CARDIOVIT AT-102 G2

User guide

SCHILLER
The Art of Diagnostics

Sales and Service Information

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www.schiller.ch

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CE 0123

The CARDIOVIT AT-102 G2 bears the CE-0123 mark (Notified Body TÜV-SÜD Produkte Service GmbH, Ridlerstr. 65, 80339 Munich, Germany), indicating its compliance with the essential requirements of the Annex I of the Medical Device Directive 93/42/EE regarding safety, functionality and labelling. The requirements apply to patients, users and third persons who come into contact with this device within the scope of its intended use.

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1 Safety notes

1.1 Intended Use

- The CARDIOVIT AT-102 G2 is a 12-lead electrocardiograph intended to be used by or under the direct supervision of a licensed healthcare practitioner in healthcare facilities to acquire ECG signals from body surface electrodes, record, analyse, display and print ECGs for diagnosis in adult and paediatric patients.
- The spirometry option is intended to record, analyse, display and print measurements and waveforms of pulmonary function tests for the diagnosis in adult and paediatric patients.
  Note: The spirometry option will be available from version 1.2.0. The indications for use, contra-indications for the patients as well as the function and operation of the spirometry option are explained in a separate user guide.
- The exercise option is intended to acquire ECG signals from body surface electrodes record, analyse, display and print ECGs of adult and paediatric patients undergoing stress exercise testing

1.2 Indications for use

- The CARDIOVIT AT-102 G2 is intended to be used for screening and assessment of cardiovascular diseases including:
  - Resting myocardial ischemia
  - Myocardial infarction (acute and former)
  - Conduction system abnormalities including atrio-ventricular blocks, bundle branch block and pre-excitation syndromes
  - Long QT syndrome
  - Atrial abnormalities
  - Ventricular hypertrophy and strain
  - Pericarditis
  - Secondary repolarisation abnormalities such as electrolytes disturbances
  - Drug-induced abnormalities

- When the CARDIOVIT AT-102 G2 is used as **exercise test system**, it is intended for:
  - Detection of coronary artery disease (CAD) in patients with chest pain (chest discomfort) syndromes or potential symptom equivalents
  - Evaluation of the anatomic and functional severity of CAD
  - Prediction of cardiovascular events and all-cause death
  - Evaluation of physical capacity and effort tolerance
  - Evaluation of exercise-related symptoms
  - Assessment of chronotropic competence, arrhythmias, and response to implanted device therapy
  - Assessment of the response to medical interventions

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1.3 Contraindications

1.3.1 System

▲ The CARDIOVIT AT-102 G2 is not intended for:

– for sterile use
– for use in areas where there is any danger of explosion or in the presence of flammable gases such as anesthetic agents
– for direct cardiac application
– for use in an MRI suite 

– for outdoor use
– to be used as a vital signs physiological monitor

1.3.2 Patient

▲ When the CARDIOVIT AT-102 G2 is used as **exercise test system**, it is not intended for patients with the following diseases:

- **Absolute Contraindications**
  – Acute myocardial infarction (MI), within 2 days
  – Unstable angina pectoris
  – Uncontrolled cardiac arrhythmia with haemodynamic compromise
  – Active endocarditis
  – Symptomatic severe aortic stenosis
  – Decompensated heart failure
  – Acute pulmonary embolism, pulmonary infarction, or deep vein thrombosis
  – Acute myocarditis or pericarditis
  – Acute aortic dissection
  – Physical disability that precludes safe and adequate testing
- **Relative contraindications**
  – Known obstructive left main coronary artery stenosis
  – Moderate to severe aortic stenosis with uncertain relation to symptoms
  – Tachyarrhythmias with uncontrolled ventricular rates
  – Acquired advanced or complete heart block
  – Hypertrophic obstructive cardiomyopathy with severe resting gradient
  – Recent stroke or transient ischaemic attack
  – Mental impairment with limited ability to cooperate
  – Resting hypertension with systolic or diastolic blood pressures >200/110 mmHg
  – Uncorrected medical conditions, such as significant anaemia, important electrolyte imbalance, and hyperthyroidism

1.4 Intended users

▲ The CARDIOVIT AT-102 G2 is intended to be used by trained operators under supervision of a licensed health care practitioner.

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1.5 Patient target group

The CARDIOVIT AT-102 G2 is intended to be used for adult and paediatric patients.

ECG

Paediatric patients are defined as follows:

- Neonates: from birth through the first 28 days of life
- Infants: 29 days of age to less than two years of age
- Children: Two years of age to less than 12 years of age
- Adolescents: 12 years of age through 21 years of age (up to, but not including, the twenty-second birthday)

Exercise tests

- The patient must be able to understand and carry out the instructions on how to perform the examination.
- There are no restrictions regarding height, weight, gender or ethnicity of the patients.

1.6 Context of use

▲ The CARDIOVIT AT-102 G2 is intended for indoor use in healthcare facilities.

1.7 Responsibility of the User

▲ The CARDIOVIT AT-102 G2 must only be used by qualified physicians or trained medical personnel.

▲ The numerical and graphical results and any interpretation given must be examined with respect to the overall clinical condition of the patient and the general recorded data quality.

▲ The responsibilities of the personnel for the operation and maintenance of the device must be specified.

▲ Ensure that the personnel have read and understood this user guide, in particular this section **Safety Notes**.

▲ Damaged or missing components must be replaced immediately.

▲ The safety, reliability and performance of the device can only be guaranteed when the maintenance intervals as stated in the section Maintenance are observed.

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1.8 Organisational Measures

- ▲ Before using the device, ensure that a medical product representative has explained its functions as well as the safety requirements.
- ▲ Keep this user guide in an accessible place for reference purposes. Make sure that it is always complete and legible.
- ▲ Observe the operating and maintenance instructions.
- ▲ These operating instructions do not override any statutory or local regulations, or procedures for the prevention of accidents and environmental protection.

1.9 Safety-conscious Operation

- ▲ Make sure that the staff have read and understood the operating instructions, in particular this section Safety Notes.
- ▲ Only operate the device in accordance with the specified technical data (see section 14 Technical Data, page 114). Non-compliance with the specified technical data may result in injury, inaccurate information and/or damage to the unit.
- ▲ The device is CF classified. It is defibrillation protected only when the SCHILLER original patient cable is used. However, as a safety precaution, remove the electrodes before defibrillation, if possible.
- ▲ Do not touch the unit during defibrillation.
- ▲ To ensure patient safety, none of the electrodes, including the neutral electrode, nor the patient or any person with simultaneous patient contact, must come in contact with conductive parts, even when these are earthed.
- ▲ Immediately report any changes that impair safety (including operating behaviour) to the responsible person.
- ▲ Do not place any liquids on the unit. If liquid is spilled on the device, immediately disconnect the device from the mains and wipe it. The device must be checked before reusing.
- ▲ Only connect the original SCHILLER patient cable to the patient socket.
- ▲ If the patient cable should become defective after defibrillation, an electrode becomes displaced, or an electrode resistance is too high, a lead-off indication is displayed in the upper right part of the screen.
- ▲ Only use accessories and disposables recommended or supplied by SCHILLER. Use of other than recommended or supplied parts may result in injury, inaccurate information and/or damage to the unit.
- ▲ To prevent pacemaker malfunction, a distance of at least 20 cm must be observed between the device and the pacemaker as soon as the Wi-Fi (wireless LAN) module is switched on.
- ▲ Should unexpected results be provided, the user must verify the connections according to section 12.1 Maintenance interval table, page 102 .

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1.10 Safety facilities

- Operating the device without the correctly rated fuse or with defective cables constitutes a danger to life! Therefore:
  - Do not operate the unit if the earth connection is suspect or if the mains lead, the power supply unit or the device is damaged or suspected of being damaged.
  - Damaged cable connections and connectors must be replaced immediately.
  - Electrical safety devices, such as fuses, must not be modified.
  - Fuses must only be replaced with the same type and rating as the original.

1.11 Operation with other Devices

- Accessories connected to the analogue and/or digital interfaces must be certified according to the corresponding IEC standards (e.g. IEC/EN 60950 for data processing equipment and IEC/EN 60601-1 for medical equipment). Furthermore, all configurations shall comply with the valid version of IEC/EN 60601-1. Everyone who connects additional equipment to the signal input part or signal output part configures a medical system and is therefore responsible that the system complies with the requirements of the valid version of IEC/EN 60601-1. If in doubt, contact the technical service department or your local representative.
- Any other equipment used with the patient must use the same common earth as the CARDIOVIT AT-102 G2.
- Special care must be exercised when the unit is used with high-frequency equipment. Use the original SCHILLER patient cable to avoid possible signal interference during ECG acquisition or burns due to missing potential equalisation. However, the stimulation units should only be used at a sufficient distance from the electrodes and both devices must be connected to the same potential equalisation. If in doubt, the patient should be disconnected from the device.
- This device can safely be used with pacemaker patients.
- There is no danger when using this unit simultaneously with electrical stimulation equipment.
- If the device is part of a medical system, only the original SCHILLER patient cable must be used with, and connected to, the CARDIOVIT AT-102 G2.
- If the patient cable should become defective after defibrillation, a lead-off indication is displayed on the screen (see page 41).
- Portable communication devices, HF radios and devices labelled with the  symbol (non-ionic electromagnetic radiation) can affect the operation of this device (page 113).

1.12 Network safety

- When the CARDIOVIT AT-102 G2 is part of a *network (LAN, WLAN, HIS, etc.),* the operator of the network/data coupling must take appropriate security measures to protect the transmission of data. Networks that are not protected and maintained can lead to failure of the data transmission or to incorrect transmission of data, which in turn can result in danger to the patient. For further safety notes, see chapter 11.
- Standard passwords for access control must be changed by the responsible persons.

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1.13 Maintenance

- ▲ Danger of electric shock. Do not open the device. There are no serviceable parts inside. Servicing must only be performed by qualified technicians authorised by SCHILLER.
- ▲ Before cleaning and to isolate the mains power supply, switch the monitor off and disconnect it from the mains by removing the plug.
- ▲ Do not use high-temperature sterilisation processes (such as autoclaving). Do not use e-beam or gamma radiation sterilisation.
- ▲ Do not use aggressive or abrasive cleaners.
- ▲ Do not, under any circumstances, immerse the device or cable assemblies in liquid.

1.14 Terms of warranty

Your SCHILLER CARDIOVIT AT-102 G2 is warranted against defects in material and manufacture, as stated in the Terms and Conditions. Excluded from this warranty is damage resulting from negligence or improper use. The warranty entitles to free replacement of the defective part. Any liability for subsequent damage is excluded. The warranty is void if unauthorised or unqualified persons attempt to make repairs.

In case the device is defective, send it to your local SCHILLER representative or directly to the manufacturer. The manufacturer can only be held responsible for the safety, reliability and performance of the apparatus if:

- assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by the manufacturer, and
- the SCHILLER device and approved attached equipment is used in accordance with the manufacturer's instructions, and
- the maintenance intervals as stated in the section Maintenance are observed.

There are no express or implied warranties which extend beyond the warranties hereinabove set forth. SCHILLER makes no warranty of merchantability or fitness for a particular purpose with respect to the product or parts thereof.

SCHILLER assumes no liability for the loss of data saved on the computer or on the device. The owner is solely responsible for the data backup.

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1.15 Symbols and Pictograms

1.15.1 Symbols used in this document

The safety level is classified according to ISO 3864-2. The following overview shows the safety symbols and pictograms used in this user guide.

For a direct danger which could lead to severe personal injury or to death.

For a possibly dangerous situation which could lead to severe personal injury or to death.

For a possibly dangerous situation that could lead to personal injury. This symbol is also used to indicate possible damage to property.

For general safety notes as listed in this chapter.

For electrical hazards, warnings or precautionary measures when dealing with electricity.

Note For possibly dangerous situations which could lead to damage to property or system failure. **Important** or helpful user information.

Reference to other instructions.

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1.15.2 Symbols used on the device

Potential equalisation.

CF symbol. The device is classified safe for internal and external use. However, it is only defibrillation protected when used with the original SCHILLER patient cable.

Manufacturer symbol, manufacturing date.

IP20

Keep dry.

Symbol for the recognition of electrical and electronic equipment

Equipment/components and accessories no longer required must be disposed of in a municipally approved collection point or recycling centre. Alternatively, you can return the equipment to your supplier or the manufacturer for disposal. Improper disposal can harm the environment and human health.

The unit/component can be recycled

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Attention: consult accompanying documents.

Consult the user guide.

Read the user guide.

Attention: non-ionising electromagnetic radiation. The device contains an HF transmitter (Wi-Fi).

The CARDIOVIT AT-102 G2 radiates high-frequency electromagnetic energy and can disturb other devices if the CARDIOVIT AT-102 G2 is not installed and operated in accordance with the user guide. However, there is no guarantee that no interference can occur in certain installations. If the CARDIOVIT AT-102 G2 causes interferences, these can be determined by switching the device off/on or by transmitting/not transmitting ECG data. The user can take the following measures to prevent electromagnetic interferences:

- Increase the distance between the disturbed device and the CARDIOVIT AT-102 G2. A minimum distance of 20 cm must be kept between the device and a pacemaker.
- Turn the device to change the angle of radiation.
- Connect the device to a different mains connector.

For more details, see page 112.

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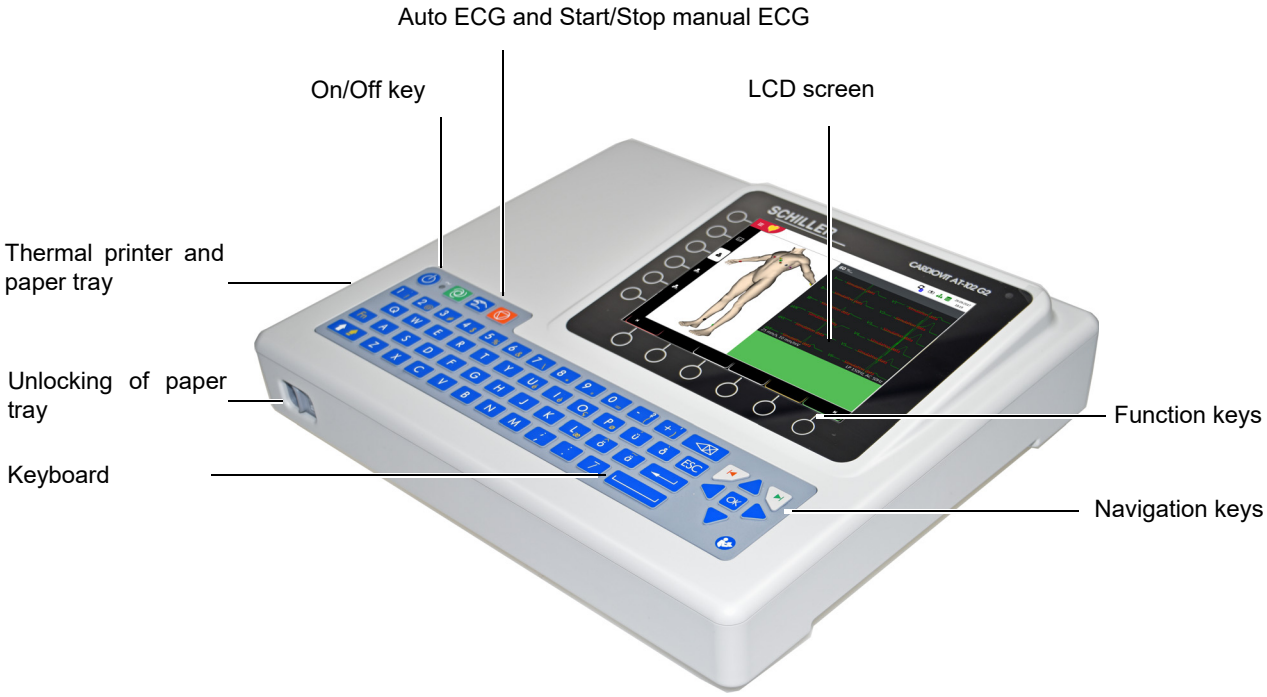
2 Introduction

The SCHILLER CARDIOVIT AT-102 G2 is a 12-channel ECG unit designed to record, display and measure resting ECGs, exercise ECGs (optional) and spirometry (optional).

The CARDIOVIT AT-102 G2 has the following features:

2.1 Main Components of the CARDIOVIT AT-102 G2



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2.1.1 Standard

- Pacemaker detection
- Manual rhythm printout in real time (leads, speed and amplitude can be changed)
- Auto mode recording (10 seconds) with user-defined layout
- Resting rhythm
- Measurements
- Full disclosure of all 12 channels
- Display of reversed electrodes
- Recording review
- Connectivity
  - Wi-Fi
  - LAN
- Schiller Link
- PDF export to USB stick

2.1.2 Options

- Interpretation with ETM Sport
- Barcode reader - to read a patient‘s ID and retrieve patient data from a database
- Culprit Coronary Artery Algorithm (CCAA)
- Worklist
- Exercise ECG
- Spirometry (available from version 1.2.0)

2.2 Connections

- Potential equalisation
- RJ-45 Ethernet connector (network)
- 2 USB interfaces for software updates with a USB stick, PDF export, connection of a barcode reader and spirometry sensor.
- 2 RS-232 interfaces for ergometer DB9
- ECG patient cable DB15
- Kensington lock

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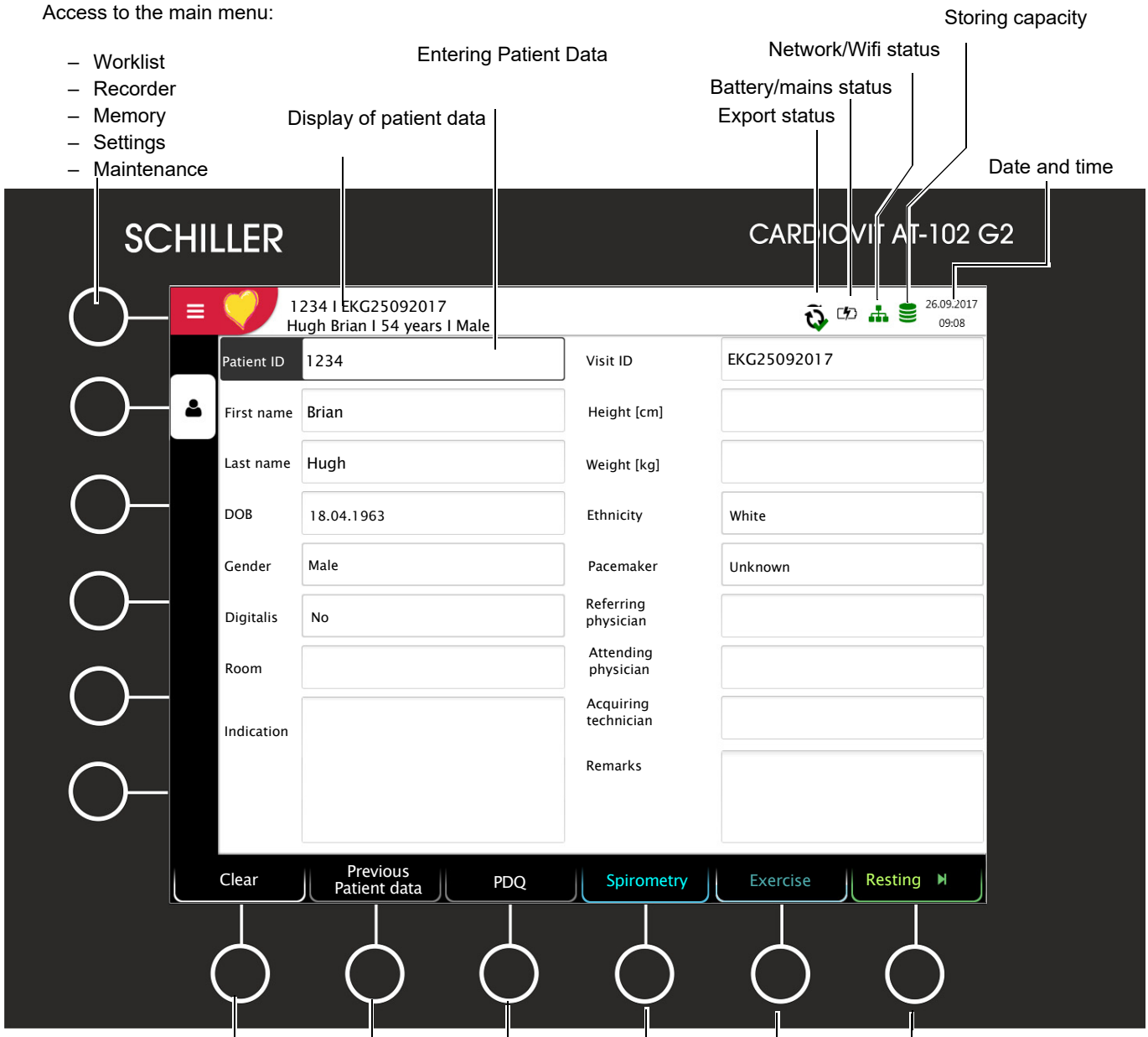
2.3 Display

The display will vary according to the task being carried out. In all screens, however, the top and bottom areas always display the same category of information. Example for a typical patient data view:



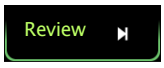
Delete patient data

The previous patient's data is loaded

Once the patient ID has been entered, patient data is retrieved by pressing **PDQ**.

Recording spirometry, exercise or resting ECG

Function key, go to the next step. The function keys change their function depending on the selected view.



Function key to return to the review screen; this is only available when the recording has not yet been accepted.

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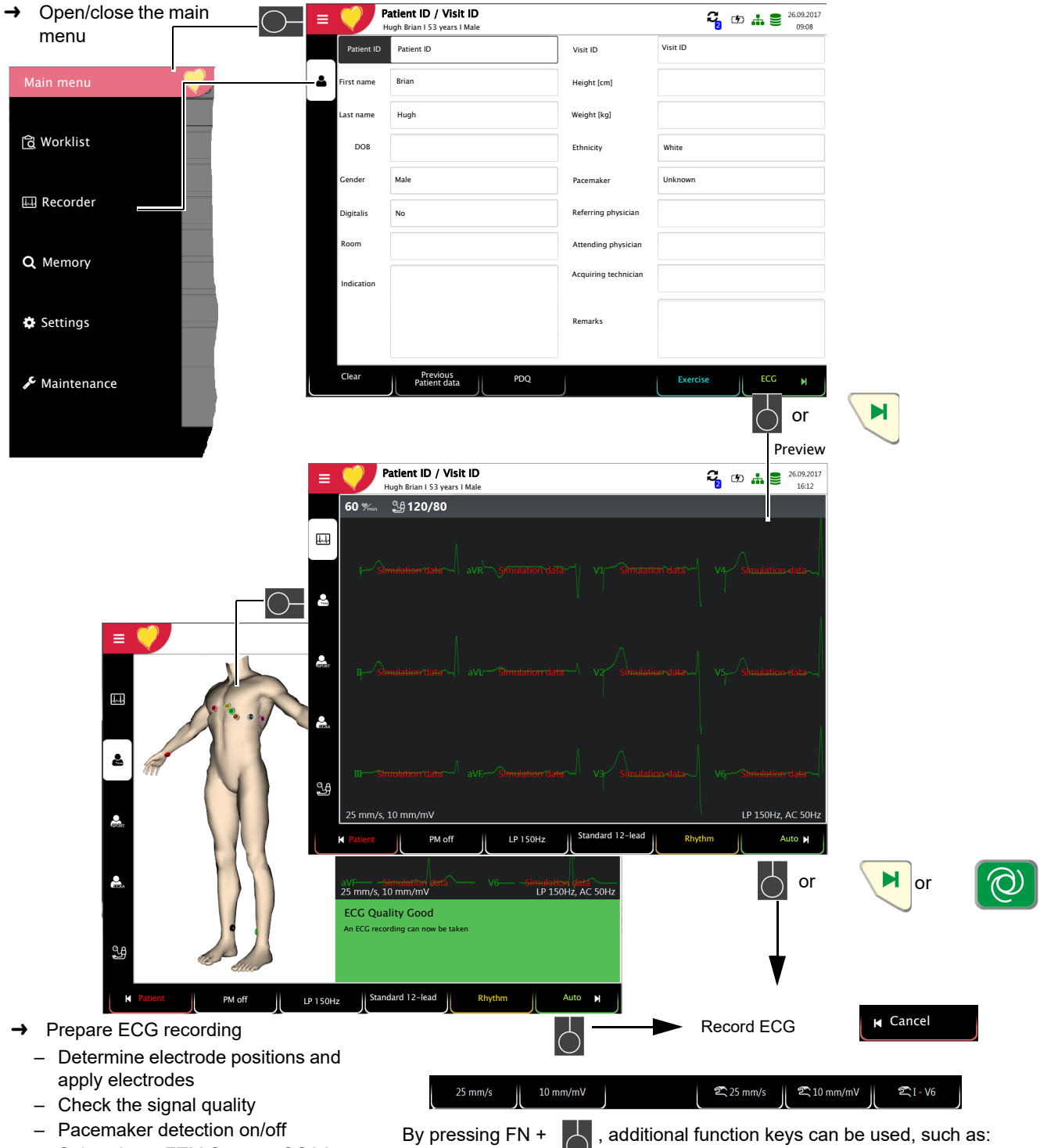
2.4 Display details

Displays and function keys during a resting ECG recording:



➜ Prepare ECG recording

- Determine electrode positions and apply electrodes
- Check the signal quality
- Pacemaker detection on/off
- Select Auto, ETM Sport or CCAA
- Enter blood pressure measurement manually

By pressing FN + , additional function keys can be used, such as:

Settings for speed/amplitude for ECG display and settings speed/amplitude and lead for ECG manual printout.

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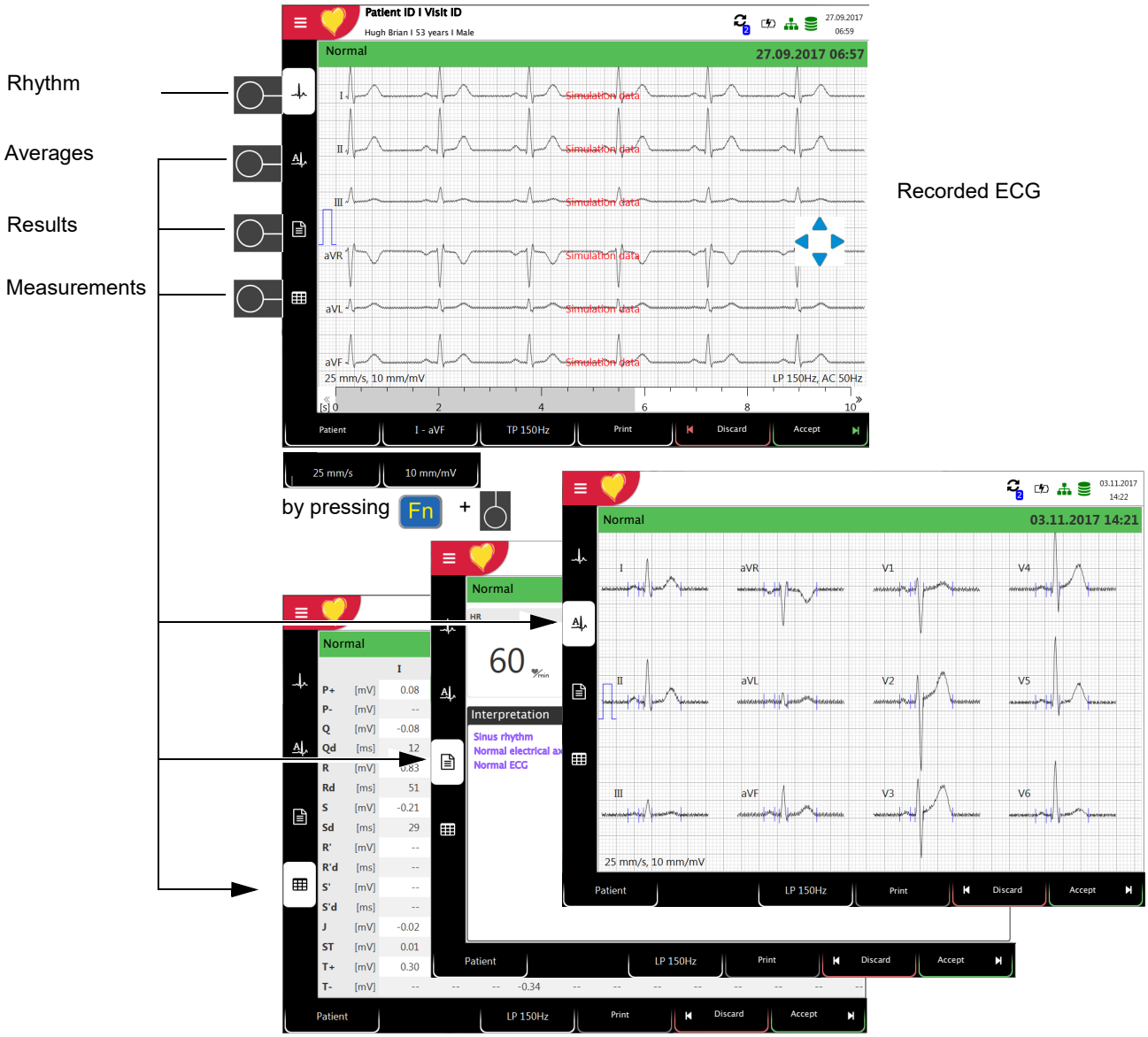

→ To edit patient data or enter patient data before recording an emergency ECG, press the key before accepting the recording, and edit/enter the patient data. Press Review to return to the review screen.

→ The recorded ECG is displayed and can be reviewed.

→ Use navigation keys to rotate leads I...V6: scroll up or down and along the time axis (left-right).

→ Display average values, results and measurements.

→ Set the filter for display to 25/40/150 Hz or Off using the Filter function key.

→ Accept the ECG (i.e. save), print, or discard.

→ Use the FN key and the corresponding function key to set the amplitude and speed.

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2.5 Keyboard

(1) Power On/OFF	Press the On/Off button to switch the device on or off.
(2) Power Indicator	The power supply LEDs indicate the power source (see page 22).
(3) Direct function key Auto Start	**Auto Start** key - take auto recording
(4) Direct function key Manual start	**Man Start** key - real time printout
(5) Direct function key Stop	**Stop** key - stop printout / advance paper to beginning of new page
(6) Delete input	The entered data is deleted
(7) Menu selection and navigation	• **OK** key - the centre key is to confirm current / displayed setting • **Left arrow** key - move cursor to the left / select previous menu option • **Right arrow** key - move cursor to the right / select next menu option • **Up arrow** key - move cursor upward • **Down arrow** key - move cursor downward • Red arrow key, left (back/cancel dialogue) • Green arrow key, right (select/confirm dialogue)

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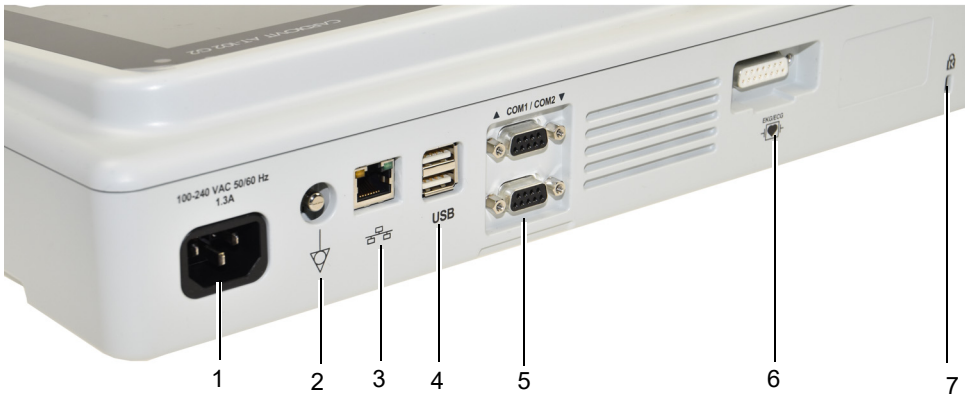
2.6 Connections

⚠ CAUTION

▲ All externally connected hardware must be approved by SCHILLER. Connection of any hardware not approved by SCHILLER is at the owner's risk. Moreover, the unit's warranty may become invalid.

2.6.1 Back panel



(1) Power supply unit connection 100 -240 VAC, 50/60 Hz, 1.3 A.

(2) Potential equalisation stud. The potential equalisation stud is used to equalise the ground potential of the unit to that of any nearby mains-powered equipment. Use the hospital or building common ground for all mains-powered units.

(3) RJ-45 Ethernet LAN connection (Local Area Network)

(4) 2 USB interfaces for the barcode scanner, USB sticks or spirometry sensor.

(5) 2x RS-232-DB9 connections for ergometer (COM1▲ Bike, COM2 ▼ Treadmill)

(6) ECG patient cable connector DB15

(7) Kensington lock

⚠ CAUTION

▲ The patient cable as well as the connector (6) comply with the safety standard CF, i.e. they are fully floating and isolated and defibrillation protected.

▲ The unit is only CF rated and defibrillation protected if used with the original SCHILER patient cable.

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3 Operation

3.1 Initial operation

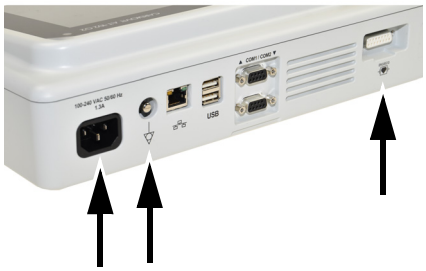
DANGER

▲ Electrical shock hazard. Do not operate the unit if the earth connection is suspect or if the power supply unit/mains lead is damaged or suspected of being damaged.

3.1.1 Location

- Do not keep or operate the unit in a wet, moist or dusty environment. Avoid exposure to direct sunlight or heat from other sources.
- Do not allow the unit to come into contact with acidic vapours or liquids.
- The CARDIOVIT AT-102 G2 should not be placed in the vicinity of X-ray or diathermy units, large transformers or electric motors.

3.1.2 Connection of external cable assemblies and ancillary equipment



1. Connect the power cable to the mains supply.
2. The mains indicator LED is lit.
3. Leave the CARDIOVIT AT-102 G2 connected to the mains for 4 hours to fully charge the battery (see page 22).
4. Connect the potential equalisation cable.
5. Connect the patient cable.
6. Connect any ancillary and optional equipment (see page 18). These may include the following:
   - Network cable
   - USB barcode reader
   - Ergo devices

3.1.3 Potential equalisation

The potential equalisation stud at the back of the unit is used to equalise the ground potential of the CARDIOVIT AT-102 G2 to that of all mains-powered equipment in the vicinity. Use the hospital or building common ground. A yellow/green earth cable is supplied as an option (article number 2.310005).

WARNING

▲ Danger of triggering ventricular fibrillation! If the CARDIOVIT AT-102 G2 is used together with devices that are designed for direct cardiac application, both devices must be connected to the hospital/building common ground (potential equalisation) to prevent equalising currents between different device potentials.

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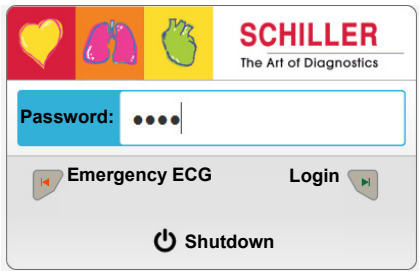
3.2 Switching on / off

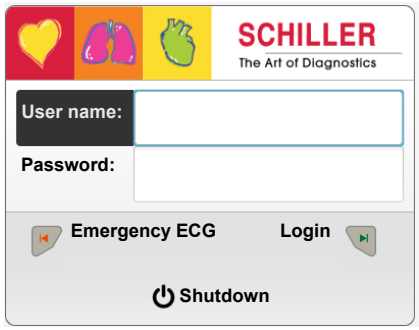
➜ The unit is switched on and off with the **On / Off** key.

- The switching off must be confirmed by pressing the key.
- If access control is activated, the **ON-OFF** key must be pressed twice.

3.2.1 Logging In and Logging Out / Emergency ECG

If access control is activated, the following dialogs are displayed:





Login

➜ Enter the password and press the key to log in.

For the access control “Local” or “Schiller Server” an additional user name is required.

Emergency ECG

➜ Press the key to bypass the login and perform an emergency ECG.

➜ Automatic logout after the ECG recording has been accepted.

Logout

➜ Press the **ON-OFF** key and in the following dialogue press the key to log off (Cancel or Switch Off)

- User login is a system setting (section Access control, page 93) and user login can be set as follows:
  - **None** - no user or password required and the program is entered directly on switch-on.
  - **Basic** - two access levels to access device (recording) and/or settings with a separate password.
  - **Local** - user and password defined locally in settings and can be defined with 3 different privileges.
  - **SCHILLER Server** - user, password and privileges defined by SCHILLER server.
- User roles and privileges are assigned to individual users and that can affect access to a workflow area and the functions that can be carried out. If a function is not available, it means that the user logged in does not have the privileges required. Individual users, and the user groups and privileges defined for individual users are defined by the **SCHILLER Server** or **locally** if not networked.
- If **Emergency ECG** is selected, login is bypassed and the patient data screen is entered directly. The login screen is displayed again after the emergency ECG recording has been accepted. No other screens can be accessed.

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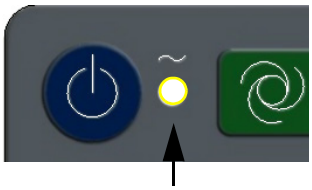
3.3 Power supply

3.3.1 Mains and battery indicators



The unit can either be operated by the mains supply or by the built-in rechargeable battery. The LED indicates that the device is connected to the mains.

The current power source is displayed in the top right corner of the screen when the unit is switched on:

Mains via external power supply unit , battery is being charged

- Internal rechargeable battery ( )
- When running on battery power and the battery capacity is limited, the battery symbol is flashing.
- When mains is connected and the battery is charging, the battery symbol is displayed ‘filling’.

Full

Half full

Almost empty

Empty

Battery capacity

The internal battery provides power for up to 8.5[a] hours. When the unit is running on battery power (mains not connected), the battery symbol indicates the battery status. When the battery is full, the symbol is solid.

When running on battery power and the battery capacity is low, the battery symbol turns red. If the capacity is ≤ 20 %[b], the user will be informed to connect the device to the mains.

Battery charging

The battery is charged when the unit is connected to the mains supply. The unit can remain connected to the mains supply without damage to either the battery or the unit.

a. With Lithium-ion 11.25V, 6.4Ah = 8 hours (05/2018-04/2020)
b. With Lithium-ion 11.25V, 6.4Ah = 10 % (05/2018-04/2020)

3.3.2 Isolating from the mains

To isolate the device from the mains supply, remove the mains plug from the external power supply unit.

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3.4 System and ECG settings

- The system settings (time, date, device ID etc.) and other general settings are described on page 91.
- Resting ECG settings (auto format, user defined leads, print options, interpretation, rhythm lead definition, etc.) are described on page 78.

3.4.1 Settings overview

Menu Settings	Sub-menu
ECG (Page 78)	• Lead & Cable • Filter & Formulas • Interpretation • Additional Leads • Resting rhythm • Colour
Reports (Page 80)	• General • Header • PDF • Manual printout • Resting ECG • Rhythm ECG • Exercise ECG[a] • Spirometry[b]
Layouts (Page 78)	• Resting • Exercise ECG[a] • Worklist • Spirometry[b]
Connectivity (Page 88)	• EMR integration • Ethernet • WLAN
Regional (Page 91)	• Date / time • Language • Units • Patient ID system
General (Page 92)	• Info • Power management • Station • Update • Manage licenses • Visible fields • Mandatory fields • Custom fields • Access control • Workflow • Memory • Printer

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Menu Settings	Sub-menu
Exercise ECG[a] (Page 95)	• General • Ergo device • Bike protocol • Treadmill protocol
Spirometry[a]	• General • Ethnic corrections • FVC measurements

a. These menu options are only displayed when the exercise ECG option is activated.
b. These menu options are only displayed when the spirometry option is activated. For more information, see separate user guide.

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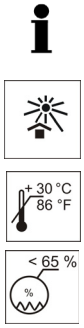
3.5 Changing the Printing Paper



Important

The device is delivered without printing paper inserted. The thermal paper is sensitive to heat, humidity and chemical vapours. The following points apply to both storage, and when archiving the results:

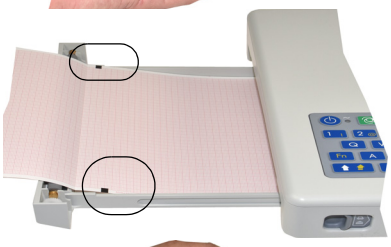
- Before use, keep the paper in its original cardboard cover. Do not remove the cardboard cover until the paper is to be used.
- Store the paper in a cool, dark and dry location.
- Do not store near chemicals, e.g. sterilisation liquids.
- Do not store in PVC folders or envelopes made of recycled paper.
- Certain glues can react with the paper. Therefore, do not use glue to attach the printout onto a mounting sheet.

SCHILLER can only guarantee perfect printouts when original SCHILLER chart paper or chart paper of the same quality is used.

1. Slide the latch to the right

2. Pull out the paper tray.

3. Remove the remaining paper.



4. Place a new paper pack into the paper tray with the printed (grid) side facing upwards.
5. Pull out the first page as shown on the left.

6. Push the paper tray home until it locks into place.

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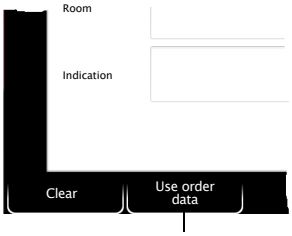
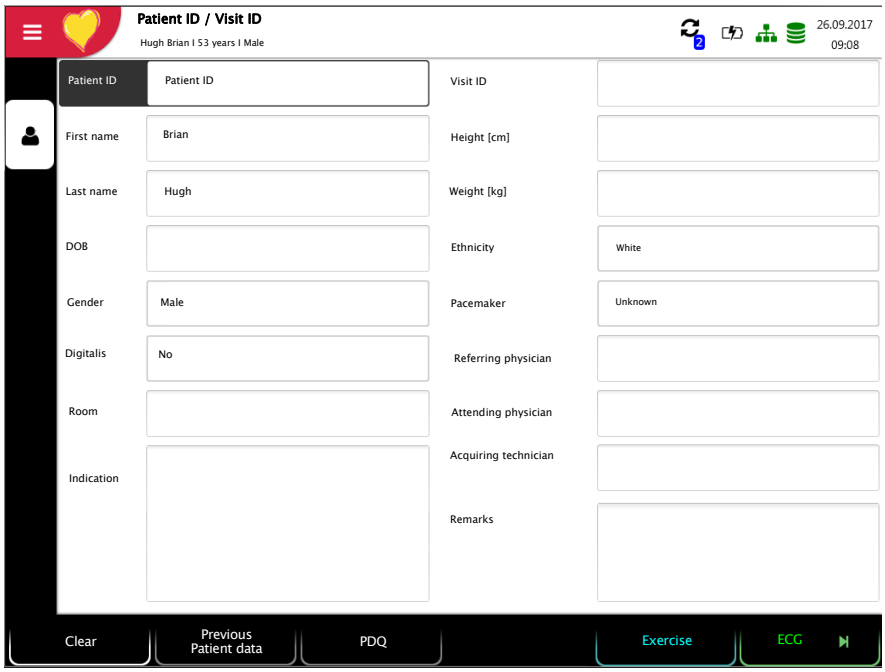
3.6 Patient / recording data

In the patient data screen, new patients can be entered and previously stored patient data can be edited

If a recording is performed without having entered a patient or visit ID, a UUID is generated instead of a patient ID, "Emergency ECG" is given instead of a last name, and the date and time are given instead of a first name. If you want to enter patient data once the recording has been performed (and before it has been accepted), you can jump to the Patient data screen by pressing the Patient key, enter the data and use the Review key to jump back to the recording to accept (save) it.



Only with Schiller Link



With the data of the current patient, you can:

- edit it directly in the entry fields
- obtain the data from the server by entering the Patient or Visit ID (configuration: see page 88)
- display the data by pressing the key "Use order data". This function key is only displayed when using the Schiller Link and when changing application and going to the screen "Patient data". (see section 11.1.4 Schiller Link, page 100)
- press Delete to reset the data and enter a new patient
- press "Previous patient" to use the previous patient's data
- read the Patient ID with a barcode scanner.
- Use the alphanumeric keyboard to enter the patient data.
  - Use the **Shift** key to switch the keyboard to capitals.

The order and visibility of the fields can be configured in the **Menu** > **Settings > General > Visible fields >** “Recorder” (see page 92).

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Patient data - left entry fields

Patient ID Enter the patient's identification number.

Last name Enter patient's name (maximum 50 characters).

First name Enter patient's first name (maximum 50 characters).

DOB[1] Enter the patient‘s date of birth in the format dd.mm.yyyy, yyyy-mm-dd or mm/dd/yyyy.

Gender[1] Enter the patient‘s gender - Male, Female, Other or Undefined

Digitalis Digitalis medication

Room Enter room

Indication Reason for medication

Patient data - right entry fields

CAUTION

▲ The field **Visit ID** must not be used to enter other types of information (e. g. technician, department). Entering this type of information in the field **Visit ID** may lead to patients being mixed up when the device is connected to the SCHILLER Server.

Visit ID The **Visit ID** is a unique patient identification provided by the hospital information system (HIS) (max. 50 characters).
For more information on the **Visit ID** and on validation options with regard to the HIS, consult the user guide for the SCHILLER Server.

Height[1] Enter the patient's height.

Weight[1] Enter the patient's weight.

Ethnicity Select one of the following:

- Undefined
- White
- Asian
- Black / African American
- American Indian / Alaska Native
- Native Hawaiian / Pacific Islander
- Hispanic
- Oriental
- Other

Pacemaker Select if the patient has a pacemaker (Yes/No/Unknown).

Regardless of this setting, for pacemaker patients the detection must be switched on before starting the ECG. A detected pacemaker pulse is therefore indicated in blue and the interpretation states that it is a pacemaker ECG.

Referring physician Referring physician

Attending physician Attending physician

Acquiring technician Acquiring technician

1. Mandatory fields for Exercise ECG. If the data is incomplete, a dialogue appears from which the recording can be started. Other mandatory fields can be set for resting and exercise ECG in **Menu** > **Settings > General > Mandatory fields**, see section 10.7 General, page 92. Mandatory fields are not considered for recordings via worklist.

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With the following settings, this "name" is read automatically, but can be overwritten at any time:

- **Menu** > **Settings > General > Station >** Parameter “Acquiring technician”
- **Menu** > **Settings > General > Access control >** Access control mode > Local > “User name”
- **Menu** > **Settings > General > Access control >** Access control mode > Schiller Server > “User name”

Remarks

Remarks about the patient/recording

For spirometry, the following additional fields are displayed by default. These fields are described in more detail in the separate spirometry user guide:

Smoker, Intensity, Years smoking, Years non smoking, Comments, Asthma, COPD, SpO2.

Keys

Clear

Deleting entered patient data.

Use previous patient

The previous patient's data is entered again.

The fields described above are displayed by default. The order as well as additional fields can be configured in the **Menu** > **Settings > General > Visible fields > “**Recorder” (see page 92):

Age, Alternative PID, BMI and Generic data 1/2/3.

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3.6.1 Patient data query (PDQ)

When the unit is connected to SEMA or another hospital patient database (via network or WLAN), patient data can be filled in automatically when the **Patient ID** or **Visit ID** is entered. This is called **Patient Data Query** or **PDQ**.

The PDQ settings are defined in **Menu** > **Settings** > **General** > **Workflow** - the following options are available:

- **Patient data query (PDQ mode)** - select one of the following:
  - Patient ID
  - Visit ID
- These settings along with other transmission settings are detailed in the system settings (see page 74).

Patient data query with key PDQ

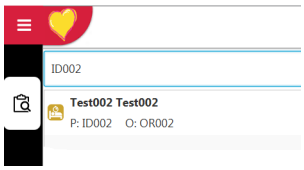
➜ Enter the patient ID or visit ID and press the **PDQ** key or OK to confirm the patient data query.

PDQ with barcode reader

➜ Scan the barcode to enter the **Patient ID** / **Visit ID**. Patient data is filled in automatically when the **Patient ID**/**Visit ID** is read with a barcode reader.

- Connect the barcode reader (see next page)
- Barcode scanner configuration: see document 2.510721.

3.6.2 PDQ in the worklist/memory



If you use the "Worklist" workflow, you can search/retrieve patient data in the same way in the worklist (see page 68)

Select the Search field by pressing OK and read the **Patient ID** or **Visit ID** using the barcode reader. The corresponding work item is shown in the worklist.

The same applies for searching recordings in the memory.

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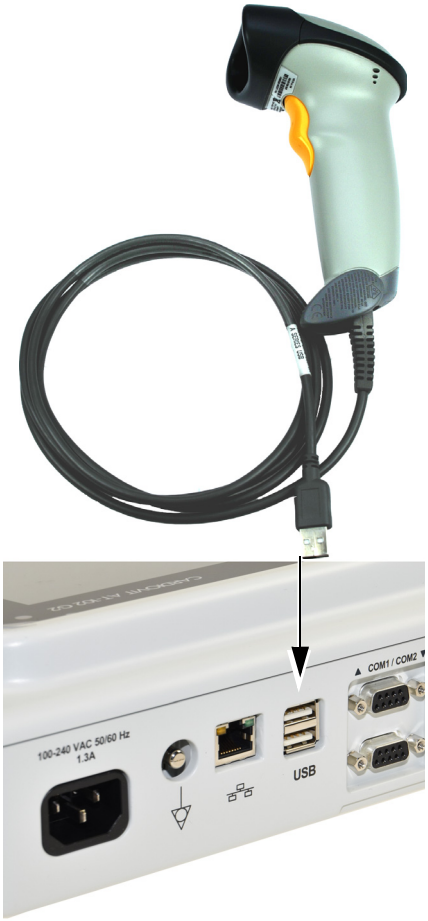
3.6.3 Barcode reader



A barcode reader can be attached to the USB port on the back panel to read the Patient ID / Visit ID. SCHILLER has tested the following barcode reader:

➜ Symbol Model LS 2208, from Symbol Tech N.Y.

When a barcode reader is connected, the patient data is read from the barcode (generated by the hospital system). If an external hospital patient database is available, all patient data is entered in the patient data fields of the CARDIOVIT AT-102 G2 as described on the previous page.

Country specific character sets can be set via the **Menu** > **Settings > Regional > Language > Barcode Scanner Layout.**

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4 Electrode placement

WARNING

▲ Ensure that neither the patient nor the leading parts of the patient connection nor the electrodes (including the neutral electrodes) come in contact with other persons or conductive objects, even when these are earthed.

4.1 Basics

Careful application of the electrodes and good electrode contact is important for a good recording (see electrode positioning on pages 33 - 41).

A minimal resistance between skin and electrode is required to obtain the best ECG signal and ensure the highest quality ECG recording. Therefore, please note the following points:

1. Only use electrodes that are recommended by Schiller AG (see accessories)
2. Before using disposable electrodes, check that the expiration date has not yet passed.
3. To increase the electrode's conductivity and adherence:
   – Shave the areas where the electrodes are to be placed, if necessary.
   – Thoroughly clean the areas with alcohol or soapy water.
   – Let the skin dry before applying the electrodes.
   – [1]When applying the electrodes, ensure that a layer of gel is between the electrode and the skin.
4. Check the electrode resistance as described in the section 4.11.
5. If the electrode resistance is higher than the acceptable level:
   – Remove the electrode and use an abrasive cleaning pad or abrasive cleaning gel [2] to remove the uppermost layer of epidermis.
   – Apply the electrode. Always use a new disposable electrode.
6. Ensure that the patient is warm and relaxed before you start the recording.
7. After the recording, remove the electrodes. Clean the suction or vacuum electrodes according to the manufacturer's instructions.

1. Electrode gel is integral with single-use electrodes and extra gel does not need to be applied when single-use electrodes are used. For biotab electrodes, solid conductive gel is incorporated in the adhesive.
2. Dedicated abrasive cleaning gel gives very good results in reducing the skin-electrode resistance.

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4.2 Electrode Identification and Colour Code

The electrode colour codes in the following sections correspond to Code 1 (IEC) for the graphics and to Code 2 (AHA) in the tables

	IEC		AHA	
	IEC label	Colour	AHA label	Colour
Limb	R	Red	RA	White
	L	Yellow	LA	Black
	F	Green	LL	Red
Chest according Wilson	C1	White/red	V1	Brown/red
	C2	White/yellow	V2	Brown/yellow
	C3	White/green	V3	Brown/green
	C4	White/brown	V4	Brown/blue
	C5	White/black	V5	Brown/orange
	C6	White/violet	V6	Brown/violet
Neutral	N	Black	RL	Green

The patient cable (type IEC or AHA) is set in the menu Lead & Cable, see chapter 10.2.1.

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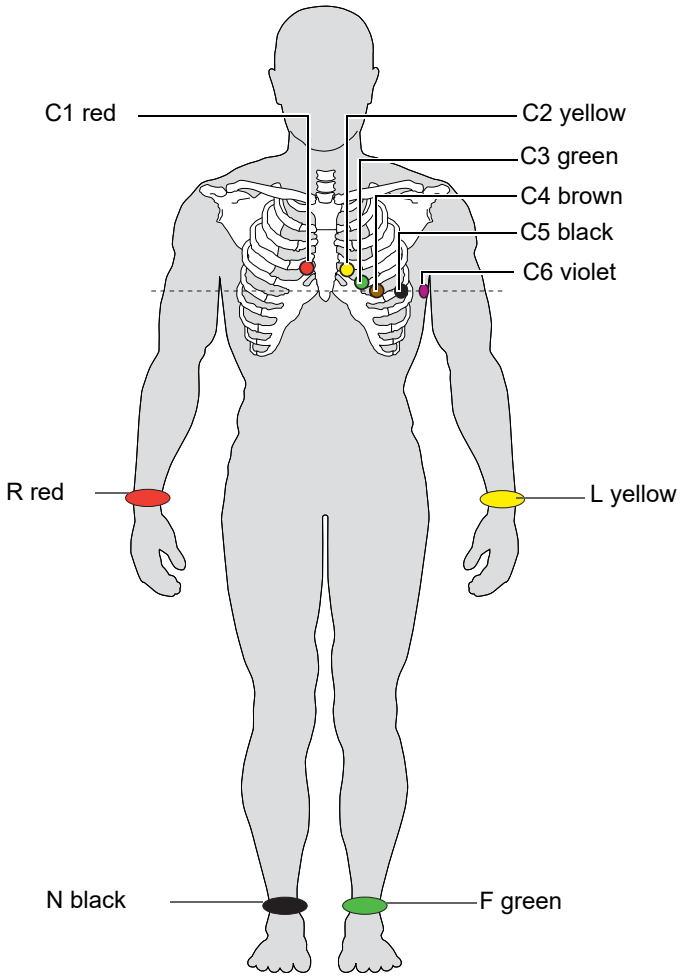
4.3 Resting ECG with 10-lead patient cable



4.3.1 Electrode placement for standard leads

IEC label	AHA label	Connecting the ECG patient cable
C1 red	V1 red	→ Fourth intercostal space at the right sternal border
C2 yellow	V2 yellow	→ Fourth intercostal space at the left sternal border
C3 green	V3 green	→ Midway between C2 and C4
C4 brown	V4 blue	→ Mid-clavicular line in the fifth intercostal space
C5 black	V5 orange	→ Anterior axillary line on the same horizontal level as C4
C6 violet	V6 violet	→ Mid-axillary line on the same horizontal level as C4
L yellow	LA black	→ Left arm (resting ECG)
R red	RA white	→ Right arm (resting ECG)
F green	LL red	→ Left foot (resting ECG)
N black	RL green	→ Right foot (resting ECG)

The electrode resistance can be checked in the electrode test screen (see page 41).

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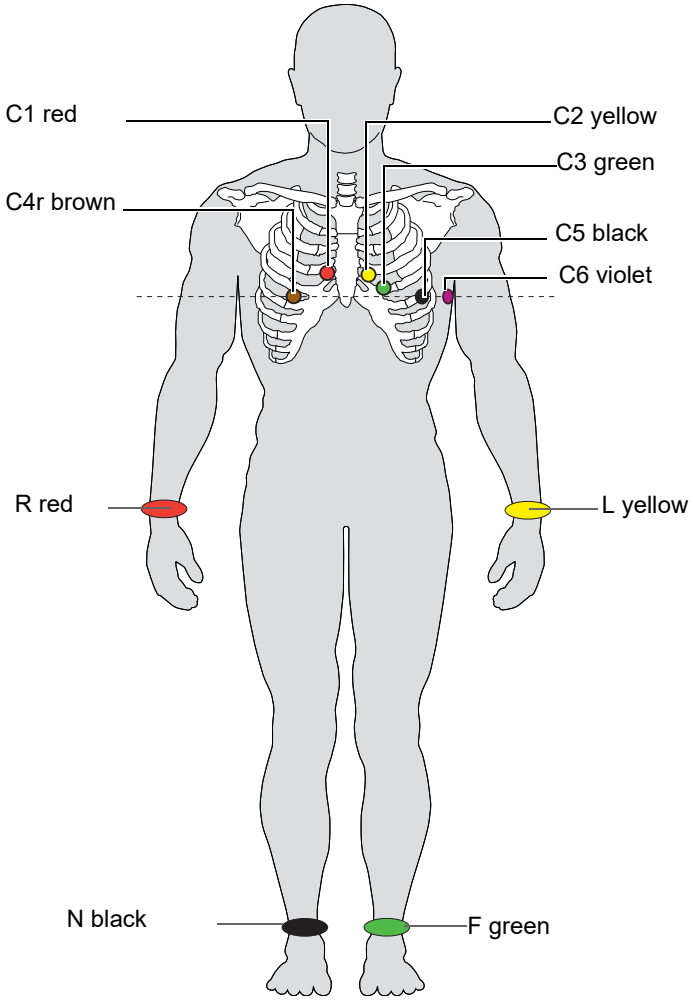
4.4 Standard (C4r)

ACC/AHA guidelines recommend examining patients suffering from a myocardial infarction with inferior ST elevation for possible RV ischaemia or RV infarction; this examination should be performed with a right precordial C4r lead.



IEC Label	AHA Label		Connecting the ECG patient cable
C1 white / red	V1 brown / red	→	Fourth intercostal space at the right sternal border.
C2 white / yellow	V2 brown / yellow	→	Fourth intercostal space at the left sternal border.
C3 white / green	V3 brown / green	→	Midway between C2 and C4.
C4r white / brown	V4 brown / blue	→	Fifth intercostal space on the mid-clavicular line.
C5 white / black	V5 brown / orange	→	Anterior axillary line on the same horizontal level as C4.
C6 white /violet	V6 brown / violet	→	Mid-axillary line on the same horizontal level as C4.
L yellow	LA Black	→	Left arm
R red	RA White	→	Right arm
F green	LL Red	→	Left foot
N black	RL Green	→	Right foot

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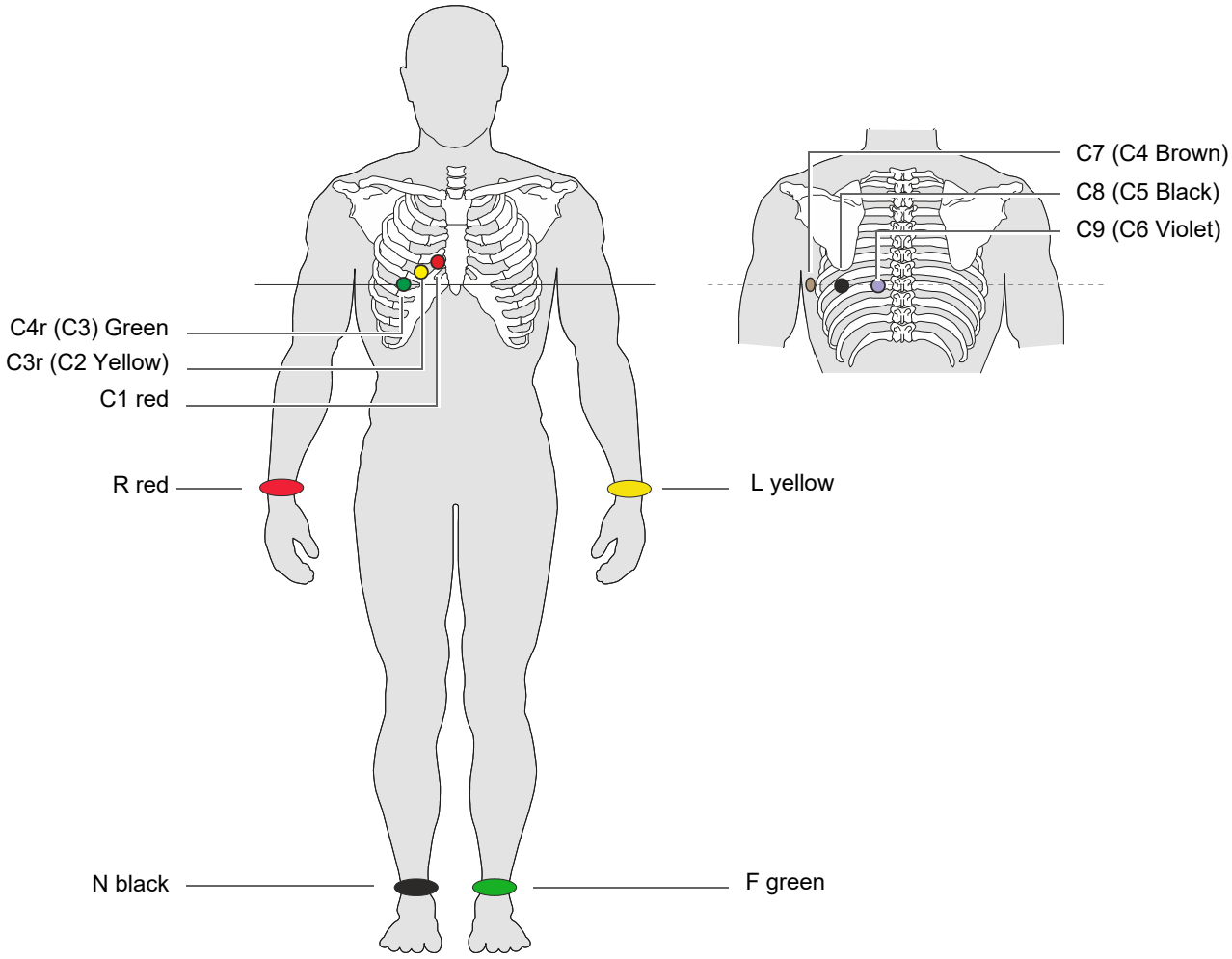
4.5 Balanced



Balanced 10-wire Cable

IEC label	AHA label	Electrode placement
C1 white / red	V1 brown / red	→ Fourth intercostal space at the right sternal border.
C3r white / yellow	V3r brown / yellow	→ Left of the mid-scapular line at the level of C3
C4r white / green	V4r brown / green	→ Left of the mid-scapular line at the level of C4
C7 white / brown	V7 brown / blue	→ Left posterior axillary line at the level of C4.
C8 white / black	V8 brown / orange	→ Left posterior axillary line opposite of C4
C9 white /violet	V9 brown / violet	→ Left posterior axillary line at the level of C4, opposite C3
L yellow	LA Black	→ Left arm
R red	RA White	→ Right arm
F green	LL Red	→ Left foot
N black	RL Green	→ Right foot

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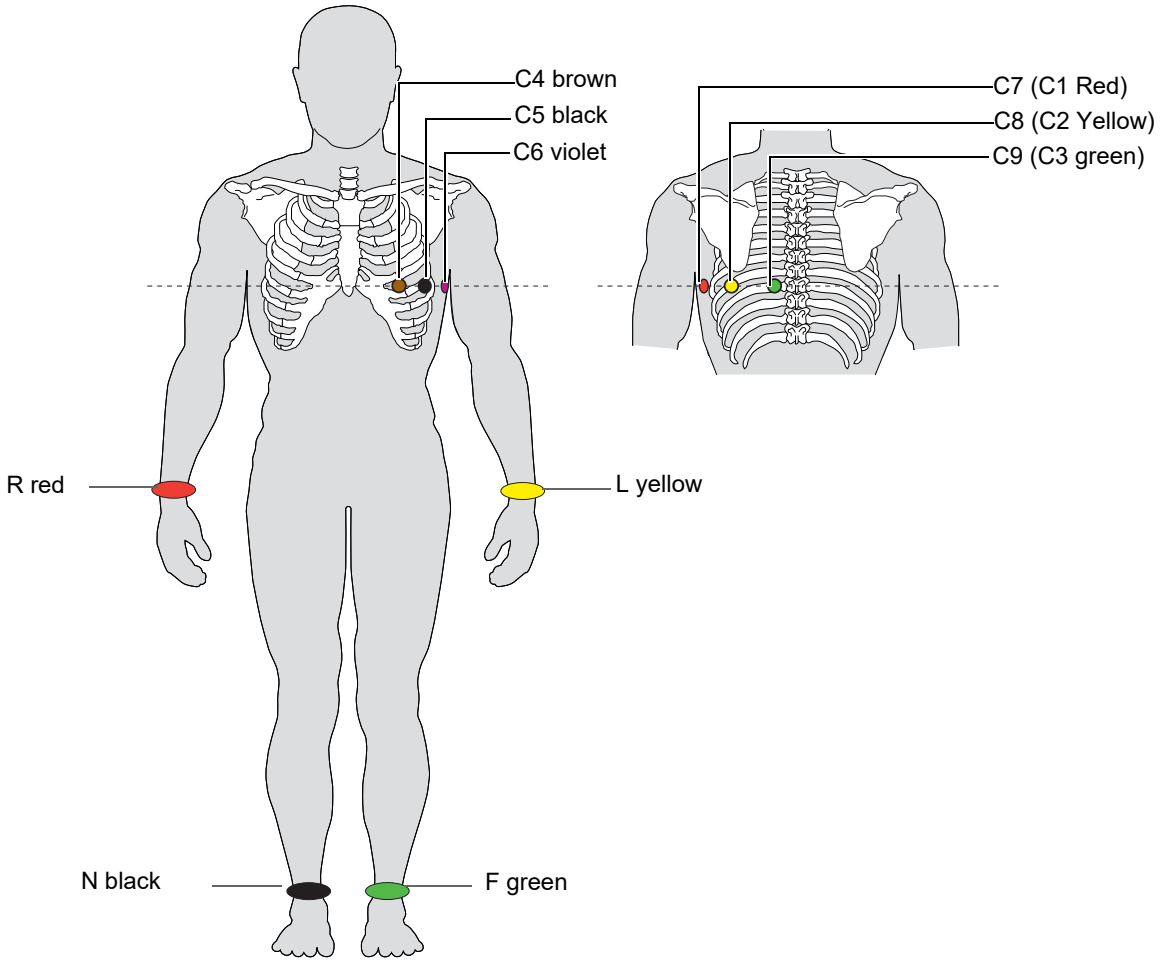
4.6 Left posterior C7-C9

If an acute coronary occlusion is strongly suspected, it is recommended to also register posterior chest wall leads (C7–C9)



IEC label	AHA label		Action Alignment
C7 (C1 white /red)	V7 (V1 brown / red)	→	Left posterior axillary line at the level of C4.
C8 (C2 white /yellow)	V8 (V2 brown / yellow)	→	Left of the mid-scapular line at the level of C4.
C9 (C3 white /green)	V9 (V3 brown / green)	→	Left paravertebral line at the level of C4.
C4 white / brown	V4 brown / blue	→	Fifth intercostal space on the mid-clavicular line.
C5 white / black	V5 brown / orange	→	Anterior axillary line on the same horizontal level as C4.
C6 white /violet	V6 brown / violet	→	Mid-axillary line on the same horizontal level as C4.
L yellow	LA Black	→	Left arm
R red	RA White	→	Right arm
F green	LL Red	→	Left foot
N black	RL Green	→	Right foot

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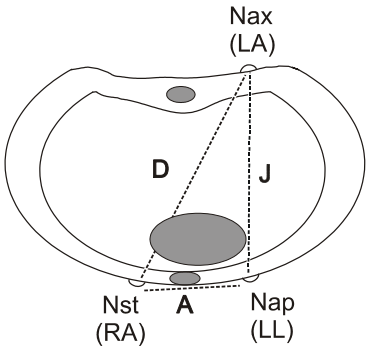
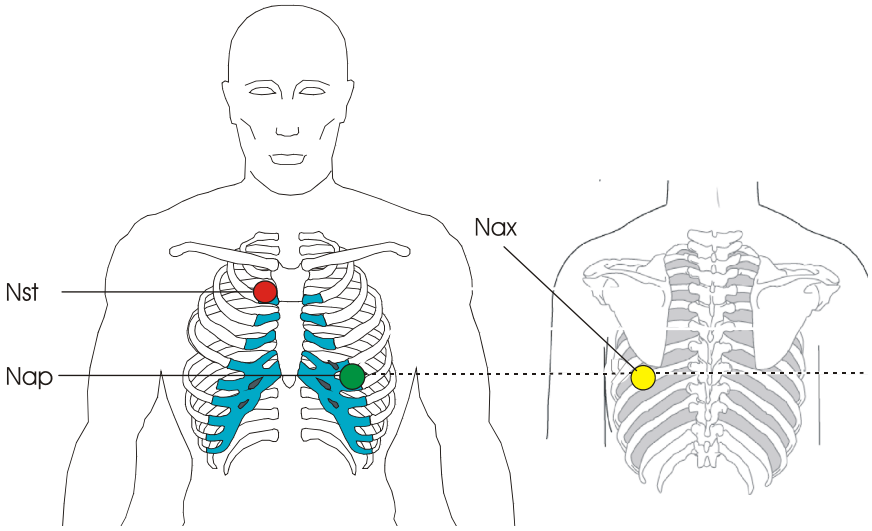
4.7 Nehb leads



The Nehb leads are bipolar chest leads. They are of special interest for the diagnosis of changes in the posterior ventricle wall. Three leads are arranged in the form of a triangle, also called the “small cardiac triangle”. Nehb dorsal (D) is measured between the electrode positions Nax and Nst; Nehb anterior (A) between Nap and Nst, and Nehb inferior (J) between Nap and Nax.



Place the electrodes as follows

IEC label	AHA label		Electrode placement
C1 white / red	V1 brown / red	➜	**Nst**: 2nd rib at the right sternal border.
C2 white / yellow	V2 brown / yellow	➜	**Nax**: left posterior axillary line (on the back), directly opposite Nap.
C4 white / brown	V4 brown / blue	➜	**Nap**: 5th intercostal space, midclavicular line (cardiac apex).

Place all other electrodes in the normal positions (page 33).

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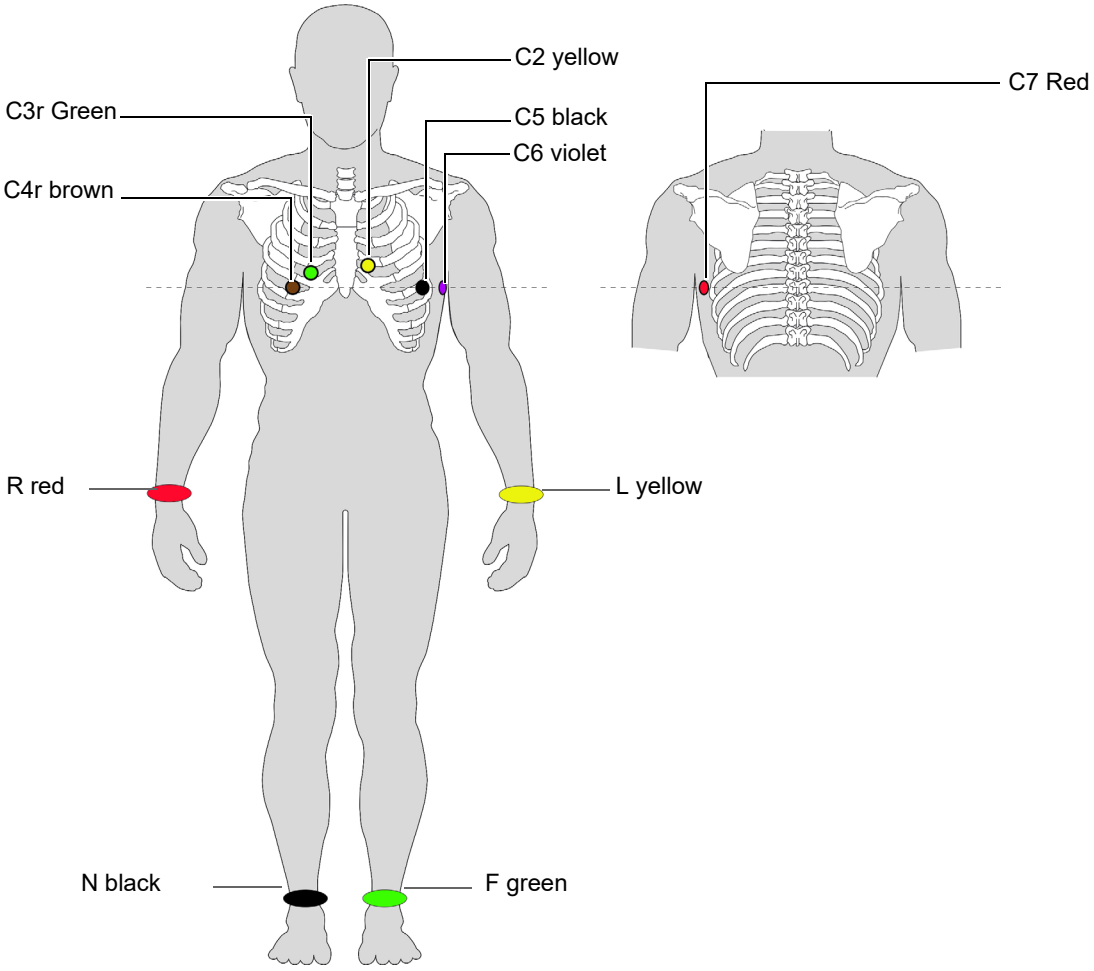
4.8 Paediatric



IEC label	AHA label		Electrode placement
C4r white / brown	V4 brown / blue	→	Fifth intercostal space on the mid-clavicular line.
C3r white / green	V3 brown / green	→	Above C4r, fourth intercostal space.
C2 white / yellow	V6 brown / violet	→	Fourth intercostal space at the left sternal border
C5 white / black	V5 brown / orange	→	Anterior axillary line on the same horizontal level as C4r.
C6 white/violet	V6 brown / violet	→	Mid-axillary line on the same horizontal level as C4r.
C7 (C1 white /red)	V7 (V1 brown / red)	→	Left posterior axillary line at the level of C4r.
L yellow	LA Black	→	Left arm
R red	RA White	→	Right arm
F green	LL Red	→	Left foot
N black	RL Green	→	Right foot

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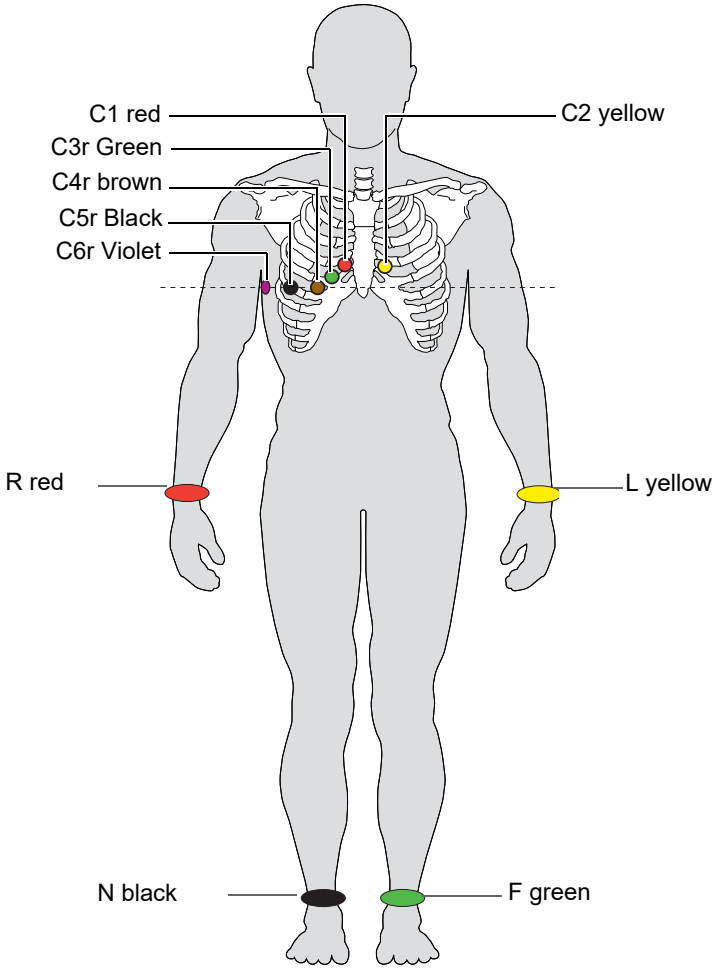
4.9 Right precordials (C3r-C6r)

Since the treatment of an infarction might depend on the influence of the right ventricle, it is suggested to perform additional recordings with right precordial leads in the case of an acute infarction of the right ventricle's inferior wall (Circulation 2007).



IEC label	AHA label		Action Alignment
C1 white / red	V1 brown / red	→	Fourth intercostal space at the right sternal border.
C2 white / yellow	V2 brown / yellow	→	Fourth intercostal space at the left sternal border.
C3r white / green	V3 brown / green	→	Designated point halfway between C1 and C4r.
C4r white / brown	V4 brown / blue	→	Fifth intercostal space on the mid-clavicular line.
C5r white / black	V5 brown / orange	→	Anterior axillary line on the same horizontal level as C4r.
C6r white / violet	V6 brown / violet	→	Mid-axillary line on the same horizontal level as C4r.
L yellow	LA Black	→	Left arm
R red	RA White	→	Right arm
F green	LL Red	→	Left foot
N black	RL Green	→	Right foot

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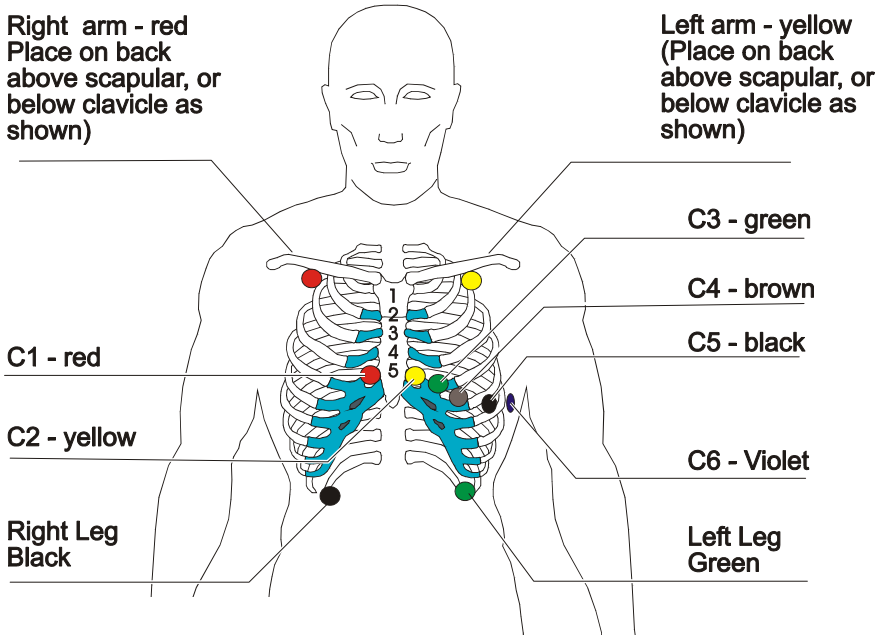
4.10 Mason-Likar modified (exercise ECG)



AHA label	IEC label	Electrode Placement
V1 red	C1 red	➜ Fourth intercostal space at the right sternal border
V2 yellow	C2 yellow	➜ Fourth intercostal space at the left sternal border
V3 green	C3 green	➜ Midway between C4 and C2
V4 blue	C4 brown	➜ Mid-clavicular line in the fifth intercostal space
V5 orange	C5 black	➜ Anterior axillary line on the same horizontal level as C4
V6 violet	C6 violet	➜ Mid-axillary line on the same horizontal level as C4 and C5
LA black	L yellow	➜ Slightly below the left clavicle
RA white	R red	➜ Slightly below the right clavicle
LL red	F green	➜ Lower edge of the rib cage, or at the level of the umbilicus
RL green	N black	at the left and right mid-clavicular lines.

For exercise testing, place electrodes C1 to C6 in the same positions as for the standard resting ECG detailed above, and place the RA, LA, LL and N electrodes as follows:

- LL on the left torso at the bottom of the rib cage
- RL (N) on right torso at the bottom of the rib cage
- LA and RR, place either on the back above the scapula or on the front just below the clavicle

i The ECG recorded with the torso placement of the limb lead electrodes may differ from that recorded with the electrodes on the limbs. Affected characteristics are the Q-waves and the frontal axes, whereas ST levels are unlikely to change.

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4.11 Skin/Electrode Resistance

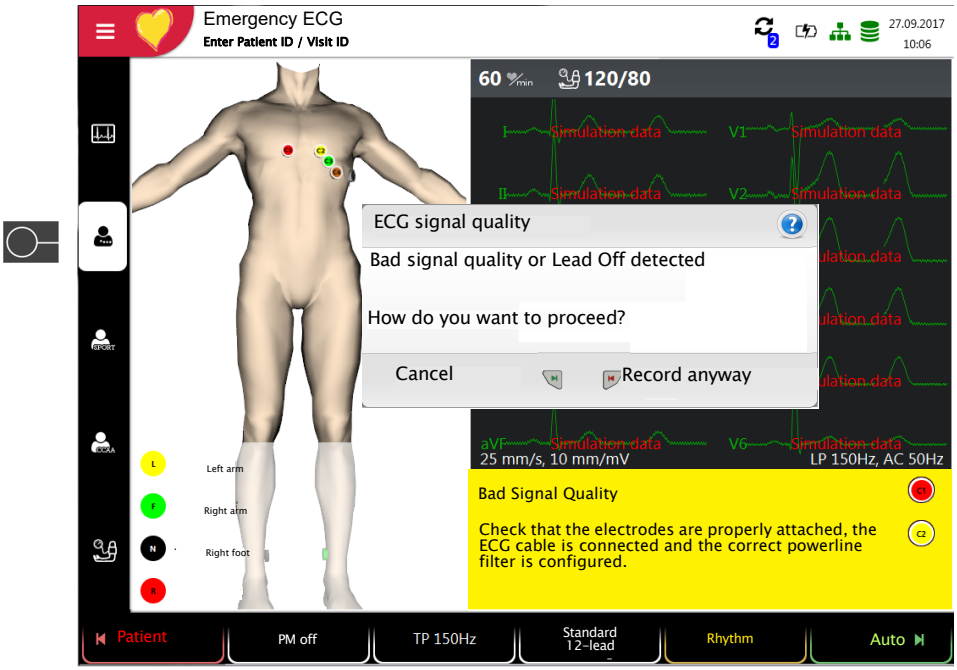
4.11.1 Electrode and patient cable check

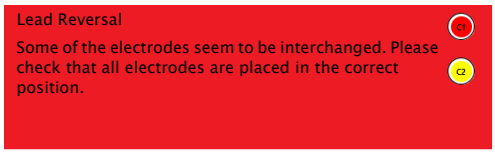
The electrode check is part of step 2 before the start of an ECG recording. The following is checked and displayed:

- Excessive noise (signal noise too high)
  - due to poor electrode contact
  - due to mains interferences (mains filter not activated)
- Electrodes reversed
- Electrodes have come off

The electrode status is shown in the bottom right information field of the screen. If an electrode is displayed red, the suspected cause is displayed. Reapply the electrode.

- If F (LL) or N is not connected or has come off, the electrode resistance cannot be measured and all leads are marked red.





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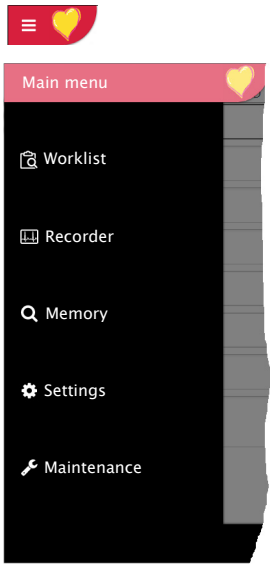
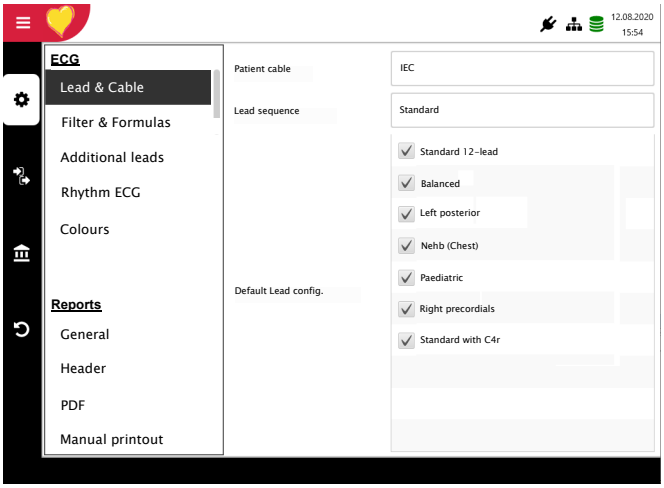
4.12 Lead sequence/lead view

4.12.1 Setting Standard or Cabrera lead sequence



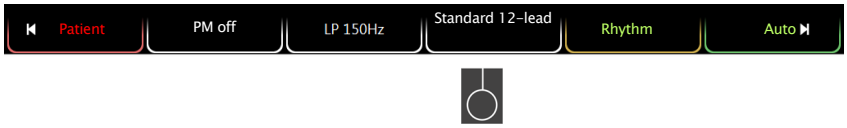
➜ The lead sequence is defined in the settings.
(**Menu > Settings > ECG > Leads & cable**).

➜ In the Lead menu, select between Standard and Cabrera.



4.12.2 Select the lead view (Standard or other settings)

The lead display can be set directly in the electrode screen using the lead selection key. Only lead configurations activated in the **Menu > Settings > ECG > Leads & cable > Default lead configuration** are available for selection.



The lead labels on the display and on printouts change accordingly.

Important

Automatic interpretation is only possible when **Standard 12 lead** is set.

For ETM Sport recordings, lead configuration Standard 12 lead is selected automatically.

For CCAA recordings, lead configuration Standard with C4r is selected automatically.

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5 Resting ECG

WARNING

▲ After heavy artefacts or lead off, the displayed heart rate may not be reliable.

CAUTION

▲ The safety notes at the beginning of this user guide must be read and fully understood before taking an ECG recording.

▲ The CARDIOVIT AT-102 G2 device is CF classified ⊣♥⊢. The patient connection is fully isolated. During the ECG recording, ensure that neither the patient nor the leading parts of the patient connection nor the electrodes (including the neutral electrode) come in contact with other persons or conductive objects, even when these are earthed.

▲ Do not operate the unit if the earth connection is suspect or if the mains lead is damaged or suspected of being damaged.

▲ If an external electronic device is connected to the CARDIOVIT AT-102 G2, use the potential equalisation stud for earth protection.

If another format than the default format is set for the automatic printout, the printout can differ from the format displayed on the screen.

The ECG display can be modified with regard to lead sequence (Standard or Cabrera), lead configuration, amplitude, speed and filter. For the preview, the following parameters can be freely programmed (before start of the recording):

- Amplitude
- Speed
- Filter
- Lead configuration

Saved recordings can be displayed and printed in another format at any time.

For further information on how to define the format, see page 80.

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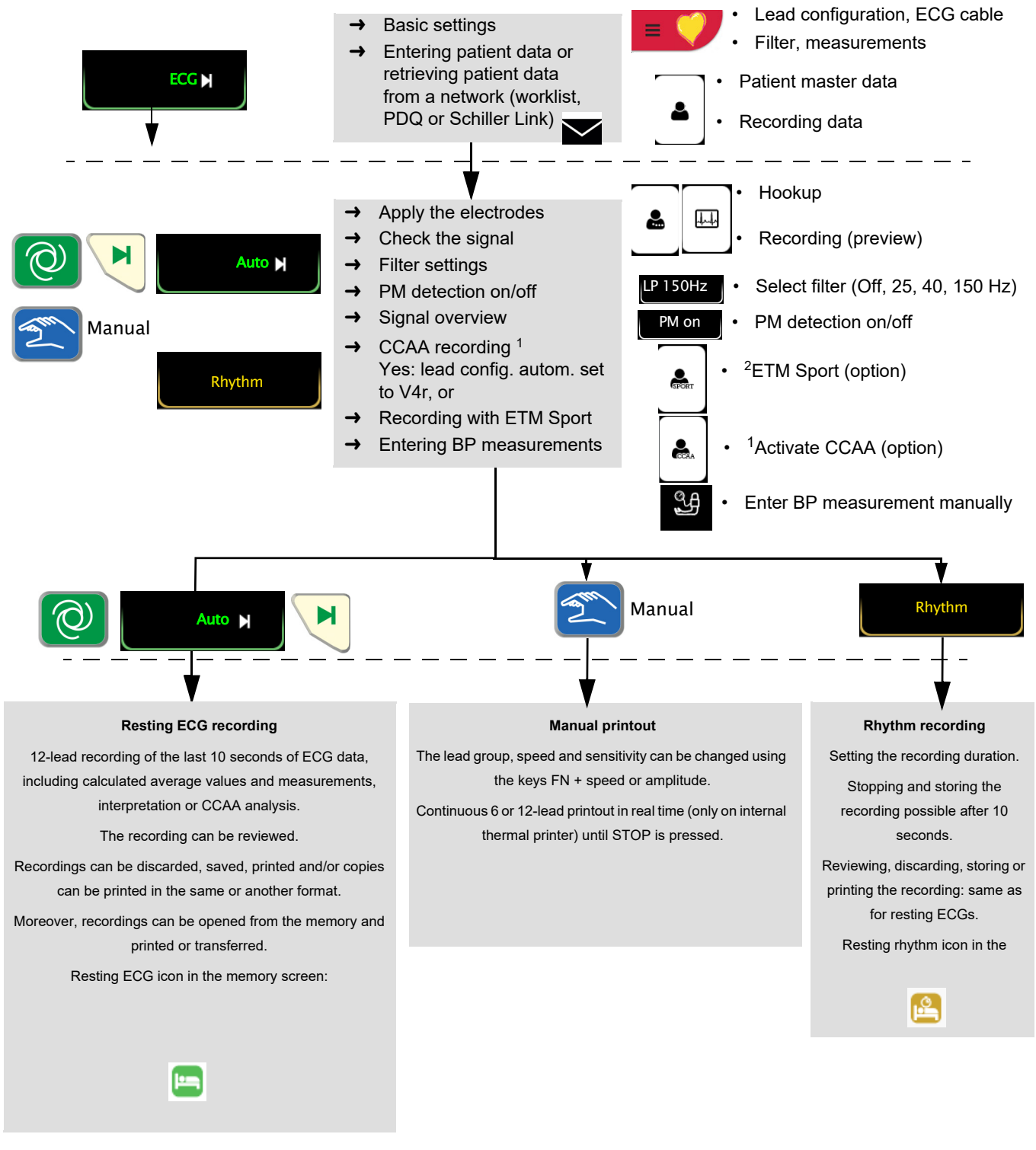
5.1 Resting ECG - Procedural Flow Diagram



1. The dialogue CCAA is only displayed if this option is installed (section 6.1.2 Starting the CCAA analysis, page 55).
2. The dialogue ETM Sport is only displayed if the Interpretation option is installed.

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5.1.1 Printing, saving and transferring automatically

Menu > Settings > General > **Workflow**

Activate **Print after acquisition**, **Transmit after acquisition** and **Delete after transmission** to automatically print and transmit a saved recording or to delete recordings after transmission.

- The transmission settings are detailed in the section Settings (see page 88).
- Further ECG settings are described later in this section (see page 78).
- Printing and transfer from the memory is described in the section Memory (see page 64).
- The settings are saved automatically. The settings can be exported (see page 77).

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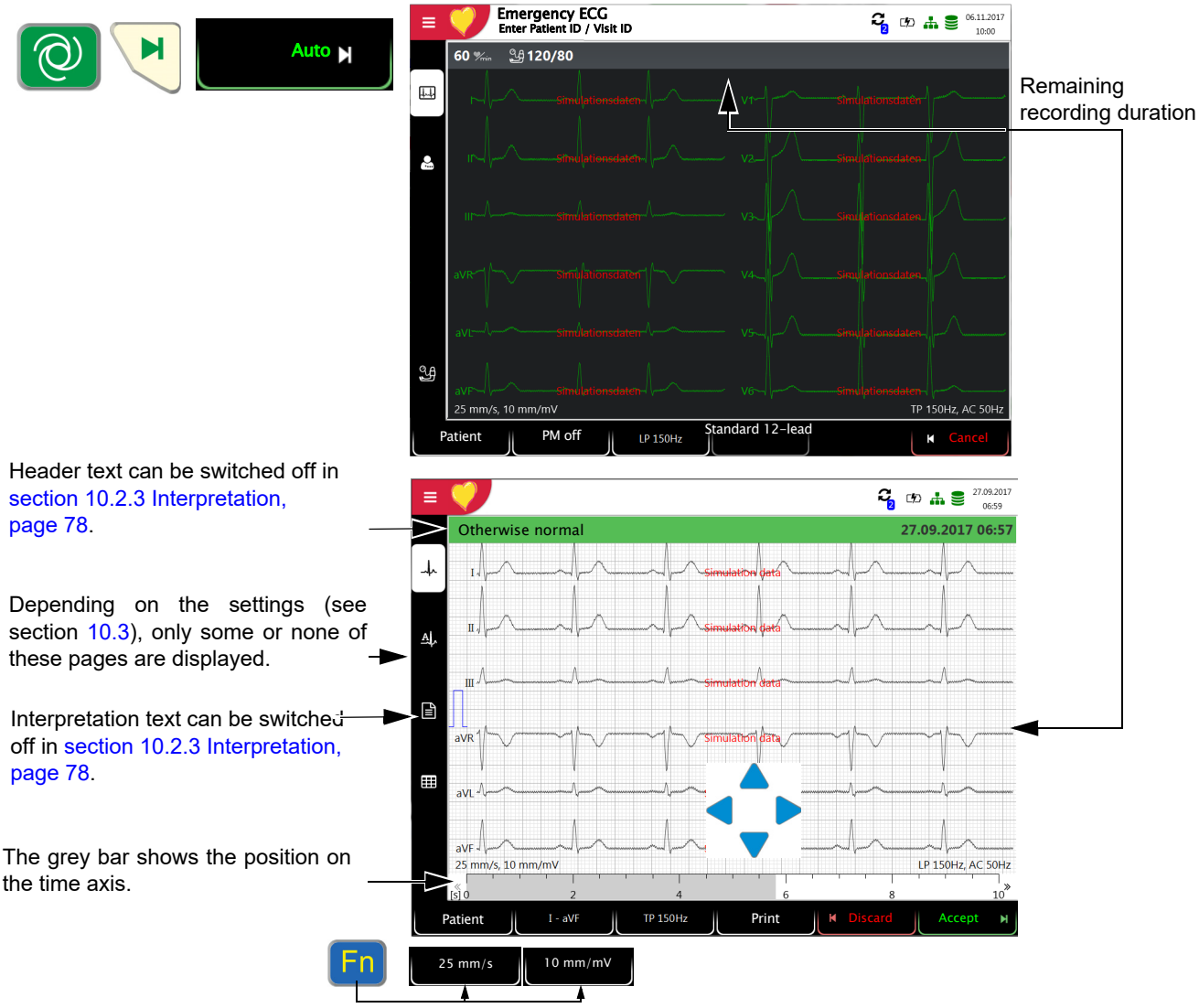
5.2 Automatic resting ECG recording

To take an automatic ECG recording, press the **Auto** key. After approx. 10 seconds, the recording is analysed and the result displayed. The recording can be checked and saved and further printouts can be obtained in different formats. Depending on the setting, the recording is deleted automatically as soon as it has been transmitted, or it remains stored in the memory.



Check the recording by moving the time axis (grey bar) and the keys (to scroll through channels).

→ Select filter (Off, 25, 40, 150 Hz) LP 150Hz

→ **Accept** the recording (recording is saved)

→ Print the recording Print (see section 10.3.5 Resting ECG, page 82)

→ Press **Discard** to exit the preview without storing the ECG.

→ In the **Memory** menu, select a recording for review and printout.

→ Open the menu **Memory** to delete a recording from memory.

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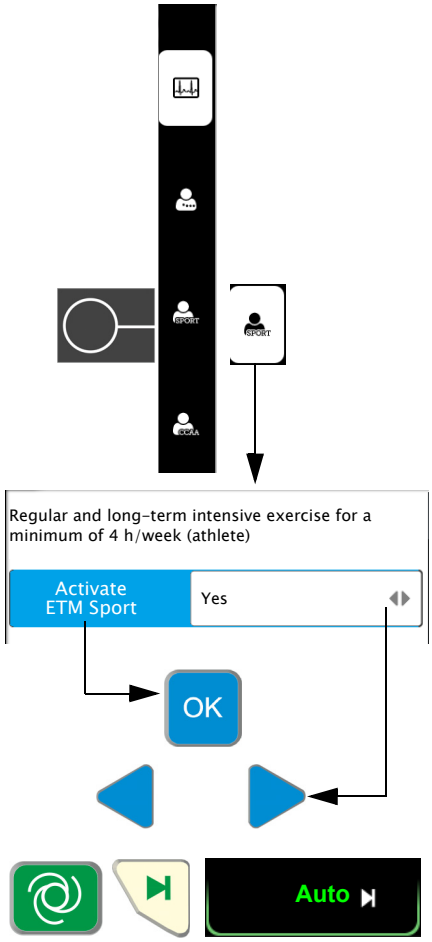
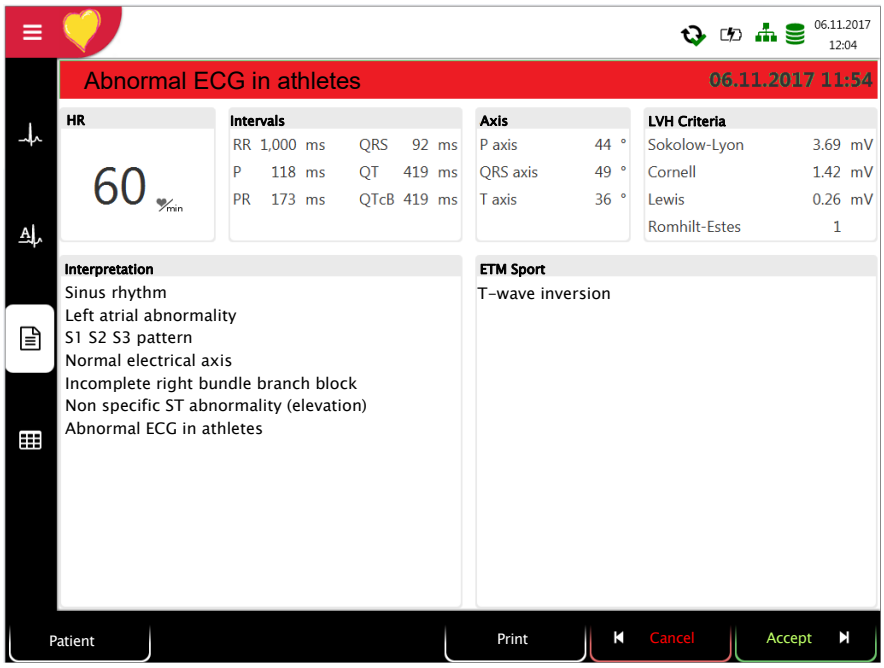
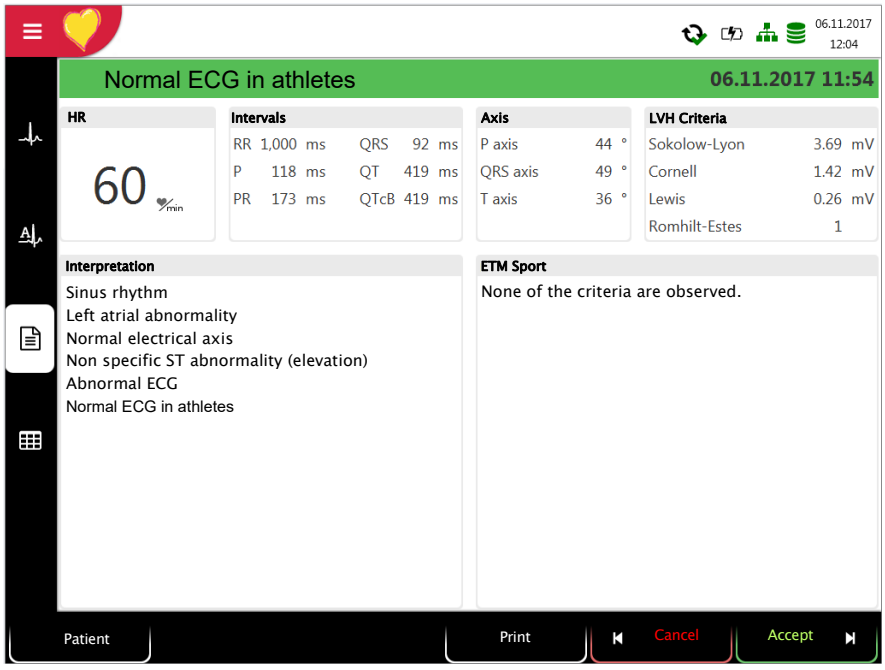
5.2.1 ETM Sport

When ETM Sport interpretation is selected before the start of a recording, the additional criteria for an athlete's ECG are analysed and displayed.



Example of an ECG rated normal for athletes, but rated abnormal when the standard interpretation is used.





ETM Sport analyses abnormal resting ECGs in athletes based on the Seattle Criteria (International consensus standards for ECG interpretation in athletes, Drezner JA, et al. Br J Sports Med 2017;1:l-28. doi:10.1136/bjsports-2016-09733).

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5.2.2 Automatic printout

The printout gives the following:

- Heart rate
- Patient name and ID
- Date and time
- Speed
- Sensitivity
- Filter
- Device ID
- Serial number
- Software version

And any combination of the following (for printout settings, see section 10.3 Menu Reports, page 80):

Patient data
- All patient data according to section 3.6 Patient / recording data, page 26

Result
- Interpretation (can be switched off in **Menu > Settings > ECG > Interpretation**, see section 10.2.3 Interpretation, page 78).
- Intervals & axis

Measurements
- Detailed measurement table

Rhythm
- ECG recording of all 12 channels in either Standard or Cabrera format (according to selection)

Averages
- Averaged cycles with markings

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5.3 Manual Rhythm Printout

- Use this function to print a real-time ECG. The print parameters such as lead sequence, print speed and sensitivity can be changed by the user during the printout.
- The real-time ECG is not saved. The chosen settings only apply to the printout.

5.3.1 Starting manual printout

1. Manual printout can be started in the Recording view.
2. To set the speed, amplitude and lead for the printout, press the key **FN** to display the additional function keys. The print setting for speed, amplitude and leads can be done before or during the printout.
3. To start a manual real-time printout, press the **Manual** key.

The factory printout settings are **25 mm/s** and **10 mm/mV.** These settings are done in the menu section 10.3.4 Manual printout, page 81.

Display speed and amplitude.

Printout speed, amplitude and lead.

Select lead sequence

→ To change the lead sequence for the printout (Standard I, II, III, aVR, aVL, aVF), press the right key **Leads I-V6** to select additional lad sequences.

The Standard and Cabrera lead sequences are as follows:

Lead sequence	Lead group 1	Lead group 2
Standard	I, II, III, aVR, aVL, aVF	V1, V2, V3, V4, V5, V6
Cabrera	aVL, I, -aVR, II, aVF, III	V1, V2, V3, V4, V5, V6

Select speed

→ To change the printout speed (12.5, **25** and 50 mm/s), press the key **Speed**.

Select sensitivity

→ To change the printout sensitivity (5, **10** and 20 mm/mV), press the key **Amplitude**.

Stopping the printout

→ To stop the manual recording (printout), press the **Stop** key.

The printout provides the following information:

- Selected leads
- Patient name and ID
- Date and time
- Speed, sensitivity, filter, device ID, serial number device, software version.

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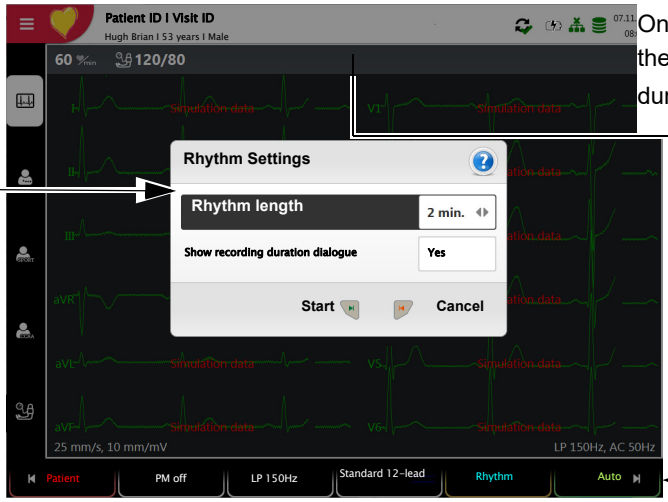
5.4 Rhythm recording

Press **Rhythm** to perform a rhythm recording. Select the recording duration in the dialogue that pops up. If a recording is cancelled after more than 10 seconds, it can still be stored. The recording can be checked and saved and further printouts can be obtained in different formats. Depending on the setting, the recording is deleted automatically as soon as it has been transmitted, or it remains stored in the memory.

The dialogue "Rhythm settings" can be deactivated in the Settings menu or directly in the dialogue. To reactivate the dialogue, tick the option in the Rhythm ECG menu, see chapter 10.2.5.



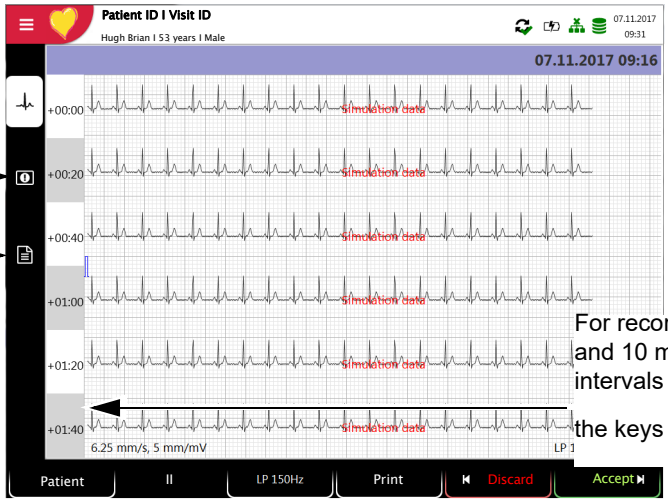
Once Start is pressed, the remaining recording duration is displayed 1:53

Cancel

After 10 s of recording, the icon Cancel changes to Stop. Press Stop to end and store the recording.

Stop

During recording, events can be entered in the event dialogue.



Graphics showing the heart rate trend

Entering the interpretation

Adjustment of Speed and Amplitude

For recordings lasting between 3 and 10 minutes, additional time intervals can be displayed using the keys

Check the recording using the keys **"FN & Lead"** (select leads) and the keys (select time interval).

- ➜ Key Select filter (Off, 25, 40, 150 Hz)
- ➜ Pacemaker detection on/off
- ➜ **Accept** the recording (recording is saved)
- ➜ **Print** the recording (see section 10.3.6 Resting rhythm, page 83)
- ➜ Press **Discard** to exit the preview without storing the ECG.
- ➜ Select a recording for review and printout via the **Memory** menu .
- ➜ Open the menu **Memory** to delete a recording from memory.

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5.5 Changing the ECG display

The ECG preview is optimised for one or two columns with 6 leads each, or for 3 columns with 4 leads each. The amplitude and speed can be set to 5, **10** or 20 mm/mV, and to 12,5, **25** or 50 mm/s. The ECG preview for electrode hook-up cannot be changed.

5.5.1 Display

Leads

→ The following presentation can be selected in **Menu > Settings > ECG > Leads & cable**:

The Standard and Cabrera lead sequences are as follows:

Lead sequence	Lead group 1	Lead group 2
Standard	I, II, III, aVR, aVL, aVF	V1, V2, V3, V4, V5, V6
Cabrera	aVL, I, -aVR, II, aVF, III	V1, V2, V3, V4, V5, V6

The lead group is selected in the ECG settings (see page 78).

The factory setting for the Default lead configuration is Standard 12 lead. The following settings can be made:

- Standard 12-lead
- Standard C4r
- Balanced
- Left Posterior
- Nebh (chest)
- Paediatric
- Right Precordials

Additional settings for the preview and review

See section 10.4 Menu Layouts, page 84

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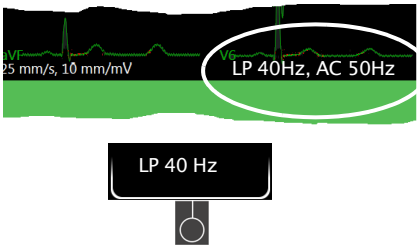
5.5.2 Myogram filter

The myogram filter suppresses disturbances caused by strong muscle tremor. In **Menu > Settings > ECG > Filters & Formulas > Resting display filter** the default setting of the **myogram filter** is defined.



In the information field, **Off**, **LP 25 Hz, LP 40 Hz** or **LP 150 Hz** is displayed and can be changed at any time using the function key.

- The **standard** cut-off frequency is user-defined at LP 25 Hz, LP 40 Hz, LP **150 Hz** or 250 Hz (Filter Off) (see chapter 10.2, page 78).
- The ECG is stored unfiltered. It is therefore possible to print the stored ECG either with or without applying the myogram filter.

⚠ CAUTION

▲ When using the 25 or 40 Hz filter, the displayed or printed ECG does not always meet the requirements of a diagnostic ECG.

5.5.3 Other filters

The following additional filters are available:

Baseline filter

The cut-off frequency for the baseline filter is based on IEC 60601-2-25 and cannot be changed.

Notch filter

This filter prevents recording interference due to mains frequency oscillation. If the filter is active, "AC 50 Hz" or "AC 60 Hz" is displayed.

- The notch filter can be changed in the ECG settings > Filter & Formulas (see chapter 10.2.2, page 78)

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6 Culprit Coronary Artery Algorithm

6.1 Introduction

The Culprit Coronary Artery Algorithm developed by Professor Hein Wellens is designed to determine the size of the cardiac area at risk by localising the occlusion site in the coronary artery and to provide clinical data to shorten the time interval between the onset of chest pain and restoration of myocardial blood flow, as well as to ensure that the patient is assigned to the most suitable hospital. The algorithm uses the ST segment deviation of 12 ECG leads to indicate the site of occlusion in the culprit artery.

The closer the occlusion site to the origin of the coronary artery, the larger the size of the area at risk. The algorithm indicates the location of the occlusion site and issues a recommendation based on the ECG data and patient history. The recommendation is based on the following:

- **Prior Bypass/ Stent.** This data is entered before the ECG recording is taken (see section 5.1 Resting ECG - Procedural Flow Diagram, page 44). If the patient has had a prior bypass or stent, the ECG is not analysed further and the advice **Go to PCI centre** (**P**ercutaneous **C**oronary **I**ntervention) is given.
- **ST Score**. The sum of the absolute ST deviations in mm in 12 leads (excluding V4r). That is the total ST deviation (mm) of all leads (I, II, III, aVR, aVL, aVF, and all leads V1 to V6).
- **Occlusion Site.** The calculated occlusion site.

The site of occlusion is determined by the following:

1. The number of leads indicating a occlusion are counted (= sum)
2. The occlusion site with the highest number is chosen as the occluded location.
3. If two locations have an equal value, then the more critical occlusion site (highest in the artery) is selected.

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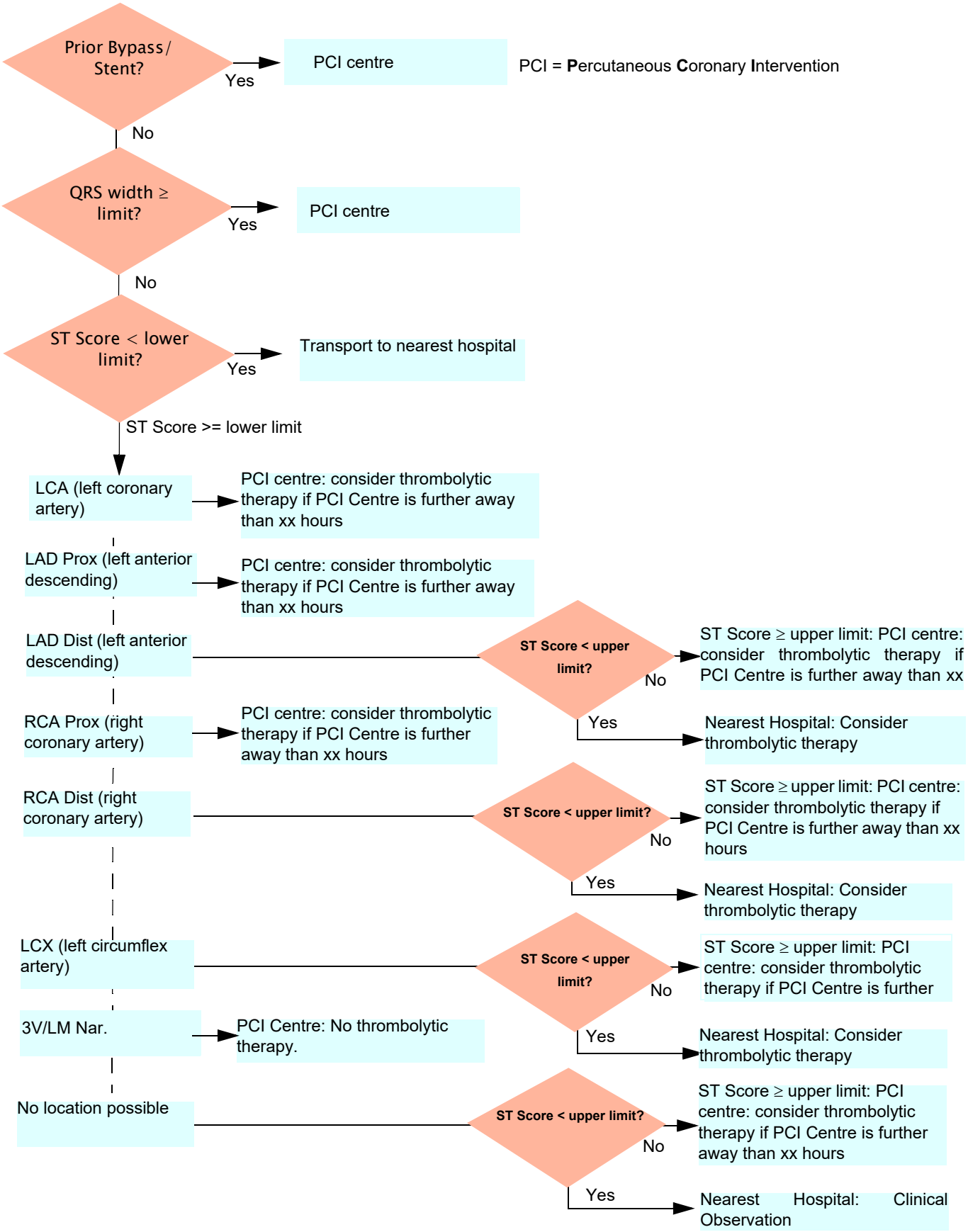
6.1.1 Culprit Artery Algorithm Decision Overview



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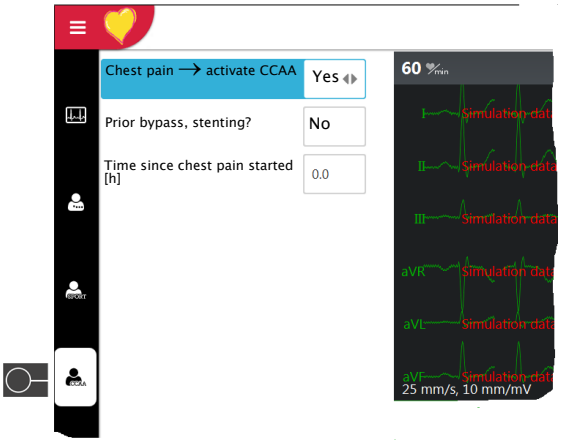
6.1.2 Starting the CCAA analysis

When CCAA analysis is set, the following applies:

- The lead setting is automatically set to Right Precordial (V4r). Ensure that the C4 electrode is placed in the C4r (precordial) position.

Procedure

1. To take an automatic ECG recording including CCAA analysis, press **CCAA**.
2. Activate the CCAA analysis: parameter Chest pain “Yes”.



3. Enter the additional parameters Bypass/stenting and time since chest pain started.
4. Check the electrode placement (V4r).
5. Press the key "Auto" to start the ECG recording.

The data is shown in the print preview. The recording can be checked, accepted and further printouts obtained in different formats.

All other settings and features (saving, printing etc.) are the same as described in section 5.2 Automatic resting ECG recording, page 46.

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6.1.3 CCAA information on print preview/printout

Information on LAD (left anterior descending)

▲ For men under the age of 40 showing early repolarisation in the anterior leads, false LAD diagnoses may occur.

The following CCAA information is given on the print preview/printout:

Manual entry before the start of the recording:

– Previous bypass or stenting (Yes/No)
– Time since chest pain started, in hours

Measured values:

- QRS width (averaged) [ms]
- ST score (averaged) [mm]

Assessed area of an occlusion:

– LCA (left coronary artery)
– LAD Prox (left anterior descending)
– LAD Dist (left anterior descending)
– RCA Prox (right coronary artery)
– RCA Dist (right coronary artery)
– LCX (left circumflex artery)
– 3V/LM narrowing (all three vessels or left main is affected)

Advice:

Recommendations based on the ST score and additional information:

- Transport to PCI centre
- Transport to nearest hospital
- Consider thrombolytic therapy if PCI centre is further away than 1.5 hours.
- Consider thrombolytic therapy
- No thrombolytic therapy

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7 Exercise ECG

7.1 Safety notes

WARNING

- The CARDIOVIT AT-102 G2 is CF classified. The patient connection is fully isolated. Always ensure however, that during the recording neither the patient nor the conducting parts of the patient connector nor the electrodes come into contact with other persons or conduction objects (even if these are earthed).
- Do not use the unit or the ergo device if the earth connection is suspect or if the mains cable is damaged in any way.
- Before starting an exercise ECG, make sure the ergometer's user guide is read and understood. The instructions given in this user guide do not override those for the ergometer.
- Ensure that the resting ECG is normal and that the patient is physically fit enough to carry out an exercise ECG.
- Ensure a charged defibrillator is to hand when carrying out an exercise test.

- To avoid possible interference from the ergometer when carrying out an exercise test, it is recommended that both the CARDIOVIT AT-102 G2 and the ergometer are connected to the same common ground.
- The potential equalisation connector is situated on the rear of the unit. A yellow/green ground cable is supplied as an option (Article number 2. 310 005).

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7.2 General

The CARDIOVIT AT-102 G2 features one interface COM1 (RS-232) to control digital treadmills and bikes; moreover, it features the following functions:

- Ten pre-programmed treadmill protocols
- Seven pre-programmed bike protocols
- Manually advancing to the next step at any time
- Manually pausing the current step at any time
- Manually entering the BP in a dialogue.
- User-defined ST measurement point
- Printout at the end of each step:
  - Step
  - Load (bike protocol)
  - Speed and slope (treadmill protocol)
  - Patient data
  - Blood pressure
  - ECG segments of all leads
- Printout of the last ten seconds (manual ECG key)
- Final report with the most important data in simple graphs and tables, a tabular overview on step duration, load/speed and slope, BP, HR as well as space for comments.

During data acquisition, 6 or 12 leads can be displayed. However, the number of displayed leads cannot be changed directly in the exercise view and needs to be defined before the exercise mode is defined (see page 86).

Amplitude and speed for display can be changed during the test using the key 

and the function keys **mm/s** and **mm/mV**.

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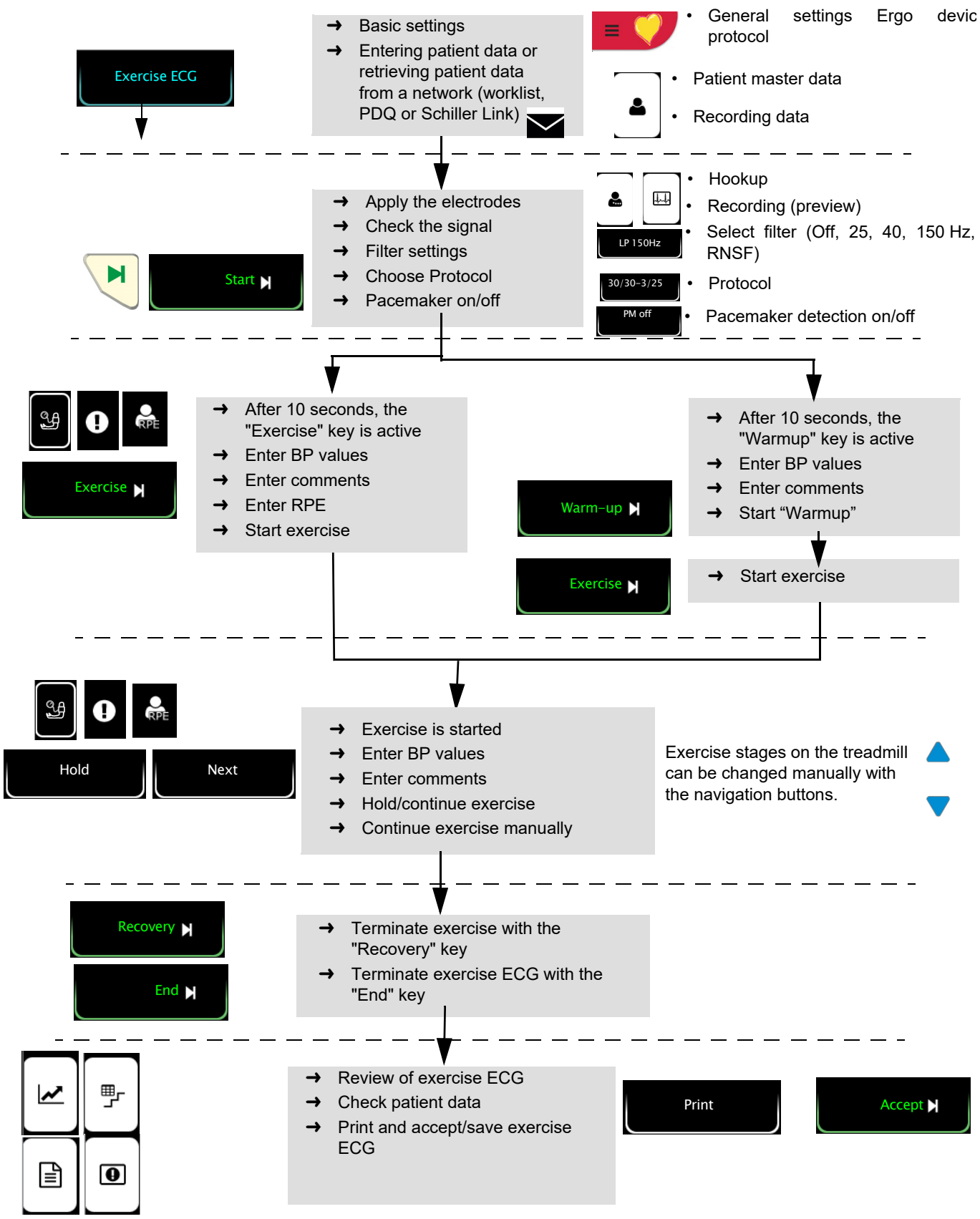
7.3 Exercise Flow Diagram



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7.4 Recording of an exercise ECG

- Make sure the ergometer is connected to the CARDIOVIT AT-102 G2 (COM1) and ready for use (see ergometer user guide).
- The ergometer/treadmill, the BP recorder, protocol settings as well as general settings for the exercise ECG are done in the **Menu > exercise ECG** (Ergo device, ST lead, J point etc., see page 95) and **Menu > Reports > Exercise ECG** (printout see page 83).
- If the ergometer/treadmill model "Not supported" is used, step changes are displayed in the middle of the display in Watt or km/h and the blood pressure symbol is blinking to remind the user to manually measure and enter the blood pressure values.

1. Connect the electrodes (see page 40).

2. Enter the **patient data** (see page 26). If gender, DOB, weight and/or height are missing, a message is displayed.
3. Press the function key **Exercise ECG**.
4. Check the ECG signal.

5. Use the Fn key and the functions keys to set the speed and amplitude.
6. Use the function key to select the desired **protocol**.
7. Let the patient know that the test will start and then start the exercise test.
8. Use the function key **Start**: the test is started after 10 seconds (with the warming-up phase or the first exercise step).

9. The test begins with the initial load defined (bicycle), or speed set (treadmill), in the protocol selected. The exercise view changes to "Warm-up" or “Exercise”, and the time since exercise start is displayed. The test proceeds according to the selected protocol.

Warm-up and recovery phase

The duration of these phases is set by the user.

Finishing the test

10. Press the **RECOVERY** function key.
11. If activated, a step printout is generated every two or three minutes (depending on the selected protocol).

12. Press the **END** function key.

13. An overview on the entire test is displayed.
14. Press **Accept** to save the test.
15. The test can be opened from the memory and printed, transmitted or exported as a PDF to a USB stick at any time.

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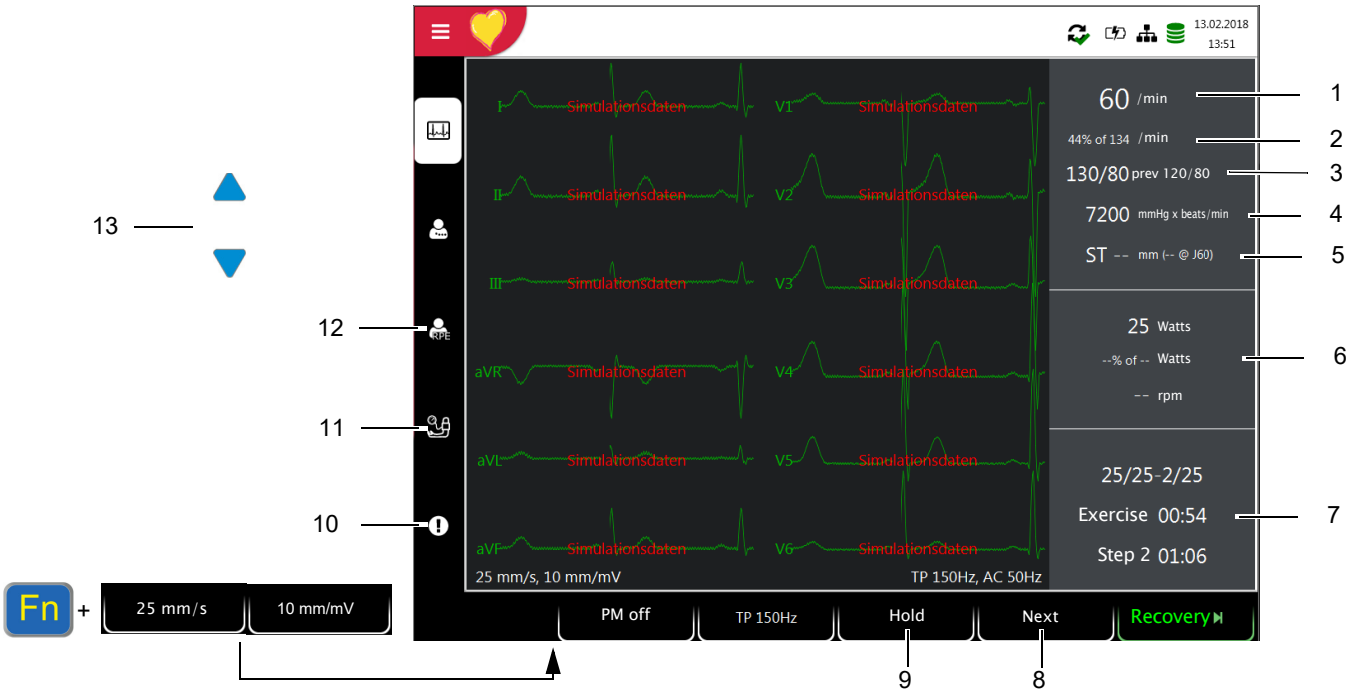
7.5 During the test



(1) Heart rate — Measured heart rate

(2) Heart rate in % — Current heart rate in % of max. target HR (the target HR depends on the age, gender and target HR calculation according to WHO or AHA).

(3) Blood pressure (mmHg) — Display of the current measured value for the load stage displayed on the screen and the value measured previously.

(4) Double product (mmHg x bpm) — Display of the double product (systolic BP x heart rate (mmHg x bpm))

(5) ST measurement — The current negative ST amplitude is displayed. The measurement interval (after the J point) is user-defined (see section 10.8.1 General, page 95).

(6) Current exercise stage — In the exercise information field, the current load, load in % of max. load , bike rpm and (for treadmill) current METs, % max. METs, km/h and slope in % are displayed.

(7) Protocol — In the protocol information field, the protocol, the current phase/step, remaining time or elapsed time are displayed (see section 10.8.1 General, page 95)

(8) Next — At any time during the test, advancement to the next stage of the protocol can be initiated manually by pressing the function key **"Next"**.

(9) Hold — Use the function key **Hold** to remain longer on a stage.

(10) Entering events — The event dialogue is opened

(11) Enter blood pressure — The BP dialogue is opened (this symbol blinks at the beginning of each step)

(12) Enter RPE information — The dialogue to enter the exertion perceived by the patient (1-20) is opened.

(13) Manually changing steps — Exercise stages (6) can be changed manually with the navigation buttons.

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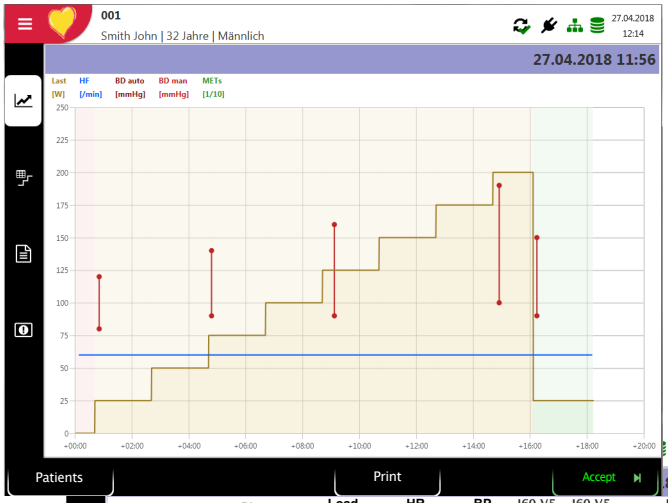
7.5.1 End of test results

The following information is displayed after completion of the test:

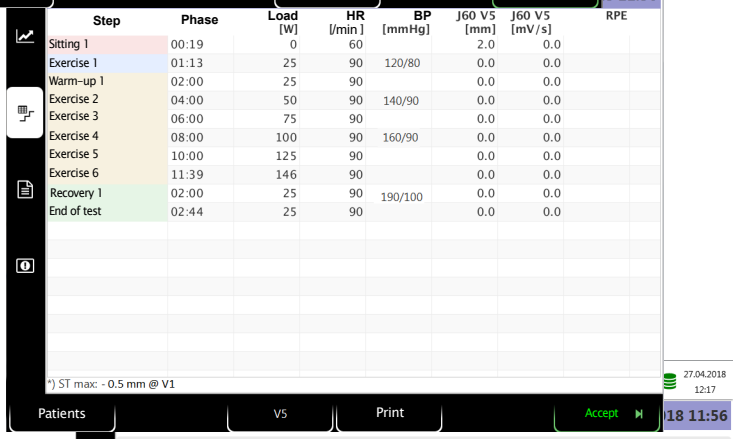
Trend view with graphic presentation of:

- Load stages
- Blood pressure Auto/Manual
- Heart rate
- METs

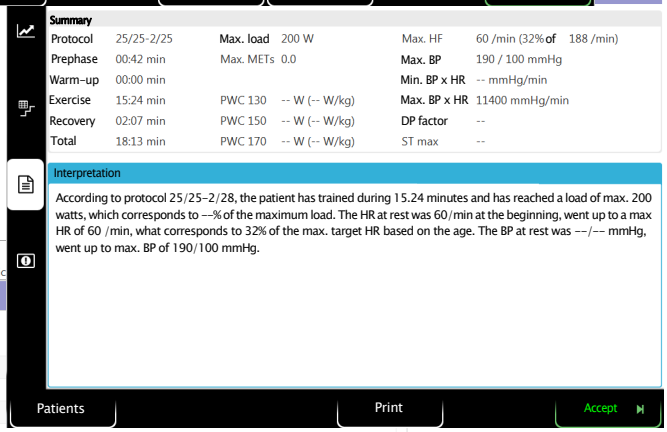


Display of the following data in table format:

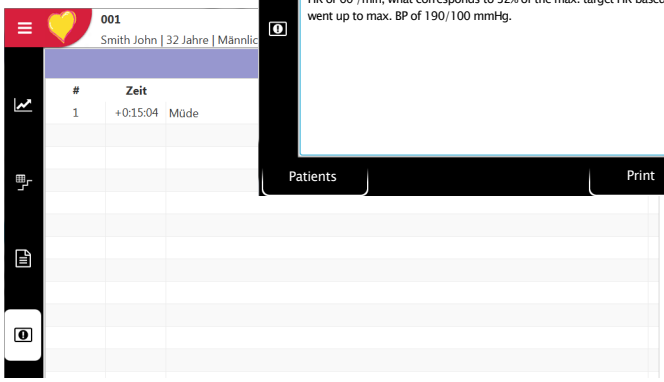
- Load stages with phase and load
- Heart rate
- Blood pressure
- ST amplitude and elevation for selected J point and lead
- RPE
- Max. ST in the bottom bar (the load stage in which the max. ST occurred is marked with " * ").



Display of summary of the exercise test with interpretation



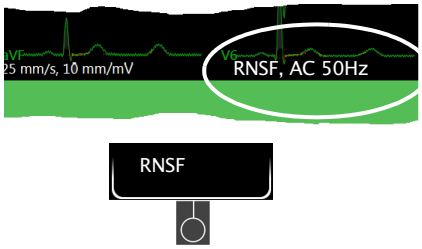
Display of the manually entered results during the test.



Art. no.: 2.511296 Rev.: d

7.5.2 Myogram filter

The myogram filter suppresses disturbances caused by strong muscle tremor. In **Menu > Settings > ECG > Filter & Formulas > Exercise display filter** the default setting of the **myogram filter** is defined.



In the information field, **Off**, **LP 25 Hz, LP 40 Hz, LP 150 Hz or RNSF** is displayed and can be changed at any time using the function key.

- The **standard** cut-off frequency is user-defined at LP 25 Hz, LP 40 Hz, LP **150 Hz**, LP 250 Hz (Filter Off) or RNSF (specially for exercise ECGs) (see chapter 10.2, page 78).
- The ECG is stored unfiltered. It is therefore possible to print the stored ECG either with or without applying the myogram filter.

⚠ CAUTION

▲ When using the 25, 40 Hz or the RNSF filter, the displayed or printed ECG does not always meet the requirements of a diagnostic ECG.

7.5.3 Other filters

The following additional filters are available:

Baseline filter

The cut-off frequency for the baseline filter is based on IEC 60601-2-25 and cannot be changed.

Notch filter

This filter prevents recording interference due to mains frequency oscillation. If the filter is active, "AC 50 Hz" or "AC 60 Hz" is displayed.

- The notch filter can be changed in the ECG settings > Filter & Formulas (see chapter 10.2.2, page 78)

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8 Memory

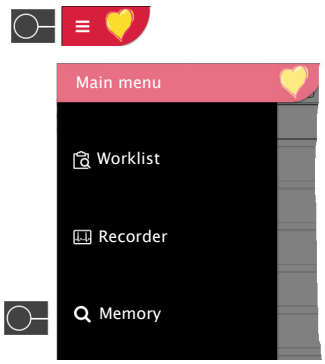
Recordings can be stored locally and/or transmitted automatically to Schiller Link or SEMA. Recordings stored in the memory can be viewed, printed, transmitted or deleted at any time.

8.1 Saving a Recording

Recordings are stored manually after completion of the acquisition.

8.2 Editing the memory

Approx. 350 resting ECGs, 100 resting rhythms and 10 exercise ECGs can be stored on the CARDIOVIT AT-102 G2.



➜ When **Menu > Memory** is selected, stored recordings are displayed

- The recordings are listed by date/time; however, different listing criteria can be selected and recordings can also be searched via the search function.
- Memory capacity is indicated by the icon in the status bar:
  - green = memory OK
  - yellow = almost full
  - red = memory full, no more recordings can be performed.

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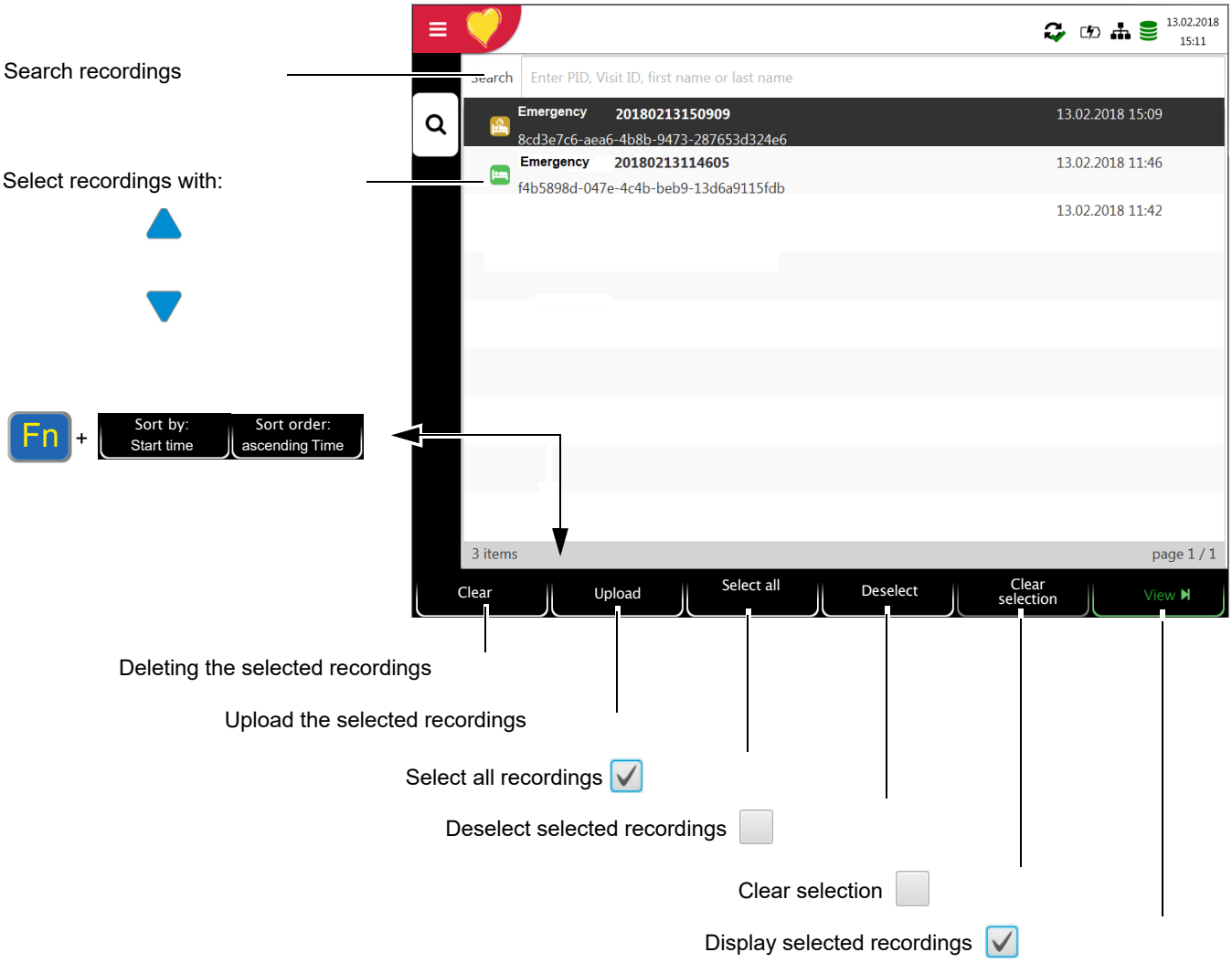

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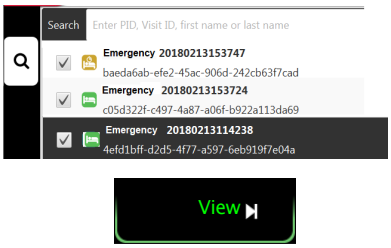
8.2.1 Opening the print preview from the memory and printing a recording

Depending on the settings in **Menu > Settings > General > Workflow**, the recording is printed automatically as soon as it has been saved.

The following procedure shows how recordings can be selected from the memory and printed or exported to a USB stick.



1. Select the recording.
2. Press the function key "View".

➜ The recording is displayed according to the settings in **Menu > Settings > Resting ECG > Resting ECG review**, and the layout can be changed for the displayed recording at any time.

3. Press the function key **Print** to print the recording in the selected format, see section 10.3 Menu Reports, page 80.
4. Press the function key **PDF** to save the recording in the set format as PDF to a USB stick, see section 10.3.1 General, page 80

Example: resting ECG

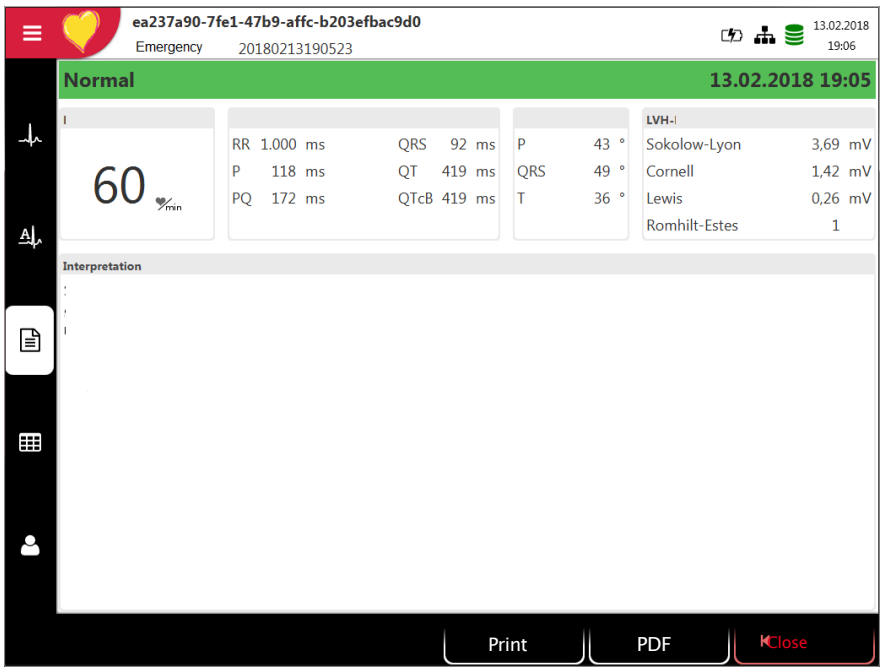
Rhythm

Averages

Results

Measurements

Patient data



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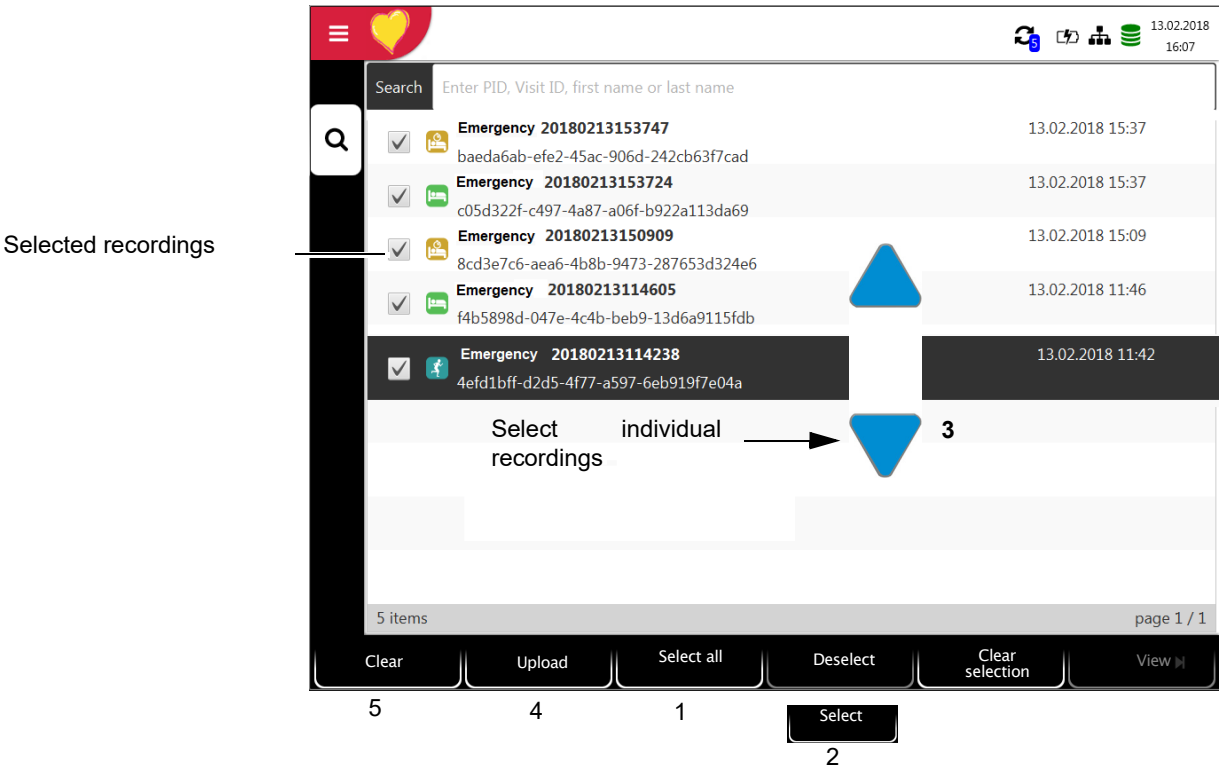
8.2.2 Transmitting and deleting stored recordings

Depending on the settings in **Menu > Settings > General > Workflow** (see page 92), the recording is transmitted and deleted automatically as soon as the recording has been finished. If automatic transmission is not activated, recordings can be transmitted as follows.



➜ To select all recordings, press the function key **Select all (1).**

➜ To select a recording, use the navigation keys **(3)** to highlight the recording, and press the function key **Select (2).**

➜ To deselect a recording, highlight the selected recording with the navigation keys **(3)** and press the function key **Deselect (2).**

➜ To upload or delete recordings, select the desired function:

– Upload for an export to the server **(4)**.

– Delete **(5)** (automatic deletion after transmission can be set in **Main menu > Settings > General > Workflow**, see page 92).

Should the network not be available, recordings that have not been transmitted are displayed with the symbol (see page 101).

If the network is available and recordings have been transmitted, the symbol is displayed.

- The transmitting options are detailed in the section System settings (see page 97).
- Use the setting **Menu > Settings > General > Memory >** Cleanup local recordings to automatically delete recordings after a defined period of time, see page 94.

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9 Worklist (Option)

9.1 General information

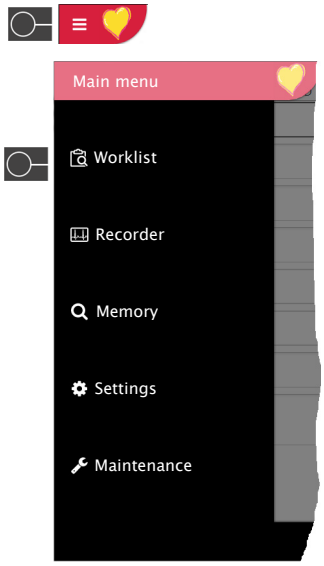
The Worklist function enables a doctor / administrator to define a worklist of patients that require recordings to be made. The doctor can define the patient, room / department, and specify the type of recording to be made. The worklist is defined directly from the Hospital information system (HIS); once the recording has been made by the CARDIOVIT AT-102 G2, it is sent back to the HIS for analysis, examination and storage.

Instead of the type of recording, "Undefined" can be set. When this is the case, only the patient demographics are sent to the unit.

- To be able to use the worklist function, the licence must be activated.
- To be able to use the worklist function, the unit must be set up to communicate with the Schiller Server (see page 88).
- The definition of the worklist on the Schiller Server is described in the Schiller Server user guide.

From the Schiller Server, a worklist can be sent to a specific unit or to all units on the system. To receive a worklist from the Schiller Server, the unit identification of the CARDIOVIT AT-102 G2 (device ID in the system) must be the same as the one defined for the Schiller Server. This is usually set when the unit is first commissioned. The Device ID is shown in **Menu** > **Settings > General > Station**.

9.1.1 Worklist settings



If worklists are to be used, the workflow can be adapted accordingly. To do so, set the Default workflow in **Menu** > **Settings > General > Workflow** to Record from worklist. In this way, the worklist is shown directly after power-up. However, worklist can also be selected manually from the menu.

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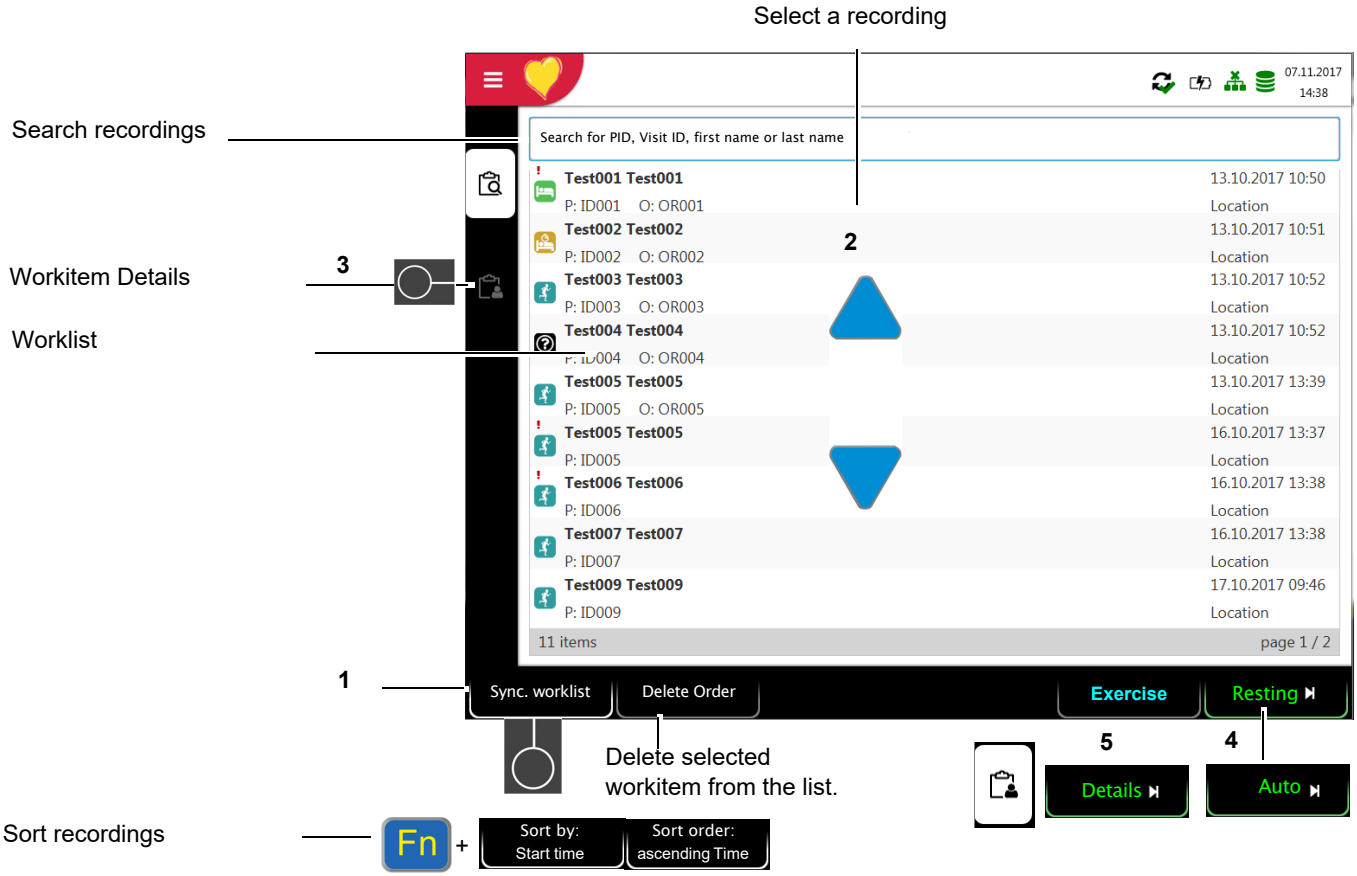
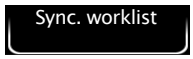
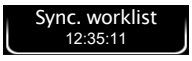
9.2 Receiving a worklist

To open the worklist proceed as follows:

1. Press **Menu** > **Worklist**.







2. To receive a worklist from a HIS, press the **Sync. worklist (1)** key to download the worklist from the server. Wait (up to a few minutes) for the worklist to be populated. If "Auto Sync Worklist" is set in **Menu** > **Settings > General > Workflow**, the list is updated every minute and the update time is displayed on the key.

3. Depending on the setting in the Workflow menu, the following workflows are possible:

- Recording from worklist

➜ You can start the selected order **(2)** directly by pressing the key **(4),** or you can first check the workitem by pressing **(3)**, return to the worklist and then perform the recording **(4)**.

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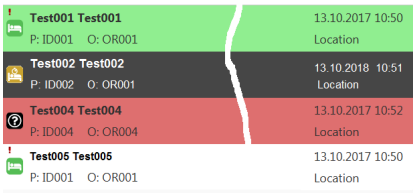
- Recording from workitem

➜ You can view the selected order's **(2)** details by pressing the key **(5)**. The recording can be started in the view Recording details by pressing “Resting” **(4)** . In the worklist, all patients are listed with their last and first name, identification number, order ID and room number. The following recording types are available:

- Resting ECG
- Resting rhythm
- Exercise ECG
- Undefined recording type. The recording type is assigned when the recording is performed.



Recording status:

- White background = recording to be performed.
- Dark grey background = selected recording.
- Green background = already performed recording. The next time the worklist is synchronised, these recordings are going to be deleted, both on the device and on the server.
- Red background = recording was cancelled and deleted.

- The order and visibility of the fields in the view "Workitem details" can be configured in the **Menu** > **Settings > General > Visible fields >** “Worklist” (see page 92).

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9.2.1 Taking a Worklist Recording

- This procedure corresponds with the worklist mode “Record from worklist”, see setting section 10.7 General, page 92, workflow.
- Patient data provided by the HIS cannot be edited (except for height and weight).
- If you have selected an incorrect work item, press the key , but **not** the key Clear. Select the new work item from the list, or use the Search field.

1. Prepare the patient and select a work item.
2. Select **Work item details** to check the work order or to complement patient data.
3. Press the **Resting ECG** key.
4. The corresponding recording acquisition screen (resting ECG or resting rhythm) is opened. If no recording type has been defined, both options are available.

Press Worklist to return to the worklist without performing the recording (last chance to do so).

5. Take the recording:
   – Resting ECG (see page 46)
   – Resting rhythm (see page 50)

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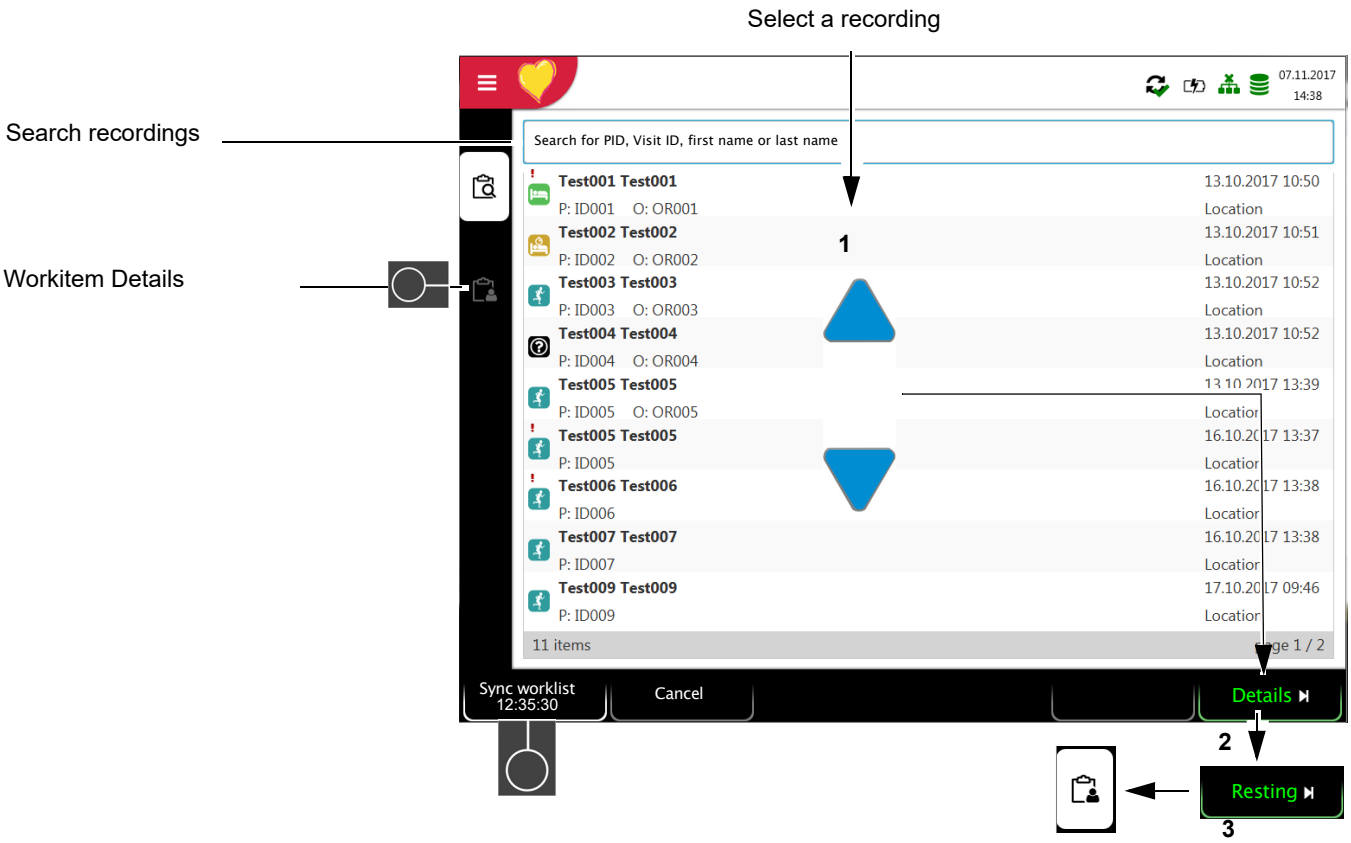
9.2.2 Performing a recording from work order details

- This procedure corresponds with the worklist mode “Record from work order details”, see setting section 10.7 General, page 92, workflow.
- Patient data provided by the HIS cannot be edited (except for height and weight).
- If you have selected an incorrect work item, press the key , but **not** the key Cancel. Select the new work item from the list, or use the Search field.

1. Prepare the patient and select a work item.



2. Select **Details (2)** to check the work order or to complement patient data.
3. Press **Resting (3)** in the “Work item details" view .
4. The corresponding recording acquisition screen (resting ECG or resting rhythm) is opened. If no recording type has been defined, both options are available.

Press Worklist to return to the worklist without performing the recording (last chance to do so).

5. Take the recording:
   - Resting ECG (see page 46)
   - Resting rhythm (see page 50)

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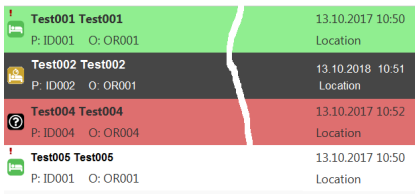
9.2.3 Sending worklist recordings to the HIS

- It is possible to automatically send performed worklist recordings. This is defined in the System settings (**Menu** > **Settings > General > Workflow > Transmit after acquisition** page 92).
- Recordings can also be transmitted manually in the memory.

➜ In order to update the worklist, press **Sync. worklist.** Wait until the synchronisation is completed, i.e. until the recordings are no longer displayed in the worklist (this can last a few minutes).



Pending work items are indicated by a white background and selected work items by a grey background.

Completed work items (green) or those that have been cancelled (red) are deleted from the worklist during the next synchronisation.

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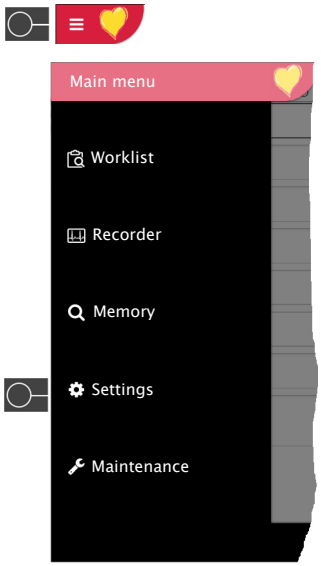
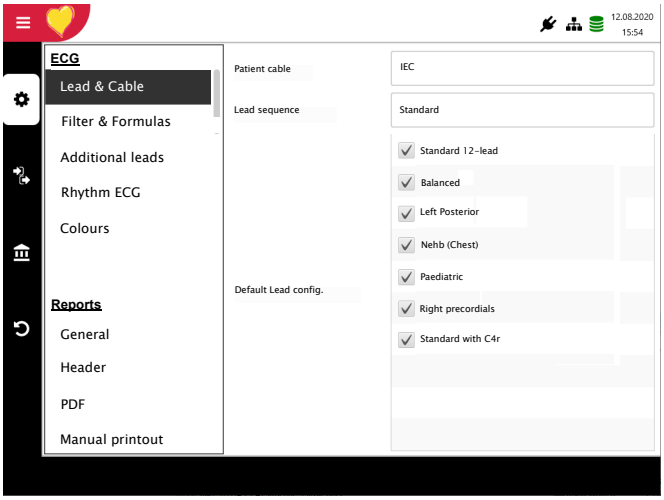
10 General and System Settings

10.1 Navigation

When pressing the Menu key , the option **Settings** is displayed.





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10.1.1 Overview "Menu > Settings"

This menu can be protected with a password via the menu **Settings > General > Access control**.

Settings overview

Menu Settings	Sub-menu
ECG (Page 78)	• Lead & Cable • Filter & Formulas • Interpretation • Additional Leads • Resting rhythm • Colour
Reports (Page 80)	• General • Header • PDF • Manual printout • Resting ECG • Rhythm ECG • Exercise ECG[a] • Spirometry[b]
Layouts (Page 78)	• Resting • Exercise ECG[a] • Worklist • Spirometry[b]
Connectivity (Page 88)	• EMR integration • Ethernet • WLAN
Regional (Page 91)	• Date / time • Language • Units • Patient ID system
General (Page 92)	• Info • Power management • Station • Update • Manage licenses • Visible fields • Mandatory Fields • Custom fields • Access control • Workflow • Memory • Printer

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Menu Settings	Sub-menu
Exercise ECG[a] (Page 95)	• General • Ergo device • Bike protocol • Treadmill protocol
Spirometry[a]	• General • Ethnic corrections • FVC measurements

a. These menu options are only displayed when the exercise ECG option is activated.
b. These menu options are only displayed when the spirometry option is activated. For more information, see separate user guide.

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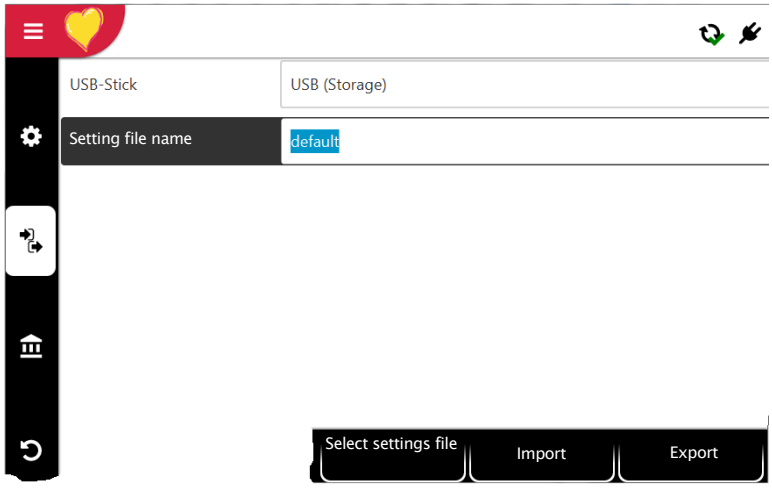
10.1.2 Saving and restoring settings

Changed settings are saved automatically. In **Menu > Settings**, settings from another device can be imported, or a backup of the settings can be restored (see page 77).



Import/export settings Select USB Storage and enter the file name to import or press the function key "Select setting files" in order to import or export the files.

Export audit log Select Export target and enter the file name to export the Audit Log.

Reset to factory settings All settings are reset to the factory defaults. If the network settings are to be reset as well, untick the check box.

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10.2 ECG Menu

10.2.1 Lead & Cable

Menu	Parameter	Description / selection
Lead & Cable	Patient cable	**IEC** or AHA
	Lead sequence	**Standard** or Cabrera
	Default lead config.	☑ Lead configuration. Use the function key Leads to de-/activate leads, and change their order with Up/Down: • Standard 12-lead • Balanced • Right Precordials • Left Posterior • Nebh (chest) • Paediatric • Standard C4r

10.2.2 Filter & Formulas

Menu	Parameter	Description / selection
Filter & Formulas	Notch filter	Off / **AC 50** / AC 60 Hz
	Resting display filter	Off/LP25/LP40/**LP150 Hz**
	Exercise display filter	Off/LP25/LP40/**LP150 Hz**/RNSF
	Default QTc calculation	**Bazett**, Fridericia, Framingham, Hodges

10.2.3 Interpretation

Menu	Parameter	Description / selection
Interpretation	Print Interpretation	**Yes**/No
	Display Interpretation	**Yes**/No
	Display abnormal/borderline header	**Yes**/No

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10.2.4 Additional Leads

Standard leads per lead configuration

These settings apply to current resting rhythm recordings and recordings from the memory as well as the printout. Therefore, saved ECGs can be displayed or printed with different settings at any time.

Menu	Parameter	Description / selection
Additional Leads	Standard 12-lead	I/ II / III aVR / aVL / aVF / V1 / V2 / V3 / V4 / V5 / V6 / -aVR Rhythm 1 **II**, Rhythm 2 **V2**, Rhythm 3 **V5**
	Paediatric	I/ II / III aVR / aVL / aVF / V7 / V2 / V3r / V4r / V5 / V6 / -aVR Rhythm 1 **V7**, Rhythm 2 **V4r**, Rhythm 3 **II**
	Right precordials	I/ II / III aVR / aVL / aVF / V1 / V2 / V3r / V4r / V5r / V6r / -aVR Rhythm 1 **V3r**, Rhythm 2 **V5r**, Rhythm 3 **II**
	Standard C4r	I/ II / III aVR / aVL / aVF / V1 / V2 / V3 / V4r / V5 / V6 / -aVR Rhythm 1 **V4r**, Rhythm 2 **V2**, Rhythm 3 **II**
	Left Posterior	I/ II / III aVR / aVL / aVF / V4 / V5 / V6 / V7 / V8 / V9 / -aVR Rhythm 1 **V8**, Rhythm 2 **V5**, Rhythm 3 **II**
	Nehb (Chest)	I/ II / III / aVR / aVL / aVF / D / A / J / -aVR Rhythm 1 **D**, Rhythm 2 **A**, Rhythm 3 **J**
	Balanced	I/ II / III aVR / aVL / aVF / V4r / V3r / V1 / V7/ V8 /V9 /-aVR Rhythm 1 **V7**, Rhythm 2 **V4r**, Rhythm 3 **II**

10.2.5 Resting rhythm

Menu	Parameter	Description / selection
Resting rhythm	**Rhythm length**	30 s, 1, **2**, 3, 4, 5 and 10 minutes Setting the recording duration.
	Show recording duration dialogue	**Yes**/No The dialogue can be deactivated during the recording and can be activated here again.

10.2.6 Colour

Menu	Parameter	Description / selection
Colour	**Background color**	**Black,** white
	Line color (good quality)	**Green**, black, white, blue, red, yellow
	Line color (medium quality)	**Yellow**, green, black, white, blue, red
	Line color (low quality)	**Red**, yellow, green, black, white, blue
	Text colour	**White**, blue, red, yellow, green, black

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10.3 Menu Reports

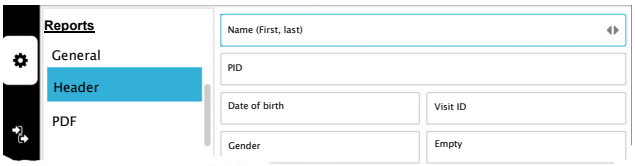
Saved ECGs can be displayed with different settings at any time.

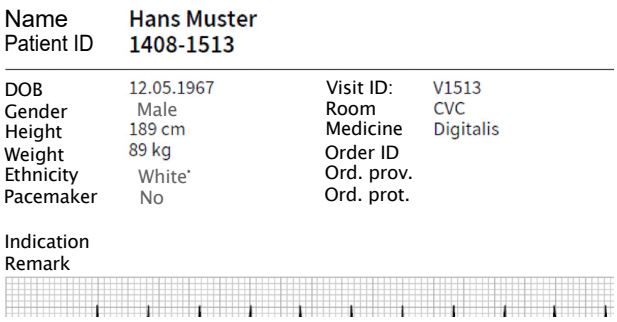
10.3.1 General

Parameter	Description
Rhythm mode	**Sequential** or Simultaneous. If Sequential is selected, consecutive time segments are used for the individual lead groups (this applies for printouts). If Simultaneous is selected, the same time segment is used for all lead groups (this applies for printouts). If a print format with a rhythm lead is defined, Sequential is used, even if you have selected Simultaneous.
Company info 1, 2, 3	Enter company information on the PDF, lines 1, 2, and 3.

10.3.2 Header

Configuration and order of the information given in the header. Select "Empty" if a field should not be displayed.





10.3.3 PDF

Parameter	Description
PDF paper format	**A4** or Letter
PDF conformance	**None**, PDF/A-1a, PDF/A-1b
Company logo	Display of the imported company logo. **Import logo:** 1. Name of the logo “reportlogo.png”. Accepted file types are jpg, jpeg, png, bmp or gif. 2. Connect the USB stick containing the file “reportlogo” to the AT-102 G2. 3. Press function key “Import logo”. “reportlogo” is loaded and displayed.
Print company logo	**Yes**/No

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10.3.4 Manual printout

In this menu, the default settings for manual printouts are defined.

Parameter	Description
Default lead group	Selection of the lead group: **All**, extremities or precordials
Default amplitude [mm/mV]	5, **10**, 50 mm/mV
Default speed [mm/s]	12.5, **25** or 50 mm/s

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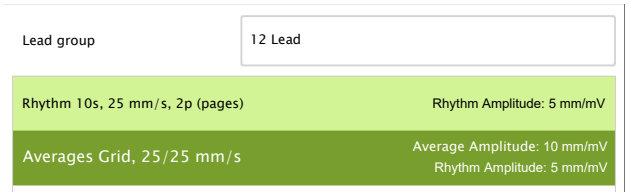
10.3.5 Resting ECG

Saved ECGs can be displayed with different settings at any time.

- Patient data is always printed.
- The order listed below can vary.
- Select (▲▼), activate/deactivate with OK or with function key , sort with keys Up/Down and Average/Rhythm amplitude 5/10/20 mm/mV.



Menu	Description / selection
Lead group	• Display of the leads listed below (12 or 9 leads). Select (with key OK or Activate) and define the order (function keys Up/Down) of the following print formats:
12 Lead	• **Rhythm 10s, 25 mm/s, 2p (pages)** • Measurements • Averages Grid, 25/25 mm/s • Averages Grid, 50/25 mm/s • Averages Wide, 50/25 mm/s • Panorama, 25 mm/s • Rhythms 10s, 25 mm/s • Rhythms 5s, 25 mm/s • Rhythms 5s, 50 mm/s, 2p • Rhythms Grid, 25 mm/s
9 Lead	• **Rhythms 10s, 25 mm/s, 2p** • Measurements • Averages Grid, 50/25 mm/s • Averages Wide, 50/25 mm/s • Rhythms 5s, 25 mm/s • Rhythms 5s, 50 mm/s, 2p

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10.3.6 Resting rhythm

Saved ECGs can be displayed with different settings at any time.

- The order listed below can vary.
- Select (▲▼), activate/deactivate with OK or with function key , sort with keys Up/Down and Rhythm amplitude 2.5/5/10 mm/mV.

Parameter	Description / selection
Rhythm	**Continuous, 25 mm/s, 2:00 min**
	Continuous, 12,5 mm/s, 5.20 min
	Continuous, 6,25 mm/s, 10.40 min
	Rhythm 10s/ p (page)
	Rhythm 20s/ p (page)
	Rhythm summary

10.3.7 Exercise ECG

Saved ECGs can be displayed with different settings at any time.

- The order listed below can vary.
- Select (▲▼), activate/deactivate with OK or with function key , sort with keys Up/Down and Rhythm amplitude 5/10/20 mm/mV.

Menu	Description / selection
Exercise ECG	• **Summary** • **ST table** • Event list 40/page • Averages 5/page • Averages compact • ST trend • Step rhythms 10s, 25 mm/s, 1p (1 page) • Step rhythms 5s, 25 mm/s • Step rhythms 5s, 50 mm/s 2p (2 pages)
Step print	At the end of each step, a step printout is generated. If the steps are longer than 2 minutes, or if a step is held, a printout is generated every 2 minutes. **None**, step print 5s, 25 mm/s, step print 5s, 50 mm/s, 2 pages, step print 1x12, 25 mm/s.

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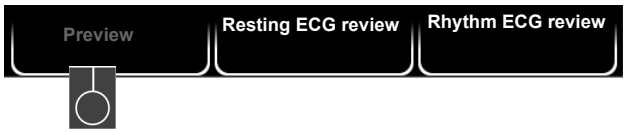
10.4 Menu Layouts

In this menu, the views and layouts for **Preview** and the **ECG review** can be set.

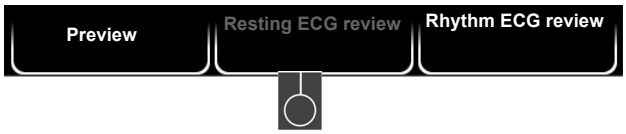
10.4.1 Resting

Preview



Menu	Parameter	Description
Preview	View order	Select whether Hookup or Recorder is shown at the top.
	12-lead layout	**2x6 /** 4x3/ 1x6
	Amplitude	5/**10** /20 mm/mV
	Speed	12.5/**25**/50 mm/s

Resting ECG review



These settings apply to current resting ECG recordings and recordings from the memory. Therefore, saved ECGs can be displayed with different settings at any time.

Menu	Parameter	Description
Resting ECG review	View selection and order	Select ☑ (with key OK or Activate) and define the order (function keys Up/Down) of the following views: • Rhythms • Averages • Results • Measurements
	Rhythm view 12 lead layout	**1x6 /** 1x12
	Rhythm view amplitude	5/**10** /20 mm/mV
	Rhythm view speed	12.5/**25**/50 mm/s
	Average view amplitude	**10**/20 mm/mV
	Average View speed	**25**/50 mm/s

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Rhythm ECG review

These settings apply to current resting rhythm ECG recordings and recordings from the memory. Therefore, saved ECGs can be displayed with different settings at any time.

Menu	Parameter	Description
Rhythm ECG review	View selection and order	Select ☑ (with key OK or Activate) and define the order (function keys Up/Down) of the following views: • Continuous/Rhythm • Rhythm summary • Results
	Continuous/Rhythm view amplitude	2.5/**5** mm/mV
	Continuous/Rhythm view speed	12.5/**6.25** mm/s

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10.4.2 Exercise ECG

Preview

Menu	Parameter	Description
Preview	Preview view order	Select whether Hookup or Recorder is shown at the top.
	12-lead layout	**2x6 /** 4x3/ 1x6
	Amplitude	5/**10** /20 mm/mV
	Speed	12.5/**25**/50 mm/s

Review

These settings apply to current exercise ECG recordings and recordings from the memory. Therefore, saved ECGs can be displayed with different settings at any time.

Menu	Parameter	Description
Rhythm ECG Review	View selection and order	Select ☑ (with key OK or Activate) and define the order (function keys Up/Down) of the following views: • Trend • Step table • Results • Event list
	Default lead for 12-lead	I/ II / III / aVR / aVL / aVF / V1 / V2 / V3 / V4 / **V5** / V6 / -aVR

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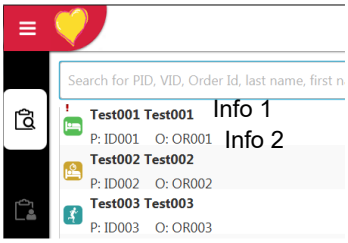
10.4.3 Worklist

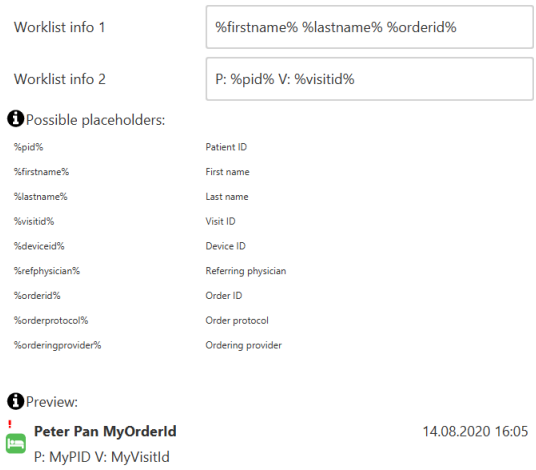
The worklist with Info 1 and 2 can be freely configured using the available placeholders.

The configuration is displayed in the Preview.

Default settings:

- Worklist info 1: %firstname% %lastname% (first/last name)
- Worklist info 2: P: %pid% V: %visitid% (patient ID, visit ID)





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10.5 Connectivity

10.5.1 EMR integration

Menu	Parameter	Description / selection
EMR integration Server settings	EMR integration (EMR = electronic medical record system)	**None** – No input field displayed Schiller Link – Device ID is displayed Schiller Server – Host, port, user and password input fields are displayed. (See following)
	Host	Name of the server
	Port	Port address
	SSL Certificate Validation	Yes/**No**
	User	User name
	Password	Password

10.5.2 Ethernet

Menu	Parameter	Description / selection
Ethernet	Use DHCP	**Yes**/No. If this is not activated, the following parameters need to be entered:
	IP address	Identifier address of the device in the TCP/IP network.
	Subnet mask	E.g.: 255.255.255.0
	Standard Gateway	Gateway IP address.
	DNS server	Domain name of the server

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10.5.3 WLAN

To select a WLAN network, press the function key “Browse networks”, select your network and confirm with the OK key. Once all parameters have been set, press the "Apply" function key .

General

Menu	Parameter	Description / selection
WLAN general	Wi-Fi enabled	Yes/**No**
	SSID	SSID = Enter network name.
	Wi-Fi security	Selection of the encryption protocol • WPA2 Pers SSID + key + (encryption = AES+ authentication) • WPA2 enterprise / ieee802.1 (*further settings see* *) SSID + certificate + (encryption = AES + authentication) SSID + user name & password + (encryption = AES + authentication)
	Password	Enter password for Wi-Fi security “WPA / WPA2 Pers”
		**For WPA2 enterprise / ieee802.1 the following additional fields are displayed:*
	**Authentication protocol*	Select the authentication protocol: • PEAP • EAP-TLS • EAP-TTLS
	**User*	Enter user name
	**Password*	Enter password
	**Client certificate*	Load the certificate via USB stick or network . Download the certificate via USB port of the device when **EAP-TLS** is selected ➜ Connect USB stick to the device and press Import certificate from USB . Certificate from USB stick... Certificate structure: a single file in pem. format contains client certificate, of origin, private key. The private key may or may not be encrypted. If it is encrypted, the user name and password need to be entered.
	**CA Certificate*	Load CA Certificate (Certificate Authority) via USB stick or network. Certificate from USB stick...

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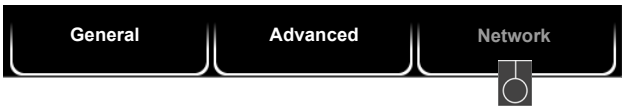
Advanced

Menu	Parameter	Description / selection
WLAN Advanced	Hidden	“Yes” = if you want the SSID to be hidden in the Wifi network. “No” = if you want the SSID to be visible in the Wifi network.
	Anonymous identity	Enter an anonymous identity name

Network



Menu	Parameter	Description / selection
WLAN network	Use DHCP	**Yes**/No. If this is not activated, the following parameters need to be entered:
	IP address	Identifier address of the device in the TCP/IP network.
	Subnet mask	E.g.: 255.255.255.0
	Standard Gateway	Gateway IP address.
	DNS server	Domain name of the server

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10.6 Regional settings

Sub-menu	Parameter	Description / selection
Date/time	Various	• Date format (dd.mm.yyyy / yy-mm-dd / mm/dd/yyyy) • Time format (HH:mm:ss/h:mm:ss) • Time zone • Date and time settings (manual setting is only possible when **EPA integration** is programmed on None). ➜ Key Sync time with server. Time and date on the device are updated. The device needs to be restarted. This function is only possible when **EPA integration** has been set on “Schiller-Link” or “Schiller Server”.
Language	Language	Select a language
	Ext. Keyboard /Barcode Scanner Layout	Select the character set language for the external barcode scanner.
Units	Weight	Units available are g, **kg** and lb
	Length	**cm**, m, inch
	Speed	**km/h** or mph
	Temperature	**C**elsius or Fahrenheit
Patient ID system	Selection of the patient ID system used	**None**, Swedish, Danish, Finnish, Norwegian

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10.7 General

Menu	Parameter	Description / selection
Info	Various parameters	Software and hardware versions are displayed.
	Information **Send info to USB**	A diagnostic file (.nfo) is written to the connected USB USB memory stick.
Power management	**With battery**	
	Dim backlight [s]	120 seconds (2 min.). If set to 0, this function is deactivated.
	Shut down device [s]	600 seconds (5 min.). If set to 0, this function is deactivated.
	Connected (to the mains)	
	Dim backlight [s]	0 seconds (2 min.). If set to 0, this function is deactivated.
	Shut down device [s]	3600 seconds (60 min.). If set to 0, this function is deactivated.
Station	Device ID	Device identification
	Institute	Name of the institute
	Department	Name of the department
	Technician	Name of the technician (this name appears automatically as acquiring technician in the patient data)
	Network host name	Set host name for network communication Standard = **at-102g2**
Update	Check Schiller Update Server	Update software The check is performed on the Schiller update server. Therefore, an Ethernet/WLAN connection is required, including the necessary network settings for this connection
	Check USB device for update file	The Update is performed via the connected USB stick.
Manage licenses	Available options	Automatic interpretation, CCAA, ETM Sport, worklist, basic exercise ECG
	Activate license	Enter the licence key and activate
	Import licence from USB	Activation via USB stick (.lic file)
Visible fields	Workflow - Recorder Workflow - Worklist	The patient data fields displayed in the workflow Recorder and in the workflow Worklist can be configured (order and visible fields). The following additional fields can be displayed: Age, Alternative PID, BMI and Generic data 1/2/3 and Study description (Worklist only)
Mandatory Fields	Recording types	Rest and rest rhythm; exercise ECG
	Selection of mandatory fields	The activated mandatory fields must be filled in before a recording can be started. Mandatory fields for **exercise ECGs** that cannot be deactivated: gender, height, weight, date of birth. Mandatory fields for **Spirometry** that cannot be deactivated: gender, ethnicity, height, weight, date of birth.

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Menu	Parameter	Description / selection
Custom fields	Generic data #1/2/3 • Label – Values 1, 2, 3	Definition of custom data fields. Designation and definition of values 1-3 that can be selected. If no value is defined, the value can be entered in field. In order for the fields to be displayed, they need to be activated in menu “Visible fields”. When they're active, these data fields can also be configured in the report header (see section 10.3.2 Header, page 80).
Access control (automatic logout when access control is activated, see menu “Automatic Logout” next page) Important! To be performed by trained staff only.	Access Control Mode	• None Open - no restriction • **Basic** Login when switching on the device and/or menu setting with password • **Local** Definition of users, passwords and privileges locally on the device • **Schiller Server** Access control is defined via the Schiller Server.
	Basic	
	Device login active	Yes, **No**. If Yes is selected, the login dialogue is displayed at switch-on.
	Device password	Define the password (default)
	Setting login active	Yes, **No**. If Yes is selected, the Settings menu is password-protected.
	Setting login active	Define the password (admin)
	Local	
	Setting login active	Administrator
	Setting login active	Enter password (administrator)
	Setting login active	Confirm password
	User rights	Selection of user rights: Edit system settings; analyze recordings (from memory); create recordings.
	Schiller Server	This requires a functioning EMR connection and Schiller Server Administrator rights. Access control is defined via the Schiller Server.
Workflow	Transmit after save	Yes, **No**. ECG data is transmitted after acquisition and storage of the recording
	PDF to USB after save	Yes, **No**. After saving, the PDF is transmitted automatically to the USB stick
	Delete after export	**Yes,** No. PDF and recording is deleted from the memory once it has been exported/transmitted to the USB stick/server.
	Print after save	**Yes,** No. ECG data is printed once it has been stored.
	PDQ mode	PDQ by **Patient ID** PDQ by Visit ID
	Default workflow	Select the first view: Worklist or Recorder
	Worklist mode	Recording from worklist or from work item (details)
	Auto sync worklist	Yes, **No**. Work list is synchronized every minute.

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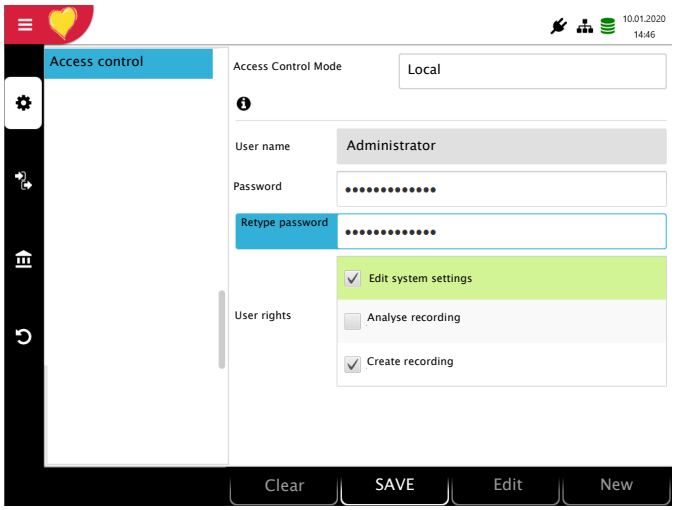
Menu	Parameter	Description / selection
Memory	Cleanup local recordings	**No**/Yes Yes = recordings older than the value defined in “Recording age in days” will be deleted.
Printer	**Contrast**	1-10 **(5)**
	Line width	Thin, **normal**, thick
Automatic log off (Only displayed when access control is activated)	**Automatic logout activated**	**Yes**/No
	Timeout logout [s]	**300**

10.7.1 Setting access control locally



1. Choose the Access control menu.
2. Confirm with OK.
3. Activate Access Control Mode with OK key (blue).
4. Use "left" key to select mode Local.
5. Use “down” key to select user name.
6. Use “right/left” key to select user, if available
7. Select the function key:
   – “Edit” to enter a new password or define user rights.
   – “”New” to create a new user.

➜ User rights can be selected or deselected with the "OK" key. The "System settings" right cannot be disabled for the administrator.

8. Select the function key “Save”

Function keys to:

- create a new user
- edit an existing user
- save settings
- delete a user

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10.8 Exercise ECG

10.8.1 General

Parameter	Description	Select
Target HR	Calculation of the target HR based on AHA or WHO guidelines	AHA or **WHO**
@J-Point	Point at which the ST measurement is performed.	J+10ms, J+20ms, J+30ms, J+40ms, J+50ms, **J+60ms,** J+70ms, J+80ms, J+90ms
Step timer	Step timer display: remaining or elapsed time	**Remaining** or elapsed.
Show RPE 	Display of dialogue to enter the exertion perceived by the patient	**Yes**/No
Show manual events 	Display of dialogue to enter events during exercise ECGs	**Yes**/No
Template	Default report template	**Yes**/No

10.8.2 Ergo device

Parameter	Description	Select
Ergo device	Select the type	Bike or treadmill
Bicycle or treadmill	Select the model	**Bicycle:** • ErgoSana • ErgoLine • Unsupported **Treadmill:** • MTM-1500 Trackmaster • MTM-1400 Trackmaster • Intertrack 8100 • Trackmaster 428 • Unsupported
Bike with NIBP (displayed when Bike is selected.)	Select bike with or without NIBP	**Yes**/No
Speed (displayed when Treadmill is selected.)	Setting the speed unit for the treadmill	**km/h** or mph

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10.8.3 Bike protocol

Pre-defined bike protocols.

25/25-2/25 corresponds to a warm-up load of 25 Watt, a base load of 25 Watt, an increase of 25 Watt per step for 2 minutes as well as a recuperation load of 25 Watt.

Menu	Parameter	Description
Bike protocol	**Protocols:** • 25/25-2/25 • 30/30-3/25 • 30/40-3/25 • 50/25-2/25 • 50/50-3/25 • 75/25-2/25 • Conconi	Order and settings options for exercise ECG display:  Select ☑ (with key OK or Activate) and definition of the order (keys Up/Down) of the following protocols.
	Use ramp	Yes/**No**. Activating the ramp in steps of 1 Watt from one step to the next.
	Use warm-up	Yes/**No**. Activating warm-up phase after start of the exercise ECG as first step of the exercise protocol.

10.8.4 Treadmill protocol

Menu	Parameter	Description
Treadmill protocol	**Protocols:** • Mode-Bruce • Balke-Ware • Bruce • Cornell • Ellestad • Mod-Balke • Mod-Balke-Ware • Mod-Naughton • Slow USAFSAM • USASAM	Order and settings options for exercise ECG display:  Select ☑ (with key OK or Activate) and definition of the order (keys Up/Down) of the following protocols.
	Use ramp	Yes/**No**. Activating the ramp in steps of 1 Watt from one step to the next.
	Use warm-up	Yes/**No**. Activating warm-up phase after start of the exercise ECG as first step of the exercise protocol.

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11 Transmission - Overview

CAUTION

- Security of the network is the sole responsibility of the network operator.
- SCHILLER AG takes no responsibility for the configuration of Windows.
- In order to guarantee the security of the network, Schiller AG recommends the following:
  - isolating the CARDIOVIT AT-102 G2 network from other networks
  - defining access authorisation for the configuration of the host system, incl. CARDIOVIT AT-102 G2 , so that no unauthorised alterations of the system are possible
  - limiting the data transmission between the host and other systems/networks to a minimum
  - installing the latest antivirus/firewall programs on the host in order to prevent malware from affecting the system
  - regularly installing security updates on the host
  - installing software updates that increase the CARDIOVIT AT-102 G2 's security
  - taking the appropriate measures to check the system's security and ensure safe operation when changing the network configuration, installing security updates and adding/removing devices.

11.1 Transmission Options

With the CARDIOVIT AT-102 G2, transmission is possible via a network or Wi-Fi. The transmission options are as follows:

WARNING

- When a non-medical device is connected to the interface, ensure that both units are securely connected to the same earth potential.
- An external device must only be connected using the original interface cable assembly.
- The transmission of ECG data via WLAN can disturb other devices, including pacemakers. Therefore, keep a distance of at least 20 cm from the patient while an ECG is transmitted.

LAN

CARDIOVIT AT-102 G2 data transmission via local LAN network (Ethernet) to the EMR system. For an Ethernet (network) connection, connect the cable assembly to the RJ-45 connector.

The network symbol can have the following three statuses:

The network symbol in the status bar at the top right, indicates the connection status of WLAN or LAN

- Symbol Green - Connected to network and SCHILLER Server
- Symbol Black - Connected to network but no connection with SCHILLER Server
- Symbol black and a cross in the symbol - no network connection

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Wifi

When Wifi is enabled, the following symbols are displayed

- Symbol Green - Connected to Wifi network and SCHILLER Server.
- Symbol Black - Connected to network but no connection with SCHILLER Server
- The strength of the signal is indicated with the number of bars.

Schiller Link Schiller Link offers easy communication with an EMR system within the same network. This communication comprises the following: import (GDT) of examination requests including patient data and recording type from an EMR system, export of recordings to an EMR system in the formats GDT, Sema2 or PDF. To activate this communication, set **Schiller Link** in the menu Connectivity > EMR integration (see page 88).

Schiller Server For patient data queries from the EMR system, the SCHILLER Server is required. A more detailed description of the transmission settings are given in the SCHILLER Communication Handbook 2.520036.

PDF export Export of a recording in PDF format to a USB stick

11.1.1 Automatic transmission

The automatic transmission setting is defined in Settings:

Menu > Settings > General - **Workflow** - **Transmit after acquisition** (Yes/No - see page 92).

When auto transmission is defined, a recording is transmitted automatically after it has been saved.

11.1.2 Manual transmission

To transmit a recording, select the recording in the **Memory** and press **Export** (see page 67)

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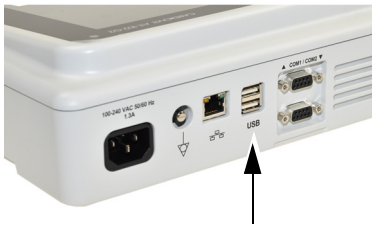
11.1.3 PDF export

Data integrity

⚠ CAUTION

▲ When exporting patient data to a USB stick, the operator needs to take appropriate security measures to protect the data:
- Make sure that only authorised persons have access to the USB stick.
- After data transmission from the USB stick to a secure system, delete all data from the USB stick.
- Deactivate the PDF export function if it is not used.

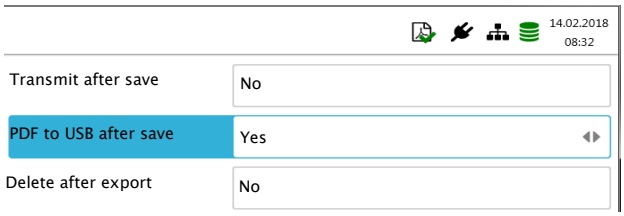


USB stick

Activate **PDF export** in the **Menu > Settings > Workflow > PDF to USB after save**. If **PDF export** is active, the recordings from the memory are transmitted as soon as a USB stick is connected. The symbol PDF export is displayed when data has successfully been transferred to the memory stick.

Caution

If **"Delete after export"** is activated in the same menu, the recordings are deleted from the memory.



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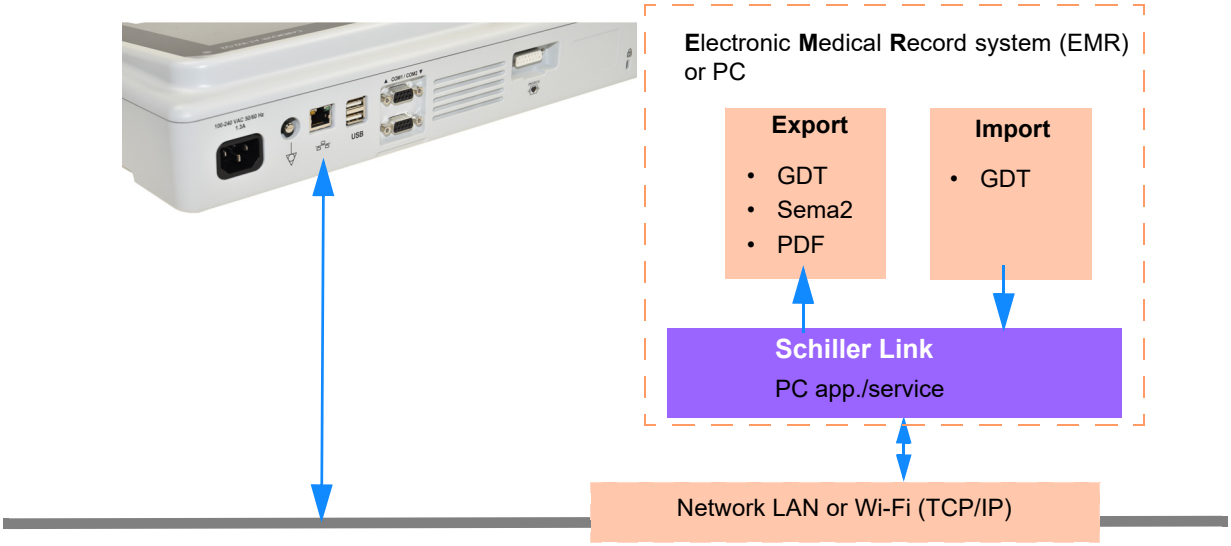
11.1.4 Schiller Link

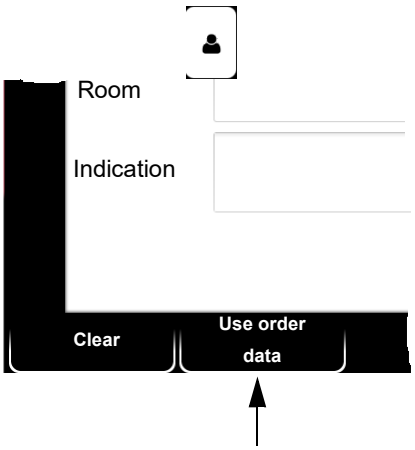
Schiller Link is a PC application/service which communicates between the EMR system and the CARDIOVIT AT-102 G2 .

➜ To activate this communication, set Schiller Link in the menu **Connectivity > EMR integration** (see page 88).

➜ Integration in the network is automatic, provided the CARDIOVIT AT-102 G2 is part of the same network as the EPA system



Procedure with EMR system



1. Enter/select a patient in the EMR system
2. Generate a new order for this patient
3. Upload the GDT file into the import folder of the Schiller Link service
4. Start and check the order incl. patient data on the CARDIOVIT AT-102 G2. Should no patient data be displayed, press the function key "Use order data". The order data will be loaded and displayed.
5. Perform the recording on the CARDIOVIT AT-102 G2.
6. Store the recording and export it automatically or manually to the export folder.
7. The EMR system imports the recording for review in the EMR system.

Procedure without EMR system

1. Manually enter the patient data on the CARDIOVIT AT-102 G2 (via keyboard or barcode reader).
2. Perform the recording on the CARDIOVIT AT-102 G2.
3. Store the recording and export it automatically or manually to the export folder.
4. Review the recording (PDF) on the PC and print or transmit it via e-mail.

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11.1.5 Retrieving data from the Schiller Server

Patient data can automatically be retrieved from the Schiller Server to the CARDIOVIT AT-102 G2. This is called patient data query (PDQ). To do this, the Patient or Visit ID is entered in the patient data screen manually or via a barcode reader (see page 30).

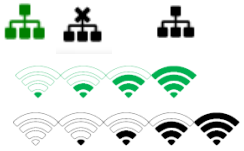
- For PDQ, the Schiller Server must be installed on the remote system.
- The server name, URL, TCP/IP address etc. as well as all other transmission settings are defined in the system settings (see page 88).
- A communication overview is given in the SCHILLER Communication Handbook (Art. No. 2.520036).

11.1.6 Failed data transmission

Should the network not be available, recordings that have not been transmitted are displayed with the symbol .

1. With the icon “EPA export “, the number of failed transmissions is displayed.
2. Recordings can be sent manually from the memory. See section 8.2.2 Transmitting and deleting stored recordings, page 67.

If no data can be transmitted, check the following:



➜ Network settings (see page 88)
➜ Network connection WLAN or LAN
➜ Encryption settings on the server
➜ Settings in the Schiller Link App.

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12 Maintenance

The regular system maintenance must include a software check according to the manufacturer's instructions. The test results must be recorded and compared to the values in the accompanying documents.

Maintenance work not described in this section may only be performed by a qualified technician authorised by SCHILLER AG.

The following table indicates the intervals and responsibilities of the maintenance work required. Local regulations in your country may stipulate additional or different inspection intervals and tests.

12.1 Maintenance interval table

Interval	Maintenance step	Responsible
Before each use	• Visual inspection of the device and ECG electrodes	➜ User
Every 6 months	• Visual inspection of the device (see page 108, 12.7 Inspection Report) – Function key test – Keyboard test – Cables and accessories – Mains cable • Functional tests according to the instructions (see page 108, 12.7 Inspection Report)	➜ User
Every 12 months	• Safety test according to IEC/EN 62353	➜ Qualified service personnel

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12.2 Visual inspection

Visually inspect the unit and cable assemblies for the following:

➜ Device casing (not damaged or cracked)
➜ LCD screen (not damaged or cracked)
➜ Electrode cable sheathing and connectors (undamaged)
➜ Mains cable sheathing and connectors (undamaged)
➜ No kinks, abrasion or wear in any cable assembly.
➜ Input/output connectors (undamaged).

In addition to the visual inspection, switch on the CARDIOVIT AT-102 G2, scroll through the menu and test some sample functions. In this way, you can check that:

- the device performs faultlessly
- the display works
- the function keys and the keyboard work

➜ Enter the results in the inspection report (see page 108, 12.7 Inspection Report).

⚠WARNING

▲ Defective units or damaged cables must be replaced immediately.

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12.3 Cleaning the casing and cables

⚠WARNING

▲ Switch the device off before cleaning and disconnect it from the mains by removing the plug. Do not, under any circumstances, immerse the device in cleaning liquid and do not sterilise it with hot water, steam or air.

⚠ CAUTION

▲ Do not autoclave the unit or any accessories.

▲ Do not immerse the device in liquid.

▲ Do not spray liquid onto the device/cable.

▲ The use of detergents with a high acid content or detergents that are otherwise unsuitable can damage the device (i.e. cracks and wear of the plastic casing).

▲ Always follow the usage instructions provided by the manufacturer of the cleaning solution.

▲ With time, the casing may become less resistant:

– if an alcaline cleaner or a cleaner with a high alcohol concentration is left for a long time on the surface, or

– if a warm disinfectant or detergent is used. Schiller AG therefore recommends using only cleaning agents that are adequate for sensitive materials such as plastics, and using them at room temperature (approx. 20°C).

▲ Never use any of the following solutions or similar products to clean the equipment: ethyl alcohol, acetone, hexane, abrasive or scouring powder or material, any cleaning material that damages plastic.

▲ The patient cable and other cable assemblies must not be exposed to excessive mechanical stress. Whenever disconnecting the leads, hold the plugs and not the cables. Store the leads in such a way as to prevent anyone stumbling over them or any damage being caused by the wheels of instrument trolleys.

▲ When cleaning, ensure that all labels and safety statements, whether etched, printed or stuck to the device, remain in place and remain readable.

Thoroughly inspect the device and the accessories before cleaning.

- Look for any signs of damage and make sure that the keys and connectors work correctly.
- Gently bend and flex cables, inspecting them for damage or extreme wear, exposed wires and bent connectors.
- Confirm that all connectors engage securely.

The casing of the CARDIOVIT AT-102 G2 and the cable assemblies can be cleaned with a cloth slightly moistened (not wet) on the surface only. If necessary, a domestic non-caustic cleaner or a 50 % alcohol solution can be used to remove grease stains and finger prints. Wipe the equipment with a cloth slightly moistened (not wet) with one of the approved cleaning solutions (see section 12.3.2). Thoroughly wipe off any excess cleaning solution. Do not let the cleaning solution run into or accumulate in connector openings, switches, or gaps. If liquid gets into connectors, dry the area with warm air and check that the device operates properly.

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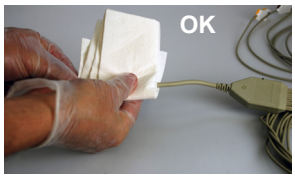
12.3.1 Cleaning the cable assembly

1. Before cleaning, inspect the cable for damage. Gently bend and flex all parts of the cable. Inspect for splits in the sheathing, damage or extreme wear, exposed wires or bent connectors.
2. Wipe the cable with a cloth slightly moistened (not wet) with one of the approved cleaning solutions listed below.
3. Gently grip the cable with the damp cloth in the centre of the cable and slide the cable through the cloth 20 cm at a time until clean. Do not clean the whole length in one single action as this may cause ‘bunching‘ of the insulation sheathing.

4. Thoroughly wipe off any excess cleaning solution. Do not let the cleaning solution run into or accumulate in connector openings, switches, or gaps. If liquid gets into connectors, dry the area with warm air.



12.3.2 Admissible detergents

- 50 % isopropyl alcohol
- neutral, mild detergent
- all products designed for cleaning plastic.

12.3.3 Non-admissible detergents

Never use products containing the following:

- Ethyl alcohol
- Acetone
- Hexane
- Abrasive cleaning powder
- Plastic-dissolving products

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12.4 Disinfection

Disinfection removes certain bacteria and viruses. Please refer to the manufacturer's information. Use commercially available disinfectants intended for clinics, hospitals and medical practices.

Disinfect the device in the same way as described for cleaning the device (previous page).

12.4.1 Admissible disinfectants

- Isopropyl alcohol 50 %
- Propanol (35 %)
- Aldehyde (2-4 %)
- Ethanol (50 %)
- all products that are suitable for sensitive surfaces, such as:
  - Bacillol® 30 foam/ Bacillol® 30 Tissues
    (10% Propanol-1, 15 % Propanol-2, 20 % Ethanol)
  - Mikrozid® AF (25 % Ethanol, 35 % 1Propanol-1)

12.4.2 Non-admissible disinfectants

Never use products containing the following:

- Organic solvents
- Ammonia-based detergent
- Abrasive cleaning agents
- 100 % alcohol
- Conductive solution
- Solutions or products containing the following ingredients:
  - Acetone (Ketone)
  - Quaternary ammonium compound
  - Betadine
  - Chlorine, wax or wax compound
  - Sodium salt

12.5 Cleaning the print head

Over a period of time, the printing ink from the grid on the paper can form a film on the thermal print head. This can cause the print quality to deteriorate. We recommend therefore that the print head is cleaned with alcohol every month. This is done as follows:

1. Open the paper tray and remove the paper. The thermal print head is located directly above the pressure roller (when the paper tray is closed).
2. With a tissue dampened in alcohol, gently rub the printhead to remove the ink residue. If the print head is badly soiled, the colour of the paper grid ink will show on the tissue.

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12.6 Battery

- No maintenance is required for the lithium-ion batteries.
- Based on its use, the battery needs to be replaced every 4 years when operation time has fallen under 6 hours.
- Storage and operation conditions outside the temperature range of 15-25 °C will reduce the service life of the battery!
- Make sure that the battery remains charged during storage. If the device is not used for more than 3 to 4 months, the battery needs to be protected from deep discharge by recharging it; the ideal capacity is 50-80%. If a fully charged battery is stored for a long period of time, this may reduce its service life.

12.6.1 Charging the battery

A totally discharged battery requires approximately 4 [1] hours to be 100% charged (when the unit is switched off). It is possible to use the unit when the battery is being charged; however, the charging time may be longer.

No harm will be done to the battery by leaving the unit connected to the mains supply.

1. Connect the device to the mains supply.
2. Mains via external power supply unit  .
3. The blinking battery LED indicates that the battery is being charged.
4. Charge the battery for at least 4 [2] hours.

12.6.2 Battery disposal

The battery must be disposed of in municipally approved areas or sent back to SCHILLER AG.

⚠WARNING

▲ Explosion hazard! The battery must not be burned or disposed of in domestic waste.

▲ Danger of acid burns! Do not open the battery.

1. With Lithium-ion 11.25V, 6.4Ah = 3.5 hours (05/2018-04/2020)
2. With Lithium-ion 11.25V, 6.4Ah = 3.5 hours (05/2018-04/2020)

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12.7 Inspection Report

▲ The user guide, especially chapter 12, must be read before the inspection.
▲ **Recommended inspection interval:** Every 6 months

Serial no.: _____

Test	Results	Date				
		❒	❒	❒	❒	❒
Visual inspection 12.2 → External condition	• Casing not damaged	❒	❒	❒	❒	❒
	• Electrode connector port not damaged	❒	❒	❒	❒	❒
→ Availability and condition of accessories	• ECG Electrodes (expiration date and compatibility)	❒	❒	❒	❒	❒
	• User guide	❒	❒	❒	❒	❒
	• Mains and patient cable	❒	❒	❒	❒	❒
Functional test 2.3 → ECG test	• No error message shown in the standard display	❒	❒	❒	❒	❒
→ Function keys	• Keys function properly	❒	❒	❒	❒	❒
→ Check the battery	• Battery OK	❒	❒	❒	❒	❒
→ Printer	• Contrast and line strength	❒	❒	❒	❒	❒
	• Cleaning the thermal print head	❒	❒	❒	❒	❒
Remarks		❒	❒	❒	❒	❒
→ Recurrent test conducted (every 12 months)		❒	❒	❒	❒	❒
Inspection carried out by:		❒	❒	❒	❒	❒

In case of a defect, please contact the service department of your hospital ❒, your SCHILLER representative ❒ or the local after-sales service ❒.

Name: .....
Phone: .....

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12.7.1 Lifed-item replacement every 3 - 5 years

Inspection	Results	Replacement				
Internal battery						
➜ Replace internal battery if operation falls substantially under six (6) hours.	• Unit sent to SCHILLER service centre for accumulator replacement.	❒	❒	❒	❒	❒
	Date of replacement:					
	Inspector:					

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13 Trouble Shooting

13.1 Possible problems

Error	Possible causes and indicators	Error localisation and troubleshooting
Unit does not switch on, blank screen	• No power connected; green LED next to the On/Off button is not lit.	→ Check the mains cable. → If the mains indicator is lit, it indicates that power is reaching the unit and the internal power supply should be OK. Press and hold the On/Off key for 10 seconds. Wait a few seconds and switch the device on again.
	• Mains connection OK, but indicator and LED are not lit.	→ If the battery is faulty, it is possible that the unit cannot be switched on even if the mains supply is connected. Have the battery replaced by your SCHILLER representative. → If the screen is still not lit, it indicates a software error, monitor or internal power supply problem. Call your local SCHILLER representative.
QRS traces overlap	• Incorrect settings for patient • Poor electrode contact	→ Change the sensitivity setting. → Check the electrode contact and re-apply the electrodes. → If the problem persists, call your local SCHILLER representative. → Note: Some patients have very high amplitudes and even on the lowest sensitivity settings, the QRS traces can overlap.
"Noisy" traces	• High resistance between skin and electrodes • Patient not relaxed • Incorrect settings	→ Check the electrode resistance (all leads need to be shown in green) → Re-apply the electrodes. → Ensure that the patient is relaxed and warm. → Check all filter settings (**Menu > Settings > ECG > Filters & formulas**). → Activate the myogram filter and change the cut-off frequency. → Ensure mains filter is correct for mains supply. → If the problem persists, call your local SCHILLER representative.
No printout obtained after an auto mode recording.	• No paper • Paper incorrectly loaded • Incorrect settings • Battery operation with less than 35 %[a] capacity: no printout possible	→ Ensure that paper is loaded. → Reload paper. → Ensure that the paper has been inserted correctly. → Check that the printout is activated for at least one setting, and that Print after acquisition is activated (see page 80 and 92) → Connect the device to the mains and charge the battery → If the problem persists, call your local SCHILLER representative.
Printout fades, is not clear, or the printout is ‘patchy‘	• Old paper inserted • Dirty print head • Print-head out of adjustment	→ Ensure that new SCHILLER paper is inserted. → Note that the CARDIOVIT AT-102 G2 thermal paper is heat- and light-sensitive. If it is not stored in its original seal, stored in high temperatures or is simply old, print quality can deteriorate. → Over a period of time, the printing ink from the grid on the paper can form a film on the thermal print head. Clean the thermal print head. → If the problem persists, call your local SCHILLER representative.

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Error	Possible causes and indicators	Error localisation and troubleshooting
No printout of interpretation statement, averaged cycles or measurements	• Incorrect settings	➜ Check that the interpretation and measurement options are enabled for the printout and that the lead sequence is set to Normal (see page 80 section 10.3 and page 42 section 4.12.2,
Function keys blocked	• Software hangs up	➜ Switch off and on again after a few seconds.
	• Function keys defective	➜ Press and hold the On/Off button for 10 seconds to force the device to switch off. Reconnect mains and switch on.
		➜ If the problem persists, call your local SCHILLER representative.
Interferences, lines on the display	• Excessive EMC interferences	➜ Check for sources of excessive EMC interferences.
Memory full	• The ECG recording cannot be stored because the memory is full.	➜ Delete old ECG recordings, see page 64.

a. With Lithium-ion 11.25V, 6.4Ah = 15 % (05/2018-04/2020)

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13.2 Preventing electromagnetic interferences

"Non ionising electromagnetic radiation"

The user can help avoid electromagnetic disturbances by keeping the minimum distance between **portable** and **mobile** HF telecommunication devices (transmitters) and the CARDIOVIT AT-102 G2. The distance of 0.3 m depends on the output performance/frequency of the communication device as indicated below.

HF source Wireless communications devices	Transmitter frequency [MHz]	Testing frequency [MHz]	Max. power P [W]	Distance d [m]
Various radio services (TETRA 400)	380-390	385	1.8	0.3
- Walkie-talkies (FRS) - Rescue service, police, fire brigade, servicing (GMRS)	430-470	450	2	0.3
LTE band 13/17	704-787	710/745/780	0.2	0.3
- GSM800/900 - LTE band 5 - Radio telephone (microcellular) CT1+, CT2, CT3	800-960	810/870/930	2	0.3
- GSM1800/1900 - DECT (radio telephone) - LTE Band 1/3/4/25 - UMTS	1700-1990	1720/1845/1970	2	0.3
- Bluetooth, WLAN 802.11b/g/n - LTE Band 7 - RFID 2450 (active and passive transponders and reading devices)	2400-2570	2450	2	0.3
WLAN 802.11a/n	5100-5800	5240/5500/5785	0.2	0.3

⚠ CAUTION

- ▲ **Portable** HF telecommunication devices must not be used within a radius of 0.3 m from the CARDIOVIT AT-102 G2 and its cables.
- ▲ Do not place the CARDIOVIT AT-102 G2 on top of other electric/electronic devices - i.e. maintain a sufficient distance to other devices (this includes the patient cables).

For permanent HF telecommunication devices (e.g. radio and TV), the recommended distance can be calculated using the following formula: $\times\sqrt{}$ for 150 kHz to 800 MHz and $\times\sqrt{}$ for 800 MHz to 2.5 GHz

d = recommended minimum distance in meters
P = transmitting power in Watts

i For more information on operation in an electromagnetic environment according to IEC/EN 60601-1-2, please consult the service manual.

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13.3 Accessories and disposables

WARNING

▲ Always use SCHILLER spare parts and disposables or products approved by SCHILLER. Failure to do so may endanger life and/or invalidate the warranty.

Your local representative stocks all the disposables and accessories available for the CARDIOVIT AT-102 G2. A comprehensive list of all SCHILLER representatives can be found on the SCHILLER website (www.schiller.ch). In case of difficulty, contact our head office. Our staff will be pleased to help process your order or to provide information on all SCHILLER products.

Art. no.:	Article
2.310005	Earth cable for the potential equalisation stud
2.400175	10-lead patient cable, IEC, push-button
2.400178	10-lead patient cable, AHA, push-button
2.400180	10-lead patient cable, IEC, banana plug
2.400179	10-lead patient cable, AHA, banana plug
2.000041	Electrode kit for adults
2.000052	Electrode kit for children
2.155020	Limb electrodes, adults
2.155000	Suction electrodes 24 mm
2.155025	Blue Sensor electrodes for exercise ECG
2.155031	Biotabs Ag/AgC electrodes for resting ECG
2.155032	Adapter snap/clip for banana plug cables (10 pieces)
2.155030	CARDIO-PREPS (abrasive skin preparation) (50 pieces)
2.157050	Thermal chart paper
2.300000	Mains cable Switzerland
2.300002	Mains cable Schuko Europe
2.300011	Mains cable UK
2.300012	Mains cable (medical grade) USA
2.300014	Mains cable China
2.300016	Mains cable Japan
2.300025	Mains cable Brazil

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14 Technical Data

14.1 Device

Dimensions	384 x 319 x 90 mm, approx. 4.5 kg including thermal paper
Ambient conditions	
Operating temperature	• 10 to 40 °C
Relative humidity during operation	• 15 to 95% (non-condensing)
Pressure during operation	• 700 to 1060 hPa
Storage temperature	
Transport temperature	• 5 to 50 °C
Humidity during storage/	• -10 to 50 °C
Transport	• 10 to 95% (non-condensing)
Pressure during storage/	
Transport	• 500 to 1060 hPa
Power supply	
Mains operation	100 - 240 VAC, 1.3 - 0.7 A, 50/60Hz
Battery	Mains-independent operation with built-in rechargeable battery
Power consumption	max. 64 VA
Display	• Backlit LCD screen for graphic and alphanumeric representation • Resolution: 1024 x 768 dots, 8 “
Battery	
Capacity	• Lithium-ion 10.8V, 6.9Ah *(05/2018-04/2020 = 11.25V, 6.4Ah)* • 8.5 *(8)* hours normal use (with printing every 15 minutes, 2 pages), without Wi-Fi or network operation
Battery life	Under normal operating conditions, 4 years
Recharging time	100 %: approx. 4 *(3.5)* hours when the device is switched off
Printer	High-resolution thermal head printer; 8 dots/mm (amplitude axis); 40 dots/mm (time axis 25 mm/s)
Chart paper	Thermo-reactive, Z-folded, 210 mm wide (A4)
Speed	• 5/12,5/ 25/ 50 mm/s
Sensitivity	• 5 / 10 / 20 mm/mV
Resting ECG review	Display on a grid of 88 x 152 mm with different layouts.
Speed	• 12.5/ 25/ 50 mm/s
Sensitivity	• 5 / 10 / 20 mm/mV
Rhythm ECG review	Display on a grid of 95 x140 mm with different layouts.
Speed	• 6.25 or 12.5 mm/s
Sensitivity	• 2.5 or 5 mm/mV

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Interfaces	• ECG cable interface • Potential equalisation • Network connection (1Gbit) • 2 USB • 2 RS-232
Memory	Memory for at least 350 ECG recordings, 100 resting rhythm recordings and 10 exercise ECGs.

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14.2 ECG

Patient input	• Fully floating and isolated, defibrillation-protected (only with original SCHILLER patient cable)
Lead configuration	• Standard 12-lead • Right precordials • Standard C4r • Balanced • Left Posterior • Nehb • Paediatric
Display	
Leads	• 6- to 12-channel display of the selected leads – Paper speed of 12.5/ 25/ 50 mm/s – Amplitude of 5 /10 / 20 mm/mV
Status	• Filter status • Power source • Leads • Electrode contact status • Heart rate (HR) • Date and time • Patient name and number • LAN / WLAN transfer status
Filter	
Myogram filter (muscle tremor)	• Set to Off, 25, 40, **150**, 250 Hz (250 Hz = Filter Off)
Notch filter	• Distortion-free suppression of superimposed AC 50 or AC 60 Hz sinusoidal interferences by means of adaptive digital filtering
Data record	• Patient data • Listing of all ECG recording data (date, time, filter) • ECG measurements results (intervals, amplitudes, electrical axes) • Averaged complexes • Guidance on interpreting adult and paediatric ECGs
With optional interpretation ETM	
ECG amplifier	Complies with IEC 60601-2-25 and ANSI/AAMI EC11

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14.3 Safety Standards

Safety standard	IEC/EN 60601-1 IEC/EN 60601-2-25
EMC	IEC/EN 60601-1-2
Protection class	Device as a system: Class I in accordance with IEC/EN 60601-1
Conformity/classification	CE/IIa in accordance with directive 93/42/EEC
Protection	This device is not designed for outdoor use (IP 20)

14.4 WLAN standards

Modules	WL1837MOD
FCC ID **IC ID**	Z64-WL180DBMOD 451I-WL18DBMOD
Transmission standards	IEEE 802.11 a, b, g, n
Safety/encryption	WPA2-PSK Enterprise with EAP-TTLS, EAP-TTL or PEA
Frequency range	Dual-band 2.4 GHz and 5 GHz
Max. power output 2.4 GHz (1DSSS)	+16.5 dBm
Max. power output 5 GHz (OFDM6)	+18 dBm

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