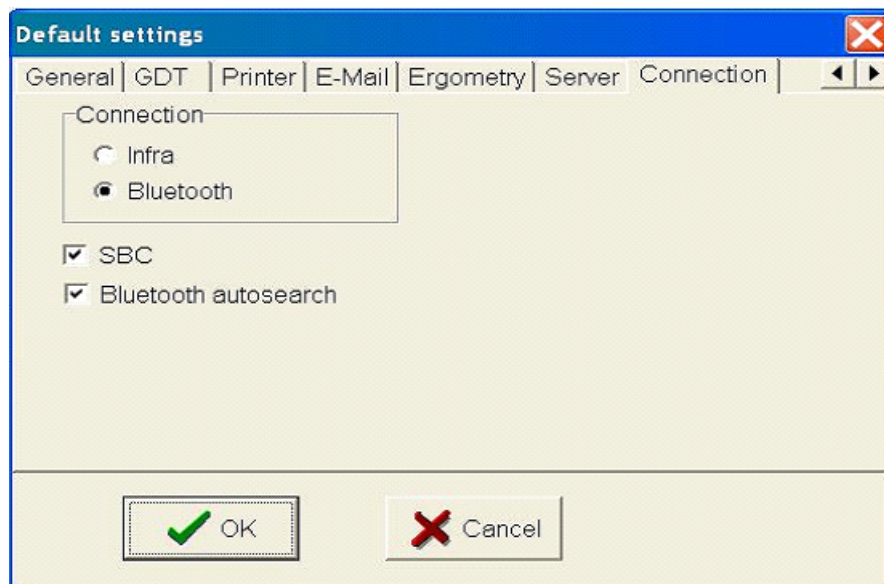
The printing position – portrait or landscape – and the line width can be set, too.



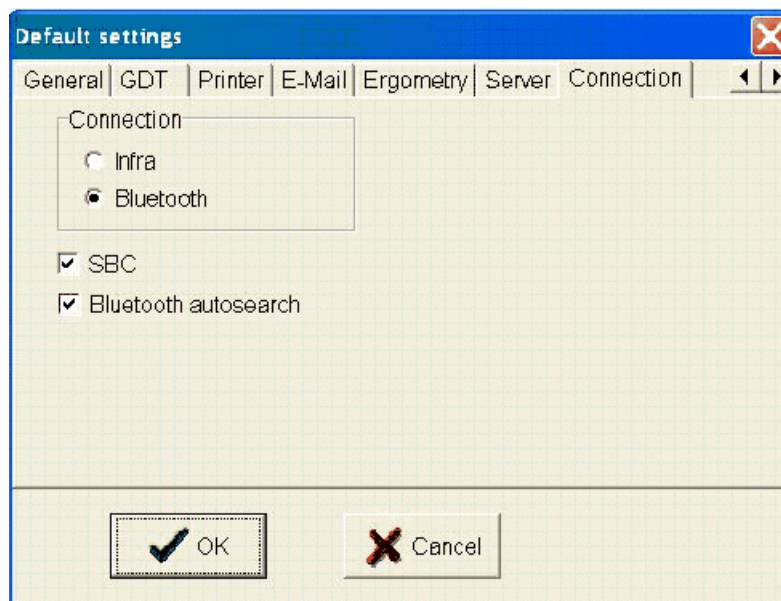


### General:

- 1<sup>st</sup>: Cardy switches off automatically after storage of the actual ECG is finished on PC
- 2<sup>nd</sup>: A number in front of the record identity in the measurement table appears, which shows the measure of abnormality (in case of every measurement made by the Cardy with PC, or for the 1<sup>st</sup> measurement of a patient made by the Cardy without PC). When measuring with Cardy without PC, this number shows the deviation of the actual ECG from the reference one. (When Cardy is used without PC, the 1<sup>st</sup> measurement of a patient is stored as a reference ECG, then all the subsequent ECG measurement is analyzed and compared to the reference one.) . The range of this quotient is 0,1... 9, when zero means normal ECG, or no deviation from reference ECG.
- 3<sup>rd</sup>: Time scale of the averaged cycle on the finding
- 4<sup>th</sup>: 2-page printout: when making an ECG measurement, one can select either the *base mode* or the *double mode*. While monitoring the ECG, the *base mode* is launched by tick icon and stores representative cycles from the twelve leads and 16s of rhythm strip from one lead. The *double mode* is launched by joker icon and besides the averaged curves it stores 16s of ECG from every leads. When 2-page printout is set, the printer icon on the "off-line ECG info" window will print out automatically raw ECG of 16s of every leads, if the double mode was selected by joker icon when ECG measurement was made.
- 5<sup>th</sup>: The automatic ECG diagnosis is shown, if there is a tick here.



**Check if the communication set properly:**



**SBC:** status bit comparison. The Bluetooth/infra communication is controlled by SBC method in the model having firmware compiled in Nov. 2011 or after.

**Bluetooth auto search:** tick this square, if you use more Cardy units with the same PC.

If you use just one Cardy with your PC, you may leave this square empty.

#### **Uploading the ECG measurements to server (option)**

If you have this option, you can set the server in this setting menu:

**Default settings**

General | GDT | Printer | E-Mail | Ergometry | **Server** | Connection

☐ Uploading to server enabled

Server URL

Medical user

Hospital

Department

Physician

Server URL2

OK Cancel

## 1.8 How to start?

A routine measurement is carried out as follows:  
**Visualization of 12-lead ECG on PC display**

• **Switch on CARDY** by pressing the **O** key. A "PC USER" message on Cardy LCD will appear. If you want to make a PC measurement, just go to the next step (**Run the PC program**)

"PC USER" is a special "patient" as no unintentional storage of ECG in Cardy is allowed. If some other user name is seen, "PC USER" is automatically set by PC, when visualization is started on PC display. If you want to store ECG in Cardy as well, select other user in Cardy with the **↓** or **↑** key, and accept it by **✓** key. Store ECG in Cardy by answering **✓** for "Save ECG" question after analysis.

If you have infra stick with your Cardy system, put the infrared connector in front of the upper IR window of the device.

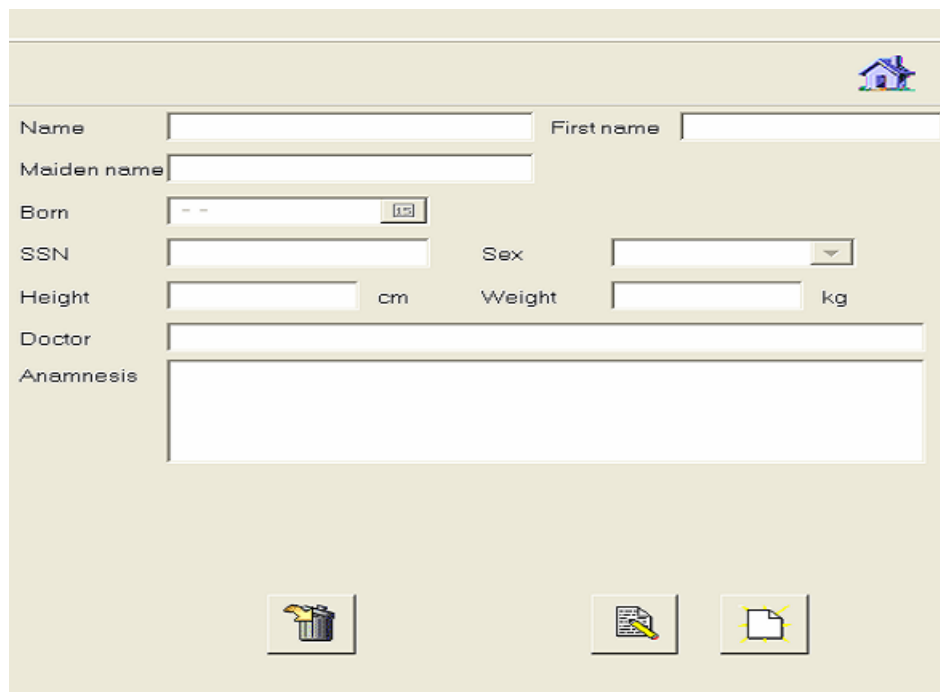






• **Run the PC program** using the "Cardy" icon.

• **Check the PC – Cardy connection** ("Cardy3 Med online" is displayed on the middle bottom line on your PC screen.) If "Cardy offline" is displayed, check Cardy and the infrared connection.

• **Record the new patient by clicking the "empty page" icon.** Type in the name - this field is obligatory, the other fields are optional. The Case History is displayed on each ECG records.

Alternatively, select an existing patient from the list. The heart icon turns red (active.)

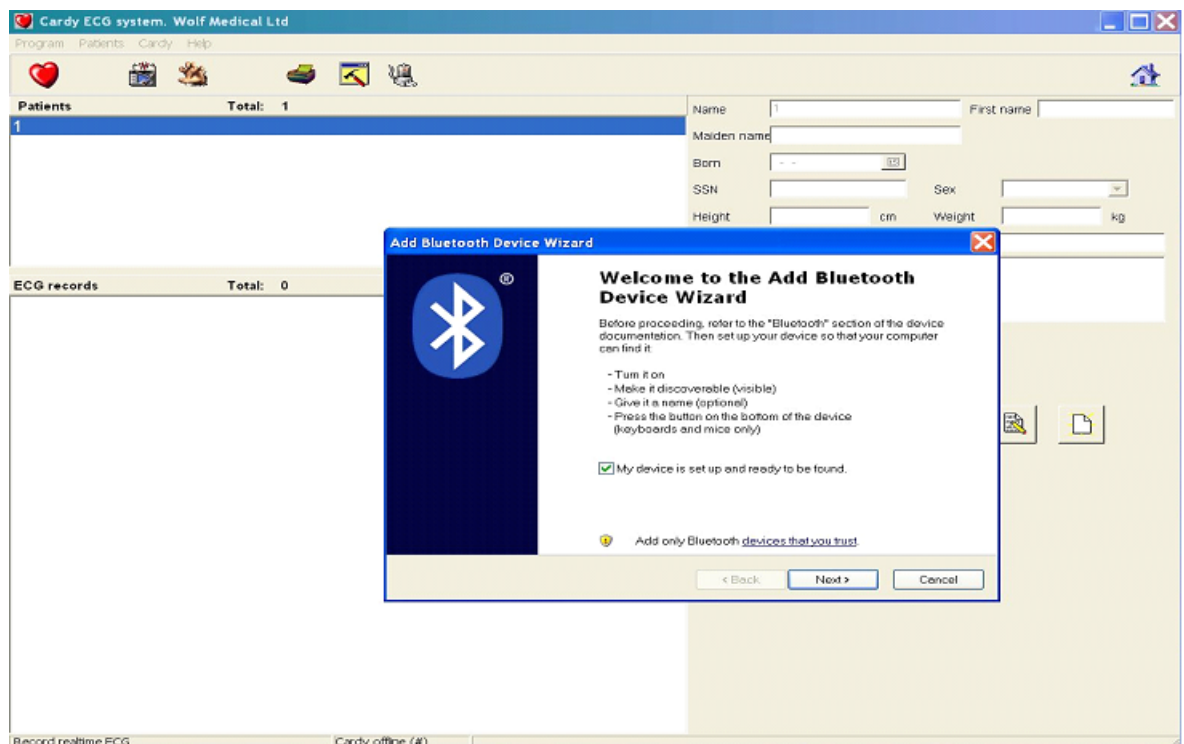


Name  First name   
 Maiden name   
 Born    
 SSN  Sex   
 Height  cm Weight  kg  
 Doctor   
 Anamnesis   
  

•Enter the monitoring window by clicking on the Heart icon:

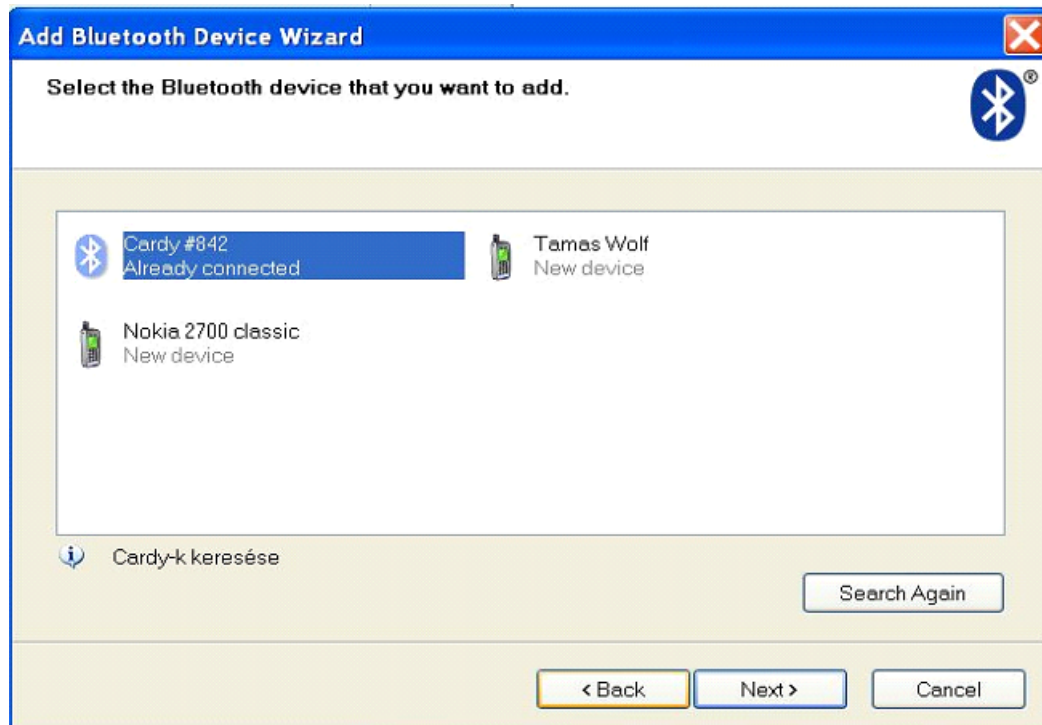


If you use your Cardy system 1<sup>st</sup> time, the Add Bluetooth Device Wizard may appear:

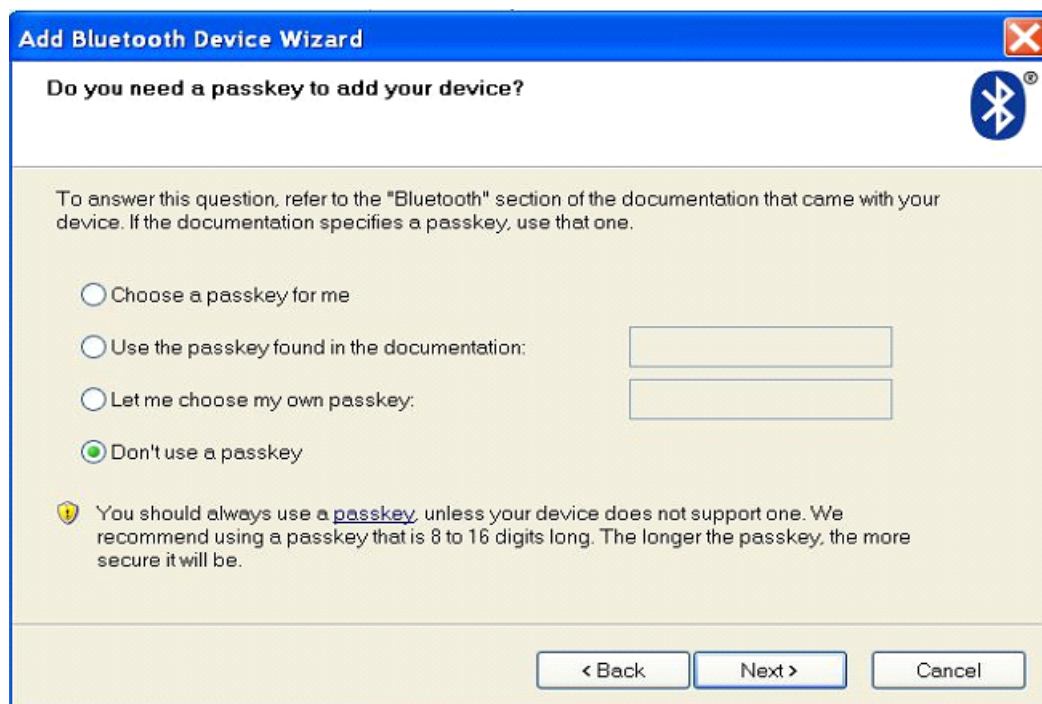




Check if the Cardy is switched on and tick the appropriate square and click "Next"



Select the Cardy and click "Next"



The Cardy serial No – on the back side of the Cardy – has the information on the passkey:

The Cardy having serial No **less than 1000** has **NO** passkey  
 The Cardy having serial No **greater than 1000** has **1234** passkey  
 After answering the passkey information click "Next."



After clicking the "Finish", the monitoring window will appear.

## 1.9 A routine measurement

1. **Switch on CARDY** by pressing the **O** key.
2. **Run the PC program** by clicking the "Cardy" icon.
3. **Record the new patient by clicking the "empty page" icon or select an existing patient name**
4. **Click "Heart" icon to enter monitoring window**

After clicking the "Finish", the monitoring window will appear.

- Set the **leads** to be monitored – right-click on any part of the visualization window to select the leads.

- Start **monitoring** with the Green light icon



- If the baseline moves, use the **block function**

- Amplification and shift can be set with the mouse or the arrow keys.

During monitoring, one of the two measurement modes can be selected:

- I. Storage of „raw" ECG
- II. Storage of raw and analyzed ECG

## I. Recording, storage and printing out a max. 60 s long part of an ECG

From 5 to 60 sec. of the monitorized ECG can be stored and printed. At the beginning of the monitoring, a yellow line is displayed that marks the filling up of the „Rough ECG storage (max. 60 sec, 100% is equal with 60 sec.). 5 sec. after the start of monitoring two icons are displayed: a floppy and a printer icon. After this, monitoring can be stopped any time if the ECG curves are to be saved. Both icons become activated as soon as the monitoring stopped. Clicking on the icons the latest 1 minute of the ECG is storable. After 60s the ECG curves are overwritten in the storage. The saved ECG is automatically named „5s", as 5 sec. is the shortest storable fraction. (The program writes the whole stored ECG on the disc, the user can determine the length by ending monitoring. E.g.: if the yellow line shows 50%, the stored ECG is 30 sec. of length.).

The stored ECG can be replayed from the rough ECG storage. The time zone indicator next to the printer icon has four icons:

0s: one click: panning, start/stop; double click: panning start from the beginning of the acceptable fraction (hotkey: r)

<: moving backward (hotkey: Page Down)

>: moving forward (hotkey: Page Up)

roller: (catching left-click on mouse) positioning

Hotkey for printing: p, hotkey for saving :t

Resume monitoring by clicking on the Green light icon or pressing "s".

## II. Storage of analyzed ECG and raw ECG of 16s

### Base mode: Measurement and analysis of a 16 sec ECG, storage of averaged cycles

Start the **measurement** with the Tick icon.



### Double mode: Measurement, analysis and storage of a 16 sec ECG

Start the **measurement** with the Joker icon.



Cardy will carry out a 16 second ECG measurement, analysis, and sends the results over to the PC.

**During monitoring** and data collection of 16s the Cardy displays useful information: The data collection time is 16 sec, but a real-time signal quality checking (SQC) method is built into the Cardy which repeats the data collection of 16s from the beginning, if the SQC detects poor ECG quality.

During data collection the algorithm continuously checks, if

- a.) the difference of the max and min. value of the signal in time-range1 greater, than threshold1 (There is no fallen electrode or faulty patient cable)
- b.) the difference of the max and min. value in time-range2 less, than threshold2 (no wandering baseline)
- c.) the difference of the max and min. value in time-range3 less, than threshold3 (no

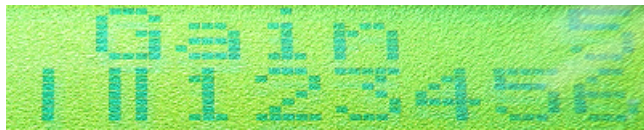
tremendous line interference or muscle noise exists)

There are 8 squares on the upper left side of the Cardy LCD :



one square turns black after 2s, if the SQC procedure results in a good signal quality. So all the 8 squares turn black after 16s, if the ECG signal was OK during sampling. If a signal quality error occurs, the sampling starts from the beginning and the squares turn white.

The name of the faulty lead is inverted on the upper right side of the Cardy LCD.



If all the three criteria are fulfilled during the 16s data-collection time, than the analysis is started.

If one of the criteria is not fulfilled, the data collection of 16s is started again and this goes during 1 min. After 1 minute, the SQC gives it up and analysis starts. The real-time signal quality check (SQC) marks the faulty lead on the Cardy LCD

During monitoring, a real-time R-peak detection is built into the Cardy and it displays the heart-rate continuously.

There are further checking during/after analysis, which can also refuse the automatic ECG parameter computation.

After analysis the ECG curves, parameters and diagnosis is displayed, which can be printed out by clicking on the Printer icon, or they can be stored by clicking the PC icon.

After saving the data, you can edit the medical opinion text with the "Opinion" tab. The opinion is stored along the ECG measurement and appears on the printout as well. You can display the calculated parameters with the "Parameter" tab.

( If you want to make several measurements on the same patient, you should select a patient in the Cardy differing from "PC user"- as measurements of the "PC user" can not be saved. In order to save the recording in the Cardy as reference ECG, press ✓ on Cardy after the result of analysis appears on the LCD of the Cardy. When this patient is selected in the Cardy for a repeated measurement, the Cardy makes a serial comparison: the actual ECG is compared to the reference one, and the difference is rated on a scale from 0 to 9.)



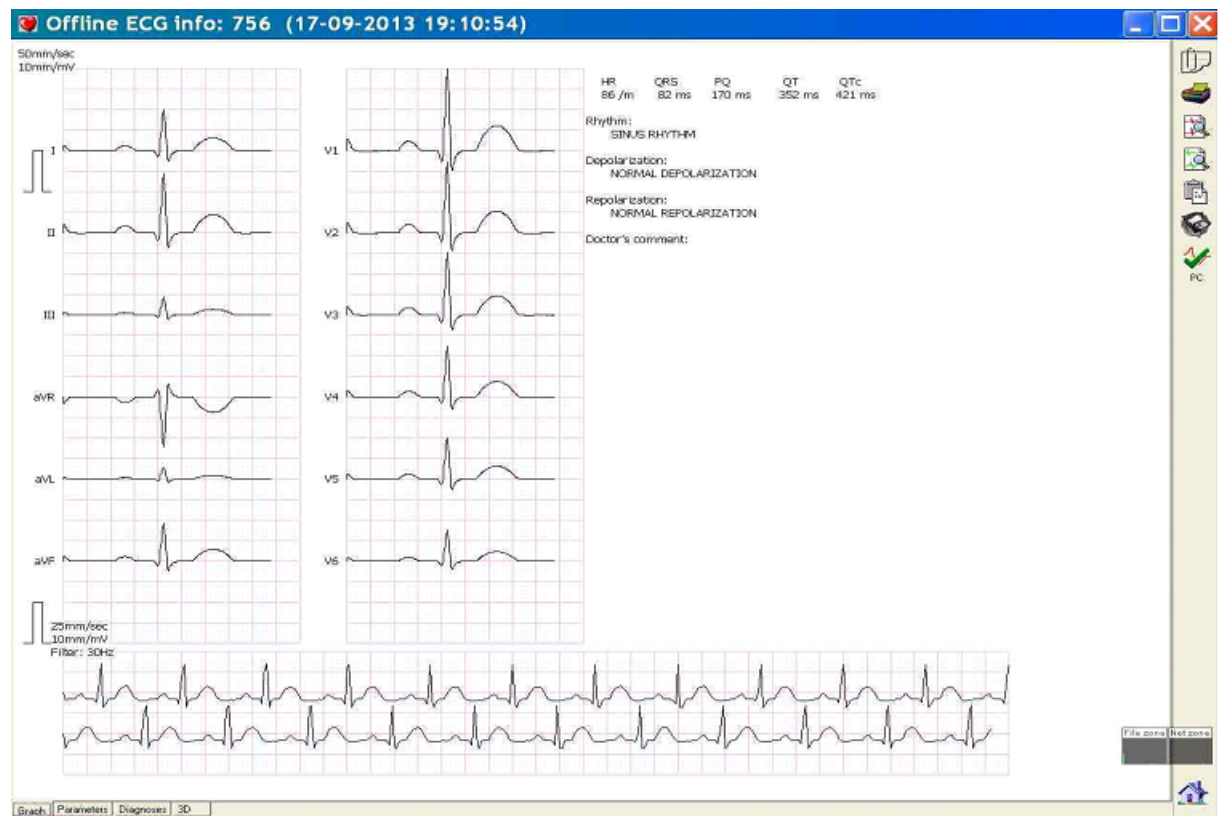
## 1.10 3D vector visualization (option)

### 3D vector visualization (option)

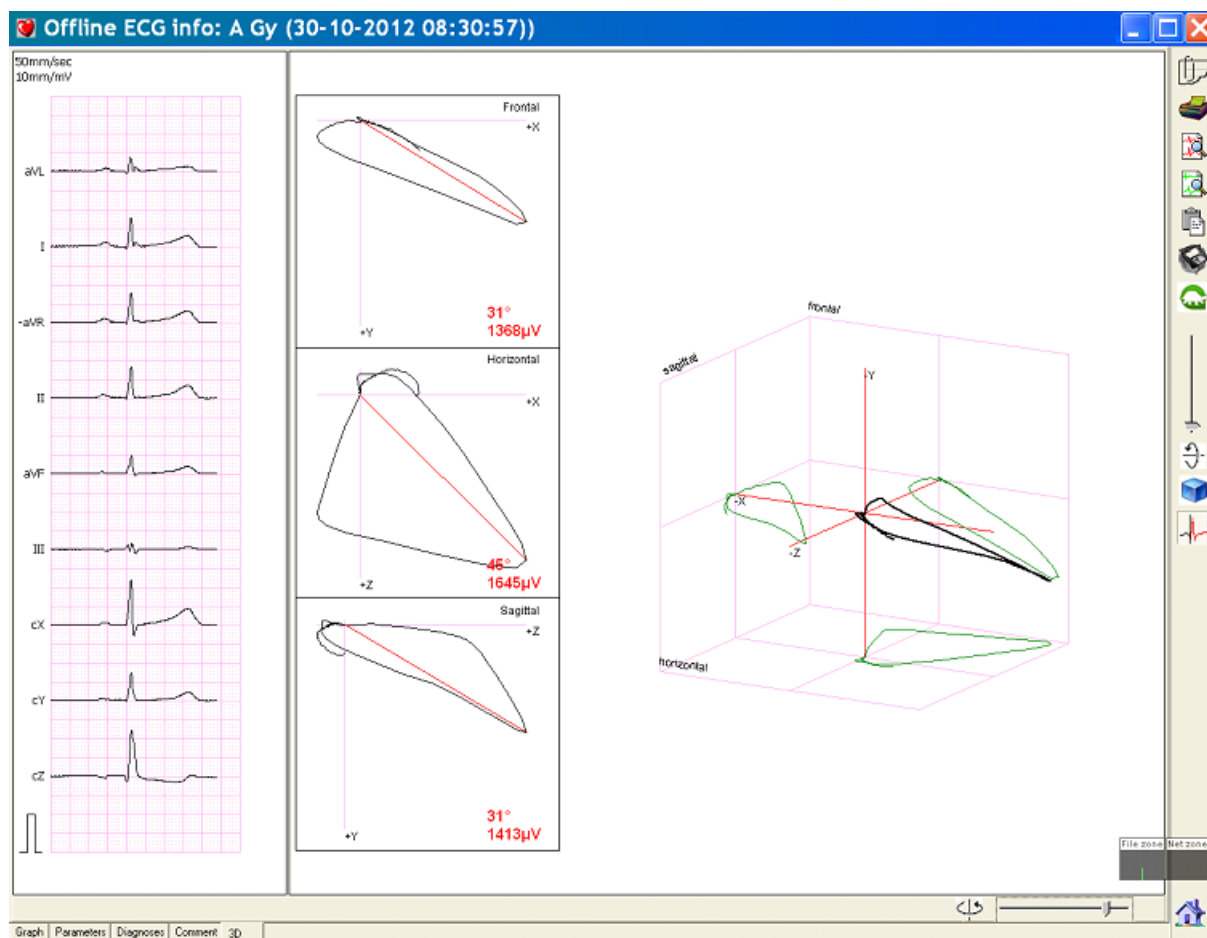
With **Cardy+** device, the Frank-lead (XYZ) vector loop can be displayed and printed out by clicking the 3D menu in the window with results of measurement. (see bellow)

**Important:** to activate the 3D function, use a Cardy in "ON" state and internet on the PC.

The PC program will check, if your Cardy have the 3D option and allows this function.



By clicking the 3D menu on the bottom, the 2D and 3D loops appear.



## 1.11 Filters

**Filters:** Both Cardy and PC program have built-in digital filters, which are operating independently. The **Cardy filter** can be set in Cardy during monitoring by the "O" button. The 1<sup>st</sup> push of the button switches on the 50Hz mains filter, next push switches on the 30Hz myogram filter (the mains filter is kept on), and the 3<sup>rd</sup> push switches both filters off. Usage of filter will not prevent the rejection of noisy ECG - as the analysis is carried out from non-filtered signal - , but it improves the quality of the rhythm curve. The setting of filters is kept by Cardy, even if it is switched off. (The ECG stored in Cardy will be filtered, too, when the filters are set on.) When Cardy filter is switched on, all the raw ECG leads and the rhythm curve will be filtered. **Note: When Cardy is used with PC, the rhythm curve - ECG of 16s seen after the averaged cycles - is filtered by the Cardy, not by the PC.**

The **filters in PC program** can be activated during monitoring by clicking the proper icon. When clicking the "30Hz" myogram filter icon, it switches on the 50Hz mains filter, too. If they are active, the program will store filtered raw ECG in the database.

## 1.12 Displaying stored ECG data

**To display stored data**, find the patient (type the first letter of the patient's name to jump forward in the list), then open the patient data by clicking on the name. Select the date of the recording by double clicking on it. The ECG curves will be displayed.

## 1.13 Comparison of ECG curves

**To compare ECG curves visually**, you can select multiple curves of a particular patient (hold down CTRL while clicking on the curves.) You can view the 6 limb and 6 chest leads separately, but always a maximum of 5 curves at the same time. Click "phone-endoscope" icon after selecting the ECG record to be compared.

### Automatic comparison

If you want to make several measurements on the same patient, you should select a patient in the Cardy differing from "PC user" - as measurements of the "PC user" can not be saved. In order to save the recording in the Cardy as reference ECG, press ✓ on Cardy after the result of analysis appears on the LCD of the Cardy. When this patient is selected in the Cardy for a repeated measurement, the Cardy makes a serial comparison: the actual ECG is compared to the reference one, and the difference is rated on a scale from 0 to 9.

This comparison can be carried out in Cardy operated with PC or in stand-alone operation mode. (The Cardy is used without PC.)

## 1.14 Hot Keys

**The complete measurement can be carried out from the keyboard** as follows:

Help:	F1
Select patient:	up/down arrows
New patient:	Ctrl+N
Modify patient data	Ctrl+M
Save and close patient data	Ctrl+S
Discard and close patient data	"Esc"
Monitoring window:	F2
Start/stop monitoring:	s
Block:	b
Measurement data gathering during monitoring:	"Enter"
Exit monitoring window:	"Esc"
Display selected recording:	F3
Editing opinion for ECG curve:	Ctrl+m
Save and close opinion:	Ctrl+s
Zoom±.....	↑ or ↓
Downloading data from CARDY®	Shift+F4
Toggle Cardy type:	F5
Printing patient data chart and case history:	F6

Settings: F7  
Turning Off CARDY®: F8

## 1.15 Visualization

### Visualization of ECG stored in the PC

- **Select the patient name by the mouse**  
(you may type the 1<sup>st</sup> letter of the patient name to find names start with that letter)
- **Select the date of the ECG to be visualized: by double clicking on it, the ECG is displayed**



The displayed ECG can be printed out **by printer icon**.

The doctor can edit comment to the ECG displayed by the **"Comment"** menu.

This comment will be printed out on the ECG finding.

## 1.16 Sending ECG e-mail

### Sending the ECG measurement from PC by e-mail

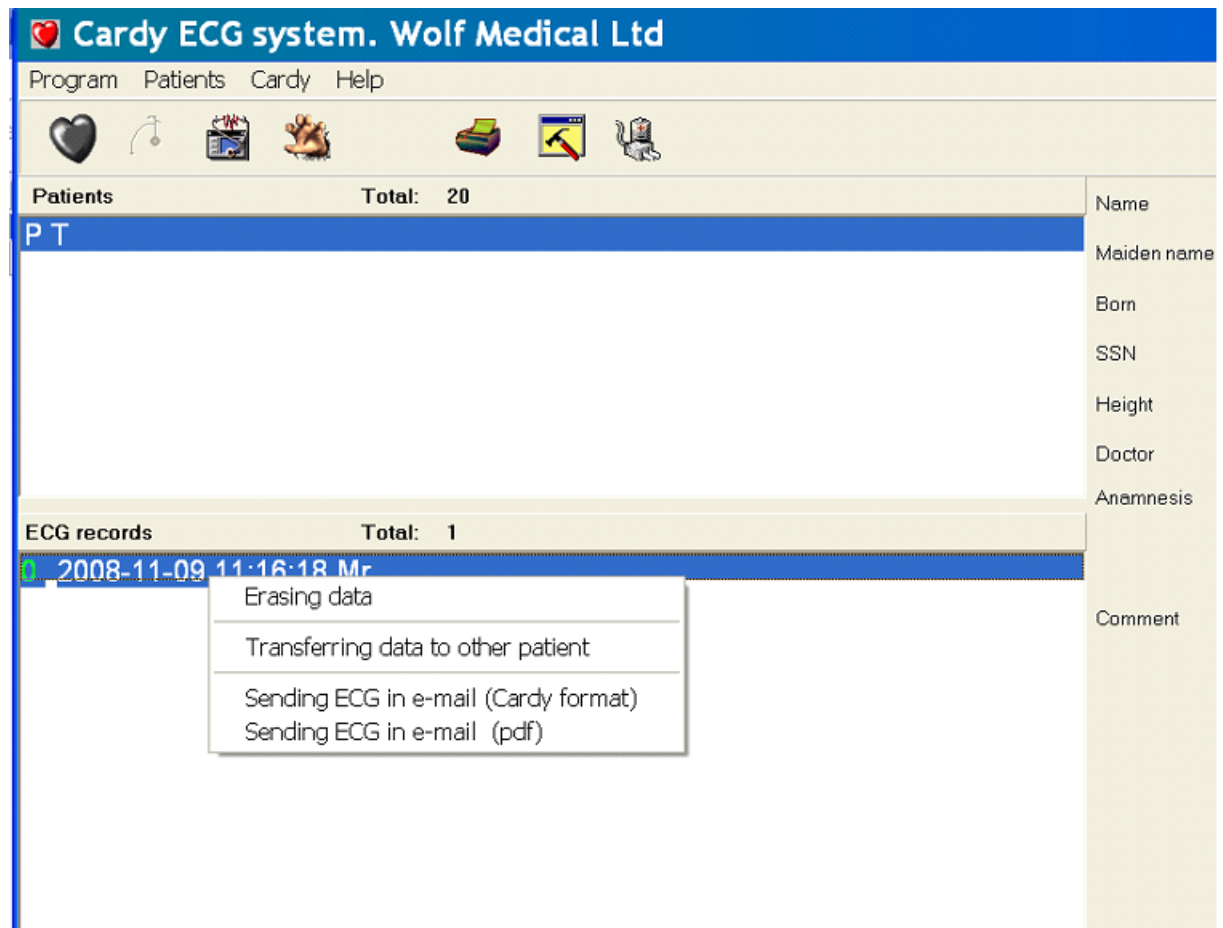
Before 1<sup>st</sup> e-mail sending, set the address of the recipient in the Setup menu

If the recipient address has been previously set, follow the steps under:

- select the patient and the ECG record to be sent by left clicking

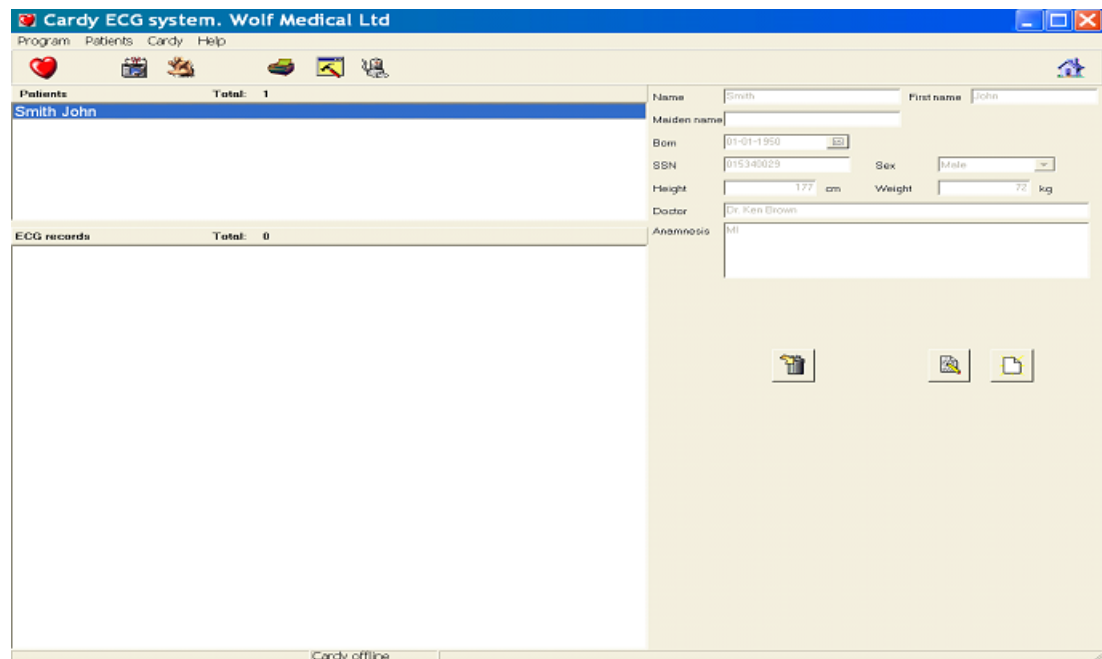
- when right clicking the selected ECG two choices appear in a window:
  - Sending ECG in e-mail (Cardy format)
  - Sending ECG in e-mail (pdf)
    - If the recipient has a Cardy program, select the 1<sup>st</sup> format (Cardy)
    - If the recipient does not have Cardy program, send the ECG in "pdf"
  - After selecting the format, your mail program appears in a few seconds, with a new e-mail, attaching the selected ECG record.
- send the e-mail by the usual way

Several ECG's can be sent in Cardy format at the same time: select the ECG's by the known process of Windows. (Left click the ECG, while holding the Ctrl key.)  
 All the ECG's of a given patient can be sent, if you select the patient, but do not select ECG, then right click the selected patient.



## 1.17 Functions of the icons

**Functions of the icons, main menu:**



### 1.17.1 Main menu



Deletes the selected item (the entire patient record or a measurement)



Opens data file of an existing patient (modification of patient identity)



Opens data file of a new patient (creates new patient identity)



Active, when a patient is selected. Click it to go into the monitoring window



Visualization of the selected ECG record



Grab it! Download all ECG's from a patient selected in Cardy



Prints patient identity and anamnesis



Setup



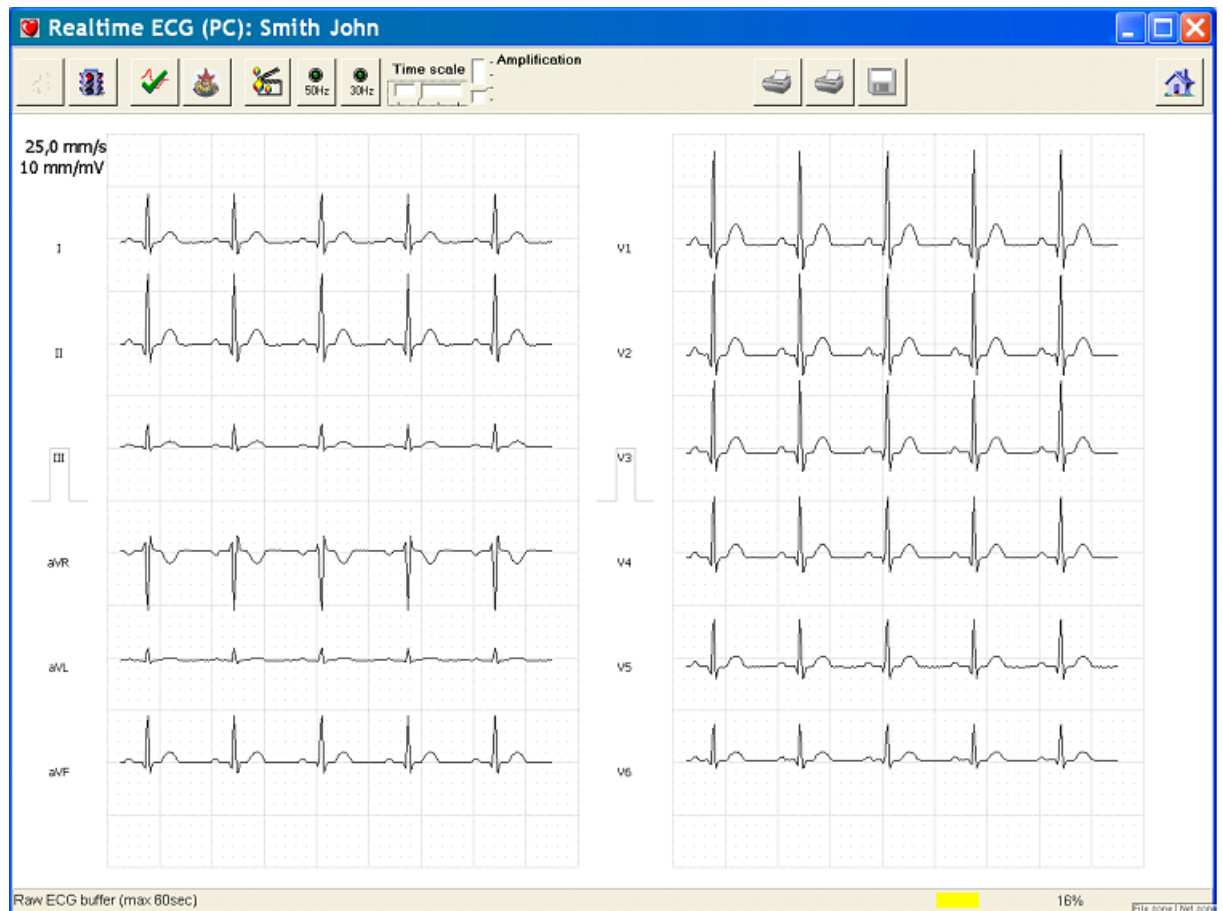
Switch the Cardy off



Exit program

## 1.17.2 Monitoring

Functions of the icons, monitoring:







mouse)

Start monitoring (To set the leads to be displayed use right-click of the



Stop monitoring



Start ECG recording for analysis



Start ECG recording for analysis and storage of raw ECG



Block of 1s. If the baseline moves, use the block function



50Hz mains filter. Click to switch on or off. The status is kept



30Hz myogram filter. Click to switch on or off. The status is kept



Time scale setting: 12,5 mm/s, 25 mm/s, 50 mm/s, 100 mm/s,



Amplification: 5 mm/mV, 10 mm/mV, 20 mm/mV, 40 mm/mV,



Displays the selected range from stored ECG

Next three icons are active, when the monitoring is stopped by "red lamp" to store or print raw ECG. (Yellow bar on the lower right side of the screen shows the status of the circular buffer: 100% means that the buffer of 1min is full, than the new ECG overwrites the old data.)



Prints the ECG displayed on display



icon)

Prints ECG of 16s, when *double mode* was used (launched by "joker"





Storage of ECG from circular buffer



Exit monitoring window

### 1.17.3 Visualization of the findings

**Functions of the icons**, offline ECG info (displaying of the findings after measurement or stored ECG):



ECG

View/hide reference curve. (When Cardy without PC measures several of a patient, the 1<sup>st</sup> ECG is considered as reference.)



Print finding



Zoom +/-



Time-scale +/-

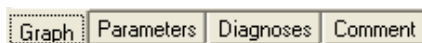


Change view of parameter table (Active in "Parameters" menu)



menu)

Save parameters to disk as text or Excel format (Active in "Parameters"



The menus on the button show different results of findings and offer possibility to edit a comment of the doctor.

The menus on the button show different results of findings and offer possibility to edit a

## 2 CARDY® MED: bedside ECG

### 2.1 Overview

#### **CARDY® MED, as bedside ECG**

You can use your Cardy as a stand-alone equipment: the 12-lead (or 8-lead) ECG

signal is displayed on its graphic LCD, and the automata program carries out ECG analysis. The measured curves, the evaluated ECG and answers for medical questionnaire can be stored for later PC data transmission.

When buying, the Cardy is ready for measuring and analyses of 12-lead ECG, but further operation modes can be set. (See at "Setup" menu)

## 2.2 A routine measurement

**A routine measurement is carried out as follows:**

Put 10 electrodes on (four limb and 6 chest electrodes) and connect the patient cable to the Cardy.

(Cardy is able to interpret 8-lead ECG: limb electrodes and V2, V5 are to be used. You can reduce no. of used electrodes in setup menu, at Leads item.)

**a. Switch on the Cardy:** Press the switch on key (O).

→ Cardy carries out self test and the patient identity table appears

**b. Select patient** with ↓ or ↑ key, and accept patient with ✓ key.

New patient can be added by holding down the X key and selecting an Icon with ↓ or ↑ key and accepting it by ✓ key.

(When Cardy is used without PC, do not select "PC USER" as no ECG storage is allowed with this special user name.)

→ Main menu of Cardy appears

**c. Start visualization** of the ECG by answering the question "10 elect's OK" by ✓.

→ Lead I is visualized.

Change lead by the ↓ or ↑ key, vary Gain by pressing and holding down the ↓ or ↑ key

**During monitoring** and data collection of 16s the Cardy displays useful information: The data collection time is 16 sec, but a real-time signal quality checking (SQC) method is built into the Cardy which repeats the data collection of 16s from the beginning, if the SQC detects poor ECG quality.

During data collection the algorithm continuously checks, if

a.) the difference of the max and min. value of the signal in time-range1 greater, than threshold1

(There is no fallen electrode or faulty patient cable)

b.) the difference of the max and min. value in time-range2 less, than threshold2 (no wandering baseline)

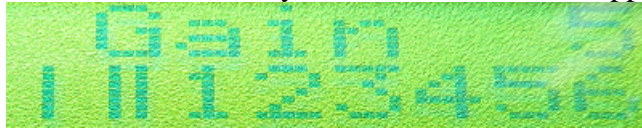
c.) the difference of the max and min. value in time-range3 less, than threshold3 (no tremendous line interference or muscle noise exists)

There are 8 squares on the upper left side of the Cardy LCD :



one square turns black after 2s, if the SQC procedure results in a good signal quality. So all the 8 squares turn black after 16s, if the ECG signal was OK during sampling. If a signal quality error occurs, the sampling starts from the beginning and the squares turn white.

The name of the faulty lead is inverted on the upper right side of the Cardy LCD.



If all the three criteria are fulfilled during the 16s data-collection time, then the analysis is started.

If one of the criteria is not fulfilled, the data collection of 16s is started again and this goes during 1 min. After 1 min, the SQC gives it up and analysis starts. The real-time signal quality check (SQC) marks the faulty lead on the Cardy LCD.

During monitoring, a real-time R-peak detection is built into the Cardy and it displays the heart-rate continuously.

There are further checking during/after analysis, which can also refuse the automatic ECG parameter computation.

d. **Check the ECG signals:** select different leads by the ↓ or ↑ key.

→ The ECG leads are displayed one by one

e. **Filter:** The Cardy program can filter noises with digital filtering:

during monitoring use "O" button to set the "mains" (50Hz) or "myogram" (30Hz lowpass and 50Hz) filter.

Usage of filter will not prevent the rejection of noisy ECG - as the analysis is carried out from non- filtered signal - , but it improves the quality of the saved ECG file. The setting of filters is kept by Cardy, even if the Cardy is switched off.

f. **Start automata program for measurement and analysis:** Press ✓ key.

→ ECG of 16 sec is sampled and evaluated.

During measurement all the 12 leads are displayed one by one automatically.

After analysis the results are displayed: if the patient has no previous ECG in the Cardy memory, the 1<sup>st</sup> window shows the degree of abnormality. (The range is 0,1...9, where normal ECG is equal to zero)

If the selected patient has a stored ECG in Cardy, the actual measurement is analyzed and the diagnosis is compared to the stored one. The 1<sup>st</sup> Cardy window after evaluation refers to the result of comparison. (A number and a bar is written out showing the degree of deviation from reference ECG)

g. **Displaying the results of analysis:** press ↓ key repeatedly to go through the findings

→ the diagnoses, the averaged cycles of different lead, lead I of 16 sec for checking the rhythm, answers for questionnaire are displayed. (Use O key to sweep over the rhythm curve.)

In the last window, a list of complains is shown: push "O" button to activate the medical questionnaire: , a question is displayed whether you want to fill in a medical questionnaire. Type ✓ for Yes or X if you prefer neglecting it.

(If ECG analysis is refused because of noise, storage of raw ECG is offered: accept it by ✓ or repeat measurement by " X "

h. **Storage of measurement:** press ✓ key for "Save ECG record" question while the results are displayed.

→ The actual measurement – leads, parameters, diagnoses – is stored in Cardy.

i. **Exit from measurement:** push X in any window showing the result of analysis.

→ The main menu appears, where you can switch off by O key.

(Cardy switches off automatically after 3 minutes.)

## 2.3 Displaying the stored ECG

### Displaying the stored ECG

a. **Switch on the Cardy:** Press the switch on key (O).

→ Cardy carries out self test and the patient identity table appears

b. **Select patient** with ↓ or ↑ key, and accept patient with ✓ key.

→ Main menu of Cardy appears

c. **Select "Saved ECG"** (directory) menu by pressing ↓ and ✓ key

→ List of stored ECG appears: type, date and time of records are listed

d. **Select ECG:** by pressing ↓ or ↑ key

**To display the selected ECG, press ✓ key** (or for **deleting**, press O key.)

→ Selected ECG appears. Press ↓ key repeatedly to go through the findings (Use O key to sweep over the rhythm curve.)

## 2.4 Saved file erasure

### Saved file erasure

a. **Switch on the Cardy: press the switch on key (O).**

→ Cardy carries out self test and the patient identity appears

b. **Select patient** with ↓ or ↑ key, and accept patient with ✓ key.

→ Main menu of Cardy appears

c. **Select Delete menu by pressing ↓ and ✓ key.**

→ List of deleting mode appears.

- d. **Select Delete Mode** by pressing ↓ or ↑ key and ✓ key  
→ Affirmation window for selected deleting mode appears. Confirm it by pressing ✓ key. (Note: "Format flash will erasure all the patient records)
- e. **See free memory at Delete / Memory status** menu item  
Check the free memory size before starting to record a rhythm curve of 256s, as this will require 128 blocks from the 3422-block total memory capacity.

## 2.5 Memory demands of ECG records

**Memory demands of ECG records in blocks (Cardy memory capacity: 3422 blocks)**

**Leads**

<b>1</b>	<b>Rhythm, 32 sec: 16</b>	<b>Rhythm+ ,256 sec: 128</b>	
<b>8</b>	<b>Home, analysis: 16</b>	<b>Home, analysis +: 20</b>	<b>Raw ECG, 4s:16</b>
<b>12</b>	<b>Med, analysis: 24</b>	<b>Med+, analysis +: 32</b>	<b>Raw ECG, 4s:24</b>

**Maximal no. of patient identity: 10** ("PC USER" + 9 selectable)

**Maximal no. of stored records: up to 107** (in basic model, in "12-lead analysis+" mode)

## 2.6 Cardy RESET

**Restarting Cardy (RESET)** Complex electronic devices in Cardy are sensitive to external noise such as static electricity, or electromagnetic waves close to electronic devices. If for any of these reasons Cardy should "freeze" – meaning that the display would not change after 30 seconds, you can reset (reboot) Cardy as follows:

- a. Press and hold the ✓ key.
- b. Press and release the switch on key (O).
- c. Release the ✓ key.

## 2.7 Setup menu

### Setup menu

The Mode, the Leads, The Rhythm and the Icon menu items are specific: they refer to the selected patient. All other menu items are general. **For "PC USER" the Mode and Leads are fixed for 12-lead analysis**, it can not be changed: use other patient for different mode/lead.

**Set ECG measurement type** by selecting Mode menu with ↓ or ↑ key, and ✓ key.

→ Modes appear:

Analysis: measurement of the leads set in Lead menu (8 or 12) and storage of averages and rhythm curve (16 sec from one lead)

Analysis +: measurement of the leads set in Lead menu (8 or 12) and storage of averages, rough ECG of 2 second from measured leads and rhythm curve (16 sec from lead I)

Rhythm: measurement and storage of one lead of 32 sec

Rhythm+: measurement and storage of one lead of 256 sec

Raw ECG, 4s: measurement and storage of 4s from all leads set in Lead menu

**Select the required Mode** by ↓ or ↑ key, and accept it with ✓ key.

**Set no. of leads** to be measured by ✓ key at "Leads" menu item.

**Rhythm:** the lead for rhythm curve with analysis mode can be I, II, V2 or V5.

**Set the sound** on/off by selecting the "Sound" menu item and pressing the ✓ key.

**Set date and time** by selecting the Date/Time menu item and using ↓ or ↑ and ✓.

**Language selection** is available in Language menu item.

**Login icon** for selected patient can be chosen at Icon menu by ↓ or ↑ and ✓ key.

**Add patient and Remove patient** menu items can be activated from patient identity window (the 1<sup>st</sup> window after switching in) by pressing and holding down the ✓ key. The former creates a new patient file for coming measurements, while the later erases the selected patient and all of its ECG records.

## 2.8 Data transfer of stored ECG

### Data transfer of stored ECG from Cardy bedside ECG to PC

**Select the patient** the ECG records of whom are to be transferred from the Cardy to PC by ↓ or ↑ and ✓ key.

→ Cardy displays the selected patient's menu window

**Run Cardy PC program** and put Cardy in front of the infraport if you have this.

**Select patient** from database or create a new the stored data in Cardy refers to.

Use  icon to transfer ECG record from Cardy to PC.

## 2.9 Frequently asked questions

### CARDY®: Frequently asked questions

**What the patient has to do to do after getting medical advice from Cardy?**

#### 1<sup>st</sup> measurement (reference ECG)

**normal ecg** When 1<sup>st</sup> ECG (Reference) is measured, the results of interpretation can be normal (if both rhythm and form are normal), or abnormal.

**abnormal ECG** Abnormal classification is made, if there is the slightest suspicion for

**Display:** abnormality for rhythm or form (even an increased heart rate)

could result in 3■■■■■■■■ "abnormal ECG" classification).

What should the patient do? The patient should keep calm and try to repeat measurement. A consultation is needed with the doctor, if the "abnormal ECG", classification persists and the patient you did not have any ECG problem before.

The number in front of the scale shows the measure of deviation from normal ECG which is also demonstrated by the number of black squares. Maximal value: 9.

### Repeated measurement

**Voice and display:** Nothing should be done, if the patient has no complain

**No change**

**Voice:** The actual ECG differs from reference ECG. Don't panic

**Change of 2<sup>nd</sup> order!** If the patient does not have any complain the correct placement of the **Display:** electrodes has to be checked and the measurement should be repeated.

3■■■■■■■■

result again

If the repeated measurement gives a **Change of 2<sup>nd</sup> order!**

and the displayed value is greater than 4, the patient has to consult the doctor

Urgently consultation is needed doctor, if the displayed value is greater, than 6.

The number in front of the scale shows the measure of deviation from reference ECG which is also demonstrated by the number of black squares. Maximal value: 9. The diagnostic statement in CardyHome is put into a form understandable by the user, not using medical terminology. If he/she wants to see the medical diagnosis, the "O" button has to be pushed when displaying the results and can go back to "user friendly result" with repeated pushing of the "O" button.

**Check lead order!** The patient cable is probable falsely connected to the electrodes. Check it, and repeat the measurement, if it is necessary.

**PACEMAKER SPIKES** Cardy detected spikes on ECG probably due to implanted PM.

**Rhythm** The rhythm diagnoses are listed

**Depolarization** List of depolarization diagnoses

**Repolarization** List of repolarization diagnoses

### What are the questions in the medical questionnaire? These are:

Do you have complains?

Do you have pain?

Location of pain:

Left chest?

Middle chest?

Neck?

Left arm?

Type of pain:  
                     Continuous?                      In waves?                      Momentary?  
 Hard breathing?  
                     At breathing in?                      At breathing out?                      Continuous short breath?  
 Changed heartbeat?  
                     Fast, regular h'beat? Fast irreg. h'beat? Missing h'beats Too strong heartbeats  
 Feeling unwell?  
                     Cold sweat                      Dizzy Nausea                      Need to urinate

### **Program installation and usage**

How many installations can be made with a software: as many, as you wish.

What happens, if reinstalling the Cardy program: will it overwrite the data? No, all the measurements will be preserved.

Error message during installation: "16- bit system does not support application of 32-bit"

Reason: No autoexec.nt file was found in directory: Windows\system32

What to do: Copy autoexec.nt file from Windows\repair directory to Windows\system32 directory

The windows of the program has not proper size (some bottoms /text are missing)

Reason: No 96dpi is set on display

What to do: Set Normal (96DPI) in Display/ Settings/Special/ General menu

The visualized chest leads on PC display are not "ECG like":

Reason: the Cardy operation mode is set to rhythm or rhythm+ where the Cardy doesn't transmit

chest leads to the PC

What to do: set "A", "A+" (8 –lead ECG), "MA", or "MA+" (12-lead ECG) operation mode on Cardy.

The "Cardy/Download new firmware" menu does not offer web-site address.

Reason: this menu is a tool to update the Cardy firmware, not the PC software.

What to do, if you wonder, whether a new firmware exists: ask your dealer.

### **The Cardy can not be switched on:**

Reason1: No battery in or no energy in batteries

Reason2: no proper connection at batteries, check it

Reason3: the equipment has not been used for a long period of time, and the contrast is forgotten because of the lack of battery

What to do: After changing the battery, set the contrast: hold down the O key and down arrow key simultaneously (brightening) or up arrow key simultaneously (darkening)



**Checking FS, Error 0x0281** error message on Cardy after switching on, or Error message "Temp. write protected" before ECG storage

Reason: no flash formatting was made after firmware update

What to do: Format flash in Delete menu, Format Flash:

Be careful: all the data will be lost in

Will the data be kept in Cardy during battery change? Yes

### Measurement error during analysis

Reason: During measurement Cardy checks the placement of the electrodes and the technical quality of the ECG. If the electrodes are not connecting well during the measurement, or the ECG is "noisy", an error message will appear after the ECG sampling:

„High noise CODE: F8"

Most frequent error code is F8, but it can be any error between -1 to -12

Check the placement of the electrodes, check if all the pins are in place, make sure that you are not too near to an electronic device, such as a TV, PC, or especially a power supply of a note-book. (If you use note-book, pull out its power cord from mains during measurement, if the ECG signal is noisy). If everything seems to be in order, press "YES" key, the patient has to relax, and the measurement can be repeated. Note: the filter is used to get noise-free signal on LCD, but the analysis is carried out from unfiltered ECG signal, so you should find the reason of noise and eliminate it.

Error codes:

```

;FF (-1): ERROR1; THDIF>9*210uV (TOO SMALL SIMILARITY FOR
THE QRS COMPLEXES)
;FE (-2): ERROR2: NO QON
;FD (-3): ERROR3: NO SOFF
;FC (-4): CHECKP: QRSd<40ms
;FB (-5): INDEX1: R(1) INDEX >1536
;FA (-6): QRSSEP: NN<4 ( TOO FEW NORMAL BEATS)
;F9 (-7): QCHECK: V2{MAX-MIN} OR V5{MAX-MIN}<300uV OR
;          {I{MAX-MIN} AND II{MAX-MIN}<200uV}
;F8 (-8): QCHECK: NOISE>200 uV IN ANY LEAD
;F7 (-9): CHECKP: {MAX-MIN}>600uV IN {QON-80ms;QON}IN ANY
LEADS (AVERAGES)
;F6 (-10): R1DET: K0>0
;F5 (-11): NOT USED
;F4 (-12): EXAMK2: N(K2=0)<4 (TOO FEW NORMAL BEATS AFTER
RSEEK)

```

**Noisy ECG**, when the ECG record is made by doctor/second person (called: "assistant")

Reason: the assistant disturbs the measurement by his own electromagnetic field.

What to do: the assistant should be located at a minimal distance of 1 m from the patient during measurement. The assistant should not touch the patient or patient cable during measurement

### Where to find Cardy PC installation program:

For CardyMed:

[http://wolfmedical.hu/Fb/Cardy\\_Infra/CardyMed\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Infra/CardyMed_e.exe) for Cardy with infra, or  
[http://wolfmedical.hu/Fb/Cardy\\_Bt/CardyMed\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Bt/CardyMed_e.exe) for Cardy with bluetooth

For CardyErgo:

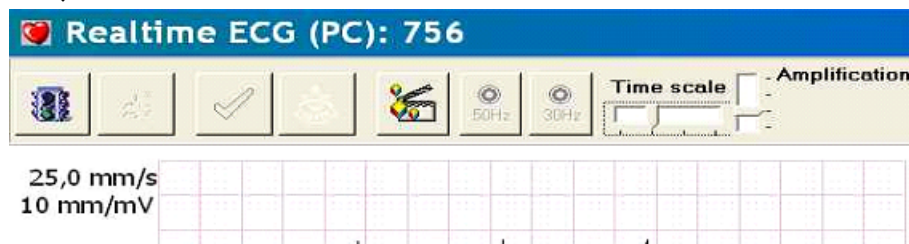
[http://wolfmedical.hu/Fb/Cardy\\_Infra/CardyErgo\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Infra/CardyErgo_e.exe) for Cardy with infra, or  
[http://wolfmedical.hu/Fb/Cardy\\_Bt/CardyErgo\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Bt/CardyErgo_e.exe) for Cardy with bluetooth

## 3 Quick user guide

1. Switch on CARDY by pressing the O key.
2. Run the PC program by clicking the "Cardy" icon.
3. Record the new patient by clicking the "empty page" icon or select an existing patient name
4. Click "Heart" icon to enter monitoring window

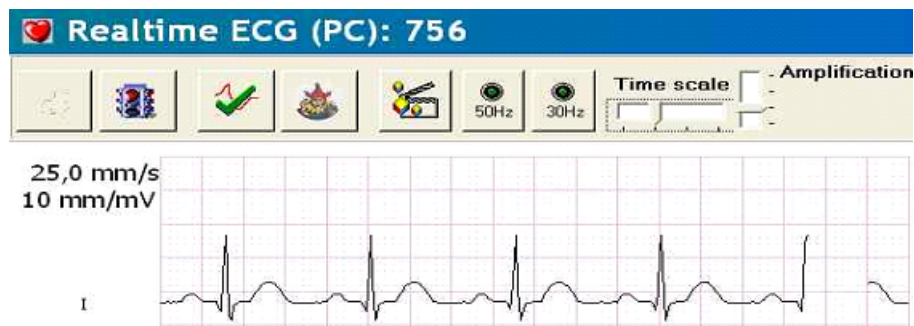


5. Click "green lamp" icon to start monitoring



6. Click "Joker" icon to start measurement (analysis and raw ECG) or ✓ (analysis)

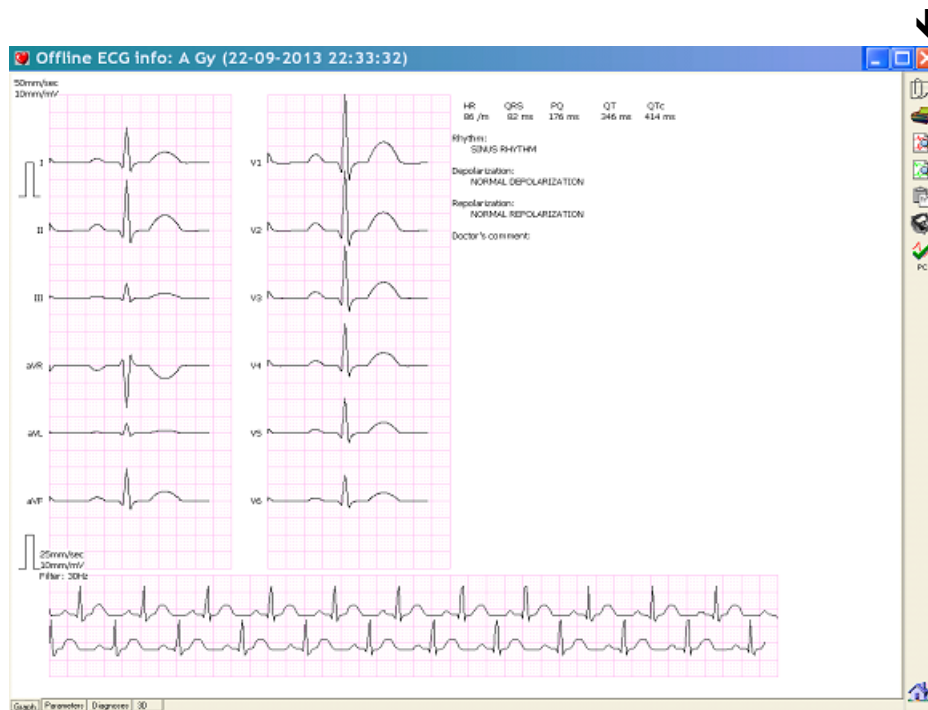




7. Cardy automatically downloads the results to the PC

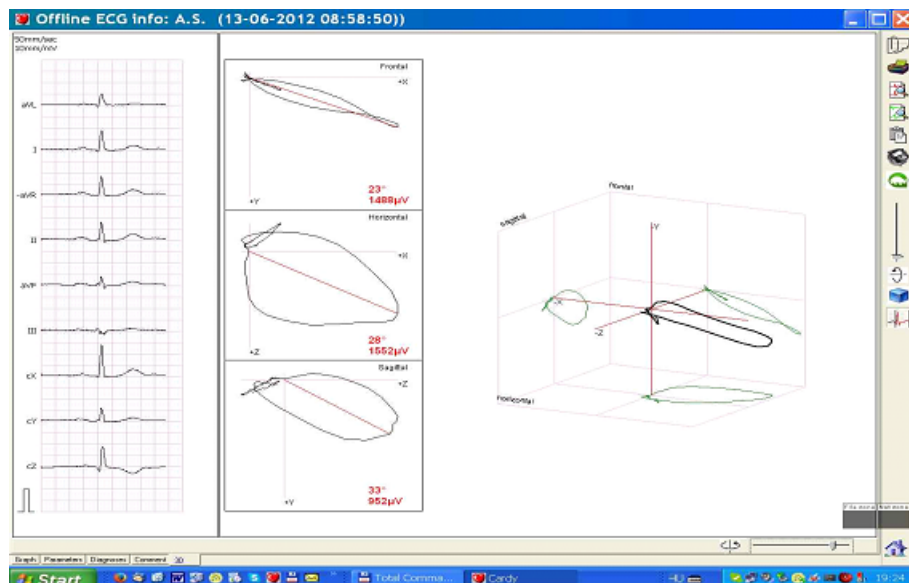


8. Click "PC with ✓" icon to store measurement in the PC data-base



9. Edit comment and/or display 3D (Frank-leads) vector





## 4 CARDY® Ergo (option)

### General requirements

Before starting read this and CardyMed manual carefully. The manufacturer can only be held responsibility for the safety, reliability, and performance of the apparatus, if:

- The electrical installation of the relevant room complies with IEC requirements
- The Cardy is used in accordance with the operating instruction

### Functions of the CardyErgo system

1. Rest ECG measurement before stress test (CardyMed function)

2. Stress test protocol set up

Before measurement the system offers the Bruce protocol as default. The user may set any kind of protocol which can be stored.

The parameters that can be changed:

Initial work load

Increment (Load step)

Duration of load phase

Load during recovery

Duration of recovery

3. Monitoring of 12-lead ECG during test: real-time ECG, averages

The program is real-time monitoring all the leads selected and displays the calculated averages which are real-time updated. The HR, ST values, actual load and elapsed time is displayed.

Digital filters can be switched on during stress test to decrease the noise generated by mains or muscle tremor.

4. The blood pressure is measured automatically (option), or can be input manually for final report.

5. Real-time calculation of HR and ST value for 12 leads

The HR is determined from 4 RR distances, ST values are calculated from the updated averages by the PC program. A "bip" signal is synchronized to R peak, which can be set on/off.

ST location is automatically determined, but it can be modified: SE+40,50,..80 ms

6. Control of ergometer with the possibility of manual control

CardyErgo SW controls the most commonly used ergometer (e.g. Lode and Ergoline ergometers).

7. Compilation of finding

The pages appear in report can be set by user: as a default, it contains phase 0, final phase

(averages, actual HR, actual ST, as seen on display), graphs (HR, load), trend (ST).

The user can select lists (with ST values in consecutive load phase) to be printed out, and compile comment of the report.

8. Storage of measurement in database

## 5 Steps of the ECG stress test

### Steps of the ECG stress test:

Rest ECG: no load, display of rest averages, HR, ST values and target HR/load

Exercise ECG: load set automatically, with the possibility of manual setting

Display of averages, HR and ST values and target HR/load

Manual stop of test by operator

Rest phase after exercise

Compilation of report

## 6 How to start stress test?

**A routine exercise ECG measurement is carried out as follows:**

**Put on the ECG electrodes. The patient cable should be suspended from upstairs to avoid movements during exercise, as it can cause artefact.**

**Switch on CARDY** by pressing the **O** key. Put the infrared connector in front of the upper IR window of the device. A "PC USER" message on Cardy LCD will appear. If some other user name is seen, "PC USER" is automatically set by PC, when visualization is started on PC display.

•**Run the PC program** using the "Cardy" icon.





•**Check the PC – Cardy connection** ("Cardy3 Ergo online" is displayed on the middle bottom line on your PC screen.) If "Cardy offline" is displayed, check Cardy

and the infrared connection.

• **Record the new patient by clicking the "empty page" icon.** Type in the name - this field is obligatory, the other fields are optional. The Case History is displayed on each ECG records.

Alternatively, select an existing patient from the list.

→  icon and the  „old bike" icon become active.

**Check if the eoec**

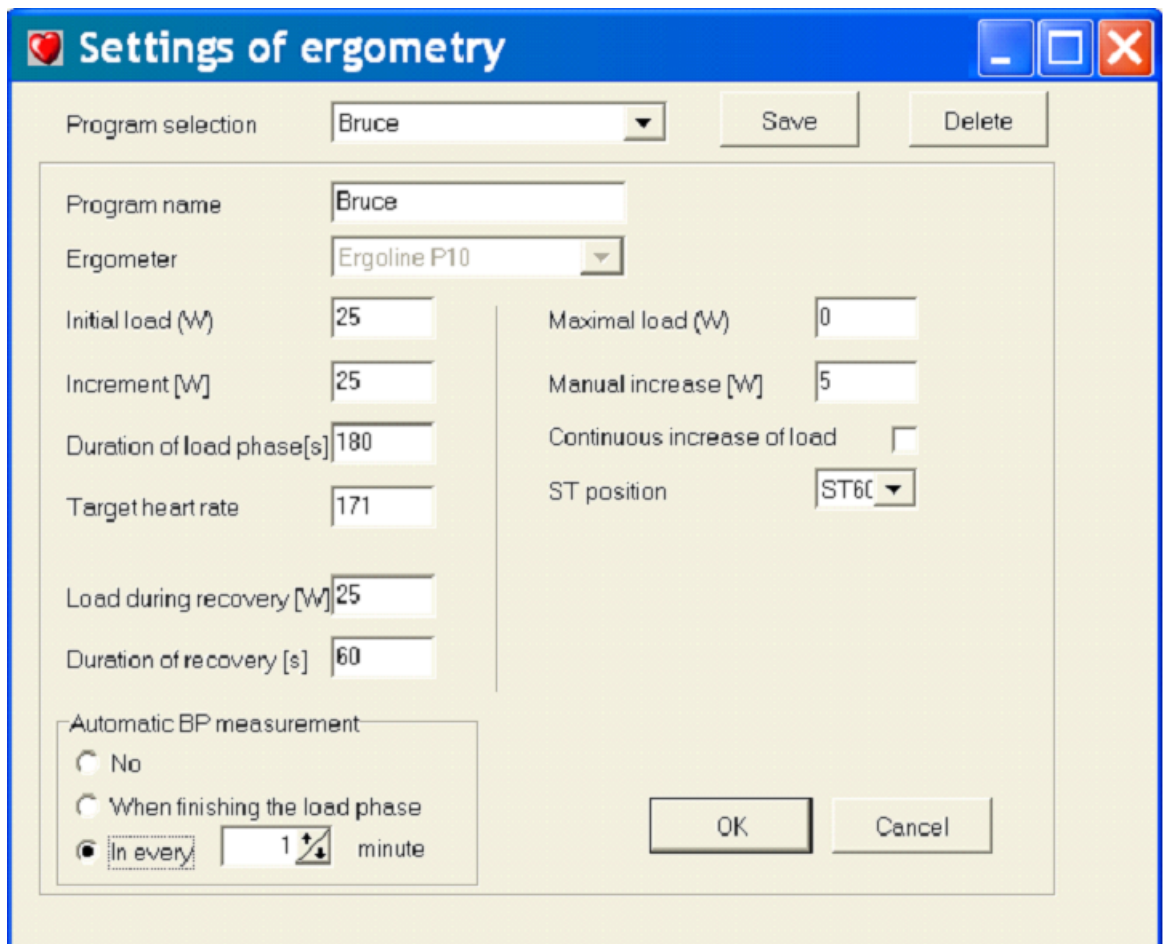
- Start stress test by old bike icon



→ Settings of ergometry appears

## 7 Settings of ergometry

Settings of ergometry



The dialog box titled "Settings of ergometry" contains the following fields and controls:

- Program selection:** A dropdown menu showing "Bruce".
- Buttons:** "Save" and "Delete" buttons.
- Program name:** A text field containing "Bruce".
- Ergometer:** A dropdown menu showing "Ergoline P10".
- Initial load [W]:** A text field containing "25".
- Maximal load [W]:** A text field containing "0".
- Increment [W]:** A text field containing "25".
- Manual increase [W]:** A text field containing "5".
- Duration of load phase[s]:** A text field containing "180".
- Continuous increase of load:** An unchecked checkbox.
- Target heart rate:** A text field containing "171".
- ST position:** A dropdown menu showing "ST60".
- Load during recovery [W]:** A text field containing "25".
- Duration of recovery [s]:** A text field containing "60".
- Automatic BP measurement:** A group box containing:
  - ☐ No
  - ☐ When finishing the load phase
  - ☒ In every  minute
- Buttons:** "OK" and "Cancel" buttons.

In the window the parameters of the stress test can be set: initial load, increment, duration of load phase, load during recovery, duration of recovery, frequency of the

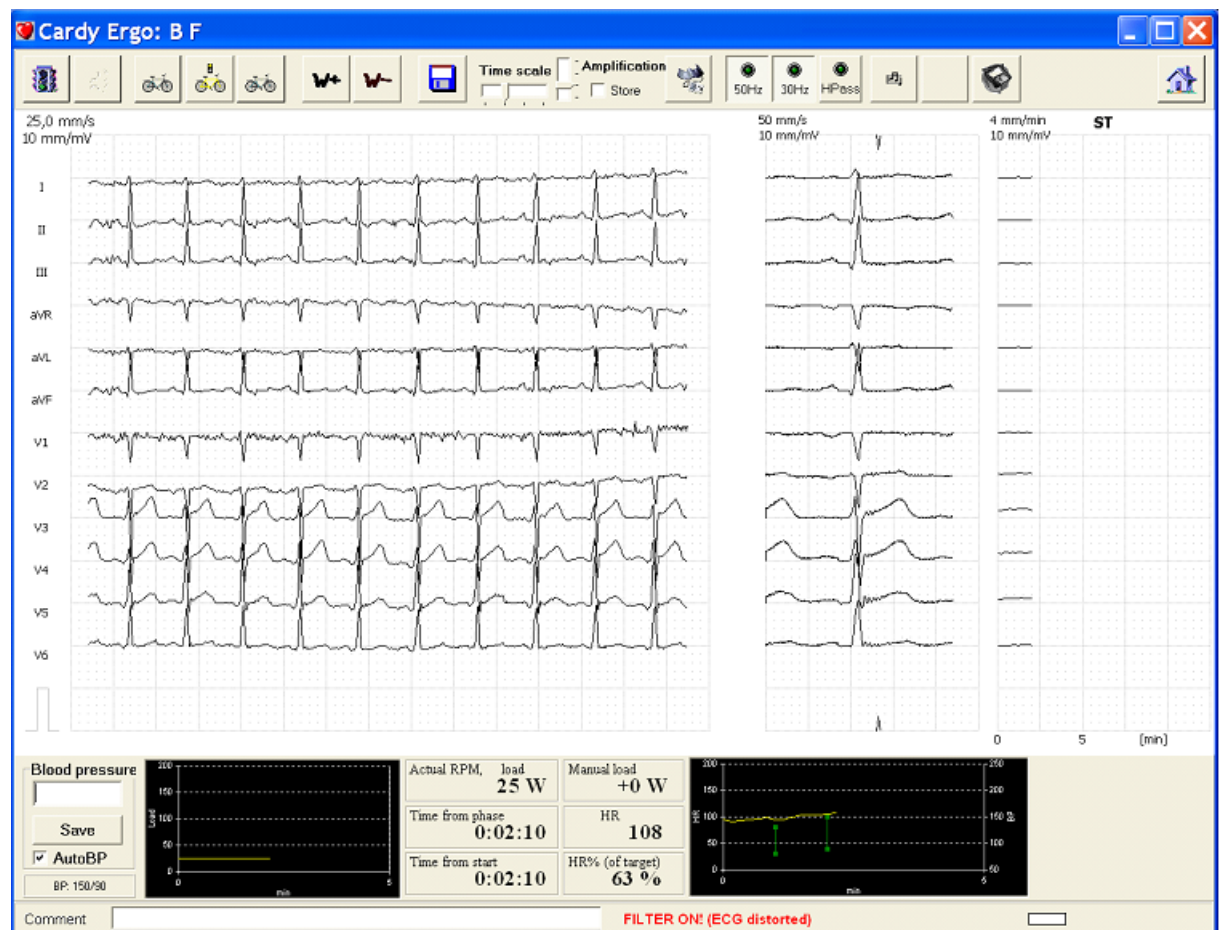


automatic measurement of blood pressure and ST location. The target heart rate is calculated from the age of the patient.

The preprogrammed exercise protocol is offered automatically and it can be rewritten and stored. This window appears always with the stress test program used last time. If no changes are requested, accept the parameters by "OK"

→ **Cardy Ergo** window is displayed

## 8 Information in the Cardy Ergo" window



### Information in the Cardy Ergo" window:

Icons in the upper line to start/stop monitoring and stress test

Raster, where the 12-lead ECG can be monitoring

Averaged cycles: 16s after initialization phase they appear

ST trend: continuously calculated by program

Window for manual input of blood pressure (BP)



Load diagram as a function of time

Window to show actual speed of the ergometer. RPM: rotations per minute

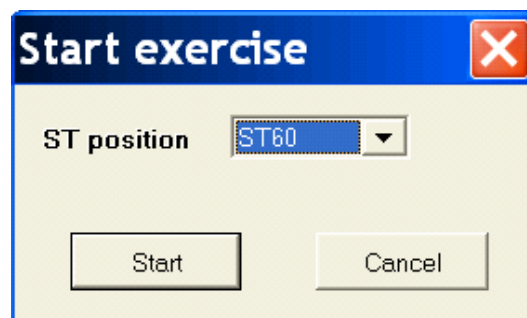
- Time windows to show the elapsed time from actual phase and start  
 Manually set load (during stress test, the load set automatically can be changed:  
 if manual load setting is activated, the automatic load setting is no longer active  
 Window to display actual heart rate (HR)  
 Window to display actual heart rate as a percentage of target heart rate (HR%)  
 HR and BP trends, Comment field

## 9 Routine measurement

### Routine measurement:

1. Set the **leads** to be monitored – right-click on any part of the visualization window to select the leads.
2. Start **monitoring** with the Green light icon  

3. If the baseline moves, use the **block function**. Amplification and shift can be set with the mouse or the arrow keys.
4. **Initialization of measurement by "lamp with green light" icon**  


It does not set the load on the ergometer yet. The patient is in rest, the program measures resting ECG of 16s and then analyses it. The results – averaged cycles, location of ST segment, HR and HR% are shown. The ST location can be changed by ← and → or can be modified in the "Start exercise" window. If automatic BP measurement unit is connected to the system and it has been programmed in the protocol, a rest BP measurement is made, before the "Start exercise" window appears. (During measurement the icon of manual BP measurement becomes passive.)



5. The stress test is launched by clicking the "Start" button: the program sets the initial load, is monitoring the ECG, calculates the HR and ST values continuously and updates the averages. The R peak detection is signaled by "bip" which can be switched off by icon with notes. If the ECG is noisy, three types of filters can be switched on, but these filters can distort the shape of the ECG. (If the filters are switched ON, the program indicates it by a red-colored warning string.) The averages and the ST values

are calculated from the non-filtered signals so they are not affected by the filters.

6. During exercise a comment can be edited which is stored by an "Enter". Prompt storage of actual ECG is done by clicking the "Floppy icon". If no automatic BP measurement unit exists it can be measured manually and input to the BP field. A BP trend is compiled from BP data input manually.

7. **Recovery** phase is started by clicking the yellow bike icon.



During recovery the load is set to the value set in the protocol, typically 25W. The reason of stopping the stress test can be written into the comment field. (Pre-edited strings are rolling down to help this.) A warning window appears at the end of the recovery phase set in the protocol, but the load is kept until the doctor stops the measurement by the "red bike" icon. The doctor can observe if the actual HR returns in 4 minutes to the 110% value of the resting HR. (The program displays this)

8. **Stop measurement by red bike icon**



The measurement is stored automatically.

9. **Exit Cardy Ergo window by**

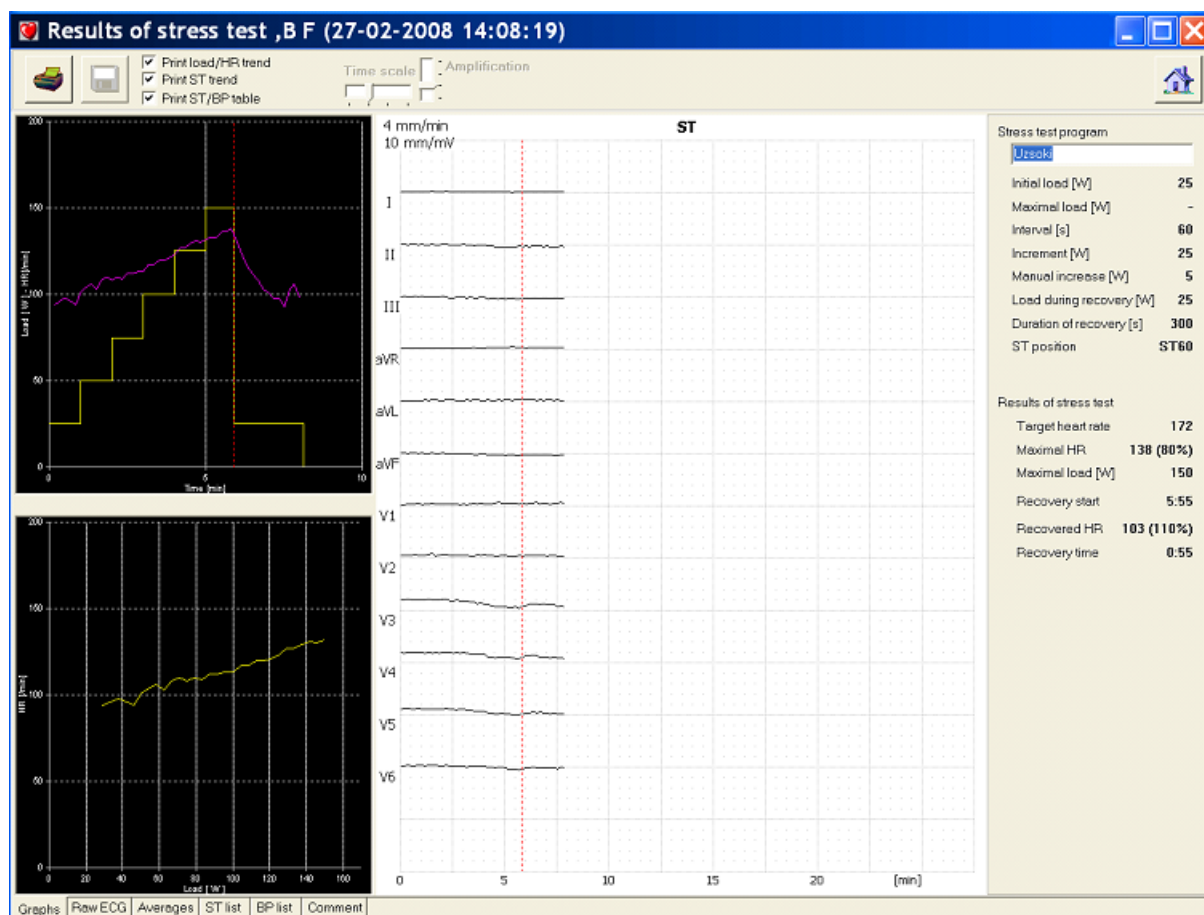


icon.

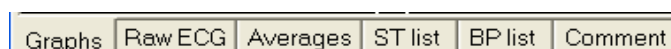
## 10 Evaluation of the stress test

### Evaluation of the stress test

In the database the stress test ECG files have "ERG" extensions. Double click on the selected measurement to see the "Results of stress test" window.



The menu items on left lower part select the different kinds of results: tables and trends.



**Graphs:** load, HR, BP and ST trend

**Raw ECG:** in every load step during exercise the program automatically stores an ECG record of 4s. The manually stored ECG records can be seen in this menu, too.

**Averages:** in every load step during exercise the program automatically stores the averages. The averages manually stored during stress test can be seen in this menu, too.

**ST list:** in every 10s the program stores the ST values

**BP list:** the BP measurements stored during stress test are shown here

**Comment:** the comment edited during stress test are shown here. The doctor may edit a summarizing comment after measurement at this menu item.

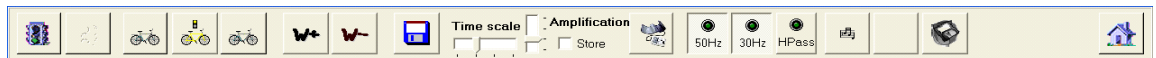
**The results can be printed out from Results window.** Put a tick to the appropriate square in upper left part of the window to select the items to be printed out. The raw ECG curves and the averaged ECG's are not printed out automatically (Default settings are off). When displaying the Raw ECG and/or Averages in Result window, put a tick

into the appropriate square in the upper left side of the window.

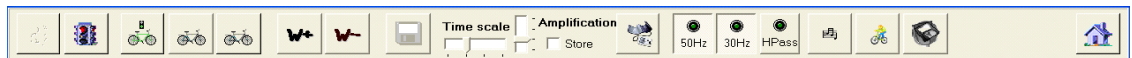


## 11 Functions of the icons

**Functions of the icons/windows of the main window of stress test.** (It appears after patient selection.)



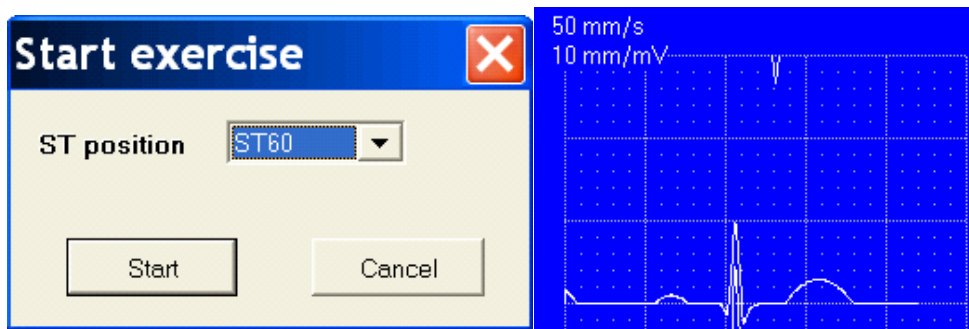
**Green lamp: starts ECG monitoring** before stress test. When clicking on it, the program starts monitoring, but the load on bike is not set. The patient waits without biking.



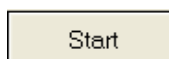
**Red lamp: stops ECG monitoring**



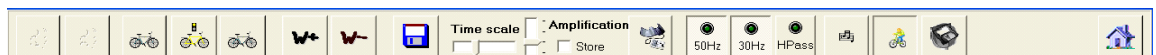
**Bike with green lamp: Initializes the stress test.** (Active during monitoring.) When clicking it, the program measures ECG of 16 s, calculates averaged cycles and location of ST and the parameters needed for signal processing. The results are displayed. During this time the patient stays calm.



The ST position is shown by the marker on the right side: it can be changed by ← and → keys or in the window in left side by setting the „ST position“.



**Starts stress test.** When clicking on it, the program sets the initial load on ergometer. The patient should start biking.





**Bike with yellow lamp. Starts recovery** phase at the end of stress test. When the patient heart rate reaches the target heart rate or the stress test is to be finished due to some reason, the program sets back the load to the value set in loading-protocol, typically 25W. The patient may continue working for 120-240 sec in order to avoid catalepsy. The doctor evaluates the ST changes and possible rhythm abnormalities during recovery and rest. During recovery the doctor can stop the patient's work and exams if the heart rate slows down to 110% of the rest heart rate. (This is displayed continuously by the program)

Comment	End point criteria: Target HR attained	▼
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When recovery starts the reason of finishing the exercise is to be written to the comment field. (The program offers some possibilities, the selected or typed comment should be terminated by Enter key in order to store it)



**Bike with red lamp. Stops stress test, stores the results.**



: Manual setting of load. After clicking on it, the automatic setting of load is finished. After this the load can be set manually. The value of manual change can be set in the "Settings of ergometry" window.



: Floppy icon: Prompt ECG storage during exercise.



: Manual starting of blood pressure measurement - if automatic BP unit is installed.



: Line (50Hz), myo (35Hz) and base-line wandering filter. During stress test it is recommended to set ON. The ECG may be distorted, so a warning is displayed. The averaged curves are not distorted as they are calculated from non-filtered signals.



Acoustic signal for R detection: On/Off



## 12 Link to SW downloads

Link to SW downloads:

[http://wolfmedical.hu/Fb/Cardy\\_Infra/CardyErgo\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Infra/CardyErgo_e.exe) for Cardy with infra, or  
[http://wolfmedical.hu/Fb/Cardy\\_Bt/CardyErgo\\_e.exe](http://wolfmedical.hu/Fb/Cardy_Bt/CardyErgo_e.exe) for Cardy with bluetooth

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