Installation

Installation of seca CardioConcept on your conputer

To install seca CardioConcept 5.5 programme on your computer run SETUP.EXE from the \SETUP directory of the installation CD. The setup programme will do the rest for you, just follow its instructions.

In order to acquire ECG you need to attach patient's adapter to USB computer port via a special USB adapter.

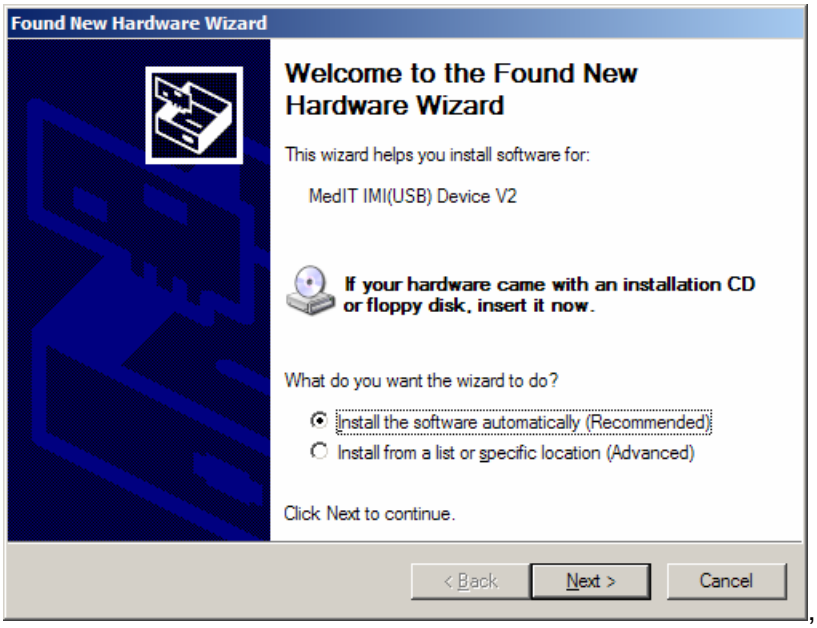
In order to use USB adapter, first you should set up seca CardioConcept and then install a driver for this adapter (see the corresponding section)

You should have administrative rights for installation of seca CardioConcept in Windows NT and Windows 2000.

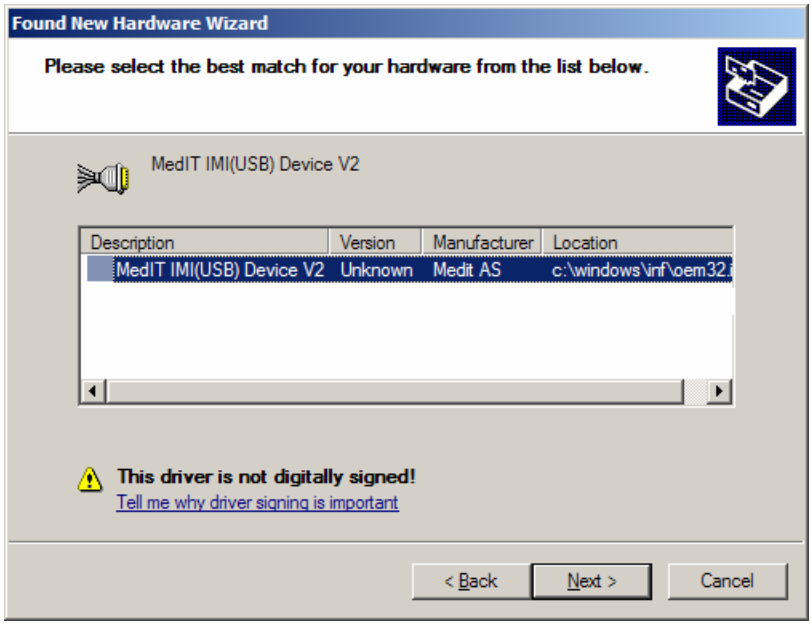
See section Configuring for further details on tuning up seca CardioConcept system.

Installation and configuration of the programme for work with USB adapter

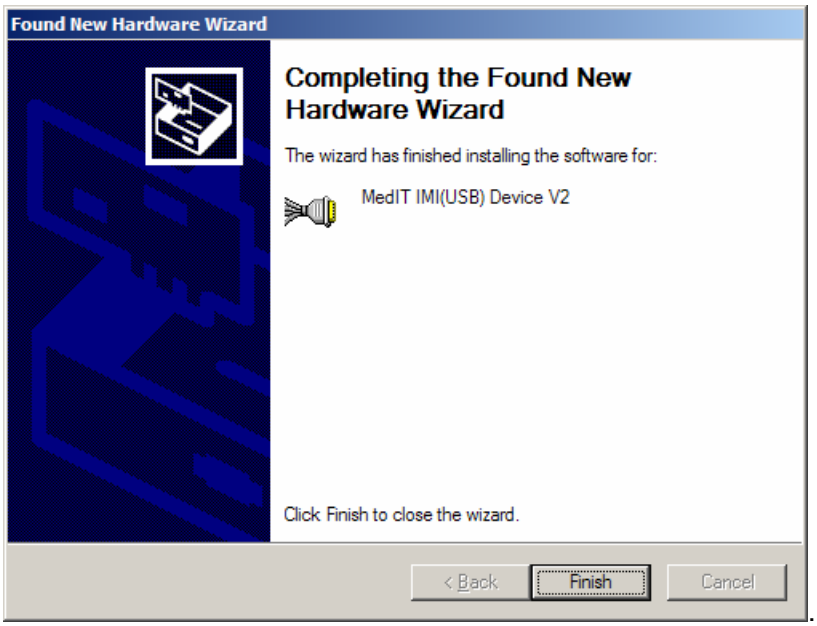
The drivers for CT110 device are normally installed during program setup. When you plug CT110 device after driver installation and reboot, the hardware will be recognized automatically and Windows New Hardware Wizard will lead you through driver installation on a specific USB port. In case of Windows XP it looks like this cartoon:



then



and then



In case of Windows 98/Me, the driver is installed automatically . Please note that you do not need to go through this procedure each time you plug CT110 into a different USB port.

Configuring seca CardioConcept for shared access to database through the local network

Configuring seca CardioConcept for using MS Access database

In order to share ECG database between several users, it is necessary to choose MS Access database format during installation and specify the directory where database will be stored. Such a directory can be either at one of the working stations of peer-to-peer network or at the file-server. All potential seca CardioConcept users need full network access to this directory. You can provide this by specifying this directory as a shared network resource. Consult with network administrator before making any changes (in some organizations these changes can be done **only** by network administrator). Please note, that the workstation can slow down under these conditions, thus the variant with file-server is preferable.

Configuring seca CardioConcept for working with Oracle server

If you choose the variant of installation with using of Oracle database, then Oracle sub-directory will be created in the installed seca CardioConcept directory (by default - C:\Program Files\Cardio Concept). Files *CB5.sql*, Oracle*DM.exe* и

readme.txt can be found in this directory. In the last one there are instructions for creating ECG database at the Oracle server. The administrator of your Oracle database server can use these instructions to create a seca CardioConcept database (this should be done only once). At every workstation Oracle client software should be installed.

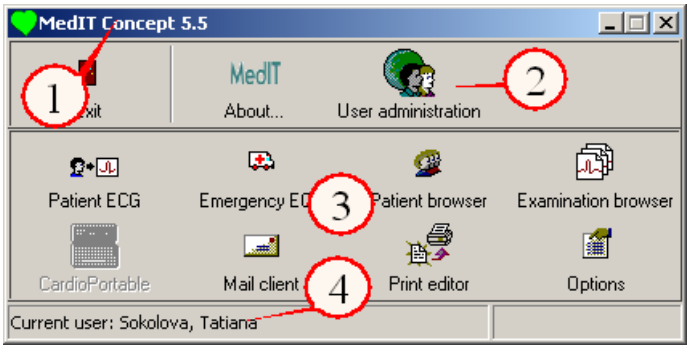
Installing CardioPortable

Installation of seca CardioConcept in client/server configuration is a prerequisite for CardioPortable setup on a portable computer. Please read corresponding sections for the detailed description of seca CardioConcept installation procedure. It is not necessary to connect the laptop to the network before the install. On the other hand, a newly created local database must be synchronized with the master database before use and this definitely requires network access to be up and running.
To setup seca CardioConcept just place the installation CD into the drive and launch the setup.exe programme that is located in X:\CardioPortable folder on the CD (X: stands for the drive letter of the CD-ROM drive on your computer). Follow the instructions on the screen after that. The installation routine will create the local database, copy the required files onto the hard disk and make necessary configuration changes.
The first synchronization needs to be carried out in order to start using seca CardioConcept functionality. Launch seca CardioConcept and login to the database as usual. Pleas note that Login Window is changed so make sure that On-line radio-button is checked in it (it actually should by default). The CardioPortable button is enabled in seca CardioConcept Control Centre now. Click it with the mouse to open CardioPortable Control Window. Click it as well to begin synchronization. Now you will be able to watch the changing messages in the Log information area and elapsed/estimated time in corresponding fields.
All required patients' data and user accounts will be copied into the local database. As soon as the first synchronization is completed, you can safely switch to off-line mode and unplug the laptop from the network (Please consult your portable computer and network card manuals how to do it properly).

Programme windows and dialogues

seca CardioConcept Control Centre

Control Centre window



This is a starting window of seca CardioConcept programme. It is used for logging into seca CardioConcept database and launching various seca CardioConcept applications and utilities.

1 Window title bar

It shows the programme name and the mode, in which the programme will work if CardioPortable module is installed. Logging window appears when seca CardioConcept is started. If you refuse to log or enter incorrect login or password, database access will be closed and Logging window will appear again when you try to activate any seca CardioConcept module.

2 Window toolbar

It contains some buttons:

- **Exit** button is used to quit seca CardioConcept.
- **About...** button shows window with information about the program.
- **User Administration** button invokes User Administrator application.

3 Buttons

They are used to start specific seca CardioConcept modules.

Two left buttons i.e. Patient ECG and **Emergency ECG** are very special ones. They serve for direct ECG acquisition.

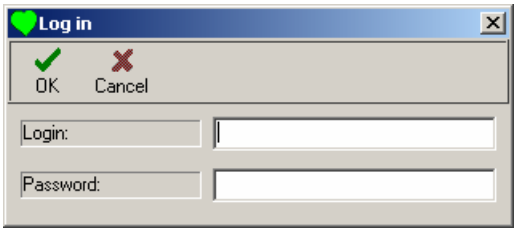
It is worth attention that the text on the User Administration button differs depending on the access rights of the current user. If the current user has administrative rights, then it is labelled "User Administration". This means that the user can invoke User Administrator application in order to manage user accounts. On the other hand, if somebody logs in using an account without administrative rights, "Change password" text appears on the User Administration button because this is the only thing an ordinary user can perform on his/her account. A special Change Password dialogue appears in this case.

4 Window status bar

It shows the name of a person who currently uses seca CardioConcept.

CardioPortable and Mail client buttons can be inaccessible (in this case the button is greyed). It happens when the corresponding modules are not installed with your seca CardioConcept programme. These modules are optional and should be licensed separately. If you obtain such a licence, then CardioPortable and Mail client modules will be activated and the corresponding buttons will be full-coloured.

Logging Window



This window is used for logging in. The user should specify his/her login name and password in order to start working with the program.

To log for the very first time user account "seca CardioConcept" is used. By default login name and password for this account are "cardio5". Don't use this login for everyday work; accounts for all users should be created instead. A user with administrative rights should change password for this account or disable this account to prevent unauthorized access to the database.

Toolbar of this window has two buttons:

- **OK** button. Login and password are verified. User can start working with seca CardioConcept if they are correct; otherwise, an error message will appear.
- **Cancel** button. Logging is cancelled, user cannot work with the programme.

If user cancels logging or enters incorrect login name or password, he will be returned to seca CardioConcept Control Centre. Logging will be repeated again when the user tries to start any seca CardioConcept module, as unauthorized users cannot work with the programme.

Change Password Window

This window allows a seca CardioConcept user without administrative rights to change his/her password for database connection. It contains two fields, one for entering new password and another for confirming it. The password does not appear in the fields, the symbol "*" will replace all the password letters instead. If the passwords in both fields are not exactly the same, a special warning message will appear on the screen and the password will not be changed. This protects the user from accidentally entering the password different from what he/she intended to.

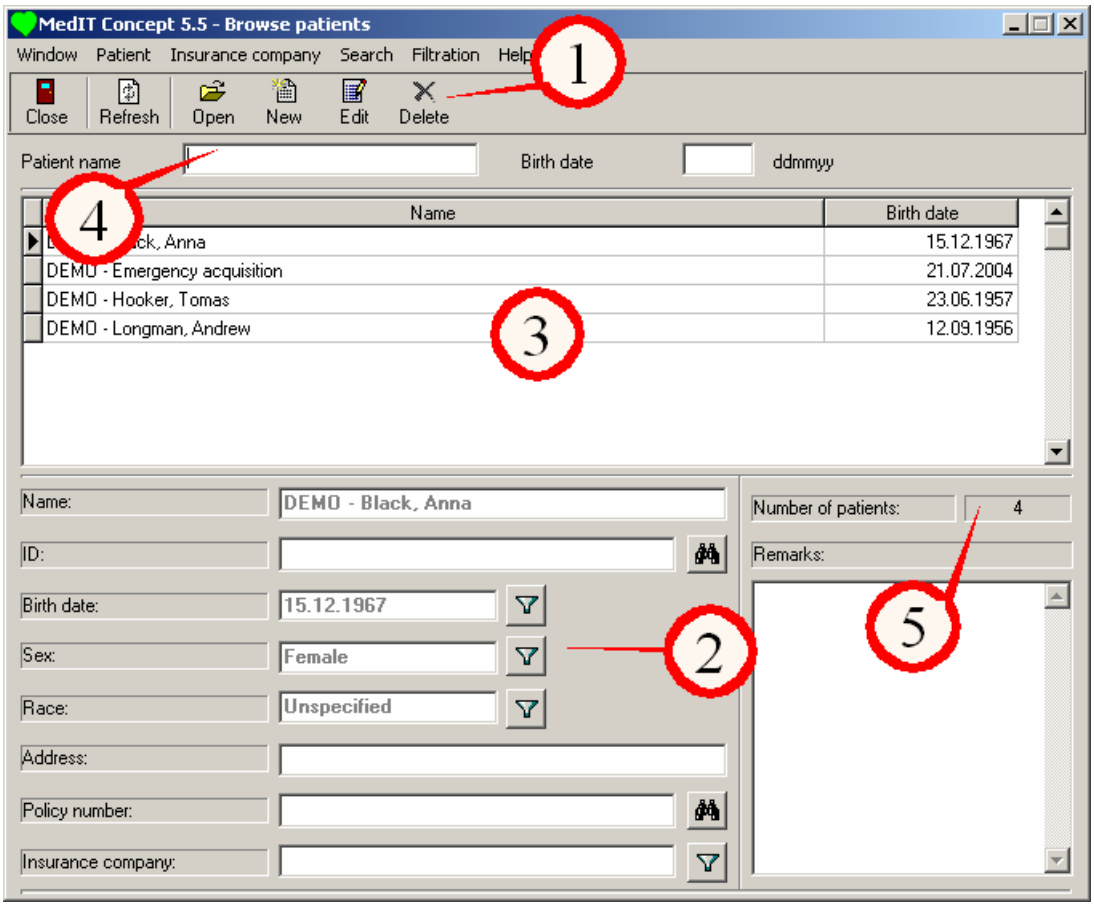
The window toolbar has two buttons in it:

OK button. If you click it, the new password will be saved if correctly confirmed.

Cancel button. It closes the window without changing password.

Patient Browser

Patient Browser Main Window



This window is used to manage patient records in database, i.e. add/delete patients and edit patient personal information. The user can also select a subset of patients using different search and filtration criteria.

1 Menu and Toolbar:

Window menu

Refresh patient list command. Forces newly entered patients to appear in patient list. This button is needed only in the network configuration to make all changes done by other computer network users visible, as in the standalone configuration all the data is refreshed automatically.

Close window command. It returns you to Control Centre.

Patient menu

New patient command and toolbar button (**Ctrl+N**). Press this button to invoke **Enter New Patient Information** window and create a new patient record.

Open patient window command and toolbar button. It opens a Patient Examination window with all examinations available for selected patient. You can do the same by double-clicking the line on the patient list that contains desired patient's name or just by pressing **ENTER** key.

Edit patient data command and toolbar button (**Ctrl+E**). Press this button to invoke **Edit Patient Information** window and edit selected patient's record.

Delete patient command and toolbar button (**Ctrl+D**). This button deletes patient's data and all his/her examinations.

Insurance Company menu

Browse command and button. It opens **Browse insurance companies** window. The latter can be used to modify information about insurance companies.

Search menu

Search **by ID** command (**Ctrl+I**) opens Enter searched ID dialogue. You can also use search button next to **ID** field box.
Search **by policy number** command opens Enter searched policy number dialogue. You can also use search button next to **Policy number** field box.

Filtration

It contains commands to filter by birth date (**Ctrl+B**), by sex (**Ctrl+S**), by race (**Ctrl+R**) and by insurance company. You can also use filtration buttons next to the corresponding fields. Filtration buttons remain pressed when the corresponding filtration is set. It is necessary to release the button in order to turn a specific filtration off. These filters are saved after you turn them off until you close the window. So you can easily repeat the filtration with the same parameters.
No filtration command turns all filtration off (**Ctrl+F**). All patients in database appear in the list of available patients.

2 Patient Information

The following information is shown for the selected patient:

- Full name.
- ID number. It can be case history number, social security number or any other type of unique identifier.
- Birth date. In Options dialogue the preferable date format can be selected.
- Patient's sex.
- Patient's race.
- Patient's address.
- Patient's medical insurance number.
- The name of insurance company covering the patient's health care expenditures.
- Remarks – a free-text field for any additional patient information you may need to save in the database.

You cannot modify the information directly in the patient browser window. Instead you should open Edit Patient Information window for it.

3 Patient's List

This is a list of all patients sorted by full name or a subset of patients matching filtration criteria if any filtration criteria are set. There is a special field specified the number of patients, which are in the list now.

One of the lines is highlighted in blue; it contains a name of so-called current patient. When the user starts to type on the keyboard, current selection moves to the patient whose starting name letters match the entered characters. If you want to lessen the list of records, among which you are looking for the appropriate one, use Filtration menu commands or filtration buttons. Search and filtering buttons are next to the corresponding data fields.

The following searching capabilities are available:

- By patient's ID.
- By patient's policy number.

The following filtration capabilities are available:

- By patients' birth dates.
- By patients' sex.
- By patients' race.
- By insurance company.

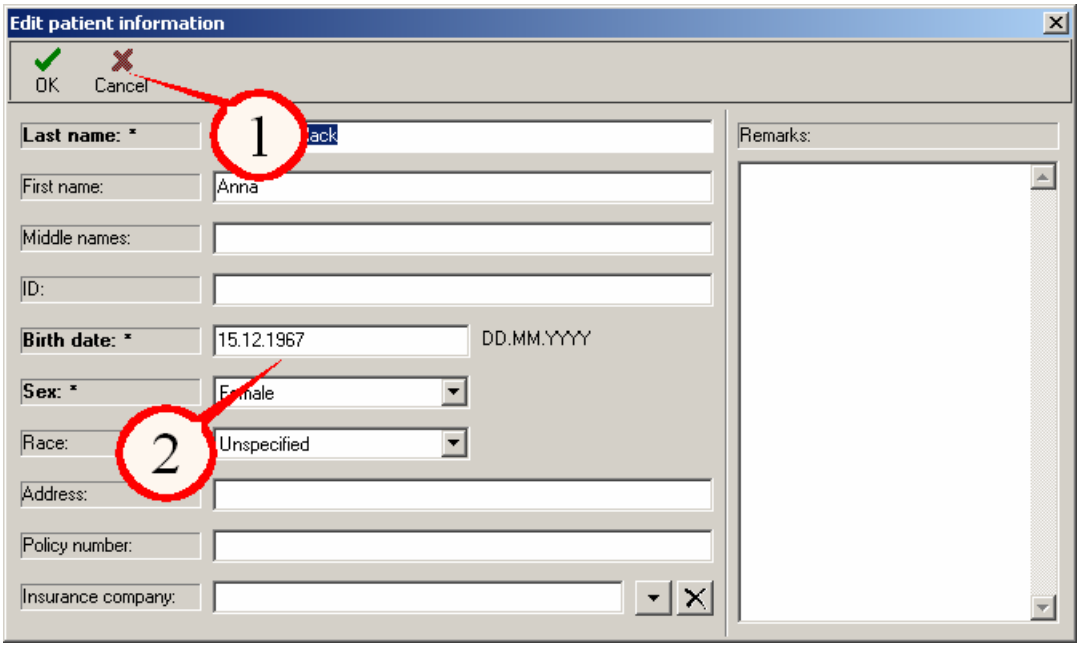
4 Search strings

When you start typing in the **Patient name** field, seca CardioConcept tries to locate the patient, whose name starts with the letters you type, and moves selection indicator on the corresponding line. It is not started immediately, but after a 1-sec delay, allowing user to enter full search string. Sometimes search can take considerable time. You can also search a patient by entering his/her birth date in **Birth date** field. The date format looks something like this "**ddmmyy**" where "d" stands for day digits, "m" stands for month digits and "y" for year digits. In order to return to the full patient's list you can turn this filtration off by using **By birth date** command in **Filtration menu** or the corresponding button .

5 Number of patients Field

It displays the **Number of patients** in the patients list. If you apply some search or filtration criteria, the field changes in accordance with the number of patients actually selected.

Edit Patient information Window



This window is used to edit information in the patient record. Depending on the situation whether New patient or Edit patient commands have been used, 'Enter new patient information' or 'Edit patient information' will be displayed on the title bar of invoked window.

1 Window Toolbar

Standard **OK** and **Cancel** buttons. **OK** button saves the modifications you made to the database. **Cancel** button allows you to close the window without saving modifications. Certain rules are applied to the data before it is saved into database. These checks are necessary for database integrity. See the section Patient Database Management for detailed explanations.

2 Data Fields

You can specify the following patient information:

- Last name. The field is marked by an asterisk. It means that this field is required.
  The Last names of the patients, who were created in demonstration mode, have prefix DEMO. See section Hardware tab for more detailed explanations.
- First name.
- Middle names.
- Patient's unique ID. It can be case history number, social security number, or whatever you use in your institution in order to uniquely identify patients. ID number must be either absent or unique.
  You can use an arbitrary string of signs as an ID number. Norwegian, Swedish and Danish policy numbers can be used in addition. In this case, birth date and sex are set automatically when the focus moves to another field.

It also happens when you enter sex or birth date. Before the windows with these data are closed, there will be another comparison of policy number with birth date and sex. If there is any disagreement, a warning will appear on the screen and the window remains open.

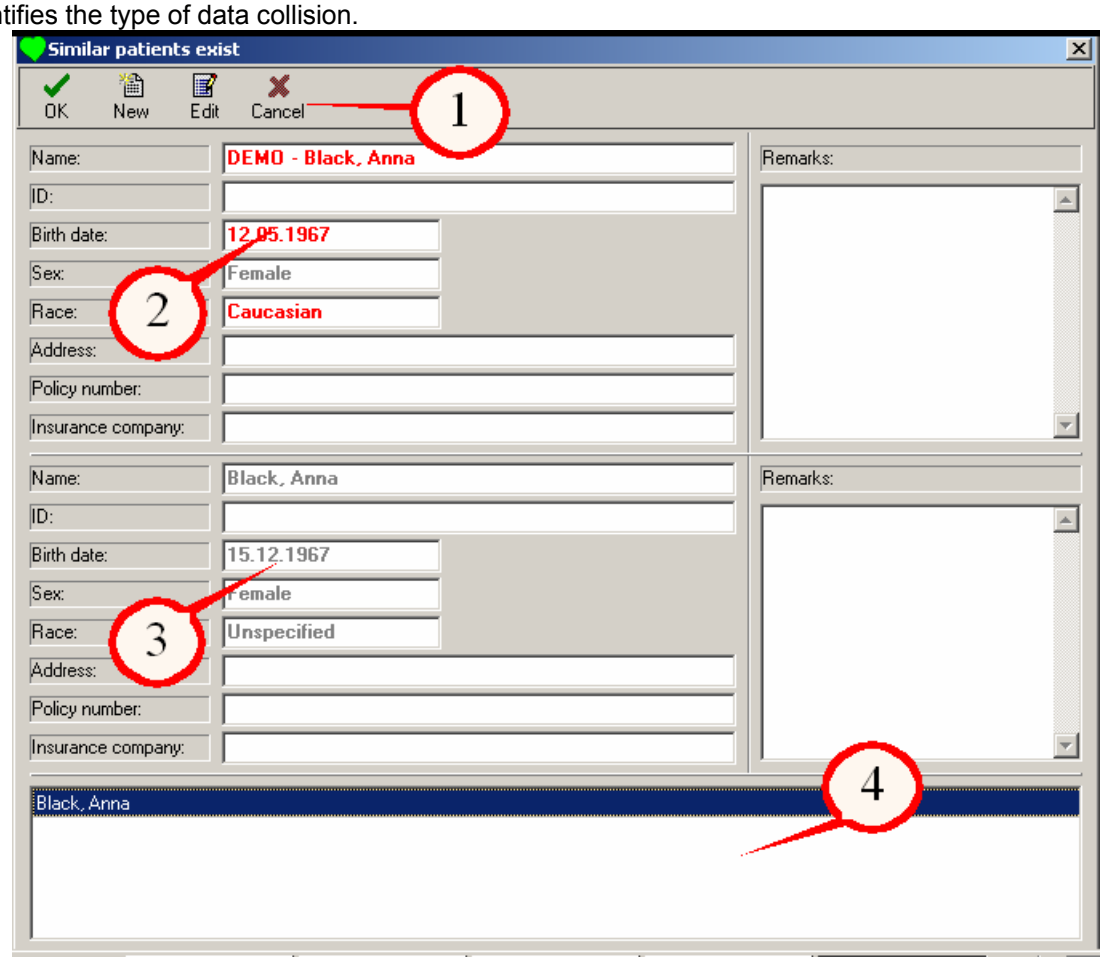
- Birth date. It is entered using a mask for the current date format. Date format can be changed in Options dialogue. Please notice that the date format is shown according to parameters set currently rather than at the moment the record was created. If you set *year of birth* as date presentation format in Options dialogue, then you need to enter the year of birth only. In this case, January 1st of corresponding year is automatically recorded as the day of birth. Notice that **ESC** or **Cancel** buttons restore the previous value. This field is required.
- Sex. It can be selected from a combo box with a fixed list: *Unspecified*, *Male*, *Female*. This field is required and only *male* or *female* can be entered as a new patient's sex.
- Race. It can be selected from a combo box with a fixed list: *Unspecified*, *Caucasian*, *Black* and *Oriental*.
- Patient's address.
- Remarks – a free-text field for any additional patient information.
- Insurance policy number. This field must be either empty or unique, i.e. there mustn't be any other patient with the same policy number. Otherwise, a warning appears that the patient with the same policy number exists.
- Insurance company name. It can only be chosen from a list of companies that are already stored in the database by pressing a button **Choose company**. This button invokes a window Choose insurance company. Both the company and the policy number must be present or absent. You can press **Delete** button in order to delete insurance company information from the patient's database record.

Notice that **ESC** button restore the previous value in any field until it has a focus. Thus if you want to quit the window Edit patient information without saving the modifications you need to press **ESC** button twice (if You use this button instead **Cancel** button).

Patient Exists Window

Patient Exists Window

When you create a new patient or edit data of an existing one, the programme prevents you from typical errors that may destroy database integrity. For example, a user can mistype patient's name or try to enter a new patient with a similar name or the same ID as an existing patient. A special window appears in this case (see the picture). Window title bar identifies the type of data collision.



The window consists of following parts:

1 Toolbar

There are the following buttons:

- **Choose patient** button. If you press it, the programme reckons that you tried to create a new patient's record by mistake instead of choosing an existing one in database. seca CardioConcept considers the data of the patient that is currently selected in Similar Patient List to be correct. Therefore, this patient's record will be chosen when you return to Patient browser window. Please realize that all data you have entered in Edit Patient Information window will be lost.
- **Overwrite patient information** button. If you click it, the programme will replace the data of the currently selected patient in the Similar Patient List with newly entered data. In this case patient information of the patient selected in the Similar Patient List will be lost and information from Edit Patient Information window will be written instead. Patient exist window closes and you return to Patient browser window. The patient picked out in Similar Patient List becomes the current patient.
- **Create New patient** button. This button forces the programme to create a new record in the database and fill it in with the data you have entered disregarding any existing discrepancies. The window closes, and you return to Patient Browser window. The new patient becomes selected.
- **Cancel** button closes the "Patient Exists" window without any modifications and returns to Edit Patient Information window.

2 Data Fields

Data fields of a newly created patient record. The specific fields that are in collision with information stored in the database are highlighted in red.

3 Data Fields

Data fields of the patient currently selected in Similar Patient List.

4 Similar Patient List

All patients whose personal data are in conflict with the newly entered data are listed here. It can be a single patient or several patients depending on the data collision. See section Patient Database integrity rules for detailed description.

How to adjust data conflict

While you are adding a new patient record a data conflict takes place, you can analyse the reason of the conflict in Patient Exist window.

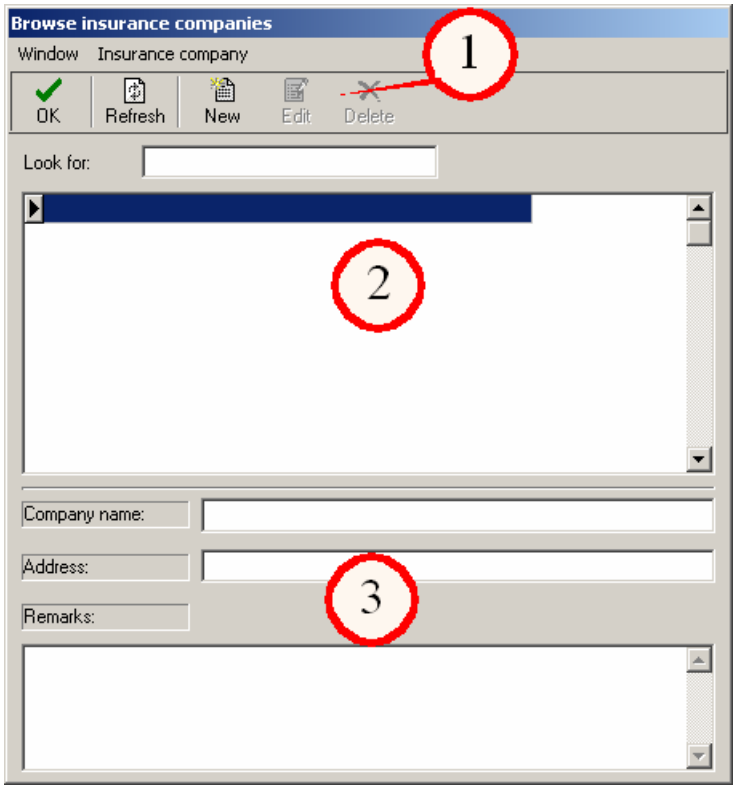
Typically, you should act in the following way:

- if you are sure that the new patient you are trying to enter is already present in database, press **Choose patient** button. If there are some variants in the Similar Patient List, then be sure that you have chosen the appropriate patient.
- if you are sure that the new patient you are trying to enter is already present in database, but the new data is more correct or more complete, press **Overwrite** button. If there are some variants in the Similar Patient List, then be sure that you have chosen the appropriate patient.
- if you are sure that the new patient whose data you are trying to enter still it is a new one though being similar to some existing patients, press **Create New** button. Please make sure that this new person doesn't really a mistakenly made alias to any other possible candidate.

Browse Insurance Companies and Choose Insurance Company Windows

These windows appear in the following cases:

- The user wants to add, view, edit or delete information about insurance companies he/she actually works with.
- The user wants to add or delete information about insurance company in patient record.



1 Window Toolbar and Menu:

- **OK** button. If the user is choosing the company, company name is saved in patient record being edited. Pressing **ENTER** button on the keyboard produces the same effect. Otherwise this button just closes the dialogue.
- **Cancel** button. This button appears only in the Choose insurance company window toolbar. It closes the window without any saving of the modifications.

Window Menu:

Refresh command and button. It forces a newly entered insurance companies to appear in the Company List. This action is only needed in the network configuration, as the data is refreshed automatically in a standalone configuration.

Insurance Company Menu:

- **New Insurance Company** command and button (**Ctrl+N**) opens a dialogue Add new company where you can enter information about a new insurance company.
- **Edit Insurance Company** command and button (**Ctrl+E**) invokes a dialogue Edit company information. You can do changes of the selected company information.
- **Delete Insurance Company** command and button (**Ctrl+D**). The information relating to the current company is deleted after the user confirms the action. The company data can be deleted only if there is no reference to it.

2 Company List

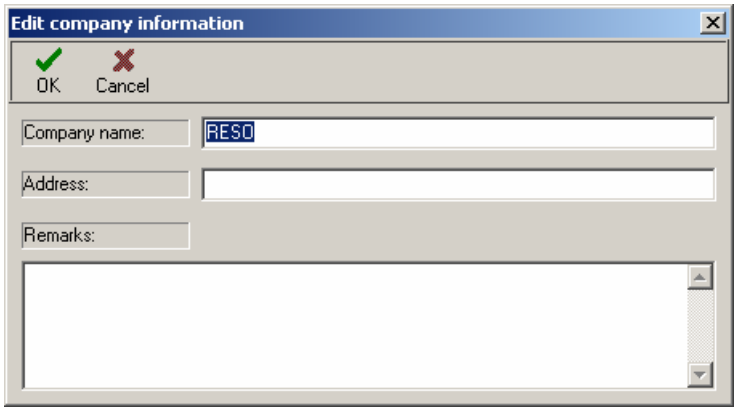
This is a list of all companies sorted by name. When the user starts typing in the **Look for** field, the selection moves to a company with first characters in its name matching those you have typed.

3 Data

Data related to the selected insurance company in the list. The following information can be stored in database and displayed for each company in the list:

- Company name.
- Company address.
- Remarks – a free-text field for any additional information.

Edit Company Information Window



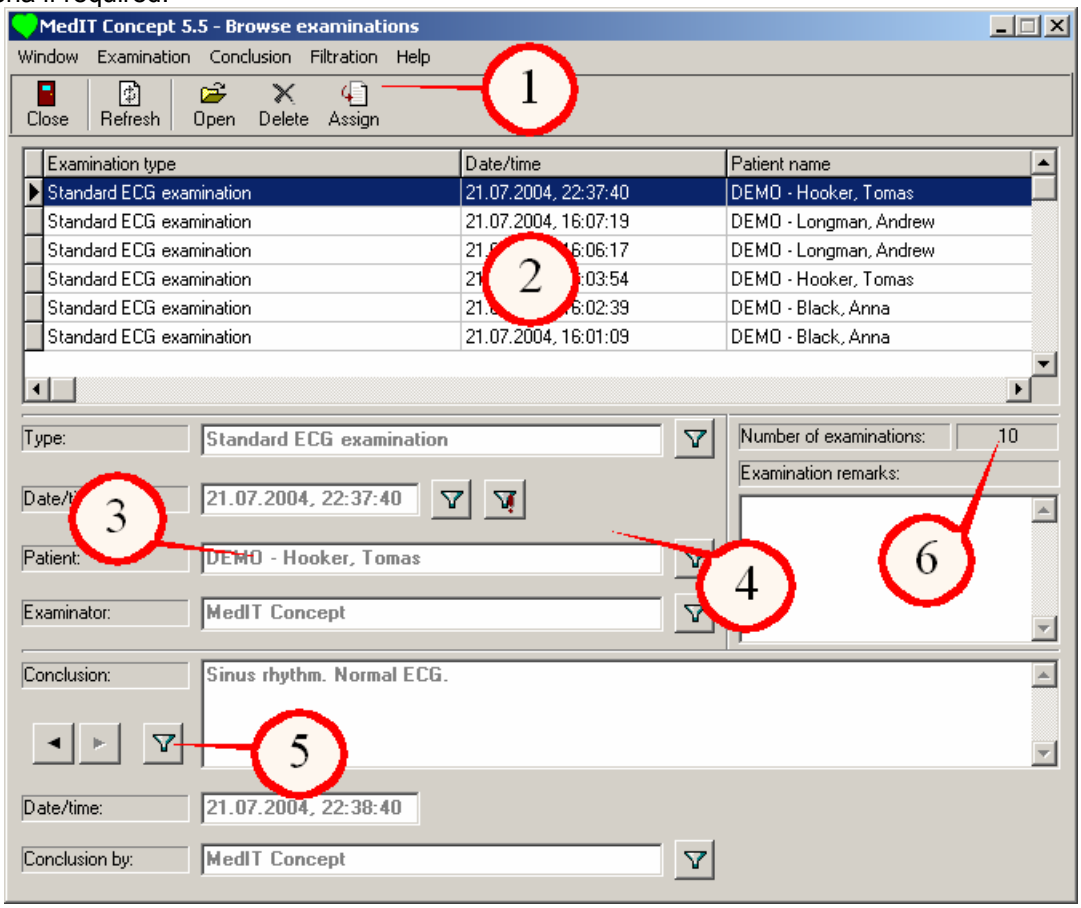
Depending on the situation whether **New insurance company** or **Edit insurance company** commands have been used, 'Add new company' or 'Edit company information' will be displayed on the title bar of invoked window.

This dialogue contains data fields for insurance company record and **OK** and **Cancel** buttons. The name of the new company must be unique.

Examination Browser

Examination Browser Window

This window is used to browse examinations stored in seca CardioConcept database. Examinations can be filtered by specified criteria if required.



Window parts are:

1 **Window Menu and Toolbar**

Window menu:

-  **Refresh** command and toolbar button. Forces newly made examination records to appear in examination list. This button is only needed in the network configuration, as in the standalone configuration all the data in the list is refreshed automatically.
-  **Close** command and toolbar button. It closes the window and makes you return back to Control Centre.

Examination menu

-  **Open** command and corresponding button on the toolbar. Use it to open the examination that is currently selected in the Examination List. If Examination List has the focus, i.e. one of the lines is highlighted in blue, you can open it also by pressing **ENTER** or clicking this line twice.
-  **Delete examination** button and corresponding command. It deletes the examination currently selected in the Examination List.
-  **Assign examination to patient** button and corresponding command.
  It evokes Assign examination to existing patient or enter new one, where you can reassign the recording belonged to the "Emergency Acquisition" patient to appropriate patient.
- **Add remark** command. Use it to open Add remark to examination window where you can write any comments on recordings.
- **Import** command. Allows user to import examinations stored as a file (for example recorded in some other seca CardioConcept database). There are two possible import(export) formats:
  a) cbe-file (examination in format produced by ActiveX ECGRecorderForm component. This component is supposed to be used by third party companies in their own applications)
  b) cbm-file (seca CardioConcept mail format)

Conclusion menu

It contains **Previous** and **Next** commands. These commands allow you to browse through diagnostic conclusions saved together with current examination. Scroll Conclusion buttons  serve the same purpose.

Filtration menu

It contains commands related to various data filtration capabilities. You can see selected examinations in the Examination List, and the indicator field specifies the number of the actually selected examinations. The following filtration modes are available through the corresponding commands:

- **By Type** command. It calls Select Filtered Examination Types dialogue to allow filtering examinations of certain types. The corresponding  button is located to the right from the box with examination type.
- By Date/time command (**Ctrl+D**). It allows specifying a range of dates/times to filter only examinations made during this period. The corresponding  button is located to the right from the box with the date and time the examination was made. This filter is saved after you turn it off until you close the window. So you can easily repeat the filtration with the same or similar parameters.
- By Patient command (**Ctrl+P**). It allows selecting a group of patients to show only examinations belonged to the selected patient. The corresponding  button is next to patient field.
- By Examinator command (**Ctrl+E**). It filters examinations that were performed by a specified attending person(s) (examinators). The corresponding  button is located to the right from the box with attending person's name.
- By Signature command (**Ctrl+G**). It filters examinations that have conclusion signed by a specific person(s). The corresponding  button is located to the right from the box with specialist name.
- By Diagnostic Statements command (**Ctrl+S**). It filters examinations by diagnostic statements contained in conclusions. The corresponding  button is located to the left from the box with the conclusion. This filter is saved after you turn it off until you close the window. So you can easily repeat the filtration with the same or similar parameters.
-  **Non-analysed** examination command and button. It filters examinations that have been made today and still doesn't have any diagnostic conclusion confirmed by a human reader. This button is located to the right from the box with the date and time when the examination was made and has an exclamation mark on it. It is worthwhile to notice that this filter cancels all other filters in effect and vice versa.
- **No filtration** command (**Ctrl+F**). It turns off all filters. You can see all examinations in the Examination List stored in database, and record indicator number renews.

2 Examination List

This is a list of all examinations sorted by date in descending order. If no filtration criteria are set, all examinations are shown, otherwise only those are displayed that match filtration criteria. Each line in the list contains examination type, date, time and full name of the patient. Selected examination can be opened by clicking **Open Current Examination** button  on the toolbar or by double-clicking the chosen examination in the list or by pressing **Enter** button.

3 Data fields

Data fields for the currently selected examination:

- Type of the examination.
- Date and time when examination was made.
- Patient's full name.
- Full name of the medical professional who made the examination.
- Examination remarks – a free-text field for any additional examination information.
- Diagnostic conclusion. More than one conclusion for examination may be available in some cases (for example, if automatic conclusion made by seca CardioConcept, it can be re-read by a human expert). The last conclusion is shown by default. It is possible to scroll through conclusions using buttons located to the left from the conclusion box.
- Date and time when the current conclusion was made.
- Full name of the physician who made the current conclusion.

4 Filtration buttons

Filtration buttons  next to each data field box. You can use these buttons with the same effect as items in the Filtration menu. Each filtration button remains pressed when the corresponding filtration is set. To turn specific filtration off it is necessary to release the corresponding button.

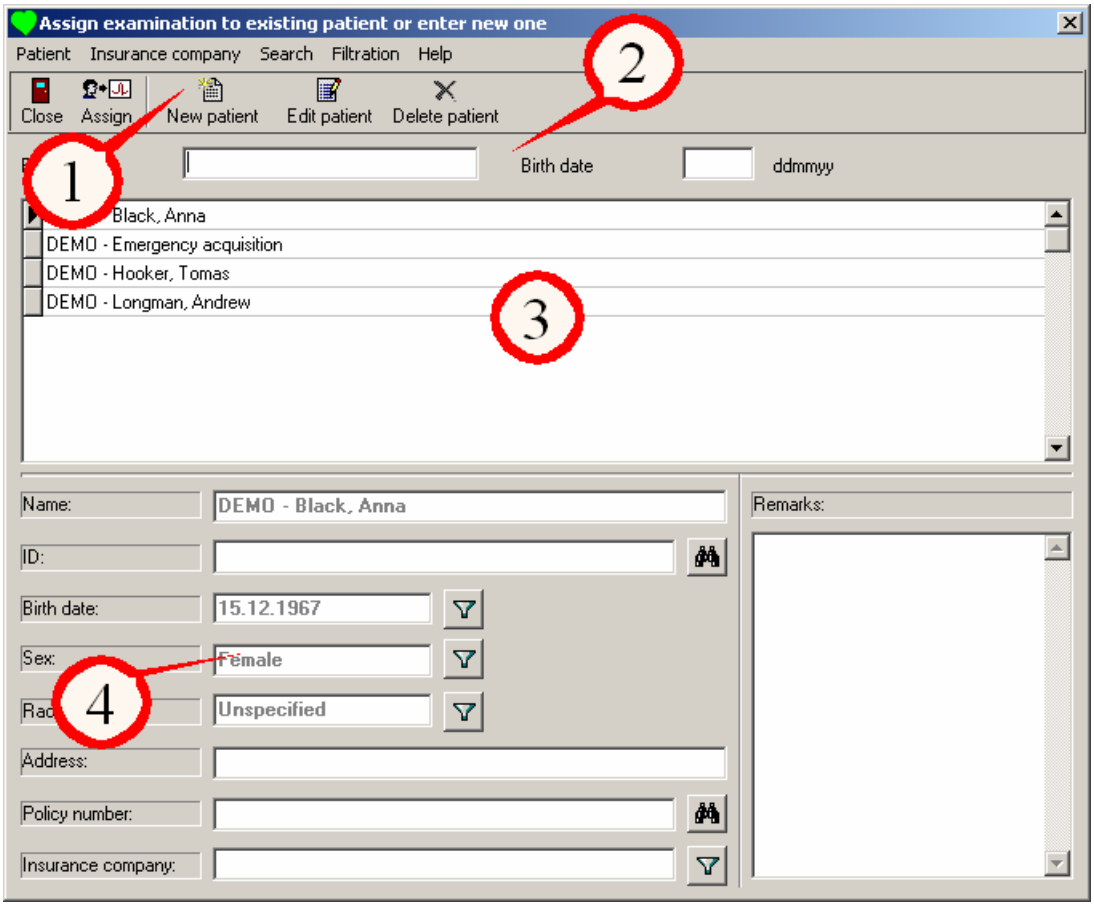
5 Buttons

Previous-next reading and Filter By Diagnostic Statements buttons. You can use these buttons  to scroll conclusions if there are some of them. And this button  is for filtering by diagnostic statements (see Select filtered diagnostic statements window).

6 Special Indicator Field

It shows the total number of examinations in the **Examination List** (in accordance with filtration criteria currently in effect).

Assign examination to existing patient or enter new one



This window is used for selecting a patient from database to reassign the examination to.
The window parts are:

- **Assign examination to chosen patient** button allows to reassign the recording to appropriate patient.
- Standard **Cancel** button allows you to close the window without modifications.

1 Menu and toolbar

Patient menu

New patient command and toolbar button (**Ctrl+N**). Press this button to invoke **Enter New Patient Information** window and create a new patient record.

Edit patient data command and toolbar button (**Ctrl+E**). Press this button to invoke **Edit Patient Information** window and edit selected patient's record.

Delete patient command and toolbar button (**Ctrl+D**). This button deletes patient's data and all his/her examinations.

Insurance company menu

Browse command . It opens **Browse insurance companies** window. The latter can be used to modify information about insurance companies.

Search menu

Search **by ID** command (**Ctrl+I**) opens Search By ID dialogue. You can also use search button next to **ID** field box.
Search **by policy number** command opens Search by policy number dialogue. You can also use search button next to **Policy number** field box.

Filtration menu

It contains commands to filter by birth date (**Ctrl+B**), by sex (**Ctrl+S**), by race (**Ctrl+R**) and by insurance company. You can also use filtration buttons  next to the corresponding field box. Filtration buttons remain pressed when the corresponding filtration is set. It is necessary to release the button in order to turn a specific filtration off. These filters are saved after you turn them off until you close the window. So you can easily repeat the filtration with the same parameters.
No filtration command turns all filtration off (**Ctrl+F**). All patients in database appear in the list of available patients.

2 Search strings

When you start typing in the **Patient name** field, seca CardioConcept tries to locate the patient, whose name starts with the letters you type, and moves selection indicator on the corresponding line. It is not started immediately, but after a 1-sec delay, allowing user to enter full search string. Sometimes search can take considerable time. You can also search a patient by entering his/her birth date in **Birth date** field. The date format looks something like this "**ddmmyy**" where "d" stands for day digits, "m" stands for month digits and "y" for year digits. In order to return to the full patient's list you can turn this filtration off by using **By birth date** command in **Filtration menu** or the corresponding button  .

3 Patient's List

This is a list of all patients sorted by full name or a subset of patients matching filtration criteria if any filtration criteria are set.

One of the lines is highlighted in blue; it contains a name of so-called current patient. When the user starts to type on the keyboard, current selection moves to the patient whose starting name letters match the entered characters. If you want to lessen the list of records, among which you are looking for the appropriate one, use Filtration menu commands or filtration buttons. Search and filtering buttons are next to the corresponding data fields.

The following searching capabilities are available:

- By patient's ID.
- By patient's policy number.

The following filtration capabilities are available:

- By patients' birth dates.
- By patients' sex.
- By patients' race.
- By insurance company.

4 Patient Information

The following information is shown for the selected patient:

- Full name.
- ID number. It can be case history number, social security number or any other type of unique identifier.
- Birth date. In Options dialogue the preferable date format can be selected.
- Patient's sex.
- Patient's race.
- Patient's address.
- Patient's medical insurance number.
- The name of insurance company covering the patient's health care expenditures.
- Remarks – a free-text field for any additional patient information you may need to save in the database.

Search and Filtration dialogues

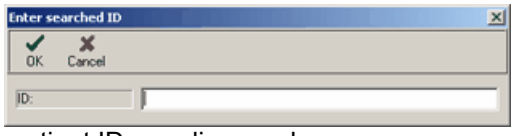
Dialogues for search and filtration

When the user presses one of search or filtration buttons or selects items in **Search** or **Filtration** menus, it invokes one of search/filtration dialogues. They allow the user to enter values to search for in the database or filtration criteria. There is a list of these dialogues:

- Search by patient ID and search by insurance policy dialogues
- Choose filtered sex and Select filtered races dialogues
- Select filtered Insurance Companies dialogue
- Filter by Examination Type dialogue
- Specify filtered period dialogue
- Patient Group Selection dialogue
- Select examinators and select users, who signed conclusion dialogues
- Select filtered diagnostic statements dialogue

Search By Patient ID and by Insurance Policy dialogues

These are two dialogues you can use to enter patient ID or policy number in order to quickly locate a patient with specific ID or insurance policy number. Both dialogues are similar and look like this (here you can see Enter searched ID dialogue):



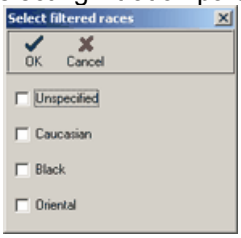
The window has one edit box to enter patient ID or policy number.
Toolbar has two buttons with functions:

OK – starts search.

Cancel – closes the dialogue without searching.

Choose filtered sex and Select filtered races dialogues

One of these dialogues opens when the user wants to filter patients by their sex or by their race. The dialogues are similar and contain check boxes for selecting filtration parameters.

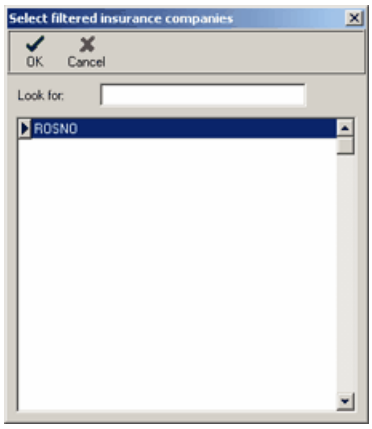


The windows have check boxes for each possible sex or race values.
User can choose one of the sexes, and only patients of this sex will be shown.
User can check any of the boxes in **Select filtered races** dialogue. Patients belonged to any of the selected races will be shown.
Toolbar has two buttons with apparent functions:

OK – start filtration.

Cancel – no filtration.

Select filtered insurance companies dialogue



This dialogue allows you to specify insurance companies to filter only those patients, whose health care expenditures are covered by them.

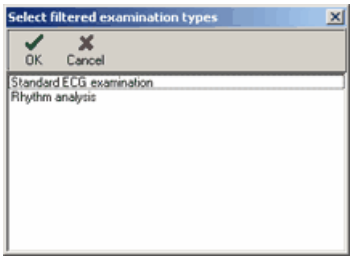
In order to search the applicable company there is a search string. When you start typing, seca CardioConcept tries to locate the insurance company that starts with the letters you type, and moves selection indicator on the corresponding line.

You can select a single company or a number of them. One or several insurance companies can be selected from the list using standard Windows technique – **shift + arrow keys**, **ctrl + mouse click**. A thick dot instead of cursor appears to the left of the selected company (or). If no companies are marked as selected, the current one (blue bar) is considered as selected.

Toolbar has two buttons:

- **OK** button starts filtration.
- **Cancel** button closes the window without any filtration.

Filter by Examination Type dialogue



This window can be used in order to view examinations of certain type only.
One or several examination types can be selected in the list box using standard Windows technique – **shift + arrow keys**, **shift, ctrl + mouse click**. Selected items are marked by blue selection bar.

Toolbar buttons:

- **OK** button starts filtration.
- **Cancel** button closes the window without any filtration.

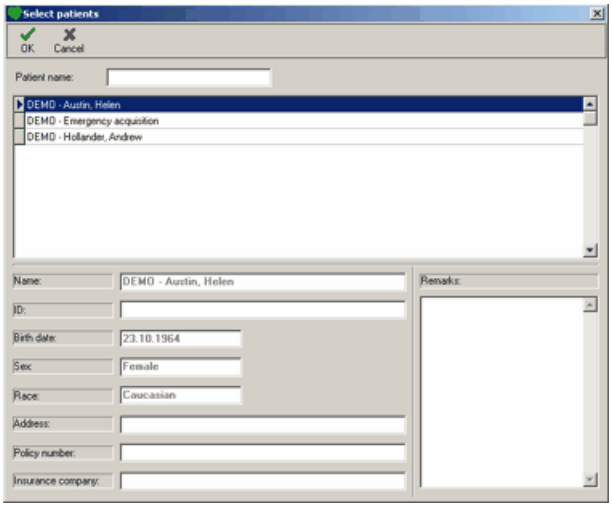
Specify filtered period dialogue

Specify filtered period dialogue is used to enter dates when you want to filter patients with specific birth dates or select examinations made in certain period. There are two edit boxes – one for the oldest date and one for the newest one, i.e. for starting and ending dates in the desired time span. Only a valid date in correct format will be accepted by the dialogue according to a date mask. At least one date must be entered, either patients born after this date or examinations done later than this date are selected in this case. If two dates are entered, then the oldest date must go before the newest one.

Dialog has two buttons on the toolbar:

- **OK** button starts filtration.
- **Cancel** button closes the window without any filtration.

Patient Group Selection dialogue



This dialogue (named **Select patients**) allows to specify a group of patients in order to show examinations of selected patients only. The patient list is sorted by name. While you are entering the first letters of the surname, seca CardioConcept tries to locate the patient, whose name starts with the letters you type, and moves selection indicator on the corresponding line.

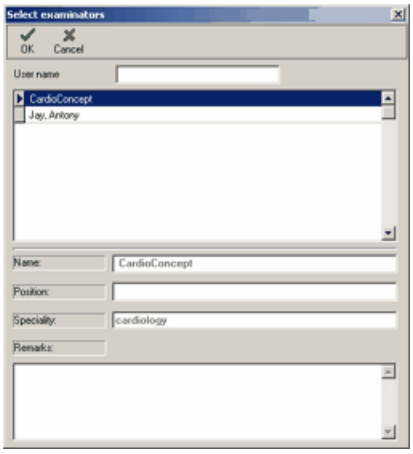
One or several patients can be selected from the list using standard Windows technique – **shift + arrow keys**, **ctrl + mouse click**. A thick dot or a cursor appears to the left of the selected patient (or). If no patients are marked as selected, the current one (blue bar) is considered as selected.

Toolbar has two buttons:

- **OK** button starts filtration.
- **Cancel** button closes the window without any filtration.

Select examinators and Select users who signed conclusion dialogues

These similar windows are used in order to find either examinations made by certain attending persons or examinations that have conclusions signed by specified users (experts). They differ from each other in window title bar:



This window is entitled either "Select examinators" or "Select users, who signed conclusion". There is a list of users registered in seca CardioConcept in the window. They have the right to make examinations or to write conclusions on examinations. In special fields, you can see the detailed information about the user selected in the list. The examinator list is sorted by name. While you are entering the first letters of the surname, seca CardioConcept tries to locate the user, whose name starts with the letters you type, and moves selection indicator on the corresponding line.

One or several users can be selected from the list using standard Windows technique – **shift + arrow keys**, **ctrl + mouse click**. A thick dot appears to the left of the selected user (or). If no users are marked as selected, the current one (blue bar) is considered as selected.

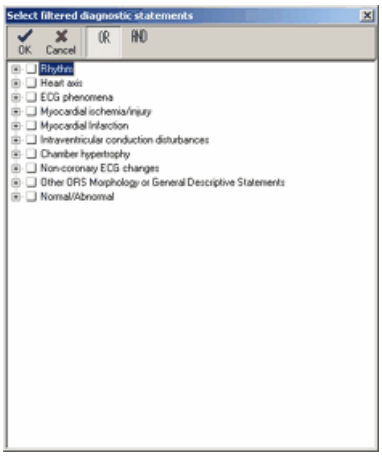
Toolbar has two buttons:

OK button starts filtration. When you have pressed this button you will only see examinations made by certain attending persons or examinations that have conclusions signed by specified users.

Cancel button closes the window without any filtration.

Select filtered diagnostic statements dialogue

This dialogue window opens when the user wants to view examinations containing certain diagnostic statements in their conclusion parts.



A statement list is arranged as a tree by category. You can choose separate 'leaves' with specific statements as well as several statements or the whole category ('branches'). Toolbar has the following buttons:

OK button. After this button is pressed only examinations containing specified diagnostic statements in their conclusion parts are displayed. If no statements are selected, no actions are undertaken.

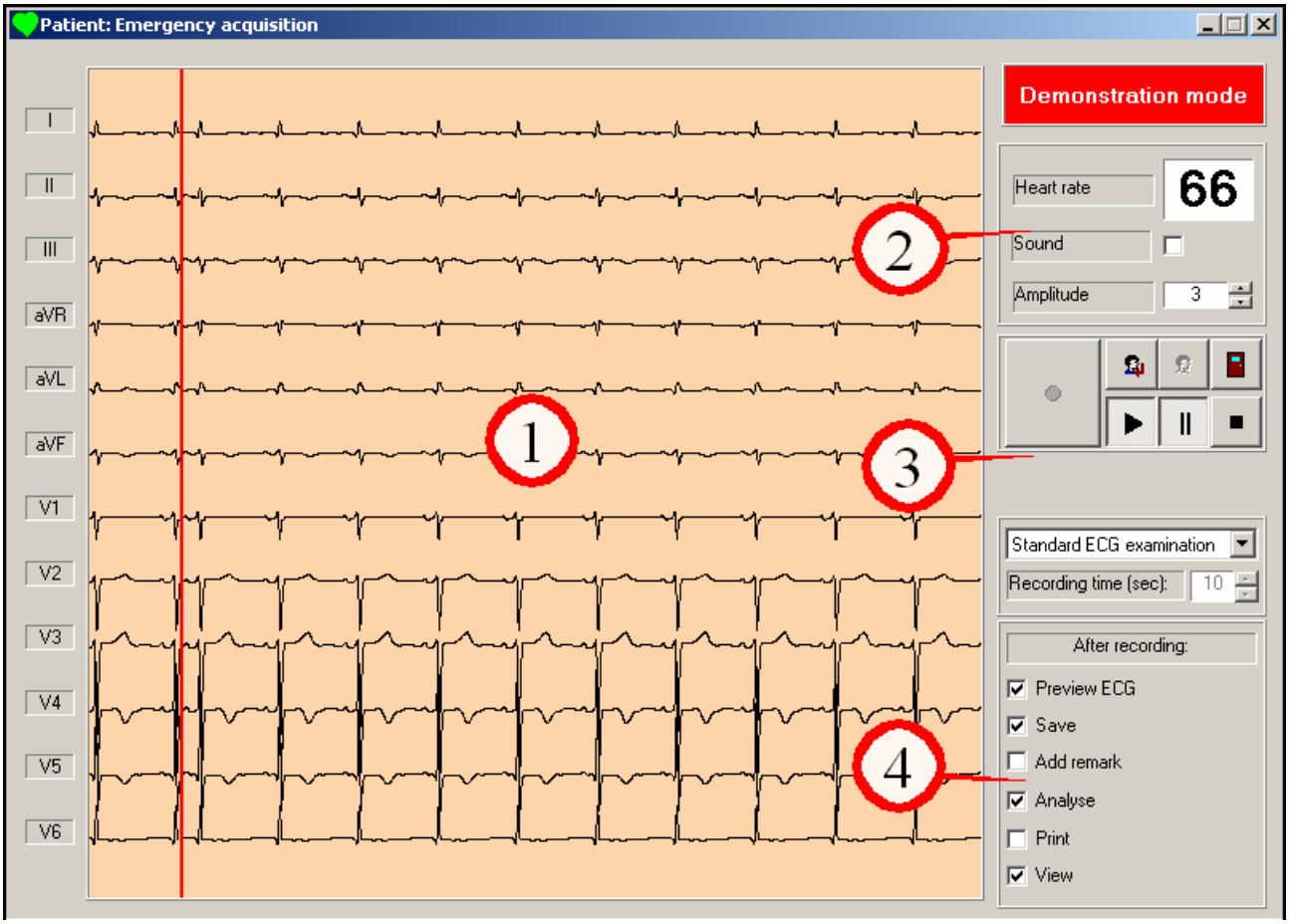
Cancel button. Window is closed and no actions are undertaken.

Set logical OR operation for selected statements. It means that an examination appears in the filtered list if any of the selected statements is present in conclusion.

Set logical AND operation for selected statements. It means that an examination appears in the filtered list if all of the selected statements are present in its conclusion part. No more than four statements can be selected for this kind of a query.

ECG recording module - Smart Cardiograph

Smart Cardiograph layout



This window is used to record ECGs in the manner similar to the work with a modern ECG chart. The window occupies full area of the Windows desktop.
If you start ECG recording module from Control Centre window, there are two ways to evoke **Smart Cardiograph** application whether you use **Patient ECG** button or **Emergency ECG**.
If you use **Patient ECG** button, when **Smart Cardiograph** appears, Choose or enter patient window will be invoked automatically. You have to select a patient from database before monitoring if possible or use Emergency examination button.
Emergency ECG button serves for urgent ECG acquisition without prior registering the patient in the database, **Smart Cardiograph window** appears and you can start acquisition process. That is done so you can easily identify such recordings later and reassign them to appropriate patients in Assign examination to existing patient or enter new one window.
If you launch/activate another application, monitoring is paused automatically. A special message "Demonstration mode" will appear at the window top right hand corner if you start Smart Cardiograph in simulation mode. See the section Option dialogue hardware tab for details how to switch the simulation mode on and off.

The window has the following panels:

1 ECG monitoring screen (ECG Display)

It occupies the major part of the window. If monitoring is on and the leads are connected to a patient, then the monitor screen shows ECG signal from all 12 leads. There are labels to the left from the window, which specify the names of the leads. A vertical line moves on the screen from the left to the right and changes the signal. New signal from the electrodes is to the left from the red line, while the oldest signal can be seen to the right from the red line and is swept continuously. Due to digital filtering a signal appears on the screen about 1.5 second later than it has been acquired from the electrodes. Ten-second signal span seen on the screen can be acquired for further processing (saved to the database, printed, etc.).

2 Acquisition parameters panel

Acquisition parameters panel. There are control elements on this panel, which regulate ECG recording conditions.

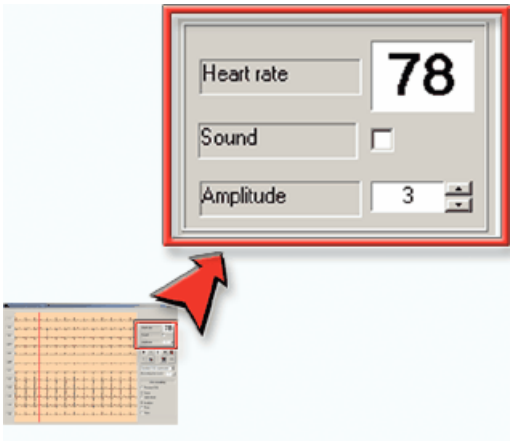
3 Acquisition controls panel

Acquisition controls panel. On this panel, there are elements, which control the process of recording, its type, duration etc.

4 After Recording panel

After Recording panel. On this panel, there are elements, which control the process of recording. The check boxes on it specify actions, which will be undertaken after an ECG record is acquired.

ECG acquisition parameters panel



The panel contains the following controls demonstrated the ECG recording mode in the monitoring process:

- Average heart rate of monitored ECG.
- A check box that turns QRS beeper on/off.
- A box that shows amplification of the signal value with a spin button to change it. This is important that this value changes only the size of signal representation on the computer screen during monitoring and DOES NOT AFFECT acquired signal itself. By default level 3 is set.

ECG acquisition controls

Main Acquisition control buttons

Start monitoring (**Ctrl+S**). The button looks pressed while monitoring is active. Choose or Enter Patient window appears when you press this button if the patient is not selected .

Record (**Ctrl+R**). This button activates acquisition and processing of ECG signal from the patient. If standard ECG signal is set as examination type, the **Record** button becomes enabled after 10 seconds of monitoring when the required length of signal curves are stored in the buffer. If you are acquiring a rhythm analysis record, the **Record** button is enabled as soon as monitoring begins. The progress bar appears on Acquisition Controls panel during the rhythm analysis record acquisition process showing the percentage of long ECG that has already been saved to hard drive.

Pause monitoring (**Ctrl+P**). The button looks pressed while monitoring of ECG signal is paused. Release this button in order to resume monitoring. The programme always assumes that the patient remains the same after resuming.

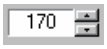
Stop monitoring (**Ctrl+T**). Monitoring of the current patient is stopped. The current patient is disposed and you have to reselect current patient in order to resume work.

Exit button. This button closes the smart-cardiograph window and returns to Control Centre. Pressing **ESC** button has the same effect, i.e. it stops monitoring and closes the window.

Additional buttons

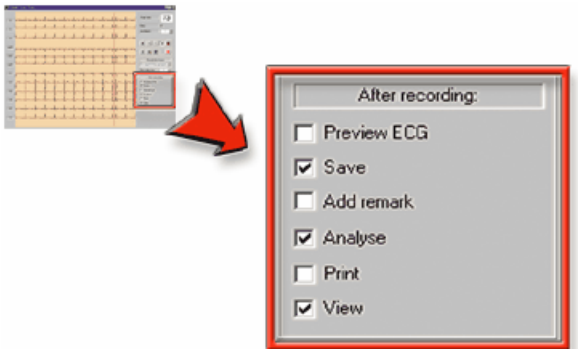
- **Choose patient** (**Ctrl+C**). This button opens patient browser to select a patient as the current patient. Full name of the current patient is shown in the smart-cardiograph title bar.
- **Reselect previous patient** (**Ctrl+V**). seca CardioConcept memorizes the patient, for which the last ECG was recorded. If this ECG is not satisfactory or if there are some pathologic findings you want to document with another ECG recording then you should reselect the patient. Pressing this button reselects the previous patient automatically.

Examination type controls

- The combo box for selecting examination type. Two types are available in the current version of seca CardioConcept. The first one is standard ECG record. The second one is rhythm analysis ECG record. Notice that monitoring is paused as soon as you change examination type.
- 

The spin button for setting length of rhythm analysis ECG record in seconds. You can change the length of record from 20 seconds to 5 minutes (300 seconds) by 10-second increments. Use arrows on the spin-button for this purpose because you cannot enter the length of the record directly. Notice that monitoring is paused as soon as you change recording time. This control is disabled if standard ECG record is selected.

After Recording panel

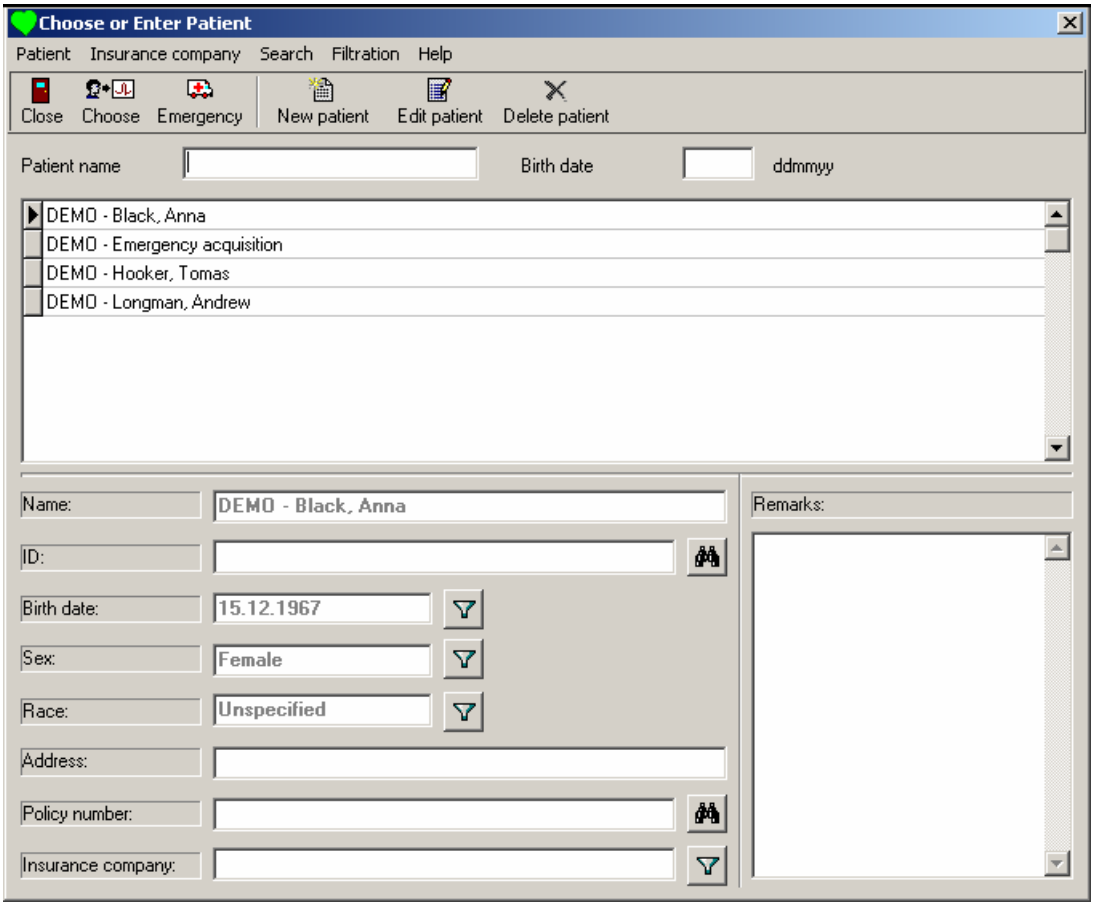


The following check boxes are available:

- **Preview ECG** – if this check box is on, Check the Quality of ECG window will appear as soon as ECG signal is acquired and before it is saved into the database. You can repeat the recording immediately if the quality of the signal is unsatisfactory.
- **Save** – save signal to database after acquisition.
- **Add remark** – if this check box is checked, Add remark to examination window will appear as soon as ECG signal is acquired. There you can write any comments on this recording. They will be saved into database and can be later viewed from Examination Browser.
- **Analyse** – turns on automated generation of the conclusion. This check box can be set only together with check box **Save** or **Print**.
- **Print** – immediately print the acquired ECG on default system printer using the default protocol template.
- **View** – switches to ECG Viewer application after acquisition. This check box can be set only together with **Save** check box**.**

It is worth noting that if you uncheck **Save** check box**,** then the programme set the check box **Print** automatically and make it untouchable (it is greyed in this case). Also notice that if you invoke ECG recorder window from Examination browser then check boxes **Save** and **View** are set and you cannot disable them. In this case you can set only **Preview ECG** and **Analyse** check boxes.

Choose or Enter Patient window



This window appears in the course of Patient ECG recording command. It gives the possibility to select a patent immediately prior to ECG acquisition.

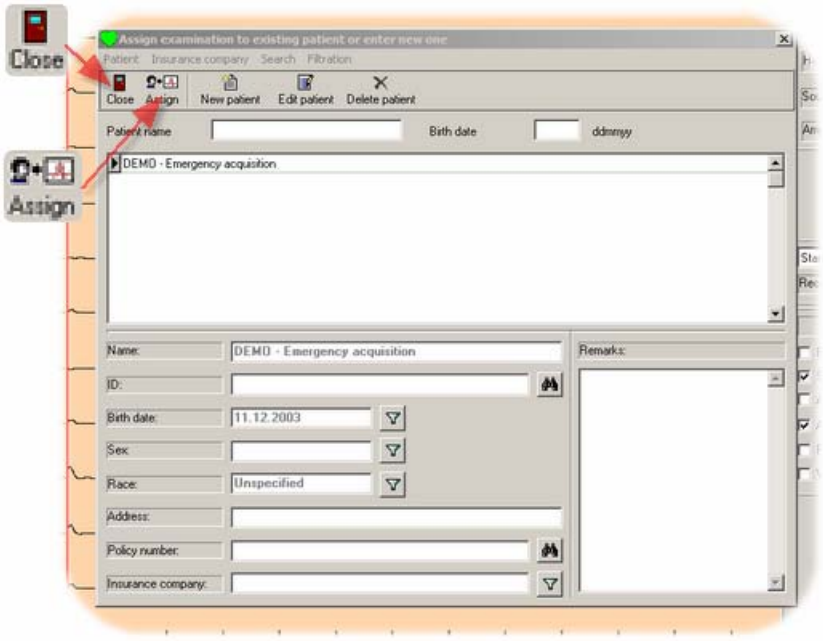
The button *Choose* selects the highlighted patient record and proceeds to Smart Cardiograph. Pressing **ENTER** key produces the same effect.

The *Emergency* button starts Emergency ECG recording.

The *Cancel recording* buttons cancels the operation and returns to Control Centre. Pressing **ESC** key produces the same effect.

In all other respects this window is similar to Patient Browser window.

Assign ECG to existing patient or Enter New Patient Info



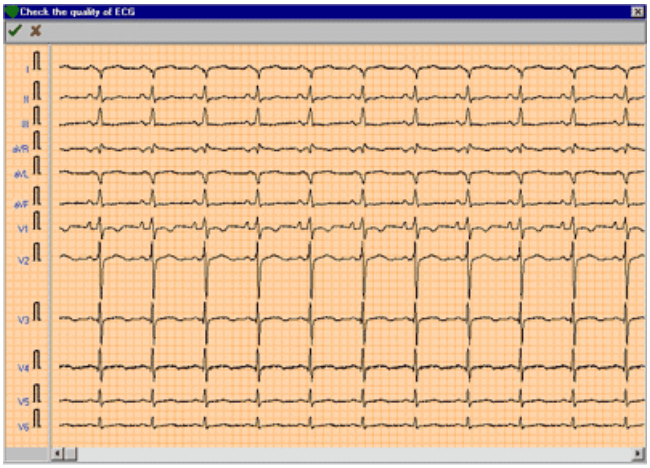
This window appears immediately prior the completion of Emergency ECG Recording command and allows to assign an "anonymous" ECG to an existing patient or create a new patient record.

The button *Assign* links the ECG to selected patient. Pressing **ENTER** key produces the same effect.

Close button leaves the ECG "anonymous" i.e. assigned to a "virtual" *Emergency Acquisition* patient. Pressing **ESC** key produces the same effect.

In all other respects this window is similar to Patient Browser window.

Check the Quality of ECG Window

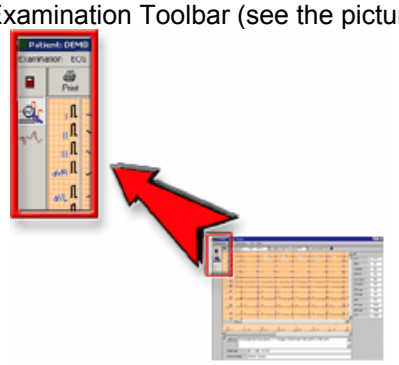


This window displays the ECG just acquired giving you an opportunity to examine its quality etc. Left-clicking on the screen will zoom-in the curves so you can peruse the details. The point of the image you click with the mouse will be approximately in the centre of the window after zooming . Right-clicking will zoom-out the ECG image allowing you to see the general properties of the acquired record. If you are satisfied with the curve quality, press **OK** button and the recordings will be processed further (i.e. saved, analysed, printed etc.). Otherwise click **Cancel** button. You will return to Smart Cardiograph and can repeat the acquisition process in order to obtain the ECG of proper quality.

ECG Analysis Workbench

Examination windows

Various windows of seca CardioConcept **ECG Analysis Workbench** are used for viewing ECG recordings, comparing new ECGs with previously acquired ones and creating new diagnostic conclusions. One of them is the main one. For example, you start viewing standard ECG recordings and get access to other windows and tools for ECG analysis in a window of this type. The name of the current patient is shown in the window title bar. Depending on examination type either ECG Viewer or Rhythm Viewer fills the window client area. The current examination type is represented by the pressed button on the Examination Toolbar (see the picture below).



You can click on icons in order to browse through examinations of required type. Please see sections Standard ECG Analysis Workbench and Rhythm Analysis Workbench for detailed description of **examination windows** and other components of **ECG Analysis Workbench**.

Standard ECG Analysis Workbench

Examination window of Standard ECG Analysis Workbench

seca CardioConcept **Standard ECG Analysis Workbench** consists of several window types that are used for viewing ECG recordings, comparing newly acquired ECGs with previous ones and creating new diagnostic conclusions. The ECG Viewer is of examination window type and contains Examination Toolbar to change the examination type to be viewed. This is the main window of **Standard ECG Analysis Workbench** through which you can access all the examinations of the currently selected patient (i.e. the current patient).
The windows of other types you can see while processing ECG examinations are Compare ECG window and New Conclusion window. It is clear that there is no sense changing the patient or examination type while comparing ECGs or analysing a specific recording. Thus, these windows do not contain **Examination Toolbar**. They do not have **Examination** menu and **Close** button in the toolbar. There are standard **OK** and **Cancel** buttons in the toolbar of New Conclusion window instead. The toolbar of Compare ECGs window has only **OK** button.

Common features of standard ECG Analysis Workbench windows

ECG Display area

Diagnostic Conclusion panel

ECG Features panel

ECG Callipers tool

Specific windows of standard ECG Analysis Workbench

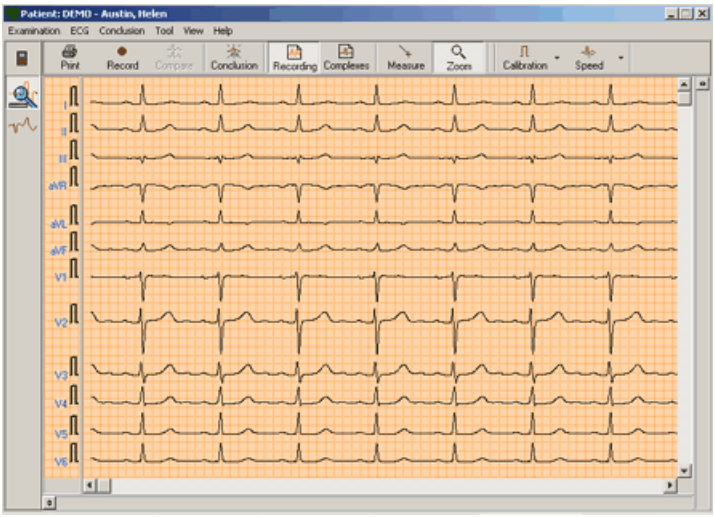
ECG Viewer

Compare ECG window

New Conclusion window

ECG Display area

ECG display of Standard ECG Viewer consists of three parts. The leftmost part contains lead names and standard reference one millivolt signals for each lead displayed. You cannot change the size of this part or remove it from the screen. Two other parts are removable and you have a splitter, so you can change the portion of **ECG Display** occupied by each part. One part displays full ECG curves and the second (the rightmost one) shows median complexes. Standard ECG paper grid is present as window's background to make it easier to analyse the curves visually. If you want to make **ECG Display** as large as possible, just hide ECG Features and Diagnostic Conclusion panels and median complexes part of the display area (see below ECG Viewer of a standard ECG record).



You can scale the ECG curves with zoom tool. The size of both full leads and median complexes changes simultaneously and as a result median complexes may not fit into the corresponding window. Double-click on the splitter bar between the **ECG Display Area** parts will change the width of median complexes area so as to make the whole length of complexes visible. At the same time, the width of median complexes part cannot exceed one third of **ECG Display Area** total width.
Use scroll bars to change the visible part of ECG record. The drawing of ECG can be rather lengthy so nothing is changed on the screen while you drag the box on the scroll bar. The visible part of the ECG will change as soon as you release the left mouse button.

Diagnostic Conclusion panel

This panel allows browsing through all diagnostic conclusions attached to a specific ECG recording. There is a special button in the top left corner of the panel that can be used to switch the panel on/off in order to enlarge ECG display area. Normally there is at least one conclusion made automatically by seca CardioConcept. If some re-reading by one or more human experts occurred, additional conclusions would be stored in the database. The last one is shown by default. Both the name of the expert who made the conclusion and the date/time when it was created are displayed in the corresponding fields. Two scroll conclusion buttons provide for browsing through available diagnostic conclusions.
Diagnostic Conclusion panel of New Conclusion window has an additional button. This is **Quick Statement** button . This button evokes Add Diagnostic Statement to your conclusion window.

ECG Features panel

This panel appears in all windows of **ECG Analysis Workbench** and contains most important patient information, ECG acquisition parameters and main ECG features. There is a special button in the top left corner of the panel that can be used to switch the panel on/off in order to enlarge ECG display area.

The following patient and ECG acquisition information is shown (if specified):

- Patient's sex.
- Patient's age.
- Virtual paper speed of ECG display.
- Virtual calibration.
- Notch filter frequency in effect at acquisition.
- Low-pass filter frequency in effect at acquisition.
- Mean heart rate in bits per minute. In New Conclusion window you can double-click the **HR** field and enter the value manually in Enter heart rate dialogue.

The following ECG features are shown if standard ECG record is being viewed or analysed:

- Average RR-interval in milliseconds. If you decide to analyse an ECG record from scratch (i.e. without employing seca CardioConcept automatic interpretation features), you have to enter average RR-interval by hand. While in New Conclusion window you can double-click the **RR** field and enter the value manually in Enter average RR dialogue.
- Representative cardiocycle P-wave duration in milliseconds.
- Representative cardiocycle PQ(R)-interval duration in milliseconds.
- Representative cardiocycle QRS duration.
- Representative cardiocycle QT/QTc duration in milliseconds.
- Representative cardiocycle QTd/QTdc in milliseconds. If you are not going to utilize seca CardioConcept automatic diagnostic capabilities while creating a new conclusion, you can enter the value manually in Enter QTd dialogue by double-clicking the QTd/QTdc field.
- Representative cardiocycle QRS axis.
- Representative cardiocycle P-wave axis.
- Representative cardiocycle T-wave axis.
- Sokolow-Lyon index
- Cornell Voltage Criteria

ECG Callipers tool

The Callipers tool can be used in all ECG Viewer, Compare ECG and New Conclusion windows. Just set Measurement button in the toolbar and then point somewhere on ECG curve, click left mouse button and drag the cursor to another location at your choice. A line connecting two selected points will appear on the screen together with a small window. Time and amplitude difference between two selected points will be displayed in it. The time difference is presented in two forms for your convenience — as time interval in milliseconds and as the corresponding rate in bits per minute. Please notice that if you drag out of ECG Display the cursor changes and no measurement will be performed.

The **Callipers Tool** will allow you to measure and compare the time intervals, determine ST segment shift, Q-wave amplitude/duration and perform many other traditional ECG measurements that are not performed automatically by seca CardioConcept. It is particularly useful in rhythm analysis and in comparison of serial ECG recordings.

ECG Viewer

Viewing ECG

You will open this window from examination browser, patient browser or smart-cardiograph applications for examining a standard ECG record . Normally it appears as working area of an examination window.

Standard ECG Viewer

ECG Viewer general layout

ECG Viewer Menu and Toolbar

Common features of ECG Analysis Workbench windows

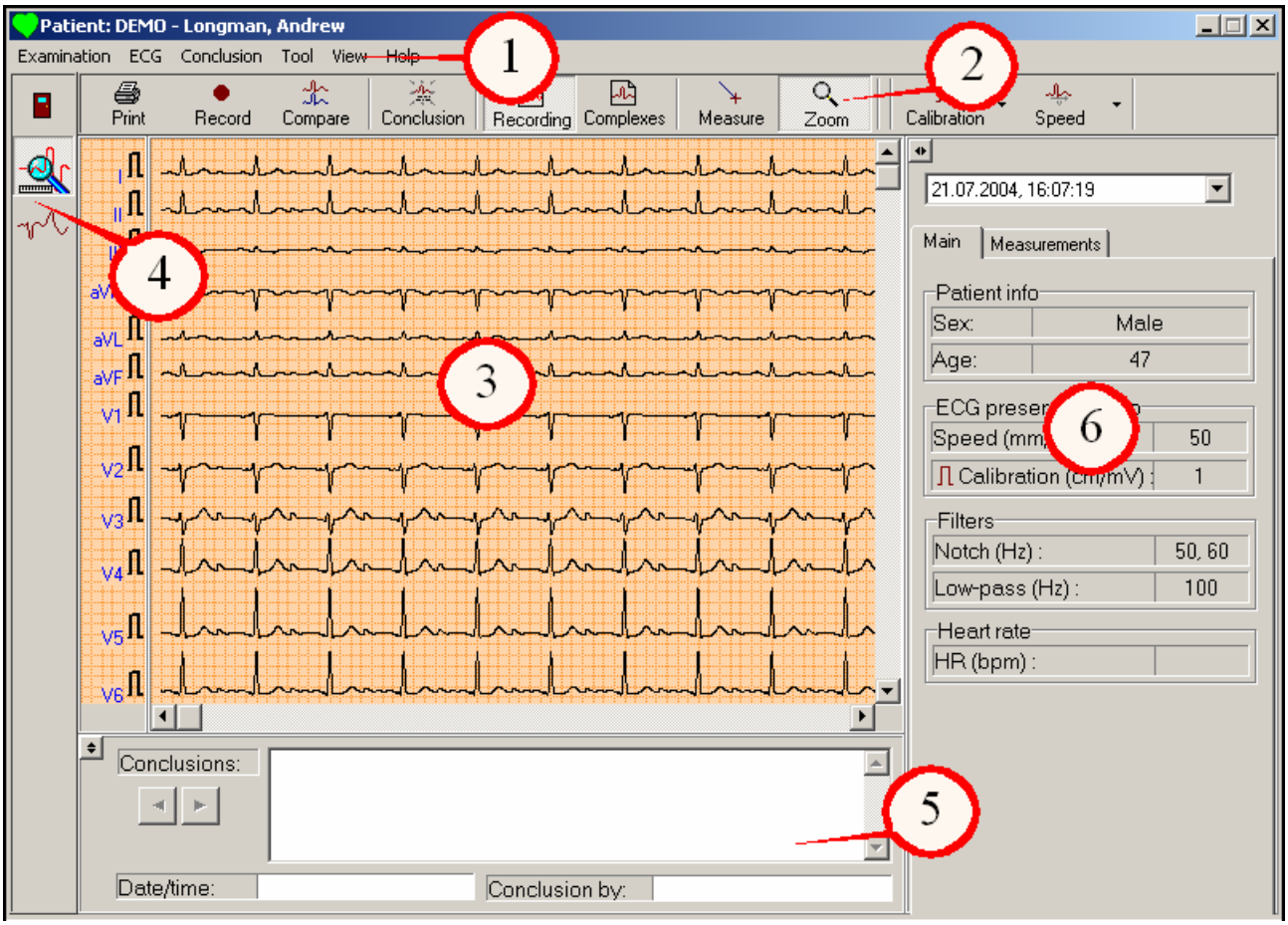
ECG Display area

Diagnostic Conclusion panel

ECG Features panel

ECG Callipers tool

ECG Viewer general layout



The name of current patient is shown in the window title bar. The main parts of **Standard ECG Viewer** are:

1 Standard ECG Viewer Menu

Standard ECG Viewer Menu will be explained in detail in the corresponding section.

2 Standard ECG Viewer Toolbar

Standard ECG Viewer toolbar will be explained in detail in the corresponding section.

3 ECG Display area

ECG Display area is the largest part of the window. It is clear that **ECG Display** is intended to show ECG recording.

4 Examination Toolbar

Examination Toolbar with examination icons on it. Current version of seca CardioConcept supports only standard ECG record  and rhythm analysis ECG record  types. You can click an appropriate icon to view examinations of the corresponding type only.

5 Diagnostic Conclusion panel

Diagnostic Conclusionpanel serves for browsing through available diagnostic conclusions and can be minimized in order to enlarge ECG display area.

6 ECG Features panel

ECG Features panel shows main diagnostically relevant patient information and ECG features and can be minimized in order to enlarge ECG Display area. The following ECG features are shown on **ECG Features panel** of **Standard ECG Viewer**:

- Mean heart rate in bits per minute.
- Average RR-interval in milliseconds. If you decide to analyse an ECG record from scratch (i.e. without employing seca CardioConcept automatic interpretation features), you have to enter average RR-interval by hand. While in New Conclusion window you can double-click the **Average RR** field and enter the value in Enter average RR dialogue.
- Representative cardiocycle P-wave duration in milliseconds.
- Representative cardiocycle PQ(R)-interval duration in milliseconds.
- Representative cardiocycle QRS duration.
- Representative cardiocycle QT/QTc duration in milliseconds.
- Representative cardiocycle QTd/QTdc in milliseconds. If you are not going to utilize seca CardioConcept automatic diagnostic capabilities while creating a new conclusion, you can enter the value in Enter QTd dialogue by double-clicking the QTd/QTdc field.
- Representative cardiocycle QRS axis.
- Representative cardiocycle P-wave axis.
- Representative cardiocycle T-wave axis.
- Sokolow-Lyon index
- Cornell Voltage Criteria

ECG Viewer Menu Toolbar

Examination menu

- **Close** command and **Close** button on **Examination Toolbar** (**ESC**). This command closes **Standard ECG Viewer** and returns to Patient Browser or Examination Browser (whichever **Standard ECG Viewer** window was evoked from).
- Buttons for examination type selection with the corresponding icons on the Examination Toolbar.
- **Export** command allows to export examinations in two possible formats: with or without patient information (i.e. as anonymous).
- **Mail client** command. If Mail Client is not installed on your computer, this button is disabled.

ECG menu

- **Print** command and **Print** button on the toolbar (**Ctrl+P**). There is a difference between the action of menu command and toolbar button. The menu command invokes Print ECG dialogue that allows you to select printing device and protocol template before actually start printing. Thus it is much more flexible but it takes more time and "mouse clicks" in order to print an examination report. Toolbar button just prints the report on the current examination using default protocol template on the printer set (default printer name is shown in the tool-tip of this button).
- **Record** command and **Record** button on the toolbar (**Ctrl+R**). This icon evokes Smart Cardiograph application in order to register new ECG for currently selected patient in standard ECG mode.
- **Compare** command and **Compare** button on the toolbar (**Ctrl+O**). It invokes Compare ECG window. You normally use it if you want to perform serial analysis of ECG records of the same patient.
- **ECG List** command (**Ctrl+L**) and **ECG List** combo box on the toolbar. You can use it to walk through examinations of currently selected type that are available for the current patient. The difference is that **ECG List** menu command opens Choose ECG dialogue.
- **Send for consultation** command. This command opens Compose request dialogue that is used for sending currently viewed ECG for consultation via the Internet Mail. Mail Client application (that allows you using Internet Mail for remote ECG consulting) is an optional application and is licensed separately. If Mail Client is not installed on your computer, this button is disabled.

Conclusion menu

-  New command and **Write New Conclusion** button on the toolbar (**Ctrl+N**). This command invokes New Conclusion window if you want make a new diagnostic conclusion.
-  **View Fiducials** command and **View Fiducials** button on the toolbar (**Ctrl+F**). This icon invokes Viewer Fiducial points window. You normally use it for checking how seca CardioConcept set fiducial points on representative cardiocycle.
-  **ECG features table** command and **ECG features** toolbar button (**Ctrl+T**). It calls View ECG Features Table dialogue where you can find out all the features calculated by the programme.
-  **Previous/Next** command and buttons on Diagnostic Conclusion panel. Use it to browse through diagnostic conclusion history stored in database.

Tool menu

-  **Measurement** command and button on the toolbar (**Ctrl+M**).
-  Zoom command and button on the toolbar (**Ctrl+Z**).

These commands switch ECG Display between measurement mode and zoom mode. These modes control how ECG Display responds to mouse clicks. ECG Callipers tool is active in measurement mode, thus you can measure time intervals and amplitude differences directly on computer screen. To the opposite, left mouse click acts as zoom-in command and right mouse click acts as zoom-out command in zoom mode. The point you click while you are zooming in will be approximately in the centre of the window for your convenience.

View menu

-  **ECG** curves command and toolbar button (**Ctrl+E**).
-  Representative complex command and toolbar button (**Ctrl+C**).

These commands turn on/off full curve and median complex ECG representation. You can see both if you wish. ECG Display area is divided into two unequal parts. The left larger area contains full curve ECG representation and the narrow right one contains median cardiocycles.

- **Scale** command and toolbar combo box allow you to zoom the ECG curves. You can set precise "zoom factor" with this combo box. Just select the scale from the list or enter the number into the box and press **ENTER**. Menu command opens the Set Scale dialogue. A special "fit" scale is used to set such a scale when all twelve leads are seen simultaneously.
-  **Calibration** command and button.
-  **Speed** command and button.

They provide for virtual "amplification" and "paper speed" selection. If you just click the button itself, you change amplification or speed to its default value (1 cm/mV and 50 mm/sec correspondingly). Please note that **Calibration** and **Speed** buttons have arrows on the right. Use them to open lists with available amplification and paper speed values. You can set 0.5 cm/mV, 1.0 cm/mV and 2.0 cm/mV amplification and 5, 10, 12.5, 25, 50, 100 and 200 mm per second paper speed. The amplification and paper speed you set with these commands are remembered by seca CardioConcept and used next time you open **ECG Viewer**. You should remember that amplification and paper speed are "virtual", i.e. they set curve sizes relative to the paper grid. Unlike a regular analogous ECG curve, digitized ECG signal can be extended to any amplification and paper speed without distortion. In the contrary, zooming changes the visible size of both the curves and the grid

- **Markers** command turns on/off small fiducial markers on median complexes.
- **Parameters** panel command turns on/off ECG Features panel.
- **Conclusion** panel command turns on/off Diagnostic Conclusion panel.

You can achieve the same effect by pressing  minimizing buttons on the tool bars.

- **Colours** command evokes Choose Colours for Viewer dialogue. It allows you to select colours for ECG representation elements (ECG curves, grid etc.).

Compare ECG window

Comparing ECG

This window is intended to help in serial analysis of standard ECG records. The programme shows the current recording and up to three previous ones. Three groups of compare modes are available. The first group contains single lead mode. The second one is represented by all leads, limb leads and chest leads modes. And the last one contains complexes and overlay modes.

Compare ECG window layout

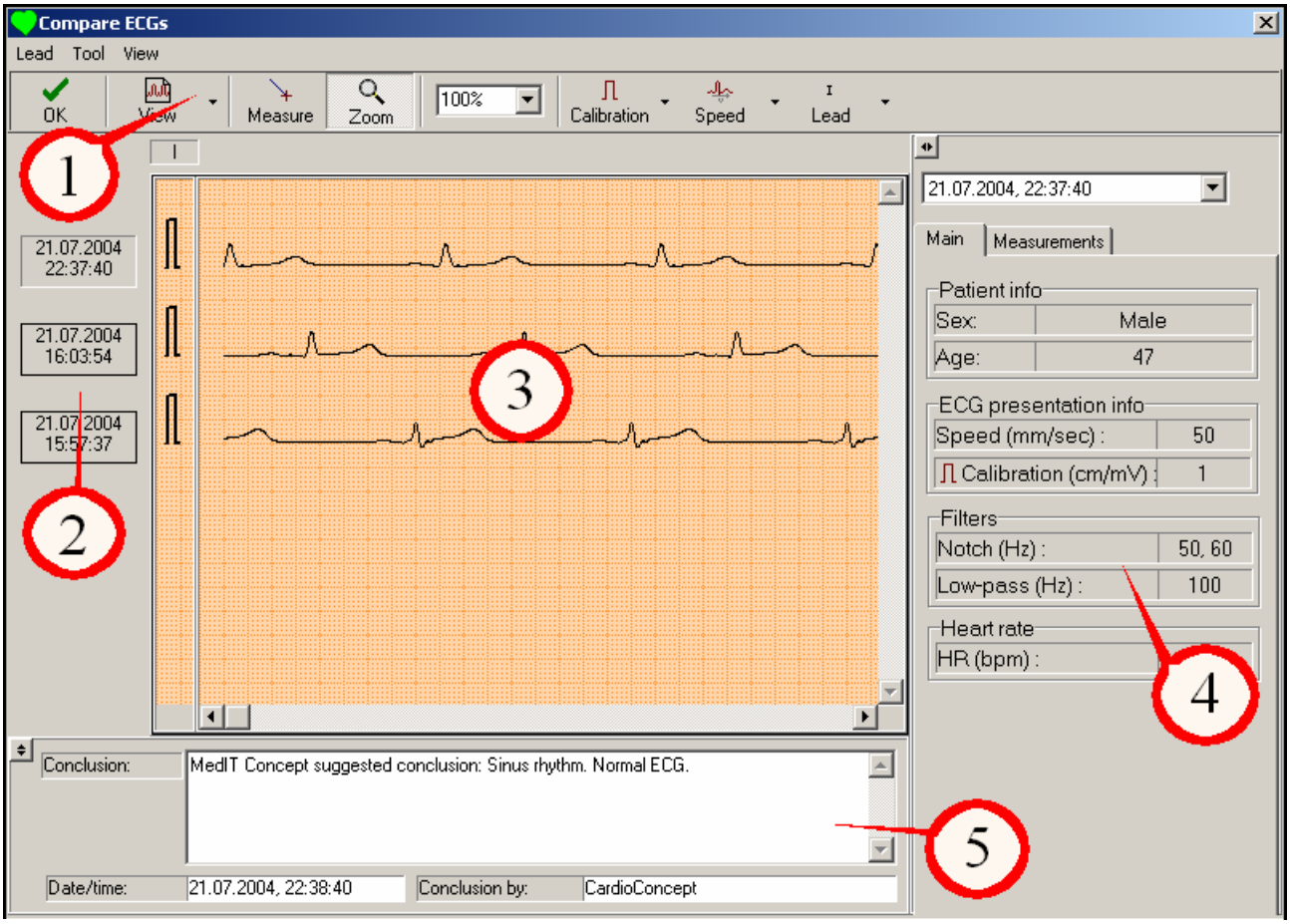
Compare ECG window menu and toolbar

Comparing ECG in single lead mode

Comparing ECG in all leads, limb leads and chest leads modes

Comparing ECG in complex and overlay modes

Compare ECG window layout



1 **Menu and Toolbar**

It is explained in the corresponding section.

2 **ECG Labels panel**

The "sunken" label indicates the currently selected ECG.

3 **ECG Display area**

ECG Display area.

4 **ECG Features panel**

ECG Features panel shows features of the currently selected electrocardiogram. In addition to a standard **ECG Features** panel, it contains a combo box with the list of ECGs being compared.

5 **Diagnostic Conclusion panel**

Diagnostic Conclusion panel shows the diagnostic conclusion of the currently selected electrocardiogram.

Compare ECG window menu and toolbar

Standard **OK** button closes the window and returns to ECG Viewer.

Lead menu

Current lead button and the corresponding command. It is used to set the compared lead in per-lead mode.

Tool menu

-  **Measurement** command and button on the toolbar (**Ctrl+M**).
-  **Zoom** command and button on the toolbar (**Ctrl+Z**).

These commands switch ECG Display between measurement mode and zoom mode. These modes control how ECG Display responds to mouse clicks. ECG Callipers tool is active in measurement mode, thus you can measure time intervals and amplitude differences directly on computer screen. To the opposite, left mouse click acts as zoom-in command and right mouse click acts as zoom-out command in zoom mode. The point you click while you are zooming in will be approximately in the centre of the window.

View menu

-  **ECG** command and toolbar button (**Ctrl+E**). It switches ECG Display into per-lead mode.
-  Representative Complex command and toolbar button (**Ctrl+C**). It switches ECG Display into median complexes mode
-  Complex superimposition command and toolbar button (**Ctrl+O**). It switches ECG Display into superimposed complexes mode.
- **Scale** command and toolbar combo box. You can set precise "zoom factor" with this combo box. Just select the scale from the list or enter the number into the box and press **ENTER**. Menu command opens the Set Scale dialogue.
-  **Calibration** command and button.
-  **Speed** command and button.

They provide for selection of virtual "amplification" and "paper speed". If you just click the button itself, you change amplification or speed to its default value (1 cm/mV and 50 mm/sec correspondingly). Please note that **Calibration** and **Speed** buttons have arrows on the right. Use them to open lists with available amplification and paper speed values. You can set 0.5 cm/mV, 1.0 cm/mV and 2.0 cm/mV amplification and 5, 10, 12.5, 25, 50, 100 and 200 mm per second paper speed. The amplification and paper speed you set with these commands are remembered by seca CardioConcept and used next time you open **ECG Viewer**. You should remember that amplification and paper speed are "virtual", i.e. they set curve sizes relative to the paper grid. Unlike a regular analogous ECG curve, digitized ECG signal can be extended to any amplification and paper speed without distortion. In the contrary, zooming changes the visible size of both the curves and the grid.

- **Markers** command turns on/off the ECG fiducial markers on median complexes in median complexes mode.
- Parameters panel command.
- Conclusion panel command.

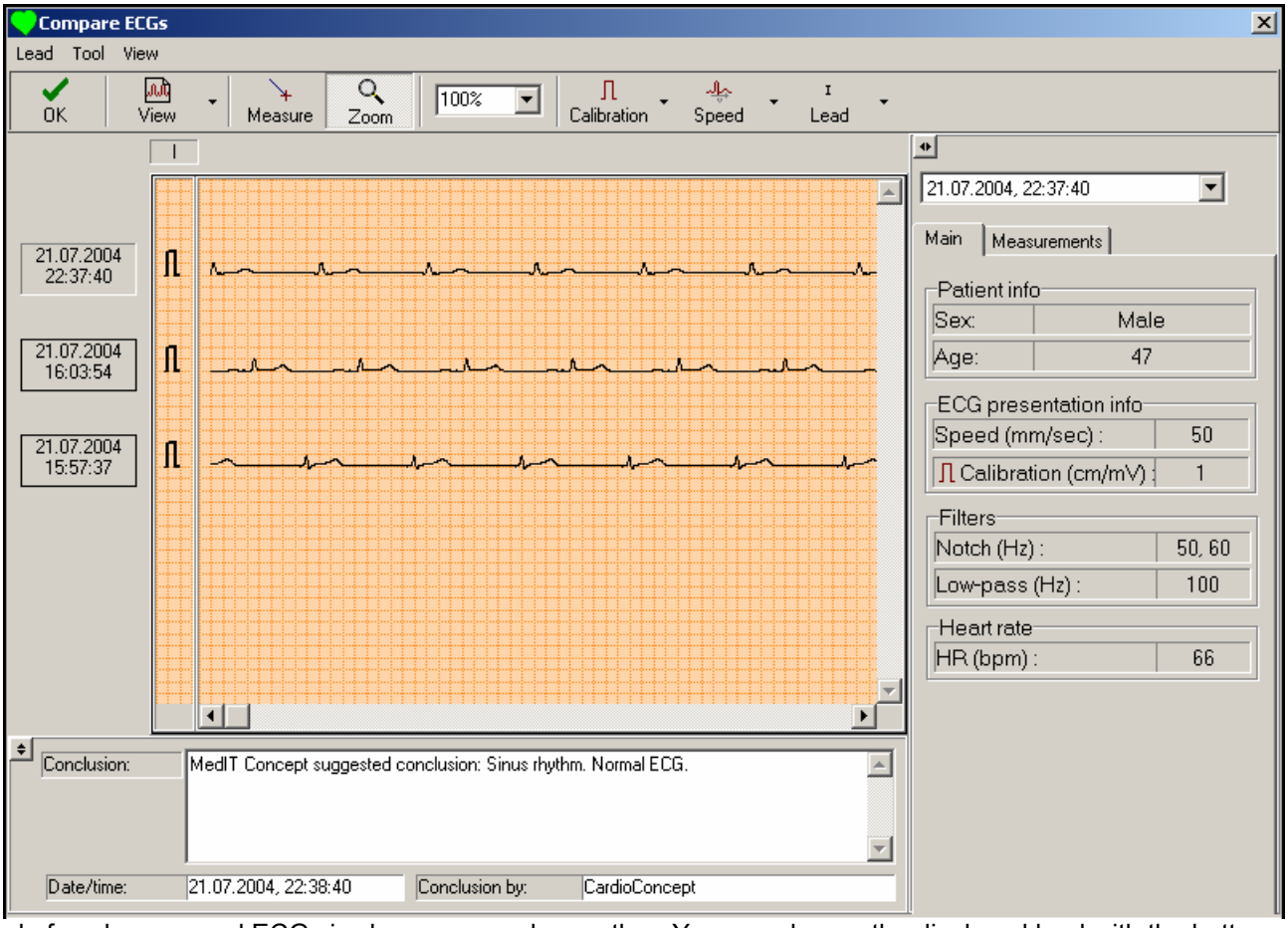
These commands and panel buttons hide/show the corresponding panels.

- **Colours** command evokes Choose colours for viewer dialogue. It allows you to select colours for ECG representation elements (ECG curves, grid etc.).

ECG Compare modes

Comparing ECG in single lead mode

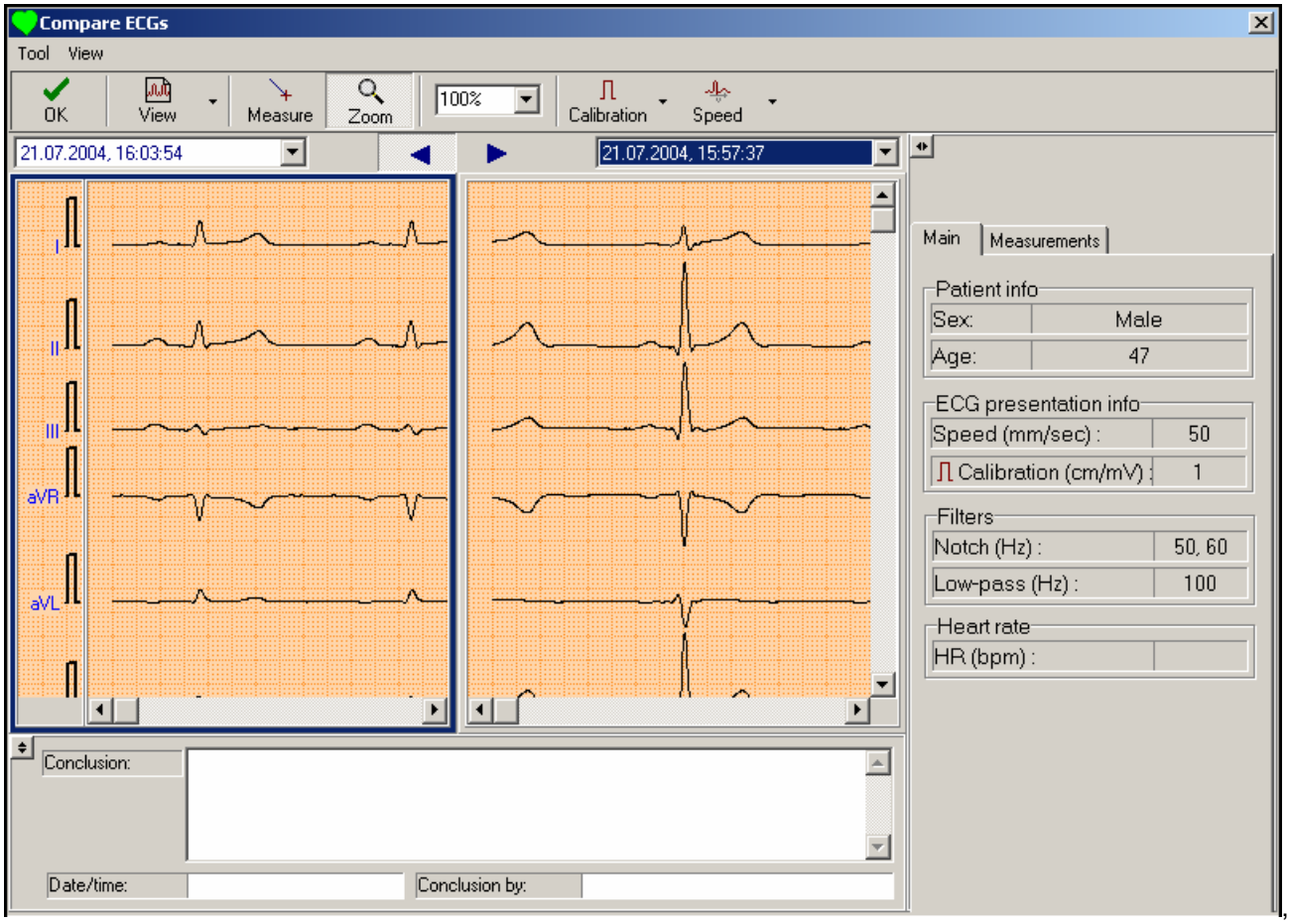
As it was told, the **Compare ECG** window has three groups of display modes. The first one is represented by **single lead mode**.



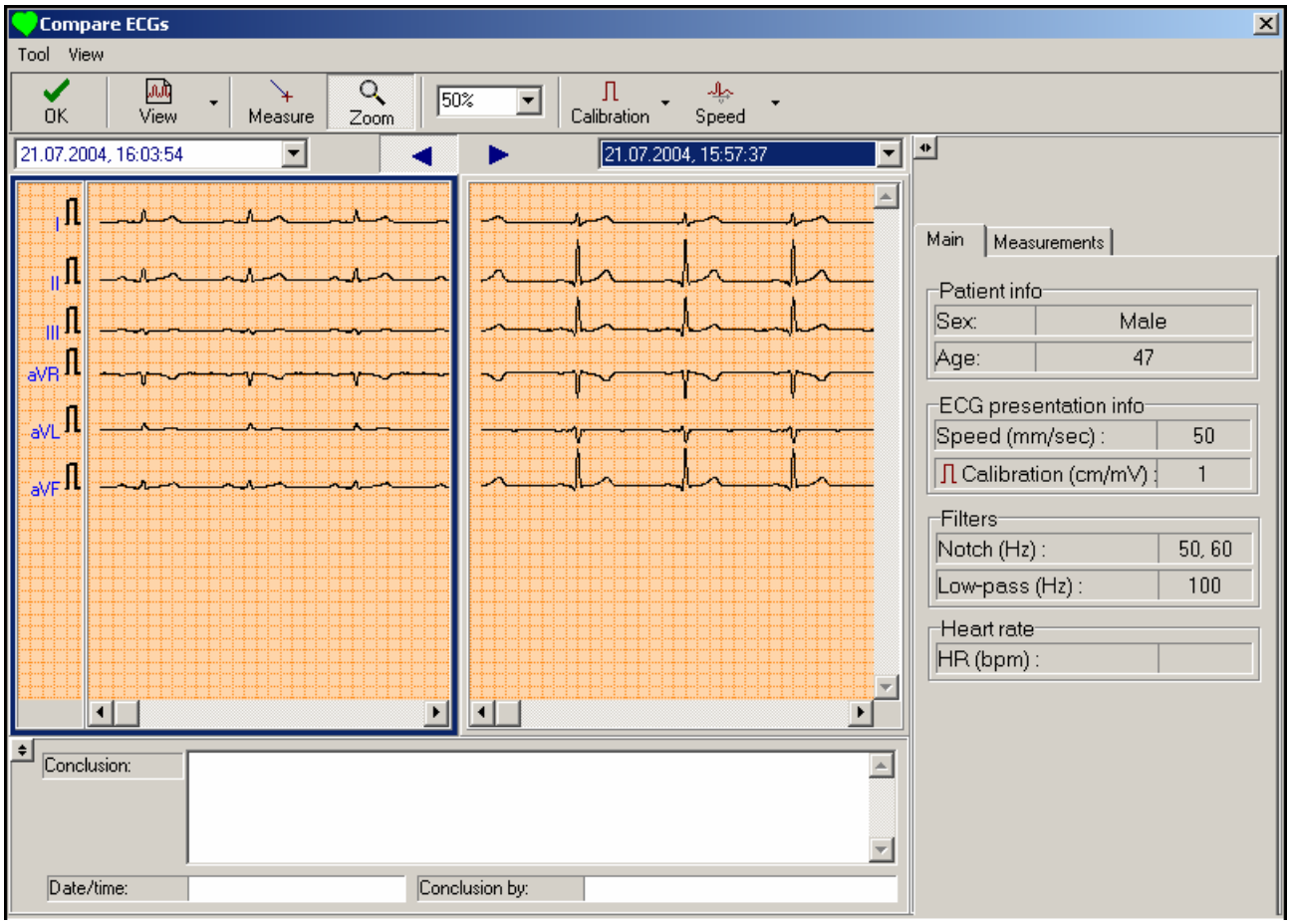
A lead of each compared ECGs is shown one under another. You can change the displayed lead with the buttons on the toolbar.
A vertical panel on the left side of the application window contains label boxes with date and time of ECGs being compared. One of the boxes looks sunken which indicates the currently selected ECG record. The conclusion and ECG featuresof the selected ECG are displayed on the corresponding ECG Features and Diagnostic Conclusion panels.
This type of ECG comparison can be used for virtually any purpose but is particularly helpful in detecting subtle rhythm disturbances, P-wave changes etc.

Comparing ECG in all leads, limb leads and chest leads modes

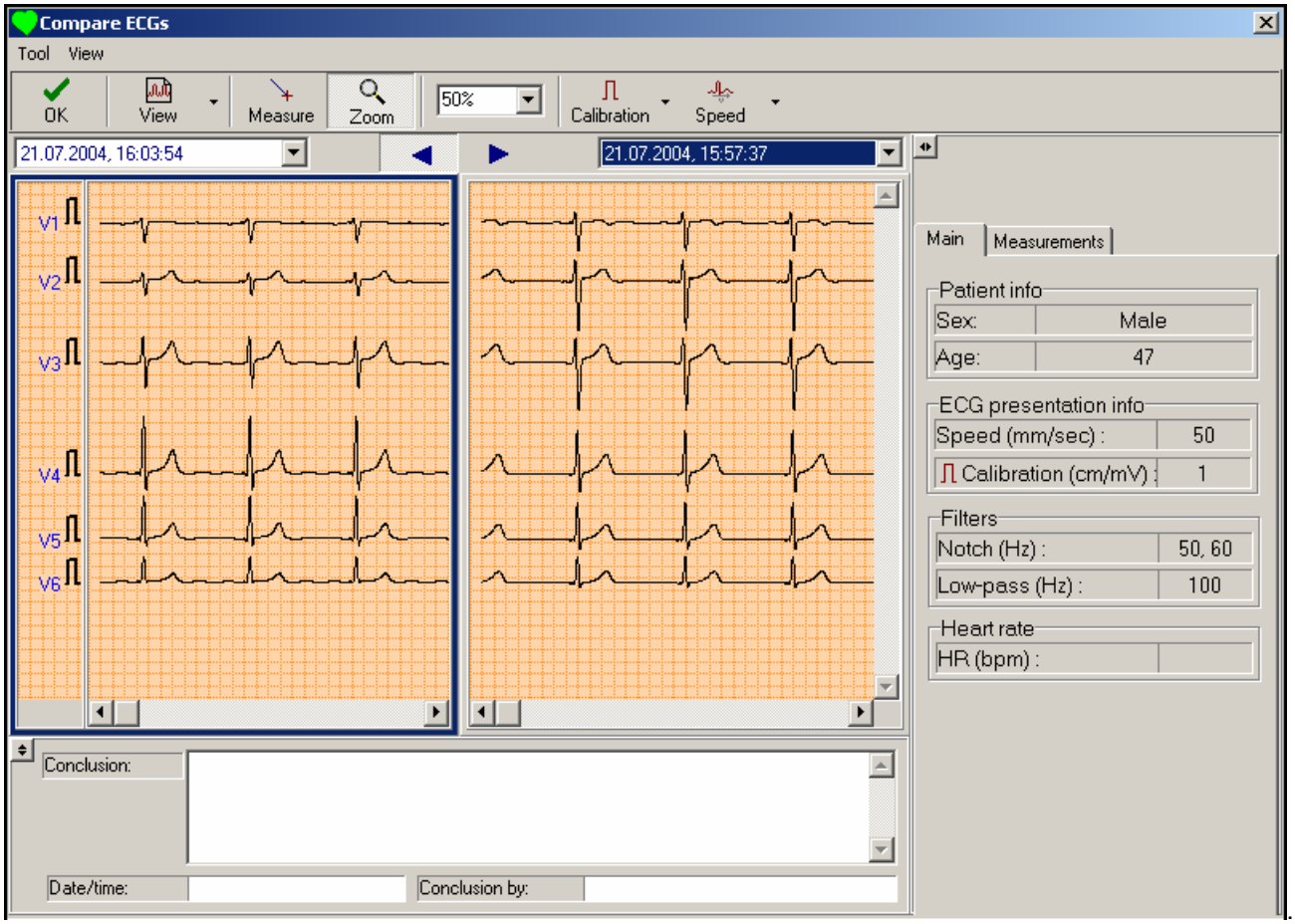
This group of compare modes contains **all leads**



limb leads



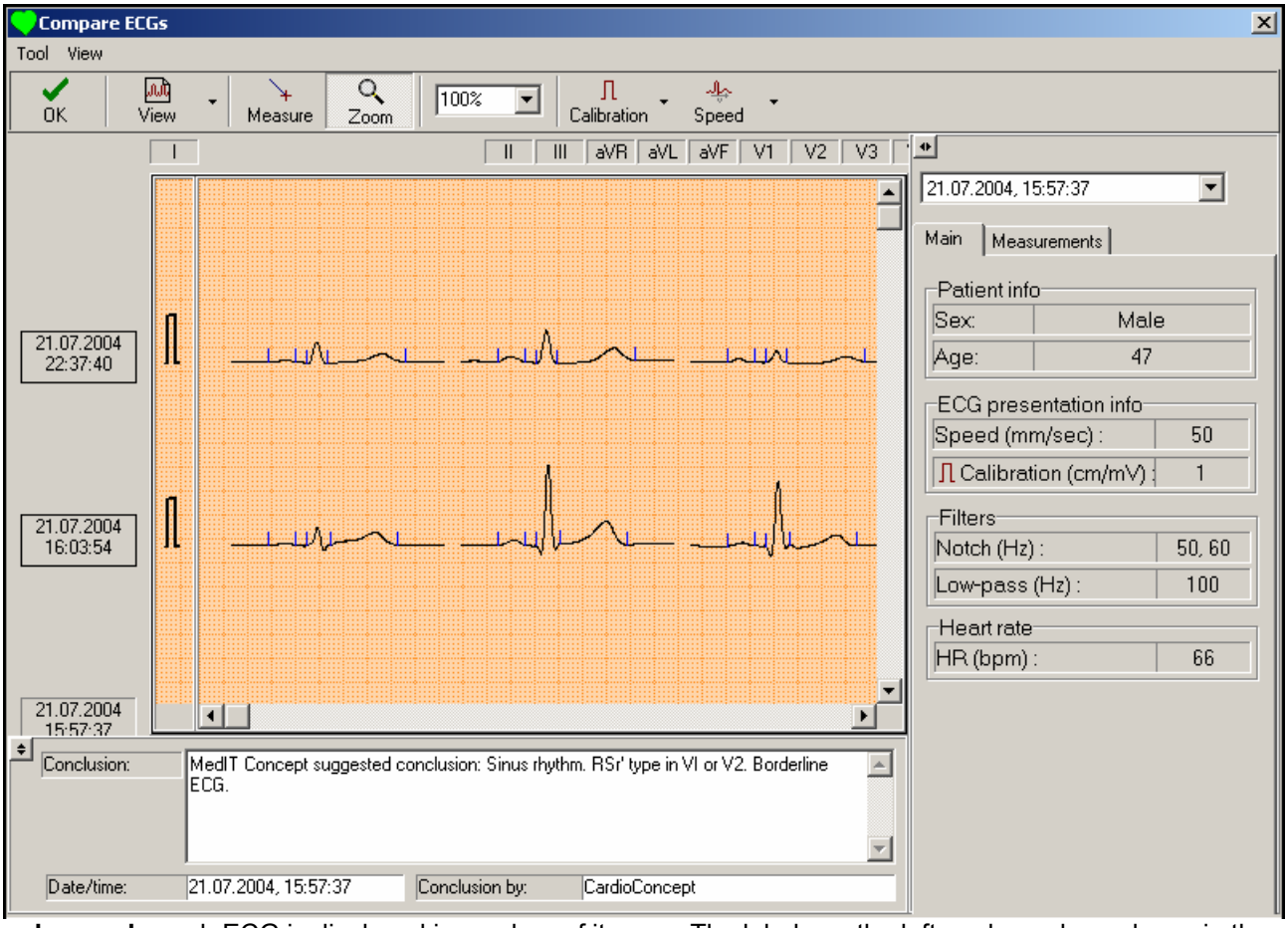
and **chest lead modes**



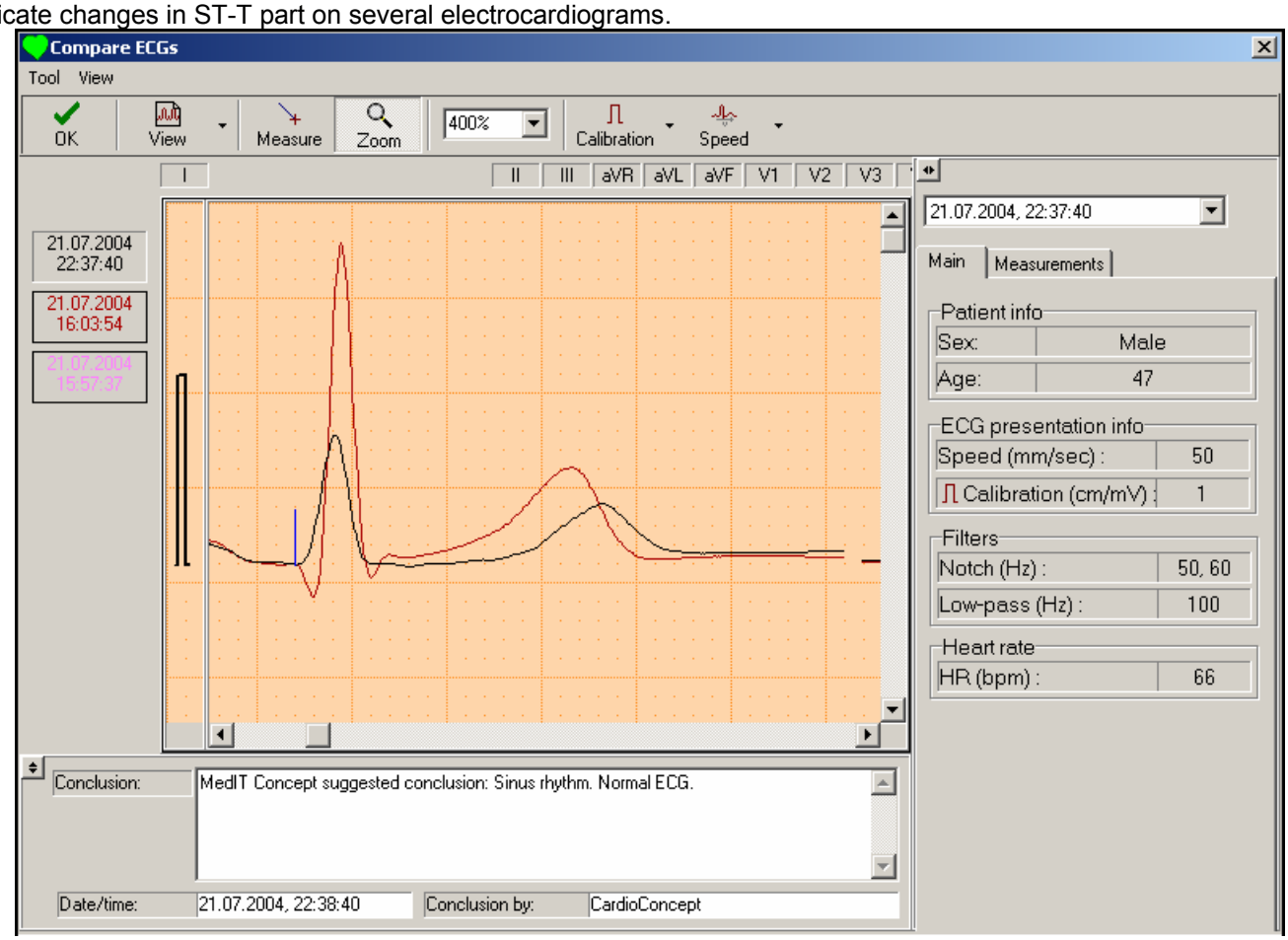
These modes allow to compare alongside any ECGs from the list of combo box. You can compare all leads, limb leads only or chest leads only. The leads of the compared ECGs are shown in the corresponding fields of the two-panel comparison window. You can change the displayed ECGs with combo boxes, which contain a list of ECGs being compared. ECG features and Diagnostic Conclusion panels show data related to the currently selected ECG (the currently selected ECG is framed in blue box and pressed Arrow button points at its combo box). When you change the displayed ECG, the corresponding panel is chosen automatically.

Comparing ECG in complex and overlay modes

The last one group is represented by **complexes** and **overlay modes**.
Median complexes are organized in rows in ECG display area. If one of ECGs has not been analysed (and thus median complexes are absent), the corresponding row is empty. The ECG features panel and Diagnostic Conclusion panel show the data related to the currently selected ECG. **Lead Select** buttons are disabled. This type of ECG comparison is very useful if you need to observe myocardial infarction evolution, transient depolarization changes in a ventricular hypertrophy patient etc.



In **overlay mode** each ECG is displayed in a colour of its own. The labels on the leftward panel are shown in the same colours so that it is possible to specify which ECG each lead belongs to. This mode allows identifying the most delicate changes in ST-T part on several electrocardiograms.



New Conclusion window

Creating new conclusion

If you are not satisfied with diagnostic conclusion that seca CardioConceptgenerated for an ECG recording, you can create a new one in ECG analysis window. It looks very much similar to ECG Viewer, but both window toolbar and behaviour are different and specifically tailored for diagnostic interpretation of ECG recordings. Before **New Conclusion** window appears you will see **Use In New Conclusion** dialogue.

Set the check boxes to specify which part of existing conclusion should be used as template for the new one. You can specify measurements and conclusion, measurements only or none.

New Conclusion window layout

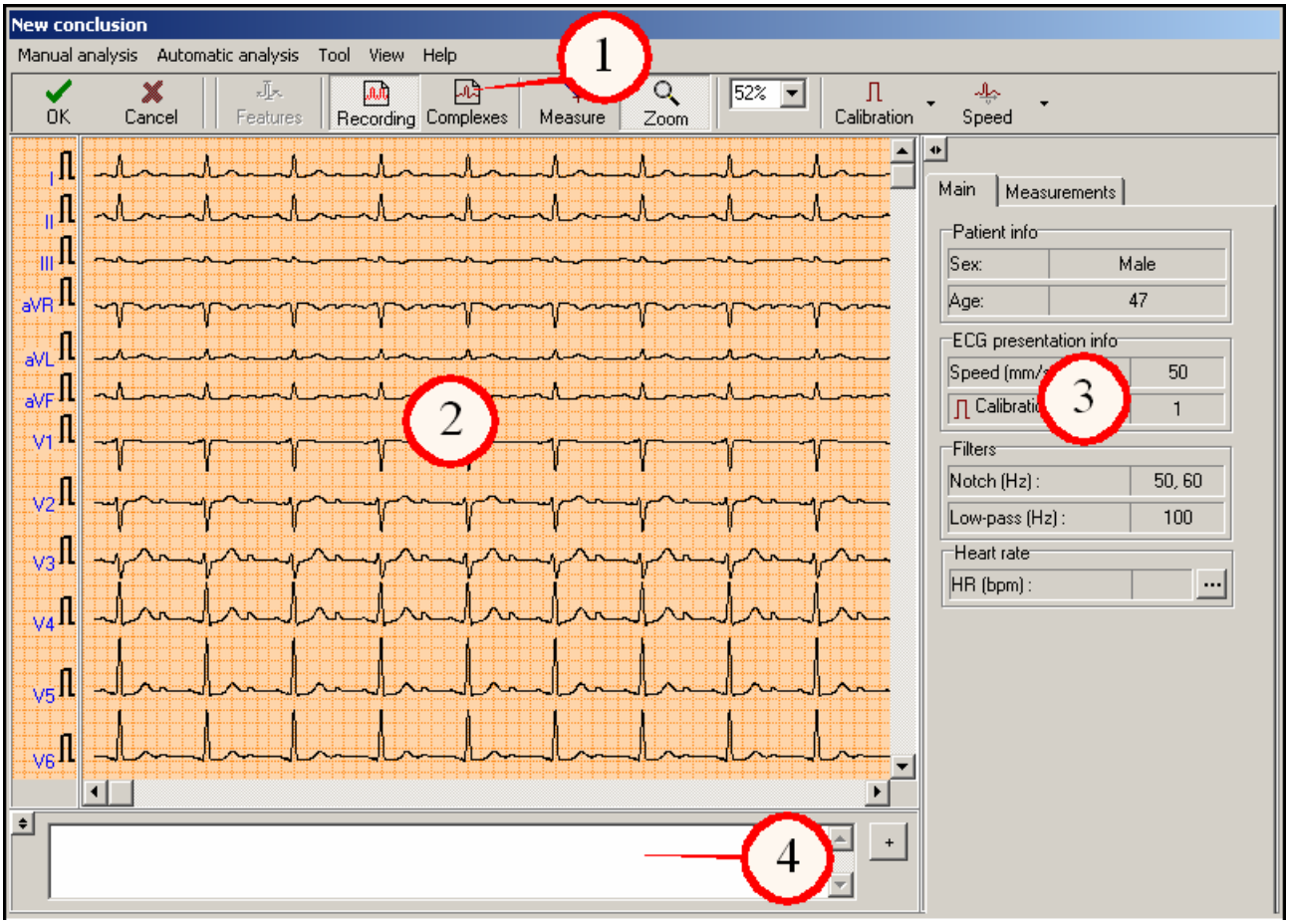
New Conclusion window menu and toolbar

Choose Representative Complex window

Diagnostic Conclusion Wizard

Add Diagnostic Statement to your conclusion window

New Conclusion window layout



The window has the following parts:

1 **Menu and Toolbar**

Menu and Toolbar is fully described in the corresponding section.

2 ECG Display area

ECG Display area.

3 ECG Features panel

ECG Features panel.

4 Diagnostic Conclusion panel

Diagnostic Conclusion panel.

New Conclusion window menu and toolbar

Standard **OK** and **Cancel** buttons on the toolbar. **OK** stores the newly created conclusion into the database and **Cancel** discards any modifications made. Both buttons close the window. The internals of seca CardioConcept ECG analysis are organized in such a way that in order for a new conclusion to be saved an average RR interval must be specified, representative cardiocycle must be selected, fiducial points must be set and diagnostic conclusion (conclusion text itself) must not be empty.

Manual Analysis menu

- **Representative Complex** command and toolbar button. Use it to call Choose Representative Complex window. Here you can select a representative complex by hand.
- Fiducial points command and toolbar button (**Ctrl+F**). Use it to call Set Fiducial points window, where you can set ECG fiducials manually.
- Manual Conclusion command and toolbar button (**Ctrl+W**). It calls Diagnostic Conclusion Wizard that will help you to write a conclusion using a set of standard diagnostic statements.

Automatic Analysis menu

- Representative Complex command and toolbar button. If you press it, seca CardioConcept creates median representative cardiocycle automatically.
- **Fiducial points** command and toolbar button. If you press it, seca CardioConcept detects the ECG fiducials automatically. If representative cardiocycle is not selected either manually or automatically, this button is disabled.
- Automatic Conclusion command and toolbar button. This button forces seca CardioConcept to generate diagnostic statements for the ECG based on available representative cardiocycle and the set of fiducial points. If no representative cardiocycle and fiducial points are specified, this button is disabled.
- **ECG feature table** command and toolbar button (**Ctrl+T**). It calls ECG Features Table dialogue. This command is only available if seca CardioConcept has performed programmatic ECG feature extraction.

The idea behind coexistence of manual and automatic analysis is to invoke seca CardioConcept automatic diagnostic facilities after performing some crucial steps manually. It helps to make best quality ECG diagnosis right on the display screen.

Tool menu

- **Measurement** command and button on the toolbar (**Ctrl+M**).
- **Zoom** command and button on the toolbar (**Ctrl+Z**).

The commands of this menu switch ECG Display between measurement mode and zoom mode. These modes control how ECG Display responds to mouse clicks. ECG Callipers tool is active in measurement mode thus you can measure time intervals and amplitude differences directly on computer screen. To the opposite, left mouse click acts as zoom-in command and right mouse click acts as zoom-out command in zoom mode. The point you click while zooming in will be approximately in the centre of the window.

View menu

- **ECG** command and toolbar button (**Ctrl+E**).
- Representative complex command and toolbar button (**Ctrl+C**).

These commands turn on/off full curve and median complex ECG representation. You can see both if you wish (see ECG Display section).

- **Scale** command and toolbar combo box. You can set precise "zoom factor" with this combo box. Just select the scale from the list or enter the number into the box and press **ENTER**. Menu command opens the Set Scale dialogue. A special "fit" scale is used to set such a scale when all twelve leads are seen simultaneously.
- **Calibration** command and button.
- **Speed** command and button.

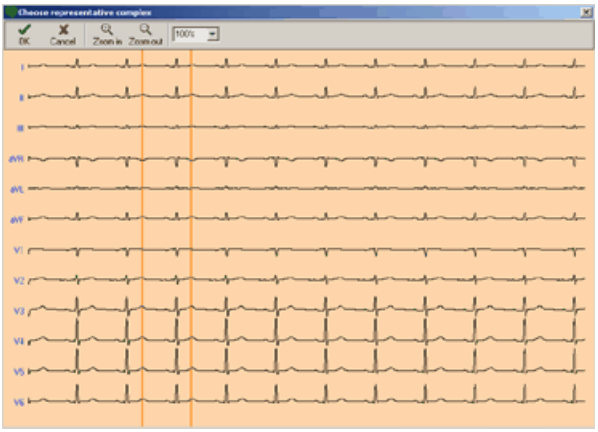
They provide for virtual "amplification" and "paper speed" selection. If you just click the button itself, you change amplification or speed to its default value (1 cm/mV and 50 mm/sec correspondingly). Please note that **Calibration** and **Speed** buttons have arrows on the right. Use them to open lists with available amplification and paper speed values. You can set 0.5 cm/mV, 1.0 cm/mV and 2.0 cm/mV amplification and 5, 10, 12.5, 25, 50, 100 and 200 mm/sec paper speed. The amplification and paper speed you set with these commands are remembered by seca CardioConcept and used next time you open **ECG Viewer**. You should remember that amplification and paper speed are "virtual", i.e. they set curve sizes relative to the paper grid. Unlike a regular analogous ECG curve, digitized ECG signal can be extended to any amplification and paper speed without distortion. In the contrary, zooming changes the visible size of the curves as well as the grid.

- **Markers** command turns on/off small fiducial markers on median complexes.
- **Parameters** panel command turns on/off ECG Features panel.
- **Conclusion** panel command turns on/off Diagnostic Conclusion panel.

You can achieve the same effect by pressing on the panels.

Choose Representative Complex Window

You call this window if you want to select representative cardiocycle manually. This window has large ECG display area and a simple toolbar.

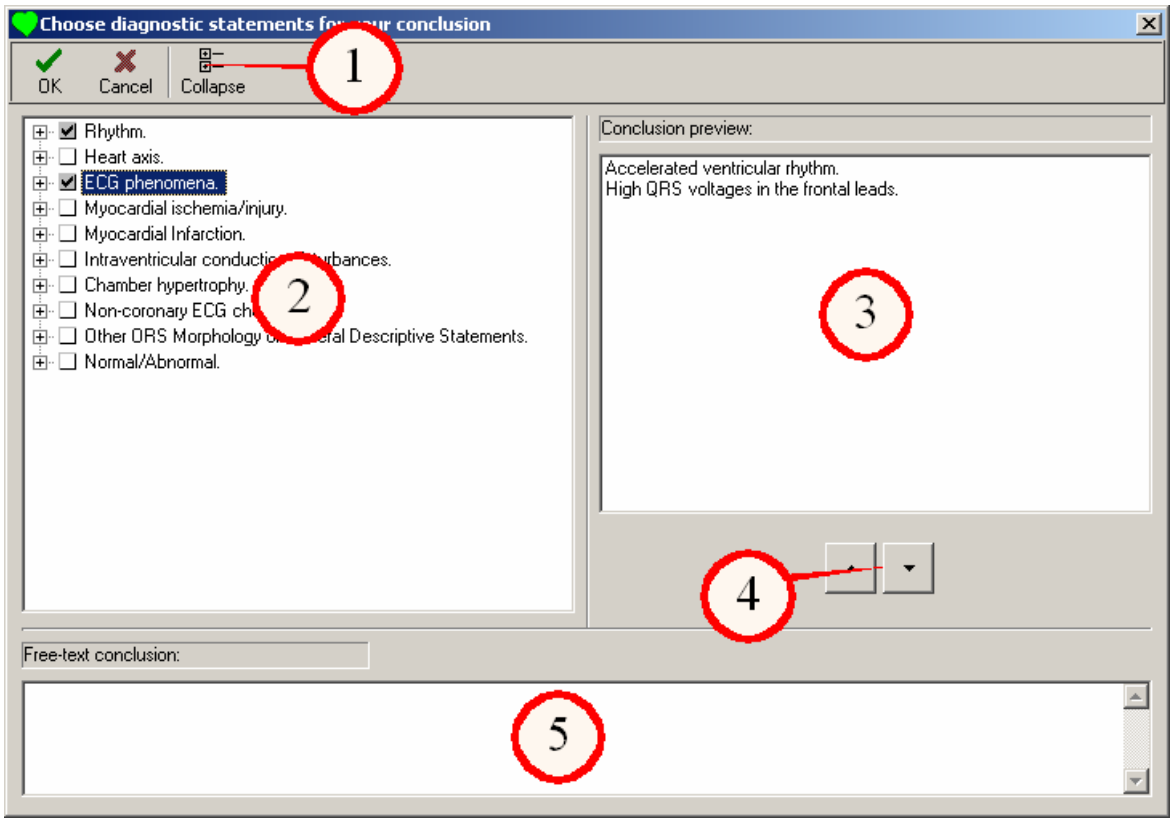


The toolbar has following buttons:

- **OK** button. It saves the selected representative cardiocycle and closes the window.
- **Cancel** button. It closes the window without saving the selected cardiocycle.
- **Zoom-In** and **Zoom-Out** buttons for changing the presentation scale interactively.
- **Presentation Scale** combo box.

If the ECG has not been analysed, the window displays just ECG curves and nothing more. As soon as you click the window, a vertical line appears. The second vertical line appears if you click the window again at another location. These two vertical lines show the borders of representative cardiocycle. You should position the lines so that first one immediately precedes the beginning of the cardiocycle (i.e. right before P wave onset or QRS onset if P wave is not present) and the second should be immediately past the T wave offset. You should choose the cardiocycle of dominant rhythm as free of noise and artifacts as possible and a representative complex to ensure accurate measurements. You can adjust lines positions "dragging" them with the mouse.

Diagnostic Conclusion Wizard



1 Windows Toolbar

It contains the following buttons:

- **OK** button. It closes the window and saves all changes made in diagnostic conclusion.
- **Cancel** button. It closes the window without saving any modifications in diagnostic conclusion.
- **Collapse all** button. Use it if you want to collapse all open branches of statement tree.

2 Diagnostic Statement Tree

It contains all diagnostic statements organized into a hierarchy by categories.

3 Conclusion Preview Area

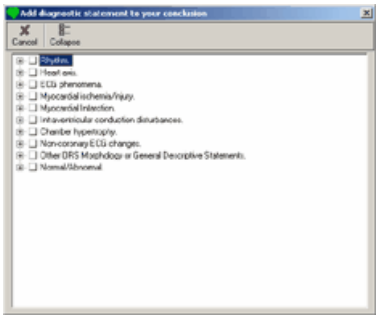
It contains selected standard diagnostic statements in the order they will appear in the conclusion.
If you select a new statement in the tree-view, a check mark will be shown against it in the tree-view and it will be added at the end of the statement list in preview panel on the right . Selecting statement in the preview panel will move the selection point in the tree-view to the corresponding statement. A Set Statement Modifiers dialogues may appear if appropriate when you insert new statements allowing you to add additional qualifiers as "rule out" or "probably old" to the inserted statement.

4 Statement Organizing buttons

Using these buttons below preview panel, you can change the order in which the statements follow each other in the conclusion.

5 Free Text Conclusion AreaIf standard statements are not sufficient to express your diagnostic opinion, you can add arbitrary text conclusion into this edit box. The free text part of the conclusion is added after the standard statement part.

Add Diagnostic Statement to your Conclusion window



This window is opened after you click Add Diagnostic Statement button of the Diagnostic Conclusion panel of New Conclusion window. This window allows you to pick up a specific standard diagnostic statement and quickly add it to your diagnostic conclusion.
The window consists of toolbar and diagnostic statement tree area. If you select a new statement in the tree-view, Set Statement Modifiers dialogues will appear before the new statement will be actually added to the conclusion. After the statement is added, you return to New Conclusion window. Use Add new statement to your conclusion window just to add one or two statements. If the order of the statements is incorrect, you can change it in Diagnostic Conclusion Wizard.

There are two buttons in the window toolbar.

- **Cancel** button. It closes the window without adding any statement to the diagnostic conclusion.
- **Collapse all** button. Use it if you want to collapse all open branches of statement tree.

Rhythm Analysis Workbench

Examination window of Rhythm Analysis Workbench

seca CardioConcept **Rhythm Analysis Workbench** consists of several window types that are used for viewing long ECG recordings, comparing newly acquired ECGs with previous ones and creating new diagnostic conclusions. This type of ECG record (a rhythm analysis ECG record) and these types of windows are particularly suitable for interpreting rhythm disturbances. The Rhythm Viewer is a window of examination window type and contains Examination Toolbar to change the examination type to be viewed. This is the main window of **Rhythm Analysis Workbench** through which you can access all the examinations of the patient currently selected (i.e. the current patient).
Other types of windows you can see while processing ECG examinations are Compare ECGs (rhythm analysis) window and New Conclusion (rhythm analysis) window. It is clear that there is no sense changing the patient or examination type while comparing ECGs or analysing a specific recording. Thus these windows do not contain **Examination Toolbar** and do not have **Examination** menu and **Close** button in the toolbar. There are standard **OK** and **Cancel** buttons on the toolbar of New Conclusion window instead. The toolbar of Compare ECGs window has **OK** button only.

Common features of Rhythm Analysis Workbench windows

ECG Display area

Diagnostic Conclusion panel

ECG Features panel

Quick Navigation panel

ECG Callipers tool

QRS Marker tool and User Marker tool

Specific windows of Rhythm Analysis Workbench

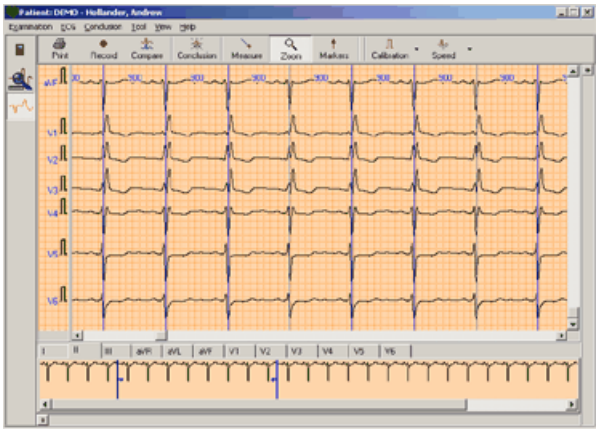
Rhythm Viewer

Compare ECGs (rhythm analysis) window

New Conclusion (rhythm analysis) window

ECG Display area

ECG display of Rhythm Viewer consists of two parts. The leftmost part contains lead names and reference millivolt signals for each displayed lead . You cannot change the size of this part or remove it from the screen. The other part displays full ECG curve. Standard ECG paper grid is present as window's background to make it easier to analyse the curves visually. If you want to make **ECG Display** as large as possible, just hide ECG Features and Diagnostic Conclusion panels.



You can scale the ECG curves with zoom tool.
Use scroll bars to change the visible part of ECG record. The drawing of ECG can be rather lengthy so nothing is changed on the screen while you drag the box on the scroll bar. The visible part of the ECG will change as soon as you release the left mouse button. Use Quick Navigation panel for navigating lengthy rhythm recordings.

Diagnostic Conclusion panel

This panel allows browsing through all diagnostic conclusions attached to a specific ECG recording. There is a special button in the top left corner of the panel that can be used to switch the panel on/off in order to enlarge ECG display area. There is no automatic conclusion for rhythm analysis ECG record. If some re-reading by one or more human experts occurred, created conclusions would be stored in the database. The last one is showed by default. The name of the expert who made the conclusion and the date/time when it was created are displayed in the corresponding fields. Two scroll conclusion buttons provide for browsing through available diagnostic conclusions.
Diagnostic Conclusion panel of New Conclusion (rhythm analysis) window has an additional button. This is Add New Statement button . This button evokes Add Diagnostic Statement to Your Conclusion window.

ECG Features panel

This panel appears in all windows of **Rhythm Analysis Workbench** and contains most important patient information, ECG acquisition parameters and main ECG features. The exact content of the panel varies depending on the window in which it is situated and on examination type that is loaded. There is a special button in the top left corner of the panel that can be used to switch the panel on/off in order to enlarge ECG display area.

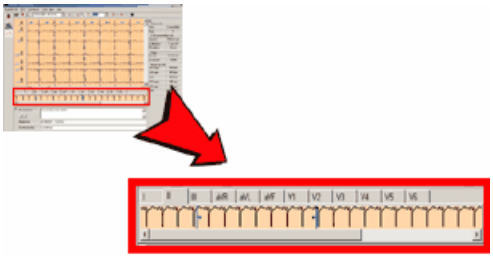
The following patient and ECG acquisition information is shown if has been specified:

- Patient's sex.
- Patient's age.
- Virtual paper speed of ECG display.
- Calibration
- Duration
- Notch filter frequency in effect at acquisition.
- Low-pass filter frequency in effect at acquisition.
- Record duration in seconds.

If rhythm analysis ECG record is loaded, the **ECG Features** panel contains the following ECG features:

- Maximum, minimum and average heart rate in beats per minute.
- Maximum, minimum and average RR interval in milliseconds.

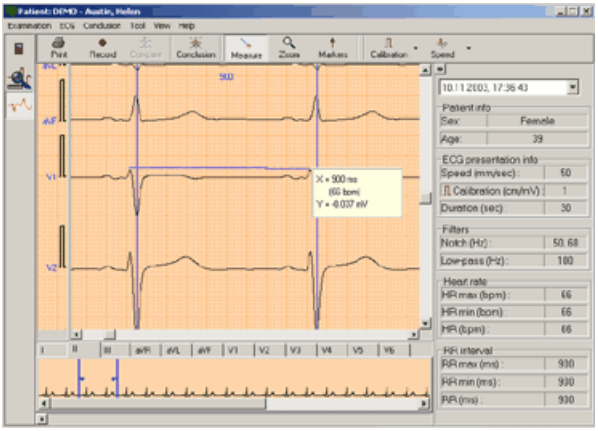
Quick Navigation panel



This panel shows one lead of long ECG record with virtual paper speed 10 mm/sec, so that a lager section of the whole recording is seen. Two blue vertical lines with arrows (aimed towards the visible part of ECG) show the limits of the record part currently displayed in the ECG Display area. Clicking the left mouse button on **Quick Navigation Panel** moves the curves in ECG Display area thus alleviating navigation within the long recording. Sometimes the lead used in **Quick Navigation Panel** is not good enough for navigating a specific ECG. You can easily change it by choosing another tab of **Quick Navigation Panel.**

ECG Callipers tool

The Callipers tool can be used in all Rhythm Viewer, Compare ECGs (rhythm analysis) and New Conclusion (rhythm analysis) windows. Just press Measurement button on the toolbar or use Measurement command of Tool menu and then point somewhere on ECG curve, click left mouse button and drag the cursor to another location at your choice. A line connecting two selected points will appear on the screen together with a small window. Time and amplitude difference between two selected points will be displayed in it. The time difference is presented in two forms for your convenience — as time interval in milliseconds and as the corresponding rate in beats per minute. Please notice that if you drag out of ECG Display the cursor changes and no measurement will be performed.

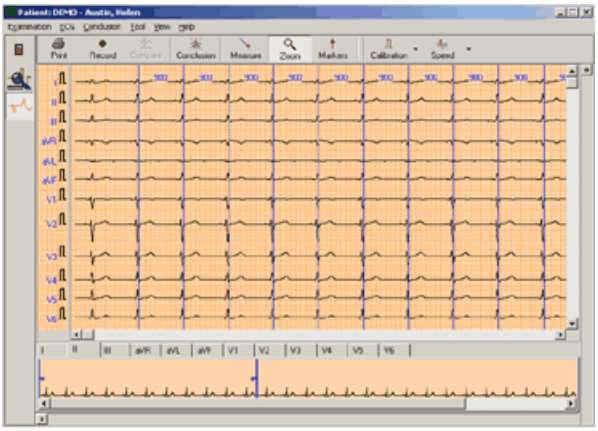


The **Callipers Tool** will allow you to measure and compare time intervals, determine ST segment shift, determine Q-wave amplitude and duration and perform lots of other traditional ECG measurements that are not performed automatically by seca CardioConcept. It is particularly useful in rhythm analysis and in comparison of serial ECG recordings.

QRS Marker tool and User Marker tool

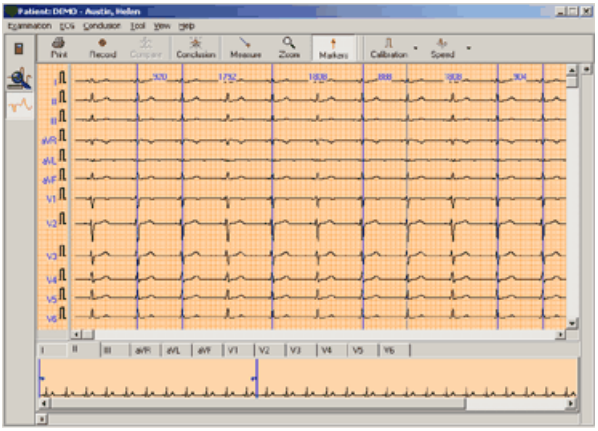
Two tools specific for analysis of long ECG records and especially for rhythm analysis are available in seca CardioConcept. These are **QRS Marker tool** and **User Marker tool** that can be used in Rhythm Viewer and New Conclusion windows of Rhythm Analysis Workbench.

QRS Marker Tool



Blue vertical lines show location of QRS complexes that seca CardioConcept uses for calculation of heart rates and RR-intervals. If the markers you see are placed correctly, the calculations are reliable. You can also easily determine the interval between each two QRS complexes. Turn the QRS marks on and off with **QRS position** command in **View** menu.

User Marker Tool



The ability to set series of marks on specific ECG components is very useful in arrhythmia detection. If you turn on the **User Marker tool** with **Markers** command in **Tool** menu and toolbar button, you will be able to set time marks anywhere on the ECG curves by clicking the left mouse button. The time intervals between every mark pair are displayed in milliseconds automatically. If you do not need a mark any more, just remove it with right mouse click.

Rhythm Viewer

Viewing Rhythm

You will open this window from examination browser, patient browser or smart-cardiograph applications for examining a rhythm analysis ECG record. Normally it appears as working area of an examination window.

Rhythm ECG Viewer

Rhythm Viewer general layout

Rhythm Viewer Menu and Toolbar

Common features of ECG Analysis Workbench windows

ECG Display area

Quick Navigation panel

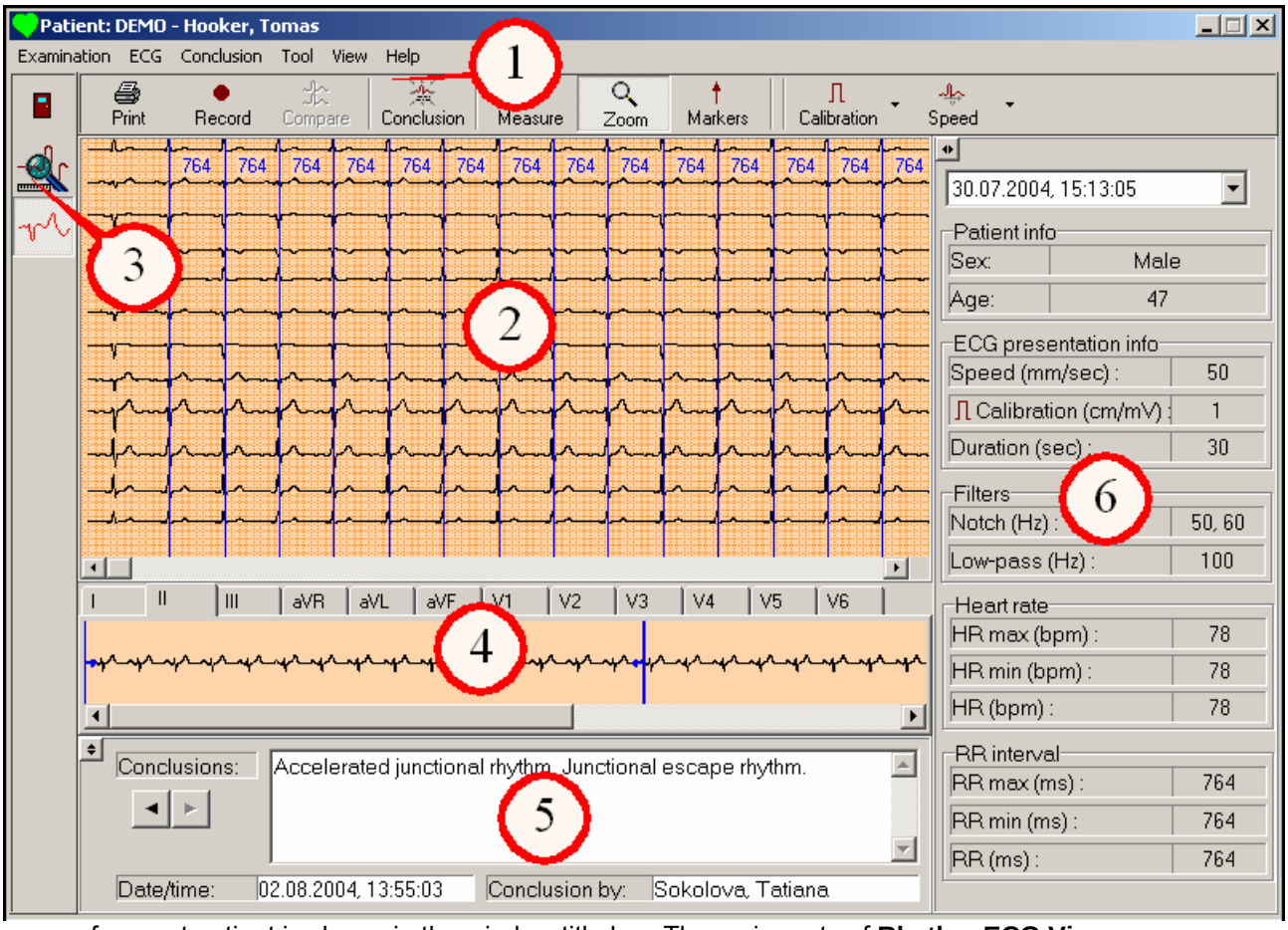
Diagnostic Conclusion panel

ECG Features panel

ECG Callipers tool

QRS Marker tool and User Marker tool

Rhythm Viewer general layout



The name of current patient is shown in the window title bar. The main parts of **Rhythm ECG Viewer** are:

1 Rhythm Viewer Menu and Toolbar

Rhythm Viewer Menu and toolbar will be explained in detail in the corresponding section.

2 ECG Display Area

ECG Display area is the largest part of the window. It is clear that **ECG Display** is intended to show ECG recording.

3 Examination Toolbar

Examination Toolbar with examination icons on it. Current version of seca CardioConcept supports only standard ECG record  and rhythm analysis ECG record  types. You can click an appropriate icon to view examinations of the corresponding type only.

4 Quick Navigation Panel

Quick Navigation Panel shows one lead of long ECG record with virtual "paper speed" 10 mm/sec, so that lager section of the whole recording is seen. Left click on the Quick navigation panel relocates the specified part of ECG into the centre of Rhythm ECG viewer.

5 Diagnostic Conclusion Panel

Diagnostic Conclusionpanel serves for browsing through available diagnostic conclusion and can be minimized in order to enlarge the ECG Display area.

6 ECG Features Panel

ECG Features panel shows main diagnostically relevant patient information and ECG features can be minimized in order to enlarge the ECG Display area. The **ECG Features** panel of **Rhythm Viewer** contains the following ECG features:

- Maximum, minimum and average heart rate in beats per minute.
- Maximum, minimum and average RR interval in milliseconds.

Rhythm Viewer menu and toolbar

Examination menu

- **Close** command and **Close** button on **Examination Toolbar** (**ESC**). This command closes **Rhythm ECG Viewer** and returns to Patient Browser or Examination Browser (whichever has evoked **Rhythm ECG Viewer** window).
- Items to select examination type with the corresponding icons on the Examination Toolbar.
- **Export** command allows to save examination with patient information or to save examination with anonymous patient.
- **Mail client** command. If Mail Client is not installed on your computer, this button is disabled.

ECG menu

- **Print** command and **Print** button on the toolbar (**Ctrl+P**). There is a difference between menu command and toolbar button. The menu command invokes Print ECG dialogue that allows you to select printing device and protocol template before actually start printing. Thus it is much more flexible but it takes more time and "mouse clicks" in order to print an examination report. Toolbar button just prints the report on the current examination using default protocol template on the printer set as system default (default printer name is shown in the tool tip of this button).
- **Record** command and **Record** button on the toolbar (**Ctrl+R**). This icon evokes Smart Cardiograph application in order to register new ECG for currently selected patient in rhythm analysis mode.
- **Compare** command and **Compare** button on the toolbar (**Ctrl+O**). It invokes Compare ECG window. You normally use it if you want to perform serial analysis of ECG records of the same patient.
- **ECG List** command (**Ctrl+L**) and **ECG List** combo box on the toolbar. You can use it to walk through examinations of currently selected type that are available for the current patient. The difference is that **ECG List** menu command opens Choose ECG dialogue.
- **Send to consultation command**. This command opens Compose request dialogue that is used for sending currently viewed ECG for consultation via the Internet Mail. If Mail Client is not installed on your computer, this button is disabled.

Conclusion menu

- **New** command and **Write New conclusion** button on the toolbar (**Ctrl+N**). This command invokes New Conclusion window if you want to make a new diagnostic conclusion.
- **Previous/Next** command and buttons on Diagnostic Conclusion panel. Use it to browse through diagnostic conclusions stored in database.

Tool menu

- **Measurement** command and button on the toolbar (**Ctrl+M**).
- Zoom command and button on the toolbar (**Ctrl+Z**).

Commands of this menu switch between measurement mode and zoom mode. These modes control how ECG Display responds to mouse clicks. ECG Callipers tool is active in measurement mode thus you can measure time intervals and amplitude differences directly on computer screen. To the opposite, left mouse click acts as zoom-in command and right mouse click acts as zoom-out command in zoom mode. The point you click will be approximately in the centre of the window.

- **Markers** command and button on the toolbar (**Ctrl+K**). This command turns on the user markers mode, i.e. it turns on User Marker tool. The **User Marker tool** is used only for rhythm ECG record.

View menu

- **Scale** command and toolbar combo box allow you to zoom the ECG. You can set precise "zoom factor" with this combo box. Just select the scale from the list or enter the number into the box and press **ENTER**. Menu command opens the Set Scale dialogue. A special "fit" scale is used to set such a scale when all twelve leads are seen simultaneously.
-  **Calibration** command and button.
-  **Speed** command and button.

They provide for virtual "amplification" and "paper speed" selection. If you just click the button itself, you change amplification or speed to its default value (1 cm/mV and 50 mm/sec correspondingly). Please note that **Calibration** and **Speed** buttons have arrows on the right. Use them to open lists with available amplification and paper speed values. You can set 0.5 cm/mV, 1.0 cm/mV and 2.0 cm/mV amplification and 5, 10, 12.5, 25, 50, 100 and 200 mm/sec paper speed. The calibration and paper speed you set are remembered by seca CardioConcept. They will be used next time you open **Rhythm Viewer**. You should remember that amplification and paper speed are "virtual", i.e. they set curve sizes relative to the paper grid. Unlike a regular analogous ECG curve, digitized ECG signal can be extended to any amplification and paper speed without distortion. In the contrary, zooming changes the visible size of the curves as well as the grid.

- **Navigation lead** submenu allows you to select the lead used in Quick Navigation panel.
- **QRS positions** command turns on/off blue lines that show location of QRS complexes as detected by seca CardioConcept software. See section QRS Marker tool for details.
- **Parameters** panel command turns on/off ECG Features panel.
- **Conclusion** panel command turns on/off Diagnostic Conclusion panel.

You can reach the same effect using  buttons on the panels.

- **Colours** command evokes Choose Colours for Viewer dialogue. It allows you to select colours for ECG representation elements (ECG curves, grid etc.).

Compare Rhythm window

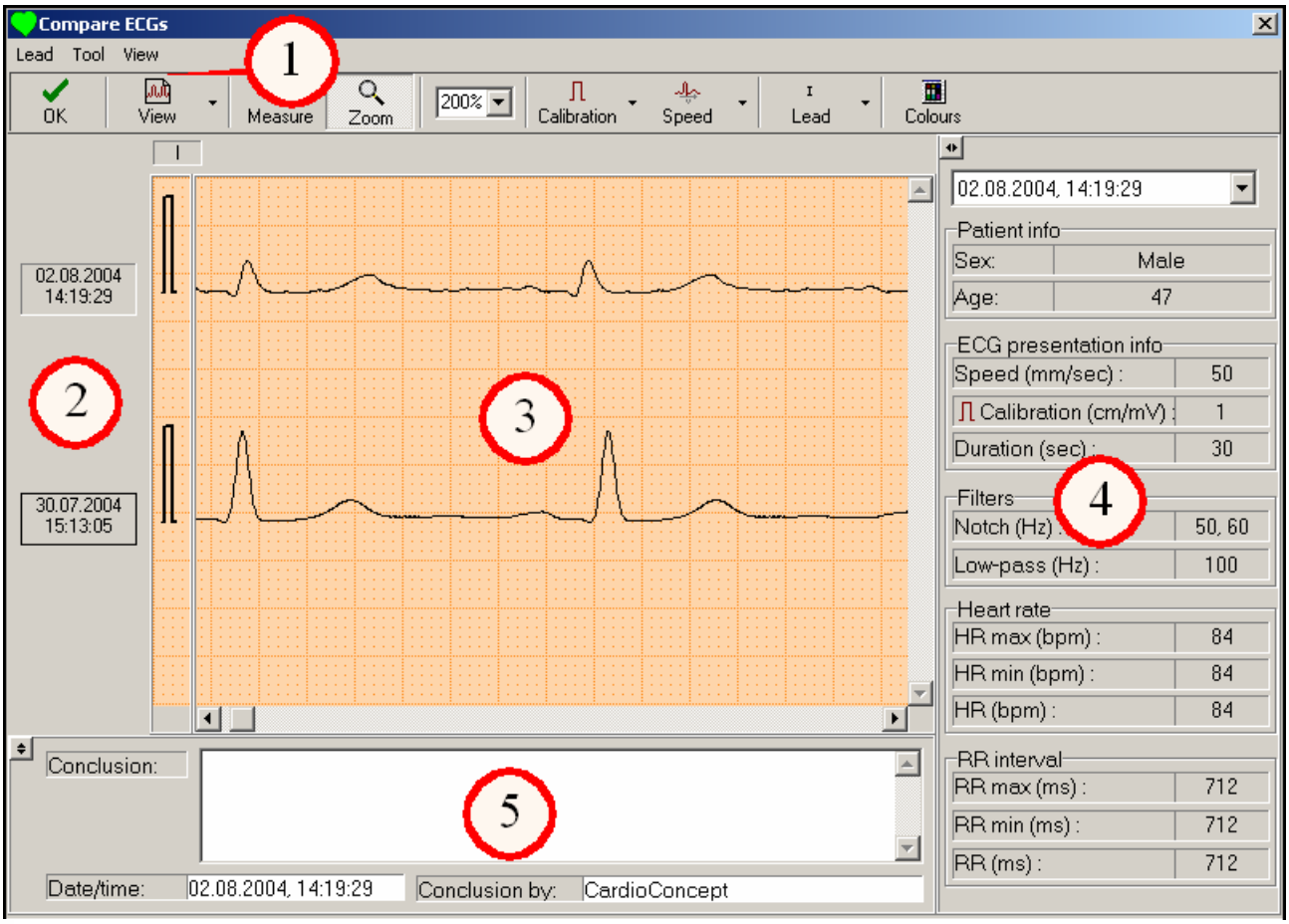
Comparing Rhythm

This window is intended to help in analysing a series of up to four long ECGs, i.e. rhythm analysis ECG records. The programme shows the current recording and up to three previous ones. A vertical panel on the left side of the application window contains label boxes with date and time of ECGs being compared. One of the boxes looks sunken which indicates the currently selected ECG record. The conclusion and ECG featuresof the selected ECG are displayed on the corresponding ECG Features and Diagnostic Conclusion panels.

Compare ECG window layout

Compare ECG window menu and toolbar

Compare Rhythm window layout



1 **Menu and Toolbar**

Menu and Toolbar is explained in detail in the corresponding section.

2 **ECG Labels Panel**

The "sunken" label indicates the currently selected ECG.

3 **ECG Display Area**

ECG Display area shows selected lead of compared ECGs.

4 **ECG Features Panel**

In addition to a standard **ECG Features** panel it contains a combo box with the list of ECGs being compared and shows features of the ECG selected in this combo.

5 **Diagnostic Conclusion Panel**

Diagnostic Conclusion panel shows the diagnostic conclusion of the currently selected ECG.

Compare Rhythm window menu and toolbar

Standard **OK** button closes the window and returns to ECG Viewer.

Lead menu

Current lead button and the corresponding command. It is used to set the compared lead.

Tool menu

- **Measurement** command and button on the toolbar (**Ctrl-M**).
- **Zoom** command and button on the toolbar (**Ctrl+Z**).

Commands of this menu switch between measurement mode and zoom mode. These modes control how ECG Display responds to mouse clicks. ECG Callipers tool is active in measurement mode thus you can measure time intervals and amplitude differences directly on computer screen. To the opposite, left mouse click acts as zoom-in command and right mouse click acts as zoom-out command in zoom mode. The point you click while zooming in will be approximately in the centre of the window.

View menu

- **Scale** command and toolbar combo box. You can set precise "zoom factor" with this combo box. Just select the scale from the list or enter the number into the box and press **ENTER**. Menu command opens the Set Scale dialogue. A special "fit" scale is used to set such a scale when all twelve leads are seen simultaneously.
- **Calibration** command and button.
- **Speed** command and button.

They provide for virtual "amplification" and "paper speed" selection. If you just click the button itself, you change amplification or speed to its default value (1 cm/mV and 50 mm/sec correspondingly). Please note that **Calibration** and **Speed** buttons have arrows on the right. Use them to open lists with available amplification and paper speed values. You can set 0.5 cm/mV, 1.0 cm/mV and 2.0 cm/mV amplification and 5, 10, 12.5, 25, 50, 100 and 200 mm/sec paper speed. The calibration and paper speed you set are remembered by seca CardioConcept. They will be used next time you open **Rhythm Viewer**. You should remember that amplification and paper speed are "virtual", i.e. they set curve sizes relative to the paper grid. Unlike a regular analogous ECG curve, digitized ECG signal can be extended to any amplification and paper speed without distortion. In the contrary, zooming changes the visible size of the curves as well as the grid.

- Parameters panel command.
- Conclusion panel command.

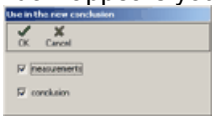
These commands and panel buttons hide/show the corresponding panels.

- **Colours** command evokes Choose colours for viewer dialogue It allows you to select colours for ECG representation elements (ECG curves, grid etc.).

New Rhythm Conclusion window

Creating new conclusions on rhythm ECG records

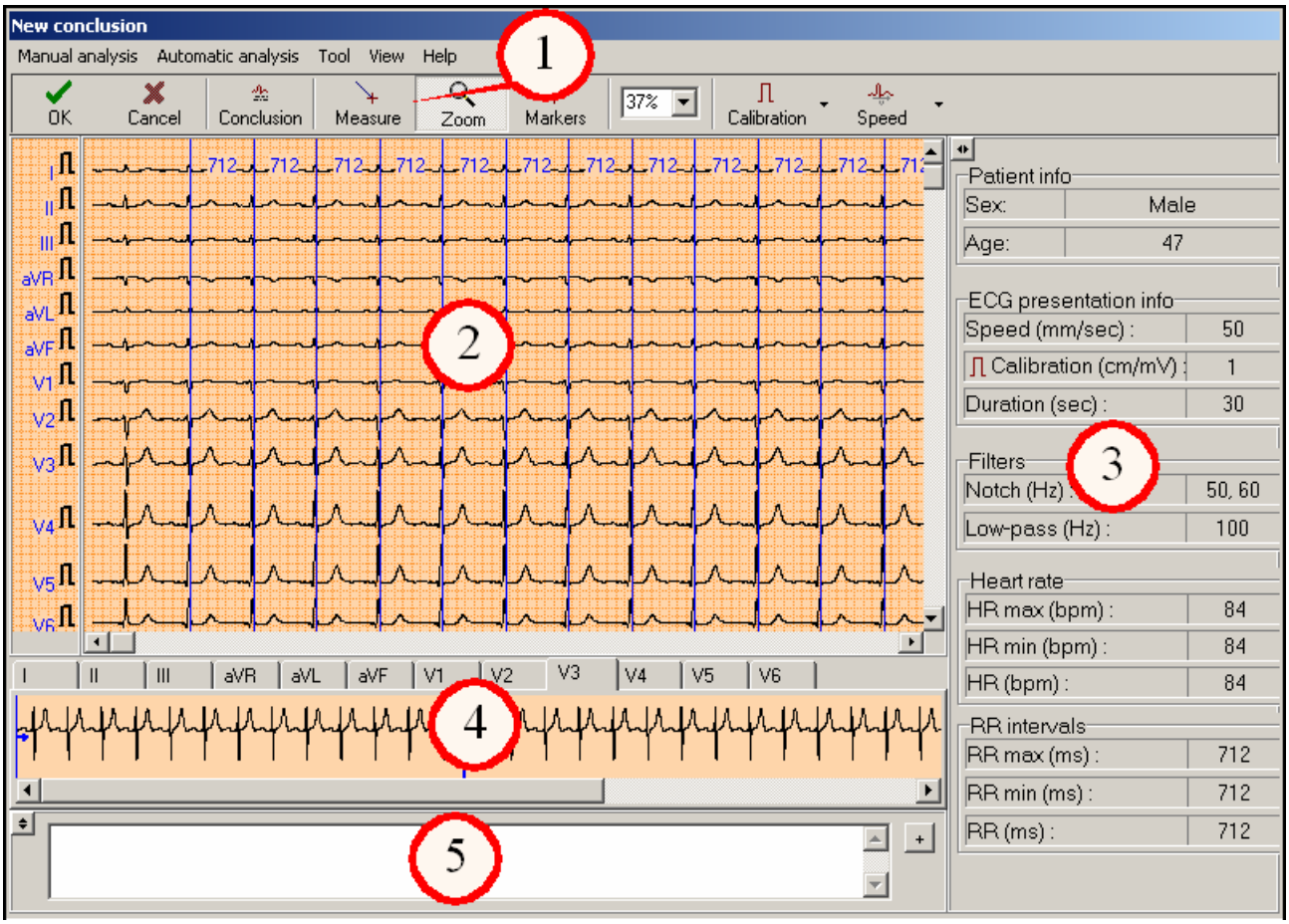
You normally get a rhythm analysis ECG record acquired in case of severe arrhythmia, bradicardia due to AV-block or any other conditions in which the 10-second standard ECG record is not satisfactory. The automatic diagnostic interpretation is limited to QRS detection and basic heart rate (RR) computations. From the other hand, seca CardioConcept provides you with useful tools to enhance your ability to cope with difficult cases of complex rhythm disturbances. **New Conclusion** window for rhythm analysis is similar to New Conclusion window of Standard ECG Analysis Workbench . Before **New Conclusion** window appears you will see **Use In New Conclusion** dialogue.



Set the check boxes to specify which part of existing conclusion should be used as template for the new one. You can specify measurements and conclusion, measurements only or none.

This section acquaints you with New Rhythm Conclusion window layout and New Rhythm Conclusion window menu and toolbar.

New Rhythm Conclusion window layout



The window has the following parts:

1 Menu and Toolbar

Menu and Toolbar is fully described in the corresponding section.

2 ECG Display Area

ECG Display area.

3 ECG Features Panel

ECG Features panel.

4 Quick Navigation Panel

Quick Navigation Panel shows one lead of long ECG record with virtual "paper speed" 10 mm/sec, so that lager section of the whole recording is seen.

5 Diagnostic Conclusion Panel

Diagnostic Conclusion panel.

New Rhythm Conclusion window menu and toolbar

Standard **OK** and **Cancel** buttons on the toolbar. **OK** stores the newly created conclusion into the database and **Cancel** discards any modifications made. Both buttons close the window.

Manual Analysis menu

- **Conclusion** command and toolbar button (**Ctrl+W**). It calls Diagnostic Conclusion Wizard.

Automatic Analysis menu

- **Detect QRS positions** command. This is the only automatic analysis option for a rhythm analysis ECG record. If you have the ECG acquired with Analyse option unchecked in the Smart Cardiograph, you can get the QRS positions detected by seca CardioConcept. The maximum, minimum and mean heart rate (together with maximum, minimum and mean RR intervals) are calculated automatically after that.

Tool menu

- **Measurement** command and button on the toolbar (**Ctrl+M**).
- **Zoom** command and button on the toolbar (**Ctrl+Z**).

Commands of this menu switch between measurement mode and zoom mode. These modes control how ECG Display responds to mouse clicks. ECG Callipers tool is active in measurement mode thus you can measure time intervals and amplitude differences directly on computer screen. To the opposite, left mouse click acts as zoom-in command and right mouse click acts as zoom-out command in zoom mode. The point you click will be approximately in the centre of the window.

- **Markers** command and button on the toolbar (**Ctrl+K**). This command turns on the user markers mode, i.e. it turns on User Marker tool. The **User Marker tool** is used only for rhythm analysis ECG record.

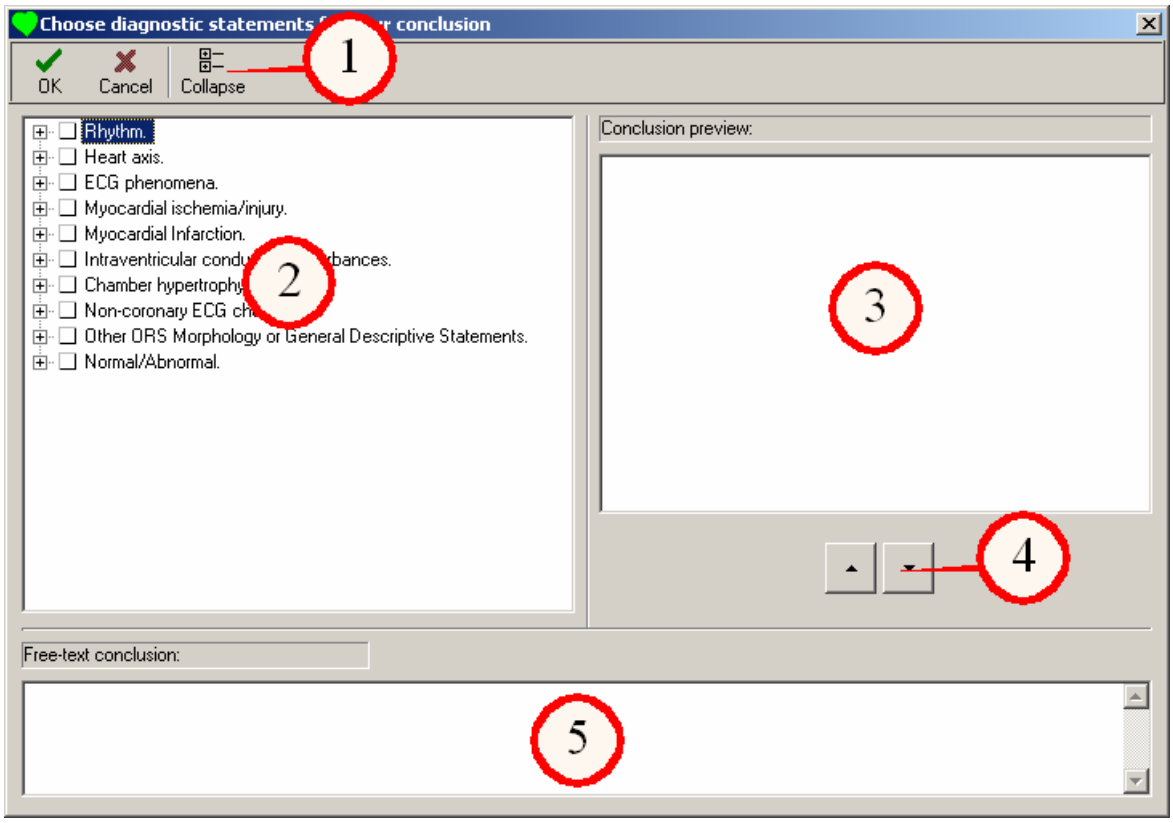
View menu

- **Scale** command and toolbar combo box. You can set precise "zoom factor" with this combo box. Just select the scale from the list or enter the number into the box and press **ENTER**. Menu command opens the Set Scale dialogue. A special "fit" scale is used to set such a scale when all twelve leads are seen simultaneously.
- **Calibration** command and button.
- **Speed** command and button.

They provide for virtual "amplification" and "paper speed" selection. If you just click the button itself, you change amplification or speed to its default value (1 cm/mV and 50 mm/sec correspondingly). Please note that **Calibration** and **Speed** buttons have arrows on the right. Use them to open lists with available amplification and paper speed values. You can set 0.5 cm/mV, 1.0 cm/mV and 2.0 cm/mV amplification and 5, 10, 12.5, 25, 50, 100 and 200 mm/sec paper speed. The calibration and paper speed you set are remembered by seca CardioConcept. They will be used next time you open **Rhythm Viewer**. You should remember that amplification and paper speed are "virtual", i.e. they set curve sizes relative to the paper grid. Unlike a regular analogous ECG curve, digitized ECG signal can be extended to any amplification and paper speed without distortion. In the contrary, zooming changes the visible size of the curves as well as the grid.

- **QRS positions** command turns on/off blue lines that shows location of QRS complexes as detected by seca CardioConcept software. See section QRS Marker tool for details.
- **Parameters** panel command turns on/off ECG Features panel.
- **Conclusion** panel command turns on/off Diagnostic Conclusion panel.

Diagnostic Conclusion Wizard



1 Windows Toolbar

It contains the following buttons:

- **OK** button. It closes the window and saves all changes made in diagnostic conclusion.
- **Cancel** button. It closes the window without saving any modifications in diagnostic conclusion.
- **Collapse all** button. Use it if you want to collapse all open branches of statement tree.

2 Diagnostic Statement Tree

It contains all diagnostic statements organized into a hierarchy by categories.

3 Conclusion Preview Area

It contains selected standard diagnostic statements in order they will appear in the conclusion.
If you select a new statement in the tree-view, a check mark will be shown against it in the tree-view and it will be added at the end of statement list in preview panel on the right. Selecting statement in the preview panel will move the selection point in the tree-view on the corresponding statement. A Set Statement Modifiers dialogues will appear if appropriate when you insert new statements allowing you to add additional qualifier as "rule out" or "probably" old to the inserted statement.

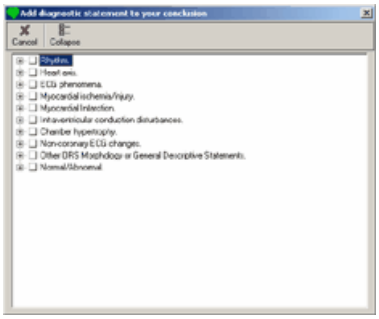
4 Statement Organizing Buttons

Using these buttons below preview panel, you can change the order in which the statements follow each other in the conclusion.

5 Free Text Conclusion Area

If standard statements are not sufficient to express your diagnostic opinion, you can add arbitrary text conclusion into this edit box. The free text part of the conclusion is added after the standard statement part.

Add Diagnostic Statement Window



This window is opened after you click Add Diagnostic Statement button of the Diagnostic Conclusion panel of New Conclusion window. This window allows you to pick up a specific standard diagnostic statement and quickly add it into your diagnostic conclusion.
The window consists of toolbar and diagnostic statement tree area. If you select a new statement in the tree-view, Set Statement Modifiers dialogues will appear before the new statement will be actually added to the conclusion. After the statements is added, you return to New Conclusion window. Use Add new statement to your conclusion window just to add one or two statements. If the order of the statements is incorrect, you can change it in Diagnostic Conclusion Wizard.

There are two buttons in the window toolbar.

- **Cancel** button. It closes the window without adding any statement to the diagnostic conclusion.
- **Collapse all** button. Use it if you want to collapse all open branches of statement tree.

Telemedical Workbench

seca CardioConcept telemedical functionality

seca CardioConcept can be used to exchange ECG recordings and diagnostic conclusions via the Internet as a special type e-mail messages. A special module is used for this purpose. This module is called **Mail client**. If you are not aware of electronic mail, first see the section Understanding electronic mail basics and Understanding telemedical model.This section will explain the use of **Mail client** layout, menu commands and dialogues that are needed for telemedical ECG exchange.

Mail client window layout

Mail client menu and toolbar

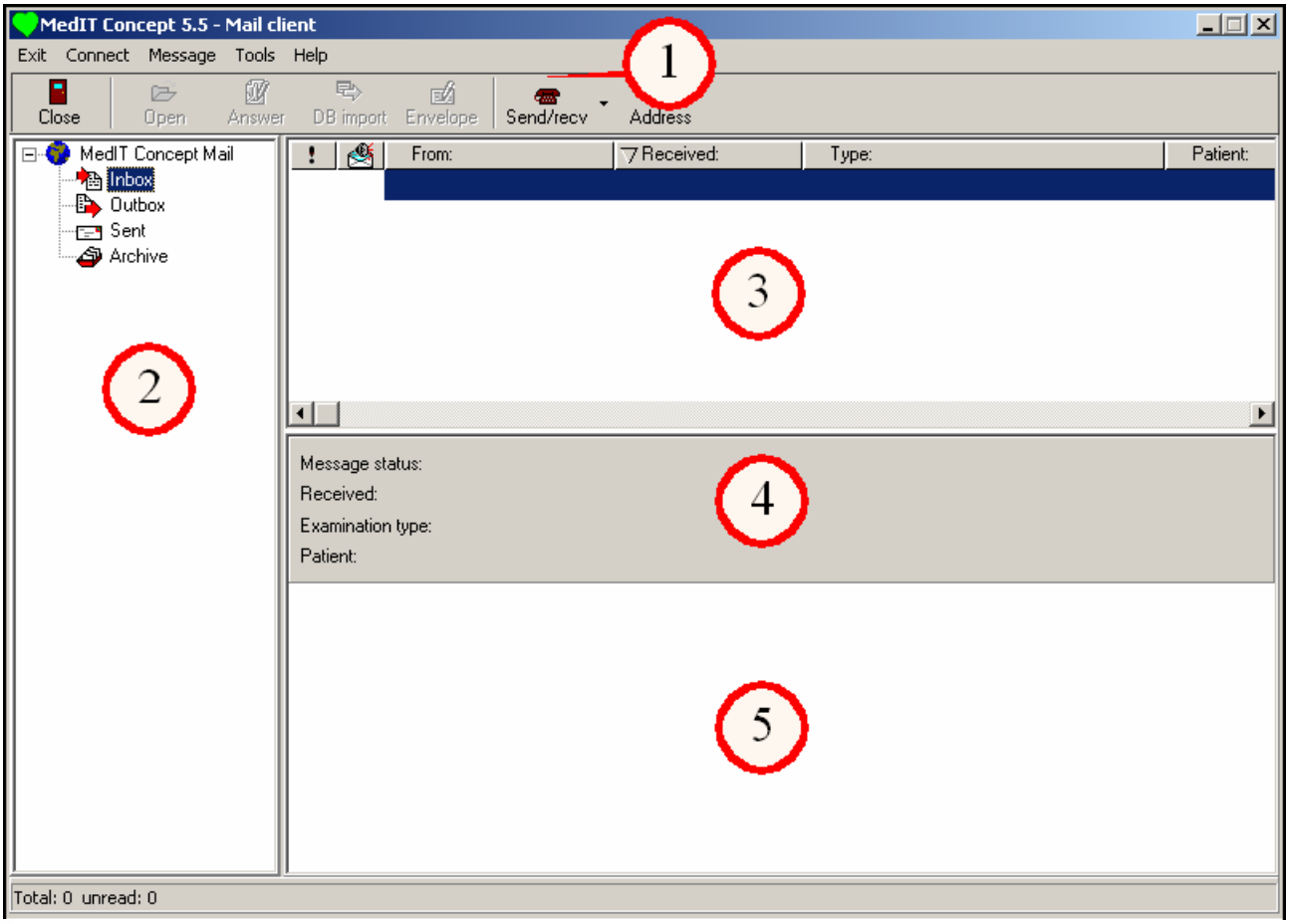
Envelope dialogue

Compose request dialogue

Edit address entry dialogue

Address book dialogue

Mail Client layout



1 Menu and toolbar

Mail Client menu and toolbar.

2 The Tree of Directories

It is for storing different message types. These are **Inbox** folder contains just received messages; **Outbox** folder contains messages prepared for sending; **Sent** folder contains messages just sent and **Archive** folder contains messages passed through the complete processing (i.e. these are either sent requests with received answers or received requests with sent answers). These messages include ECGs, which were requested, and texts of requests and answers. If you select a folder on the tree, you can work with ECG messages contained in that folder.

3 The List of Messages

The messages are stored in the currently selected folder.
The list is organized in columns.

- First column marked with exclamation sign contains the icon if the message is marked as an urgent one.
- The second column shows the type of the message and its processing status. The processing status shows the stage of consulting cycle (sending to consulting, examining by the consultant, receiving the consultant's answer and etc.) Several icon types are used for it. The icon indicates the outbox or inbox message contains a request. The icon is used for sent requests with delivery confirmation and the icon shows the messages contain consulting results. And this icon indicates the outbox message includes the answer to the request. Achieved messages are not marked graphically. The confirmed answers at the consultant's side become achieved automatically. The received answers at being consulted side become achieved manually only after the browsing.
- The third column contains the sender's or the receiver's address. It depends on message status.
- The forth column indicates the date and time a message has reached the corresponding processing status.
- The fifth column contains the examination type of ECG attached to the message.

- The last column shows the patient name.

Clicking the column header sorts the message by data in this column. Subsequent clicks change the sorting order from ascending to descending and vice versa.
Double-clicking the selected message opens the ECG attached to the message in the examination window.

4 The Header Panel

It contains the following fields for currently selected message:

- Processing status field. Status of the message can be one of the following:
  - "Request - prepared" - request has been prepared and is ready for sending
  - "Request - sent" - request has been sent
  - "Request - sent, confirmation received" - request has been sent and confirmation has been received from the addressee about delivery of the message
  - "Request - received" - request has just been received
  - "Request - received, confirmation sent" - request has just been received and confirmation has been sent to the addresser about delivery of the message
  - "Answer - prepared" - answer has been prepared and is ready for sending
  - "Answer - sent" - answer has been sent
  - "Answer - sent, confirmation received" - answer has been sent and delivery confirmation has been received from the addressee
  - "Answer - received" - answer has just been received
  - "Answer - received, confirmation sent" - answer has just been received and delivery confirmation has been sent to the consultant
  - "Request - achieved" - processing cycle of the request is over, answered request is stored in archive
  - "Answer - achieved" - processing cycle of the answer is over, answered request is forwarded to archive
- Time stamp. It indicates the date and time the message has reached the processing status as indicated in the previous field.
- Examination type of the main examination in the envelope.
- Patient's name.

5 Messages Body Panel

It contains two text fields that are associated with every message. The **request message** is filled in while preparing the outcoming envelope and normally contains the information that explains the consultation goal and patient's conditions. The **answer message** contains the recommendation of the expert that cannot be expressed in standard ECG diagnostic conclusion. These fields can be filled by using Envelope dialogue (see Envelope dialogue).

Mail Client menu and toolbar

Connect menu

- **Send** (**Ctrl+S**) and **Receive** (**Ctrl+V**) commands and **Send/Receive messages** combo button on the toolbar. Use these commands to connect with your Internet Service Provider and send/receive messages via the e-mail server. Small down arrow on **Send/Receive messages** combo button opens a list with **Send** and **Receive** items that stands for the corresponding menu commands. If you click the **Send/Receive messages** combo button itself, a *combined delivery* will be initiated, i.e. seca CardioConcept will connect to the server, and receive the available messages first and send queued messages afterwards.

Message menu

- **Answer** command (**Ctrl+A**) and toolbar button. It opens ECG examination window with all the recordings of the current message in order to make ECG diagnostics, i.e. to create an answer. You can analyse ECG in the same way as if they are stored in seca CardioConcept database.
- Envelope command (**Ctrl+E**) and toolbar button. It opens Envelope dialogue for the currently selected message.
- Open command (**Ctrl+O**) and toolbar button opens the ECGs in the current message in the ECG examination window without generating an answer message. You can reach the same effect double clicking the string with the message in the message list.

Delete command (**Ctrl+O**). You can delete a message in most cases. But you cannot delete the request sent to consulting if you haven't received the answer to it.

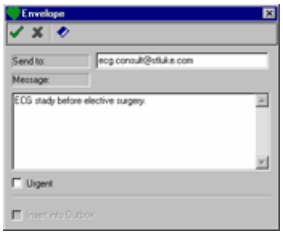
- **Save into database** command **(Ctrl+Alt+I)** and toolbar button allow to store a message into seca CardioConcept database.

Tools menu

- **Export** command. Clicking the arrow, which is to the right of the menu, you can open the format list, where you are able to export ECG. In this version of seca CardioConcept export is possible only in the specific format. as file CBM. Using this command you can save the mail message as a file at the hard disk or diskette. In launching Export message as... dialogue opens, if you want to export a message, which contains both a request and an answer, but if you are exporting a message that contains only a request this command will invoke a standard Windows dialogue **Save mail message as file**.
- **Import** command allows to import ECG from mail message file into database. It opens a standard Windows dialogue, where you can choose a file from importing.
- **Add to address book** command and **Address book** button open Edit address entry and Address book windows. These windows are used for entering, saving and editing the recipients' e-mail addresses.

Envelope Dialogue

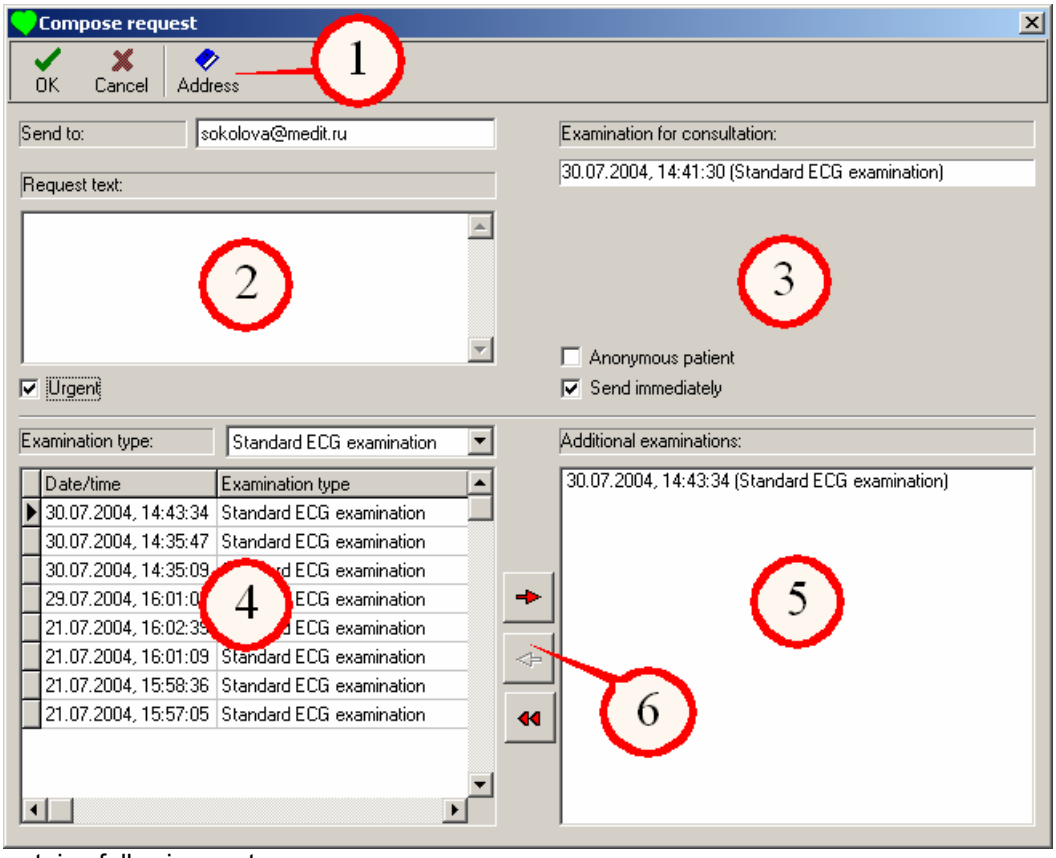
This dialogue is used for editing message envelope within the **Mail client**.



Standard **OK** and **Cancel** buttons close the dialogue saving or discarding changes correspondingly. You can change recipient's e-mail address and the message text for request or answer depending on the message type. The **Urgent** check box marks the message as an urgent one. The check box **Put into Outbox** marks the message as ready for delivery and places it into **Outbox** (only for requests, received by consultant, with answer already prepared). If you do not check this box, the message will remain in its folder and will not be sent. Afterwards you can drag it into the **Outbox** folder using the mouse. This check box becomes inaccessible when you are editing the message , which is already in the **Outbox** folder.

Compose Request Dialogue

This dialogue allows you to prepare an examination (possibly, accompanied by several examinations of the same or another type) to be send to remote consulting service.



The dialogue contains following parts.

1 Dialog Toolbar

Dialogue toolbar with standard **OK** and **Cancel** buttons. **OK** button puts the created message into **Outbox**. The entered data are checked before sealing the envelope. And if there is an error, an explanation will appear.

2 Request Text Field

Place here any additional information you think is valuable for ECG re-reading by the consultant.

3 Time Mark

The field shows the date and time of acquisition for the examination to be sent.

4 The List of Available Examinations

It can be considered as previous relative to the examination to be sent. Use the combo to choose desired examination type. So you can add one or several previously recorded ECGs to the examinations to be sent for better comparison.

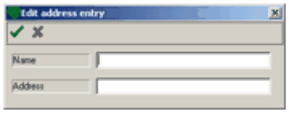
5 The List of Previous Examinations

It is a list of examinations, which are already added to the message.

6 The Arrow Buttons

Use these arrows to add/remove examinations to/from the message. The arrow buttons are enabled/disabled depending on the availability of items in the left and right lists and on which list has the focus.

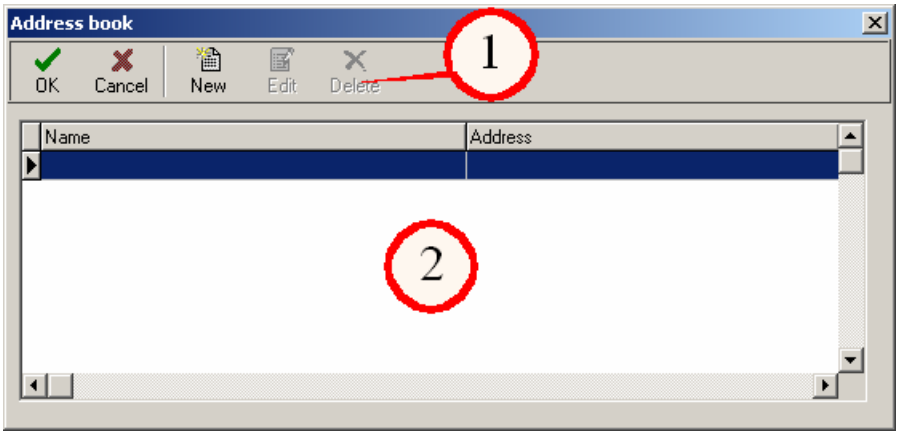
Edit address entry dialogue



Here you can edit consultant's name or address in the address book (or create new one's data).

Standard **OK** and **Cancel** buttons close the window saving or not modifications correspondingly. You can change the consultant's record in the appropriate **Name** and **Address** fields.

Address book dialogue



This dialogue allows to enter new information about the consultant, edit or delete it.
The dialogue consists of the following parts:

1 Toolbar

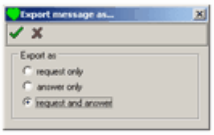
- Standard **OK** and **Cancel** buttons close the window saving or not modifications correspondingly.
- This is **New entry** toolbar button.
- This is **Edit entry** toolbar button.
  Both these buttons open Edit address entry window, which allow to enter new consultant data or to change the current selected one's data.
- This is **Delete entry** toolbar button. It removes the consultant record and all the information about him. Before the record is to be deleted a message asking for a confirmation of deleting appears.

2 The List of Existing Consultants' Data

This list is organized in two columns:

- The first column contains consultant's name.
- The second one shows consultant's address.

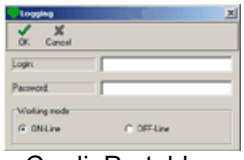
Export message as dialogue



This dialogue allows you to export messages, which contain both a request and an answer.
Standard **OK** and **Cancel** buttons close the window exporting the message or not correspondingly.
Set the radio button to specify what part of the message you want to save: a request only, an answer only or both a request and an answer.

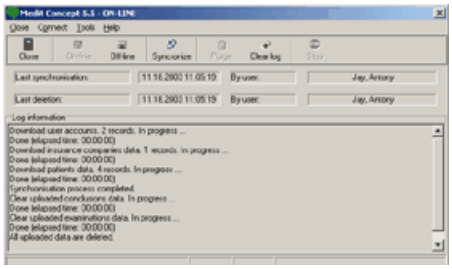
CardioPortable Module

New Login Window



It is probably the first thing you note after installing CardioPortable.
It has "Working mode" radio-button group for operating mode selection in addition to the Login and Password fields. Two radio-buttons correspond to ON-line and OFF-line mode respectively. Please note that a login error can occur in two cases now. First, you can mistype you login name or password. Second, if network is not available and you trying to start the programme in on-line mode, it is impossible to connect to the master database (see the section Error messages and troubleshooting).

CardioPortable Control Window



This window contains the following controls:

Close menu

Standard **Close** button and **Close** command with obvious function.

Connect menu

- The buttons and corresponding commands for switching between on-line and off-line modes. Normally only one of the buttons is enabled, e.g. the **Switch On-line** button in off-line mode and vice versa.
- Both buttons are active if seca CardioConcept application is not connected to any database (e.g. if user entered a wrong password). The programme is in kind of "undefined" mode in this case and may select any of them.
- **Synchronize** button on the toolbar and **Synchronize** command. It is clear that these button and command can be used for launching synchronization.
- Info fields that show date and time of the last synchronization and the name of the user that performed the action.
- **Stop** button and the corresponding command. It terminates synchronization process as soon as the current record is transferred. This function can be useful in case an urgent need for ECG machine occurs right in the course of data transmission.

Tools menu

- **Purge synchronized data** button and the corresponding command.
- Info fields that show the time of the last deletion and the name of the user that performed the action.
- **Clear log** button and the corresponding command. You can delete all messages from the log by clicking this button.
- **Log information** area that shows the messages in synchronization log file. If some messages are hidden, you can use scroll bar to make them visible.
- **Work time indicators**—the fields **Elapsed time** and **Estimated time**. During synchronization these fields show actual time elapsed from the start of the process and full time estimation calculated on the data transferred rate so far.

- Check box **Autodelete synchronized data**. If this option is on, all the data successfully transferred to the master database is deleted from the local base. Otherwise, the programme prompts for purging the local database every time synchronization completes.

seca CardioConcept configuration utilities

User Administration

Administering user accounts

This module is used to manage user accounts. A user account is a special record in the database that contains user information and access rights. It is referenced when ECG or conclusion is saved in the database (to let you know who recorded an ECG or made a conclusion). It is also used by seca CardioConcept to prevent unauthorized access to data or data modification.

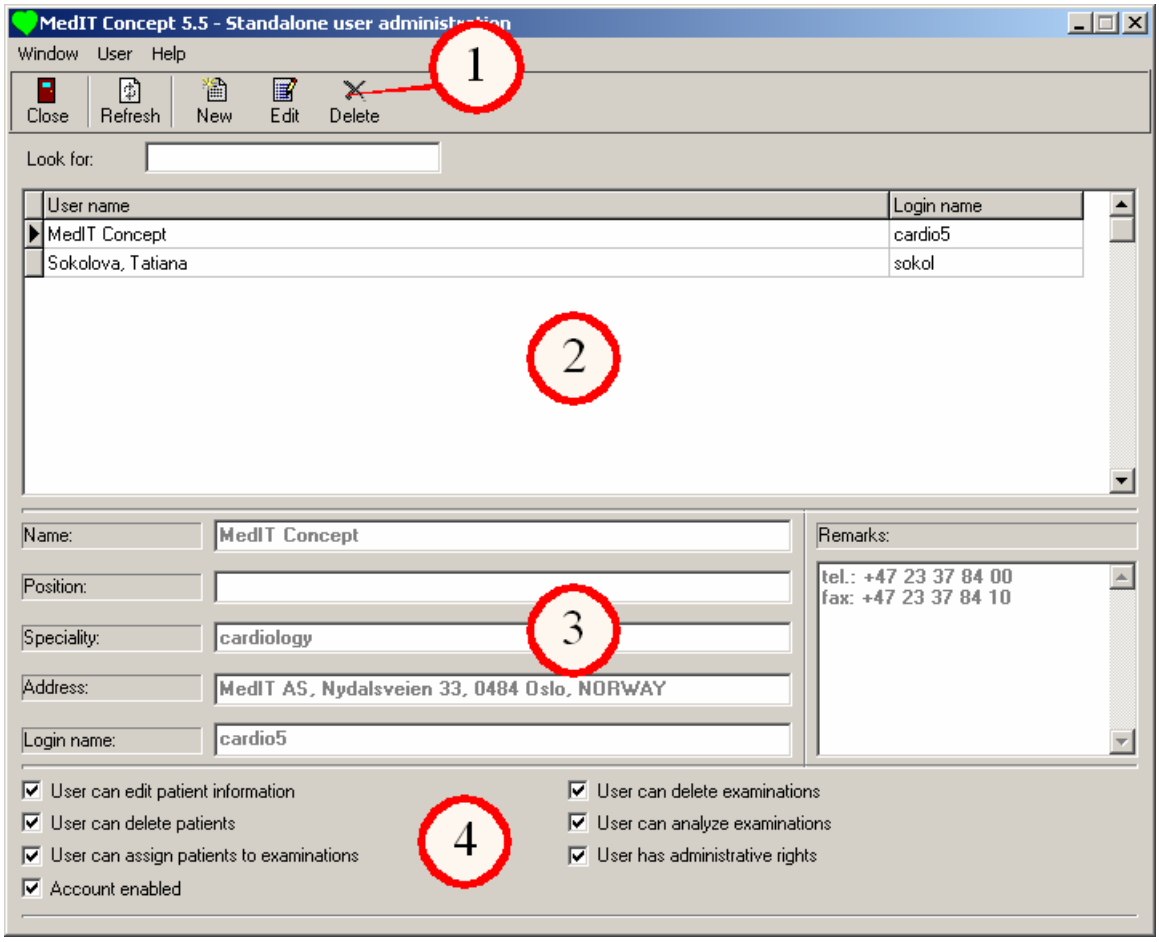
User Administration main window

User Administration menu and toolbar

Edit User Account window (Add New User and Edit User Information windows)

Administering user accounts

User Administration layout



1 **Menu and Toolbar**
Menu and Toolbar of User Administration.

2 List of All Registered Users

List of all registered users, sorted by user name. When you start typing, seca CardioConcept tries to locate the user, whose name starts with the letters you type, and moves selection bar on the corresponding line.

3 Data Fields

User information data fields:

- User name.
- User position in the institution where he works.
- User Medical specialty.
- User Address.
- Login name.
- Remarks.

4 Flags

User rights flags.

- Administrative rights. The user can administer user accounts and edit protocol templates.
- The right to edit patient information. The user can add new patient records and edit patient information in the database.
- The right to delete patients. The user can delete patients. This action cannot be undone because all examination data (ECGs etc.) of the specified patient will be removed from database if you delete a patient record.
- The right to assign patients to examinations.
- The right to delete examinations.
- The right to analyse examinations.
- Whether user account is enabled or not. If a particular account is disabled, it cannot be used to work with seca CardioConcept. It is important to mention that user account cannot be deleted if there are any references to it (for example, any conclusions are signed by this user). So if you don't need this user's database access, then it is better to disable the user account than to delete.

User Administration menu and toolbar

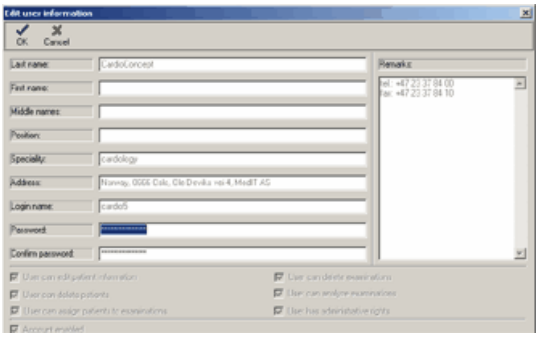
Window menu

- **Refresh** command and toolbar button. Forces newly entered user records to appear in user list. This button is needed only when editing or deleting a user account in the network configuration, as in the standalone configuration all the data is refreshed automatically.
- **Close** command and toolbar button.

User menu

- **New User** command and toolbar button (**Ctrl-N**). It evokes Add New User window where you can create a new account.
- **Edit User** command and toolbar button (**Ctrl-E**).
  If you want to edit any user account, you can open Edit User Information window using this command or button.
- **Delete User** command and toolbar button (**Ctrl-D**). Use it when you want to delete a user account. It is worthwhile to notice that it is impossible to delete a user if he/she is referenced in the database (user reference is stored with every examination and/or conclusion). If a user does not work with seca CardioConcept any more, just disable his/her account to prevent unauthorized access to the database.

Edit User Account Window



The dialogue has either Add New User or Edit User Information title bar (it depends on what it is used for).The window has the same data fields as User Administration main window except that you can enter new values in any of them. Data fields are blank if you create a new account. The new user name you enter must be unique. It is impossible to create two accounts to the same user. If you decide to change something in an existing account (for example after change in address or if you want to disable the account of a retired person), the window will contain the corresponding information. The toolbar contains two buttons:

- **OK** button saves all changes or newly entered data.
- **Cancel** button closes the window and discards all changes.

Printing Protocols Editor

Editing protocol templates

This module is used for managing templates for printing examination protocols. In order to make hard copies of examination protocols you will need at least one protocol template for each examination type and each interface language. At the same time, it is possible to have several templates for examination of a certain type and seca CardioConcept comes with a set of protocol templates specifically tailored for various purposes. With Printing Protocol Editor, you can create new templates and modify existing ones if you wish. For each examination type, one of the templates is set as default template. This default template will be used for quick printing using toolbar **Print** button or automatic printing from Smart Cardiograph.

Printing Protocols Editor

Printing Protocols Editor menu and toolbar

New Printing Protocol window

Protocol Editor window

Protocol Editor menu and toolbar

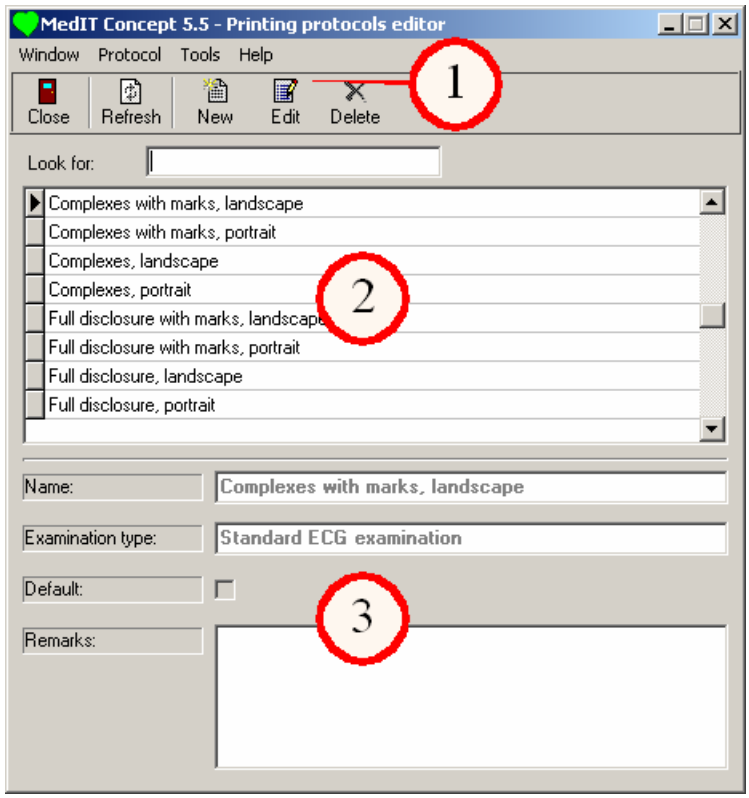
Protocol Layout elements

Preview window

Save Protocol as...

Set Margins Dialogue

Printing Protocols Editor layout



1 Menu and Toolbar

Printing Protocols Editor Menu and Toolbar.

2 List of Available Protocol Templates

The list contains all protocol templates for the language selected in the Options dialogue. Different templates can be available for different languages. There is a search string. When you start typing, seca CardioConcept tries to locate the name of the template, which starts with the letters you type, and moves selection bar on the corresponding line.

3 Attributes

Attributes of the currently selected template:

- Name of the template.
- Examination type to which it is applied.
- Whether this is a default template or not. The default template will be used for quick printing using toolbar **Print** button or printing from Smart Cardiograph.
- Any remarks concerning the protocol template.

Printing Protocols Editor menu and toolbar

Window menu

- **Refresh** command and toolbar button. Forces newly entered protocols to appear in protocol list. This button is needed only in the network configuration after creating a new protocol template, as in the standalone configuration all the data is refreshed automatically.
- **Close** command and toolbar button. Pressing **ESC** key has the same effect.

Protocol menu

- **New** command and toolbar button (**Ctrl+N**). Use it to create a new protocol template.
- **Edit** command and toolbar button (**Ctrl+E**). Use it to change currently selected protocol template.

New and **Edit** commands open Protocol Editor window, where you can create or modify protocol layout. If you create a new protocol, New Printing Protocol windowappears first.

- **Delete** command and toolbar button (**Ctrl+D**). Use it to delete a currently selected template. A message box asking you to confirm the deletion appears before the template is actually deleted. If a default template is deleted the first template on the list for the current language will be the new default.
- **Make Default** command. Makes currently selected protocol a default printing protocol. The template that has been set as default previously looses its default status.

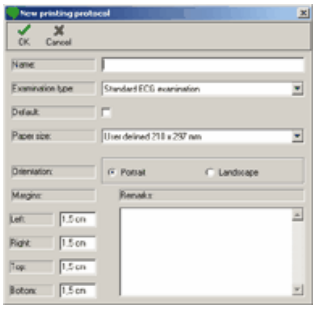
Only users with administrative rights can create, edit or delete protocol templates.

Tools menu

Import command (**Ctrl+I**). Allows user to import protocol template stored as prt-file.

New Printing Protocol Window

This window appears if you create a new protocol template.



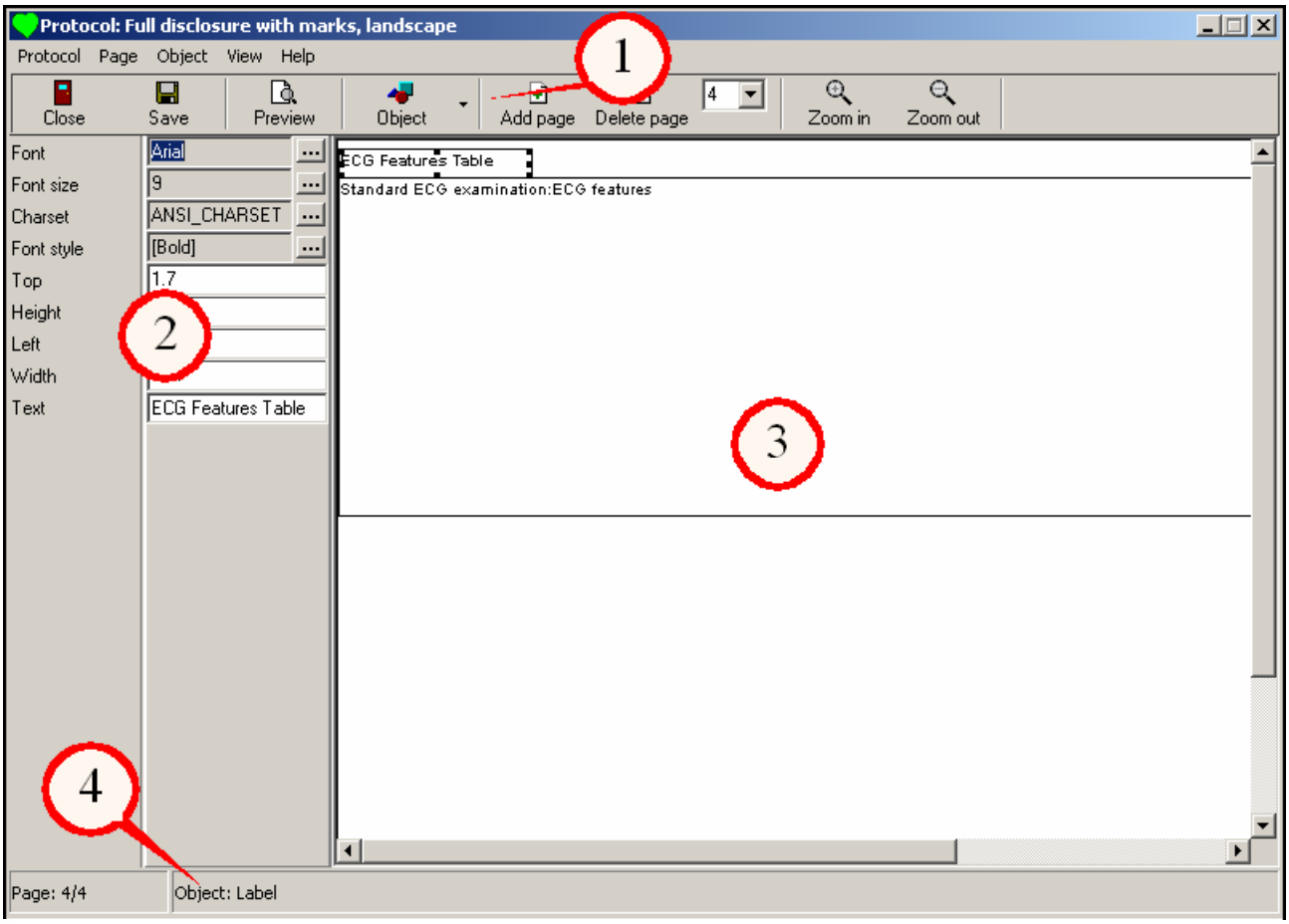
You can specify the following information:

- Name of the protocol (should be unique for selected language).
- Examination type to which it is applied.
- Whether this is a default protocol or not.
- Remarks concerning the protocol.
- Size of the paper used for printing.
- Paper orientation ("portrait" or "landscape").
- Margins.

When necessary information for the new protocol is specified or when the user chooses to edit a protocol, Protocol Editor window is opened.

- **OK** button opens Protocol Editor window. Only users with administrative rights can edit protocol templates.
- **Cancel** button closes the window without creating a new protocol template.

Protocol Editor window



1 Menu and Toolbar

Protocol Editor Menu and Toolbar. The title bar of the window shows the name of the loaded protocol template.

2 Object Property Area

Properties of selected layout element (object) like font size and dimensions are shown in this area. You can enter property value directly into the corresponding text box (e.g. label text), choose the value from combo boxes (e.g. paper speed for displaying ECG curves), or call standard Windows dialogue (for setting font typeface and size etc.). See section Protocol layout elements for details concerning layout elements and their properties.

3 Protocol Layout Area

A layout of currently selected page of a protocol template is shown here. You can see the size and location of the layout elements. Name of the element is written inside its bounding rectangle. It does not fit the size of the rectangle in many cases so the full name of the element is shown in the status bar and in the tool tip that appears when you place the mouse cursor over the element. See the section Customizing printed reports for more detailed information.

4 Status Bar with Main Object Info

Protocol Editor menu and toolbar

Protocol menu

- **Save** command and toolbar button (**Ctrl+S**). It saves newly created protocol or modifications made to an existing one.
- **Save As...** command. It allows you to save a copy of the opened protocol template under a different name. Before you save the new template, Save protocol as... dialogue appears. After the copy of template is saved, it is automatically loaded into the editor. Thus you start to edit the new copy instead of the original template.

- **Save to file** command. It allows to save protocol template to file in internal format. Can be imported afterwards into another seca CardioConcept database.
-  **Preview** command and toolbar button. It calls Preview window.
- **Margins...** command. Use it to set page margins. It invokes Set margins dialogue.
-  **Close** command and toolbar button. It closes the window. User is prompted to save changes if any modifications have been made.

Page menu

-  **Add page** command and toolbar button. It adds new page to the end of protocol template.
-  **Delete** current page command and toolbar button. It removes the selected page from the protocol template.
- A combo box for changing current page of the edited protocol.
-  **First** page command and toolbar button sets the first page of the template as the current page.
-  **Previous** page command and toolbar button sets the previous page of the template as the current page. If the first page is shown, the command and button are disabled.
-  **Next** page command and toolbar button sets the next page of the template as the current page. If the last page is shown, the command and button are disabled.
-  **Last** page command and toolbar button sets the last page of the template as the current page.

Object menu

-  **Insert** command and **Objects** toolbar button. A hierarchical menu opens if you choose it. It contains objects (layout elements) of three categories:
  - Elements of patient data record
  - Elements of ECG data record. The set of available elements depends on the type of the ECG record for what the protocol template is designed (either standard ECG record or rhythm ECG record).
  - Text blocks, i.e. labels containing an arbitrary text.

  Just select with the mouse an object you want to see in the protocol page. Mouse cursor will turn into a cross. Click on the layout area to place the object where you want. Further you can change the location of the layout element dragging it with the mouse. Or you can resize the element dragging the handles on its bounding rectangle.
-  **Delete** command (**Ctrl+Del**). It deletes the currently selected object.
-  **Cut** command and toolbar button (**Ctrl+X**). It places the currently selected object into Windows clipboard and removes it from the page layout.
-  **Copy** command and toolbar button (**Ctrl+C**). It places the copy of the currently selected object into Windows clipboard.
-  **Paste** command and toolbar button (**Ctrl+V**). It inserts the object from the clipboard into the current page area at the same position relative to the upper left corner of the Protocol Layout area where it was at the moment of copying.

View menu

-  **Zoom-in** command and toolbar button (**Ctrl+I**).
-  **Zoom-out** command and toolbar button (**Ctrl+O**).
- **Scale** command calls Set Scale dialogue.
- A combo box with current scale of protocol layout presentation. You can set precise "zoom factor" with this combo box. Just select the scale from the list or enter the number into the list box and press **ENTER**.
- **Header / Footer** command. It switches between *standard editing mode* and *header/footer editing mode*. In *standard editing mode y*ou can edit all elements on each page of the protocol template except page headers and footers. . To the opposite, the header and footer (common for all pages) are active and available for editing in *header/footer mode* while the main layout area is greyed and you cannot edit it. See the section Customizing printed reports for more detailed information.

Protocol layout elements

You can customize the "feel and look" of printed report template placing layout elements on the page. Three types of layout elements exist. These are:

- **Text blocks**. These are rectangles containing an arbitrary text.
- **Database fields**. They contain values from seca CardioConcept database fields, e.g. PQ(R) duration or patient's name.
- **ECG element**. It can be an ECG lead block, a median complexes block or a standard ECG record block (a rhythm analysis ECG record block).

Each layout element has certain properties that determine its appearance and content. Use Object property area to set or change the object properties. Object property area shows the properties specific for the selected layout element, and the set of displayed properties changes in accordance with the layout element selection. The properties of different object types are described below.

A **text block** has the following properties:

- **Font** used for displaying the label text.
- **Font size** used for displaying the label text.
- **Charset** property specifies character set that is used for label text.
- **Font style** property sets plain, bold or italic font style.
- **Top** and **Left** properties determine distance of the element left top corner from the page left top corner in mm.
- **Height** and **Width** that determine the size of the element in mm.
- **Text** of the element.

Database field contains text representation of its value and has the properties similar to a **text block**:

- **Font**.
- **Font size**.
- **Charset** property specifies character set that is used for field text.
- **Font style** property sets plain, bold or italic font style.
- **Top** and **Left** properties determine distance of the element left top corner from the page left top corner in mm.
- **Height** and **Width** that determine the size of the element in mm.

ECG element properties vary depending on the element subtype. The following are the common **ECG element** properties:

- **Font** used for displaying lead names etc.
- **Font size**.
- **Charset** property specifies character set that is used for text.
- **Font style** property sets plain, bold or italic font style.
- **Top** and **Left** properties determine distance of the element left top corner from the page left top corner in mm.

Single ECG lead block specific properties:

- **Lead name**. Use the combo box to change the lead to be displayed.
- **Lead height**. It determines the vertical space used for displaying the curve in mm.
- **Speed**. Virtual paper speed used to display the curve.
- **Calibration**. Virtual amplification used to display the curve.
- **Presentation** property. It can be *short* or *full*. The property determines whether the lead block can expand in order to accommodate all curve length.

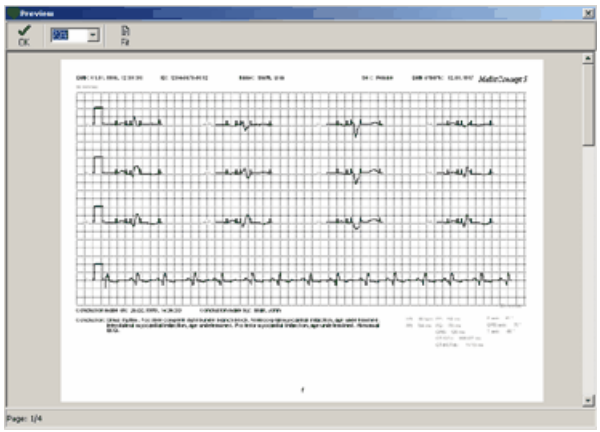
Median complexes block specific properties:

- **ColCount** property sets the number of columns used for displaying the representative cardiocycles of all leads.
- **Lead height** sets the vertical space for each ECG complex in mm.
- **Speed**. Virtual paper speed used to display the curve.
- **Calibration**. Virtual amplification used to display the curve.
- **Markers** property indicates whether vertical markers for ECG fiducials are shown.

ECG record block specific properties:

- **ColCount** property sets the number of columns used for displaying the curves.
- **Lead height** sets the vertical space for each ECG complex in mm.
- **Speed**. Virtual paper speed used to display the curve.
- **Calibration**. Virtual amplification used to display the curve.
- **Presentation** property. It can be *short* or *full*. The property determines whether the lead block can expand in order to accommodate all curve length.

Protocol Preview Window

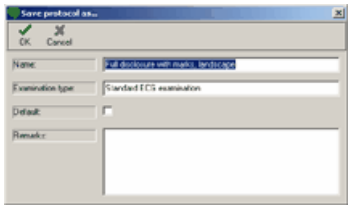


The toolbar has following buttons:

- **OK** button. It closes the window.
- Combo box with presentation scale.
- **Fit page** button. It adjusts the presentation scale, so that one page fits into window.

If protocol template has more than one page in it, you can use **Page Up**/**Page Down** buttons or scroll bar to navigate through pages. Current page number and total number of pages are indicated in the status bar.

Save Protocol as... Dialogue



This dialogue appears when you are going to save a copy of protocol template with a different name. Enter new protocol template name into the **Name** field. You can also indicate whether the new template should be used as default for the selected examination type. The new name must be unique for the current language and examination type. Any additional information concerning the new protocol template can be saved in **Remarks** field.

Set Margins Dialogue

Use this dialogue to set top, bottom, left and right page margins correspondingly. It is worth noting that some layout elements can overlap after the margins are changed so you will have to adjust their property specifies character set that. The toolbar contains standard **OK** and **Cancel** buttons to save or dispose changes you made.

Options dialogue

Changing seca CardioConcept options

This dialogue is used when a user wants to change preferences of seca CardioConcept programme. It consists of four pages.

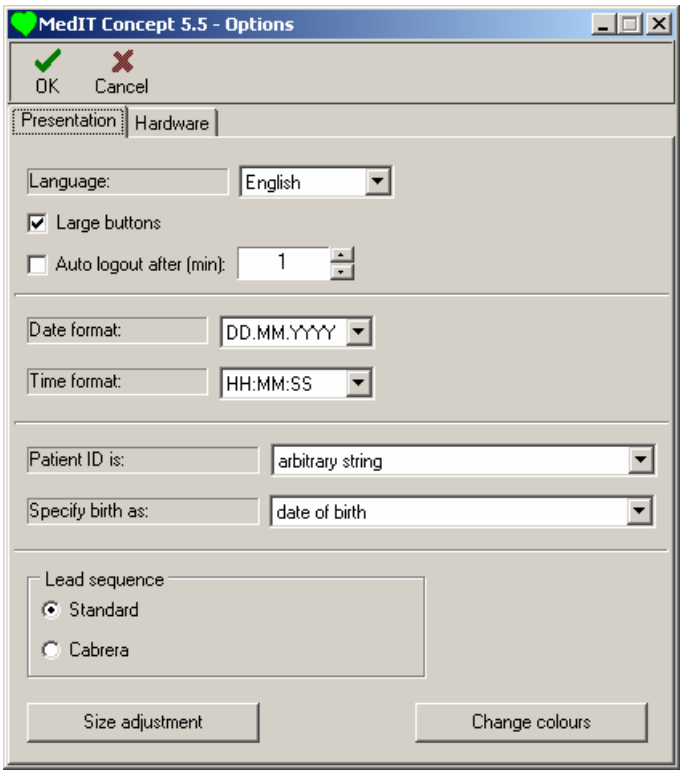
Presentation tab

Hardware tab

Mail tab

Screen Adjustment dialogue

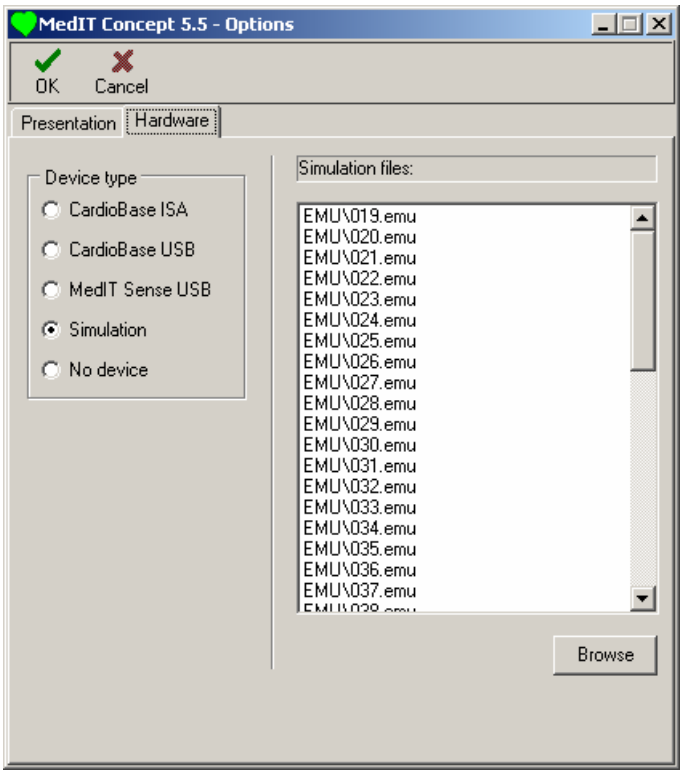
Presentation tab



Using this tab you can change the programme form and data layout format. This page contains controls that define some properties of seca CardioConcept user interface.

- Combo box for choosing the language for user interface and standard diagnostic statements.
- Combo box specifies whether all buttons are large or not.
- Auto log out after. May be not accurate. In fact - auto termination of the application after N minutes of user inactivity.
- Two combo boxes with available date and time formats if you are not satisfied with one that is set by default. The date format looks something like this "**YYYY\MM\DD**" where "Y" stands for year digits, "M" stands for month digits and "D" for day digits. The format string for time may look like "**HH:MM:SS**" where "H" stands for hour digits, "M" for minute digits and "S" for second digits. Seconds may not be indicated in some of the formats.
- **Patient ID is** combo box specifies patient ID. You can select *arbitrary string* (the default) that will allow you to enter patient ID in any format. Three other options are *Norwegian social security number, Swedish social security number* and *Danish social security number*.
- **Specify birth as** combo box allows you to select whether a patient's birth date is entered as full *date of birth* or just *year of birth*. This option is available only if you select *arbitrary string* as **Patient ID** type. If *Norwegian social security number, Danish social security number* or *Swedish social security number* option is selected, only the full date of birth can be set, as it is coded in a social security number. The format of birth date affects the data entry only. January, 1 of the corresponding year will be displayed as birth date if this option is selected.
- Standard (**I, II, III, aVR, aVL, aVF**) or Cabrera (**aVL, I, -aVR, II, aVF, III**) ECG leads presentation scheme can be set with **Lead sequence** radio buttons.
- A special size adjustment button can be used for calling Screen Adjustment window.

Hardware tab



On this page the user can specify seca CardioConcept hardware settings. A group of device types is shown to the left:

- **CT110**. USB device type delivered by MedIT as.
- **Simulation.** This check box set emulation mode. By choosing it a list of emulation files appears to the right. Using Browse button you are able to choose one or several files with beforehand recorded ECGs. These ECGs will be used instead of real signal. The ECG files (*.emu) are copied to the hard drive during the seca CardioConcept installation.
  Please note that emulation mode should be used for demo purposes only! By choosing this device type the programme is switched off to the demonstration mode. All the names of the patients created in this mode will have prefix DEMO. The sets of these patients and patients created in the mode of real signal will not across each other.
  The emulation mode can be used when there is no digital signal processor.
- **No device**. This option allows you to work with seca CardioConcept properly when there is no ECG acquisition device. This configuration is needed when computer is to be used as a workbench (usually in local network) for interpretation of ECGs acquired in another place (on another workstation or with CardioPortable) and stored in net database or sent via e-mail.
  In this configuration there is no possibility to evoke Smart cardiograph window and acquire ECG accordingly. But you can view ECG from database, create a new conclusion for it and save it. ECG (or a selection of ECGs) sent through e-mail can be stored into database as well.

Mail tab

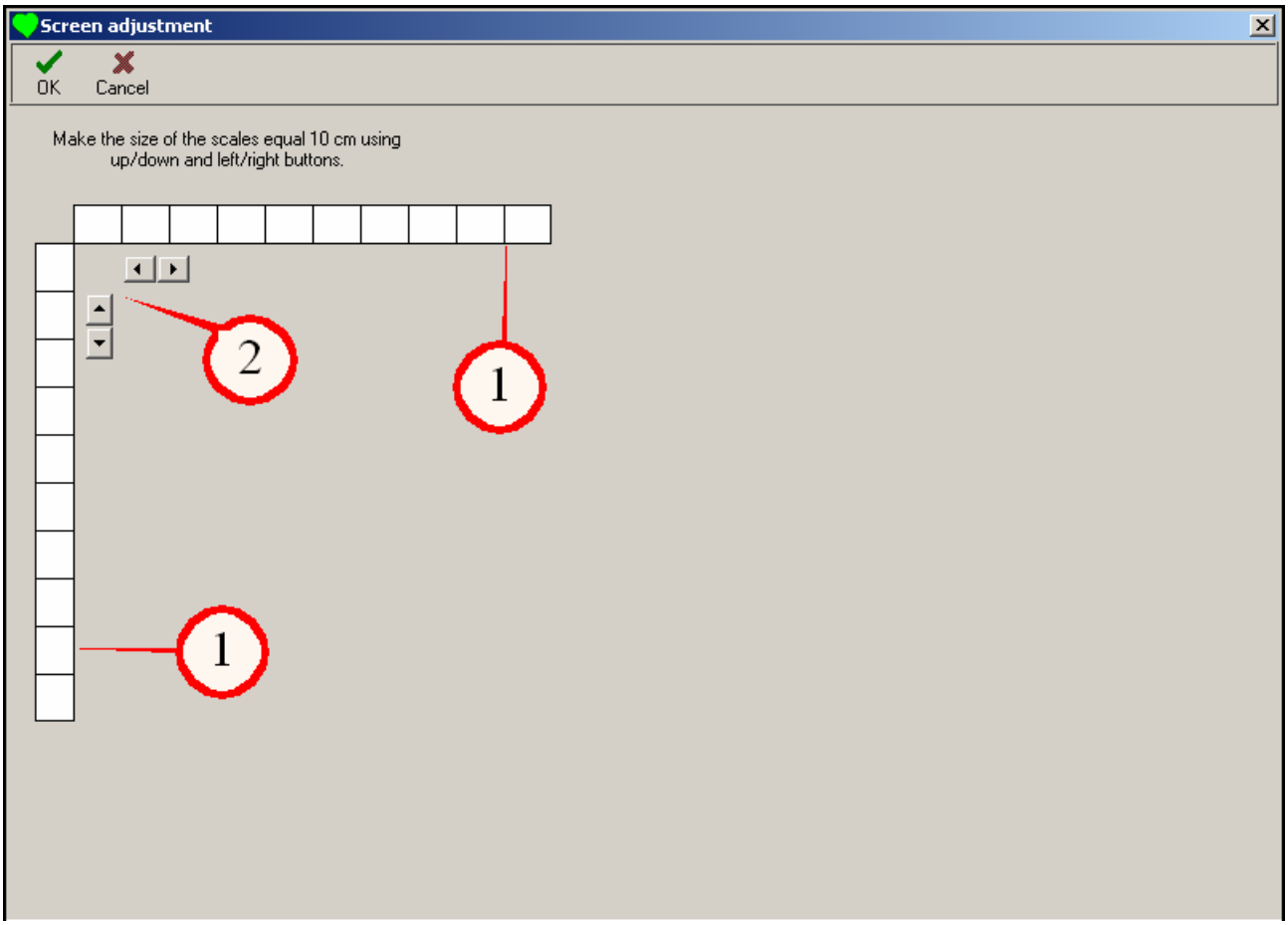
This tab allows you to configure Internet connection parameters in order to use telemedical functionality. It contains the following groups of controls.

- **Dial-up service combo box**. This combo allows you to select the dial-up connection if you have several of them configured on your computer for dial-up networking. You can also select *None* for Dial-up service. In this case, seca CardioConcept will try to connect to the Internet through local computer network. If this is not possible (the access in not configured properly or absent), the telemedical functionality will be disabled.
- **User information** group. Fill in three fields, specifically user name, organization and e-mail address that identify you as a participant of electronic communication. The name and organization will appear in the **From** field of the message. The address you enter will be used for replying by the other communication parties.
- **Server information** group. This section allows you to set addresses of SMTP and POP3 servers that are used for sending and receiving e-mail. Contact your Internet Service Provider for information how to configure that.
- **Incoming Mail Server** group. It contains account name and password that is used to connect to the Internet mail servers. **Server timeout** field sets the time period in seconds, during which the programme will try to connect to e-mail server before reporting a connection error.

See the section Understanding electronic mail basics if you are not familiar with the e-mail configuration.

Screen Adjustment dialogue

This window allows you to tune the scale of ECG presentation so that signal amplitude and duration on computer screen are the same size as on standard ECG paper. The window contains vertical and horizontal scales 1 with the resize buttons 2. You should change the size of the scales so that the distance between graduations is exactly one centimetre. Just put a ruler (a transparent ECG ruler will suit the best) to the computer screen next to the vertical grid first and adjust grid size with resize buttons (you can also click somewhere on the scale and drag mouse cursor – the size of the scale will change). Repeat the procedure for the horizontal grid. Now the size of ECG on the screen of your computer is exactly the same as you get accustomed to with your traditional ECG machine.

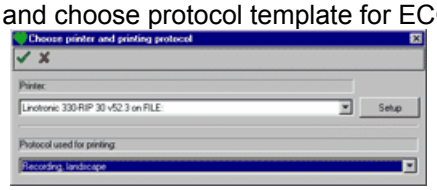


See Screen adjustment section for details.

Miscellaneous windows and dialogues

Print Dialogue

This dialogue appears if you decide to make a hardcopy of the current ECG using **Print** command of the menu. You can specify a printer, change its settings and choose protocol template for ECG printout.



Default system printer and default protocol template are chosen when this dialogue is open. Pressing **ENTER** or clicking **OK** button prints the currently selected ECG with the conclusion seen on the screen. There is **Setup** button next to the combo box with printers available in the system. This button calls standard Windows **Printer Setup** dialogue. Use the combo and **Setup** button to change the printer and its settings before obtaining ECG hardcopy.

Two buttons can be found in the toolbar:

- **OK** button – starts printing with selected settings.
- **Cancel** button – abandon printing closes the window.

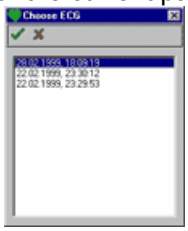
Add remark to examination

This window appears both in Smart Cardiograph window as soon as ECG signal is acquired, if **Add remark** check box is checked on the After Recording panel, and in Examination Browser, if you use **Add remark** command.

There you can write any comments on this recording. They will be saved into database and can be later viewed from Examination Browser.

Choose ECG Dialogue

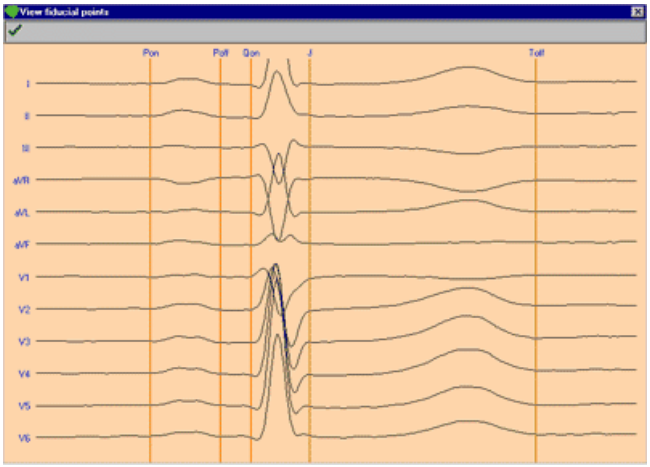
This dialogue contains a list of all ECGs available for the current patient with acquisition date and time.



The dialogue has standard **OK** and **Cancel** buttons.

View Fiducial Points Window

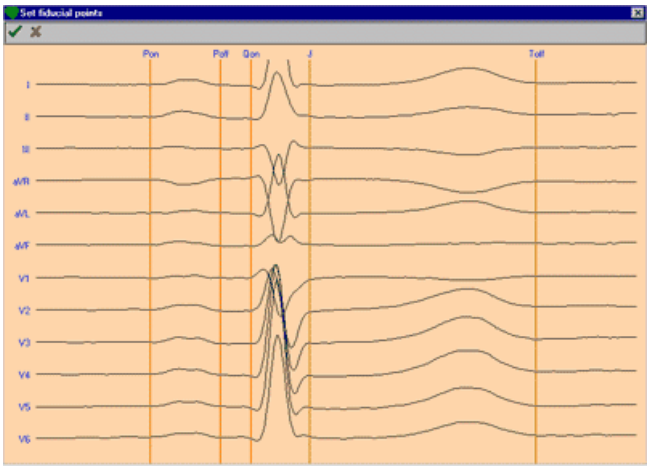
Computer assisted ECG analysis depends very much on correct placement of ECG fiducials within representative cardiocycle. It is a good idea to check the fiducials if you are not satisfied with automatic diagnosis or are in doubt if ECG intervals are measured correctly. This window allows achieving the goal quickly.



The window shows magnified representative cardiocycles of all twelve leads placed in such a way that fiducial points can be seen in all twelve leads simultaneously. Five vertical lines point at the positions of ECG fiducials, thus characterizing cardiocycle as a whole rather than single leads only. Each line is marked in the following way: **Pon** stands for P-wave onset, **Poff** for P-wave offset, **Qon** for QRS onset, **J** for J-point and **Toff** for T-wave offset. See section Creating a conclusion from scratch for more detailed information.

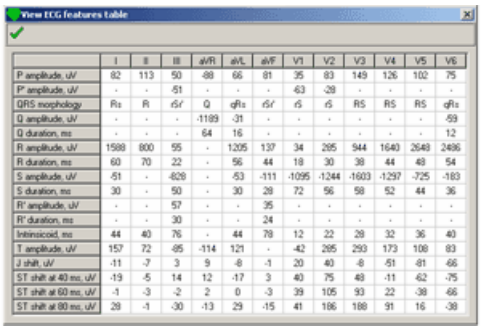
Set Fiducial Points Window

This window is used to set fiducial points on representative cardiocycle manually . It looks similar to View Fiducial Points window.



If you select a new representative cardiocycle before opening this window only enlarged ECG curves will be seen. Otherwise, you will see vertical lines each marked with fiducial point name. These lines show positions of fiducial points on representative cardiocycle. You can change the position of a line by dragging it with the mouse. Right clicking on a fiducial line removes it. Left clicking on fiducial name changes this name from **Pon** through **Toff**. If required fiducial is absent just click on the place where it should be and then set proper name and adjust the position of newly created fiducial. It is clear that nothing will happen if you click to the left of **Pon** line or to the right of **Toff** line. For more detailed information see section Creating a conclusion from scratch.

View ECG Features Table

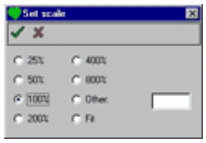


This dialogue shows all ECG features extracted by seca CardioConcept diagnostic algorithms for each lead : PQ(R) duration, amplitude of R and Rr' and etc. You can examine this table in order to save the work of calculating these

ECG features manually. Another application is finding out why seca CardioConcept generated diagnostic statement you are interested in.

Set Scale Dialogue

This dialogue contains radio buttons to select fixed scales of ECG presentation and a text box to enter numeric value of magnification factor. The dialogue has standard **OK** and **Cancel** buttons.

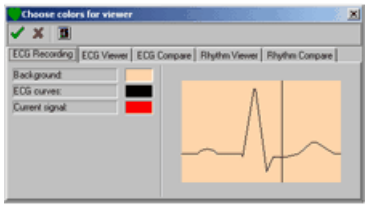


The text box for entering custom scale becomes selected as soon as you select **Other** scale.

Choose Colours for viewer Dialogue

Choose Colours for viewer Dialogue

This rather simple dialogue is used for tuning colours of ECG presentation in ECG Viewer .



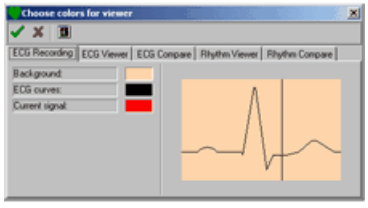
Toolbar has three buttons:

- **OK**. The colours are saved and the ECG curves are shown in the chosen colours.
- **Cancel**. Changes are lost and no actions are undertaken.
- **Default Colours** button restores seca CardioConcept default colours.

Colour settings are organized in groups corresponding to different windows for working with ECG and shown on five tabs:

- ECG Recording.
- ECG Viewer.
- ECG Compare.
- Rhythm Viewer.
- Rhythm Compare.

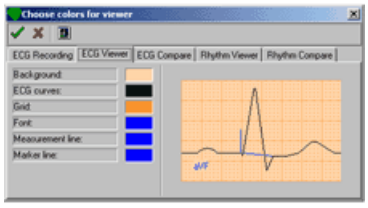
ECG Recording Tab



On the left side of the window the labels of possible colours are shown:

- Background
- ECG curves
- Current signal, i.e. the colour of the line, which shows the current signal in **Smart-cardiograph.**

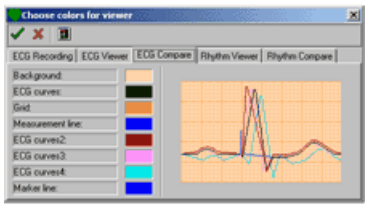
ECG Viewer Tab



On the left part of the window those elements are shown, whose colour can be changed:

- Background
- ECG curves
- Grid of virtual ECG paper
- Font colour for lead labels etc
- Measurement line colour for callipers tool
- Maker line

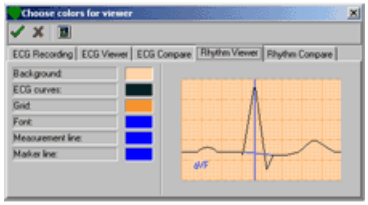
ECG Compare Tab



On the left there is a list of elements, which you can set a colour:

- Background
- ECG curves
- Grid
- Measurement line
- ECG curves2
- ECG curves3
- ECG curves4
- Marker line

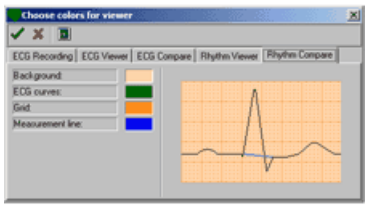
Rhythm Viewer Tab



On the left side of the window the labels of possible colours are shown:

- Background
- ECG curves
- Grid
- Font
- Measurement line
- Marker line

Rhythm Compare Tab



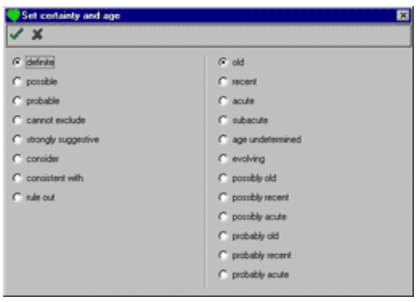
On the left side of the window the labels of possible colours are shown:

- Background
- ECG curves
- Grid
- Measurement line

Within every tab there is a bar to the right from each of the above labels, which has the colour of the corresponding element. Double clicking on this bar invokes the standard Windows colour dialogue.
Schematic sample ECG screen allows previewing new colour settings.

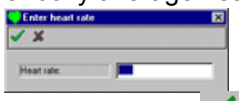
Set Statement Modifiers Dialogues

These dialogues allow you to add different statement modifiers like "rule out" or "possibly old" to standard diagnostic statements (see Diagnostic Conclusion Wizard and Add Diagnostic Statement window for details).



Enter Average Values Dialogues

These three similar dialogues are used to enter manually average heart rate, RR and QTd values correspondingly.



All the dialogues have two buttons in toolbar. Standard **OK** button  saves the entered value in the database while **Cancel** button  abandons the changes.

Operating instructions

Configuring seca CardioConcept

General notes

This section describes how to configure seca CardioConcept and adjust it to your needs.

The basic configuration parameters are described in the following sections:

- Administering user accounts
- Screen adjustment
- Customizing printed reports
- Configuring Internet Mail access

Administering user accounts

For more detailed description see section User Administration. Here we just explain some basic ideas of network database administration in conjunction with seca CardioConcept.
User administration is used in order to prevent unauthorized data access. Special database records named user accounts are maintained in database for this purpose. A user login name, password and data access rights are kept in

this account together with some additional user information. The following data access rights are used in seca CardioConcept database:

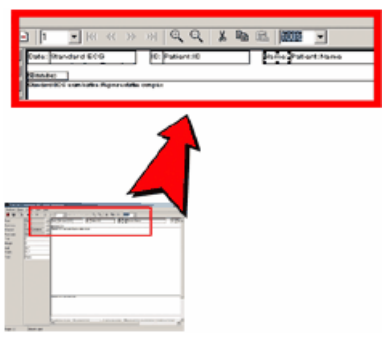
- Administrative rights. Assign this right very carefully, since these rights give full control over seca CardioConcept. A user with administrative rights can add, edit or delete user accounts and edit protocol templates. The idea behind is to prevent these crucial data from being unintentionally damaged. Another point is to keep them in proper order by dedicated person(s).
- The right to edit patient information. Only users with edit patient rights can add patients and edit patients' personal data. All other users are only able to view patients' information.
- The right to delete patients. Assign this right very carefully, as if a patient record is deleted from database, this action cannot be undone and all examination data (ECGs etc.) of a specified patient will be removed from database.
- The right to assign patients to examinations. Only users with these rights can reassign recordings to appropriate patients.
- The right to delete examinations. Only users with such rights can delete examinations.
- The right to analyse examinations. Obviously not everybody should have such a right.
- Whether user's account is enabled or not. It may be a problem for database management system (the detailed description can be found in section Managing database) if you just delete a user account of, for example, a person on leave or a retired person. So just disable an account in order to prevent using it by mistake.

Screen adjustment

Various computer monitors have different pixel size at various screen resolutions. This makes visible amplitude and duration of signal curves unpredictable. We recommend screen resolution 1024X768 or more if your computer video system allows it. In this case, ECG curves are displayed as close to print quality as it is possible with computer displays. But you have to calibrate seca CardioConcept in order to make the size of screen ECG image correct. See section Screen Adjustment Dialogue for detailed description.

Customizing printed reports

seca CardioConcept is shipped with a number of predefined protocol templates that can satisfy most of the users. If you want to create a specific type of printouts, Protocol Template Manager allows you to prepare very elaborate templates for examination protocols. Just drag a desired element of ECG printout (for instance patient's name or representative cardiocycles block) with the mouse from Object Menu and place it at the place you chose on the Protocol Layout area.
If necessary, move or resize layout elements. If you click on an element, it becomes selected. A bounding box with handles appears around the selected element. Name of the element is written inside its bounding rectangle. It does not fit the size of the rectangle in many cases so the full name of the element is shown on status bar or in the tool tip that appears when you place the cursor over the element. You can move it around the layout area just dragging with the mouse. Dragging of the handles of the currently selected element can be used to resize it. Use Object property area in order to change properties (e.g. text of a label) of an element.
You can select several elements clicking them with the **shift** key pressed forming a *selection group*. The selection group can contain either text elements (labels and database fields) or ECG elements. It is impossible to mix those types of elements in the same selection group. After a group of elements is selected, you can modify them simultaneously, i.e. change properties, move them around and place the whole group into clipboard.
There are two working modes for Protocol Layout area. The first is the *standard mode*. You can edit all elements on each page of protocol template. The second one is *header/footer mode* in which the main layout area is greyed and you cannot edit it. To the opposite, the header and footer common for all template pages are active and available for editing (see the picture). ***seca CardioConcept 5.5*** is an obligatory label in the top right corner of each page.



See the section Protocol Editor menu and toolbar for more details about actions and commands available for editing protocol templates.

Configuring Internet Mail access

In order to use seca CardioConcept for telemedical networking it is necessary to configure Internet access options. Use Mail tab of Options dialogue for setting the dial-up networking, personal information that will identify you in the network and server information for connecting to Internet Mail servers of your Internet Service Provider. Contact your Internet Service Provider in case any problems occurs.

Managing seca CardioConcept database

Patient Database Management

When a user (a nurse for instance) is going to acquire an ECG, the programme asks her to choose a patient from the database. A specific patient must be selected (a new one can be created alternatively) before ECG is actually recorded. Two main types of records—patient records and examination records, are stored in seca CardioConcept ECG database. Patient records contain data about patients — i.e. patients' surname, address, date of birth etc. Examination date, ECG signal curves, averaged cardiocycles, conclusions etc. are kept in examination records. Each examination record is internally linked to a certain patient record. Saving ECGs into database means that each examination record is linked only to one patient record. In order not to break this rule, the programme demands to choose a patient record (or to create a new one) before ECG is recorded. Database management system prevents creation of an examination record without the link to an existing patient being specified. Thus, no examination can be "lost" or "hanged". This is an example of data integrity. Why is it important to support data integrity?

In traditional record systems, it is always possible to mistype for example a patient's name. *Mr. Smith* and *Mr. Smiht* become different persons since then and there is no way to look up all Mr. Smith's ECGs except for careful browsing through all database in order to find all erroneous entries manually. This type of mistakes cannot occur if you use database management system instead a simple traditional record system.

Another advantage is that if some data like address or family name is changed you have to enter changes in one place only so all ECGs of Ms You-should-know-her will be still linked to Mrs. You-should-know-him-as-well after she marries and consecutively changes her name. It may seem unnecessary to look up patient name each time you are going to register a single ECG but it can save you a lot of time when the number of ECGs grows. The database management system helps you to keep all your examinations in proper order (practically it forces you to do so) and you never loose or shuffle any patient or examination record.

See next section Patient database integrity rules for detailed explanations of rules applied to patient records.

Patient Database Integrity Rules

The following rules are applied whenever a patient record is created or modified.

- If patient's first name or middle name consists of a single letter, the programme considers the letter to be an initial and adds a period (.) to it.
- For each patient the following information should be specified:
  - Last name.
  - Birth date. Birth date should be a correct date after January 1, 1900 and before the current date.
  - Patient's sex.
- Patient Exists window appears to help you identify and correct the problem if the following is the case:
  - If patient's ID is not unique
  - If patient's insurance policy number is not unique.
  - If a patient exists with the same full name, sex, race and birth date.

If similar patients exist (i.e. patients with the same surname, sex, birth year and at least one initial), they are listed in Patient Exists window. All these situations are identified as data collision.

The rules explained above may seem to be too complicated and make data entry more difficult at the beginning. But you will certainly appreciate their value after a large number of patients are entered into database.

Recording, looking up and printing ECGs

Direct ECG Recording

seca CardioConcept gives the user two ways to record ECG immediately after application start i.e. from Control Centre. The first one is *Patient ECG Recording* and the second one is *Emergency ECG Recording*.

Patient ECG Recording

1. While in Control Centre, press Patient ECG button.
2. Select the patient in Choose or Enter Patient Window. You can easily switch to emergency acquisition mode if there is no time to enter patient information.
3. You are in Smart Cardiograph now with ECG monitoring on. Record the ECG. See more details on working with Smart Cardiograph in Recording ECG from Smart Cardiograph section.
4. Leaving Smart Cardiograph returns you to Control Centre.

Emergency ECG Recording

1. While in Control Centre, press Emergency ECG button .
2. You are in Smart Cardiograph now with ECG monitoring on. Record the ECG. See more details on working with Smart Cardiograph in Recording ECG from Smart Cardiograph section.
3. After all actions possibly set at After Recording panel are done, you get to ECG Viewer and then while closing this window to Assign ECG to existing patient or Enter New Patient Info window. So you can decide to link the ECG just recorded to a new/existing patient or leave it assigned to an artificial *Emergency Acquisition* patient.
4. You return to Control Centre window.

Recording ECG from Smart Cardiograph

seca CardioConcept supports two additional scenarios for ECG recording. They can be named *serial ECG acquisition* and *individual ECG acquisition*.

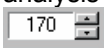
Serial ECG acquisition

This scenario is tailored for serial ECG registration in a specialized environment like an emergency room or other workplace specifically assigned for ECG acquisition. A nurse is a typical seca CardioConcept user in this case. In order to operate the programme in this mode you should start Smart Cardiograph application from Control Centre with Patient ECG command. Just leave in Smart Cardiograph after you acquire the first ECG. As it was said above, a patient must be specified before ECG acquisition. It can be done in three ways. First, you can select an existing patient from database or create a new one in Choose patient window, which automatically appears, if you launch Smart Cardiograph from Control Centre. Secondly, you can select a patient with  **Choose Patient** button, which evokes Choose Patient window as well. And at last, you can choose a patient you have just recorded ECG for to be the current patient with  **Choose Previous Patient** button. The latter is possible only if you have already acquired ECG just before, but you are not satisfied with the quality of the record or you can decide to make a long rhythm analysis record after an acquired standard record proved to be insufficient for complete diagnostic interpretation. In all cases a patient is selected as the current patient and any ECG recording is stored in database as belonging to the current patient.

Individual ECG acquisition

The second scenario can be useful in more individualized settings like GP (general practitioner) office. In this case, Smart Cardiograph window is activated either from Patient Browser or Examination Browser. The current patient is already specified and there is no reason to reselect it in such a case. So there are no  **Choose Patient** and  **Choose Previous Patient** buttons on Acquisition control panel of Smart Cardiograph.

Another significant difference between the two scenarios is that you can stay using Smart Cardiograph in case of serial acquisition if, of course, the check box View is not set on After recording panel. This is convenient if the user (typically a nurse) is just to acquire ECG without analysing them. The second scenario supposes ECG diagnostic interpretation immediately after its registration that's why the check box Preview is set automatically and you cannot disable it. After you have set the current patient you have to select the required examination type with the combo box in Acquisition Controls of Smart Cardiograph. In the second scenario, when you enter this window from examination window, examination type is already chosen and cannot be changed. Recording length should be set for rhythm

analysis record if you want a recording longer or shorter than the default 30 seconds. Please use spin button arrows 

to change the duration in ten second increments.

As soon as a patient is selected,  **Play** button gets available and you can press it in order to enter ECG monitoring mode. The ECG leads should be properly mounted by that moment otherwise you will get a "wild screen" instead of ECG curves. Just press the  **Pause** button in this case (actually in any case something is wrong and there is a need to fix leads and patient's cable). Due to digital filtering, a signal appears on the screen about 1.5 second later than it has actually been acquired from the electrodes. In order to obtain a good quality recording ensure that the ECG signal is OK and no excessive noise and/or artifacts are present. Pause the acquisition and check the leads and patient cable if you are not satisfied with the signal.

The 10-second span of the ECG curves that is visible on the screen is to be acquired from the seca CardioConcept hardware if you press  **Record** button and standard ECG record is selected as examination type. The  **Record** button becomes enabled after the 10-second time span passes and the required length of ECG signal is stored in the temporary buffer. If you are acquiring a rhythm analysis record, the  **Record** button is enabled as soon as monitoring begins. The progress bar appears on Acquisition Controls panel during the rhythm analysis record acquisition process showing the percentage of long ECG that has already been saved to hard drive. Long ECG recordings occupy much storage space, so make sure that enough free room is available at the drive where temporary directory is located (by default, temporary directory is C:\WINDOWS\TEMP).

Printing ECG

You can print an ECG protocol either during the acquisition process or from ECG Viewer. In order to print the protocol immediately after it is recorded just turn on the **Print** check box on After Recording panel of Smart Cardiograph window. The ECG will be forwarded directly to the printer. Make sure the printer is ready if you turn this option on. The ECG is sent to the default system printer and default protocol template is used.

Another possibility is clicking the  **Print** toolbar button to quickly print the ECG you are currently viewing in examination window. No dialogue will appear and the examination report will be printed using default protocol template on system default printer. Use **Print** menu command if you need to change protocol template or use a different printing device. Print ECG dialogue will appear so you can change the printer device (if there are several of them available), printer settings and protocol template to be used.

Browsing ECG examinations

You can find the ECG recording in two ways. First, you can look up the patient in Patient Browser and then activate examination window with all ECGs available for the patient. Use **ECG List** combo box or **ECG list** command of examination window **ECG** menu in order to look for the specific ECG record you need. Alternatively, you can locate the ECG record you are interested in using Examination Browser. Then activate the examination window from within Examination Browser and the required examination data appears in it in this case.

ECG diagnostic interpretation with seca CardioConcept

Introduction

As it was already discussed, seca CardioConcept has a module for algorithmic ECG analysis. With this module, diagnostic conclusion can be created automatically. Such an automated conclusion cannot substitute a cardiologist but can help a physician inexperienced in electrocardiography. However the most important aim of automated diagnosis is to help the specialist in quick and perfect ECG interpretation directly on the screen without preliminary printing the electrocardiogram. The point is that seca CardioConcept is primarily referred to integration into medical information systems and work in telemedical environments. Under such conditions preliminary printing can considerably slow down the work and even put it into trouble. It is not necessary to use automated diagnosis though and seca CardioConcept provides tools ECG interpretation in more traditional way. Sure you can just print ECGs out and then write your diagnostic conclusion by hand on the hardcopy pages. On the other hand, seca CardioConcept automated module can do routine ECG measurements and write a draft diagnostic conclusion for you. If it is necessary you can use tools for doing measurements, comparing several ECGs and editing diagnostic conclusions manually. You can do it just on the screen without printing, because the capabilities of ECG curves presentation in seca CardioConcept give you the opportunity to see ECG layout as well as curve details on display with the same (and sometimes even better) quality as printed ECG. ECG curves, measurement results and diagnostic interpretation

will be stored into database and at any time can be sent for second opinion to an expert via Internet. Finally it is important to mention that seca CardioConcept supports two types of ECG examination, specifically standard ECG record and rhythm analysis ECG record. Algorithmic diagnostic interpretation can be done with a standard ECG record only. The way to analyse a long ECG record with seca CardioConcept tools is discussed in a special section of this manual.

We begin with computer ECG diagnostic basics, as it will help to explain the work of ECG diagnostic interpretation tools.

Steps of computer ECG diagnostic

Computer analyses ECG curves in several stages shortly outlined below.

- After digitized ECG signal is acquired, the programme looks for QRS complexes in order to prepare median cardiocycle for further analysis. Such a median complex is more suitable for precise measurements due to better signal/noise ratio.
- After that the programme tries to define global ECG fiducial points. "Global" means that all leads are taken into account rather than determining fiducial position in a single lead.
- ECG features (PQ interval etc.) are determined at the next step.
- Logic production, probability or other artificial intelligence techniques are used to derive diagnostic statements from the set of ECG features obtained at the previous stage.
- The standard diagnostic statements are formatted into text diagnostic conclusion.

Computer diagnosis cannot be perfect in all cases. Understanding the workflow of programme analysis allows you to correct the erroneously performed stages and let the software do the rest. This is the easiest and most productive way to analyse the ECG on the computer screen without printing it. Let us consider the process of creating new diagnostic conclusion in detail. First, press  **New Conclusion** button of ECG Viewer and/or menu command to activate **New Conclusion** window.

Correcting representative complex

If you are not satisfied with the median cardiocycle generated by the programme (it is quite possible when a patient has a rhythm disturbances with polymorph QRS complexes or if you are analysing an ECG, which was not analysed automatically), you can manually select a representative complex in Choose Representative Cardiocycle window. You can invoke this window by using **Representative complex** command (**Manual analysis** menu) or the corresponding toolbar button  of **New Conclusion window**. In this window choose (P)QRST complex recorded with best possible quality and then define its right and left boundaries with mouse clicks. In interpreting the non-analysed ECG, it is possible to create a median cardiocycle automatically by using **Representative complex** command (**Automatic analysis** menu). The representative complex is selected. Now seca CardioConcept can calculate average RR interval duration and heart rate. Since that time the  Automatic Fiducials and  Fiducial points buttons become available.

Then you can get fiducials to be found automatically by pressing  **Automatic Fiducials** button (**Fiducial points** command of **Automatic analysis** menu) and correct them later if necessary. Alternatively you need to define fiducials of your own in Set Fiducials window with  Fiducial points command (**Manual analysis** menu).
Set Fiducials window displays very enlarged representative cardiocycle with all twelve leads "stacked" one on another. This specific display allows observing fiducial position in each lead simultaneously. You should define P-onset, P-offset, QRS-onset, J point and T-offset locations by mouse clicks on the corresponding points of one of the curves. Drag the fiducial lines with the mouse to correct their position. Ensure that fiducials are correctly placed for all leads. It means that "global" J point (*J* fiducial) should correspond to QRS end in a lead in which it has the longest duration, i.e. to the **rightmost** J point position among all leads. The opposite is true while selecting QRS onset point that should correspond to the earliest sign of ventricular activation. Thus, "global" QRS onset (*Qon* fiducial) must be set to the **leftmost** QRS onset among all leads. Positions of other fiducials should be set in similar way, i.e. P wave onset (*Pon* fiducial) corresponds to the earliest atria activation, P wave offset (*Poff* fiducial) to the latest P wave termination and T wave end (*Toff* fiducial) should fall on the end of the longest T wave (but not on the U wave!) among all twelve leads.

Press  **OK** when finished.
Now you have got basic ECG features properly set and basic ECG intervals calculated, and they appear on ECG features panel.

Standard diagnostic statements

seca CardioConcept uses ECG interpretive statements harmonized with SCP-ECG proposals. SCP-ECG presents a set of standardized clinically significant diagnostic statements, each of them mapped to a short code. The proposed set is a result of broad international consensus among many cardiology experts and major manufacturers of ECG equipment. The advantages of standardized statements are:

- Clinical relevance and meaning of each statement are both strictly defined and tested worldwide.
- Standard diagnostic codes are much shorter than their text representation. That saves storage space of ECG databases and network traffic in telemedical applications.
- The national language problem is eliminated because localized application displays the text representation of each statement in national language.

Of course, you are not obliged to employ the standard statements. seca CardioConcept allows you to create conclusions in free text format and fully ignore the standard diagnostic statement set. The free text part of the conclusion is added after standard statements if any are present.

How seca CardioConcept stores diagnostic conclusions

One cannot just modify a conclusion once created. The conclusion might be used as a basis for an important clinical decision! If somebody modifies it later, the decision "hangs without ground" and there is no way to restore the history. Thus, a conclusion cannot be modified once it is "signed". On the other hand, any conclusion made by seca CardioConcept or a human ECG reader can be wrong. If you are not satisfied with a conclusion, you can create a new one. This process is called ECG re-reading and the new conclusion overrides all previously made. seca CardioConcept stores all conclusions ever entered together with the information about the user who "signed" them. The conclusions automatically generated by software are signed by "seca CardioConcept" reader. You can browse through all available conclusions with **Previous** and **Next** buttons on **Diagnostic Conclusion Panel** of examination window.

Editing conclusion created by seca CardioConcept

The process of changing conclusion for rhythm analysis ECG record is covered in Analysing rhythm ECG records section. This section explains the editing conclusions for standard ECG records. Click  New Conclusion button if you want to tune the existing software- or user-generated conclusion. A dialogue appears. This dialogue allows you to specify which parts of present conclusion — measurements, diagnostic statements or both — you want to use as starting point for modification. If measurement and conclusion check boxes are turned on, seca CardioConcept will use existing data. Otherwise you will have to create all conclusion components from scratch.
The programme switches to New Conclusion Window. If you have not selected "measurements" check box at the previous step, just press consecutively  Automatic Representative Complex and  Automatic Fiducials buttons to allow seca CardioConcept determine median cardiocycle and fiducials. Correct the fiducial position if required (see the more detailed description in the next section). Now you are ready to create a diagnostic conclusion and  Automatic Conclusion button is enabled. Just press it and the programme will select statements in accordance with new set of ECG features. You should open the Conclusion Wizard in order to edit a ready conclusion. The previous conclusion is displayed as a template if you have selected "conclusion" check box at the beginning. Check any additional or uncheck unnecessary conclusions in the tree panel on the left side of the wizard's window. You cannot delete a statement directly from the list. Instead you have to use a tree panel for that. The Wizard behaves in the following way in order to make it easier for you. If a statement is selected in the statement list on the right, the tree view automatically moves focus and selects the same statement in the tree structure on the left. Just uncheck the statement in the tree and it disappears from the list.
The tree view organizes all the statements in several categories, which represent parts of standard ECG conclusion. You can expand or collapse the branches of conclusion tree in order to navigate through the tree structure easily. When you add a statement, dialogue with additional attributes like "probable" or "acute" appears if appropriate for the statement's semantics. When you add a statement from the tree, it appears in the statement list on the right. After you add and delete some statements in an arbitrary order, the sequence they appear in the conclusion may be wrong. Use Up and Down buttons below the statement list to change the position of selected statement within the conclusion.
You do not need to open the Conclusion Wizard in order to add a single standard diagnostic statement to the conclusion. If you press  **Add Diagnostic Statement** button on the Diagnostic Conclusion panel, the Add Diagnostic Statement to your conclusion window appears. You can easily pick a required statement to be added to the existing conclusion.
Some diagnostic information cannot be expressed with the built-in set of statements. Unfortunately it relates to comparison of present ECG with previous ones. Type the necessary text into Free-text conclusion area in the bottom of **Conclusion Wizard** window.

Creating a conclusion from scratch

Click **New Conclusion** button of ECG Viewer or Rhythm Viewer (or use **New** command of **Conclusion** menu) and make sure that **measurements** and **conclusion** check boxes are unchecked in the **New Conclusion** dialogue. The system discards the existing set of ECG features and diagnostic statements in this case and creates a new conclusion from scratch. The following relates to Standard ECG Analysis Workbench. As automatic ECG analysis is very rudimentary for rhythm analysis ECG record, a new conclusions for it is always made "from scratch". Thus the process of creating new conclusion for this type of record is covered in special section of this manual.

Press  Choose Representative Complex button or use **Representative complex** command (**Manual analysis** menu) in order to enter Choose Representative Complex window. This is the only enabled button at the beginning of analysis. Examine the ECG carefully and select the complex with least noise and artifacts. Scale the view to see the details better. Click with the mouse to set the left boundary line of the representative complex some milliseconds before the P wave or about 200 msec before QRS onset if no P wave is present. The same way click to set the right boundary a few milliseconds after the end of T wave. Two vertical lines appear. Drag them with the mouse to correct their positions if required. Make sure the left line is situated before the P wave and that the right line is after the T wave end in all lead. Press **OK** button to return to New Conclusion Window. Now the representative cardiocycle is set. The RR interval and average HR are calculated automatically at this point. You can measure RR with Callipers Tool and enter right figures manually by double-clicking on the corresponding field on ECG Features Panel if you are not satisfied with automatically calculated value. In order to renew automatically calculated HR you should reenter **Choose Representative complex** window and quit it by pressing **OK** button.

Press  Set Fiducial Points button (is activated by now) or use Fiducial points command (Manual analysis menu) in order to open the Set Fiducial Points window. If you click on the window with the left mouse button, a vertical line marked "**Pon**" appears. The second click creates the line marked "**Poff**", the third — "**Qon**", then "**J**" and at last "**Toff**" line is created. These points correspond to P wave offset, QRS onset, J point and T wave offset. You can move lines by dragging them with the mouse. If you want to change the mark of the line (i.e. the fiducial it represents), you can click on the text label with the fiducial name. The mark will be changed in series with each click from "**Pon**" through "**Toff**", i.e. **Pon** to **Poff**, **Poff** to **Qon**, **Qon** to **J**, **J** to **Toff**. So click the P wave onset, then P wave offset and so on. If there is no P wave, just set the mark of the leftmost fiducial to be "**Qon**". Click on the mark with right mouse button to remove the fiducial point represented with the corresponding line. Obviously nothing will happen if you click to the left of **Pon** or to the right of **Toff** positions.
Representative complexes of all twelve leads are very enlarged in **Set fiducial points** window, thus you can see ECG fiducials of all leads in detail. It is very important that fiducial points position is correct in all leads. It means that "global" J point (*J* fiducial) should correspond to QRS end in a lead in which it has the longest duration, i.e. to the **rightmost** J point position among all leads. The opposite is true while selecting QRS onset point that should correspond to the earliest sign of ventricular activation. Thus, "global" QRS onset (*Qon* fiducial) must be set to the **leftmost** QRS onset among all leads. Positions of other fiducials should be set in similar way, i.e. P wave onset (*Pon* fiducial) corresponds to the earliest atria activation, P wave offset (*Poff* fiducial) to the latest P wave termination and T wave end (*Toff* fiducial) should fall on the end of the longest T wave (but not on the U wave!) among all twelve leads. When all ECG fiducials are set correctly, close the window by pressing **OK** to save fiducials position and continue the ECG analysis. If you want to resume the process, press **Cancel**. Now when the fiducial points are set, main ECG features (PR(Q) interval, QRS duration, QT/Qty, QTd/QTdc, P-, QRS- and T-axis) will be calculated by the software and displayed in ECG Features Panel. If you are not satisfied with calculated QTd/QTdc you can manually correct it. Other features cannot be changed as they depend on fiducial points position. You have to change the fiducials to correct these values. The  Automatic Conclusion and  Manual Conclusion buttons are enabled.

Now you can press  Automatic Conclusion button or use **Conclusion** command of **Automatic analysis** menu to have seca CardioConcept generate new automatic conclusion in accordance with the fiducials you have just set. If you want to add a couple of standard diagnostic statements to the conclusion, just press  **Add Diagnostic Statement** button in order to evoke Add Diagnostic Statement to your conclusion window.

Alternatively you can create the conclusion from scratch. Call the Conclusion Wizard with  Manual Conclusion command (**Manual analysis** menu) or the corresponding button. If you do not agree with some of the statements, just remove them. First of all remove the last statement that qualifies the ECG as normal, borderline normal, etc. This statement is automatically generated by software because it is a requirement of the **Common Standard for Quantitative Electrocardiography**. It is clear that this type of statement is redundant in a human-made conclusion. Add all statements you need and arrange them in proper order as described in the previous section. You are free to add some additional text into Free-text conclusion area. If you do not want to use standard diagnostic statement set, you can type the whole conclusion into Free-text conclusion area in free text format. Press  **OK** to save newly created conclusion and return to New Conclusion Window. This is the end of diagnostic interpretation. Press  **OK** button on New Conclusion Window toolbar. The conclusion together with new representative complex and all ECG features are now stored in the database and "signed" by you.

Analysing rhythm ECG record

You can create diagnostic conclusion in New Rhythm Conclusion window. This type of recording is mostly used for documenting rhythm disturbances, thus serving as an add-on to a standard ECG record. As automatic QRS detection is the only type of automatic analysis available for rhythm analysis ECG record, diagnostic interpretation is performed in more traditional way than that of a standard ECG record. seca CardioConcept provides you with following tools for alleviating analysis and increasing your performance.
First, you can use Conclusion wizard to create a diagnostic conclusion quickly.
Second, you can measure ECG parameters with the ECG Callipers.
QRS Marker tool will allow you to easily calculate maximum, minimum and mean heart rate and RR interval of the long ECG record.
And the last but not the least, you can use User Marker tool to set markers on any place of ECG curves. Time intervals between them are calculated and displayed automatically. This is particularly useful while discriminating between various arrhythmias and conduction disturbances. For example you can decide if P-wave "candidates" follow in the proper order. Or check that coupling intervals of two premature complexes are the same.
These tools will make it possible to analyse the long ECG record directly on computer display.

Using telemedical functions of seca CardioConcept

General notes

seca CardioConcept has been designed with telemedical application in mind. You can prepare a package of ECG recordings (ECG Envelope) to be sent to remote consulting. An ECG expert on the other end of telemedical network can use seca CardioConcept for viewing and analysing this examination. New conclusion and comments are added to the envelope. Then it can be sent back to you so you can use the conclusion and recommendation of the consultant in patient management. A special programme module Mail client is used for message exchange via the Internet.

Understanding electronic mail basics

seca CardioConcept uses Internet Mail for organizing telemedical remote ECG consulting. If you are an experienced user of the Net, you can skip this section.
Electronic mail *message* is composed of a *header* with information about sender and recipient, a text *message body* and possibly one or more *attached binary files*. In order to use electronic mail a user has to obtain *an e-mail address* from his/her *Internet Service Provider* (ISP). ISP creates *a mail account* and a temporary message storage (a so-called *mailbox*) for the user within its host computer. Since this moment the user is able to send and receive messages via the Internet.
Message exchange in the Internet is based on two main protocols of data transmission. First, *SMTP* protocol is used to send messages to other e-mail users. *POP3* protocol is used to receive messages from your mailbox. Actually two programmes, *SMTP server* and *POP3 server*, run on ISP host computer and process request from *mail client* applications accepting and storing new messages to and from the user, automatically creating special types of messages used as confirmation of delivery and forwarding all the messages appropriately.
Thus, a mail client application is required for a user to connect to SMTP and POP3 servers and send/receive messages. In order to work properly this mail client must be configured. First, the user address is required for your messages to be replied. Second, you must set the *names* (a special Internet addresses like smpt.provider.com) of your provider's SMTP and POP3 servers. Third, the name of your mail account and password is required for your mail client to authorized connection to your provider.
There are two types of mail client applications. First one is a *general purpose mailer application* that is capable of sending and receiving any types of e-mail messages for general purpose communication. seca CardioConcept Mail client is an example of *specialized mail client* that relies on Internet protocols for message transfer only. The specific information is stored in proprietary format and can be utilized by seca CardioConcept only.
You can use either *dial-up networking* or *local area network* (*LAN*) in order to reach your ISP. Dial-up networking allows you to connect through standard telephone lines and a modem while LAN access is configured by a network administrator to be shared all over the local network. Both dial-up connection through telephone lines or local network gateways can be used for access to the Internet (remote networking). These parts are integrated into the operating system of your computer. As seca CardioConcept can be run on 32-bit Windows operating systems only, it uses Windows RAS (Remote Access Services) for Internet connection. Please see Windows manual or ask your system administrator for details how to configure Windows RAS.

Understanding seca CardioConcept telemedical model

As it was mentioned above, seca CardioConcept uses Internet Mail for transport purposes. Being configured as mail client, every computer with seca CardioConcept forms a node of telemedical network capable of:

- sending ECG recordings for rereading or second opinion;
- receiving ECG for interpretation, analysing data and replying the requests;
- collecting and managing answered requests.
- importing received results of the consulting into seca CardioConcept database.

The main idea behind seca CardioConcept telemedical model is that every seca CardioConcept installation can function as both a client of remote consulting service and as a workstation for processing consulting requests.
Every seca CardioConcept message or ECG Envelope is an ordinary e-mail message with "seca CardioConcept Mail 5.5" line in the Subject field. The body of the message contains the string "seca CardioConcept 5.5". All information specific to electrocardiography is stored in an attachment file with ".cbm" extension. The size of the message depends on the number of ECGs in it and approximately amounts to 20-25 kilobytes per a standard ECG record. The size of rhythm analysis ECG record depends on its length and can be calculated using the formula:

message size = length of record (sec) X 2.5 kB.

The information in a message is equivalent to that stored in seca CardioConcept database. Two additional text fields are included into messages. The first one is called "Request message" and normally is filled in during preparation of the envelope for sending. It can contain any supplementary clinical or organizational information. The second one is called "Answer message" and is filled in by the consultant. It may contain any comments that are not suitable for ECG diagnostic conclusion. The parties of telemedical network are called in the following way: *a client* sends electrocardiogram and other diagnostic data to *a consultant* seeking for expertise or second opinion. Message is called *request* in this case. The consultant reviews the data sent and comes to a *conclusion* that is sent back to the client. This reply message is called *answer* in this case.
The Mail client stores all messages in a special mail database, sends the queued outgoing messages, checks for incoming messages on the ISP server and manages the processing of the messages. The typical route of an ECG record is like this:

- The message is prepared and put into Outbox folder of mail database and is marked as a request that is ready for delivering;
- As soon as you connect to the net, the message is forwarded to the recipient. The message is put into **Sent** folder;
- The recipient checks his/her mailbox with his/her Mail client. All seca CardioConcept messages are retrieved from the server, are put into **Inbox** folder and marked as pending requests. A special delivery confirmation is generated for each received message and forwarded to the sender;
- As soon as the expert analyses the ECG, creates new conclusion and fills in the Answer message field, the message is marked as an answered request (or just an answer) that is ready for delivery and is put into **Outbox** folder;
- The queued answers are forwarded in accordance with their reply addresses during next Internet session;
- The client receives the message with answer and puts it into **Inbox**. Mail client matches the arrived answer with the corresponding request in the **Sent** folder and merge them. At the same time it generates the confirmation of delivery and forwards it to the consultant;
- You can view the answer with standard seca CardioConcept tools.

Thus, your seca CardioConcept workstation can be used both for sending/receiving requests and receiving/sending answers. This makes seca CardioConcept suitable not only for simple star-topology telemedical networks (that means a central consulting station with several clients connected) but for more complex distributed telemedical solutions as well. At the same time seca CardioConcept can be used for general purpose ECG data exchange between medical professionals or for sending examination data from one medical institution to another.

Sending, receiving and analysing seca CardioConcept messages

We assume that you use ECG Viewer for sending a standard ECG record. The usage of Rhythm Viewer is absolutely analogous.
If you decide to send an ECG to remote consulting service, just select the **Send to consultation** command of ECG menu. Compose request dialogue will appear. You have to specify the recipient address and fill in the request text. There is a possibility to mark the outgoing message as an urgent one. Add some previous examinations if they are required for comparison. You can add as many additional records as you like. Just remember that it increases the size of the message thus boosting requirements for storage capacity and transfer time. Press  **OK** button on the toolbar. New seca CardioConcept message - ECG Envelope - is placed into **Outbox** folder of mail database by default. If it is necessary to send the message immediately, you should set the corresponding check box in **Compose request**

window. In this case after pressing **OK** button Mail client will try to set a remote connection and send a message. If Send immediately check box is not set, you have to exit ECG Viewer and enter Mail client for sending messages.

While in Mail client, you can edit the ECG Envelope using  **Envelope** command of Message menu or the corresponding toolbar button. Envelope dialogue will appear. You can change recipient e-mail address, the text of request message and set urgency flag.

Use **Send** command of Connect menu or  **Send/Receive** toolbar button to have all queued messages sent. The connection status messages will appear on the status bar. If you select **Send/Receive** or **Receive** commands, the program will check the messages available on server. These can be requests from other seca CardioConcept nodes and answers on your earlier requests. The answers will be merged with the corresponding requests in the **Inbox** folder together with received requests. The Header and Message body panels show the content of the selected message. Use Open command and  toolbar button to view the ECGs itself. Use Answer command or corresponding button  for viewing ECG of a request message, confirm the automatic conclusion or create a new one and place the answer into **Outbox** folder as it is ready.  **Envelope** command is available for editing the ready answer messages. You have to use the  **Envelope** command and set the **Put into Outbox** flag in order to place the answer into **Outbox** for delivery, otherwise the message will stay where it is. If there is no space for the message in **Outbox** folder you can drag the message there by using the mouse later.  **Send** command will allow you to send the answers back.

CardioPortable operation specifics

CardioPortable operation

Introduction

The usefulness of multi-user ECG databases is diminished by the need to acquire ECG at "the site"—in a ward, at a patient's home etc. The task is easy to accomplish with a portable ECG machine but then the problem of storing the recordings in the database arises. Diverse digital ECG equipment employs proprietary and incompatible data formats while traditional analogous devices lack this capability at all. The main idea behind CardioPortable is to alleviate development of complex "paperless" solutions for health care institutions.
CardioPortable module allows the clinicians to combine the advantages of multi-user ECG database on a network server with capabilities presented by a portable computer. After CardioPortable is installed and configured, you can unplug the computer from network and use in any relevant environment—in an ambulance vehicle, during rounds in patients' homes, in a hospital ward etc.—while having all the functionality of networked seca CardioConcept software still at hand. You can acquire new ECGs, view them on the screen, compare with those in the local database, create new diagnostic conclusions and print examination reports. The access to the information is governed by the same strict rules as in client/server seca CardioConcept settings. At the end, you will have all the data collected in off-line mode safely transferred to the sever database by the data synchronization utility as soon as the portable computer is connected to the network again.
Some understandable limitations are posed by data integrity considerations on work in off-line mode though. Users cannot edit or delete patient records and user accounts downloaded from the server. It does not affect the programme main intent—ECG acquisition and analysis. Moreover, no limitations at all apply in on-line mode when CardioPortable computer is connected to the master database.
You will find CardioPortable equally useful in environments other than large hospitals and outpatient centres, e.g. in a GP's office or in CICU. Even if you use only two PCs (a desktop and a portable one), CardioPortable allows to benefit from mobility, digital ECG archive and easy access to ECG recordings where and when a need occurs.

What CardioPortable is particularly intended for

When designing CardioPortable, the developers took in mind two main scenarios.
The first one is aimed at selective ECG acquisition hospitals and large outpatient centres for the patients that cannot be brought to a fixed-site cardiograph based on a desktop PC. A nurse or a technician is a typical CardioPortable user in this case. After all administered ECG recordings are performed; CardioPortable notebook can be connected to the server through any available network socket and the acquired data are uploaded. Since this moment, new ECGs are accessible all over the network.
The access to patient records and ECGs on a portable computer in off-line mode is controlled in the same way as it is in client/server seca CardioConcept environment. After successful synchronization, uploaded data can be purged from the local database automatically in order to preserve privacy, keep the local database small and do not tangle with

further off-line CardioPortable sessions. Alternatively, the synchronized data can be cleaned up manually from local database at any time at user discretion.
In the second scenario, CardioPortable laptop serves as a mobile mirror of the master database. A GP that needs to visit patient at their homes or work in a hospice is the proposed user. The doctor, a nurse or a doctor assistant performs the acquisitions and on-screen ECG analysis (if necessary) right at the site using portable computer. The data is transferred to an office desktop or to a server with seca CardioConcept installed after the rounds for permanent storage. Recordings of the patients that require frequent electrocardiographic assessment are accumulated in the course of day-to-day work so it is practical to compare a newly recorded ECG with the relevant previous ones directly at the site of examination rather than postpone the final judgment until return to the office. A full set of data is still available at the office at any time.

Switching between operation modes

First, the mode of operation can be chosen while launching seca CardioConcept application. Just select the corresponding radio-button in the Login Window. Make sure the computer is properly connected to the network if you are intended to work in on-line mode. Otherwise, an error message will appear and you will have to login again. If you use Windows NT operating system, you may need to restart seca CardioConcept or even reboot the laptop to enable network access.
The second procedure can be used if seca CardioConcept is already running. Normally it is used for switching CardioPortable off-line after synchronization but this is not obligatory. Use the CardioPortable Control Window button for turning on the mode alternative to that the programme currently is. If you click it with the mouse, Login Window appears and prompts you to enter your user name and password. The programme will switch to the required mode of operation after the connection to corresponding database is established. If you provide wrong login data or the master database is not accessible due to network failure in case you try to switch on-line, error message will appear and you will have to repeat the procedure.
It is useful to know that the mode of operation is indicated on the title bar of Control Centre.

Data synchronization and synchronization log

Make sure that seca CardioConcept is in on-line mode and network is up and running prior synchronization and switch into on-line mode if necessary. In order to initiate the process, open CardioPortable Control Window and mouse-click  **Synchronize** button. Log information area and time indicators show the course of the process. Patient records added in off-line mode would be checked against those in the master database. If data collision is revealed, a Similar patients exist window will appear. Please see the corresponding section for detailed description of data integrity rules and means of resolving data collisions in seca CardioConcept database.
In the case synchronization is cancelled by the operator, the process will not be terminated immediately. The programme will wait for completion of current record transfer and stop synchronization after that. Therefore, you have to be patient if the network connection is slow. We suggest you use  **Stop** button only in case of emergency ECG acquisition or similar reason occur during synchronization.
If **Autodelete** synchronized data option is on, all data that have been successfully uploaded is deleted from the local database. Otherwise, the operator is prompted to delete it. Removal of synchronized records from local databases can be primarily stipulated by privacy considerations. It is useful to keep the local database small for performance reasons as well.
The log of the messages generated during the last synchronization is shown in Log information area of the CardioPortable Control Window. Alternatively, you can view the file lastsync.log that resides in seca CardioConcept installation folder (C:\Program Files\Cardio Concept by default) in any text editor. As information describing all errors and exceptions that took place during synchronization are written in this file, you can use it to backtrack the problem. If some synchronization errors persist, it is a good idea to send a copy of lastsync.log file to seca CardioConcept technical support.

Off-line operation mode specifics

What you can do in off-line mode

The following functionality is available in off-line mode:

- Adding new patient records;
- Adding information of insurance companies;
- You can edit or delete patient and insurance company records until they are synchronized;
- ECG can be acquired for the newly entered patients as well as for those whose records were downloaded from the server/synchronized;

- New diagnostic conclusions can be created for any ECG recording stored in local database. It is worthwhile to notice though that the ECGs and diagnostic conclusions made in on-line mode are not uploaded at synchronization;
- Print examination reports on a printer connected to the portable computer;
- Edit protocol templates in the local database. These templates will be accessible in off-line mode only;
- Change the programme settings. The changes will affect both modes;
- Send the electrocardiograms in the local database to a remote consultant and receive the answers of the consultant through e-mail;
- Receive ECGs for reviewing and send the conclusions back through e-mail. The received recordings can be imported to the local database.

Things that cannot be done while off-line

Two types of activities are not allowed while in off-line mode even for user with administrative privileges:

- Although you can modify or delete non-synchronized patient records, any patient related data (e.g. patient records or insurance company records) that are downloaded from or successfully uploaded to the master database cannot be changed or deleted while seca CardioConcept application is in off-line mode.
- User accounts cannot be modified, created or deleted in off-line mode.

In order to correct, create or delete patient records, insurance company records or user accounts, you have to switch the seca CardioConcept application to on-line mode. You also need to carry out synchronization for the changes become available in off-line mode.

Error messages and troubleshooting

Hardware and system error messages

CBMMD.DLL not found or corrupt.
One of the files needed to run seca CardioConcept is missing. Ask seca CardioConcept administrator to reinstall the programme.

COMPRESS.DLL not found or corrupt.
Some internal error occurred during the work of DSP board. If the error persists apply to technical support.

Emulation file not found or corrupt.
You are working in emulation mode but the emulation file, which contains ECG data, was deleted or corrupted. Open Options dialogue, choose hardware tab and look at the list of emulation files. Check that all of them are present. Choose different files using **Browse** button (normally, emulation files are located in EMU subdirectory of the seca CardioConcept working folder).

Patient adapter not connected.
seca CardioConcept cannot detect the presence of patient adapter. Check the connection of patient adapter to DSP board. If the error persists apply to technical support.

Time out when starting driver.
This error may appear when seca CardioConcept was unable to initialise DSP board and patient adapter during nominal time. Wait 10 seconds and try to start recording again. If the error persists apply to technical support.

Cannot open pipe for CT110 USB device.
CT110 device not found.
Please ensure that CT110 recorder is connected and turned on.
USB version of patient adapter or CT110 ECG recorder does not functioning properly. First thing, try to unplug the USB connector and plug it in again. If this does not work, you have to reinstall USB driver. If this fails as well, call technical support.

Device not working properly.
Something is wrong with seca CardioConcept ECG acquisition hardware. Shutdown and restart the computer. If the error persists, call technical assistance.

Not enough memory to run diagnostics.
This error may occur if too many Windows applications are loaded at the same time and thus too little is rest to seca CardioConcept. Close unused application and repeat the operation that was interrupted by the message.

This language is not supported by the system.
You are trying to set seca CardioConcept interface language in conflict with Window international settings. Install National language support you need and try to reconfigure seca CardioConcept again.

Error opening device driver.

An error occurs while loading seca CardioConcept ECG acquisition driver. Reboot the computer. If the error persists, call technical service.

Database connection error messages

Access verification failure. Check login and password.
When seca CardioConcept is started, you have to enter login name and password. seca CardioConcept was either unable to find login name in the list of user accounts, or the password is incorrect. Try to enter login and password again. If error persists apply to seca CardioConcept administrator.

Login is not unique.
This message may appear when you add new user or edit user information. You can have in the database only one user with specific login name.

The password was not correctly confirmed.
This message may appear when you are trying to add new user or changing your password. To avoid typing errors you have to enter new password and confirm it. Retype your password and confirm it again.

This user is referenced in database and cannot be deleted.
There are references to this user in the database, and thus you cannot delete it.

User cannot delete himself.
This message may appear when you try to delete your own user record in User Administration window. Ask another seca CardioConcept user with administrative rights to do this.

User seca CardioConcept cannot be deleted.
There is a predefined user account "seca CardioConcept", which is used internally to sign conclusions made by the programme. This account cannot be edited (except for password) or deleted.

User with the same full name already exists.
This message may appear when you enter new user account. You can have in the database only one user with specific full name.

User's last name and login must be set.
This message may appear when you are editing user information. For each user the following information should be specified: surname, login name.

Cannot create unique ID for new record.
Something obscure and evil happened in seca CardioConcept database internals. Call for clerical support.

Invalid ID number.
Inconsistency between ID and birth date.
Inconsistency between ID and sex.
Patient data and Swedish, Danish or Norwegian Social Security number are in conflict. Check the data for errors and correct if necessary.

Cannot decompress ECG conclusion data.
Cannot decompress ECG data.
Examination not found.
These are internal DBMS errors. Try to reboot. If error persists, call for technical service.

ECG analysis error messages

RR interval not specified.
Representative complex not specified.
Fiducial points not specified.
Conclusion not specified.
One of these messages may appear when you are entering a new conclusion. Conclusion consists of several parts, and each of them should be present. These parts are: average RR interval, representative cardiocycle, fiducial points, conclusion itself (conclusion text).

Too many diagnostic statements for this mode.
This message may appear when you are trying to filter examinations by diagnostic statements contained in conclusions. When you choose logical "AND", the number of statements is limited to 4.

Fatal error in diagnostics.
This message may appear if internal error occurs while retrieving ECG information from database. Restart seca CardioConcept and try again. If error persists, call technical support.

Invalid value.
In New Conclusion window of Standard ECG analysis, you may enter RR, HR, QTd values manually rather than calculating them automatically. Due to internal limitation of diagnostic algorithms these values must be within

following limits: RR>170 and RR<3000, QTd>200, or HR>20 and HR<350. Check the values you have entered and correct them if necessary.

Wrong representative complex

This message appears if you set a wrong representative complex, i.e. either you have set only one boundary or both boundaries are the same.

Printing ECG errors

No default protocol found.

This message may appear when you try to print from the Smart Cardiograph window ("**Print**" check-box is set). In this case default protocol template is used, but none is specified. Ask seca CardioConcept administrator to set default protocol template.

Protocol with the same name already exists.

This message may appear when you are trying to add new protocol template. You can have in the database only one protocol with specific name.

Database integrity error messages

Insurance company is specified, but policy number is not specified.

Policy number is specified, but insurance company is not specified.

These messages may appear when you edit patient information. If you enter insurance information, you should specify both the policy number and the name of the insurance company that issued it.

Insurance company name must be set.

Insurance company with the same name already exists.

One of these messages may appear when you enter new insurance company. You can have in the database only one insurance company with specific name.

Patient birth date not specified.

Patient surname not specified.

Patient sex not specified.

One of these messages may appear when you are editing patient information. For each patient the following information should be specified: surname, birth date, and sex.

This insurance company is referenced in database and cannot be deleted.

There are references to this insurance company in the database, and thus you cannot delete it.

Wrong date.

seca CardioConcept checks the validness of dates you enter. This message appears when you try to enter an invalid date.

Message transfer related topics

You must specify some recipient for the message.

This message appears if you try to place a message into **Outbox** without specifying recipient address.

seca CardioConceptPortable operation error messages

Information messages

Clear log file?

The programme asks the user to confirm log file deletion.

Purge all synchronized data?

This message appears after successful synchronization if **Autodelete synchronized data** option is off. Yes/No buttons allow you to select one of the alternatives.

Error messages

Couldn't login to database
This message appears if wrong login/password is entered or network access to the master database is broken.

Cancelled by user.
This message appears after synchronization was cancelled by user command.

Couldn't create log file
This message appears when seca CardioConcept fails to open lastsync.log file. The problem may occur if the disk is full or due to incorrectly set permissions in Windows NT/Windows 2000 based systems.

Messages in synchronization log

Insurance company XXX, created in off-line mode exists in master database. Local record discarded.
This message is written to the log file if the insurance company record transferred from the local database collides with that in the master database and the user attending synchronization discards the local record in favour of the one in the master database. See the corresponding section for detailed explanations of data integrity rules used in seca CardioConcept.

Synchronized insurance company 'XXX' not found in master database. Record will be appended.
This message is written to the log file if the insurance company record in use in the local database is deleted from the master database prior the synchronization. The record in the master database is restored in order to keep data integrity. See the corresponding section for detailed explanations of data integrity rules used in seca CardioConcept.

Couldn't synchronize patient 'XXX'. Patient ID: 'XXX'. Identical record exists.
This message is written to the log file if the patient record transferred from the local database collides with that in the master database. If no one of the messages below follows, the user attending synchronization takes no action. Otherwise, the following message provides description of user decision. No changes are made in the master database and all relevant data is left in the local database. After the problem is investigated, it is possible to resolve it at next synchronization. See the corresponding section for detailed explanations of data integrity rules used in seca CardioConcept.

Synchronized patient 'XXX' not found in master database. Record will be appended.
This message is written to the log file if the patient record is in use in the local database is deleted from the master database prior the synchronization. The record in the master database is restored in order to keep data integrity. See the corresponding section for detailed explanations of data integrity rules used in seca CardioConcept.

Server record was accepted by user.
This message is written to the log file after the message "Couldn't synchronize patient 'XXX'. Patient ID: 'XXX'. Identical record exists." in case the user takes decision in favour of the record in the master database. See the corresponding section for detailed explanations of data integrity rules used in seca CardioConcept.

Server record was updated by user.
This message is written to the log file after the message "Couldn't synchronize patient 'XXX'. Patient ID: 'XXX'. Identical record exists." in case the user takes decision in favour of the record in the local database. See the corresponding section for detailed explanations of data integrity rules used in seca CardioConcept.

Record was added to server by user.
This message is written to the log file after the message "Couldn't synchronize patient 'XXX'. Patient ID: 'XXX'. Identical record exists." in case the user decides both records correspond different people though they bear similarities. The local patient record is added to the master database. See the corresponding section for detailed explanations of data integrity rules used in seca CardioConcept.

User 'XXX' not found in master database. Couldn't append a record.
The account of the user attending synchronization was deleted from the server for some reason. Synchronization is aborted and all data left in the local database.

Synchronization process completed.
This message is written into the log after successful synchronization.

Errors occurred during synchronization.
This message is written into the log if synchronization was incomplete due to some errors.

Cancelled by user.
This message is written into the log if incomplete synchronization was cancelled by user.