# AT-104 PC

## 12 Channel ECG Unit

DESIGNED AND MANUFACTURED IN SWITZERLAND

**User Guide**

**SCHILLER**

The Art of Diagnostics

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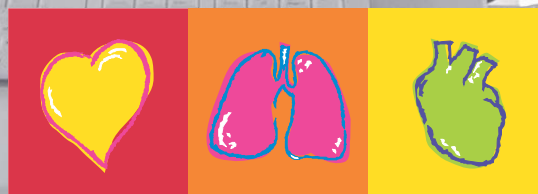
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www.schiller.ch

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The software version is displayed in the help menu. This user guide is for software version 2.60 and later.

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# Contents

# 1  Safety Notes

## 1.1  Responsibility of the User

- ▲ This device must only be used by qualified doctors 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 indications given by this equipment are not a substitute for regular checking of vital functions.
- ▲ Specify the competencies of the personnel for operation and repair.
- ▲ Ensure that personnel have read the operating instructions of the AT-104 PC and the operating instructions of any ancillary equipment, especially an ergometer. In particular the safety instructions of the AT-104 PC and the ergometer must be read and understood.
- ▲ Damaged or missing components must be replaced immediately.
- ▲ The operator is responsible for compliance with all applicable accident prevention regulations and safety regulations.

## 1.2  Intended Use

- ▲ The AT-104 PC is a 12-channel ECG device used for the recording, analysis and evaluation of ECG recordings. Recordings made with the AT-104 PC can be used as a diagnostic aid for heart function and heart conditions. The AT-104 PC is designed for indoor use and can be used for all patients of both sexes, all races, and all ages.
- ▲ There is no danger for patients with pacemaker.
- ▲ Only operate the device in accordance with the specified technical data.
- ▲ The device is not designed for sterile use nor is it designed for outdoor use.
- ▲ Do **not** use this unit in areas where there is any danger of explosion or in the presence of flammable gases such as anaesthetic agents.
- ▲ ♥ This unit is CF classified and defibrillation protected only when the original patient cable is used. However, as a safety precaution when possible, remove electrodes before defibrillation.
- ▲ This product is not designed for internal use. This product is not designed for direct cardiac application.

## 1.3  Organisational Measures

- ▲ Before using the unit, ensure that an introduction regarding the unit functions and the safety precautions has been provided by a medical product representative.
- ▲ Keep these operating instructions in an accessible place for reference when required. Make sure that they are always complete and legible.
- ▲ Observe the operating instructions and maintenance instructions.
- ▲ These operating instructions do not override any statutory or local regulations, or procedures for the prevention of accidents and environmental protection.

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## 1.4    Safety-conscious Operation

▲ Ensure that the patient is informed about the procedure for stress testing and is aware of the risks (for example, of falling on a running treadmill). Ensure the patient is aware of the location and use of the emergency stop knob when using a treadmill.

▲ Do not touch the unit casing 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 person responsible.

▲ Do not place any liquids on the unit. If liquid should be spilled over the device, immediately disconnect the device from the mains and wipe it. The device must be serviced before reusing.

▲ Only connect the original SCHILLER patient cable to the patient socket.

## 1.5    Safety Facilities

▲ To avoid the risk of electric shock, this equipment must only be connected to a mains supply with protective earth.

▲ 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 is damaged or suspected of being damaged.
  – Damaged cable connections and connectors must be replaced immediately.
  – The electrical safety devices, such as fuses, must not be altered.
  – Ruptured fuses must only be replaced with the same type and rating as the original.

▲  Any changes or modifications made to the equipment which are not expressly approved by the relevant standards authority could void your authority to operate the equipment.

▲ Danger of explosion if battery is incorrectly replaced, replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according the manufacturer's instructions.

## 1.6    Networks and Internet

▲ When the unit is part of a network, (LAN, WLAN, HIS, etc.), transmitting over a telephone network or any other transmission /reception medium, or if exposed to the Internet or other insecure networks, appropriate security measures must be provided to protect the patient data stored.

▲ Patient security and security of the network is the sole responsibility of the user.

▲ SCHILLER takes no responsibility for the configuration of Windows.

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## 1.7  Operation with other Devices

▲  Use only accessories and other parts recommended or supplied by SCHILLER AG. Use of other than recommended or supplied parts may result in injury, inaccurate information and/or damage to the unit.

▲  Ancillary equipment connected to the analogue and/or digital interfaces of the PC must be certified according to the respective 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 the system standard IEC/EN 60601-1-1. Everybody 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 the system standard IEC/EN 60601-1-1. If in doubt, consult the technical service department or your local representative.

▲  Any other equipment used with the patient must use the same common earth as the AT-104 PC.

▲  Precautions must be observed when using high frequency devices. Use the special high frequency SCHILLER patient cable to avoid possible signal interference during ECG acquisition.

▲  There is no danger when using the ECG unit simultaneously with electrical stimulation equipment. However, the stimulation units should only be used at a sufficient distance from the electrodes. If in doubt, the patient should be disconnected from the device.

▲  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 and an acoustic alarm given.

▲  If the device is a part of a medical system, the original SCHILLER patient cable must only be used with, and connected to, the patient connector on the AT-104 PC.

▲  Portable communication devices, HF radios and devices labelled with the symbol (non-ionic electromagnetic radiation) can affect the operation of this device (see para 15.3, Electromagnetic Radiation, page 219).

## 1.8  Transporting & Placement of the Optional Medical Panel

▲  When moving the unit on a cart be very cautious. Quick stops, excessive forces and uneven surfaces may cause the cart to overturn thus risking the unit to fall to the ground.

▲  If the medical panel does fall to the ground, immediately turn the power off and disconnect cords. Then contact a service technician for repairs. Continual use of the unit may result cause a fire or electric shock.

▲  Transporting the medical panel is a two man lift.

▲  If wall-mounting the unit ensure the material is firm and stable. If not properly mounted, the display unit may fall and cause serious injury to people standing nearby as well as to the unit itself.

▲  Only use mounting hardware recommended by the manufacturer.

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## 1.9     Electrical and Power Source Related

▲   Only use power cords provided by the dealer to ensure safety and EMC compliance.

▲   The Medical panel and the AT-104 PC unit must be connected to a power source as shown on the specification label. If you are not sure what type of power supply used in the area, consult your dealer or local power supplier.

▲   The power cords must not be damaged. Applied pressure, heat, and stress can damage the power cord.

▲   The power cords must be routed properly so as to help prevent people from stepping on the cords or the cords being run over by, for example, the trolley

▲   Do not overload the mains outlet or extension cords. Electrical shocks or fires may occur from overloading.

▲   Do not touch the power source during a thunderstorm.

▲   If your hands are wet, do not touch the plug.

▲   Do not pull the power cord to remove it from the mains socket because this can damage the cable. Use your thumb and index finger to grip the plug itself.

## 1.10    Maintenance

▲   Danger of electric shock! Do not open the device. No serviceable parts inside. Refer servicing to qualified technician authorised by SCHILLER only.

▲   Before cleaning and to isolate the mains power supply, switch the unit 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 solvent or abrasive cleaners on either the unit or cable assemblies.

▲   Do not, under any circumstances, immerse the unit or cable assemblies in liquid.

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## 1.11    Safety Symbols and Pictograms

### 1.11.1    Symbols used in this Document

The safety level is classified according ANSI Z535.4. The following overview shows the used safety symbols and pictograms used in this manual.

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

⚠**WARNING**    For a possibly dangerous situation, which could lead to heavy bodily injury or to death.

⚠ **CAUTION**    For a possibly dangerous situation which 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.

Used for electrical dangers, warnings and other notes regarding operation with electricity.

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

Reference to other guidelines.

### 1.11.2    Symbols used on the Device

Potential equalization.

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

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 SCHILLER AG for disposal. Improper disposal can harm the environment and human health.

The unit/component can be recycled.

CE 0123    Notified body of the CE certification (TÜV P.S.).

May cause or be susceptible to electromagnetic disturbances (see para 15.3, Electro-magnetic Radiation, page 219).

IP2X    According DIN VDE 0470 PART 1 /EN 60529 / IEC 529

Protection against deposits of dust and protection against spray water. (The first digit indicates the protection of the equipment against ingress of solid foreign bodies and dust and the second digit indicates the degree of protection of the equipment inside the enclosure from ingress of water).

Read and follow the instructions in the accompanying documentation.

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## 1.12   Terms of Warranty

The AT-104 PC is warranted against defects in material and manufacture for the duration of one year (as from date of purchase). Excluded from this guarantee is damage caused by an accident or as a result of improper handling. The warranty entitles 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 of a defect, send the apparatus to your dealer 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 him, and

•   the AT-104 PC and approved attached equipment is used in accordance with the manufacturers instructions.

**i**   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 AG is not liable for the loss of data saved on the device or a remote database. The user is solely responsible for the data backup.

**i**   This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to both Part 15 of the FCC (Federal Communications Commission) Rules and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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# 2  Introduction

The SCHILLER AT-104 PC is an ECG unit that can be used to record resting ECGs in standalone mode or can be used with a PC to provide a complete ECG recording system.

In **standalone mode,** the unit can be powered by the mains supply or from an internal battery. A 12-channel ECG can be printed on the integral real-time printer. The user interface for standalone mode is described later in this book (see para 13, The AT-104 PC as a Standalone Unit, page 184).

When the AT-104 PC unit is connected to a PC, the AT-104 PC unit with SDS-104 program becomes an ECG diagnostic system that can record, display, archive, and analyse both resting and exercise ECG recordings. In this mode the SDS-104 program initiates all functions.

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When the AT-104 PC is connected to the computer, it acts as an amplifier/ interface only. All standalone features (recording, printing etc.) are disabled and all functions are initiated from the PC (with the SDS-104 program). The AT-104 PC keypad is inactive.

## 2.1    AT-104 PC unit



The AT-104 PC Unit

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## 2.2    Location

**⚠ DANGER**

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

• 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 AT-104 PC unit must be placed in the vicinity of X-ray or diathermy units, large transformers or electric motors.

## 2.3    Operation

The AT-104 PC can work as a standalone unit or with a PC and the SDS-104 program.

• For standalone use (see para 13, The AT-104 PC as a Standalone Unit, page 184).
• When the AT-104 PC unit is connected to a PC, all the keys on the unit are inactive and the recording procedure and switching the AT-104 PC on /off, is controlled by the SDS-104 program (see para 3, The SDS-104 Program, page 26).

## 2.4    Power Supply

The AT-104 PC unit can be operated from either the mains supply or from a built-in rechargeable battery. The mains indicator lamp is lit all the time the unit is connected to the mains supply.

The internal battery provides power for up to three hours.

In standalone mode when working from battery power, the unit automatically switches off after 3 minutes (30 seconds if battery capacity is limited) if no key is pressed.

• The unit has a built in battery charger and 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.

## 2.5    Isolating the Mains Supply

To isolate the power supply, remove the mains plug from the wall socket.

## 2.6    Connection of Cable and Ancillary Equipment

### 2.6.1    AT-104 PC unit

- Connect the power cable at the rear of the AT-104 PC. Leave connected to the mains for 7 hours to fully charge the battery.
- Connect the patient cable (side panel).



\*USB to Medical
Panel / PC

Potential
Equalisation

Mains power in



Patient Cable
Connector

\*RS-232 connector to the PC
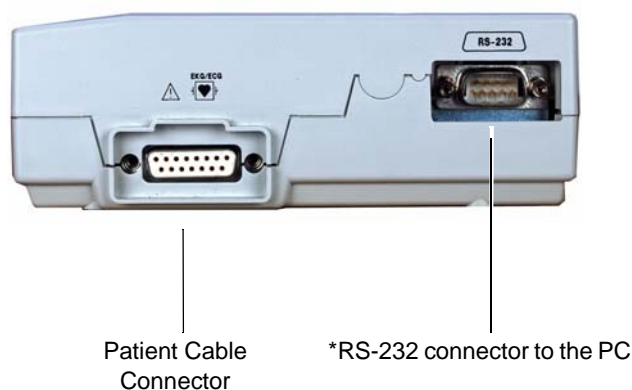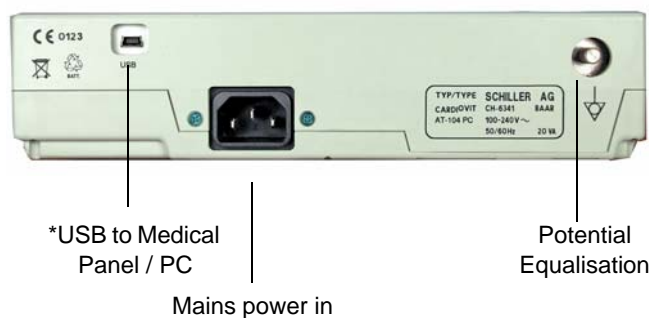
i    \*The USB connector or the RS-232 connector can be used to connect to the PC.

#### Potential Equalisation

The potential equalisation stud at the rear of the AT-104 PC unit is used to equalise the ground potential of the device to that of all mains powered equipment in the vicinity. Use the hospital or building common ground. A yellow/green ground cable is supplied as an option (Article number 2. 310 005).

i    To avoid possible interference from the ergometer when carrying out an exercise test, it is recommended that both the AT-104 PC and the ergometer are connected to the same common ground.

# 2.7   Connection Overview

### Medical Panel

The following is a connection overview of the AT-104 PC unit when the optional medical panel is used.



Patient Cable    (Side panel)

USB Cable from AT-104 PC unit to Medical panel

Mains power to AT-104 PC unit    Mains Supply

Ergometer or Treadmill

Isolated dc power to medical panel    Mains    Mains Supply
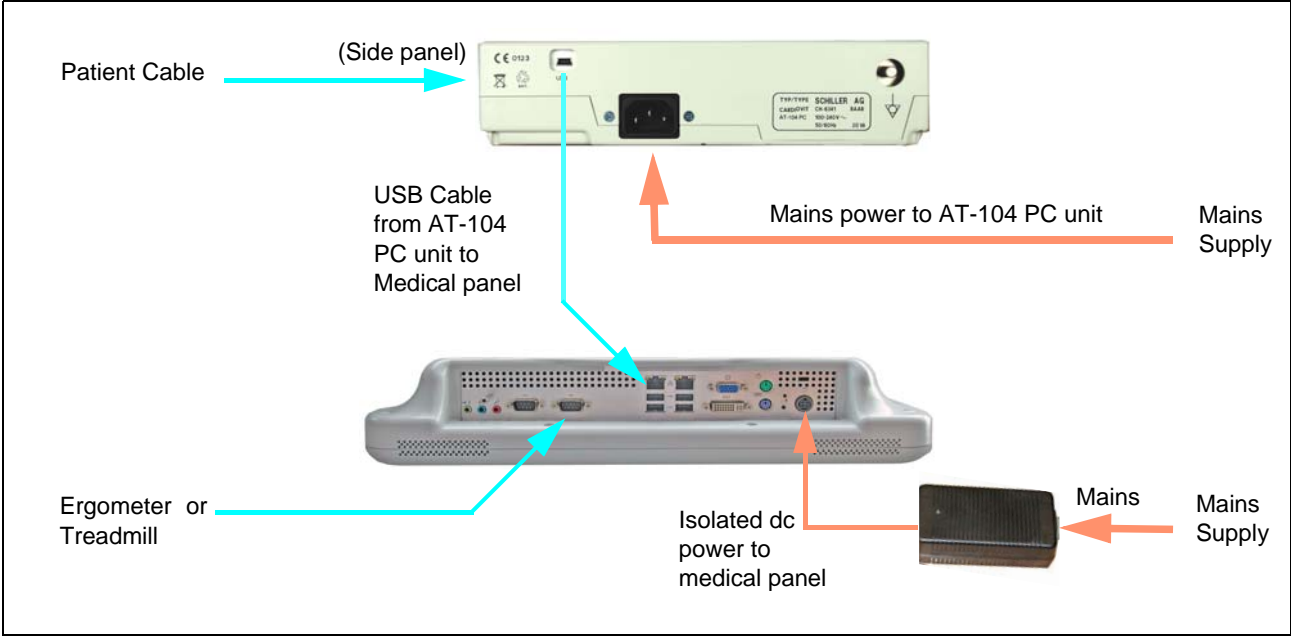
### PC / Laptop

The following is a connection overview of the AT-104 PC when using a PC / laptop.



Patient Cable    (Side panel)

USB or RS232 (side panel) to PC

Mains power to AT-104 PC unit    Mains Supply

RS232    USB

Ergometer or Treadmill

PC / Laptop

(see manufacturers documentation for connection details)

Mains Supply
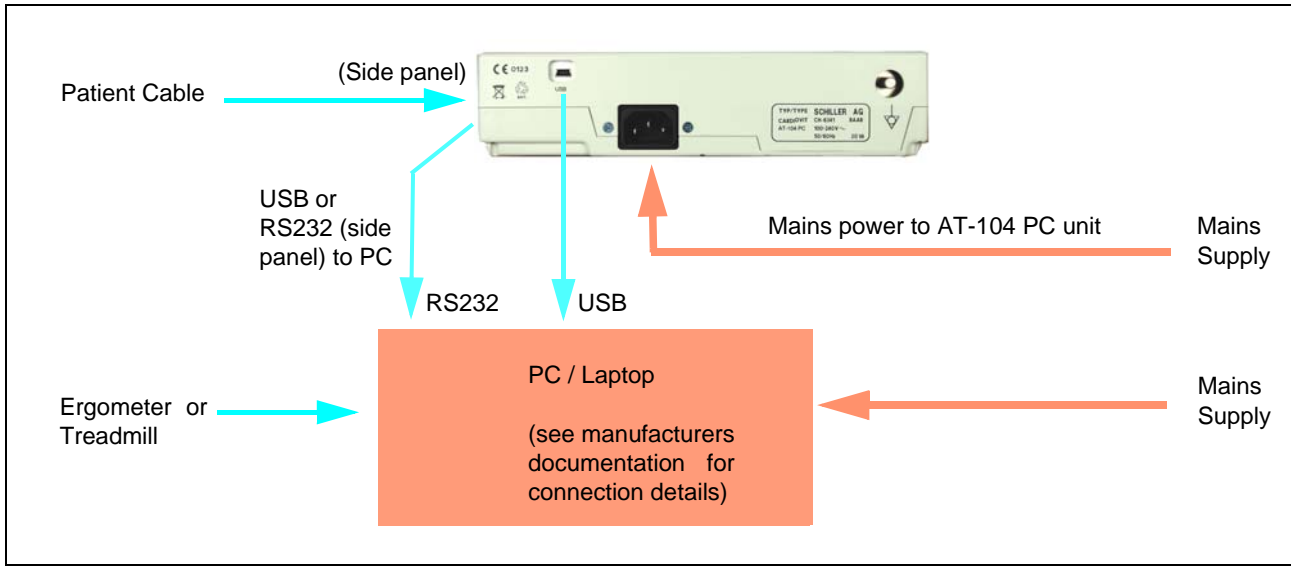
### 2.7.1   PC / Laptop

The operating system of the PC / Laptop must be Windows (XP or later), and the PC must have sufficient processor power and memory.

- Connect the AT-104 PC unit to the PC in one of the following ways:
    - RS-232 cable between the AT-104 PC (side panel) and the PC (using the COM port defined on SDS-104 software installation - see PC documentation for location.
    - USB cable between the AT-104 PC (back panel) to the PC using the USB cable assembly.

- If exercise testing is to be carried out, connect ergometer/treadmill to the PC COM port (defined on SDS-104 software installation).
- For the Touch screen medical panel, connection details are shown on the connection overview (see para , Medical Panel, page 21).

## 2.8   Switching On / Off

ℹ️

When the AT-104 PC unit is connected to the medical panel / PC, it is automatically switched on / switched off when the PC is switched on / switched off.

### Touch Screen Medical Panel

The system is switched on and off with the On / Off switch on the from panel of the medical panel.

### PC / Laptop

Switch on the PC in the normal way with the on/off switch (see manufacturer's documentation for details).

# 2.9   Touch Screen Medical Panel (option)

The optional medical panel is a touch screen computer and is recommended for use with the AT-104 PC.

The medical panel is a touch screen PC with high brightness TFT screen. Interfaces for connection of ergometers, a network connection, external control devices, backup devices, etc., are incorporated.

## 2.9.1   Medical Panel Front Controls and Side Panel



(1)   Brightness lower
(2)   Brightness higher
(3)   On / off button
(4)   Volume down
(5)   Volume up

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### 2.9.2    Connection Panel

The connection panel is situated on the bottom of the unit.
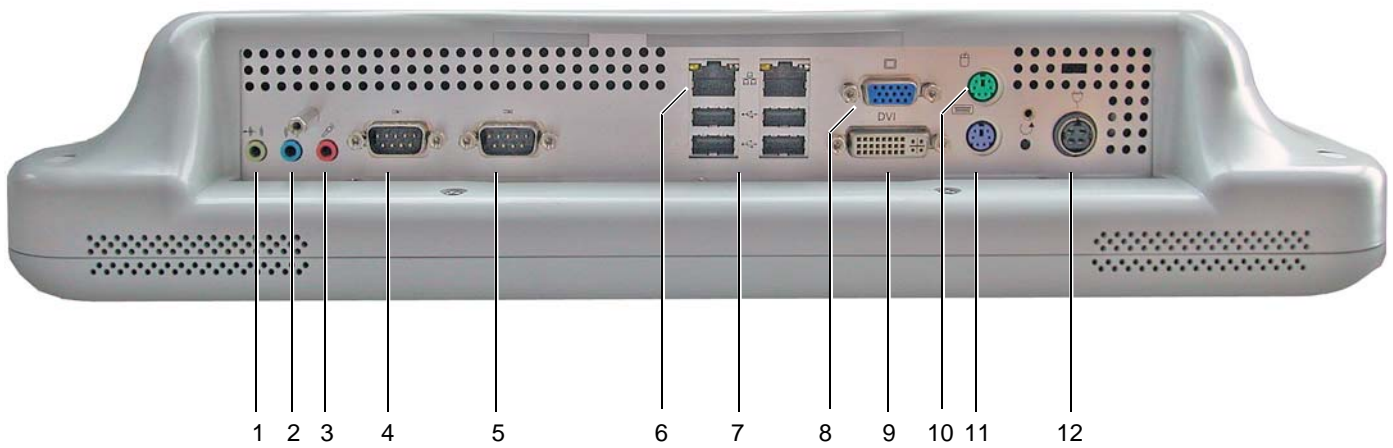


(1)  Line in

(2)  Line out

(3)  Mic

(4)  RS-232 (ergo device)

(5)  RS-232 (ergo device)

(6)  LAN (x2)

(7)  USB (x4). USB ports for connection to the AT-104 PC unit. The other ports can be used for example, printer, external storage device, etc.

(8)  VGA connector (for second monitor)

(9)  DVI

(10) PS2 connector (for pointing device)

(11) PS2 Connector (for external keyboard)

(12) Power DC in

### 2.9.3    Touch Screen Operation

The screen is touch sensitive and items are selected with the finger or with the pointing device supplid with the screen.

⚠ Do not use a pointer with a sharp point as this can damage the screen.

### Entering text

When a text screen is displayed (for example for patient data entry, interpretation, etc., press in the text field to display the keyboard icon. Use the keyboard to enter text in the selected text field.

1
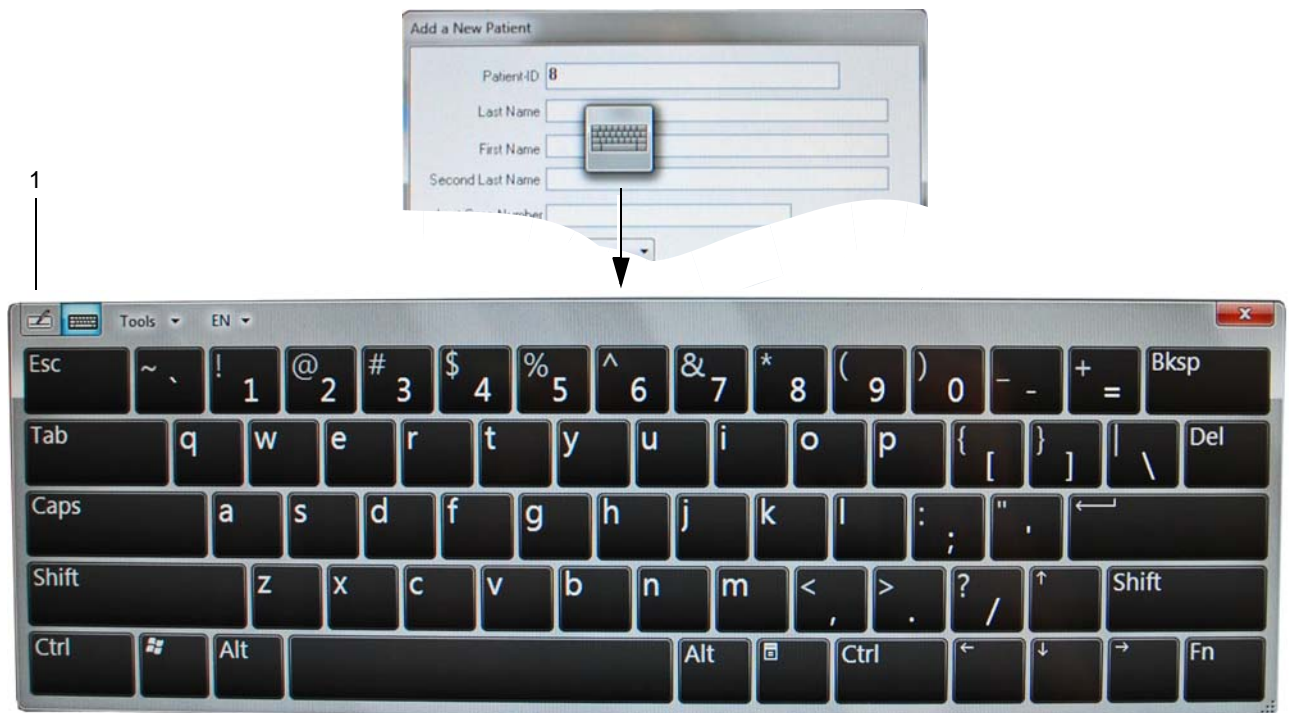


### Handwriting

When the handwriting icon (1) is clicked on the keyboard, the handwriting screen appears; use the pointing device to write the text, the entered text appears to the left. Press the Insert icon, to enter the written text in the text field.
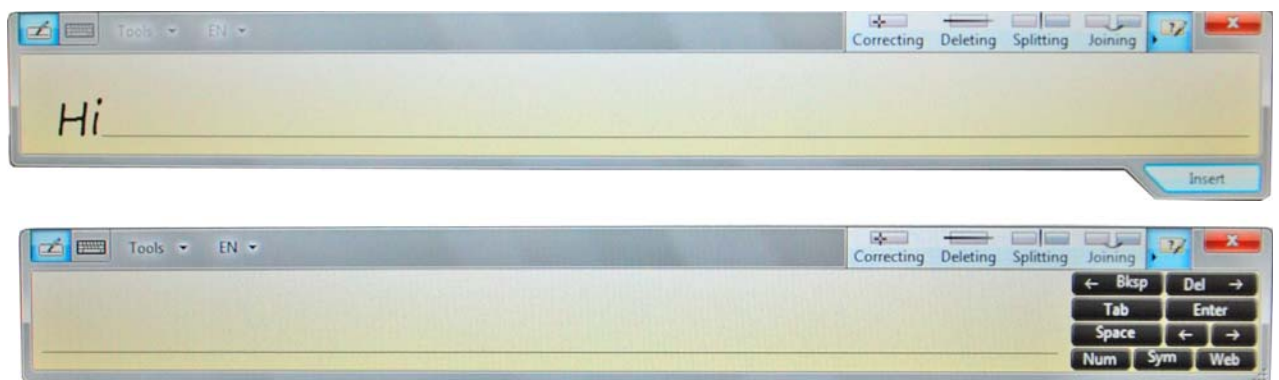
# 3  The SDS-104 Program

## 3.1   Opening and Closing the SDS-104 Program

**i**   The AT-104 PC unit must be connected to the PC to enable all SDS-104 functions. If the AT-104 PC is not connected to the PC, **Demo Version** is displayed on the login screen and recordings cannot be made. However, previously stored recordings can be viewed.

### 3.1.1   Login

Click the on the desktop icon to open the program. [SDS-104]. The Login screen is displayed:
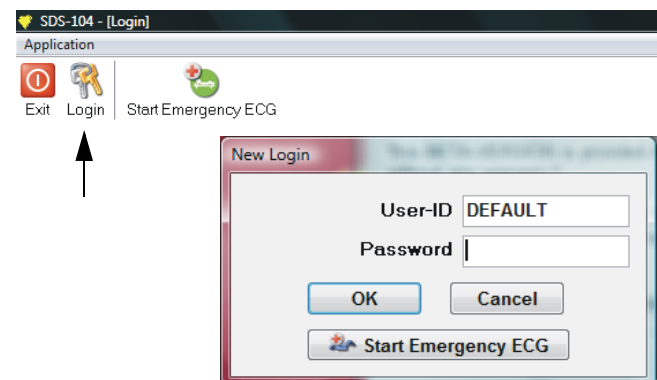
If the login dialogue is not displayed, click the login icon to display.

**i**   For the first time only (or if ID or password has been forgotten), the following can be typed to open the program:

**User ID:       default**

**Password:    system**

- The default user should only be used in special cases and may be deleted or have the password changed to increase security. Please consult your local SCHILLER representative before making any changes.
- The user rights given to the default user (when first logged on) are limited and do not allow editing or recording functions but do give access to system settings. This means that some menu options and function icons may not be displayed or may be dimmed.
- If a menu item or function described in this user guide is not available, check the user rights. These are defined in system setting **Settings > Users, departments, Institutes** (see para 9.1, Defining Users Departments and Institutions, page 124) - (login name and password must be defined by a user with system administrator rights).
- New users should be added to the system with specific user rights.
- When a new user is defined, a setting can be made that requires the user to change the password when first logging on ( see para 9.1, Defining Users Departments and Institutions, page 124). A setting is also available that allows user to change passwords at any time (see para 9.2.8, Database Settings, page 133).

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### 3.1.2   Windows Authentication
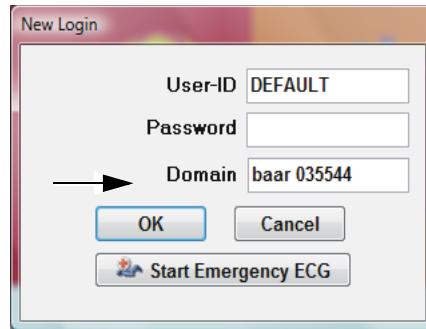
It is possible to have Windows® authentication of user ID and password and auto login if required. This is set in system settings (see para 9.2.8, Database Settings, page 133). When windows authentication is set an extra field appears in the login screen where the Windows domain is specified. When this is shown it indicates that only users registered on the PC can log into SEMA. Note that the system default user ID and password (shown on the previous page) cannot be used (unless added in Windows).

### 3.1.3   Closing the Program

Closing the program should only be carried out from the login screen. Click the **Exit icon** to close the program.

### 3.1.4   Logging out from the Patient Screen
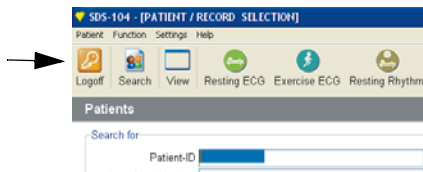
Logout can only be carried out from the patient screen. To logout from a view screen, first go into the patient screen and click the Logout icon in the top left of the screen.

A system control can be set to automatically logout after a user defined time if no activity is detected. This function is defined in system settings (database tab - see para 9.2.8, Database Settings, page 133).

### 3.1.5   Returning to the Patient Screen from a View Screen
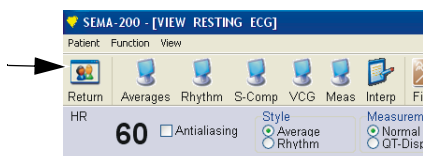
To return to the patient screen from any view screen, click the return icon in the top left of the screen.

## 3.2    The Patient Screen

The patient screen is the first screen displayed after logging in. In the patient screen you can:

- Enter the Recording screens
- Select data management functions.
- Enter the system settings and user setting screens.
- Make patient and recording selection.
- Edit patient data.
- Search for patients.
- Enter the advanced search screen.
- Select a recording for viewing.
- Send / export / receive recordings.
- Print a recording.
- Initiate a spiro recording.
- Define a worklist item.
- Display and download a worklist.
- Initiate a Holter recording (if MT-200 Holter recording program installed).
- Initiate a Holter download (if MT-200 Holter recording program installed).
- Initiate a BP recording (if MT-300 BP program installed).
- Initiate a BP download (if MT-300 BP program installed).

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- If any of the options detailed on the following pages are not available (icons not shown, menu options greyed etc.), check the user rights and other settings (see para 9.1, Defining Users Departments and Institutions, page 124 et. seq.).
- When the long term ECG or BP recording programs are installed icon(s) are shown in the toolbar to provide direct access to these programs.
- An icon can be added to the toolbar to open any program or carry out any user defined function (see para 10.2, Adding a Program Start Button, page 173).

## 3.2.1    Patient Screen Function Overview

1
2
3
4
5a
5b
6
7
8

(1) **Program Menus** - the menu options will change according to the screen displayed:
– Patient - patient data and recording editing options (see following pages).
– Function - print, refresh, import, sort, etc.
(2) **Function icons** - Standard icons, from the left, are as follows:
– The **logout icon** logs out the current user and displays the login screen so that a new user can log in. Note **auto logout is available and set in system settings (**see para 9.2.8, Database Settings, page 133**)**.
– **View** - displays highlighted recording (for analysis, editing, validating, etc.).

– **This is followed by icons to enter various acquisition screens and may include:**

> Resting ECG
>
> Exercise ECG
>
> Resting Rhythm
>
> Spirometry (Schiller)
>
> Spirometry (LF8)
>
> Long term BP and ECG (d) program icons (when the long term BP program and /or long term ECG program are installed.
>
> Program icon - an extra icon can be user defined and added to open any program.
>
> Signal Averaging ECG

(3) **Search** area - search for a patient by **Patient ID**, **Case number**, or **Name** and/or Date **of Birth**

– **Note:** Some user login settings will not allow full viewing functions. (see para 9.1.3, User Rights, page 126).

(4) The **data base icon** updates the database. This can be used for example, if the program is in a network and/or SEMACOMM is installed. When this icon is clicked, the list of patients and recordings in the database is refreshed and externally edited recordings, received since the program was opened, are referenced.

– Full details of the SEMACOMM program are available from the service department.

(5) **List of patients** - highlight a patient to list all recordings for that patient

– Click on **Patient-ID (5a)** to sort by Patient ID and set the search field for ID or case number (see (3) above). Click on **Name (5b)** to sort by name and set the search parameter for name / date of birth.

**i**

• Some user login level settings can restrict the viewing rights. The user rights are defined in system settings (see para 9.1.3, User Rights, page 126).

• There is also a **hide patient list** function that (when set) will not show any patients on login. Patients are only shown when a search is initiated (see para , Searching for a Patient by Name or Date of Birth, page 33). The hide patient list setting is defined in the system settings (database - see para 9.2.8, Database Settings, page 133).

(6) **Edit** and **new patien**t icons (see para 4.2, Entering / Editing Patient and Recording Data, page 34), and **worklist** icons (see para 4.12, Other Database Functions, page 51).

**i**

The functions are also available by 'right clicking' in the patient column (see para 3.2.2, Right Click Functions in the Patient Column, page 32).

(7) Recordings of the selected patient. Highlight a recording and click the **View icon (2)** or double click to open the recording. The recording types are indicated by icons as follows:

| | | Date | Time | V | P | S | E | A |
|---|---|---|---|---|---|---|---|---|
| | LF8 - Spirometry | 28.04.2009 | 14:10:45 | | | | | |
| | Resting ECG | 15.04.2009 | 15:52:06 | | | | ✔ | |
| | Spirometry | 14.04.2009 | 11:54:08 | | | | | |
| | Exercise ECG | 23.01.2009 | 09:08:40 | | | | ✔ | |
| | Ambulatory BP | 09.08.2005 | 08:01:00 | | | | | |
| | Resting Rhythm | 10.11.2004 | 11:28:46 | | | | ✔ | |
| | SA ECG | 09.06.1999 | 15:42:57 | | | | | |
| | Holter-ECG | 20.07.1998 | 10:27:00 | ✔ | | | | |

Labels pointing to icons:
- Spirometry (LF8)
- Resting ECG
- Spirometry (SCHILLER)
- Exercise ECG
- BP Long Term (MT-300)
- Rhythm ECG
- Signal Averaged ECG
- Holter ECG (MT-200)

Long term Holter ECG recordings (MT-200 /MT-210), long term BP recordings (MT-300) and LF8 spirometry recordings, open a new program in a second window.

A tick against a recording in the lettered columns indicates the following:

| Column | Meaning |
|---|---|
| V | **Validated** - Recording has been validated. |
| P | **Printed** - Recording has been printed. |
| S | **Sent** - Recording has been sent to external device (not used in this version). |
| E | **Exported** - Recording has been exported (or transferred) to file server (when the program is networked), or folder, drive etc. |
| A | **Archived** - Recording has been stored on an archiving medium CD, server, Tape, optical disk, etc.). |

(8) General and recording Information.

### 3.2.2    Right Click Functions in the Patient Column

New Patient
Edit Patient
Delete Patient
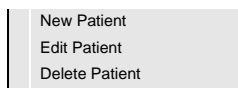
When a patient is highlighted right clicking provides patient editing functions. These functions are as follows:

New Patient             (see para 4.2, Entering / Editing Patient and Recording Data, page 34)

Edit Patient            (see para 4.2, Entering / Editing Patient and Recording Data, page 34)

Delete Patient          Deletes selected Patient - you are prompted to confirm. If the patient has recordings you are prompted to delete the recordings first.

### 3.2.3    Right Click Functions in the Recordings Column

Edit Recording
Assign Recording
Delete Recording
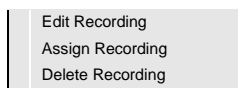
When a recording is highlighted right clicking provides recording editing functions. These functions are as follows:

Edit Recording          The height, weight, BP, etc., can be changed for the recording. Note that data applicable to the recording only can be changed. This means that name, date of birth, etc., cannot be changed. This is changed in the edit screen.

Assign Recording        If the recording has accidentally been recording under the incorrect patient, the recording can be assigned to another patient.

Delete recording        Deletes selected recording - you are prompted to confirm. Go into the Patient menu to delete a patient.

# 4 SDS-104 Program Functions

## 4.1 Quick Patient Search by Name or ID

### Searching for a Patient by Name or Date of Birth

To search for a patient by name or date of birth proceed as follows:



1.  Click on the title bar **Name (b)**, or press **function key (F7)**.
2.  To search for a category of patients, for example all patients with surname beginning with 'w', simply type 'w' in the **Name field (c)**. To refine the search, type in the first name (or the first letter(s) of the name) in the first name field. Enter as many characters as you wish to identify the (group of) patient(s).
3.  All patients beginning with the entered character(s) are listed when **Search (e) (or Enter)** is clicked.
4.  To search for a patient by date of birth enter the patients full date of birth and click **Search (e) (or Enter).**

To clear the search, click **Clear (f)**.

### Searching for a Patient by ID

To search for a patient by patient ID / Case number proceed as follows:

1.  Click on the title bar **Patient ID (a),** or press **function key (F8).** The name field changes to patient ID.
2.  Type the ID in the **Patient ID** field. Enter as many characters as you wish to identify the (group of) patient(s).
3.  All patient IDs beginning with the entered character(s) are listed when **Search (e) (or Enter)** is clicked.

**Note:** Some user login settings will not allow full viewing functions.

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# 4.2    Entering / Editing Patient and Recording Data

ℹ️    Recording specific data (such as weight, height, blood pressure etc.) are changed for a specific recording only. General patient data such as gender, data of birth etc., are changed for all patient recordings.

## 4.2.1    Patient Data

Enter the patient screen by highlighting the patient / recording in the patient list and clicking edit patient icon **(b)**. Define a new patient with the New Patient icon **(a)**. The following is displayed:



### Downloading Patient Data from a Database

To download / update the patient data from a remote data base, enter patient ID or case number and click the Patient Data Query icon (c, d). If the patient is found, a new patient will be defined or an existing patient updated when confirmed by the user.

ℹ️    • The Worklist PDQ function requires that a SCHILLER Communication Server (SCS) handles the interfacing. The address of the SCS must be defined in system settings (see para 9.2.8, Database Settings, page 133).

**Pat ID**    The patient ID is an easily identifiable short form of identifying a patient - a maximum of 20 characters can be entered.

ℹ️    The patient ID format can be user defined. For example BC-123-1122 (two letters followed by three digits followed by four digits). This is defined in system settings (see para 9.2, System Configuration, page 128).

**Last Name**    Enter patients name (maximum 30 characters).

**First Name**    Enter patients first name (maximum 15 characters).

**Second last name**    Enter patients second name (maximum 30 characters).

**Sex**    Enter the patient's gender - M or F.

**Date of Birth**

Enter patient's date of birth dd-mm-yy.

For a quick and easy way of doing this click the icon to the right of the field to display a calendar.

The years and months are scrolled with the arrows **(a).**

a
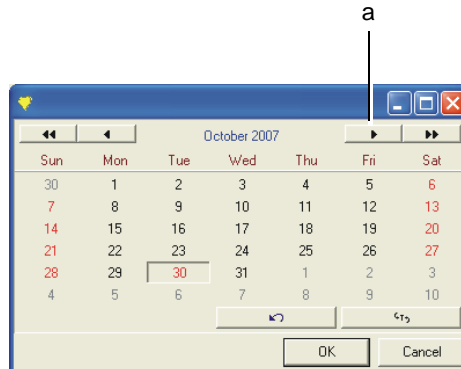


**Weight**

Enter patient's weight between 0.5 and 250kg (5 and 500 lbs).

**Height**

Enter patient's height between 20 and 250cm (10 and 80 inches).

**Pacemaker**

Check if the patient has a pacemaker fitted.

**Insurance and Insurance type**

These must be entered in the recording screen (see next page). Select using the arrows at the side.

### Downloading Patient Data from a Database

To download / update the patient data from a remote data base, enter **patient ID** or **case number** and click the **Patient Data Query** icon **(c, d)**. If the patient is found, a new patient will be defined or an existing patient updated when confirmed by the user.

### 4.2.2   Recording Data

Highlight the patient and the recording in the patient screen and click the edit patient icon or **Edit Recording** in the patient menu. The following is displayed:



The patient fields highlighted yellow cannot be changed for a recording and are shown for reference. If any of this data needs to be changed the patient edit field must be entered (see previous page).

**Patient Physical Attributes, Insurance, Case No. and Medication (First Page)**

The patients weight, height, BP, pacemaker and insurance can be edited for each recording. The case number, order ID and any further remarks can be entered as required.

**Insurance (first page)**

To make an entry in the insurance entries proceed as follows:



- Click the **Write icon (b)** in the edit screen
- Select the type of table **(c).**
- Click **New (d)** to enter the data.

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**Indications, Remarks, and Acquiring, Requesting and Analysing Institutes and Departments (Page 2)**



Entries for indication, remark, and cost type are entered in same way as for insurance detailed on the previous page.

The Institute, the Department and the Technician can be defined for the Acquiring, Requesting and Analysing functions of the recording. Select the Acquiring, Requesting and Analysing tab as required and select the relevant institutes / departments with the right-hand arrow of the entry field.

The Institutes and departments are defined in system settings (see para 9.1, Defining Users Departments and Institutions, page 124).

## 4.3    Deleting a Recording / Deleting a Patient

| Patient | |
|---|---|
| New Patient | Shift F2 |
| Edit Patient | |
| Delete Patient | |
| Add Workitem | |
| Edit Recording | |
| Assign Recording | |
| Delete Recording | |
| Search. Recordings | F3 |
| Return | Esc |
| Send mail (RST - file) | |

a ——
b ——
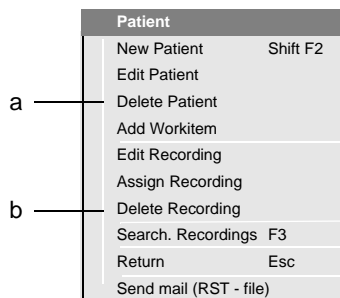
### To delete a recording:

1.   In the main patient screen, highlight the specific recording with the mouse.

2.   Select the **Delete Recording (b)** option in the patient menu.

A confirmation message is displayed. You must confirm that you wish to delete.

### To delete a patient:

Before a patient entry can be deleted, all recordings associated with that patient must have been deleted. If delete is selected and the patient has recordings, a message is displayed that the recording(s) must be deleted first.

1.   Highlight the specific patient with the mouse as previously described.

2.   Select the **Delete Patient (a)** option in the patient menu.

**i**    In hospital installations where patient data may be imported via the hospital system, it is possible to end up with many patients on the database that do not have recordings. A function exits to batch delete all patients in the SEMA database, without recordings. This is carried out in the Function menu (see para 4.12.3, Deleting Patients with no Recordings, page 57).

# 4.4 Assigning a Recording

ⓘ It is only possible to assign a recording to another patient if user rights allow (see para 9.1.3, User Rights, page 126).

**Patient**

| | |
|---|---|
| New Patient | Shift F2 |
| Edit Patient | |
| Delete Patient | |
| Add Work Item | |
| Edit Recording | |
| **→** Assign Recording | |
| Delete Recording | |
| Search. Recordings | F3 |
| Return | Esc |
| Send mail (RST - file) | |
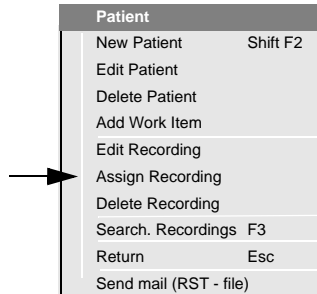
A recording assigned to the incorrect patient can be reassigned. All recordings must be assigned individually - it is not possible to assign a group of recordings. To assign a recording, proceed as follows:

1. In the Patient screen highlight the recording that is to be reassigned.

2. Select **assign record** from the patient menu or 'right click' on the recording to display the recording menu.

| |
|---|
| Edit Recording |
| Assign Recording |
| Delete Recording |
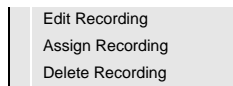
3. Enter the new patient ID number and click the find icon.

| Assign record | ⌐ ◻ ✕ |
|---|---|
| 🟢 **Doe John** | |
| **20.03.2009 11:18:29** | |
| **Assign record to** | |
| Patient-ID | |
| OK | Cancel |
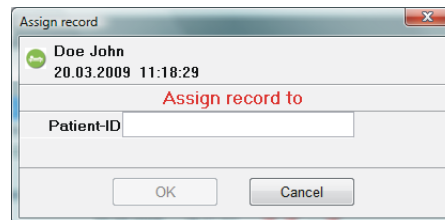
4. When the number is found click the **OK** icon to reassign the selected recording to the new patient.

If the number cannot be found the **OK** icon remains dimmed and a message is displayed indicating this. Check the number entered and click find again.

ⓘ Patient and Recording editing and defining a new patient is detailed earlier in this book (see para 3.2, The Patient Screen, page 28).

## 4.5    Sending a Recording by E-mail

| Patient | |
|---|---|
| New Patient | Shift F2 |
| Edit Patient | |
| Delete Patient | |
| Add Work Item | |
| Edit Recording | |
| Assign Recording | |
| Delete Recording | |
| Search. Recordings | F3 |
| Return | Esc |
| Send mail (RST - file) | |
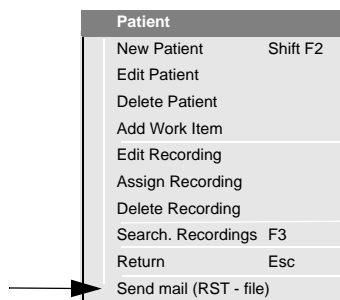
To send a recording by e-mail proceed as follows:

1.    In the patient screen, highlight the recording that you wish to send.

2.    In the patient menu select `send mail`.

The default browser opens with the selected recording already as an attachment. Define the recipient and message, and send in the usual way.

**i**    Recordings sent by e-mail are not indicated by an `S` (sent) in the recordings section of the patient screen.

# 4.6 Importing a Recording

This function imports recording from an external source or folder. When this function is selected all imported recordings are placed in the SDSRECS folder and are available for viewing directly. To import a recording or group of recordings, proceed as follows:
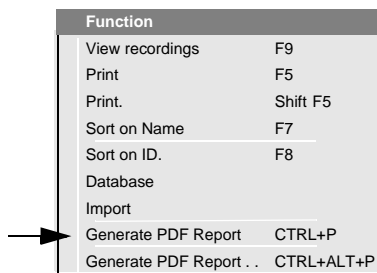
1. In the patient data screen function menu, select **Import** and select the data to be imported.

| Function | |
|---|---|
| View recordings | F9 |
| Print | F5 |
| Print. | Shift F5 |
| Sort on Name | F7 |
| Sort on ID. | F8 |
| Database | |
| Import | |

Schiller Format
Patient Data from Interfaces
ECG Holter Data
BR-102 plus Data

**Import Schiller Files**

C:\SDS104\SDSIMP     ...     a

| Recordings | | Statistic | |
|---|---|---|---|
| Resting ECG | 0 | Patients | 0 |
| Exercise ECG | 0 | Errors | 0 |
| Spiro | 0 | Total | 0 |
| LaPo | 0 | | |
| RestRhythm | 0 | | |
| Ergo-Spiro | 0 | | |

**File Name**

Start    Cancel      b
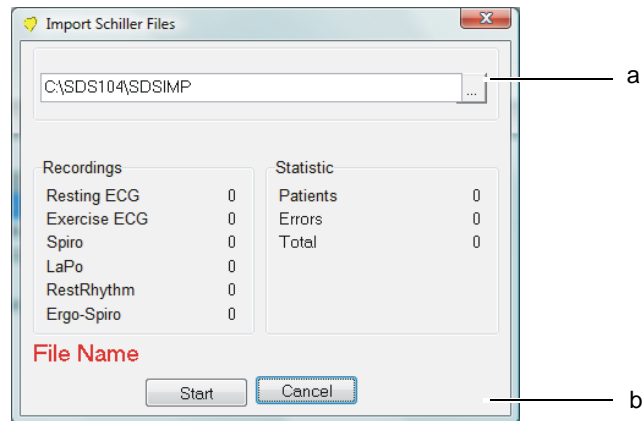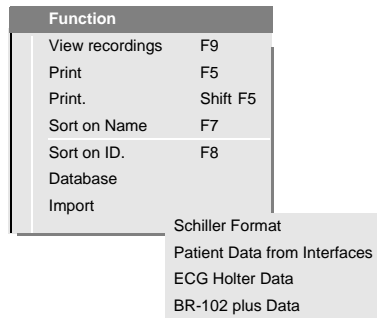
2. Select the drive in the top field of where the files to be imported are located. (Click on the 'browse' icon **(a)** to the right of the field to display the drives connected to your system and select the file(s).
3. Click on the **Start** icon **(b)**.

All recordings on the disk/medium selected will be copied to the SDSRECS file and will be available for view directly. If the recordings are not available for view select **restore database** from the function menu ().

# 4.7  Generating a PDF file

| Function | |
|---|---|
| View recordings | F9 |
| Print | F5 |
| Print. | Shift F5 |
| Sort on Name | F7 |
| Sort on ID. | F8 |
| Database | |
| Import | |
| Generate PDF Report | CTRL+P |
| Generate PDF Report . . | CTRL+ALT+P |

To generate a pdf file, highlight the recording (in the patient screen) and select **Generate PDF Report** or press the control key **CTRL + P**. This menu option is also given when a recording is open.

To define the data to be included in the file before generating the file, press the control key **CTRL + ALT + P**.

When the PDF file has been generated, it can be viewed, stored, send by email, etc., in the normal manner.

**i**

A PDF file can also be generated when a recording is exported (see next page).

The pdf data defaults are defined in system settings (see para 9.5, PDF Defaults, page 144).

# 4.8 Exporting a Recording

The export function copies an rst file, xml and/or pdf file to a specific directory / folder. This can then be accessed by for example, a hospital network.

## 4.8.1 Manually Exporting a File / Generating PDF File

In the patient screen, highlight the recording that you wish to export and click the **export icon**.

ℹ The folder that the generated file(s) will be placed is defined in system settings > directories (see para 9.8, Directories, page 151).

Further details of address book, directories and transfer settings are given in the settings section (see para 9.6, Transfer and Export Settings, page 145 and sequence).

The title of the pdf file generated can be defined to include name, date, type and other variables. To define the pdf file name (see para 10.1, Defining the Name of the Generated PDF File, page 171).

ℹ The synchronise icon is used to synchronise any recordings taken when the AT-104 PC was offline. When the unit is reconnected to the network, synchronisation is normally automatic, however, if automatic synchronisation does not occur, the synchronise icon can be pressed to achieve this.

### 4.8.2   Export Settings

**Address Book**

To export a file /generate a pdf file proceed as follows:

In the address book in the system settings, define an export address where the recording will be sent.

| Settings |
| --- |
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 |
| Resting ECG |
| Rhythm ECG |
| Exercise ECG |
| Direct Print |
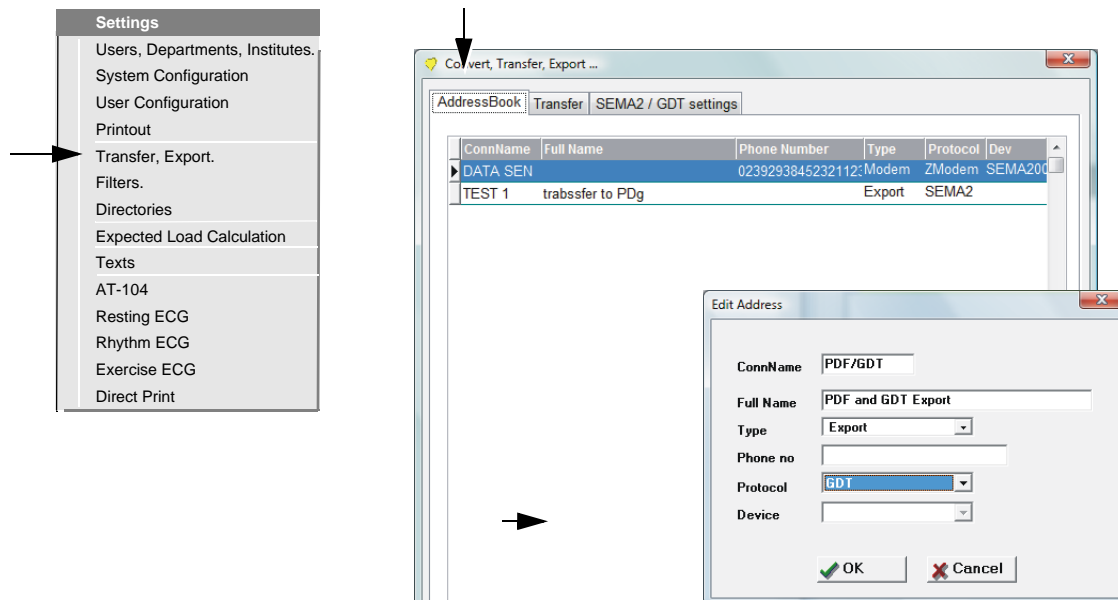
- **ConnName** - select any suitable name or acronym
- **Type** - select **Export**
- **Phone Number** - Not applicable
- **Protocol** - select SEMA2
- **Device** - not applicable

**Transfer Settings**

In the transfer tab in the system settings, define the data to be exported i.e. rst file (SEMA format) or pdf, and the export address (defined above).

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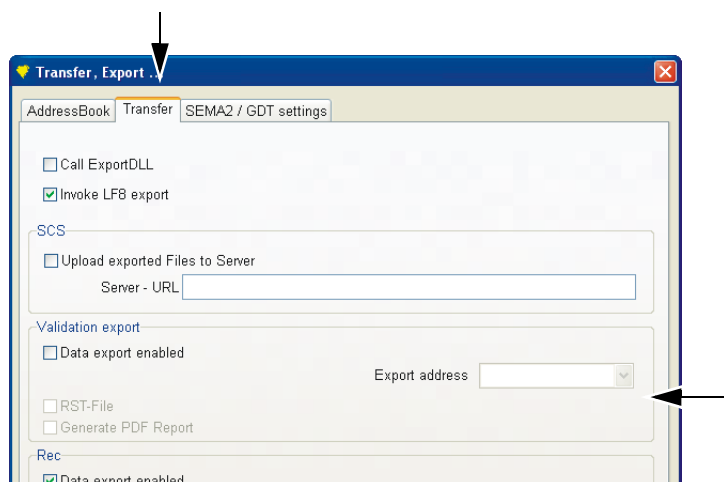
# 4.9 Sending Patient Data

ℹ️ The send patient data function sends a patient data to the data base of an external device.

### Send the Patient Data

1. Select the patient from the patient screen and click the **send PatData** icon.

2. A list of all addresses is shown. Select required address and time to send and click the OK icon.
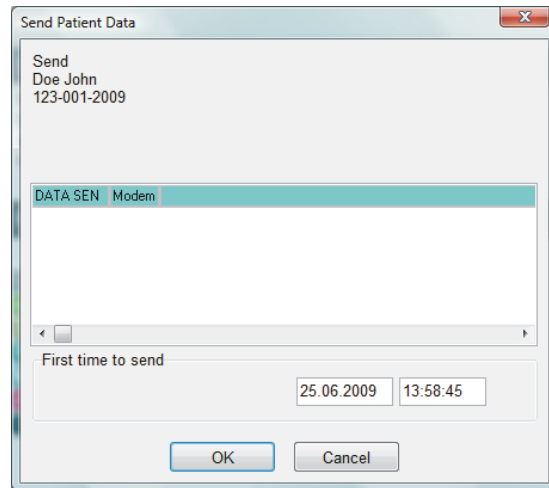


## 4.9.1 Defining the Recipient Address

In the address book in the system settings, define the address where the patient data will be sent (see para 9.6, Transfer and Export Settings, page 145). The following must be observed when defining the address:

• The **ConnName** can specific to the device and COM port. When this is the case the ConnName must be in the following format:

  – **xxxxxx-y** (maximum 8 characters) where xxx is the location ID of the device and y is the COM port starting with 0, (i.e. 0 = COM 1, 1 = COM 2 etc.).

  – Between xxxx and y there must be a hyphen '-'.
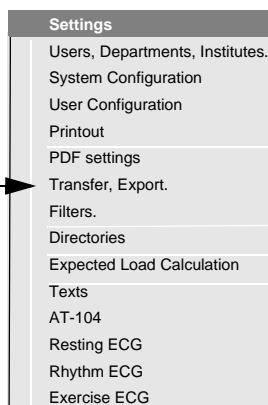
# 4.10    Refreshing the Database

If the SDS-104 program is in a network and the program is open, any externally edited recordings may not be updated automatically.

The SemaComm program is automatically opened when the computer is switched on and all received recordings are stored on the import directory (defined during installation). These recordings are transferred to the SDS-104 database when the SEMA program is first opened i.e. all recordings stored in the import directory are automatically transferred to the SDS-104 database. However, when the SDS-104 program is already open, transfer may not automatic.
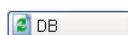
To refresh the database click the **DB icon** in the patient screen.

Details of the SemaComm program, installation and settings are provided in the SCHILLER communication guide (Art. No. 2.52003) available from the SCHILLER service department.

# 4.11  Worklist

The worklist function sends patient demographics to the worklist of an external device or devices. The following units can accept worklists:

• AT-10 plus
• AT-102 plus
• CS-200
• AT-104 PC (SDS-104)
• SEMA-200

**i**     • The Worklist function requires that a SCHILLER Communication Server (SCS) handles the interfacing. The address of the SCS must be defined in system settings (see para 9.2.8, Database Settings, page 133). Note that the **Create Worklist icon will only be shown when the address of the SCS is defined.**

## 4.11.1  Generating a Worklist Item

The worklist functions are defined / viewed from the Patient screen.

| Patient | |
|---------|---|
| New Patient | Shift F2 |
| Edit Patient | |
| Delete Patient | |
| Create Workitem | |
| Edit Recording | |
| Assign Recording | |
| Delete Recording | |
| Return | Esc |
| Send mail (RST - file) | |
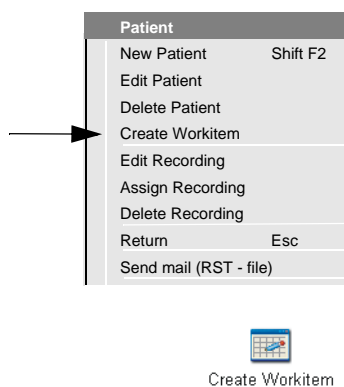
Create Workitem

1. In the patient screen, highlight the patient and create a work Item by:
   – Click the **Create Work Item** icon
   – Select **Create workitem** from the patient menu**.**

**Create Workitem**

Select Examination Type
⊙ Patient Data Only
○ Resting ECG
○ Exercise ECG
○ Spirometry
○ Late potentials
○ Resting Rhythm
○ Exercise Spirometry
○ Holter ECG
○ Holter BP

**Create Workitem**

Select/Enter Referring Doctor
1, 1

Select/Enter Device Target ID
654, 76

Enter Order ID

Enter Room ID

Back        Can

**Create Workitem**

Create new Workitem with following Data:
| Patient: | 000001 |
| | At10 N0nscp |
| Examination Type: | |
| Referring Doctor: | 1 |
| Case Number: | |
| Order ID: | |
| Room ID: | |
| Device Target ID: | 654 |

Back        Cancel        Finish

2. Define type of recording (or leave empty to not define a recording type).
3. Define:
   – Referring doctor / user (or leave empty for any)
   – Target device (or leave empty for all)
   – Department ID (or leave empty for any)
   – Room number /ID (or leave empty for any)
4. Review settings and click the Finish icon to save the work item.

**i**     After a recording has been made, the data is uploaded back to SEMA when instructed by the acquiring unit.

## 4.11.2    Defining Recipient Address

In the address book in the system settings, define the address where the worklist will be sent (see para 9.6, Transfer and Export Settings, page 145). The following must be observed when defining the address:

| Settings |
|---|
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout |
| PDF settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 |
| Resting ECG |
| Rhythm ECG |
| Exercise ECG |

Edit Address

| | |
|---|---|
| ConnName | ECG1 ICU |
| Full Name | Worklist to AT10plus |
| Type | Line |
| Phone no | |
| Protocol | Block |
| Device | ASCII |

OK    Cancel
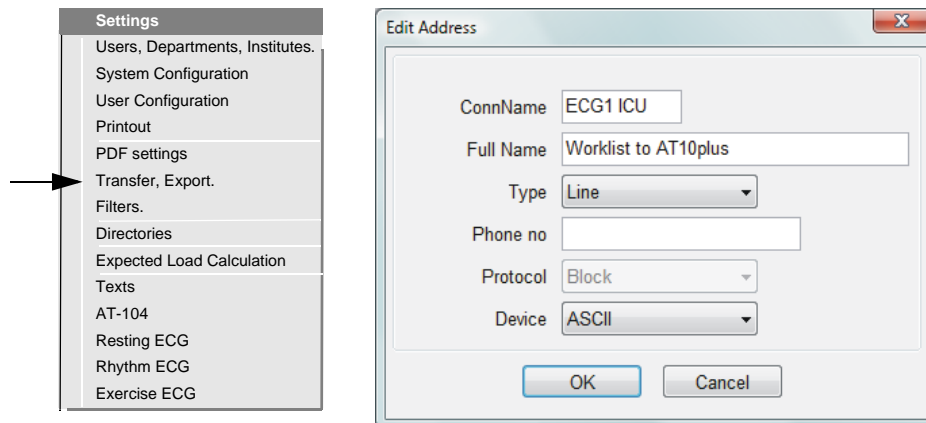
- **ConnName**[1] - this is specific to the device and is the User ID of the unit (see the user guide for the device). It must be entered exactly the same as defined for the device.
- **Type** - always select **Line**
- **Phone Number** - Not applicable
- **Protocol** - Not applicable
- **Device** - select **ASCII**

---

1. If you wish to **send to all devices** type **star (*)** in the **ConnName.** This means that any patient data broadcast will be entered on the worklist of all devices connected on the network.

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### 4.11.3    Viewing and Down-loading a Worklist

1. From the patient screen click the **Worklist icon** to display the worklist.
2. The worklist is displayed:



Click **Retrieve new Worklist (e)** to update / download a worklist. Any worklist items that have been defined for the specific unit and for all units will be down-loaded.

When Retrieve worklist automatically **(c)** is checked, worklists are downloaded automatically when the worklist icon is clicked.

A progress bar is displayed during worklist upload.
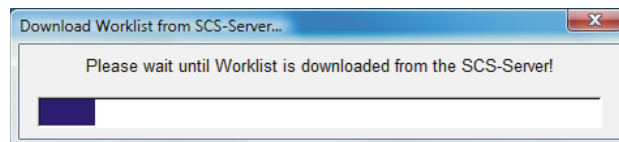


3. When a recording is highlighted, the patient name is given to the left **(f).**

### Search

When there are many worklist items, a search function is available to search for a specific recording or group of recordings.

Patients can be searched for by any of the following categories.

- Patient ID
- Last Name
- Order ID
- Location
- Referring Physician

To make a search for example, of patients referred by Mr Smith with surname beginning with 'w', simply type 'Mr Smith' in the **referring Physician** field and type 'w' in the **Name field.** Enter as many characters as you wish to identify the (group of) patients.

All patients beginning with the entered characters are listed when **Search (d) (or Enter)** is clicked.

To clear the search (and display the complete list), click the **Clear** icon (**d).**

### Performing a Workitem

**i**

- The icons and recording types are detailed in the patient screen ().

1. Highlight the patient in the list - the selected patient details are shown on the left of the screen **(f)**.
2. Click the Perform workitem icon **(a)**.
3. The patient data screen is opened and the data acquisition program is opened.
4. When the recording has been taken, it is automatically uploaded.

### Cancelling a Workitem

5. Select the workitem and click the Cancel workitem icon **(b)**. The workitem is removed**).**

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# 4.12 Other Database Functions

## 4.12.1 Archiving

Archiving is not to be confused with backup, which we strongly recommend is carried out on a daily basis.

Archiving is carried out when a recording is no longer required for active access. Archiving is normally carried as a batch process i.e. a number of recordings are archived together. Dependent on your system methodology we recommend that you archive on regular basis (monthly, 6-monthly, yearly etc.). When the archive function is selected data files are moved or copied to an archive directory. This can be to another hard disk, to another directory on the same hard disk, or an archive medium, optical disk, CD ROM, zip drive, etc.

When a recording is archived the reference to the patient and the recording remains in the database and it is displayed in the patient screen. The recording can still be opened in the normal way. If an attempt is made to open an inaccessible recording (stored for example, on an optical disk, server etc.), a message is displayed to mount the archived disk.

| Recordings | | | | | |
|---|---|---|---|---|---|
| T | | Date | Time | V P S E A | |
| Resting ECG | | 15.04.2009 | 15:52:06 | ✓ | |
| Spirometry | | 14.04.2009 | 11:55:24 | | |
| Spirometry | | 14.04.2009 | 11:54:08 | | |
| Spirometry | | 14.04.2009 | 11:53:52 | | |
| Resting Rhythm | | 03.04.2009 | 11:35:49 | ✓ | |
| Exercise ECG | | 23.01.2009 | 09:08:40 | ✓ | |
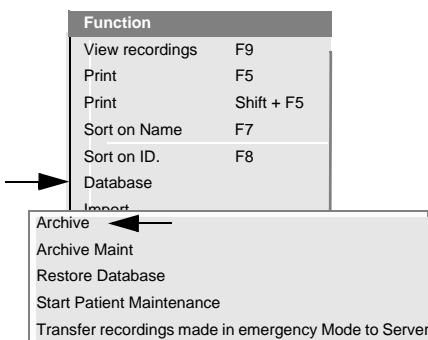
In the patient data screen, select **Database > Archive** from the function menu:

At the top of the archive menu screen, 2 pages can be selected indicated by tabs; these are Archive and Settings. A second menu item 'archive maintenance' gives further setting which are described later. The current page is highlighted bold.

| Function | |
|---|---|
| View recordings | F9 |
| Print | F5 |
| Print | Shift + F5 |
| Sort on Name | F7 |
| Sort on ID. | F8 |
| Database | |
| Import | |

| |
|---|
| Archive |
| Archive Maint |
| Restore Database |
| Start Patient Maintenance |
| Transfer recordings made in emergency Mode to Server |

**Archive Directory**

Specify the drive and directory on which you wish to archive. The default storage medium (drive) can be pre-programmed in system settings (see para 9.8, Directories, page 151). It is recommended that no more than approximately 1000 recordings are stored in a sub- directory. When more than this number is stored access speed can suffer.
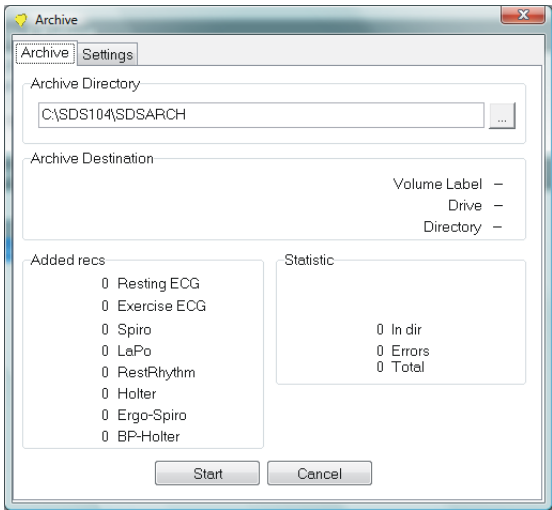


ⓘ    Always review the **Archive Settings** (see next page) before archiving to ensure that the recordings are archived as required.

Click on the **Start** icon to archive the defined recordings (see following for defining recording type.

The following fields are displayed after archiving.

**Errors**    The number of recordings that could not be archived.

**Totals**    This box is a counter indicating the total number of recordings being archived.

**in Dir**    This box indicates the total number of recordings in the archive directory.

## Archive Settings
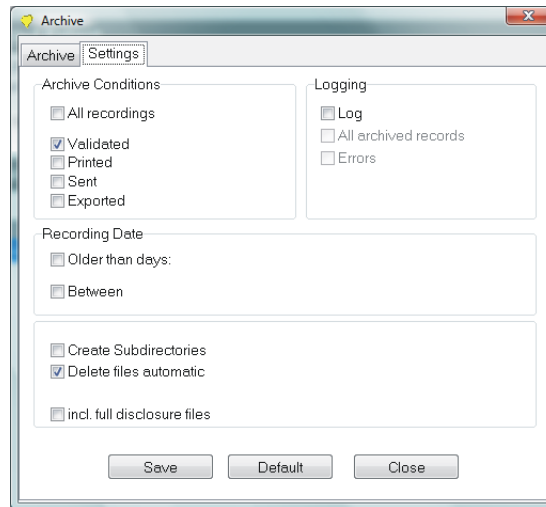


**Archive Conditions**

Tick the boxes of all classifications of recordings that you wish to archive.

**Date**

This is an archive date filter. Do not click either box if you do not wish to specify a date. A number of days back or specific dates can be defined:

– To define all recording older than a certain age that you wish to archive the recordings tick the **Older than box** to display a field to enter the number of days.
– To define date parameters, click the **Between** box to define specific dates (as shown).

**Delete Files Automatic**

If you wish to automatically delete the original recordings after archiving, check the automatic deletion box.

Note: If this box is not checked the data file remains in the original file location. This means that the same recording can appear twice in the patient screen. The archived version is indicated by the archived flag in the patient screen.

Recordings can also be deleted manually - (see para , Special Tasks, page 55).

**incl. full disclosure files**

Check the full disclosure box to archive the saved full disclosure recordings. Note that a full disclosure file may be very large. Ensure that you have enough disk space when selecting this option.

**Log**

Check this box to keep a log of all archived records and/or errors. The directory where the log file will be generated is specified in the Directories (logs) submenu of the system menu (see para 9.8, Directories, page 151).

**i**

• Archive settings can be **stored as default** by clicking **Save.**
• If changes have been made and you want to **restore to the default setting**, click **Default**.
• To exit without storing the changed settings, click **Close.**
• To start archiving go to the archive screen (see para 4.12.1, Archiving, page 51).

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## Archive Maintenance - Rebuild Archive

| Function | |
|---|---|
| View recordings | F9 |
| Print | F5 |
| Print | Shift + F5 |
| Sort on Name | F7 |
| Sort on ID. | F8 |
| Database | |
| Import | |

Archive
Archive Maint
Restore Database
Start Patient Maintenance
Transfer recordings made in emergency Mode to Server

**Archive Maint**

Archiv Rebuild | Special Tasks

Read directory
C:\SDS104\SDSARCH    ...

Select directories from list below

C:\SDS104\SDSARCH

Directory

File Name

Recordings        Patients
0  Resting ECG                    0
0  Exercise ECG
0  Spiro          Errors
0  LaPo                           0
0  RestRhythm
0  Ergo-Spiro     Total
0  BP-Holter                      0

Start    Cancel

**Read Directory**

Select archive maintenance to retrieve archived recordings and for further special archive settings.

When recordings have been manually moved into an archive directory, or if an error in the database occurs, some files in the archive directory may not be available for view until 'mapped' by the database. Other archive directories can also be made available (for example from another hospital/practitioner) for view in the database. To make these recordings available, select the archive directory form the read directory field and click the start icon. The number of updated files and the number of patients updated are displayed. The total number of recordings in the archive directory is given at the bottom of the screen.

## Special Tasks



**Delete Original**

Check this box to manually delete original recordings that have been archived. Note that recordings can also be deleted automatically after archiving ().

**Delete Recording Ref.**

When this box is checked a date can be defined. All archived recording references before the date specified are deleted in the data base.

Note: With this function only the index reference to the recordings are deleted. The actual recordings are not deleted. If at a later stage you wish to have access to the archived data select 'rebuild archive` above.

**Reset Archive Flag**

This is a special function that resets the archive flag on archived recordings. This allows you for example, to re-archive recordings in another directory.

### 4.12.2    Restoring the Database

**What to do if you cannot see imported files**

The SDS-104 database contains a reference index (pointer) to the directory (volume and disk etc.) where recordings are stored. Sometimes when recordings are imported, the database pointer must be set so that the database knows where the recording are stored (directory, folder etc.). To do this the restore database option must be selected as follows:

| Function | |
| --- | --- |
| View recordings | F9 |
| Print | F5 |
| Print | Shift + F5 |
| Sort on Name | F7 |
| Sort on ID. | F8 |
| Database | |
| Import | |

| |
| --- |
| Archive |
| Archive Maint |
| Restore Database |
| Start Patient Maintenance |
| Transfer recordings made in emergency Mode to Server |

1.    In the main screen select the **Restore database** option in the system menu.
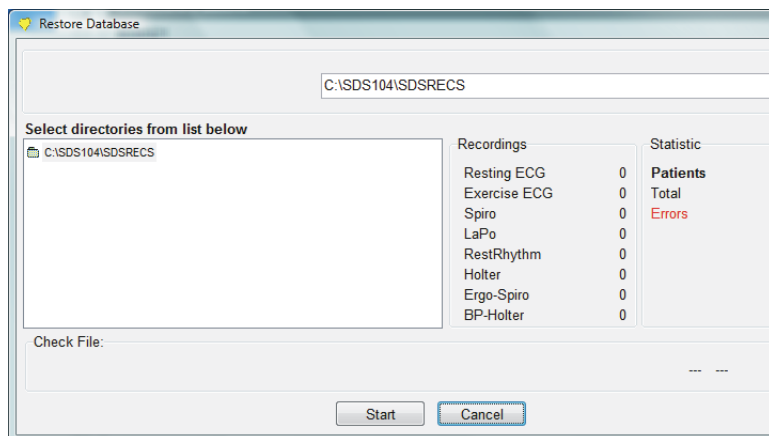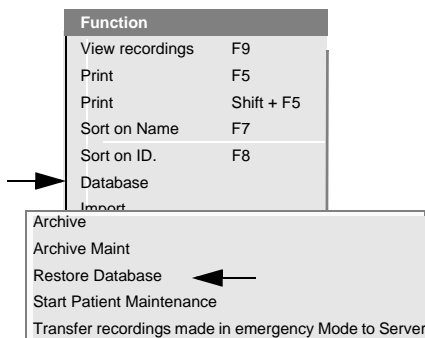


2.    Select the drive where the recordings are stored - click on the browse icon to the right of the field to display the drives connected to your system and select the file.
3.    Click on the Start icon.
4.    All recordings in the specified directory will be available for view directly.

ⓘ    The **Refresh DB** icon on the patient data screen has a different function and is used to refresh the database to view / list recordings added at another location.

| Function | |
|---|---|
| View recordings | F9 |
| Print | F5 |
| Print | Shift + F5 |
| Sort on Name | F7 |
| Sort on ID. | F8 |
| Database | |
| Import | |

| |
|---|
| Archive |
| Archive Maint |
| Restore Database |
| Start Patient Maintenance |
| Transfer recordings made in emergency Mode to Server |

### 4.12.3    Deleting Patients with no Recordings

Patients in the database with no recordings, and that have not been edited within a specified time, can be deleted. This may include, for example:

• Patient data entered manually but no recording taken.
• Automatically imported patient data from external systems but with no recordings.
• Patients that had recordings but are now deleted.

These patients can be batch deleted from the database as follows:

Select **Start Patient Maintenance** from the Data menu. The following is displayed:
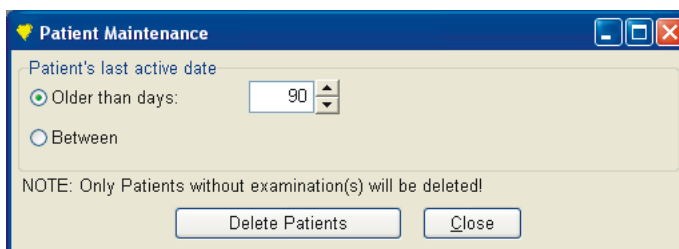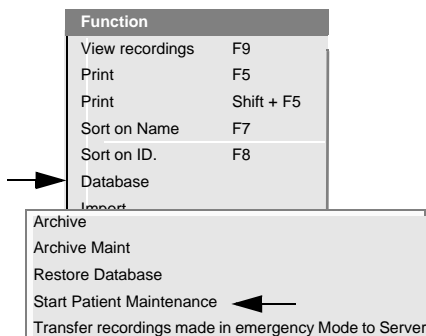


Select time scale or days back to delete all patients as follows:

• When **older than days** is selected, patients with the following criteria are deleted:
  – patients that have no recordings, and
  – the patient data was entered / edited more than x days ago and has not been edited since.
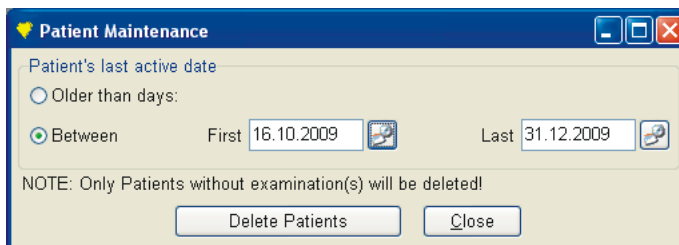


• When **between** is selected patients with the following criteria are deleted:
  – patients that have no recordings, and
  – the patient data was entered / edited between the specified dates and has not been edited since.
•

ℹ Deletion of individual patient data is carried out in the patient screen (see para 4.3, Deleting a Recording / Deleting a Patient, page 38).

### 4.12.4   Transferring Emergency Recording to Server

Use this function to transfer any locally stored recording. This function is provided for networked units only that use a central database (e.g. SEMA) to store recordings.

| Function | |
|---|---|
| View recordings | F9 |
| Print | F5 |
| Print | Shift + F5 |
| Sort on Name | F7 |
| Sort on ID. | F8 |
| Database | |
| Import | |

| |
|---|
| Archive |
| Archive Maint |
| Restore Database |
| Start Patient Maintenance |
| Transfer recordings made in emergency Mode to Server |
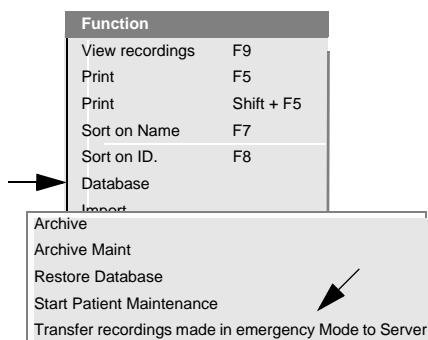
# 5 Electrode Placement

## 5.1 Electrode Identification and Colour Code

The electrode placements shown in this Section are labelled with the colours according to Code 1 requirements.

| Lead System | CODE 1 (Usually European) | | CODE 2 (Usually American) | |
|---|---|---|---|---|
| | Electrode Identifier | Colour code | Electrode Identifier | Colour code |
| Limb | R | Red | RA | white |
| | L | Yellow | LA | Black |
| | F | Green | LL | Red |
| Chest according to Wilson | C | White | V | Brown |
| | 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 |
| Position according to Frank | I | Light blue/Red | I | Orange/Red |
| | E | Light blue/Yellow | E | Orange/Yellow |
| | C | Light blue/Green | C | Orange/Green |
| | A | Light blue/Brown | A | Orange/Brown |
| | M | Light blue/Black | M | Orange/black |
| | H | Light blue/Violet | H | Orange/Violet |
| | F | Green | F | Red |
| Neutral | N | Black | RL | Green |

## 5.2   Electrode Placement Basics

**⚠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.

Careful application of the electrodes is important for a good ECG recording. For successful exercise recording, good electrode contact is essential. 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 recommended by SCHILLER.
2.  Check the expiry date on the electrode packaging. Ensure that the electrodes are within date.
3.  To ensure the electrode's conductivity and adherence:
    – If necessary, shave the application areas.
    – Thoroughly clean the area with alcohol or soap and water before applying the electrodes.
    – Thoroughly dry the electrode area before applying the electrodes.
    – When applying the electrodes, ensure that a layer of gel is between the electrode and the skin.[1]

4.  After the electrodes have been applied, the skin electrode resistance can be checked on the screen (see para 5.8, Check Skin/Electrode Resistance (Electrode test), page 66).
5.  If electrode contact is not within tolerance:
    – Remove the electrode and clean the skin area.
    – Use an abrasive pad or proprietary abrasive cleaning gel[2] to remove the upper layer of the epidermis.

6.  Reapply the electrode. Always use a new electrode when single-use electrodes are used.
7.  Ensure that the patient is warm and relaxed before you start the recording.
8.  After the recording, remove the electrodes. Clean suction and vacuum reusable electrodes according to manufacturers instructions to remove any remaining gel. Electrode Placement

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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 single-use electrodes solid conductive gel is incorporated in the adhesive.
2.  Abrasive cleaning gel will help reduce skin resistance and achieve good results.
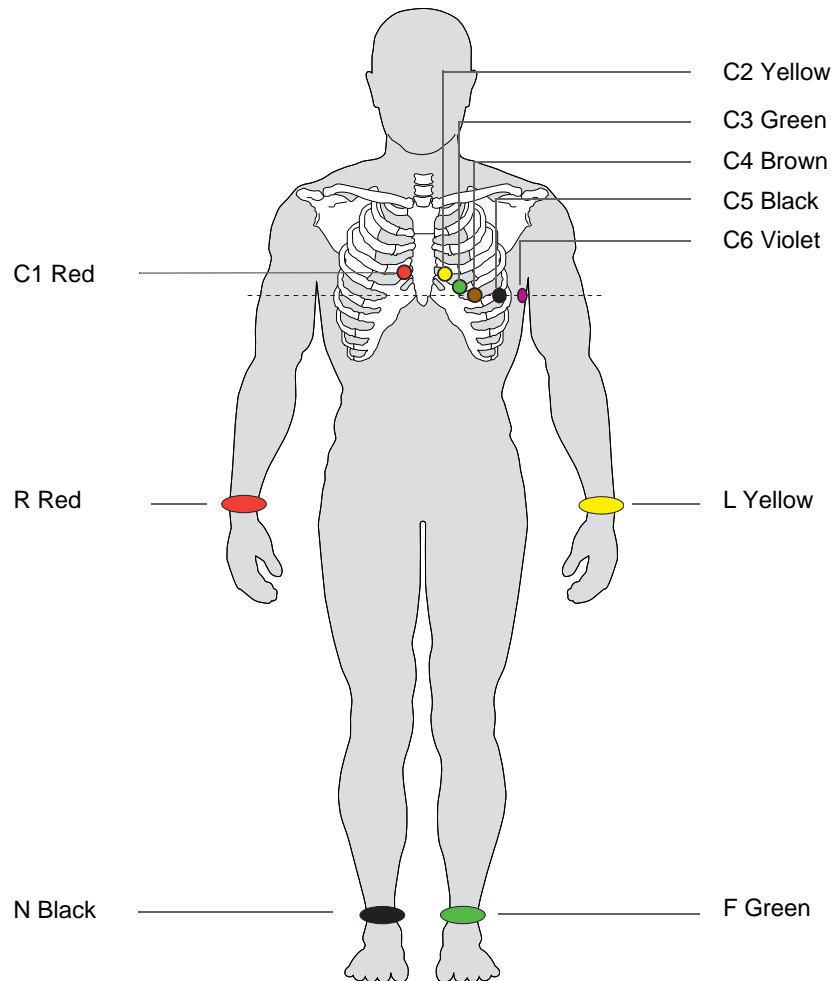
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# 5.3  Standard Resting ECG



| IEC Label | AHA Label | Electrode Placement |
|---|---|---|
| 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 sites C2 and C4 |
| C4 white / brown | V4 brown / blue | ➜ Mid-clavicular line in the fifth intercostal space |
| C5 white / black | V5 brown / orange | ➜ Anterior axillary line on the same horizontal level as V4 |
| 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 |

The electrode resistance can be checked in the recording screen ().

ℹ️  When making an ECG with a child it is sometimes physically difficult to place all electrodes. When this is the case electrode V4 can be placed on the right side of the chest.

## 5.4   Exercise ECG
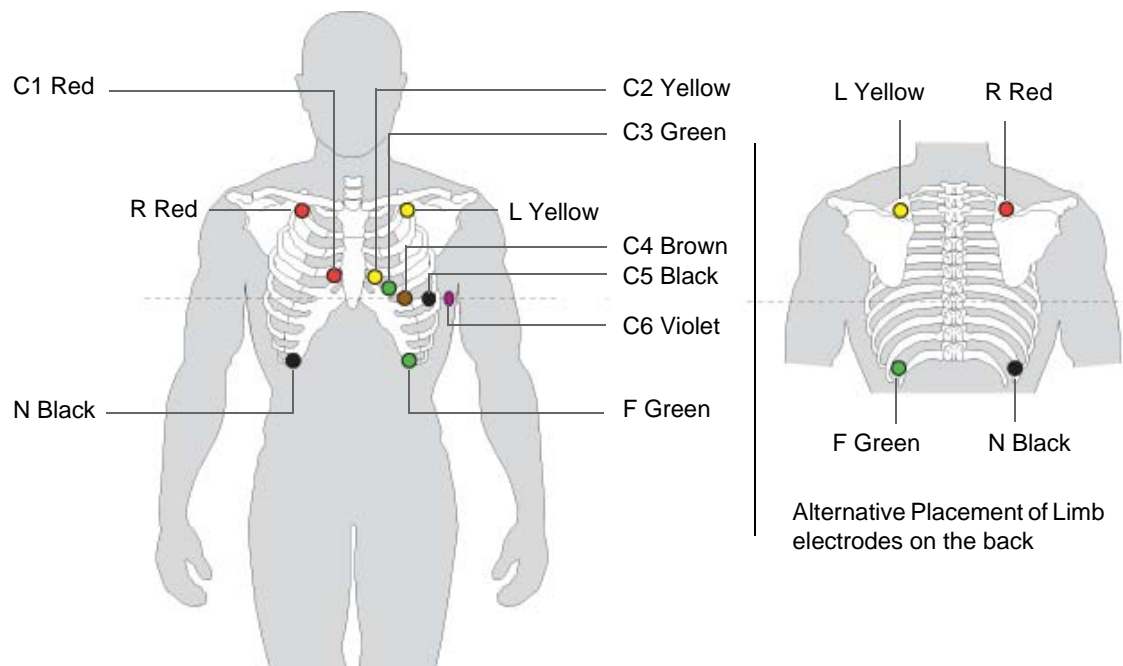
C1 Red      C2 Yellow
    C3 Green
R Red     L Yellow
    C4 Brown
    C5 Black
    C6 Violet
N Black     F Green

L Yellow     R Red

F Green     N Black

Alternative Placement of Limb electrodes on the back

| IEC Label | AHA Label | | Electrode Placement |
|---|---|---|---|
| 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 C4 and C2 |
| C4 white / brown | V4 brown / blue | ➜ | Mid-clavicular line in the fifth intercostal space |
| 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 and C5 |
| L yellow | LA black | ➜ | Slightly below left clavicle |
| R red | RA white | ➜ | Slightly below the right clavicle |
| F green | LL red | ➜ | Lower edge of the rib cage, or at the level of the umbilicus at the right mid-clavicular line |
| N black | RL green | ➜ | Lower edge of the rib cage, or at the level of the umbilicus at the left mid-clavicular line |

For exercise testing place electrodes C1 to C6 in the same positions as for the standard resting ECG detailed previously and place the R, L, F and N electrodes as follows:

– F, on the left torso at the bottom of the rib cage
– N, on right torso at the bottom of the rib cage
– L and R, place either on the back above the scapular or on the front just below the clavicle.

**i**

• The limb electrodes can also be placed on the back as shown above.

• 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.

# 5.5  Nehb Leads (DAJ)

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.
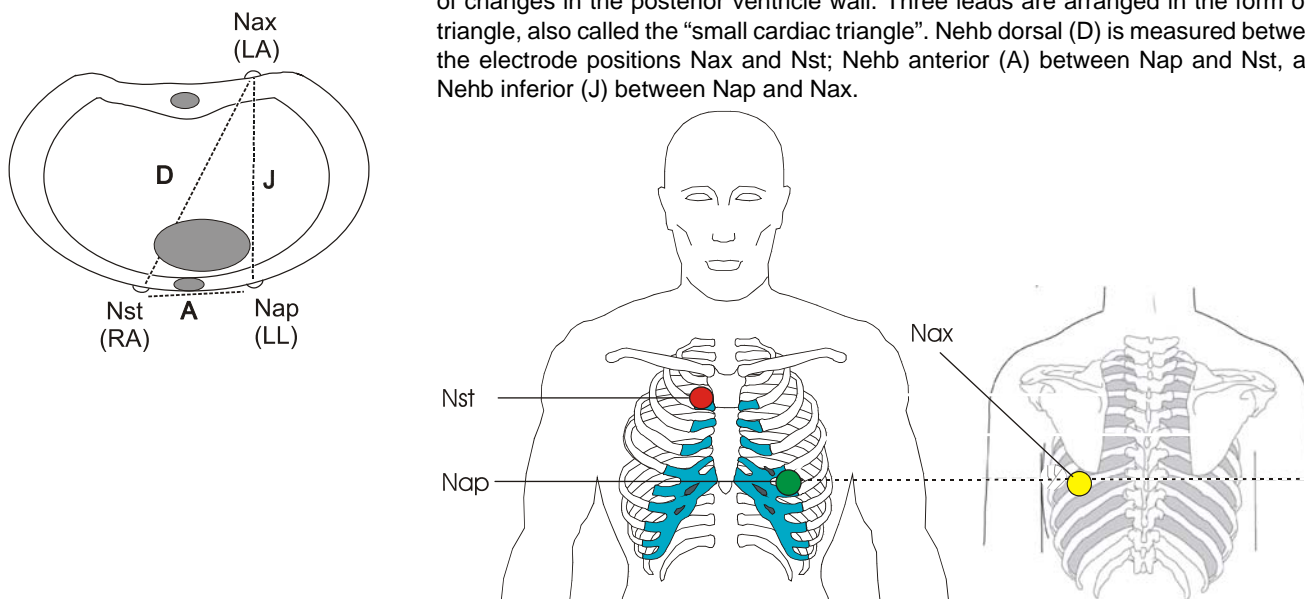
**10-wire Cable**

| IEC Label | AHA Label | Electrode Placement |
|---|---|---|
| R red | RA white | ➜ **Nst** - 2nd rib at the right sternal border. |
| L yellow | LA black | ➜ **Nax** - The left posterior axillary line directly opposite (on the back,) from Nap. |
| F green | LL red | ➜ **Nap** - 5th intercostal space mid-clavicular line (cardiac apex equates to V4 / C4). |

All other electrodes placed in their normal position (see para 5.3, Standard Resting ECG, page 61).

# 5.6    Frank Leads X, Y, Z

The orthogonal lead configuration is based on the theory of the heart as centre of a three-dimensional system of coordinates:

➜    lateral axis X

➜    longitudinal axis Y

➜    sagittal axis Z
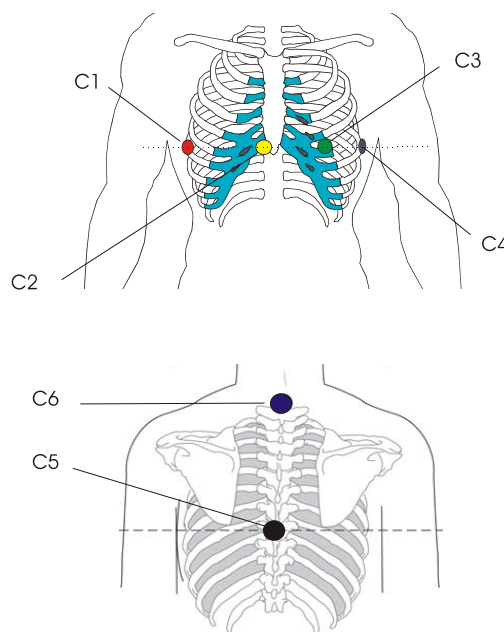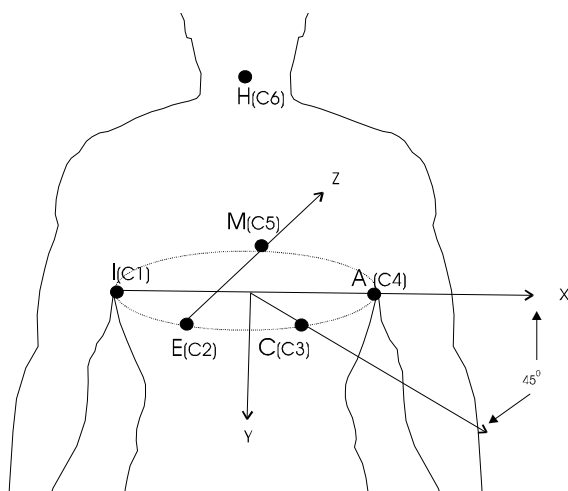


With the patient lying down, attach the electrodes on a level with the fourth intercostal space. With a patient in a seated position, attach the electrodes in the fifth intercostal space.

| IEC Label | AHA Label | Electrode Placement |
|---|---|---|
| C1 white / red | V1 brown / red | ➜ **I (-X) -** right midaxillary line |
| C2 white / yellow | V2 brown / yellow | ➜ **E (-Z) -** front midline |
| C3 white / green | V3 brown / green | ➜ **C (+Y) -** between E (-Z) and A (+X) |
| C4 white / brown | V4 brown / blue | ➜ **A (+X) -** left midaxillary line |
| C5 white / black | V5 brown / orange | ➜ **M (+Z) -** back midline (on the back) |
| C6 white / violet | V6 brown / violet | ➜ **H (-Y) -** neck (on the back) |
| L yellow | LA black | ➜ Standard position - left arm |
| R red | RA white | ➜ Standard position - right arm |
| F green | LL red | ➜ Standard position - left foot |
| N black | RL green | ➜ Standard position - right foot |

All other electrodes placed in their normal position (see para 5.3, Standard Resting ECG, page 61).

## 5.7   Left Posterior (V7, V8, V9)

C4 Brown
C5 Black
C6 Violet

C7 (C1 Red)
C8 (C2 Yellow)
C9 (C3 Green)

R Red

L Yellow

N Black
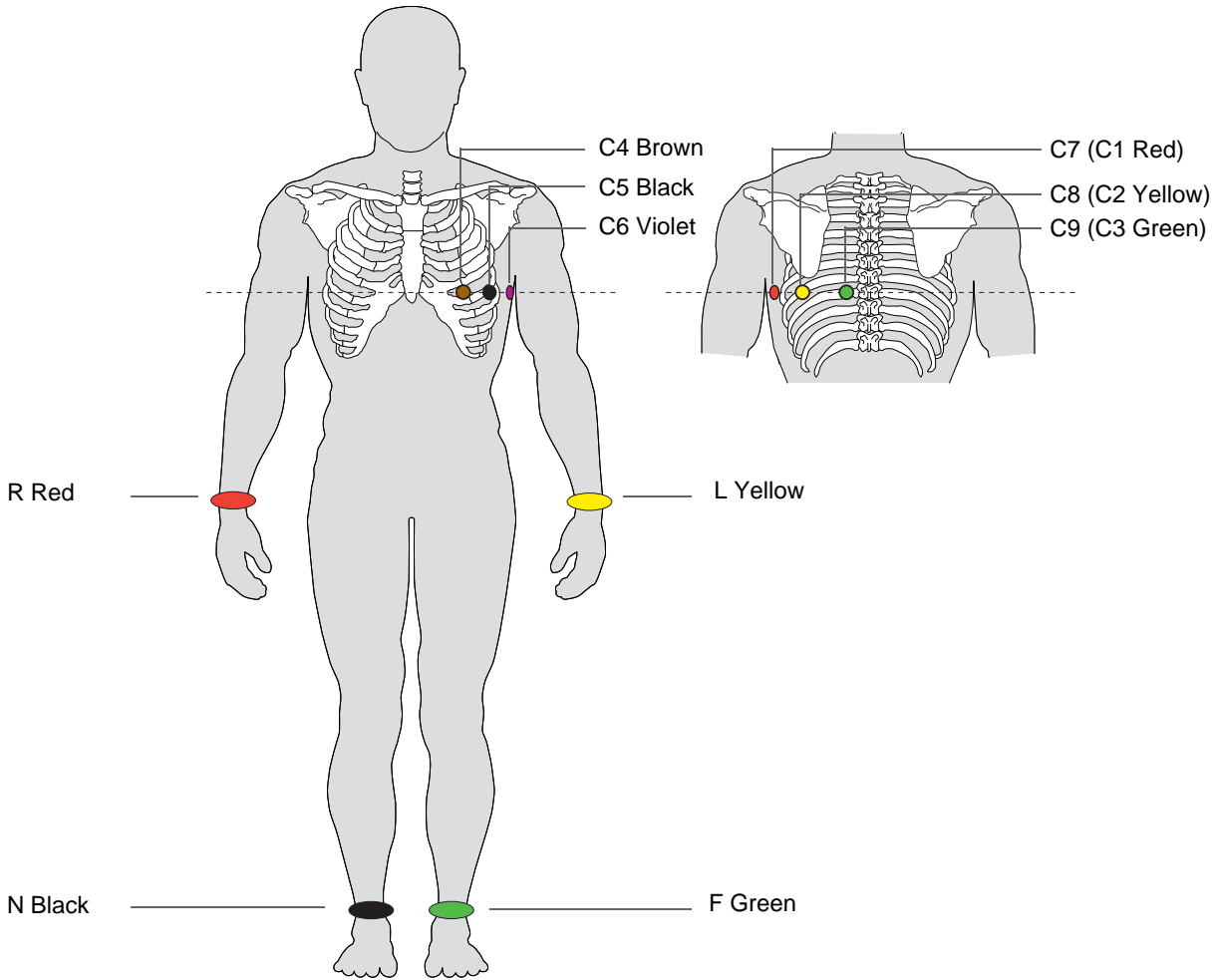
F Green

| IEC Label | AHA Label | | Electrode Placement |
|-----------|-----------|---|---------------------|
| 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 midscapular line at the level of C4. |
| C9 (C3 white /green) | V9 (V3 brown / green) | ➜ | Left paraspinal border at the level of C4. |
| C4 white /brown | V4 brown / blue | ➜ | Mid-clavicular line in the fifth intercostal space. |
| 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 |

## 5.8    Check Skin/Electrode Resistance (Electrode test)

Electrode placement on the chest is indicated with a green circle showing that the electrode resistance is within range. If an electrode resistance is out of this range (resistance too high for a good recording), the green circle changes to a red triangle. The electrode indicated must be reapplied.

| Function | |
|---|---|
| Auto ECG | F5 |
| QRS Beep | |
| Electrode Test | |
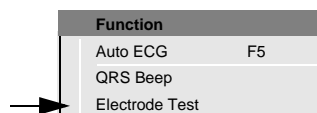
The following screen is displayed if a poor electrode contact is detected when a an ECG is started. This screen can also be displayed at any time by selecting the **Electrode test** menu option in the **function menu** in the ECG acquisition screen.



**i**
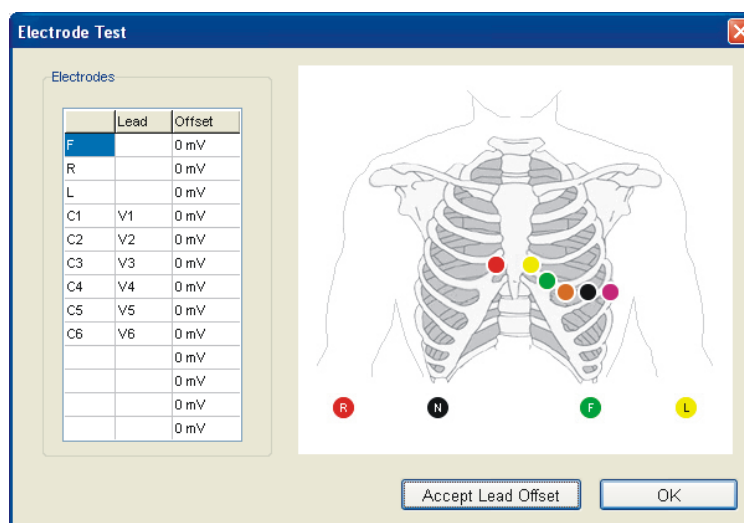
If an electrode becomes dislodged the beeper sounds.

The Offset measurement table on the left of the illustration, gives an indication of the electrode/skin resistance for all the electrodes and displays electrode dc offset and is the voltage drop in the patient cable and electrodes. The right-hand column gives the detected voltage for each electrode in millivolts measured between the electrode on the left leg and each of the individual electrodes. It can indicate any faults in the patient cable or patient electrode. The measured voltage value will depend on where the electrodes are connected. The voltage readings that can be expected are as follows:

- With patient connected (good connection, low resistance): ± 100mV. An offset of up to ±300mV will give an acceptable recording.
- With patient simulator connected: ± 20 mV. This will depend on the patient simulator used and must be taken as a flexible measurement.
- With all electrodes shorted together: ± 20 mV.
- No patient cable connected: -350 to -500mV.

# 6 Resting ECG

## 6.1 Taking a Recording

When a recording is started (auto icon clicked), the previous 10 seconds of the ECG (i.e. prior to requesting an auto recording) are used for processing. A printout can be obtained and the recording can further be edited, stored and/or transmitted. An auto mode recording is saved in the raw data form.

During data acquisition, the number of channels, the lead group, the speed and the sensitivity can be freely selected. The ECG format displayed on the screen is independent of the printout obtained.

System information and settings not directly required in the recording procedures, are detailed in the System Settings Section. Complete interpretation and analysis of results is given in the accompanying publication - Physicians Guide to the SCHILLER Interpretation and Measurements program.

## 6.2 General Cautions

**⚠WARNING**

▲ The warnings at the beginning of this handbook must be read and fully understood before using the program.

▲ The unit is CF rated. 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).

## 6.3 Preliminaries
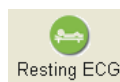
1. Prepare the patient and connect the electrodes (see para 5, Electrode Placement, page 59).
2. In the patient screen, highlight a patient or click on **New Patient** (see para 3.2, The Patient Screen, page 28).
3. Click on the resting ECG icon to enter the data acquisition screen.
4. Check and enter patient data.
5. Check electrode offset - check signal quality on the screen. If the signal quality is not good, reapply the electrodes.

## 6.4     Emergency Printout

### 6.4.1    Monitor or Power Failure

The AT-104 PC and thermal printer are disabled when the unit is connected to the PC and the SDS-104 program is active.

In the event of a mains power failure the AT-104 PC unit remains on and a printout can be obtained on the thermal printer as follows:

➜   Press key **Auto** to obtain a printout in auto mode.

➜   Press key **Manual** to obtain a printout in manual mode (continuous printout).

**⚠ CAUTION**

▲   If the monitor alone fails or any other malfunction occurs, i.e. the PC is still on, no printout can be obtained until the cable assembly (RS232) between the PC and the AT-104 PC, is disconnected.

## 6.5     Auto Recording

•   To take an auto mode recording, do any of the following:

| Function | |
|---|---|
| Auto ECG | F5 |
| QRS Beep | |
| Electrode Test | |

–   Click on the **Auto icon** in the tool bar
–   Press the **Auto key (1)**
–   Press **Function key F5**
–   Select **Auto ECG** in the **Function menu**

The recording is taken and will be stored and available for view and editing. A printout will be given if set for direct print ().

**i**

If a lead-off is detected at any time on any of the electrode connections, an audible alarm is sounded and the electrode screen is displayed. When this happens re-apply the electrode.

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## 6.6 Resting ECG Screen Settings and Options
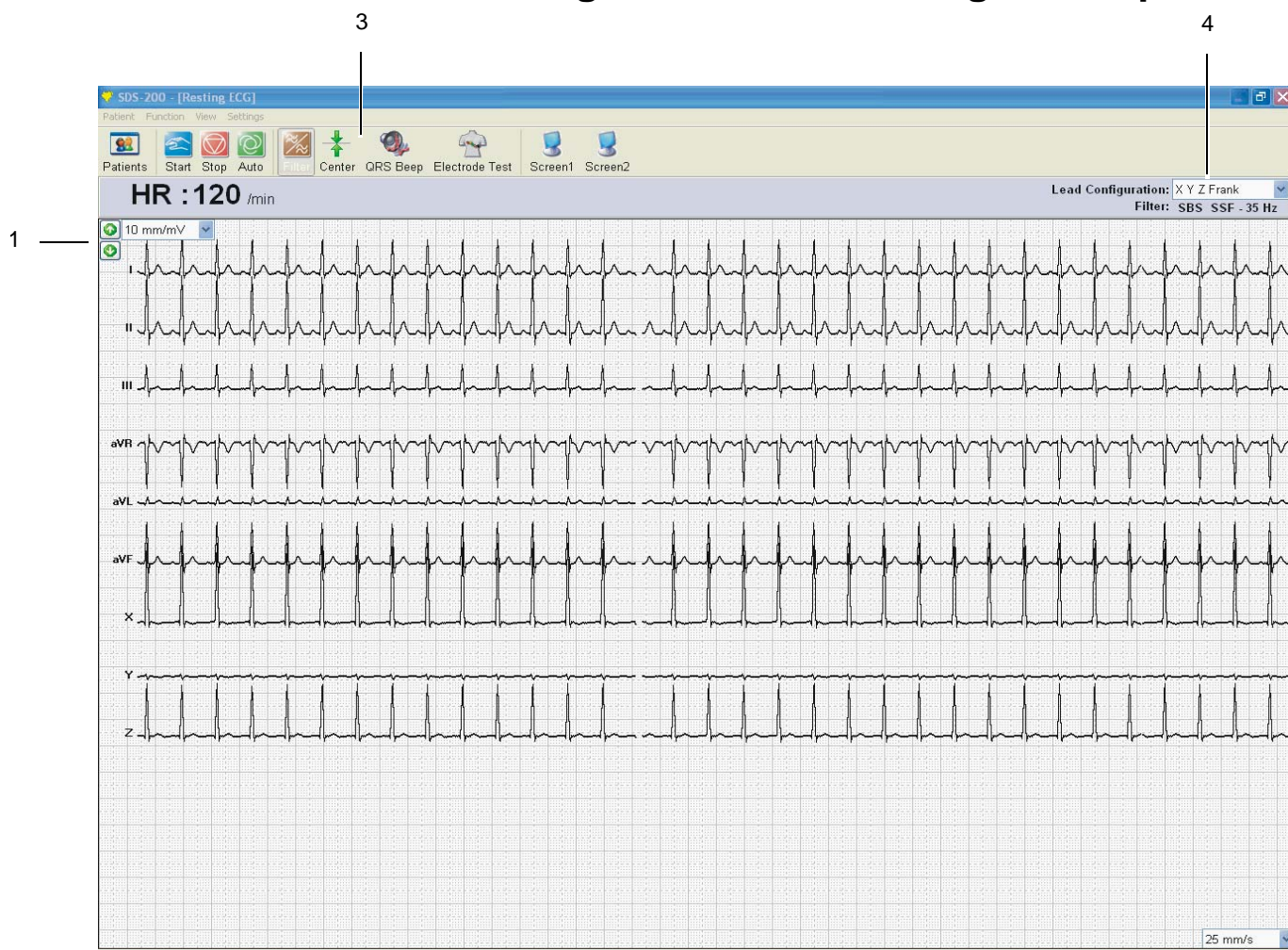


(1) Lead Group and Sensitivity - To change the lead group displayed click in the up and down arrows.The sensitivity of the trace on the screen is displayed next to the lead order arrows. Change the sensitivity of the ECG trace by clicking on the downward facing arrow and select sensitivity between 2.5, 5, 10 or 20 mm/mV.

(2) Speed - Change the speed of the ECG trace by clicking on the downward facing arrow: select a speed between 12.5, 25 or 50 mm/ms

(3) Control and setting icons including:
  – **Auto record** - take an auto mode recording (with printout in format 1)
  – **Filter** - apply Myogram filter. The cut frequency of the filter is defined in system settings (see para 9.7, Filter Settings, page 150).
  – **Centre** - click the icon to recenter the signal
  – **Screen 1/Screen 2** icons  - click to select 2 predeterimed screen layouts. The screen settings are defined in system settings (see para 9.12, Resting ECG Defaults, page 158). Also see view menu on the next page.

(4) Select lead order between:
  – Normal
  – DAJ
  – V7, V8 V9
  – XYZ Frank
  – XYZ Bipolar

### 6.6.1    View Menu (during Resting Acquisition)

The view menu gives various display options in the resting ECG acquisition mode as follows:

| View | |
|---|---|
| Screen 1 | |
| Screen 2 | |
| Screens | |
| Next Leads | PgDn |
| Previous Leads | PgDn |
| PM - Detection | |
| Filter | F6 |
| Recentre Signal | Shift + F6 |
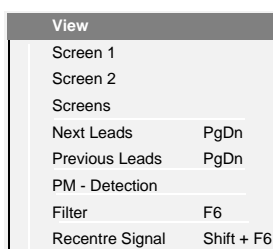
**Screen 1 / Screen 2**

These two options have the same function as the screen 1 and screen 2 icons at the top of the screen. They select the two screen layouts as defined in the settings menu (see para 9.12, Resting ECG Defaults, page 158).

**Screens**

When this is selected other screen layouts can be displayed. Click on the desired layout to display.
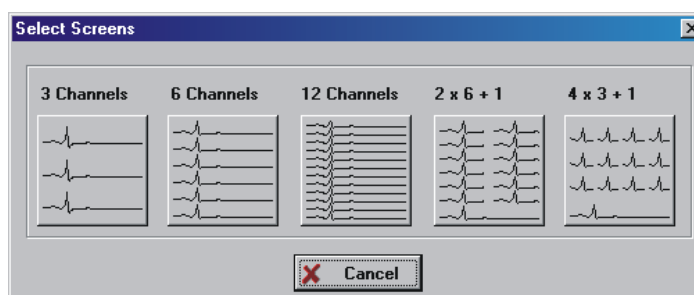


**Next Leads**

Display next lead group.

**Previous leads**

Display the previous lead group.

**PM Detection**

When this is selected a tick is placed before the option and detected pacemaker spikes are given as a vertical red line on every lead.

ℹ    The pacemaker spikes shown here are standard height and duration and are not representative of voltage or pulse duration. Pacemaker timing measurements are an option and can be displayed (selected from the function menu - see next page).

**Filter**

Switches the Myogram filter on or off. When the filter is applied, the filter icon (see previous page) is yellow and a tick is placed before the filter option.

**Recenter Signal**

Resets the leads to the baseline.

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### 6.6.2    Function Menu (during Resting Acquisition)

The function menu gives the following functions in the resting ECG acquisition mode as follows:

| Function |   |
|----------|---|
| Auto ECG | F5 |
| QRS Beep |   |
| Electrode Test |   |

**Auto ECG**                                       Takes an auto mode ECG recording.

i

- A printout can be produced after an auto mode has been taken. The direct printout is set in system settings (see para 9.15, Direct Print, page 163).

**QRS beep**                                       Enable / Disable the QRS beep.

**Electrode test**                                 Displays electrode resistance. If an electrode resistance is too high for a good recording a red triangle shows the poor electrode and the electrode indicated must be reapplied.

The Offset measurement table on the left of the illustration, gives an indication of the electrode/skin resistance for all the electrodes. These should all be in the range +/- 200 mV (see para 5.8, Check Skin/Electrode Resistance (Electrode test), page 66).

# 6.7  Post Test Review and Editing

Resting ECG recordings are indicated in the patient recording list by the patient symbol.

## 6.7.1  Average Screen
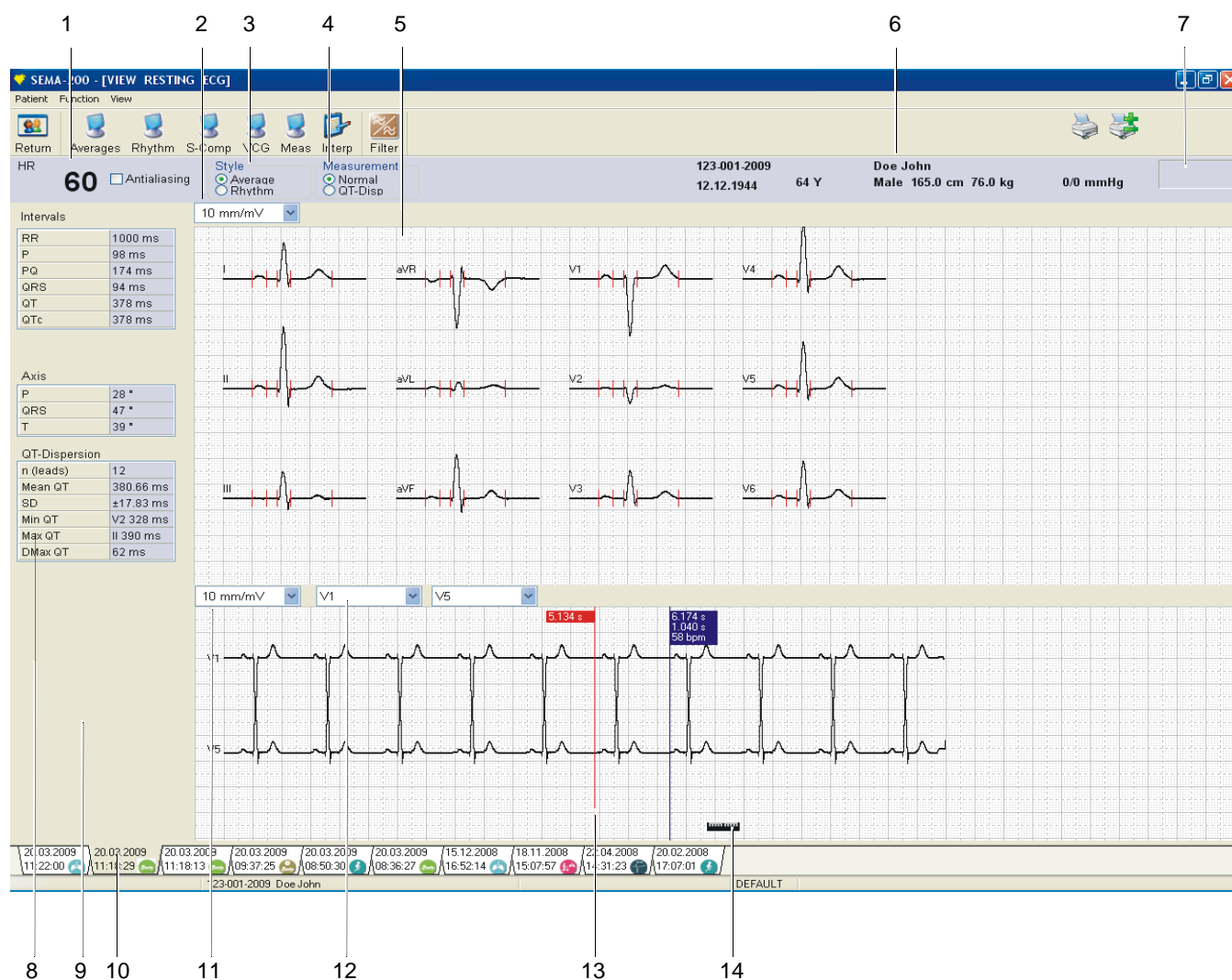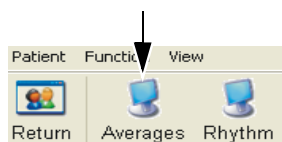
(1) **Calculated average values** over the entire 10 second recording:

– **Heart Rate** - The heart rate, averaged over the entire 10 second recording is given in the top left of the screen.

– **RR** - the time interval in milliseconds between consecutive ventricular (QRS) complexes (peak to peak).

– **P** - the duration of the P wave in milliseconds.

– **PQ** interval - the time between the beginning of the P-wave and the beginning of the Q wave.

– **QRS** - the duration of the averaged QRS complex

– **QT** - the time between the beginning of the Q wave and the end of the T wave in the averaged ECG.

– **QTc** - the normalised time of the QT average above, if the heart rate were 60 beats/minute (i.e. RR = 1000ms).

– **Axes** - Calculated on the basis of the sum of the deflections in leads I and aVF.

Details of the average values and calculated axes are given in the SCHILLER `Guide to the Interpretation and Measurement programs` booklet Article number 2. 510179.

(2) **Sensitivity** (size) of trace. The sensitivity can be changed by clicking with the cursor on the arrow and selecting required value.

(3) **Average / Rhythm**. Toggle this icon to select between Average and Rhythm displays:

– With the Rhythm icon highlighted all 12 leads are given in four columns of three. The first column shows the first 2.5s of the recording, the second column the next 2.5s etc., (10 seconds in all).

– With the Average icon highlighted the average complexes of all leads are given.

– The sensitivity of the display is given on the left hand side highlighted yellow (2).

(4) **Normal / QT dispersion** - Toggle this icon to select zoom view of Normal or QT dispersion.

– In normal view average complexes can be zoomed and edited (see para 6.7.2, Averaged Zoom, page 75).

– In QT dispersion view average complexes can be zoomed and edited (see para 6.7.5, QT Dispersion, page 79).

(5) **Average or Rhythm complexes** of all 12 leads (selected (3)).

(6) **Patient Data** overview.

(7) **Filter settings** - displayed if active when the recording was taken. Note that the Myogram filter can be applied to the recording at any time (click on the Filter icon).

(8) **QT Dispersion** Measurements (see para 6.7.5, QT Dispersion, page 79).

(9) Area for **Pacemaker Measurement**.

**i** The pacemaker information is only displayed when a recording has been taken by the a unit with the pacemaker measurement option installed. The information measured is:

– The rate of the pacemaker (pulses/minute).

– The interval (VV and AV) in milliseconds.

– The duration of the pulse (V and A) in milliseconds.

(10) **Recording type and date** and time. Other recordings and type of recording for the same patient are also shown (and can be displayed by clicking on the record).

(11) **Sensitivity** (size) of two leads in the bottom section.

(12) **Selected Leads**. The bottom section gives the ECG trace of two leads over the entire 10 seconds of the recording. The two leads can be changed to any of the standard leads by clicking on the up and down arrows.

(13) **Measurement lines**. Two measurement lines are positioned on the two leads when the measurement reference icon is clicked (14). The first red line gives the instantaneous time from the beginning of the recording. The second blue line also gives the instantaneous time from the beginning of the recording and additionally the delta value (difference) between the two measurements; this is the lower measurement on the blue line. Both lines can be moved at will by clicking with the mouse and moving to the required position.

**i**

• The measurement lines can be fixed to move both lines at the same time to check and compare predetermined intervals over the complete recording. To do this press the **Ctrl key** and then click with the mouse to lock the two measurement lines and move them at will.

(14) **Measurement display control.** Toggle icon to display/don't display measurement lines (13)

### 6.7.2 Averaged Zoom

To display a zoom view of a single averaged lead proceed as follows:

1. Ensure that the Measurement box is **Normal** (see (4) previous page).

2. Position the cursor ⊕ on the required lead in the average screen in the upper part of the screen and click the mouse button.

Lead selection
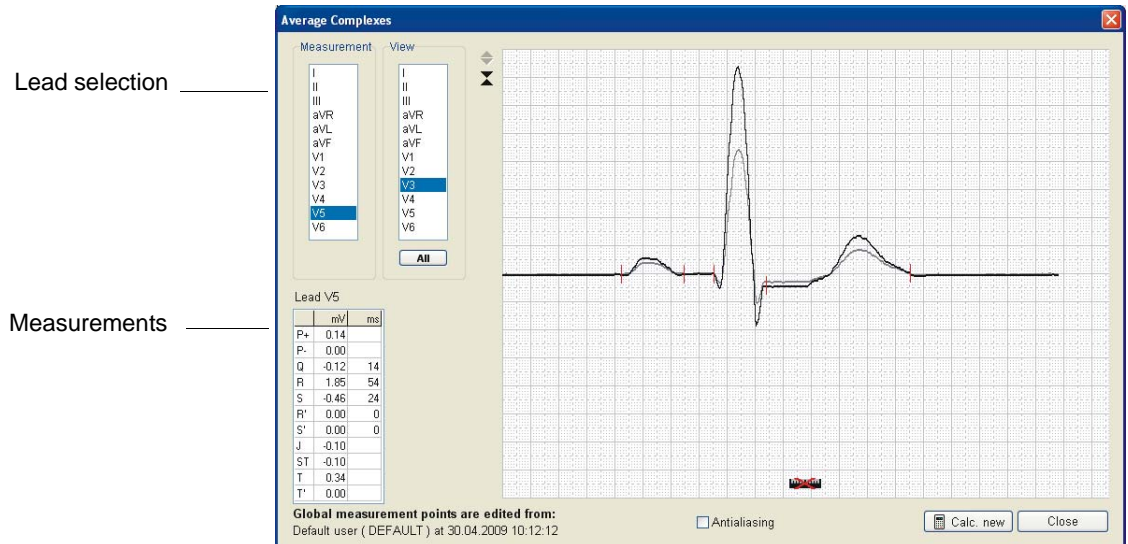
Measurements



ℹ When more than one lead is displayed, all measurements relate to the original i.e. the lead highlighted yellow.

The t**able of measurements** gives the measurements for the selected lead averaged over the entire 10 second recording. The measurement points can be edited (see next page).

The **lead selection** icons enables other leads to be selected. The current lead selected is highlighted yellow. To display another lead click on the lead designation in the lead box. To superimpose one or more average leads on the screen, click on the desired lead in the View box. The lead is displayed superimposed on the original in a different colour. As many leads can be superimposed on the original lead as desired.

### 6.7.3    Global Measurement Points

The measurements are displayed to the left of the averaged complexes and the global measurement points are indicated by red vertical lines on each complex as follows:

- Beginning and end of the P- wave
- Beginning and end of the QRS complex
- The end of the T- wave

Global intervals

Measurement points
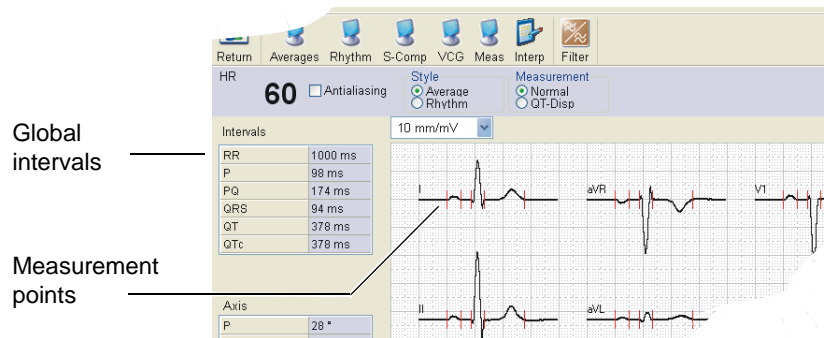


In the zoom view, the user can globally set the measurement points. After editing, interval measurements of the averaged ECG complexes are automatically displayed and the measurement points changed.

### 6.7.4    Editing the Global Measurement Points

Edit the global measurement points (indicated by a red vertical line), in the zoom view as follows:
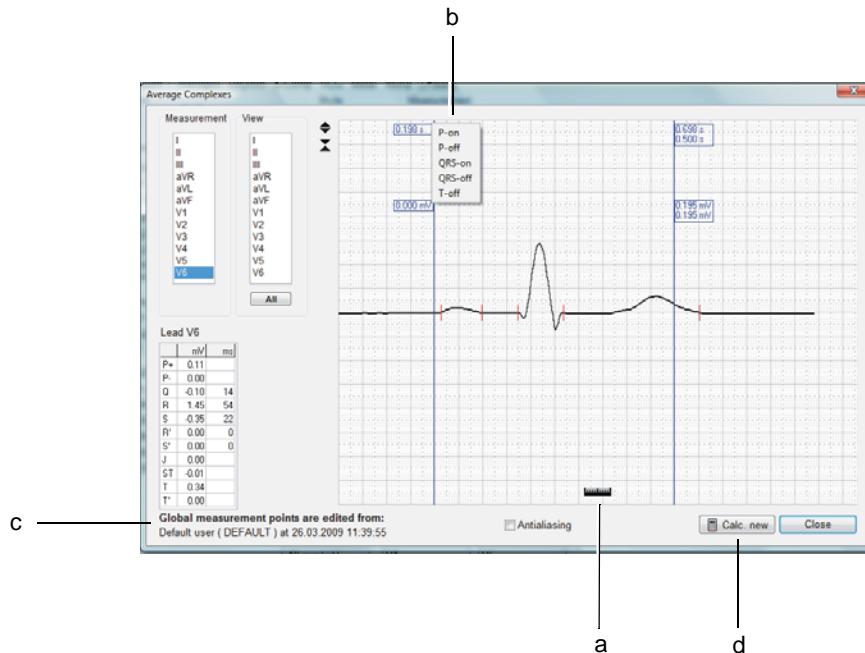


1. Display the blue instantaneous measurement lines by clicking the measurement icon **(a)**.
2. Position the measurement line with the mouse and click the right mouse button to display the popup menu **(b)**.
3. Highlight the measurement point you wish to edit and click the left mouse button. The red measurement indicator moves to the point defined.
4. Repeat for desired measurement points.
5. The re-edited intervals are instantly changed as the measurement points are set.
6. When you leave the zoom view you are prompted to save the changes or not to save.
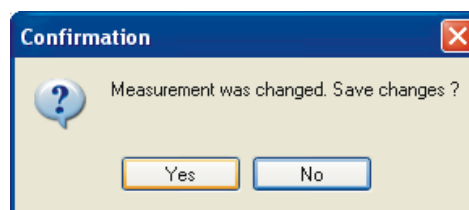
After saving the edited measurement points, a statement is given **(c)** that the global measurement points have been edited. The ID of the user that set the measurement points, and the time and date that they were changed, is also indicated.

▲  Automatic interpretation of an ECG recording is based on the default measurement points and not the edited measurement points. When an interpretation is given after the global measurement points have been saved, a statement (below the user ID that validated the interpretation), confirms that the software generated interpretation is based on the software generated measurement points.
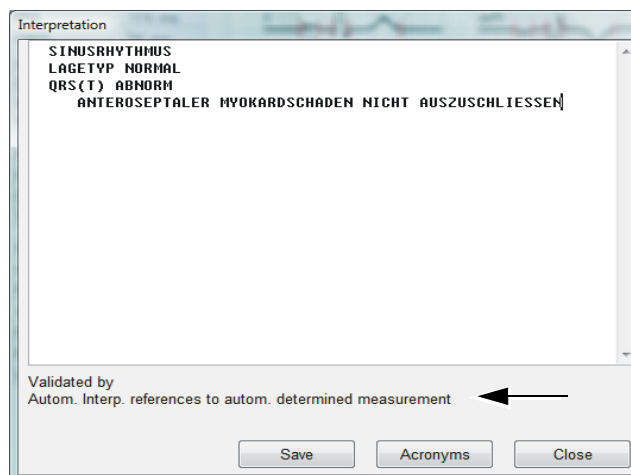


### Restoring Default Measurement Points

By clicking the **Calculate new icon (d)**, the software calculated default measurement points are restored.

## 6.7.5 QT Dispersion

QT dispersion determines the spatial QT dispersion in the resting ECG. QT intervals measured in individual leads can differ significantly from the normal QT interval derived from all 12 leads in the resting ECG (measured from the beginning of the first Q in any of the 12 leads until the end of the last T wave in any of the 12 leads). In contrast to the normal QT interval the spatial QT dispersion is defined as the difference between the maximum and the minimum QT interval measured in all 12 leads of the resting ECG.

The QT dispersion indicates how inhomogeneous the ventricular repolarisation is. The greater the dispersion, the more inhomogeneous is the repolarisation and the greater the potential risk for the patient. Along with late potential analysis and heart rate variability analysis the QT dispersion is considered as an additional non-invasive method for identifying patients with a potential higher risk of lethal arrhythmia.

In the SCHILLER analysis of the QT dispersion, the different QT intervals in each of the 12 individual leads are calculated after averaging the resting ECG over 10s. The end of T is determined by means of an algorithm as described in the publication 'Validation of QT Dispersion Algorithms and some Clinical Investigations' by G. Bortolan, M. Bressan, C. Cavaggion, S. Fusaro, issued in 'IEEE Computers in Cardiology' 1996, S.665-667.

The end of T wave should be determined in at least 8 leads for a correct interpretation of QT dispersion.

It is difficult to give a pathological limit for QT dispersion. Studies have indicated considerable variations in the QT dispersion with regard to the time of day. However, based upon the latest findings, a spatial QT dispersion measured at rest of more than 50 ms (difference between maximum and minimum QT interval), can be considered as abnormal.

In principle, it is also possible to give a time-related QT dispersion by analysing the variations in the duration of the QT intervals over many heart activities, e.g. in the long-term ECG or after examination of a considerable number of QRS complexes. The analysis method used by SCHILLER for determining the QT dispersion in the resting ECG is a spatial analysis which shows the spatial relationship of the QT intervals in the different ECG lead positions.

The table displayed in the left data area of the main screen (average view) gives the following:

- n(leads) - The number of leads in which the end of T can be determined by means of the algorithm. When the amplitude of the T wave is too small (less than 0.1mV) or when a very flat T wave is detected, the end of T is not calculated by the algorithm.
- Mean - The average value of all measured QT intervals
- SD - The standard deviation of all QT intervals:

$$SD = \sqrt{\frac{\left(\sum dd\right)}{(n-1)}}$$

where dd = QT deviation from the mean and

n = number of leads (where QT has been measured)

- Min QT - The minimum QT interval duration and the lead in which it occurred
- MaxQT - The maximum QT interval duration and the lead in which it occurred
- Delta QT - The difference between the maximum and the minimum QT interval. This value in particular is to be regarded as a parameter for QT dispersion.

To display the QT zoom view

• Click the measurement box to display **QT Disp (2)**.

• The cursor changes - position the cursor ⊕qt on the required lead in the **average screen (3)** and click to display the QT measurements.
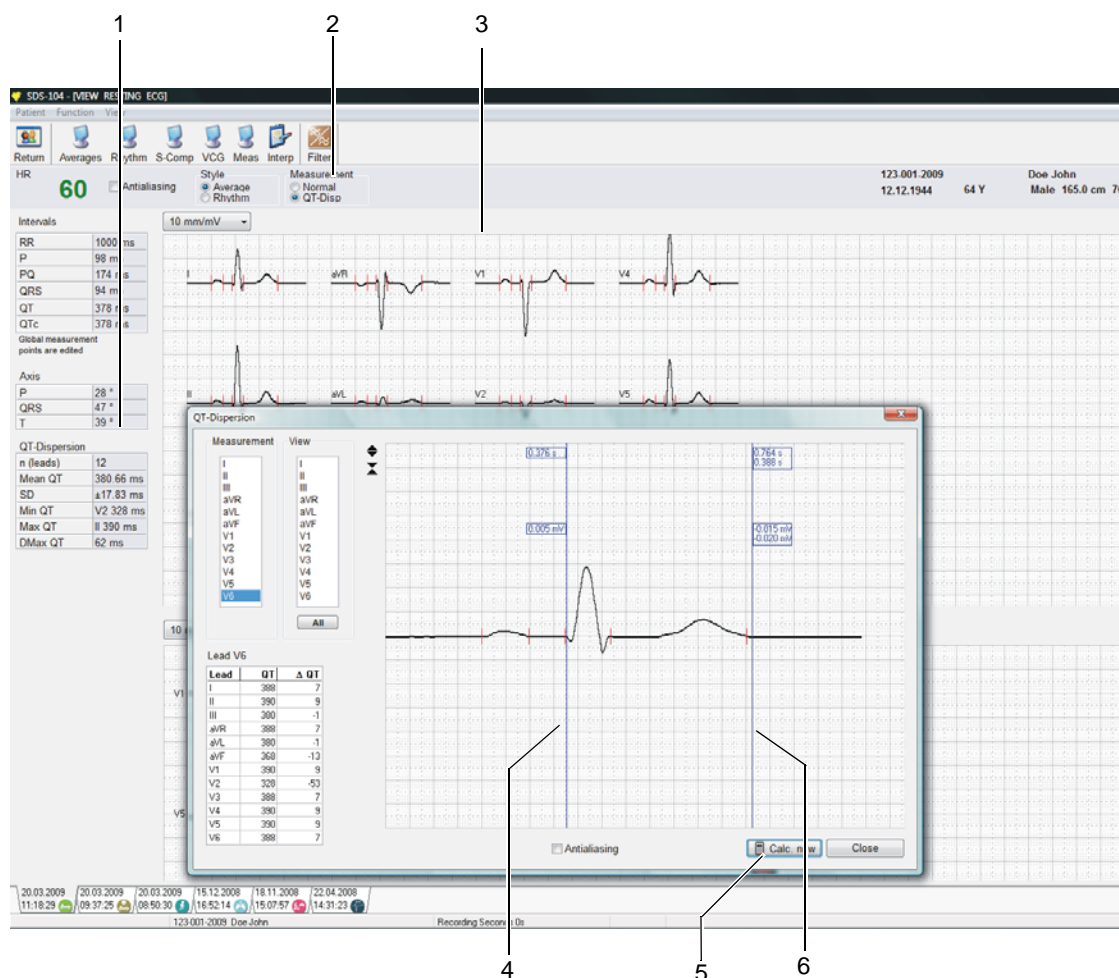


The first vertical line **(4)** is the measurement point determined from all 12 leads and marks the beginning of the P wave - this cannot be changed.

The **End of T wave point (6)** can be changed by moving the blue cursor line. When moving, it will indicate the time difference and the amplitude at the current position. All measured parameters for the QT dispersion given above will be recalculated when the blue cursor is released. The **End of T wave** point can be changed manually in all leads and the values recalculated.

The table on the left hand side gives the QT measurements **(1)**. The delta QT value is the difference between the QT interval and the mean QT value. If no measurement is displayed (a dash `-` displayed) for a lead, it indicates that end of T wave cannot be determined by the algorithm for that lead. Measurement can however be given when the lead is selected and the end of T manually selected as described previously.

Different leads are selected in the same way as displaying average zoom leads (see para 6.7.1, Average Screen, page 72).

Clicking the **Calculate new icon (5)** will reset all measurement points.

### 6.7.6    Rhythm Screen
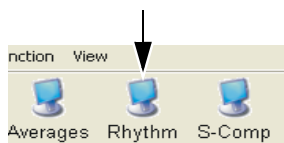


In this screen you can view all leads over the entire 10 seconds of the recording. Either 3, 6 or 12 leads an be displayed at one time. Select preference in the top left hand corner with icons `3`, `6` or `12` **(1)**. When 3 or 6 leads are displayed the following/preceding leads are selected with the red up and down arrows**.**

The time in seconds from the beginning of the recording is shown at the bottom of the screen. 10, 5 or 2 seconds of the recording are displayed corresponding to 25, 50 and 100 mm/s respectively or, 12 leads are displayed, 1, 2 or 5 seconds. The amplitude scale and the speed are shown at the top left of the screen. Select and click with the mouse on the desired value to change these settings.

**Displaying Measurement Lines**

Two measurement lines can be displayed when the measurement reference icon is clicked **(2)**. The first red line gives the instantaneous time from the beginning of the recording. The second blue line also gives the instantaneous time from the beginning of the recording and additionally the delta value (difference) between the two measurements; this is the lower measurement on the blue line. Both lines can be moved at will by clicking with the mouse and moving to the required position.

**i**

• The measurement lines can be fixed to move both lines at the same time to check and compare predetermined intervals over the complete recording. To do this press the **Ctrl key** and then click with the mouse to lock the two measurement lines and move them at will.

### 6.7.7    Measurement Screen

Click on the Meas icon:
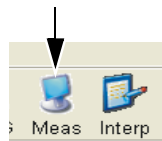


| | I | II | III | aVR | aVL | aVF | V1 | V2 | V3 | V4 | V5 | V6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PPos-Ampl [mV] | 0.13 | 0.13 | 0.00 | 0.00 | 0.06 | 0.07 | 0.16 | 0.03 | 0.09 | 0.15 | 0.13 | 0.11 |
| PNeg-Ampl [mV] | 0.00 | 0.00 | 0.00 | -0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Q-Dur [ms] | 16 | 14 | 10 | 0 | 30 | 12 | 0 | 0 | 14 | 14 | 14 | 14 |
| Q-Ampl [mV] | -0.11 | -0.14 | -0.04 | 0.00 | -0.08 | -0.09 | 0.00 | 0.00 | -0.08 | -0.14 | -0.12 | -0.10 |
| R-Dur [ms] | 54 | 52 | 52 | 14 | 60 | 54 | 14 | 10 | 54 | 54 | 54 | 54 |
| R-Ampl [mV] | 1.40 | 2.40 | 1.02 | 0.13 | 0.25 | 1.72 | 0.15 | 0.04 | 1.07 | 2.15 | 1.80 | 1.45 |
| S-Dur [ms] | 22 | 26 | 24 | 54 | 0 | 26 | 56 | 76 | 18 | 20 | 20 | 22 |
| S-Ampl [mV] | -0.31 | -0.68 | -0.42 | -1.89 | 0.00 | -0.55 | -2.20 | -0.56 | -0.25 | -0.54 | -0.44 | -0.35 |
| R'-Dur [ms] | 0 | 0 | 0 | 24 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 |
| R'-Ampl [mV] | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| S'-Dur [ms] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S'-Ampl [mV] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| J-Ampl [mV] | -0.01 | -0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| ST-Integ. [mV] | -0.01 | -0.01 | 0.00 | 0.01 | 0.00 | -0.01 | 0.02 | 0.01 | 0.00 | -0.01 | -0.01 | -0.01 |
| TPos-Ampl [mV] | 0.37 | 0.48 | 0.12 | 0.00 | 0.13 | 0.30 | 0.52 | 0.13 | 0.27 | 0.49 | 0.42 | 0.34 |
| TNeg-Ampl [mV] | 0.00 | 0.00 | -0.03 | -0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

This screen can be superimposed on the average, rhythm or serial comparison screens at any time. The measurement screen gives the average measurements for all 12 leads over the entire 10 seconds of the recording.

Click `OK` to remove the measurements screen.

Details of the measurements are given in the SCHILLER `Guide to the Interpretation and Measurement programs` booklet Article number 2. 510179.

### 6.7.8 Interpretation

Click on the Interp icon:
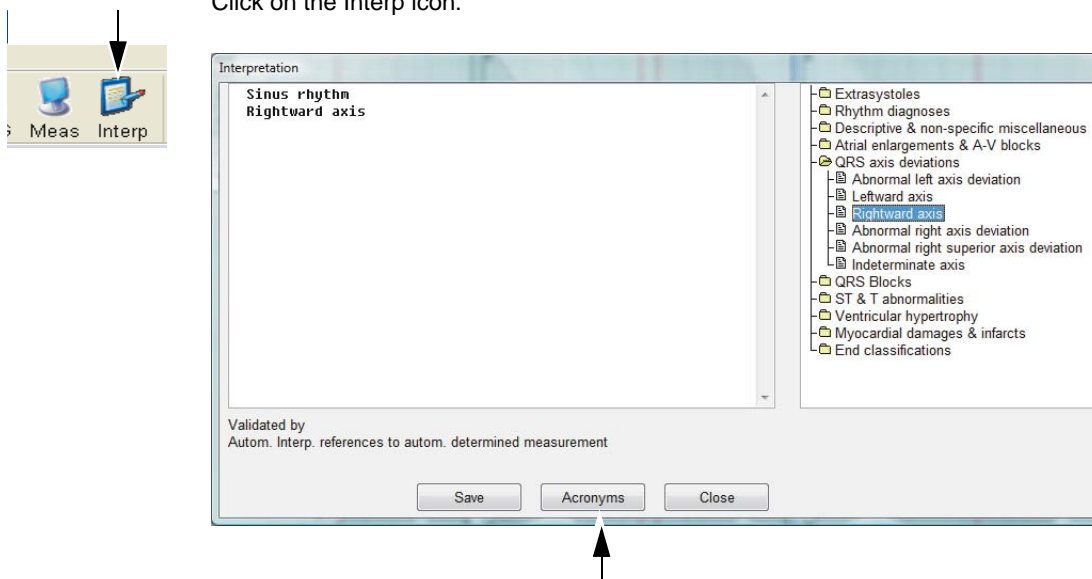


This screen can be superimposed on the average, rhythm or serial comparison screens at any time.

The interpretation in the left hand field, can be manually entered and edited. When the **acronym icon** is clicked a list of common interpretation statements is displayed to the right of the statement (as shown above). When one is selected it is automatically inserted into the interpretation statement in the left field, at the point where the cursor is situated.

To save an interpretation statement after editing click on the **Save icon**. When you click on the **Close icon** before saving you are asked if you wish to save the changes or not.
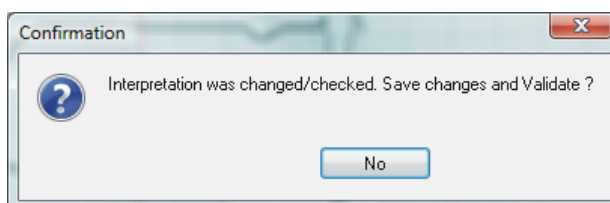


Click on yes to exit and save the currently displayed interpretation statement, or no to exit this screen without saving the changes.

### Acronym Expansion

A number of predefined acronyms are defined by the system. User can also freely define their own acronyms and corresponding statements or modify system defined acronyms. These are defined in system settings (see para 9.10, Texts, page 155) Settings > Texts > Acronyms.

When an acronym is entered it can be expanded automatically by entering a star (∗) before the acronym to display the full statement:

For example:

If LBBB is defined as Left Bundle Branch Block when *LBBB followed by a space is entered it is automatically expanded to read Left Bundle Branch Block.

### 6.7.9   Serial Comparison
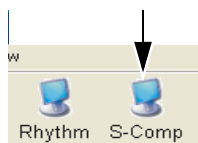


Click on the Serial Comparison icon.
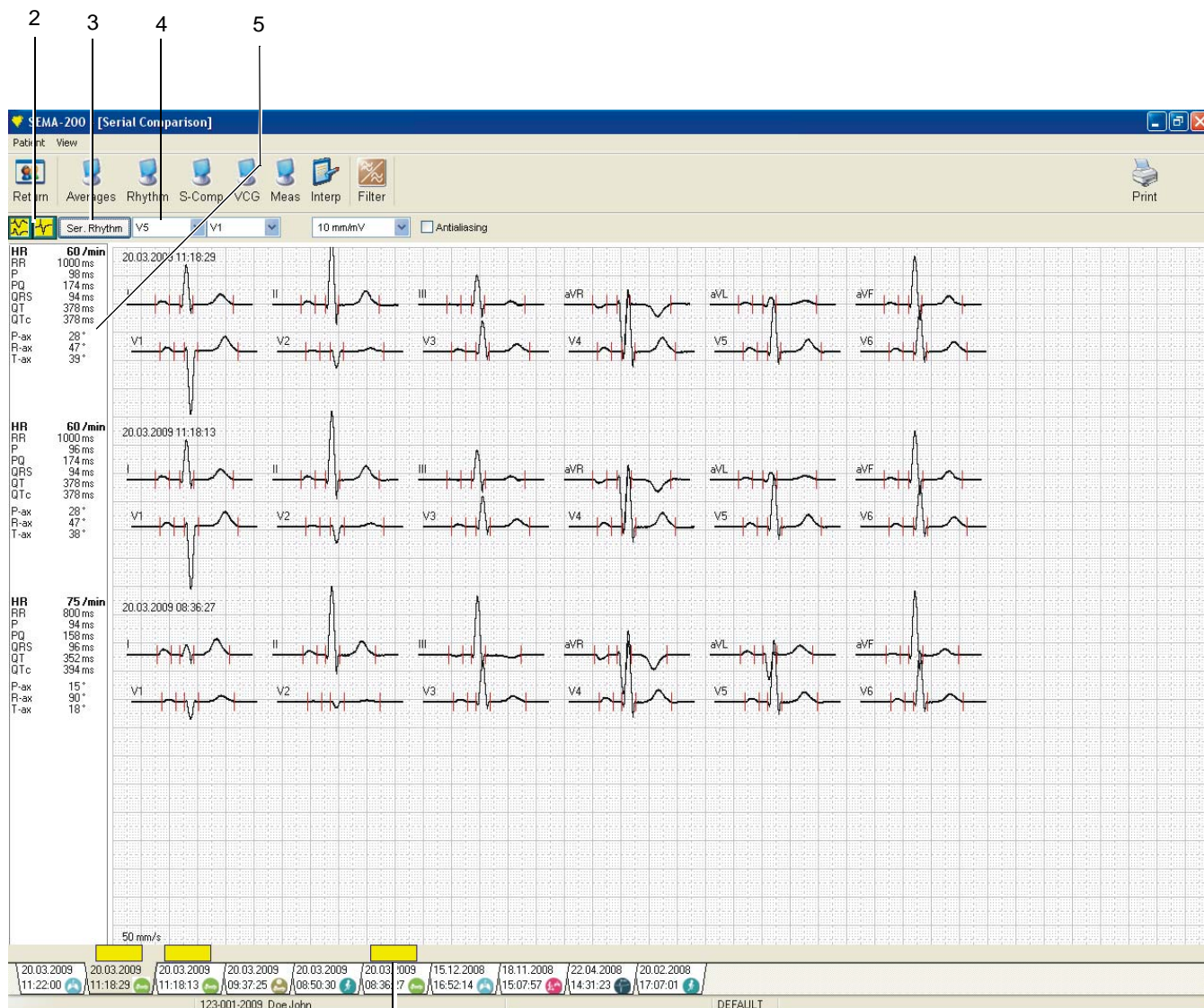


In the serial comparison screen it is possible to view a maximum of four recordings from the same patient for comparison. The recordings can be displayed as an average of all leads for each recording, or two selectable rhythm leads can be displayed for each recording. The recordings are displayed with the most recent (of the selected recordings) at the top of the screen. The 4 recordings currently displayed are indicated by the yellow rectangle above the recording tab at the bottom of the screen **(1)**. Select different recordings for display by clicking on a rectangle.

## Average and Rhythm Views

Rhythm or Average screens comparisons can be displayed with the **average / rhythm icon (3).**

**Average Screen**

The average screen (shown above) displays the average complexes for all 12 leads of the selected recordings. Two display formats are available, selected by the yellow icons in the top left corner of the display (**2**). The left hand icon (with the two QRS complexes) gives two rows of 6 average complexes with measurement reference lines. The right hand icon gives one row for each recording of all 12 average complexes.

**Rhythm Screen**

In serial rhythm view, two leads are displayed over the entire 10 seconds for each recording. Any two leads are user selected **(4).**

## Heart Rate, Intervals and Electrical Axes

To the left of each recording in both the average view and the rhythm view are the heart rate and interval measurements **(5):**

**Heart Rate HR**

Averaged heart rate (HR) calculated on the basis of the entire 10 second recording and shown as number of beats per minute.

**Intervals**

RR  Averaged time interval between two consecutive QRS complexes

P      Duration of the P wave (of averaged ECG complexes)

PQ    P-Q interval: time between the beginning of the P wave and the beginning of the QRS complex (of averaged ECG complexes)

QRS   The duration of the QRS complex from the beginning of the Q wave to the end of the S wave (of averaged ECG complexes)

QT    Interval between the beginning of the QRS (beginning of ventricular depolarisation) and the end of the T wave (end of repolarisation phase) (of averaged ECG complexes)

QTc   Normalised QT interval. As the QT interval is dependent on the heart rate, it is often converted to the normalised QTc interval i.e. the QT the patient would show at a heart rate of 60 / min. Usually, the QTc amounts to 390 $\pm$ 40 ms.

The conversion is according to Bazetts` formula:

$$QTc = QT \times \sqrt{\frac{1000}{RR}}$$

**Electrical Axes**

The electrical axes of the heart are determined separately for the P, QRS and T waves. They indicate the main spreading direction of the electrical vector in the *frontal plane*.

Details of the measurements and axes calculations are given in the SCHILLER `Guide to the Interpretation and Measurement programs` booklet SCHILLER Article number 2. 510179.

# 7   Rhythm ECG

The resting rhythm option allows up to 75 minutes or more of ECG data to be recorded. To commence a rhythm recording proceed as follows:

## 7.1   Taking the Recording

1.  Click on the Resting Rhythm icon to enter the rhythm acquisition screen.
2.  Select patient / enter new patient data.
3.  Check the ECG for signal quality.
4.  Click on the control icon Start (top left of screen)
5.  Select duration of test.
    –  Note that the time dialogue screen is only displayed when this function is enabled in system settings (see para 9.14, Resting Rhythm Defaults, page 162).

6.  The count commences indicating the time the test has ran **(b)** and the heart rate trend **(a).**
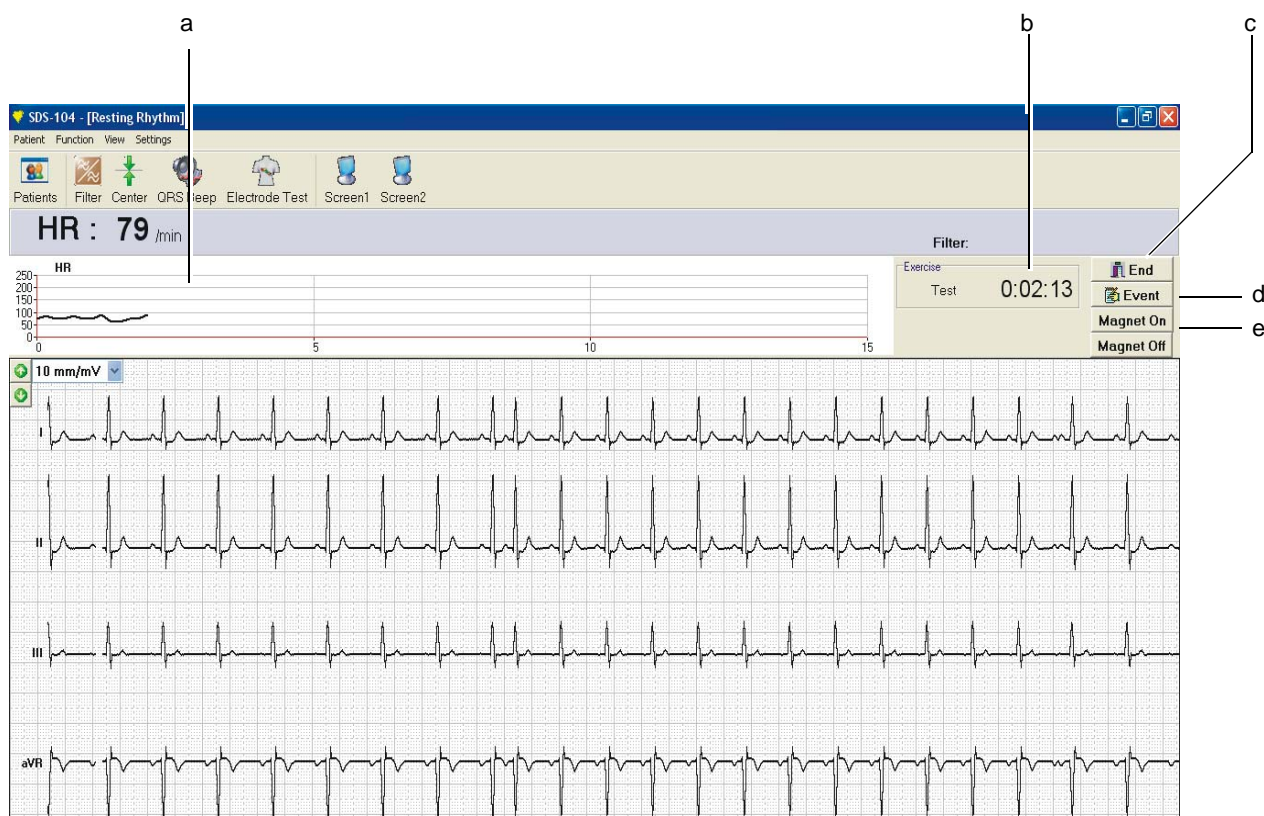


7.  At the end of the test, press the control icon **End (c)** to stop the recording.

•  The event icon **(d)** is pressed at any time during acquisition to reference an event. When clicked you are prompted to enter the type of event.
•  The Magnet on / off icons **(e)** can be clicked to indicate when a magnet is used to activate / deactivate a magnetically controlled pacemaker.
•  Both events and magnet on / off registrations are displayed on the stored recording as small triangles below the baseline of the ECG trace.

# 7.2 Post Test Review and Editing

Resting Rhythm recordings are indicated in the patient recording list by the clock symbol.

1 2 3



The icons at the top of the screen **(1)** change the speed scale to display between approximately 1 minute and 15 minutes of recorded data.

Lead Selection and Sensitivity - select in the top left corner of the display **(2)**.

Page up/Page down - use the scroll bar on the left of the screen to page through the recording **(3)**.

### 7.2.1    Defining a Rhythm Event

To display a zoom view of a section of the selected rhythm lead select and click with the cursor on the section that you wish zoomed.
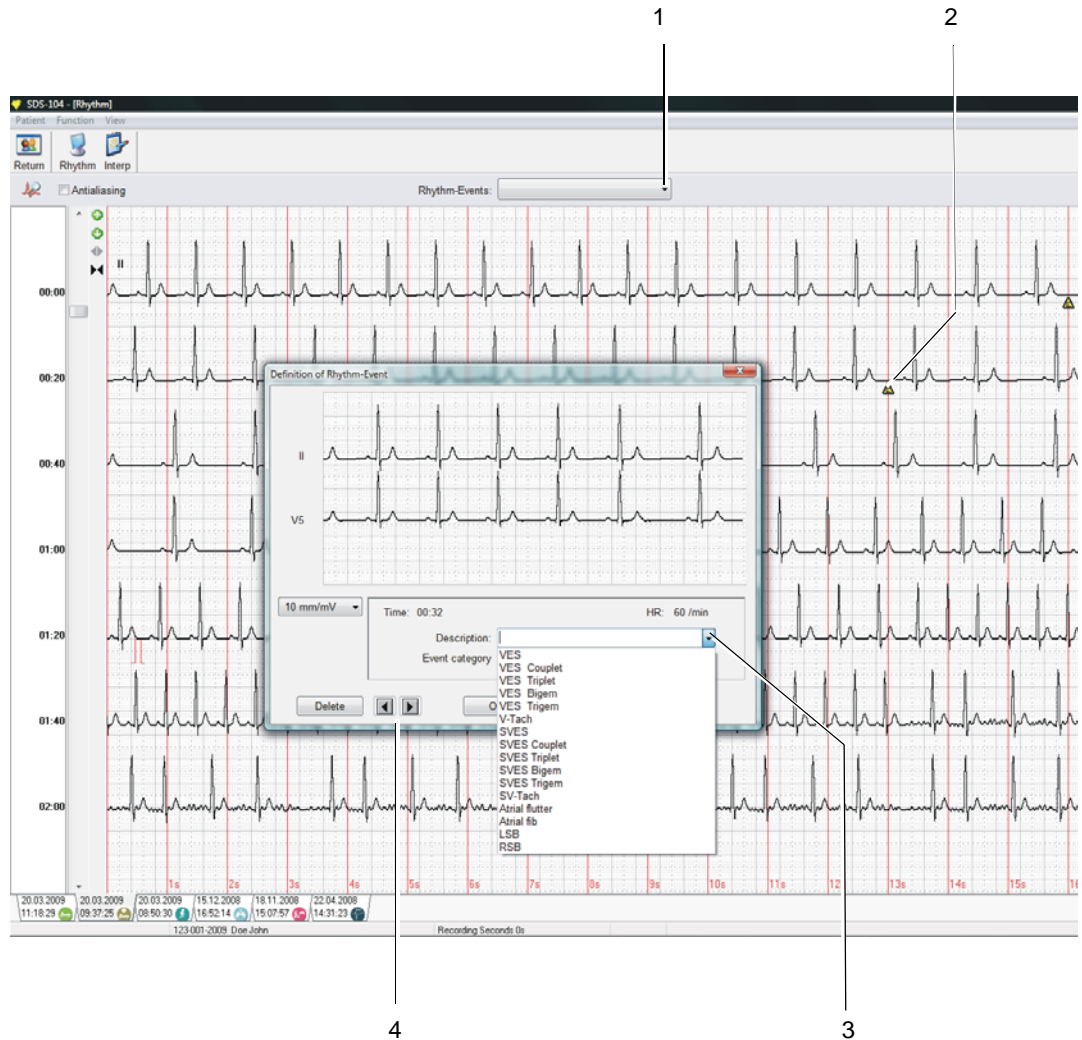


If you wish to classify the section as an event enter the classification in the `Description` field. Click on the downward facing arrow **(3)** to the right of the field to display possible options.

When OK is clicked the ECG section that has been classified as an event is highlighted in the Rhythm screen.

### 7.2.2     Zooming an Event

Click on the event icon **(2)** (red for manually set, yellow for program set) to obtain a zoom view of the event. Use the forward/Backward arrows **(4)** to select the next / previous event.

### 7.2.3     Displaying Events When in Another Time Section

A list of all events is displayed by clicking on the arrow in the top right of the rhythm screen **(1)**. Selecting an event displays the ECG segment.

### 7.2.4    Full Disclosure

Full disclosure enables a zoom view of all 12 leads from any 10 second time segment of the entire recording to be displayed.

Full disclosure allows all 12 leads to be displayed at the end of a rhythm recording. However, because full disclosure data takes a lot of disk space (10 minutes of recording requires approximately 10Mbytes), the number of recordings stored with full disclosure can be limited and is defined in system settings (). When this number is exceeded, the full disclosure data of the oldest recording is automatically deleted.
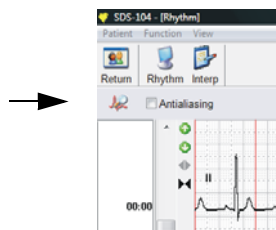
1. To display full disclosure:
2. Click on the FD icon (top left).
3. The cursor changes to the full disclosure icon ⊕ FD.
4. Move the cursor to select a time segment and click with the mouse.
5. 10 seconds of all 12 leads of the selected 10 seconds are available for display.



Move to the next/previous 10 second segment, and display the next lead group with the up/down, left/right arrows **at the top of the full disclosure insert.**

ℹ Full Disclosure recordings take a lot of disk space (c. 10MB for 10 mins of recording). Because of this the number of full disclosure recordings stored can be limited in system settings (). When a limit is reached the oldest stored full disclosure file is overwritten.

# 8   Exercise ECG

**⚠WARNING**

- ▲ Do not use the unit or the ergo device, if the earth connection is suspect or if the mains cable is in any way damaged.
- ▲ A stress test may only commence when the operating instructions of the ergometer have been read and understood. This applies particularly to the safety instructions. The instructions given in this book do not override those for the ergometer.
- ▲ A stress test may only be started if the patient has been informed of the test procedure and the risks involved (for example of falling on the treadmill). Ensure the patient is aware of the location of the emergency stop knob and its use.
- ▲ Ensure that the resting ECG confirms that the patient is able to carry out an exercise ECG.
- ▲ 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 conductive objects (even if these are earthed).
- ▲ 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 AT-104 PC 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 2.310005).

## 8.1   Emergency Printout

### 8.1.1   Monitor or Power Failure

The AT-104 PC and thermal printer are disabled when the unit is connected to the PC and the SDS-104 program is active.

In the event of a mains power failure the AT-104 PC unit remains on and a printout can be obtained on the thermal printer as follows:

➜ Press key **Auto** to obtain a printout in auto mode.

➜ Press key **Manual** to obtain a printout in manual mode (continuous printout).

**⚠ CAUTION**

- ▲ If the monitor alone fails or any other malfunction occurs, i.e. the PC is still on, no printout can be obtained until the cable assembly (RS232) between the PC and the AT-104 PC, is disconnected.

## 8.2 Starting a Test

**i** Operation of the ergometer will be given in the operating instructions supplied with the device.

### 8.2.1 Preliminaries

1. Prepare the patient, connect the electrodes (see para 5, Electrode Placement, page 59), select an existing patient from the patient screen or enter new patient details (see para 4.2, Entering / Editing Patient and Recording Data, page 34), and take a resting ECG. Check the resting ECG and ensure that the patient is fit to carry out an exercise ECG

2. Ensure the ergometer is connected to the PC and apply power.

3. From the patient screen, click the exercise icon. The exercise acquisition screen is displayed.

**Settings**

1 ——— Bicycle
Treadmill
2 ——— Heart Rate Alarm
Save Screen SettingsCntl + S
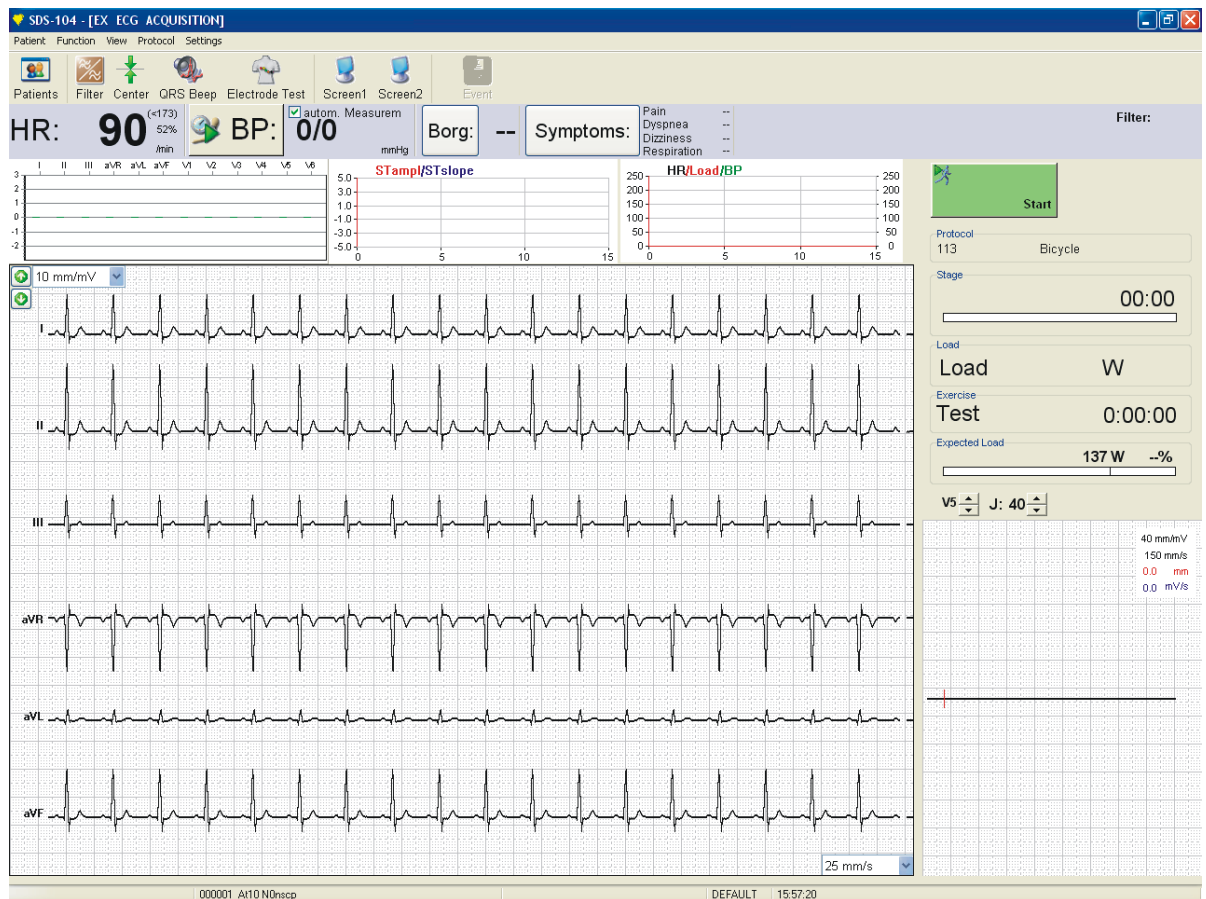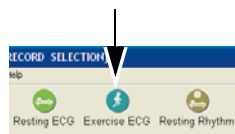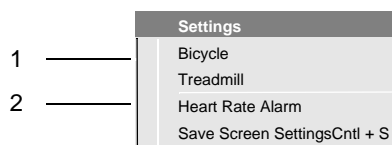
4.  If not already defined, define the exercise equipment that is going to be used for the test (treadmill or bicycle) in the settings menu **(1).**
    –   If neither bicycle or treadmill can be selected i.e. the option is dimmed, the type of ergometer must be selected in the main settings menu (see para 9.2.4, Ergo Device, page 131).

5.  From the settings menu select **Heart rate alarm (2)** to display the options:

**Heart Rate Alarm**

☐ Audio alarm

Heart Rate Alarm
◉ 90% of 220 - Age
○ 220 - Age
○ 200 - Age
○ M: 205 - 1/2 Age;  F: 220 - Age
○ Manual        0
○ 208 - 0.7 * Age
○ No Alarm

[ OK ]        [ Cancel ]
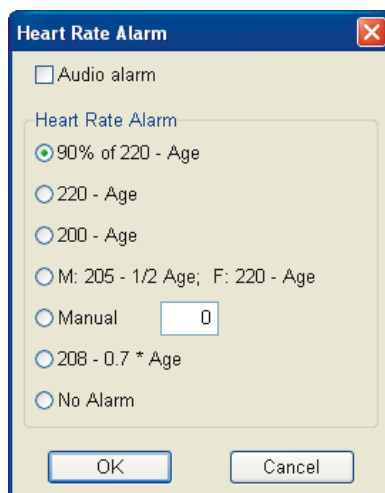
6.  This setting enables automatic visual and audible indication (HR flashes red on the screen) as soon as the heart rate limit is reached during the course of the exercise test. Before each test, the heart rate alarm limit must be set for the patient. Once the stress test has been started, the alarm limit will be displayed in parenthesis in the right-hand side of the screen above the heart rate. The patient data, in particular the date of birth and sex must have been entered for auto heart rate alarm setting. Manual input allows for any heart rate alarm setting to be defined.

**i**    The default protocol will be used when the test is commenced. If you wish to select another protocol, or wish to change the default, continue with the next step.

**SCHILLER**
AT-104 PC       **User Guide**       Exercise ECG     8
Starting a Test     8.2

| Protocol |
|---|
| Select Bicycle |
| Select Treadmill |
| Edit Bicycle |
| Edit Treadmill |
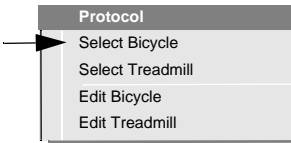
7.  In the protocol menu, select required ergo device (bicycle or treadmill). Note that only one will be able to be selected as defined in the settings menu (step 4)
    –  Use this step to display all the protocols programmed for the bicycle and treadmill.
8.  If you wish to change the default protocol (the protocol that is selected when the exercise screen is first entered) highlight the protocol and check the `Use as Default` box. The next time an exercise test is entered, this protocol will be selected.
    –  The procedure to define a protocol is described later in this book (see para 9.15, Direct Print, page 163, et seq.).

**Select Protocol**

**Bicycle**

| Type | ID | Description |
|---|---|---|
| Step | 1005025 | |
| Step | 113 | 113 |
| Step | 252525 | |
| Step | 502525 | |
| Step | CON1 | Conconi 50W 10W/St. 6kJ/St. |
| Step | CON2 | Conconi 100W 20W/St. 12kJ/St. |
| Step | DEFAULT | |
| ID | KIDRMPHI | Kids Prorocol Ramp Trained |
| ID | KIDRMPLO | Kids Protocol Ramp Not Trained |
| Type | KINDER | Kinder Rrotokoll Watt per Kilo |
| Type | W_KILO | Childrens prot based on weight |

☐ Use as Default

OK     Cancel

### 8.2.2   Start the Test

**⚠WARNING**
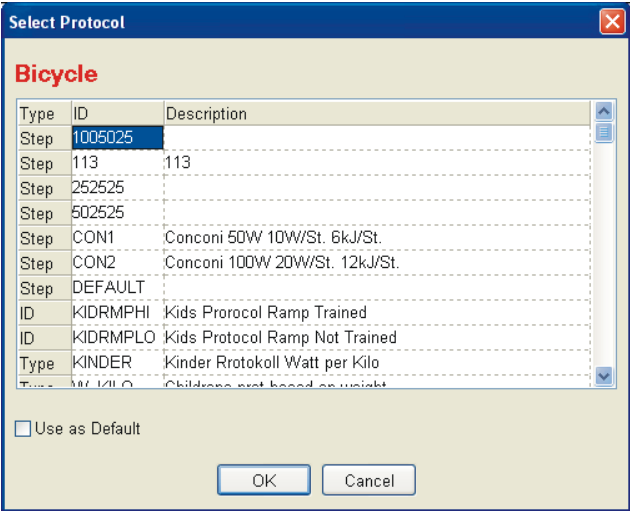
▲   Danger of Injury. During the test, the patient must be under constant observation. If a treadmill is used, the emergency stop switch must be accessible at all times to both the patient and the person conducting the test.

9.   Warn the patient that the test is to begin.

10.  Click on the control icon which in the top right corner of the screen which will be displaying **Start**, or Press Function Key F7.
   –   When a treadmill protocol has been selected the treadmill starts at the speed defined in the protocol selected.
   –   When a bicycle protocol has been selected the load defined in the warm-up protocol (see bicycle settings later in this chapter), is applied to the bicycle.

11.  The control icon now displays **Begin** to indicate that the warm-up stage has commenced.
   –   If the body positions have been defined in system configuration (see para 9.13.1, Screens and Formats, page 159), they will appear before the Begin icon is displayed. Up to three positions can be defined: Supine, Sitting, Standing)
   –   Go to the next position by clicking on the `Skip` icon until **Begin** is displayed.
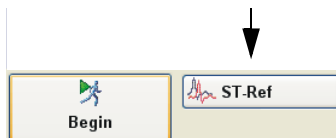
12.  Click on ST-Ref **icon** to define the QRS reference. This icon is only displayed below the control icon when **Begin** is displayed.

13.  The current average QRS complex displayed in the zoom average window, is used as a reference complex during the test. If the ST-Ref icon is not clicked, the reference QRS is taken as the average qrs (displayed) when the test is commenced (i.e. when `begin` is clicked).
   –   Although one lead is displayed, a reference complex for each lead is stored by the unit to allow comparison of all leads throughout the test.
   –   During the test the reference complex is coloured grey with the current QRS superimposed on the reference complex in black.

14.  Click on the control icon (**Begin**) to start the test, or Press Function Key F7.
   –   The test starts and continues according to the protocol defined and the control icon now displays **Recover.**
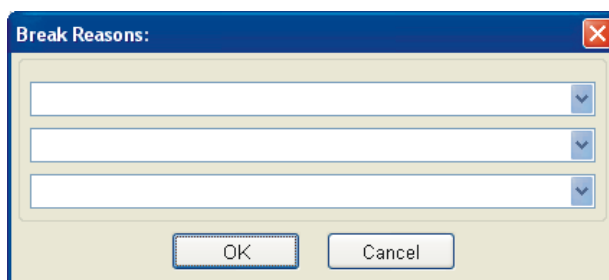
### 8.2.3   Recovery Stage



15. To end the test and commence the recovery phase click the control icon which now displays **Recover**, or Press Function key F7.

   – The recovery phase commences at the end of the current step - during this time the recover icon turns yellow.
   – To enter the recovery phase directly and not wait until the end of the current step, the recover icon is again pressed i.e. the recover icon is clicked twice to directly enter the recovery phase.
   – The ergometer reverts to the defined recovery load or speed either gradually or immediately as defined in the protocol. During this phase the load and the time, since the recovery phase was commenced, are displayed. The (protocol) Step window displays `REC`.
   – ECG recording continues during the recovery phase.
   – During the recovery phase the control icon displays End

### 8.2.4   Criteria for Ending the Test

Click on the **Criteria** icon (which is displayed below the control icon in the End phase), to enter the reasons for ending the test.



Various options are detailed or you can enter your own text. Up to three reasons can be entered.

   – After a few seconds the final report is displayed automatically. Edit options for the final report are detailed later in this section

### 8.2.5    Ending the Test

When the end icon is clicked you are prompted to confirm:
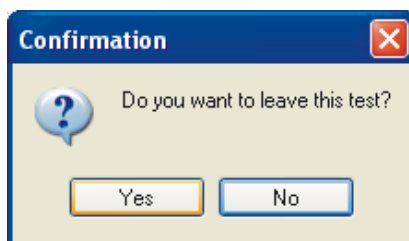


### 8.2.6    Removing the Load During Recovery

To immediately remove the load on a bicycle, or stop the treadmill during the recovery phase click on **Full Rec**. This removes the load but recording carries on until **End** is clicked.

## 8.3   Information During the Test

### 8.3.1   ECG Information

The following example shows the display for a test with a bicycle.
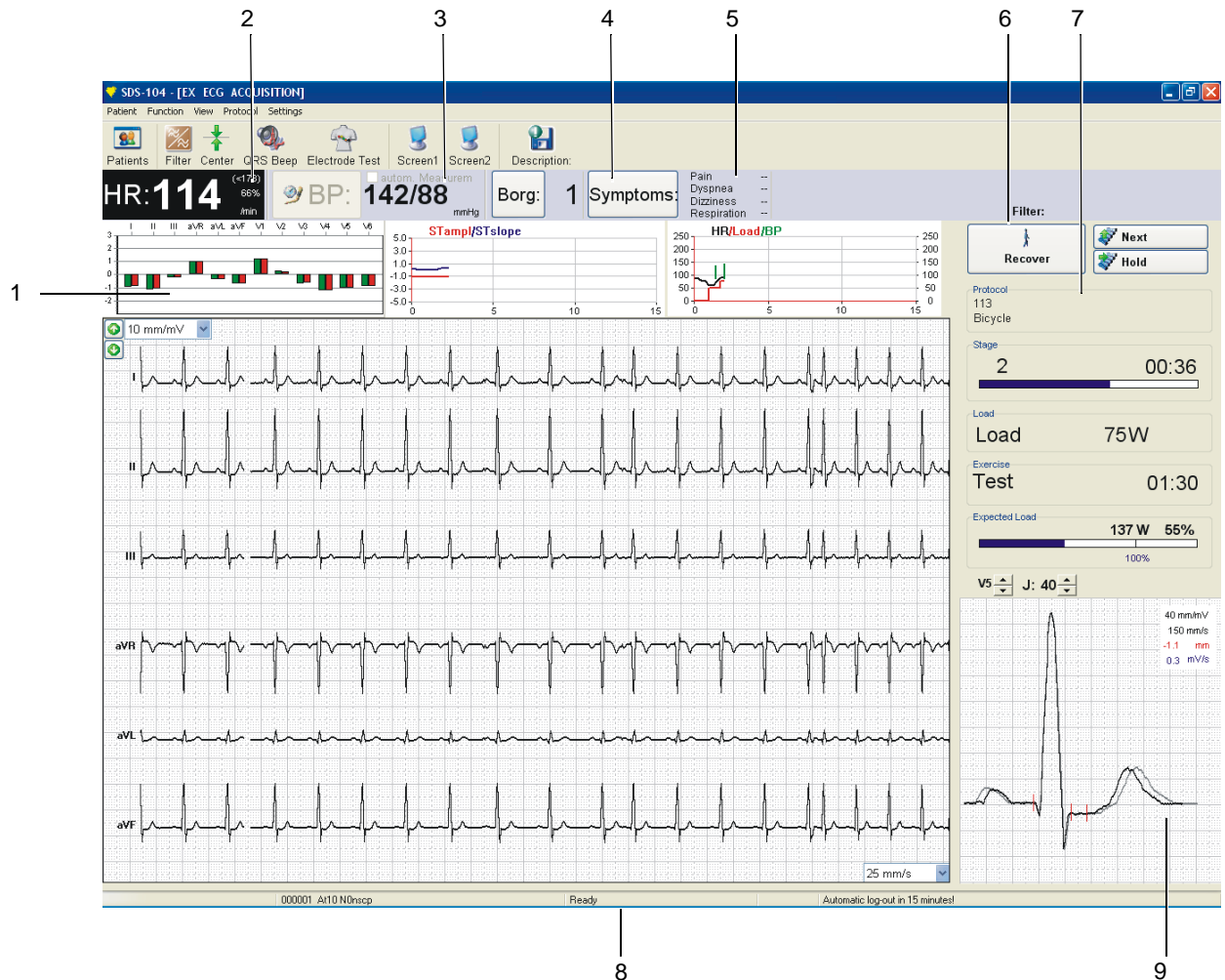


**(1) Real time and trend graphs**

- **ST Measurement** - Current average ST measurement of all leads. The point where the ST is measured is defined in block (10).
- **Trend ST amplitude and slope** - graphical indication of the ST measurements.
- **HR/Load/BP Graph** - Heart rate (blue), Load (red) Blood Pressure (green) graph against time. Note that the blood pressure is only displayed after the first entry has been made.

**(2) HR**

- The current heart rate in beats per minute. The target heart rate (alarm setting) is given in parenthesis after the heart rate.

**(3) BP**
- Last entered/recorded Blood Pressure measurement (see following).

**(4) Borg rating**
- The last entered Borg Rating (see following).

**(5) Symptom Ratings**
- The last entered symptom rating (see following).

**(6) Test Step Icon**
- This icon indicates the next step of the test. Click the icon to go from the current step to next (indicated) step:
  - **Start** - start warm-up phase with the load /speed defined in the selected protocol.
  - **Begin** - begin test with the load / speed defined in stage 1 of the protocol selected.
  - **Recover** - enter recovery stage.
  - **End** - end test.
  - The **Next** and the **Hold** icons are displayed when the test has begun. When **Hold** is active the icon dims indicating that the current stage is currently held. When **Next** is selected the next stage of the test protocol is entered.

**(7) Stage Identification**
- Protocol and duration Box. The protocol title is displayed at the top of this box and underneath the current status of the protocol as follows:
- **Step** - The step number
- Time - The time elapsed from the start of the current step (shown in step above)
- **Test** - Total time elapsed from the start of the test (warm-up start)
- **Load** - for a bicycle the current load in Watts applied to the bicycle is displayed. Optionally, the calculated METs value can be displayed (see system settings). For a treadmill METS is displayed. An explanation of metabolic equivalents is given in the view explanation (see para 8.5.14, Metabolic Equivalents (METS), page 121). The speed in km/h (or m.p.h.) and elevation in % is also displayed.

**(8) Information bar**
- Patient name and ID.

**(9) Zoom Lead**
- This section gives the current zoom average view of a selected lead, with the ST amplitude measurement and slope (see following).

# 8.4 Settings During the Test
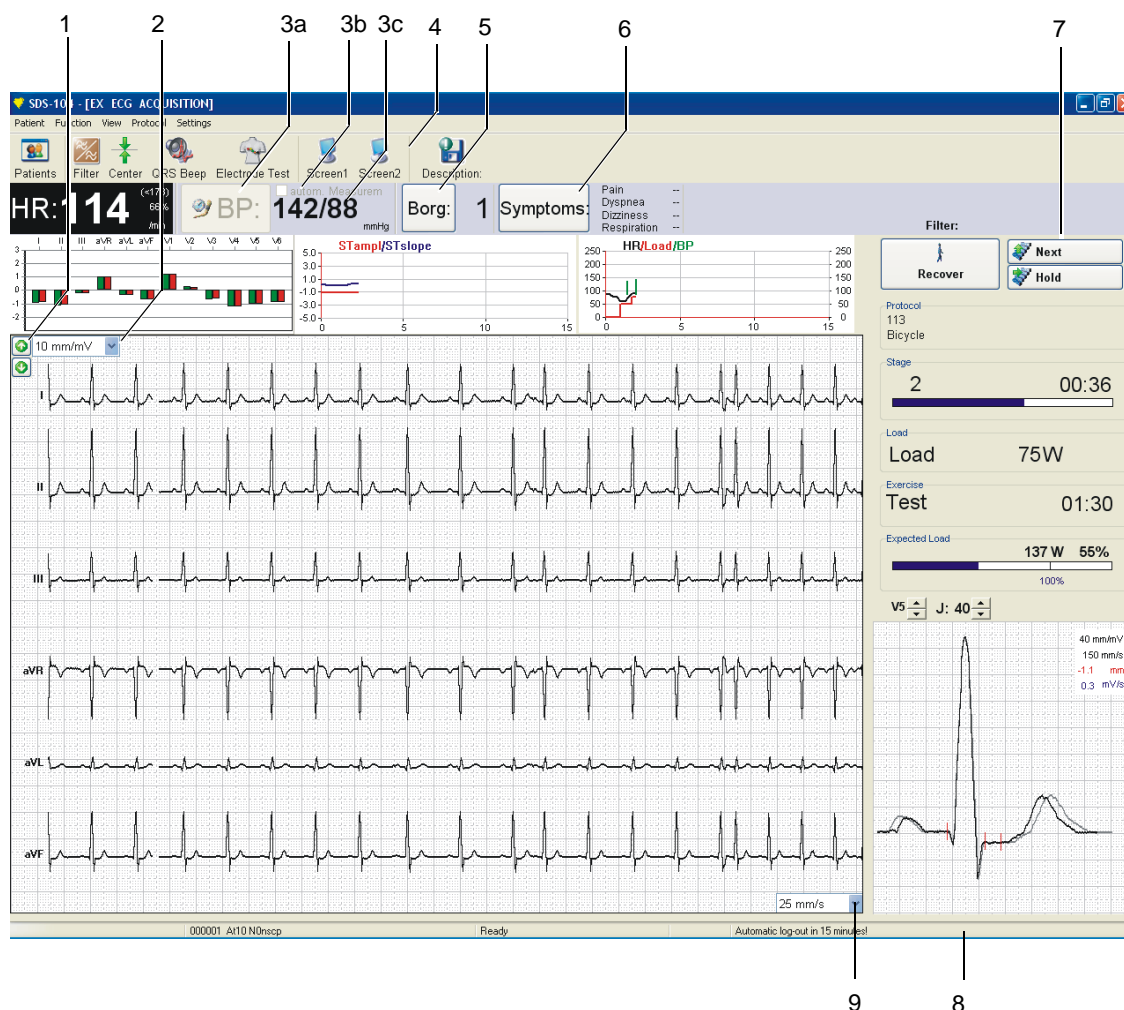


## 8.4.1 Lead Group

**Display Lead Group** - Lead groups can be changed at any time during the recording. Click on the up and down arrows **(1)** in the top left of the screen to toggle through the standard / Cabrera lead sequence followed by the user defined lead sequence (note that the user defined lead sequence is defined in system settings.

## 8.4.2 Trace Sensitivity and Speed

The sensitivity scale of the leads is displayed in the top left box above the leads. Click on the arrow by the side of sensitivity indication **(2)** to change the sensitivity to 2.5, 5, 10 or 20 mm/mV.

The speed of the screen is displayed in the bottom right box below the leads. Click on the arrow by the side of speed indication to change **(9).** The display speed can be 10, 12.5, 25 or 50 mm/s.

### 8.4.3    Blood Pressure

**Automatic Measurements**

When a blood pressure device is connected (and defined in system settings (see para 9.2.4, Ergo Device, page 131) the measuring interval is defined in the individual protocols with blood pressure measurement taken automatically at the interval set (Autom Measurement box ticked **(3b)**. When this box is not ticked, auto BP measurement is stopped; individual measurements can still be taken at any time (next paragraph).

Additional measurements can be made at any time during the test. Click on the **BP icon** next to the blood pressure display to take a measurements **(3a)**.

When a measurement is being taken by a BP unit controlled by the AT-104 PC, the icon is yellow.

**Manual Entry of Blood Pressure Values**

When blood pressure measurements are made independently of the electrocardiograph and the ergometer, the results can be entered manually as follows:
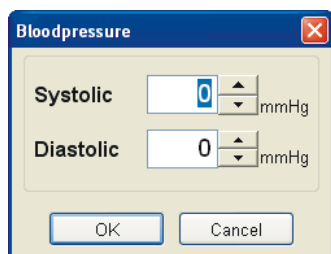
    – Click on the BP measurement **(3c)**.
    – **Input Blood Pressure** from the function menu
    – Press function key F11
• Enter the systolic value and the diastolic value. Click on OK.
    – **Note:** The up / down keys on the keyboard can also be used within the BP input dialogue to edit BP values.

• The entered blood pressure appears on the display below the heart rate. The values remain displayed on the screen until overwritten.
    – The BP is also recorded in the HR/load/BP graph in the top area of the display (if selected for view)

**i** • The BP (and HR) can also be edited at the end of the test in the stage table by double clicking on any BP measurement.

### 8.4.4    Screen Presentation (number of leads)

Two screen lead configurations are available during the test and are selected with the screen 1 and screen 2 icons **(4).** The number of leads displayed for each of the screen configurations is defined in the system configuration.

### 8.4.5    Borg Rating

During the test, subjective patient Borg rating can be entered. The borg rating can be entered at any time in the test after the warm-up period. Click the icon **(5)** to enter a new rating. Enter a value between 0 and 99. All entered ratings are stored. The information entered appear by the side of the icon and both in a table at the end of the test and on the final printout.

### 8.4.6   Entering Symptom Ratings

During the test, subjective patient symptoms can be entered according to their severity. Display the symptoms input screen in one of the following ways:

– Click on the symptoms icon **(6)**.
– Select **Input Symptoms** from the function menu
– Press the <shift> key followed by function key F11

The information entered appear by the side of the icon and both in a table at the end of the test and on the final printout.

### 8.4.7   Average Zoom

a

b
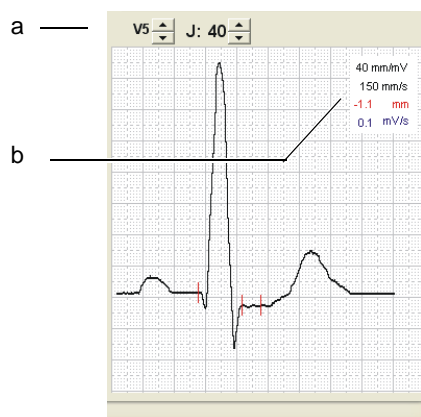
The reference average QRS (defined in the warm-up phase) **(8)** is coloured grey with the actual QRS superimposed in black. The designation of the displayed lead is given above the average complex. The average lead displayed can be changed at any time by the up and down arrows immediately to the right of the lead designation **(a)**.

**ST Measurement**

The measurement point for the ST value is displayed as ms after the J point. In the example screen given, the setting is 40 ms after the J-point. The measurement point can be changed at any time by the up and down arrows immediately to the right.

The measurement point can also be changed by:

– pressing the left/right arrows on the keyboard
– selecting **J-point plus/minus/** in the **view menu**

The ST measurement in mm and slope in mV/s for the selected lead is displayed above the zoom view **(b)**. The ST measurement is calculated between the baseline (see below) and the measurement point. The ST slope is given as the slope between 10 ms after the J-point and the measurement point.

The red vertical lines on the zoom lead shows the measurement points as follows:

• The first line on the left gives the beginning of the QRS complex. The baseline reference for ST measurement is taken 10 ms before this point
• The second vertical line gives the J-point, the third vertical red line gives the ST measurement point.

### 8.4.8   Entering an Event

An event can be registered at any time during the recording as follows:

- Display the event screen input screen by clicking on the event icon**.**
- Enter an event title and click on OK.

The entered event appears on the rhythm screen at the end of the recording, as a location triangle. The event can be viewed and edited (see para 8.5.8, Exercise Rhythm, page 116).
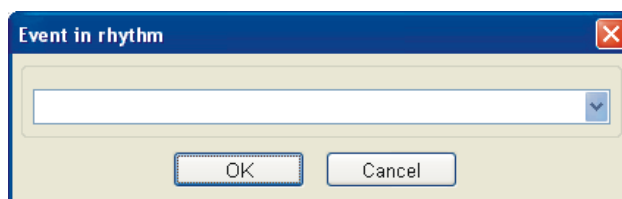
### 8.4.9   Advancing to the Next Stage

At any time during the test, manual advancement to the next stage of the protocol can be initiated manually. This can only be done however, after the first 20 seconds of the pre-exercise phase have elapsed. Click on the **Next** icon **(7)**.

### 8.4.10   Holding Stage

The duration of any stage of exercise can be extended beyond the pre-programmed duration at any time during the test. Click on the **Hold** icon **(7)**. The bicycle load (treadmill speed/and elevation) remains constant and staging will not occur until `next` icon is clicked.

### 8.4.11   Bicycle Control

Bicycle load that is programmed for a particular stage can be manually increased or decreased from the current values at any time in the test.

### Load

Click on the load indication. The load screen is displayed: Enter the desired load. The maximum load is dependent on ergometer.

The increment indicates the current protocol load step increment. If you wish to change the load enter the new desired increase. All subsequent step increases in load will be by the amount defined.
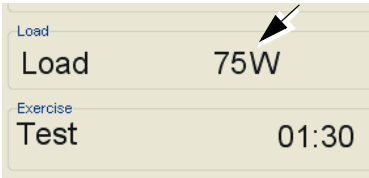
### 8.4.12   Treadmill Control

Treadmill elevation and speed that is programmed for a particular stage can be manually increased or decreased from the current values at any time in the test.
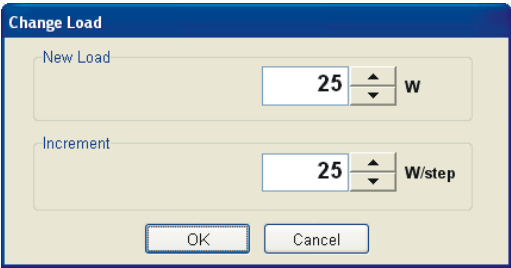
### Speed

Click on the speed indication in the top right corner. The speed screen is displayed. Enter the desired speed. The maximum speed that can be defined is dependent in treadmill.

The increment indicates the current protocol speed step increment. If you wish to change the increment enter the new desired increase. All subsequent step increases in speed will be by the amount defined.

### Elevation

Click on the elevation indication in the top right corner. The elevation screen is displayed. Enter the desired elevation. The maximum elevation that can be defined is dependent in treadmill.

The increment indicates the current protocol elevation step increment. If you wish to change the increment enter the new desired increase. All subsequent step increases in elevation will be by the amount defined

**i**    Not all treadmills are capable of increasing to the maximum speed or elevation. Please consult the treadmill documentation for details.

# 8.5   Post Test Review and Editing

## 8.5.1   Main Screen
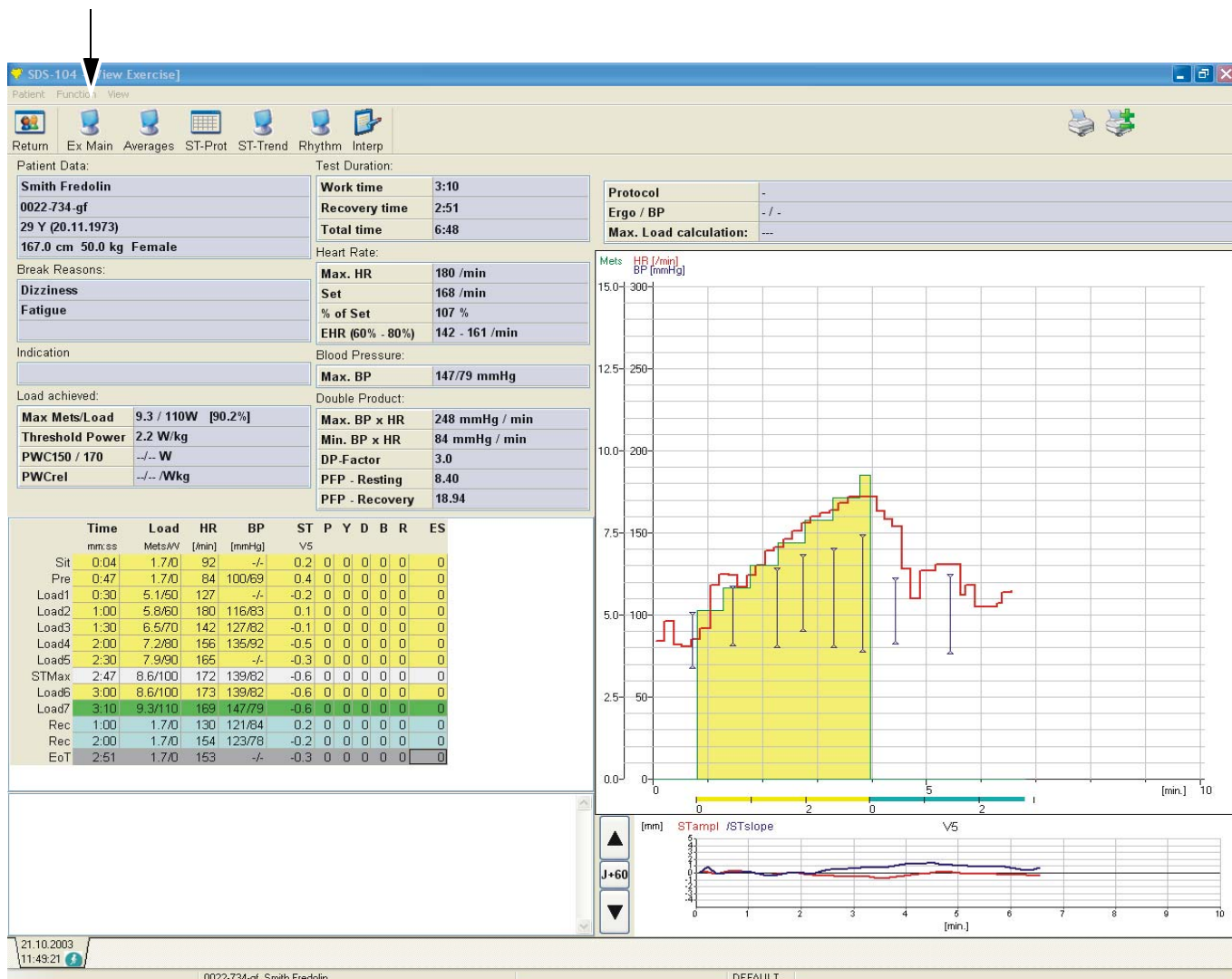


| | |
|---|---|
| **Patient Data** | Name, date of birth, age, height, weight and sex. |
| **Break Reasons** | The reason the test was ended. |
| **Indications** | Physical indications at the end of the test. |
| | The break reasons and Indications are normally entered at the end of the test but can be edited at any time by clicking in the field. |

**Load Achieved**

**Max Load** - Maximum load achieved.

Note that the maximum load achieved can be calculated in different ways and is defined in exercise settings (see para 9.13.1, Screens and Formats, page 159).

**PWC (Bicycle) -** Physical working capacities (PWC max., PWC 150/170, PWC rel.).

**i** The PWC can be set to be displayed or not displayed. This is set is system settings (see para , Exercise ECG, page 138).

**METS (Treadmill)** - When using a treadmill, METs values replaces PWC. That is Max METs which is the maximum metabolic equivalent achieved.

**Threshold Power** - for Bike. Calculated as follows: achieved Load/Weight of Patient.

**Test Duration**

**Work Time** - Total time of work stages.

**Recovery Time** - Total time of recovery stage.

**Total Time** - Total time of test including warm-up and recovery.

**Heart Rate**

**Max. heart rate** - Maximum heart rate achieved

**Set** - the heart rate limit that was set for the patient

Note that the maximum calculated heart rate can be on the basis 220 - age, m: 205 - 1/2 age or other selected formula or manually entered limit. This is defined in the exercise settings.

**% of set** - the percentage value of the maximum heart rate achieved of the set limit .

**EHR (60% - 80%)** - Exercise Heart rate range, that is:

• EHR 60% : Resting HR + (max. HR – Resting HR) * 60%
• EHR 80%: Resting HR + (max. HR – Resting HR) * 80%

**Max BP**

The systolic pressure reached during the recording, and the diastolic pressure.

**i** BP measurements can be edited, or new BP measurements can be entered at any stage of the test (see next page).

**Double product**

**Max BP*HR -** The systolic blood pressure at the maximum load stage, multiplied by the maximum heart rate at the maximum load stage.

**Min BP*HR -** The systolic blood pressure during the warm-up stage multiplied by the minimum heart rate during the warm-up stage.

**DP Factor -** The Double Product (DP) factor gives the work difference between the resting and max effort and is calculated as follows:

$$DP\ Factor = \frac{Max\ Sys\ BP\ x\ Max\ HR}{Resting\ (Sys\ BP\ x\ HR)}$$

**PFP - Resting -** The Pressure Frequency Product (PFP) is the product of the Systolic blood pressure and heart rate to give an indicator of $O_2$ / $CO_2$ exchange based on the heart frequency and BP. Under maximum load this value is not considered reliable because of changes in ventricle volumes and left ventricular geometry. The formula used is as follows:

$$PFP = \frac{Sys\ BP\ x\ HR}{1000}$$

The **PFP - Resting** value is calculated using the last measurement before first stage of the test begins.

**PFP - Recovery -** The PFP - Recovery value is calculated using last the measurement in the recovery stage before End Test.

ℹ The double products and exercise heart rate (60% - 80%) can be set to be displayed or not displayed. This is set is system settings (see para , Exercise ECG, page 138).

**Step Table**

Overview of the complete test giving:

- Step/load stage number
- Time - Accumulative time from the beginning of the test (including the recovery stage)
- Load - The load applied at the beginning of the step
- HR - maximum heart rate measured in the step
- BP - blood pressure measured during the stage or entered manually during the stage. Any HR and BP value can be edited by double clicking on the value in the table (see below).
- ST - the ST measurement at the end of the stage in mm for the specified lead. Note that the lead can be changed in the ST graph.
- P Y D B R - symptoms (Pain, Dyspnoea and Dizziness, Borg and Respiration respectively) manually entered during the test on a scale from 1 to 99. Any symptom value can be edited by double clicking on the value in the table.
- The step highlighted green indicates the final complete step made and the steps indicated in blue indicate the recovery phase

**Trend plots**

Graph giving the blood pressure, load and heart rate with relation to time.

*The yellow and turquoise strip under the time axis of the BP/HR/Load graph shows the load (yellow) and recovery (turquoise) phases.*

**ST Graph**

ST measurements with relation to time. The red line indicates the amplitude in mm (equating to mV), and the blue line gives the slope in mm/s. The lead is changed with the up/down arrows to the top/bottom of the measuring point (J point).

Note that the lead selected here is also reflected in the ST measurements in the load table.

Details of maximum load calculations, DP factor, PWC and METS are given later in this section.

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### 8.5.2    Entering or Editing a BP measurement

A new BP can added at any stage of the test, or any existing BP can be edited. To add a BP measurement, right click in the main graph where the new measurement is to be inserted. Select **Add BP,** and enter the blood pressure. A new BP measurement appears on the graph
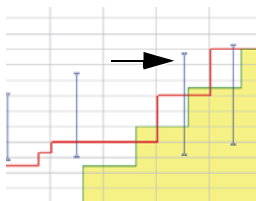
To edit an existing BP measurement, position the cursor over a measurement until the cursor changes to a 'hand'. Right click and select **Edit BP**. The edited value appears on the graph and on the step table. To delete a BP measurement enter zero for both the systolic and diastolic measurements.

### 8.5.3    Average Screen
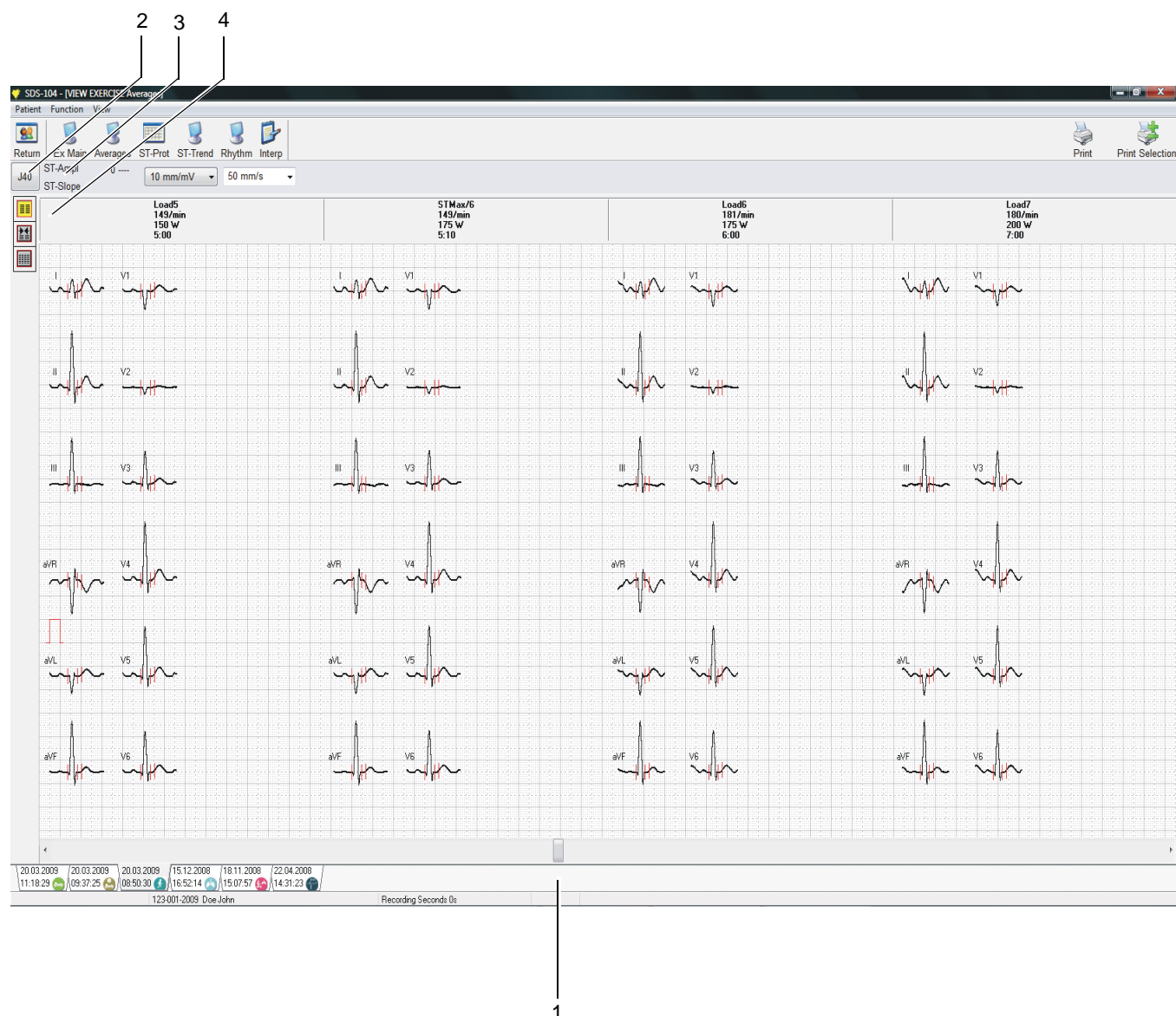


The average screen gives average QRS complexes for every lead of every step. The screen is divided into columns. At the top of each column is the following: the step, the Load or speed, the maximum heart rate, the time. The average screen can also display the average ST amplitude and slope for every lead at every stage in the test. Page through the stages with the forward/back slider **(1)**.

The average complexes can be displayed so that all leads are displayed per stage, or 6 leads are displayed per stage **(4)** - this can give direct comparison of a single lead from stage to stage. The point at which the ST amplitude and slope is measured can be changed at will. Clicking on the J indication in the left side of the screen **(2)** enables the point where the ST is measured to be changed.

Click the **ST Amplitude** and **ST slope icons (3),** to display the measurement for each lead at every stage of the test.

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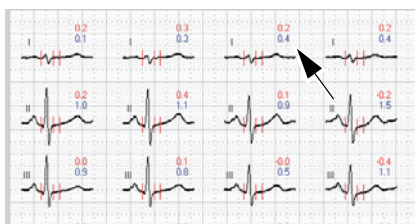
### 8.5.4    Average Zoom

To display a zoom average of a single lead display, from the average screen select and click with the cursor on the lead that you wish zoomed.
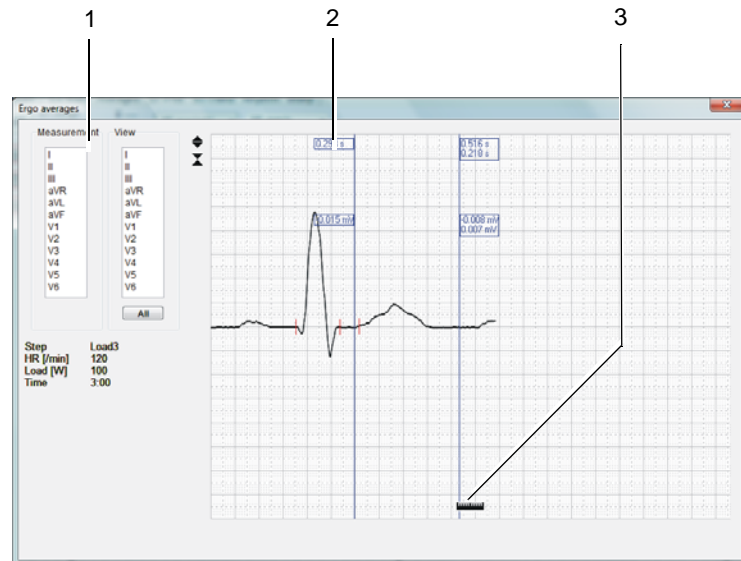


Two measurement lines are situated on the curve **(2)** when the measurement enable icon **(3)** is clicked. These give the instantaneous amplitude value of the leads at t time. The lower value in the second measurement line gives the delta value between the two measurements. Both measurement lines can be freely positioned anywhere on the recording.

The lead box **(1)** enables other leads to be selected. The reference lead given is highlighted. To display another lead click on the lead designation in the lead box.

To superimpose one or more averaged leads on the screen, click on the desired lead in the View box. The lead is displayed superimposed on the original. As many leads can be superimposed on the original lead as you wish.

**i**    When more than one lead is displayed, all measurements relate to the reference lead i.e. the lead highlighted.

### 8.5.5    Editing the Start and End Point of the QRS

**i**    The beginning and end points of the QRS complex can be edited by the user. This is done in the same manner as for a resting recording (see para 6.7.4, Editing the Global Measurement Points, page 77).

### 8.5.6   ST Amplitude table

| | Time | Load | HR | I | II | III | aVR | aVL | aVF | V1 | V2 | V3 | V4 | V5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pre | 0:37 | 0 | 75 | 0.0 | -0.1 | -0.2 | 0.1 | 0.1 | -0.1 | 0.1 | 0.1 | -0.1 | -0.1 | -0.1 |
| Load1 | 1:00 | 50 | 90 | 0.1 | -0.1 | -0.2 | 0.0 | 0.1 | -0.1 | 0.1 | 0.0 | -0.0 | -0.1 | -0.1 |
| Load2 | 2:00 | 75 | 90 | -0.0 | -0.1 | -0.1 | 0.1 | 0.1 | -0.1 | 0.1 | 0.0 | -0.1 | -0.1 | -0.1 |
| Load3 | 3:00 | 100 | 120 | 0.3 | 0.2 | -0.2 | -0.3 | 0.3 | 0.0 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| Load4 | 4:00 | 125 | 150 | 1.5 | 1.2 | -0.2 | -1.3 | 0.8 | 0.5 | 0.8 | 0.3 | 0.6 | 1.2 | 0.9 |
| Load5 | 5:00 | 150 | 149 | 1.4 | 1.2 | -0.2 | -1.3 | 0.8 | 0.5 | 0.9 | 0.3 | 0.7 | 1.1 | 1.0 |
| STMax | 5:10 | 175 | 149 | 1.6 | 1.2 | -0.4 | -1.4 | 1.0 | 0.4 | 0.6 | 0.2 | 0.6 | 1.1 | 0.9 |
| Load6 | 6:00 | 175 | 181 | 2.3 | 2.0 | -0.3 | -2.2 | 1.3 | 0.8 | 1.0 | 0.3 | 0.9 | 1.8 | 1.5 |
| Load7 | 7:00 | 200 | 180 | 2.1 | 1.9 | -0.4 | -1.9 | 1.3 | 0.7 | 0.8 | 0.3 | 0.7 | 1.6 | 1.3 |
| Load8 | 8:00 | 225 | 180 | 1.9 | 1.5 | -0.4 | -1.7 | 1.1 | 0.6 | 0.7 | 0.2 | 0.7 | 1.3 | 1.1 |
| Load9 | 9:00 | 250 | 181 | 1.9 | 1.6 | -0.3 | -1.7 | 1.1 | 0.6 | 0.7 | 0.3 | 0.7 | 1.4 | 1.2 |
| Rec | 1:00 | 25 | 120 | 1.5 | 1.1 | -0.4 | -1.3 | 0.9 | 0.3 | 0.6 | 0.1 | 0.5 | 1.0 | 0.9 |
| Rec | 2:00 | 25 | 90 | -0.1 | -0.1 | -0.1 | 0.1 | 0.0 | -0.1 | 0.2 | 0.1 | -0.1 | -0.1 | -0.1 |
| Rec | 3:00 | 25 | 75 | 0.0 | -0.1 | -0.1 | 0.0 | 0.1 | -0.1 | 0.1 | 0.0 | -0.1 | -0.1 | -0.1 |
| EoT | 3:30 | 25 | 60 | -0.0 | -0.1 | -0.1 | 0.1 | 0.1 | -0.1 | 0.1 | 0.0 | -0.1 | -0.2 | -0.1 |

The ST measurement table gives average ST measurement for every lead of every step.

### 8.5.7    ST Trend

1
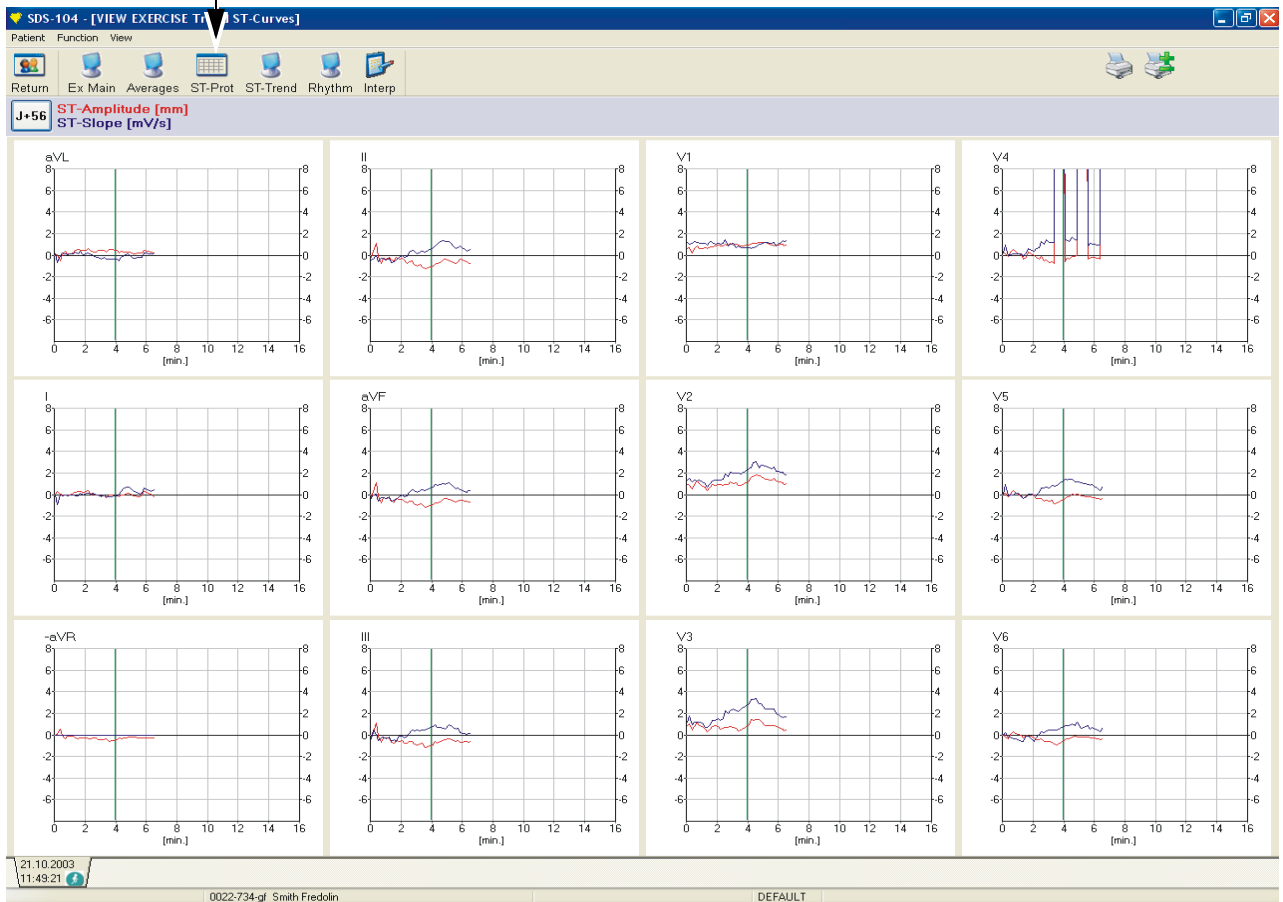


The ST graph gives ST measurements for every lead with relation to time.

• The red line indicates the amplitude in mm (equating to mV)
• The blue line gives the slope in mV/s

The point at which the ST amplitude and slope is measured can be changed at will. Clicking on the J indication **(1)** enables the point where the ST is measured. to be set.
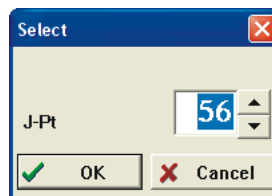
### 8.5.8   Exercise Rhythm



In this screen a selected lead can be viewed over the entire recording.

The icons at the top left of the screen change the lead displayed (toggle between two leads defined in system settings (see para 9.13.1, Screens and Formats, page 159)) and the speed to display between approximately 1 minute and 15 minutes of recorded data.

The time scale is displayed at the bottom of the screen.

### 8.5.9    Defining a Rhythm Event

Click anywhere in the rhythm view on the section that you wish to classify as an event.

Click on the downward facing arrow to the right of the field **(1)** to display possible options.

• To confirm the event classification click OK
• To delete a classification click Delete
• To leave the event screen without making any changes click on Cancel.
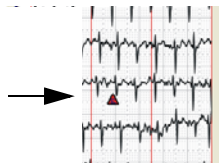


When OK is clicked the ECG section that has been classified as a manual event is highlighted as a triangle.

• red triangle = manually defined event
• yellow triangle = auto event

### 8.5.10    Viewing an Event

Click on the event icon (red for manually set, yellow for program set) to obtain a zoom view of the event. Use the forward/Backward arrows **(2)** to select the next / previous event.

### 8.5.11    Rhythm Screen - Full Disclosure

Full disclosure enables a zoom view of all 12 leads from any 10 second time segment of the entire recording to be displayed.

Full disclosure allows all 12 leads to be displayed at the end of an exercise test. However, because full disclosure data takes a lot of disk space (10 minutes of recording requires approximately 10Mbytes), the number of recordings stored with full disclosure can limited and defined in system settings (see para 9.2, System Configuration, page 128). When this number (maximum 99) is exceeded, the full disclosure data of the oldest recording is automatically deleted.



1.    To display full disclosure:

2.    In the rhythm screen, click on the FD icon (top left) so that it is yellow (active).

3.    The cursor changes to the full disclosure icon ⊕ FD.

4.    Move the cursor to select a time segment and click with the mouse.

5.    10 seconds of all 12 leads of the selected 10 seconds are available for display.
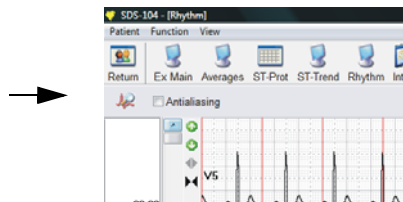


Move to the next/previous 10 second segment, and display the next lead group with the up/down, left/right arrows (1).

### 8.5.12    Interpretation
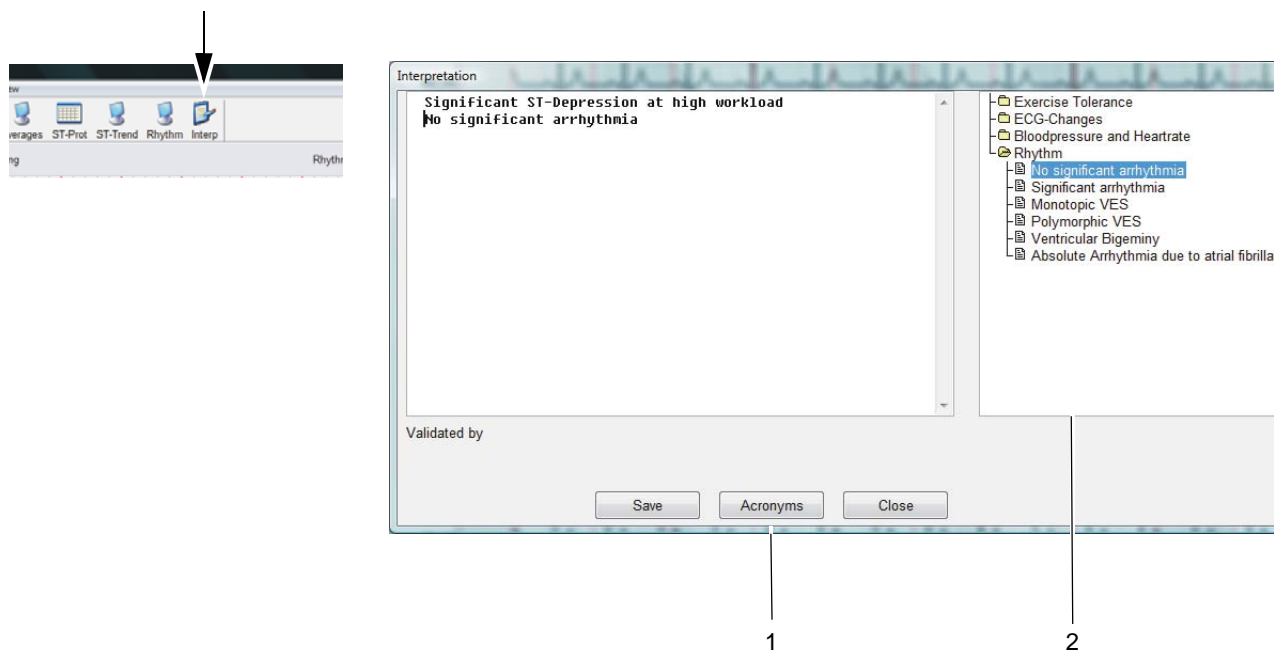




The list of statements to the right **(2)**, is only displayed after the acronyms icon has been clicked **(1).** The interpretation can be manually entered via the keyboard. Additionally standard interpretation statements and acronyms can be selected for inclusion in the interpre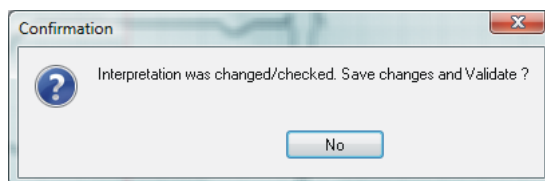tation statement. To display the standard statement click on the `acronyms` icon at the bottom of the screen. A list of all statements are displayed. Click on a statement to enter the interpretation statement.

To save an interpretation statement after editing click on the **Save icon**. When you click on the **Close icon** before saving you are asked if you wish to save the changes or not.



**i**

**Acronym Expansion**

A number of predefined acronyms are defined by the system. User can also freely define their own acronyms and corresponding statements or modify system defined acronyms. These are defined in system settings (see para 9.10, Texts, page 155) Settings > Texts > Acronyms.

When an acronym is entered it can be expanded automatically by entering a star(∗) before the acronym to display the full statement:

For example:

If LBBB is defined as Left Bundle Branch Block when *LBBB followed by a space is entered it is automatically expanded to read Left Bundle Branch Block.

### 8.5.13    Physical Working Capacity (PWC) (Bicycle only)

The PWC value is an indicator of the physical working capacity at a specific heart rate. Following is an explanation of the PWC values given on the final report.

**PWC 150/170**

The physical working capacity of the patient for a heart rate of 150/min and 170/min.
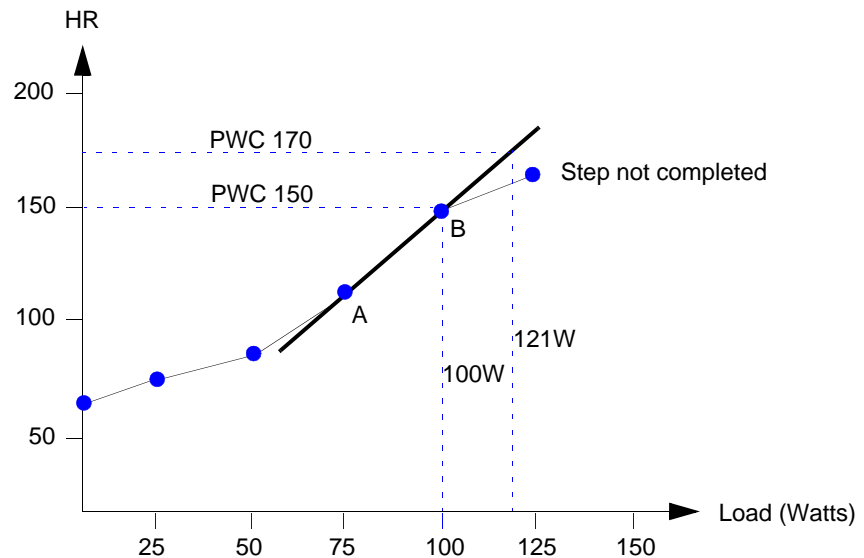


Assuming that there is a linear relationship between work load and heart rate, those values may be calculated based on the measured heart rate at the end of the last completed load stage and the measured heart rate at the end of the previous load stage (load stages which have been interrupted before the programmed time has elapsed will not be considered).

PWC 150/170 is given in Watts and can only be calculated when there is an increase in heart rate between the last two load steps of the test. Otherwise the value is not indicated.

The PWC 150/170 values are determined by the last two stages which the patient has *fully completed*. The two points A and B given by these stages (see Figure) are connected by a straight line. The PWC values are given where this line crosses the projected 150/170 heart rate. This means that if a patient exceeds a heart rate of 170 the software still determines the PWC in the same manner. This can cause some slight deviation from the absolute PWC values but these are insignificant for a correct diagnosis.

### 8.5.14    Metabolic Equivalents (METS)

The metabolic equivalents, or METS, provides a simple means of determining energy expenditure during exercise.

The provision of a MET value for each stage of an exercise test assists in determining the exercise tolerance of a patient in conjunction with factors such as weight, degree of fitness, sex and age.

ℹ   To display Watts in METS the **Additionally show Watts in METs** box must be clicked in user settings - Settings > User Configuration.

### 8.5.15    Expected Load Calculation

The maximum load in Watts achieved by the patient and the percentage that this value is compared to the expected maximum load.

ℹ   One of three formulae can used to calculate the expected load:

• SCHILLER type
• W150/W170
• Wasserman

These are based on patient weight and age. The SCHILLER formulae can be edited by the user.

The expected load formulae are detailed in the settings section (see para 9.9, Expected Load Calculations, page 153).

## 8.5.16    Definition of METS

<div style="border:1px solid;padding:10px">

1 METS = 3.5 ml of $O_2$ per minute per kilogram of body weight

</div>

One Met is defined as the resting metabolic rate, i.e. the amount of oxygen consumed by the patient while seated at rest. As such, an individual exercising at two METS requires twice the oxygen requirement compared to the resting metabolism - at three METS, three times as much oxygen etc.

For a standard stress test without gas exchange measurements, the METS value is calculated on the basis of an approximation formula. The calculated value may thus differ from the actually measured value.

### Formula applied - Treadmill

The formula is taken from `American College of Sports Medicine, 1995. Guidelines for Exercise testing and Exercise Prescription, 5th edition, (pages 269-287). Philadelphia: Lea and Febiger. It states the formula as follows:

<div style="border:1px solid;padding:10px">

Speed below 5 miles per hour:

$$METS = \frac{(mph * 26.8) * (0.1 + grade\ in\% * 0.018) + 3.5}{3.5}$$

</div>

<div style="border:1px solid;padding:10px">

Speed 5 miles per hour or above:

$$METS = \frac{(mph * 26.8) * (0.2 + grade\ in\% * 0.009) + 3.5}{3.5}$$

</div>

Since values in the SCHILLER program are calculated in kph, the factor 26.8 changes to a factor of 16.75. Thus below 5mph (8kph) we get the expression:

<div style="border:1px solid;padding:10px">

Speed below 8 kph:

$$METS = \frac{(kph * 16.75) * (0.1 + grade\ in\% * 0.018) + 3.5}{3.5}$$

</div>

Multiplying the expression in brackets, one gets:

<div style="border:1px solid;padding:10px">

$$METS = \frac{kph * 1.675 + 0.3015 * kph * grade\ in\% + 3.5}{3.5}$$

</div>

or

<div style="border:1px solid;padding:10px">

**V < 8km/Hr**

$$METS = \frac{V * 1.675 + 0.3015 * V * G + 3.5}{3.5}$$

**V ≥ 8km/Hr**

$$METS = \frac{V * 3.35 + 0.15075 * V * G + 3.5}{3.5}$$

</div>

V = treadmill speed (kph)

G = treadmill elevation (%)

### Formula applied - Bicycle Ergometer

The formula is taken from `American College of Sports Medicine, 1995. Guidelines for Exercise testing and Exercise Prescription, 5th edition, (pages 269-287). Philadelphia: Lea and Febiger. It states the formula as follows:

$$\text{METS} = \frac{12 * \text{Load} + 3.5 * \text{Weight}\S}{\text{Weight} * 3.5}$$

Load = Watt

Weight = Kg

**i**  When the test is finished between stages the max value METs value can be interpolated if required. The correct METS value is reached after a time of 2 minutes in the stage. The maximum load calculation is set in system settings (see para 9.13, Exercise ECG Defaults, page 159)

# 9  SDS-104 Program Settings

This section details the various general and miscellaneous functions and settings available to the user in the settings menu.

## 9.1    Defining Users Departments and Institutions

The three tabs at the top of the screen allow the modification, deletion and new entry of Institutions, Departments and Users. These are used in various locations and can be given on the printout of a recording.
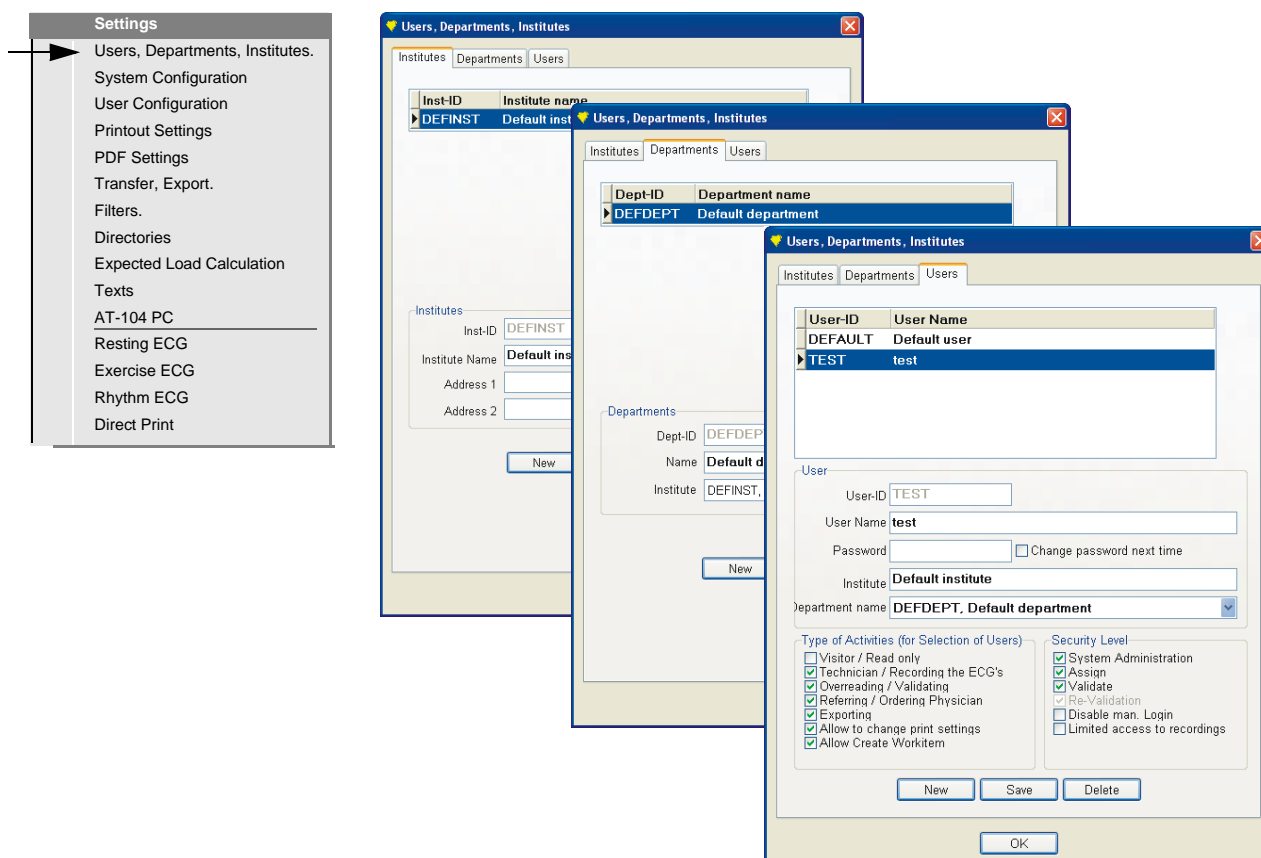
### 9.1.1    Departments and Institutions

Enter as many institutes and /or departments as required. This data can be entered against patient recording data, for example acquiring institute, analysing department etc. (see para 4.2, Entering / Editing Patient and Recording Data, page 34)

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### 9.1.2    Users

Enter the relevant data and tick the required boxes. Assign rights to individual users as required. The User ID and the password defined for a user must be remembered. These are required when first opening the program and when a new login is requested.

When Windows® Authentication is selected (see para 9.2.8, Database Settings, page 133), the user ID must be the same as that defined for the windows system. On login, the password that must be entered is the Windows password.

The maximum number of characters that can be entered in the ID field of all sections is 8. The maximum number of characters that can be entered in the address fields is 40.

### Change Password (User)

The user password is set in the user screen by the administrator. If it is required that the user changes the password, check the **change password next time** box. When this is checked, the next time the user logs on, the following screen is displayed requiring the user to change the password:



Note that the user ID remains the same.

i    This setting is used to require that the user changes the password the next time he/she logs in. A general setting enabling the user to change his / her password at any time is available in the database (login) settings screen (see para 9.2.8, Database Settings, page 133).

### 9.1.3    User Rights

When **System Administration** is checked, the user rights (defined in the user screen), are as follows:

## Type of Activities

**Visitor / Read Only**                 ➜   No editing, validating or system functions. Read Only.

**Technician /Recording the ECG**       ➜   Recording Rights

**Overreading / Validation**            ➜   Departmental validation rights

**Referring / Ordering Physician**      ➜   Validation rights for all departments

**Exporting**                           ➜   Export functions enabled

**Allow to change print Settings**      ➜   All print functions enabled

## Security Level

**System Administration**               ➜   All system setting available

**Assign**                              ➜   Assign a recording to another patient

**Validate**                            ➜   Validation of recording

**Re-Validate**                         ➜   Overwriting of a Validated recording

**Disable Manual Login**                ➜   If SDS-104 is to be used as a slave application for example, in a larger hospital system, ticking this box prevents users from logging in to the program as a standalone application.

**i**

**Caution:** When this box is checked it is **not possible to login to the program in the normal manner** and the only way to log in is from another system or for system administrators using the CMD facility.

**Limited access to Recordings**

➜   Ticking this box opens another window that enables the administrator to define the recordings that can accessed by this user.



In this way only recordings from for example specific departments or, types of recordings, validated recordings, etc., can be defined for access by the user.



When this box is set a new icon appears to allow you to changes the defined recordings.

**i**

When a search is initiated, only the recordings specified are shown and can be accessed.



When a patient search is initiated, all patient recordings are shown patient screen (see following). However, only the specified recordings can be opened. If an attempt is made to open a recording that is not specified a non-read message is given.
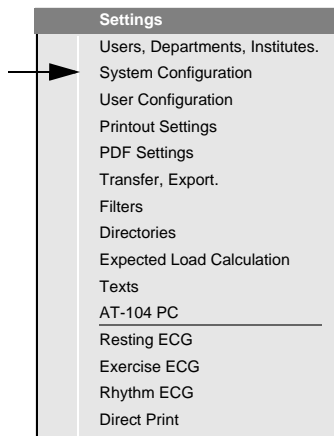
To only display the specified recordings (and not any other recordings that a patient may have) check **Hide all other examinations in Patient Search (1)**. When this is checked no recordings other than those specified, will be displayed.

# 9.2    System Configuration

**i**    Settings made in the System configuration are universal and apply to all users.

## 9.2.1    Formats



**Lead Order**    Select Standard or Cabrera.

**Units**    This defines the units that will be used for entering patient data and on the printout. Select between Metric (kg/cm) and US (lbs / ins). For exercise recordings, Km/h or mph can be defined.

**Patient ID Format**    The format of the patient identification is defined here. A number of format options exist to fit into your system. The number of characters, the case (upper/lower), the type of character (letters only, numbers only) along with other attributes can all be defined. The patient ID is defined in this field by a series of characters. The maximum number of characters is 20. Characters that can be used are as follows:

- 'X` (upper case X) - any character
- `x` (lower case x) - any character - initial letter upper case
- `!`(exclamation mark) - any character upper case
- `L` (upper case L) - any character lower case
- `a` (lower case a) - alpha characters only
- `A` (upper case A) - alpha characters only upper case
- `1 ` (number 1) - alpha characters only lower case
- `9` (number 9) - number or space
- `i` (lower case i) - number or space or '-'(dash or minus)
- `#`(hash) - number or space or '.'(period)

| | |
|---|---|
| **Date Format** | Select **dd.mm.yyyy** or **mm.dd.yyyy** |
| **Time Format** | Select **hh.mm.ss** or **hh.mm** |
| **Limit Number of Full disclosures** | Full Disclosure recordings take a lot of disk space (c.. 10M for 10 mins of recording). The number of full disclosure recordings stored can be limited between 1 and 65,000. |
| **Show ethnic** | Check this box to show race in the patient data field. |
| **Edit patient before** | Check this box to display the patient data field for editing purposes before a recording is made. |
| **Device name** | This is for use only when your computer is connected to a GDT system. Enter your device (computer) identification. Up to 8 characters can be entered. Note that the GDT system requires that the first four characters must be unique. |

### 9.2.2    Program Directories

The top fields are for ergo-spiro only.
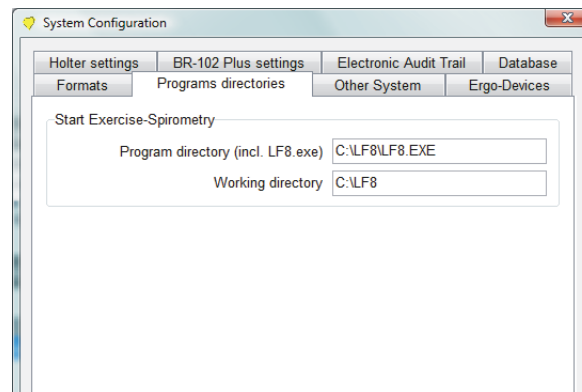
### 9.2.3   Other System

In the Other System page the RS-232 ports on the PC can be defined. The ports are defined for connection of the following:

- The AT-104 PC unit (defined on installation of the SDS-104 software but can be changed here if required).
- An RS-232 controlled ergometer for exercise testing.
- A blood pressure unit.
- Spiro sensor (SP250 / 260).

i   If any of these units are not used, a port must **not** be specified and -- (double dash) must be placed in the field.

### 9.2.4    Ergo Device

Defining a bicycle - A number of analog and digitally controlled bicycles are predefined. If the bicycle that you want to use is not defined here contact Schiller for the correct setting.

Defining a Treadmill - A number of analog and digitally controlled treadmills are predefined. If the treadmill that you want to use is not defined here contact Schiller for the correct setting.

Defining a Blood Pressure Unit - A number of analog and digitally controlled blood pressure units are predefined. If the unit that you want to use is not defined here contact Schiller for the correct setting.

The automatic BP intervals are defined individually for each protocol.

### 9.2.5    Holter Settings

These settings are only applicable when the MT-200/MT-190 Holter system is installed on the PC. Here the Holter device can be defined and other general Holter settings when used with the SDS-104 program.

### 9.2.6    BR-102 plus Settings
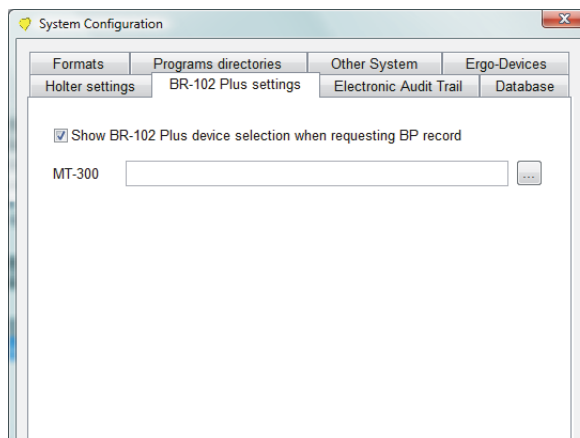
These settings are only applicable when the MT-300 long term BP system is installed on the PC. Here the BR-102 device can be defined and other general BP settings when used with the SDS-104 program

### 9.2.7    Electronic Audit Trail (with general network licence only)
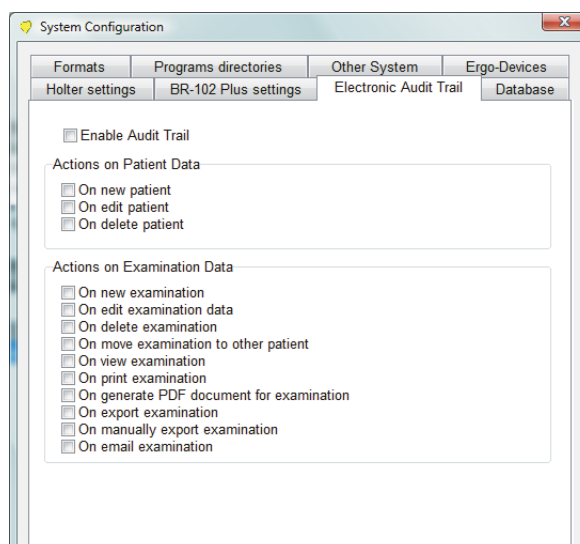
To enable an audit trail an Advantage data base must be installed either locally or in a server. Settings can only be defined while the ADS is running. When in a network, the settings defined for the audit trail apply to all SEMA programs connected to the same Advantage database.

Define here all the data categories that are recorded in the database. Recovering and viewing the audit trail (see para 10.3, Audit Trail, page 174).

## 9.2.8 Database Settings
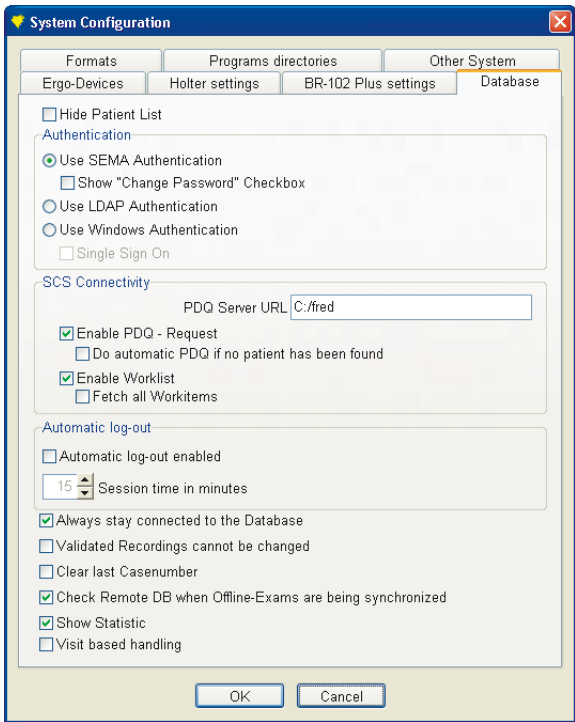


### Hide Patient List

When this box is checked the patient list is not shown on login. Patient(s) can be displayed when a search is performed for a specific patient or group of patients. When the Clear icon (in the search screen - see para , Searching for a Patient by Name or Date of Birth, page 33) is clicked, the patient list is again cleared. This means that only patients / recordings specifically requested are displayed.

**Note:** there is also a setting in the user rights screen (see para 9.1.3, User Rights, page 126) that defines the type of recordings that the user has access.

### User Authentication
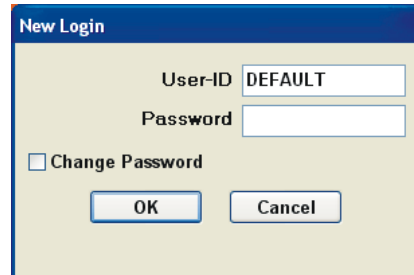
Three user authentication settings can be made as follows:

| | SEMA (SDS-104) Authentication | LDAP Authentication | Windows Authentication |
|---|---|---|---|
| **User Name** | ➜ defined in SDS-104 for each user. | ➜ defined in LDAP only. | ➜ defined in Windows and in SEMA (must be the same). |
| **Password** | ➜ defined in SDS-104 for each user. | ➜ defined in LDAP only. | ➜ defined in Windows only. |
| **User Groups** | ➜ N / A | ➜ defined in LDAP and in SDS-104 (must be the same) | ➜ N / A |
| **User Rights** | ➜ set in SEMA for each user. | ➜ Set in SDS-104 for each group of users. (a user must belong to a LDAP group known by SDS-104 to be allowed access) | ➜ set in SDS-104 for each user. |

**Use SEMA Authentication**

This is the standard login. User name and password are entered for each user on every SDS-104 installation. The SDS-104 program checks that the name and password is registered for this installation and assigns the defined user rights.

When the **Show 'Change password' checkbox** is checked, the user can change his/ her password at login:



**i**     This is a general setting enabling the user to change his / her password at any time. A setting is also available in the user screen that requires the user to change the password on login (for example when a new user is defined). This is set in the user screen (see para 9.1, Defining Users Departments and Institutions, page 124).

**Use LDAP Authentication[1]**

LDAP stands for Lightweight Directory Access Protocol. Use this setting to define LDAP interface to external user management systems (like Microsoft Active Directory (or Novell eDirectory), including role based login[2]. Users (user name and password) are entered on the LDAP system in a defined user group. This user group is also defined in SEMA. User Authentication is carried out by the LDAP system.

User groups are defined in LPAD and a user and password defined within the LPAD system. When LDAP is selected, the user name and password is authenticated by the LDAP system and assigned the user rights defined for his / her user group in SEMA. The LDAP Authentication can only be used with general licenses.

---

1. LDAP Authentication allows for the group rights of individual users (e.g. groups could be Cardiologist, Referring Doctor, Administrator). When a new user is entered, the user name password is assigned to a specific group and the same user can login using the same user name and password to different PCs and software. User rights are defined for each group.

2. Roll based login means that when a user (with the same name and password) is a member of two distinct groups, he / she is prompted to set the user group he / she wishes to enter on login.

**Use Windows Authentication**

User name and password is defined in Windows (PC). This user is also defined in SEMA (with the identical name). User rights are defined in SEMA for the user. SEMA checks the user ID and password with Windows (PC). Use this setting to set Windows® responsible for validating the user name and password pair before allowing login.

When Windows Authentication is set the windows domain (PC) is shown. This indicates that only windows registered users can login to SEMA.



PC User

PC Password

Indicates which Windows authenticates the user.
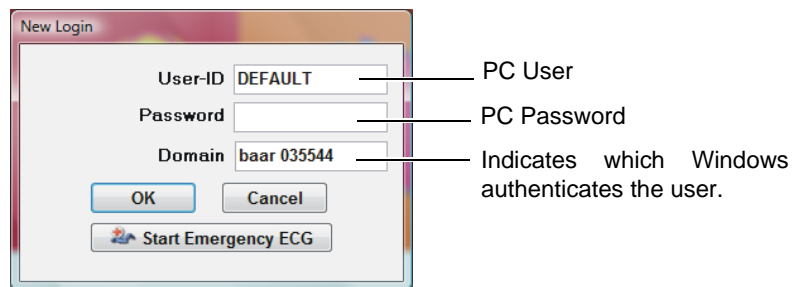
**Single Sign On**

Tick this box bypass the normal login screen and automatically login using the current user name / password of windows (only if **Use Windows Authentication** is set).

## SCS Connectivity

Define the address of the SCHILLER Communication server (SCS) required for Patient Data Query (PDQ). Usually, this will be in the form IP Address followed by path e.g. http://192.168.10.1:8080/SCS/SCSServlet.

Define here if the installation can:

• **Enable a PDQ** (Patient Data Query) - request patient data from a SCHILLER unit.
• **Do automatic PDQ if no patient has been found** - (see **Visit Based Handling** on the next page).
• **Enable Worklist** - receive worklists from external units.
• **Create a worklist Item** - define a worklist for external units

## Automatic Logout

Check this box and define the time for automatic logout if no activity is detected. One minute before automatic logout a screen is displayed informing that logout is about to start. To logout immediately select 'now'. To cancel the logout click 'Cancel'. When cancel is selected a new logout countdown is initiated.

**Note:** The Auto logout function is disabled when adding / reviewing a recording in MT-200 / MT-300 (and when in the data acquisition screen.)

⚠️ Any data that has not been stored is lost when automatic logout occurs.

### Always Stay Connected to Database

When this box is unchecked, connection with the database is established when a user logs on and is disconnected when the user logs out. In a system with floating licences, one licence is used up when a used is logged in.

When this box is checked, database connection is established as soon as the program is started and remains established all the time the program is open including when the user logs out (but the program is still open). This enables the user to quickly login again when required. Note that all the time the database connection is held one licence is used.

### Validated Recordings cannot be Changed

Users cannot re-validate recordings when this box is checked.

**i**

Note that the **Validated Recordings cannot be Changed** setting is a general setting for all users. This setting is individually overwritten when a user has re-validation rights defined user settings (see para 9.1.3, User Rights, page 126).

### Clear Last Case Number after Examination

**i**

This is only used in special installations where case numbers are in use with HL7 installations.

When this box is unchecked the case number is stored for the patient and all further recordings for this patient are stored with this number until updated. When this box is ticked, the case number is cleared before a new recording is taken and the case number for any new recording is empty.

### Check Remote DB when Offline Examinations are being Synchronised

Tick this option to check the database before synchronising. The patient ID is checked and when a patient ID is already registered in the databank the patient data registered on the DB is used. For example, if an patient ID 111 Fred Jones, is entered but on the master DB patient ID 111 is John Smith, the new recording are stored under the patient ID 111, John Smith.

When this box remains unchecked, the ID will overwrite the one on the server, and all recordings of John Smith become the recordings of Fred Jones.

### Show Statistic

Tick this box to display the number of recordings / patients found when a search is initiated.

### Visit Based Handling

This setting is for clinics that use a Visit ID (case number) based system. When this box is checked the following occurs:

- In the patient search screen, the focus is on the Visit ID (case number) search field (when ID search is active).
- If the user searches for a patient (to start a new examination) by their new Visit ID and the Visit ID cannot be found, an automated PDQ (Visit ID) is performed and the New Patient dialogue is opened.
- The PDQ is only performed if the system is set to **Automated PDQ if no patient has been found** is set (see previous page).
- The Visit ID can be displayed on the acquisition screen and Window bar when an examination is opened, when **Show patient info in toolbar** is set (see next page).
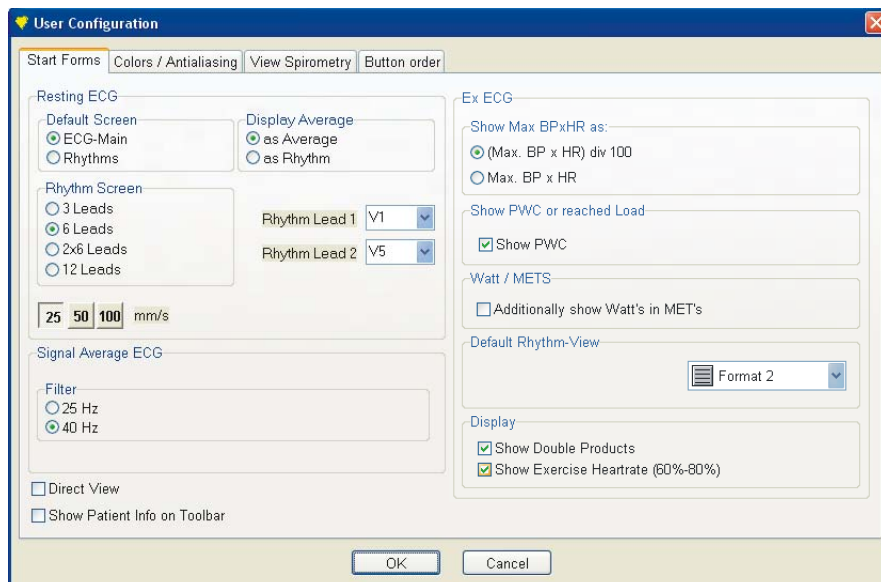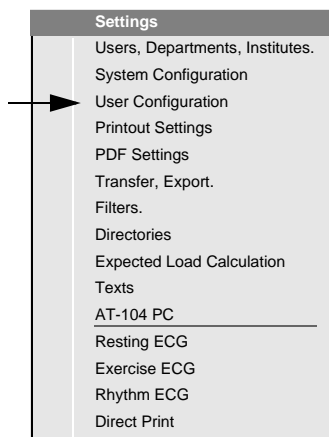
# 9.3    User Configuration

ℹ

The settings made in this screen apply to the individual user and are automatically set when the user logs in.

## 9.3.1    Start Forms

### Resting ECG Defaults

| Settings |
|---|
| Users, Departments, Institutes. |
| System Configuration |
| → User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |



**Default screen**

When a recording is opened the default is to display ECG the average screen or the Rhythm screen.

**Display Average**

Default setting for average view as follows:

• As Average - this gives the average QRS for all 12 leads measured over the complete 10 seconds of the recording

• As Rhythm - this gives all 12 leads of the ECG recording (in standard or Cabrera format) in four, 2.5 second consecutive time segments. Each time segment contains three leads

**Rhythm Screen**

Check the number of rhythm leads for display - select 3, 6 or 12 lead display. Select the default speed 25, 50 or 100 mm/s.

**Rhythm Lead**

Define the default rhythm leads displayed for a resting ECG.

### Signal Averaging Defaults

Not applicable for SDS-104.

### Direct View

Check this box to view after an auto mode recording has been made.

### Show Patient Info in Toolbar

Check this box to display the Visit ID (case number) and patient name, in the top right corner of the toolbar during a test. The Visit ID is also shown on the Window bar when an examination is reviewed.

### Exercise ECG

**Show Max BP x HR as**            Display the maximum blood pressure x heart rate as the actual value or this value divided by 100.

**PWC or Reached Load**            This setting is applicable for bicycle ergometer only. Check the 'show PWC' box to display the physical working capacity calculations on the final report.

**Additionally show Watts in METS**    If you wish to display the bicycle load as metabolic equivalents (METs), check this box.

**Rhythm Lead**            Define the default rhythm lead and how it is displayed.
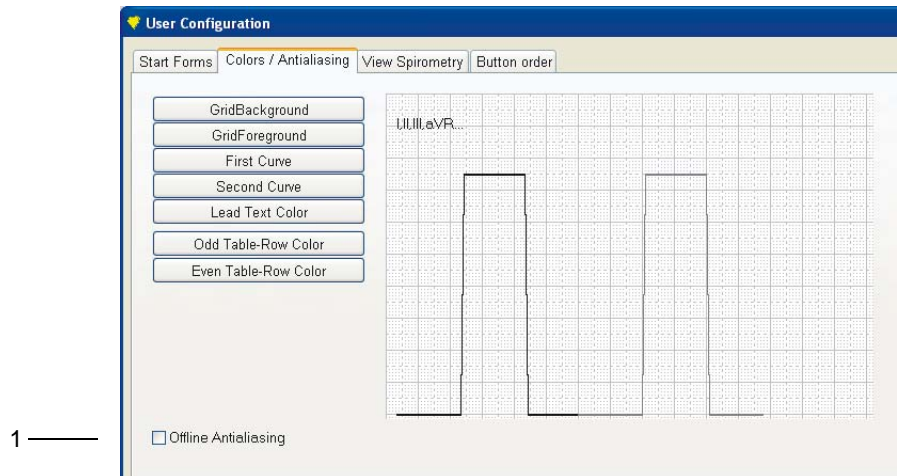
**Display double products**        Tick to display the double products in the exercise screen final report.

**Show exercise heart rate 60%, 80%**    Tick to display heart rate 60% and 80% in the exercise screen final report ().

### 9.3.2   Colours



In this screen colour preferences can be defined for grid (background and foreground), leads, and lead designation text. Colours can also be set for table rows, for example, in the patient screen.

To set a colour:

1. Click on the relevant box on the left of the display. The colour palette is displayed.
2. Select the desired colour and click OK. The grid on the display changes to the selected colour.

### 9.3.3   Anti-aliasing

Anti-aliasing 'smooths' the traces to prevent 'stepping' on the ECG traces. This can be more pronounced on slower heart rates with large amplitudes.

When the anti-aliasing box **(1)** is ticked the anti-aliasing option in the view screens (averages, rhythm, etc.), is set to default on. The anti-aliasing option can be switched on / off as desired when in the view screens. This feature is not applied during data acquisition.
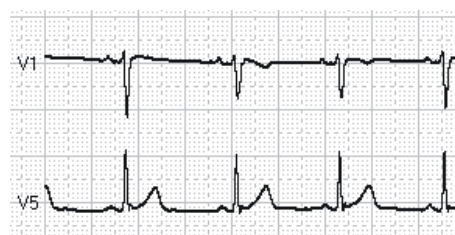


Anti-aliasing Off                      Anti-aliasing On

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### 9.3.4    Spiro Settings
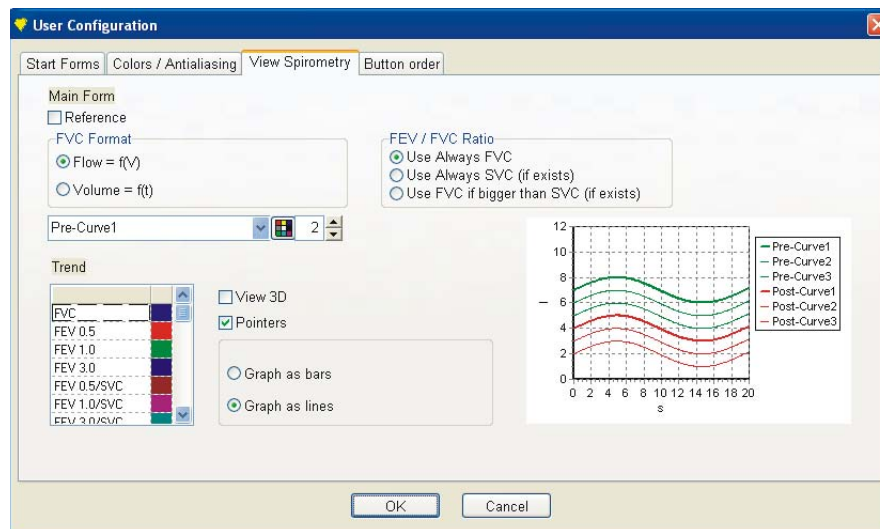


**Main Form**

**Reference**

When this box is checked reference marks will appear on the loop graph of the spiro recording detailing:

- horizontal line giving the predicted PEF value
- the measured values of MEF25, MEF50 and MEF75
- the predicted value of FVC

**FVC Curve**

Check to view the FVC value as flow against time or flow against volume.

**Line Thickness and Colour**

Choose colour and thickness of both pre and post measurements. As the settings are defined the sample graph (right) shows the colour and line thickness.

**Trend**

In this section select the default measurements and graph settings that are used when the trend view is requested (Trend icon clicked in the view screen).

### 9.3.5    Button Order



In this screen the extra program buttons (icons) can be displayed in the patient screen for easy access. The extra icons that can be shown are as follows:

**Holter ECG**

If the SCHILLER Holter program (MT-200) is installed, Holter recordings and the Holter program, can be started directly from the SDS-104 program.
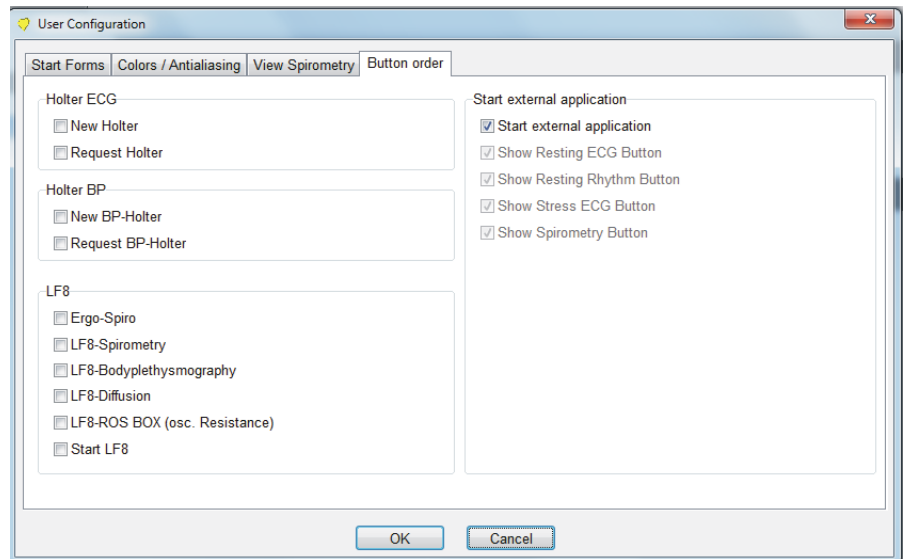
**Holter BP**

If the SCHILLER long term BP program (MT-300) is installed, BP recordings and the BP program, can be started directly from the SDS-104 program..

**LF8**

**Ergo Spiro and Spiro:** If the Ganshorn LF8 program and Ganshorn power cube hardware are installed, the ergospiro and spiro program can be started directly from the SDS-104 program..

**Start external application**

Check the **Start external application** box to display the external program icon.

**i**

An extra program icon can be added to the icon bar in the patient screen. This icon can be defined so that it opens any program installed on your PC. For example word can be opened for writing patient notes, or excel can be opened for reference data, etc. To show this external program icon click the **The Show External Application start** box ().
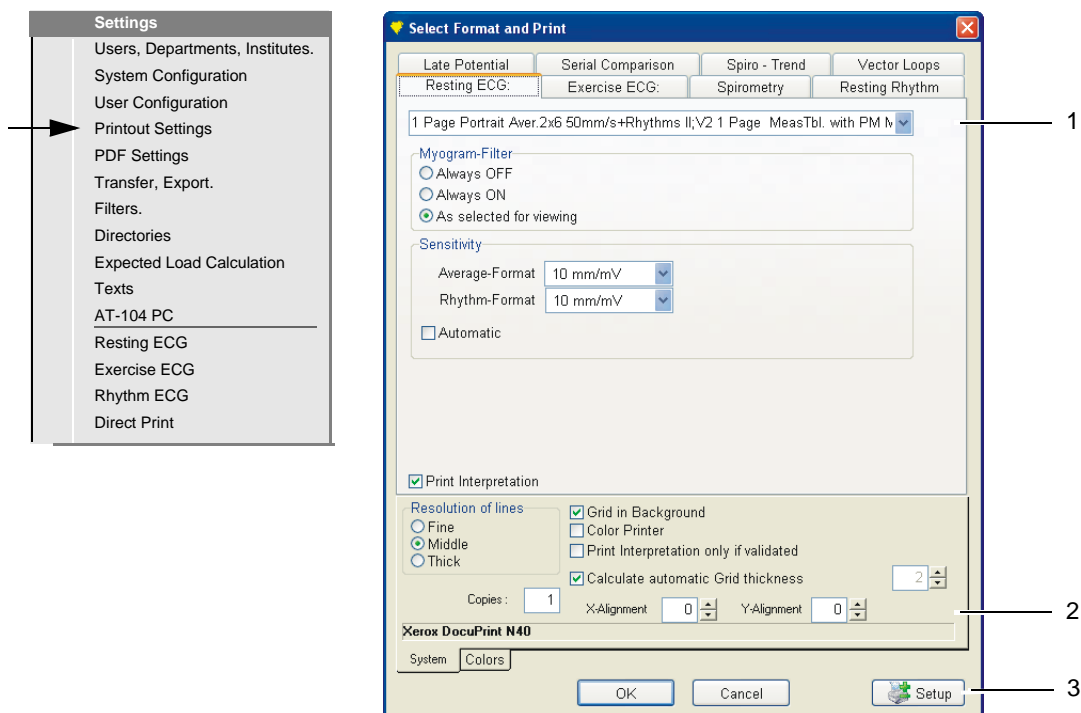
The boxes below the start external application box are to display / not display the **resting, resting rhythm, exercise ECG icons and the spiro icon** in the patient screen. Uncheck the box to not display the function.

# 9.4    Printer Defaults

**i**

Settings made here are universal and apply to all users. The user rights must be set to allow print editing (Settings > Users, departments, institutes > users).

Defaults are defined for the printing of resting ECGs, exercise ECGs, spirometry recordings, serial comparison, signal averaging, vector loops, rhythm, and spiro trend data.

| Settings |
|---|
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |



Various print options are available but the following is always given:

• Patient Data (short version)
• Heart Rate
• Date and Time of Recording
• Sensitivity
• Speed
• Measurements
• Filter Setting
• Interpretation Statement (if selected)
• Software version
• User name

Display the print options for each type of recording by selecting and clicking with the mouse on the required page (tab) at the top of the screen **(1)**. Interpretation, grid background, reference beat, average format and other dedicated options etc. can be defined individually for each record type.

**Print Image Alignment (2)**

If you wish to change the position of the image on the printout, this can be achieved by changing the x and y alignment setting **(2)**. The printout image can be shifted left/ right and up/down.

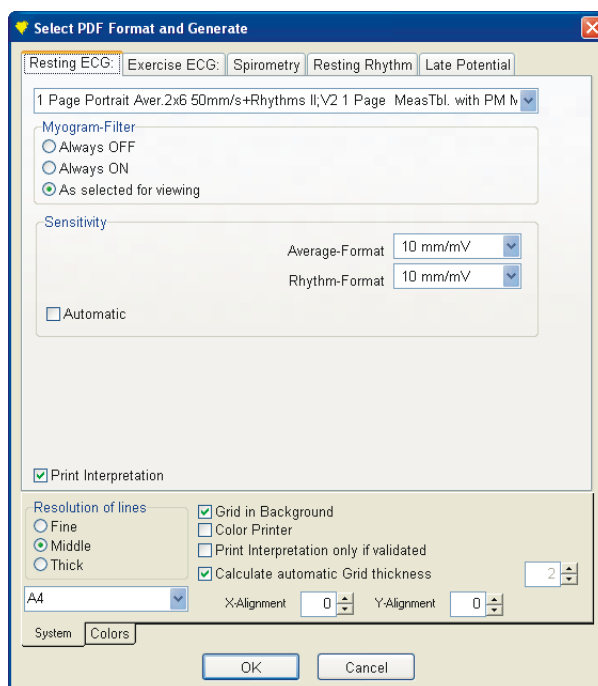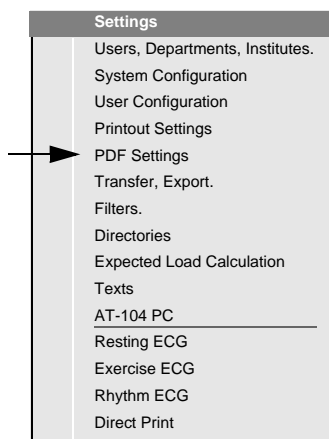**Printer Setup (3)**

If problems are experienced in printing e.g. no printout obtained, no readable data given or the wrong printer is defined the printer settings must be checked or changed, click on the `Setup` icon **(3)**. The screen displayed will vary according to the printer connected to your system. Ensure that the correct printer is specified and that the correct settings are detailed.

# 9.5   PDF Defaults

**i**  Settings made here are universal and apply to all users. The user rights must be set to allow print editing (Settings > Users, departments, institutes > users).

Defaults are defined for resting ECGs, exercise ECGs, spirometry recordings, rhythm, signal averaging. The settings are similar to those given for the print settings.

| Settings |
| --- |
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |

# 9.6 Transfer and Export Settings

## 9.6.1 Address Book

In this menu option RS232, network and other transmission options can be defined.
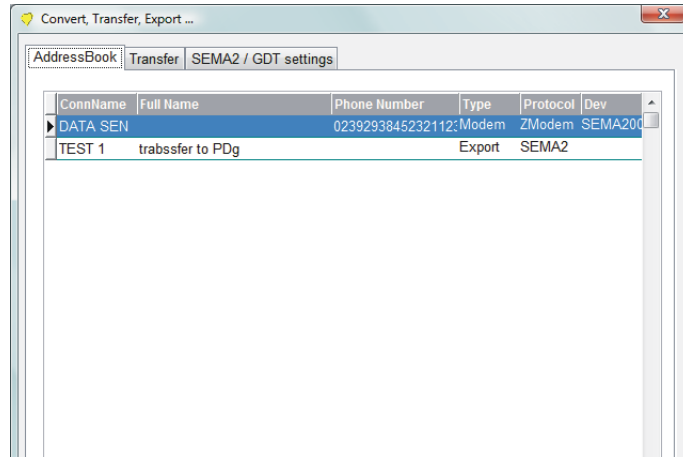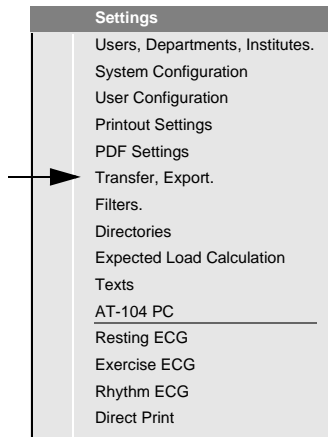
To enter a new destination click on the **New** icon.

Typical Entry for Worklist

The entries detailed as follows:

**Conn Name and Full Name**

Under **Conn Name** enter the designation of the communication channel to which the modem or line is connected (it must be the same designation defined for **port name** in the SEMACOMM program.

**Type**

Select between modem, line, export or file.

- Modem is for transmitting over a modem to a remote computer/ unit.
- Line is for direct connection to a local PC or other device.
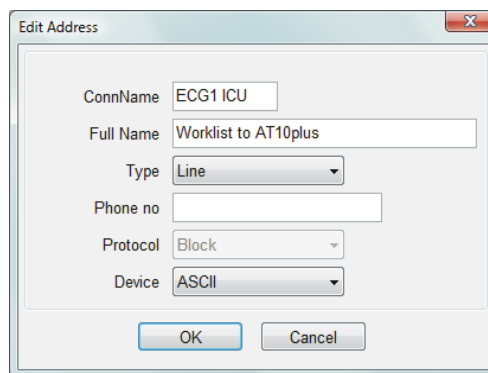- Export is to transfer a recording to another system e.g. a hospital record system HL7 or GDT.
- File is to transfer a recording to a backup medium e.g. floppy disk.

**Phone number**

This is only applicable when Modem is selected above. If it is necessary to enter a pause in the dialling sequence enter a comma (,) in the number. The comma gives a one second pause. If a longer pause is required, two or more commas can be entered. This may be required for example, if you have to wait for an outside line. It is also a good idea to insert a pause after a national or international code.

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**Protocol**                    The options given here depend directly on the `Type` selected above.

- Line - for direct export over an RS232 port.
- Modem - for export over a serial modem.
- Export -for export to a third party management system (SEMA1, SEMA2, ADTS or GDT).

**Device**                      The options given here are only applicable when Line or Modem is selected in `Type` above. The device options available are as follows:

- SCP (Standard Communication Protocol)
- ASCII (default)
- IBMPC - use this setting for transmitting to a PC.

**i**    Details of the SemaComm program, installation and settings are provided in the SemaComm installation Guide available from the SCHILLER service department.

### Settings to Send Patient Data:

**i**    This function requires the Semaexport program and this function is only used on older installations.

- The **ConnName** is specific to the device and COM port and must be in the following format:
- **xxxxxx-y** (maximum 8 characters) where xxx is the location ID of the device and Y is the COM port starting with 0, (i.e. 0 = COM 1, 1 = COM 2 etc.).
- Between xxxx and y there must be a hyphen '-'.

### Settings to define Worklist:

- **ConnName** - this is specific to the device and is the User ID of the unit (see the user guide for the device. It must be entered exactly the same as defined for the device.

**i**    If you wish to send to all devices type star (*) in the ConnName. This means that any patient data broadcast from the SDS-104 program will be entered on the worklist of all devices connected on the network.

- **Type** - always select **Line**
- Phone Number - Not applicable
- Protocol - Not applicable
- **Device** - select **ASCII**

## 9.6.2 Transfer
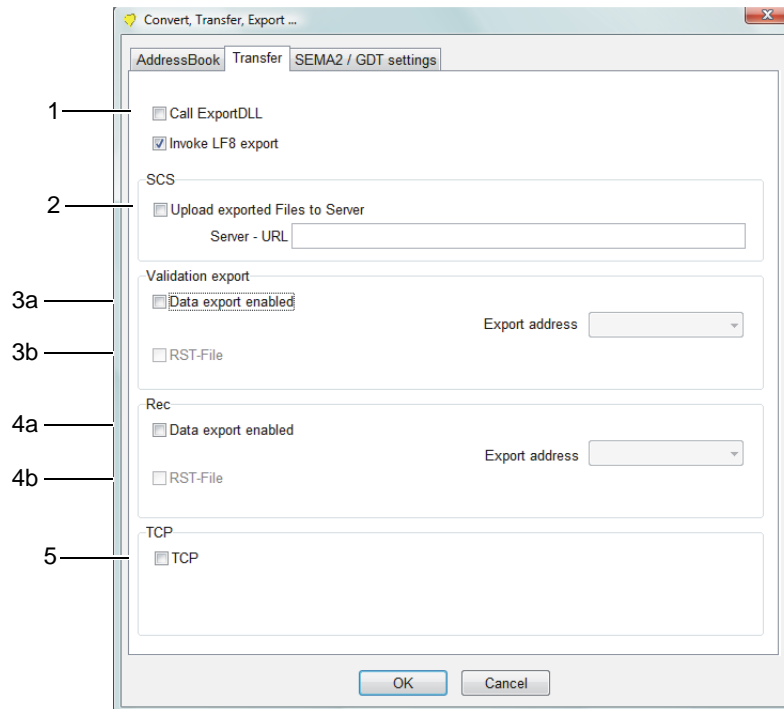


### Validation Export

Tick **Data Export Enabled (3a)** box to automatically export a file (recording) after it has been validated. When this is ticked the file can be exported as an **RST-file** (SEMA format) or **PDF file (3b)**. When validation export is specified the Export address must be defined.

### Reception Export (after a recording has been taken)

Tick **Data Export Enabled (4a)** box to automatically exports a file (recording) after it has been recorded. When this is ticked the file can be exported as an **RST-file** (SEMA format) or **PDF file (4b)**. The Export address must be defined.

ℹ

- The options given in `Export Address` are specified in Address Book (previous item). Addresses only appear when at least one `Export' address has been entered ().

Tick the **Upload exported files to server (2)**, and define the URL if you additionally wish to upload the files on reception.

The Call Export DLL **(1)**, is a specialised application and is used for research purposes. This setting can be left unticked.

Similarly, the TCP setting **(5)** is a customised settings used for dedicated networks. This should also be left unchecked.

### 9.6.3   SEMA 2 and GDT settings
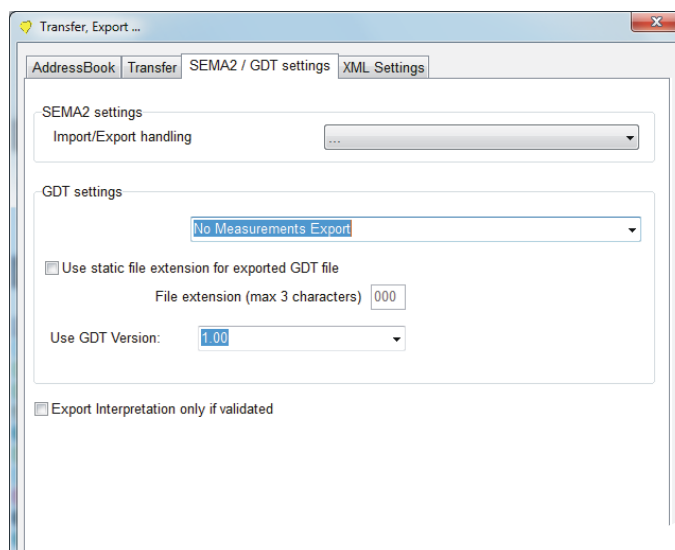


**SEMA 2 Settings**

In the SEMA2 Settings, select **Use import file name as export file name** to use the same file name (and format for name, date, ID format) when again exporting patient data that has been imported. For example if an imported patient data file has the file name XYZ.imp, when the file is again exported (for example after validation), the export file name will be XYZ.exp.

**GDT Settings**

Define one of the follows:

**No Measurements Export** - No GDT export

**Attach Measurements to Interpretation** -

**Preformatted Export of Measurements** - No GDT export

**Export Measurements as preformatted List** - No GDT export

If you wish to have a user defined file extension tick the **Use static file extension for exported GDT files** and define the extension. If this function is not selected the extension will count up for each recording. This must be set according to the system used (see the system administrator).

The **GDT version** can be specified:

- 1.00
- 2.10 - Appendices are numbered in the sequence: 6302, 6303, 6304, 6305, etc.
  **Recording Remark 3** is stored in field 6227.
  **Validated By ID** is stored in field 8990.
- 2.10 with Schiller Extensions - This is the same as for 2.10 with additionally the following fields:
  Field 3629 = Ethnic
  Field 4100 = Case number
  Field 8310 = Order number (OrderID)

Tick the **Lines optimised for 6220 output to** optimise the output.

**i** The optimised output is currently only implemented for Resting ECG.

**Example GDT Output without optimised output:**

– 0186220Intervals
– 0146220HR 75
– 0156220RR 800
– 0146220P 100
– 0156220PQ 162
– 0156220QRS 94
– 0156220QT 350
– 0166220QTc 391
– 0136220Axis
– 0136220P 31
– 0156220QRS 47
– 0136220T 38

**Example GDT Output with optimised output:**

– 0586220   CANNOT RULE OUT ANTEROSEPTAL MYOCARDIAL DAMAGE
– 0506220These are some additional descriptions...
– 0186220Intervals
– 0566220HR 75,RR 800,P 100,PQ 162,QRS 94,QT 350,QTc 391
– 0136220Axis
– 0256220P 31,QRS 47,T 38

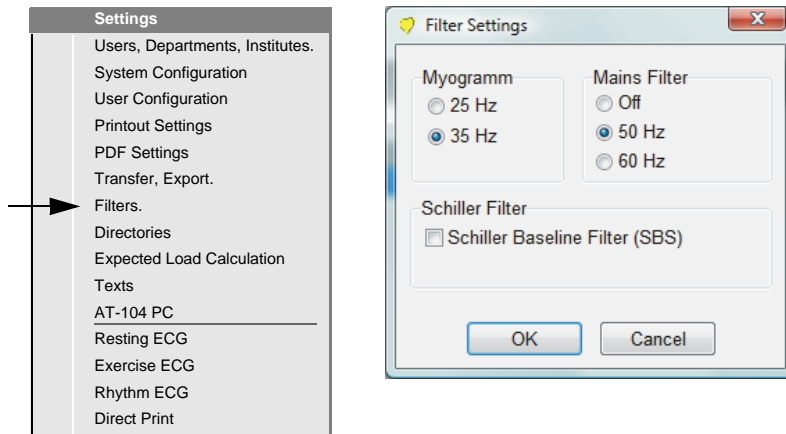**Export interpretation only if validated**    Tick this box to only export the recording when validated.

### 9.6.4    XML settings
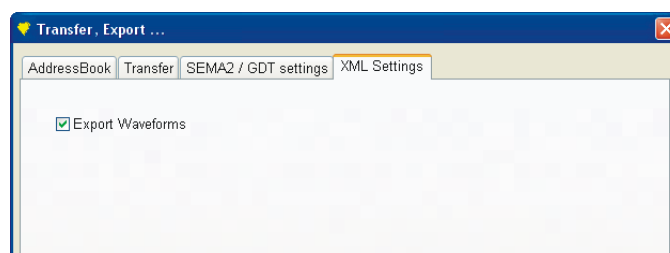


Tick this box to export the waveforms with the XML file.

# 9.7   Filter Settings

| Settings |
|---|
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |

**Filter Settings**

Myogramm
○ 25 Hz
◉ 35 Hz

Mains Filter
○ Off
◉ 50 Hz
○ 60 Hz

Schiller Filter
☐ Schiller Baseline Filter (SBS)

[ OK ]   [ Cancel ]

**Myogram filter**

The myogram filter reduces muscle induced noise. The use of the myogram filter can reduce the signal amplitudes by 20%. Average cycles and measurements are not affected by this filter. The Myogram filter setting here defines the cutoff frequency only (and not if the filter is on or off). Select the cutoff frequency for 25 or 35 Hz.

The selected filter setting 25 or 35 Hz. is shown on the bottom line of the printout and on the display when active.

The filter is switched on or off with the **Filter icon** at the top of the screen. When the filter is switched on the filter icon changes colour to **Yellow**.
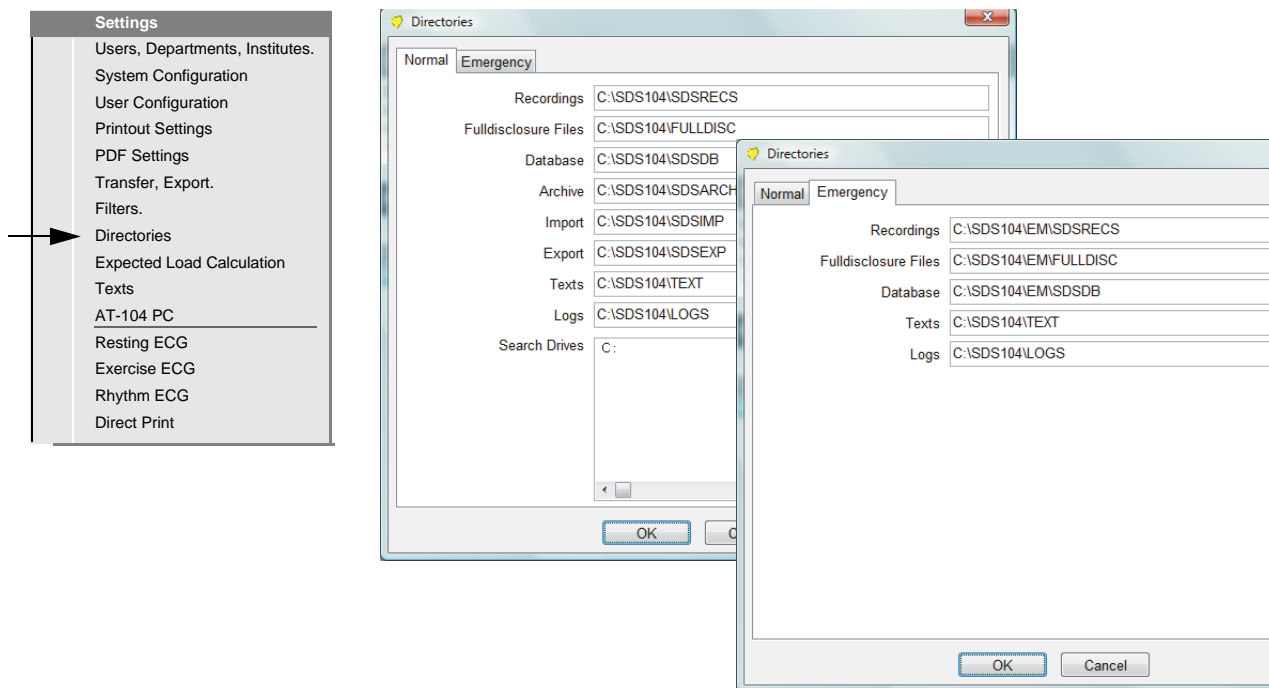
**Mains filter**

The mains filter is an interference filter that suppresses AC interference without disordering the ECG. It should always be selected when recording an ECG. Select between OFF, 50 Hz, or 60 Hz, according to your local mains supply frequency. When the filter is set, `F50` or `F60` is shown on the printout.

**Baseline Filter**

The baseline filter (SBS SCHILLER Baseline Stabiliser) greatly reduces the baseline fluctuations without affecting the ECG signal. The purpose of this filter is to keep the ECG-signals on the baseline of the printout. This filter is only effective in auto mode printout.

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# 9.8 Directories

Two Directories are defined. The **Normal** defines the directories during normal working and the **Emergency** defines the directories that are used when the normal locations are not available for any reason, e.g. the network is down, etc. For this reason the Emergency locations are usually set to a local drive. Select Directories from the System menu. The following is displayed:

| Settings |
| --- |
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |

**Directories — Normal**

| | |
| --- | --- |
| Recordings | C:\SDS104\SDSRECS |
| Fulldisclosure Files | C:\SDS104\FULLDISC |
| Database | C:\SDS104\SDSDB |
| Archive | C:\SDS104\SDSARCH |
| Import | C:\SDS104\SDSIMP |
| Export | C:\SDS104\SDSEXP |
| Texts | C:\SDS104\TEXT |
| Logs | C:\SDS104\LOGS |
| Search Drives | C: |

**Directories — Emergency**

| | |
| --- | --- |
| Recordings | C:\SDS104\EM\SDSRECS |
| Fulldisclosure Files | C:\SDS104\EM\FULLDISC |
| Database | C:\SDS104\EM\SDSDB |
| Texts | C:\SDS104\TEXT |
| Logs | C:\SDS104\LOGS |

**Recordings**

This defines the default location (folder) where recordings (data files) are stored.

**Full Disclosure Files**

This defines the location where full disclosure files are stored.

**Database**

This defines the location of the SDS-104 database. This is where the program is stored including the index for all ancillary information (patient data, drugs tables, institution/ department/ user data, etc.) and reference to the directory (volume and disk etc.) where patient data files are stored. Note that this is not where the data files are stored.
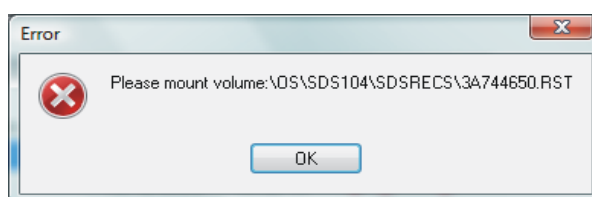
**Archive**

This defines the default location that will be used when archiving recordings for long term storage or for backup. For example you may wish to store on a server, optical disk or tape streamer. A sub-directory can also be specified.
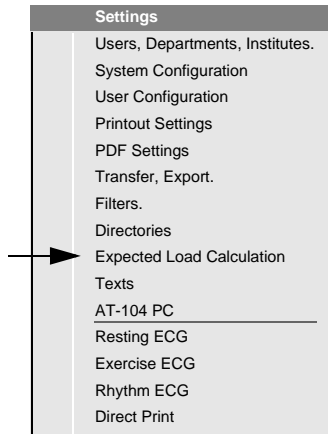
**Import**

This is the default directory used by the program when importing *patient data* - not ECG data files themselves), from another system (GDT, SEMA etc.).

To enter the imported patient data on the SDS-104 system the import option on the system menu must be selected and the `Patient data from interfaces` option clicked. Specify the location (directory) that is the default when importing recordings.

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**Export**                              Specify the default location (directory) that can be selected when sending recordings.

**Texts**                               This is the location of the program text file used by the program. This is mainly used in larger network installations where text can be edited in one location (server) and then the same text used by all PCs on the network.

**Log**                                 This is the location of the program file used by the program to log all transactions.

**Search Drives**                       This defines the drives, and the order of drives that are accessed when making a recording search. All the drives that contain data are to be defined here. When the SDS-104 program is asked to display a specific file the data location (including drive) is stored in the data base - but not the data file. The program searches all drives specified here in the order given. It is important therefore, that all drives where data files are stored are specified and that the most commonly used drive(s) is (are) specified first otherwise speed may suffer. If the program is asked to view a recording the location of which is not specified here an error message appears.

# 9.9  Expected Load Calculations

| Settings |
|---|
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| → Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |

Select **Expected Load Calculations** from the System menu and the following texts can be edited.

In this screen the load calculations and body surface calculation used by the program can be edited for user preference. This calculation is used in the final report.



The expected load calculation is set using one of the following formulae:

**Wasserman**

According to Principals of Exercise Testing and Interpretation, fourth edition Table 7.2.

The equation used is a follows:

Men:    $W_{max} = \dfrac{W * (50.72 - 0.372 * Age) - 5.8 * W - 151}{10.1}$

Women:  $W_{max} = \dfrac{(43 + W) * (22.78 - 0.17 * Age) - 5.8 * W - 151}{10.1}$

– Age = Age in years
– W = Weight in kg

**W150 / W170**

According to Dr. Theodor Stemper: The expected load is based on the physical working capacity (PWC) of the patient for a heart rate of between 150/min and 170/min. The formula used is as follows:

Patient Age >= 18 and <=42:

Expected load = W * 3

Patient Age >42:

Expected Load = W * 2.1

– W = Weight in kg

For patients <18 the expected load is given as 0.

Note that there is no difference for gender.

**Schiller type**

According to Prof. Du Bois, European Journal of Applied Physiology and Occupational Physiology Volume 19, Number 1, 56-66, DOI: 10.1007/BF00693628

The equation used is as follows:

Men:     $6.773 + (136.141 \times BSA) - (0.064 \times Age) - (0.916 \times BSA \times Age)$
Women:   $3.933 + (86.641 \times BSA) - (0.015 \times Age) - (0.346 \times BSA \times Age)$

BSA refers to the **B**ody **S**urface **A**rea of the patient (according to DuBois and DuBois) and is calculated as follows:
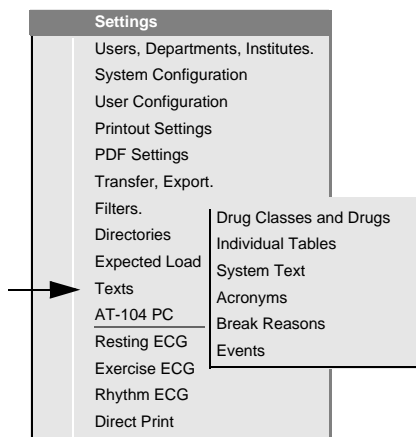
- $BSA = H^{0.725} \times W^{0.425} \times 0.007184$
  – H = Height in cm
  – W = Weight in kg

The user can edit the constant (default = 6.773 (male) or 3.933 (female)) to modify the equation.

# 9.10    Texts

Select **Texts** from the System menu and the following texts can be edited.

| Settings |
|---|
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |

| |
|---|
| Drug Classes and Drugs |
| Individual Tables |
| System Text |
| Acronyms |
| Break Reasons |
| Events |

## Editing a Text Field

1.  Position the cursor where you wish to edit/insert text.
2.  Enter the desired text.
3.  Save the edited text by either:
    –  pressing function key F2 or
    –  enter the file menu at the top of the screen and select save.
4.  Exit by clicking on the cross in the top right of the screen.

**Drug Classes and Drugs**

The drugs entered in the drug table are available for entry against patient data for a recording.

**Individual Tables**

In these tables the information that can be entered in for example the patient data and analysis tables, can be defined. To enter any data proceed as follows:

1.  Select the table category - these include insurance type, cost type and indication (diagnosis summation) - select and click with the mouse.
2.  Click on the **New Type** icon on the bottom of the display - the top section of the screen is highlighted.
3.  Enter text and ID as prompted.
4.  Click OK to confirm the entry.

Statements entered here are available for example, in the patient edit screen. By clicking the arrow (to the right of the data entry field), statements are displayed and can be selected to accompany a stored recording. In this way typical individual commonly used statements can be entered against a patient recording.

**System Text**

The program text is provided for reference only. In this screen it is possible to edit the text that appears in the program. It is recommended that no modifications are made to this entry field. If modifications are made and you wish to revert to the default the program must be reinstalled. If this is necessary, no recordings will be lost.

**Interpretation Acronyms**    Acronym tables are provided for resting ECGs, exercise ECGs, signal averaging recordings, and for spiro recordings. In these tables all the standard interpretation statements are listed. These can be inserted in the interpretation screen (see Section `Viewing a Recording`). Any statements can be edited or new statements added.

Note: Acronyms are limited to 255 characters. If more than 255 characters are entered, an access violation is registered.

**i**

## Acronym Expansion

A number of predefined acronyms are defined by the system. User can also freely define their own acronyms and corresponding statements or modify system defined acronyms. These are defined in system settings (see para 9.10, Texts, page 155) Settings > Texts > Acronyms.

When an acronym is entered it can be expanded automatically by entering a star(∗) before the acronym to display the full statement:

For example:

If LBBB is defined as Left Bundle Branch Block when *LBBB followed by a space is entered it is automatically expanded to read Left Bundle Branch Block.

**Break Reasons**    When viewing an exercise ECG, standard break reasons can be displayed and selected in the main exercise screen. The option ' break reasons' in the text menu displays a list of all the standard break reasons and events. These can be edited or new reasons can be defined.

**Events**    User defined event text can be added.
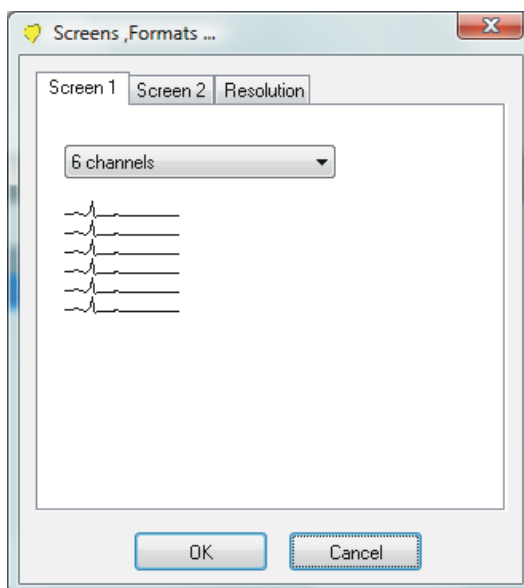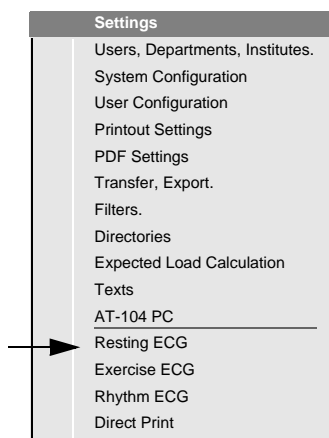
## 9.11   Options and Unit Software

| Settings |
|---|
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| → AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |

**AT-104 Options**

✓ **Resting ECG:**

   ✓ **Measurements**

   ✓ **Interpretation**

✓ **Resting Rhythm**

✓ **Exercise ECG:**

   ✓ **Fulldisclosure**

✓ **Data management:**

   ✓ **PDF reporting**

Versions

| | |
|---|---|
| SDS104 | 9.2.60.3 |
| Type Number | AT-104 |
| System Program | 1.85 |
| Resting ECG | 5.71 |
| Serial Number | 0000289 |

OK

A tick indicates that the parameter is installed.

### Installing a Software Option

All software options are already installed in the instrument and can be activated by entering an upgrade code. The upgrade code is available from SCHILLER.

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# 9.12   Resting ECG Defaults

## 9.12.1   Screens and Formats

| Settings |
| --- |
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |



**Screen 1 and Screen 2**

These can be individually set for your preference and defines the display layout (no. of leads displayed, way of display etc.) when either SCREEN 1 (layout 1) or SCREEN 2 (layout 2) is selected. The options are 3 leads, 6 leads, 12 leads, 2 x 6+1 or 4 x 3+1. The plus 1 in the last two options is the rhythm lead. A window of how the display will look is given below the selection.

During ECG data acquisition clicking the screen 1 or screen 2 icons displays the defined format.

**Resolution**

Define the defaults for the standard leads (upper screen), and rhythm leads, if defined in the layout, (lower screen).
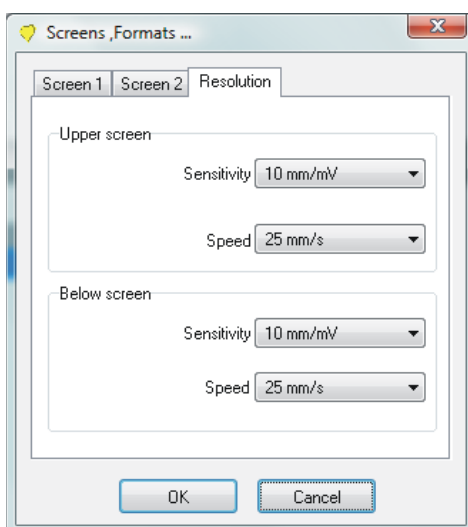


- **Sensitivity** - Select between 5, 10, or 20 mm/mV.
- **Speed -** Select between 5, 10, 12.5, 25 or 50 mm/s.

# 9.13    Exercise ECG Defaults

### 9.13.1    Screens and Formats

| Settings |
| --- |
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |

Select Exercise ECG from the System menu and **Screens, Formats**. The following is displayed:
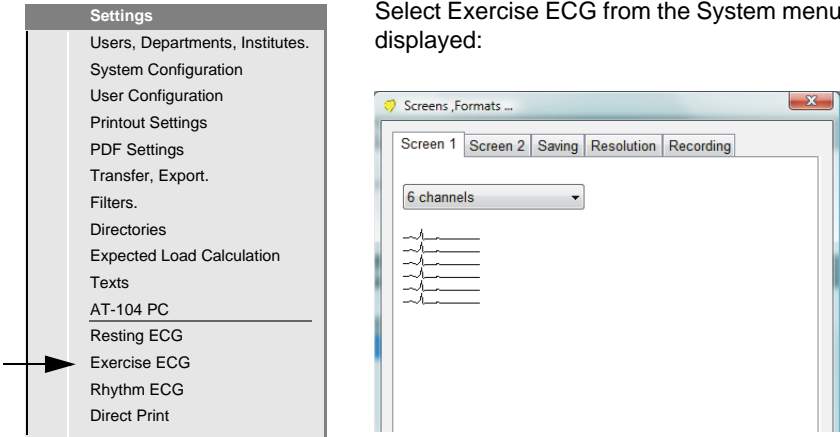


**Screen 1 and Screen 2**

These can be individually set for your preference as for the resting settings (see previous page).

**Saving**

Select the Saving tab to select the two rhythm leads that can be stored with a recording.
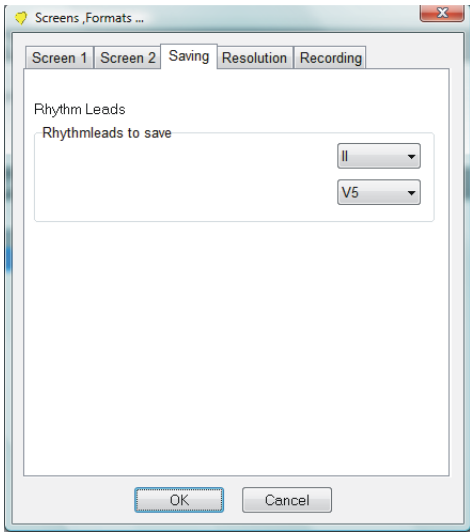


**Resolution**

The default sensitivity and speed can be individually set for your preference as for the resting settings.

**Recording**

**Rec Pre Exercise** - This defines the body positions during warm-up. Click on any combination of Supine, Sitting and Standing. If none are checked, they are not displayed during the warm-up phase.
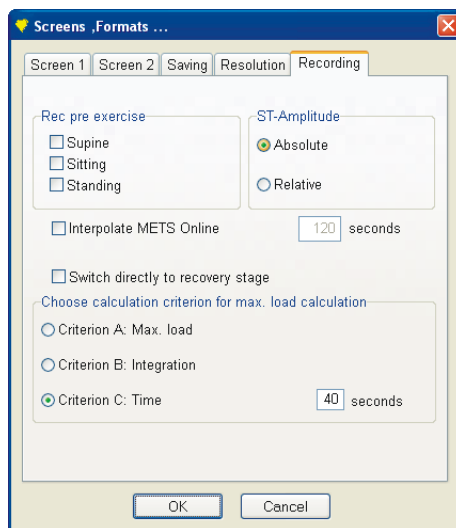


**ST - Amplitude** - The ST Amplitude defines the way that the ST amplitudes and slope is calculated. Select one of the following:

- **Absolute** - The absolute ST measurement of the selected lead(s) is shown in mm.
- **Relative** - The ST measurement of the selected lead(s) is given as the difference between the reference complex (defined during warm-up) and the actual complex.

**Switch directly to Recovery** - When the recovery stage is selected during an exercise test, the recovery phase is entered only after the current stage has been completed. Check this box to go directly to the recovery stage when recovery is selected.

**Choose calculation criteria for max. load calculation** - Three options can be selected as follows:

• **Criteria A - Max Load** - The actual load achieved. i.e. the load applied at the time the test was stopped. This means that even if only 10 seconds of the step has been completed this is the value given

• **Criteria B - Integration** - The load achieved is interpolated from the last step / time into the step. Note that this is only used for treadmill ergometer

• **Criteria C - Time** - The load achieved is stated as the load of the last completed step.
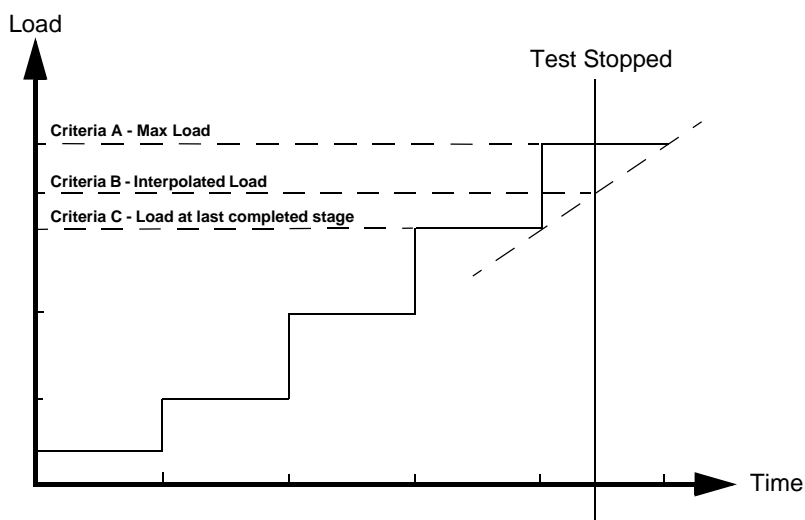
# 9.14   Resting Rhythm Defaults
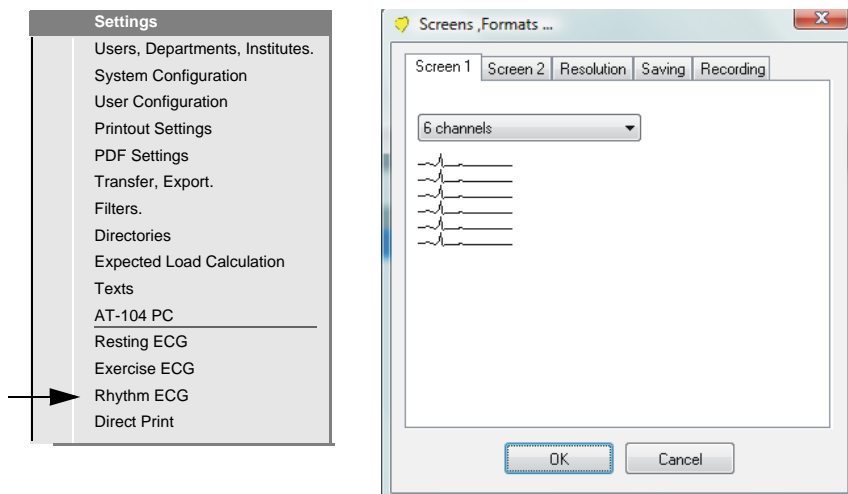


**Screen 1 and Screen 2**

These give the same options as for the resting screen (see para 9.12, Resting ECG Defaults, page 158).

**Saving**

Select the two rhythm leads to save. Note that during the recording all leads can be viewed.

**Resolution**

The default sensitivity and speed can be individually set for your preference as for the resting settings (see para 9.12, Resting ECG Defaults, page 158).

**Recording**

Tick this box to display a dialogue before rhythm recording to define recording length.

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# 9.15   Direct Print

| Settings |
| --- |
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| →   Direct Print |

**Direct Print**

Resting ECG
☑ Direct Print

Exercise ECG
☐ Direct Print

OK    Cancel
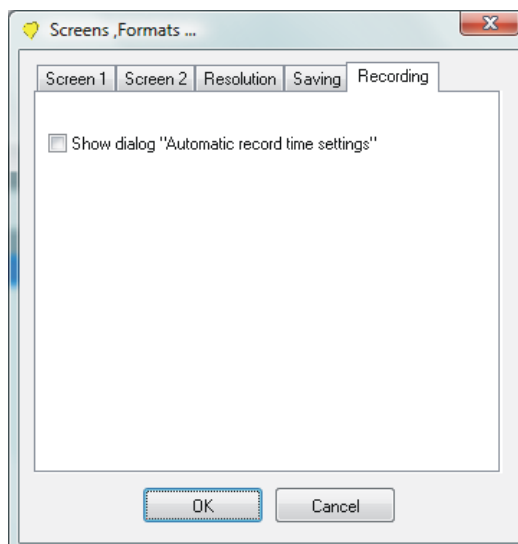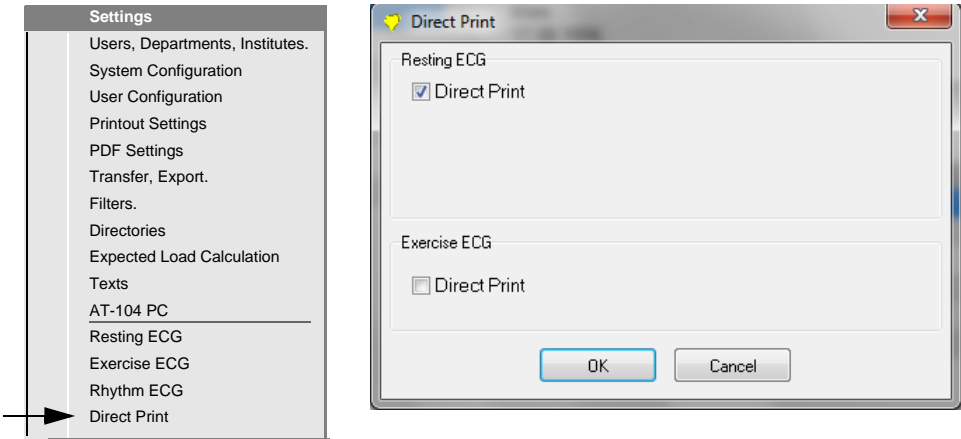
Check the box to give a printout directly after taking a resting or exercise ECG.

# 9.16   Defining a Bicycle Protocol

Protocol are defined from the **exercise acquisition screen**. An unlimited number of user protocols can be defined.

In the protocol settings screen you can:

- Create a new protocol.
- Edit an existing protocol.
- Delete an existing protocol.

Define / Edit a bicycle protocol as follows:

- Ensure a bicycle is selected in the settings menu.
- Select **Edit Bicycle** from the Protocol menu.
- The settings / selections are as follows:
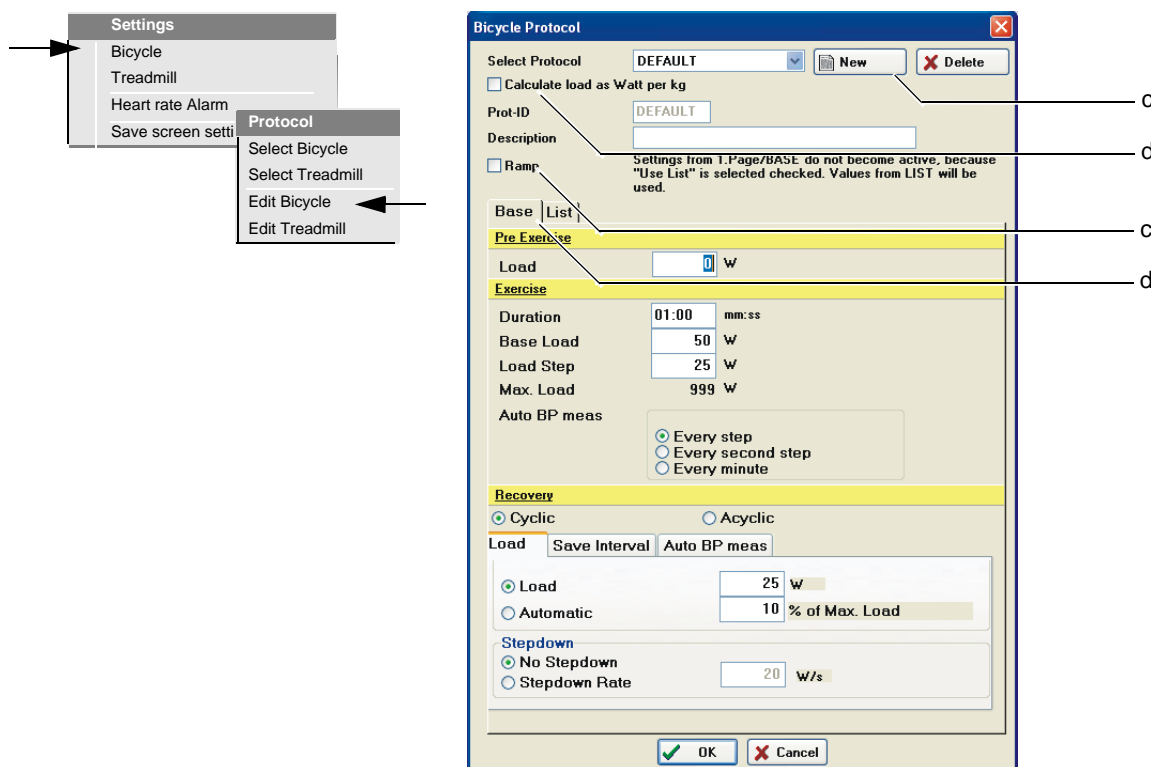


The following details give the settings for a protocol with regular steps (**Base**). When **List** is clicked **(d)**, protocols with irregular step load intervals and / or loads can also be defined ().

| | |
|---|---|
| **Select Protocol** | Selects the protocol that you wish to edit, delete or use as the basis for a new protocol. |
| | When the **New** icon is pressed **(a)**, a new protocol name can be entered. and a new protocol defined. |
| **Prot - ID** | Displays the new protocol identification. |
| **Description** | A description of the protocol is entered here. |
| **Ramp** | A ramp protocol means that the load increase (see step load below) is applied gradually over the duration of the stage instead of suddenly at the beginning of the next stage. When this box is checked **(c)** it indicates that a ramp protocol is defined. |

### Pre Exercise

| | |
|---|---|
| **Load** | Defines the load applied during the warm-up phase. Note that the time of the warm-up phase is undefined and can be as long or as short as you wish when running the test. |

### Exercise

| | |
|---|---|
| **Duration** | The time duration of each stage - the length of time a load step is maintained before moving on to the next one. |
| **Base load** | This is the load which is applied at the beginning of the test. i.e. step/stage 1. |
| **Load step** | The load step determines the load increase for each step. |
| **Max load** | This is the maximum load that the bicycle can apply. |
| **Auto BP Measurement** | These settings are applicable for an external BP unit. |
| | Define here interval that blood pressure measurements are taken: |

- **Every step -** A BP measurement is initiated approximately 50 seconds before the end of every stage.
- **Every second step -** A BP measurement is initiated 50 seconds before the end of every odd numbered stage**.**
- **Every minute -** A BP measurement is initiated every minute

**i**

When the **Calculate load as Watt per Kg (b)** is checked, the load is determined by the patient's weight. This means that the Pre exercise Load, the base load and the Load step must be entered as Watts per Kilogram. When the exercise test is started, the load applied at all stages of the test will be determined by the patient's weight and the entered values of Watts per Kilo.

### Recovery Cyclic
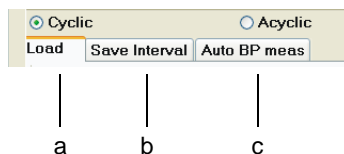


When the Cyclic setting is checked the saving interval and the BP measurement is taken at set intervals as follows:

**Load (a)**

Click on load or automatic to define the load applied during the recovery phase.

- **Load** - Defines a fixed load to be applied during the recovery phase.
- **Automatic** - defines the load to be applied during the recovery phase as a percentage of the maximum load achieved during exercise testing.
- **Stepdown** - Select the recovery load method as follows:
    - **No Stepdown** - goes directly to the load defined above.
    - **Stepdown Rate** - goes gradually to the load defined above at the rate set in Watts per second.

**Save Interval (b)**

This defines the (regular) time interval during the recovery phase for automatic save / printout.

**Auto BP Measurement (c)**

These settings are applicable for an external BP unit and defines the time interval during the recovery phase for the automatic mode blood pressure interval.

- **Every step** - A BP measurement is initiated approximately 50 seconds before the end of every save interval defined above in **(b)**.
- **Every second step** - A BP measurement is initiated 50 seconds before the end of every odd numbered save interval defined above.
- **Every minute** - A BP measurement is initiated every minute.

### Recovery Acyclic

When the Acyclic setting is checked the saving interval and the BP measurement is taken at irregular intervals defined by the user as follows:

**Load (a)**

The Load settings are as defined above.

**Save Interval (b)**

The user can define the exact times that a save is made during recovery.



**Auto BP Measurement (c)**

The user can define the exact times that a BP measurement is made during recovery.

ℹ    Protocols with irregular step load intervals and / or loads can also be defined ().

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### 9.16.1 Defining a Protocol with Irregular Loads / Intervals

Click on **List tab (c)**. The following is shown:



Here protocols that have individual duration intervals and individual loads for each stage can be set. The protocols are defined and remembered as described on the previous page.

### 9.16.2 Modifying a Specific Stage Duration / Stage Load

1. Select the base protocol or define new protocol **(a).**

2. The maximum number of steps is defined **(e)**, and entered in the list when Generate is clicked.

3. Modify in the list as required.

4. Check the **Use List box (d).**

5. The defined list will be used as the selected protocol and a message is displayed **(b)**, to indicate this.

# 9.17   Defining a Treadmill Protocol

- Ensure a treadmill is selected in the settings menu.
- Select **Edit Treadmill** from the Protocol menu. The following is displayed:
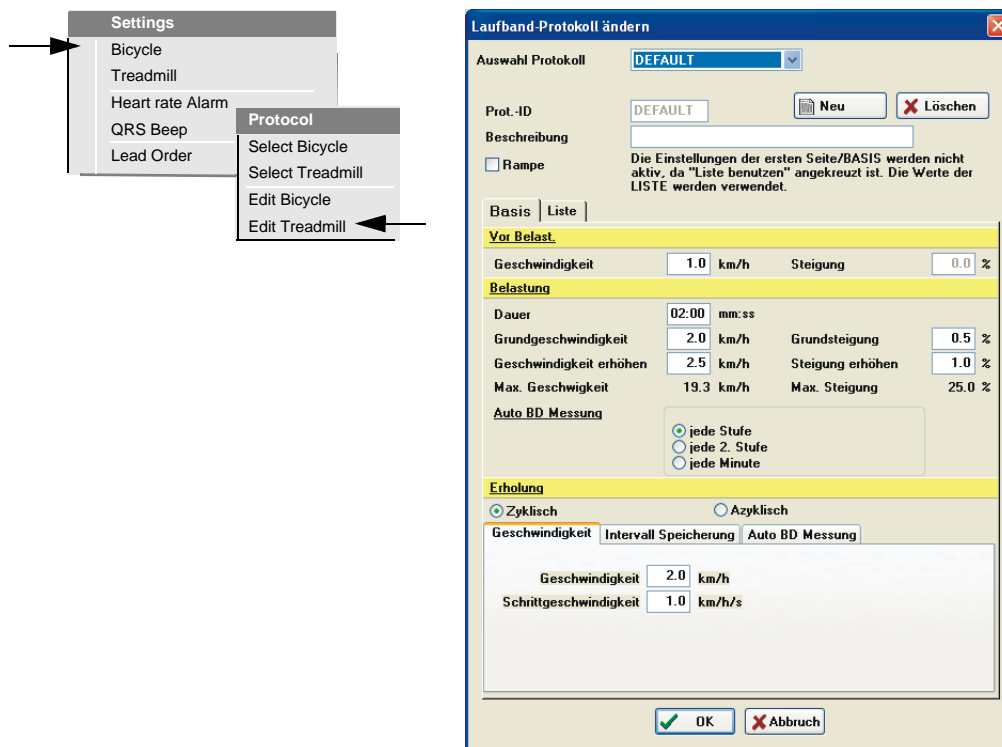


In this screen treadmill protocols can be edited and defined.

The duration and BP settings are the same as for the bicycle protocol (see para 9.15, Direct Print, page 163), with pre-exercise recovery, recovery save cyclic and acyclic, and BP measurement intervals etc. Both speed and elevation are defined for the exercise stages.

### 9.17.1    Standard Treadmill Protocols

Some of the proven protocols are as follows:

### 9.17.2    Bruce

| Stage | Duration [minutes] | Speed [km/hr] / [mph] | Elevation [%] |
|-------|--------------------|-----------------------|---------------|
| 1 | 3 | 2.7 / 1.7 | 10 |
| 2 | 3 | 4.0 / 2.5 | 12 |
| 3 | 3 | 5.4 / 3.4 | 14 |
| 4 | 3 | 6.7 / 4.2 | 16 |
| 5 | 3 | 8.0 / 5.0 | 18 |
| 6 | 3 | 8.8 / 5.5 | 20 |
| 7 | 3 | 9.6 / 6.0 | 22 |

### 9.17.3    Balke

| Stage | Duration [minutes] | Speed [km/hr] / [mph] | Elevation [%] |
|-------|--------------------|-----------------------|---------------|
| 1 | 2 | 5.0 / 3.0 | 2.5 |
| 2 | 2 | 5.0 / 3.0 | 5.0 |
| 3 | 2 | 5.0 / 3.0 | 7.5 |
| 4 | 2 | 5.0 / 3.0 | 10.0 |
| 5 | 2 | 5.0 / 3.0 | 12.5 |
| 6 | 2 | 5.0 / 3.0 | 15.0 |
| 7 | 2 | 5.0 / 3.0 | 17.5 |
| 8 | 2 | 5.0 / 3.0 | 20.0 |
| 9 | 2 | 5.0 / 3.0 | 22.5 |
| 10 | 2 | 5.0 / 3.0 | 25.0 |

### 9.17.4    Naughton

| Stage | Duration [minutes] | Speed [km/hr] / [mph] | Elevation [%] |
|-------|--------------------|-----------------------|---------------|
| 1 | 3 | 3.0 / 2.0 | 0.0 |
| 2 | 3 | 3.0 / 2.0 | 3.5 |
| 3 | 3 | 3.0 / 2.0 | 7.0 |
| 4 | 3 | 3.0 / 2.0 | 10.5 |
| 5 | 3 | 3.0 / 2.0 | 14.0 |
| 6 | 3 | 3.0 / 2.0 | 17.5 |

### 9.17.5   Ellestad

| Stage | Duration [minutes] | Speed [km/hr] / [mph] | Elevation [%] |
|---|---|---|---|
| 1 | 3 | 2.7 / 1.7 | 10.0 |
| 2 | 3 | 4.8 / 3.0 | 10.0 |
| 3 | 3 | 6.4 / 4.0 | 10.0 |
| 4 | 3 | 8.0 / 5.0 | 10.0 |
| 5 | 3 | 8.0 / 5.0 | 15.0 |
| 6 | 3 | 9.6 / 6.0 | 15.0 |

### 9.17.6   Cooper

| Stage | Duration [minutes] | Speed [km/hr] / [mph] | Elevation [%] |
|---|---|---|---|
| 1 | 1 | 5.3 / 3.3 | 0.0 |
| 2 | 1 | 5.3 / 3.3 | 2.0 |
| 3 | 1 | 5.3 / 3.3 | 3.0 |
| 4 | 1 | 5.3 / 3.3 | 4.0 |
| 5 | 1 | 5.3 / 3.3 | 5.0 |
| 6 | 1 | 5.3 / 3.3 | 6.0 |
| 7 | 1 | 5.3 / 3.3 | 7.0 |
| 8 | 1 | 5.3 / 3.3 | 8.0 |
| 9 | 1 | 5.3 / 3.3 | 9.0 |
| 10 | 1 | 5.3 / 3.3 | 10.0 |
| 11 | 1 | 5.3 / 3.3 | 11.0 |
| 12 | 1 | 5.3 / 3.3 | 12.0 |

# 10 Miscellaneous Program Functions

## 10.1 Defining the Name of the Generated PDF File

When a pdf file is generated, it is possible to define the file name. This can be used for example, if a pdf report must clearly be assigned to a patient in a practice system.

The structure of a pdf file name/printer title is defined in an 'ini' file called **PDF-Filename.ini.** The generated file name will be separated by underlines for example:

A resting rhythm recording from patient John Smith (with patient ID 12345) taken on 25th November 2010 at 12.34:56, could have the following pdf file name:

**EKG02_12345_John Smith @25-11-2010 12.34.56 TestPDF.pdf**

To define the file name proceed as follows.

1. In the root directory of the program (usually SDS104 on your local harddisk), open the file **PDF-Filename.ini**.
2. The following is displayed:
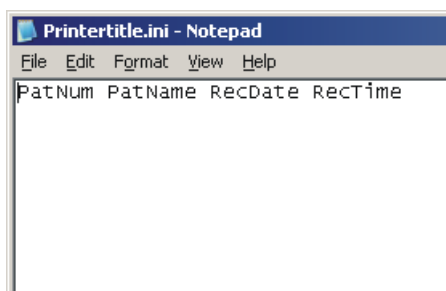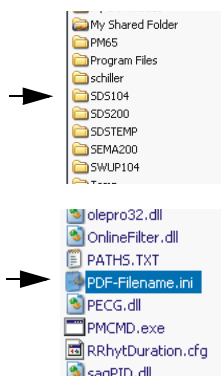
3. The Ini file contains 3 lines:
   – 1. The template for the file name
   – 2. The date format
   – 3. The time format

4. Place any code in the variable field %[VARIABLE]% to define that parameter for the pdf title. The following definitions can be made:

5. Define the variables as follows:

| Variable | Description |
|---|---|
| PatName | • Patient name |
| PatNum | • Patient number |
| PatLastName | • The patient's last name |
| PatFirstName | • The patient's first name |
| PatBorn | • Date of birth of the patient in the defined date format |
| PatAge | • Patient's age at the time of the recording |
| PatEthnic | • Patient's race |
| PatSex | • Patient's gender |

| Variable | Description |
|---|---|
| PatHeight | • Height of the patient in cm at the time of the recording |
| PatWeight | • Weight of the patient in kg at the time of the recording |
| PatRem1 | • Remark 1 in the patient data |
| PatRem2 | • Remark 2 in the patient data |
| PatRem3 | • Remark 3 in the patient data |
| PatRem4 | • Remark 4 in the patient data |
| PatCaseNo | • Case number of the recording |
| PatUSERID | • ID of the assigning physician |
| PatMTAID | • ID of the user who made the recording |
| RecRem1 | • Remark 1 concerning the recording |
| RecRem2 | • Remark 2 concerning the recording |
| RecRem3 | • Remark 3 concerning the recording |
| RecRem4 | • Remark 4 concerning the recording |
| RecIndic | • Indication of the recording |
| RecDate | • Recording date in format defined in row 2 |
| RecTime | • Recording time in format defined in row 3 |
| RecType | • Examination type. Convention as in GDT:<br>– resting ECG = EKG01<br>– resting rhythm = EKG02<br>– Signal averaging = EKG03<br>– ECG Holter = EKG04<br>– exercise ECG = ERGO01<br>– ergo-spiro = ERGO05<br>– Blood pressure Holter = BDM01<br>– spiro = LUFU00<br>– Bodyplethysmography = LUFU04<br>– Osz. Resistance = LUFU09<br>– $CO_2$-Diffusion = LUFU13 |
| RecAqrInstID | • ID of the institute in which the examination was carried out |
| RecAqrInst | • Name of the institute in which the examination was carried out |
| RecAqrDeptID | • ID of the department in which the examination was carried out |
| RecAqrDept | • Name of the department in which the examination was carried out |
| RecRoom | • Room |
| RecReqInstID | • ID of the requesting institute |
| RecReqInst | • Name of the requesting institute |
| RecReqDeptID | • ID of the requesting department |
| RecReqDept | • Name of the requesting department |
| RecAnaInstID | • ID of the institute in which the recording was analysed |
| RecAnaInst | • Name of the institute in which the recording was analysed |
| RecAnaDeptID | • ID of the department in which the recording was analysed |
| RecAnaDept | • Name of the department in which the recording was analysed |
| RecRefPhysID | • ID of the referring physician |
| RecRefPhys | • Name of the referring physician |
| RecTechnicianID | • ID of the technician |
| RecTechnician | • Name of the technician |
| RecValByID | • ID of the validating physician |
| RecValBy | • Name of the validating physician |

# 10.2    Adding a Program Start Button
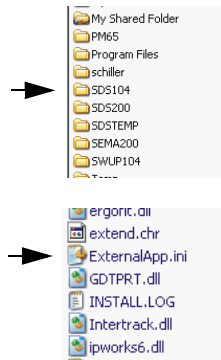
An extra program icon can be added to the icon bar in the patient screen. This icon can be defined so that it open any program installed on your PC. For example word can be opened for writing patient notes, or excel can be opened for reference data, etc. To add an extra program icon, proceed as follows:

1.  In the root directory of the program (usually SDS104 on your local harddisk), open the file **ExternalApp.ini.**

2.  The following is displayed:
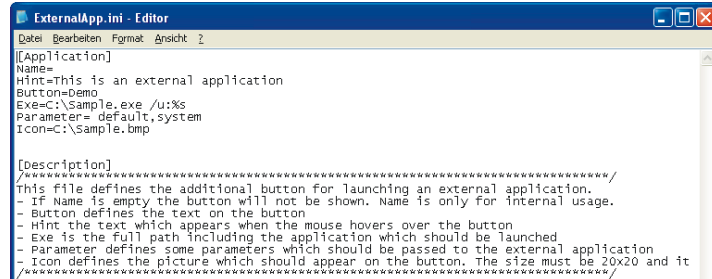
3.  Enter the following:

| | |
|---|---|
| **Name** | A suitable label for the application. This is used by the program for access only. |
| **Hint** | Write any text here that will appear in a box when the cursor is positioned over the icon. |
| **Button** | The name that appears on the icon in the program |
| **Exe** | The full path of the program that is to be opened when the icon is clicked. |
| **Parameter** | Leave this as default, system. |
| **Icon** | Leave this as defined. |

4.  Save the file (File > Save). When the Program is again opened the icon will appear in the icon bar and when clicked, the selected program will open.

**i**    If the icon does not appear it must be defined in the user settings. System Settings > user configuration > button order > external application
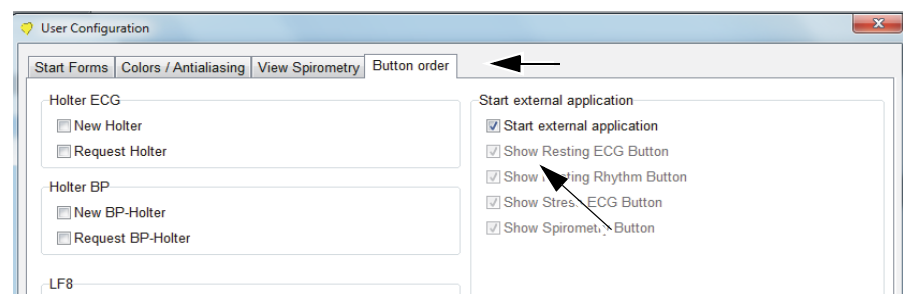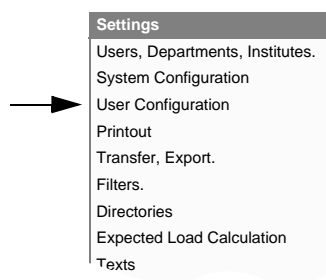
# 10.3   Audit Trail

To be able to follow up and prove defined operations important actions can be recorded in a database. This enables for example, proof of patient / recording editing / deletion or, history checking that a recording has been printed, mailed or exported, etc.

**i** To enable an audit trail an Advantage data base must be installed either locally of in a server. This is not supplied with the SDS-104 program and must be purchased separately.

Note that the audit trail is not available for SEMA light versions.

Settings can only be defined while the ADS is running. When in a network, the settings defined for the audit trail apply to all SEMA programs and / or all SCHILLER units connected to the same Advantage database. The settings are defined under Settings > System Configuration > Electronic Audit Trail (see para 9.2.7, Electronic Audit Trail (with general network licence only), page 132).

## 10.3.1   Viewing the Audit Trail

**i** Settings can only be defined and the menu options given when the ADS (Advantage database is running.

The audit trail is viewed and printed from the function menu in the patient screen **Function menu > Show Audit Trail**. The following is displayed

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### Searching for Recordings from a Specific Patient or User

Define the search parameters and click the Search icon **(1)** to display only the recordings from the defined settings.

### Reviewing and Printing the Search result

To review or print the search results click the Preview or print icon **(2)**.

# 11  Direct Function Keys

In each screen in addition to the menu options and function icons, function keys F1 to F12 perform different functions dependent on display. The function keys are as follows:

## 11.1  Acquisition Screens

| | Patient Scrn | Resting ECG | Rest. Rhythm | Exercise ECG | Spiro |
|---|---|---|---|---|---|
| F2 | | | | | |
| <Ctrl> F2 | | | | | |
| <Shift>F2 | New Patient | | | | View Loop |
| F3 | Search | Start Man Print | Start Man Print | Start Man Print | FVC |
| <Ctrl> F3 | | | | | |
| <Shift>F3 | | | | | |
| F4 | | Stop Man. Print | Stop Man. Print | Stop Man. Print | SVC |
| F5 | Print | Auto ECG | | | MW |
| <Ctrl> F5 | | | | | View Quadrant |
| <Shift>F5 | Print Format | | | | |
| F6 | | Filter | Filter | Filter | MV |
| <Shift>F6 | | Centre Signal | Centre Signal | Centre Signal | |
| F7 | Sort by name | | Start | Start / Begin / Recovery / End | |
| <Shift>F7 | | | | | |
| F8 | Sort by ID | | Magnet on | | Start/Stop |
| <Shift>F8 | | | Magnet off | | |
| F9 | View Recording | | | | |
| <Ctrl> F9 | | | | | View Results |
| <Shift>F9 | | | | | |
| F10 | | | | | |
| F11 | | | | Enter Bld. Pres. | |
| <Shift>F11 | | | | Enter Symp. | |
| F12 | | | | Arrhythmia Event | |
| <Ctrl>+S | | Save Screen Settings | | Save Screen Settings | |
| <Shift>+T | | | | | |
| <Shift>+V | | | | | |
| Esc | | | | | Return |
| PgDn | | Next Lead Group | Next Lead Group | Next Lead Group | |
| PgUp | | Prev. Lead Grp. | Prev. Lead Grp | Prev. Lead Grp | |
| up | | | | Next Lead | |
| down | | | | Previous lead | |
| left | | | | ST point Plus | |
| right | | | | ST point Minus | |

# 11.2 View Screens

| | Resting ECG | Vector | Rest. Rhythm | Exercise ECG | Late Potentials | Spiro | Ergo-Spiro |
|---|---|---|---|---|---|---|---|
| F2 | Patient Screen | Patient Screen | | Patient Screen | Patient Screen | Patient Screen | Patient Screen |
| <Ctrl> F2 | | | | | | | |
| <Shift>F2 | | | | | Change Pat. Data | | |
| F3 | Rhythm | Rhythm | | | | FVC | |
| <Ctrl> F3 | | | | | | | Rhythm |
| <Shift>F3 | Next Record | Next Record | | Next Record | | | Next Record |
| F4 | | | | | | SVC | |
| F5 | Print | Print | | Print | Print | MVV | Print |
| <Ctrl> F5 | | | | | | | |
| <Shift>F5 | Print Format | Print Format | | Print Format | Print Format | | Print Format |
| F6 | Filter | Filter | | ST-Curve | | MV | ST-Curve |
| <Shift>F6 | | | | | | | |
| F7 | Av. Complexes | Av. Complexes | | Overview | | | Overview |
| <Shift>F7 | Serial Comp. | Serial Comp. | | | | | |
| F8 | | | | Av. Complexes | | | Av. Complexes |
| <Shift>F8 | | | | | | | |
| F9 | Interpretation | Interpretation | | Interpretation | | | Interpretation |
| <Ctrl> F9 | | | | | | View | |
| <Shift>F9 | Measurements | Measurements | | ST-Protocol | | Table | ST-Protocol |
| F10 | | | | | | | |
| F11 | | | | | | Trend | |
| <Shift>F11 | | | | | | View V(t) | |
| F12 | | | | | | | |
| <Ctrl>+S | | | | | | | |
| <Shift>+T | | | | | | | |
| <Shift>+V | | | | | | | |
| Esc | Return | | Return | Return | Return | Return | Return |
| PgDn | | | | | | | |
| PgUp | | | | | | | |
| up | | | | | | | |
| down | | | | | | | |
| left | | | | | | | |
| right | | | | | | | |

# 12  Installation and Network Setup Guideline

**i**  Different networks will have different setups, protocols and settings and installation is usually carried out by SCHILLER personnel trained in network installation. This section gives general guidelines for the installation of SEMA and an outline of the settings to be made after installation.

The following guideline procedure is applicable when installing the SDS-104 software used with the AT-104 PC unit. This software is part of the SDS series software that comprises the following.

- SEMA-200 - The SEMA Database software.
- SDS-200 - The software used in the SCHILLER CS-200 unit
- SDS-104 - The software installed in the PC for the AT-104 PC unit

The procedure given here is applicable to all software installations.

## 12.1  Requirements

**i**  Read the Software License Agreement. By agreeing to it you are bound by the terms of the agreement.

To install the SDS-104 program it is recommended that the computer has the following minimum specification:

- PC compatible computer with approximately 10Gbyte or more of free disk space.
- Windows operating system (see the SDS-104 program release note for the Windows versions with which the software has been tested).
- 512Mbyte RAM or more.

The above are general recommendations. For specific installations or for installations with more than 100,000 recordings, please contact your local SCHILLER office for detailed information on recommended minimum server configurations.

In addition, the following software must be installed:

- Latest version of Adobe Reader
- Advantage database server (ADS) (if installing a General Network License)
  - the ADS is installed once in the network usually at the same location as the database and recordings.

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# 12.2 Notes before Installing

- Ensure that you are installing the latest version of the SDS-104 software and that you have it on a CD or USB drive. The latest version can be obtained from your distributor.
- In order to use the program, you will need to have the AT-104 unit connected to the computer.

If the unit is to be networked with other units or with a SEMA database, the following licenses are available for SEMA :

- SEMA Standard (with Dongles for each PC),
- SEMA Light (with a CD/USB containing the License file),
- and/or SEMA General Network (with a CD/USB containing the License file).

.

- Because of mapping restrictions, the drive where the program resides must be 'named'. It cannot be called "Local Disk" and it cannot be left blank. This is carried out in the windows explorer. Rename the volume name of the hard-disk where the application will be installed. Any name can be used.
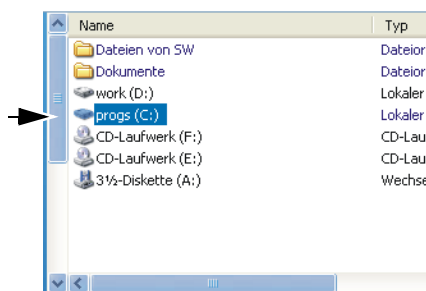
- Refer to the **Upgrade Instructions** if any of the following situations exist:
  - You are installing an upgrade of an existing installation of SDS-104.
  - You are interfacing with a SEMA/SDS database.

## 12.2.1 Network

### Licensing

If the SDS-104 program is to be networked with a SEMA database the following SEMA licenses are available:

**SEMA Standard** — A single SEMA installation with a security dongle in the USB or parallel port of the PC.

**SEMA Light** — The license must be installed in the SEMA directory (default - C:\SEMA200\)

**SEMA General Network License** — The license must be installed in the shared database directory (default - C:\SEMA200\SDSDB\).

If the license is not installed properly or the dongle not inserted, DEMO - VERSION is displayed when SEMA is launched and if a print/export/import, etc. instruction is attempted.

The General Network Licence number is displayed in the Help menu > About. The General Network Licence number is also given on the bottom of each page of the printout.

SCHILLER

AT-104 PC

## 12.3   Installing the Software

Proceed as follows

1.  Insert the CD / USB into the relevant drive of your computer and open the in-stall.exe file.
2.  Read through the license agreement and select 'I Agree'. Click next if you wish to continue with the installation.
3.  Choose the location for the installation of SDS-104 software (for example, C:\Program Files\SDS104), and click Next.
4.  Select the language preference and click Next.
5.  Select the ANSI and OEM character sets
    – Usually the default settings are recommended, click Next.
    – The Character set defines the character set to use when accessing the DB and for example, defines the sorting order for different alphabets.
    – The character set defined here must be the same character set defined for the database.

6.  Check 'ECG-Acquisition with AT-104` box.
    – If the spirometry program is to be installed in conjunction with the AT-104 PC ECG unit, check the `PC-Spirometry with SP-250` as well.
7.  Select Port.
    – This refers to the RS-232 communication ports on the back of your computer where the unit is to be installed. In most cases this can be left at the default. In case of difficulty after installation the port can be checked and/or changed in the program settings (see para 9.2, System Configuration, page 128).
    – When the USB converter box (driver software) is installed more COM ports are given. The COM port is found in system configuration.
8.  Click Next.
    – The program commences installation and creates a new folder on your hard disk called SDS104. A progress screen is displayed during installation.
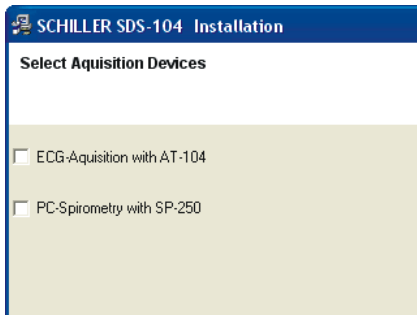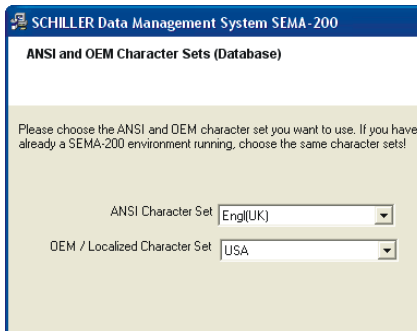
### 12.3.1 Defining Users and Settings

| Settings |
| --- |
| Users, Departments, Institutes. |
| System Configuration |
| User Configuration |
| Printout Settings |
| PDF Settings |
| Transfer, Export. |
| Filters. |
| Directories |
| Expected Load Calculation |
| Texts |
| AT-104 PC |
| Resting ECG |
| Exercise ECG |
| Rhythm ECG |
| Direct Print |

1. Log-in using **default / system** user.

2. Select **Settings > Users, Departments, Institutes**. Click the Institutes tab and the Departments tab to define the Institute names and department names that will use SEMA. (see para 9.1.1, Departments and Institutions, page 124).

3. Select **Settings > Users, Departments, Institutes** and define the Institute the users that will use SEMA.
   – Create a UserID and assign the appropriate rights for each person that will use SEMA
   – (see para 9.1.2, Users, page 125).
   – Make a note all user IDs and passwords.

4. Select **Settings > System Configuration** and proceed to set the configuration settings, for example:
   – Units of Measurement
   – Lead Order (Standard / Cabrera)
   – Date/Time Format
   – Other / Show Ethnic (if using PC-Spirometry)
   – Other / Device Name (if you will use Worklist or Export functions)
   – (see para 9.2, System Configuration, page 128).

5. Select **Settings > Printout Settings** and proceed to select and configure the reports, based on the regional and system preferences (see para 9.4, Printer Defaults, page 142).

6. Repeat the same for **Settings > PDF Settings.**
7. Logout and login for each of the defined users, select Settings > User Configuration and set the user settings for all users (the users can also do this themselves).

### 12.3.2    Network Setup

All units and SEMA installations must be on the same network domain and have network security privileges to the same network. That is, all units and SEMA installations must have access to a shared and common network path or volume.

Ensure that you have a shared network folder and that all users accessing SEMA have full rights to the path where data will be located.

#### Procedure

1.  Open the SDS-104 application - log-in using **default / system**.

2.  Select **Settings > Directories** option, and change the following folders to the location where the data files will be located on the network:
    – Recordings:
        (for example: \\FILESERV\SCHILLER\SDS200\SDSRECS)
    – Full disclosure Files:
        (For example: \\FILESERV\SCHILLER\SEMA200\FULLDISC)
    – Database:
        (For example: \\FILESERV\SCHILLER\SEMA200\SDSDB)

3.  Add the same UNC or path to the data files to the Search Drives and click OK. For example, \\FILESERV\SCHILLER\SEMA200
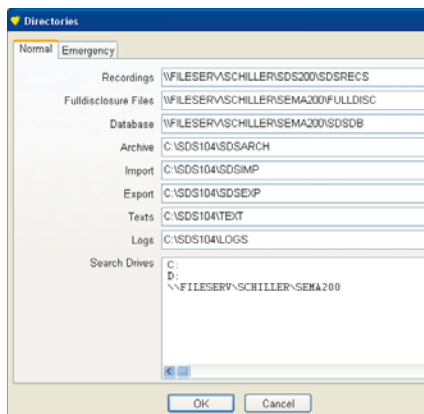
i    UNC path (universal naming convention) is preferable to drive letters as this is a more efficient means of accessing data. Drive mappings may change.

### 12.3.3   Upgrade Procedure

ℹ

If an earlier version of the SDS-104 program is being updated:

• All applications using the SEMA/SDS database must be closed before installing SDS-104.

• All *.ADI files must be deleted in the database directory

• The first application to connect to the SEMA database must be the latest version of SEMA (this application will update the database files and re-create the deleted ADI files).

• After the update, a mixed network with different versions is compatible (details in the release note).

#### Procedure

To upgrade installation or to install SDS-104 in an environment where there are multiple clients connecting to the same source of data (that is other versions of SDS-104, SEMA and/or SDS-200), proceed as follows:

1. Ensure that there are no other applications connected to the source of data files. If so, terminate and exit any of the following programs that may be running:
   – SEMA
   – SEMACOMM
   – SCS (Schiller Communication Server)
   – SEMAIMPORT
   – SEMAEXPORT
   – SDS-104 (used with the Schiller Cardiovit AT-104 and/or PC-Spirometry)
   – SDS-200 (used with the Schiller Cardiovit CS-200)
   – Any CardioLaptop AT-110 system that is connected to the network.
   – HL7 converter, 3th party interfaces

2. Launch SEMA from a single PC and log-in using a user ID that has administrative privileges to setup the SEMA program.
3. Click **Settings >Directories** and note the location of the Database folder.
4. Exit SEMA and all Schiller applications that may be running.
5. Use Windows Explorer and access the database folder.
6. Make a back-up copy of the files in the SDSRECS folder.
7. Remove all files of type ADI before proceeding with the installation of any software.
   – These files are usually located in the database folder \\SEMA200\SDSDB. It is recommended that a search is initiated (*.adi) to ensure that all files are found.
   – Only remove those that are type ADI and ensure that you do not delete the files of type ADT or ADM.
   – If you encounter a sharing violation error, there is a possibility that there is an application that is still connected to the database and it must be terminated first. You may also not have sufficient (Full Rights) to the shared network path.

8. After installing (reinstalling) the SEMA database software, make sure you launch SEMA before any other applications. SEMA must be the first application to run, before SEMACOMM, SDS, etc.

Upon execution of the SEMA program, it will automatically re-create all ADI files and you will be able to use SEMA in situations where there are multiple versions of the software.

# 13   The AT-104 PC as a Standalone Unit

## 13.1   Control Buttons and Indicators

(Back panel - see para 13.2, Back panel, page 187)



(Side panel - see para 13.3, Side panel, page 187)
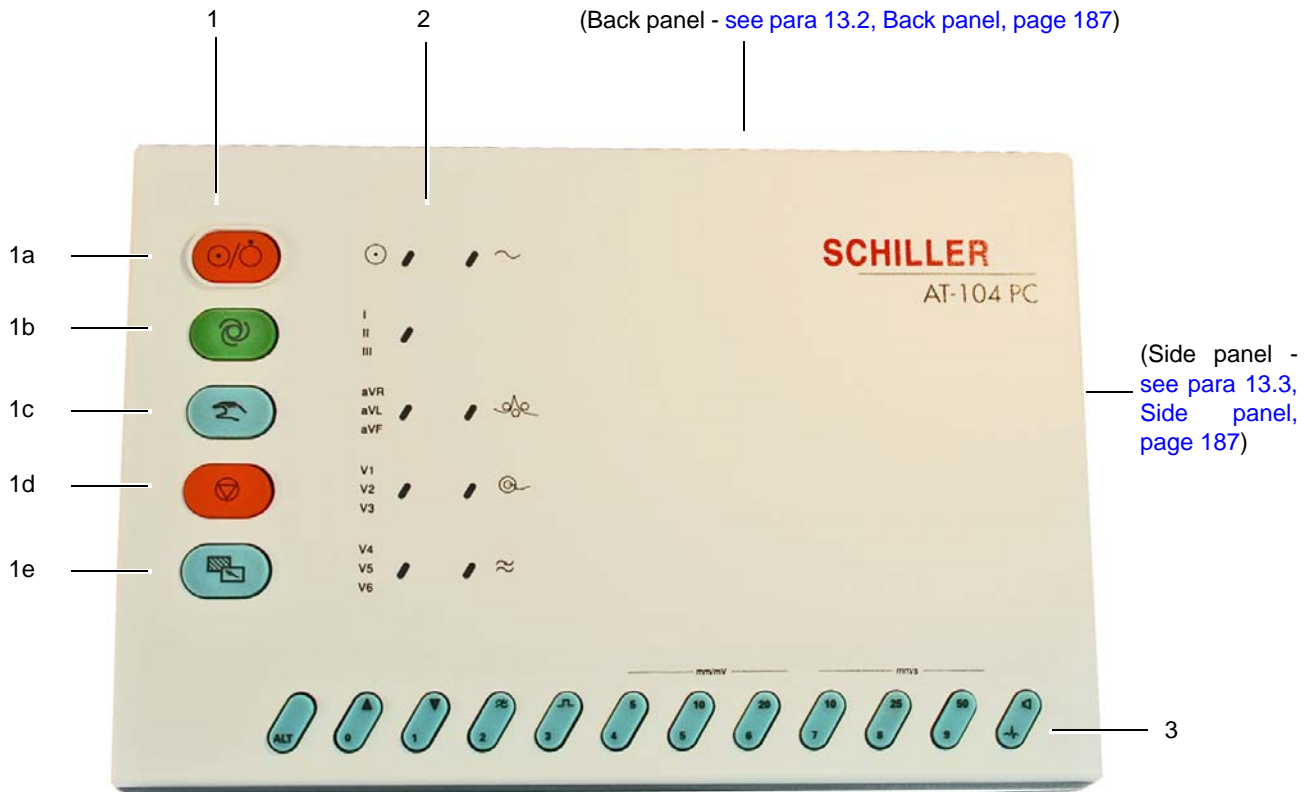
When the AT-104 PC is connected to a PC all functions are initiated from the PC (SDS-104 program) and the AT-104 PC keypad is inactive. The following provides an overview of the AT-104 PC key functions in **standalone mode** when the unit is not connected to a PC.

**(1)   Function Keys**

1a. **On/Off key**

Switch the unit On or Off.

1b. **Auto Key**

Start an ECG recording (resting) in auto mode.

Press **Alt** key followed by this key for auto mode 2.

1c. **Manual key**

Continuous printout of ECG.

Printout continues until **Stop** key pressed.

The lead group, speed and sensitivity of the printout along with filter application, QRS beep and other settings are changed with the bottom row of keys (5).
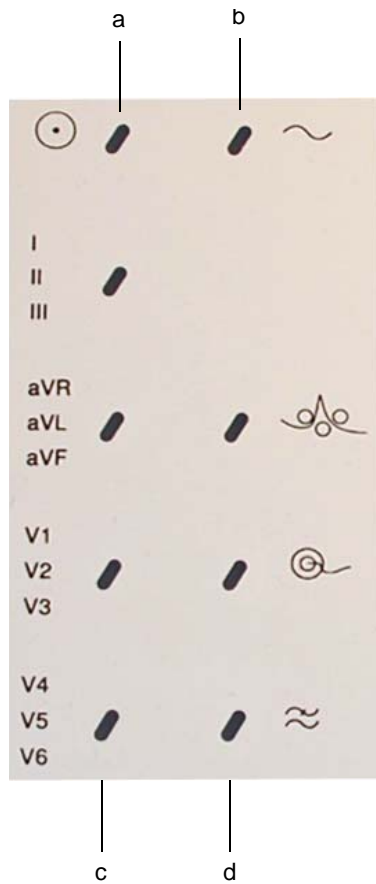
1d. **Stop key**

Stop printout, run paper to start position, confirm (new) setting.

1e. **Copy Key**

Print extra copy of Auto mode recording currently in memory.

Press the **Alt** key first followed by this key to obtain a copy in Auto format 2.

**(2) Indicators**

a. **On Indicator**

Unit switched on.

b. **Mains Indicator**

Lit when mains connected.

c. **Lead Group Indicators**

Indicates the lead group selected (manual printout).

d. **Status and Technical Indicators** as follows:

**Paper Indicator** - lit when the paper tray is empty or a paper jam has occurred.

**Electrode Indicator** - lit when an electrode resistance is too high or the electrode has been removed.

**Myogram filter Indicator** - lit went the myogram filter is active.

**(3)  Settings Keys**
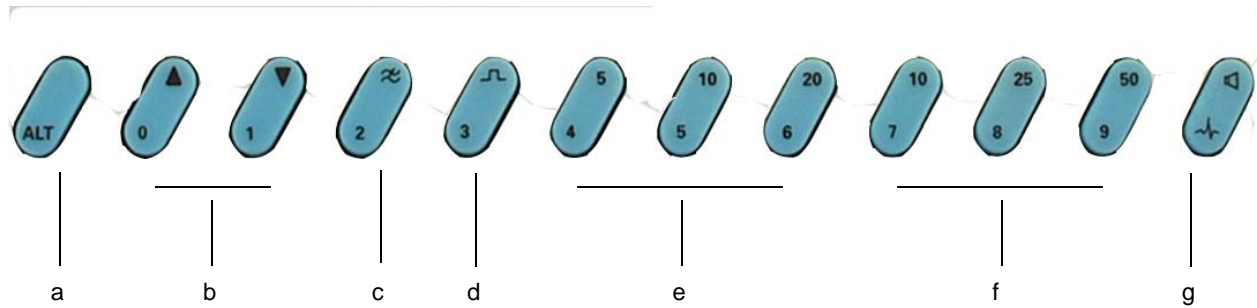


a.  **Alt key**

    For initiation of setups and selection of second format for printout and auto mode recording.

b.  **Select next / former lead group**

    (manual printout only).

    The lead group selected is indicated by the LEDs

c.  **Myogram filter On / Off**

    When recording and viewing a recording from the PC, the Myogram settings are defined in the program.

d.  **1mV key**

    Insert a 1mV square wave reference point on the printout.

e.  **Select printout sensitivity**

    (manual mode only).

f.  **Select printout speed**

    (manual mode only).

g.  **QRS Beep**

    Toggles the QRS beeper On/ Off

## 13.2    Back panel



a           b           c
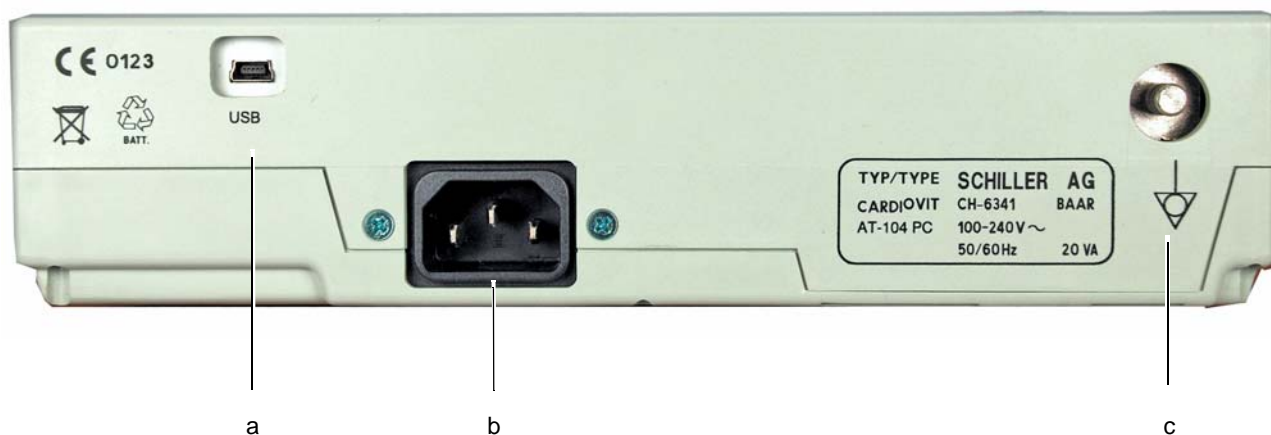
a. **USB connector** - for connection to the PC
b. **Mains connector**
c. **Potential equalisation stud**

## 13.3    Side panel



d           e
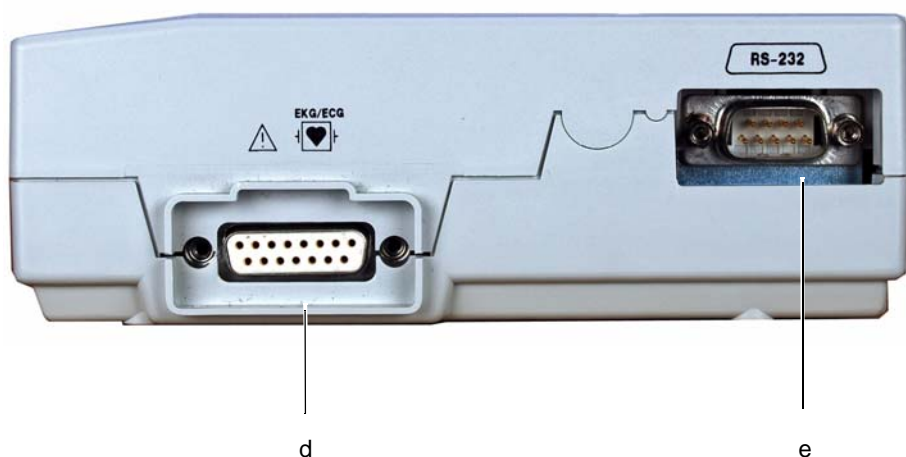
d. **Patient connector**

    The connector for the patient cable

e. **RS-232 connector** for connection to the PC.

**i**    Usually, the USB connector is used for connection to the PC. T he RS-232 connector may also used as an alternative.

## 13.4   Operating Modes

There are two ways of obtaining a printout with the AT-104 PC as a standalone unit - Automatic and Manual Mode.

### 13.4.1   Automatic Mode

Automatic Mode provides a printout giving 10 seconds of ECG recording of all 12 leads in 2 different formats with a sensitivity of 10 mm/mV. The following can be programmed freely in each of the formats before recording:

These two formats are defined in ECG settings ().

The printout provides the following information:

• Patient Data field to manually write patient details
• ECG recording of all leads in either Standard or Cabrera format according to se-lection
• Sensitivity
• Heart Rate
• Speed


and if set:

• Average Cycles
• Intervals
• Axis
• Detailed Measurement Table
• Interpretation (option C only)

### 13.4.2   Manual Mode

Manual Mode provides a real time rhythm printout of 3 leads that are selected and indicated on the keyboard.

The following can be freely selected before or during recording:

• Lead Group
• Chart Speed
• Sensitivity
• Myogram Filter

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## 13.5   Taking an Auto Mode Recording
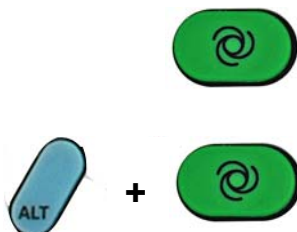
- To take an automatic ECG recording in **Format 1 press the Auto key.**

- To take an automatic recording in F**ormat 2 press the Alt key followed by the Auto key.**

### 13.5.1   Obtaining Further Printouts
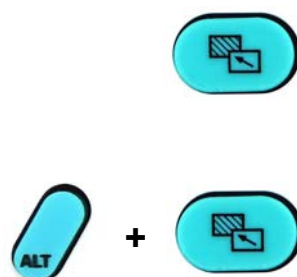
- To obtain an extra printout of the ECG recording in **Format 1 press the Copy key.**

- To obtain an extra printout of the ECG recording in **Format 2 press the Alt key followed by the Copy key,**

- The printout given will depend on the settings defined ().

# 13.6    Taking a Manual Mode Recording

- To start the manual printout: press the **Manual Start** key.
- To stop the manual printout: press the **Stop** key.

The printout provides you with the following information:

- The group of the three selected leads with lead identification.
- Chart speed, sensitivity and filter settings (if on).
- The heart rate as current average of 4 beats.

## 13.6.1   Changing the Leads, Speed and Sensitivity

The following settings can be made before and during the printout:

### Lead Group

Change the Lead group with the **Lead Group** keys.

- The lead groups are changed with the lead group keys. The lead group selected is indicated on the unit with the lead group LEDs.

### Additional Leads
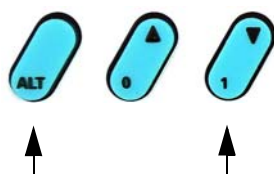
- Additionally lead V1, II and V6 can be printed by pressing the **Alt** key followed by the **lead group down** key:

### Speed
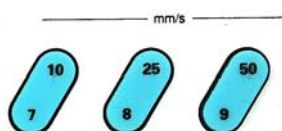
- Speed (10, 25 or 50 mm/s) with the **Speed** keys.

### Sensitivity
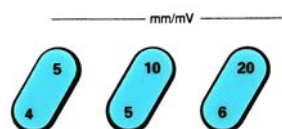
- Sensitivity (5, 10 or 25 mm/mV) with the **Sensitivity** keys.

### QRS Beep

- The acoustic QRS indication can be switched on or off at any time with the **QRS beep** Key.

# 13.7    General and Auto Format Settings

Each parameter is set by means of a code. This code comprises a combination starting with the **ALT**ernative key followed by a number of keys and is always confirmed with the **Stop** key.

As soon as the **Alt** key is pressed, the keyboard is dedicated to the programming function.

The setting is remembered and the keyboard is only released for other functions when the **Stop** key is pressed. Once the settings have been confirmed, they are stored in the memory even when the unit is switched off.

## 13.7.1    Default Settings

The default settings are as follows:

**Language**                       English

**Leads**                          Standard (s)

**Auto Format 1**                  ECG:                25mm/s, Short (o) three pages
                                   MECG:               2*6 (50mm/s) + 1 Rhythm
                                   Measurements:       suppressed (-)
                                   Marks:              enabled (+)
                                   Interpretation:     enabled (+) (option C)

**Auto Format 2**                  ECG:                25mm/s, long (ooo) six pages
                                   MECG:               suppressed (-)
                                   Measurements:       suppressed (-)
                                   Marks:              enabled (+)
                                   Interpretation      disabled (-)

**Rhythm Leads**                   V1, II

**Auto Centring**                  Enabled (+)

**Printout of Signals**            Sequential

**Baseline Filter Setting**        0.05 Hz

**Mains Filter Setting**           50 Hz

**Myogram Filter Setting**         35 Hz, Off

### 13.7.2    Resetting the Unit to the Default Settings
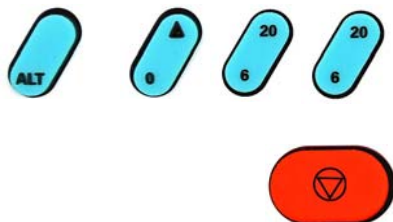
To reset the unit to the default settings press the key sequence **Alt > 0 > 6 > 6**

• Confirm the selection by pressing the **Stop** key.

### 13.7.3    Printout of Current Settings

To obtain a printout of the current settings press the key sequence **Alt > 0 > 1 > 1**

A printout of the current settings will be given with the following information, depending on the installed software:

| | |
|---|---|
| **Unit designation** | AT-104 PC, Software version and serial number. |
| **Leads** | Standard (S) or Cabrera (C). |
| **ECG Format 1 and 2:** | • Long (ooo), Short (o). |
| | • MECG: Average cycles as defined in auto ECG recording setup (e.g. 4 * 3 (25 mm/s)). |
| | • Measurements:Enabled (+) or Suppressed (-). |
| | • Marks: Enabled (+) or Suppressed (-). |
| **Interpretation** | Enabled (+) or Suppressed (-). |
| **Selected Rhythm leads** | R1, R2 . |
| **Automatic Centring** | Enabled (+) or Suppressed (-). |
| **Printout of signals** | Sequential or Simultaneous. |
| **Baseline Filter** | 0.05 Hz, 0.15 Hz or 0.30 Hz. |
| **Mains Filter** | 50 Hz, 60 Hz or Off (-). |
| **Myogram Filter** | 25 Hz or 35 Hz, On (+) or Off (-). |
| **Interpretation settings** | • N/A: +/- 'normal/abnormal' is written (+) or suppressed (-). |
| | • U:+/- 'unconfirmed report' is written (+) or suppressed (-). |
| | • A30:+/-patient age is assumed to be < 30 (-) or >30 (+). |
| | • S: +/- low (-) or high (+) sensitivity - may influence less critical interpretations. For mass screening we recommend the low setting. |

**13.7.4    Language**

Press key sequence **Alt > 0 > 2**, then press:

- **key 1** for German
- **key 2** for English
- **key 3** for French
- **key 4** for Swedish
- **key 5** for American
- **key 6** for Italian
- **key 7** for Spanish
- **key 8** for Portuguese
- **key 9** for Dutch

- **key 0** for Russian.

- Confirm the selection by pressing the **Stop** key.

**13.7.5    Filters**

There are three different filters which can be set individually as follows:

- Baseline filter
- Mains filter
- Myogram filter

**Baseline**

Press key sequence **Alt > 5** then press:

- **key 0** for 0.05 Hz Cutoff
- **key 1** for 0.15 Hz Cutoff
- **key 3** for 0.30 Hz Cutoff

- Confirm the selection by pressing the **Stop** key.

The set value is the lower limit of the frequency range and is normally set to 0.05 Hz. The settings 0.15 and 0.30 Hz should only be used when absolutely necessary, as the possibility exists that they could affect the original ECG signal, especially the ST segments.

**Mains**

Press key sequence **Alt > 8** then press:

- **key 5** for main filtering of 50 Hz
- **key 6** for main filtering of 60 Hz
- **key 9** to switch the mains filter off.

- Confirm the selection by pressing the **Stop** key.

**Myogram Filter**

The **Myogram filter** suppresses disturbances caused by strong muscle tremor. The set value is the upper limit of the frequency range.

Press key sequence **Alt > 8** then press:

- **key 2** - cut off frequency of 25 Hz
- **key 3** - cut off frequency of 35 Hz
- **key 1** - the default setting of the myogram filter is On
- **key 8** - the default setting of the myogram filter is Off.

- Confirm the selection by pressing the **Stop** key.

An auto mode recording is stored with the mains filter (50/60Hz) applied but without Myogram filtering. It is therefore possible to print the stored ECG either with or without passing the myogram filter.

Switch the Filter on or off with the **Filter** key

**Filter On** is indicated by the filter control lamp

### 13.7.6 Lead Sequence and Printout

The selectable printout forms are:

**Simultaneous**

All 12 ECG leads are printed as 4 groups of 3 leads. All ECG leads are printed in the same time segment (in automatic mode only).

**Sequential**

All 12 ECG leads are printed as 4 groups of 3 leads. Each group is a contiguous time segment of approximately 2.5 or 5 seconds (in automatic mode only).

**Auto-Centring ON**

All ECG traces are centred dynamically for optimal use of paper width.

**Auto-Centring OFF**

ECG traces are set to a fixed baseline position and may possibly overlap.

Press key sequence **Alt > 7** then press:

- **key 1** - Standard Lead Sequence
- **key 2** - Cabrera Lead Sequence
- **key 3** - Simultaneous print
- **key 4** - Sequential print
- **key 5** - Auto-centring ON
- **key 6** - Auto-centring OFF

- Confirm the selection by pressing the **Stop** key.

### 13.7.7    Auto Mode Settings

Two separate ECG auto mode formats can be defined.

➜    To define auto mode format 1, the key sequence start is **Alt** followed by **key 1**.

➜    To define auto mode format 2, the key sequence start is **Alt** followed by **key 2**.

#### ECG Format

Press key sequence **Alt > 1 (auto format 1), or Alt > 2 (auto format 2) then key 1,** then press:

- **key 5** - no leads are printed.
- **Key 6** - leads are printed in short form (3 shts).
- **Key 7** - leads are printed in long form (6 shts).
- **Key 8** - chart speed 25 mm/s.
- **Key 9** - chart speed at 50 mm/s.

- Confirm the selection by pressing the **Stop** key.

#### Average Cycles

Press key sequence **Alt > 1 (auto format 1), or Alt > 2 (auto format 2) then key 2,** then press:

- **key 5** - no average leads are printed.
- **key 6** - 4 * 3 (25 mm/s). The average complexes are printed in four groups of three leads at a chart speed of 25 mm/s.
- **key 7** - 4 * 3 (50 mm/s). The average complexes are printed in four groups of three leads at a chart speed of 50 mm/s.
- **key 8** - 2 * 6 (50 mm/s) + 1Rhy. The average complexes are printed in six groups of two leads at a chart speed of 50 mm/s. One Rhythm lead is printed of the entire 10 second recording.
- **key 9** - 1 * 12 (25 mm/s) + 2 Rhy. The average complexes are printed out for all 12 leads individually with two rhythm leads at a chart speed of 25 mm/s. Two Rhythm leads are printed of the entire 10 second recording.

- Confirm the selection by pressing the **Stop** key.

To define the rhythm lead (see para , Rhythm Leads, page 198).

### Measurements and Markings

Press key sequence **Alt > 1 (auto format 1), or Alt > 2 (auto format 2) then key 3,** then press:

- **Key 5** - detailed table of measurement results is omitted. (However the values of electrical axes, intervals and heart rate are not suppressed).
- **Key 6** - detailed table of measurements results is printed.
- **Key 7** - Reference markings (beginning and end of P wave and QRS, and end of T wave) are omitted.
- **Key 8** - Reference markings (beginning and end of P wave and QRS, and end of T wave) are added to the ECG cycles.

- Confirm the selection by pressing the **Stop** key.

### Interpretation printed/ not printed (c version only)

Press key sequence **Alt > 1 (auto format 1), or Alt > 2 (auto format 2) then key 4,** then press:

- **key 5** - interpretation statements are omitted
- **key 6** - interpretation statements are printed

- Confirm the selection by pressing the **Stop** key.

### Interpretation Settings

Press key sequence **Alt > 6** then press:

- **key 1** - normal/ abnormal is not printed
- **key 2** - normal/ abnormal is printed
- **key 3** - unconfirmed report is not printed
- **key 4** - unconfirmed report is printed
- **key 5** - Patient age assumed to be < 30 years
- **key 6** - Patient age assumed to be > 30 years
- **key 7** - Low sensitivity
- **key 8** - High sensitivity

- Confirm the selection by pressing the **Stop** key.

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### Rhythm Leads

The rhythm leads are printed out in the last two average cycle selections (see para , Average Cycles, page 196). Two separate rhythm leads can be defined.
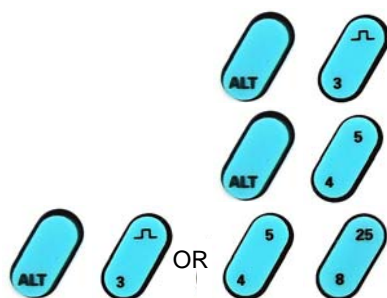
→  To define **rhythm lead 1** (R1**)** press the key sequence **Alt** followed by **key 3**.

→  To define **rhythm lead 2 (R2)** press the key sequence **Alt** followed by **key 4.**

Press key sequence **Alt > 3 (R1), or Alt > 4 (R2) then key 8,** then press:

- **key 1** - lead I
- **key 2** - lead II
- **key 3** - lead III
- **key 4** - lead aVR
- **key 5** - lead aVL
- **key 6** - lead aVF
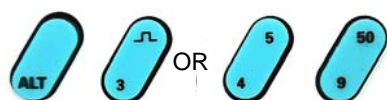
Press key sequence **Alt > 3 (R1), or Alt > 4 (R2) then key 9,** then press:

- **key 1** - lead V1
- **key 2** - lead V2
- **key 3** - lead V3
- **key 4** - lead V4
- **key 5** - lead V5
- **key 6** - lead V6

- Confirm the selection by pressing the **Stop** key.

### 13.7.8    Settings Overview Table

| | | Key | | | |
|---|---|---|---|---|---|
| **Setting** | **1st** | **2nd** | **3rd** | **4th** | **5th** |
| Reset unit to default settings | **Alt** | 0 | 6 | 6 | Stop |
| Printout of current settings | **Alt** | 0 | 1 | 1 | Stop |
| **Language** German | Alt | 0 | 2 | 1 | Stop |
| English | | | | 2 | Stop |
| French | | | | 3 | Stop |
| Swedish | | | | 4 | Stop |
| American | | | | 5 | Stop |
| Italian | | | | 6 | Stop |
| Spanish | | | | 7 | Stop |
| Portuguese | | | | 8 | Stop |
| Dutch | | | | 9 | Stop |
| Russian | | | | 0 | Stop |
| **Filter - Baseline** 0.05 | Alt | 5 | 0 | Stop | |
| 0.15 | | | 1 | Stop | |
| 0.3 | | | 3 | Stop | |
| **Filter - Mains** 50 Hz | Alt | 8 | 5 | Stop | |
| 60 Hz | | | 6 | Stop | |
| Off | | | 9 | Stop | |
| **Filter - Myogram** 25 Hz | Alt | 8 | 2 | Stop | |
| 35 Hz | | | 3 | Stop | |
| default on | | | 1 | Stop | |
| default off | | | 8 | Stop | |
| **Print Seq.** Standard | Alt | 7 | 1 | Stop | |
| Cabrera | | | 2 | Stop | |
| Simult. | | | 3 | Stop | |
| Sequent. | | | 4 | Stop | |
| Auto centring on | | | 5 | Stop | |
| Auto centring off | | | 6 | Stop | |
| Auto Mode 1 | **Alt** | 1 | | | |
| Auto Mode 2 | **Alt** | 2 | | | |
| **ECG Format** no leads | Alt | 1 / 2 | 1 | 5 | Stop |
| short form (3 shts.) | | | | 6 | Stop |
| long form (6 shts.) | | | | 7 | Stop |
| chart speed 25 mm/s | | | | 8 | Stop |
| chart speed 50 mm/s | | | | 9 | Stop |
| **Av Cycle** no av. cycles | Alt | 1 / 2 | 2 | 5 | Stop |
| 4 * 3 (25 mm/s) | | | | 6 | Stop |
| 4 * 3 (50 mm/s) | | | | 7 | Stop |
| 2 * 6 (50 mm/s) + 1 Rhythm (see below) | | | | 8 | Stop |
| 1 * 12 (25 mm/s) + 2 Rhythm (see below) | | | | 9 | Stop |

| Setting | 1st | 2nd | Key 3rd | 4th | 5th |
|---|---|---|---|---|---|
| **Meas and Marks** no meas | Alt | 1 / 2 | 3 | 5 | Stop |
| Tab. of meas printed | | | | 6 | Stop |
| Ref. marks not printed | | | | 7 | Stop |
| Ref. marks printed | | | | 8 | Stop |
| **Interpretation** not printed | Alt | 1 / 2 | 4 | 5 | Stop |
| printed | | | | 6 | Stop |
| **Normal/abnormal** not printed | Alt | 6 | 1 | Stop | |
| printed | | | 2 | Stop | |
| **Unconfirmed report** not printed | | | 3 | Stop | |
| printed | | | 4 | Stop | |
| **Pat. age** assumed <30 | | | 5 | Stop | |
| assumed >30 | | | 6 | Stop | |
| **Sensitivity** low | | | 7 | Stop | |
| High | | | 8 | Stop | |
| Rhythm Lead 1 | Alt | 3 | | | |
| Rhythm Lead 2 | Alt | 4 | | | |
| Lead I, II, III, aVR, aVL, aVF | Alt | 3 / 4 | 8 | 1, 2, 3, 4, 5, 6 resp. | Stop |
| Lead V1, V2, V3, V4, V5, V6 | Alt | 3 / 4 | 9 | 1, 2, 3, 4, 5, 6 resp. | Stop |

# 13.8    Changing the AT-104 PC Printing Paper

**i**    The thermo-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 in a cool, dark and dry area.
- Do not store near chemicals e.g. sterilisation liquids.
- In particular do not store in a plastic cover.
- Certain glues can react with the paper - do not attach the printout onto a mounting sheet with glue.

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

The recording paper should be replaced when the paper LED is lit and the end of the paper is indicated by a red stripe on the lower edge. After the indication first appears, there are about 8 pages left. However, we recommend that the paper be replaced immediately.

If no paper is left, the printing process is interrupted and the paper warning lamp starts to blink.

1. Push paper compartment release upwards, and pull paper tray away from the unit.
2. Remove the remaining paper.
3. Place a new paper pack into the drawer.
4. Check that the printed (grid) side is facing upwards, and place the beginning of the paper over the guide roller, replace the paper tray.
5. Press the paper tray firmly home (with a section of paper (grid side up) over the roller).

6. Press the **Stop** key to transport the paper to the start position.

# 14 Maintenance

**i**    All maintenance work must be carried out by a qualified technician authorised by SCHILLER AG. Only maintenance procedures given in this book, for example visual inspection, etc., may be carried out by the user.

The following table indicates the maintenance intervals, the maintenance requirement, and the person authorised to carry out the procedure.

| Interval | Service | Responsible |
|---|---|---|
| As required | • Medical panel calibration (see following)[1] | ➜ User |
| Every 6 months | • Keyboard test.<br>• Visual inspection of the unit and cables (see following). | ➜ User |
| Yearly or as defined by local regulations. | • All maintenance work performed at the six monthly interval.<br>• Recurrent and Functional tests according to the AT-104 PC Medical panel recurrent test service handbook (IEC 62353) | ➜ SCHILLER AG authorised technician |
| circa. every 48 months | • Replacement of backup battery if running time is substantially reduced. | ➜ SCHILLER AG authorised technician |

1. Only if the touch screen medical panel used.

# 14.1 AT-104 PC unit

### 14.1.1 Visual Inspection

### 14.1.2 Cable Assemblies

Visually inspect the patient cable, mains cables, and connecting cable assembly for the following:

→ Cable sheathing - no splits, scruff damage, signs of strain, or any other damage. No signs of excessive wear.
→ No kinks in the cable.
→ All Input/output connectors and pins straight and undamaged.
→ Damaged cable assemblies must be replaced immediately.

### 14.1.3 Medical Panel

Visually inspect the Medical Panel for the following:

→ Device casing not scuffed, broken or cracked. No signs of misuse.
→ Screen clear with no fault pixels. No scratching on the screen.
→ All Input/output connectors on the bottom panel undamaged and no signs of excessive wear.

### 14.1.4 AT-104 PC unit

Visually inspect the unit

→ Device casing not scuffed, broken or cracked. No signs of misuse.
→ All Input/output connectors on the back and side panels undamaged and no signs of excessive wear.
→ Damaged panels must be replaced.

## 14.2    Tests After Defibrillation

Check patient cable with cable tester. This is detailed in the service handbook.

## 14.3    Cleaning the AT-104 Casing and Cable Assemblies

**⚠WARNING**

▲  Switch off the unit before cleaning and disconnect from the mains by removing the plug. Do not, under any circumstances, immerse the apparatus into a cleaning liquid or sterilise with hot water, steam, or air.

**⚠ CAUTION**

▲  Do not autoclave the unit or any accessories.

▲  Do not immerse in liquid when cleaning.

▲  Use of cleaning solutions which have a high acid content or are otherwise inappropriate can cause damage to the equipment, including cracking and deterioration of the plastic case.

▲  Always follow the mixing/diluting instructions provided by the manufacturer of the cleaning solution.

▲  Never use any of the following solutions or similar products to clean the equipment: ethyl alcohol, ethanol, 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 unit, remain in place and remain readable.

Before cleaning the unit or any accessories, thoroughly inspect them.

• Look for any signs of damage and any improper mechanical function of buttons or connectors.

• Gently bend and flex cables, inspecting them for damage or extreme wear, exposed wires, or bent connectors.

• Confirm that all connectors engage securely.

The casing of the AT-104 PC and the cable assemblies can be cleaned with a cloth slightly moistened (not wet) on the surface only. Where necessary a domestic non-caustic cleaner or 70% alcohol solution can be used for grease and finger marks. Wipe the equipment with a cloth slightly moistened (not wet) with one of the approved cleaning solutions listed below.

Thoroughly wipe off any excess cleaning solution. Do not let the cleaning solution run into or accumulate in connector openings, latches, or crevices. If liquid gets into connectors, dry the area with warm air, and then check the equipment to confirm that it operates properly.

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### 14.3.1 Cleaning Cable Assemblies

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 equipment with a cloth slightly moistened (not wet) with one of the approved 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. Wipe off any excess cleaning solution. Do not let the cleaning solution run into or accumulate in connector openings, latches, or crevices. If liquid gets into connectors, dry the area with warm air.



### 14.3.2 Approved Cleaning Solutions

- 70 % solution isopropyl alcohol
- Neutral mild detergent solution
- All products designed for cleaning plastic.

### 14.3.3 Cleaning Materials that must not be used

Never use products containing the following:

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

## 14.4    Disinfection

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

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

### 14.4.1   Admissible Disinfectants

• Isopropyl alcohol 70%
• Propanol (70-80 %)
• Ethyl hexanal
• Aldehyde (2-4 %)
• Ethanol (70-80 %)
• all products that are suitable for ABS plastic

### 14.4.2   Non-admissible Disinfectants

Never use products containing the following:

• Organic solvents
• Ammonia-based detergent
• Abrasive cleaning agents
• 100% alcohol, Virex, Sani-Master
• Sani-Cloth, Ascepti or Clorox wipes
• HB Quat
• Conventional cleaner (e.g. Fantastic, Tilex, etc.)
• Conductive solution
• Solutions or products containing the following ingredients:
    – Acetone
    – Ammonium chloride
    – Betadine
    – Chlorine, wax or wax compound
    – Ketone
    – Sodium sal.

## 14.5    Cleaning the AT-104 Thermal Print Head

A residue of printers ink (from the grid on the paper) can build up on the print head over a period of time. This can cause the print quality to deteriorate. We recommend therefore that every month the print head is cleaned with alcohol as follows:

Extend the paper tray and remove paper. The thermal print-head is found under the paper tray. With a tissue dampened in alcohol, gently rub the print-head to remove the ink residue. If the print-head is badly soiled, the colour of the paper grid ink (i.e. red or green) will show on the tissue.

# 14.6    AT-104 PC Unit Battery Maintenance

The battery requires no maintenance during its life.

Replace the battery approx. every 4 years (depending upon application) when the battery running time falls substantially under one hour.

i    The battery should remain charged during storage. If the storage period exceeds three months, recharge the battery.

## 14.6.1    Charging the Battery

i    A totally discharged battery requires approximately 3 hours to be 80% charged, and approximately 15 hours to be 100% charged. It is possible to use the unit when the battery is being charged, however the charging time will be extended.

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

1. Connect the device to the mains but do not switch it on
2. The green mains LED is lit
3. Charge the battery for at least 7 hours

## 14.6.2    Battery Disposal

**⚠WARNING**

▲  Danger of explosion! Battery may not be burned or disposed of domestic refuse.
▲  Danger of acid burns! Do not open the battery.

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

## 14.7   Optional Medical Panel

### 14.7.1   Medical Panel Calibration

Two options are available to calibrate the screen as follows:

### 14.7.2   Standard Calibration

Standard Calibration function lets you match the touchscreen to your display so that the point you touch is accurately tracked on screen. Standard Calibration only requires four points for calibration and one point for confirmation. Under normal circumstance Standard Calibration is all you need to perform an accurate calibration.

### 14.7.3   Advanced Calibration

Advanced Calibration function improves the accuracy of calibration by using more involved engineering calculations. Use this function only if you have tried the Standard Calibration and there is still a discrepancy in the way the touchscreen maps to the display. You can choose 9, 16 or 25 points to calibrate, though we suggest that you first try 9 points, if it is still not tracking well then try 16 or 25 points. The more points you use for calibration, the greater the accuracy. Errors in calibration may occur due to viewing angle, or individual skill, and there may be little difference in using 16 or 25 points.

### 14.7.4    Procedure

Calibrate the screen as follows:

**i**

Note that a stylus is recommended for the most accurate results.

1.  Click the **Pen Mount Control Panel** icon (this icon will be located on the desktop of in the quick start notification area.
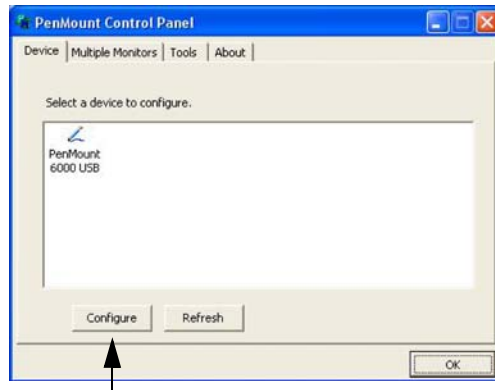
2.  Click the Configure icon. The following screen is displayed:
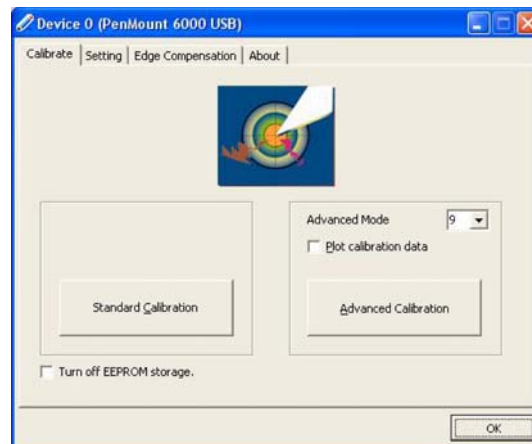
3.  Click the Standard calibration icon. The following screen is displayed.
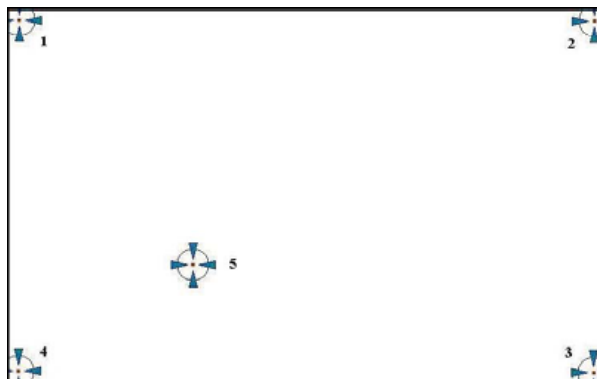


4.  Using the pointing device, to press the calibration points in sequence.

### 14.7.5    Advanced Calibration

i

The **advance calibration** (see step 2), gives more calibration points. Use this option for great accuracy when calibrating.
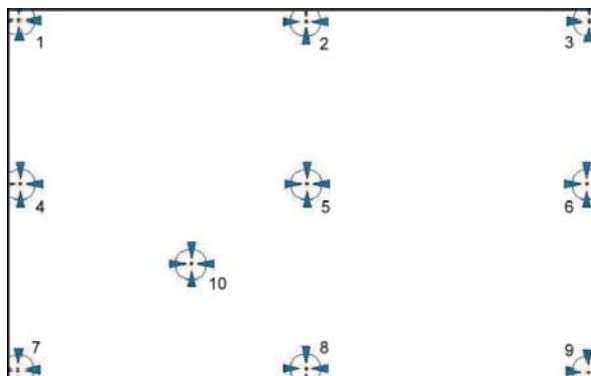
**Plot Calibration Data** (2)
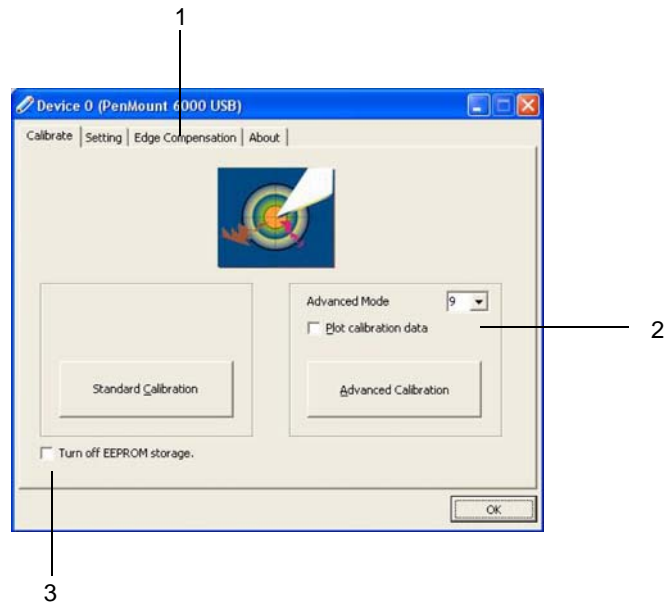


Check this function to have touch panel linearity comparison graph appear when you finish Advanced Calibration. The black lines reflect the ideal linearity assumed by Pen Mount's application program while the blue lines show the approximate linearity calculated by Pen Mount's application program as the result of user's execution of advance calibration.

### Turn off EEPROM storage (3)

This function disables the write-in of calibration data in the controller.

### Edge Compensation (1)

This page is the edge compensation settings for the advanced calibration. You can adjust the settings from 0 to 30 for accommodating the difference of each touch panel.

## 14.8   Medical Panel Mounting

The Medical Panel has a standard VESA mounting mount. Installation should be carried out by a professional technician.

The wall-mounting attachment comprises a back bracket and mounting bracket. Install as follows:

1.  Attach the back bracket to the rear of the unit and secure with four Phillips screws provided.
2.  Attach the mounting bracket to the wall or another flat surface.
3.  The back bracket slides vertically from the top into the mounting bracket and secured with four Phillips screws provided.

▲  Ensure the mounting bracket and Medical Panel are securely attached. Injuries can result if the Medical panel is not secured properly to the mounting bracket.
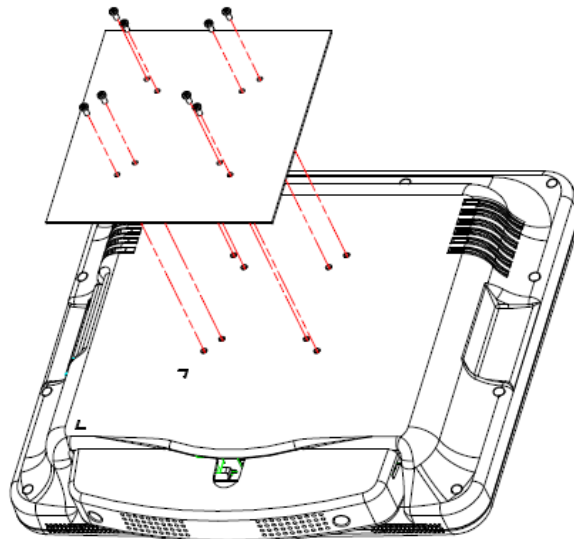
# 14.9 Accessories and Disposables

| ⚠WARNING | ▲ Always use SCHILLER replacement parts and disposables, or products approved by SCHILLER. Failure to do so may endanger life and invalidate the guarantee. |
|---|---|

Your local representative stocks all the disposables and accessories available for the AT-104 PC. A full 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 and provide any details for all SCHILLER products

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# 14.10 Inspection and Check List Report

In accordance with the maintenance interval detailed previously, the following check list should be copied and followed.

Unit Serial Number:

## 14.10.1 Every Six Months

| Inspection | Results | Check oK | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **General Examination**<br>➜ Visual inspection of the unit (and monitor). | • Device casing not broken or cracked. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ➜ Visual inspection of all cable assemblies and sensors. | • Electrode cable sheathing and connectors undamaged. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | • No kinks, abrasion or wear in any cable assembly. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ➜ Plug and socket connectors | • Input/output connectors undamaged. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| ➜ Keyboard | • keyboard keys functioning and no keys sticking | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Inspection Date** | | | | | | | | | | | | | | | | | | | | | |
| **Inspector**: | | | | | | | | | | | | | | | | | | | | | |
| Comments / Remarks: | | | | | | | | | | | | | | | | | | | | | |

### 14.10.2 Every Year

| Inspection | Results | Check oK | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Functional, safety checks and inspections**<br><br>➜ Confirm the date of last factory inspections and test. | • If the unit is due for the factory inspections and safety tests (every 12 months or according to local directives), return the unit to your nearest authorised SCHILLER agent. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Date Of Inspection:** | | | | | | | | | | | | | | | | |
| **Inspector:** | | | | | | | | | | | | | | | | |

### 14.10.3 Lifed Item Replacement Every 3 - 5 years

| Inspection | Results | Replacement | | | | | |
|---|---|---|---|---|---|---|---|
| **AT-104 PC Unit Internal Accumulator**<br><br>➜ Replace Internal Accumulator if operation falls substantially under one hour. | • Unit sent to SCHILLER service centre for accumulator replacement. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Date Of Replacement:** | | | | | | | |
| **Inspector:** | | | | | | | |

# 15   Technical Data

## 15.1   AT-104 PC Unit

| **Dimensions** | 230 x 150 x 50 mm, approx. 1.9 kg |
|---|---|

**Power supply**

| Mains Voltage | • 100 - 240 V (nominal), 50 / 60 Hz; |
|---|---|
| Power consumption | • 20 VA (Max) |
| Battery | • Operation with built-in rechargeable battery |

**Battery**

Nicad 7.2 V

| Capacity | • 1 hours of continuous ECG printout or 2 hours normal use |
|---|---|
| Battery Life | • Under normal operating conditions, 4 years |
| Recharging time | • 90 %: approx. 7 hours, 100 %: approx. 15 hours |

**Printer**

High-resolution thermal printing, 8 dots/mm (amplitude axis)

| Chart paper | • Thermo reactive, 90mm wide, perforation 90mm |
|---|---|
| Chart print-out speed | • 10/25/50 mm/s (manual print) |
| Sensitivity | • 5/10/20 mm/ms (manual print) |
| Recording tracks | • 3 channels, positioned optimally on 80 mm, automatic baseline adjustment |

**Environmental conditions (Operation)**

| Operating temperature | • + 10°C to + 40°C (+ 50°F to + 104°F) |
|---|---|
| Relative humidity | • 15 to 95 % (non-condensing) |
| Pressure during operation | • 700 to 1050 hPa |

**Environmental conditions (storage and transport)**

| Temperature transport | • - 10°C to + 50°C (+ 14°F to + 122°F) |
|---|---|
| Temperature storage | • + 5°C to + 50°C (+ 41°F to + 122°F) |
| Relative humidity (storage and transport) | • 10 to 95 % (non-condensing) |
| Pressure (storage and transport) | • 572 to 1050 hPa |

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### 15.1.1 ECG

| | |
|---|---|
| **Patient input** | Fully floating and isolated, defibrillation-protected (only with original SCHILLER patient cable) |

**Leads**
- 12 simultaneous leads
- Standard
- Cabrera

**Data Record**    ECG measurement results (intervals, amplitudes, electrical axes), average complexes with optional measurement reference markings.

**Filters**

Myogram filter (muscle tremor):
- Adjustable at 25 or 35 Hz

Line frequency filter:
- Distortion-free suppression of superimposed 50 or 60 Hz sinusoidal interferences by means of adaptive digital filtering

Schiller Baseline Stabiliser
- Filter that suppresses or significantly reduces baseline fluctuations without distorting the measured values (for resting and exercise ECG's)

Anti-aliasing
- Offline anti-aliasing of ECG curves

**ECG amplifier**    Simultaneous recording of all active electrode signals (= 12 leads)

Sampling frequency
- 1000 Hz

Resolution
- 5 µV

Frequency range
- 0.05 ... 150 Hz (IEC/AHA)

Measurement range
- dynamic ±10 mV, DC ±300 mV

Input Impedance
- >10 MΩ

Defibrillation protection
- 5000 VDC

Patient leakage current
- < 5 µA

## 15.2    Safety Standards

### 15.2.1    AT-104 PC Unit

| | |
|---|---|
| **Safety standard** | IEC/EN 60601-1 |
| | IEC/EN 60601-2-25 |
| **EMC** | IEC/EN 60601-1-2 |
| **Protection class** | I according to IEC/EN 60601-1 (with internal power supply) |
| **Conformity/Classification** | CE/IIa according Directive 93/42/EEC |
| **Safety class** | CF according to IEC 601-1, IEC 601-2-25, CSA, UL; IIb according to MDD 93/42/EEC |
| **Protection** | This device is not designed for outdoor use (IP 20) |

### 15.2.2    Medical Panel

| | |
|---|---|
| **EMI / Safety** | cUL 60601-1, FCC/VCCI class B, |
| | EN 60601-1(MDD)/EN 60601-1-2(EMC) |

**i**    Technical details of the medical panel are provided in the accompanying documentation.

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# 15.3   Electromagnetic Radiation

The user can help avoid electromagnetic disturbances by keeping the minimum distance between portable and mobile HF telecommunication devices (transmitters) and the MS-12 blue unit. The distance depends on the output performance of the communication device as indicated below.

| HF source | Transmitter frequency [MHz] | Power [W] | Distance [m] |
|---|---|---|---|
| Radio telephone (micro cellular) CT1+, CT2, CT3 | 885-887 | 0.010 | 0.23 |
| Cordless DECT telephone, WLAN, UMTS phone | 1880-2500 | 0.25 | 1.17 |
| Mobile phone USA | 850/1900 | 0.6 | 1.8 |
| Mobile phone<br>- GSM900,<br>- GSM850, NMT900, DCS 1800 | 900<br>850,900,1800 | 2<br>1 | 3.3<br>2.3 |
| Walkie-talkie (rescue service, police, fire brigade, service) | 81-470 | 5 | 2.6 |
| Mobile telephone system (rescue service, police, fire brigade) | 81-470 | 100 | 11.7 |

**i**   As a general rule do not use **portable** HF telecommunication transmitting devices within a radius of 3 metres from the MS-12 blue and its cables.

Further measures to prevent electromagnetic interferences:

The user can take the following measures to prevent electromagnetic interferences:

- Increase distance to the source of interference.
- Turn the device to change the angle of radiation.
- Connect the potential equalisation cable
- Connect the device to a different mains connector.
- Only use original accessories (especially patient cables).

**i**   For more information on the use in an electromagnetic environment in accordance with IEC/EN 60601-1-2, tables 201, 202, 204 and 206, please consult the service handbook.

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