mennen medical

EMS-XL

Electrophysiology System

USER MANUAL

DDE-965-001
Rev A August 2011

CE
0473

Conformity according to the Council Directive 93/42/EEC concerning Medical Devices as amended by 2007/47/EC

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Publication No. DDE-965-001 Ver 1.39
Revision: Rev A August 2011

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- Repairs are carried out by authorized Mennen Medical personnel only.
- Electrical installation of the room in which the system is installed complies with all aspects of the relevant internationally recognized electrical safety standards, as well as specific hospital requirements.
- The equipment is used in accordance with instructions for use.

EMS-XL User's Guide

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Chapter 1

What You Should Know

Intended Use of the EMS-XL System

The EMS-XL is a computerized Cardiac Electrophysiological Measurement System, designed for conducting regular or experimental electrophysiology (EP) studies.

The EMS-XL System is intended to be used for performing computerized Cardiac Electrophysiological and Ablation procedures.

The EMS-XL is intended for sale as a system for performing Cardiac EP clinical studies.

Using the EMS-XL System

Before commencing patient monitoring, always perform the following routine checks:

1. Check the system for signs of any mechanical damage.

2. Check all external leads, plug-ins and accessories.

3. Check all functions of the instrument needed to monitor the patient and ensure that the system is in proper working order

.

Do not use the EMS-XL System for any monitoring procedure on a patient if you identify features which demonstrate impaired functioning of the system.

Contact the hospital biomedical engineer, or a Mennen Medical Ltd. service engineer.

Notes:
For recommended EMS-XL System cleaning procedures, see *General Cleaning Procedures on page 8-1*.

For information on *Calibration and Preventive Maintenance on page 8-5*.

Replacement of the CPU Battery

Whenever the EMS-XL System is disconnected from the mains power supply, the CPU battery provides the back-up power to the system set-up.

In the event that the system is disconnected from the mains power supply for an accumulated period of 2 months (1440 hours) or more, or if it is only intermittently attached to the power supply, the CPU battery should be replaced.

Compliance

The EMS-XL System is designed to comply with (amongst others) the following international safety requirements for medical electrical equipment:

IEC 60601-1
IEC 60601-1-2
IEC 60601-2-27
AAMI (voluntary performance standards): ES1 EC-11

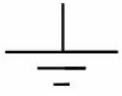
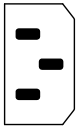
The European Directive of 93/42/EEC classifies the EMS-XL as a Class IIb device. The system is designed to have special protection against electric shocks and is defibrillator-proof.

The ECG application is classified as Type CF equipment for direct cardiac application. The EMS-XL provides protection against the effects of defibrillation and electrosurgery. If the correct electrodes are used and applied in accordance with the manufacturer's instructions, the screen display will recover within 10 seconds of defibrillation. Type CF equipment is designed to have special protection against electric shocks (particularly regarding leakage current) and is defibrillator-proof.

For descriptions and locations of the symbols used on the modules of the EMS-XL System, see Label Locations & Symbol Descriptions on page 1-4.

Label Locations & Symbol Descriptions

The following provides a short description of the meaning of various labels and symbols that appear on the EMS-XL System and identifies their location on the equipment.

Symbol	Description	Location
	Attention, consult accompanying documents. (Service to be performed by qualified technician; consult Service Manual before removing cover).	Isolation Transformer and front and rear panels on Amplifier
	ON (power from mains power supply)	Power switch (Isolation Transformer - front panel)
	OFF (power disconnected from mains power supply)	Power switch (Isolation Transformer - front panel)
	Defibrillation – Proof Type CF Applied Part	Amplifier - front panel (next to all ECG-related connectors)
	Earth	Isolation Transformer (rear panel)
	AC Output 220-240V: 10A	Isolation Transformer (rear panel)
	CE Approval by Notified Body	Manufacturer Identification Label (Isolation Transformer - rear panel)
	Date of Manufacture	Manufacturer Identification Label (Isolation Transformer - rear panel)

General Use of Accessories

- Use only Mennen Medical-approved accessories with the EMS-XL System. This includes - but is not limited to - those accessories approved for use with the Vital Signs Modules: ECG and IBP.
- Do not use a damaged accessory. Always refer to the instructions for use included with each accessory.
- A disposable (single patient) accessory should not be sterilized or cleaned for re-use.
- Use care when installing accessories such as adapters and cables.
  Do not use force. Do not cause tension in cables when connecting them to the vital signs modules.

Environmental Specifications

Operation

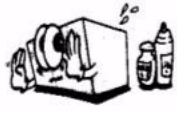
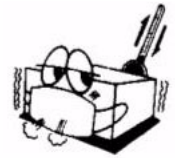
Mode of Operation	Continuous use during EP study.
Humidity	10%-93%, non condensing
Temperature	5°C to 35°C (41°F-95°F)

Environmental Conditions for Transport and Storage

Temperature	-15°C to68°C (5°F-158°F)
Relative Humidity	10%-93%, non condensing
Atmospheric Pressure	700hPa to 1060hPa

For easy reference, a table showing the Environmental Conditions and Situations to be Avoided is provided on the next page.

Table 1-1 Environmental Conditions and Situations to be Avoided

***Do not* operate EMS-XL System equipment in these environmental conditions.** **Always adhere to the safety instructions.**			Locations where sudden impact or vibration may occur.
	Avoid damp locations. Do not operate the equipment with wet hands.		Locations exposed to chemicals or explosive gases.
	Locations with large temperature fluctuations (Operational range: 5-35°C; humidity 10-93%)		Do not allow dust or metal debris to penetrate the monitors.
	Locations where: • moisture level may increase considerably • room is inadequately ventilated		Do not plug in the mains power cable until all installation procedures are completed. Damage can be caused to the equipment!
	Locations exposed to direct sunlight.		Do not pull directly on the mains power cable. Always hold the plug when pulling the cable out of the wall socket.
	Locations near electrical heating apparatus.		Do not dis-assemble the equipment! This should be done by authorized personnel *only*, otherwise Mennen Medical Ltd. will not be obligated to provide technical service.

Where to Find Information

This guide contains the following additional chapters:

Chapter 2 - Warnings and Precautions: includes detailed warnings and precautions you should adhere to.

Chapter 3 - Introduction: describes the main features and the hardware of the EMS-XL system.

Chapter 4 - Getting Started: describes the Run Time and Review screens and provides a short description of their funcutionalities. In addition it describes logging in and out of the application.

Chapter 5 - Setting Up Monitoring: describes how you can setup the run-time display as well as other parameters that can constitute a Configuration which you can save choose to load for an EP study.

Chapter 6 - Performing the EP Study: describes the steps involved in performing an EP study and how to perform them.

Chapter 7 - Case Playback: describes the Case Playback function which enables off-line review of a closed EP Study.

Chapter 8 - Care and Maintenance: describes the routine care and maintenance procedures and provides recommendations for the frequency with which they should be performed.

Chapter 9 - Offline Utilities: describes the available offline utilities: Configuration Setup Utilitiy and Archive Utility.

Chapter 2

Warnings and Precautions

Prescription Notice

Federal United States law restricts the sale and use of this instrument to qualified medical personnel only. In addition, the user should be properly trained in the use of the system. The instructions for use presented in this guide should in no way supersede established medical protocol concerning patient care.

Biocompatibility

All materials used in the patient cables and applied parts have been tested for biocompatibility by the OEM manufacturer(s) and are in compliance with the applicable standards on biocompatibility.

The following information contains general warnings and cautions for the user before initial use of the system. Specific warnings and cautions pertaining to the operation of part of the system or to an individual module, appear in the relevant section of the manual.

Radiation

Radio frequency (RF) generates an electromagnetic field. The intensity of the radiated field, at any point in space, is directly proportional to the source of the voltage, and inversely proportional to the distance from the source. In the case of Ablation, the active electrode, return plate, and their cables act as transmitting antennas.

Electromagnetic fields radiate perpendicular to their associated cables. Therefore, susceptibility of the ECG cable to this RF is maximum when the ECG cable is parallel to the Ablation cable. Separating or placing cables perpendicular to one another will minimize radiation coupling effects.

In summary, radiation interference can be minimized by the following:

- Using the lowest possible Ablation power setting.
- Keeping ECG cables as far from Ablation cables as possible.
- Keeping ECG cables at right angles to Ablation cables.

Transducer Protection

Immunity requirements of IEC Collateral Standard 60601-1-2 for Electromagnetic Compatibility are met with the transducers recommended for use with the unit.

SAFETY WARNINGS

A WARNING INDICATES A SITUATION IN WHICH THE USER OR THE PATIENT MAY BE IN DANGER OF INJURY OR DEATH.

Note: *This symbol is also used to signify a potential risk of permanent loss of data.*

Explosion Hazard

The equipment is not suitable for use in the presence of flammable anesthetic mixture with air or with Oxygen or Nitrous Oxide.

Electrical Shock Hazards

To eliminate the risk of electrical shock, always adhere to the precautions shown below.

- Do not touch the patient, bed or instrument during defibrillation.
- Before cleaning the monitor, switch the monitor OFF and disconnect it from the power supply and electrical outlet. After cleaning, or if liquid has accidentally entered the interior of the monitor, make sure that every part of the monitor is dry before reconnecting it the power supply. See Chapter 8 - Care and Maintenance for more information on cleaning the monitor.
- Access to any internal part of the EMS-XL System and/or the performance of any service procedures should only be carried out by a qualified technician, fully trained in the operation of the system.

For continued protection against fire hazard, fuses should be replaced only with those of the same type and rating. Disconnect the power supply before servicing.

Risk of Permanent Loss of Data

To eliminate the risk of permanent loss of data, always adhere to the procedure instructions provided in this manual.

CAUTIONS

A CAUTION INDICATES A SITUATION IN WHICH THE UNIT, OR DEVICES CONNECTED TO IT, MAY BE DAMAGED OR MALFUNCTION.

- The EMS-XL System is designed to conform to Electromagnetic Compatibility (EMC) standard IEC 60601-l-2 and will operate accurately in conjunction with other medical equipment which also meets this requirement.

  To avoid interference problems affecting the Monitor, do not use Monitor in the presence of equipment which does not conform to these specifications.

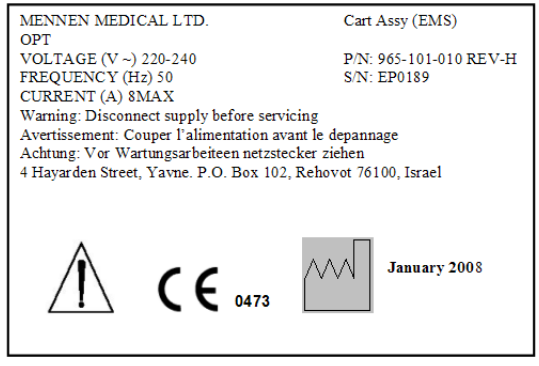
  Note: *The term "Monitor" refers to both the EMS-XL RT Monitor (Run Time) and the EMS-XL Review Screen.*

- Do not apply pressurized air to any outlet, or tubing connected to the monitor. Pressure may destroy sensitive elements.
- Do not store the system outside the specified temperature range
  (-20ºC to +65ºC [-4ºF to +149ºF]).
- Leave space for circulation of air to prevent the system from overheating.
- Do not subject critical components of the system to excessive heat, bending or magnetic fields.
- To prevent any liquid from entering the casing of the display screen, do not tilt the display more than 45 degrees *backwards*, or 15 degrees *forwards*, and ensure that the display screen is not exposed to knocking and bumping.

- Dispose of the entire device, or parts of it, in accordance with local environmental and waste disposal regulations.

Safety Rating and Manufacturer Identification Label

A Safety Rating and Manufacturer Identification label for the EMS-XL System is located on the *right* side of the isolation transformer rear panel.



As shown in the above example, the label includes the following warnings and compliance information:

- Identification information:
  Part Number (P/N), Serial Number (S/N), and model name.
- Electrical power information: Voltage, Current, and Frequency.
- Warnings: Disconnect supply before servicing.

Warning and Compliance Labels

The EMS-XL System is fitted with warning and compliance labels, located as follows:

- **Isolation Transformer**:

CAUTION - Electrical Shock Hazard
Do not remove the cover

- **Monitor**:

Note: *The term "Monitor" refers to both the EMS-XL Run Time (RT) Monitor and the EMS-XL Review Screen.*

Complies with DHHS radiation performance standards, 21 CFR subchapter J.

Complies with Part 15 of FCC rules.

Place of manufacture.

Chapter 3

Introduction

Overview

The EMS-XL is an advanced Electrophysiology Measurement System designed for use by cardiac specialists as a diagnostic aid when conducting electrophysiology (EP) studies on patients, in a clinical situation.

This dual-monitor system has 32 channels (or 64 [optional]) and features an integrated two-channel programmable stimulator, continuous *Full Disclosure* waveform storage, and two invasive BP channels. In addition, pacing protocols are integrated into the display and recording system.

Designed by EP professionals, the EMS-XL may be used for performing computerized EP and ablation procedures and is suitable for a variety of clinical applications. Ranging from simple EP diagnostic investigations to complex cardiac procedures.

The compact amplifier combines signal acquisition and cardiac stimulation capabilities. Inherent flexibility of the system, and easy-to-use stimulation protocols, enables the EP specialist to view, measure and focus on events of cardiac electrophysiological activity which occur either naturally, or are induced via external stimulation.

Introduction to Basic System Hardware Components

The EMS-XL system operates on a Windows® XP platform. Two 20" color monitors are mounted side-by-side on a central console. The dedicated **Run Time (RT) Monitor** (on the *left*) displays up to 32 (or 64) traces of continuous data in real time; the Review Screen (on the *right*) displays still trace images.

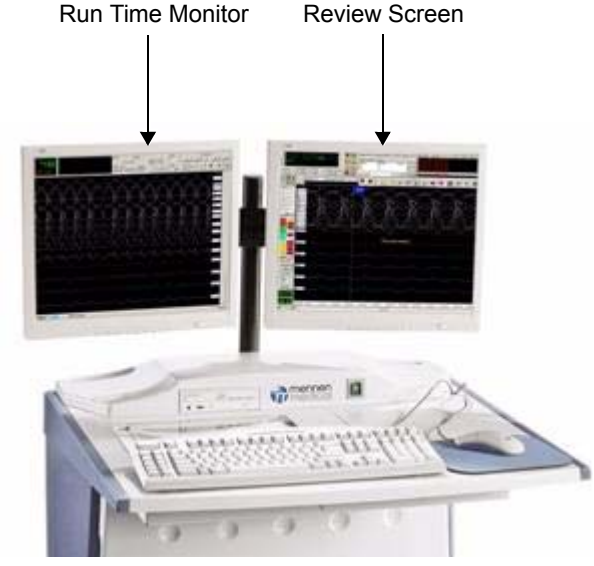


Figure 3-1 Typical EMS-XL System Configuration

During an EP study, acquired information is presented in graphic on-line displays (waveforms, traces), text format (reports, lists), as well as hard copy printouts (waveforms).
There are two options of the EMS-XL 32 and 64 channels. For the 32 channel option the system is supplied with one master amplifier, one patient box and a 10 lead surface ECG patient cable.
For 64 channel option the system is supplied with one

master amplifier and one expansion amplifier with 4 patient boxes and a 10 lead ECG cable.

Channel Allocation

Each of the channels has gain control and an Invert switch. The BP channels have a zero mode and calibration factor. The EMS-XL has 64 channels with the following characteristics:
Master Amplifier

Channels	Box	Mode	Filter	Note
1 to 12		ECG 12L	Selectable	
13 to 24	A 1-12	Mono or Bipolar	Selectable	Stimulator Output
25		Bipolar	40 Hz-Fixed	
26	BP cable	BP		No gain controls
27		Bipolar	40 Hz-Fixed	
28	BP cable	BP		No gain controls
29-32		Bipolar	40 Hz-Fixed	

Expansion Amplifier

Channels	Box	Mode	Filter	Note
33 to 44	B 1-12	Bipolar	40 Hz - Fixed	
45 to 56	C 1-12	Mono or Bipolar	Selectable	
57 to 64	D 1-8	Bipolar	40 Hz-Fixed	

Amplifiers

Amplifier 1

This amplifier is integral to the system and includes a built-in stimulator and the connections seen in Figure 3-2.

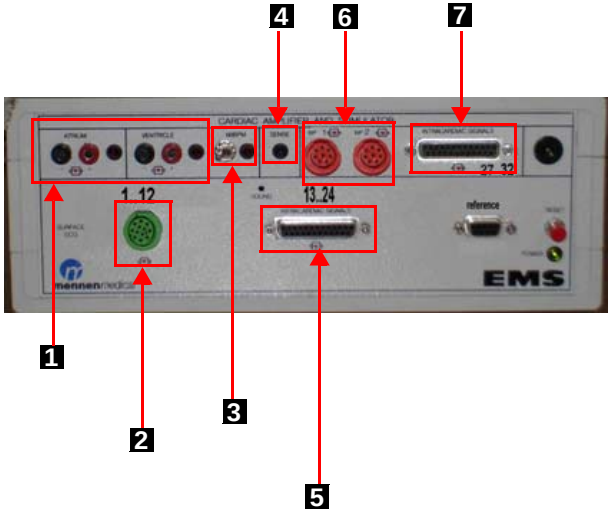


Figure 3-2 Amplifier Connections

1 Front connections Outputs of the Atrial and Ventricular stimulation. Used for service and not required for clinical use.stimulation.

2 1-12 surface ECG leads

3 60 BPM switch for stimulator testing

4 LED indicator- blinks when HR is detected.

5 13-24 ICECG leads

6 2 IBP channels .

7 27-32 ICECG leads

Amplifier 2 (for 64-lead Option)

This amplifier is an additional that includes 3 connectors to Intracardiac ECG leads. This amplifier is used for the 64 lead option
only.

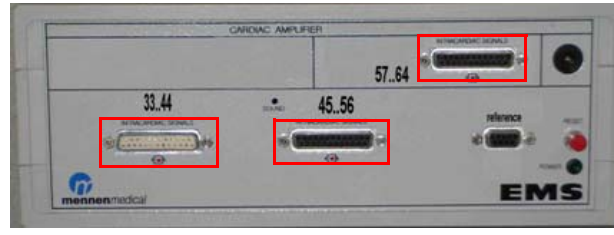


Figure 3-3 Additional Amplifier Connectors

Connection Boxes

The Connection boxes enable connecting the Intracardiac leads to the amplifier(s).
Each Connections box includes 12 plugs for Intracardiac leads and a cable to connect between the box and the amplifier.

- The 32 channel option- requires 1- 2 connection boxes.
- The 64 channel option- requires up to 5 connection boxes.

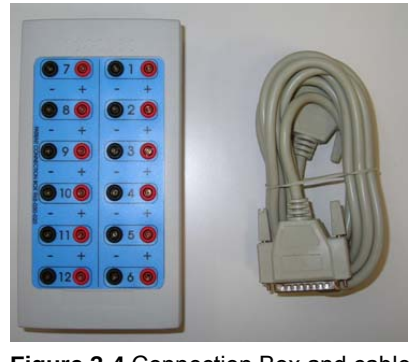


Figure 3-4 Connection Box and cable

EMS-XL Special Features

Comprehensive Full Disclosure

All sampled data is recorded during an EP study (*Full Disclosure* [FD]). This enables viewing of the information while the procedure is in progress, or during replay of the session in *Playback Mode*.
Patient data is written to the hard disk throughout the case.

Note: *For standard 32-channel systems, up to 16 hours per patient may be recorded. On EMS-XL Systems with the 64 channel option, up to 8 hours per patient may be recorded.*

During the case, snapshots may be saved as bitmap or JPEG images for future presentation. At the end of the case, all recorded study data may be archived to a DVD R/W, a CD R/W or a magnetic optical disk (MOD).

Computerized Integrated Stimulator

Two channels of programmable stimulators with all basic modes of pacing are integrated into the display. Also featured are automatic *increment*/*decrement* functions with triggered displays.

Continuous Case Log

The EMS-XL provides a window showing stimulation and marker events to quickly locate a region of interest (ROI). Clicking the associated event evokes display of the marker in *Full Disclosure* context.

Reports

The EMS-XL provides an instantaneous laser printout of all displayed traces or 12 lead printing (as selected), of either the RT Monitor or the Review Screen. Measured data and notes are automatically integrated into the fully editable Microsoft Word® Report.

Additional Features and Functions

The EMS-XL System supports the following functions:

- Programmable Stimulator - pre-defined or user-defined

pacing protocols; Burst pacing; Autopace.

- Stimulation protocols library (can be customized and extended).
- Playback of previous Case sessions.
- Event handling for both user-indicated events and system-generated events enable quick zoom-in on recorded information.
- Holter - enables minute-by-minute viewing of data (in the Review Screen) and jumping to event.
- Snapshot capture storage (Bitmap format) - saved on the local hard disk or DVD magnetic optical disk.
- Tachycardia detection - automatically detects onset of arrhythmia according to user-defined preferences.
- Ability to extract part or parts of a previous case, using time reference points (including all system and user events: marked events and stimulator activities) and save such data separately.
- Archiving of Full Disclosure (FD) information to DVD.
- SNRT (sinus node recovery time) automatically calculated.

Offline Utilities

- Configuration Setup utility for editing registry entries for EMS-XL configuration
- Archive utility for storing and restoring patient files.

EMS-XL Review Station - Complementary Product (Optional)

The EMS-XL Review Station enables viewing and playing back patient data files created in EMS-XL.

System Specifications

See the following pages for system specifications.

EMS-XL

Specification

A computerized cardiac electrophysiological measurement system intended for performing electrophysiological and ablation procedures

Hardware And Parameters:

PC—Personal Computer

- CPU: 2.4 GHz or Higher
- Memory: 512 MB or more
- Graphics Card: Matrox G450 Dual Head 1600x1200
- Network: Built-in Ethernet capability
- Optical Drives: DVD-RW
- Hard Drives: 80 GB or more
- Serial Ports: 2 for 32 channels, 3 for 64 channels
- Display resolution: 1600x1200
- Enclosure: Tower or Desktop System
- Dimensions for Tower:
  - Height: 420 mm (16.5 inches)
  - Width: 190 mm (7.5 inches)
  - Depth: 430 mm (16.9 inches)
- Dimensions for Desktop:
  - Height: 150 mm (5.9 inches)
  - Width: 380 mm (15.0 inches)
  - Depth: 460 mm (18.1 inches)

Laser Printer

- Parallel HP3005 or an equivalent

Displays

- 2 local displays: TFT/LCD 20" each
- 2 remote displays (Optional)

System Configurations

- Console or Cart
- EMS Console Dimensions (with external computer):
  - Width: 1050 mm (41.3 inches)
  - Width: 1180 mm (46.4 inches) with display
  - Height: 1300 mm (51.2 inches) with display
  - Depth: 820 mm (32.3 inches)
- Cart Dimensions (including displays):
  - Height: 1550 mm (61.0 inches)
  - Closed Position Width: 800 mm (31.5 inches)
  - Closed Position Depth: 700 mm (27.5 inches)
  - Open Position Width: 1150 mm (45.3 inches)
  - Open Position Depth: 600 mm (23.6 inches)

System Power Requirement

- 100-120 VAC, 12A, 50/60 Hz
- 230-240 VAC, 6A, 50 Hz

Environmental Operating Conditions

- Temperature:5°C to 35°C (41°F to 95°F)
- Humidity: 10 to 93 percent, noncondensing

Environmental Storage Conditions

- Temperature:-15°C to 68°C (5°F to 158°F)
- Humidity: 10 to 93 percent, noncondensing

Software

- Operating System Platform: Windows XP® Pro
- GUI: C++ MFC, Visual Studio 2003
- Video Board Driver: DIRECT X7
- MS Word 2007

Features

- Built-in stimulator
- Multiple display configurations
- User definable waveform color
- Caliper measurements
- Event marking
- Complete full disclosure playback
- Snapshot storage
- Versatile customized automatic reporting
- Holter mode
- Template comparison
- Interface availability for various ablators (RF Generators):
  MAESTRO 3000, EPT 1000 (Boston Scientific)
  IBI 1500T (Irvine Biomedical Inc)
  STOCKERT (Biosense Webster)
  ATAKR II (Medtronic)
  HAT 300 Smart (Osypka)
- Connectivity to Horizon Xvu –Hemodynamic System (combo)

Amplifier

Two options: 32 channels, 64 channels

ECG

32 channel amplifier:
12 Surface ECG, 18 Intracardiac ECG (12 Unipolar/Bipolar, 6 Bipolar)
64 channel amplifier:
12 Surface ECG, 50 Intracardiac ECG (24 Unipolar/Bipolar, 26 Bipolar)

- Defibrillation protection in the cable.
- Input Dynamic Range: ±5 mV peak to peak AAMI EC11 par 3.2.3
- Baseline Correction: ±300 mV AAMI EC11 par 3.2.3
- Input DC Offset: ±530 mV
- Notch Filtering: 50 Hz / 60 Hz
- High pass filter: 0.05, 0.2, 40, 80 Hz
- Low pass filter: 500 Hz
- Sample Resolution: 12bit
- Sample Rate: 1000 sample/sec
- Gain: 0.1 to 25.6 mV/cm
- Beat detection from any chosen lead
- Heart rate counting (beat by beat)
- Common Mode Rejection: 120 dB minimum
- Noise: 30 µV
- Input Impedance: 2.5 megaΩ
- Baseline Recovery: < 8 sec
- Ablation (RF) Filtering: 100 W
- Saturation Recovery < 1sec

Invasive Blood Pressure

- Channels: 2
- Input Sensitivity: 5 µV/V/mmHg transducers
- Pressure Range: -50 to +300 mmHg
- Zero Range: ±150 mmHg
- Total Dynamic Range: -200 to +450 mmHg
- Transducer Excitation: +5 VDC, with separate excitation driver for each channel
- Zero Accuracy: ±0.2 mmHg
- Zero Drift: Less than ±0.2 mmHg in 24 hours, at constant temperature
- Blood Pressure Accuracy: ±2 mmHg or ±2%, whichever is greater, exclusive of transducer
- Blood Pressure Linearity: Within 1% across entire range
- Common Mode Rejection: 100 dB minimum
- Digital Sample Rate: 480 Hz
- Sample Resolution: 24 bit
- Frequency Response: Operator Selectable: DC to 12 Hz
- Calculated Values: Systolic, Diastolic and Mean pressures

Stimulator

- Built-in
- Dual channel output
- Basic + 4 extra stimuli
- Programmable pacing controls
- Automatic or manual increment and decrement
- Auto snapshot after stimulation
- SNRT protocol
- Pulse Width: 0.1-9.9 msec
- Pulse Range: 0-25.5 mA, 40 V
- Pulse Interval: 70-9999 msec

Regulatory Approvals

- EN 60601-1
- EN 60601-1-1
- EN 60601-1-2
- Degree of protection against electrical shock
  - ECG, IECG and IBP = Type CF
- CE Mark (0473)
- FDA Approval K071348

We follow every beat of your heart

Chapter 4

Getting Started

This chapter describes the procedure for starting the EMS-XL application (Starting the EMS-XL Application on page 4-1) and exiting the application (Exiting the EMS-XL Application on page 4-35).

It also includes the following:

- Run Time Monitor on page 4-5: A description of the Run Time Monitor screen and its functionalities.
- Review Screen on page 4-15: A description of the Review screen and its functionalities.
- Printing on page 4-34: Printing information.

Starting the EMS-XL Application

The system is supplied ready for use, therefore no special set-up or installation procedures are required.

Note: *In some situations, a user password may be necessary to start the program (for example, when the EMS-XL system is networked to a hospital information system). For user access, contact your system administrator.*

You need to check if your system has 32 or 64 channels (One or Two Amplifiers).

Note: *Make sure that the program you are using is for 32 or 64 channels accordingly.*

❖To check the number of amplifiers:

1. Right-click the EMS-XL Icon.

2. Select Properties.

3. Set the Target to :

   "D\EPVersions\EmsOseRT_V1_1.37.exe" XX

   Where **1.37** serves as an example of the software version, and the value of **XX** is set according to the number of amplifiers: If the system has one amplifier **XX**=**32**, if two **XX**=**64.**

❖To Start the EMS-XL Program

- Double-click on the EMS-XL program icon  on the Run Time Monitor desktop (the monitor standing on the *left*).

  The EMS-XL program starts running; the Run Time Monitor opens with an initial display showing scrolling waveforms (see 4-1), and the Review Screen opens displaying still traces as shown in the example in Figure 4-3 Review Screen - Initial Display at Start-up on page 2-15.

  The Run Time Monitor layout, menus, and tools are described in the next section - see Run Time Monitor on page 4-5.

  An overview of the Review Screen layout, menus, and tools is provided in Review Screen on page 4-15.

  For a list of keyboard shortcuts, see Table 4-1 on page 4-3.

Note: *For details on using the Run Time Monitor and Review Screen during an EP study, see Chapter 6 - Performing the EP Study.*

Keyboard Shortcut Keys

Table 4-1 Keyboard Shortcut Keys and Functions

Key	Function
<F1>	Help Screen
<F2>	Configuration Menu
<F3>	Pacing Protocol list
<F4>	Note Dialog
<F5>	Sweep Speed of Real-Time screen
<F6>	Zoom all Real-Time channels
<F7>	Freeze Real-Time Screen
<F8>	Print all Real-Time Screen
<F9>	Cont A 600 - Stimulation
CTRL+<F9>	Cont 600V
<F10>	Basic A
CTRL+<F10>	Basic V
<F11>	Burst A
<F12>	Burst V
<G>	Start Stimulation
<SPACE>	Stop Stimulation
<A>	Start Automatic Pacing
<C>	Display and cancel Caliper
<S>	Snapshot
<M>	*Mark event*
<T>	Timer
<B>	Toggle Big Numbers view for Stim window

In addition to the keyboard shortcuts, you can use the following buttons:

- Click  to refresh the view. (This is particularly useful when using the EMS-XL Report feature).

- Click  (Help) to see the basic EMS-XL commands.
- Click **Open help file** to open a PDF of the User Manual

Note:*Close the Help panel before trying to activate any other function.*

Run Time Monitor

The layout of the Run Time Monitor is designed to provide effortless viewing of waveforms in *Real-time Mode*. The greater portion of the Run Time Monitor comprises the Traces Display (in the center). Above this, the screen is divided into three main areas (see Figure 4-1):

- Heart Rate and BP/Ablation windows (*left*).
- Information panel: patient details, date & time (*center*).
- Traces Display controls, and shortcut buttons (*right*).

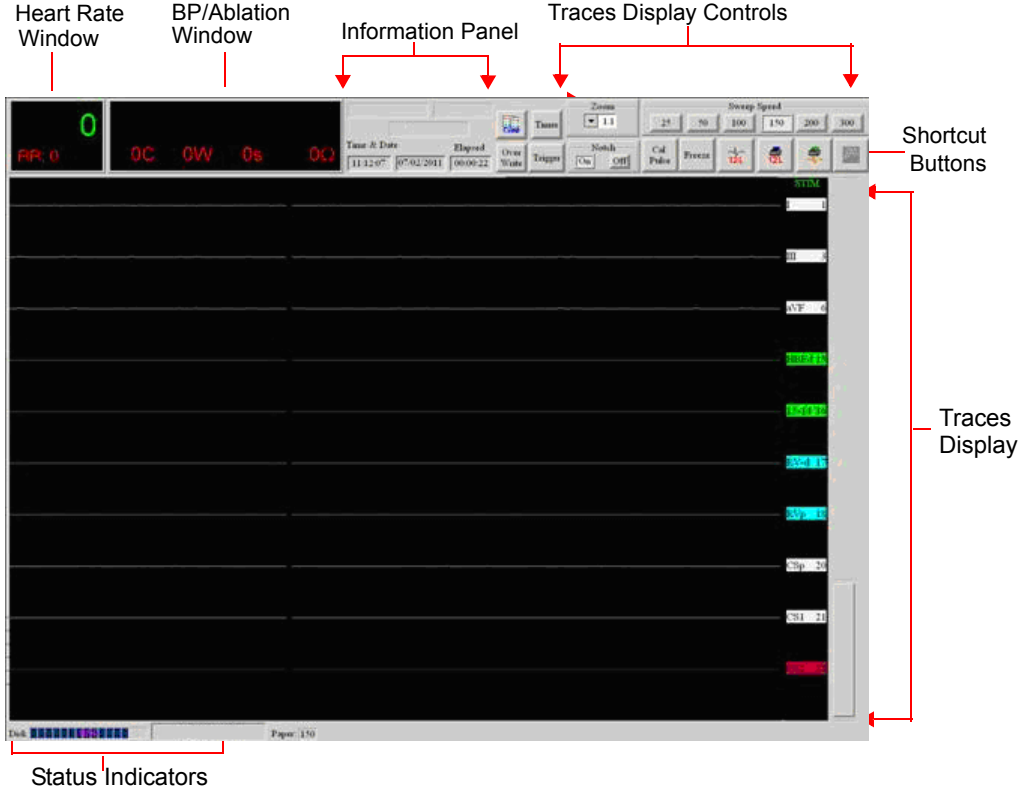


Figure 4-1 EMS-XL Run Time Monitor - Initial Display at Start-up

At this stage, the display appears empty, apart from flat traces, and the actual date and time. Since no patient is currently registered in the EMS-XL system, there is no monitoring of vital signs, and therefore channel waveforms are not visible.

When a patient has been registered (refer to Registering a Patient on page 6-2), waveforms and additional information can be seen, as shown in the example in Figure-4-2 below.

During stimulation and stimulation setting, the Zoom and Notch areas are used to display the stimulation parameters.

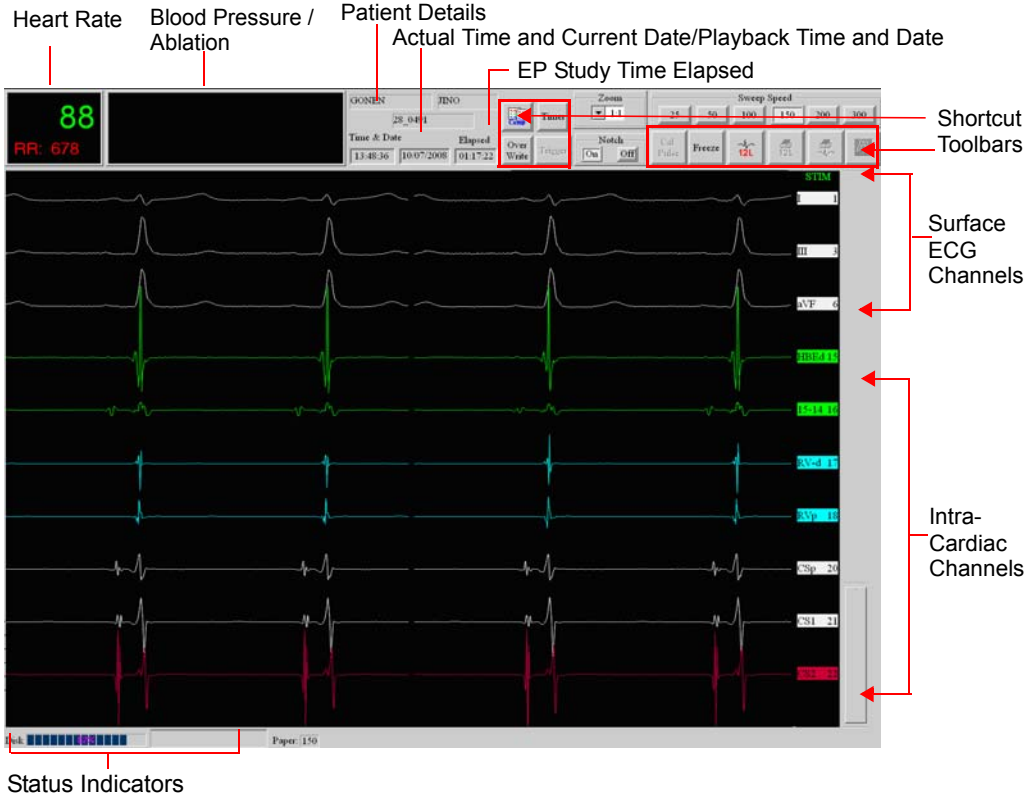


Figure 4-2 EMS-XL Run Time Monitor - Run Time Display

Hemodynamic Data

Patient hemodynamic data is visible in the Heart Rate (HR) and BP windows located at the top left of the screen.

The heart rate (beats per minute) is displayed in large green figures; the smaller figure in red underneath is labeled RR, and represents the RR Interval (distance in mSec between R to R peaks).

Note: *The flashing asterisk* on the left indicates sensing of the heart rate (HR).*

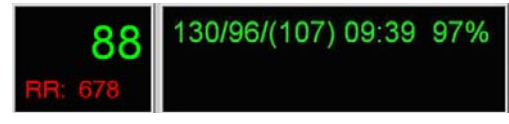
To the right of the HR, a dynamically-updated view of the patient's blood pressure is visible in the BP window.

Pressure values are shown in the following order:

Systolic/Diastolic/(Mean)

Note: *If the BP display setting has not been enabled from the Review Screen, BP values will not be visible in the Run Time Monitor and the area will appear blank. For details, refer to* *Setting Up BP Display on page 6-8.*

Note: *In Mennen Combo systems this area displays SpO2 and NIBP measurements, if measured from the patient. If the patient is connected to both an Invasive Pressure line and a NIBP cuff, only the IBP reading will show.*



Ablation Data

Ablation results are displayed on the RT screen inside the hemodynamic data window located at the top left of the screen.

The following information is displayed:

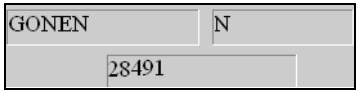
- Temperature in Degrees Celsius (acceptable range: 15-80).
- Power in Watts (acceptable range 1-150).
- Time in seconds (acceptable range 1-240).
- Impedance in Ohms (acceptable range 25-300).

Information Panel

Patient Details

To the right of the BP window, patient details are displayed in an information panel (in the center of the screen), in the following format:

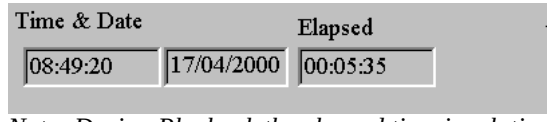
First Name Last Name
Case ID



Note: *Patient details are only displayed here when a case is started, or when Play-back Mode is activated in the Review Screen. In all other situations, these fields appear empty.*

Date and Time

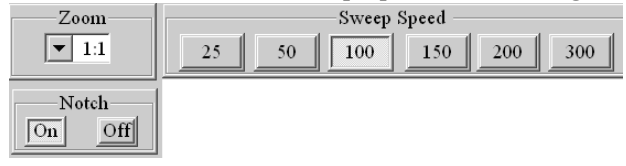
Below the patient details, the information panel displays the *actual* time and current date on the left, and the *elapsed* time (since the start of the case) on the right.



Note: During Playback the elapsed time is relative to the recorded elapsed time. Note, however, that since the playback is at a different speed than real time it is different than the actual elapsed time.

Traces Display Setup Panel

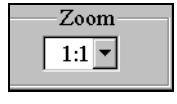
There are three display controls located on the right of the Information panel: *Zoom* and *Notch* are positioned one beneath the other, and *Sweep Speed* is on the right:



Note: *When the stimulator panel is on the Review screen, the Zoom and Notch area will be used to display the stimulation parameters.*

Zoom

Using the Zoom control, you can see the overall picture 'at a glance' or Zoom in to view the waveforms in greater detail - in much the same way that you would use a zoom lens on a camera. This is particularly useful for viewing events, or special regions of interest.



The Zoom display control has a combo box and is used to *increase* or *decrease* the display zoom factor.

Possible selections of a Zoom factor may be made from a drop-down list of the following pre-defined values:
1:1; 1:2; 1:4; 1:8; or 2:1.

Note: *The selection list may not be edited, and the default value is 1:1. This may be overwritten however, by loading any other configuration. For details, refer to* *Loading the System Setup for the Study on page 6-6.*

Note: *When selecting a Zoom factor, only the display of the waveforms in the RT Monitor will be affected. The recorded (FD) data will remain unchanged.*

Sweep Speed

Sweep Speed is the rate (in mm/Sec.) at which the waveforms are seen to move across the Traces Display (from *left* to *right*). Increasing the Sweep Speed will influence the Traces Display by making the waveforms move *faster*; decreasing the speed will make them move *slower.*

There are six Sweep Speed control buttons, positioned horizontally in one row and labeled (in mm/sec [incrementing from *left* to *right*]), as follows:

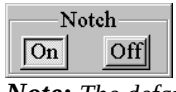
Each of the six buttons provides exclusive selectivity. The button corresponding to the currently-selected sweep speed appears as pressed; all others appear normal (and are ready for selection).

Note: *The default Sweep Speed is 100 mm/Sec.*
In Trigger Mode (only), any changes made to the Sweep Speed will have an effect on the positioning of the vertical line displayed on the RT Monitor.

Notch

The function of the Notch control is to *enable* or *disable* the 50Hz Notch Filter on the EP-Box amplifiers.

The Notch control has two buttons: ***On*** and ***Off***:



Note: *The default value is ON. However. this may be overwritten by loading any other configuration. For details, refer to* *Loading the System Setup for the Study on page 6-6.*

Run Time Monitor Shortcut Toolbar

Below the Sweep Speed controls and to the right of the patient information panel (*upper right* corner of the Run Time Monitor) there is a Shortcut Toolbar containing a row of buttons. These provide quick access to various frequently-used functions and are explained in Table 4-1.

Table 4-1: Run Time Monitor Shortcut Buttons and Functions

Button	Function
	Provides a comparison between a template and the Run Time screen. See Comparing the Run Time Screen to a Template on page 6-57
	Start, Stop and Reset Timer displayed on lower bar of the RT screen. *Note: Keyboard <T> performs the same function.*
	Save changes done online to the chosen screen configuration.
	Toggle between Sweep and Triggered.
	Activates Calibration Pulse (1mV).
	Used to *Freeze* the display. Button toggles between *Freeze/Unfreeze.* *Or use keyboard shortcut - press <**F1**> key.*
	Displays 12 lead ECG.

Table 4-1: Run Time Monitor Shortcut Buttons and Functions

Button	Function
	Activates 12 lead printout.
	Activates displayed channels printout.
	Activates Calipers (used for performing interval measurements). In *Run Time Monitor*: only available in *Trigger Mode.*

Traces Display

The waveforms visible in different portions of the Traces Display, are as follows:

- Surface ECG channels
- Intra-cardiac channels
- BP channels

Surface ECG Channels

In Figure-4-2, traces from five surface ECG leads may be seen at the top of the Traces Display. Each waveform is labelled (on the right) with an associated channel.

Up to 12 channels (# 1 through 12) may be displayed here, as required.

Intra-cardiac Channels

The next three rows of traces beneath those of surface ECG (refer to Figure-4-2), show waveforms input from the intra-cardiac channels.

Up to 20 (or optional 52) intra-cardiac channels (#13 and *onwards*) may be displayed here. However, one or two of these channels may be used for the display of BP signals, if required.

BP Channels

Below the intra-cardiac waveform signals, there may be one or two BP channels displayed.
Note: *If you choose not to display BP channels, the lower portion of the screen is used to display Intra-cardiac signals.*

The total number of channels displayed in the Run Time Monitor reflects the currently-selected settings. These may be changed from the Run Time Monitor, using the tools provided in the Review screen - see Setting Up Surface ECG Channels on page 5-11 and Zoom Control on page 4-33.

Note: *The settings may also be changed by loading a pre-defined (or customized) configuration setup. See Loading the System Setup for the Study on page 6-6.*

The word STIM is visible in green letters at the top *right* corner of the Traces Display. This is associated with anything displayed adjacent to (and on the left of) this, and provides a visual indication of Stimulator Spikes.

When in Trigger Mode, a single, vertical white line is visible on the Traces Display. All information displayed to the *right* of this line represents the last (most recently updated) beat.

Caution: Some of the software keys in the EMS-XL do not show the active Status, but the Response to the activation of the key.

Status Bar and Indicators

The Status Bar, located beneath the Traces Display and extending the full width of the Run Time Monitor, displays indicators showing general system information and application modes, as described below (from *left* to *right*).

Disk Space

This window indicates how much free space is still available on the system hard drive, during recording.

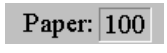
Warning: Do not allow the disk to be full - Delete files when you reach 85 %

Note:

- *When the disc reaches 85%, it will not be possible to start a new case unless files are deleted.*
- *When the disc reaches 85% during a case, a warning panel, that allows file delete will be presented.*
- *If the disc reaches 90% a warning panel will appear every 5 minutes*
- *When the disc reaches 92% the case will be terminated.*

Paper Speed

Shows the currently-selected printer paper speed setting (mm/sec).

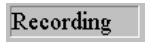


Recording/Playback/Pause

This indicator shows the current system status and will display one of the following:

- **Playback** - a recorded case is being played back

  Note: *if the indicator appears grayed out, Playback mode is currently inactive.*

- **Recording -** a case is being recorded 

- **Pause -** a case is not being recorded to file.

Review Screen

When the Review Screen is activated at system start-up (refer to Starting the EMS-XL Application on page 4-1), it initially opens displaying still traces as shown in the example below.

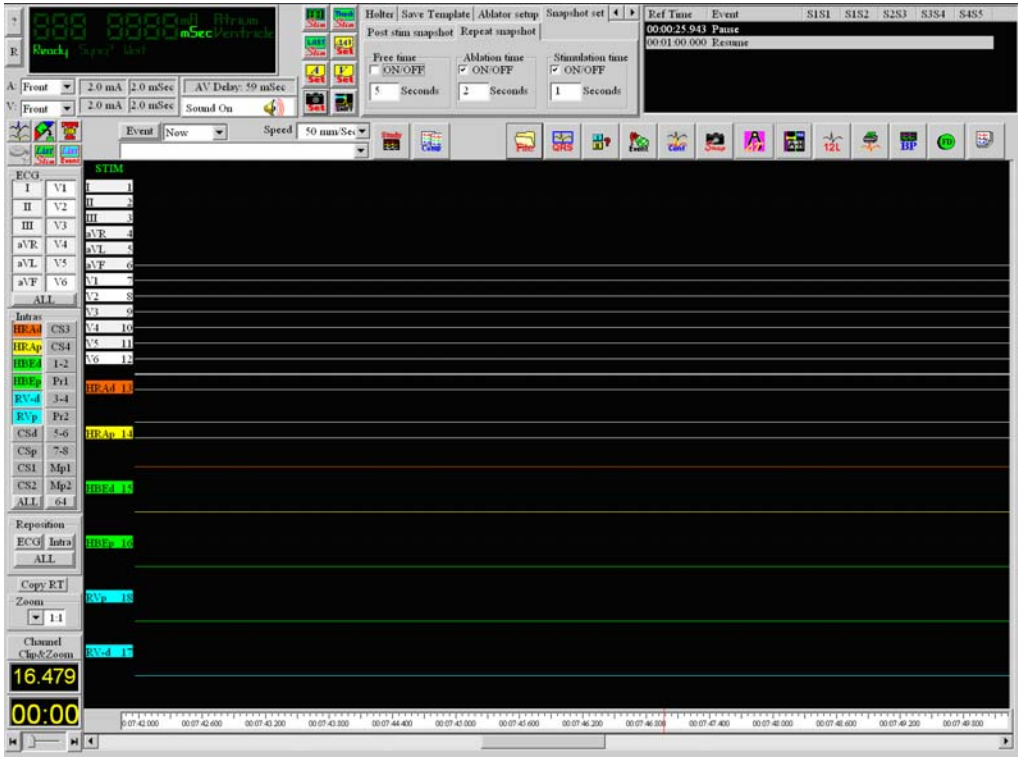


Figure 4-3 Review Screen - Initial Display at Start-up

Note: *The Review Screen is subject to the registration of a patient - if no patient is currently registered, the screen will show blank traces .*
Once a patient has been registered, the Review Screen display will appear as shown in the example in 4-4.

The Review Screen is dedicated to the measurement and uninterrupted manipulation of data and provides a view of waveforms based on the *Full Disclosure* (FD) data. This enables you to focus on events, control stimulation protocols, perform measurements, and study various relationships of the cardiac complex.

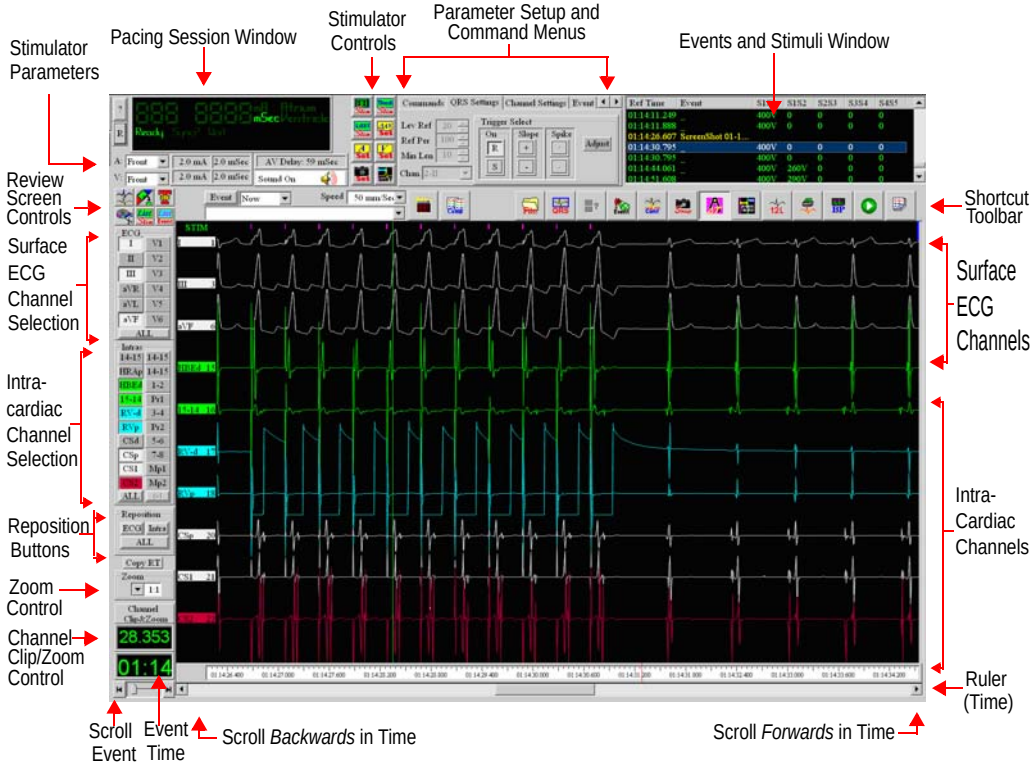


Figure 4-4 EMS-XL Review Screen - after Patient Registration

As can be seen in Figure-4-4, the greater portion of the Review Screen comprises the Traces Display (in the center); the areas *above* and to the *left* of the Traces Display provide you with easy access to the various menus and buttons, as described in the following sections.

Designed for the execution of programmed stimulation protocols working with one or more extras, and in conjunction with auto-snapshot, the Review Screen offers a triggered display at up to 300 mm/sec, focused around the last extra.

The last extra (or with shorter intervals, the last two stimuli) is displayed, and the screen refresh is triggered each time by the last extra.

A pair of electronic calipers is used to indicate the time of atrial or ventricular activation, and the conduction time. In combination with the automatic *increment*/*decrement* mode of the stimulator, you can easily observe the execution of the pace protocols.

Updating images is accomplished automatically at the end of stimulation, or manually by clicking the *Snapshot* shortcut button (described below). When the Calipers are used to measure intervals, the measured intervals are included in the final report.

When the mouse scrolls over a lead (in NRT) the waveform changes its color temporarily to orange. This makes the selected lead stand out from all the rest and helps studying it.

Upper Panel Controls

Help 

The  icon on top, left of the Review screen provides basic EMS-XL commands.

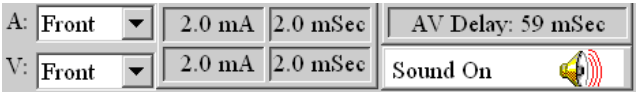
Pacing Session Window

The Pacing Session window is located at the *upper left* corner of the Review Screen.

When the Stimulator is activated, this window provides a useful view of the Pacing session and also indicates the current pacing protocol.

Stimulator Parameters

The Stimulator Parameters are written in the 8 fields, visible below the Pacing Session window. Here the current Stimulator parameter settings are displayed, showing the characteristics that have been defined via the Stimulator Setup commands. The fields showing the output amperage and length are read-only fields. The A and V channel selectors are drop-down lists for choosing the channel output.



Note: *For more details, see Using the Stimulator on page 6-15.*

Stimulator Controls

Table 4-2: Stimulator Tool Bar Buttons and Functions

Button	Function
	Click to access the Stimulator program. See page 6-23. Stimulation panel Actual stimulation
	Click to access Stimulator *Threshold* setup. See page 6-21. Stimulation threshold Actual stimulation
	Click to access the Last Stimuli tab
	Click to access A-V coupling interval setup for stimulation of both Atrium and Ventricle.
	Click to access Stimulator pulse (*Atrium*) setup.
	Click to access Stimulator pulse (*Ventricle)* setup.

Table 4-2: Stimulator Tool Bar Buttons and Functions

Button	Function
	Click to jump to Auto Snapshot Setup (Stimulator setup sub-menu).
	Click to activate Sinus Node Recovery Time (SNRT) measurement. (This is a one-time procedure, testing the recovery of the sinus node). For details see The SNRT Procedure on page 6-45.

Review Screen Controls Toolbar

Table 4-3: Review Screen Tool Bar - Buttons & Functions

Button	Function
	Controls trace thickness. This button has 4 states: Click once for thick trace lines on NRT; click twice for thick lines on RT; click 3 times for thick lines to appear on both screens; click 4 times to return to regular trace line thickness. This feature allows for a clearer view of traces when snapshots are presented on slides.
	Saves a snapshot of the Review Screen to file. Used to take a snapshot of the currently-displayed traces and save it in various image formats (default format is JPEG).
	Click to open Insert Text window. Used to type text on the display.

Table 4-3: Review Screen Tool Bar - Buttons & Functions

Button	Function
	Saves a partial Case to file. Enables you to cut part of a case and create a shorter case, saving it as a new file. For example, cut 2 hours from a 5-hour study.
	Click to open Stimulation List window.
	Click to open Event List window.

Review Screen Shortcut Toolbar

The Review Screen Shortcut Toolbar is located below the Command Menus and Events and Stimuli List - refer to Figure-4-4. It contains a row of buttons that provide quick access to frequently-used functions, as shown in Table 4-4.

Note: *During playback and when no case is selected some of the icons will be dimmed (this means that the function is unavailable.*

Table 4-4: Review Screen Shortcut Toolbar

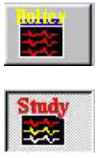
Button	Function	No case	Playback
	Toggle between Holter and Study (Normal) view. **Holter mode** - Click to display one minute of single lead (Default - lead II) at 25 mm/min. See Setting Up BP Display on page 6-8 for details. **Study**- Cancels the Holter view, returning the study to normal view.	Yes (only Study)	Yes
	Provides a comparison between a template and the Run Time screen on the right side of the NRT screen. See Comparing the Run Time Screen to a Template on page 6-57.	Yes	Yes
	• Opening a patient file: See Registering a Patient on page 6-2. • Add online Notes. See Adding On-line Notes on page 6-48. • Reports generator: See Editing the EMS-XL Report on page 6-60. • Exiting EMS-XL application. See Exiting the EMS-XL Application on page 4-35. • "Set up printing. See Printing from the Run Time Monitor Screen on page 6-51.	Yes	Yes
	Click to add Notes to a Case. *Note: Or use keyboard shortcut - press <**F3**> key.* See Adding On-line Notes on page 6-48.	No	Yes
	Opens the QRS settings Tab to set the Heart Rate source channel and settings. See QRS Settings on page 4-25.	Yes	No
	Click to access Channel Select commands. For details, see Channel Select - Run Time Screen on page 5-7.	Yes	Yes

Table 4-4: Review Screen Shortcut Toolbar

Button	Function	No case	Playback
	Click to access the Mark commands menu. For details, see Marking an Event on page 6-28.	No	Yes
	Click to access the Config commands menu. *Note: Or use keyboard shortcut - press <**F4**> key.* For details, see Loading the System Setup for the Study on page 6-6 and Saving and Loading a Configuration on page 5-17.	Yes	Yes
	Click to copy snapshot of the current display of the patient's waveform status in the RT Monitor to the Review Screen. *Note: Or use keyboard shortcut - press <**S**> key.*	No	No
	Click to activate Calipers for performing interval measurements. See Using the Calipers for Interval Measurements on page 6-32 .	Yes	Yes
	Click to activate Traces Location bar - used to associate a measurement with a location. See Using the Calipers for Interval Measurements on page 6-32.	Yes	Yes
	Click to activate 12 lead printout.	No	Yes
	Click to activate displayed channels printout.	No	Yes
	Click to access BP Display commands. See Setting Up BP Display on page 6-8.	Yes	Yes
	*Note: Available in Run-Time Mode **only**.* Click to *stop* saving Full Disclosure data to the system hard disk. The FD button changes color and becomes a red "stop sign". Click again to *resume* saving FD data to the hard disk.	No	No

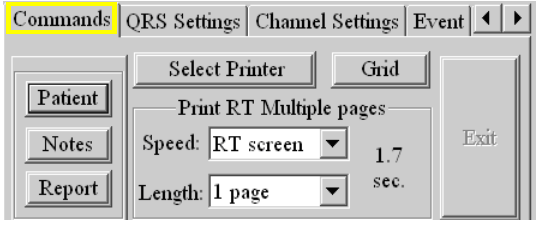
Table 4-4: Review Screen Shortcut Toolbar

Button	Function	No case	Playback
	*Note: Available in Playback Mode **only**.* *Click to start playback of the event case from a time selected in the lower left corner of the Review screen*	No	Yes

Parameter Setup and Command Menus

The Parameter Setup and Command Menus are centrally located in the upper portion of the Review Screen. Each group of commands can be identified by labelled tabs at the top of the screen. Use the scroll arrows (*left* and *right*) to access the required tab; the command groups and functions are described below.

Commands



Note: *You can display the Commands menu directly by clicking the File*  *icon on the Review screen shortcut toolbar (see Review Screen Shortcut Toolbar on page 4-21).*

The three buttons on the left (*Patient*, *Notes*, and *Report*) are used to access the following windows: ***Patient & Study Information***, ***Notes,*** *and* ***Report Generator***, respectively.

Use the *Select Printer* button (in the center) to access the ***Select Printer*** window to choose the printer you want to use. Use the panel to set Print Speed (mm/sec) and the number of pages to be printed.

Click the ***Exit*** button to quit the EMS-XL program (and return to the Windows desktop).

See:

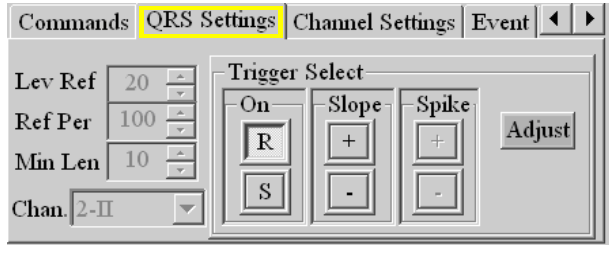
Registering a Patient on page 6-2.

Adding On-line Notes on page 6-48.

Editing the EMS-XL Report on page 6-60.

Printing on page 6-51

QRS Settings



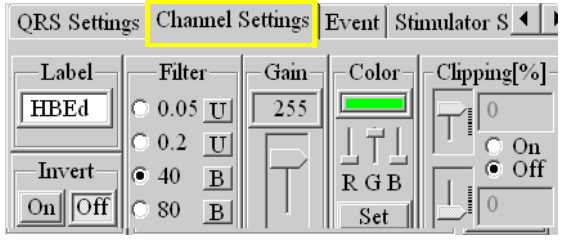
This panel enables setting the channel from which the HR will be measured.

Use the **Chan**.combo box to select the HR source from a list of Surface and Intra-cardiac channels (1-32 or 1-64 [optional]), named according to the current configuration.

Use the other combo boxes to adjust the HR detection

See: QRS Settings on page 6-12

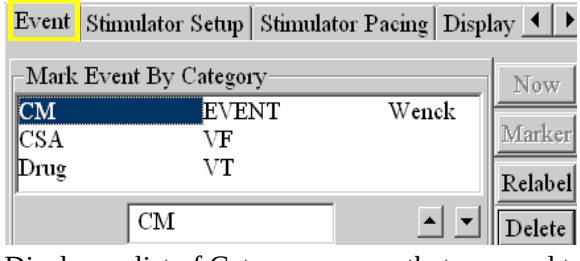
Channel Settings



Use to set up various channel parameters of the RT waveforms.

See: Channel Select - Review Screen on page 5-11.

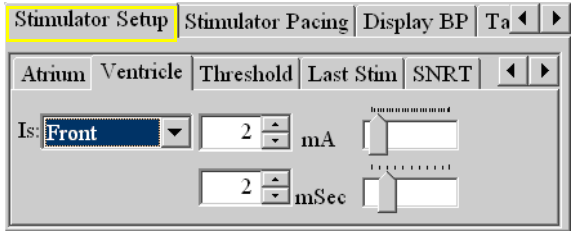
Event



Displays a list of Category names that are used to mark events during the procedure. You can scroll through the list, using the *up* and *down* arrows

See: Marking an Event on page 6-28.

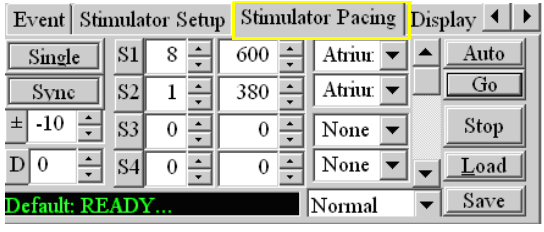
Stimulator Setup



The Stimulator Setup tab has nine sub-groups: Sound, AV delay, atrium, ventricle, Threshold, Sensing Counter, Auto Snapshot, Last Stim and SNRT. Each provides access to the Stimulator control settings.

See: Using the Stimulator on page 6-15.

Stimulator Pacing



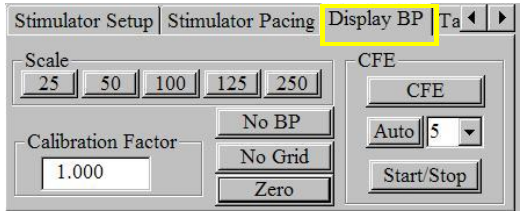
Used for conducting all pacing & stimulation protocols and provides tools for achieving precise control of the Stimulator Pacing settings. There are five sets (S1-S5) available. The panel gives access to continuous/single stimulation, sync/non-sync stimuli, automatic increment/decrement stimulation and loading pre-saved protocols at ease and in one screen.

See:

Using the Stimulator on page 6-15

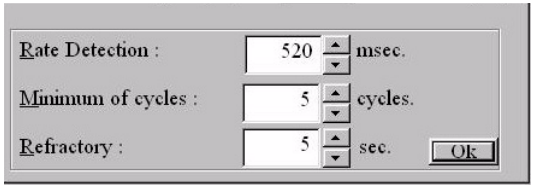
Automatic Pacing on page 6-24

Display BP



Use the Display BP panel to set up the BP display: Activate/Deactivate, Grid/No grid, Zero and to activate the display of the NIBP and SpO2 from the CFE in COmbo systems. See: Setting Up BP Display on page 6-8.

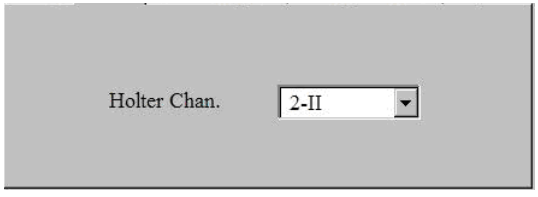
Tachycardia



Use the controls under the Tachy tab to set the system parameters for the detection and recognition of tachycardia

See: Setting Up Tachycardia Detection on page 5-21

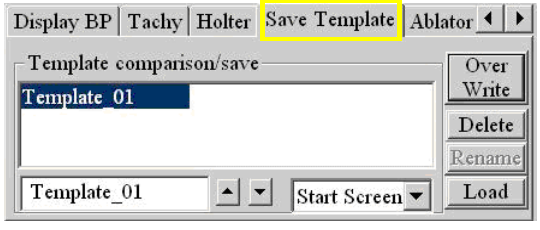
Holter



Enables choosing the channel which will be shown in Holter mode.

See: Setting Up the Holter Display Mode on page 5-22

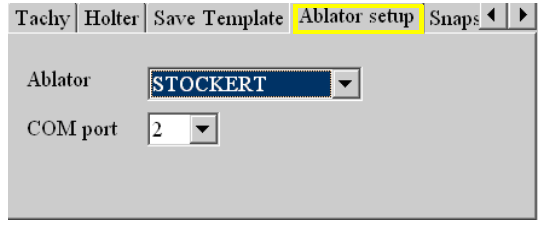
Save Template



Enables saving a section of the recording as a template for future comparison to the real time recording.

See: Creating a Template on page 6-56

Ablator Setup



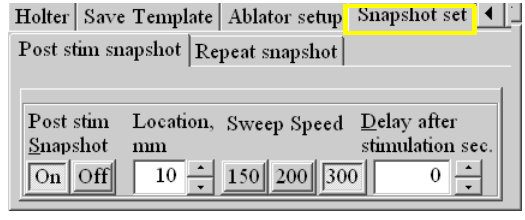
The EMS-XL has interface ability for connectivity to a Generator. See Setting Up Ablation on page 5-28 for a list of Generators that have this ability.

Use this window to select the abalator and the COM port to connect to.

See: Ablation Events on page 6-37

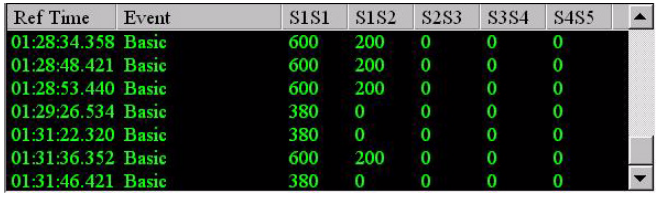
Snapshot Setup

Enables changing the settings of the snapshots that are taken automatically after each stimulation (Post stim snapshot tab) and setting the ability for automatic repeat snapshots taken during stimulation and/or ablation (repeat snapshot tab).



See Setting Up the Stimulator Auto Snapshot on page 5-26

Events and Stimuli List



Ref Time	Event	S1S1	S1S2	S2S3	S3S4	S4S5
01:28:34.358	Basic	600	200	0	0	0
01:28:48.421	Basic	600	200	0	0	0
01:28:53.440	Basic	600	200	0	0	0
01:29:26.534	Basic	380	0	0	0	0
01:31:22.320	Basic	380	0	0	0	0
01:31:36.352	Basic	600	200	0	0	0
01:31:46.421	Basic	380	0	0	0	0

At the *upper right* corner of the Review Screen, a window displays the Events and Stimuli List. This provides a visual, time-referenced display of all events and stimuli during the case. You can easily scroll through the list using the scroll bar or *up*/*down* arrows.

- Double click a listed event to display the signals during the event on the Review screen. Note that the left side of the scale at the bottom of Review screen is set to the time of the event.

Left Panel Controls

ECG and Intra-cardiac Channel Selection Buttons

These buttons control the channel set-up of the Review screen.

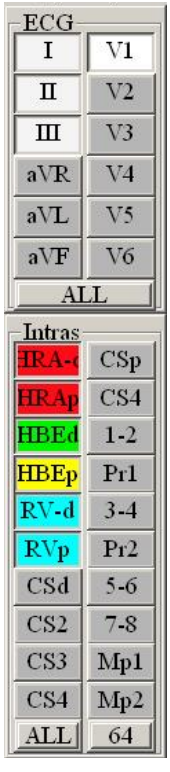


Figure 4-5 ECG and Intracardiac Selection Buttons

❖**To Display (turn ON) a Channel:**

- **Click** on the required ECG / Intra-cardiac channel button (or click ***ALL*** to display all channels).

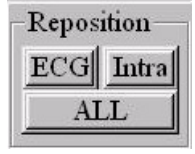
❖**To Remove (turn OFF) a Channel:**

- **Click** on the appropriate ECG / Intra-cardiac channel button (one that appears pressed) (or click ***ALL*** to remove all channels).

❖ **To change the color for the channel:**

- Right-click the selected channel and select the new color.

Reposition Buttons



Use **Reposition** buttons to control the view of the currently-displayed Surface ECG and/or Intra-cardiac ECG channels

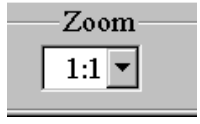
Click to re-position the channels vertically and to re-distribute them evenly on the screen.

Right-click arranges channels in sequence with equal spacing.

Copy RT

Click **Copy RT** to copy the Run Time screen channel setup to the Review Screen.

Zoom Control



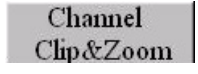
Use **Zoom** control combo box to select required zoom option.

Selections may be made from the following pre-defined values: 1:8; 1:6; 1:4; 1:3; 1:2; 1:1; 2:1; 3:1; 4:1.

Note: The selection list may not be edited; the default value is 1:1.

Note: It is possible to change the zoom directly (without entering properties) of the channel by buttons "UP" and "DOWN" of the keyboard, or by means of scroll button of the mouse. If channel label is selected, it's color is grey/purple.

Channel Clip and Zoom Control



Use **Channel Clip and Zoom** control to clip and zoom the view of a *specific* Surface ECG or Intra-cardiac ECG channel.

Click to access the appropriate windows.

Event Time

Use the slider to set the time for playback of a specific time.

The time from the start of the case is displayed in the window.

Printing

You can print from the Run Time Monitor screen (see Printing from the Run Time Monitor Screen on page 6-51) and from the Review (NRT) screen (see Printing from the Review Screen on page 6-53).

Note: Due to difference in printer paper size and display size, the printed page does not include the same information as the display. A red marker at the bottom of the display indicates the printer page end.

Screen / Print Size Information

Table 4-6 gives the time range (in milliseconds) covered by one printed page under different printing speeds and page sizes. It also presents the percetage of the NRT screens in Study and Holter modes covered by different page sizes.

Table 4-6: Screen / Print Size Information

Speed mm/sec	A4 Page	Letter Page
25	11,200	10,400
50	5,600	5,000
100	2,800	2,500
150	1,900	1,700
200	1,400	1,300
250	1,100	1,000
300	950	~850
% from NRT Study screen	~70%	~63%
% from NRT Holter screen	~100%	~90%

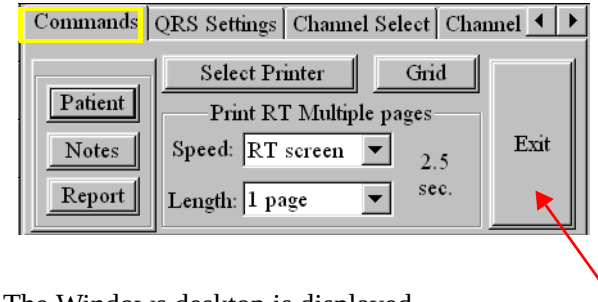
Exiting the EMS-XL Application

Before exiting the program you need to close the patient case (see Ending a Case on page 6-64).

❖To exit EMS-XL

In the **Commands** menu at the top of the Review Screen click **Exit**.

Note: *You can display the Commands menu directly by clicking the File*  *icon on the Review screen shortcut toolbar (see page 21).*



The Windows desktop is displayed

Chapter 5

Setting Up Monitoring

Before starting Medical Procedures it is possible to set-up certain parameters according to specific EP Lab requirements. These parameters are saved from patient to patient and do not need to be changed after each procedure.

You can define the screen layout and channel settings and save the settings in a Configuration file. The following sections detail the procedures involved in building a configuration and saving it:

- Setting Up Traces Display on page 5-2
- Channel Select - Run Time Screen on page 5-7
- Channel Select - Review Screen on page 5-11
- Setting Up Intra-cardiac ECG Channels on page 5-13
- Channel Settings on page 5-14
- Saving and Loading a Configuration on page 5-17

Additional setups are described in the following sections:

- Setting Up Tachycardia Detection on page 5-21
- Setting Up the Holter Display Mode on page 5-22
- Setting Up the Stimulator Auto Snapshot on page 5-26
- Setting Up Ablation on page 5-28

Building a Configuration

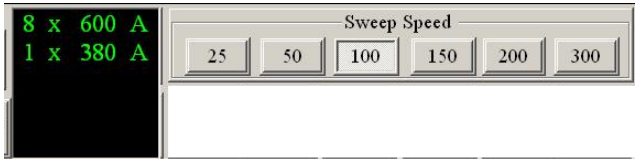
You can build a Configuration file that includes the screen layouts and channel settings. If you save this file you can then load it and use it in future procedures.

Setting Up Traces Display

Modifying the Traces Display Appearance

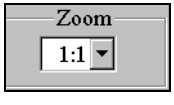
There are three display controls located on the right of the RT Information panel: *Zoom* and *Notch* are positioned one beneath the other, and *Sweep Speed* is on the right:

Note: *When the stimulator panel is used on the Review screen, the Zoom and Notch area will be used to display the stimulation parameters.*



Zoom

Using the Zoom control, you can see the overall picture ‘at a glance’ or Zoom in to view the waveforms in greater detail - in much the same way that you would use a zoom lens on a camera. This is particularly useful for viewing events, or special regions of interest.



The Zoom display control has a combo box and is used to *increase* or *decrease* the display zoom factor.

Possible selections of a Zoom factor may be made from a

drop-down list of the following pre-defined values: 1:1; 1:2; 1:4; 1:8; or 2:1.

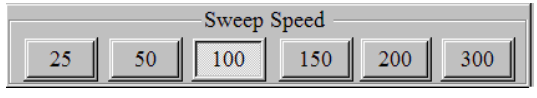
Note: *The selection list may not be edited, and the default value is 1:1. This may be overwritten however, by loading any other configuration. For details, refer to* *Saving and Loading a Configuration on page 5-17.*

Note: *When selecting a Zoom factor, only the display of the waveforms in the RT Monitor will be affected. The recorded (FD) data will remain unchanged.*

Sweep Speed

Sweep Speed is the rate (in mm/sec.) at which the waveforms are seen to move across the Traces Display (from *left* to *right*). Increasing the Sweep Speed will influence the Traces Display by making the waveforms move *faster*; decreasing the speed will make them move *slower.*

There are six Sweep Speed control buttons, positioned horizontally in one row and labeled (in mm/sec [incrementing from *left* to *right*]), as follows:



Each of the six buttons provides exclusive selectivity. The button corresponding to the currently-selected sweep speed appears as pressed; all others appear normal (and are ready for selection).

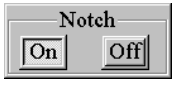
Note: *The default Sweep Speed is 100 mm/Sec. In Trigger Mode (only), any changes made to the Sweep Speed will have an effect on the positioning of the vertical line displayed on the RT Monitor.*

Notch

The function of the Notch control is to *enable* or *disable*

the 50Hz Notch Filter on the EP-Box amplifiers.

The Notch control has two buttons: *ON* and *OFF*:



Note: *The default value is ON. However. this may be overwritten by loading any other configuration. For details, refer to* *Saving and Loading a Configuration on page 5-17.*

Changing Channel Settings

In addition to modifying the general appearance of the Traces Display, you can also change the number of channels displayed (by adding or removing a channel from the display), reposition a channel, make changes to the channel settings and select the channel for stimulation output.

Note: *When a channel is selected, it becomes grey in color to indicate that it is the currently-selected channel.*

❖To add or remove a channel from the Run Time display:

- Refer to the Channel Select - Run Time Screen instructions on page 5-7.

Note: *The channel display/hide commands for the RT Monitor can **only** be executed from the Channel Select window, accessed from the Review Screen.*

❖To Reposition a channel:

1. Click on any channel button (see Figure 5-1) and hold down while dragging the button *up* or *down*.
2. Release the mouse button; the channel (and its corresponding button) remains in the new position.

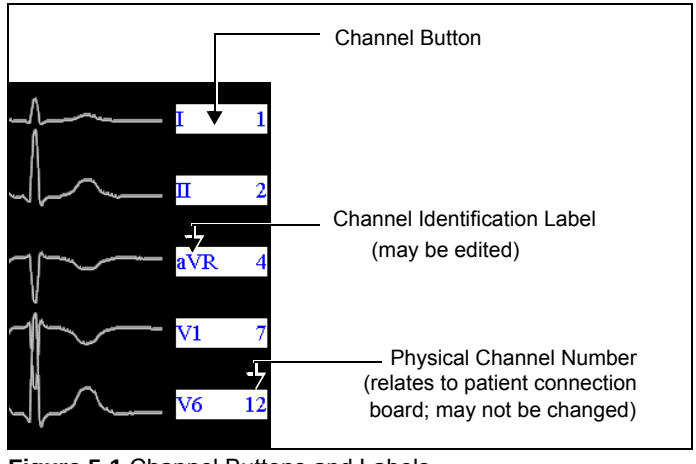


Figure 5-1 Channel Buttons and Labels

Note: *It is possible to arrange the channels with equal spacing or in sequence. See Channel Select - Run Time Screen on page 5-7 for details*

Each channel has pre-defined settings (as supplied with the system). However, right-click access to the *Channel Settings* controls enables you to make any of the following changes to the currently-selected channel, as required:

- Change the **Name** of a channel identifier label
- **Invert** the displayed polarity of a channel
- Change High Pass **Filter**
- Change **Polarity** - *Bipolar* to *Unipolar* (or *vice-versa*)
- Set the **Gain**

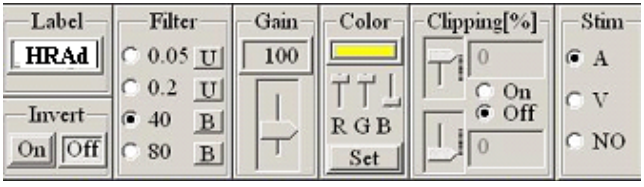
Note: *It is possible to change the gain without entering Channel Setting. Click with the mouse on the channel and use the mouse scroller (up/down) or keyboard keys (up/down) to change the gain.*

- Change the **Color** of a channel
- Perform **Clipping** of traces

- Set the channel to be the Stimulator Output for A or V stimulations

❖To Access the Channel Settings controls:

1. Right-click or double-click on any channel button (refer to Figure 5-1 on page 5-5). The Channel Settings window opens:



2. Proceed to the instructions for changing the required channel setting (*Label*, *Invert*, *Filter*, *Color*, *Gain*, and/or *Clipping*) - see Channel Select - Review Screen on page 5-11.

❖To set the same Settings to multiple channels:

1. Select the channels:

   - To select a range of channels: Click in the first channel you want to include in the selection, and then hold down <Shift> and click the last channel you want to include.
   - To add channels out of sequence to a selection: Hold down <Control> and click the channel you want to add.

2. Right-click the selected channels to open the **Setup** dia-log box.

3. Proceed to the instructions for changing the required channel setting (Label, Invert, Filter, Color, Gain,and/or Clipping) - see Channel Select - Review Screen on page 5-11. Settings are applied to all selected channels.

Channel Select - Run Time Screen

The left side of the **RT Channel setup panel for RT screen** window contains two groups of selection controls: *Surface ECG (on the left)*, and *Intra-cardiac ECG (on the right).*

The right side of the **RT Channel setup panel for RT screen** window contains the list of the Active RT channels with fields that enable changing the Label, Filter, Polarity, Gain and Color of the channels.

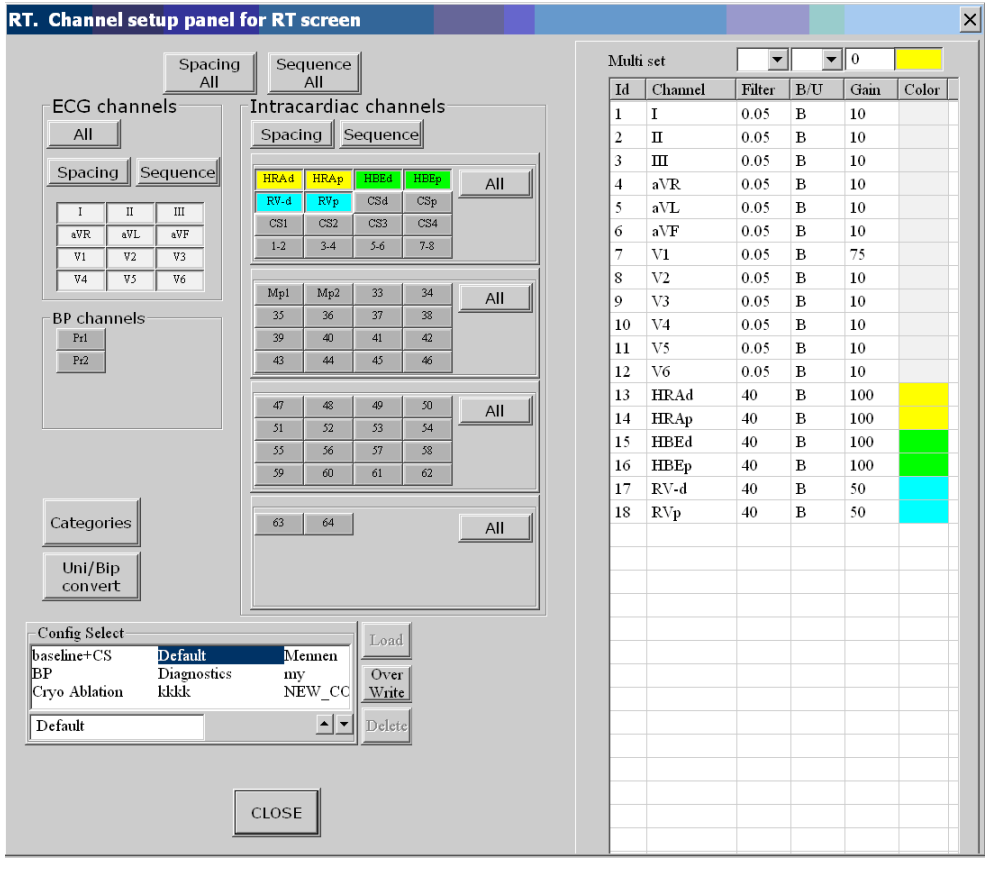


Figure 5-2 Channel Setup Panel

- Click **SPACING** to cause the currently-viewed ECG or

ICECG channels to be evenly repositioned on the RT Monitor.

- Click **SEQUENCE** to cause the ECG channels or ICECG to be displayed in numeric order.
- Click **SPACING ALL** or **SEQUENCE ALL** to cause all channels to displayed evenly spaced or in numeric order.

Surface ECG Channels

Used to add or remove Surface ECG channels displayed on the RT Monitor

Also used to change a specific channel color, as described below.

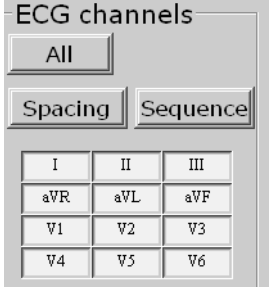


Figure 5-3 Surface ECG

❖To change the Surface ECG channel display

- *Click* on any of the buttons in the three columns (under *Surface ECG*) to toggle between the add/remove functions for a specific channel.
- *Click* **All** to toggle between the add/remove functions for *all* surface ECG channels.
- *Click* on **Spacing** to cause the currently-viewed ECG channels to be evenly repositioned on the RT Monitor.
- *Click* **Sequence** to cause the currently-viewed ECG channels to be repositioned numerically on the RT

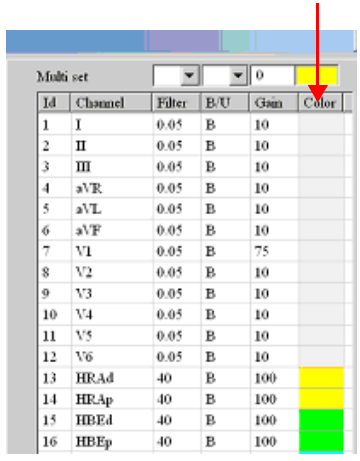
monitor.

Note: Channel identification label names may be edited - for instructions see Channel Select - Review Screen on page 5-11.

❖To change a specific channel color:

1. *Do one of the following:*

   - *Right-click* a currently-activated channel button. A drop down palette of colors appears. Choose a color.
   - *Right-click* the **Color** column of the channel in the active channels list.



Id	Channel	Filter	B/U	Gain	Color
1	I	0.05	B	10	
2	II	0.05	B	10	
3	III	0.05	B	10	
4	aVR	0.05	B	10	
5	aVL	0.05	B	10	
6	aVF	0.05	B	10	
7	V1	0.05	B	75	
8	V2	0.05	B	10	
9	V3	0.05	B	10	
10	V4	0.05	B	10	
11	V5	0.05	B	10	
12	V6	0.05	B	10	
13	HRAd	40	B	100	
14	HRAp	40	B	100	
15	HBEd	40	B	100	
16	HBEp	40	B	100	

Note: *The EMS-XL System is supplied with a library of pre-defined colors. If required, additional colors may be customized, as described in Channel Select - Review Screen on page 5-11.*

Intracardiac Channels

You can add or remove intra-cardiac ECG channels displayed on the RT Monitor. You can also change a specific channel color.

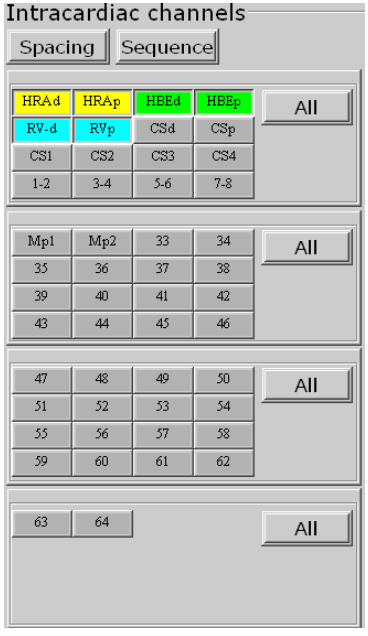


Figure 5-4 Intracardiac ECG.

❖To change the Intracardiac ECG channel display

- *Click* on any of the buttons in the four columns (under *Intracardiac*) to toggle between the add/remove functions for a specific channel listed in those columns.
- Click **All** to toggle between the add/remove functions for all Intracardiac ECG channels.
- Click **Spacing** to cause the currently-viewed Intracardiac ECG channels to be evenly repositioned on the RT Monitor.
- Click **Sequence** to cause the currently-viewed Intra cardiac ECG channels to be repositioned numerically on the RT monitor.

Note: *Channel identification label names may be edited; for instructions, see* *Channel Select - Review Screen on page 5-11*.

Note: *One or two Intra-cardiac channels (physical channels 26 and 28 only) may be used for BP display, if required. By default, these are labelled Pr1 and Pr2.*

❖To change a specific channel color:

- Right-click on any channel button or right-click on the **Color** column of the channel in the active channels list and select the required color from the pre-defined colors. The button background color changes in accordance with your selection.

Note: *Colors available for selection may be customized under the Channel Select - Review Screen tab - see page 5-11*

Channel Select - Review Screen

Setting Up Surface ECG Channels

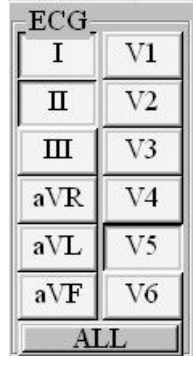


Figure 5-5 ECG Channel Selection Buttons.

❖To Display (turn ON) a Channel:

- **Click** on the required ECG channel button (or click *ALL* to display all channels).

❖**To Remove (turn OFF) a Channel:**

- **Click** on the appropriate ECG channel button (one that appears pressed) (or click *ALL* to remove all channels).

Note: *Buttons for currently-selected channels will have a pressed appearance; inactive channel buttons appear normal. Buttons toggle ON/OFF.*

❖**To Change a Channel Color:**

1. **Right-Click** on a currently-activated channel button. The button changes to a new color.

2. Click again to "scroll" to the next color (as pre-defined in the system).

3. Repeat Step 2 until the required color is selected.

The EMS-XL System is supplied with a library of pre-defined colors. If required, additional colors may be customized, as described in *Channel Select - Review Screen* on page 5-11

Setting Up Intra-cardiac ECG Channels

Figure 5-6 Intra-cardiac Channel Selection Buttons.

❖**To Display (turn ON) a Channel:**

- **Click** on the required channel button (or click *ALL* to display all channels).

❖**To Remove (turn OFF) a Channel:**

- **Click** on the required channel button (or click *ALL* to remove all channels).

Note: *Buttons for currently-selected channels will have a pressed appearance; inactive channel buttons appear normal. Buttons toggle On/OFF.*

❖**To Change a Channel Color:**

1. **Right-click** on a currently-activated channel button. The button changes to a new color.

2. Click again to scroll to the next color (pre-defined in the system).

3. Repeat Step 2 until the required color is selected.

Note: *The EMS-XL System is supplied with a library of pre-defined colors. If required, additional colors may be customized, as described in Channel Select - Review Screen on page 5-11*

Channel Settings

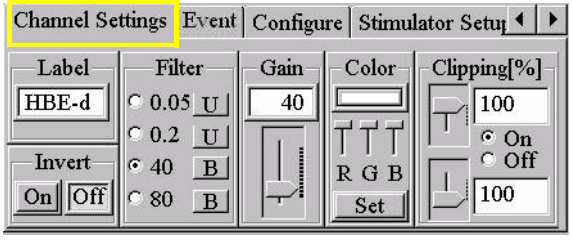


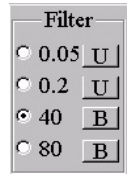
Figure 5-7 Channel Settings

Label contains an editable field, to enable renaming of the currently-selected Channel Identification Label (Figure 5-1 on page 5-5.

- Click in the field and type the required name over the existing label name.

Note: *You can enter up to 5 characters only.*

Click **Invert** ON or OFF to mirror the channel polarity, as required. Changes the displayed polarity of the currently-selected channel.
Note: FD data is unaffected; the default setting is OFF.



Each channel has its own pre-defined default High Pass **Filter** setting (as supplied with the system). However, the setting may be changed, if required.

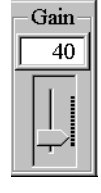
Note: *By default, 0.05 and 0.2 are unipolar; 40 and 80 are bipolar.*

Channels 1 to 12 are Surface leads and are not effected by the Unipolar/Bipolar switches

Channels 13 to 24 and Channels 45 to 56 are switchable between Bipolar and Unipolar. Channels 25-32, 33 to 44 and 57 to 64 are Bipolar channels .In Unipolar mode the (-) black sockets will be used as reference. The reference is the Wilson reference of the surface limb leads

Note: *Filters -- Channels 25 to 32, 33 to 44, and 57 to 64 have fixed High Pass filters of 40 Hz*

- To change the Filter for the currently-selected channel, activate the appropriate radio button (0.05, 0.2, 40 or 80Hz).
- To change the polarity, click the associated button (*Bipolar* [**B**] or *Unipolar* [**U**]).
  Buttons toggle between B and U.



Gain contains an editable text field used to edit the gain value (0-255) of the currently-selected channel in the RT Monitor.

In addition, a slider vertically positioned beneath the edit field, points to a row of gain value marks on the right. Moving the slider *up* or *down* changes the value in the text field above. Similarly, any editing of text in the edit field will automatically change the slider to the position corresponding with the new value (0 at the bottom; 255 at the top).

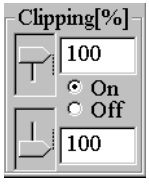
Color provides the tools for color customization of colors.

Three movable sliders (labeled R, G, and B [*red, green, blue*]) - are used to define the colors available for selection in the system.

❖**To define a new color:**

1. Drag the *R*, *G*, and/or *B*, slider until the required color is displayed in the bar above.
2. Click **Set** to save the color setting.

Note: *To change the color of a currently-selected channel, it is recommended to refer to the instructions for Channel Select - Run Time Screen on page 5-7.*



Clipping is used to control the amount of clipping applied to the currently-selected channel in the RT Monitor and to prevent overshooting of traces.

Note: *An overshooting trace (i.e., one that overshoots to the neighboring trace) may be clipped to prevent it from overwriting another channel.*

The **Clipping[%]** controls are two pairs of editable fields and sliders. The pair on the *top* defines (by percentage) the clipping applied **above** the currently-selected channel; the pair *below* defines the clipping applied **below** the currently-selected channel.

Radio buttons indicate whether clipping is *enabled* (ON) or *disabled* (OFF) for the currently-selected channel.

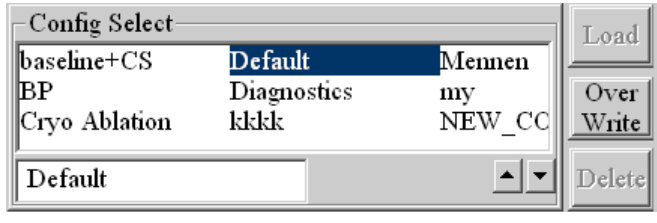
Note: *By default, the channel clipping is set to OFF and 0% is displayed in the editable fields. 0% means no clipping, 100% means full clipping.*

❖**To activate channel clipping:**

1. Activate the ON radio button.
2. Click and drag the *upper* or *lower* slider (as appropriate) to the required position.
   The percentage of clipping to be applied to the channel (*above* or *below*) is shown in the corresponding field.

Saving and Loading a Configuration

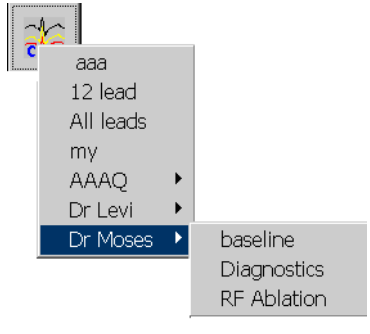
The Channel set-up shortcut  in the Review screen toolbar, opens a window for Config Select that displays text items (listed alphabetically) which are configuration file names used to Load or Save entire screen layouts and channel settings. .



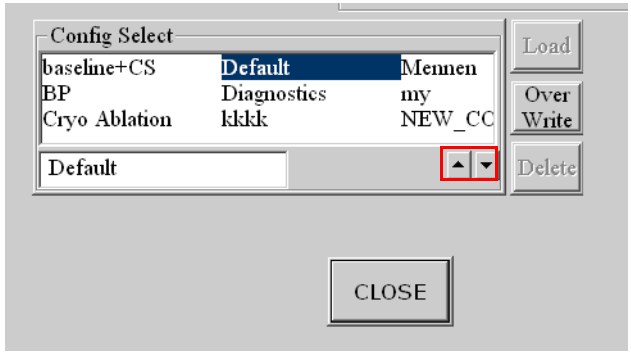
❖**To open a defined configuration setting:**

1. Do one of the following:

- Press the **Configuration**  toolbar button and choose a Configuration or Category/sub-config from the menu that opens.



- Click the **Channel set up**  . toolbar button to open the Channel set-up panel.



Click or scroll through the Config Select list, using the up and down arrows, to choose a pre-configured configuration.

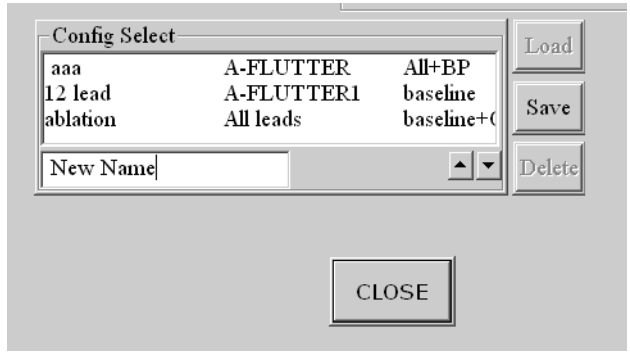
Press **Load.**

Press **CLOSE** to close Channel-set-up panel.

❖To save a newly-defined configuration setting to the system hard drive:

1. Click the Channel set up  toolbar button to open the Channel set-up panel.

2. In the textbox at the bottom of the pane, type the chosen name for the new configuration.



Note: *If the configuration name already exists in the system, the* ***Save*** *button will be labeled* ***Overwrite****.*

Use the  button to delete a configuration setting from the system.

Note: Some file names may not be deleted, in which case the Delete button is automatically disabled.

The currently-selected configuration file name is displayed in an editable text field under the list control. Editing the text in this field will create/modify the file name when the Save/Overwrite button is pressed.

A new configuration name appearing in the selected text field causes the **Load** and **Delete** buttons to be disabled.

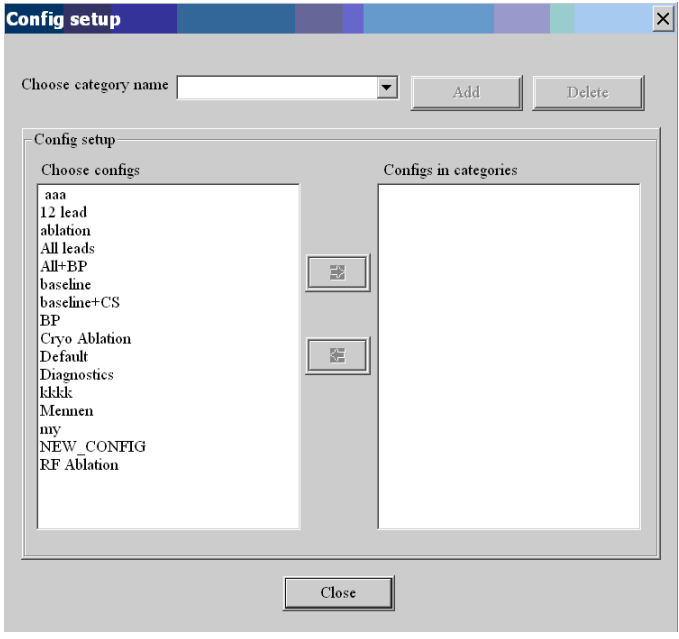
Combining Configurations Under One Category

It is possible to combine several configurations under a common Category name (for instance the Category AVNRT will include a configuration for diagnosis and another configuration for ablation.)

❖To build a category:

1. In the Channel set-up panel press **Categories** (see Figure 5-2) .

The Config Setup window opens.



2. Choose a name for the Category you are building and enter to the text box at the top of the panel. Click **Add.**

3. Choose the configurations that will be under this category and use the arrow to move the category from the available category list (in the left pane) to the right pane.

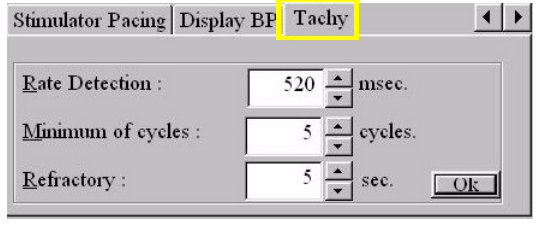
4. Click **Close**.

Note: *It is also possible to choose a category form the drop down list and edit its contents or to delete it.*

Setting Up Tachycardia Detection

You can setup the the EMS-XL to automatically detect onset of arrythmia according to your preferences.

Use the controls under the **Tachy** tab in the Review screen to set the system parameters for the detection and recognition of tachycardia.



- **Rate Detection**

  Set the required *Rate Detection* value (in msec).

  A Heart Rate faster than this (for example, 120 BPM) will be considered by the system as being tachycardia. When this occurs, an event named "Tachycardia" will be added to the Events and Stimuli List (seen at the upper *right* corner of the Review Screen - refer to the next page).

- **Minimum Cycles**

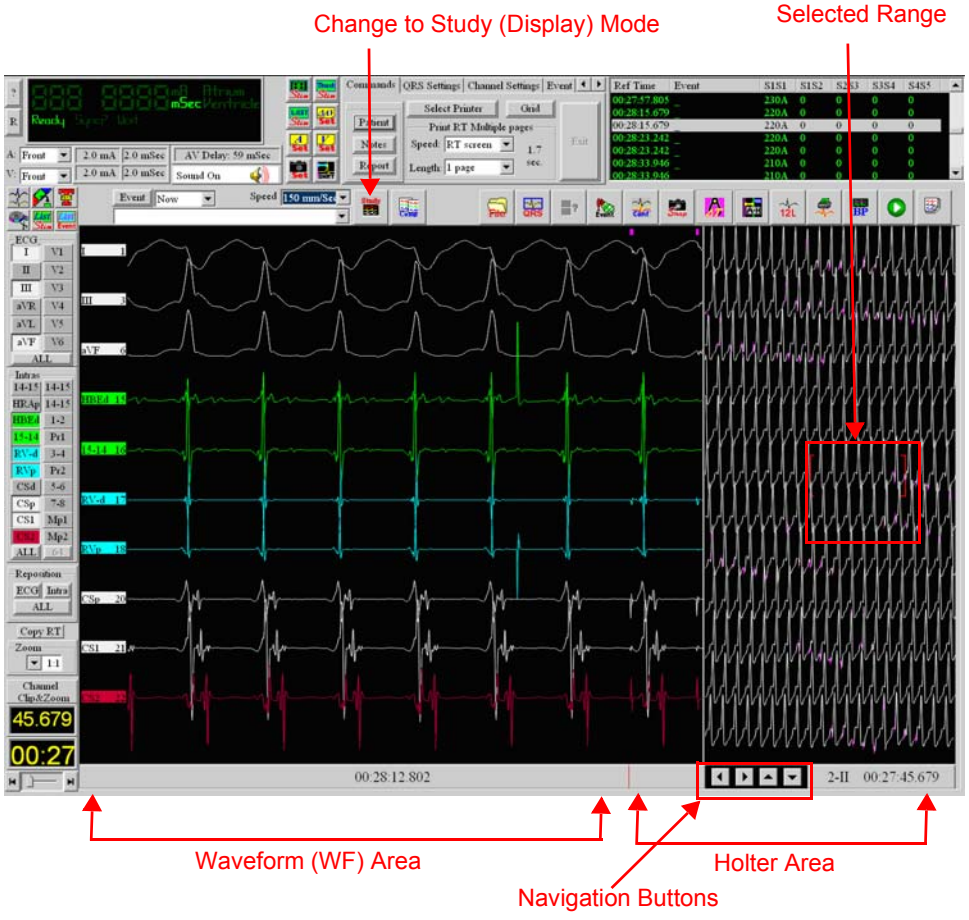
  Set the number of beats that should sustain, before the rate is considered as being tachycardia.

- **Refractory**

  Use this control to set the *length of the pause* (secs) to be counted by the system after arrhythmic tachycardia has ceased, before the next arrhythmia is considered as being tachycardia.

Setting Up the Holter Display Mode

The Holter Display mode enables minute-by-minute viewing of data in the Review (NRT).



The Holter Display mode divides the Review screen (NRT screen) into 2 areas: Holter area (about 30 % of original NRT screen at right side) and Waveform (WF) Area (about 70 % of original NRT screen at left side) that displays WF channels in the same way as during StudyDisplay mode.

The Waveform (WF) Area

The WF Area is the same as in Study Display mode in the Review (NRT) screen with two exceptions:

- There is no navigation scroll bar - Navigation is done in the Holter area.
- Trace location cannot be modified by dragging the channel labels. You need to return to Study Display mode in order to modify trace locations.

Note: Calipers activities in the WF area are the same as in Study Display mode in the Review (NRT) screen.

Holter Area - Description

The Holter area displays 1 minute of single channel WF data of a specific channel (defined in the Holter window).

The one minute Holter display start at the beginning of the minute selected on the Review screen (bottom left of the screen).

This waveform is displayed in 25 mm/sec divided into 12 lines, each showing 5 seconds of a single channel WF data.

Two red markers **[** and **]** on the Holter area, show the selected Holter range. The selected range width depends on the WF Area sweep speed (see Figure 2-11).

The distance between the brackets **[ ]** is equal to the length of the WF area, that is for example:

- About 12 seconds in 25 mm/sec
- About 6 seconds in 50 mm/sec
- About 3 seconds in 100 mm/sec

Any change of the selected area presents the

corresponding multi-lead waveforms in the WF Area.

Stimulation Events are shown on both the Holter and the WF area by magenta markers on the Holter waveform and on the top of the WF area.

Holter Area Navigation

You can move the selected range by setting the Start, End or Middle position of the range. You can also use the navigation buttons to move the range back or forward in steps, to another line or to the beginning or end of a page.

❖To set the selected Holter area:

1. Do one of the following:

   - **Set the Start position**: Select the Start position of the brackets ([) in Holter area and click the mouse.
   - **Set the End position**: Select the End position of the brackets (]) in Holter area and right-click the mouse.
   - **Set the position of the middle of the range**: Select a middle position of the brackets in the Holter area and while holding down <Ctrl> click or right-click the mouse.

❖To move the selected Holter area:

1. Use the navigation buttons at the bottom of the Holter area in the Review screen (see Figure 2-11):

    **Move the brackets to previous / next data in Holter area** . Each step is about 1/12 of the WF area duration:

   - Click the mouse to move one step forward or backward (1 second if WF area speed is 25 mm/sec).
   - Right-click the mouse to move 2 steps forward or

backward (2 seconds if WF area speed is 25 mm/sec).

 **Move to previous / next line in Holter area.**

- Click the mouse to move one page forward or backward (Start of new brackets at the end of the previous brackets). (about 11.5 seconds with WF area speed of 25 mm/sec).
- Right-click the mouse to move move 1 line forward or backward (5 seconds with WF area speed of 25 mm/sec.).

Note: New 30 seconds are loaded automatically when the brackets cross the limit of the Holter displayed minute.

❖To change to Study Display mode / Holter mode:

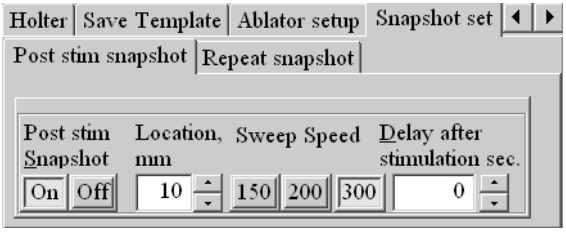
1. Click the **Study Display** mode button  to change from Holter mode to Study Display mode.

2. Click the **Holter** mode button  to change from Study Display mode to Holter mode.

Changing from one mode to another keeps the same time location and view.

Note: If calipers are active they are removed when changing from one mode to another.

Setting Up the Stimulator Auto Snapshot



The **Post stim Snapshot** tab enables you to control the automatic snapshot settings in use when the Stimulator is activated.

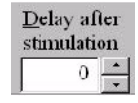
This feature is particularly useful for measuring refractoriness, where the Review Screen is triggered by the last stimuli. The triggered display is continuously refreshed by the last extra premature stimulus.

A pair calipers is used to indicate the time of *Atrial* or *Ventricular* activation, as well as the conduction time. In combination with the automatic *increment*/*decrement* mode of the Stimulator, you may easily observe the execution of the pace protocols. The RT Monitor running display monitors the patient, and gives information about the capture of the stimuli; the triggered portion represents the conduction time differences in full-time resolution.

Use this control to set Automatic Snapshot ON or OFF.

Sets the position of the last stimulus (mm).

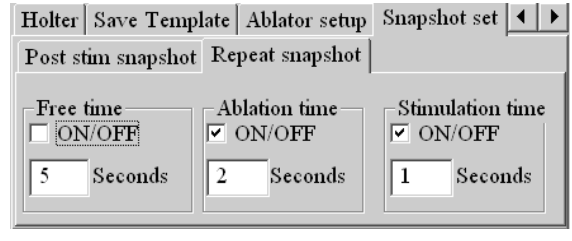
Sets the sweep speed (msec).



Sets the delay after stimulation (the number of secs required to delay the autosnapshot after capturing).

When all the above-mentioned settings are correct, click **OK**.

Setting Up the Repeat Auto Snapshot



The Repeat Snapshot tab enables you to set up auto snapshots (shown on the NRT screen) every X seconds during the ablation and/or stimulation and/or free time.

- **For automatic snapshots during the study**: Check **Free Time**, and enter the interval at which automatic snaphots are taken during the study.
- **For automatic during any ablation event**: Check **Ablation**, and enter the interval at which automatic snaphots are taken during any ablation event.
- **For automatic during any stimulation event**: Check **Stimulation**, and enter the interval at which automatic

snaphots are taken during any stimulation event.

Setting Up Ablation

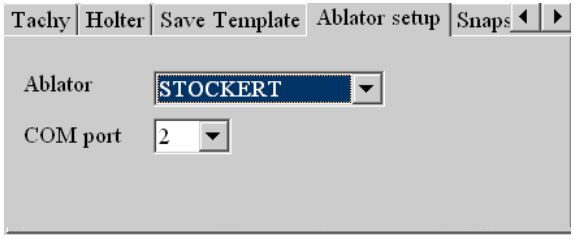
The EMS-XL has the ability to connect to a number of ablators (generators). Connection to ablators enables seeing the ablation data on the EMS-XL screen during the ablation as well as a graph of the data and printing this data. It is possible to change the ablator and COM port from the application.

The ablators that connect to the EMS-XL are :

- MAESTRO 3000 (Boston Scientific)
- IBI 1500T (Irvine Biomedical Inc)
- STOCKERT (Biosense Webster)
- EPT 1000 (Boston Scientific)
- ATAKR II (Medtronic)
- HAT 300 Smart (OSYPKA)

❖To set up ablation:

1. Click the **Ablation setup** tab.



2. Choose the COM port to which the ablator is connected.

3. Choose the type of abaltor (generator) connected.

4. Click **Apply**.

Chapter 6

Performing the EP Study

EP Study Overview

Performing an EP Study consists of the following:

- Registering a patient (see Registering a Patient on page 6-2)
- Setting up the EP study parameters. You can start by loading a saved configuration or start a new setup.(see Setting Up a Procedure on page 6-6)
- Using the Stimulator and selecting the required pacing protocols (see Performing Stimulation on page 6-23)
- Performing the study.
- Ending the case (see Ending the EP Study on page 6-60).

In addition you can add notes (see Adding On-line Notes on page 6-48) and print the RT and the NRT screens (see Printing on page 6-51). You can also compare the Run Time waveforms with a pre-defined template (see Working with Templates on page 6-56).

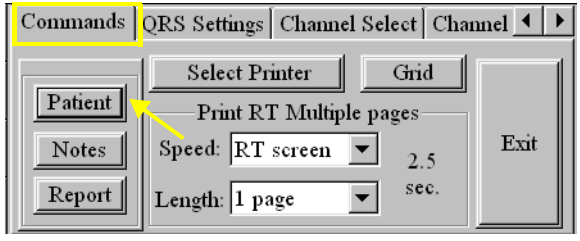
After ending the case you can cut part of a case and create a shorter case, saving it as a new file (see Saving Part of a Case on page 6-64).

Registering a Patient

An EP study begins with patient registration. After this, the study procedures should be continued in the order given in the subsequent sections.

❖To register a patient

1. From the *Command* menus at the top of the Review Screen, scroll to the **Commands** tab.
2. Click **Patient**:



Note: *Alternatively, click the*  *shortcut icon (instead of performing Step 1 and Step 2, above).*

The *Patient & Study Information* window opens, as shown in Figure-6-1. The window has four main areas:

- Patient General Information
- Study-related Information
- Patient Tree
- Case Control Buttons

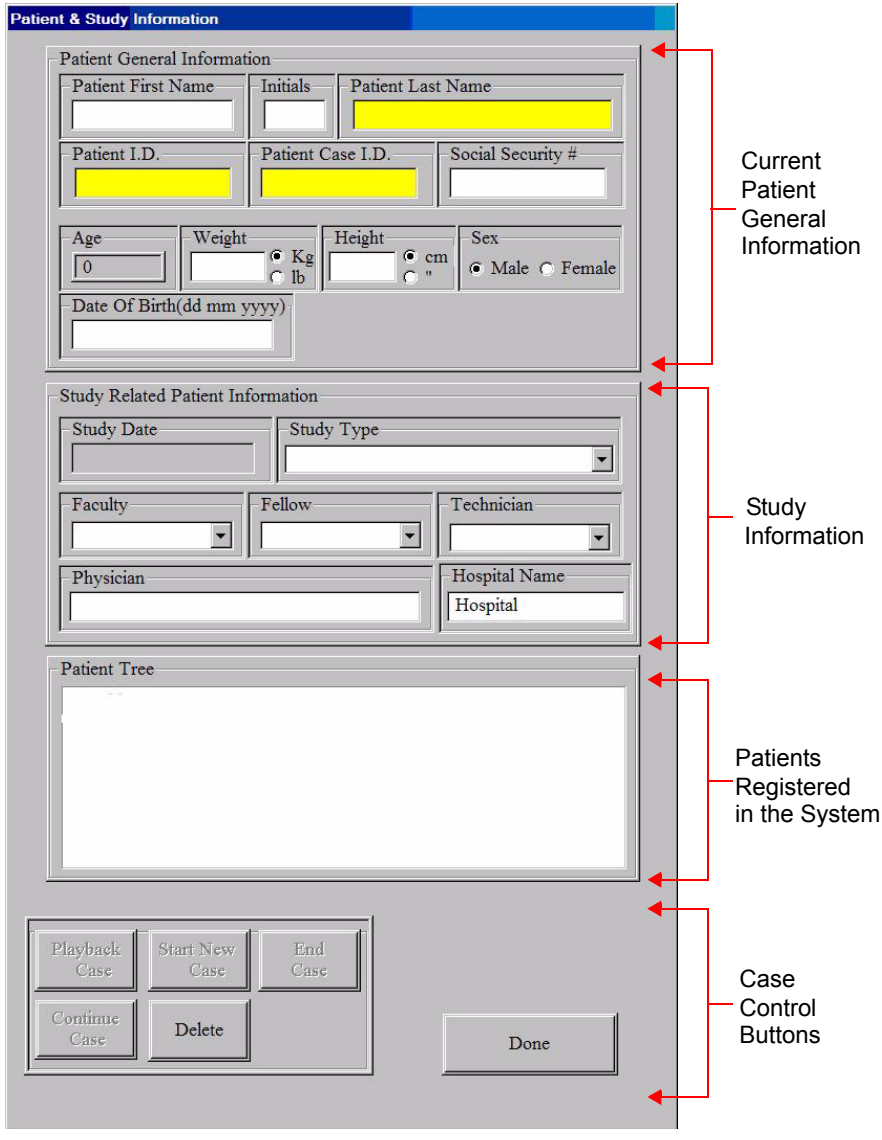


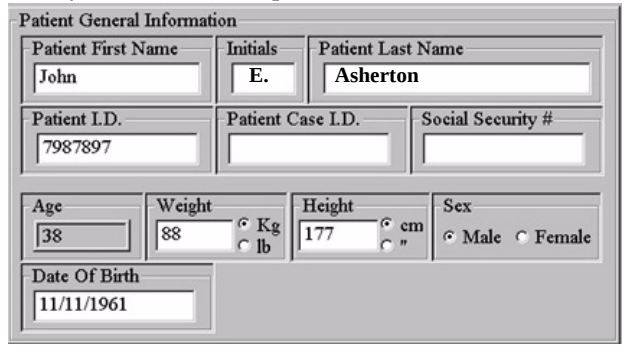
Figure 6-1 Patient and Study Information Window

Note: *For an explanation of the Case Control buttons, refer to Table 6-1.*
*Click **Done** to close the panel before trying to activate any other function*

Table 6-1 Case Control Buttons & Functions

Button	Function
Playback Case	Starts playback of a closed Case from a previously-registered Patient File (after "End Case", enables re-opening Case for playback). See Chapter 7 - Case Playback
Start New Case	Starts recording data from a newly-registered patient.
End Case	Ends (closes) the current Case (both in *Real-time* and *Playback* modes).
Continue Case	Resumes recording of a closed case from a previously-registered Patient File. *Notes:* *1. The system adds a pause between the case parts.* *2. **Continue Case** is only enabled for 24 hours after closing the case.*
Delete	Used to Delete a Case from a Patient File.  ***This function is irreversible!*** All data in the currently-selected Case will be removed from the hard drive. Make sure the **correct** *Patient File* and *Case* is selected *before* clicking the Delete button.
Done	Used to close the *Patient and Study Information* window.

3. Enter the appropriate details in the *Patient General Information* data input fields, as shown below



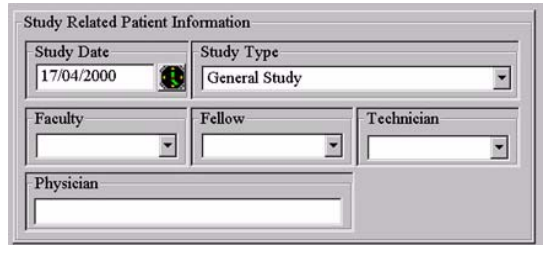
Note: *There are four fields for which entering information is obligatory (see below); all other fields are optional:*

- Patient First Name
- Patient Last Name
- Patient I.D.
- Case I.D.

Note: *When entering the Case I.D., if a separator is required, use underscore and not dash. For example, case #276 of year 2003 should be written as 276_2003.*

Activate the relevant radio buttons: *Weight*, *Height*, and *Sex*.

4. Under the *Study Related Information* select the required **Study Type**. For example, *General*, *Syncope*, *VT*, *WPW*, *VF*, *etc*.



Note: *The Study Date is automatically inserted on* ***Start New Case****.*

Enter additional information, as required (*Faculty, Fellow, Technician, Physician*).

5. Check that all details entered in the window are correct, then click the Start New Case button.

   The patient is now registered in the system.

   The timer starts.

   The recording of Full Disclosure data onto the hard disk commences.

   In the RT Monitor, the newly-registered Patient details are displayed in the Information panel (center, top of the screen - refer to Figure-4-2).

   Note: *The Patient & Study Information window remains open.*

6. Press **Done**.

Setting Up a Procedure

Loading the System Setup for the Study

The setup procedure is required to configure the EMS-XL System with a setup appropriate for the specific study.

Note: *Some studies may require more channels, and others (basic studies) will require less channels.*

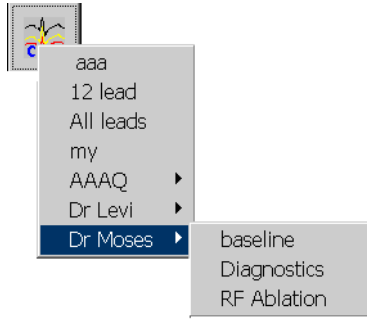
System setups can be loaded using either the *Configuration* command, or simply tailored manually for the particular case.

❖To load the system setup for the study

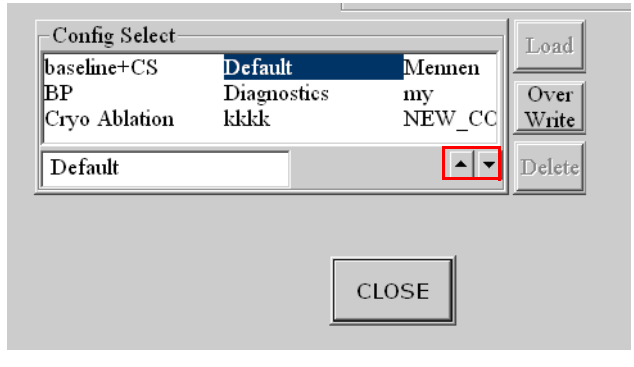
1. Do one of the following:

- Press the **Configuration** 

toolbar button and choose a Configuration or Category/sub-config from the menu that opens.



- Click the **Channel set up**  . toolbar button to open the Channel set-up panel.



Click or scroll through the **Config Select** list, using the up and down arrows, to choose a pre-configured configuration.

Press **Load.**

Press **CLOSE** to close Channel-set-up panel.

Note: *If the required setting is not available for selection, configure the system parameters, as required (see Chapter 5 - Setting Up Monitoring). If you wish to name and save the newly-defined configuration setting to the system hard drive for future use, click* Save.

Note: ***Print Baseline:*** *With the appropriate system setup selected, click the* 12L *icon (on the Run Time Monitor display) to print a 12-lead printout.*
The 12-lead printout (called 'baseline' printout) is recommended as it provides a reference of the basic status of the ECG, prior to the intervention.

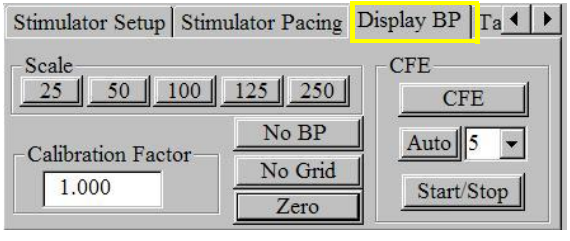
Setting Up BP Display

You need to prepare the system for BP display by activating the BP channels.

❖To activate the BP channels:

1. Add PR1 (26) and PR2 (28) to the screen.

2. Use the **Display BP** panel to: Activate/Deactivate BP display, Grid/No Grid, Zero, Activate/Deactivate CFE connection.



The **Display BP** tab is used to configure the two BP channels (Pr1 and Pr2). Once they have been configured, they are permanently displayed in the lower portion of the RT Monitor (Figure-4-1), below the intra-cardiac channels.

The tab is also used to display the parameters received from the CFE in a Combo system. The parameters received from the CFE are the NIBP readings and SpO2 readings. They are displayed in the BP window of the RT screen.

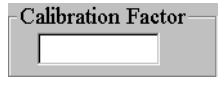
Scale

The grid scale ranges from zero, to one of five maximum values: *25*, *50*, *100*, *125*, or *250*.

Choose the required grid scale by clicking the appropriate button.

Calibration Factor

The Calibration Factor is a numeric field, provided to enable calibration of the EP-box (amplifier).



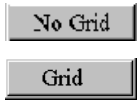
Note: The default is 1.000.

BP Channel Display

When the BP channel display is disabled (**No BP**), the BP grid and scale are automatically removed from the RT Monitor display.

Grid Display

The **Grid** button toggles between *No Grid* and *Grid*. Click **No Grid** to *hide* display of the BP grid; click **Grid** to show the grid.



Note: The default setting is No Grid.

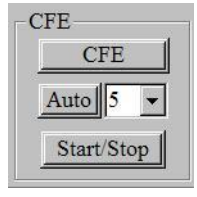
Zero

Zero is used to indicate that the current values received by the two BP channels should be regarded as the *zero* values - see note below.

Note: *This button should **only** be used when the transducer has been opened to the atmosphere.*

Note: *Channels are zeroed one at a time. Before clicking Zero, each BP channel has to be defined from the RT Monitor (right-click on the channel button to define the channel identification label - refer to Channel Select - Review Screen on page 5-11).*

CFE



CFE: activates display of NIBP and SpO2 parameters taken from the CFE to the BP display window of the RT screen.

Figure 6-1 BP dispaly in RT window

Note: *This option is active only in COMBO systems (combined Horizon XVu and EMS-XL)*

Auto: Enables selecting automatic measuring of NIBP every X minutes.

Start/Stop: Starts or Stops NIBP cuff inflation for a NIBP measurement.

Each NIBP and SPO2 measurement is entered in the Events list with a time stamp.

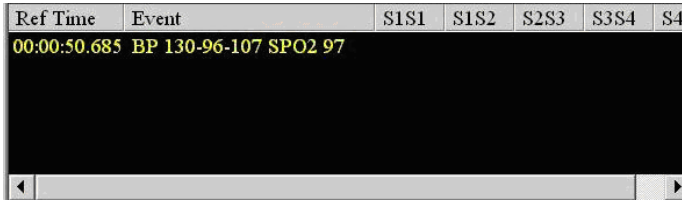


Figure 6-2 Measurement with time stamp.

QRS Settings

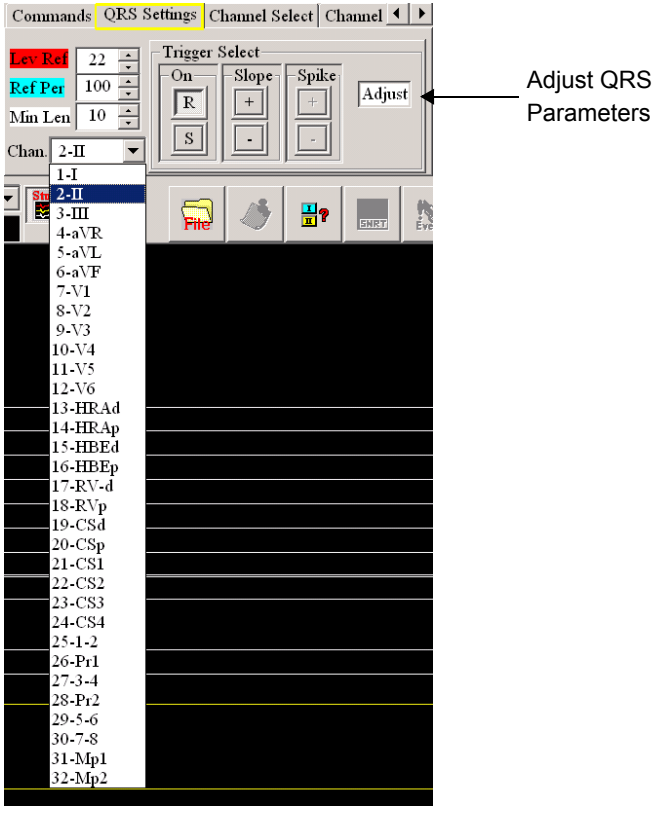


Figure 6-3 QRS Setting Window

Channel Settings

Use the combo box to select from a list of Surface and Intra-cardiac channels (1-32 or 1-64 [optional]), named according to the current configuration.

The selected channel is used for *HR calculation* and *QRS detection*, and is the default Stimulator trigger source.

Note: *The Stimulator can be used on Channels 13-24 only (i.e. the first 12 Intra-cardiac channels). The selected channel will be used in synchronization procedures in the system. Lead II will be used as a default.*

Lev Ref (Level Reference)

Use the combo box to select the appropriate *Level reference.*

- For low voltage levels (i.e. patients with a low QRS), adjusting the Level reference to a *lower* value may be required.
- For patients with a tall T-wave level, it may be necessary to *increase* the Level reference.

  (*The default is 20, an arbitrary factor without units*).

Ref Per (Refractory Period)

Use the combo box to select the required *Refractory Period.*

- For patients with a tall T-wave level, this is useful to block the T-wave in order to to prevent falsely identifying it as a QRS and triggering on it. Once a QRS is detected, the system will start "searching" for another QRS only after the refractory period has passed.

  (*The default is 100 msec*).

Min Len (Minimum Length)

Use the combo box to select the required *Minimum Length.*

- To prevent false detection of the T-wave as QRS, the minimum length (width) of a complex may be set.

  (*The default value is 10 msec*.)

Trigger Select

- **On** - contains two mutually-exclusive radio buttons labeled **R** and **S**. These indicate whether synchronization will be on the R *peaks* (high points) or S *troughs* (low points) of the QRS.

Note: *This subgroup is used for surface ECG channels only.*

- **Slope** - contains two mutually-exclusive radio buttons labeled **+** and **-** . These synchronize on the ECG with various slope shapes.

Note: *Relevant for surface ECG channels only.*

- **Spike** - contains two mutually-exclusive radio buttons labeled **+** and **-**. The Spike is used to detect fast deflection in the intra-cardiac signal.

  Use the **+** or **-** to set the required level.

Note: *Relevant for Intra-cardiac ECG leads only.*

Displaying the QRS Parameters on the RT screen

Click the **Adjust** button to display the QRS parameters on the RT screen:

- The ECG channel used for QRS detection is displayed between two brown border lines. Below the ECG is the detected channel displayed as derivative of the QRS detection channel. A special green marker appears on the signal when QRS is detected.
- Red line marking the level reference. Use the Up/down **Rev Lev** arrows to adjust the level reference (see above).
- White line marks the minimum length in milliseconds. Use the Up/down **Min Len** arrows to adjust the minimum length (see above).
- light blue line marks the time of the refractory period in miliseconds.Use the Up/down **Ref Per** arrows to adjust

the refractory period (see above).

Figure 6-4 Stimulation of RT Screen

Using the Stimulator

The system includes 8 pre-defined stimulation protocols:

- Default.prg - Stimulation loaded during startup
- Cont A 600.prg - F9
- Cont V 600.prg - CTRL F9
- Basic A.prg - F10
- Basic V.prg - CTRL-F10
- SNRT.prg - Loaded during SNRT Procedure
- Burst A.prg - Loaded during Burst Procedure
- Burst V.prg - Loaded during Burst Procedure

The Auto Snapshot feature enables you to control the automatic snapshot settings in use when the Stimulator is activated (see Setting Up the Stimulator Auto Snapshot on page 5-26).

Although stimuli can be performed via the dedicated Stimulator menu (see Stimulator Controls on page 4-19), it is recommended to use the keyboard short-cut keys. Best results are achieved by a combination of the following keys:

<**G**>	=	Start stimulation protocol
Spacebar	=	Stop stimulation protocol
<**A**>	=	Automatic pacing
↓	=	Decrement extra stimuli
↑	=	Increment extra stimuli
<B>	=	Big numbers view

Note: *An example of stimulation technique is shown in the procedure below. The following basic pacing protocol will be used and the pacing parameters set accordingly:*

S1:	8	600	Atrium
S2:	1	380	Atrium

In this example, there is a drive train of eight 600 msec time intervals at the atrium, followed by one extra premature beat of 380 msec at the atrium.

Stimulator Pacing

Precise control of the Stimulator Pacing settings is achieved using the tools provided under the Stimulator Pacing Tab

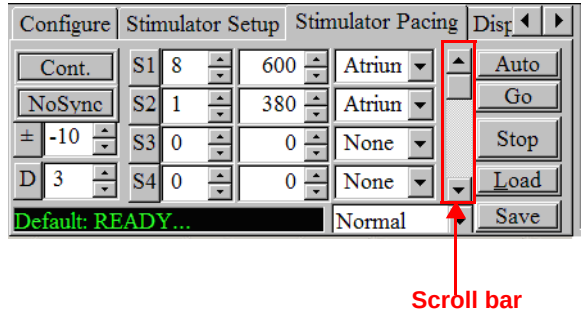
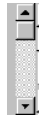
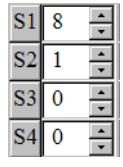


Figure 6-5 Stimulator Pacing Setup tab



Use the vertical scroll bar and arrows to scroll through the extra stimuli controls (***S1*** through ***S5***).

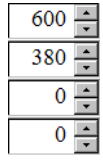


Use the  arrows to set the number of control to set the number of extra stimuli to be executed.
Scroll to the required number (or type to edit the number currently displayed).

Note: *S1 is usually referred to as the drive train. When it is used in conjunction with extra stimuli, it is usually given a value of between 6 and 10, followed by 1, 2, 3, or 4 extras.*
For example:

S1:	8	600	Atrium
S2:	1	360	Atrium

In this example, there is a drive train of eight 600 msec time intervals at the atrium, followed by one extra premature beat of 360 msec at the atrium.



Set the required *duration* between pulses.
Scroll with the arrows to the required number.

Note*: Values range between:*
0 and 9999 msec.

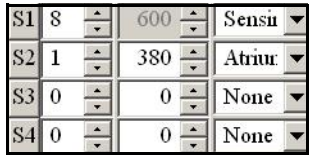
Location of Stimulation

Use this control to select the required *location* for the stimulation.

Choose one of the following

- None
- Atrium
- Ventricle
- **Both**: If Both is selected the interval between the ventricular and Atrial stimulation will be as set by the A-V delay
- **Sensing**: If Sensing is selected the stimulator will sense the heart beat for a given number of beats and then continue to S2. No stimuli will be given for the number of pulses written in the Left most column.

  For example in the following setup, the stimulation will start with Sensing of 8 beats and then 1 atrial stimulation 380 ms from the last beat :

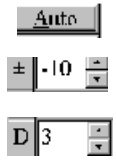


Type of Stimulation

Set the *type* of stimulation; toggles between *Cont* (continuous) and *Single*.

Stimulation Synchronization

Use this control to enable/disable synchronization of stimulation with configured data;
toggles between *Sync* and *No Sync*.
Refer to QRS Settings on page 6-12.



Use the **Auto** button to initiate stimulation whereby each time a complete protocol stimulation has finished, the the last stimuli will be *decremented*/*incremented*, as specified in the ± field. The new protocol will be executed after the delay (in seconds) specified in the **D** field.

Change the ± and **D** settings, as required.

Use these controls (or the keyboard shortcuts), as follows:

Go - initiate stimulation in accordance with the current settings.
*(or press the <**G**> key).*

Stop - abort stimulation.
(or press the space-bar).

Load - access pop-up menu and select required protocol from a list of pre-defined stimulation protocols.

Save - save a complete set of *Pacing Protocol* settings for future use.

Note: *Using the Save Protocol window, you can define a unique name for the new set of Pacing Protocols.*

Stimulator Setup

The **Stimulator Setup** tab has nine sub-groups: *Sound*, *AV delay*, *Atrium*, *Ventricle*, *Threshold*, *Sensing Counter*, *Auto Snapshot*, *Last Stim* and *SNRT (see* Sinus Node Recovery Time - SNRT on page 6-42*)*. Each provides access to Stimulator control settings, as described below.

Sound

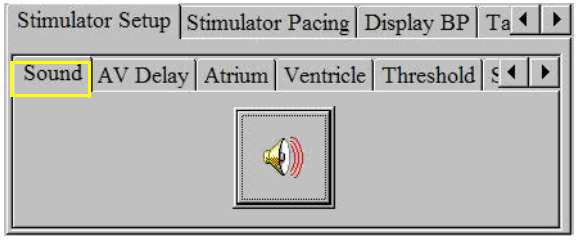


Figure 6-6 Sound Setup tab

Click the icon in this tab to turn the stimulation beep on/ off.

When the tab is turned on, each stimuli will cause a auditory beep.

AV Delay

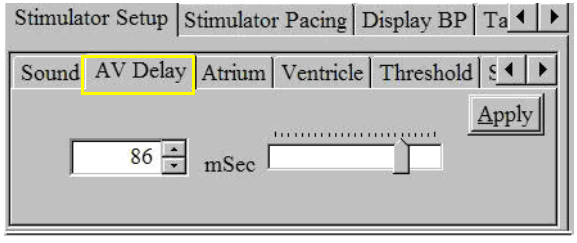


Figure 6-7 Stimulator AV delaySetup Window

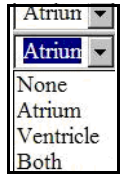
Use this panel to set the interval delay between the atrial and ventricular stimulations that will be used during Dual chamber stimulation.

❖To set the interval for Dual Chamber stimulation:

1. Use the spin-box or the slider to set the required AV delay

2. Click **Apply**

Note: *Dual chamber stimulation is produced by Choosing* ***Both*** *on the stimulator panel*



Threshold

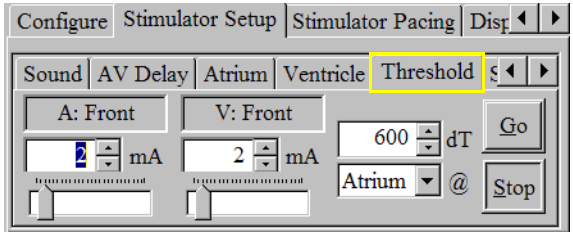
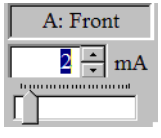
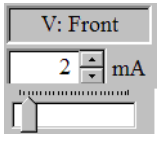


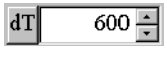
Figure 6-8 Threshold Setup Window



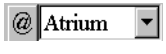
Use the mA editable field and the slider beneath it to control the value of current supplied during stimulation on the channel indicated in the corresponding static control A: (**Atrium**), above.



Use the mA editable field and the slider beneath it to control the value of current supplied during stimulation on the channel indicated in the corresponding static control V: (**Ventricle**), above.



Set the required interval (in msecs).



Set the location for the extra (in this example, Atrium).

Click to **activate** the Stimulator.
The Stop button becomes *enabled*.

Click to **stop** the Stimulator.
The Go button becomes *enabled*.

Atrium Setup

Use this panel to set the electrode that would be used for Atrial stimulation and to set the atrial stimulation pulse duration and current.

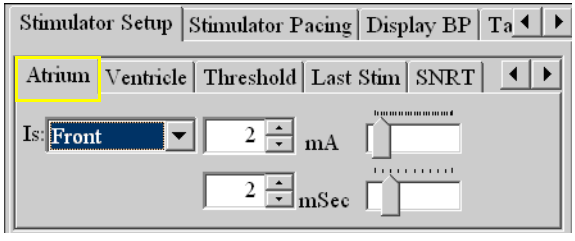


Figure 6-9 Attrium Setup Window

Ventricle Setup

Use this panel to set the electrode that would be used for Ventricular stimulation and to set the Ventricle stimulation pulse duration and current.

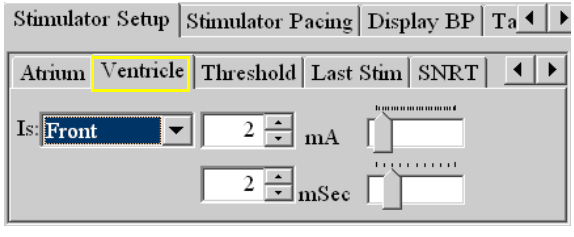


Figure 6-10 Ventricle setup Window

WARNING: *For each new case the output electrodes for Atrium and Ventricle have to be set manually. When a new case starts the stimulation output will always become Front.*

Last Stim

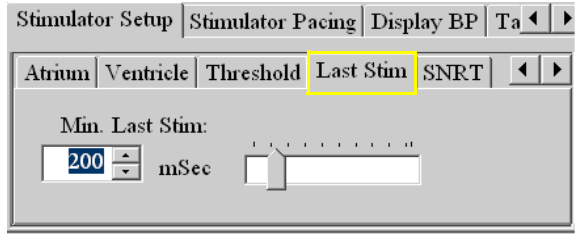


Figure 6-11 Last Stim Setup Window

Use this panel to set the minimal interval of an automatic stimulation.

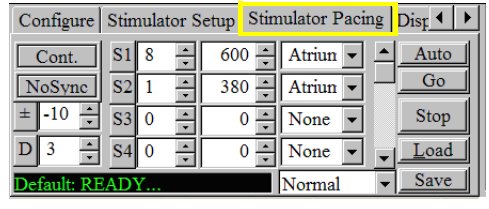
❖**To set the minimum automatic stimulation interval:**

1. Use the spin-box or the slider to set the required minimal interval.

Performing Stimulation

❖**To perform stimulation**

1. From the *Command* menus at the top of the Review Screen, scroll to the **Stimulator Pacing** tab:



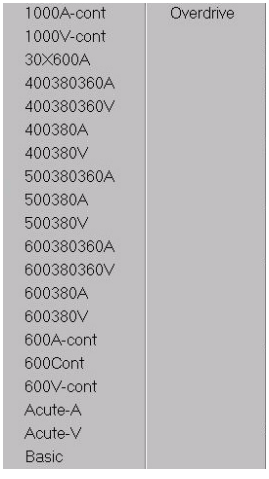
2. Use the *up*/*down* arrows to select the required pacing parameters for S1 and S2 (as per the example):

	#	dT	@
S1:	8	600	Atrium
S2:	1	380	Atrium

The selected parameters are visible in the appropriate fields (as above).

Note: *Instead of performing Steps 1 and 2, a set of pacing protocols may be loaded from a pre-defined list, as follows:*

Click the Load *button (or press the <**F3**> key) to access the Protocols List (see below). Select and load the required protocol set, by clicking the appropriate name in the list.*



3. Ensure that the pacing catheter is located at the correct site, then press <**G**> to start the stimuli protocol.

4. To *decrement* the Extra stimuli (in this example, S2) simply use the ↓ down-arrow (this will decrement S2 by 10); press <**G**> again.

5. Repeat Step 4 until the required results are achieved.

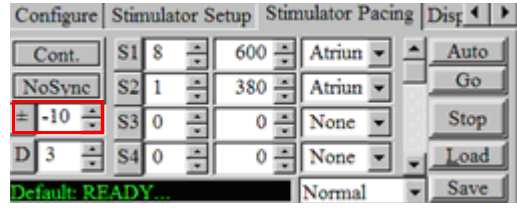
6. To stop pacing, press the space-bar.

Automatic Pacing

When using auto-stimulation, the Stimulator gives continuous stimuli according to values stated in S1-S5, but in each cycle the interval of the last extra stimuli is incremented/decremented automatically.

For example :

The increment/decrement is according to what is specified in the Stimulator Setup tab:



S1 8 600
S2 1 380

S1 8 600
S2 1 370

S1 8 600
S2 1 360

etc.

Pacing will automatically stop at the value stated in the Last Stim tab of the Stimulator Set-up. Values under this value can only be accessed manually. The lowest stimulation allowed is 70msec.

❖To perform auto-stimulation:

1. Press the <A> key to start the auto-stimulation process.

   Process and will decrement the last extra continuously, until it reaches the value stated in Last Stim tab.

F Key Shortcut to Stimulator Setup

F9, F10, F11 and F12 serve as shortcuts to user defined stimulation protocols.

The following table lists the shortcut keys.

#F Key	Stimulation Protocol labels	Sequence Mennen default
F9	Cont A 600	Continuous Atrial stimulation at 600 mSec
<Ctrl>+F9	Cont V 600	Continuous Ventricular stimulation at 600 mSec
F10	Basic A	8 x 600 + 1 x 380 A
<Ctrl>+ F10	Basic V	8 x 600 + 1 x 380 V
F11	Burst A	(If defined in the Offline Configuration Utility as Burst) See below
F12	Burst V	(If defined in the Offline Configuration Utility as Burst) See below

Burst Mode

The EMS-XL has 3 modes of stimulation dialog:

- **"Normal**
- **"Burst A**
- **"Burst V**

Normal mode is the default mode when starting a new case.

Burst modes are indicated by a red background on the

Stimulator Pacing panel.

Note: *If the Panic buttons F11 and F12 were configured as Burst in the Configuration Offline Utility then:*

F11 *toggles between* ***Burst A*** *and* ***Normal*** *modes.*

F12 *toggles between* ***Burst V*** *and* ***Normal*** *modes.*

The first time Burst mode is used in a case receives the Mennen default parameters.

Changes made to stimulation parameters while in **Burst** mode are stored as updated Burst parameters.

Returning from **Burst A** or **Burst V** to Normal mode sets the stimulation protocol to the last normal setting prior to activation of the Burst.

Using the mouse switching between modes is done by opening the combo box with 5 options:

- **Normal** - Exit Burst A or Burst V modes
- **Burst A** - Enter Burst A mode
- **Burst V** - Enter Burst V mode

Burst Defaults:

The stimulation files Burst A and Burst V are used as defaults on the start of a new case. The content of these files is user defined.The labels of these files can not be deleted of modified.

Note: F11, F12 keys and Stimulation mode combo box not active during Playback.

Caution : The G key will not start stimulation and the space key will not stop stimulation if panels that use the keyboard are open. For Example: -Patient - Notes - Report

Stimulation List

When you click the **List Stim** icon 

a panel with a list of all stimulations performed during the examination appears. To view the signal during a selected stimulation select the Stimulation line and click on **View Selected**. This will display the signals during the stimulation on the Review screen. Note that the left side of the scale at the bottom of Review screen is set to the time of the stimulation.

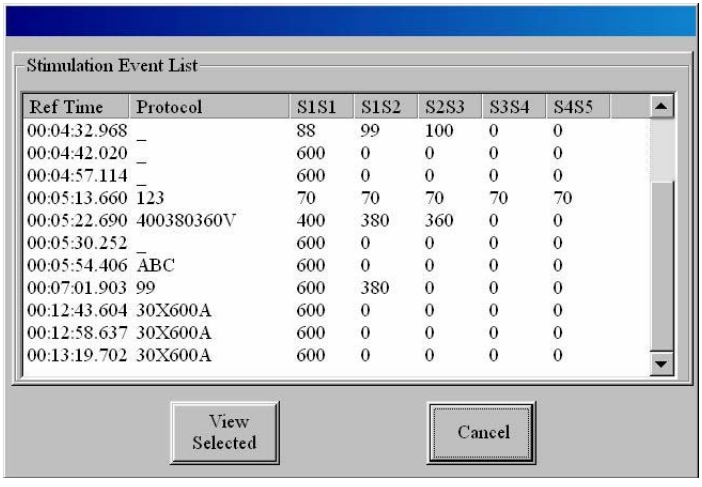
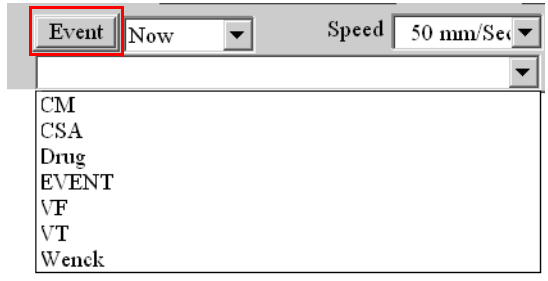


Figure 6-12 Stimulation List Window

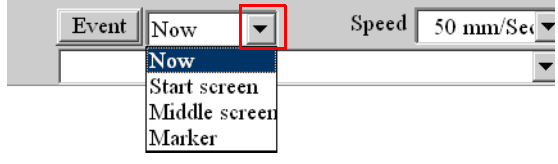
Marking an Event

❖To mark an event

1. Click **Event** and select the appropriate event category- from the list.



2. Open the drop-down list next to **Event** and mark the event by doing one of the following:



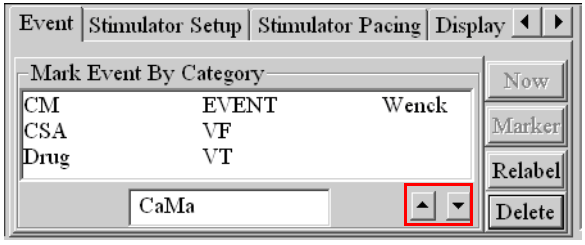
- Click **Now** to mark an event at the current time of activation.
- Click **Marker** to mark at any previous time during the procedure by setting the marker (caliper) at the point of interest.
- Click **Start Screen/Middle screen** to mark at the corresponding place on the NRT screen.

3. Click ENTER. The Event is added to the Events List, together with a timestamp and the selected category. This enables jumping to the event by double-clicking it in the *Events and Stimuli List* window at the top right corner of the Review Screen (see Events and Stimuli List on page 4-30).

Note: *All new events entered during the current case are added to the Evenets list. At END CASE the list returns to the default.*

Deleting or Renaming an Event

The Event tab displays the list of events (listed alphabetically) that can be used to collect events marked during the procedure or new events that were entered by the user diring the current procedure.



You cn scroll through the list using the up and down arrows.

❖To delete an event:

1. Select the event in the Event and Stimuli List and click **Delete**.

❖To rename an event:

1. To rename an event, select the event on the Event and Stimuli List type the new name in the text-boxand click **Relabel.**

Event List

When you click the **Event List** 

icon, the **Events Selected** window appears with a list of all available event sub-sets (categories) in the left pane and selected categories in the right pane. The bottom pane lists all the events from the selected sub-sets (categories) that were listed during the case.

You can use the left arrow  to de-select a subset of Events. When you de-select a category, all the events of

this sub-set will be erased from the list in the bottom pane.

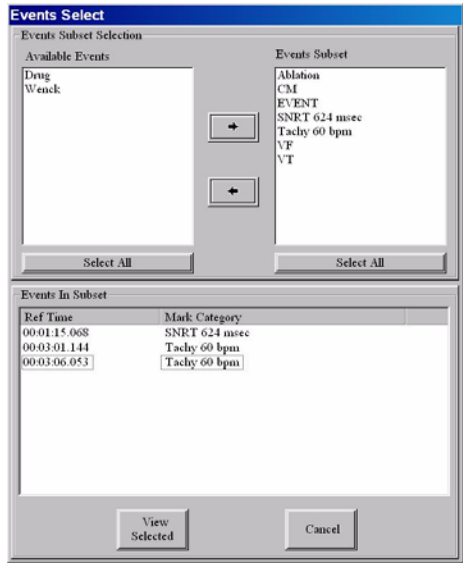


Figure 6-13 Events Table Window

To view the signal during a selected event, select the line of the event in the bottom pane and click **View Selected**.

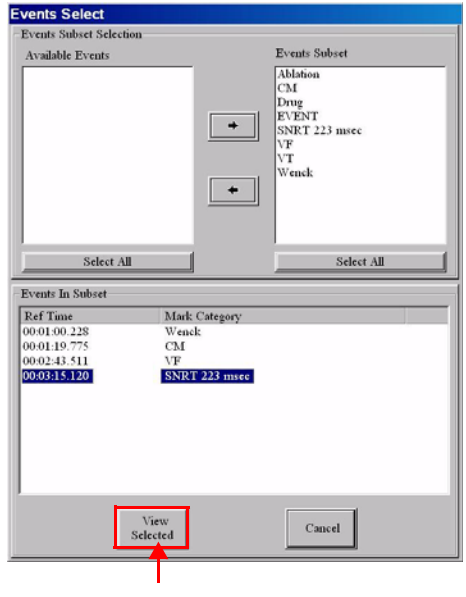


Figure 6-14 Events Select Window

This displays the signals during the event on the Review screen. Note that the left side of the scale at the bottom of Review screen is set to the time of the event.

Events (Markers) and Stimuli List in the Review Screen

At the upper right corner of the Review Screen, a window displays the Events (Markers) and Stimuli List (see Figure 4-4).

You can scroll through the events or stimulations one at a time by using the Scroll button. (the Scroll-Event button is a single button that toggles between functions).

Choose **Stimuli** to see a visual, time referenced display of all stimulations during the case. Choose **Markers** to see a visual, time referenced display of all non-stimulation events during the case. You can easily scroll through the list using the left/right arrows. The event and time stamp appear in the window beneath the Event-Scroll button.

Figure 6-15 Event and Time Stamp

Using the Calipers for Interval Measurements

This section describes the technique for using the pairs of interactive calipers, specially designed for easy operation when performing interval measurements.

Note: *The calipers may be used at any time in the Review Screen, but can only be used in Trigger Mode on the RT Monitor.*

Intervals can be measured by:

- Up to 10 pairs of Magenta - Green cursors
- One Magenta cursor and several green cursors with intervals measured between the Magenta to each Green cursor.

As a general rule the cursors are activated by:

- Mouse-click: Click mouse and drag: Activates and fixes a pair of Green & Magenta cursors marking the Start and End of an interval.
- Right-click: Activates and fixes Green cursor - marks End of interval

It is possible to lock and move a pair of calipers by clicking on connection line between cursors.

In order to delete a pair of calipers right-click on a connection line between cursors.

❖To Activate Caliper mode:

1. Do one of the following:

   - Press the Caliper  icon
   - Press the <C> keyboard key.
   - Click the mouse.

❖To set the calipers:

1. Once the magenta caliper appears you can click on it and drag so that a Green caliper appears ; In this state the **Elapsed Time location** (sec.ms format) of each caliper is displayed in it's corresponding color at the box above the **Hour-Minute** box at bottom - left of the NRT screen.

2. . Using the mouse you can move the Green caliper by

standing on the caliper, this changes it's color to yellow, and draging it to the required location.

The absolute delta time between the calipers is displayed beside the top of the green caliper.

3. You can click the mouse anywhere on the screen to produce another Magenta caliper and pair .

4. You can move a caliper pair with the mouse by clicking the mouse on the brown line between the pair of calipers.

The absolute delta time between calipers is displayed in the blue box beside the green caliper.

Note: *Right-clicking the Blue Box displays the interval rate in bpm (beats per second)*

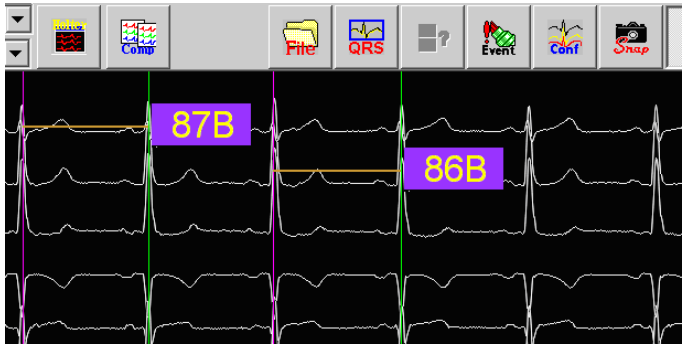


Figure 6-16 Interval Rate display

To Erase a pair of calipers from display right-click the mouse on gray line between needed pair of calipers.

❖ **To exit Caliper mode:**

1. Do one of the following:

- Press the Caliper icon  .
- Press the <C> keyboard key.
- Jump to new minute
- Manual snapshot.
- Modify NRT speed.
- Exit from Holter/display mode.
- Start/End case or playback.

❖**To mark an Event by caliper:**

1. The current caliper time is taken.

2. This time is displayed in magenta or green at the bottom-left of NRT screen. (sec.ms format).

Note: *The Elapsed Time box (bottom - left) shows the active caliper elapsed time. It will adapt the active caliper color Magenta for the first marker and Green for the second marker. When no calipers is active the box shows the NRT screen start time in Yellow*

❖**To perform interval measurements using the calipers**

1. Click the **Calipers** icon  to activate the calipers.

   The magenta-colored vertical line is the reference point for the measurement. The second caliper - green - measures the interval between the calipers in msec.

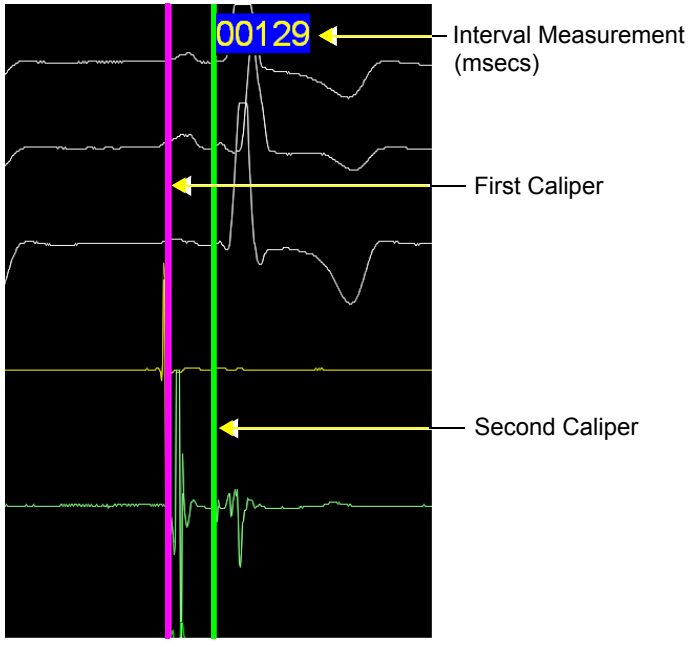


Figure 6-17 Interval Measurement using Calipers

2. Move the green line (second caliper) to the *left* or *right* of the magenta line (by moving the mouse), as required.

   When this line is in the appropriate position for the required measurement (i.e. relative to the first caliper), click on it to fix it in position (see Figure 6-17).

Note: *The interval measurement value displayed on the icon adjacent to the calipers (*see *Figure 6-17) can be entered to the Events list and stored in the EMS-XL Report (Word format) - see next steps.*

❖To Enter a Measurement to the Events list and EMS-XL Final Report:

1. Click the  icon.

   A Trace Properties bar opens.

2. From the list of locations, select the appropriate location to which the measurement is to be associated. (for example, QRS, QT, etc.).

   The measurement is written to the appropriate place in the Events list and EMS-XL Report.

3. When done, click  to clear the screen (or press <**C**> on the keyboard).

Ablation Events

Ablation results are displayed on the RT screen inside the hemodynamic data window located at the top left of the screen.

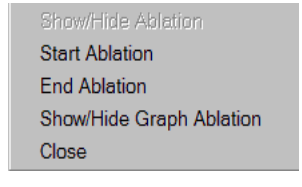
The following information is displayed:

- Temperature in Degrees Celsius (acceptable range: 15-80).
- Power in Watts (acceptable range 1-150).
- Time in seconds (acceptable range 1-240).
- Impedance in Ohms (acceptable range 25-300)..

❖**To start/end an ablation event**

1. Right-click the hemodynamic data window.

   The ablation menu is displayed.



2. Select **Start Ablation** / **End Ablation**.

   This will enter a manual event in the events list accordingly. These lines are grayed out when an ablator is connected to the EMS-XL system. (because the events will be entered to the Events list automatically after activating/stopping the ablator)

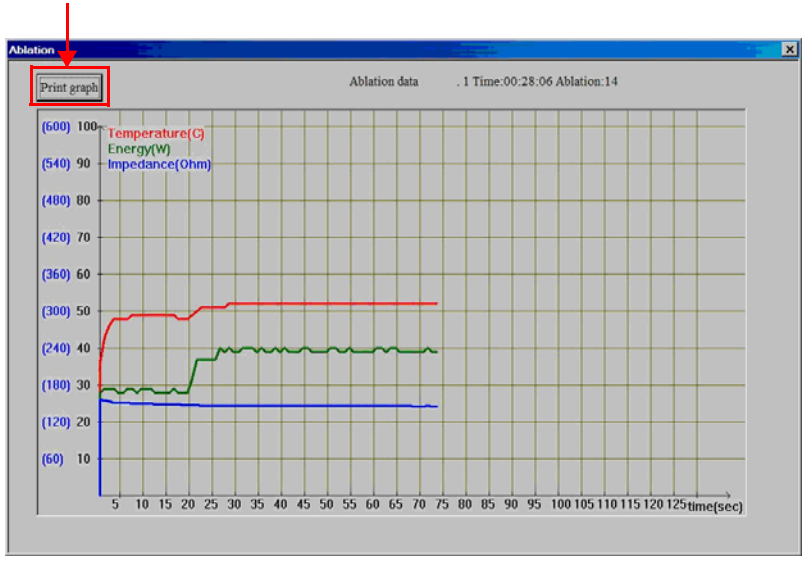
   A Start Ablation/End Ablation event is displayed in orange in the Events list in the review screen.

   During an ablation events results are displayed automatically in the hemodynamic data window.

Note: You can select Show/Hide Ablation to display/hide ablation data.

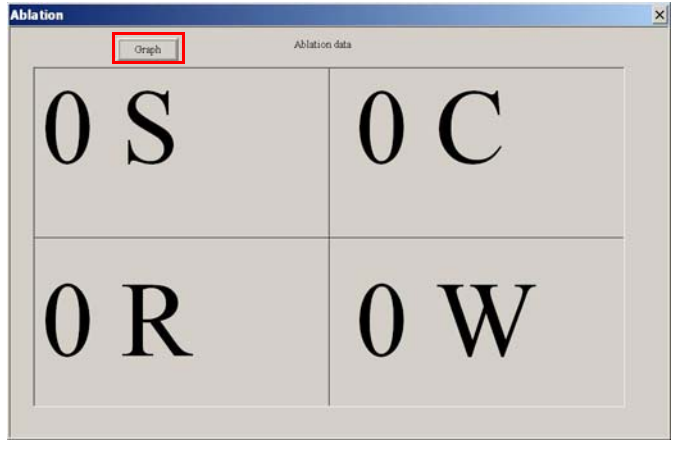
3. Select **Show/Hide Graph Ablation** to show/hide data in graph form. Double-clicking on events of Start Ablation from the event list on the NRT screen displays previous graphs of ablations.

   The graphs appear on the NRT screen.



You can print the graphs by pressing ***Print graph*** *button. The ablation graph printout contains patient's first name, last name and number of ablation from the event list.*

4. Press **BIG** for Big numbers display of ablation data. Press **Graph** to return to graphic display.



Save a Snapshot

Using this icon  displays a "Save As" window in which you can browse to a folder, name the image file name , and select the format of the NRT snapshot image to be saved in the computer (default format is JPEG). This also enters an event of the Screen shot into the Events list, and enter the screenshot into the final report.

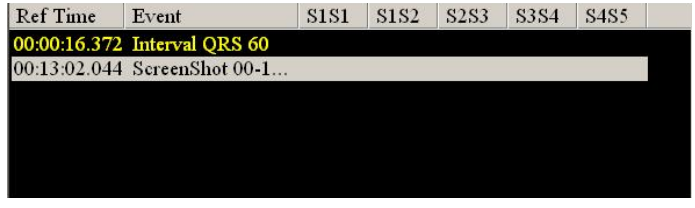


Figure 6-18 ScreenShot Event

❖**To insert the saved picture into a report:**

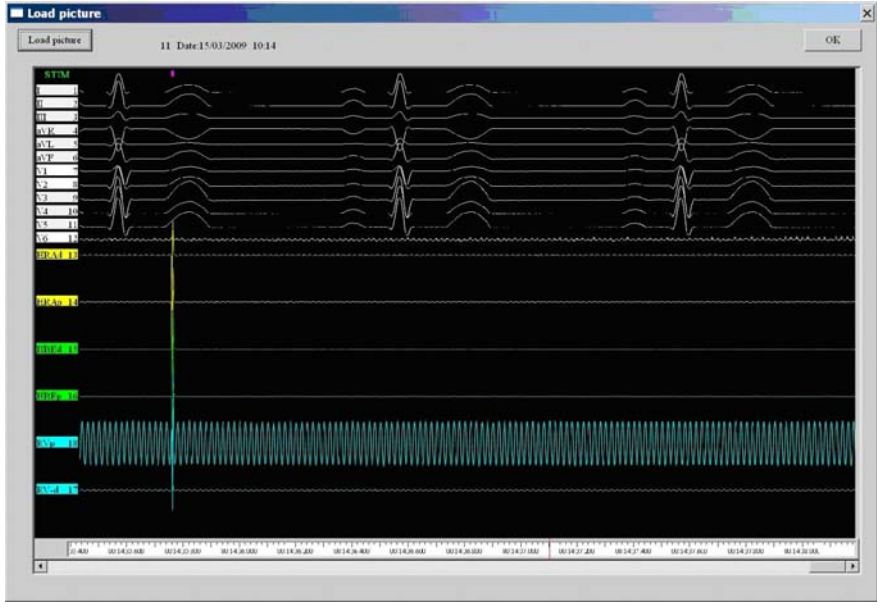
1. Open the report.

2. Set the Cursor at the end of the report.

3. Select: **Insert** > **Picture** > **From File** and select the image file to insert.
   The saved snapshot is inserted into the report.

❖**To view all saved snapshots:**

1. "Right-click the "Save shapshot to graphic file" button to show window for reviewing all saved snapshots.



❖**To load a saved picture:**

Figure 6-19 Load Picture window

1. Click **Load Picture** to open a directory for searching saved pictures.

Insert Text

❖**To insert text on the Review Screen:**

1. Click the Insert Text icon 

. A window opens at the top-right corner of the Review screen.
2. Using the mouse set the focus to the Text window.
3. Use the keyboard to print the required text.
4. Using the mouse place the cursor arrow at the required location of the text.
5. CTRL+right-click the mouse to place the text on the screen.

Note: *To clear the text click the Insert Text icon again.*

Note: *To draw a line on the screen, press <Ctrl> then click and drag to place the line where required.*

Sinus Node Recovery Time - SNRT

Overview

The Sinus Node Recovery Time (SNRT) is measured by driving the atrium with a stimulation rate greater than the spontaneous rate. The procedure includes atrial driving for a user defined period SD (default is 30 seconds) and measuring the interval from the last atrial stimuli to the first sinus activity.

It is expected that as the stimulation interval becomes shorter, the recovery time becomes longer.

The procedure is repeated at shorter and shorter stimulation Cycle Length (CL) i.e., at increasing rates.

At the end of the SNRT procedure a table that relates SNRT to stimulation interval is created.

Corrected SNRT (CSNRT) **= SNRT - IR** is the difference between the recovery time and the spontaneous beat to beat interval prior to the atrial driving.

Normal range values for SNRT are up to 1,500 msec. Normal range values for CSNRT are up to 500 msec.

The EMS-XL provides a semi - automatic SNRT procedure.

Terminology

Table 6-1 SNRT Terminology

Label	Description	Formula
SNRT	Sinus Node Recovery Time	
IR	Intrinsic Rate stimulation	
SD	Stimulation duration	
CSNRT	Corrected SNRT	CNSRT = (SNRT -IR)
MSI	Minimum stimulation interval	
CL	Stimulation Cycle Length	

SNRT Parameters

SNRT Dialog panel allows the user to define the SNRT parameters:

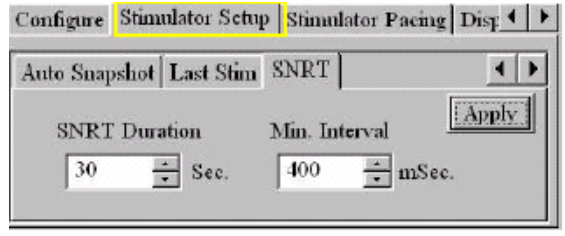
SD = Stimulation Duration during SNRT procedure in seconds (10-60 seconds range, in steps of 10 sec, default = 30 sec).

MSI = Minimum Stimulation Interval in msec (200-1,000 ms range, in steps of 100 msec, default 400 = msec).

❖**To set SNRT Parameters:**

1. From the **Command** menus at the top of the Review

Screen (see Figure 2-5 on page 18), use the Left/Right arrows  to scroll to the Stimulator Setup tab.



2. In the SNRT tab use the Up/Down arrows  to set the stimulation duration.

3. Use the Up/Down arrows  to set the minimum interval for the SNRT procedure.

4. Click **Apply**.

The SNRT Procedure

After setting up the parameters you can start the SNRT procedure. You are permitted up to 10 SNRT cycles.

SNRT mode is active only after selecting a patient. SNRT is not available in Burst mode.

The Auto button in the Stimulation panel is not active in SNRT mode.

Note: SNRT procedure uses only S1 stimulation. Do not use S2,S3...

❖**To start the SNRT Procedure:**

1. Click the SNRT icon 

.

   The stimulation dialog panel is displayed with the SNRT stimulation protocol.

   The default protocol shows:

   CL = S1 period = 800 msec and S1 counter = SD*1000 / CL .

Note: The default SNRT stimulation protocol file can be modified but not deleted.

Default attributes are: Single, Sync,S1=37X800 msec, SD=30 sec, Atrium, Delta=-50msec.

2. You can now manually set the first S1 period (usually it is set to: Spontaneous interval minus 50 msec).

   The S1 counter is then set automatically to provide the preset SD duration (No. of Beats = SD*1000/ CL).

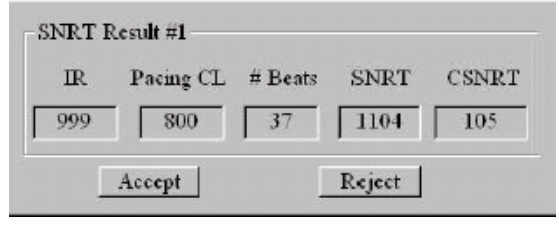
3. Press <G> or click Go to start stimulation series.

The system stores the last spontaneous RR interval = **Intrinsic Rate - IR** .

At the end of the train:

- Automatic Snapshot is displayed on the NRT screen with a sweep speed of 150 mm/sec .
- The NRT magenta caliper is located on the last stimulation (caliper is fixed).
- The NRT green caliper is located on the first spontaneous spike after last stimulation. (caliper can be moved).
- The interval between the calipers is displayed on-screen (SNRT measurement).
- To allow you to correct the position, you can change the NRT green caliper position by moving the mouse.

Popup dialog is displayed with **IR**, **SNRT** and **CSNRT** values and you are requested to confirm the results by clicking the **Accept/Reject** buttons.



SNRT values greater than 1,500 msec and **CSNRT** values greater than 500 msec are displayed in red.

Note: The calipers are removed after you accept or reject the values.

After clicking Accept or Reject the S1 period is decremented according to the +/- field for the next

SNRT measurement. (The minimum period is the user-defined value **MSI**). In addition the S1 counter changes according to the user-defined value for **SD**.

4. You can now click Go again to start a new SNRT cycle with the new CL.

Note: You can run up to 10 SNRT cycles.

5. To exit SNRT mode click the SNRT icon.

SNRT Table in a Report

The following table is presented in the report with each line representing one SNRT test cycle.

Table 6-2 Sinus Node Recovery Time

IR-Intrinsic Rate (msec)	Pacing CL (msec)	Number of beats	SNRT (msec)	Corrected SNRT-CSNRT (msec)
953	700	60	1143	190
1010	650	93	1160	150

Normal range for SNRT is up to 1,500 msec.

Normal range for CSNRT is up to 500 msec.

Abnormal SNRT values are displayed with a red background. In the report abnormal SNRT values are marked by a star (*).

Procedure Documentation

Adding On-line Notes

Note: *On-line notes may be added at any time during a Case.*

❖To add a note

1. From the *Commands* menu at the top of the Review Screen, click Notes.

Note: *You can display the Commands menu directly by clicking the* ***File*** 

icon on the Review screen shortcut toolbar (see page 4-21).

Or

Click the  icon

Or

Press <**F3**> on the keyboard.

The Notes window opens.:

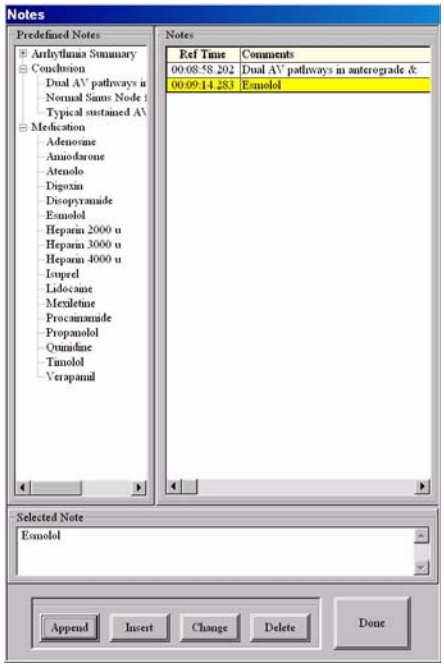


Figure 6-1 Notes Window

*Note : Close the panel (**Done**) before trying to activate any other function.*

The Notes window is divided into three main areas, enabling you to append pre-defined Notes to the Case, and/or create new Notes, as required:

- **Pre-defined Notes** - enables selection of a ready-made note from a list of Notes (already defined in the system)
- **Notes** - contains a table with two columns:
  Ref Time: automatically displays the current time offset from the start of the Case
  Comments: may be used for a pre-defined or user-defined note.

- **Selected Note** - editable text field for editing a note.

Note: *For an explanation of the Notes window buttons, refer to Table 6-1 below.*

Table 6-1 Notes Buttons & Functions

Button	Function
Append	Appends a new note to the Case.
Insert	Inserts a note in a specific location in the selected Notes list. For example, used to insert a note at the appropriate time when medication has been administered.
Change	Used to edit the contents of a Note - clicking Change accepts the edited text.
Delete	Used to Delete a Note from the Case.
Done	Closes the *Notes* window.

2. Select the required Note from the *Pre-defined Notes* list and click **Append** to add it to the *Notes* list.

   OR

   click and drag the required Note from the *Pre-defined Notes* list to the *Notes* list.

Note: *A Note may be added at a specific location in the Notes List (e.g. the line before an existing Note) by clicking **Insert** (instead of Append).*

3. If preferred, add free text to the Notes list by typing the required text in the *Selected Notes* text input field (see Figure 6-1), and using the **Append** or **Insert** buttons, as previously described.

4. Repeat Step 2 or Step 3 to add any additional Notes to

the Case, as required.

5. Click **Done** to clear the Notes window.

Note: *All Notes added to a Case are saved in the Patient File, together with the Case data. They are automatically printed in the EMS-XL Report.*

Printing

You can print from the Run Time Monitor screen and from the Review (NRT) screen .

Note: *For details of the time range (in milliseconds) covered by one printed page under different printing speeds and page sizes see Screen / Print Size Information on page 4-34.*

Printing from the Run Time Monitor Screen

You can print from the Run Time Monitor (RT) screen.

Note: Due to difference in printer paper size and display size, the printed page does not include the same information as the display. A red marker at the bottom of the display indicates the printer page end.

❖To print Surface ECG from the RT Screen:

1. In the Run Time Monitor screen click the RT 12 Lead  button.

2. From the popup menu that appears select one of the following:

   - **3 x 4 + Selected lead:**

Paper speed is 25mm/sec.

Start time of print is 10 sec before user click time.

The default Rhythm lead is Lead II.

It is possible to select a different Rhythm lead by selecting one of the Surface ECG channels on the RT display.

- **Lined 12 X 10 seconds**

  Paper speed is 25mm/sec

  Start time of report is 10 sec before user click time

  12 Lead consecutively from top to bottom. Lead I to Lead V6.

- **Close:** To close the popup menu.

Printing RT Displayed Channels

You can print RT waveforms according to the definitions in the Print panel.

❖To print RT displayed channels:

In the Run Time Monitor screen click the Print RT **Displayed Channels** button  .

The default of the RT printing is one page printed at a paper speed equal to the RT sweep speed. In the Print panel you can select printing length by Time (10/20/30/40/50/60 seconds), or by the Number of Pages (1/2/3/4). The print speed can be set to Same as RT screen or 25/50/100/150/200/250/300 mm/sec.

Note: *The print panel is located in the Commands tab on the NRT screen.*

Click the **Print RT Displayed Channels** button or <F8> keyboard key, to start and stop multi-page printing.

While printing is in progress, the current page number is displayed on the bottom line of the RT screen. The start time of the first printed page is the time of the last page before the user Click time. Page number, and elapsed time are displayed on each printed page.

Note: RT Printing is functional in both Sweep and Trigger modes. However, it uses the FD to prepare a signal for printing, thus it is not activated if FD is set to Off.

Printing from the Review Screen

You can print from the Review screen during a case and during playback in both Study and Holter display.

❖To print Surface ECG from the NRT Screen:

1. In the Review screen click the printing button  .

2. From the popup menu select one of the following:

   - **3 x 4 + Selected lead**
   - **Lined 12 X 10 seconds**
   - **Close:** To close the popup menu.

Printing NRT Displayed Channels

You can print RT waveforms according to the definitions in the Print panel.

The following printing options are available:

- **Current View:**

Prints current signals displayed on the NRT screen on one page.

The printing speed matches the NRT sweep speed. Start

time of the printing is the Begin time of the NRT screen sweep. Printing includes: Calipers / Caliper measurement / Text / Graphics Elements.

The Waveforms trace thickness is according to the current NRT view.

• Multiple Pages:

This option opens a special dialog window where you can select speed/report time/grid for printing the current signals displayed on NRT on multiple pages. The dialog screen displays the number of pages and the total report time. Each report page includes the page number.

Waveforms trace thickness according to current NRT view.

The User Defined report length can be given in seconds (10/20/30/40/50/60) or number of pages 1/2/3/4 pages) (Default : 1 Page).

The User Defined print speed can be the same as the RT screen sweep or 25/50/100/150/200/250/300 mm/sec (Default: The same as the NRT screen).

The Start time of the report is the NRT screen Sweep Begin time. If Single Marker is selected, the print starts on event marker time.

• ECG 3 x 4 + 10 seconds of Holter Channel

This option is only available in Holter mode.

Printing speed for this option is 25 mm/sec.

The Start time of the report is the NRT screen Sweep Begin time. If Single Marker selected, printing starts on event marker time.

- **1 minute Holter**

This option is only available in Holter mode.

Prints the entire 1 minute buffer of Holter selected channel (surface or intracardiac channel).

Printing speed for this option is 25 mm/sec.

The report includes 10 sec X 6 rows (each row contains 1 channel waveforms).

- **2 channels Holter**

This option is only available in Holter mode.

Print the entire 1 minute buffer of Holter selected channel + user selected channel (Surface, intracardiac or pressure channel). Default 2nd lead is V1.

Printing speed for this option is 25 mm/sec.

The report includes 10 sec X 6 rows (each row contains 2 channel waveforms).

❖**To print NRT displayed channels:**

1. In the Review Screen click the Printing button  .
2. From the popup menu that appears select one of the following:
   - **Current View**
   - **Multiple Pages**
   - **ECG 3 x 4 + 10 seconds of Holter Channel** (Active Only in Holter mode)
   - **1 minute Holter** (Active Only in Holter mode)
   - **2 channels Holter**(Active Only in Holter mode)
   - **Close**: To close the popup menu.

Working with Templates

The EMS-XL allows the user to compare waveforms with predefined templates.

To use this mode you first need to store template waveforms, label the templates and then call any of the templates for comparison with the waveforms on the RT or NRT display.

Creating a Template

You can create a 600 msec template by clicking the **Save Template**  icon on the NRT screen ruler or the **Save Template** Tab.

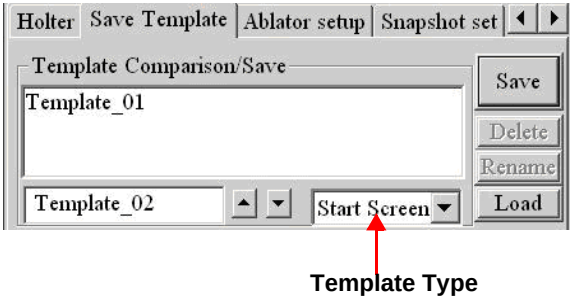


Figure 6-1 Save Template Tab

You can create a template storing 600 msec as follows:

Trigger RT: Stored 600 msec from the Run Time screen.(Only when the RT is in Triggered mode.)

Start Screen: Stored 600 msec from the start of the Review (NRT) screen.

Start Marker: Stored 600 msec from the location of the marker on the Review (NRT) screen.

Marker in Middle: Stored 300 msec before and 300 msec after the location of the marker on the Review (NRT) screen.

The template receives a default label Template 01 or 02 etc. This label can be changed by the user using the keyboard.

❖To create a template:

1. In the **Save Template** select the template type from the dropdown list ((see Figure 6-1)).

2. Click **Save**.

Comparing the Run Time Screen to a Template

You can compare stored templates to the Run Time (Monitor) screen.

❖To compare templates:

1. In the RT screen click the **Comp** icon 

.

   The Template Comparison window opens with a list of the current patient templates sorted alphabetically.

Note: Click the icon again to close the window.

2. Click **Side Pos.** to activate the side position area in the RT screen - 600 msec at the right end of the screen.

3. Click **Super Position** to activate superposition of the 600 msec template on the live triggered waveforms in the RT screen (active only in Trigger mode).

4. Click **Color** to paint all superimposed tem-plate channels with the same color. If unselected each channel has its own original color (active only in Trigger mode).

5. Select the template for comparison from the list and click **Load** to load the template.

Notes:

The last selected template label is displayed at the bottom of the RT screen (near timer view). This label is removed during End/Start case.

During End/Start case the Template Comparison window closes automatically.

Since templates are related to patients, the template list is emptied at End/Start case.

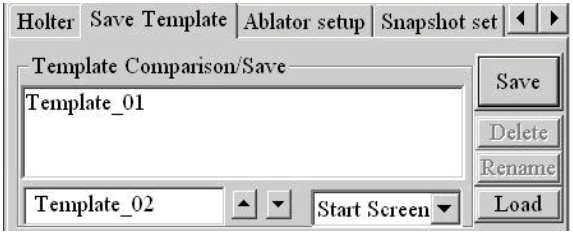
Comparing the Non-Real Time Screen to a Template

You can compare stored templates on the Non-Real Time (NRT) (Monitor) screen.

❖To compare templates:

1. In the NRT screen click the **Save Template** icon  or **Save Template** Tab.

   The Template Comparison window opens with a list of the current patient templates sorted alphabetically.



2. Select a template from the list and click **Load** to load the template for comparison on the NRT screen.

   Note: Click the icon again to close the window.

Deleting and Over-writing a Template

❖**To Delete a template:**

In the NRT screen click the Save Template icon or Tab.

The Template Comparison window opens with a list of

the current patient templates sorted alphabetically. Select a template from the list and click the Delete button.

❖**To Overwrite a template name:**

1. In the NRT screen click the **Save Template** icon or Tab.

   The Template Comparison window opens with a list of the current patient templates sorted alphabetically. Select the template from the list that you want to over-write with a new template and click the ***Overwrite*** *button.*

Ending the EP Study

Saving and Storing the EP Study

During recording, all *Full Disclosure* data is automatically saved to the Patient File on the system hard disk.

Note: *It is possible to copy data directly via Windows Explorer.*

There are two ways in which waveform data may be stored:

- DVD R-W
- CDR-W - *non-erasable*

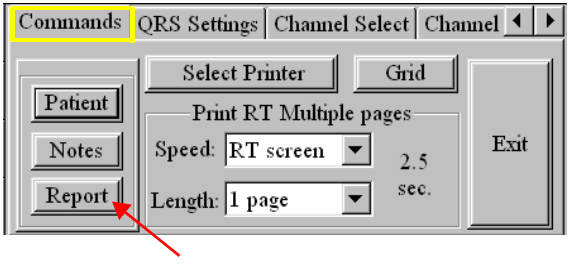
Editing the EMS-XL Report

Note: *On-line notes may be added at any time during a Case.*

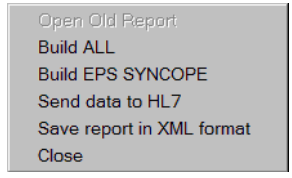
❖To edit a report

1. From the *Commands* menu at the top of the Review Screen, click **Report**:

Note: *You can display the Commands menu directly by clicking the File*  *icon on the Review screen shortcut toolbar (see page 4-21).*



A menu with the following options appears:



- **Open Old Report**: this report includes report previously saved. All information added since last report built- is NOT included in report.
- **Build All**: The Reports Generator opens, displaying the EMS-XL Report template (Microsoft Word® rich text format[rtf]). By default, the patient information from current case is already entered in the template - see the example in Figure 6-2.
- **Build EPS Syncope**: builds specific report with details specified for Syncope study.
- **Send Data to HL7**: sends data to HL7 server (optional mode available in some models)
- **Save Report in XML format**: saves report in special XML format. File is saved in special XML format.

Note : It is possible to build reports specified for the end-user using XML Format.

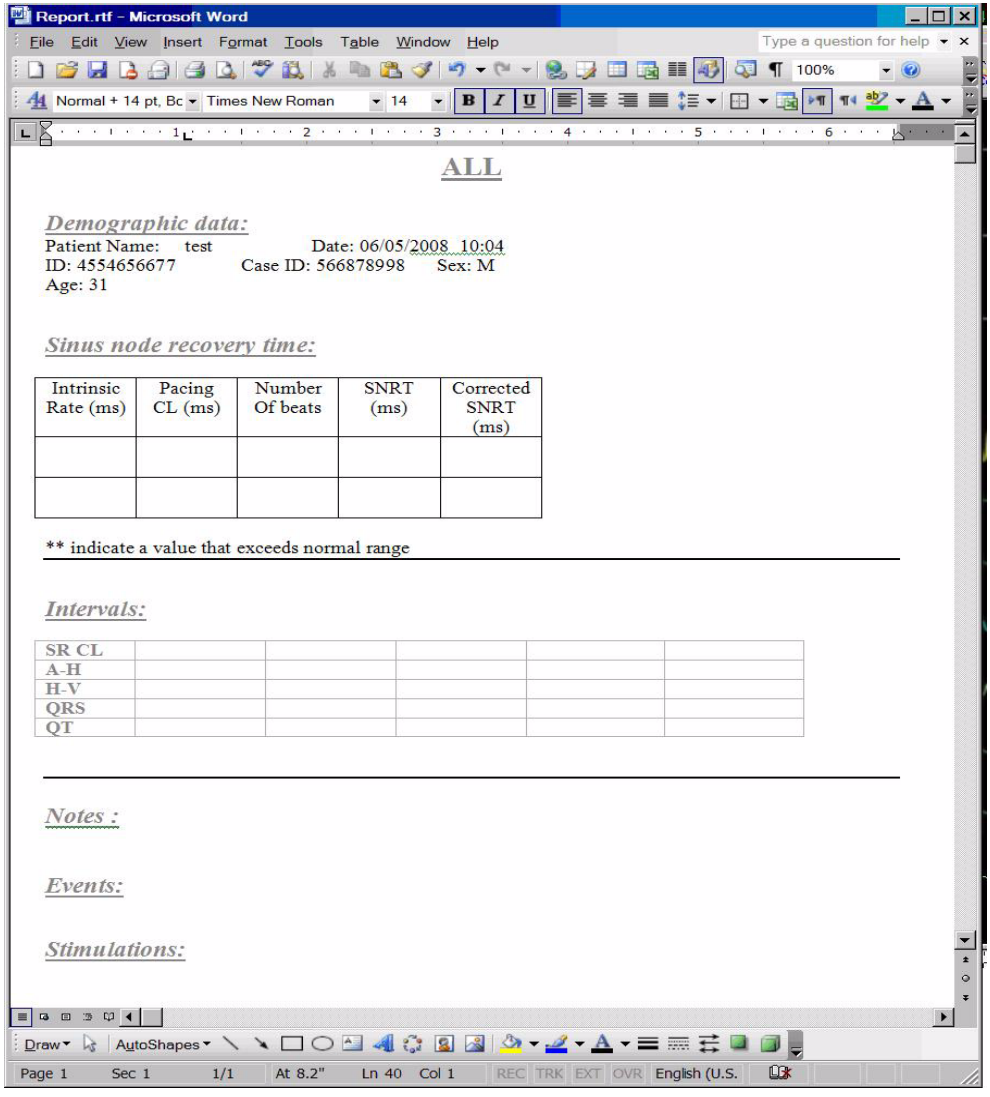


Figure 6-2 EMS-XL Report Template

Note: *Close the panel before trying to activate any other function.*

2. Add information to the report as required by clicking and typing text where appropriate.

Note: *The following data is inserted into the report automatically:*

- *1.Patient name, Patient ID and Case ID*
- *2.Labeled Intervals, measured by the cursor on the review screen and labeled as: SR CL, A-H, HV, QRS, QT*
- *3.SNRT measurement results*

Note: *You can insert the last saved snapshot into the report by pressing CTRL+V. (See* *Save a Snapshot on page 4-15**).*

3. When done, click on any blank (non-active) area on the Review Screen to hide the Report

   OR

   Click ✕ at the top right corner of the Report template to close the file.

Note: *During Playback the report may be edited manually, but no additional information is entered automatically.*

Note: *The report is automatically stored in : D:/EP/Patients/"Patient Name"/"Case ID"/ Report.RTF*
*It is possible to store the report as an *.RTF file under any other name.*

The report can be retrieved via the Report Word panel or any Word panel, or via Explorer.

Ending a Case

❖To end a Case

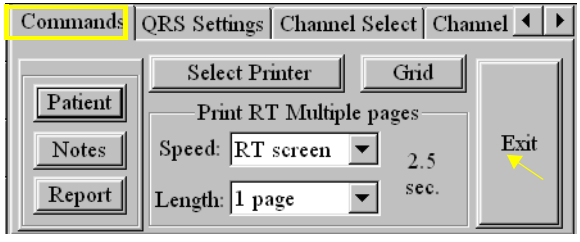
1. Check that all stages of the EP Study have been completed successfully (i.e. all relevant data acquired).

2. From the *Patient and Study Information* window, click End Case (refer to Figure-6-1 on page 6-3).

   Full Disclosure recording stops and the patient's details are cleared from the RT Monitor.

3. Click Done to exit.

4. From the *Commands* menu at the top of the Review Screen, click **Exit** to quit the EMS-XL program:



The Windows desktop is displayed.

Saving Part of a Case

After ending the EP study it is possible to save a part of a case.

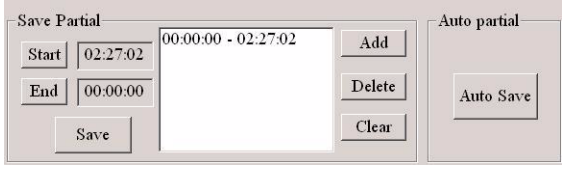
You can save up to 25 sections of an event into one file.

In addition you can use the **Auto Save** option to create a new file that will contain all the events/stimulations in the case study including 30 seond pre-event and 30 second post event recordings.

❖**To save part of a case:**

1. Click the **Save Partial** icon  in playback mode.

   A window opens enabling you to select the Start and End times.



2. Use the Hour / Minute scroll bar located at the bottom corner of the NRT screen (see Figure-4-4) to the required Start Time and click **Start**.

3. Use the Hour / Minute scroll bar located at the bottom corner of the NRT screen (see Figure-4-4) to the required EndTime and click **End**.

4. Click **Add** to add another segment and repeat.

5. When you finish selecting the segments click **Save** to display the Save partial Case - Patient Information panel.

6. Type a name for the saved partial file or modify the default name (default name is the original case file with an underscore after it, for example if the original case number is 557 Partial Case no. is 557_. You can add to this name for example 557_part1 or change the name altogether.

   Note: *If you wish to save more than one part of the same case, it is recommended to add a suffix after the underscore for each of the saved parts.Example: Case ID = 137.*

The partial case is automatically marked as 137_. This is a new Case ID and can be stored as such, or you can change the file name to any new name. It is, however, recommended to add a suffix to each part, such as: 137_A, 137_B, etc. This will enable you to recognize the parts as belonging to the same case

7. Click **Save Part**.

Notes: *The required part of the case is saved to the new file .*
The waveforms and the list of stimulations and events, for the saved part, are also saved.
You can now delete the original file to save disk space .

❖To auto save events / stimulations of a case:

1. Click the **Save Partial** icon  in playback mode.

2. In the window that opens click **Auto Save**.

   The Save partial Case - Patient Information panel appears.

3. Type a name for the saved partial file or modify the default name and click **Save Part**.

Chapter 7

Case Playback

Overview

The EMS-XL *Case Playback* function enables off-line review of a closed EP Study. The recorded data in a Patient File may be re-opened and the entire Case (or portions of the Case) may be played back, analyzed, and printed.

Note: *The Case Playback feature is enabled only after "End Case" has been indicated.*

During playback, the following types of configuration changes that were done during the study will be shown on the RT screen:

- Changes of configuration that were done by Config button.
- Manual change of appearance/disappearance of leads.
- Label change of lead
- Changes of lead positions

Run Time Screen in Playback

During Playback the Run Time screen plays with all the changes that were done during the recording.

The Run Time screen changes automatically according to changes done during recording.

During playback you cannot perform manual changes to the Run Time screen or to the channel set-up.

Pressing the **PLAY**  button on the NRT screen during playback sets the RT screen to the same time as the NRT screen. The configuration of the screen is the original recorded configuration.

Review Screen in Playback

You can manually display/hide a lead during playback.

You can change the position, label, zoom and color of the lead.

Pressing **COPY RT** copies the configuration shown on the RT screen at time of playback to the NRT screen. This will overwrite any manual changes done to the NRT screen.

Double-clicking an event in the event list displays the event in the Review screen with the configuration used during the recording of that specific event. This overwrites any manual changes done to the Review screen.

Movement in time - ruler and minute steps (on the left bottom of the Review screen.) show on the Review screen with the configuration used during the recording

Movement with the ruler in the Review does not change the configuration that was determined manually on the screen until it reaches a point where the configuration changes on the RT (done during recording), and then it too changes accordingly on the Review.

You can use the Snapshot feature during playback.

You can enter events and notes during playback.

During Playback, you may use the Calipers to measure events. In addition, the EMS-XL Report is also active and can be edited and printed if required.

During playback you can also select a specific time from the case recording and playback the case from that time onward.

In Playback Mode, a few EMS-XL features are disabled rendering the following functions ***unavailable***:

- Printing from the RT Monitor
- Using the Stimulator
- Inserting Measurement Results (with assigned location) in the EMS-XL Report

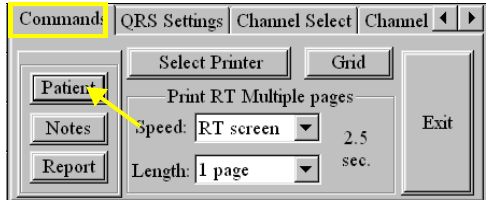
❖To Playback a Case

1. Click the  shortcut icon.

   OR

   From the *Command* menus at the top of the Review Screen, scroll to the **Commands** tab.

2. Click **Patient**:



   The Patient & Study Information window opens (refer to Figure-6-1 on page 6-3).

3. Under the *Patient Tree*, scroll the list of Patient Files and find the required patient Name.

Note: *If a patient has more than one Case, a + sign is displayed next to the listed patient name. Click + to expand the list.*

4. Click on the required *Case ID* to select it.

5. Click the Playback Case button.

6. Click Done to close the Patient & Study Information window.

   Allow a few seconds for the screens to be filled with the recorded data:

   The RT Monitor will start displaying continuous waveforms (starting from beginning-of-file); the Review Screen will be filled with the first few seconds of data.

7. Proceed to review the case, using the tools and techniques previously described (refer to the following):

   - ·Use the minutes bar, left bottom of the NRT screen, to select the required minute.
   - ·Use the scroll bar and arrows for fine-tuning the time settings.
   - Using the Calipers for Interval Measurements on page 6-32.

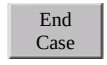
   Note: *In Playback Mode you are not able to assign a location to the measurement or save the results in the Report.*

   - Printing on page 6-51.
   - Editing the EMS-XL Report on page 6-60.

Note: *While reviewing the Case, you may jump to an Event via the Events and Stimuli List (see page 4-50), or by simply scrolling through the data using the timer located at the lower-left corner of the Review Screen.*

8. When done, exit Playback as follows:

Click the  shortcut icon; the Patient & Study Information window re-opens.

Click the  button.

The Patient Tree becomes active again, enabling playback of another Case, or registering another patient.

❖**To Playback the case from a selected time:**

1. In the lower left corner of the Review screen use the slider to select the case time from which you want to start playback.

The selected time from case start is displayed in the window.

2. Click the **Playback** button  .

The RT Monitor will start displaying continuous waveforms starting from the selected time.

Chapter 8

Care and Maintenance

General Care and Maintenance

This section describes the routine EMS-XL System *Care and Maintenance* procedures and provides recommendations for the frequency with which these should be performed. Following the simple guidelines presented will help to maintain the system in proper working order, and ensure safe and efficient operation.

General Cleaning Procedures

Note: *In all cleaning and maintenance procedures, the term "Monitor" refers to both the EMS-XL Real Time (RT) Monitor and the EMS-XL Review Screen.*

Before cleaning the EMS-XL System, note all the Safety Warnings and precautions to be taken when performing cleaning or maintenance procedures. Refer to the information in the front of this User's Guide.

The EMS-XL System, including the amplifier, may be cleaned with most commonly-used hospital cleaning solutions and detergents.

General Cleaning

Purpose: To remove dirt and most microbes.

At least once per month, clean and wipe off the frame of the amplifier and the monitors, using a soft, wet cloth (moistened with lukewarm water and cleaning solution).

CAUTION
Do not use caustic detergents, oxides, hypochlorite, lacquer, thinners, ammonia, or acetone-based cleaning solutions. ***These may damage the system*.**

Most cleaning agents must be diluted before use. Take care to follow the manufacturer's directions for dilution.

Note: *In the event that harmful (unauthorized) materials are used for cleaning, the damaged or contaminated equipment will be serviced at a cost, regardless of the warranty period.*

Cleaning the EMS-XL System and Accessories

❖**To clean the EMS-XL and accessories:**

1. Before cleaning the monitor or the BP sensor**,** switch the monitor OFF and disconnect it from the power supply. Clean the OEM sensors according to the instructions provided by the manufacturer.

CAUTION
Do not sterilize the BP sensor by irradiation, steam, or ethylene oxide (EtO).

2. Dust the EMS-XL regularly. Clean with a lint-free cloth or sponge dampened with cleaning solution. Abrasive scouring powders and pads should be avoided to prevent damage to the system.

3. Clean the display screen with a non-abrasive, anti-static glass cleaner. Use a lint-free cloth; a paper towel may damage the screen.

4. Clean patient cables and all exposed surfaces with mild soap solution *only.* For example, use a fine-hair cloth moistened in mild soap liquid or cleaning agent containing 70% ethanol.

   Note: *Using alcohol or any type of concentrated cleaning solution may impair patient cable flexibility.*

5. Remove any adhesive used to attach the cable to the patient.

   To remove adhesive residue, use a plaster remover solution made up of one-third alcohol, two-thirds water. Alternatively, use a commercially-available tape remover such as, *Scholl Double Seal Tape Remover.*

   Note: *Do not use strong solvents (for example, acetone, pure alcohol, ammonia, etc.). These will damage the cable.*

CAUTION

Do not autoclave patient leads, transducer components or other sensors. Autoclaving permanently damages these instruments.

If you need to sterilize accessories, Mennen Medical Ltd. recommends Ethylene Oxide (EtO) gas sterilization.

CAUTION

Check the amplifier frame, cables, and BP sensor carefully after cleaning the system.

Do not use equipment or accessories that are worn or damaged.

Sterilization

Purpose: To kill and remove pathogenic microbes.

To avoid extended damage to the equipment, sterilization is only recommended when stipulated as necessary in the Hospital Maintenance Schedule.

- Recommended sterilization material

  Use an ethylene oxide mixture such as, Ethylate (70% alcohol, 70% isopropanol) and Acetaldehyde, at the following temperature: 50 to 60^{o}C (122 to 140^{o}F). Follow the sterilizer manufacturer's recommendation for required aeration times.

Disinfection

Purpose: To kill microbes and bacterial spores.

To avoid extended damage to the equipment, disinfection is only recommended when stipulated as necessary in the Hospital Maintenance Schedule. Disinfection facilities should be cleaned first.

CAUTION
Do not use Ethylene Oxide (EtO) gas or formaldehyde to disinfect the equipment.

Calibration and Preventive Maintenance

Mennen Medical Ltd. recommends that the EMS-XL System be checked ***at least once a year*** by qualified Mennen Medical personnel, to determine proper calibration of the unit.

The exterior of the unit should be checked periodically for any signs of damage or abuse. Units or parts which show any signs of damage should be immediately referred to a qualified technician.

Do not use the EMS-XL for any monitoring procedure on a patient if you identify features which demonstrate impaired functioning of the system.

Contact the hospital biomedical engineer, or a Mennen Medical service engineer.

Full performance checks, including safety checks, must be performed by qualified service personnel ***at least once a year*** and ***after every repair***. This should include the monitor, as well as all vital sign modules.

The grounding and equipotential resistances of the EMS XL system, including power cables, must be tested ***at least every 3 months***.

All checks which require the instrument to be opened must be made by qualified service personnel. Safety and maintenance checks can also be made by Mennen Medical personnel. Your local Mennen Medical Ltd. agent will be glad to give you information about service contracts.

Chapter 9

Offline Utilities

Overview

This section describes the offline utilities that are part of the EMS-XL System.

These utilities are automatically installed when you install EMS-XL on a workstation. Their icons appear on the desktop.

The following utilities are described:

- Configuration Setup Utility on page 9-1
- Archive Utility on page 9-5

Configuration Setup Utility

The Configuration setup utility allows editing registry entries for EMS-XL configuration.

The following categories are supported by this utility:

- Hospital name
- Predefined notes
- Predefined events
- Study list

- Technician list
- Fellow list
- Faculty list
- Ablation
- Language
- Channels
- Panic buttons F11 and F12

  You can define the the panic buttons F11 and F12 in two modes:

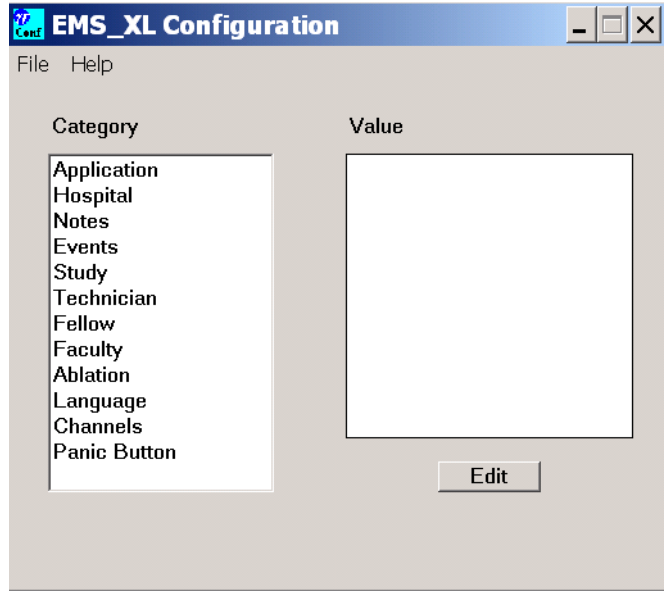
  - Burst: F11=Burst A F12= Burst V
  - Overdrive: F11=Overdrive A F12= Overdrive V

❖To edit a configuration category

1. Double-click the **Configuration Setup** utility 

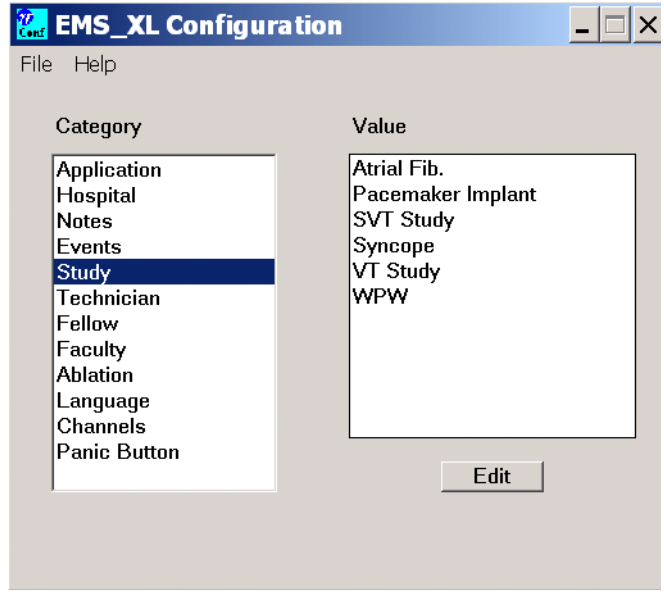
icon on the desktop of the workstation.

   The Configuration Setup window appears.



2. In the category pane select the category you want to edit.

   The current entries appear in the list in the Value pane.



3. Double-click the category or click **Edit** to open the Edit window for the category.

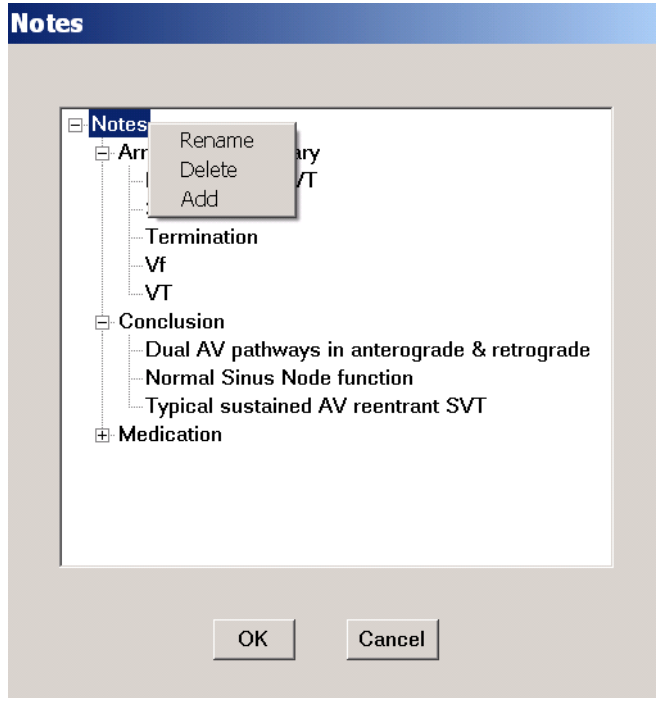
❖To edit predefined notes

1. Display the *EMS_XL Configuration* window.
2. From the **Category** list select **Notes**.

   The Notes window opens.
3. Right-click the note you want to edit.

   The pop-up menu enables you to:

   - *Rename note*
   - *Delete note*
   - *Add a pre-defined note*



4. Click **OK**.

Archive Utility

The Archive utility enables DB management by storing and restoring patient files. You can store files on a network drive or via a DVD burner.

After archiving you can locate the archiving media in order to enable restoring data.

Storing Patient Data

You can store files on a network drive or via a DVD burner.

Setting up the storage target options is done in the

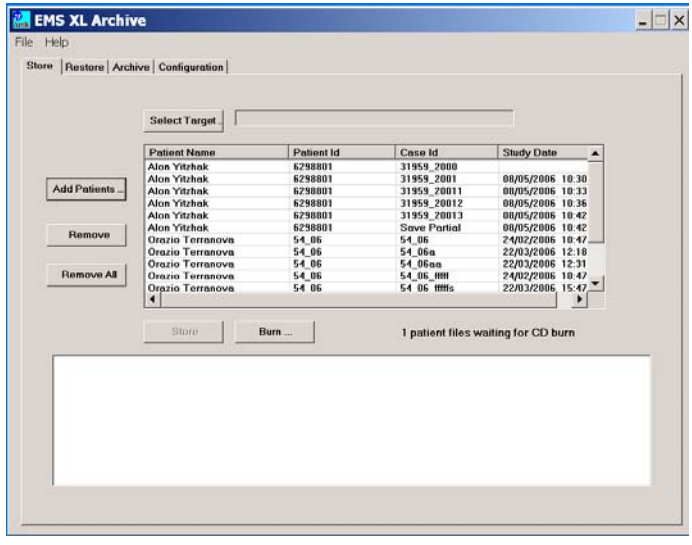
Configuration tab.

❖To store patient data

1. Double-click the **Archive** utility 

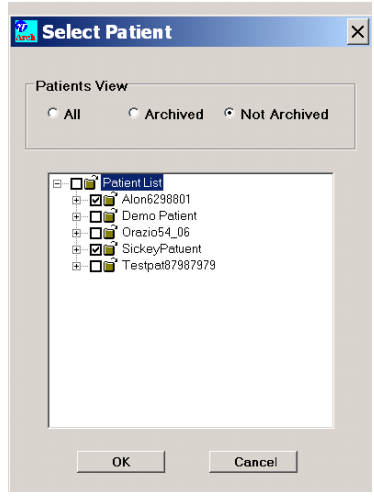
icon on the desktop of the workstation.

   The Archive window appears.



2. Click **Add Patients.**

   The Select Patient window opens enabling selecting patients for archiving.



Note: *You can filter the list to display All Patients, patients already archived or patients not yet archived (default value).*

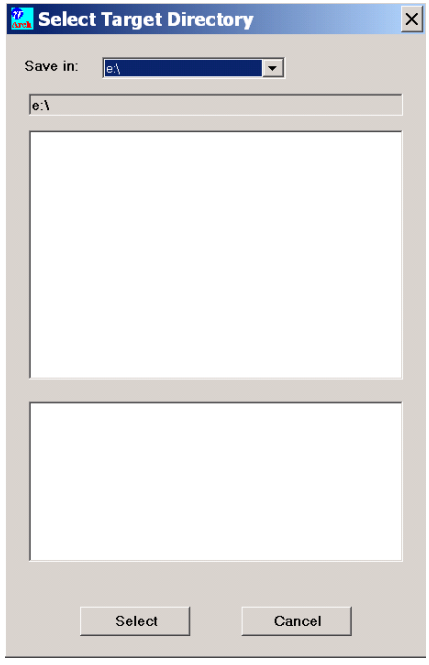
Note: *You can select all the patient files or expand the folder and select specific case/s.*

3. Select the cases for archiving and click **OK**.

   The selected cases are displayed in the Patient list.

4. Click **Select Target** to select the storage target.

   The Select Target Directory window opens.



5. From the **Save in** drop-down list select the target (network drive or DVD).

6. Click **Select** to close the window.

7. In the Archive tab Click **Store**. The information is stored compressed for future Burn or archive operations.

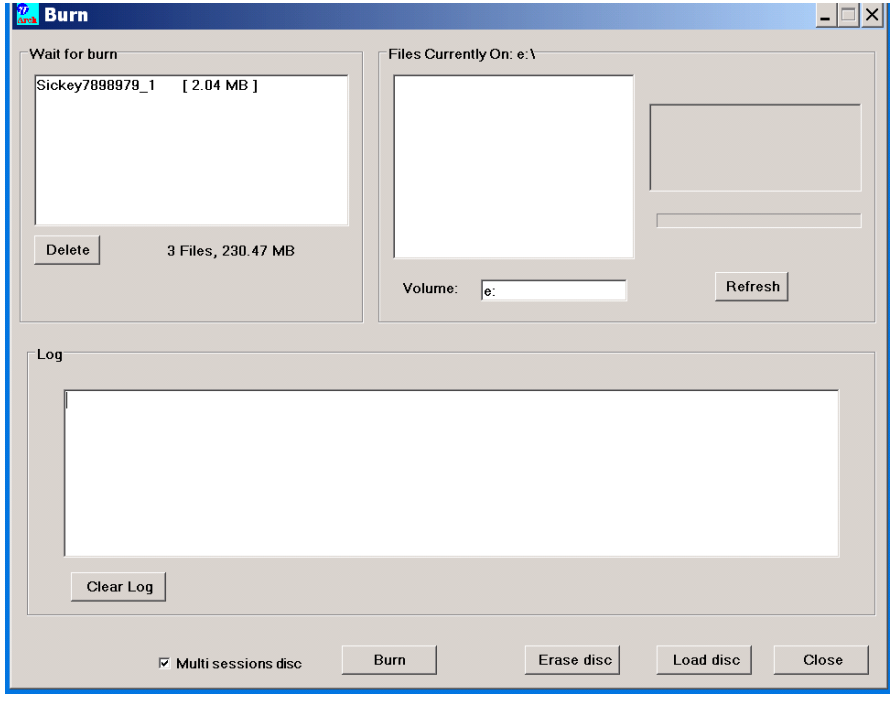
   The Burn window opens.

Note: *This could take a few minutes.*

Note: *If target selected was a hard disk- the information was compressed and stores in the final destination.*

If target selected is a DVD drive- the information is stored temporarily until pressing burn.

Note: *It is possible to store a case more than once in different media / network drives.*



8. Click **Burn**.

   The Burn process starts. The log information appears in the Log pane.

   Note: *If there isn't enough space in the media you can delete files.*

9. When the Burn operation finishes the media is ejected automatically. Click **Close** to close the Burn window.

Restoring Patient Data

The Restore operation enables restoring old cases from archives to the current online patient list. After a Restore

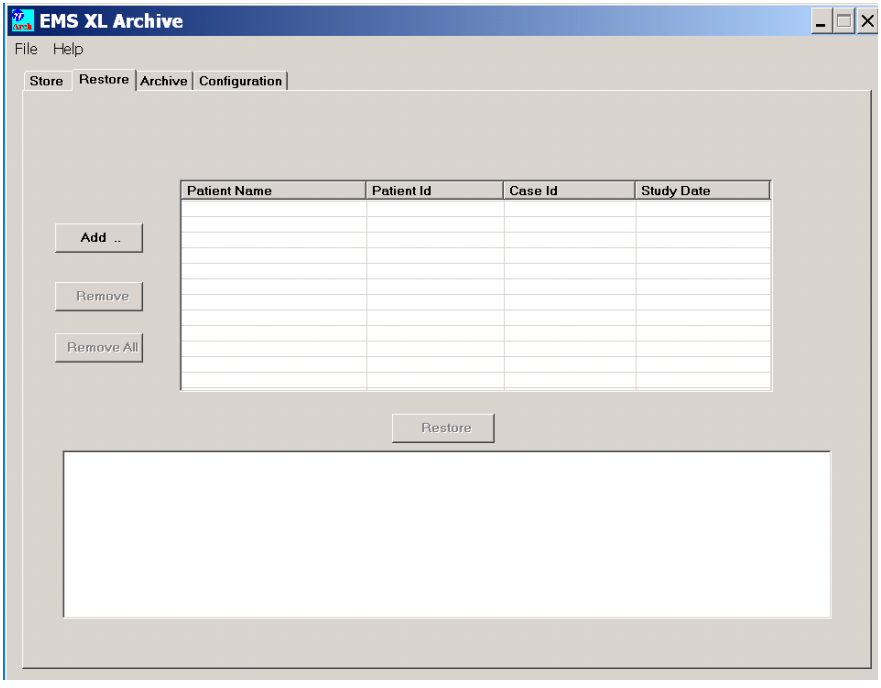
operation EMS-XL can playback the archived case.

❖To restore a case

1. Double-click the **Archive** utility 

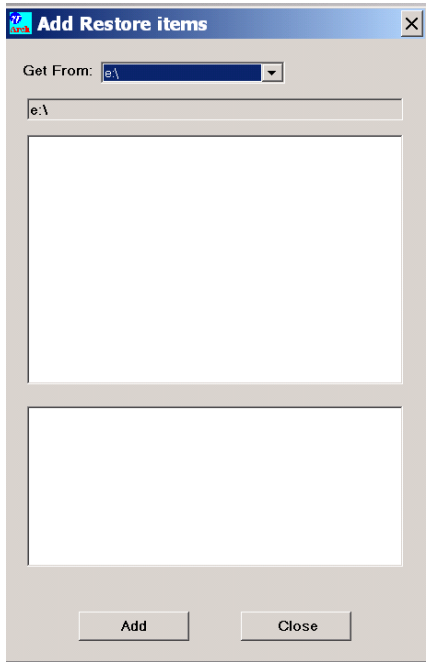
icon on the desktop of the workstation.

2. Click the **Restore** tab.



3. In the **Restore** tab click **Add**.

   The Add Restore Item window opens.



4. In the **Get From** drop-down list select the archiving target from which to restore.

   The items available for restoring appear in the window.

5. Select the items you want restored and click **Add**.

   The window closes.

6. You can now restore or delete the case study / case studies.

   Note: *Use multi-selection to restore more than one case study.*

7. Select the cases marked in green (meaning they are archived) that you want restored and click **Restore**.

   When restoration is finished cases are available for playback in EMS-XL.

Locating Archived Case Studies

The Archive utility creates a database for storing references to all case studies stores by the Archive utility.

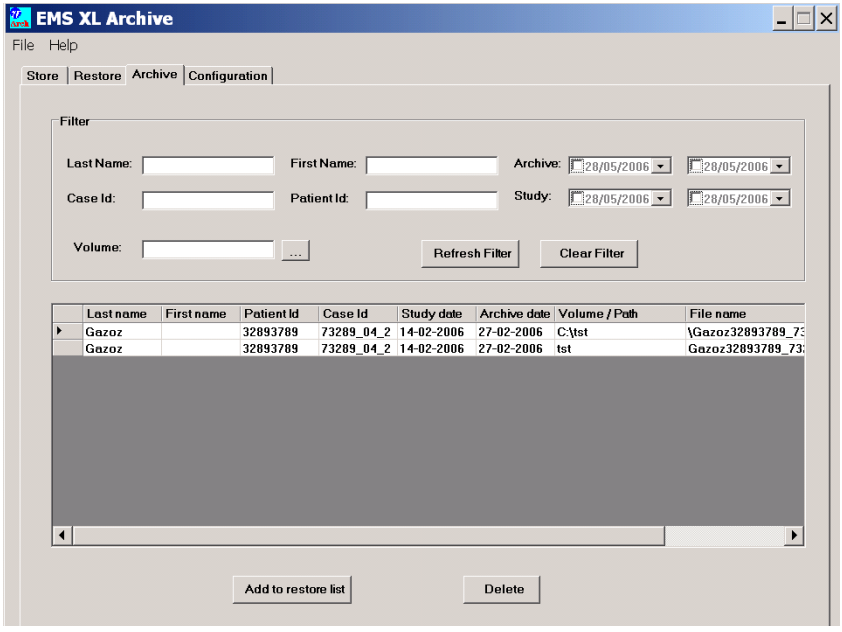
It is possible to search the database for archived cases through the following fields:

- Last name
- First name
- Case ID
- Patient ID
- Selected range of case study dates
- Selected range of case study arciving dates

❖To locate a study case for restoring

1. Double-click the **Archive** utility 

icon on the desktop of the workstation.
2. Click the **Archive** tab.



3. Select the field/fields for filtering archived data

4. Click **Refresh Filter**.

   The list displays study cases fitting the filter.

5. Click **Add to restore list** to add the items to the restore window.

   Note: *You can click Delete to delete the the archiving entry from the database.*

6. You can now proceed to restore the selected cases.

7. If the archived item is on a DVD you need to insert the DVD into the DVD drive.

Configuring a Target

You can configure the target archiving devices for the Archive utility. You can configure up to 2 different archiving devices which can be network drives or DVD drives or one of each.

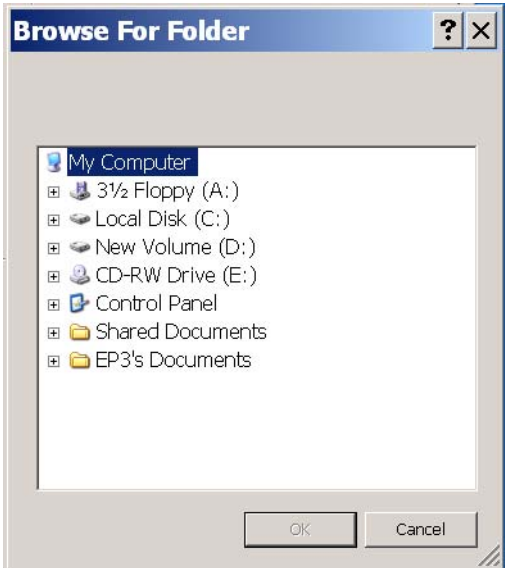
The DVD drives are used for burning DVD. The default target is the DVD drive.

❖To configure a target

1. Double-click the **Archive** utility 

icon on the desktop of the workstation.
2. Click the **Configuration** tab.
3. In the Configuration tab click Edit.

   The window opens.



4. Select the target drive and click **OK**.

The window closes and the target drive is selected.

5. Click **Apply** to save the current configuration.

Note: *It is recommended that you define a special network drive as the disk archive target.*
This operation can be done once from Windows XP OS- ***Windows Explorer*** *>* ***Tools*** *>* ***Map Network drive.***

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