

EC Sense

version 4.0



Resting ECG
Exercise ECG
Operator's manual

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1 Introduction

1.1 Intended use

EC Sense is intended to be used for recording of Rest ECGs, Exercise ECGs and Long ECGs. *EC Sense* can be used for patients using implanted pacemakers.

1.2 Contraindication for use

The application of ECG is widespread and a recognized form of examination. Users are required to have sufficient training and knowledge to judge whether the device can be used or not. There are no known medical impediments for using ECG.

1.3 About *EC Sense*

Cardiolex AB has developed a series of ECG recording products named *EC Sense* (previously Lexor X100) intended to be used for the recording of Rest ECGs and Exercise ECGs.

Depending on how *EC Sense* was ordered it can be delivered with different acquisition units and software options.

1.4 System components

1.4.1 *EC Sense* components

The *EC Sense* series consists of the following components:

Product	Description
<i>Lexor D</i>	Acquisition unit for connecting to the patient, if the <i>Lexor D</i> option is ordered.
<i>Lexor Q</i>	Acquisition unit with vacuum electrode unit for connecting to the patient, if the <i>Lexor Q</i> option is ordered.
<i>EC Sense</i>	Product for recording and reviewing Rest ECGs, Exercise ECGs and Long ECGs. <i>EC Sense</i> can be ordered with different options.

1.4.2 Related services and products

The following services and products could be used together with *EC Sense*.

Product/Service	Description
<i>EC Store</i>	Central storage system from Cardiolex that could be connected to <i>EC Sense</i> , used for Rest ECGs, Exercise ECGs and Long ECGs.
<i>MegaCare</i>	Central storage system that could be connected to <i>EC Sense</i> , used to archive Rest ECGs, Exercise ECGs and Long ECGs. Reports sent for archiving can be edited in MegaCare.
<i>MegaCare FD</i>	Service from Cardiolex that could be connected to <i>EC Sense</i> , used for Rest ECGs, Exercise ECGs and Long ECGs. <i>MegaCare FD</i> is a combination of <i>EC Store</i> and <i>MegaCare</i> to offer <i>MegaCare</i> clients full disclosure Exercise ECGs.
<i>EC View</i>	Product from Cardiolex for viewing and editing Rest ECGs, Exercise ECGs and Long ECGs stored in a central storage system. <i>EC View</i> is very similar to <i>EC Sense</i> except that it is not possible to record ECGs.

1.4.3 External devices

The following external devices may be connected to *EC Sense*: (Not delivered by Cardiolex)

Product	Model/Manufact	Description
Ergometer	Ergoline 500 Ergomed 940 Rodby 990 Monark 839/939	Ergometers suitable to connect to <i>EC Sense</i> with Exercise ECG option.
Blood pressure device	<i>SunTech</i> Tango+ Ergoline	Automatic blood pressure devices suitable to connect with <i>EC Sense</i> with Exercise ECG option.
SpO2 device	Ergoline	SpO2 measurement device that can be connected to <i>EC Sense</i> with the Exercise ECG option.

External devices that use a QRS signal may be connected to *EC Sense* with Exercise ECG option.

1.5 Safety information

This manual contains different types of safety messages written in italics on a grey background. These safety messages are placed where it is most likely that a potential danger may arise, or where the user needs additional information. The following types of messages are used:



Warning indicates a potential hazard which, if not avoided, may result in death or serious injury for the patient and/or the user.



Caution indicates a potential hazard which, if not avoided, may lead to personal injury or product damage.

NOTE:

NOTE provides the user with information on how to use the device in the best way.



Read accompanying documents (user instructions).

1.6 Operator's manual

This operator's manual is intended for the user and it includes important information for safe use and proper care of the device. The Operator's manual is an integral part of the device which should always be made available to the user. There is also a System manual, intended for technical staff, which includes information about technical specifications, installation instructions, configuration information, EMC declaration and service instructions.

1.6.1 How to read this manual

Please read all instructions and pay extra attention to safety information, warnings and cautions. Verify that the device has been properly installed in accordance with the instructions and that the users have sufficient knowledge about the requirements, including the safety instructions that have to be followed to protect the patient and yourself.



The user should read the entire operator's manual.

Read this manual carefully and pay attention to all of the safety instructions before using EC Sense. If this is neglected the patient's and your own safety is at risk.

The safety information in this manual is presented where it seems most likely that a potential hazard could occur.

1.6.2 Revision history


The information in this manual is subject to change without further notice. Version number and date is printed on each page of the operator's manual.

1.6.3 Legal rights

No part of this Operator's manual may be copied, reproduced in any form or translated without the written permission from Cardiolex.

1.7 Regulatory requirements

1.7.1 Medical Device Directive

EC Sense fulfils the requirements of the Medical Device Directive MDD/93/42/EEC and the Swedish legislation of medical devices LVFS 2003:11 and bears the marking:  0413

1.7.2 Electrical safety

EC Sense fulfils the requirements of the Electrical safety standard IEC/EN 60601-1 and applicable parts of IEC/EN 60601-1-1 and IEC/EN 60601-2-25.

1.7.3 Classification

EC Sense is classified as follows:

Requirement	Specification
MDD class	Class IIb equipment
Type of protection against electric shock	Medical equipment class I
Applied parts	Type CF. Equipment is defibrillation-proof.
Degree of protection against harmful ingress of water	No protection against ingress of water
Method of cleaning	May be disinfected with a combination of water and alcohol. Please refer to the section "Cleaning and maintenance" for further information.
Degree of safety application in the presence of flammable anaesthetic gas	Not suitable for use in the presence of flammable anaesthetic gas
Mode of operation	Continuous mode

1.7.4 Electromagnetic emission and immunity

EC Sense fulfils the requirements of the EMC standard IEC/EN 60601-1-2.

The electromagnetic compatibility with other equipment in the proximity must be considered when using ECG equipment.

Electronic equipment can both receive electromagnetic interference from other electrical equipment as well as causing electromagnetic interference with other electrical equipment. The acquisition unit is tested for electromagnetic compatibility (EMC) in accordance with the standard IEC 60601-1-2. In Europe the IEC standard is recognised as the European norm EN 60601-1-2.

The acquisition unit should not be placed nearby or on top of any other electrical equipment. If the equipment needs to be placed near to other equipment, a functionality check should be carried out to verify proper performance in the environment where it is intended to be used.

Fixed, portable and mobile communication equipment that uses radio communication may affect the performance of a medical device. Please refer to the “EMC declaration” in the System manual for recommended distances between radio communication equipment and ECG equipment.

The use of other cables than those provided by the manufacturer may cause higher emissions and reduced protection against disturbances.

1.8 Information about the manufacturer

EC Sense is designed and manufactured by the Swedish company Cardiolex AB.

Manufacturer
Cardiolex AB
Vretenvägen 6
SE-171 54 Solna
Sweden

2 Acquisition unit

2.1 Description

EC Sense comes with an acquisition unit. This manual describes the use and care of the acquisition unit named *Lexor D*. Technical information regarding *Lexor D* can be found in the System manual.

The acquisition unit connects to a PC via an USB port, from which the acquisition unit also gets powered.

The acquisition unit and the associated PC software are the fundamental parts in the *EC Sense* system (previously *Lexor 100*).

The acquisition unit must be connected to a CE marked PC, which meets the requirements of IEC 60950, and shall be placed outside the patient's vicinity. If a PC shall be used in the patient's vicinity it must be CE marked and meet the requirements of IEC 60601-1 (please refer to the System manual).

The connector of the patient cable of *Lexor D* is tamper proof as specified in the System manual.

Lexor D is intended to be connected to a patient cable.



WARNING

Lexor D may only be used together with an electrode system that has integrated defibrillation proof.

Only approved electrode systems with proper tamper proof connectors may be used.

2.2 Responsibility of the user

The product described in this manual is designed to function in accordance with the labelling and supplied information. This applies to all parts, and if any part or the entire product is worn, damaged, incomplete, corrupted, infected or can not be used for other reasons the product shall NOT be used at all. Such part or product shall be immediately replaced in accordance with the manufacturer's replacement service program. The user of the product is solely responsible for any malfunction caused by the improper use of the product as described above or if any modification has been carried out by anyone other than a Cardiollex authorized person.

2.3 Safety and cautions

2.3.1 Prior to use

Before using the product, make sure to check that no interferences occur between this product and any other devices used nearby. This also applies to nearby equipment that emits or receives radio frequencies.

2.3.2 During use

The product and the performance may be disturbed by interference from other devices which emit higher levels than what is permitted according to IEC/EN 60601-1-2. It is therefore recommended to place the product as far as possible from any emitting sources.

This product may be susceptible to ESD (Electro Static Discharge) that is introduced to the product through the patient or the user. Electro static discharges may cause artefacts in the ECG data which may lead to false interpretation. The user must be aware of this and check that no artefacts are present in the ECG data which constitute the basis for interpretation and treatment.

2.3.3 Interference

Keep power cords and other cables away from the acquisition unit, electrode set, patient cable and USB cable to avoid AC interference.

Cardiollex is not responsible for any problems caused by radio frequency interference between the product and other sources. Neither for emitted radio frequencies from the product, that may affect other medical devices exceeding the permitted levels according to applicable standards. More information about interference can be found in the "EMC declaration" in the System manual.

2.3.4 Patient safety

Lexor D is constructed so that the connection of the patient always should be “floating” (isolated) from the connection of the PC via the USB and thereby not in contact with electrical protective earth.

The user should NOT connect any other systems to the patient without verifying that a reliable isolation can be achieved for any such system. If this is neglected, the permitted levels of total leakage current may be exceeded.



WARNING

Electrical equipment that are non-medical devices, such as PCs, may not be placed in the vicinity of the patient, as specified in the IEC/EN 60601-1-1 standard.

Any combination of acquisition units and non-medical devices shall be approved by personnel competent to verify electrical safety prior to use. This also applies when isolation transformers are used.



WARNING

No patient cables or electrode sets other than those specified in this manual should be used. They are part of the safety system of this product, and the use of other systems may put the patient at risk and alter the product's performance and the defibrillation proof

Do not come into contact with any part of the *EC Sense* system during defibrillation. It is advised to check the performance of the system after defibrillation.

EC Sense should not be used together with HF surgery devices.

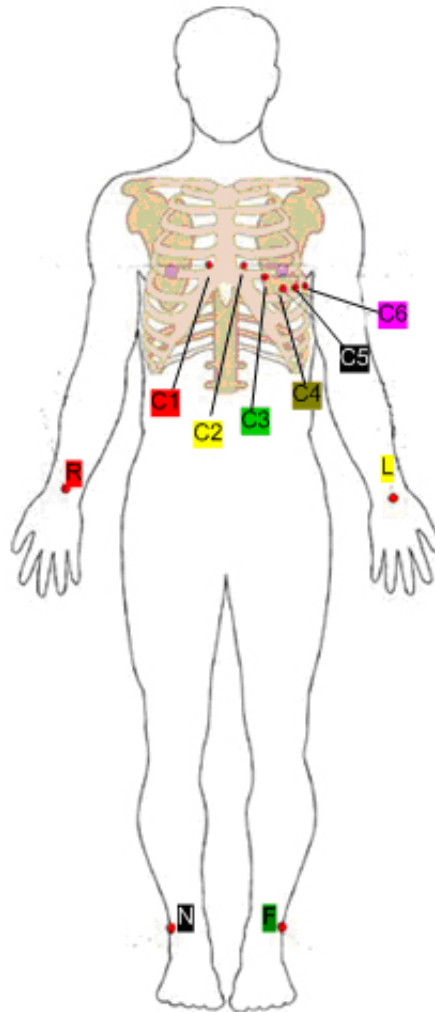


CAUTION

Place a towel or similar between the patient's skin and Lexor D to prevent possible allergic reactions if Lexor D is to be used for a longer period.

2.4 Electrode setting

2.4.1 Adult ECG electrode setting



The electrodes should be placed according to the figure above. Shave excessive hair growth if needed.

NOTE

If the electrodes are placed differently the analysis may generate misleading results.

2.4.2 Pediatric ECG electrode setting

The electrode placement on children differs from the placement on adults. When the program analyses an ECG as a pediatric ECG, it assumes that this placement is used.

NOTE

If the electrodes are placed differently the analysis may generate misleading results.

The electrodes on children should be placed as follows:

- C1 shall be placed where C4 normally is but on the right side.
- C2 shall be placed where C1 is normally placed.
- C3 shall be placed where C2 is normally placed.
- C4-C6 shall be placed where they normally are placed.
- R, L, N, F shall be placed where they normally are placed.

This gives the following leads:

- C1 – V4R
- C2 – V1
- C3 – V2
- C4 – V4
- C5 – V5
- C6 – V6

2.4.3 Electrodes

EC Sense displays leads that are based on all electrodes. The quality of the examination depends on all electrodes being properly attached and that thorough skin preparation has been carried out.

The following electrodes have been verified to be used together with EC Sense:

Lexor D: Unomedical Unilect long-term, Ref 4060
Ambu Blue Sensor M, REF M-00-A
Ambu Blue Sensor M, REF M-00-S



WARNING

Use of other electrodes may affect the recovery time during defibrillation and the user will have to take the full responsibility for such use. When connecting to the patient, make sure that the electrodes don't come into contact with other conductive materials. The patient's safety will then be at risk.

2.5 Maintenance and care

2.5.1 Millivolt pulse

Use the millivolt pulse at regular intervals to check the integrity of the amplifier chain.

2.5.2 Cleaning of Lexor D

Lexor D can be cleaned with water, lukewarm soap water or a neutral detergent.

It is also possible to disinfect *Lexor D* with chemical disinfectants containing ethanol (70-80%), propanol (70-80%) or aldehydes (2-4%).

Avoid excessive fluid; instead use a cloth that is slightly damp.



Cleaning and disinfection shall only be done by surface cleaning.

Lexor D is not protected against ingress of dust or water. This must be considered when cleaning the product.

2.5.3 Cleaning of electrode system connected to Lexor D

Follow the recommendations of the manufacturer when cleaning the electrode system.

2.5.4 Recycling and disposal

Used single-use electrodes should be handled according to the appropriate manufacturer's recommendation. The product and its packaging shall be recycled in accordance with local and national waste management regulations.

The waste of electric and electronic equipment must not be disposed of as unsorted municipal waste, but must be collected separately for disposal. Contact Cardiolex for further information on how the acquisition unit *Lexor D* shall be disposed of.

2.6 Storage and transport

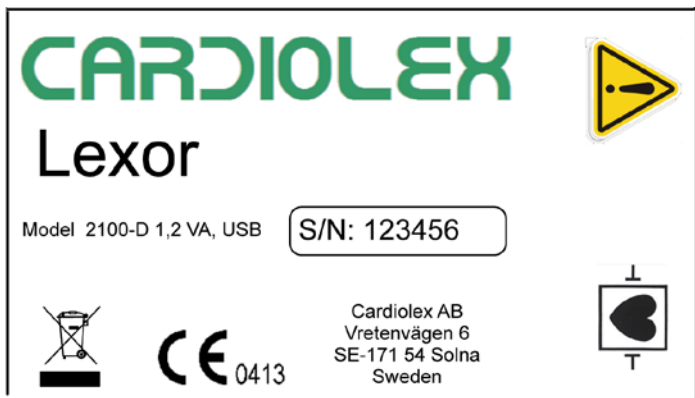
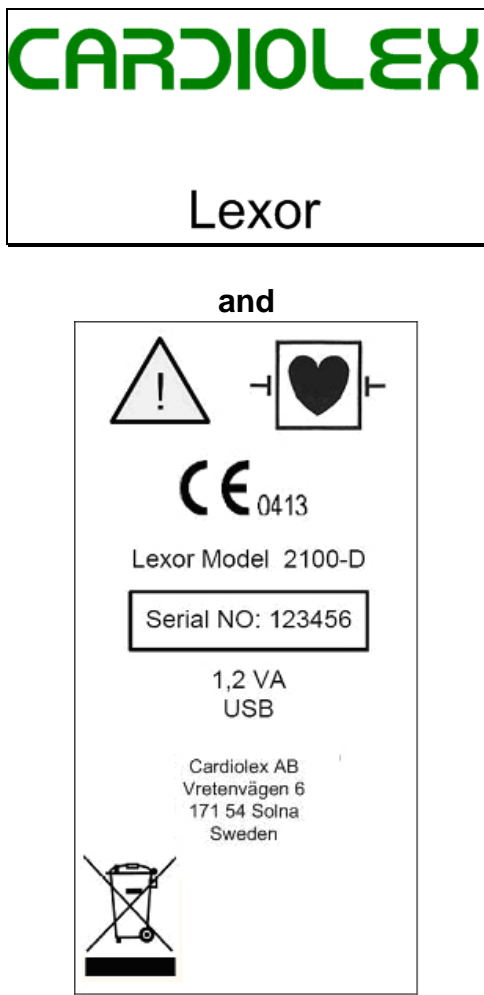
Storage and transport of the system, or any parts thereof, must meet the following requirements:

Temperature: -20°C to + 70°C





Humidity: 10% to 90%, non condensing

2.7 Labels

The system marking is placed on the *Lexor D* unit.

Serial numer over 100810	Serial number under 100810
	

2.7.1 Explanation of symbols

Marking/Symbol	Meaning
	Defibrillation proof, type CF equipment
	Refer to the Operator's manual
	CE marking. Indicates that the product conforms to the Medical Device Directive 93/42/EEC. The number refers to the Notified Body that has approved the product. Fulfills the requirements of the Swedish legislation LVFS 2003:11.
SERIAL NO: 123456	Serial number
1,2 VA	Power consumption
USB	PC connection via USB
Manufacturer and address	Cardiolex AB Vretenvägen 6 SE-171 54 Solna Sweden
	Indicates that the product conforms to the EU directive 2002/96/EC regarding waste from electric and electronic equipment. Please refer to separate instructions on the decommissioning of products.

3 About *EC Sense*

3.1 *Menus and basic functions*

This section gives a general explanation of the basic functions of *EC Sense* and how to operate the menus. The user shall be familiar with these functions before starting an ECG examination.

3.1.1 *Start-up screen*




The start-up screen will be presented for a few seconds to indicate that *EC Sense* has started.

3.1.2 *Menus and shortcut key commands*

Many functions in the program can be activated in several ways: To select a function you can either:

- Click on a menu item in the upper menu bar
- Click on an icon
- Right or left click on the mouse inside the ECG/Report windows to open a pop-up menu
- Use the keyboard and shortcut key commands

In general the keys function as follows:

Key	Function
F1-F12	Activate program functions with the function keys F1-F12.
Alt + letter	Press the Alt key and the first letter in a command simultaneously to open a menu.
Return	Use the Return key to confirm a selection and/or move to the next text box.
Tab	Use the Tab key to move inside a list of selections and/or move to the next text box.
↑ ↓	Increase/decrease a value or move up/down in a list of selections.
ESC	Stop and escape from an activity.
	An exclamation mark in a red circle will be displayed if data entry is incorrect.

If you don't want to, or can't use, the mouse most patient data can be entered from the keyboard with a few shortcut key commands using the function keys. When working with reports or settings it will be more or less necessary to use the mouse.

NOTE

Shortcut key commands have a different meaning depending on from where they are activated in the program. Commands that are used for entering patient data do not have the same function as they have in the report mode. The tables in each section show which shortcut key that can be used for the described mode.

3.1.3 Real time display

Depending on the selected system settings the items on the screen may look different. In this manual the settings for *EC Sense* reflects the system as when it is delivered from the factory.












- | | |
|---------------------------|-------------------------------|
| 1. ECG monitoring window | 5. Lead ID |
| 2. Upper icon bar | 6. Lower icon bar |
| 3. Menu bar | 7. Patient ID and information |
| 4. Monitoring information | |

3.1.4 ECG monitoring window

EC Sense uses most of the screen for curve display. The curves are updated with a wiping bar. The most recent ECG data from the patient can be seen to the left of the empty gap in the ECG traces. The ECG presented to the right is delayed for a few seconds, depending on the selected sweep speed

3.1.5 Upper icon bar

Most icons are presented on the upper part of the screen. They have the following functions: (Corresponding function key is also presented).

Icon	Fn	Function
	F2	Enter patient information.
	F3	Use AUTO 1 to record a Rest ECG according to a predefined sequence.
	F4	Use AUTO 2 to record a Rest ECG according to a second type of predefined sequence.
	F5	Start a real time printout of the traces displayed on the screen.
	F6	Start a predefined printout of the real time ECG.
	F5 F6	Stop the ongoing printout.
	F7	Show a list of the examinations that are stored in <i>EC Sense</i> or in the central storage system.
	F8	Start the option Exercise Test. (The icon is not displayed if the option is not installed).
	F9	Start the option Long ECG. (The icon is not displayed if the option is not installed).

3.1.6 Menu bar

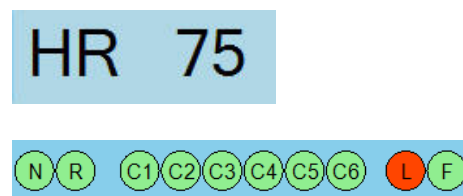
The following selections are available from the menu bar:

Menu	Command		Function
<i>File</i>	<i>Patient Info</i>	F2	Enter patient information
	<i>Auto 1</i>	F3	Start automatic ECG sequence 1
	<i>Auto 2</i>	F4	Start automatic ECG sequence 2
	<i>Man Print</i>	F5	Direct printout of traces in real time
	<i>Rhythm Print</i>	F6	Formatted printout of traces in real time
	<i>Exercise Test</i>	F8	Start Exercise Test (option)
	<i>Long ECG</i>	F9	Start Long ECG (option)
	<i>Examinations</i>	F7	Open the list with examinations
	<i>Settings</i>	Ctrl+ Shift+ Up	Change settings
	<i>Exit</i>		Quit the program
<i>View</i>	<i>Leads</i>	►	Select which leads to be displayed
	<i>Speed</i>	►	Select sweep speed
	<i>Gain</i>	►	Select gain
	<i>Tremor Filter</i>	Ctrl+F	Activate tremor filter
	<i>Millivolt</i>	F10	Print a millivolt pulse (calibration)
<i>Tools</i>	<i>Patients</i>		Add new or delete old patients
<i>Help</i>	<i>About</i>		Information about <i>EC Sense</i> software versions etc. that is needed in the case of any complaints or problems.



3.1.7 Monitoring information

The upper right area displays current HR and information about the signal quality of the electrodes. The HR value is updated after every new heartbeat.



If any of the electrodes has a poor connection, the corresponding electrode will be indicated with a red circle. Electrodes where the signal quality is very weak or questionable will be indicated with a yellow circle.

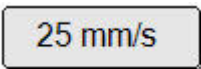
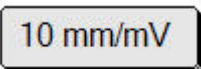

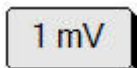
3.1.8 Lead ID

The area displaying the lead IDs is located to the left on the screen.

Key/Icon	Function	Selection
	<p>Used to change lead combination. Click on the mouse inside the area to show a list of different lead combinations →</p> <p>It is possible to define which leads that should be displayed under each selection (see "Settings" in the System manual).</p>	
	<p>If less than 8 leads are selected, all leads will not be displayed simultaneously on the screen. Instead the leads will be shown on several consecutive pages. The up arrow at the top, or the down arrow at the bottom, can be used to scroll between the pages. (The arrow will only be displayed if less than 8 leads are selected).</p>	

3.1.9 Lower icon bar

When clicked on, the icons on the lower part of the screen display different options on how to record the ECG. They are used to change speed, gain and/or filter characteristics. *EC Sense* can be configured so that filter, gain, lead combinations, heartbeat values and grid will be reset to default settings upon start-up and selection of a new patient ("see "Settings" in the System manual).

Key/Icon	Function	Selection
	Used to change sweep speed. The speed on the screen (or on the printout when MAN is selected) can be selected to one of the following →	<div> <div>200 mm/s</div> <div>100 mm/s</div> <div>50 mm/s</div> <div>25 mm/s</div> <div>10 mm/s</div> <div>5 mm/s</div> </div>
	The gain on the screen (or on the printout when MAN is selected) can be selected to one of the following →	<div> <div>40 mm/mV</div> <div>20 mm/mV</div> <div>10 mm/mV</div> <div>5 mm/mV</div> </div>
	Muscle filter can be activated or deactivated. → Frequency can be selected between 35, 75 or 100 in <i>Settings</i> . The selected frequency will be displayed. Filter status will be displayed on the screen and on MAN/RHYT printouts.	<div> <div>75 Hz</div> <div>Off</div> </div>
	Generate a millivolt pulse throughout the amplifier chain.	

3.1.10 Information area

The name of the patient and the ID are displayed on the lower part of the screen. This area also indicates the status of any connection to a central storage system and if a MAN or RHYT printout is in progress.

3.2 Patient information

3.2.1 Introduction

The patient information contains all data about the patient. The type of information that is acquired depends on how *EC Sense* is configured. A unique identifier code (ID) is used to identify the patient. When *EC Sense* is connected to, and communicates with, a central storage system related patient data can be retrieved from that system.

NOTE

A large number of patients and examinations can be stored in EC Sense. EC Sense is designed to manage only one patient at a time to avoid the risk of mixing up patients.

If no ID is selected for the patient, the system allocates a temporary ID.

3.2.2 Patient data and examination data

Patient data and examination data differs in the way that:

- Patient data is the information that has to do with a patient's personal details.
- Examination data is the information that is connected to a specific examination such as blood pressure, height and weight at the time of the examination.

EC Sense allows for one patient to have several examinations. The patient ID number is the unique information that identifies the patient and corresponding ECG in *EC Sense* and the central storage system.

EC Sense offers several ways to configure what type of patient information that shall be requested and how to perform the examinations. See "Settings" in the System manual on how to configure the system.

3.2.2.1 Patient data

The following type of information relates to the patient:

Item	Data used for	Free choice
Patient ID (unique patient identifier)	Mandatory , different ID formats can be configured.	
Last name	Will be automatically entered if the patient is stored in <i>EC Sense</i> or when connected to a central storage system.	
First name	Will be automatically entered if the patient is stored in <i>EC Sense</i> or when connected to a central storage system.	
Birth date	Can be automatically calculated depending on the configured ID format.	
Age	Input parameter used in the analysis. Can be automatically calculated depending on the configured ID format.	
Sex	Input parameter used in the analysis. Can be automatically calculated depending on the configured ID format. Possible selections: <ul style="list-style-type: none"> • Undefined • Man • Woman 	
Race	Input parameter used in the analysis, select either: <ul style="list-style-type: none"> • Undefined • Caucasian • Asian • Afro American • Other 	√

3.2.2.2 Examination data

The following type of information is connected to a specific examination:


Item	Data used for	Free choice
Drugs. Two selections are possible	Input parameter used in the analysis, select two out of: <ul style="list-style-type: none"> • No medication • Unknown medication • Digitalis • Diuretic • Beta blocker • Quinidine • Procainamide • Amiodarone • Disopyramide • Lignocaine • Other anti-arrhythmics • Psychotropic • Steroid • Other medication 	√
Clinical class. Two selections are possible	Input parameter used in the analysis, select two out of: <ul style="list-style-type: none"> • Normal • Myocardial infarction • Myocardial ischemia • Hypertension • Congenital heart disease • Valvular heart disease • Pericarditis • Respiratory disease • Endocrine disease • Implanted pacemaker • Pulmonary embolism • Post operative cardiac surg • Other • Cardiomyopathy • Unknown 	√
Location	Free text box	√
Operator	Free text box	√

Physician	Free text box	√
Height	Enter a value (only figures could be entered). A red exclamation mark indicates an incorrect entry.	√
Weight	Enter a value (only figures could be entered). A red exclamation mark indicates an incorrect entry.	√
Blood pressure	Enter a value (only figures could be entered). A red exclamation mark indicates an incorrect entry.	√
Electrode setting	Input parameter used in the analysis, select either: <ul style="list-style-type: none"> • Standard • Pediatric 	√
User Defined Items. Up to 5 items are possible	Input parameter used in the analysis. See "Settings" in the System manual.	√

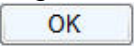

3.2.3 Entering patient data

Patient data needs to be entered before the examination starts. This can be done by either selecting a patient from a predefined list or by entering new information in the patient data window.

Patient data entry

1. Click on  or press F2.
2. Enter information about the patient in the window that opens.

Click on *New Patient* to clear the window if a new patient shall be registered. Enter any information necessary for the examination. Click with the mouse inside a white text box or move between the boxes by using the return key.

If the patient is stored on the local PC, or when the central storage system is connected, simply enter the patient ID and click on  to retrieve the related patient information. An ID check is performed, indicated by  that flashes if the information is incorrect or disappears when the correct ID is entered.

If the patient is already stored in the system, the information will be filled in automatically when leaving the text box or when clicking on *OK*.

3.2.4 Retrieving patient data

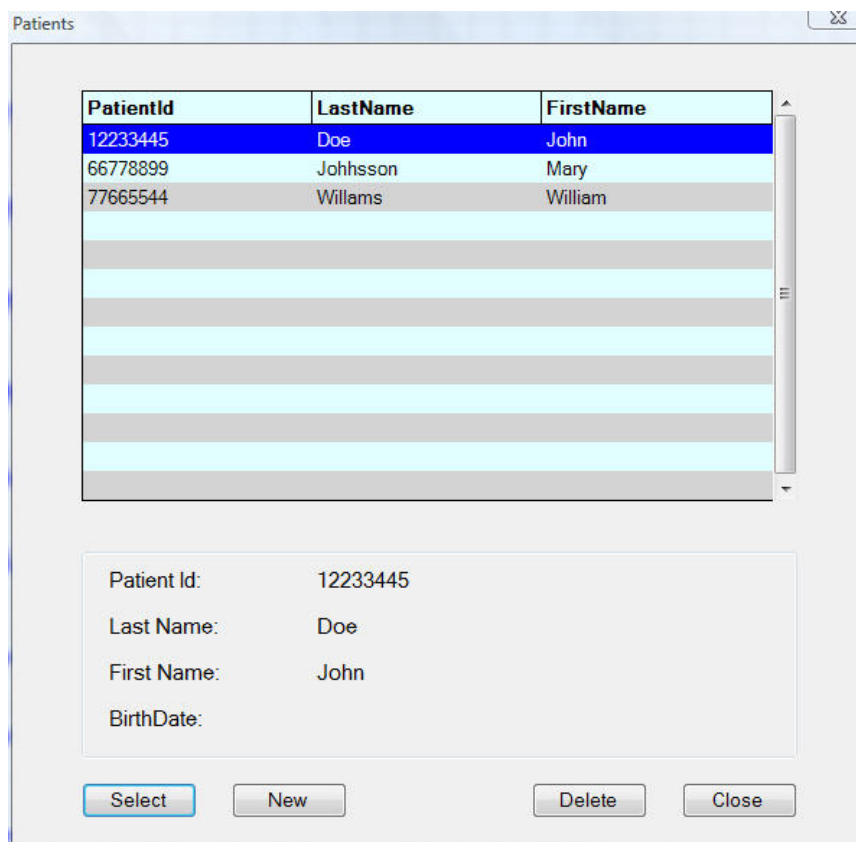
Patient data, for previously registered patients, can be retrieved by making a search on the local PC or in the central storage system.

1. Click on *Patient ID*.



The screenshot shows a 'Patient' form with the following fields: Patient ID, Last Name, First Name, and BirthDate. The 'Patient ID' field is highlighted with a red circle.

2. The patient list opens.



The screenshot shows a 'Patients' window with a table of patient data and a form below it. The table has columns for PatientId, LastName, and FirstName. The first three rows are highlighted in blue, green, and red respectively. The form below the table has fields for Patient Id, Last Name, First Name, and BirthDate, with the Patient Id field containing the value 12233445. At the bottom of the window are buttons for Select, New, Delete, and Close.

PatientId	LastName	FirstName
12233445	Doe	John
66778899	Johhsson	Mary
77665544	Williams	William

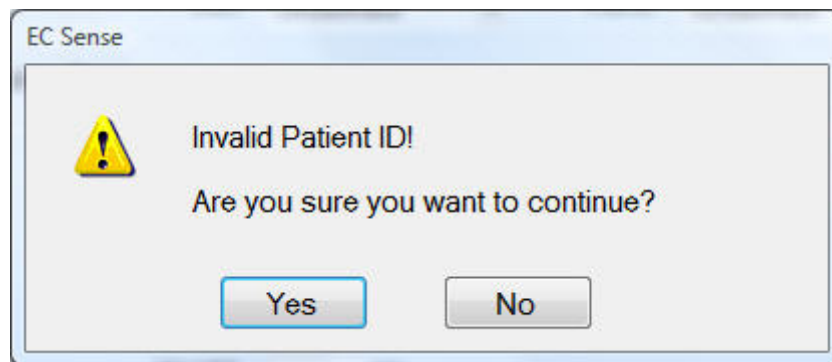
Patient Id: 12233445
 Last Name: Doe
 First Name: John
 BirthDate:

Select New Delete Close

3. Highlight a patient on the list and click on *Select*.
4. Patient data for that patient will be entered automatically in the text boxes.

3.2.5 Examination without patient ID

If *AUTO 1*, *AUTO 2* or *Exercise Test* is started, and no patient data has been entered, the patient data window will open automatically. Ignoring to enter patient ID, followed by a click on *OK*, will open the following window indicating that the patient ID is invalid.



If *Yes* is selected then *EC Sense* will allocate a specific ID for the examination according to the following format:

YYMMDDHHMMSSCart-ID

NOTE

It is not possible to acquire, analyse and store an ECG without any attached ID information about the patient. This is a safety function to avoid the risk of mixing patients and ECGs.

3.2.6 Temporary ID number

If the information about the patient is unknown at the time of the examination a temporary ID could be used. *EC Sense* supports the allocation of a temporary ID according to the Swedish "National Temporary ID number CIS 10/2003"

The temporary number has the same format as a Swedish personal ID number, such as: *YYMMDDNNXC* or *CCÅÅMMDDNNXC*

Explanation:

- 'CC' is the century for the patient
- 'YY' is the birth year of the patient
- 'MM' is a number between 00 and 19
- 'DD' is a number between 32 and 59 (to differ from true IDs that have numbers between 01 and 31).
- 'NN' is an arbitrary number between 00 and 99
- 'X' is the sex (males have odd numbers and females have even numbers).
- 'C' is a checksum number using an algorithm to check the whole number

The following example is an ID number for a female patient:
57 04 18 0024.

EC Sense calculates the sex and verifies the check sum according to the format above if temporary ID numbers are used.

3.2.7 Validity of patient ID

The following method is used to avoid a mix-up of patients in *EC Sense*:

- Patient data is reset after 30 seconds of leadfail (or 30 s after finished MAN printout) in all electrodes, or in the R electrode, if an ECG has been printed out or stored for that patient.
- Patient data is reset after 5 minutes of leadfail in all electrodes or in the R electrode.

3.2.8 Managing patient information

Click on *Tools* → *Patients* in the menu bar to open the list of stored patients.

PatientId	LastName	FirstName
12233445	Doe	John
66778899	Johhsson	Mary
77665544	Williams	William

Patient Id:	12233445
Last Name:	Doe
First Name:	John
BirthDate:	

NewCleanupDeleteClose

The window allows you to add new patients, manage and remove old patients.

- Click on *New* to add a new patient.
- Click on *Cleanup* to remove all patients without examinations.
- Click on *Delete* to remove the patient that is highlighted on the list.
- Click on *Close* to close the patient management window.

NOTE

Please observe that Cleanup and Delete will also remove all examination data for each patient.

3.2.9 Add a new patient

It is possible to register patient data in advance without starting an examination. This is done by selecting *New* from the *Patients* window.

New patient window


Patient ID must be entered.

Click on *OK* when the required information has been filled in. The information will be stored in *EC Sense* and can be used later when starting an examination. If *EC Sense* is connected to a central storage system a search will be initiated and the corresponding text boxes will be filled in automatically when leaving the patient ID box, provided that the patient exists in the system.

3.2.10 Patient data from work list with booked patients

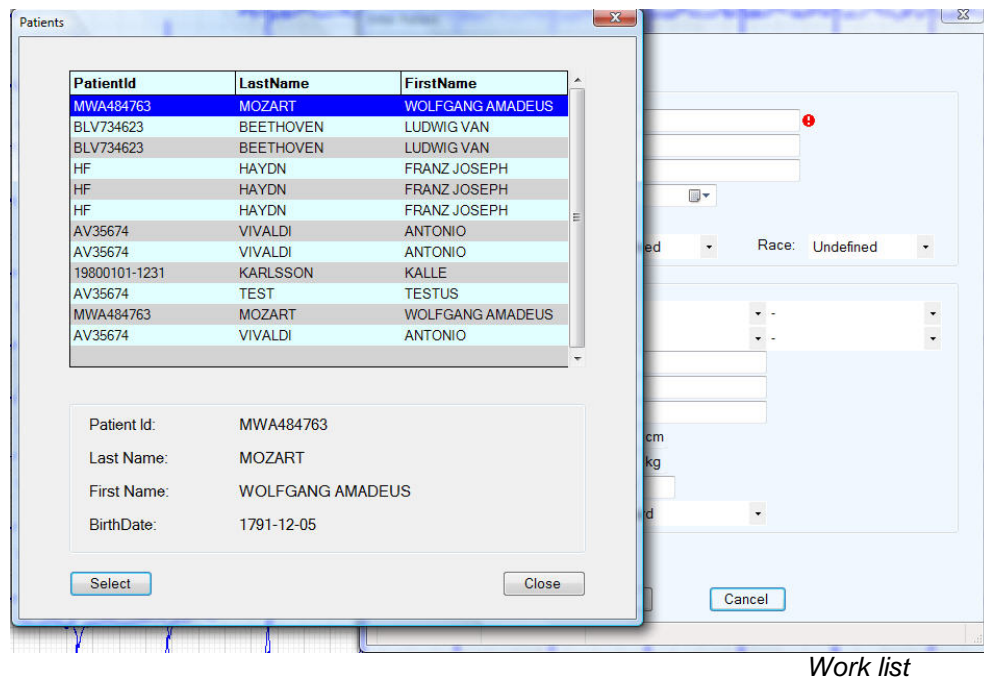
The patient list with booked patients will open automatically for every new examination if *Work list* has been selected in *Settings*, and if *EC Sense* is connected to a central storage system that can manage work lists. The patient to be examined is selected from the work list which contains all data about the patient. The patient data is registered in the work list when the patient is being scheduled for an examination, which is often done in advance.

The patient list is normally opened when a new examination is selected, i.e. when Rest ECG is started from Auto 1 or 2. The work list will also

open when clicking on  or F2, or when selecting *File* → *Patient Info* from the menu.

NOTE

The work list will open automatically when a new examination is selected, if EC Sense is configured with work list. When the work list is deselected under Settings, the patient info window will be opened directly without the work list.



Patients can be selected from the patient list once it is opened.

- Click on *Select* to select a highlighted patient. The information will be copied to the window for patient data.
- Click on *Close* to close the patient data window.

Enter Patient

New Patient

Patient

Patient ID: HF

Last Name: Haydn

First Name: Franz Joseph

BirthDate: 2012-04-30

Age: 0 Y 0 M 0 D

Sex: Male

Race: Undefined

Examination Data

Drugs: -

Clin.Class: -

Location:

Operator:

Physician: MEYER

Height: cm

Weight: kg

BP: /

Electrode setting: Standard

OK Cancel

Patient from work list

At the bottom of the window you can see from where the patient information is retrieved.

Patients must have been entered in advance and a network connection must exist, otherwise the patient list will be empty.

The *Settings* allows for different configurations, such as:

- Only show patients that have been entered today, last week, last month or with no limit.
- Select patients from different lists.
- Select patients according to examination type.
- Select patients according to Unit name.

See the System manual for information on how to configure the *Work list* and how to connect to a central storage system.

4 Resting ECG

4.1 Introduction

EC Sense is designed to acquire, interpret, print out and store the ECG in a safe and efficient way. This section includes a quick start guide, step-by-step instructions for resting ECG, descriptions of all functions and options available for the user in each step and a reference chart of commands.

4.1.1 Intended use

Rest ECG in *EC Sense* is intended to be used for acquisition, interpretation, printout and storage of 12 lead ECG. It is implied that the patient is at rest and that the electrodes are properly attached according to the instructions in this manual.

4.1.2 Evaluation of presented data

All data that is displayed and printed out by *EC Sense* matches the acquired data. In addition, the user can enter own patient data. It is important for the user to be aware of, and verify, that the patient ID and other information are entered correctly. *EC Sense* has a number of safety mechanisms to avoid the risk of mix-ups and user mistakes.

4.1.3 No contact with ECG unit

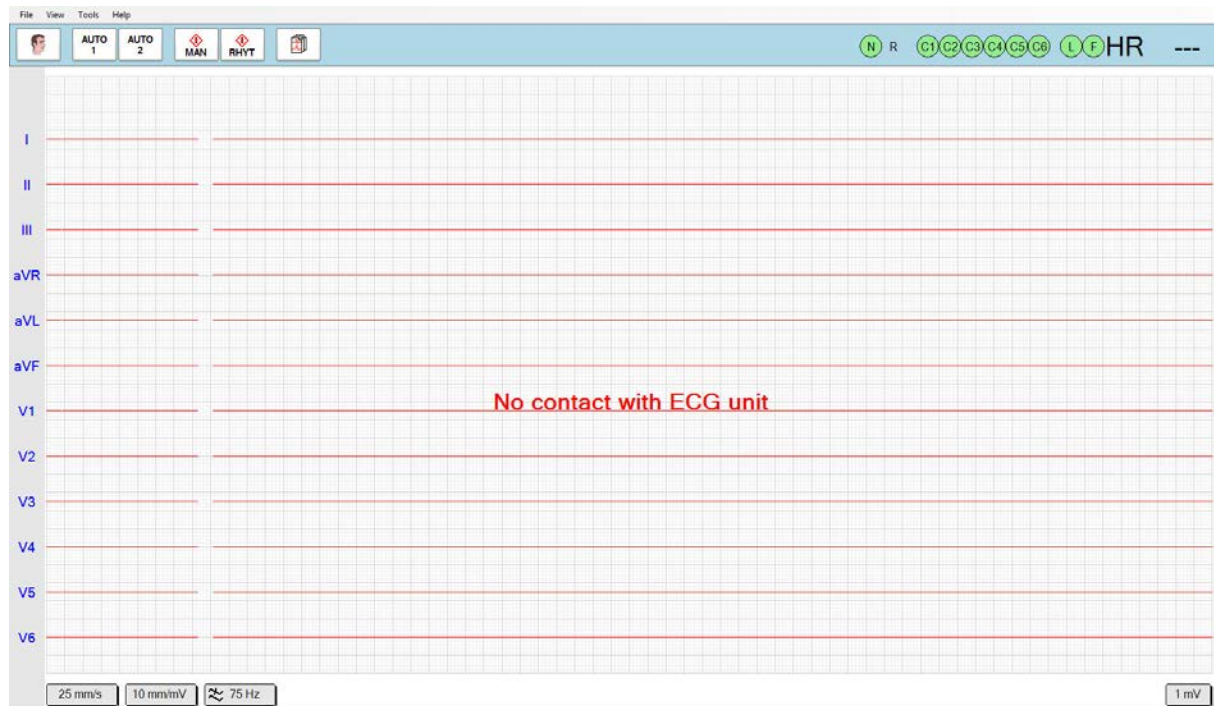
This message is displayed when there is poor or no contact with the acquisition unit.

The following message will be displayed with red text in the ECG monitoring window: **No contact with ECG unit**. In addition, leadfail will be displayed.



WARNING

When the message “No contact with ECG unit” is displayed, the user must be aware that all ECG data and other presented information shall be considered to be false and shall therefore not be used for clinical evaluation.

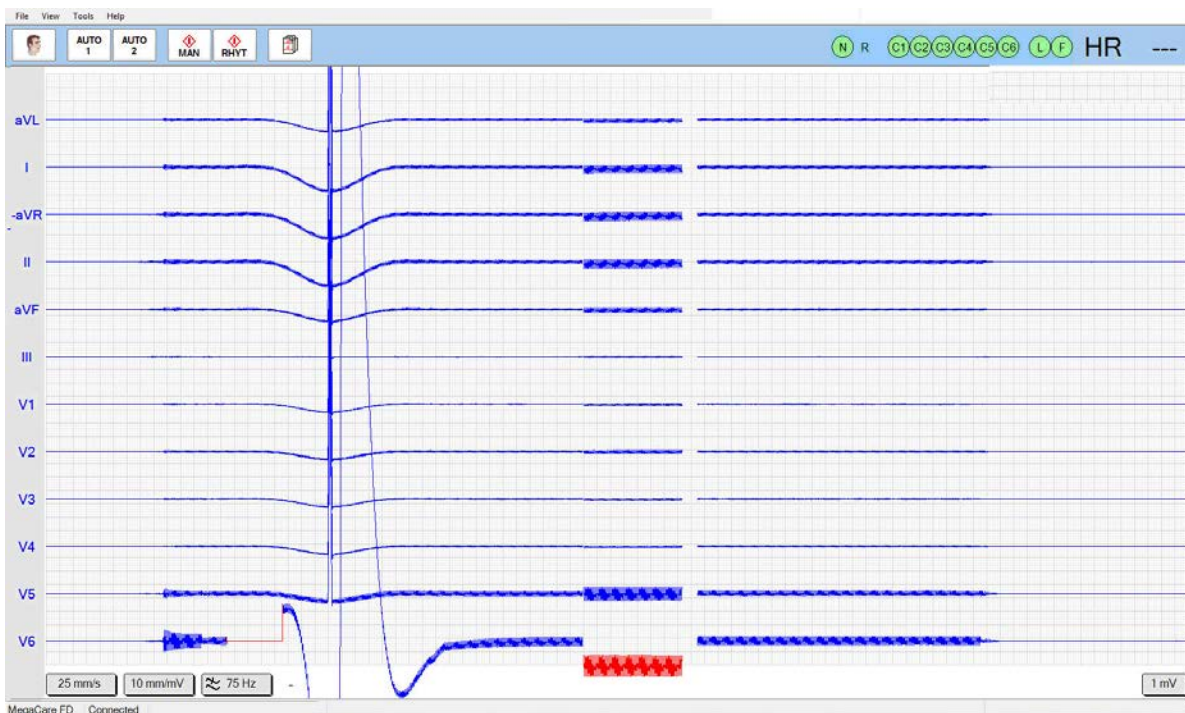


4.1.4 Monitor filter

At defibrillation high energy is generated which may cause the ECG data to be displayed outside the ECG monitoring window. To reset the ECG traces to the baseline as quickly as possible a 0.5 Hz filter (monitor filter) is automatically activated. This filter will affect the signals. It is only the non-delayed baseline filter that uses the automatic monitor filter.

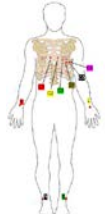

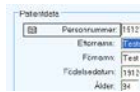
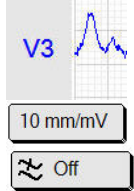
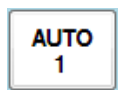





ECG data that is presented directly after defibrillation may be affected by a monitor filter.



4.2 Quick start guide

This quick start guide gives a brief explanation on how to use *EC Sense* for Resting ECG. The user can use this "quick start guide" as a summarised description on how to record an ECG.


Icon	Key	Instruction
		1. Prepare the patient and connect all electrodes according to desired lead electrode placement. Check that the patient cable is connected to the acquisition unit.
	F2	2. Click on the icon for entering patient data.
		3. Enter the patient information in the dialogue box. If the PC is connected to a central storage system the information will be filled in automatically.
		4. Select desired leads, gain and filter settings. Check the quality of the ECG signals.
	F3	5. Start an automatic sequence, e.g. AUTO 1.
		6. Verify that the quality of the analysed ECG is OK.
	F4	7. Print out the result if desired (when a printer is connected and if not automatically done in the AUTO sequence).
	F5	8. Review and save the analysed ECG on the local PC or in a central storage system. This could be included in the automatic sequence.
		9. Disconnect the patient.

4.3 Recording a resting ECG

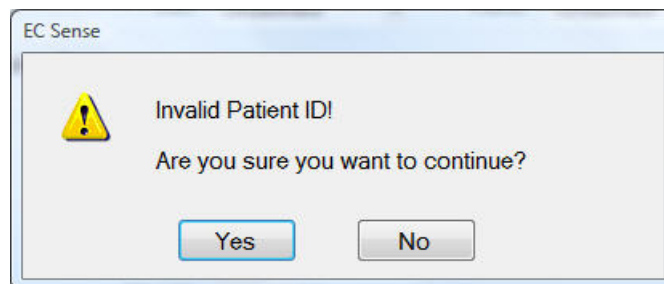
The step-by-step instructions below explain how *EC Sense* can be used to record a resting ECG.

1. Prepare the patient. Attach the electrodes to the patient and connect the patient cable to the acquisition unit. For electrode settings see previous section.



2. Press  and enter patient data. If the patient is already stored in the system, just enter the patient ID.



If no patient ID is entered, a message will be displayed when trying to start an AUTO sequence.



WARNING

For the patient's safety, ask the patient for the patient ID and verify that it corresponds to the information on the screen before starting the examination.

3. Check the quality of the ECG signals. Look at the ECG and make any necessary adjustments, e.g. changing leads. (See 4.4 for further information.) Start the acquisition when the patient is relaxed and when the ECG signals are displayed with good quality. It is also possible to print out the displayed ECG directly by selecting one of the following alternatives:
 - MAN printout: A manual printout of a real time ECG is started on a printer and will continue until the STOP key is hit.
 - RHYT printout: One page of ECG is acquired and is printed out on a printer. The page could be configured in different ways in *Settings*.

4. Start the acquisition. The acquisition is started by selecting one of the two alternatives:
 - *AUTO 1*. Automatic acquisition where *EC Sense* runs a series of tasks in a sequence that have been configured in *Settings*. In the *AUTO* sequences *EC Sense* acquires the ECG and calculates the values continuously. Depending on how it is configured it is possible to analyse acquired data either forward or backward. The sequences could also be configured to include a quality check question and a printout on a printer. For more information of the automatic sequences see 4.8.
 - *AUTO 2*: Automatic acquisition where *EC Sense* runs an alternative series of tasks that have been configured.
5. Review the result from *AUTO 1* or *AUTO 2* in the Report mode. In the automatic sequence it is possible, if configured, to check the signal quality before the result is displayed. If the signal quality is accepted, the ECG can be reviewed in the Report mode. The Report mode offers several types of reports to be reviewed. See 5.
6. Click on  to start a printout of the report on a connected printer (this task can also be included in the *AUTO* sequence). More options for printouts are available in the Report mode. See 5.
7. Click on  and select where to save the result. (Automatic sequences may include automatic saving as a task).
8. Disconnect the patient.

NOTE

Printouts from MAN and RHYT will not be saved. Printouts to a PDF or XPS printer will generate files that can be saved.

4.4 Real Time mode

In real time mode it is possible to change the settings of the ECG that is displayed in real time.

4.4.1 Selecting leads

Clicking in the leads area opens a menu with different lead combinations to be selected. Click on any of the options to select a lead combination. The selected lead combination will be displayed on the screen as well as being printed out if MAN printout is activated. However, *EC Sense* always acquires a 12 lead ECG irrespectively of which lead combination that has been selected.

Some lead combinations doesn't display all leads simultaneously on the screen. When this happens an arrow will appear in the left upper and lower part of the screen.

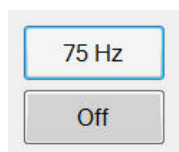


Click on the arrow to show next page in the lead combination.

4.4.2 Filter

The tremor filter can be changed with the filter button in the lower icon bar. Depending on how *EC Sense* is configured the following filters are available:

- Notch filter (50 Hz/60Hz/Off)
- Tremor filter (35Hz/75Hz/100Hz could be configured)
- Baseline filter (a correcting filter is always activated)
- Baseline filter with lead check (a correcting filter as well as a filter of 0.05 Hz for checking electrodes, can be configured under *Settings*).



The only filter that can be activated from the ECG monitoring window is the tremor filter. All other filters must be configured under *Settings*. Click on the filter button and select to turn the filter on or off. The frequency of the filter can be configured under *Settings*. The button will show the status of the filter, with *off* when deselected, or with the selected frequency when it is activated.

Depending on the selected filters (see "Settings" in the System manual) the scrolling ECG will be displayed in real time with different filter settings and delays.

- When *Filtered* is selected, the ECG will only be displayed with the correcting baseline filter, since this filter always is activated. The displayed ECG will be delayed.
- When *Filter with Electrode Check* is selected, the ECG will also be displayed with a baseline filter of 0.05 Hz without delay, so that the signal quality can be checked in real time.



Filtered with Electrode Check

Green arrow points out old data that is going to be wiped out with the new sweep.

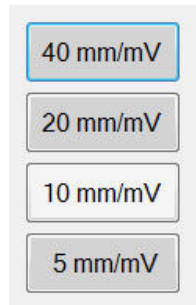
Blue arrow points out the start of baseline filtered (0.05 Hz) data, meaning real time.

Red arrow points out the start of baseline filtered (correcting) data with delay.

Black arrows point out the delay introduced by the correcting baseline filter. The electrodes could be checked within this area if *Filtered with Electrode Check* is selected.

4.4.3 Gain

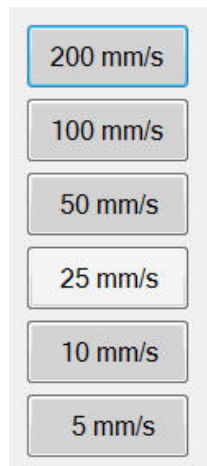
Select with the button in the lower icon bar.



Click the gain button to select different gain for display and MAN printout. The text on the button will show the selected gain.

4.4.4 Speed

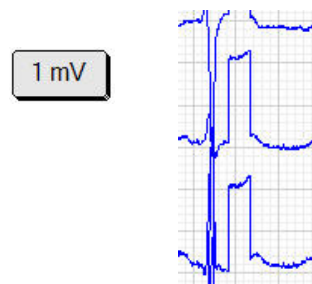
Select with the button in the lower icon bar.



The speed is equivalent to paper speed and represents how many mm per second the ECG data travels on the screen or on paper. The ECG in the ECG monitoring window and the MAN printouts is based on the selected speed.

4.4.5 mV pulse

Select with the button in the lower icon bar.



This button is used to generate a 1 mV pulse throughout the amplifier chain. It will be presented in the ECG monitoring window and on MAN and RHYT printouts. Click on the button to generate a pulse of 1 mV.

4.5 Electrode information and HR

4.5.1 Heart rate

This area displays the heart rate and is continuously updated.



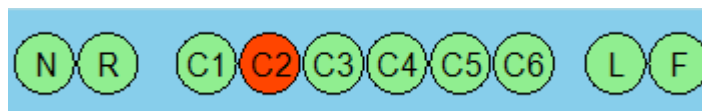
4.5.2 Leadfail

The upper part of the screen shows information about the electrodes and if any electrodes have poor skin contact. Electrodes with poor contact will also show in the corresponding lead with a red trace instead of a blue trace in the ECG monitoring window.

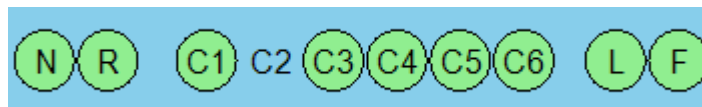
4.5.3 Electrode check

The electrode check information consists of 10 circles where electrodes with poor skin contact will be indicated between an alternating red flashing circle and no circle. Electrodes with good skin contact will have a green colour.

If there is a failure in **C2**, the electrode check information will alternate between:

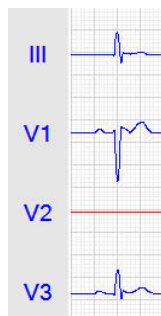


and



Failure in the **N** electrode can not be detected and will therefore never be presented. When failure occurs in all electrodes, it will only flash red on the **R** electrode.

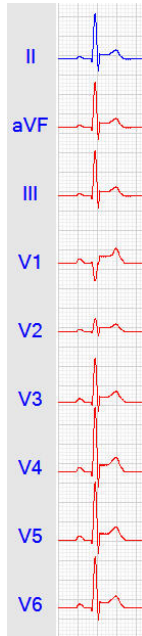
A leadfail will be shown in red in the ECG monitoring window. In the example below **V2** is indicated with red.



When a failure occurs in one electrode that is included in many leads, as for instance **L**, then the lead check information will display:



At the same time the affected leads will be indicated as red traces (in this case all except lead II)



Red ECG traces indicate that these leads are incorrect since they are affected by the missing electrode.

If an electrode is missing

- C1-C6 are indicated individually
- L-F are indicated individually
- R is indicated individually
- N is not indicated (signal earth)


NOTE


Red traces mean that these leads are not reliable signals.

4.6 Real Time printouts

4.6.1 Manual printout on printer

The printout function can be activated at any time during the ECG

acquisition by clicking the  button in the upper icon bar, or pressing the F5 key.

Once activated the button will change to , and the message "Printing in progress", followed by the number of pages, can be seen at the bottom of the screen.

NOTE

A dimmed (grey) button indicates that there is no printer connected. The printer to be used as Real Time printer must be configured. See "Settings" in the System manual.

Even if the actual printing on the printer is delayed, the printed ECG will still correspond to the ECG displayed on the screen. The example below shows an ECG with leadfail.



The following information will be printed on each page together with the ECG data:

1. The top left corner will show date and time period (start – stop) for the current page together with name and ID of the patient.
2. Any detected leadfail will be indicated in the middle at the top. If a problem has occurred in any electrode during the time period of the printed page, this will be indicated. If the automatic defibrillation filter has been activated to reset the leads that are out of range, then these will be indicated as leadfail. Regardless of the chronological order in which the electrodes failed they will be presented in the order of C1, C2, C3, C4, C5, C6, L and F. If leadfail occurred in all electrodes on the current page, then only R will be displayed.
3. The current heart rate is presented in the top right corner.
4. At the bottom of the page, the following information is presented, from left to right:
Paper speed, Gain, Tremor/Notch filter, Cart ID, Location, current page number and the software version number of *EC Sense*.

If the lead combination, gain or any other parameters are changed while the printing is in progress, then the page will be printed out with the current settings and selections for the page that is transferred to the printer.

The manual printout will continue until stopped by the user by clicking



on  , or after 100 printed pages.

A MAN printout is also stopped when the user selects a new function, for instance an automatic sequence.


NOTE

*The current patient ID will be printed on the MAN printout.
It is the responsibility of the user to verify that the correct ID is printed in order to prevent mixing ECGs up.*

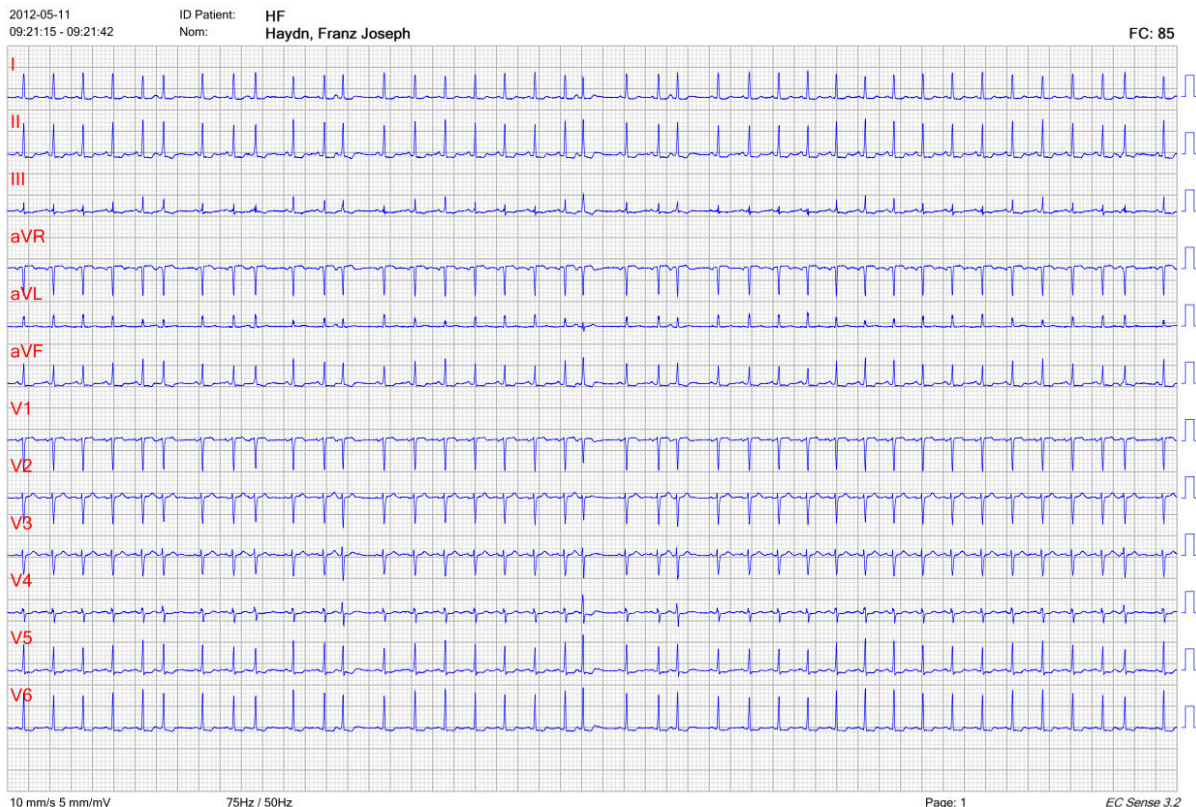
4.6.2 Rhythm printout on printer

For Rhythm printout the ECG will be printed according to the selected settings. To change the settings for printouts, see "Settings" in the System manual.



The function is activated by clicking on  in the upper icon bar. Even if the actual printing on the printer is delayed, the printed ECG will still correspond to the ECG displayed on the screen. An example of a printing format will follow. The printout will take into account whether

EC Sense is setup for Cabrera leads and/or paediatric leads. A dimmed button means that no printer is available.



The following information will be printed on each page together with the ECG data:

1. The top left corner will show date and time period (start – stop) for the current page together with name and ID of the patient.
2. Any detected leadfail will be indicated in the middle at the top. If a problem has occurred in any lead during the time period of the printed page, this will be indicated.
If the automatic defibrillation filter has been activated to reset the leads that are out of range, then these will be indicated as leadfail. Regardless of the chronological order in which the electrodes failed they will be presented in the order of C1, C2, C3, C4, C5, C6, L and F. If leadfail occurred in all electrodes on the current page, then only R will be displayed.
3. The current heart rate is presented in the top right corner.
4. At the bottom of the page the following information is presented, from left to right:
Paper speed, Gain, Tremor/Notch filter, Cart ID, Location, current page number and the software version number of *EC Sense*.

The printout speed will be according to the selected speed.

NOTE

The current patient ID will be printed. It is the responsibility of the user to verify that the correct ID is printed in order to prevent mixing ECGs up.

NOTE

If the page has been transferred to the printer but not yet printed, it can only be stopped if the printer supports such functions.

4.7 ECG with interpretation

Depending on how *EC Sense* is configured, the automatic sequence can include interpretation of the ECG. Interpretation can be activated in the *Settings*. The interpretation program also analyses any interference, which means that ECG with poor quality (like artefacts or noise) or missing electrodes will be included. If the signals have poor quality the interpretation will be less accurate compared to signals that have high quality (without interference). In the worst case the interpretation will be incomplete or misleading.

It is our recommendation that the user verifies the clinical quality of the signals on the screen before starting acquiring the ECG. As part of the automatic sequence a signal quality check can be included, giving the user the possibility to check whether the acquired ECG has high quality, see 4.8 in the next section.

EC Sense uses a confirmed unmodified version of GRI (Glasgow Royal Infirmary, prof. Peter W Macfarlane) which is a well recognised program for proposing interpretation of the ECG. The proposed interpretation is based on calculated data and can not fully replace the clinical opinion from a professional.

All interpretation must always be reviewed and evaluated by clinical personnel with proper training and competence.



CAUTION

The GRI interpretation program is integrated in EC Sense. This advanced, clinically well recognised program presents highly reliable interpretation. However, the user must bear in mind that the proposed diagnosis only is a suggestion! Prior to using the proposed diagnosis to make decisions about the treatment of a patient, it must always be evaluated by skilled and competent personnel.

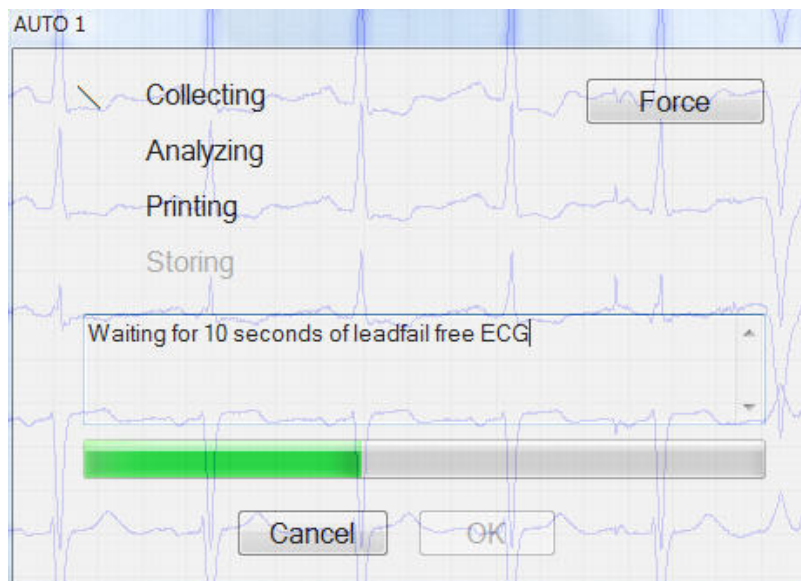
4.8 Automatic sequences

Two types of automatic sequences (*AUTO 1* and *AUTO 2*) can be configured and used. An automatic sequence is started when clicking on any of the two icons.



The steps in the automatic sequence are presented in the progress window, as shown in the example below. Different steps may be included depending on how *EC Sense* is configured (See "Settings" in System manual).

Below is an example of the steps in a typical automatic sequence:




In this configuration the sequence starts with acquisition, continues with analysing and finally prints out the ECG. No automatic storing will take place, hence the dimmed text. In the message window an explanatory text for each step is displayed.

The sequence can be stopped at any time with the *Cancel* button.

The button *Force* stops the acquisition and starts analysing the ECG directly, even if the 10 seconds of ECG without leadfail has not yet been acquired.

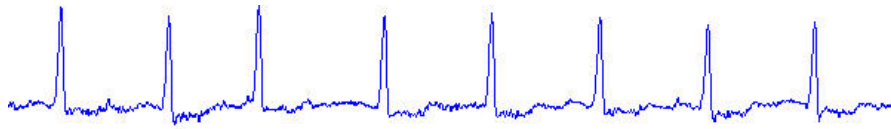
Along with each step in the sequence, a symbol will be displayed with the following meaning:

- An active step is indicated by a rotating bar to the left of the text.
- A finished step is indicated by a tick mark. ✓

- If an error has occurred in a step, this will be indicated by the symbol .

A progress bar shows how far the sequence has elapsed in time.

The user is given the possibility to check the quality of the ECG before the analysis result is presented, and will be prompted with the following question:



Quality OK?	<input checked="" type="button" value="Yes"/>	<input type="button" value="No"/>
-------------	---	-----------------------------------



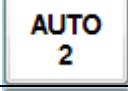









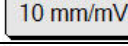


The message will only be displayed if the AUTO sequence is configured with this setup (see “Settings” in the System manual). If *Yes* is selected the analysis continues, while *No* stops the sequence and returns to real time mode.

4.8.1 Report after automatic sequence

After the automatic sequence (AUTO 1 or AUTO 2) the report mode is normally activated. There are different types of report formats to be selected. Please refer to the section “Resting ECG reports” for the different reports.

4.9 ECG Commands

The table below shows the commands that are available for Resting ECG.

Function	Icon	Menu item	Fn key	Comment
Enter patient data		<i>File → Patient Info</i>	F2	
Automatic sequence 1		<i>File → Auto 1</i>	F3	
Automatic sequence 2		<i>File → Auto 2</i>	F4	
Print out real time ECG		<i>File → Man Print</i>	F5	
Print out rhythm ECG		<i>File → Rhythm Print</i>	F6	
Stop print out		<i>File → Man Print/Rhythm Print</i>	F5, F6	The button is active if a printout has started
Examinations		<i>File → Examinations</i>	F7	
Settings		<i>File → Settings</i>	Ctrl+ Shift+Up	Configure the program
Exit this program		<i>File → Exit</i>		Click on X in the top right hand corner
Exercise Test		<i>File → Exercise Test</i>	F8	Only active if Exercise ECG option is installed
Start Long ECG			F9	Only active if Long ECG option is installed
Stop Long ECG			F9	
Leads		<i>View → Leads</i>		Click inside the leads area
Speed		<i>View → Speed</i>		
Gain		<i>View → Gain</i>		
Tremor filter		<i>View → Tremor Filter</i>	Ctrl + F	
mV-pulse		<i>View → Millivolt</i>	F10	
Patients		<i>Tools → Patients</i>		

5 Resting ECG reports

5.1 Menus and functions

The report mode opens after the registration or when opening an ECG examination. The table below gives a brief explanation of the common functions that can be used in the report mode.


5.1.1 Menu bar





The menu bar at the top of the Report mode page has the following drop down menus for Resting ECG:

Menu	Command	Function
<i>File</i>	<i>Patient info</i>	F2 Enter patient information
	<i>Print</i>	F4 Print out the default report
	<i>Print ...</i>	Change the printout temporarily, see 5.2.11
	<i>Print Preview</i>	Ctrl + W Preview the report that is currently displayed
	<i>Save</i>	F5 Save the examination
	<i>Real time Examinations</i>	F6 Quit and return to real time mode
	<i>Settings</i>	F7 Open the examination list
	<i>Exit</i>	Ctrl+Shift+Up Open settings to configure program (refer to the System manual for information) Quit the program
<i>Tools</i>	<i>Patients</i>	Patient data management
<i>Help</i>	<i>About</i>	Information about the software

5.1.2 Icon bar

The following functions are available in the report mode from icons or function keys:

Icon	Key	Description
	F2	1. Change or add patient information. Information in the grey areas cannot be altered. Please note that it is not possible to change the patient ID. Re-analysis will occur automatically if any of the parameters that affect the interpretation is changed.

	F4	2. Print out the default report. If no printer is connected the button will be dimmed. More options are available if clicking on the arrow: <i>Print page</i> - Print the page that is on the screen <i>Print sub report</i> - Print all pages in the report
	F5	3. Store the ECG on the local PC or in the central storage system, if connected.
	F7	4. Retrieving an examination from the local PC, or from central storage system, can only be done after the current ECG has been stored. The user will be asked if the current examination should be stored or not.
	F6	5. Quit and return to real time mode. If the ECG has not been stored, the user is prompted with a question.

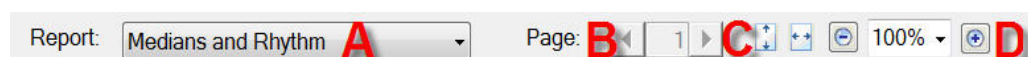
NOTE

Please note that it is not possible to modify Resting ECGs in EC Sense.

5.2 Report printouts

This section describes and presents the different report formats. All reports can be viewed and printed. It is possible to select one report format to be opened as a default report. See settings in the “System manual” for information on how to select a report as default.

The following functions can be used when viewing reports:



- A. Select a report type.
- B. Move to next page, if the report has several pages.
- C. Enlarge the displayed report sideways or in height.
- D. Zoom in/zoom out of the displayed report.

Report example



A on the report shows the patient ID.

B indicates different types of reports that can be selected in a menu.

Cardiolex Standard

2x6

3x4

12-lead

H1

Medians and Rhythm

Medians, Rhythm and Matrix

Megacart Standard

Combined Report

C presents the proposed interpretation. (Interpretation is only available if the option has been ordered and is selected in Settings.)

D presents calculated examination results. Time is given in milliseconds and amplitude in millivolt.

E shows information on selected Speed, Gain, Tremor/Notch filter, Card ID, Location and software version for printout.

F shows the software version number of the acquisition program.

NOTE

No interpretation will be shown under C if the program has been configured to exclude interpretation. See “Settings” in the System manual.



CAUTION

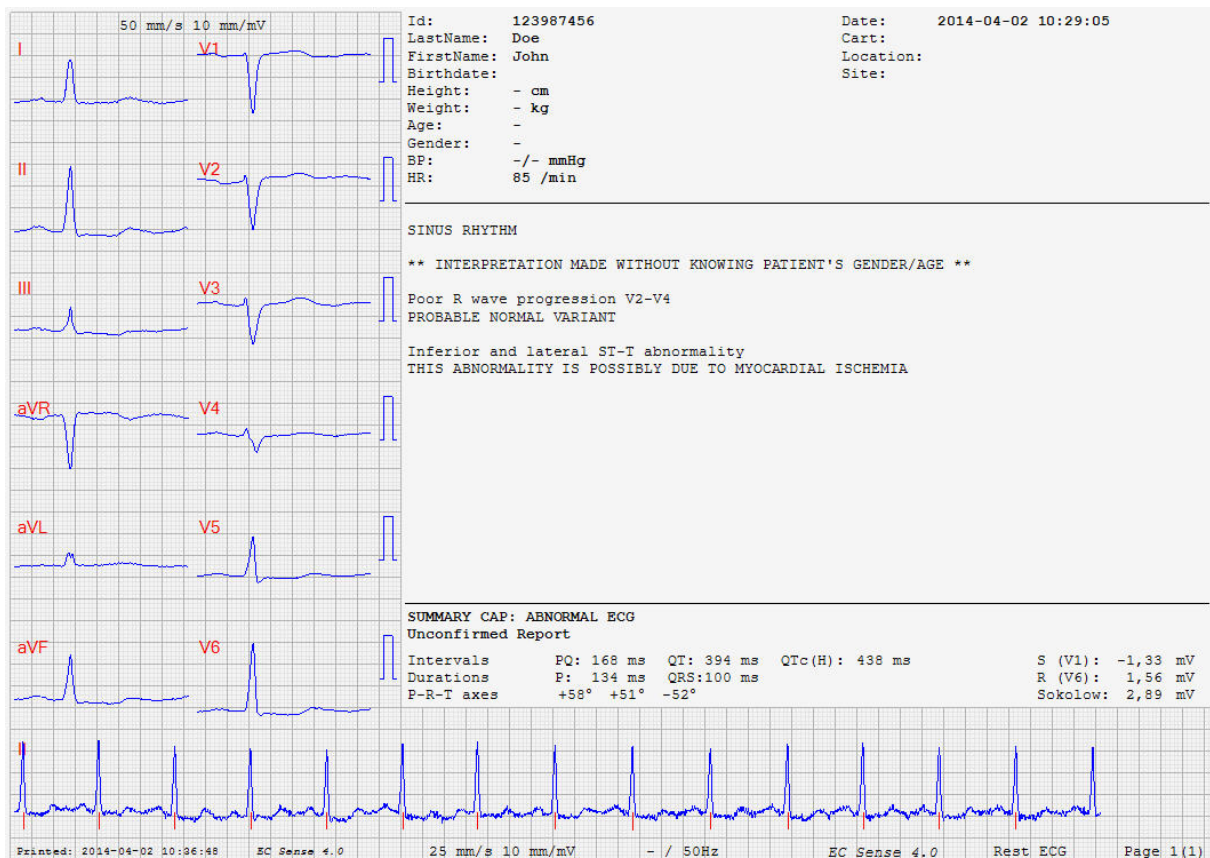
The GRI interpretation program is integrated in EC Sense. This advanced, clinically well recognised program presents highly reliable interpretation. However, the user must bear in mind that the proposed diagnosis only is a suggestion! Prior to using the proposed diagnosis to make decisions about the treatment of a patient, it must always be evaluated by skilled and competent personnel.

Report formats

The following types of reports are available under the *Report* tab:

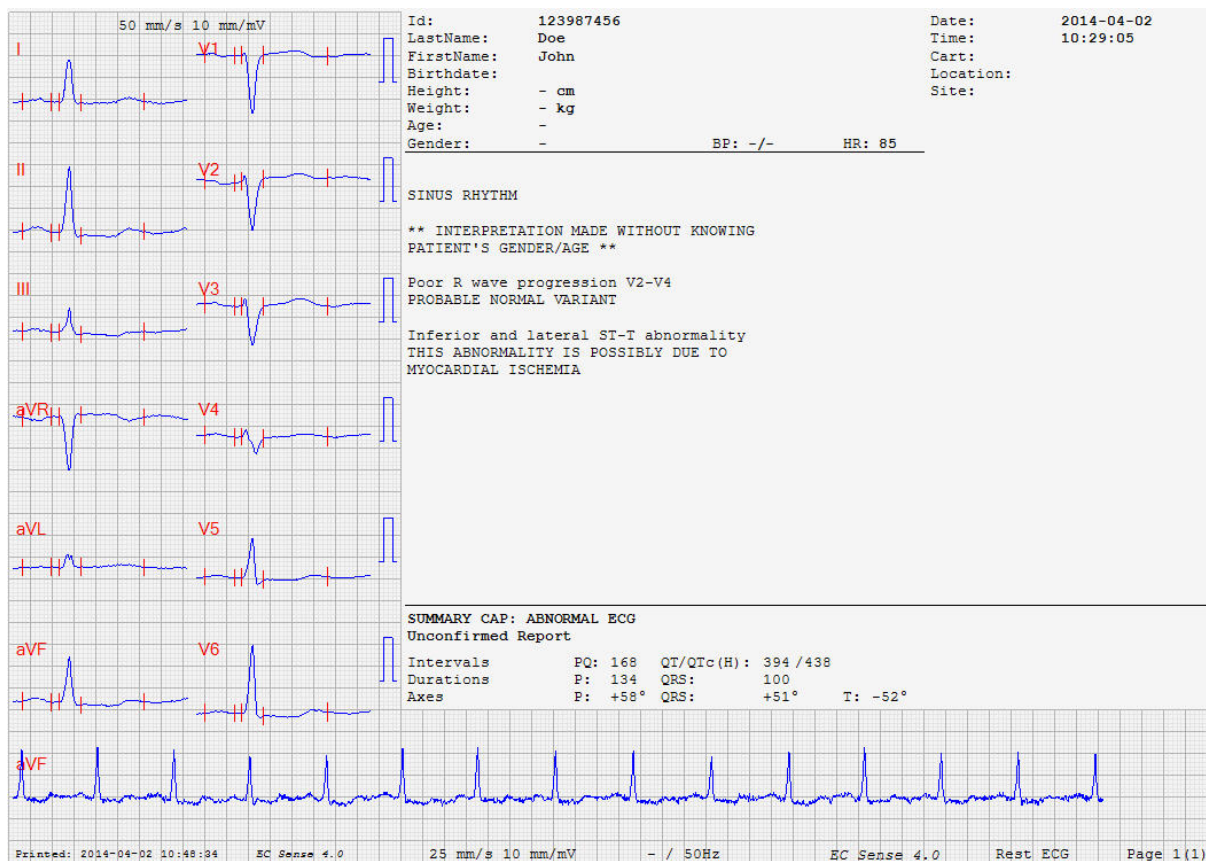
5.2.1 Cardiolex Standard report

This type of report is similar to the MegaCart report which is very common in many clinics. In addition the Cardiolex report includes the Sokolov-Lyon index and QRS markers (if selected in *Settings*). It consists of a page with averaged complexes for 12 standard leads, interpretation (if configured with interpretation) and a rhythm trace. It is printed in landscape format.



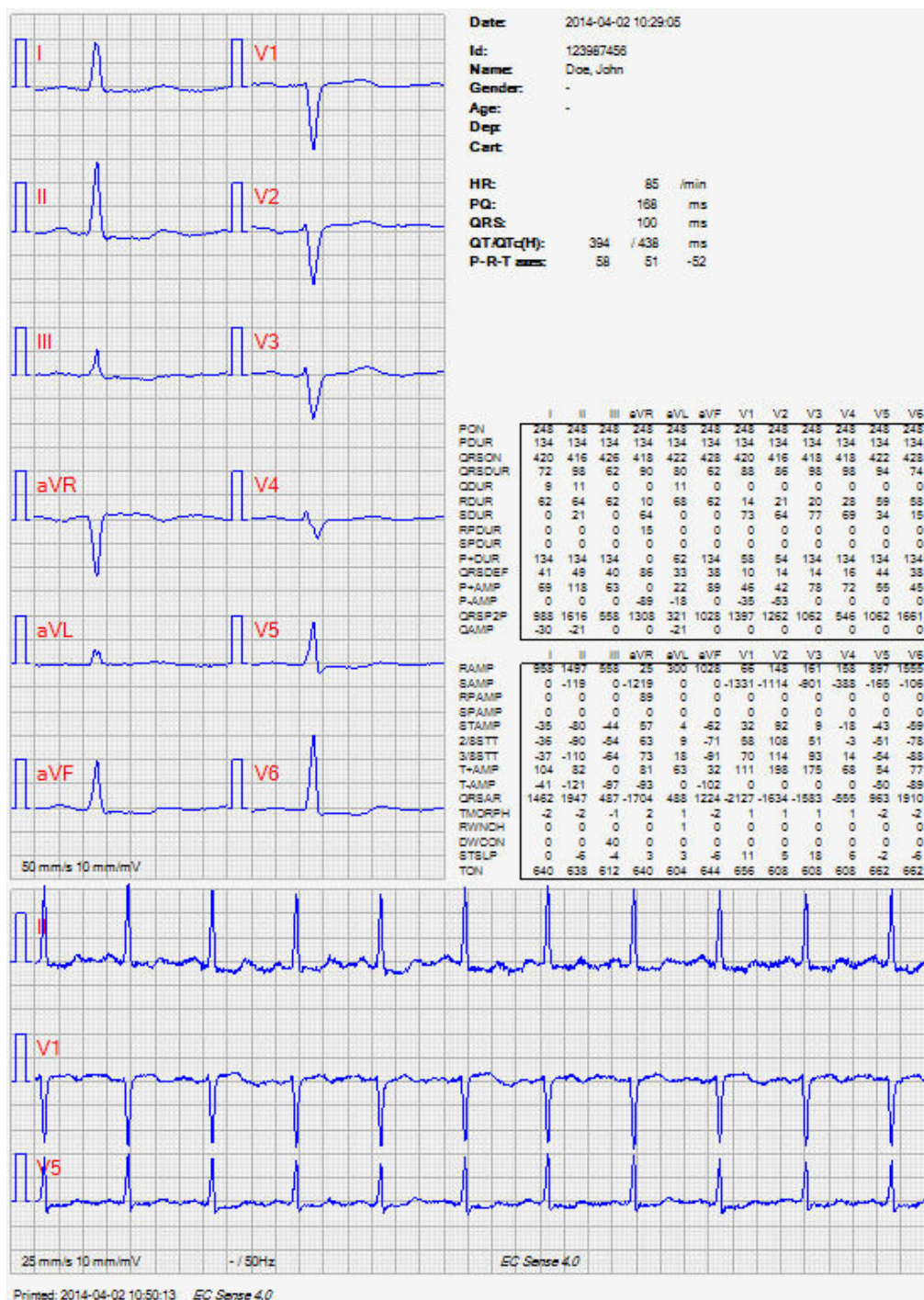
5.2.2 Megacart Standard report

This type of report is very common in many clinics. It consists of a page with averaged complexes for 12 standard leads, interpretation (if configured with interpretation) and a rhythm trace. It is printed in landscape format.



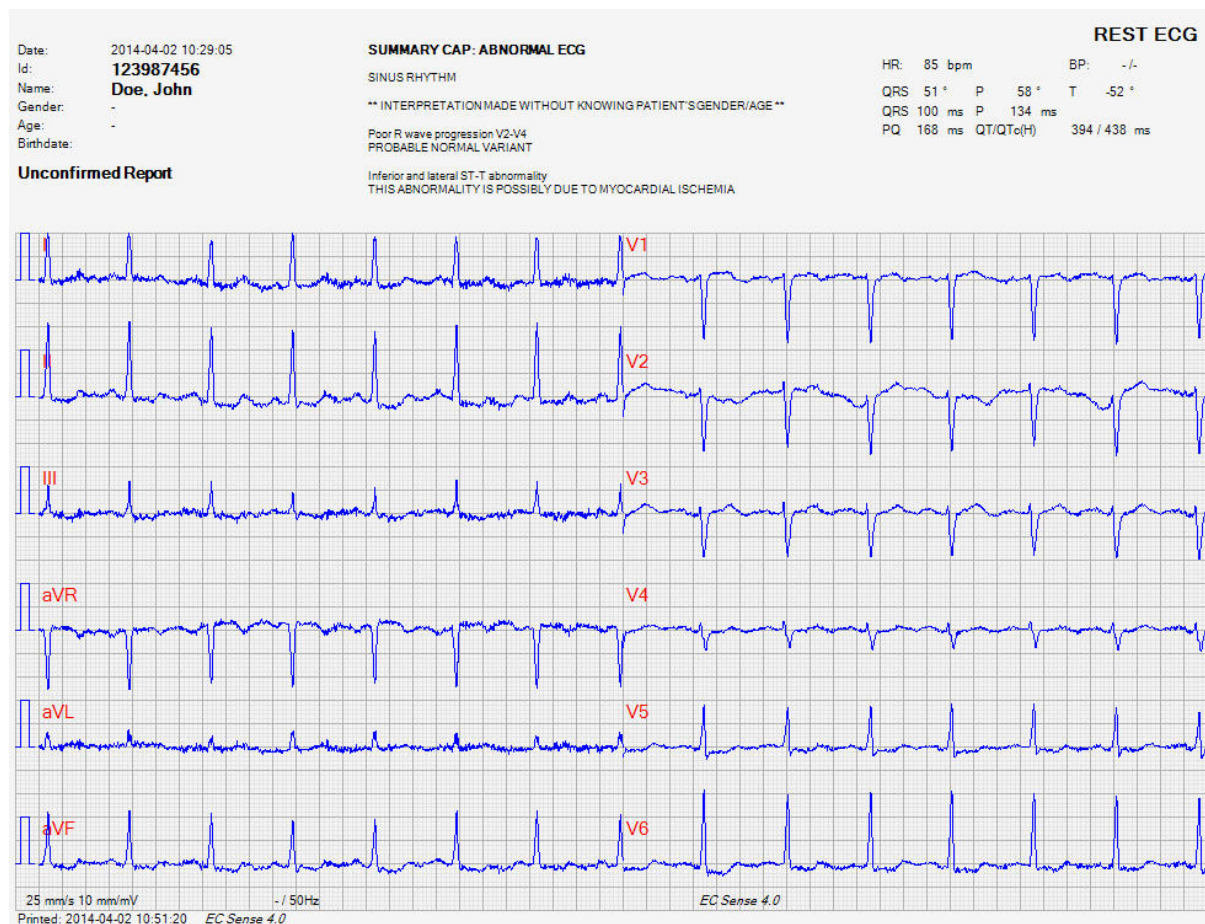
5.2.3 Medians, Rhythm and Matrix report

This report contains averaged complexes for 12 leads, detailed ECG information in a matrix and rhythm ECG for 3 leads (can be configured). It is printed in portrait format.



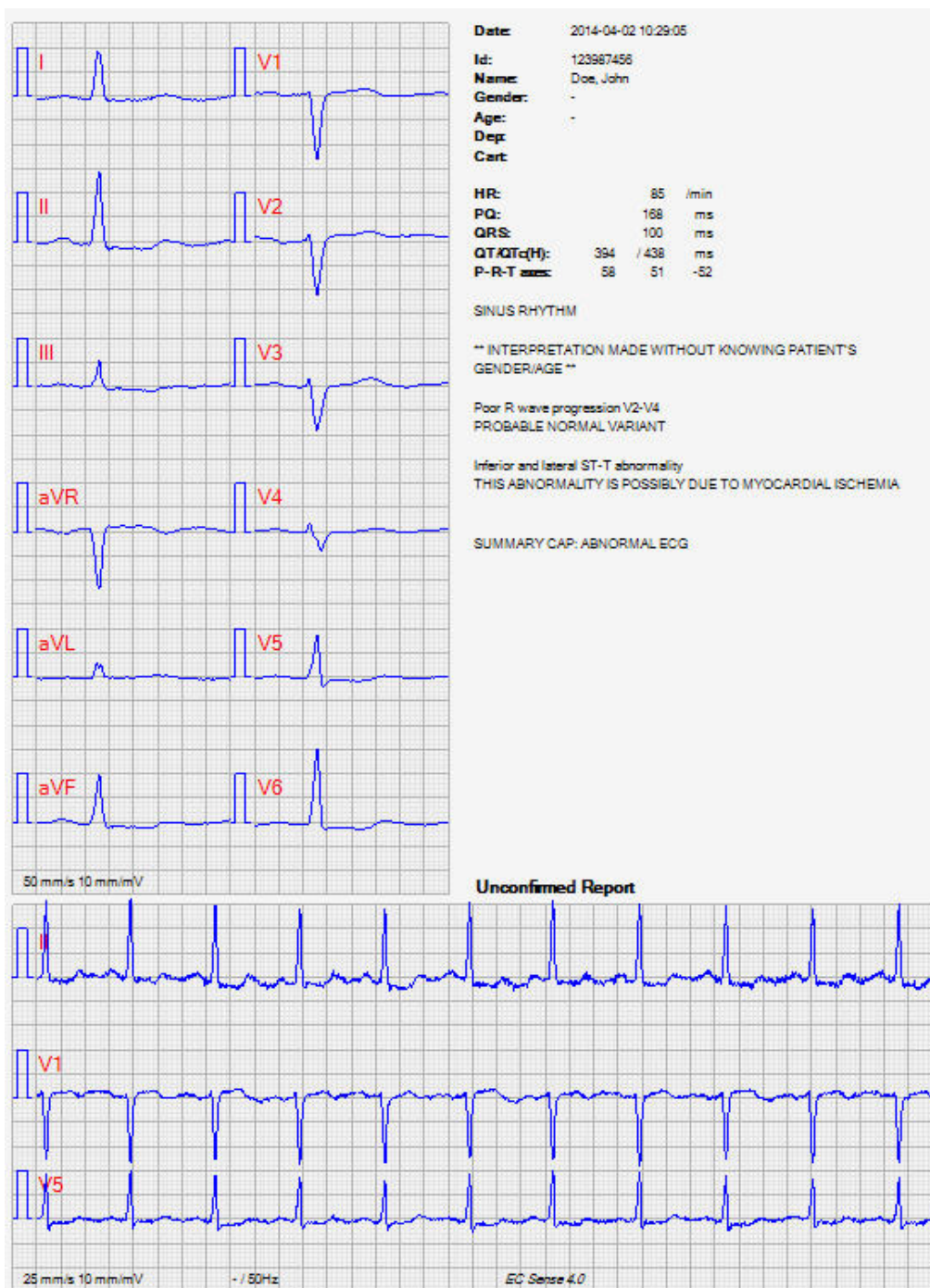
5.2.4 2x6 report

This report contains interpretation (if configured) and rhythm ECG for 2 x 6 standard leads. It is printed in landscape format.



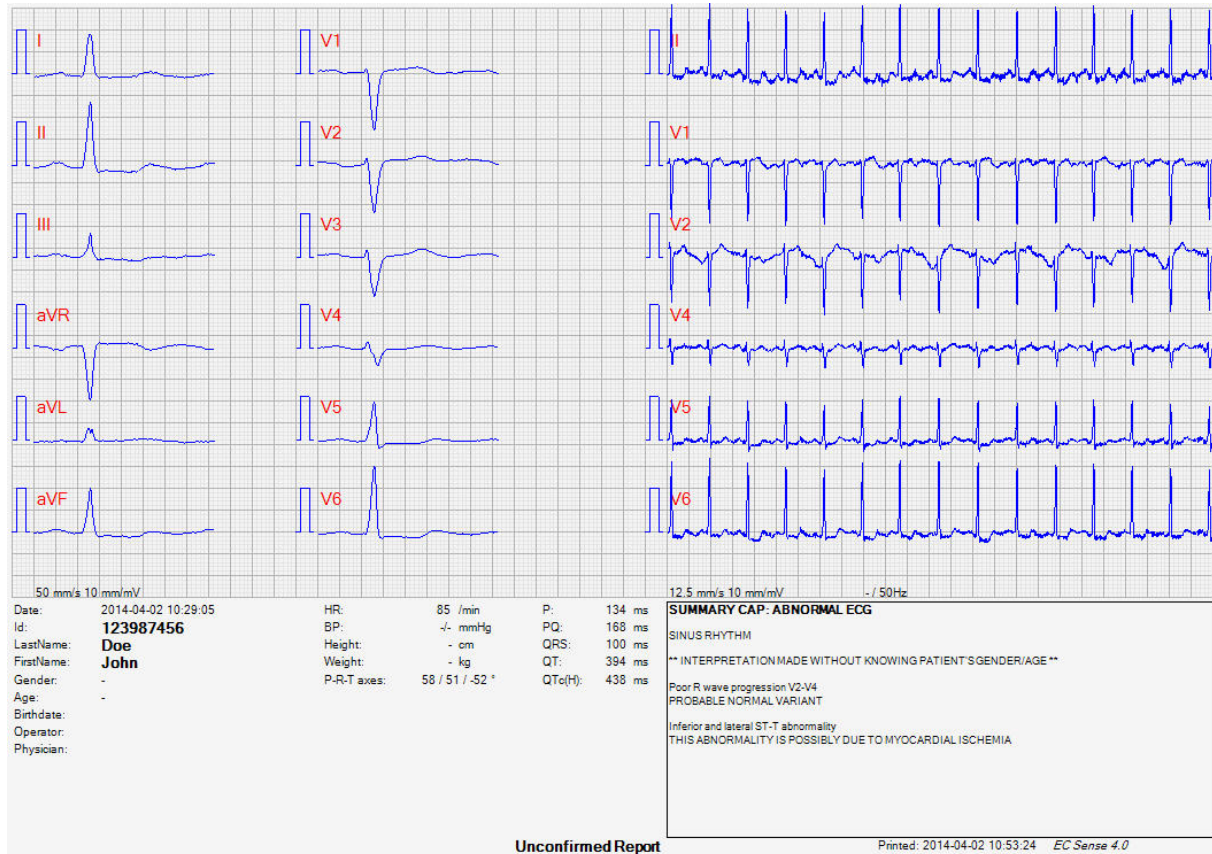
5.2.5 Medians and Rhythm report

This report consists of interpretation (if configured), averaged complexes for 12 leads and rhythm ECG for 3 leads (can be configured). It is printed in portrait format.



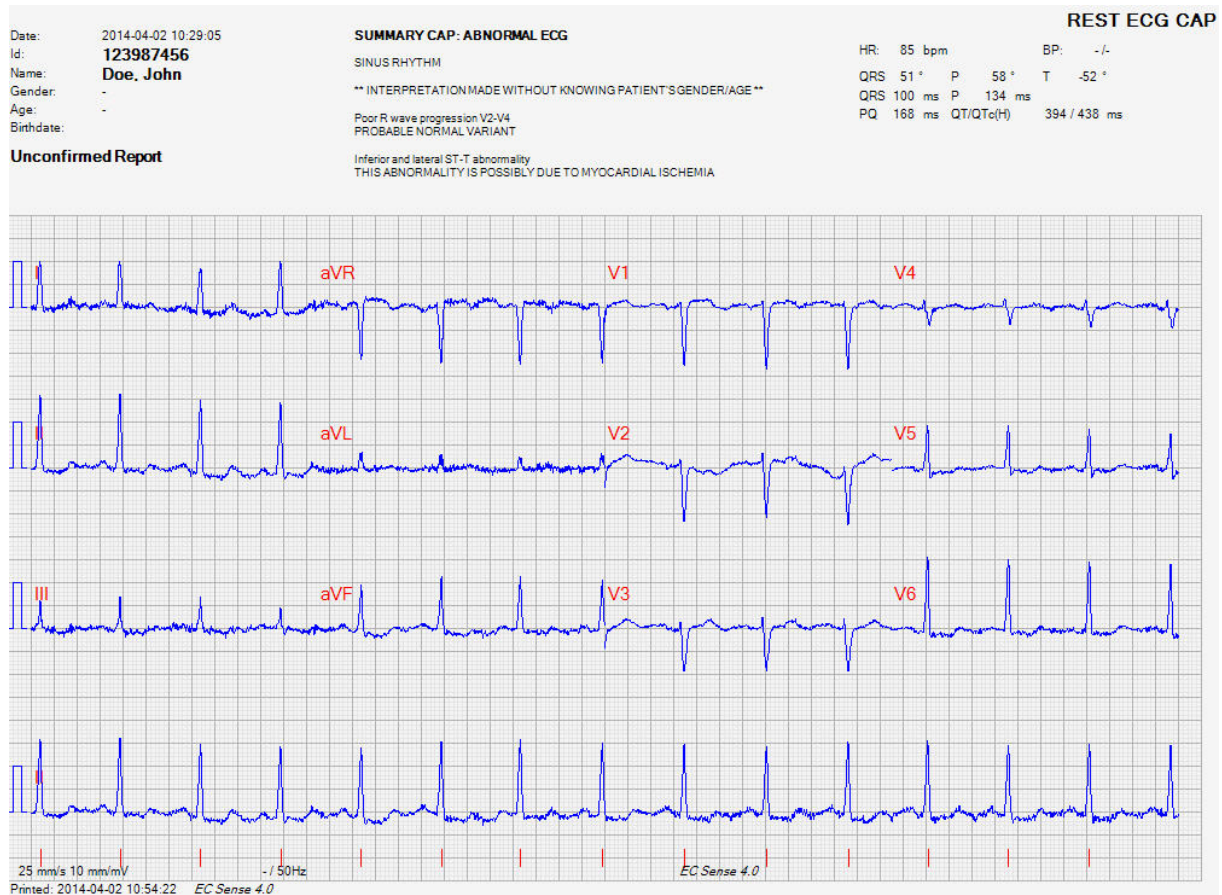
5.2.6 H1 report

This report consists of interpretation (if configured), averaged complexes for 12 leads and rhythm ECG for 6 leads (can be configured). It is printed in landscape format.



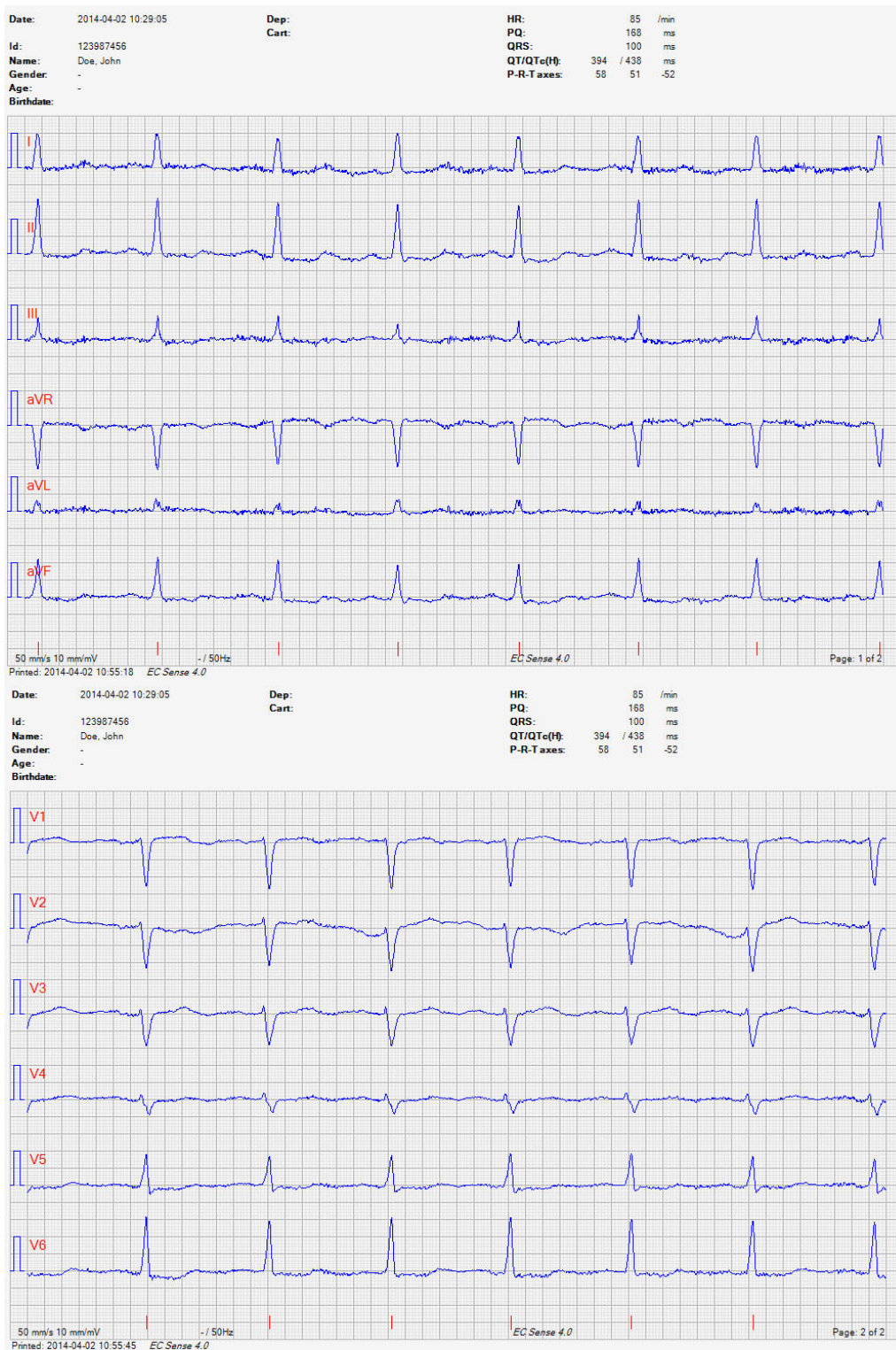
5.2.7 3x4 report

This report consists of interpretation (if configured), rhythm ECG for 3x4 leads and one rhythm ECG with QRS markers (can be configured). It is printed in landscape format.



5.2.8 12-lead report

This report contains rhythm ECG for 12 standard leads. It is printed on two pages in landscape format, one page with chest leads and one with limb leads. It can be printed with QRS markers, if configured in *Settings*. These are printed as red vertical bars.



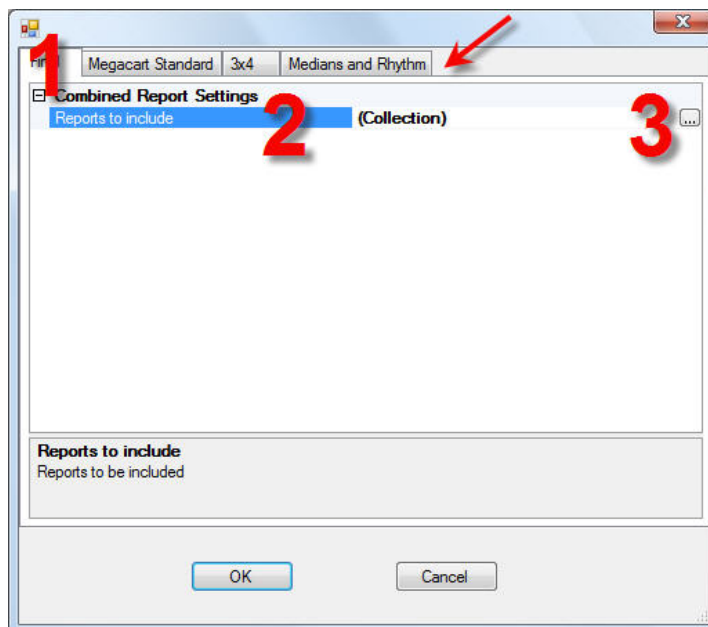
5.2.9 Combined report

The combined report consists of several types of reports that are printed out after each other. Depending on the different reports included, it will be printed in both landscape and portrait format. Which reports to be included can be configured in *Settings*, but it is also possible to make a temporary change and print out different reports. The change is only temporary and as soon as a new examination is opened it will reset to default configuration.

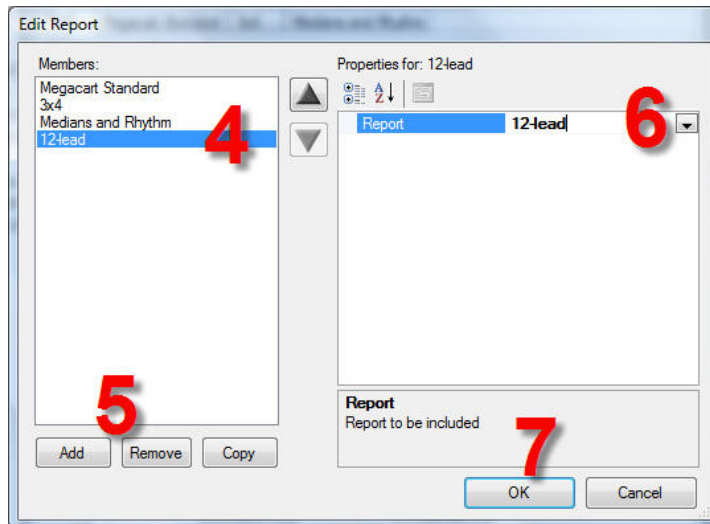
To change the content select *Combined report* from the report drop down menu.



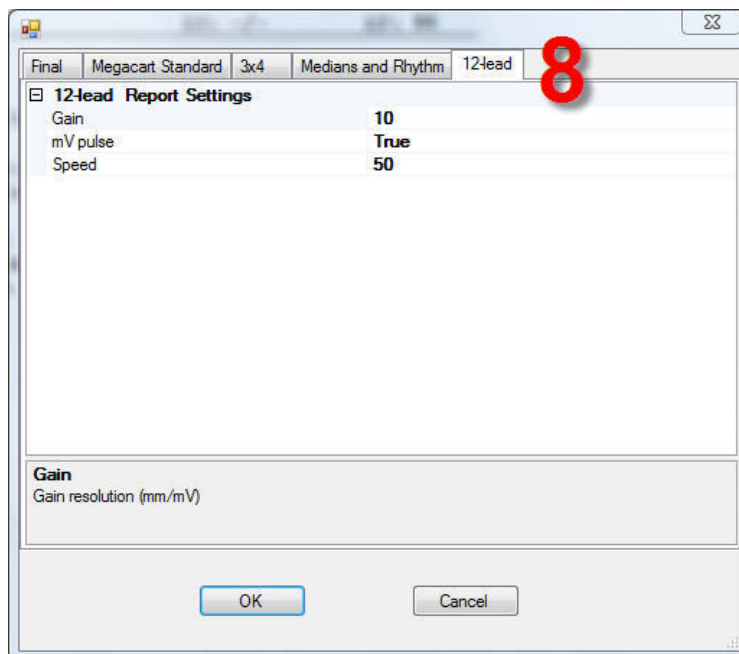
Right click with the mouse somewhere in the report. A pop-up menu opens where the configured reports are displayed as tabs.



1. Click on the sign next to *Combined Report Settings*.
2. Click on *Reports to include*.
3. Click on the list symbol to the right.



4. The list opens and displays the predefined reports.
5. Click on *Add* to add a new report type. (Or highlight a report that shall be excluded and then click on *Remove*).
6. Click on the arrow to the right and highlight a report type in the list that opens.
7. Click on *OK* to include the report.



8. The temporary report window will add a new tab (it will be displayed the next time the window is opened).

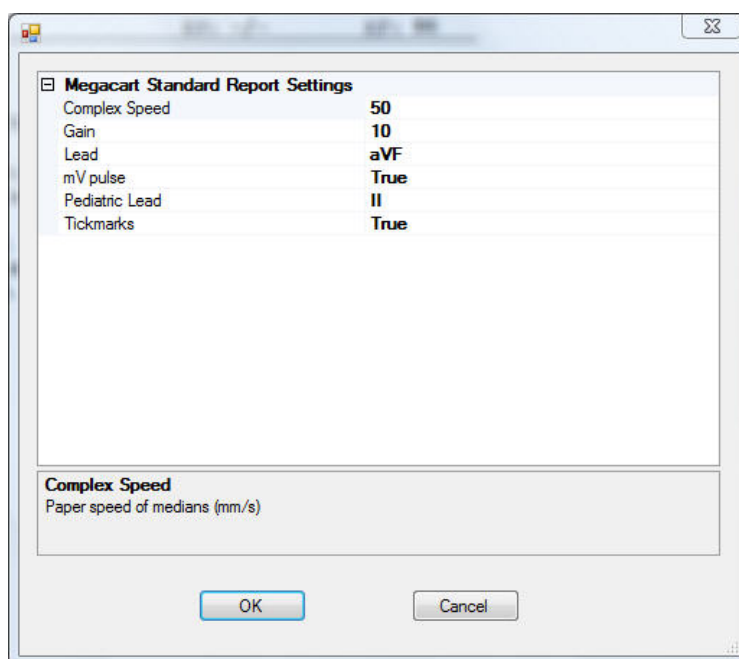
To change the content within a report see section 5.2.10 .

5.2.10 Temporary change of report content

Each report type is predefined. The content and layout of the report can be configured in *Settings*. It is also possible to make a temporary change for the current examination.

To change the content in the report for the current examination follow these steps:

1. Right click with the mouse somewhere inside the report window.
2. A pop-up menu for the selected report opens. See the example below.



Report content pop-up

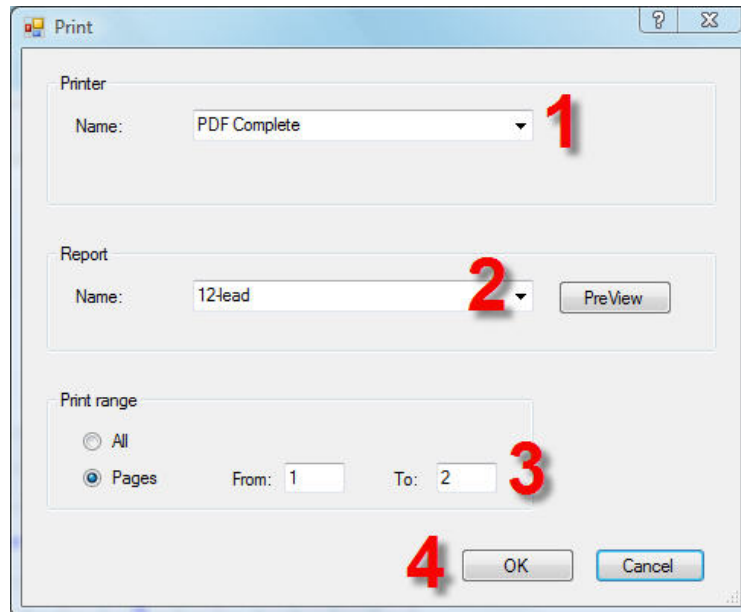
3. Click to the right of the parameter that shall be changed and select an option in the list. The change is only temporary and as soon as a new examination is opened it will reset to default configuration.

Information about how each parameter affects the recording is explained under "Settings" in the System manual.

5.2.11 Temporary change of report printout

The *Print...* function can be activated to make a temporary change for printouts, for instance selecting a different printer.

Select *File* → *Print...* to open the window for temporary change.



1. Select a different printer under *Printer* (the printer must be installed and predefined). The report will be printed out on the selected printer instead of the default printer.
2. Select a different report from the drop down list. Click on *PreView* to see how the selected report will be printed out.
3. Select which pages (for some reports) to print out.
4. Click on *OK* (or *Cancel*).

The change will only affect the current examination and will reset to the default printer on next examination. If a permanent change of default printer is desired it must be configured in *Settings*.

5.3 Beat tab

Under the *Beat* tab it is possible to review all leads and also to make measurements on a representative complex. The following options are available:

Change speed

Click on **50 mm/s** in the menu bar and select the speed to 25, 50, 100 or 200 mm/s.

Change gain

Click on **10mm/mV** in the menu bar and select the gain to 5, 10, 20 or 40 mm/mV.

Show tick marks

☐ **Tickmarks** Show or hide tick marks for QRS onset, QRS offset and ST point.

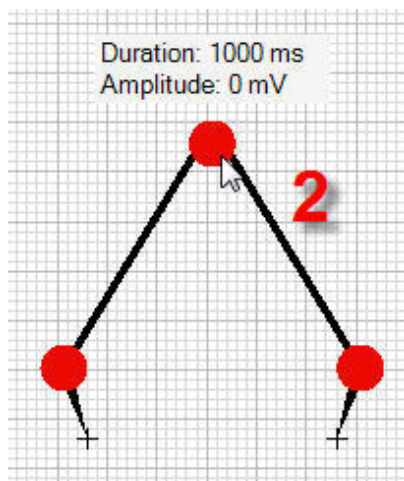
ISO Level

☐ **Iso Level** Show or hide the isoelectric level of 0 mV for which the amplitude will be referenced to at measurements.

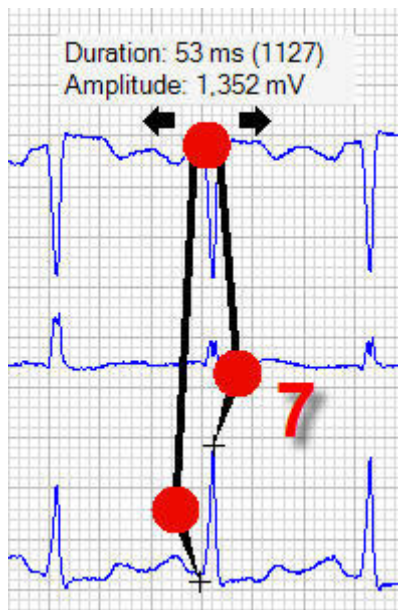
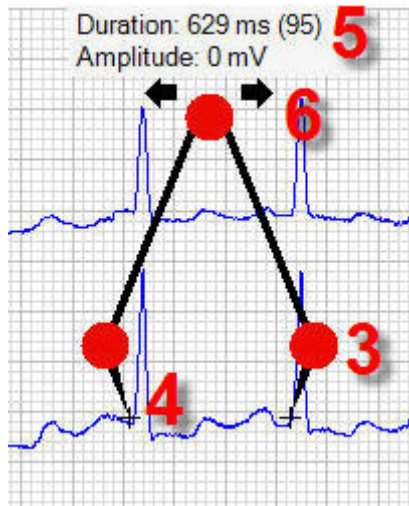
Measure duration/amplitude



To the right in the menu bar there is a box for activating a measurement tool for measuring duration and amplitude on the ECG.

1. Click on **Measure**. A pair of compasses is presented which functions as drag-and-drop.



2. Move the pair of compasses to the desired position by clicking on the left mouse button while pointing on the upper red dot and drag the pair of compasses over the screen.

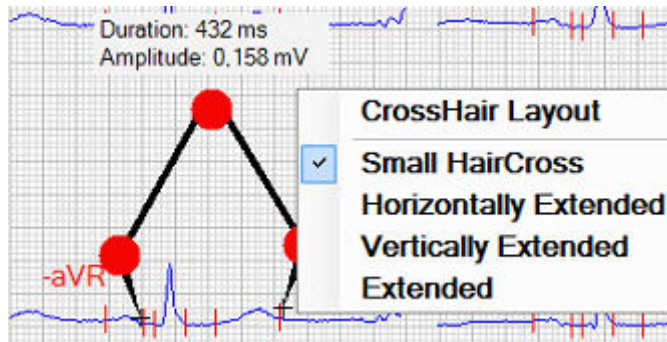


3. Measure the duration by dragging the lower red dots sideways.
4. The measurement values at the top are calculated from the small cross-hairs, and are according to the scale on the screen.
5. The duration is in milliseconds. The heart rate is within brackets (such as 1/ms) when measuring an RR interval.
6. Move the pair of compasses to the next interval by clicking on  or  on the screen. It is also possible to press Ctrl + left/right arrow on the keyboard.
7. Measure the amplitude by dragging the lower red dots up or down. The amplitude is presented in mV at the top.

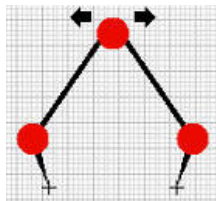
Change the layout of the pair of compasses

The compasses can be presented in various ways.

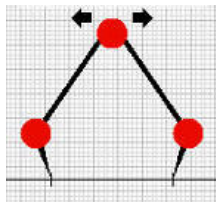
1. Hold the mouse over the upper red dot and right click. A pop-up menu will open.



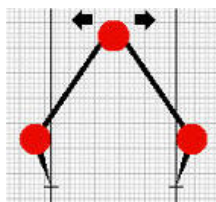
2. Select an alternative by selecting one of the following:



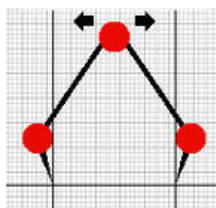
Small HairCross



Horizontally Extended



Vertically Extended



Extended

5.4 Leads tab

Under the *Leads* tab it is possible to review and to make measurements on individual ECG leads. The following options are available:

Change speed

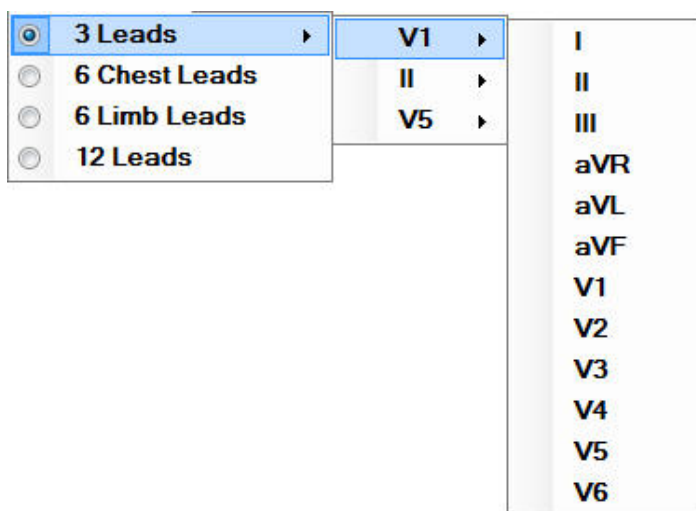
Click on **50 mm/s** in the menu bar and select the speed to 25, 50, 100 or 200 mm/s.

Change gain

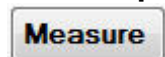
Click on **10mm/mV** in the menu bar and select the gain to 5, 10, 20 or 40 mm/mV.

Change lead

Click on **Leads** in the menu bar and select 3 leads, 6 chest leads, 6 limb leads or 12 leads from the drop down list. If the option of 3 leads is selected it is possible to choose which 3 leads to be displayed.










Measure duration/amplitude



See previous section 5.3 on how to measure amplitude and/or duration.

5.5 ECG report commands

The table below shows the commands that are available in the report mode for Resting ECG.

Function	Icon	Menu item	Fn key
Edit patient information		<i>File → Patient Info</i>	F2
Print out default report		<i>File → Print</i>	F4
Change printout temporarily		<i>File → Print...</i>	
Change report temporarily		Right hand click inside the report for a pop-up menu	
Print the page that is on the screen		<i>→Print page</i>	
Print the report shown		<i>→Print sub report</i>	
Preview the report shown		<i>File → Print Preview</i>	Ctrl + W
Save examination		<i>File → Save</i>	F5
Exit and return to real time mode		<i>File → Real time</i>	F6
Open an examination		<i>File → Examinations</i>	F7
Configure the program		<i>File → Settings</i>	Ctrl+Shift+Up
Exit this program		<i>File → Exit</i>	

NOTE

Shortcut key commands have a different meaning depending on where in the program they are activated. Commands that are used for entering patient data do not have the same functions as they have in the report mode.


6 Exercise Test

6.1 Introduction Exercise Test

This chapter outlines information necessary before using the exercise test function for the first time in *EC Sense*. Specific information about installation and connection of different devices are described in "Installation" in the System manual, which is intended for biomedical engineers/technicians and IT personnel.

The chapter describes the functions to be used in the *Exercise ECG* option only. It is necessary for the user to read the entire Operator's manual and especially the chapter for Resting ECG since many references will be made to that chapter. The Exercise Test chapter describes the normal procedure when carrying out an exercise test and the available functions. The system offers several different ways of configuration which are described in the System manual. Different selections and functions will be described only once and in relation to where it is most likely that they are needed to be used. This means that the user must read the whole Exercise Test chapter to get complete information.

6.1.1 Exercise test function

The exercise test function is an optional software function that will be activated if the user has purchased and installed an option key, or has purchased a software version that already includes that function. The option key is a code with several digits that corresponds to the serial number of the acquisition unit. When the option key has been installed on the PC, the *Exercise ECG* icon  will be displayed on the screen in the upper icon bar.

NOTE

The acquisition unit must be connected and the correct code for the option key must have been installed for the icon to be displayed. To install the software see "Installation" in the System manual.

6.1.2 Default configuration

Each time the program is started, *EC Sense* will reset to the preconfigured settings. The configuration is done in the *Settings* function which is described in "Settings" in the System manual. The system offers several ways of changing parameters and presentation. In brief, the following can be changed:

- Number of traces to be displayed
- Number and combinations of leads to be displayed
- Trends and trend options
- Selection of default protocol
- Definition of customised start values
- Definition of customised protocols
- Screen layout

This section describes the default configuration set by the factory when delivering *EC Sense*. For that reason the user may see different menus, windows and options on the screen compared to what is described in this manual.

6.1.3 Low hard disc space

When acquiring exercise ECG data *EC Sense* will store all information on the hard disc. If the hard disc space is too low the user will be warned.

- A message will be displayed if the space is less than 2 GB when the examination starts. The user can decide to ignore the message and click on *OK* to continue.
- A message will be displayed if the space is less than 1 GB when the examination starts. No examination can be started and nothing will happen if the user clicks on *OK*.



An exercise test requires at least 1 GB of hard disc space. When the 2 GB message is displayed the user should empty the hard disc of old data to ensure that future examinations can be stored properly.

6.2 External devices



WARNING

Consult a biomedical engineer/technician or other competent staff prior to connecting the system to external devices. Specific requirements apply when connecting medical devices together as a system. See "Settings" in the System manual.

6.2.1 Ergometer

During the exercise test *EC Sense* will control the connected ergometer so that the correct load will be applied for each stage, provided that an ergometer recommended by Cardiolex is connected. *EC Sense* has been designed to communicate with different ergometers available on the market. The recommended ergometers are described in "Installation" in the System manual. It is however possible to use other types of ergometers without connecting them to *EC Sense*. The user will then have to change the load manually in each stage. This manual describes how an exercise test can be carried out when an ergometer is connected to, and can communicate with, *EC Sense*. The System manual contains information on selections, installation and connection instructions for the ergometers that are recommended to be used with *EC Sense*. Usually this procedure is only carried out once and it is recommended to consult a biomedical engineer/technician, or ask your distributor for help. Refer to the manufacturer of the ergometer for instructions on how to use the ergometer.



WARNING

Calibration of the ergometer must be done according to the recommendation of the manufacturer of the ergometer.

6.2.2 Treadmill

Instead of using an ergometer a treadmill could be connected and used during the exercise test. The treadmill will be controlled by *EC Sense*, meaning that the speed and grade will be changed according to the selected protocol. It is also possible to use a treadmill that is not connected to *EC Sense*, but the speed and grade has to be adjusted manually on the treadmill. The Operator's manual describes how the exercise test is carried out with an ergometer connected to *EC Sense*. However, the functions are identical for ergometer and treadmill, apart from that at the treadmill both speed and grade increases while at the ergometer only the load increases. Other differences will depend on the selected protocol. For configuration of protocols see "Settings" in the System manual, where different stages and trends could be selected. The "Installation" section in the same manual has information about the

different requirements that needs to be met when connecting a treadmill to *EC Sense*. It is advisable to consult a biomedical engineer or other technical staff for help with the installation since specific safety precautions applies when installing medical systems. Refer to the manufacturer of the treadmill for instructions on how to use the treadmill.



WARNING

Calibration of the treadmill must be done according to the recommendation of the manufacturer of the treadmill.

To prevent injury the user must allow for sufficient space behind the treadmill in case the patient falls off treadmill and falls backwards.

6.2.3 Automatic blood pressure device

The blood pressure device *Tango+* from *SunTech* is suitable to connect and use together with *EC Sense*. The blood pressure is measured with the help of the automatic device and the blood pressure values are used in the program. For proper use and care of the automatic blood pressure device, please refer to the manufacturer's instructions.



WARNING

The user must read the associated Operator's manual for Tango+ before using Tango+ for blood pressure measurement.

Blood pressure measurements with Tango+ may not be used on children.

6.2.4 QRS signal

It is possible to use the QRS signal from the serial output on *EC Sense* and connect the signal to an external device for showing the heart rate.

NOTE

The QRS signal is only an output signal that generates a short pulse for every heartbeat.

The QRS pulse will be detected by the external device, depending on the type of the external device.

6.3 Menus and basic functions

This section outlines general information about basic functions and menus that the user shall be familiar with before starting an exercise test. If you don't want to, or can't use, the mouse most of the functions in *Exercise ECG* can be entered with the keyboard with a few shortcut key commands using the function keys. When working with reports or settings it will be more or less necessary to use the mouse.

NOTE

Before the exercise test can start you must select a patient and enter patient data. See previous section on "Resting ECG"

Shortcut key commands have a different meaning depending on where in the program they are activated. Commands that are used in Exercise ECG do not have the same function as they have in Rest ECG or in the report mode. The tables in each section show which shortcut key commands that can be used for the described mode.

6.3.1 Menu bar

The menu bar at the top of the Exercise ECG screen has the following drop down menus.

File	View	Tools	Actions	Help
Patient Info F2 Status Report F4 Man Print F5 Rhythm Print F6 Settings Ctrl+Shift+Up Exit	Real time ECG ▶ Rhythm Complex Trends ▶		Next phase F8 Next stage F7 Change protocol Change load Hold stage F9 Mark event F10 Enter measurements F11 Enter BP F12 Relearn complex Alt+R <input checked="" type="checkbox"/> Tremor filter Ctrl+F Tremor filter frequency ▶	About

Used for

↓
Selecting patient and printouts

↓
Changes in the displayed ECG

↓
Exercise test functions






↓
Software information






Apart from clicking on the options in the drop down menu it is possible to use the Alt key + the first letter in the menu to activate a function. For instance, opening the *File* menu can be done by:

- Pressing Alt + F simultaneously.

6.3.2 Icon bar

The icons below the menu bar display the different functions that can be activated during the exercise test. Many icons have the same function as in the menu selections shown in the previous section. In addition, the function keys on the keyboard could also be used. Below is an overview of all icons, function keys and a brief explanation of the functions to be used in the exercise test.

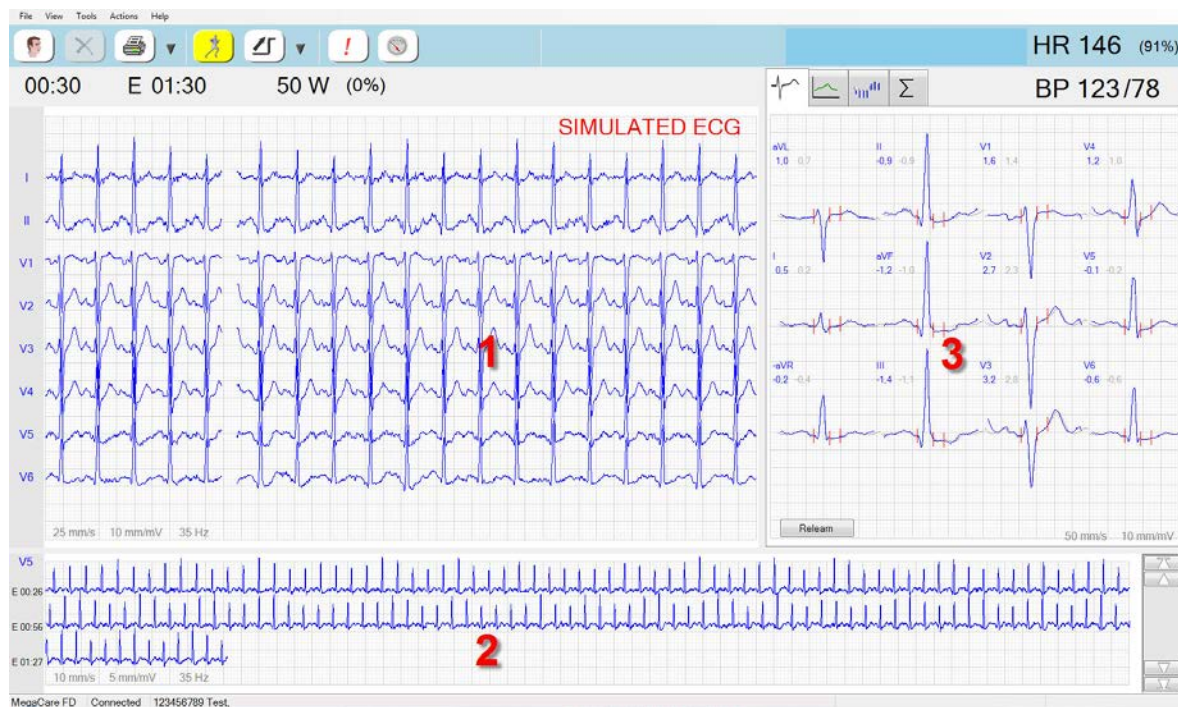
Icon	Key	Function
	F2	Enter patient data – Patient data can only be changed before the exercise test starts. Examination data could on the other hand be changed during an ongoing exercise test.
		Cancel Exercise test – The exercise test could only be stopped in the pre-exercise phase, which is before the actual exercise starts. A message will be displayed, with the possibility to select Yes or No for final decision. Selecting Yes means that all ECG data will be lost. The exercise test could be stopped from the exercise phase and recovery phase if selecting <i>File</i> → <i>Exit</i> from the drop down menu.
	F4 F5 F6 F4 Alt+F4	Printout – Print the ECG on the connected printer. The connected printer must be configured prior to use. See “Settings” in the System manual. Click on the printer icon for a default report or select a different printout option from the drop down menu when clicking on the arrow. - <i>Manual (MAN)</i> F5 - <i>Rhythm (RHYT)</i> F6 - <i>Status Report</i> F4 - <i>Latest Arrhythmia/Event</i> (dimmed if no arrhythmia or event has occurred). A dimmed printer icon means that there is no printer connected to <i>EC Sense</i> .
	F5 F6	Stop manual/rhythm printout – Stops the print procedure if activated. The icon is only displayed if printing has been activated.
	F8	Pre-exercise – The icon is green to indicate that the patient is resting and that exercise has not yet started. Click on the icon to activate the next stage in the pre-exercise phase. The exercise phase starts after the last stage in the pre-exercise phase.

	F8	Exercise phase – The icon will remain yellow during the exercise phase. The stage change will take place automatically and according to the selected protocol. Clicking on the icon stops the exercise phase and a message will be displayed, asking for the reason for termination.
	F8	Stop Exercise – The icon turns red once the exercise phase is finished and the recovery phase starts. The load disappears and the patient may rest. Clicking on the red icon causes the exercise test to stop and the report window to open.
	F7	Next stage – Go the next stage and load in the selected protocol. Normally the stages change automatically in the exercise phase according to the selected protocol. Every time a stage is changed the stage clock starts from zero.
	F10	Marking events – If activated a marker will be placed on the ECG. Different markers can be used for different events by selecting the appropriate symbol, or the user can enter a specific comment.
	F11	Measurements – Numeric data on blood pressure, exhaustion, chest pain, leg fatigue etc. can be entered any time by clicking on the measurement symbol. Enter numbers with the keyboard or select values by using the arrows. Depending on how it is preconfigured, different data will be presented. See “Settings” in the System manual.

The description above is not a complete explanation of the functions. Detailed information will follow in the next sections.

6.3.3 Exercise test windows

When the *Exercise ECG* function is activated, the exercise test windows open with the patient's ECG together with available functions. The exercise ECG is presented in three different windows.



Exercise test windows

1. Real time ECG display window
2. Rhythm ECG display window
3. Complex display window

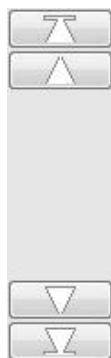
Real time ECG

The Real time display window shows the current ECG for the selected leads. For information on how to change settings in the Real time display window, please refer to 6.5.5.2.

Rhythm ECG

The Rhythm ECG display window shows one lead in an extended time interval. ECG data will be saved from the start of the exercise test until it is stopped by the user. All arrhythmias, changed settings or events will be stored at the time of its occurrence.

Use the arrows to the right to scroll forward or backward in the ECG for viewing or printing an interval. Depending on the selected speed, the pages will be displayed in different time intervals.



← Go to the beginning of the ECG

← Go back one step in the ECG

← Go forward one step in the ECG

← Go to the end of the ECG

Complex display

The complex display window shows the averaged complexes and reference complexes that have been acquired during the exercise test. Altogether there are four windows that can be used for analysing and presenting data in different ways.

Icon	Window
	Show complex – Displays averaged complexes and reference complexes. This window allows you to select new reference complexes and to view the complexes as enlarged single complexes or in a group of three or twelve.
	Show trends – Displays different trends in the exercise phase. Values that have been acquired or entered by the user can be displayed as trends. All values that have been entered by the user can be edited. The trends can be displayed as enlarged single trends or as a group.
	Show ST-graph – Displays the ST level for all leads in real time. The reference complexes are displayed with grey numbers and as grey vertical bars. The blue values represent the current updated averaged complexes.
	Show exercise summary – Displays the information in the examination window. This window allows you to enter some final comments to be included in the summary report. It is also possible to edit this information in the report mode.

Each function is described in more detail in the *Exercise phase* section.

6.3.4 General functions

The exercise test windows have several functions that display values and information under the ongoing exercise test.



Clock



The exercise timer starts when the exercise phase starts. The left clock shows the time in the current stage and the right clock shows the total elapsed time in the exercise test. The letter E (exercise) or R (recovery) in front of the phase time indicates the current phase. The stage clock starts from zero for each new stage. Before starting the exercise phase, the current stage in the pre-exercise phase will be displayed instead of the clock, e.g.: *Sitting up*. The text displayed depends on the type and settings of the protocol. Only the phase time will be displayed in the recovery phase.

Protocol



Before the exercise test starts the selected protocol will be displayed. When the exercise test has started it is only the current load that will be displayed. If required, the load could be changed any time to a different value by clicking on the displayed load. In the pre-exercise phase it is possible to change the protocol by clicking on the name of the protocol or by selecting *Actions* → *Change protocol*. In the exercise phase the protocol could only be changed from the menu.

Leadfail



The small circular electrode symbols will only be displayed if a signal problem occurs. On leadfail the corresponding electrode will be indicated with red. Electrodes where the signal quality is very weak or questionable, a yellow circle will be displayed. Red indicates that the traces are incorrect, since they are affected by the missing electrode. The corresponding ECG trace will be displayed with red instead of blue.

See previous section of “Resting ECG”. A faulty electrode could also be followed by a beep sound, if configured. See “Settings” in the System manual.

NOTE

If a leadfail is indicated, make sure to carefully check the connection of all electrodes before continuing.

Heart rate

HR 119 (74%)

The current heart rate will be displayed next to HR as well as the percentage of the estimated max heart rate within brackets. The HR value is updated after every new heartbeat.

Blood pressure

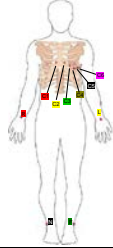







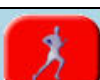


BP 138/88

The blood pressure could be taken automatically or manually during the exercise test, depending on configuration. If manual blood pressure has been selected, use a standard sphygmomanometer and enter the values in the blood pressure window, at your own initiative, or when requested by the protocol. It is always the latest value that will be displayed on the screen. The blood pressure value is normally displayed for one minute. After that it will be counted as non-representative and the value will be dimmed to indicate that it is old. Information on how to enter blood pressure values see section 6.5.6 nedan on “Exercise phase, enter blood pressure”.

For information on automatic blood pressure measurements see 6.5.5.1 “Automatic blood pressure”.

6.4 Quick start guide

This quick start guide describes the normal procedure for an exercise test.

Icon	Key	Instruction	Patient
		1. Prepare the patient and connect the electrodes according to the desired lead electrode placement and connect the patient cable to the acquisition unit and <i>EC Sense</i> .	
	F2	2. Enter the patient information and verify with the patient that correct ID has been entered.	<i>Do resting ECG</i>
	F8	3. Start the exercise test.	
	Return	4. Select the protocol, start and target values that match the patient and start the pre-exercise phase.	<i>Take the BP Pre-exercise lying down</i>
	F8	5. Go to next stage in the pre-exercise phase and ask the patient to sit up (or stepping up on the treadmill).	<i>Take the BP Pre-exercise sitting up</i>
		6. Freeze the ECG when the complexes look representative.	
	F8	7. Start the exercise phase and ask the patient to start pedalling (or start walking).	<i>Take the BP Exercise phase</i>
	F8	8. Stop the exercise phase, enter reason for terminating exercise and ask the patient to rest.	<i>Take the BP Recovery phase</i>
	F8	9. Stop the exercise test, disconnect the patient and start reviewing and editing the final report.	<i>Take the BP</i>
	F4	10. Print out the final report.	
	F5	11. Store the examination.	



Before starting an exercise test it is necessary to have read all instructions in this Operator's manual regarding Resting ECG and Exercise ECG.

6.5 How to perform an exercise test

This section describes how to prepare and carry out an exercise test, including available functions. The exercise test normally consists of the following phases:

Pre-exercise phase; is the phase before the exercise starts and where the patient is at rest while the patient's ECG and other values are acquired.

Exercise phase; is the phase when the patient is pedalling and the load increases for every stage according to a selected protocol while the ECG and other values are acquired. When a treadmill is connected the patient walks or runs and the load includes both speed and grade, which increases according to the selected protocol.

Recovery phase; is the phase when the load disappears and the patient is resting while the ECG is acquired.


After these phases the preparation of the report summary starts, which could be basic standard reports or customized reports. See the description on report summary in section "Exercise ECG reports".

6.5.1 Prepare the patient

Inform the patient before the test starts regarding what will be expected of the patient and how long the test will take. Normally an exercise test is physically demanding. However, if the patient experiences discomfort or weakness the test should be stopped.

6.5.2 Enter patient data

A patient must be selected before the exercise test function can be started. To select a patient:

1. Click on  or press F2.
2. Enter patient data in the window that opens (if not already filled in). If it is a new patient, enter the patient ID and other information relevant for the exercise test. Click with the mouse inside a white text box or move between the boxes by using the return key.



WARNING

For the patient's safety, ask the patient for the patient ID and verify that it corresponds to the information on the screen before starting the exercise test.

Patient data entry

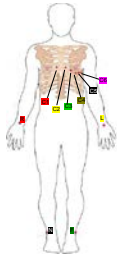
If the patient has been previously registered on the local PC, click on *Patient ID* to do a search. It is also possible to search for patients externally by using the HIS system or the central storage system (search patient) when connected to these services. Information on how to enter patient data and selecting previous patients can be found in the section 3 "About EC Sense". Also refer to 6 "Examination data base" for information on how to search patients locally or externally.

NOTE

If no patient data is entered, it is not possible to start the examination in the normal way. However, an examination can be started without entering patient data if the warning message on invalid patient ID is ignored.

6.5.3 Check the ECG

Before starting the exercise test it is recommended to do a regular resting ECG to ensure that everything is correct.



1. Connect the electrodes according to the desired electrode setting and verify that all electrodes are properly attached. See the section "Acquisition unit" for electrode setting.
2. Watch the ECG on the screen for a while to confirm that the quality of the ECG signals is good and that everything seems to be correct.

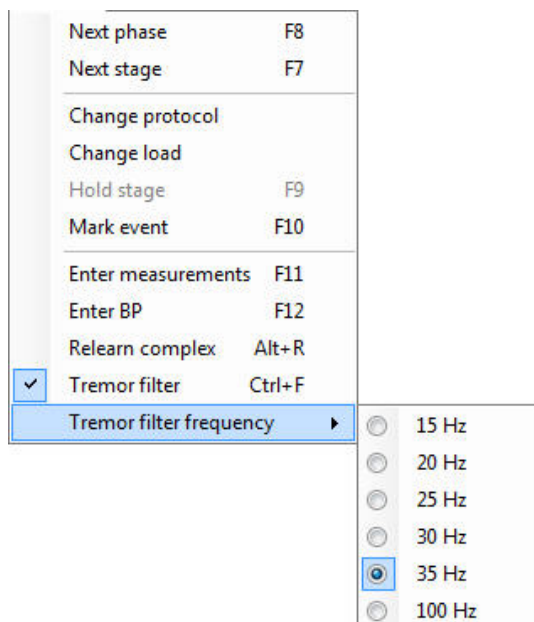
NOTE

Verify that the ECG is free from interference and that the electrodes are correctly connected before starting the exercise test. Check especially that all electrodes have good skin contact with the patient. Electrodes can easily become loose when the patient is moving or sweating.

Tremor filter

The tremor filter can be configured under *Settings*. Often it is set to 35 Hz, which is a standard frequency for filtering out unwanted interference from muscles. The tremor filter can be selected/deselected and the frequency of the filter can be changed from 15 to 100 Hz during the on-going examination.

1. Select *Actions* → *Tremor filter* from the menu, or click on Ctrl + F.
2. The activated filter will be indicated in the Real time and Rhythm ECG windows.
3. To deselect the tremor filter, the procedure is repeated.
4. Select *Actions* → *Tremor filter frequency* from the menu to change frequency.
5. Select a frequency from the drop down list.



The tremor filter is added to the ECG signal after the acquisition, which means that ECG raw data is not affected. In the report mode the signal could be displayed as unfiltered or with different frequencies.

Arrhythmia detection

EC Sense has an arrhythmia detection function and marks the arrhythmias with letters and symbols which are saved together with the ECG.

The type of arrhythmia can be reviewed and edited by the user in the ongoing exercise test and later in the report mode.



Detected arrhythmia

The following types of arrhythmias will be marked by *EC Sense*:

Type	Name	Description
?	Questionable	A QRS complex with abnormal shape that occurs for the first time.
S	SVES	SupraVentricularExtraSystole. A normal QRS complex with shorter interval compared to previous RR interval.

V	PVC	Premature Ventricular Contraction. Complex with a shape that differs from normal shapes.
I	Irregular	Irregular rhythm.
P	Prolonged	Prolonged interval.




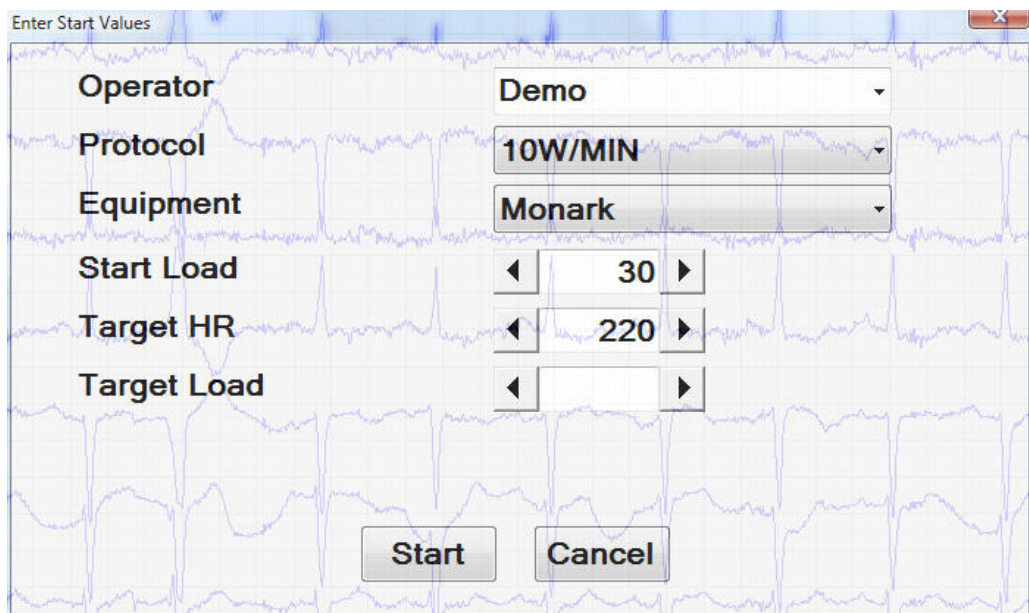
WARNING

Arrhythmias suggested by EC Sense shall always be reviewed by skilled and competent staff. Any reclassification can be done both during the exercise test as well as in the report mode.

6.5.4 Selection of start values

Before the exercise test starts the window for *start values* opens. This window allows you to enter, or accept, the values that will control the exercise test, and which should match the work capacity and ability of the patient.

1. Click on  to open the window with start values.



Window with start values

2. Enter your name under **Operator** or type the name of the person who will be in charge of carrying out the exercise test. Use the Tab key to confirm and to move to next text box, or click inside a box.
3. Select **Protocol** and **Equipment** from the drop down list, appropriate to the patient's ability. To select a treadmill protocol, go to step 6.

Ergometer protocol

4. Select the connected ergometer from the **Equipment** list.
5. Check the proposed start values for **Start Load**, **Target HR** and **Target Load**. If necessary, use the up/down arrows to change, or enter values with the keyboard. *EC Sense* suggests the values based on the patient's age, gender and selected protocol, and in some cases also weight and height. The predefined protocols could be changed under *Settings*. Please be aware that there might be different start values other than presented here, depending on what has been defined in *Settings*.

Treadmill protocol

6. Select *Treadmill* from the **Protocol** list.
7. Select treadmill model under **Equipment**.

Enter Start Values

Operator	Demo
Protocol	Treadmill
Equipment	Treadmill
Start Speed	1,0
Start Grade	1,0
Target HR	160

Change Stages

Start Cancel

Treadmill window

8. Check the suggested start values at **Start Speed** and **Start Grade** (and **Target HF** if configured). The settings could be changed by clicking on the arrows or by entering digits.
9. To change a predefined stage protocol without an increase interval click on **Change Stages** (will only be displayed if the increase interval is set to 00:00 in *Settings*). A table will be displayed where all stages with speed, grade and duration can be changed by entering new values in the table.

Stages in Exercise Phase

Name	Speed	Grade	Duration
Stage 1	1	1	00:01:00
Stage 2	1,5	2	00:01:00
Stage 3	2	3	00:01:00
Stage 4	2	4	00:01:00

OK Cancel

Change stages window

Watt protocol for treadmill control

10. Select Treadmill W under **Protocol** if the treadmill shall be controlled by a different device. (A Watt protocol must first be configured in *Settings*). Enter or change any values desired.

Enter Start Values

Operator	Demo
Protocol	Treadmill W
Equipment	No treadmill
Start Load	5
Treadmill Speed	1,00
Target HR	160
Target BP	
Target Load	

Start Cancel

The Treadmill window with W control

11. When starting the exercise phase, W will be displayed (speed as m/s and grade as %). The load will increase automatically according to the preconfigured values.

NOTE

The weight of the patient must be entered in the patient information window in order to control the treadmill.

Overview for start values

Parameter	Function
Operator	The name of the person that is carrying out the test is normally selected from the list. You can enter your own name by using the keyboard. However, the name will not be saved. If you need to add more operators to the list it can be configured in <i>Settings</i> .
Protocol	A number of predefined protocols are available. You should choose a protocol that is adapted to the patient's ability and select an increase that is suitable. Protocols can be defined under <i>Settings</i> , which is only recommended to be done by advanced users.
Equipment	Select the type of equipment that is connected and suitable for the protocol. The list only displays equipment types that have been defined under <i>Settings</i> .
Target HR	<i>EC Sense</i> suggests the target heart rate based on a formula and the patient's age (subtract patient's age from 220). Change the patient's target heart rate with the arrows or enter a numeric value if the value seems incorrect.
Start load	For ergometer. <i>EC Sense</i> suggests a start load that is suited to the selected protocol. The start load can be changed with the arrows or by entering the load by numbers, if a different start load is desired.
Target Load	For ergometer. <i>EC Sense</i> suggests a target load based on the age (according to a table of reference values). Change with the arrows or enter a new numeric value if it does not match the patient's expected work capacity.
Start Speed	For treadmill. The window displays the start speed for the treadmill and according to the protocol defined in <i>Settings</i> . The start speed can be changed by clicking on the arrows.
Start Grade	For treadmill. The window displays the start grade for the treadmill and according to the protocol defined in <i>Settings</i> . The start grade can be changed by clicking on the arrows.

Target BP	Applies to treadmill with W control. If desired, enter the patient's expected maximum systolic blood pressure value by using the arrows or the numeric keys.
Treadmill Speed	Applies to treadmill with W control. The treadmill speed is entered as m/s and is preconfigured in <i>Settings</i> . Use the arrows or enter a value between 0,5 and 2 if the speed needs to be adjusted.
Change Stages	For treadmill with stage protocol. This button is only displayed when stages are predefined (the increase interval must be set to 00:00 in <i>Settings</i>). Click on the button to open the window to change the speed, grade and duration for each stage. When the exercise test is finished the settings will return to the predefined settings. The values could be changed during the ongoing exercise test.
Start	The exercise test starts when this button is clicked, or if the return key is pressed.
Cancel	Click on this button if you want to cancel all entries and return to the resting ECG.


Other target values could be defined and displayed in the window (see "Settings" in the System manual).

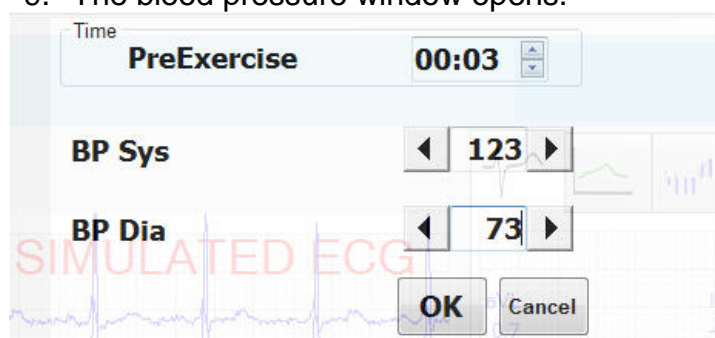
NOTE

The window with start values will reset to default setting between each examination.

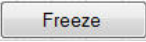
6.5.5 Pre-exercise phase

When the patient data is entered and when the patient is ready:

1. Click on **Start** to accept the start values and the protocol, or confirm by using the return key. (Clicking on **Cancel** deletes all entries and you will return to Resting ECG.)
2. The screen now shows the windows for Real time ECG, Rhythm ECG and Complexes.
3. Ask the patient to remain in a resting position and check the signal quality of the ECG in the Real time ECG window. The leads I, II, V1, V2, V3, V4, V5 and V6 will be displayed simultaneously in the Real time ECG window until changed (or if differently configured).
4. Check the speed, gain and leads and make necessary adjustments. See "Settings" in the System manual for configuration.
5. Take the blood pressure in the resting position and enter the values in the window that opens when clicking on **BP** or pressing F12. The time for the measurement will correspond to the time the window was opened. You can click on **BP** or press F12 anytime to enter new values.
6. When the patient has rested for a while, ask the patient to sit up on the bicycle, or step up on the treadmill.
7. Click on  or press F8 to go to the next stage.
8. The screen now displays **Sitting up** (this may vary depending on the protocol and configured *Settings*).
9. The blood pressure window opens.



Blood pressure window for manual measurements

10. Take the blood pressure and enter the values in the boxes. Click on **OK**.
11. Ask the patient to remain sitting up for a few minutes. Take the blood pressure again, if prompted.
12. Check the averaged complexes. Freeze the complexes by clicking on  as soon as the complexes look representative and are free from muscle interference or noise. The frozen complexes will be used as reference complexes. Verify that the QRS and ST markers are in the correct position on the complexes. The ST measurements during the exercise test will depend on where the ST markers are placed on the reference complexes. If the complexes have not been frozen by the user before the exercise test starts, they will be frozen automatically when the exercise phase starts. See the 6.5.6.2 on Reference complexes.

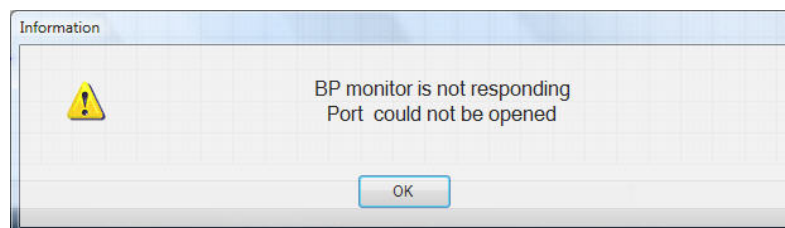
NOTE

If you during the exercise test observe that the reference complexes no longer look representative, you should update them with “relearn” as soon as possible.

6.5.5.1 Automatic blood pressure measurement

The blood pressure device *Tango+* from *SunTech* is suitable to connect and use together with *EC Sense*. When the blood pressure device has been properly installed (see the System manual) and connected, the blood pressure window that opens will display buttons for *starting* and *stopping* a blood pressure measurement.

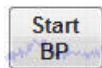
If the blood pressure device is not connected, and it has been configured under *Settings* to be used, the following message will be displayed:



Connect the blood pressure device or deselect it as connected equipment in *Settings*.

The BP measurement will function in the same way as when you get prompted to do a BP measurement in the protocol (or started by the

user) as a manual BP measurement. In the automatic mode the cuff will inflate as soon as the user clicks on *Start BP*.



To start:

1. Click on *Start BP* when the BP shall be taken.



2. The cuff inflates and the measurement starts.
3. The values will be entered in the window automatically when the measurement is finished, provided it was successful.



4. If the values from the automatic measurement were incorrect, the blood pressure measurement can be started once again by clicking on *Start BP*. It is also possible to take a manual blood pressure measurement and enter those values in the numeric boxes.



The blood pressure measurement could be stopped any time.

To stop:

1. Click on *Stop BP*.
2. The cuff will deflate and no values will be displayed on the screen. It is not possible to start a new BP measurement while the cuff is deflating. When the device is ready for a new measurement, the *Start BP* button will be displayed on the screen.

NOTE

Automatic blood pressure measurement does not mean that the device starts automatically without a command from the user. It is up to the user to decide when to start the measurement by clicking on Start BP.

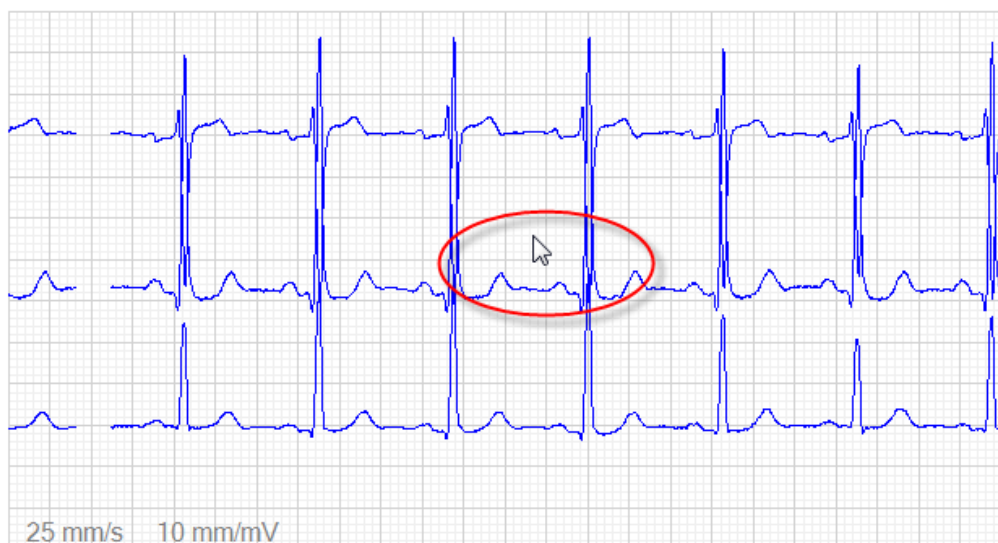
The Start BP button will not be displayed unless an automatic blood pressure device has been installed and connected. If the automatic blood pressure device has been installed but the device has not been powered, the following message will be displayed: "BP monitor is not responding". However, the blood pressure could always be taken as a manual measurement.

6.5.5.2 Functions

Several functions and settings could be activated in this mode.

To change speed, gain or leads:

- Right click with the mouse somewhere in the Real time ECG window or on the Rhythm ECG. The menu for changing *Speed*, *Gain* or *Leads* opens. The Rhythm ECG window also has functions for adding events and making printouts. The time for the event will be saved at the time where the mouse was clicked.



Real time ECG window

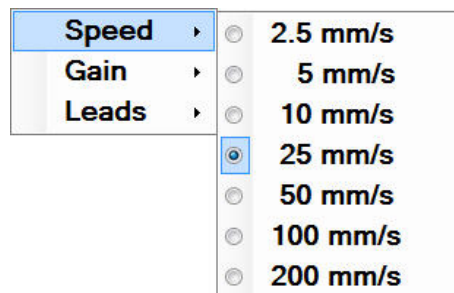
Add events

- Right click with the mouse inside the Rhythm ECG window and select *Add event*. A pop-up menu shows the types of events that can be selected with a mouse click.



Change speed

- Right click with the mouse in the window and select an option from the drop down list.

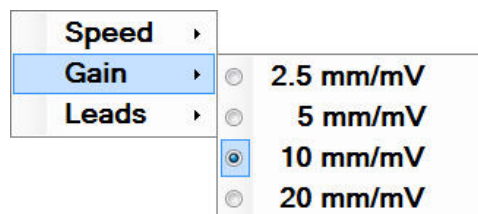


or

- Select speed from the list in the menu *View → Real time ECG → Speed*.

Change gain

- Right click with the mouse in the window and select an option from the drop down list.

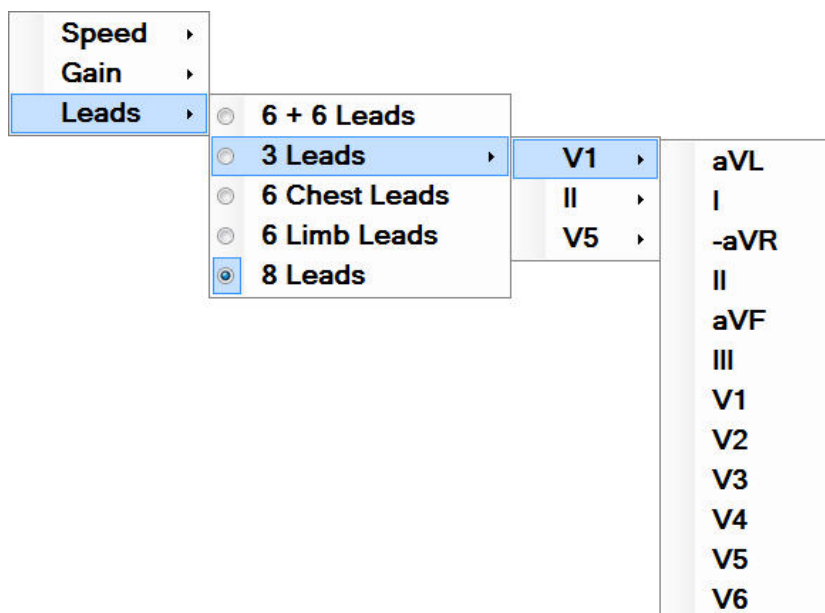


or

- Select gain from the list in the menu *View → Real time ECG → Gain*.

Change leads

- Right click with the mouse in the window and select an option from the drop down list, or



- Select lead combination from the list in the menu *View → Real time ECG → Leads*.



The default lead combination depends on how it has been configured in *Settings*.

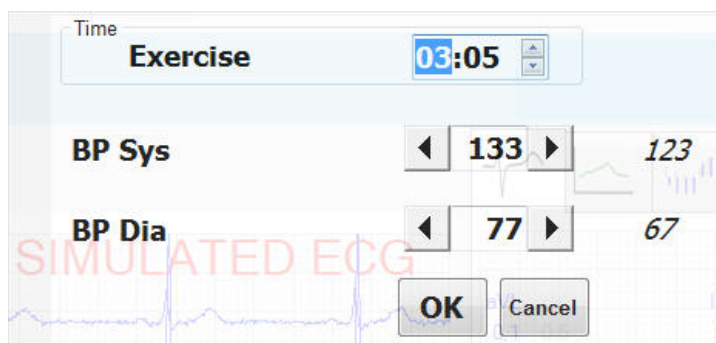
NOTE

The option with 3 leads has different display options since it is possible to select different combinations of the 3 leads. The individual lead to be displayed for each of the 3 leads can be selected after the arrow.

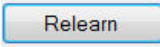
6.5.6 Exercise phase

To continue with the exercise phase that starts after the pre-exercise phase:

1. Click on  to start the exercise phase, or press F8. (You can also click on the next stage  icon).
2. The blood pressure window opens (if not configured differently in the protocol).



Blood pressure window

3. Take the blood pressure and enter the values in the boxes. The previous values are displayed to the right. (By clicking on the previous values they get copied into the boxes).
4. Check that the reference complexes and markers are correct. If the complexes are misleading wait until you see an acceptable complex and click on . See the section 6.5.6.2 on "Relearn".
5. Ask the patient to start pedalling/walking.
6. The exercise timer starts when the exercise phase starts.

Display for ergometer:

00:07	E 02:03	70 W	(87%)
Current stage	Phase time	Current load	% of target load

Display for treadmill:

00:22	E 00:22	1,0 km/h	1,0%
Current stage	Phase time	Current speed	% grade

Display for treadmill with W control:

00:08	A 00:08	10 W	(1,0 m/s	1,4%)
Current stage	Phase time	Watt	Speed	% grade


7. The change of stage and increase will occur automatically according to the selected protocol, unless they are changed manually.
8. The increase continues until the exercise phase is stopped.
9. The blood pressure measurements will continue with the interval as set by the protocol.
10. All ECG data will be stored and can be used later.

6.5.6.1 Functions

Several different entries and changes can be carried out in the exercise phase:


Next phase

To go to the next phase:

1. Click on  or press F8. (This starts the recovery phase).

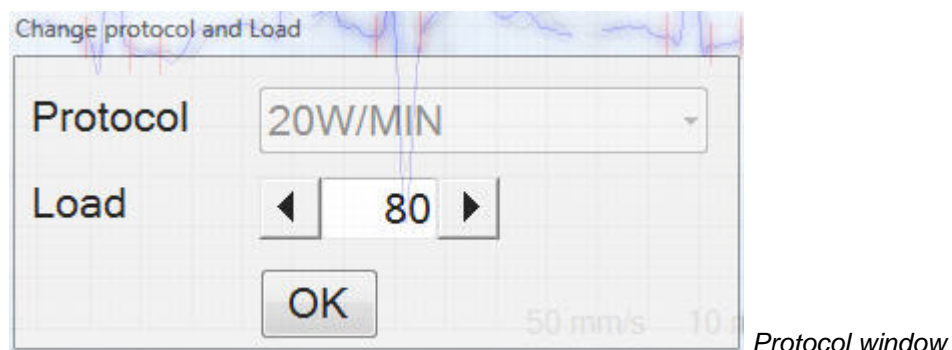
Next stage

To go to the next stage manually:

1. Click on  or press F7. The load increases one stage according to the selected protocol.

Change load

To change load:



1. Select *Actions* → *Change load*.
2. Choose a new value for load by using the arrows or enter a numeric value in the box.
3. Click on *OK* to close the window.

Change speed/grade

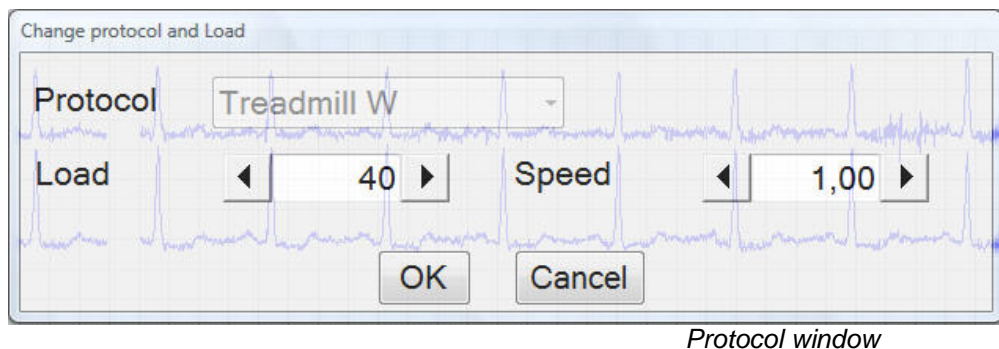
To change speed/grade:



1. Select *Actions* → *Change load*.
2. Choose new values by using the arrows or enter numeric values in the boxes.
3. Click on *OK* to close the window.

Change load/speed

To change load/speed for treadmill with W control:



1. Select *Actions* → *Change load*.
2. Choose new values by using the arrows or enter numeric values in the boxes.
3. Click on *OK* to close the window.



The load increase may only be made in small steps so that it is predictable to the patient. If the load increases suddenly the patient can get injured.

NOTE

It is possible to change the load and protocol once the exercise phase has started.

Stop the treadmill

The treadmill could be stopped with the STOP button on the treadmill. The ECG will be registered even though the treadmill is stopped, and if suitable it is possible to continue the exercise test if the treadmill is restarted. At restart *EC Sense* starts from the latest speed and grade.

To stop the Exercise test without losing ECG data select *Next phase* or F8 and enter the reason for terminating.

Hold stage

Towards the end of the exercise test it may be desirable to hold a stage on the same level and to keep the patient exercising.

To hold a stage with the same load:

1. Select *Actions* → *Hold stage*, or press F9.
2. The current load remains the same until the function is deselected. If a stage hold is activated, the load will be displayed in pink, see below.

00:18 E 01:18 50 W (62%)


3. It is NOT possible to change the load for the stage on hold.
4. To continue to the next stage in the protocol select *Actions* → *Hold stage*.

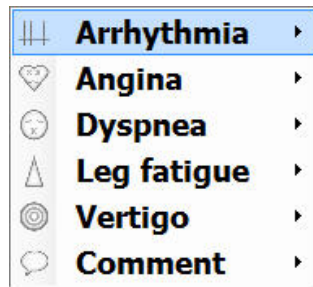
Add events

Event markers could be added anywhere during the ECG. The function is useful if the condition of the patient changes or if you for any other reason would like to make a note or point out an interesting occurrence.

To add and mark events:



1. Click on  or press F10. It is also possible to click somewhere inside the Rhythm ECG window to open the menu with event markers. The window opens:



The menu for adding events

2. Select an event from the list by clicking on a symbol. Move the pointer to the left, click inside the text box and enter a comment about the event and then press return. The types of events that can be selected from a list can be configured in *Settings*.
3. If you prefer only to add a comment, just click on *Comment* and type in your text (may depend on *Settings*).

The event will be saved on the ECG at the same time as when you first clicked.

NOTE

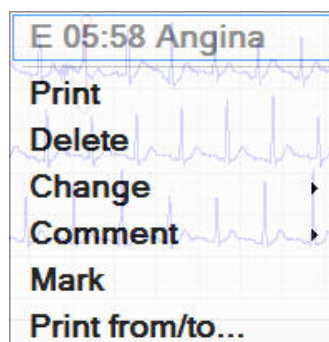
You can edit your own types of events in *Settings* under *Exercise ECG* → *General* → *Events*. See the *System manual*.

Edit and print out events and arrhythmias

All events and arrhythmias that have been marked from the very beginning of the exercise test will be stored. Events can be added, printed, deleted or changed anytime in the exercise ECG.

To edit/print an event:

1. Scroll through the Rhythm ECG to find the event.
2. Place the mouse pointer over the event symbol and right click.
3. The menu for editing/printing events opens. Select one of the following options:



Print the interval with the event

Remove the marked event

Change the type of event or arrhythmia

Add your own comment

Mark that the event shall be included in the report

Print out an ECG interval, see below

NOTE

It is important to hold the mouse pointer precisely over the symbol. The time when the event occurred and the name of the symbol will be displayed in a small grey box when pointing with the mouse on the event.

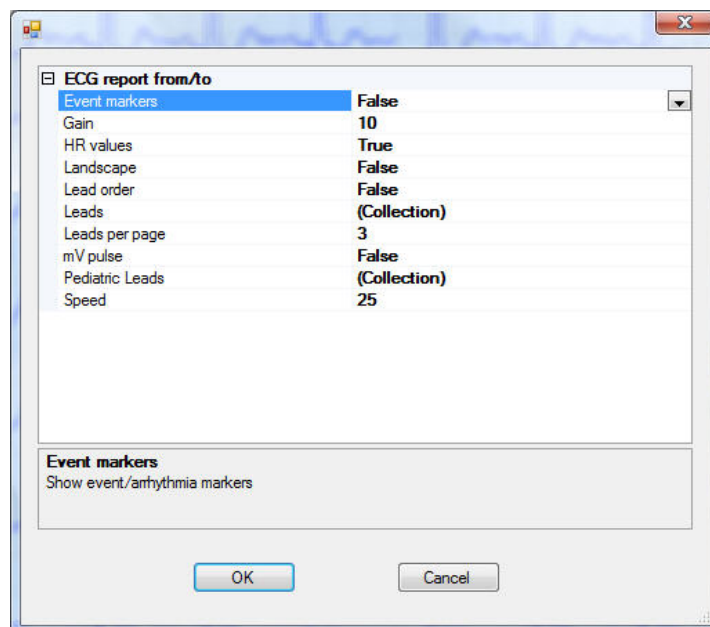
To print a report with a desired ECG interval:

1. Mark the starting point on the Rhythm ECG by clicking with the left mouse button and then move the mouse to the stopping point.

NOTE

The Rhythm ECG will be printed out from the very beginning of the ECG if no starting point has been marked (this could result in several pages of ECG).

2. Hold the mouse pointer over the stopping time and right click.
3. Select *Print from/to...*



Temporary change

4. The window opens for temporary change of predefined report options.
5. Change a setting or click on **OK**.

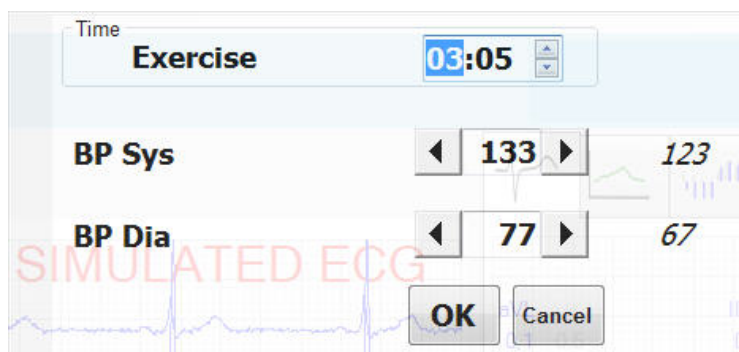
The report options will reset to default configuration when a new examination starts.

Enter blood pressure

Blood pressure values can be entered in all phases at any time. Take the blood pressure as many times as needed during the exercise test and enter the values directly or later. The window for entering BP values will open automatically if it has been predefined for the current protocol.

To enter BP values:

1. Click on **BP** to open the window for entering BP values, or press F12.




blood pressure window

2. Enter the blood pressure values with the numeric keys or use the arrows, then click on **OK**. (You can copy the previous value into the boxes by clicking on the value to right).
3. The blood pressure will be displayed for 1 minute before it will be dimmed.

Enter measurements

To enter other measurement values (this can be done any time during the exercise test):

1. Click on  or, press F11, or select *Actions* → *Enter measurements* from the menu.

Time **Exercise** 03:54

BP Sys	◀ 128 ▶	123
BP Dia	◀ 72 ▶	67
Pain	◀ 3 ▶	
Exhaustion	◀ 1 ▶	
Resp. rate	◀ ▶	
Oxygen sat.	◀ 92 ▶	

OK Cancel

The window for entering measurements

2. Select a value with the arrows or with the numeric keys. The value to the right is the previous value. You can copy the previous value by clicking on it.

All entered values will be saved and included in the trends. (The parameters in the window above depend on how the system has been configured, see “Settings” in the System manual).

6.5.6.2 Complex display



The complex display to the right on the screen has four tags where you can choose different windows with information by clicking on the icons. The default window is the Complex display with the averaged complexes.

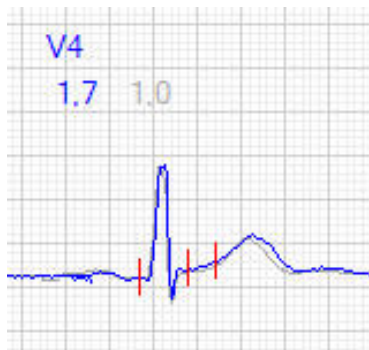
Averaging of complexes is an ongoing activity which starts as soon as the exercise test starts. Each new complex that is acquired will be analysed and the dominant complex will be presented as the averaged complex. Averaging means that all new dominant typical complexes will be added to old complexes and then be updated according to an algorithm. The display is updated every 5 second with new complexes that will be saved. The averaged complexes can be compared to the reference complexes that are saved automatically when the exercise phase starts, or when the reference complexes are saved by the user.



Complex display in pre-exercise

Reference complex

All averaged complexes (blue) will be compared to a reference complex (grey) that is fixed on the display. Reference complexes are dominant typical complexes that will be saved at a time when the complexes are representative. The complex will be frozen at the moment when the exercise phase starts and then later be the reference complex that could be used as a basis for comparative analysis. No reference complexes will be saved in the pre-exercise phase, unless the user clicks on *Freeze*. The complex display shows the reference complexes and the averaged complexes together.



The blue complexes represent the ongoing averaging that is updated after every new complex.

The grey complexes are the reference complexes – either saved by the user by freeze/relearn, or saved automatically at the start of the exercise phase.

The red vertical bars | are markers. The markers are placed at the QRS onset, QRS offset (J-point) and ST point. The numeric values represent the ST level and ST slope. (The presentation of ST area, ST level, ST slope and ST index can be configured in *Settings*.)

NOTE

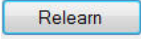
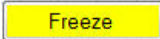
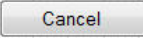
*The reference complexes may not be visible on your screen since it is possible to deselect presentation of reference complexes in *Settings*.*

It is also possible to change the colours of the complexes which means that they may have different colours than blue and grey, as shown above.

Relearn reference complex

If the dominant complex differs much from the current complex it is possible to save a new reference complex to get better accuracy. This function is referred to as "relearn" and it can be used any time during the exercise test.

To update and save new reference complexes:

1. Click on  at the bottom in the Complex display window.
2. Click on  when you see a representative complex to be used as a reference complex, or click on  to return without changing complex. (You can not click on a new tab before a reference complex has been saved).
3. The new reference complex will be displayed after a couple of seconds.

By clicking on *Freeze* the displayed averaged complex will become the new reference complex. *Relearn* and *Freeze* can be done as many times as needed. All occasions will be saved and presented in the report.

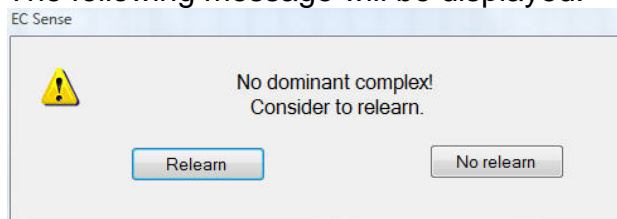
NOTE

No ST values will be acquired in the trends when "Relearn" is in progress.

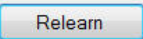
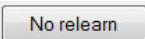
Relearn message

If no dominant complexes have been shown within 10 seconds after a change in shape, e.g. bundle branch block, the complexes are considered to be misleading. You will be requested to consider to "Relearn", meaning that you are advised to save a new reference complex.

The following message will be displayed:



Message displayed upon missing complex

1. Click on  to acquire a new reference complex or click on  to ignore the message.



Warning

This is a safety message to prevent that calculations will be based on incorrect complexes. It is the responsibility of the user to decide if a complex is correct or not.

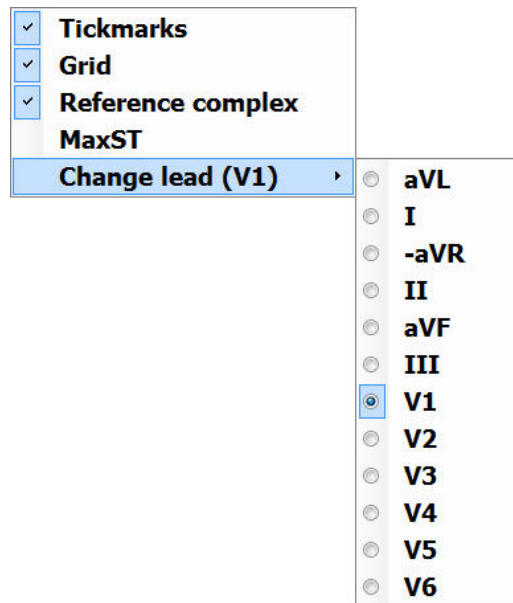
NOTE

It can take up to 10 seconds before the new reference complex is displayed on the screen.

Display options

The Complex display window allows you to see information in different ways.

1. Click on a complex to enlarge it.
2. Point with the mouse in the window and right click to open a menu with display options.



Menu with display options

To hide or show markers for QRS onset, QRS offset (J-point) and ST point:

- Click on *Tickmarks*

To hide or show a grid in the background of the complexes:

- Click on *Grid*

To hide or show reference complexes:


- Click on *Reference complex*

To show Max ST:

- Click on *Max ST* to show the lead with the smallest value at the ST point.

To change lead:

- Click on *Change lead* and select from the drop down list.

3. Click on  to return to 3 or 12 lead display.

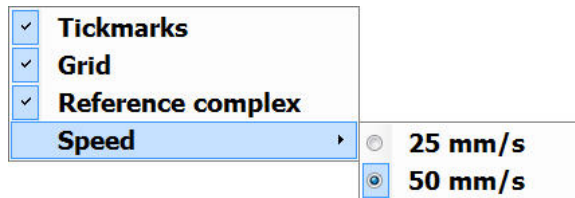
4. In the 12 lead display it is also possible to change the speed.

Change speed

Point with the mouse in the window and right click to open a menu with display options.

To change speed:

- Click on Speed and select 25 or 50 mm/s.




All other functions work in the same way as previously described for one lead.



Display individual complexes

All leads will be displayed as default (if not configured to display 3 leads in *Settings*). You can toggle between showing individual leads or a group of 3 leads.

To display 3/12 leads:

- Click on .
- Click once again to return to all leads.

To display one lead:

- Place the mouse pointer in the Complex display window and click.
- Click on  to change lead.
- Click on  to return to 3 or 12 lead display.

6.5.6.3 Trend display



The Trend display window shows all data and events that have been saved during the exercise phase. In the Trend display the user can look at trend data for different parameters. For instance *Heart rate*, *Blood pressure*, *ST level in V5* and *Load*. The user can decide which trends to display. It is also possible to edit acquired data later on. The acquisition of automatic trend data begins when the exercise phase starts and continues until the recovery phase is stopped. Any trend values that have been entered in the pre-exercise phase will also be included in the Trend display. Trend data is normally showed in 20 minutes intervals. If the exercise phase continues for a long time, the interval will be extended with an extra 10 minutes for every 10 minute period that is started.

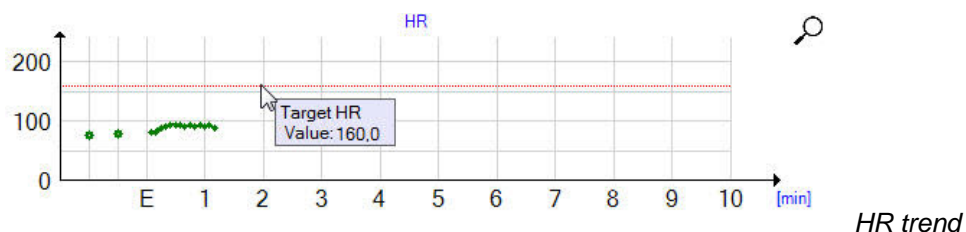


E = Start of exercise phase
R = Start of recovery phase

Show target value

To show the target value in a trend:

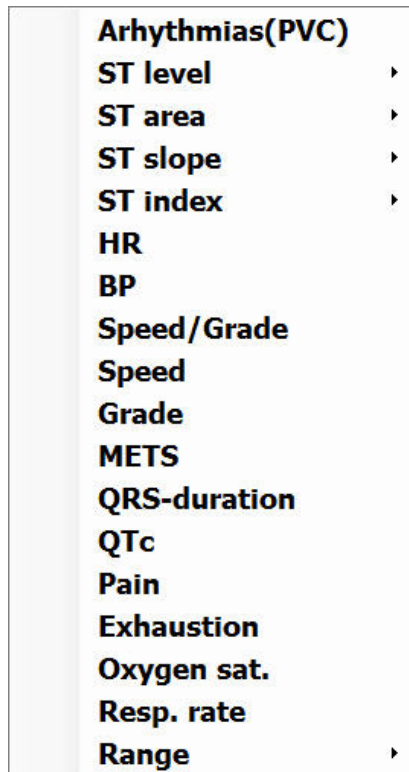
1. Point with the mouse on the target line to show the value.



Change trends

To select a different parameter on the Trend display:

1. Point with the mouse on the trend to be replaced.
2. Right click and select a new trend from the drop down list.



Menu for selecting trend

The trends that could be selected depend on which protocol that is active and also what has been configured in *Settings*.

For ST level, ST slope, ST area and ST index you must also select the lead. Typically V5 will be the lead that is presented.

Change scale

To change the scale in a trend:

1. Right click and select the *Range* from the menu.
2. Select a different scale or *Adjusted*.

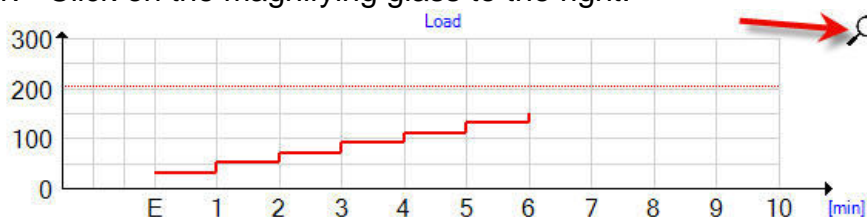
When the option *Adjusted* is selected the scale will be adjusted to fit the range of measurement values.

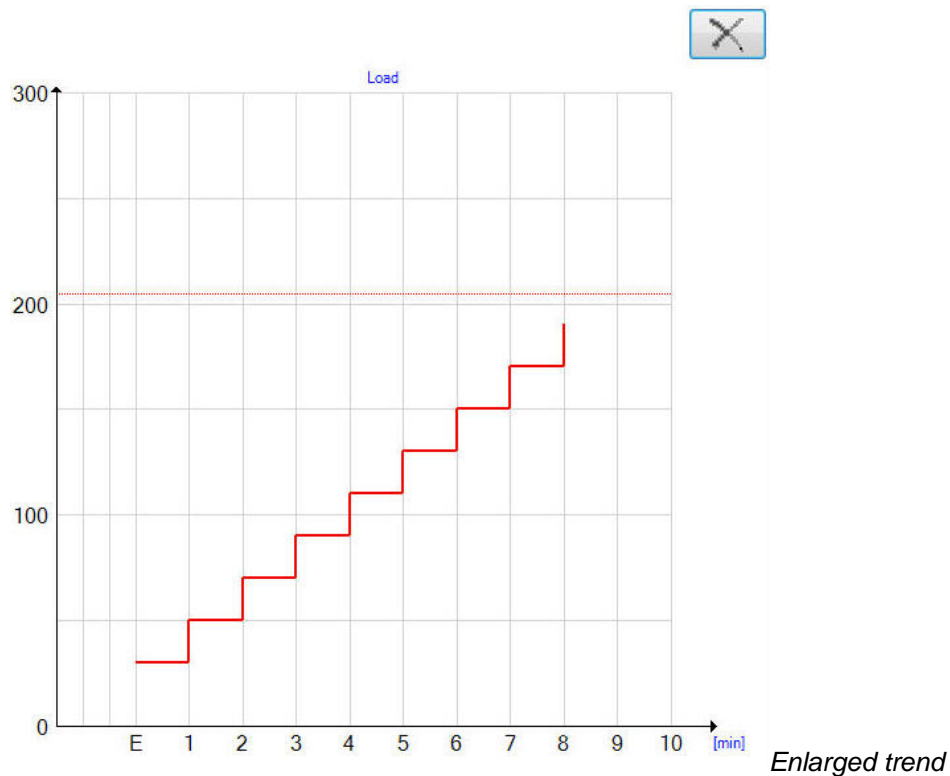
Enlarge trend

Each trend could be displayed individually and enlarged.


To show a single trend:

1. Click on the magnifying glass to the right.






The trend is displayed as enlarged.

1. To change trend, right click and select a different trend from the drop down list.
2. Click on  to return.

Edit trend

It is sometimes useful to be able to change the data in a trend e.g. correcting a blood pressure value or adding other measurements. Values that have been entered in the trend by the user can be edited any time.

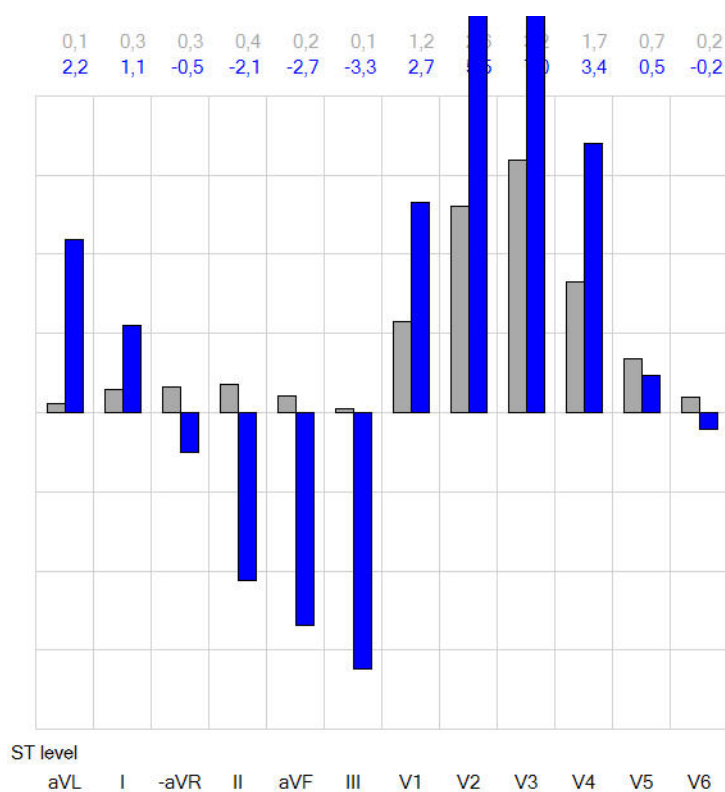
To change/add values:

1. Click on a position in the trend where a value should be changed or added.
2. Adjust the time by using the arrows.
3. Enter the new value.
4. Click on  to accept the new values.
5. The time corresponds to where the pointer is positioned when you click in the trend.

6.5.6.4 ST display



The window for ST graphs only shows a bar graph and numerical values for the ST level and is momentary data. It is the same information as in the Complex display. All leads will be shown. The reference complex is displayed with grey numbers and as grey vertical bars. The blue values represent the current updated complexes.



ST graph display

6.5.6.5 Summary display



The information in the Summary display window summarises data from the exercise test which can be edited. All information that is entered here can be edited in the report mode. The parameters in the list and how it is presented on the screen will vary depending on the configuration in *Settings*.

Examination information

Operator: Demo

Reason for termination: Chest pain

Comments:

Templates

Statement:

Templates

ECG was normal

Results

Löpmatta

Time in Exercise: 04:16

	Max:	Target:	Time:
Speed/Grade:	6,0/9,0		Ex 04:00
HR:	105 (66 %)	160	Ex 01:25
BP:			
ST-60(V5):	-0,8		Ex 01:25
Exhaustion:			
Pain:			


Summary display

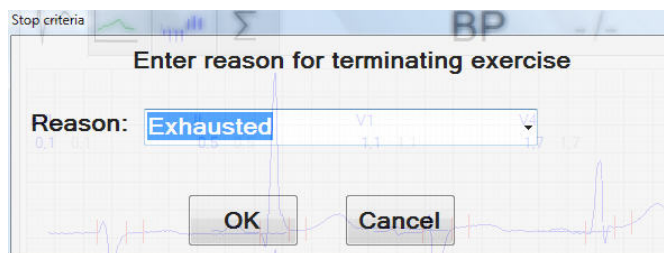
In the summary display you can insert a default text from different templates. The templates are configured in *Settings*. See “Exercise reports” for more information on how to use the templates.

6.5.7 Recovery phase




The recovery phase begins once the exercise phase ends. This is normally when you ask the patient to stop exercising or when the patient stops pedalling/running for any other reason.

To finish the exercise test:

1. Click on .
2. A window opens that asks why the exercise shall be terminated.






Reason for termination

3. Enter the reason why the exercise test should be terminated, or select an option from the drop down list. Click on  (or  to return to the exercise test). If no reason is entered it is always possible to add information later in the Summary display or in the Report mode.
4. Ask the patient to step down from the ergometer/treadmill and to lie down.
5. Take the blood pressure. The BP window opens automatically at regular intervals, according to the selected protocol. Enter the blood pressure values in the window when prompted to do so.
6. While the patient is in the recovery phase the user can begin to prepare the report. It is quite useful to enter comments and do minor editing while the patient is resting in the recovery phase. This spare time offers a possibility to start working with the report.
7. Click on .
8. Enter new, or change, information that is displayed in the window.
9. In the comments box you can enter a few sentences about the exercise test.
10. Click on *Templates* to add a default text under Comments or Statement.

6.5.8 Finish the exercise test

After the recovery phase you can start working on the report.

1. Click on  to finish.
2. You will be asked whether you want to finish the test or not.
3. Click on  to quit or  to return.
4. The report window for reviewing and editing opens. It could take some time before the Report window opens, which may depend on how many arrhythmias that have been detected.
5. Disconnect the patient.

Please refer to “Exercise ECG reports” for a description on how to work in the Report mode with review and editing.

6.6 Printouts

The printing function can be activated any time during the exercise test, provided that a printer has been connected and configured. The various types of printouts can be selected from the drop down menu next to



NOTE

A dimmed (grey) button indicates that there is no printer connected. Default printer and Real time printer must to be configured. See "Settings" in the System manual.

6.6.1 Manual printout on printer

To print out a continuous printout of the Real Time ECG:



1. Click on → *Manual* or press F5.
2. The ECG will be printed out in real time with the same lead combination as displayed in the Real time ECG window (a minor delay is normal) and continue until stopped by the user. At the bottom of the screen you will see the message "Printing in progress" and current page number.



3. Click on to quit printing, or press F5.

See the section on "Printouts" under Resting ECG for further information.

6.6.2 Rhythm printout on printer

To print out Rhythm ECG:




1. Click on → *Rhythm* or press F6.
2. The ECG will be printed out according to the configuration in *Settings*.

See the section on "Printouts" under Resting ECG for further information.

6.6.3 Status report printout

To print out a Status Report:



1. Click on  → *Status Report* or press F4.
2. The Status report consists of one page with the current real time ECG + complexes (depends on *Settings*).


NOTE

It is recommended to start the exercise phase and allow some time for acquiring trend data and complexes before printing a Status Report.

6.6.4 Event report printout

To print an Event Report (provided that events have occurred):



1. Click on  → *Latest Arrhythmia/Event* or press Alt + F4 (a message is displayed if no events or arrhythmias have occurred).
2. A page with the latest event or arrhythmia is printed out.

6.6.5 Print an ECG interval

To print a desired ECG interval:

1. Search the Rhythm ECG for an area of interest.
2. Mark the starting point by clicking with the mouse before the event.
3. Right click and select *Print from/to...*
4. Click on *OK* in the window for temporary change.
5. The interval will be printed out on the Real Time printer.

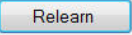
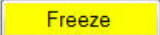


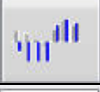

NOTE

The Rhythm ECG will be printed out from the very beginning of the ECG if no starting point has been marked (this could result in several pages of ECG).

6.7 Exercise ECG overview

The summary below shows the available functions in the exercise test mode.

Function	Icon	Menu item	Fn key	Comment
Patient Entry		<i>File → Patient Info</i>	F2	Cannot be changed when exercise test starts
Cancel Exercise test		<i>File → Exit</i>		X is only displayed in pre-exercise phase
Print a Status Report		<i>File → Status Report</i>	F4	
Real Time ECG on printer		<i>File → Man Print</i>	F5	
Rhythm ECG on printer		<i>File → Rhythm Print</i>	F6	
Print Latest Event/Arrhythmia			Alt+F4	Event/arrhythm. must have been detected
Print an ECG interval	Pop-up in rhythm	<i>Print from/to...</i>		Print from start marker to clicking point
Stop printing			F5/F6	The button is active if a printout has started
Start pre-exercise phase		<i>Actions → Next phase</i>	F8	F8 changes to next stage in pre-exercise
Start exercise phase and pedal		<i>Actions → Next phase</i>	F8	Exercise phase starts
Stop exercise test		<i>Actions → Next phase</i>	F8	Recovery phase starts
Change stage		<i>Actions → Next stage</i>	F7	
Hold same load in stage		<i>Actions → Hold stage</i>	F9	To return – F9 or Actions → Hold stage
Mark an event on ECG		<i>Actions → Mark event</i>	F10	
Enter trend data		<i>Actions → Enter measurements</i>	F11	
Take the blood pressure and enter the BP values		<i>Actions → Enter BP</i>	F12	

Change protocol	20W/MIN	<i>Actions → Change protocol</i>		
Change load	20W/MIN	<i>Actions → Change load</i>		Only 20 W in exercise phase
Save a new reference complex		<i>Actions → Relearn complex</i>	Alt + R	Confirm with 
Select or deselect tremor filter		<i>Actions → Tremor filter</i>	Ctrl + F	
Change frequency of tremor filter		<i>Actions → Tremor filter frequency</i>		Select filter frequency from drop down list
Close pop-up window			ESC	
Change settings in Real Time ECG	Pop-up real time	<i>View → Real Time ECG</i>		Select settings in drop down list
Change settings in Rhythm ECG	Pop-up in rhythm	<i>View → Rhythm ECG</i>		Select settings in drop down list
Change trends in trend display	Pop-up in trends	<i>View → Trends</i>		Select trends in drop down list
Show complexes		<i>View → Complex</i>		
Show trend data				Displayed trends depend on <i>Settings</i>
Show ST in real time				
Show exercise summary				Can be edited in report mode
About EC Sense		<i>Help</i>		Shows software information

7 Exercise ECG reports

7.1 Menus and functions

The Report mode that automatically opens after the recovery phase has many functions. Different types of information can be reviewed, edited and printed out by selecting any of the tabs under the menu bar. It is also possible to select the parameters to be included in the report. See “Settings” in the System manual.





7.1.1 Menu bar

The menu bar at the top of the Report mode page has the following drop down menus.

Menu item	Fn	Description
<i>File → Patient Info</i>	F2	The patient information cannot be changed in report mode
<i>File → Print</i>	F4	Print the displayed report
<i>File → Print...</i>		Print... the report after temporary change, see 7.3.4
<i>File → Print Preview</i>	Ctrl + W	Preview the report before printout
<i>File → Save</i>	F5	Save after changes
<i>File → Real time</i>	F6	Quit and return to realtime mode
<i>File → Examinations</i>	F7	Open the list with examinations
<i>File → Settings</i>	Ctrl + Shift + Up	Open the <i>Settings</i> window to configure the program, see the System manual for information
<i>File → Exit</i>		Exit the program
<i>Tools → Patients</i>		Manage the list of patients
<i>Actions → Tremor filter</i>	Ctrl + F	Select or deselect tremor filter
<i>Actions → Tremor filter frequency</i>		Select frequency when the tremor filter is selected
<i>Help → About EC View</i>		Information about the software

7.1.2 Icon bar

The icons to be used in the Report mode are placed under the menu bar. The overview below gives a brief explanation of the functionality.

Icon	Key	Function
	F4	Printout – Print the final report on the default printer. (See “Settings” in the System manual.) Two other types of printouts are available: <i>Print page</i> – Print the page that is currently displayed <i>Print sub report</i> – Print out the report that is displayed
	F5	Save examination – Save the examination on the PC or in the central storage system.
	F7	Open examination – Retrieve an examination from the local database or the central storage system.
	F6	Enter Realtime Mode – Exit from the report mode and return to real time display. If you exit without saving, a message whether to save or not will be displayed. If you select <i>No</i> , all data will be lost.

7.2 Review and Edit Exercise ECG

The screenshot shows the 'Summary' tab of the Cardiolex interface. It is divided into several sections:

- Patient Information:** Includes fields for Patient ID (123987456), Last Name (Doe), First Name (John), Birth Date, Age, Sex (Undefined), and Race (Undefined).
- Examination Data:** Includes fields for Drugs, Clin. Class, Location, Operator (Demo), Physician, Height (cm), Weight (67 kg), BP, and Electrode setting (Standard).
- Exercise Examination Data:** Includes fields for Equipment (Treadmill), Protocol (Lopmatta), Start load (0 W), and Reason for termination (Chest pain).
- Comments:** A text area with a template button and a dropdown menu. The comment reads: 'Patient had problems breathing and chest pain'.
- Statements:** A section with a template button and a dropdown menu, currently showing 'Many arrhythmias'.
- Results:** A table of exercise test results:

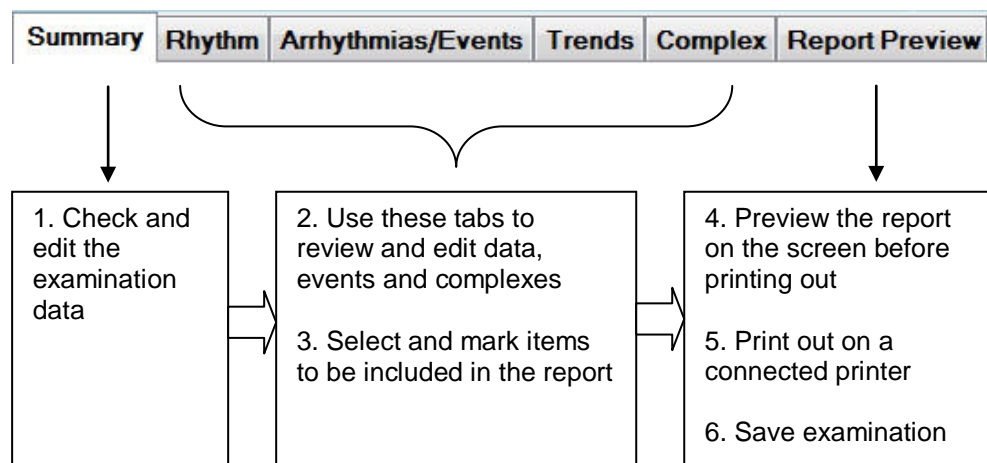
	Max:	Target:	Time:
Time in Exercise:	04:16		
Time in Recovery:	22:28		
Speed/Grade:	6,0/9,0		Ex 04:00
HR:	138 (86%)	160	Re 21:10
BP:			
ST-60 (V5):	-1,3		Re 07:10
Exhaustion:			
Pain:			

Summary page

In the review mode the user can utilize several pages and windows for reviewing and editing the examination before it is printed out and stored.

Review procedure

How to best work with reports is an individual choice and the user can review the pages and data in any order. In general the following procedure could be used:



The time reference

The time reference works as a reference marker and is a useful tool for searching and reviewing events on the different pages. By setting the time reference in one location in the ECG it is possible to review other parameters, complexes and leads for the same interval of time. The following example shows a typical review procedure:

1. Click on the *Rhythm* tab.
2. Right click on a position in the ECG to set the time reference.



Rhythm page

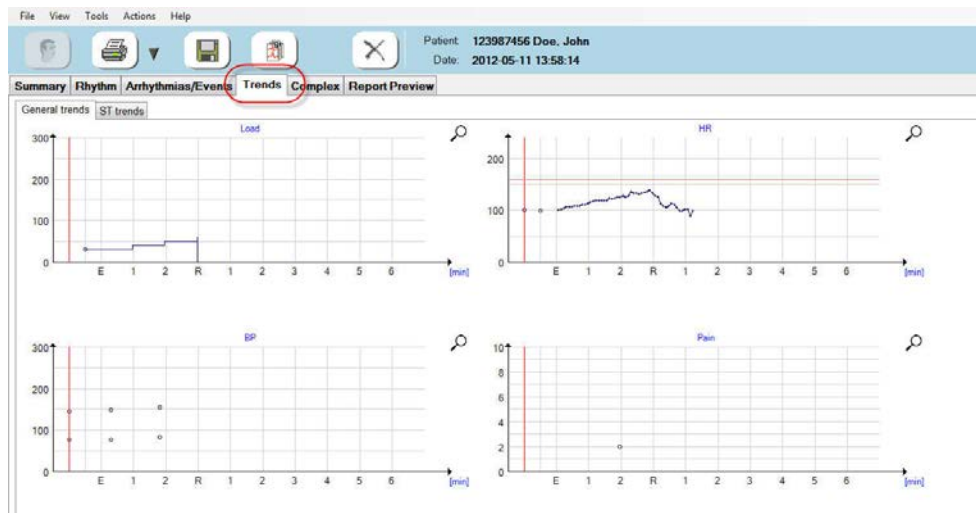
3. Then click on the *Arrhythmias/Events* tab.



Arrhythmias/Events page

4. The time reference on this page is a long red vertical marker placed over the arrhythmia. (The time reference can be set in *Rhythm*, *Arrhythmias/Events*, *Trends* and *Complexes*.)

5. Click on the *Trends* tab.



Trends page

6. The time reference will be synchronised for the same time on all trends.

7. Click on the *Complex* tab.



Complex page

8. The time reference is still fixed at the same time interval but will now have the shape of a red rectangle.

9. Select a different time for reviewing by clicking on a different event.

10. Repeat the procedure for the items to be reviewed.

7.2.1 Summary tab

The summary page is the first to be displayed in the review mode and it contains summarised information about the patient and exercise data. The user can enter or change the information in the white boxes. Any changes on this page will be included in the final report.

To edit:

1. Click with the mouse inside a white box and enter the text.

	Max	Target	Time
Speed/Grade:	6.0/9.0		Ex 04:00
HR:	138	(86%) 160	Re 21:10
BP:			
ST-60 (V5):	-1.3		Re 07:10
Exhaustion:			
Pain:			

NOTE

The patient data can not be edited after the examination has started. (However, it is possible to edit patient data in the Exercise ECG when stored in a central storage system). On the other hand examination data can be changed in the summary page.

The patient information contains all data about the patient. Different parameters will be displayed depending on the configuration and how the exercise test was carried out. A unique identifier code (ID) is used to identify the patient when starting the test. If no ID is selected for the patient, the system allocates a specific ID. Since one patient could have several examinations, the patient ID is the data that uniquely connects the examination to the patient.

Patient data and examination data differs in the way that:

- Patient data is the information that has to do with a patient's personal data and it can not be changed.

- Examination data is the information that is connected to a specific examination such as blood pressure, height and weight at the time of the examination.

Text box

The summary page has two larger text boxes for entering own comments.

- You can enter or change the information that is displayed under *Comments*. It is possible to preconfigure text as templates to make it easier to enter commonly used text. Clicking on *Templates* shows a list with text templates to select from (text templates are entered in *Settings*). Use the arrows at upper left to regret or to step forward.

The text in the example above was entered when a template was selected.

Text templates

To select a text template:

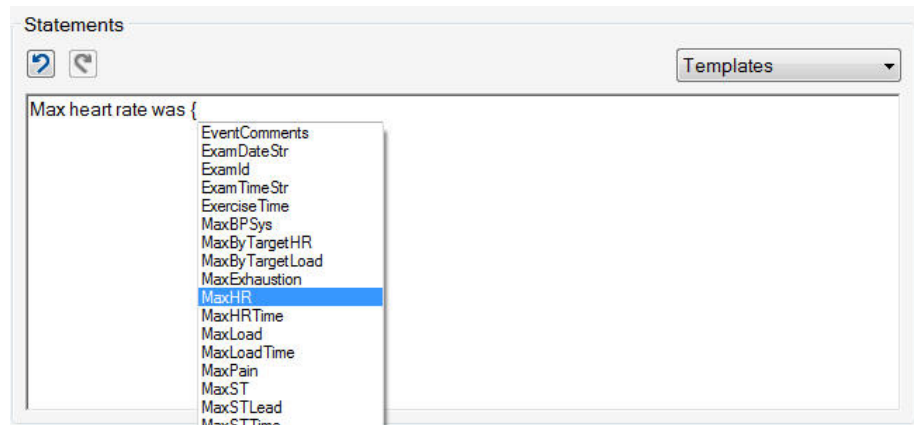
1. Click on *Templates* under *Comments* and/or *Statements* and select a text template from the list. The content in the list is predefined in *Settings*.

Inserting values

By entering different codes, values from the examination can be inserted automatically inside the text boxes for *Comments* and *Statements*. The codes can be selected from a predefined list when the { sign is entered.

To insert values from the examination:

1. Type or select a text from *Templates*. Add the { sign where the value shall be inserted and a list with codes will be displayed.



2. Select a code from the list (MaxHR in the example above) and press return.
3. The maximum heart rate value from the examination will be inserted in the text.



NOTE

If the codes are included in the text templates they will be inserted automatically when a template is selected. It is also possible to insert a value by entering the { sign and select a code from the list.

7.2.2 Rhythm tab

The *Rhythm* page shows the ECG for one lead at a time.

Change speed

Click on **50 mm/s** in the menu bar and select the speed to 2.5, 5, 10, 25, 50 or 100 mm/s.

Change gain

Click on **10mm/mV** in the menu bar and select the gain to 2.5, 5, 10, 20 or 40 mm/mV. Use the scroll bar to the right to move backward or forward in the ECG.

Change lead

Click on the lead in the menu bar and select a new lead from the drop down list. Only one lead can be displayed at a time. The first lead to be displayed as default could be configured in *Settings*.

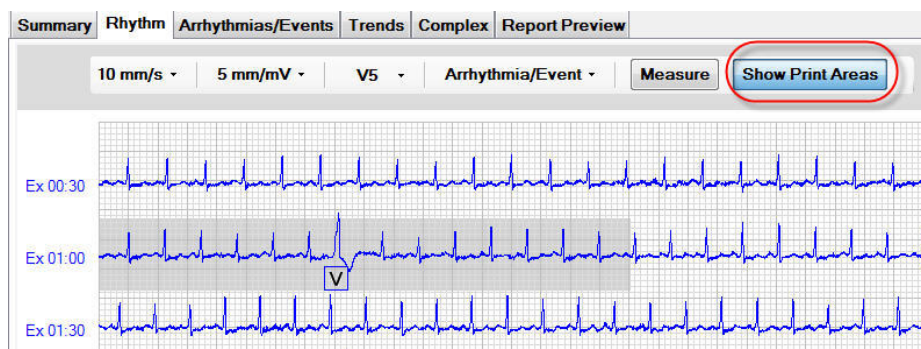
Review Arrhythmias/Events

All detected arrhythmias and events are collected under *Arrhythmia/Events*.

Click on **Arrhythmia/Event** to display a drop down list of all arrhythmias and events that have been detected during the exercise ECG. See next section on how the function can be used.

Select for printout

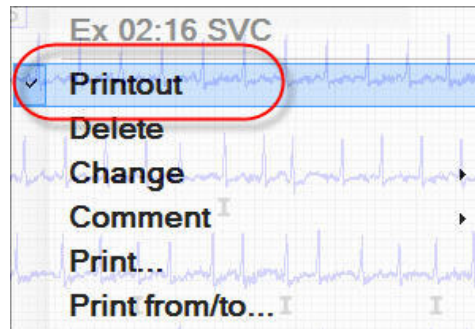
Show the print areas with arrhythmias/events that will be printed out by selecting *Show Print Areas*.



The highlighted areas will be printed out in the report.

Remove printout

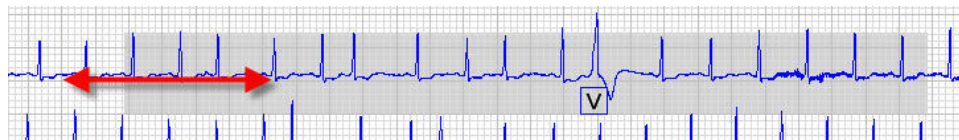
Open the pop-up window by right clicking on the arrhythmia or event. Deselect *Printout* by clicking on it.



The printout will be removed from report. However the arrhythmia or event will stay intact. If this however shall be removed, instead click on *Delete*. Then both the arrhythmia and printout is removed.

Change the Printout Area size

The area to be printed out could be reduced or increased by simply placing the mouse at the end of the area and then left click while dragging the area to a desired size.

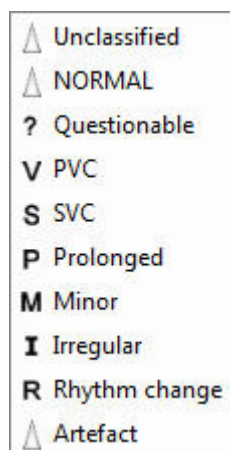


NOTE

Arrhythmias or events must first have been added before they can be selected for printout. The default time for a print area can be selected in Settings.

Change arrhythmias / events

Reclassify an arrhythmia or an event by holding the mouse over the highlighted arrhythmia or event and then right click on *Change*. Select a different type from the pop-up list.



Comments

Add a comment by holding the mouse over the arrhythmia or event and right click. Move the mouse to the blank field, click inside the field and add a comment. Press Return.



Print an event


To print out a page with the actual arrhythmia/event select *Print*
Please observe that the arrhythmia/event first must have been added, otherwise it will not be printed.

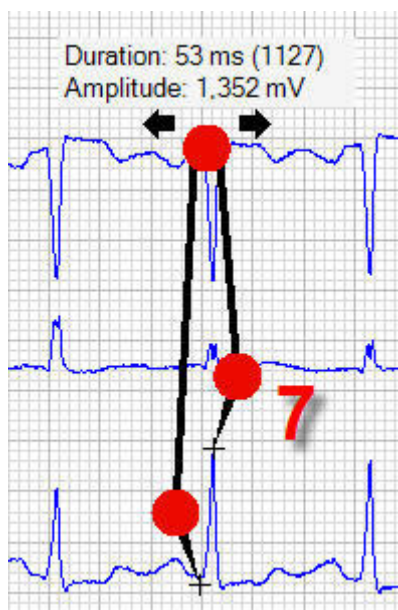
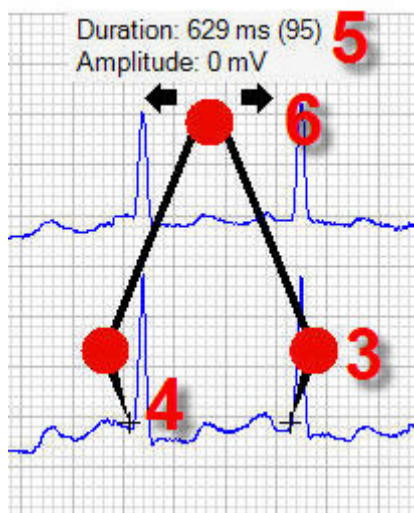
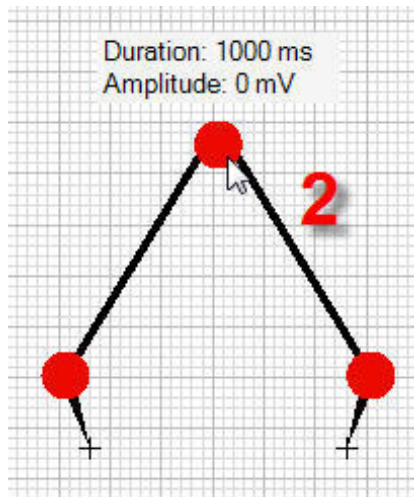
Print an ECG interval

To print out an ECG interval position the timer reference on a desired ECG interval and right click on *Print from/to...* The interval between the time reference and the present position will be printed out as an ECG report.

Measure duration/amplitude

To the right in the menu bar there is a box for activating a measurement tool for measuring duration and amplitude on the ECG.

1. Click on . A pair of compasses is presented which functions as drag-and-drop.



2. Move the pair of compasses to the desired position by clicking on the left mouse button while pointing on the upper red dot and drag the pair of compasses over the screen.
3. Measure the duration by dragging the lower red dots sideways.
4. The measurement values at the top are calculated from the small cross-hairs, and are according to the scale on the screen.
5. The duration is in milliseconds. The heart rate is within brackets (such as 1/ms) when measuring an RR interval.
6. Move the pair of compasses to the next interval by clicking on ◀ or ▶ on the screen. It is also possible to press Ctrl + left/right arrow on the keyboard.
7. Measure the amplitude by dragging the lower red dots up or down. The amplitude is presented in mV at the top.

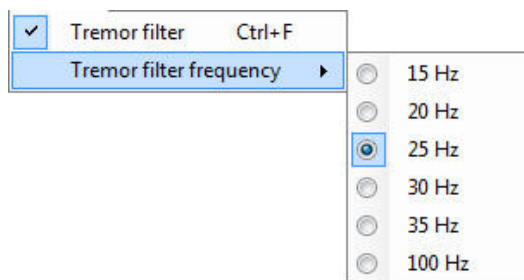
NOTE

The measurement tool can also be used in Arrhythmias/Events and Complex. It works in a similar way apart from that in Complex it is not possible to select the next interval, and the heart rate will not be presented.

Change filter

In the report mode it is possible to select a Tremor filter or change the filter frequency. All ECG data is acquired and stored in the central storage system without filtering. The filter can be changed from the menu bar and can be used in all reports.

To select/change filter frequency:
Select *Actions* → *Tremor filter*



Filer frequency options

The window opens. Choose a new frequency by clicking on an option in the drop down list.

NOTE

When retrieving ECGs from other systems than EC Store, it may not always be possible to change filter or select/deselect a tremor filter since those ECGs may be saved as filtered.

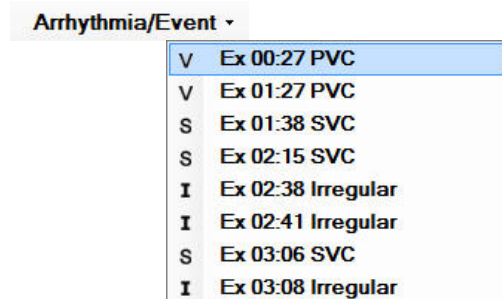
7.2.3 Arrhythmia/Event tab

This page can be used for searching and reviewing arrhythmias and events that have been detected in the ECG. The following types of review options are available:

Review Arrhythmias/Events

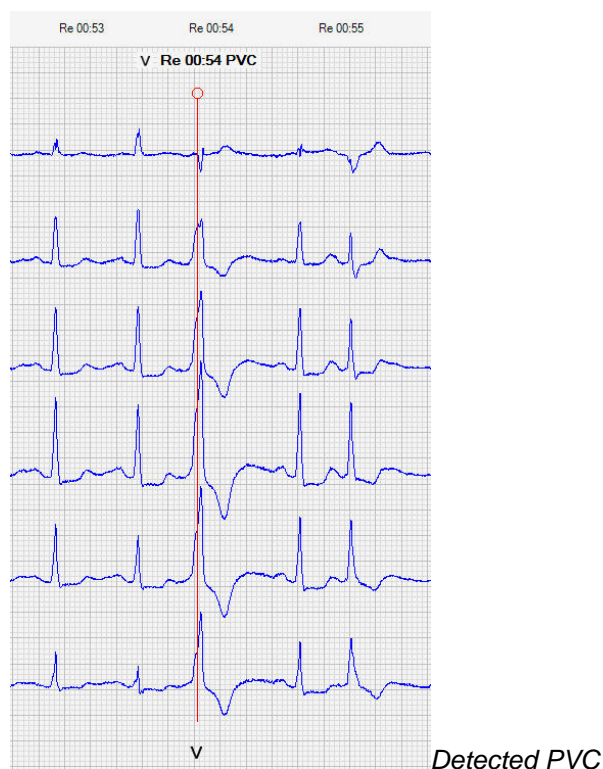
All suggested arrhythmias and events are collected in a list. To review them:

1. Click on



in the menu bar to display a drop down list of all arrhythmias and events that have been detected during the exercise ECG. The time reference will correspond to the arrhythmia or event that is highlighted in the list.

2. Click on the arrhythmia or event of interest to display it on the screen.





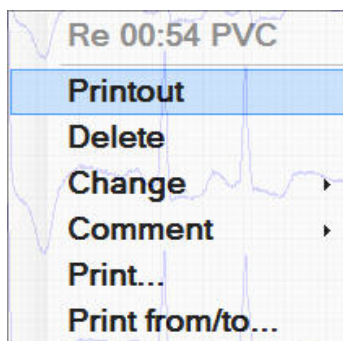
WARNING

All suggested arrhythmias and events shall be reviewed by skilled and competent staff. If necessary, events and arrhythmias could be reclassified in the Printout menu under Change.

Select Printout

Since the list of arrhythmias, events and questionable arrhythmias can become very long, all of them will not be included in the report unless they have been actively selected for printout.

1. Place the pointer over an arrhythmia or event and right click.
2. The *Printout menu* opens with the following options:



- Click on **Printout** to include it in the report printout.
- **Delete** arrhythmia/event from ECG.
- **Change** the name of arrhythmia/event.
- Add your own **Comment**.
- **Print ...** this arrhythmia/event.
- **Print from/to...** the interval between time reference and current position

To add the arrhythmia or event:

1. Click on *Printout* for it to be included in the report.
2. All arrhythmias that have been added will be marked and presented in reports.



Arrhythmia marked to be included in reports

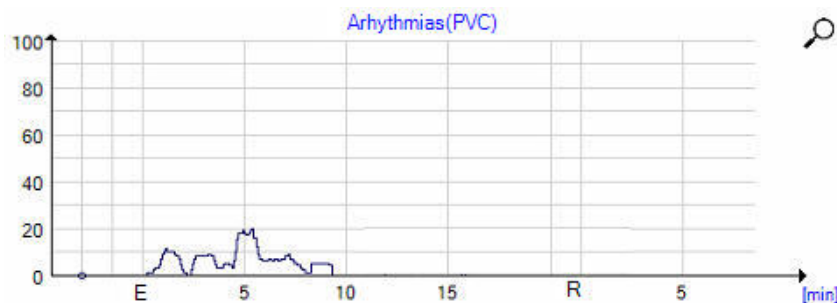
NOTE

If no arrhythmias or events have been marked for printout the report page for arrhythmias or events will be empty.

PVC counter

From trends it is possible to show a summary of PVC's as a trend graph. To show a PVC trend:

1. Go to Trends.
2. Right click on any trend and select Arrhythmias(PVC) from the list of trends (if not already displayed). The total amount of PVC's are displayed in a graph. See section 7.2.4 for more information about trends.



Delete / Change / Comment

To delete, change name or add a comment to the arrhythmia/event:

1. Select the appropriate option from the *Printout* menu.

Change speed

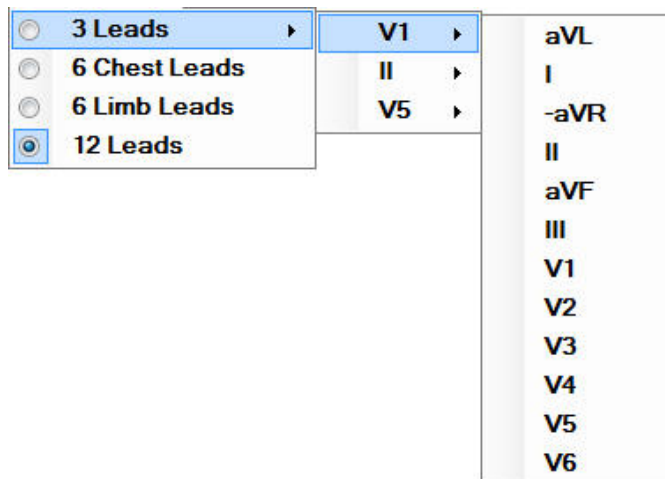
Click on **50 mm/s** in the menu bar and select the speed to 10, 25, 50 or 100 mm/s.

Change gain

Click on **10mm/mV** in the menu bar and select the gain to 5, 10, 20 or 40 mm/mV.

Change lead

Click on **Leads** in the menu bar and select 3 leads, 6 chest leads, 6 limb leads or 12 leads from the drop down list. If the option of 3 leads is selected it is possible to choose which 3 leads to be displayed.



Scroll forward/backward

Click on **◀** or **▶** to go to the previous or next arrhythmia/event.

Click on **◀◀** or **▶▶** to go to the previous or next arrhythmia/event outside the page.

Click on **◀◀◀** or **▶▶▶** to go to the first or last arrhythmia/event.

Measure duration/amplitude

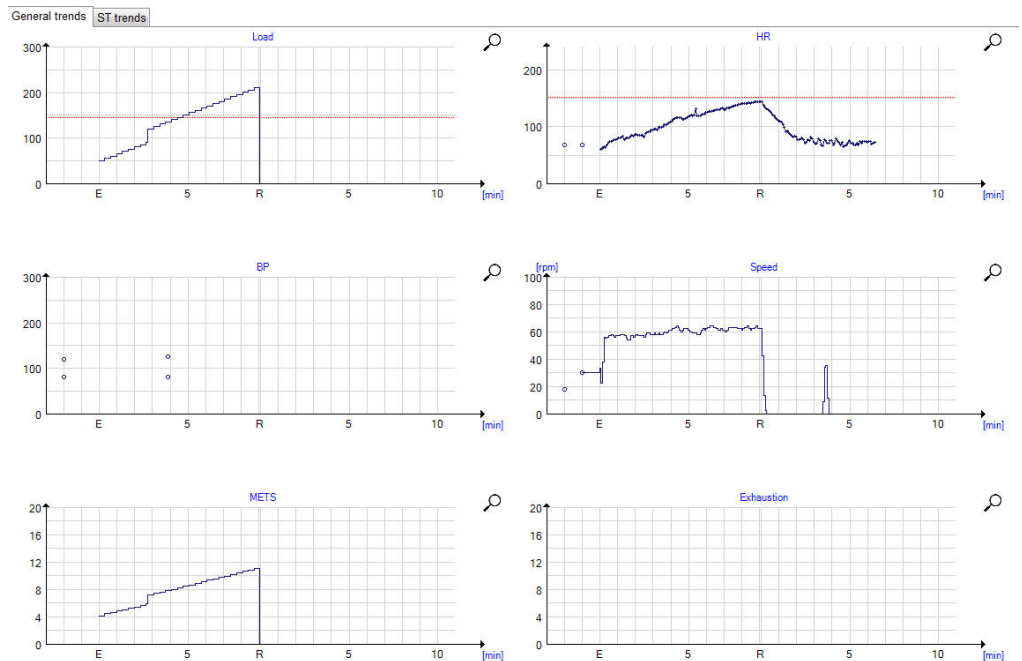
See 7.2.2 *Rhythm* tab.

7.2.4 Trends tab

Comparative analysis of the collected trend data can be made from the trends page.

General trends

The trend page displays data for those trends that have been configured in *Settings*.



General trends data page

It is also possible to show other trends.

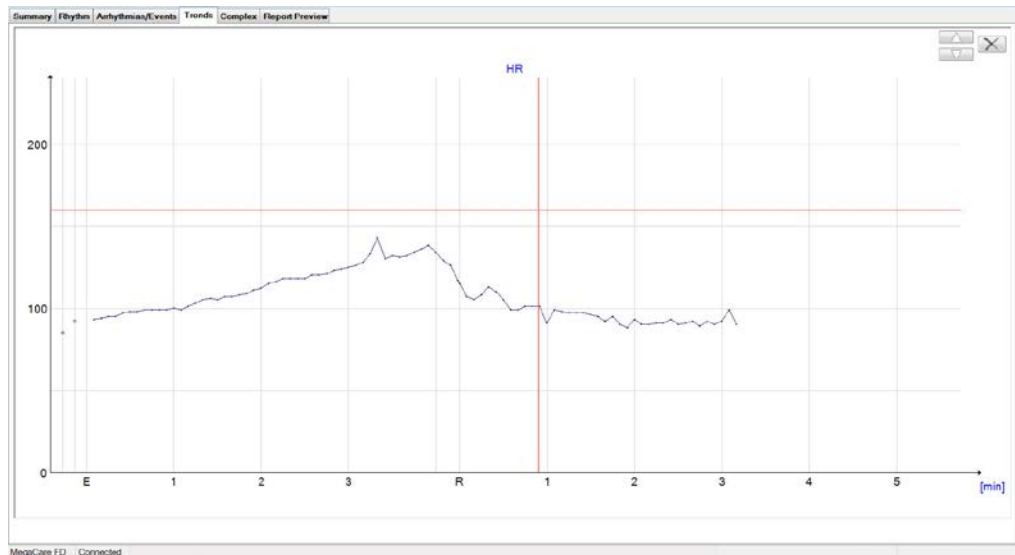
To select a different parameter on the Trend display:

1. Point with the mouse on the trend to be replaced.
2. Right click and select a new trend from the drop down list.

Each trend can be displayed individually and enlarged.

To enlarge a single trend:



1. Click on the magnifying glass to the right.



Enlarged HR trend

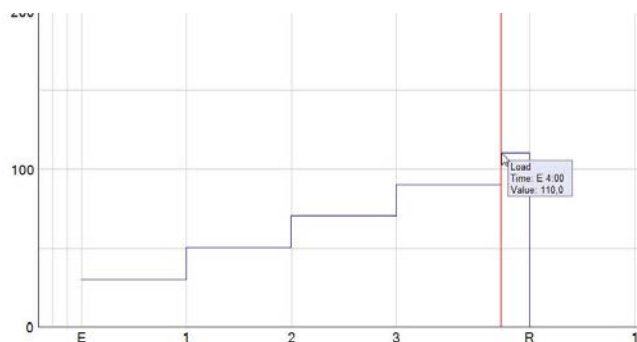
To change trend to be displayed:



1. Click on  to change trend.
2. Click on  to return to the group of trends.

To display trend data:

1. Place the mouse on a point in the trend to display a value.



Enlarged Load trend

2. The measurement values can be seen inside the small grey box when pointing with the mouse on the trend.

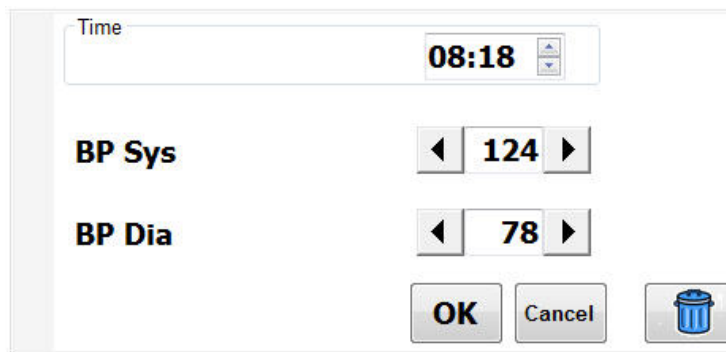
Edit trends

All trends with measurements manually entered by the user during the examination can be edited. Typical trends that can be edited:

- Blood pressure
- Exhaustion
- Pain
- Saturation
- Respiration rate
- Other trends configured by the user


To edit values in a trend:

1. Click on a position in a trend (here the blood pressure).



The screenshot shows a 'Blood pressure window' with a 'Time' field displaying '08:18'. Below this, there are two rows for blood pressure: 'BP Sys' with a value of '124' and 'BP Dia' with a value of '78'. Each value is flanked by left and right arrow buttons. At the bottom, there are three buttons: 'OK', 'Cancel', and a trash can icon for deleting values.

Blood pressure window

2. Enter the blood pressure. The new values will be added in the trend.
3. To delete blood pressure values, click on the marked BP in the trend and then on .

NOTE

No trend data that has been generated by the system can be edited, such as typically heart rate and load.

ST trends

The page with *ST trends* displays the ST levels for the leads that have been configured in *Settings*, e.g. *aVF*, *V2*, *V3*, *V4*, *V5* and *V6*. The functionality when reviewing the trends is the same as described in *General trends*, described above.

More information on trends and how trends are displayed for other leads is described under “Settings” in the System manual. These trends are generated by the system and the data can not be edited.

7.2.5 Complex tab

The *Complex* page shows all averaged complexes during the exercise test. You can select gain and speed, show the complexes for Max ST and Max load and scroll backward and forward. This is especially useful when reviewing and analysing the complexes before the final report is compiled.

The menu bar has several functions that could be used when reviewing:

50 mm/s ▾	10 mm/mV ▾	1 min ▾	<input checked="" type="checkbox"/> Tickmarks	<input checked="" type="checkbox"/> Reference	⏮ ⏪ ⏩ ⏭	Max ST	Max Load	Measure
<input checked="" type="checkbox"/> PreExercise 00:18 Liggande HR: 83 BP: 143 / 78 ---	<input checked="" type="checkbox"/> PreExercise 00:43 Sittande HR: 87 BP: 148 / 83 ---	<input checked="" type="checkbox"/> Exercise 00:11 50 W HR: 85 BP: 153 / 78 Reference	<input checked="" type="checkbox"/> Exercise 00:20 50 W HR: 86 BP: 153 / 78 Max ST & Max Load					

Data for the displayed complex.

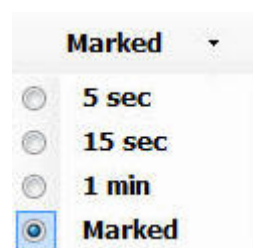
NOTE

The functions for reviewing complexes can be combined and used together in many different ways. It may take some training before the user finds the most efficient way to analyse the ECG.

Select interval

Select a suitable review interval when reviewing the complexes.

Click on



in the menu and choose to show complexes every 5 seconds, 15 seconds, one minute or only the complexes that are marked.

The following complexes have been marked by the system:

- All reference complexes
- All stage changes
- Max ST
- Max Load
- The last complex in the exercise test

Depending on *Settings*, it is possible to include only the complexes after pre-exercise, or include the complexes in the stages from pre-exercise as well as the frozen complexes.

Mark your own complexes

You can mark or deselect which complexes that shall be included in the final report. Once you have found a complex to include in the final report mark it by clicking in the box.

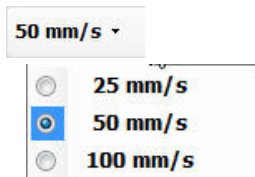


All complexes with check marks will be included in the final report.

To deselect a marked complex, simply click on the check mark.

Change speed

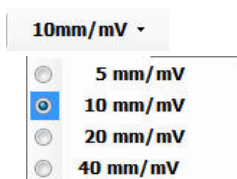
Click on



in the menu bar and select the speed to 25, 50 or 100 mm/s.

Change gain

Click on

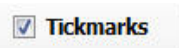


in the menu bar and select between 5, 10, 20 or 40 mm/mV. All leads will be displayed on the same page if 5 mm/mV is selected. If a higher gain is selected, i.e. 40 mm/mV, only 2 leads will be displayed at a time.



Use the scroll bar in the window to move to the next group of leads.

Show tick marks



ST point.





Show or hide tick marks for QRS onset, QRS offset and

Show reference complex

☒ Reference

Show or hide reference complexes (grey).

Scroll forward/backward

Click on  or click  in the menu bar to go to the start or the end, or go to previous or next complex by clicking on  or .

It is also possible to use the scroll bar:



Go to the next interval by dragging the cursor on the scrollbar.

Max ST

Max ST

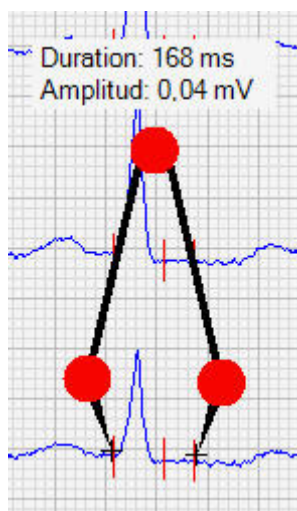
Show Max ST complexes. The Max ST complexes are the complexes with the lowest amplitude at the ST point.

Max Load

Max Load

Show Max load complexes.

Measure duration/amplitude



See section 7.2.2 under *Rhythm* tab.

NOTE

When measuring complexes it is not possible to move the pair of compasses to the next interval or show heart rate.

7.2.6 Report Preview tab

The *Report Preview* tab is used once the review task is completed, or if it is required to preview the report before it is printed out. From this page it is possible to look at summarised data and preview the report format for all type of reports before printing and storing. The function can only be used to look at information.

Report type

The report types that are available can be printed and previewed. To select a report type:

1. Click on the arrow next to *Report* for a drop down list. The following report types will be displayed:

Final Report	- Includes the reports configured in <i>Settings</i>
Arrhythmias and Events	- Marked events and arrhythmias
Complexes	- Marked complexes
Rhythm	- Rhythm ECG report
Test Summary	- Tabular exercise test data and text
Trends	- Trends in a graphical format


2. Select a report by clicking on it. Use the functions described below to look through the different reports that are of interest.

NOTE

The content in each report depend on how the reports have been configured. See "Settings" in the System manual. A temporary change in individual reports can be made from a pop-up window by right click. See the section on "Report printout".

Next page

To go to the next page:

1. Click on the arrows next to  in the menu bar.

Change height

To increase or decrease the height in a report:

1. Click on .

Change width

To increase or decrease the width in a report:

1. Click on .

Zoom in/ Zoom out

To zoom in or out in a report:

1. Click on the + or – signs at  100% ▾  The size is displayed as a percentage.

It is also possible to click on the arrow to select a size from the drop down list.

NOTE

The options selected in the report will be included in the report printouts. However, size and different ways to preview the reports do not affect the printouts.

7.3 Report printout

After reviewing and editing, the selected reports can be printed out on the connected printer. There are several different options for printing out reports.


7.3.1 Preview before printing out

It is useful to preview the printout before it is sent to the printer.

1. Select *File* → *Print Preview* or *Ctrl + W* to open the window for preview.
2. Enlarge the size of the window and click on the magnifying glass to zoom in or out a page. Click on the left square icons to select how many pages that shall be displayed simultaneously.
3. Go through the report pages of by using the arrows at the top of the right corner.
4. Click on the *Print* icon to start printing or *Close* to return.

7.3.2 Print out the final report



1. To print out the final report click on  or F4.
2. The report will be printed out on the connected printer. The content in the report depends on how it has been predefined.

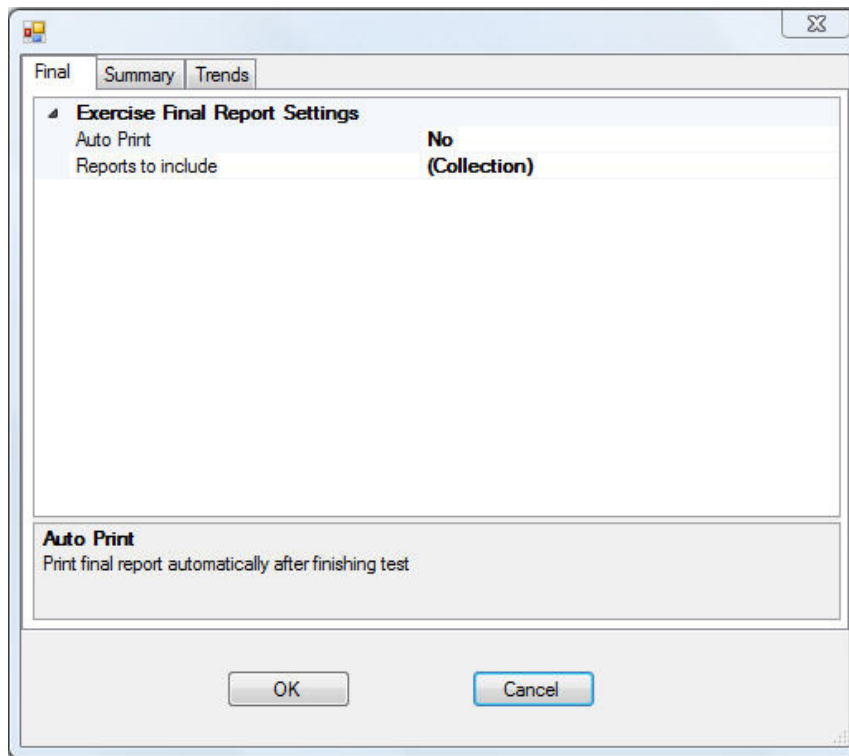
7.3.3 Temporary change of report content

Each report type is predefined. The content and layout of the report can be configured in *Settings*. If required, a temporary change can be made for the current examination.

To change the content in the report for the current examination follow these steps:

1. Go to the *Report* page.
2. Select a report from the drop down list.
3. Right click with the mouse somewhere inside the report window.

4. A pop-up menu for the selected report opens. See the example below.



Report content pop-up


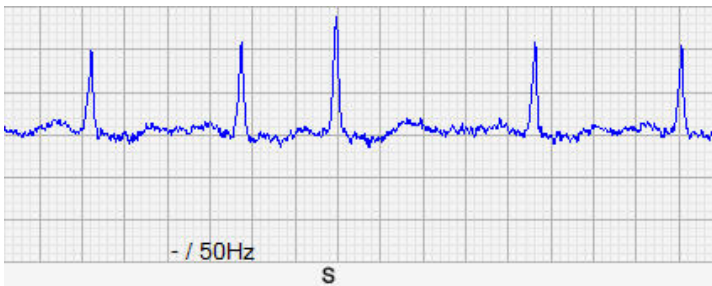
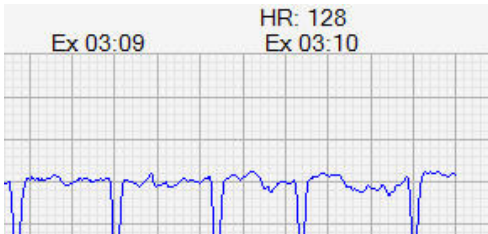
5. Click to the right of the parameter that shall be changed and select an option from the list with the arrow. The change is only temporary and as soon as a new examination is opened it will reset to default configuration.

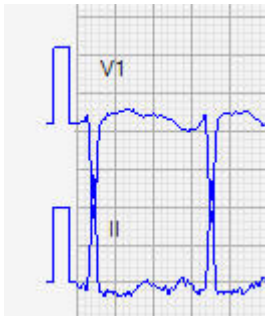
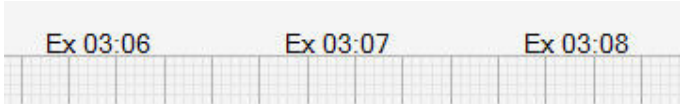
Information about how each parameter affects the examination can be found under “Settings” in the System manual.

The summary below explains the different settings that can be made temporarily.


Final report

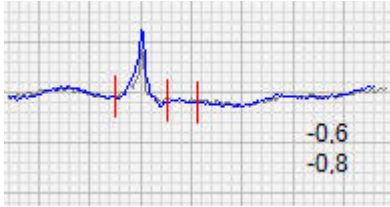
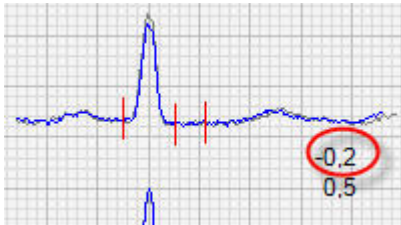
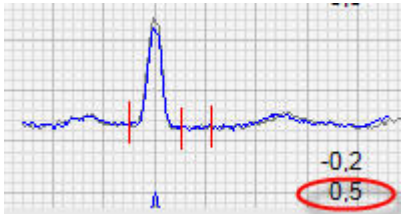
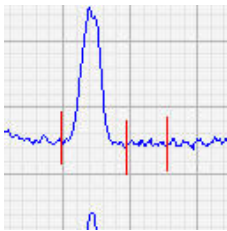
Setting	Description
Automatic Printout	Activate automatic printout when the exercise test is finished.
Reports to include	Select the individual reports to be included in the Final Report from the collection editor.

Setting	Description
Complex	<p>Show averaged complexes.</p> 
Event markers	<p>Show event and arrhythmia markers.</p> 
Gain	5, 10, 20, 40 mm/mV.
HR values	<p>Show the heart rate.</p> 
Landscape	Print landscape format.
Lead order	Print pages in lead order.
Leads	Select in the collection editor which leads to include.
Leads per page	Select between 1-12. The leads must first have been configured, as described previously. It is not possible to print out 12 leads if only 6 leads have been selected in the collection editor.

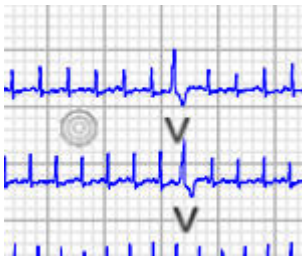
mV pulse	<p>Show mV pulse on all pages.</p> 
Pediatric Leads	Select in the collection editor which leads to include.
Speed	5, 10, 25, 50, 100, 200 mm/s paper speed.
Time stamps	<p>Show the time at the top of each page.</p> 

Complexes

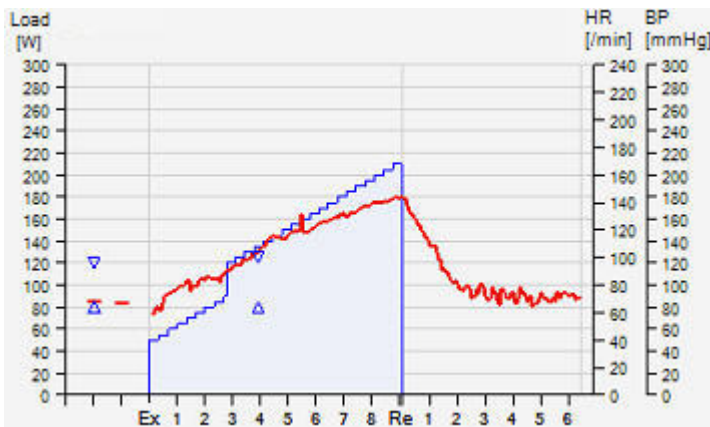
Setting	Description
Gain	10, 20, 40 mm/mV.
Grid	Show complexes on a grid.
Landscape	Print landscape format.
Lead order	Print pages in lead order and show the complete interval for the first leads.
mV pulse	<p>Show mV pulse on all pages.</p> 
Reference	The reference complexes are shown in the background.

	
Speed	25, 50, 100 200 mm/s in paper speed.
ST level	<p>Show ST level on the complexes.</p> 
ST slope	<p>Show ST slope on the complexes.</p> 
Tickmarks	<p>Show tick marks on complexes.</p> 

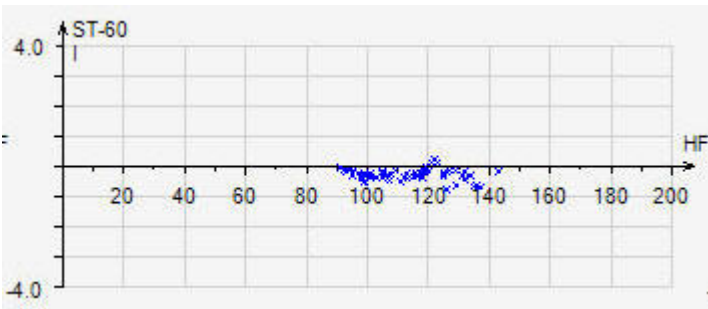
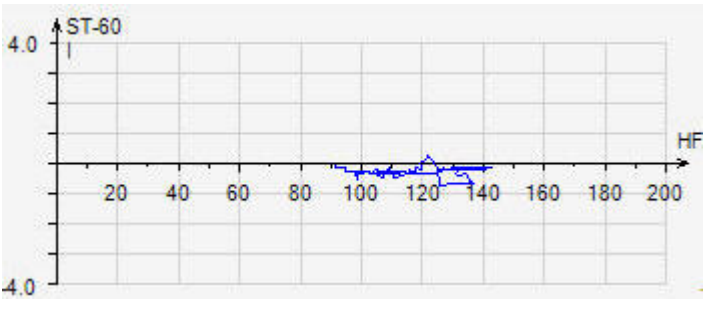
Rhythm

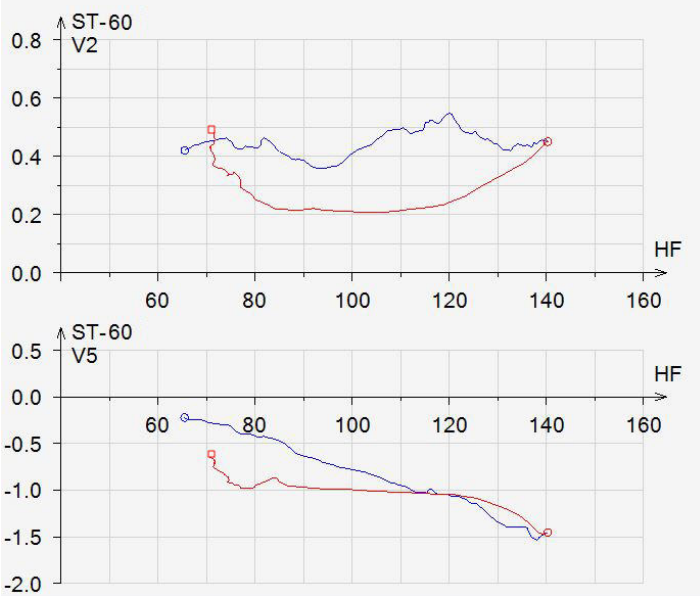
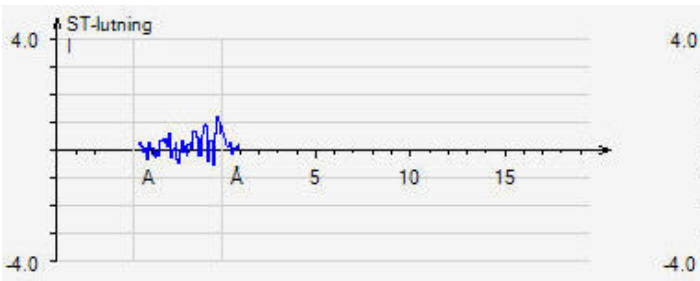
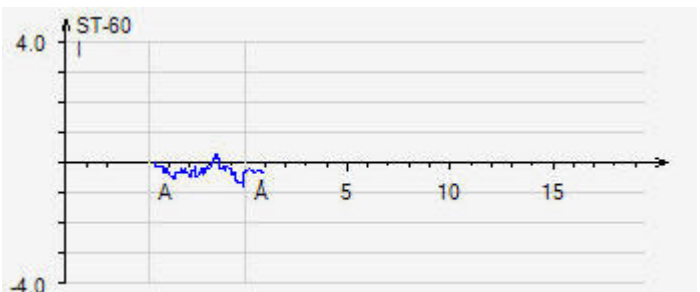
Setting	Description
Gain	2.5, 10, 20 mm/mV.
Include Pre-Exercise	Print the ECG from the pre-exercise phase.
Landscape	Print landscape format.
Lead	Select <u>one</u> lead from the list as the default rhythm trace.
Pediatric Lead	Select <u>one</u> lead from the list as the default rhythm trace.
Show marks	<p>Show event and arrhythmia markers on the ECG.</p>  <p>The image shows a two-lead ECG trace on a grid. The top lead is labeled 'V' and the bottom lead is labeled 'V'. There are several blue vertical markers on the baseline, indicating event or arrhythmia markers. A circular icon is visible on the left side of the trace.</p>
Show pace pulses	Print the pace pulses on the ECG.
Speed	<p>5, 10, 12.5, 25 mm/s for portrait format.</p> <p>4, 8, 12.5, 25 mm/s for landscape format.</p>

Test Summary

Setting	Description																														
Combined trend	<p>Select if Load, HR and BP should be presented in the same trend.</p> 																														
Landscape	Print landscape format.																														
PWC	Show PWC in the Test summary. The target value will be based on the PWC formula, if selected.																														
Trends to print	<p>Select which trends to include in the table of the Test Summary. Choose trends from the collection editor.</p> <table><thead><tr><th>Time [min]</th><th>BP Sys / Dia [mmHg]</th><th>HR</th><th>ST-60 (II)</th><th>Load</th><th>Speed [rpm]</th></tr></thead><tbody><tr><td>Ex 01:00</td><td></td><td>94</td><td>-0.5</td><td>50</td><td>18.0</td></tr><tr><td>Ex 02:00</td><td></td><td>101</td><td>-0.8</td><td>50</td><td>30.0</td></tr><tr><td>Ex 03:00</td><td></td><td>116</td><td>-1.0</td><td>70</td><td>57.0</td></tr><tr><td>Ex 04:00</td><td></td><td>130</td><td>-1.0</td><td>70</td><td>56.0</td></tr></tbody></table>	Time [min]	BP Sys / Dia [mmHg]	HR	ST-60 (II)	Load	Speed [rpm]	Ex 01:00		94	-0.5	50	18.0	Ex 02:00		101	-0.8	50	30.0	Ex 03:00		116	-1.0	70	57.0	Ex 04:00		130	-1.0	70	56.0
Time [min]	BP Sys / Dia [mmHg]	HR	ST-60 (II)	Load	Speed [rpm]																										
Ex 01:00		94	-0.5	50	18.0																										
Ex 02:00		101	-0.8	50	30.0																										
Ex 03:00		116	-1.0	70	57.0																										
Ex 04:00		130	-1.0	70	56.0																										
Vertical Time Scale	Select if the trends shall be printed in vertical order. If True is selected, it will be presented as the figure above.																														
Work capacity	Show work capacity in the Test summary. The target value is based on the work capacity in the tabular summary, if selected.																														

Trends

Setting	Description
Auto Time Scale	This function adjusts the time scale on the trends to match the duration of the exercise test. If deactivated the time scale starts with 20 minutes and then increases with 10 minute intervals.
Landscape	Print landscape format.
ST vs HR	<p>Show ST level in relation to HR for 12 leads.</p> 
ST vs HR Vector Plot	<p>Show ST level in relation to HR using vectors. To show the plot, ST vs HR must first be selected (see above).</p> 
ST vs HR automatic scaling	<p>Select if the scale should be adjusted automatically to fit each individual graph or if the same scale should be used for all.</p> <p>Blue circle = starting point Blue graph = exercise phase Red circle = start of recovery phase Red graph = recovery phase Red square = stop point</p>

	
ST slope	<p>Show ST slope for 12 leads on one page.</p> 
ST level	<p>Show ST level for 12 leads on one page.</p> 
Trends to print	<p>Select in the collection editor which trends to print on the first page.</p>
Vertical Fill	<p>Select if the trends shall be presented in a column or side by side.</p>

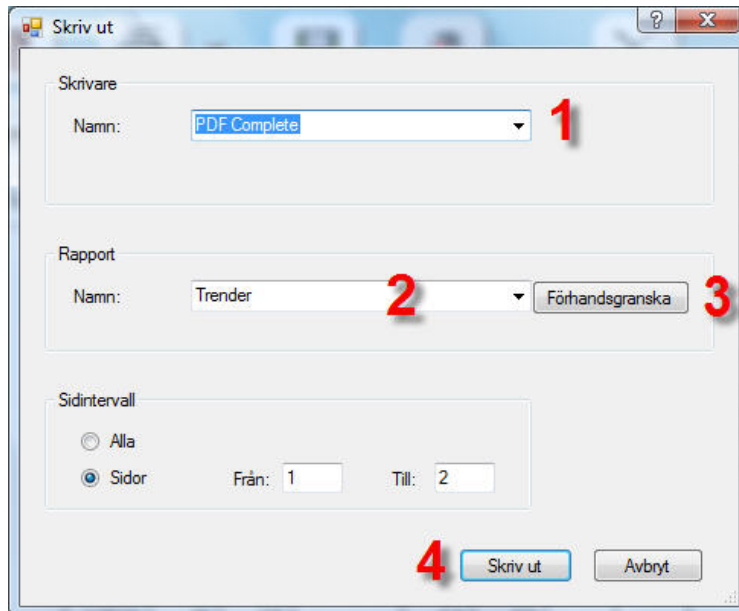
7.3.4 Temporary change in a report printout

If required, the report format can be changed temporarily.

To preview, change printer, select report and/or to print out other pages in the report:

Select *File* → *Print...*

The *Print* window opens:



Print window

1. Select a different printer from the drop down list.
2. Select a different type of report to print out.
3. Click on *PreView* to see how the report will be printed out.
4. Click on *OK* to start the printout.

7.3.5 Print out a specific page in a report

To print out a specific page in a report:

1. Click on the *Report Preview* tab and select a report from the drop down list.
2. Scroll to the desired page in the report.

3. Click on  *Print page*.

4. The report page will be printed out on the connected printer.

NOTE

The Print page option can only be selected from the Report Preview tab.

7.3.6 Print a specific report

To print out a specific report:

1. Click on a tab in the menu bar or select a report from the drop down list under *Report Preview*.




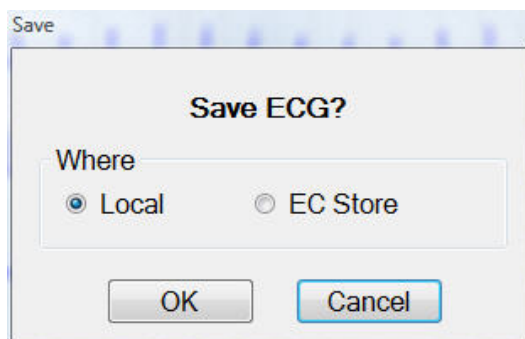
2. Click on *Print sub report*.
3. A pop-up menu opens where a temporary change can be made, if desired.
4. Click on *OK* to start the printout.

7.4 Save examinations

All examinations can be saved on the local PC or in the central storage system. To save an examination:



1. Click on  (or select *File* → *Save F5*).
2. The window for saving ECG opens.



Saving ECG

3. Select where to save the examination.

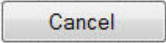
Location	What is saved?
Local	All of the exercise ECG, including raw data and marked areas for printout, will be saved locally on the PC. You can retrieve, review, edit and print out the report and then save again. The saved exercise ECGs can be sent to a central storage system at a later time.
Central	All of the exercise ECG can be sent to and stored in a central storage system in the same manner as when saving it locally. (Depending on the type of central storage system that is connected, the name of the system will be displayed in the window, e.g. EC Store as above.) The exercise ECGs can be retrieved for printouts and reviews. In EC Store all of the exercise ECG data will be stored.

NOTE

When storing in MegaCare, all ECG data will not be saved. A 10 second ECG interval of an arrhythmia or an event that have been selected by the user will be saved in MegaCare. Only complexes that have been selected and marked for printout will be sent and stored.

4. Click on  to save the ECG and the report.

or

5. Click on  to return to the report mode without saving.

NOTE


The examination and the report will be saved with the same name as the report date, patient ID and report type.

If EC Sense is not connected to a central storage system this option will not be displayed in the message. Saving is only possible on the local PC. To connect to a central storage system see "Examination data base".

7.5 Opening an examination

All examinations that are saved on the local PC can be reviewed and printed out at any time. (Please observe that examinations that have been retrieved from a central storage system can't be edited and saved locally.) To open the menu with stored examinations:



1. Click on  (or select *File* → *Examinations F7*).
2. The examination list is displayed.

Date	Type	PatientId	LastName	FirstName
2011-05-19 14:39:48	Exercise	66778899	Johhsson	Mary
2011-05-19 12:33:57	Exercise	55667788	Smith	James
2011-05-18 16:58:15	Exercise	12233445	Doe	John
2011-05-14 14:24:22	Exercise	12233445	Doe	John

Diagnosis:

Summary:

Open Send Delete Cancel

Examination list

3. Click on an examination in the list to open it.

The *send* button is only displayed when connected to a central storage system. Refer to the chapter on "Examination data base" for information about how to use the examination list.

NOTE



Exercise ECGs from MegaCare can be reviewed and printed out, but not stored again in MegaCare.

Since not all ECG data will be stored, it is only possible to view the stored ECG intervals in Rhythm and Arrhythmia/Events sections of the report.

It is recommended to first edit and save the report on the local PC, and then send it to MegaCare when no further editing is required.


7.5.1 Edit examinations saved on the local PC

Examinations that have been saved on the local PC can be edited again. Any changes that are made in the examination will be saved, and the old information is replaced.







1. Open an examination by clicking on  in the real time mode.
2. Make the required changes.
3. Save the changes by clicking on .

7.6 Exit from Exercise ECG reports

You can exit from the report mode any time.

1. Click on  to return to real time ECG.
2. If the examination has not been saved you will be asked whether to save the report or not.

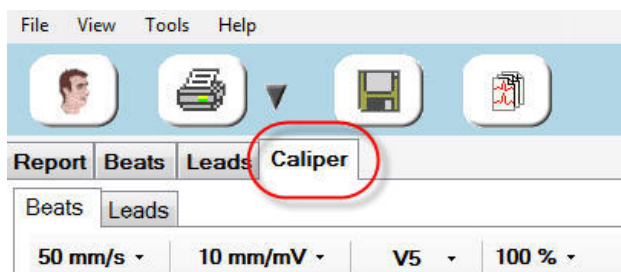
7.7 Exercise ECG report overview

Function	Icon	Menu item	Key	Comment
Print whole report		<i>File → Print</i>	F4	
Preview, change printer, report, pages		<i>File → Print...</i>		Temporary change in settings
Preview the report to be printed out		<i>File → Print Preview</i>	Ctrl+W	
Print a page of the current displayed report		<i>Print page</i>		The <i>Report</i> tab must be selected
Print the whole currently displayed report		<i>Print sub report</i>		
Print an interval in Rhythm ECG	Pop-up in rhythm	<i>Print from/to...</i>		Print from time reference to clicking point
Print an interval in Arrhythmia/Event	Pop-up in Arrhy/Event	<i>Print from/to...</i>		Print from time reference to clicking point
Change final report	Pop-up in report			Temporary change of report content
Change settings		<i>File → Settings</i>	Ctrl+Shift+Up	Configure the program
Save examination		<i>File → Save</i>	F5	
Open examination		<i>File → Examinations</i>	F7	
Exit and return to real time mode		<i>File → Real time</i>	F6	
Exit this program		<i>File → Exit</i>		

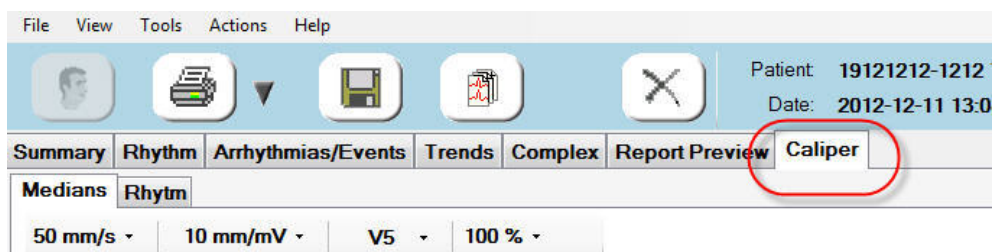
8 Advanced measurement functions

8.1 The Caliper option

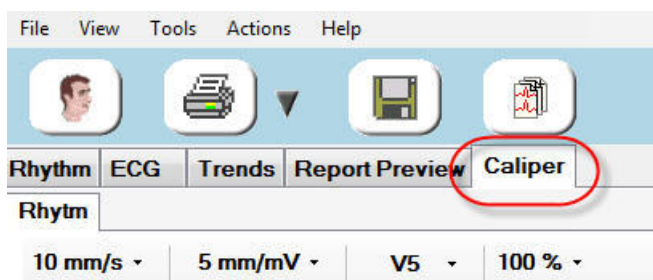
EC Sense and EC View offer the possibility to make advanced measurements on the ECG if the “Caliper” option is installed. The *Caliper* tab will be displayed on the report menu for different types of ECG modes, as illustrated below:



Caliper option in Rest ECG mode



Caliper option in Exercise ECG mode



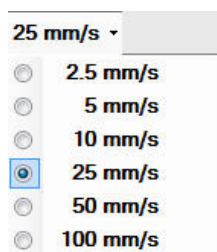
Caliper option in Long ECG mode

8.2 Menus and functions

The following functions are common for *Rest ECG*, *Exercise EKG* and *Long ECG*.

Change speed

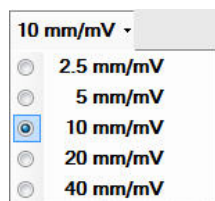
Click on



in the menu bar and select the speed to 2.5, 5, 10, 25, 50 or 100 mm/s.

Change gain

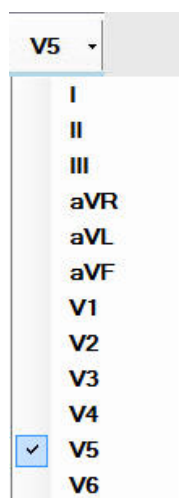
Click on



in the menu bar and select the gain to 2.5, 5, 10, 20 or 40 mm/mV.

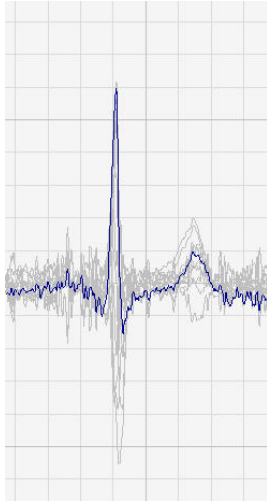
Change lead

Click on



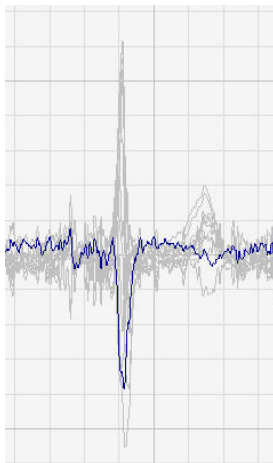
in the menu bar and select the lead.

It is also possible to change lead if you click on the desired lead when the option *Show all leads* is activated.



Example:

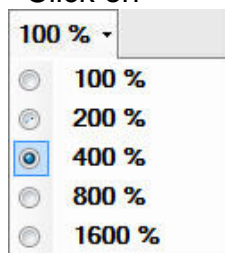
Show all leads is activated and V5 is selected.



A different lead can be selected by clicking on one of the "grey" traces, in this example V1.

Zoom in/out

Click on



in the menu and select to magnify.

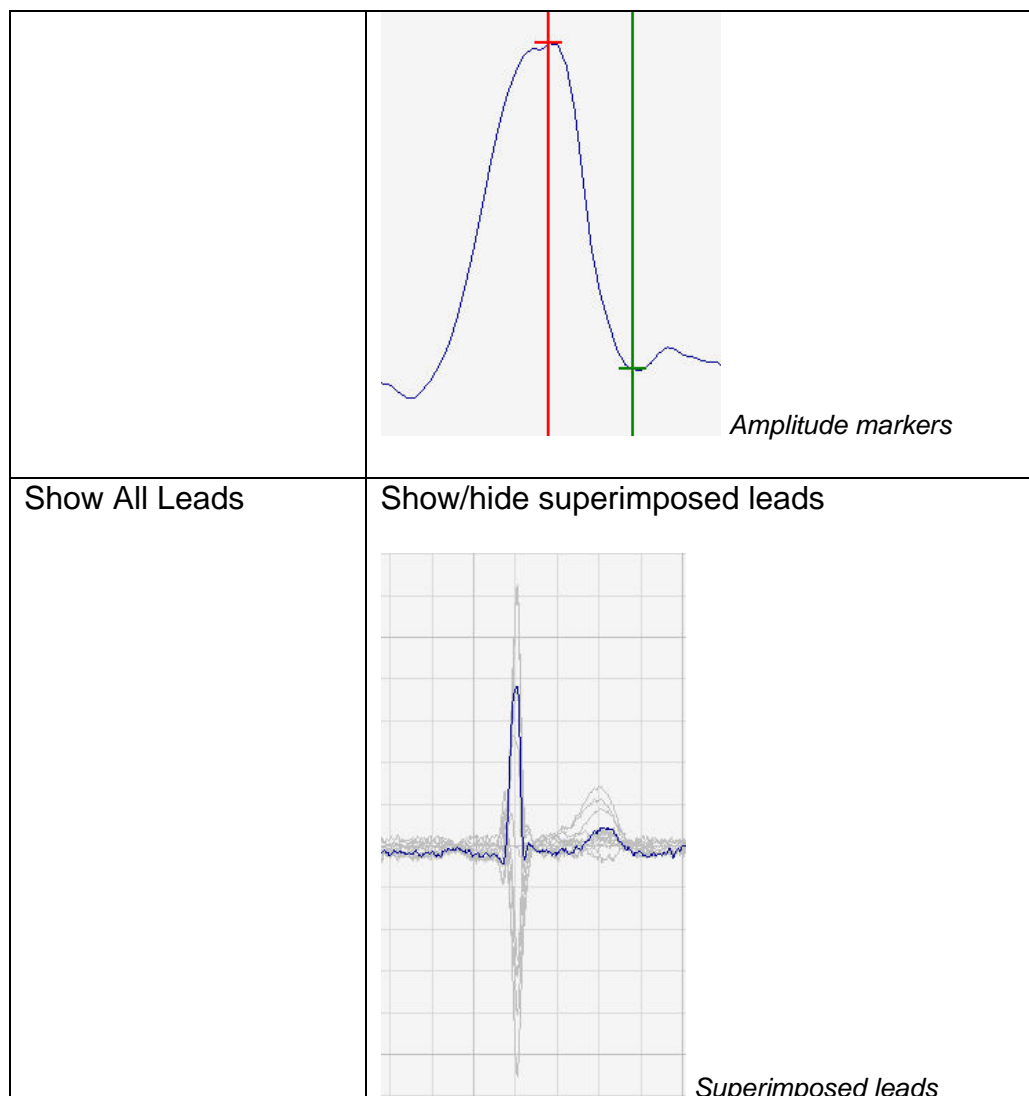


Zoom 400%

Pop-up menu

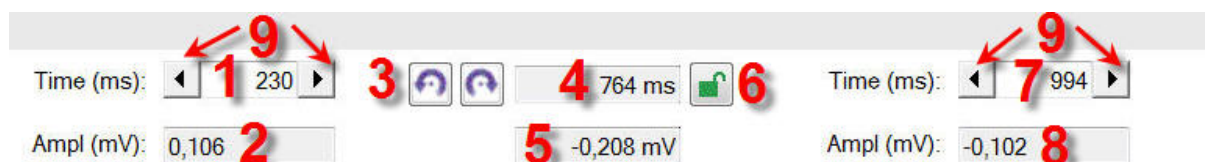
Right click inside the ECG window for a pop-up menu.
The menu offers the following measurement functions:

Function	Description
Set Left Marker	Place the left marker on a desired location and left click.
Set Right Marker	Place the right marker on a desired location and right click.
Set Markers on Tickmarks	Sets the markers on the selected tickmarks. (At the first two if there are more than two).
Make Markers Visible	Returns to the position where the markers are visible.
Show Grid	Select to show or hide the background grid.
Show Horizontal Ruler	Show or hide the horizontal bars that mark the amplitude on the trace for the left or right marker.



Measurement area

The measurement area under the ECG window presents measurement values, and from this menu you can also move the markers.



No	Description
1	Presents the absolute time from the left for the left marker.
2	Presents the amplitude for the left marker.
3	Click on these to shift the markers one interval to the right/left. This is a useful function for detecting deviations on RR intervals.

4	Presents the time difference between the markers.
5	Presents the amplitude difference between the markers.
6	Click on the padlock to lock/unlock a set distance between the markers. When locked, both markers are moved simultaneously while maintaining the same difference between them.
7	Presents the absolute time from the left for the right marker.
8	Presents the amplitude for the right marker.
9	Click on the arrows to move the markers forward/backward.

Drag-and-Drop

It is also possible to move the measurement markers by using the Drag-and-Drop method in the following way:

Place the mouse over the measurement marker, press down the left mouse button and drag the marker in any direction, release button.

8.3 Measurements on Rest ECG

8.3.1 Beats tab

It is possible to work with the measurements independent of each other. The following describes one possible method.

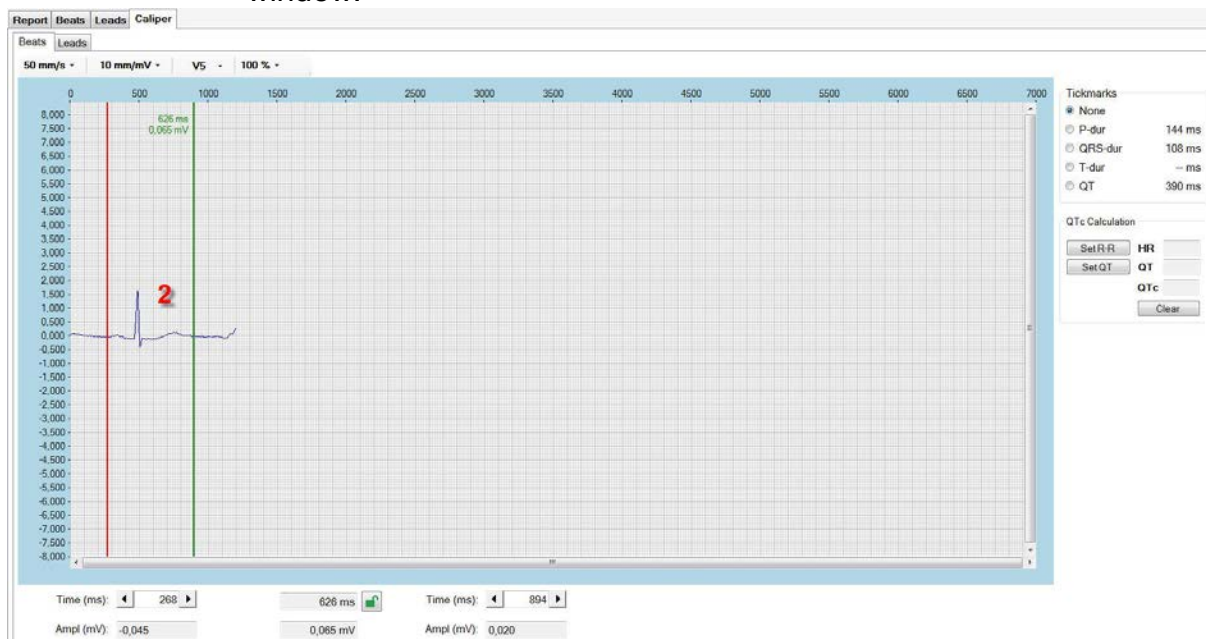
Tickmarks

Under the *Beats* tab the following type of markers can be used for measurements on the ECG. Tickmarks are shown as vertical dotted lines.

Tickmarks		
<input checked="" type="radio"/> None		No markers on the trace
<input type="radio"/> P-dur	144 ms	Show markers for P-duration
<input type="radio"/> QRS-dur	108 ms	Show markers for QRS-duration
<input type="radio"/> T-dur	-- ms	Show markers for T-duration
<input type="radio"/> QT	390 ms	Show markers for QT interval

Example:

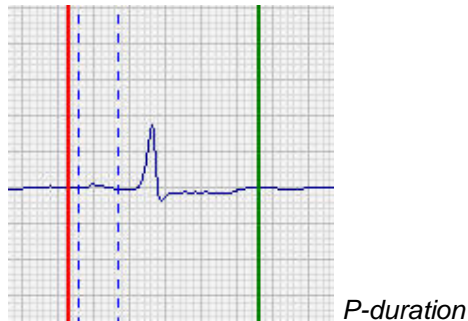
1. Click on the *Caliper* tab.
2. The averaged ECG complex in *Rest ECG* is presented in the window.



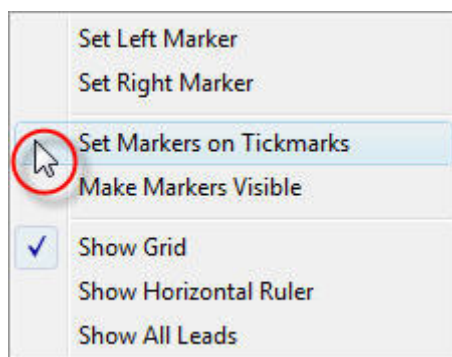
3. Move the markers, if desired, by using the arrows.

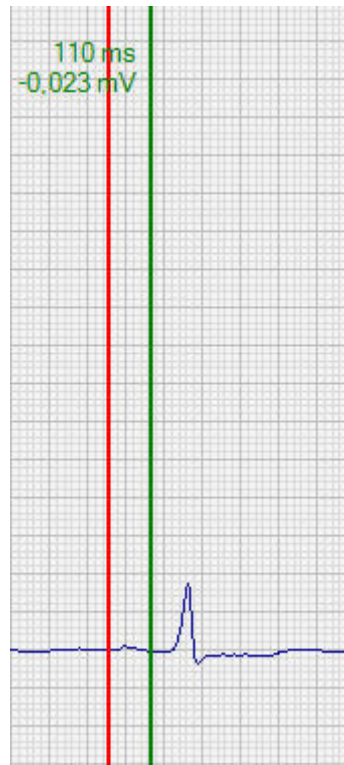
Tid (ms): <input type="text" value="232"/> 3	<input type="text" value="532 ms"/> 4	Tid (ms): <input type="text" value="764"/> 3
Ampl (mV): <input type="text" value="-0,001"/>	<input type="text" value="0,005 mV"/>	Ampl (mV): <input type="text" value="0,004"/>

- The difference in amplitude and duration is presented in the middle of the measurement area.
- Click on P-duration to place the tickmarks.



- Right click for a pop-up menu and click on *Set Markers on Tickmarks*.





Markers placed at P-duration

The time for P-duration is presented above the trace as well as in the measurement area.

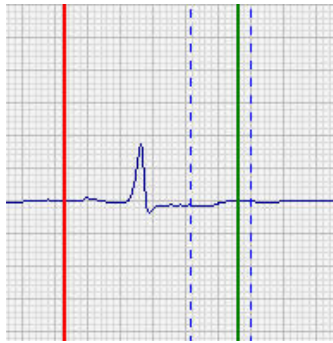
7. Click on QRS-duration to place the tickmarks.



QRS-duration

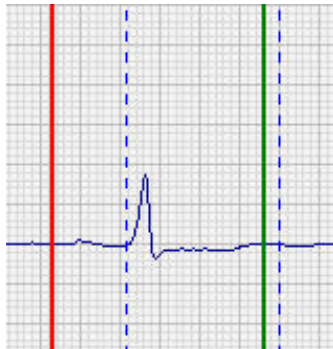
Carry out each measurement in a similar way as described in step 6 to show the markers on the measurements.

8. Click on T-duration to place the tickmarks.



T-duration

9. Click on QT to place the tickmarks.



QT interval

8.3.2 Leads tab

Tickmarks

Under the *Leads* tab the following type of markers can be used for measurements on the ECG.

<p>Tickmarks</p> <p><input checked="" type="radio"/> None</p> <p><input type="radio"/> QRS list</p> <p><input type="radio"/> Pace pulses</p>	<p>No markers on the trace</p> <p>Set markers on QRS list</p> <p>Set markers on pace pulses</p>
--	---

Note:

Pace pulses are only visible if the ECG has been registered with pace pulses.

The measurement functions works in the same way as described under the *Beats* tab. See 8.3.1

8.4 Measurements on Exercise ECG

8.4.1 Medians tab

It is possible to work with the measurements independent of each other. The following describes one possible method.

Tickmarks

Under the *Medians* tab the following type of markers can be used for measurements on the ECG.

Tickmarks

- ☒ None
- ☐ QRS-dur
- ☐ ST-60

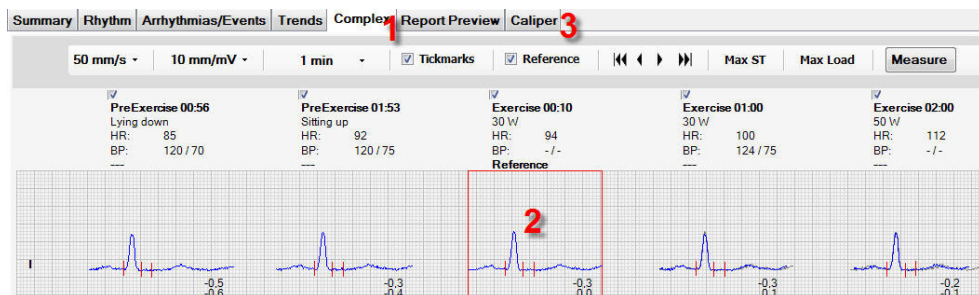
No markers on the trace

Set markers for QRS duration

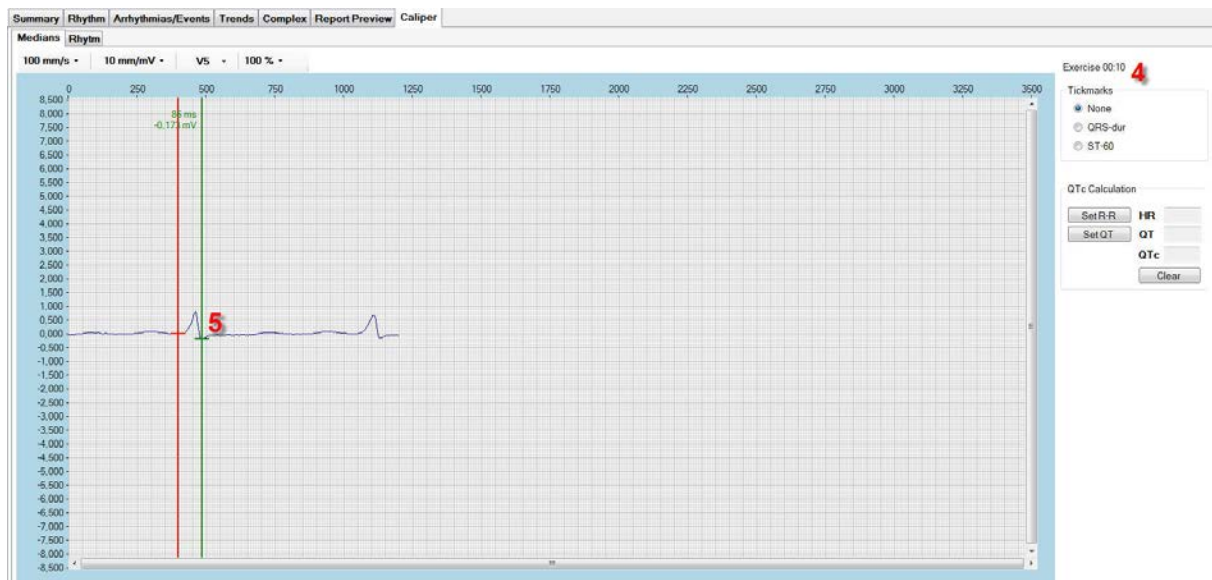
Set markers for ST-60 duration

Example:

1. Click on either *Summary*, *Rhythm*, *Arrhythmias/Events*, *Trends* or *Complex*. In this example, *Complex*.
2. Set the time reference on a desired complex.



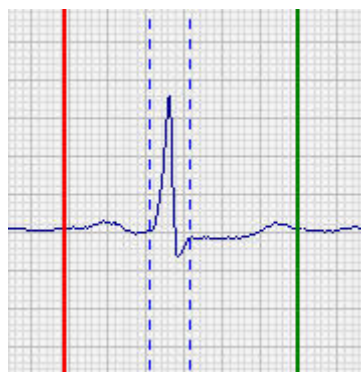
3. Click on the *Caliper* tab.
4. The averaged complex is presented in the ECG window. The time for the selected complex is shown in the upper right corner and corresponds to the selected time reference.
5. The markers are shown on the complex.



6. Move the markers with the arrows or use drag-and-drop by placing the mouse over the marker and drag with the left mouse button.

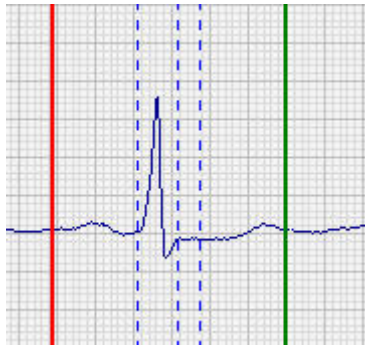


7. The difference in amplitude and duration is presented in the middle of the measurement area.
8. Click on *QRS-dur* to show the markers for the detected QRS.



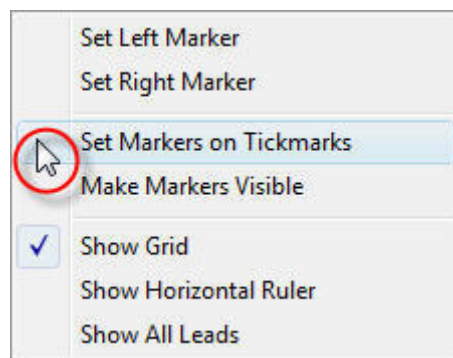
QRS-duration

9. Click on *ST-60* to show the markers for the detected ST interval.

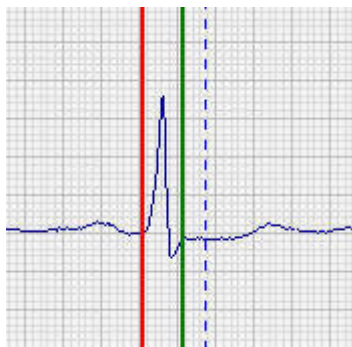


ST-60 markers

10. Right click for a pop-up menu and click on *Set Markers on Tickmarks*.



11. The red and green measurement markers are placed on top of the tickmarks. Amplitude and duration is seen above the complex as well as in the measurement area at the bottom.



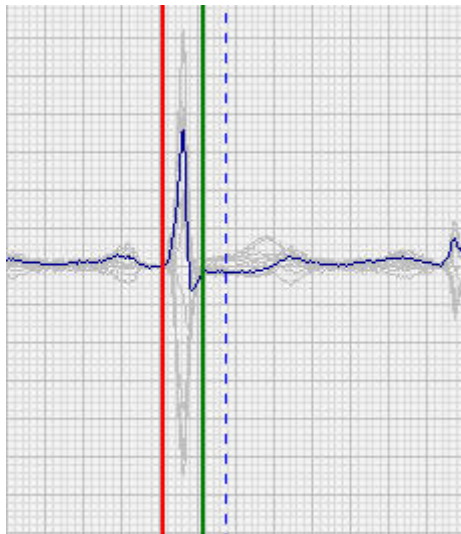
Set Markers on Tickmarks

12. Right click to bring up the pop-up menu and select/deselect *Show Horizontal Ruler*. The horizontal bars indicate the intersection on the trace.



Show Horizontal Ruler

13. Right click to bring up a pop-up menu and select *Show All Leads*. This shows a superimposed mode with all leads.



Show All Leads

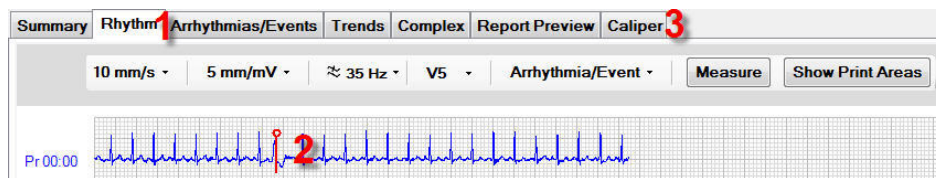
14. To select a different complex click on any of the tabs for *Rhythm*, *Arrhythmias/Events*, *Trends* or *Complex* and place the time reference on the desired complex.

8.4.2 Rhythm tab

The functions under *Rhythm* tab are similar to the functions described under the *Medians* tab.

Example:

1. Click on either *Summary*, *Rhythm*, *Arrhythmias/Events*, *Trends* or *Complex*. In this example, *Rhythm*.
2. Set the time reference by clicking on the desired location in the ECG or trend.



3. Click on the *Caliper* tab.
4. The corresponding time segment is presented in the ECG window.

Tickmarks

Under the *Rhythms* tab the following type of markers can be used for measurements on the ECG.

Tickmarks

☒ None
☐ QRS list
☐ Pace pulses

No markers on the trace

Set markers on QRS list

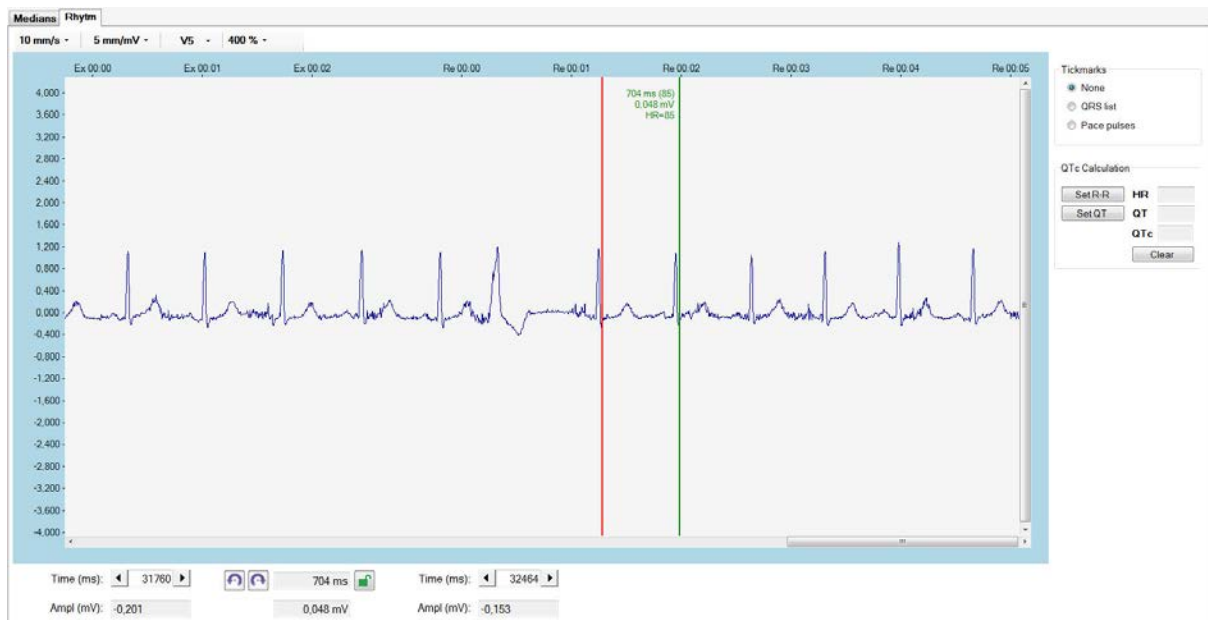
Set markers on pace pulses

8.4.3 QTc calculation

To carry out a QTc calculation set the markers on a RR interval and a QT time and click on *Set R-R* and *Set QT*. The markers can be set in any order and the QTc will be automatically calculated when both values are available.

Example:

1. Select an R-R interval by setting the left and right marker.

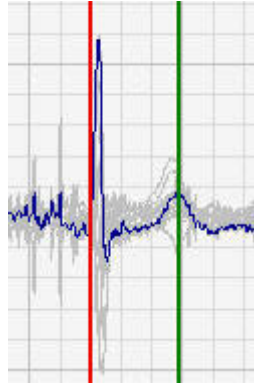


2. Click on *Set R-R*.
3. The value is shown as:

QTc Calculation

Set R-R	HR	85
Set QT	QT	
	QTc	
Clear		

4. Then select QT with both markers.



5. Click on *Set QT*.
6. The following calculation is presented:

QTc Calculation

Set R-R	HR	85
Set QT	QT	600
	QTc	644
Clear		

7. Click on *Clear* to delete the calculation and to restart.

8.5 Measurement on Long ECG

8.5.1 Rhythm

The measurements for *Long ECG* are similar to the functions described under the *Rhythm* tab for *Exercise ECG*.

Tickmarks

Under the *Rhythm* tab the following type of markers can be used for measurements on the ECG.

Tickmarks	
<input checked="" type="radio"/> None	No markers on the trace
<input type="radio"/> QRS list	Set markers on QRS list
<input type="radio"/> Pace pulses	Set markers on pace pulses

Example:

1. Click on either the *Rhythm*, *ECG* or *Trends* tab.
2. Set the time reference by clicking on the desired location in the ECG or trend.
3. Refer to section 8.4.2 for general description.
4. For QTc calculation refer to section 8.4.3.

9 Examination data base

9.1 Local and central storage of examinations

In *EC Sense* it is possible to store Resting ECGs and Exercise ECGs on the local PC or in a central storage system. Examinations that are stored on the local PC can be exported to the central storage system at a later time. The user can on the other hand also search and retrieve examinations from the central storage system and import them into *EC Sense*.

The functions for importing and exporting examinations are accessible from the *Examination* data base which opens when clicking on the



icon in the upper menu bar.

A list with all examinations will be presented.

9.1.1 Local examinations

When opening the *Examination* list, all locally stored examinations will be presented in a similar fashion:

Examinations

Local

Central

Date	Type	PatientId	LastName	FirstName
2011-05-23 12:06:22	Rest ECG	77665544	Williams	William
2011-05-20 08:39:40	Exercise	12233445	Doe	John
2011-05-19 15:53:38	Exercise	66778899	Johhsson	Mary
2011-05-19 15:23:52	Exercise	66778899	Johhsson	Mary
2011-05-19 14:39:48	Exercise	66778899	Johhsson	Mary
2011-05-19 14:33:57	Exercise	55667788	Smith	James
2011-05-18 16:58:15	Exercise	12233445	Doe	John
2011-05-14 14:24:22	Exercise	12233445	Doe	John

Diagnosis:

SINUS TACHYCARDIA

 Poor R wave progression V2-V4
 PROBABLE NORMAL VARIANT

Summary:

ABNORMAL

Open

Send

Delete

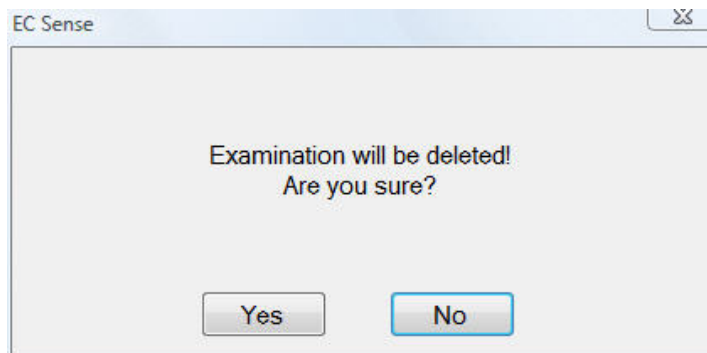
Cancel

The lower window will display the diagnosis and interpretation for the highlighted examination.

Double click on an examination in the list, or click on *Open*, to open the examination in report mode.

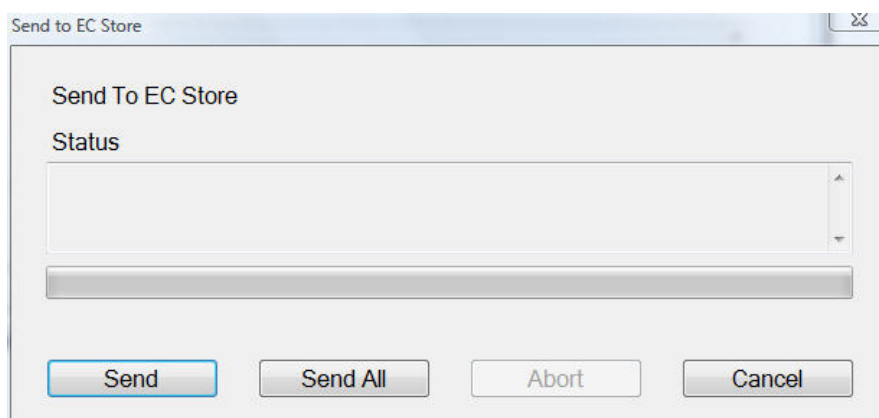
9.1.2 Delete local examinations

Highlight the examination to be deleted and select *Delete*. You will be asked whether you are sure that you want to delete it or not.



9.1.3 Send examinations to the central storage system

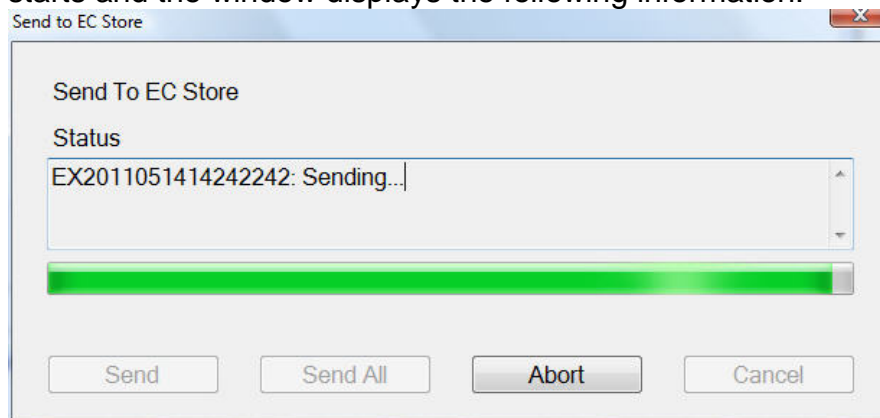
All examinations that have been exported to, and successfully imported into, the central storage system will automatically be deleted from *EC Sense*. Click on the *Send* button to start the transmission to the central storage system. The following window will be displayed:



Click on *Cancel* if you wish to close without sending.

Send highlighted examination

When *Send* is selected, the transmission of the selected examination starts and the window displays the following information:

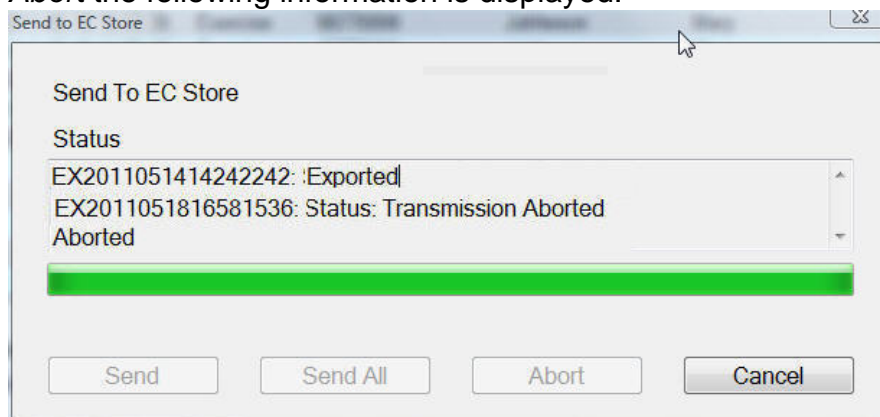


Send all examinations

If *Send all* is selected, all local examinations will be transferred.

Abort transmission

By clicking on *Abort* the transmission will be cancelled as soon as the ongoing transmission of an examination is finished. When clicking on *Abort* the following information is displayed:



This window will be showed until the user confirms by selecting *Cancel*.

9.1.4 Retrieve examinations from the central storage system

Click on the *Central* tab to open the search window.

[illegible]

Enter the patient's ID, if not already filled in (if a current patient is selected that patient's ID number will be filled in). All characters in the patient ID must be entered. The patient ID information can not be changed by the user.

The examination list will be empty until the search is activated with the *Search* button. The *Import* button will be dimmed while the list is empty.

After clicking on *Search*, the list with examinations will be displayed in a similar way:

Date	Type	PatientId	LastName	FirstName	Status
2011-05-23 13:01:47	Exercise	12233445	Doe	John	Unconfirmed
2011-05-23 12:57:48	Rest ECG	12233445	Doe	John	Unconfirmed
2011-05-20 08:39:40	Exercise	12233445	Doe	John	Unconfirmed
2011-05-14 14:24:22	Exercise	12233445	Doe	John	Unconfirmed

The *Import* button can now be activated, and the selected examination can be retrieved to be viewed in the report mode. You can also select an examination by double clicking on it.

An examination that has been retrieved from the central storage system can not be stored again on the local PC. Such examinations can only be viewed and printed out.

When importing examinations from the central storage system to *EC Sense*, the communication with the central storage system will depend on the user's access rights. It might be necessary to log in with user name and password. This will depend on the system administrator of the central storage system.

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