NicoletOne Software Reference Guide

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natus.

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Introduction

Patient Database Administration and Workflow

Recording Data

Reviewing Data

Marking and Annotating

Performing measurements

Alerts

Archiving

Viewing Overview information related to EEG

Using the Control Panel

Edit Settings and Options Dialogs

Video

EEGToGo

Sleep Analysis

EEG Viewer

Central Monitor

Grid/Strip/Depth Electrodes

v32 and v44 with an SPO2 Sensor

Nicolet Cortical Stimulator

1 Introduction

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Intended readers

The NicoletOne Software facilitates the capture and review of electroneurophysiological data. This Software Reference Guide has been written for those experienced in this field for administrative staff, nurses, technicians and physicians who will be using this application. As the NicoletOne Software Applications are designed for the Microsoft® Windows® operating system, you will need to be familiar with its basic features. Refer to the documentation supplied with Microsoft Windows.

NOTE: The term **application** will be interchangeable hereafter with **Nicolet** software program.

Manufacturer

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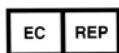
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CE Mark

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Basic organization

NOTE: Please refer to the NicoletOne Service Guide for cabling diagrams for the various NicoletOne configurations.

Chapter 1 - General Information

Provides information on the intended readers and basic organization of this Reference guide as well as other reference documents. It also provides information on miscellaneous features such as the **Dynamic Language Switch** feature and the interface to set up different amplifier headbox configurations.

Chapter 2 – Patient Database – NicVue or Study Room

Contains the location of information about using NicVue, the primary database administration program for NicoletOne systems. It also contains instructions on how to record, review, and archive your recordings using the alternative Study Room patient database administration program.

Chapter 3 - Recording Data

Describes the routine operation of recording EEG for later analysis, including the option of recording video of the patient during the exam.

Chapter 4 - Reviewing Data

Describes how to review, analyze, and annotate the recorded EEG; generate reports; and print the reports and annotated EEG.

Chapter 5 - Marking Events and Annotations

Describes how to mark events and enter annotations on the EEG.

Chapter 6 - Performing Measurements

Describes how to perform measurements on the EEG.

Chapter 7 - Alerts

Describes the various alerts available for use.

Chapter 8 – Archiving

Describes how to archive your files using the Study Room archiving functions.

Chapter 9 - Viewing EEG Information

Describes how to use the Overview pane, which allows you to view various information related to the EEG.

Chapter 10 - Data-viewing Tools

Describes the Panel, which allows you to select various tools for viewing that can be used to instruct the system to perform various operations quickly.

Chapter 11 - Using the Edit Settings and Options Dialogs

Describes how you can customize the NicoletOne System to suit your needs and then save those settings as a protocol, which can be recalled later for quick setup.

Chapter 12 - Video

Describes how to capture video with the EEG and the tools available for reviewing the recorded video.

Chapter 13 - EEGToGo

Describes the EEGToGo application, which allows you to send an unlimited number of digital data files to other medical professionals.

Chapter 14 - Sleep Analysis

Describes the NicoletOne System Sleep Analysis option.

Chapter 15 - EEG Viewer

Describes the EEG Viewer program, which allows you to review EEG files, Video (if recorded) synchronized to the EEG, Patient and Test information, Hypnograms, and 'as recorded' Trends.

Chapter 16 - Central Monitor

Describes the setup and use of the Central Monitor application to remotely monitor up to 4 recording sessions per remote Reader system.

Chapter 17 - Grid/Strip/Depth Electrodes

Describes using the Grid/Strip/Depth electrodes with the NicoletOne system.

Chapter 18 - Shared Functions

Describes various functions that are identical to both the Recorder and the Reader applications. This chapter is used to reduce redundant information.

Chapter 19 - V32 and XPod

Describes how to use the XPod with the V32 amplifier.

Chapter 20 - Cortical Stimulator

Describes how to use the NicoletOne software to setup/control the Cortical Stimulator.

Safety Summary

In this manual, two labels identify potentially dangerous or destructive conditions and procedures:

⚠ WARNING

The **WARNING** label identifies conditions or practices that may present danger to the patient and/or user.

◇ CAUTION

The **CAUTION** label identifies conditions or practices that could result in damage to the equipment.

NOTE: Notes help you identify areas of possible confusion and avoid potential problems during system operation.

Also See: This note will direct you to the chapter in this guide for a description of the application function or for additional information.

IMPORTANT: Read and follow all WARNINGS, CAUTIONS and NOTES provided in *Additional Information and Safety Notes for Assorted Nicolet Brand Products Reference Guide* 269-594705 on CD part number 482-638702. To avoid the possibility of injury, damage to your system or lost data, always observe these safety precautions during system operation.

Read the NicoletOne Information for Use guide

This reference guide is intended as supplemental information on the software applications used on NicoletOne Systems. Please read the NicoletOne Information for Use Guide before using your system (English and translated PDF versions supplied on CD P/N 482-639403).

Read the Safety Reference guides

1. Please read the ***Additional Information and Safety Notes for Assorted Nicoler Brand Products Reference Guide*** on CD (part number 482-638702) thoroughly, paying special attention to the **Safety** information before using your NicoletOne system.

2. Please refer to the ***Electromagnetic Compatibility Reference Guide*** on CD (part number 482-638702) for information concerning your system.

NicVue users

If your are using NicVue, consult the online Users guide for instructions.

Additional manuals available

Additional manuals are available providing more detailed information on your system's software operation:

- 269-604503 NicoletOne Information For Use Guide
- 269-609002 Nicolet Ambulatory User Guide
- 269-656700 Nicolet Service Guide on CD 482-639403, which also contains the wiring diagrams for the various Nicolet systems

Software components

The most important component of the system is the software. It coordinates all the hardware functions, translates the data into a comprehensible form, analyses it and provides you with an interface enabling you to operate the system. The system consists of a number of software modules:

NicVue

NicVue is a program for managing patient information and tracking exam data. This versatile program can be set up for ease of use in a range of facilities - from the small clinic with one NicoletOne instrument, to the large hospital with multiple NicoletOne systems networked together.

Nicolet Study Room

Study Room is an alternate patient/test information tracking system that can be in place of NicVue.

Nicolet Acquisition program

This application is used for recording and monitoring EEG tests. It provides features for Recording, marking and recording comments on electrophysiological data.

Nicolet Review program

This application enables you to review and analyze EEG files, supporting derivation, filtering, and topographical maps.

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All warranties for third-party products used within the system are the responsibility of the relevant manufacturer. Please refer to the relevant documentation on each product for further details.

Product specifications

The system records and processes EEG signals using a PC.

⚠️ **WARNING**⸱ **US and Canada use only 115 VAC.**

For Technical Specifications on NicoletOne Systems:

Refer to the **Nicolet Monitor** Product Specification Sheet (P/N 169-433600) for a complete set of technical specifications.

Refer to the **Nicolet with vEEG** Module Product Specification Sheet (P/N 169-433000) for a complete set of technical specifications.

Refer to the **NicoletOne with nEEG Module** Product Specification Sheet (P/N 169-432800) for a complete set of technical specifications.

Refer to the **Nicolet Ambulatory Product Specification Sheet** (P/N 169-435300) for a complete set of technical specifications.

Product variants

The NicoletOne systems are available in a variety of product variants:

- Nicolet nEEG Desktop (v32 or v44)
- Nicolet nEEG Notebook (v32 or v44)
- Nicolet LTM/Sleep Desktop (C64)
- Nicolet LTM/Sleep Desktop (C64 * 2)
- Nicolet vEEG Desktop (v32 or v44)
- Nicolet vEEG Notebook (v32or v44)
- Nicolet Monitor (v32 or v44)
- Nicolet Ambulatory EEG

The **Nicolet nEEG Desktop** (v32 or v44) uses a desktop PC and either the v32, or v44 amplifiers. The v32 supports display of impedances on the amplifier. The v32 amplifiers handle up to 32 channels. The v44 amplifier handles up to 44 channels. The v32 or v44 amplifier connects to an ethernet port on the computer.

The **Nicolet nEEG Notebook (v32 or v44)** uses a notebook PC and either the **v32** or **v44** amplifiers. This system requires an ethernet port to connect to the v32 or **v44** amplifier.

The **Nicolet LTM/Sleep Desktop (C64/C64 * 2, v44)** uses a desktop PC and the C64 compact amplifier for 64 channels, or two 64 channel compact amplifiers can be connected together for 128 channels. This system requires the USBIFB/01 interface card installed in the desktop PC.

The **Nicolet vEEG Desktop (v32** or **v44)** uses a desktop PC and the **v32** amplifier, which handle up to 32 channels **or v44,** which handles up to 44 channels. The v32 or **v44** amplifier connects directly to the ethernet port of the computer.

The **Nicolet vEEG Notebook (v32** or **v44)** uses a notebook PC and the **v32** amplifier, which handle up to 32 channels **or v44** amplifier, which handles up to 44 channels. The **v32** or **v44** amplifier connects to the ethernet port of the computer.

The **Nicolet Monitor** (v32 or v44) uses a panel PC. With the v32 or v44 amplifier, the amplifier interfaces to the Ethernet port of the PC. A video card is mounted in the PC if video is used with the v32 or v44.

The **Nicolet Ambulatory EEG** uses either a desktop PC or a portable PC. The recorder is a 32 channel electroencephalograph designed for use in a variety of diagnostic, screening and monitoring applications, including those concerned with neurological and sleep disorders. For intended use and instructions on use, please refer to the Nicolet Ambulatory EEG User Guide (pn: 269-609000).

NOTE: All Nicolet amplifiers are fitted with a green LED to indicate when power is applied to them.

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Responsibility of manufacturer

The manufacturer and distributor consider themselves responsible for the equipment's safety, reliability and performance only if:

*   The system is run on supplied PC equipment from Natus Neurology Incorporated.
*   Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by the manufacturer.
*   The electrical installation of the relevant room complies with the appropriate requirements.
*   The equipment is used in accordance with the instructions for use.

The manufacturer has a policy of continual product improvement; hence the equipment specifications are subject to change without notice.

Dynamic language switch

Recorder and Reader The Dynamic Language Switch allows you to view the Nicolet application software in different languages.

NOTE: The Dynamic Language Switch changes languages for the NicoletOne applications only. See the NicVue online Users guide for information on changing languages in NicVue.

Changing the language

1. Open either the Recorder or Reader application.

2. Select **Tools > Options** menu.

3. Click on the **Regional** tab.

4. Click on the desired **language**.

5. Restart the **application**.

NOTE: Making this change in one application affects other applications (Reader, Reader/Monitor, StudyRoom, etc).

NOTE: Selecting a different language **does not** take effect until after the application is restarted.

NOTE: Each system must be set individually, even if they are networked.

Using different amplifier headbox configurations

Recorder

NOTE: NicoletOne systems ship to most countries with the 10/20 amplifier and headbox **except** those countries with German-trained clinicians.The configuration change noted here **does not** include most countries.

In order to configure the software to use an A2-A1 overhead (reverse) amplifier and headbox, you must start the Recorder application and perform the following steps.

1. Click on the **Settings** Settings button on the main toolbar or click on **Protocol > Settings**.

2. Click on the **Amplifier link** on the bottom of the Setup screen.
    Steps 3 through 8 will change FP1 - FP2 to FP2 - FP1.

3. In the Amplifier editor, double-click on **Fp1** in the Sensor column.

4. Click on the **Show Menu** arrow.

5. Click on **ROC** (for example, any option listed may be chosen) from the drop-down menu to set FP1 temporarily to ROC.

6. Double-click on **FP2** in the Sensor column and set it to **FP1** from the drop-down menu.

7. Double-click on **ROC**.

8. Click on **FP2** from the drop-down menu.
    The original FP1 - FP2 is now set to FP2 - FP1.

9. Repeat steps 3 through 8 for the following label pairs. F3 & F4, C3 & C4, A1 & A2, P3 & P4, O1 & O2, F7 & F8, T3 & T4, T5 & T6, and Pg1 & Pg2.

10. When finished, click on **Save** to save the settings as part of the protocol. You should not have to perform procedure again.

Special instructions for use

The equipment should be used only by medically trained and qualified personnel.

Conductive parts of the electrodes, including the neutral electrode, should not come into contact with other conductive parts including earth.

After-sales service support

The manufacturer of system and the distributors provide comprehensive after-sales service support. Service contracts are available. For details, please contact the manufacturer or the local distributor.

A Service manual (part number: 269-656700) is available for purchase containing all the information necessary to enable appropriately qualified technical personnel to repair those parts of the equipment that are repairable.

Technical support

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Sources of artifacts

In addition to the aforementioned sources of interference, the following can induce artifact in the recording making it difficult to interpret.

- Dirty electrodes
- Broken electrode lead wire including neutral electrode wire
- Electrode lead wire movement
- Poor ground electrode location
- Incorrect electrode connection to apparatus
- Ungrounded wheelchair or table
- Ungrounded observers
- Microphone
- Audio feedback
- Pick-up from CRT screen
- Power cables near patient not unplugged at wall socket
- Poor apparatus ground
- Fluorescent lights
- Electronic dimmers
- Intermittent power line load
- Excessive low or high power line voltage
- Diathermy
- Radio and TV
- Ignition noise
- Multiple grounds in screened room

Also note that, although this system is compliant with EMC requirements it might interfere with other more sensitive equipment.

Wiring diagrams

Please refer to the Nicolet Service Guide 269-656700 furnished on CD 482-639403.

Nicolet C64 Amplifier
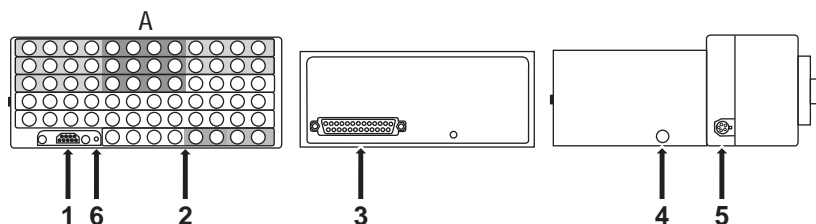
A. C64 Amplifier

1. **General Purpose Connector:** Four analog inputs for general-purpose use + alternate Event input.

2. **Electrode Connectors:** 64 channels + Reference + Ground (Neutral) for patient connections.

3. **Host Connector:** 36-pin connector for host connection. Connect a cable a between this connector and the host computer USB Interface Card.

4. **Event Button Connector:** Stereo connector for patient event button connection. Refer to *Service manual* for the connection diagram.

5. **5-pin circular connector:** Currently not supported.

6. **Power on** indicator.

NOTE: The 64 channel system uses one C64 amplifier; the 128 channel system uses two C64 amplifiers with the appropriate cabling.

Nicolet v32 Amplifier
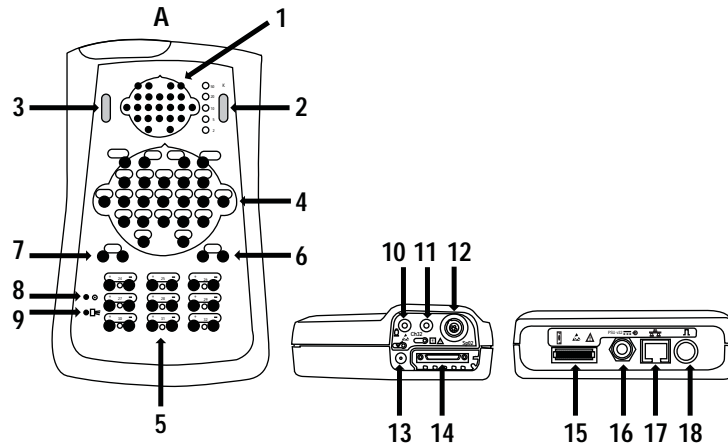
A. **v32 Amplifier**
1. **Impedance Display**
2. **Impedance Tolerance Threshold Selection Button**
3. **Start Impedance Check Button**
4. **Electrode Connectors** - 23 Referential
5. **Electrode Connectors** - 9 Differential/Bipolar
6. **Ground Connectors**
7. **Reference Connectors**
8. **Power On LED**
9. **Sending Data LED**
10. **Patient Event Button**
11. **Channel 32** - DC Input
12. **SpO2** - Nonin Xpod Pulse Oximeter Input
13. **Headbox Calibration Check**
14. **Headbox Input**
15. **AES** (Future use)
16. **Power Supply**
17. **Network** - LAN
18. **Photic Connector**

Nicolet v44 Amplifier

A. v44 Amplifier	8. Not used (future Media port)	15. Network - LAN
1. Power On LED	9. Panasonic Camera Control	16. Photic Connector
2. Sending Data LED	10. Microphone	17. DC Inputs
3. Start Impedance Check Button	11. Composite 1 - Video	18. Serial 1 - CPAP
4. Patient Event Button Input	12. Composite 2 - Video	19. Serial 2 - ISS
5. SpO2 - Nonin Pulse Oximeter Sensor Input	13. Not used (future AES out)	20. Aux. Input/Output - Digital I/O
6. Headbox Calibration Check	14. Power Supply Input	21. Patient Neck Yoke Input
7. Headbox Input Connector		
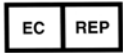
Nicolet IBox

A. **IBox**

1. **Power Cable Connector**.

2. **USB Host Interface Cable**.

3. **Photic Connector**.

4. **General Purpose Connector:** For pin-out information, refer to *Service manual*.

Labels and symbols

The following labels and symbols may be affixed to the NicoletOne system:

⚠	**When applied on device:** Attention: Consult Accompanying Documentation. (ISO 7000-0434A) **When used in documentation:** Caution, Warning or Precaution follows.
	Consult Operating Instructions. Failure to follow operating instructions could place the patient or operator at risk. Image on blue background. (ISO 7010 M002)
	Consult Operating Instructions. (ISO 7000-1641)
EC | REP	Natus EU Authorized Representative.
	Manufacturer.
	Disposal at end of operating life instructions. When the equipment comes to the end of its operating life, it should be disposed of in accordance with local waste regulation authority, which is typically within the local government office.
CE 2797	CE Mark and Notified Body.
	Type BF equipment.
RX Only	**CAUTION**: USA Federal law restricts this device to sale or on the order of a licensed Neurology practitioner.

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2 Patient Database Administration and Workflow

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NicVue patient database

NicVue overview

NicVue is the standard patient database administration program for all NicoletOne systems, and it can be ordered as an option on Nicolet vEEG systems.

All information for NicVue is found in the NicVue Online User Guide.

ICU Monitor quick start

You can start Nicolet ICU Monitor without going through NicVue.

1. Click on the **Monitor** shortcut icon on the Desktop.
2. Select **Start** to begin recording.
3. Click on **File > Patient Info**.

For new patients

a. On the Patient Properties dialog box, enter the patient's **Last Name**, **Middle Name**, and/or **First Name**.
b. Click on the **Create New Patient** button.

NOTE: NicVue does not allow you to enter or edit a **Patient ID** when outside the NicVue program.

For existing patients

NicVue must be installed and running on the system.

a. On Patient Properties dialog box, enter the **Patient ID**, **Last Name**, **Middle Name**, and/or **First Name** in the *Search For An Existing Patient* section.
b. Click on the **Search NicVue for Matches** button.
c. Select the correct **patient** from the list and click **Use This Patient**.

The standard Patient Information window will appear with the fields filled from NicVue and the study will be registered under the correct patient.

For stand-alone operation

a. On the Patient Properties dialog box, click on the **Don't Track Exam** button.
b. A warning dialog box appears, which restates that the exam must be manually tracked by you, the user. To return to the Patient Information window, click **No**.

Networking

Any NicoletOne system can be removed from the network to be used as a portable Recorder system. On reconnecting the system to the network, EEG data is automatically updated to the main database.

NOTE: The system must be **turned off** when removing from or reconnecting to the network.

A NicoletOne system connected on the network to a main database will show the message "Main Database" in the bottom right hand corner of the Study Room.
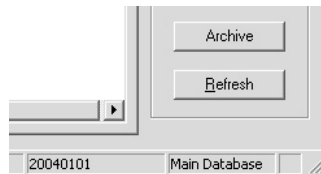
On a system disconnected from the network, "Local Database" will be shown together with a **yellow square** in the Study Room.
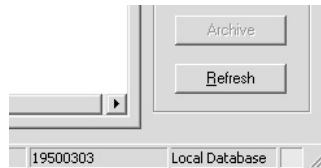
3 Recording Data

Legends

Note that in the left column you will see *Recorder, Reader, or Recorder and Reader* listed. These help identify whether the related topic applies to the Recorder and/or Reader applications.

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Introduction

The Nicolet Recorder program provides a range of features to assist you with a recording session's routine operations and its unexpected events. The toolbar and panel buttons allow point-and-click control of the Recorder window of up to 128 EEG channels, synchronous digital video, montage selection, filtering, photic sequences, hyperventilation, trend analysis, and spike and seizure detection. You can mark user-defined events quickly and accurately with the customizable event palette.

Acquisition application license

You can launch the Nicolet Acquisition application even if the Acquisition license has not been enabled. However, you will not be able to acquire any data from any amplifier unless the Acquisition license is on the PC. You will be able to create and manipulate recorder protocols though.

The Generation mode will not be allowed if you do not have the Acquisition license.

If you apply a different protocol than the current protocol, the amplifier for that protocol will not be usable.

Topics discussed in separate chapters

Please see the *Shared Functions* chapter.	
Patient, Test and exam properties	The patient, test, and exam properties can be viewed and edited at any time.
Numerical displays	You can choose to set the selected channel(s) to display only a trace, a trace with numerical values, or numerical values only.
The Event palettes	The event palettes are used to insert event markers into the recorded EEG.
The Context menu	You can quickly change various parameters (sensitivity, deflection, baseline, etc.) as desired to obtain the desired results on the collected EEG.
Showing/Hiding traces	You can select specific traces to either be removed from the screen display or remain displayed.
Reordering the channels	You can reorder the traces by dragging them to their new positions.
Marking Special channels	You can mark channels as Special changing various parameter settings. This alerts the viewer that the trace(s) do not have the same settings as when the EEG was acquired.
Carrying Special channels when changing the Montage	You can choose to carry or not carry Special channels when changing Montages.
Event palettes	An event palette is a set of events available for marking the EEG at any time. You can create custom event palettes to use for different types of recordings.
Flat lining signals that exceed the vertical display limits	You can choose to have the tops and bottoms of signals that exceed the vertical deflection display limits to be connected with a straight line.
Inserting an empty space between traces	You can insert an empty channel in the Montage Editor panel to separate or group actual display channels.
Calibration Bar	Allows you to make measurements from the EEG in Recorder and/or Reader.
Print Marker	Used to mark a specific section of EEG for printing.
Please see the *Settings* chapter.	
Events	**Event markers** can be selected from the Event palette to mark moments or time intervals of interest.
Event editor	You can create custom event markers using the **Event Editor**.
Assigning events to specific sensors	Events can be assigned to a specific sensor (channel). When the event is selected for placement on the EEG, the event will 'snap' directly to the trace to which it has been assigned.
Assigning numerical values to an event	You can assign an Integer or Decimal value, or an Enumeration to the selected event type.
Please see the *Video* chapter.	
Video acquisition	You can record video synchronized with the recorded EEG.
Please see the *Panel* chapter.	
View > Panel	You can display several Palettes to the right side of the Recorder window, which allows quick control over various operations for the Recorder application.
Please see the *Overview* chapter.	
View > Overviews	You can display various panes containing summaries of data below the Toolbar.

Recorder window components

The Nicolet nEEG and LTM Recorder offers a convenient, customizable graphical interface. You can view the Recorder window alone (below) or a split window of Reader pane and the Recorder pane (next page).

Recorder window only

Following is the Nicolet nEEG window with its main features displayed.
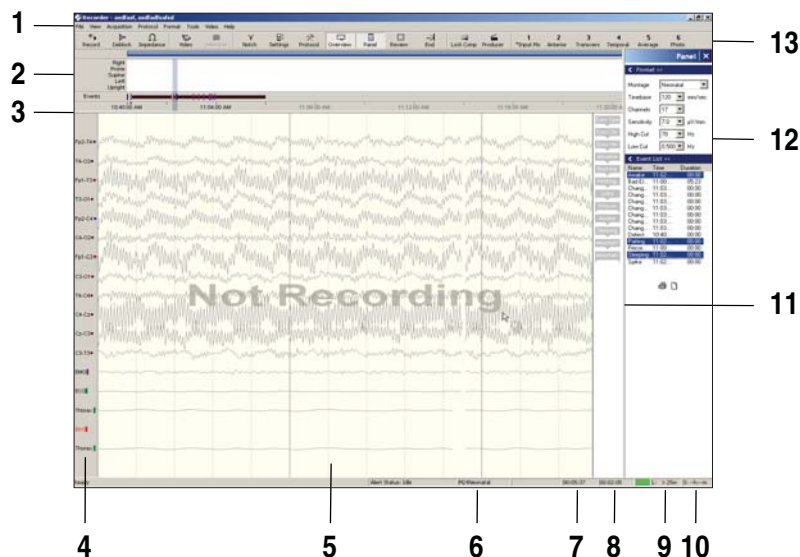
Key:
1. Menus
2. Overview
3. Movable Split Bar
4. Trace Labels
5. Recorder Pane
6. Current Protocol being used
7. Total recording time
8. Time since last Montage change
9. Amount of recording time available on the local drive
10. Amount of recording time available on the server
11. Record Event Palette
12. Pane
13. Toolbar

Reader pane/
Recorder pane
display

Following is the Nicolet nEEG and LTM Reader and Recorder panes with their main features displayed.
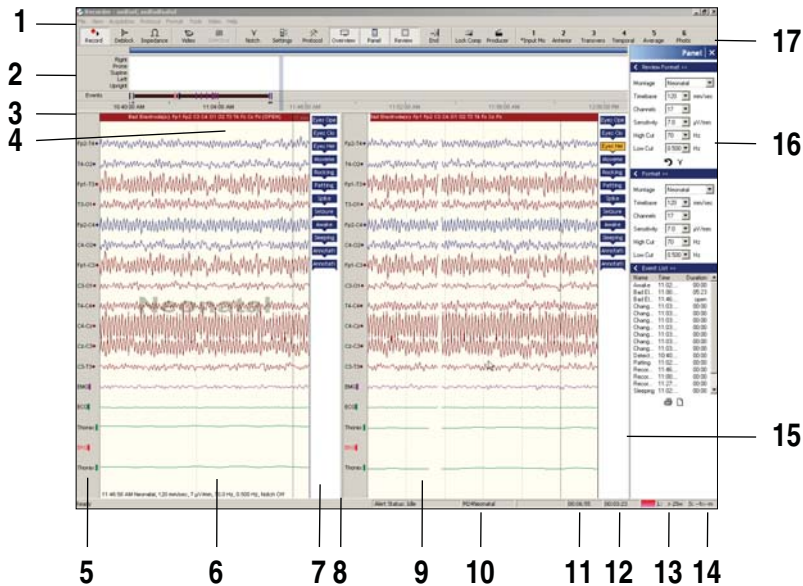
Key:
1. Menus
2. Overview
3. Movable Split Bar
4. Event Marker
5. Trace Labels
6. Reader Pane
7. Reader Event Palette
8. Movable Split Bar
9. Recorder Pane
10. Current Protocol being used
11. Total recording time
12. Time since last Montage change
13. Amount of recording time available on the local drive
14. Amount of recording time available on the server
15. Record Event Palette
16. Panel
17. Toolbar

The EEG trace display(s)

The EEG trace display makes up the main part of the Recorder and Reader interfaces. The window can be divided into two EEG display panes with the Reader pane on the left side and the Recorder pane on the right. The size of the panes can be resized by clicking on and dragging the split bar located between the two panes.

Recorder pane   The Recorder pane shows the EEG traces in real time in both the preview and record modes.

Reader pane   The Reader pane displays the recorded EEG from the beginning and up to the current position in the recording session. Use this pane to review previous parts of the recording and perform some editing to mark events and add annotations while recording EEG. To refresh the EEG data for viewing, position the mouse pointer over the right section of the EEG and click the mouse button; repeat as necessary.

Displaying the Reader pane   To display the Reader pane on the left side of the Recorder pane:

1. Click on the toolbar **Review** Review button.

    - or -

    Click on **View > Review Pane > Show**.

Displaying the Reader pane on a second display screen

Recorder   If your computer is connected to a second monitor/screen, the Reader pane can be moved to that display. This will provide you with full screen displays of both the Reader and the Recorder panes.

1. Click on **View > Review Pane > Float**.

2. To return (anchor) the Reader pane to the left side of the Recorder pane, click on **View > Review Pane > Float** again.

NOTE: If you exit and then return to Recorder/Monitor, the Reader pane will return to the same state it was in (floating or anchored) when you exited Recorder/Monitor.

Navigating the Reader pane

You can use any of five methods to navigate through the recorded EEG on the Reader pane when it is displayed to the left of the Recorder pane.

See: *Shared Functions* chapter for descriptions.

Editing Individual Channel Inputs in the Review Pane

Recorder Reader Pane

You can change from which channel signals will be derived for individual channels on the **Review pane** while viewing the split screen Reader/Recorder window. This is useful for sleep scoring in the presence of a noisy signal.

To change from where the signal is derived, you may select an "Active" and "Reference" signal.

Active signals available for selection include:

- EEG signal types defined for the current amplifier

Reference signals available for selection include:

- EEG signal types defined for the current amplifier (including derived EEG types: EKG, ECG)
- The "Ref" signal
- The "AV" signal
- The "A1A2" signal – if it is defined in the current "Calculated Channels" set, it will not change the corresponding derivation in the Recording pane.

To edit an individual channel input

1. Right-click on the **Channel label** on the Review pane.

2. Select **Derivation** to display the Derivation panel.

3. Click on the **Active** show menu ▼ button and then click on the desired derivation.

4. Click on the **Reference** show menu ▼ button and then click on the desired derivation.

5. Click **OK**.

Recording EEG

Recorder   The Nicolet Recorder program allows you to acquire up to 128 EEG channels, as well as synchronized digital video. Before you start recording data to disk, it is recommended that you preview the live, online traces and perform an impedance check to make sure that all electrodes are in place and functioning properly.

When the program starts, a preview of the EEG traces is started. The right end of the Status bar shows a **green rectangle** indicating that previewing is in progress and no data is being saved to disk. The words **Not Recording** are displayed over the trace display.

To begin recording and saving EEG (and digital video if turned on):

Turn the system on

⚠️**WARNING** **Switch ON before connecting patient electrodes.**

◇**CAUTION** All peripheral equipment must be connected to the system prior to switching the system on.

1.   For a **desktop** system, press the green power switch recessed on the right side of the cart to the **On** (|) position.
     - or -

     For a portable system, press the laptop power switch to the **On** position.

     A **Green rectangle** on the right side of the Status Bar indicates that data is being saved to disk.

     Recorded EEG traces are also displayed in the Reader pane (the left pane) if you clicked on the **Review** button or clicked on **View > Review Pane > Show**. To refresh the EEG data for viewing, position the mouse pointer over the right section of the EEG and click the mouse button; repeat as necessary.

Switching off the system

⚠️ **WARNING**   **Before switching OFF, disconnect all patient electrodes.**

Before switching OFF the instrument, it is essential that the system's application and Windows be closed down first. Failure to do this may result in loss of data and operating problems the next time the instrument is switched on.

    a. Close down the system by click on **File > Exit** or by clicking on the **Close** icon on the title bar.

    b. Select **Shut Down** from the Windows **Start** menu. The PC will power down automatically.

    c. Switch OFF before unplugging the power plug. If the instrument is to be switched OFF and ON again, wait approximately 5 seconds before switching back ON.

Log on

2. If a password is required, type in your **password**. If no password is required, press the system's keyboard **Enter** button.

3. Click **OK**.

NicVue

*From the NicVue window, click on **Help** > **Help Topics** for additional information concerning NicVue.*

4. From the desktop, double-click the **NicVue** icon.

Create the patient file

1. From the NicVue window, click **New**.

2. On the Patient Information window, highlight the Examiner's folder, then enter the **patient information**. The patient ID should be a permanent medical record number that will not be changed.

Schedule the patient

1. Click **New Appointment**.

2. From the Schedule a Patient panel, select the **Examiner** and the reading **Physician**.

3. Enter the **Schedule Date** and **Time**.

4. Enter the exam **Location**.

5. If your system is multi-modality, click on the **NicoletOne** icon.

6. Click **OK** to close the Schedule a Patient panel.

7. Click **OK** to close the Patient Information panel.

Study Room

1. Choose **New Patient**.
2. Click on the **Next** button. The wizard displays the **Enter New Patient** dialog.
3. Fill in patient information as appropriate.
4. Click **Next** to open the Test Info dialog.
5. Fill in the test information.
6. After you have completed the New Test Wizard, click **Finish**. The test is added to the list on the Record List tab.

EEG recording

⚠️ **WARNING** **Turn ON the NicoletOne and open the Recorder software before connecting patient electrodes.**

◇ **CAUTION** **All peripheral equipment must be connected to the NicoletOne system prior to switching the system on.**

Prepare the patient

1. Abrade and apply the electrodes to the patient.

NOTE: Make sure you include the reference (common reference) and neutral (ground) electrodes; they are mandatory!

2. From the Examiner (technician's) folder, click on the patient's **name**.

Open the NicoletOne Recorder software

3. Click **NicoletOne** .

4. If Ambulatory is enabled, click **Acquire** .

   Either the Recorder window appears with a 'Not Recording' watermark displayed or the Impedance Test panel appears. See the Note on the next page.

Select a Protocol

5. Click on **Protocol** on the menu bar then click on the desired **Protocol** at the bottom of the menu.

   - or -
6. Click on one of the **Protocol** buttons at the top of the window.

   - or -
7. Click on the **Protocol** show menu button and then click on the desired **Protocol**.

NOTE: The current protocol is displayed in the mid-right side at the bottom of the Recorder screen.

Enabling Continuous Electrode Monitoring	You can monitor the 50/60 Hz interference on raw data continuously during a recording. This is useful in determining if an electrode has become loose or showing high impedance, which reduces the quality of the signal. If the peak-to-peak amplitude exceeds the preselected tolerance, you will be notified. This helps to eliminate manual insertion of impedance information in your reports.

NOTE: Continuous Electrode Monitoring is disabled for the V32 and V44 amplifiers. Continuous Electrode Monitoring is designed to NOT involve applying active current to the electrodes through an impedance circuit.

1. Click on the **Settings** Settings button and then on **Misc** at the bottom of the Editor window.

   - or -

   Click **Protocol > Settings** and then on **Misc** at the bottom of the Editor window.

2. Checkmark **Use Continuous Electrode Monitoring**.

3. Enter an **Interference tolerance** value above which you want to be alerted that an excessive interference occurred. The default setting is 250 uV.

4. Click **Save**.

5. Click **Close**.

Check the Impedance

NOTE: Skip step 8 if the **Startup in Impedance mode** checkbox was checked earlier (**Tools > Options > Acquisition tab**). Checking this box causes the Impedance window to appear automatically when you open the **Recorder software**. See **Acquisition tab** in the *Miscellaneous Quick Steps* chapter for additional information.

6. Click **Impedance** 🎧 to display the Impedance Test window.

    - or -

    Click **Acquisition > Impedance**.

7. The acceptable impedance range is selected by clicking on the **Threshold** show menu button ▼ and then clicking on the desired **threshold value**.

    - or -

    Enter a custom **value**.

    The acceptable range should be **5K ohms or less**.

    The measured impedance values are displayed for each electrode. Electrodes with acceptable impedances are displayed in green. Those that are not acceptable are displayed in red. Allow time for the Impedance Test window to update as you work to lower impedances as necessary.

8. When the impedances are acceptable, click **Start**.

9. The Recorder window appears with the EEG scrolling across the screen, but not being saved to the hard drive. Click the **Record** button to start the recording unless the EEG was initiated using "Quick Start".

Enabling Automatic Impedance testing after changing the Montage

The system can test the electrode impedances each time you change to a different Montage.

1. Click on the **Settings** Settings button and then on **Misc** at the bottom of the Editor window.

   - or -

   Click **Protocol > Settings** and then on **Misc** at the bottom of the Editor window.

2. Checkmark **Automatic Impedance Test on Montage Change**.

3. Click **Save**.

4. Click **Close**.

Display the Control Panel
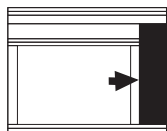
5. Click **Panel** from the toolbar.

6. Click **View > Panel > Format** to display the Format palette, which lets you easily change the sensitivity, LFF, HFF, timebase, montage and the number of channels displayed.

Select the Montage

7. Click on the **Montage** button on the **Format** palette in the Control Panel and then click on the desired **montage**.

   - or -

   Click **Format > Montage** and then click on the desired **montage**.

   - or -

   Click on the desired **Montage shortcut** button 1 2 3 4.

   - or -

   Right-click on the **trace labels**, click on **Montage** and then click on the desired **montage**.

Select the Sensitivity	8.	Click on the **Sensitivity** ▼ button on the **Format** palette in the Control Panel and then click on desired **sensitivity**.

- or -

Click **Montage > Sensitivity** and then click on the desired **sensitivity**.

- or -

Right-click on the **trace labels**, click on **All Traces > Sensitivity** and then click on the desired **sensitivity**.

- or -

Right-click on the trace labels, click on **Adjust Selected** and then click on the desired **sensitivity**. The selected traces change color for easy identification.

Select the Timebase	9.	Click on the **Timebase** ▼ button on the **Format** palette in the Control Panel and then click on the desired **timebase**.

- or -

Click **Montage > Timebase** and then click on the desired **timebase**.

- or -

Right-click on the **trace labels**, click on **All Traces > Timebase** and then click on the desired **timebase**.

Select the High Cut/Low Cut filters (*optional*)

10. Click on the **High Cut** or **Low Cut** ▼ button on the Format palette in the Control Panel and then click on the desired **filter settings**.

    - or -

    Click **Montage > High Cut**/**Low Cut** and then click on the desired **filter** settings.

    - or -

    Right-click on the trace labels, click on **All Traces**, click on **HighCut**/**LowCut** and then click on the desired **filter** settings.

    - or -

    Right-click on the trace labels, click on **Adjust Selected** and then click on **HighCut**/**LowCut** and then click on the desired **filter** settings. The selected traces change color for easy identification.

Turn the Notch filter on (*optional*)

11. Click on **Notch** ˠ from the toolbar.

    - or -

    Click **Montage > Notch**.

    - or -

    Right-click on the trace labels, click on **All Traces** and then click on **Notch**.

    - or -

    Right-click on the trace labels, click on **Adjust Selected** and then click on **Notch**. The selected traces change color for easy identification.

Display the Reader window (*optional*)

12. Click **Review** ⬚ from the toolbar to display the Reader window to the left of the Record window if you want to review the EEG (or look back in the EEG) while it is being recorded.

NOTE: The Reader window does not update automatically. To view the latest EEG that was recorded, click the **End** button in the toolbar.

Splitting long recordings into multiple files (optional)

You can split the recording into multiple files at a specified time or at the end of a predetermined file duration.

1. Click on the **Settings** ⬚ Settings button and then on **Misc** at the bottom of the Editor window.

    - or -

    Click **Protocol > Settings** and then on **Misc** at the bottom of the Editor window.

Splitting the recording at a specified file duration

    a. Click on the **Maximum File Duration** radio button.

    b. Select the **file duration** after which the file will close and a new file begins storing data.

    c. Click **Save**.

    d. Click **Close**.

Splitting the recording at a specified time

    a. Click on the **Start New File at** radio button.

    b. Select the **time of day** (AM or PM) at which you want the file to close and a new file begins storing data.

    c. Click **Save**.

    d. Click **Close**.

Start recording EEG

2. If the Impedance Check panel was enabled to appear automatically when the Recorder application was started, the system begins recording as soon as you close the Impedance Check panel.

If the feature was not enabled, start the recording by clicking on **Record** from the tool bar.

NOTE: Click on **Record** again to stop recording EEG.

Start recording video (*optional*)

NOTE: The system must be recording and storing data to disk to start recording video synchronized with the EEG recording.

---

3. Click **View > Control Panel > Video** to display that palette.

4. Click **Video** from the toolbar to start recording video.

   - or -

   Click **Video > Save Video**.

NOTE: Click **Video** again to stop recording video.

Controlling the Video camera

5. Click **View > Panel > Camera Control** to display that palette.

6. Click on a **Camera Direction** button and hold down the mouse button until the desired effect is reached and then release the mouse button.

7. Repeat step 22 as necessary until the camera is pointing in the desired direction.

Steps 26 through 30 are for the Sony camera only!

8. Click on the **Zoom** 🔍🔍 buttons until the desired zoom level is reached.

9. To move the video camera in small steps by clicking on the Camera Direction buttons, check the **Step Video** checkbox.

10. To preset the position of the video camera, click on the **Set Presets** button.

11. There are three presets you can choose to use. Type in a **label** for the preset you want to use (or accept the 'Not Assigned' default).

12. Click on the corresponding **Set** button.

13. Click **OK**.

NOTE: On the Video Control Palette, click on the **Go** button at any time to position the video camera automatically.

Calibrate the inputs (*optional*)

NOTE: It is NOT recommended to use the Calibration mode for validation of Brain Symmetry Trend calculations.

14. Click **Acquisition > Calibration** to calibrate the system.

15. Record about one full screen of calibration.

16. When satisfied with the trace display, click **Acquisition > Calibration** to stop calibrating.

    The starting montage returns on the Recorder window and the system continues recording EEG.

    If the calibration signal is not the size or duration that is expected, it can be changed

    by clicking on 📊 and then on **Amplifier** at the bottom of the Montage Editor panel.

Mark the events
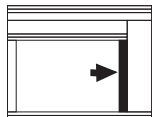
17. If the Event palette is not displayed to the right of the trace display, click on **View > Event Palette**.

Transient events

Transient Event buttons have a **single** point ▼. They are used for events that have no particular duration, such as a cough.

a. When a Transient event appears, click and drag the corresponding **event** from the Event List into the EEG.

b. To annotate an event that is not present in the Event List, just left click in the EEG recording area and a text box will appear. Type in your comment. The annotation will appear above the Event Marker when reviewing EEG.

Duration events

Duration Event buttons have **two** points ▬. They are used for events that last over a period of time, such as a seizure.

a. When the start of a Duration event appears, click on **Duration Event**. The start of the Duration event is marked on the EEG.

b. When the Duration Event ends, click on **Duration Event** again. The end of the Duration Event is marked on the EEG.

c. To enter free text about an event that occurs over time, click and drag the duration annotation to the beginning of the event. When the event ends, click that duration annotation again. A text box will appear allowing you to type in a description of the duration event.

Annotation events

You can choose to

a. Display the Event Annotation dialog automatically when you place selected

Event Markers (click on **Edit Settings** ▦, click on **Events** at the bottom of the Montage Editor panel, checkmark **Annotation Event**, click **Save**).
- or -

b. Leave **Annotation Event** unchecked to display the dialog only when you click on the Event marker.

Adding a missed Annotation while recording

1. Click **Review** ▦. The EEG trace display divides in half, with the Reader window on the left and the Recorder window on the right.

2. Scroll to the **event** you want to annotate.

3. Click **Annotation** in the Event List panel to the right of the EEG display area.

4. Click on the **event** and type in the **annotation**.

5. Click **OK**.

Display the Overview (optional)
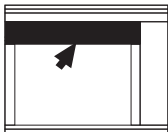
1. Click **Overview** from the toolbar.

2. Click **View > Overview** and then click on the desired **Overview pane**.

3. Repeat steps 1 and 2 for each additional **Overview pane** you want to use.

Performing Photic sequences

1. Click **View > Panel > Photic** to display that palette.

▶	Starts Photic timing.
↩	Resets the Photic sequence.
❚▶	Stops/Starts the Photic session.
☀	Sends a single flash.

Performing Hyper-ventilation

1. Click **View > Panel > Hyperventilation** to display that palette.

▶	Starts Hyperventilation (HV) timing.
■	Starts Post Hyperventilation (HV) timing.
↰	Resets the timers.

End the EEG recording

1. Click **Record** from the toolbar.

Close the Recorder window

2. Click **Close** ✕ in the upper right corner of the Recorder window.

3. Click **OK** to close the window.

    The Nicolet Recorder window closes and the NicVue window appears if the Nicolet application was launched from NicVue.

Move the session to the Physician folder for review

4. Display the NicVue window.

5. Click on (highlight) the patient's **file**.

6. Click on the **Acquisition Done** button .

7. On the *Move session for review* dialog, click on the **Physician** show menu ▼ button.

8. Click on the **Physician's folder name** in which you want to move the session.

9. Type in any comments you want included.

10. Click **OK** to close the dialog. The session is now located in the selected Physician's folder in NicVue awaiting review.

Pausing/
stopping a
recording
(Preview
mode)

1. Click on the **Record** button .

   - or -

   Click on **Acquisition > Record**.

The system stops storing data to disk and the **Green rectangle** changes to a **Yellow rectangle** indicating the system is now in the Preview mode.

Calibration Bar

Displays the Calibration Bar, which allows you to make measurements along the x-axis and y-axis (y-axis units matches the **All Channel Control** units). If in Recorder with the Reader window also displayed, turning the Calibration Bar on displays a Calibration Bar in both windows. Each of the Calibration Bars' scaling and orientation can be set independently of each other.

1. Click on the **Calibration** button.

   The first time you turn on the Calibration bar, it appears in the lower right section of the window. Thereafter, when you turn the Calibration off and on, the Calibration bar reappears in its current location in the window.

Remote control

Recorder

This optional feature allows you to control a recording from a remote computer connected via the network.

All data is stored on the host computer while recording.

On the remote computer:

a. The test title includes the text [REMOTE CONTROL].

b. Interface components (i.e., the Panel) can be displayed independently of the host computer.

c. New data is available every 10 seconds in the Reader pane and the recording clocks are updated in the same interval.

d. Remote video can be viewed and the acquisition of video can be paused/resumed. Video properties (such as resolution, compression, etc.) must be set on the Recorder system.

Controlling a recording remotely

1. Open the **Study Room** on the **remote** computer.

2. Select a **test** currently being recorded (indicated by a red arrow) on the Record List tab.

3. Click the **Remote Control** command button to open the test with remote control activated.

   - or -

   Right-click the **test** and click on **Remote Control** from the pop-up menu.

   A pop-up notification appears on the host computer to indicate that the test is being controlled remotely.

The File menu

Recorder

File > Edit
Patient
Properties

Displays the Patient Properties dialog, which you can use to create a new patient. You can choose to save the new patient file in NicVue or track the file manually outside of NicVue. Also, if Recorder was launched from the Desktop shortcut icon, you can also search NicVue for an existing patient.

Creating a new patient record

If Recorder was launched from NicVue:

NOTE: NicVue does not have to be launched to use this feature.

1. Click on **File > Patient Properties**.

   or

   Click on the **Edit Patient Properties** button.

2. Enter the patient's information.
3. Click **Save**.
4. Click **Close**.

If Recorder was launched from the Desktop :

1. Click on **File > Patient Properties**.

   or

   Click on the **Edit Patient Properties** button.

2. Enter the patient's **name**.
3. Click **Create New Patient**.
4. Enter the patient's **Patient ID**.
5. Enter the remaining information fields as necessary.
6. If you want to track the new file in NicVue, click **Save**. If you do not want to store the file in NicVue, select the **Don't Track Exam** button.
7. Click **Close**.

Searching NicVue for a patient record

NOTE: NicVue does not have to be launched to use this feature.

If Recorder was launched from the Desktop Recorder (not NicVue), you can search NicVue for an existing patient record.

1. Click on **File > Patient Properties**.

    - or -

    Click on the **Edit Patient Properties** button.

2. Enter the patient's **information** in the Search for Existing Patient pane. The more information you include, the more refined the search results.

3. Select the **patient** you want from the search results pane.

4. Click on the **Use This Patient** button.

5. The Patient Properties dialog appears with the selected patient's information filled in, which you can edit or add information.

6. Click **Save**.

7. Click **Close**.

File > Test Properties

Displays the Test Properties dialog, which you can enter/edit information pertaining to the selected patient's exam.

1. Click on **File > Test Properties**.

    or

    Click on the **Edit Patient Properties** button and then click on **Test Properties** at the bottom of the Patient Properties dialog.

2. Review/edit the Test Properties as necessary.

3. Click **Save**.

4. Click **Close**.

File > Lock Computer

Locks the computer and darkens the screen display while the computer is unattended and for patient privacy. To unlock the computer, enter your password.

The View menu

The **View** menu is used to control the main visual elements of the display.

1. Click on **View** from the Menu bar.

2. Click on the desired menu **option** you want displayed. A checkmark indicates that element is selected for display.

   - **Toolbar** - *See this chapter.*
   - **Status Bar** - *See this chapter.*
   - **Panel** - *See the **Data-viewing Tools** chapter.*
   - **Overview** - *See the **Viewing Information Related to EEG** chapter.*
   - **Review Pane** - *See the **Review Data** chapter.*
   - **Event Palett**e - *See this chapter.*

3. To remove an element from the display, repeat the above procedure to remove the checkmark.

Tip: Hide elements such as the toolbar or panel to increase the size of the trace display. Most of the controls can still be accessed via the menus or shortcut keys.

View > Toolbar

Recorder

Displaying the Toolbar

1. Click on **View > Toolbar > Show** to display the toolbar just below the menu bar.

2. To hide the Toolbar, repeat the above procedure.

Labelling the Toolbar buttons

1. Click on **View > Toolbar > Label** to label the buttons.

2. Repeat step 1 to hide the labels.

The following is a short description of the various Recorder button functions and the menu where you can access the command if the toolbar is not displayed

Record		Start recording data to disk. *Acquisition Menu.*
Grayed out Record		EEG traces are displayed in real time without recording to disk. *Acquisition Menu.*
Edit Patient Properties		Displays the Patient Properties dialog. If Recorder was launched from **NicVue**, you can review/edit the patient's information and select to view the Test Properties dialog. If Recorder was launched from the **Desktop**, you can create a new patient record, search for an existing patient record, and select to view the Test Properties dialog. *File Menu.*
Deblock		Trigger deblock on the amplifier. *Acquisition Menu.*
Impedance	Ω	Open the Impedance Test dialog in the right pane of the Recorder window. *Acquisition Menu.*
Video		Start recording video. Press again to stop. Note that the system must be recording and storing EEG for video recording to take place. *Video Menu.*
Selective		Record video only when user-defined events occur. *Video Menu.*
Notch		Apply notch filter. *Format Menu.*
Calibration		Calibrate the inputs. *Acquisition Menu.*
Settings		Open the Edit Settings dialog in the left pane of the Recorder window. *Format Menu.*
Overview		Display the overviews selected from the Overview submenu of the *View Menu.*
Panel		Display/hide the Panel. *View Menu.*

Review	⊠	Toggle the Reader Pane on and off in Recorder. The size of the panes is still adjusted by dragging the split bar as before. *View Menu.*
Quick Insert (Rubber Band)	⊐	When enabled, you select Events for insertion into the EEG from a popup menu rather from the Events Palette. *Tools Menu.*
Calibration Bar	⌐	Allows you to make measurements on the EEG. *Tools Menu.*
End	→⎸	Jump to the end of the recording in the Reader Pane.
Lock Comp.		Locks out anyone from using the computer. Click again and enter your password to unlock the computer. *File Menu.*
Montage	See below	Easily switch between common montages:

1	2	3	4	5	6	7	8
*Input La	Ambulator	AP Long	AVE Ref	Contra Ea	Ipsi Ear	CZ Ref	Input Ref

View > Status Bar

To display the Status Bar at the bottom of the screen display:

1. Click on **View > Status Bar**.

Status bar clocks

The Status Bar displays two clocks.

- The one closer to left shows the time since the last montage change.
- The other shows the total recording time.
  Both clocks show time in an **hour:minutes:seconds** format.

The color of the rectangle to the right of the clocks identifies the current status of the system:

- **Yellow rectangle**: Stopped
- **Green rectangle**: Previewing
- **Red rectangle**: Recording
- **Blue rectangl**e: Impedance test

Configuring the display

Setting individual channel control parameters

Recorder and Reader   You can set individual channel parameters (e.g., sensitivity, HFF, LFF, etc.) and see the effects of those changes immediately.

1. Right-click on the **trace label** at the left side of the screen display.
2. Click on the **parameter** you want to edit.
3. Click on the desired **menu option**.

Setting multiple channel control parameters

Recorder and Reader   You can set multiple channel parameters (e.g., sensitivity, HFF, LFF, etc.) and see the effects of those changes immediately.

1. While holding down the **Shift** key (or **Ctrl**) key on the keyboard, click on the trace labels you want to set.
2. Right-click on one of the highlighted trace **labels**.
3. Click on the **parameter** you want to edit.
4. Click on the desired **menu option**.

Formatting the EEG

Recorder and Reader   When the Format and Review Format palettes are displayed in the Panel, you can quickly set the Montage, Timebase, Channels, Sensitivity, High Cut frequency, and Low Cut frequency.

See: *Panel* chapter for details.

You can also right-click on the trace labels and change settings from the pop-up menu.

Acquisition menu

Acquisition > Record

1. Click on **Record** to begin acquiring EEG. You can also use the **Record** ⬥▸ Record button.

Acquisition > Calibrate

**NOTE: It is NOT recommended to use the Calibration mode for validation of Brain Symmetry Trend calculations.**

1. Click on the **Record** ⬥▸ Record button.

    - or -

    Click on **Acquisition > Record**.

2. Click on **Acquisition > Calibrate** to start recording the calibration.

    The displayed calibration signals are conditioned appropriately to reflect the currently selected sensitivity, as well as low, high and notch frequency filter settings.

    You can choose the **Calibration Period** and **Calibration Level**.

3. Click on the **Settings** Settings button.

    - or -

    Click on **Settings > Amplifier**.

4. Click on **Amplifier** at the bottom of the Montage Editor panel to display the Amplifier Setup panel.

For amplifiers that do not have internal calibration or a means of external calibration, you can use a software generated calibration signal. This feature is currently provided for the C32, C64 and C64/C64 amplifiers.

Acquisition > Impedance

Starting an Impedance test

Recorder

1. Click on the **Impedance** Impedance button.

   - or -

   Click on **Acquisition > Impedance**.

   The Impedance Test dialog is displayed and a **Blue Rectangle** is displayed in the status bar in the bottom right corner of the screen display.

The impedance of each channel is measured and the impedance measurements are displayed in a user-selectable graphical representation. The measurements are compared against the threshold value selected in the Threshold box. Color-coding allows at-a-glance interpretation.

Green	Impedance is lower than the selected threshold value. Electrode is properly connected.
Red	Impedance is higher than the value selected. Electrode needs readjusting.
No color	The channel is not selected in the Amplifier Setup dialog.

Acquisition > Information

Click on to view the amplifier configurations.

Acquisition > Deblock

Trigger deblock on the amplifier.

Acquisition > Ambulatory EEG

Click on to set up an Ambulatory EEG study.

Acquisition > Reset Alert

Click on to reset an event triggered alert.

The Protocol menu

Selecting a protocol

Recorder

You can apply a whole group of settings, called a protocol, at one time by selecting the desired **protocol** listed at the bottom of the Protocol menu.

1. Click on **Protocol > desired protocol option**.

Also See: *Protocols Editor* in the S*ettings and Options Dialogs* chapter.

Creating a new protocol from the current settings

1. Click on **Protocol > Save As**.

2. On the **Save Protocol** dialog, type in a **name** for the protocol and click **OK**.

    The new protocol appears on the **Protocol** menu. The following settings are saved to the Recording Protocol:
    - Amplifier Setup
    - Sensor Group
    - Montage
    - Trend Template
    - Event Palette
    - Alert Template
    - Detection Template
    - Photic Sequence
    - Video Template
    - Views
    - Frequency Analysis
    - File Format
    - Format (Format Palette or Format menu) **The Notch setting is not saved.**
    - Panel and Overviews (View menu).

Creating a <u>Recorder</u> Protocol

*Also see **Organizing a Protocol** later in this chapter.*

A **Recorder** Protocol will consist of an **Amplifier**, **Montage**, **Events Palette**, optional **Trends Template**, **Alerts Template**, and **Detections Template** (if applicable - some of these choices are licensed options).

Display the Protocol Setup editor

1. Click on **Protocol > Setup**.

   There are six summaries on the Protocol Setup panel showing the current settings for various parameters/templates.

2. To make changes to any of the six summaries, click on the corresponding **Edit** button and refer to the related instructions in this chapter, if necessary, to make your edits.

3. After finished making your changes to the Editor panel, click on the **Back** button to return to the Protocol Summary panel.

NOTE: You can turn on/off the **Amplifier channels**, show/hide the **Montages**, and enable/disable the **Detection events** directly from the Amplifier Summary panel by clicking on the associated **checkboxes**.

---

4. Click on one of the three **Video** choices. For information on Selective Video, please refer to *Recording Selective Video* in this chapter.

Apply or Save the Protocol

5. Click on the **Apply to this exam** button to apply your changes temporarily to the current exam on your system. This does **not** save the new Protocol or your edits permanently.

   To **save** the protocol to <u>all</u> networked systems permanently, click on **Save for all networked systems** button. **Each system must be restarted for the new Protocol to be used.**

6. Click **Close** ☒ in the upper right corner of the panel.

Protocol > Settings

See: *Settings* chapter for descriptions.

Protocol > Save

Replaces the original Protocol settings with the current setting.

Protocol > Save As

Saves the current Protocol settings under a new name, which you then can edit for new settings. The original Protocol settings will remain intact.

Format menu

You can quickly select the following formats from the **Format** menu:

- Montage
- Timebase
- Channels to Display
- Sensitivity
- Deflection
- High Cut Filter
- Low Cut Filter
- Notch Filter

Also See: The *Panels* chapter for a description on how to set these parameters from the Format and Review Format palettes.

Exception: Deflection and Notch Filter are not available on the Format palettes in the Panel view on the right side of the screen display.

Format > Deflection

Recorder and Reader

Deflection describes the vertical measurement of a trace before it is cut off. You can select a Deflection setting for all channels in the current montage not marked as **Special**.

Click on **Format > Deflection** and then select one of the **Deflection** options listed in the menu.

Format > Notch Filter

Recorder and Reader

Applies the notch filter.

Format > **As Recorded**	Returns to the original Montage used to acquire the EEG after selecting a different Montage. You can also use the **As Rec.** ↩ As Rec button.
Format > **Hide Selected Traces**	After clicking on (highlighting) the trace labels you want to hide, click on **Hide Selected Traces** to hide those traces. To return the hidden traces, click on **Format > Show All Traces**.
Format > **Show Selected Traces**	After clicking on (highlighting) the trace labels you want to remain displayed, click on **Show Selected Traces** to leave those traces displayed while the unselected traces are hidden from view. To return the hidden traces, click on **Format > Show All Traces**.
Format > **Show All Traces**	Brings all of the hidden traces back for viewing.

Tools menu

Click on the **Tools** menu to display command options to:

- Start/Stop/Reset Hyperventilation
- Start/Stop/Reset the Photic
- Start the current session with photic
- Choose to have the Photic produce a single flash
- Show/Hide the calibration bar
- Launch Producer Basic

Tools > Options

You can select various program-wide settings from a single dialog box.

- Paths
- Powerloss Recovery
- Display
- Customize Toolbar
- BST (Brain Symmetry Trend)
- Miscellaneous
- Acquisition
- Screen Size
- Regional
- Color Coding
- Alerts

See: *Settings and Options* chapter for descriptions.

Keystroke shortcuts

Standard Windows

- **Ctrl**+ **N** - New

Other

- **Ctrl**+ **R -** Start/Stop recording
- **Ctrl**+ **I** - Impedance Test
- **Ctrl**+ **D** - Deblock
- **Ctrl**+ **K** - Record Video
- **Ctrl**+**Q** - Selective Video
- **Ctrl**+ **G** - Notch Filter
- **Ctrl**+ **T** - Edit Settings
- **Home** - Go to beginning of recording in Reader Pane
- **End** - Go to end of recording in the Reader Pane
- **Left Arrow** - Step left one second in the Reader Pane
- **Right Arrow** - Step right one second in the Reader Pane
- **Page Down** - Next Page in the Reader Pane
- **Page Up** - Previous Page in the Reader Pane
- **Ctrl**+ **H** - Next High cut filter
- **Ctrl**+**Shift**+ **H** - Previous High cut filter
- **Ctrl**+ **L** -Next Low cut filter
- **Ctrl**+**Shift**+ **L** - Previous Low cut filter
- **Ctrl**+ **A** -Next Paper speed value
- **Ctrl**+**Shift**+ **A** - Previous Paper speed value
- **Up Arrow** - Next Sensitivity value
- **Down Arrow** - Previous Sensitivity value
- **Ctrl**+ **J** - Start Photic
- **Ctrl**+ **F** - Flash Photic
- **Esc** - Stop Photic
- **Ctrl**+ **Y** - Start/Stop Hyperventilation
- **Ctrl**+ **W -** Toggle Panel

Events Shortcut

The first 16 events in a palette are assigned a shortcut, starting with the function keys **F3 - F10** and **then SHIFT**+ **F3 – F10**. You can adjust the order of the events in the Event Palette Editor.

Montage Shortcuts

The first 10 montages in a montage set are assigned a shortcut ranging from **Ctrl**+**1** to **Ctrl**+**0**. The order of the montages in a set can be adjusted in the Montage Set Editor.

4 Reviewing Data

Legends

Note that in the left column you will see *Recorder, Reader, or Recorder and Reader* listed. These help identify whether the related topic applies to the Recorder and/or Reader applications.

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Introduction

The Nicolet Reader provides options for reviewing, analyzing, annotating, and printing an EEG file. Recordings can be registered automatically in the system or imported at a later stage from various sources. You can review a recording using any montage or filter settings and quickly switch it back to the As-Recorded state. The Reader software also offers powerful tools for analyzing data and generating reports in various Windows-based applications.

Legacy files NicoletOne Reader is designed to support most Nicolet legacy file formats, which you can edit events and exams and then save them to the current file format.

File Type	Read Only	Editable
NicoletOne, Nicolet vEEG, Nervus EEG (.e)		x
Nervus 2x EEG (.eeg)	x	
European Data Format (.edf)	x	
Embla (.ebm)	x	
Medelec DG (.dat)	x	
cEEG (.0000)	x	
BMSI 6000, AllianceWorks (.eeg)	x	
Cephalo Pro (.sbi)	x	
NicoletOne EEGToGo (.exe)	x	

With NicoletOne Reader, you have two main methods of reviewing EEG recordings:

As Recorded: Using the same montage settings when the recording was made.

Reformatted: Using montage settings other than those in effect when the recording was made.

Reformatting   Reformatting is performed by:

Selecting various options listed on the **Format menu**.

- or -

Available on the *Format* pane**l** in the Control Panel on the right side of the screen display, which is displayed from the **View > Panel** menu.

- or -

Modifying the settings of the current montage.

See *Montage Editor* in the *Edit Settings and Options Dialog* chapter.

- You can return to the **As Recorded** state by clicking **As Recorded**   .

- The current montage and format settings are shown at the bottom of the main window.

Topics discussed in separate chapters

Please see the *Shared Functions* chapter.	
Patient, Test and Exam properties	The patient, test (Classic View), and Exam (Tabbed View) properties can be viewed and edited at any time.
Numerical displays	You can choose to set the selected channel(s) to display only a trace, a trace with numerical values, or numerical values only.
Event palettes	The event palettes are used to insert event markers into the recorded EEG.
Context menu	You can quickly change various parameters (sensitivity, deflection, baseline, etc.) as desired to obtain the desired results on the collected EEG.
Showing/Hiding traces	You can select specific traces to either be hidden from view or remain displayed.
Reordering the channels	You can reorder the traces by dragging them to their new positions.
Marking Special channels	You can mark channels as Special channels, which are not affected when formatting changes are applied.
Producer Basic	You can e-mail, print, or save a .jpg file of the screen display.
Flat lining signals that exceed the vertical display limits	You can choose to have the tops and bottoms of signals that exceed the vertical deflection display limits to be connected with a straight line.
Inserting an empty channel (space)	You can insert an empty channel in the Montage Editor panel to separate or group display channels.
Calibration Bar	Allows you to make EEG measurements in Recorder and/or Reader.
Print Marker	Used to mark a specific section of EEG for printing.
Please see the *Settings* chapter.	
Events	Event markers can be selected from the *Event* palette to mark moments or time intervals of interest.
Event editor	You can create custom event markers using the Event Editor.
Event palettes	An event palette is a set of events available for marking the EEG at any time. You can create custom event palettes to use for different types of recordings.
Assigning events to specific sensors	Events can be assigned to a specific sensor. When the event is selected for placement on the EEG, the event will 'snap' directly to the trace to which it has been assigned.
Assigning numerical values to an event	You can assign an Integer or Decimal value, or an enumeration to the selected event type.
Please see the *Overview* chapter.	
View > Overviews	You can display various panes below the Toolbar containing summaries of data.
Please see the *Control Panel* chapter.	
View > Panels	You can display several palettes to the right side of the Reader pane, which allows quick control over various operations for the Reader application.

Nicolet Reader Window components

Reader pane
only

This figure shows the basic elements of the Nicolet Reader window.
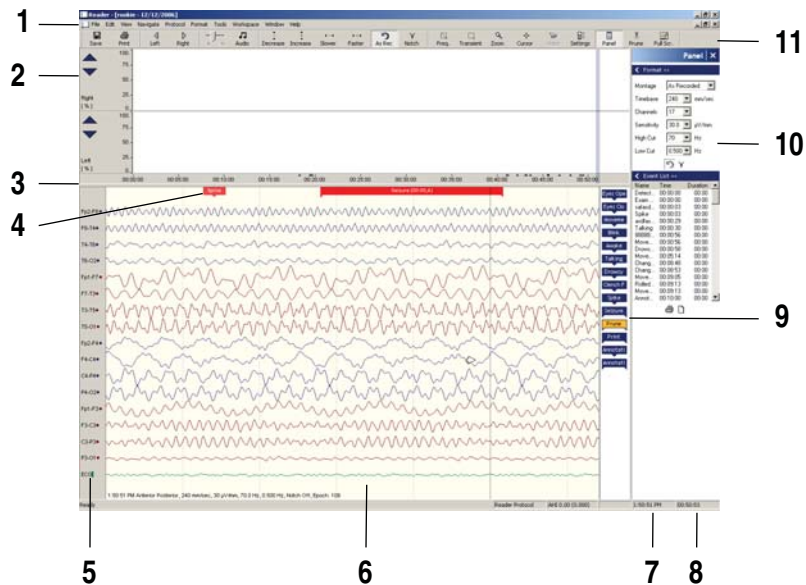
Key:

1. Menu Bar
2. Overview
3. Movable Split Bar
4. Event Marker
5. Trace Labels
6. Trace Display
7. Total recording time
8. Time since last Montage change
9. Event Palette
10. Panel
11. Toolbar

**Reader pane/
Recorder pane
display**

Following is the Nicolet nEEG and LTM Reader and Recorder panes with their main
features displayed.

Key:
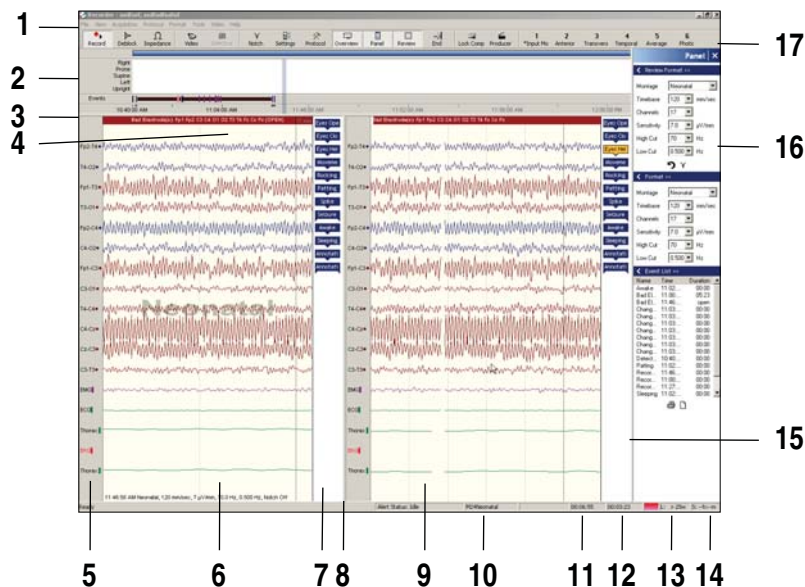
1. Menus
2. Overview
3. Movable Split Bar
4. Event Marker
5. Trace Labels
6. Reader Pane
7. Reader Event Palette
8. Movable Split Bar
9. Recorder Pane
10. Current protocol use
11. Total recording time
12. Time since last Montage change
13. L: Local hard drive space available
14. S: Server space available
15. Panel
16. Toolbar

The EEG trace display(s)

The EEG trace display makes up the main part of the Recorder program interface. The window can be divided into two EEG display panes with the Reader pane on the left side and the Recorder pane on the right. The size of the panes can be resized by clicking on and dragging the split bar between the two panes.

Reader pane

The Reader Pane displays the recorded EEG from the beginning and up to the current position in the recording session. Use this pane to review previous parts of the recording and perform some editing to mark events and add annotations.

Closing the Reader automatically

You can choose to close the Reader application when the last open exam in Reader is closed.

1. Click on **Tools > Options > Misc tab**.

   Check **Close Reader when last study is closed**.

Displaying the Recorder pane

To display the Recorder pane on the right hand side of the Reader window

1. Click on **View > Live Pane**.

Using keyboard control

Bring a pane into focus

In order to use the keyboard for the following functions, the pane must be in focus.

1. To bring a panel into focus, click on the **Focus** button.

The pane in focus has the Focus button displayed with a blue background .

Hiding the Focus button

The Focus buttons are displayed by default. To hide the Focus button:

1. Click on **Tools > Options > Display** tab.
2. Uncheck **Show Target Label**.
3. Select **OK**.

Adjusting the channel sensitivity with the Up/Down Arrow keys

You can adjust the sensitivity for the selected channels by pressing the **Up** and **Down Arrow** keys on the keyboard. These keys work in Reader, Recorder, and the Live Review pane in Recorder.

1. Press the **Up** arrow to decrease the sensitivity value of any selected channel and press the **Down** arrow to increase the sensitivity value. If no channels are selected in the display area, the **Up/Down** arrow buttons will increase/decrease the ACC sensitivity.

Once the sensitivity has reached its maximum/minimum setting, that arrow key will have no more effect.

Displaying events in front or behind the traces in Reader
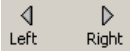
When reviewing data in Reader, you can choose to display placed events in front of the traces for easy viewing or behind the traces so the entire trace can be viewed.

1. Press the **Spacebar** on the keyboard to toggle the events in front of or behind the traces.

Navigating through the Reader EEG

There are several ways to navigate through the Reader. You can use automatic paging with or without audio enhancement. Or you can step through the recorded EEG a page at a time. You can even go directly to a specific point or event.

Following are five methods of navigation.

a. Use the **Left** and **Right** Left   Right **Paging** buttons on the toolbar (or the paging commands on the Navigate Menu) to start automatic paging. Click again on the buttons to stop paging.

The speed can be adjusted using the **slider** on the toolbar. Press the **Audio** Audio button (or click on **Navigate > Audio**) to start the audio.

b. Click on the trace display with the cursor to page a step at a time. The Cursor changes into one of four different arrow cursors, depending on its position on the Reader pane:

- **Far left**: **Large** left-pointing arrow. Click to page back one page.
- **Left**: **Small** left-pointing arrow. Click to page back 1/2 page.
- **Right**: **Small** right-pointing arrow. Click to page back 1/2 page.
- **Far right**: **Large** right-pointing arrow. Click to page forward one page.

Use the following keyboard shortcuts:

- **Home:** Go to beginning of recording.
- **End:** Go to end of recording.
- **Left Arrow:** Step left one second.
- **Right Arrow:** Step right one second.
- **Page Down:** Go forward one page.
- **Page Up:** Go back one page.

c. Drag the thumb markers on the Time Scale overview, or click on a **point** on the Trend Overview.

d. Click an **event** on the event list to go to a specific event in the recording.

Also See: *Navigate menu* **later in this chapter for alternative means of navigation.**

View menu

From the **View** menu you can change what features the system displays in the Reader window. Checked elements indicate what the system is displaying. To hide these elements from view, uncheck them by selecting them again in the **View** menu.

View > Toolbar

1. Click on **View > Toolbar > Show** to display/hide the toolbar buttons.

2. Click on **View > Toolbar > Label** if you want the buttons labeled as shown below. Repeat to hide the labels.

Below are descriptions of the individual items on the standard Reader toolbar. From the toolbar you can access most basic functions of the Reader.

Save	💾	Saves the changes to the file.
Print	🖨	Prints the currently displayed page.
E2Go		Saves the current file as an EEG ToGo archive.
Save Trends to File		Saves the currently displayed Trend to file, which can be opened in Reader for review.
Paging Buttons	◁ ▷	Plays the recording backward or forward in one second time increments. Click a second time or click anywhere on the trace display to stop the playback.
Paging Speed		Increases or decreases the paging speed.
Audio	♫	Enables or disables the audio in playback mode.
Sensitivity		Changes the sensitivity one step at a time. (Sensitivity can also be changed via the *Format* Panel, Format Menu, or by pressing the Up/Down Arrow keys on the keyboard). If no channels are selected when pressing the Arrow keys, they will change the ACC sensitivity.
Time Base	▸—◂ ▸+◂	These buttons adjust the "paper speed" or time base. (The time base can also be adjusted via the *Format* Panel or the Format Menu).
As Recorded	↺	Quickly changes the trace display back to the As-Recorded state after reformatting.
Notch	⋎	Use the paging speed slider to increase or decrease the paging speed.
Frequency Analysis		The spectral analysis of the selected area is displayed in a graph.

Box Cursor		A Box Cursor can be drawn across several traces resulting in a measurement of the time interval between the left and right sides of the cursor and a measurement of the voltage differential between the bottom and top of the cursor.
Zoom		Click once on the Zoom button, then drag on an area of the trace display to zoom in for a larger view. You can enlarge an area several times by continuing to click and drag on the area. Click on the button again to return the trace to its original size.
Channel Cursor		The Channel Cursor allows you to measure the elapsed time from the start of the recording to a point you select on a trace and the voltage differential between the baseline and the selected point. If two points are selected on the trace, the first point you select becomes the Reference point and the voltage and time differential between the two points are measured.
Video		Enables video (if recorded) to be played back in sync with the recorded EEG.
Edit Settings		Displays the Edit Settings dialog.
Panel		Displays the Control Panel in which you can select various 'control' palettes to be displayed. Also available in the View menu.
Prune		Toggles Prune Preview (also available on the File menu). Choose Save to save the pruned version. Please refer to the *Edit Settings and Options Dialogs* chapter for a description of the Prune settings dialog.
Full Screen		Displays a full EEG screen display. Repeat to return to the normal display mode. Alternatively, press F11.
Edit Patient Properties (Edit Test Properties)		Displays the Patient Properties/Test Properties dialog. Also available in the File menu.
Rubber Band (Quick Insert)		Allows you to insert events from a popup menu without having to return to the Event Palette. To exit, press ESC or click on the Insert User Events button again.
Calibration Bar		Displays the Calibration Bar, which allows you to make measurements along the x-axis and y-axis (y-axis units matches All Channel Control units).
Protocol Setup		Displays the Protocol Setup panel.

Producer		Captures the current screen display, which can then be emailed, printed, or saved to a file using the Producer Basic function.
Show Hidden Toolbar Buttons	〉〉	Displays a drop down menu of toolbar buttons that are not visible when there is not enough horizontal room to display them.

View > Format bar

This bar is available when **Label** is unchecked on the **View > Toolbar** submenu. You can quickly switch montages, timebase, number of channels displayed, sensitivity, and high and low frequency filters.

| As Recorded ▼ | 2 secs/screen ▼ | 13 ▼ | 20.0 µV/mm ▼ | 70 Hz ▼ | 0.500 Hz ▼ |

View > Status bar	The Status Bar appears at the bottom of the Reader window when **Status Bar** is selected in the **View** menu.

The Status Bar displays two clocks.

- The one closer to left shows the time since the last montage change.

- The one closer to the right shows the total recording time.

Both clocks show time in a **hour:minutes:seconds** format.

View > Overview

An **Overview** panel can be displayed below the Toolbar. You then can choose various Overview panes for display in which data summaries can be viewed. You can also use the **Overview** Overview button to display/hide the Overview.

View > Trends

You can choose from a list of Trends for viewing.

1. Click on **View > Trends**.

2. Click on the desired **Trend**.

Copying Trends to the clipboard

1. Click on **Edit > Copy Trends** to copy the trends to the clipboard.

2. You can paste the image into many Windows applications such as Word, Excel and MS-Paint. The image can be attached to a patient's folder.

Printing Trends

You can print all or part of the Trends.

1. Click on **File > Print Trends**.

2. Choose the **duration** you want to print on the **View > Overview** submenu, or by right-clicking on the **overview** and selecting a **duration** from the popup menu.

3. Slide the **Zoom bar** to the desired location.

4. Click on **File > Print Preview Trends** to show how many pages the printing will require. To reduce the number of pages, choose a longer duration.

5. Click on **File > Page Setup Trends** to set the page size and access your printer setup.

View > Panel	The Control Panel can be displayed on the right side of the screen display in which you can display various panels. These panels allow you quick and easy manipulation of various controls for the system. You can also use the **Panel** [Panel] button to display/hide the Control Panel.

> **See:** *Using the Control Panel* **chapter for descriptions.**

View > Event Palette	Displays a list of Events from which you can choose to mark points of interest on the displayed EEG.
View >Video	Displays the *Video* palette in the Control Panel display at the right side of the screen display. Also available through **View > Panel > Review Video**.
View > Live Pane	Displays the Recorder pane to the right of the Reader pane.
View > Recorded channels	Displays information about the channels used in the recording and the sampling rates.
View > HW Info	Generates a list of the hardware connected to the NicoletOne.
View > Full Screen	Removes the Menu bar and the Status bar at the bottom of the screen display to provide a full screen display of the Reader window. You can also use the **Full Scr**. [Full Scr.] button or press the **F11** key.

To return to the 'normal' screen display, press the **F11** key or click on the **Full Scr**. [Full Scr.] button. |

Navigate menu

The Navigate menu contains various commands with which you can use to navigate through the displayed EEG.

Command	Keystroke(s)
Forward	Alt+PgDown
Backward	Alt+PgUp
Next Page	Pg Down
Previous Page	Pg Up
Go to End	End
Go to Beginning	Home

Navigate > Page and Prune

Inserts a prune event marker on the current page and then moves forward one page.

Navigate > Audio

Click on **Audio** to play back any audio that was recorded along with the video recording.

Protocol menu

Selecting a protocol

You can apply a whole group of settings, called a protocol, at one time by selecting the desired **protocol** listed at the bottom of the **Protocol** menu.

Saving a new protocol

To save the current configuration of settings (protocol):

1. Click on **Protocol > Save**.

2. Type in a **name** for the protocol.

3. Click **OK**. The new protocol appears on the **Protocol** menu.

In addition to format settings, the protocol also saves the Event palette, Trend, Frequency and View settings. These settings can all be changed via **Protocol > Organize**.

Protocol > Settings

Clicking on **Settings** displays the *Montage Editor* panel from which you can setup a Montage. At the bottom of each *Editor* panel are other linked panels with which you can set up other various parameters. You can also use the **Settings** Settings button.

See: Please see the *Edit Settings and Options Dialogs* chapter for detailed descriptions on each of the *Editor* panels**.**

Creating a <u>Reader</u> Protocol

*Also see **Organizing a Protocol** on the next page.*

The Reader Protocol will consist of a *Montage* palette and an *Events* palette.

Display the Protocol Setup editor

1. Click **Protocol > Protocol Setup**.

    There are two summaries on the *Protocol Setup* panel showing the current settings for the *Montage* and the *Events* Editor panels.

2. To make changes to either of the summaries, click on the corresponding **Edit** button and refer to the related instructions in this chapter, if necessary, to make your edits.

3. When done making your edits, click the **Back** button to return to the *Protocol Setup* panel.

Apply or Save the Protocol

4. Click on the **Apply to this exam** button to apply your changes temporarily to the current exam on your system. This does **not** save the new Protocol or your edits permanently. (Disabled on **Read Only** systems.)

    To **save** the protocol to <u>all</u> networked systems permanently, click on **Save for all networked systems** button. (Disabled on **Read Only** systems.) **Each system must be restarted for the new Protocol to be used.**

NOTE: Click **Close** ☒ in the upper right corner of the panel.

Format menu

You can quickly select the following formats from the **Format** menu:

- Montage
- Timebase
- Channels to Display
- Sensitivity
- Deflection
- High Cut Filter
- Low Cut Filter
- Notch Filter

See: Please see the *Using the Control Panel* chapter for a description on how to set these parameters from the *Format* and *Review Format* palettes.

Exception: Deflection and Notch Filter are not available on the *Format* palettes.

Format > Deflection

Recorder and Reader

Deflection describes the vertical measurement of a trace before it is cut off. You can select a Deflection setting for all channels in the current montage not marked as **Special**.

Click on **Format > Deflection** and then select one of the **Deflection** options listed in the menu.

Format > Notch Filter

Recorder and Reader

Click on **Format > Notch** to apply the notch filter.

Format > As Recorded

Click on **As Recorded** to return to the original Montage used to acquire the original EEG after selecting a different Montage to view the EEG. You can also use the **As Rec.**

button.

Tools menu

Tools > Frequency Graticule	Allows you to perform a Spectral Analysis of the recorded EEG. You can also use the **Freq.** Freq. button.

See:Performing Measurements chapter for details.

Tools > Box Cursor	Enables you to draw a Box Cursor for a variety of measurements. You can also use the **Box Cursor** Box Cur. button.

See:Performing Measurements chapter for details.

Tools > Channel Cursor	Allows you to measure the time and voltage value of a single point on a trace. It also allows you to measure the differential time and voltage values between two points on the trace. You can also use the **Cursor** Cursor button.

See:Performing Measurements chapter for details.

Tools > Rubber Band Cursor	The Rubber Band mode allows you to select event markers from a popup menu that you want to place on the EEG.
Tools > Zoom	Click on **Zoom** and then, using the Magnifying Glass pointer, draw a box around the section of EEG you want to expand. You can also use the **Zoom** Zoom button.

Tools > Vertical Marker	The Vertical Marker moves along the trace display during Video or Amplitude map playback. You can drag the marker to a point where you want to view the video or amplitude map.
Tools > Producer Basic	Launches producer basic.
Tools > Calibration Bar	Displays/Hides the on screen calibration bar tool.
Tools > Detections	Select a **detection template** from this list on the **Tools** menu.
Tools > Create Report	Choose **Create Report** to display a report in html format.
Tools > Organize Report	Choose **Organize Reports** to open the Organize Reports dialog box. You can use this dialog box to edit and review reports.
Tools > Delete Video	Click on **Delete Video** and then on the **OK** button to confirm you want to delete all of the video related to the test currently being reviewed.
Tools > Options	Launches the Options dialog.

Workspace menu

Workspace > Organize

1. Click on **Workspace > Organize** to open the Workspace folder in a Windows Explorer window if you want to rearrange the folders or shortcuts.

2. Create shortcuts on the Workspace menu to EEG tests of interest for conferences, training, etc.

Workspace > Add

1. Click on **Workspace > Add** to add a test to any workspace folder. Any number of folders can be created (by clicking the **Add Folder** button).

2. Click **OK**. The test is added to the Workspace Menu.

Window menu

Window > New Window

This feature allows a test to be viewed in multiple windows with different montages. Changes made to events in one view are automatically changed in the other windows.

1. To open a new window, click on **Window > New Window**.

    The test is added to the list at the bottom of the menu and numbered. A checkmark indicates which window is currently active (on top).

2. Switch between active windows by selecting the desired one from the list, or by clicking on any visible portion of the window.

Window > Cascade

Displays the open windows in Cascading order.

Window > Tile

Displays all of the open windows Horizontally or Vertically.

Switching between multiple Reader windows

If you have multiple Reader windows open, you can quickly switch from one to another for viewing by clicking on the **Window** menu and then clicking on the **Reader window label** you want to view.

File menu

File > Export   You can choose to export the recorded EEG as an ASCII, EDF, or Trends file and choose whether to export only a portion of the recorded EEG data or the entire EEG data file.

1. Click **File > Export** to display the Export dialog.

2. Click on either **ASCII**, **EDF**, **EDF+** or **Trends**.

3. Click on **Whole File** to export the entire EEG data file.

   - or -

4. Type in the **Start time** and **End time** of the EEG data span you want to export.

5. If the EEG data file was segmented to include only the EEG data you are interested in, checkmark the **Link Segments** box. (Available for EDF+ only when not using *as recorded montage*).

6. Click on **Current Montage** to export the EEG using the Montage currently being used.

   - or -

7. Click on **Raw Data** to export the raw data only.

8. When finished, click on **Export**.

9. On the **Save As** dialog, choose the **location** into which you want to store the exported file.

10. Type in a **File name** for the new file.

11. Click on **Save**.

Exporting EDF and EDF+ formatted files	EDF formatted files make it easier to use NicoletOne data for research purposes with external analysis applications. The EDF+ file format support can handle multiple segments using the same Amplifier inputs. The software can support events and sleep scores in multiple segmented EDF+ files. If the exam contains multiple montages (as in As Recorded), multiple EDF+ files are created. Multiple sleep scores cannot be exported, just the current sleep score. An extra channel is added to the EDF+ file, which is used to store the scores from 0 to 9.
Requirements	• Reader
	• A previously recorded exam

EDF+ formatted files contain the following:

• Annotations (Text only)

• Sleep Data (Epoch and Stage)

Electrode labels containing spaces are not valid. When exporting to EDF or EDF+, spaces in the electrode labels are replaced with underscores.

NOTE: Third party EDF readers are not compatible for use.

Exporting EDF or EDF+ formatted files

1. Open a study in Reader.
2. Click **File > Export**
3. Select **EDF** (or **EDF**+) in the File Type section.
4. Select **Raw Data** in the Montage section.
5. Click on the **Export** button.
   The exported file now contains underscores instead of spaces in the electrode names.

NOTE: External EDF readers that do not recognize the EDF+ format display the events and sleep score as two traces with meaningless data. You can exclude those traces by modifying the montage.

File > Patient
Properties

Displays the Patient Properties dialog, which you can use to review/edit patient information.

1. Click on **File > Patient Properties**.

    - or -

    Click on the **Edit Patient Properties** 🔲 button.

2. Review/edit the patient's information.

3. Click **Save**.

4. Click **Close**.

File > Test
Properties

Displays the Test Properties dialog, which you can enter/edit information pertaining to the selected patient's exam.

1. Click on **File > Test Properties**.

    - or -

    Click on the **Edit Patient Properties** 🔲 button and then click on **Test Properties** at the bottom of the Patient Properties dialog.

2. Review/edit the Test Properties as necessary.

3. Click **Save**.

4. Click **Close**.

Remote live review
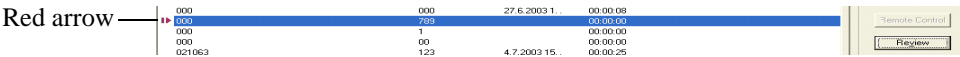
Red arrow

A test can be reviewed in real time, but not edited.

Exception: Remote Live Review is not available in vEEG.

1. Select a **test** currently being recorded (indicated by a red arrow) in NicVue or Study Room.

2. Click the **Review** button to review it live in a Reader station on the Network.

3. Make sure **Live Pane** is checked on the **View** menu.

Remote review in Central Monitor

You can review remotely on the Central Monitor.

NOTE: NicVue or Study Room must be installed and the database connection must be functioning properly for remote review.

1. Click **Review** 　Review　 on the Patient strip to launch online review.

Printing

The Reader program uses printer settings from windows. The standard page setup dialog can be displayed and a slightly modified print dialog:

The Page Range is the only modified part.

- **Current Page and [n] Next:** Prints out the current page and n next pages.
- **Print Markers:** There are two kinds of Print markers, duration print marker and non-duration print marker. Pages with non-duration markers and possibly multiple pages marked by duration events are printed.
- **Pages:** Prints out the pages specified in the edit box.

Layout of pages

On each page there will be the following information:

- **Top left:** [Last Name], [First Name] - [Date of Birth]**.**
- **Top Right:** Test Start Time: [Test Start Time].
- **Bottom left**: [Start time of Page] [Montage], [Time Base], [Sensitivity], [High Cut], [Low Cut], [Notch].

The main part of the page is the signals and labels.

Printing using the Print button

When using the **Print** button, the current page is printed without any prompt dialog appearing.

Printing from Print Event Markers

Please refer to Chapter 18, *Shared Functions*.

Print Preview

In Print Preview mode the main window shows the pages, one at a time, as they will print out. Available commands:

- **Print:** Closes Print Preview and displays the Print dialog.
- **Setup:** Displays the Page Setup dialog.
- **Zoom:** Zooms in or out to the page. Choose from: 50%, 75%, 100%, 150%, and 200%.
- **Previous:** Display Previous page.
- **Next**: Display Next page.
- **What to preview:** Choose from Current (the current page), Markers (Prints out all EEG that is marked with Print events), All (all pages).
- **Close:** Close Print preview.

Print Trends

The following Trend options are located in the **File** menu.

- **Print Trends:** Displays the Print Trends dialog to allow printing all or a part of the trends.
- **Print Preview Trend:** Puts the Reader in Print Trends Preview mode.
- **Page Setup Trends:** Displays Page Setup Trends dialog.

Layout of pages

On each page there is:

- **Top left:** [Last Name], [First Name] - [Date of Birth].
- **Top Right:** Test Start Time: [Test Start Time and Date].
- **Bottom left:** [Start time of Page].
- **Bottom right:** [The Date of the Page].

The main part of the page is the Trends, labels and time scale.

Pruning EEG

The original recording can be pruned to reduce its length for archiving. This is best done by using Duration markers or creating a Prune event to create sections of interest.

Prune view overview displays vertical markers to indicate where prune segment boundaries are located in the record. A vertical marker is also shown in the signal view at the location of prune segment boundaries.

The vertical marker appears only BETWEEN pruned segments when in the Prune Preview mode. These markers are applied to both segments pruned manually as well as segments pruned automatically as defined in **Protocol > Settings > Prune > Event Types in Template**.

In the example below, three segments were pruned; one automatically (**Spike** - from the **Prune** Settings Editor panel) and two manually (**Prune**).

Prune Markers

Pruned Segments
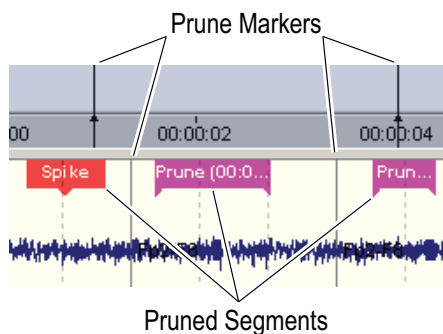
In case a test is being reviewed that is currently being recorded, the Recorder Pane and *Remote Video* panel item become enabled. The Recorder pane shows data in the "As Recorded" format and no reformatting is possible. Remote video shows near real time video from the recording station if being recorded.

Saving pruned files	You can not save a Prune file if you are not in the Prune Preview mode. If you click on **File > Save as**, the following message appears:

"*Save as will save a copy of the entire exam. If you want to save a prune file, first select the Prune Preview menu and save from inside the prune preview. Do you wish to save a copy of the entire exam? [Yes/No]*"

If you never want to view this message again, check the **Never show this message again** checkbox.

⚠ WARNING

Please make sure you really do not want to view the above message again. Once it is disabled, the only way to return this message is through the registry. Please do not attempt to re-enable the message yourself or your Natus Neurology Incorporated's warranty may become void. Please contact Natus Neurology Incorporated Customer Support for assistance.

Pruning the EEG

NOTE: Multiple Prune Templates can be created if you want specific events pruned separately (e.g., seizure events pruned separately from routine events). Also see *Creating a Prune Template* later in this guide.

NOTE: Saved Trends are not removed when a file is pruned.
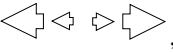
Select the exam	1. From the NicVue window, locate and click on the **patient name**.

2. Click on the desired **EEG exam** (NicoletOne or nEEG) and then click **Review** 🔍.

You can choose from two options when pruning the EEG.

- **Option 1** prunes a specific section of the EEG that you choose. That is, you may want to prune only a specific Spike event and nothing else.

- **Option 2** prunes the EEG while you page through the EEG. This option is useful for pruning pages of events quickly.

**Option 1:
Pruning
specific events**

1. Page through the EEG until the start of the EEG you want to prune is displayed.

   - To auto-page one page at a time, click the **Play** buttons ◁ ▷. To stop auto-paging, click on the button again.

   - To set the auto-paging speed, drag the small speed control until the desired speed is achieved.

   - To page one page at a time manually, click on the **Page** arrows ◁ ◁ ▷ ▷, which appear when you hover the mouse pointer over the EEG display.

   - To move to a specific event, drag the Event Bar (**View > Overview > Events**) in the Overview pane.

2. From the Event Palette to the right of the EEG trace display, click on **Prune**. The mouse pointer turns into an Event Marker symbol . If Prune is not listed in the Event Palette, go to **Protocol > Settings > Event Palette Editor**.

3. Position the **Marker** towards the top of the EEG display, identify the start of the event you want to prune and click the mouse button.

4. If necessary, page to the **end** of the event you want to prune.

5. Identify the end of the event you want to prune and click the mouse button.
   If the **View > Overview > Events** is enabled, a predefined colored bar appears across the top of the EEG display, spanning the pruned event.

6. If you want to annotate the prune marker, double-click the **Prune marker** and type in the desired annotation.

**Option 2:
Pruning page
by page**

To prune page by page, the prune event must be selected as an Event Type in the **Prune** editor. Each of the Prunes are combined into a single Prune.

1. Display the page of EEG on which you want to start pruning.

2. Hold down the **Ctrl** key on the keyboard.

3. Press the **Page Down** key on the keyboard. The currently displayed page of EEG is captured in the Prune and the next page of EEG appears.

4. Repeat step 3 as often as necessary to prune as many pages of EEG as you need.

5. When finished pruning, release the **Ctrl** key.

| Previewing pruned events | 1. If you used multiple Prune Templates for the recorded EEG, click **Toggle Prune Preview** ✂ or click **File > Prune Preview > Prune Event**. |

2. Click on the desired **prune template** from the list.

The EEG is pruned accordingly for the Event Types in the selected template.

3. To return the normal EEG display, click **Toggle Prune Preview** ✂ or click **File > Prune Preview > Off**.

Saving pruned events

To save the pruned events as a separate file in NicVue:

1. Click **File > Save Prune** or **File > Save Prune As**.

2. Type in a **name** for the pruned file.

3. If the recording has video and you want to include it in the prune, leave the **Save Video** checkbox checked. If you want to exclude it, remove the checkmark.

4. Click **OK**.

You can not save a Prune file if you are not in the Prune Preview mode. If you click on **File > Save as**, the following message appears:

"*Save as will save a copy of the entire exam. If you want to save a prune file, first select the Prune Preview menu and save from inside the prune preview. Do you wish to save a copy of the entire exam? [Yes/No]*"

If you never want to view this message again, check the **Never show this message again** checkbox.

⚠ WARNING

Please make sure you really do not want to view the above message again. Once it is disabled, the only way to return this message is through the registry. Please do not attempt to re-enable the message yourself or your Natus Neurology Incorporated's warranty may become void. Please contact Natus Neurology Incorporated Customer Support for assistance.

Creating a Prune template

How EEG is pruned is determined by the settings you choose for the following three controls on the **Prune Settings Editor** panel:

- **Prune Video Only** checkbox
- **Keep EEG Only** radio button
- **Keep Video & EEG** radio button

The following chart illustrates the results for each of the four possible setting combinations.

Without Pruning

	Unpruned Video →	Unpruned Video
	Unpruned EEG →	Unpruned EEG
	No Prune Events	Stored Results

With Pruning

☑ Prune Video Only	◉ Keep EEG Only ○ Keep Video & EEG	Pruned Video Pruned Video Unpruned EEG → Prune Event Prune Event	No Video Saved Unpruned EEG Stored Results
	○ Keep EEG Only ◉ Keep Video & EEG	Pruned Video Pruned Video Unpruned EEG → Prune Event Prune Event	▯ ▯ Unpruned EEG Stored Results
☐ Prune Video Only	◉ Keep EEG Only ○ Keep Video & EEG	Unpruned Video Pruned EEG Pruned EEG → Prune Event Prune Event	No Video Saved ▯ ▯ Stored Results
	○ Keep EEG Only ◉ Keep Video & EEG	Pruned Video Pruned Video → Pruned EEG Pruned EEG → Prune Event Prune Event	▯ ▯ ▯ ▯ Stored Results

1. To create a Prune Template, click on the **Edit Settings** button.

2. Click on **Prune** at the bottom of the Settings Editor panel.

3. Click on the **New** icon in the lower left corner of the Prune Settings Editor panel.

4. In the Prune Template list, type in a **name** for the Prune Template you are creating.

5. In the Event Types list, click on the **Event** you want to add to the template and then click on the right pointing arrows.

NOTE: Please refer to the chart on the previous page to determine the settings for steps 6 and 7.

6. If you want to prune only the video, check the **Prune Video Only** checkbox. **Step 6 is optional or you can create a different Prune Template for proof of recording.**

7. Select whether you want to **Keep EEG Only** or **Keep Video & EEG**.

8. If you want a specific period of time before and/or after the event you want to include in the prune, type in the desired period of time(s) in seconds.

9. You can prune for routine activity using time samples.

   a. At the bottom of the Prune Settings Editor panel, check the **Keep** checkbox.

   b. Type in the number of **minutes** you want to prune out of the specified number of **hours**. For example, prune **5** minutes every **1** hour. This type of template will automatically prune periodically; i.e., 5 minutes out of every 1 hour.

10. Repeat steps 5 through 8 for each additional prune event you want to add to the template.

11. When finished, click **Save**.

Creating reports

NicVue users

1. For **NicVue** users, click on the desired **Exam** and then click on the **Review** button.

2. Click **Tools > Create Report**.

3. Click on the **type of report** you want to create.
   - Split Night
   - Impedance
   - Comprehensive PSG
   - Concise PSG
   - Power Spectrum
   - Sleep Referral
   - Referral
   - Cortical Stim
   - MSLT
   - Coherence
   - Band Power
   - Sleep Score Inter Rater
   - Test Report

Impedance report

The table contains a row for each input that was measured. If more than one impedance measurement was taken, a blank row is used to separate each set of measurements.

Polysomnography report

The Hypnogram image included in the Polysomnography report represents the region being reported.

Split Night report

The Hypnogram image included in the Split Night or multi-condition report represents the union of the regions being reported.

Sleep Score Inter-Rater reports

If you select to create a Sleep Scorer or Scoring Inter-Rater Reliability report for comparing two Hypnogram files or two Apnea files, an Inter -Rater Reliability Statistical Analysis dialog appears. At least two Sleep Scores of the same type are needed to create this type of report. One will be chosen as the 'primary' (Gold Standard) and another as the 'secondary' (Trainee).

Apneagrams

Each epoch can only include one Apnea score, but each Apnea can have multiple Epochs.

If the Apnea has a duration longer than one Epoch, then the included Epochs must have at least a 10 second duration.

If the Epochs in the Apnea have durations less than 10 seconds, the Epoch with the longest duration is included.

Since each Epoch can have only one Apnea; the **last valid Apnea** added to the Epoch is included.

Cohen's Kappa Coefficient is an agreement indicator calculation where 100% is total agreement. **Total number of agreed epochs** + **Number of Identical Scored Epochs** divided by the **Total Number of Epochs**.

1. You can create a seperate **Hypogram** or **Apnea** report or both on a single report.

   Creating a Hypnogram Inter-Rater report
   a. Click on the Gold Standard **Sleep Score** show menu button.
   b. Select the **Sleep Score** you want to use.
   c. Click on the Trainee **Sleep Score** show menu button.
   d. Select the **Sleep Score** you want to use.
   e. Click **OK**.

   Creating an Apnea Inter-Rater report
   a. Click on the **Comparing Apneas** show menu button.
   b. Select the **file** you want to use.
   c. Click on the **Trainee** show menu button.
   d. Select the **file** you want to use.
   e. Click **OK**.

Study Room users

1. Select a **test** and click **View Report**.

   Patient and Test information will be entered into the report automatically, which uses either an HTML template or a Word template. This is selectable in the Administrator Center.

2. Click the **Environment Variables** tab.

3. Click the **HTML Report**.

4. Click the **Modify** button to change the status. These templates can be edited if necessary.

You also choose to include any patient information stored via NicVue and/or exam specific information stored in the exam as well as the date and time when the report was generated.

When using the Word template, there are no limitations to the length of the report. Examples of waveforms can be copied and pasted into the report.

1. Click **Edit > Copy EEG** in Reader.
2. Move to the report and click on **Edit > Paste** in Word.

Keystroke shortcuts

Keystroke shortcuts

Keystrokes	Recorder	Reader
Ctrl+A	Decrease Timebase	
Ctrl+Shift+A	Increase Timebase	
Up Arrow	Increase Sensitivity	
Down Arrow	Decrease Sensitivity	
Up Arrow	Increase Sensitivity of selected channels If no channels are selected, the ACC sensitivity is changed	
Down Arrow	Decrease Sensitivity of selected channels If no channels are selected, the ACC sensitivity is changed	
Ctrl+D	Deblock	-
Ctrl+Down Arrow	-	Previous montage
Ctrl+I	Toggle Impedance Test	-
Ctrl+R	Start/Stop recording	-
Ctrl+T	Display Montage Edit Settings panel	
Ctrl+W	Toggle Control Panel on/off	
Ctrl+Y	Start/Stop Hyperventilation	-
F11	-	Toggle full screen

Events shortcuts

Keystrokes	Recorder	Reader
F3 - F10	The first 16 events in a palette are assigned a shortcut. The order of the events is set in the Event Editor.	
Shift + F3 – F10		

Paging shortcuts

Keystrokes	Recorder	Reader
Alt+Page Down	-	Page Forward
Alt+Page Up	-	Page Backward
End	Go to end of recording in the Reader pane	
Home	Go to beginning of recording in Reader pane	
Right Arrow	Step right one second in the Reader pane	
Left Arrow	Step left one second in the Reader pane	
Page Down	Next Page in the Reader pane	
Page Up	Previous Page in the Reader pane	
Space bar	-	Stop paging in Reader Pane

Video shortcuts

Keystrokes	Recorder	Reader
Alt+Right Arrow		Toggle play Video forward
Ctrl+K	Record Video	-
Ctrl+Left Arrow	-	Step Video back one frame
Ctrl+Right Arrow	-	Step Video forward one frame
Ctrl+Shift+V	-	Float/dock Video panel

Photic shortcuts

Keystrokes	Recorder	Reader
Ctrl+F	Flash Photic	-
Ctrl+J	Start Photic	-
Esc	Stop Photic	-

Filter shortcuts

Keystrokes	Recorder	Reader
Ctrl+G	Notch Filter	
Ctrl+H	Next High cut filter	
Ctrl+Shift+H	Previous High cut filter	
Ctrl+L	Next Low cut filter	
Ctrl+Shift+L	Previous Low cut filter	

Montage shortcuts

Keystrokes	Recorder	Reader
Ctrl+1 to Ctrl+0	The first 10 montages in a montage set are assigned a shortcut The order of the montages is set in the Montage Set Editor.	

Sleep Stage shortcuts

Number Keypad Keystrokes	Adult Sleep Stages AASM	Earlier Version	Infant Sleep Stages AASM	Earlier Version
0	W	W	W	W
1	N1	1	N1	AS1
2	N2	2	N2	AS2
3	N3	3	N3	I
4	N3	4	N	Q
5	R	R	R	-
6	W	M	W	M
9	?	?	?	?

Pruning shortcuts

Keystrokes	Recorder	Reader
Ctrl+Page Down	-	Prune page by page and combine them into a single Prune file.

5

Marking and Annotating

Legends

Note that in the left column you will see ***Recorder, Reader, or Recorder and Reader***. These help identify whether the topic applies to the Recorder or Reader or both.

Blank Page

Marker summary

Nonduration events (Transient events)

Nonduration Event buttons have a **single** point [image] and are used to mark moments of interest in the recording. Examples are behavioral information about the patient, a clinically interesting waveform, notification of drug injection, or a text annotation.

Duration events

Duration Event buttons have **two** points [image]. They are used for events that last over a period of time, such as a seizure.

Rubber Band mode

Rubber Band (Quick Insert) Button	Event Palette Buttons		To Mark an Event
Off [image]	**Unlocked Mode** Blue button	[image]	Click on the **Event** button and then on the EEG **nonduration event**.
		[image]	Click on the **Event** button and then click on the **start** and **end** of the EEG duration event.
	Locked Mode* Gray button	[image]	Double-click on the **Event** button to lock it and then click on the EEG **nonduration event**. Repeat clicking on the EEG events to place the locked nonduration marker.
		[image]	Double-click on the **Event** button to lock it and then click on the **start** and **end** of the duration event. Repeat clicking on the start and end points to place the locked duration marker.
On [image]	**Unlocked Mode** Blue button	[image]	Click on the area of interest and then click on the **nonduration event** from the popup menu that you want to place on the EEG.
		[image]	Position the pointer at the **start** of the area of interest, click and drag the mouse to the **end** of the duration event, release the mouse button and then click on the **duration event** from the popup menu that you want to place on the EEG.

* To exit the Locked Mode, click on the **locked Event button** or press the **Esc** key on the keyboard.

Shared marker procedures

The information on this page applies both Nonduration and Duration markers.

Moving a nonduration marker

1. Click on the **nonduration marker** and hold down the mouse button.

2. Drag the marker to the desired location and release the mouse button.

   - or -

1. Right-click on the **nonduration marker**.

2. Position the **Hand** symbol to where you want to move the marker.

3. Click the **Left** mouse button.

Moving a duration marker

1. Right-click on the **duration marker**.

2. Click **Move**.

3. Position the **Hand** symbol over the location to where you want the **left edge** of the marker to move.

4. Click the **Left** mouse button.

Relabeling a marker

1. Right-click on the **marker** you want to relabel.

2. Click **Change to**.

3. Click on the **new event label** from the list of labels.

Deleting a marker

1. Right-click on the placed **marker**.

2. Click **Delete**.

Annotating a marker

1. Right-click on the placed **marker**.

2. Click on **Annotation**.

3. Type in the **annotation**.

4. Click **OK**.

Standard event marking mode

The Standard event marking mode uses the Event Palette to place event markers on the EEG. The Rubber Band (Quick Insert) event marking mode uses a popup menu from which event markers are selected for placement on the EEG. The Rubber Band mode is described later in this chapter.
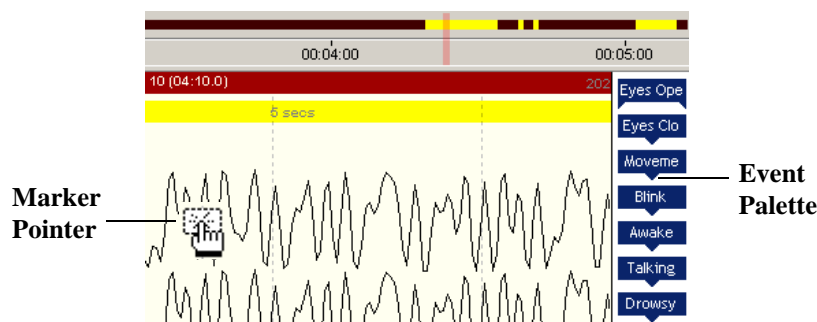
Also See: *Event Type* Editor and *Palette* Editor in the ***Edit Settings and Options Dialogs*** chapter for additional information.

Marking nonduration events - Standard mode

Recorder and Reader

The Event Palette (Figure 1) contains the current set of user-defined events.

1. Click on the **nonduration event** you want to mark.

2. Click on the **Event Marker** in the Event Palette that you want to place on the EEG.

3. Repeat steps 1 and 2 as often as needed to place additional nonduration event markers.

Nonduration marker shortcuts

The first 16 events in the *Event* palette are assigned a shortcut, starting with the function keys **F3 - F10** and then **Shift** + **F3 – F10**. You can adjust the order of the events in the Event *Palette* Editor.

Moving nonduration Reader markers

NOTE: This procedure is **not** applicable with Duration Event Markers.

Once you have placed a marker on the EEG, you can fine tune the marker's location.

1. Place the mouse pointer over the **Marker.** The pointer changes into a **Move** icon.

2. Click and hold down the left mouse button.

3. Drag the Marker to its new location and then release the mouse button.

   - or -

1. Right-click on the **Marker** and then click on **Move** from the menu. The pointer changes into a **Move** icon.

2. Position the **Move** icon to where you want to move the Marker.

3. Click the left mouse button.

Marking duration events - Standard mode

Reader

1. Click on the **Duration Marker** in the Event Palette that you want to place on the EEG.

2. Click on the **Start** of the duration event you want to mark.

   The start of the duration marker is placed on the event.

3. Click on the **End** of the duration event you want to mark.

   The end of the duration marker is placed on the event.

4. Repeat steps 1 through 3 as often as needed to place additional duration event markers.

Scrolling to the end point of a duration marker

If the end point of the Duration Event is not visible after clicking on the Start of the event:

1. Press the **Page Down** key to move forward one page at a time until the end of the duration event is visible. You can also use the **Right Arrow** key to scroll through the EEG in smaller increments.

2. Click on the **end** of the duration event.

Marking duration events - Standard mode

Recorder

1. When you see a duration event that you want to mark, click on the duration **Event Marker** button on the Event Palette.

   The selected Event Marker button turns gray and the start of the duration event is marked on the EEG.

2. When you see the end of the duration event, click on the duration **Event Marker** button again.

   The button returns to blue and the end of the duration event is marked on the EEG.

Rubber Band (Quick Insert) event marking mode

The Rubber Band mode allows you to select event markers from a popup menu that you want to place on the EEG. This eliminates having to return to the Event Palette each time you want to place a marker, thus speeding up your ability to place markers quickly.

Marking nonduration events - Rubber Band mode

Recorder and Reader

1. Click on the **Quick Insert** button or right-click anywhere on the EEG display.
2. Click on the EEG display where you want the non-duration event to be located.
3. From the popup menu, click on the **nonduration marker** that you want to place on the EEG.
4. Repeat steps 2 and 3 as needed to place additional nonduration event markers.

Marking duration events - Rubber Band mode

Reader

1. Click on the **Quick Insert** button or right-click anywhere on the EEG display.
2. Click on the EEG display where you want the duration event to start.
3. Hold down the Left mouse button and drag the mouse until the duration event is enclosed in the marker box.
4. Release the mouse button and click on the popup menu **duration marker** that you want to place on the EEG.
5. Repeat steps 2 through 4 as often as needed to place additional duration event markers.

Exiting the Quick Insert mode

To exit the Rubber Band (Quick Insert) mode:

- Click on the **Insert User Events** ⬜ button again.
- Press **ESC**.
- If you click on an Event marker in the Event Palette, the system will exit the Rubber Band (Quick Insert) mode and select that Event Marker for placement on the EEG.

Setting a Quick Insert Duration

When using the Quick Insert 🔲 feature for inserting events on the EEG, you can place an assigned Duration event for a specific duration using a click-drag.

Mouse action	Event type assigned to the channel	Result
Click-drag	None	A popup menu appears with the **duration** events listed in the Events Palette.
	One duration event	The **duration** event is inserted automatically with the preset duration value.
	Multiple duration events	A popup menu appears with the **duration** events listed in the Events Palette.

Threshold detections

Recorder and Reader   You can set a threshold level, which when crossed by the mean value of the signal for a specified duration, the assigned event is inserted automatically.

NOTE: Threshold detection works for only **DC** or **Trigger** input signals.

When used in Recorder, threshold detections can be used to trigger an alarm.

1. Click on [Settings icon] **Settings**.
    - or -
    Click on **Protocol > Settings**.
2. Click on **Detections** at the bottom of the *Montage Editor* panel.
3. Check the **Threshold** checkbox in the Detections pane.
4. Click on the **Add** button.
5. Click on the **Sensor** show menu button.
6. From the drop down menu, select the **Sensor** you want to add.
7. Choose the manner in which you want the threshold to determine when to insert an event marker.
    a. Click on the **Under/Over** (or **Between**) radio button.
    b. Enter the **Under threshold** and **Over threshold** values (or, if you selected **Between** above, enter the **Lower** and **Upper** level values).
8. Check the **Use moving average** box if you want to use a moving average during the detections.
9. Enter the minimum duration that signal must interact with the threshold before the event is inserted. In the **For min duraton of entry** box:
    a. If you checked **Use moving average** in step 8, enter the minimum duration of the moving average.
    b. If you left **Use moving average** unchecked in step 8, enter the minimum duration that must be exceeded by the sensor values before an event is inserted into the recording.
10. Click on the **Event type** show menu button.
11. Click on the **Event type** that you want inserted into the recording if a threshold detection occurs.
12. If the selected Event type is a **Numerical event** (set in the *Event Type Editor* panel) enter the **value** you want assigned to that event.

Locking an event marker for insertion

Recorder and Reader
You can lock an event in the Event Palette, which then allows you to insert that event every time you click on the trace display.

1. Double-click on the event listed in the Event Palette that you want to lock for selection each time you click the mouse button. The locked event is now colored gray in the Event Palette.

2. Each time you click on the EEG trace display, that event will be selected automatically for insertion. If the locked event is assocated with a specific channel (sensor), the event will be placed on the channel (sensor).

Unlocking an event marker

Recorder and Reader
1. Click on the **locked** (gray) Event button in the Event Palette or press the **Esc** button on the keyboard.

Assigning an event to a specific sensor

Recorder

You can select an event type and assign it to always be placed on a specific sensor trace. For example, you can assign the **Obstructive Apnea** event to the **Nasal Respiration** channel, then, every time you place an Obstructive Apnea event on the EEG, it will 'snap' automatically to the Nasal Respiration channel. If multiple channels have been assigned the same event type, the event will be attached to the first channel associated with that sensor.

1. Click on **Settings** Settings.

2. Click on **Events** at the bottom of the *Montage Editor* panel.

3. From the Event Types list, select the **event** that you want to assign to the sensor.

4. Click on the **Sensor** ▼ show menu button.

5. Click on the **Sensor** to which you want to assign the event.

6. Click **Save**.

7. If the event is not already in the Event List palette, select Palettes at the bottom of the Event Type Editor panel.

8. Select the Event from the Event Types list.

9. Click on the ⟩⟩ button.

10. Click **Save**.

11. Click **Close**.

Unassigning an event from a sensor

To unassign an event from a sensor:

1. Click on **Settings** Settings.

2. Click on **Events** at the bottom of the *Montage Editor* panel.

3. Select the **Sensor** ▼ show menu button.

4. Scroll to the **top** of the sensors list.

5. Click on the **blank line**.

6. Click **Save**.

7. Click **Close**.

Context Events

Recorder Context events preserve the recorder settings when those events are placed.

Once a context marker has been placed on the EEG, it will always remain as a context marker, even after turning Context off for that marker.

Likewise, a noncontext marker placed on the EEG will always remain as a noncontext marker, even after if you turn that marker into a context marker.

1. Click on **Settings** Settings .
2. Click on **Events** at the bottom of the *Montage Editor* panel.
3. Select the **Event Type** you want to turn into a Context Event.
4. Check the **Context Event** checkbox.
5. Click **Save**.
6. Click **Close**.

IMPORTANT: Context Events increase storage requirements significantly.

Example:

1. From the Event Type Editor panel, set Event Types to **Spike**.
2. Check the **Context Event** box.
3. Click **Save**.
4. Click **Close**.

5. From the Panel, Set Notch Y to **On** and High Cut to **35**.
6. Record EEG and mark the **Spike event**.
7. Change the High Cut setting to **150**.
8. Stop acquisition and close the exam.
9. Open the exam in Review and locate the **Spike event marker**.
10. The marker is appended with 'Not in Context.' Right-click on the marker and select **Switch to Context**.
11. The High Cut setting returns to **35**, the setting during which the Spike marker was placed and the 'Not in Context' annotation disappears.

Numerical events

Recorder and Reader When a numerical event type is created (please refer to the **Event Editor - Assigning Numerical Values to an event** later in this chapter), a calculated sensor is also created with the same name as the numerical event.

For example, if you create a numerical event labeled **Track**, then a calculated sensor labeled **Track** is also created. If you then add the **Track** sensor to the montage, a trace labeled **Track** is created with the values of the numerical **Track** event(s) inserted. The channel (**Track** in this example) will be assigned automatically as a "Special" channel.

Until the first numerical event is placed on the EEG, the system will be in a 'no data available for the channel' state. When the first numerical event is placed on the EEG, the value of the trace is set equal to the value entered for the event. This value remains until a new event of the same type is inserted.

Creating a numerical event sensor

Add the numerical event sensor to the Montage

1. Click on **Settings** [Settings].

2. On the Montage Editor, click on the **Montage** into which you want to place the numerical event type.

3. Double-click on the **Active** field (or **Reference** field) for which you want to assign the numerical event type.

4. From the drop-down list, click on the desired **numerical event type**.

5. Click on **Apply** to view the results of your settings.

6. Click on **Save** to save your settings.

Add the numerical event to the Event palette

1. Select **Palettes** at the bottom of the Montage Editor panel.

2. Click on the desired **Palette** from the Palettes list.

3. Select the **numerical event** from the Event Types list.

4. Click on the >> (move right) button.

5. Click on **Apply** to view the results of your settings.

6. Click on **Save** to save your settings.

Assigning numerical values to an event	You can assign an Integer or Decimal value, or an enumeration to the selected event type. By default, the numerical definition for CPAP, IPAP, EPAP, and O2 have been predefined and cannot be changed. You can use the Recorder's Sleep Treatment Panel to insert numerical events into the recording during treatment. No Data is displayed in place of the numerical values until the first numerical event is placed, thereafter the numerical values appear.

1. Click on **Settings** Settings.
2. Click on **Events** at the bottom of the *Montage Editor* panel.
3. From the Event Types list, select the **event** that you want to assign.

4. Click on the **Sensor** show menu button.
5. Select the **Sensor** to which you want to assign the event.
6. Click on the **Numerical** show menu button.
7. Select whether you want an **Integer** or **Decimal** value displayed and then enter a **Minimum** and **Maximum** value, which determines the minimum and maximum value you can enter manually (or enter a **Default** value that will be entered automatically).

    - or -

    Select **Enumeration** if you want text appended to the Event Marker. Select the **New** icon and type in the desired **text**. The maximum total length of all the enumeration strings can not exceed 96 characters (for example, you can create 9 enumerations of 10 characters each or 4 enumerations of 24 characters each, or any combination of characters as long as the total character count does not exceed 96 characters).
8. Click **Save**.
9. Click on **Montage** at the bottom of the Event Type Editor panel.
10. From the Active column, double-click on the sensor you want to turn into a numerical event type.
11. Select the **sensor** you chose in step 5 above.
12. Select **Apply**.

13. Click on the **Update Period(s)** show menu button and select the **duration** between which each numerical value is displayed.

14. Click on the **Decimal Places** show menu button and select how many decimal places you want displayed.
15. Check the **Show Units** checkbox if you want the units displayed.
16. Select **Save**.
17. Select **Close**.

Placing numerical events on the EEG

When you place a numerical event marker on the EEG, a dialog appears in which you can enter a value for the event.

1. From the Event Data dialog that appears after the marker has been placed, enter an **Event Value**.

    If you created a default value, that value will be displayed (see step 7 on the previous page). The default value can be changed (or, if you did not create a default value, enter the desired value). If you attempt to enter a value smaller or larger than what was defined on the Events Editor panel when the numerical event was defined, you will be prompted by a popup to enter a value within the specified range.

2. If you want to add an annotation, type in the **Annotation** that will be appended for display with the marker.

3. Select **OK**.

Quick overview of numerical event values

A quick overview of the numerical event values can be displayed in the Overview pane. The scale of the numerical event overview is determined by the minimum and maximum values entered for the numerical event.

1. Click on **View > Overview > Numerical Events**.

2. Select the **numerical event** you want to view. The selected numerical event is displayed in the Overview if it has been enabled for display (**View > Overview > Show**).

Marking events with arousal

This improvement allows sleep events to have an Arousal event associated with them.

Requirements

- Sleep license
- Exam converted or recorded as a "Sleep" exam

The events listed below can be added with an associated Arousal event if they are in the current event palette.

- Obstructive Apnea
- Central Apnea
- Mixed Apnea
- Obstructive Hypopnea
- Central Hypopnea
- Mixed Hypopnea
- LM
- PLM
- Apnea
- Hypopnea
- Desat
- Snoring

Duration events that are not listed above, but are in the current Events palette, are available for insertion from the menu without an associated "Arousal."

Enabling the Event Insertion mode

The following features must be disabled to enter the Event Insertion mode:

- Box Cursor
- Channel Cursor, and/or
- Frequency Graticule review tools.

To disable these features:

1. Click on **Tools > "listed menu option."**

2. If any of the above three features are checked, click on the checked menu option to remove the checkmark.

You can toggle between the Event **Insertion mode** and either the **Navigation Arrows**

or **Zoom Review** tool (**Tools > Zoom**).

Marking Arousal events

1. Right-click on the **signal area** of the Review Pane to enter the Event Insertion mode.

   The navigation arrow changes to a ⬛ icon.

2. To insert an event, hold the left mouse button and drag a box around the desired insertion region. Release the mouse button when the desired region is enclosed.

   A popup menu appears. To cancel an insertion, click anywhere on the trace display.

3. To insert an event **without** an arousal marker, click on the listed **event**.

   To insert an event **with** an arousal marker, click on the word **Arousal** to the right of the event you want to insert.
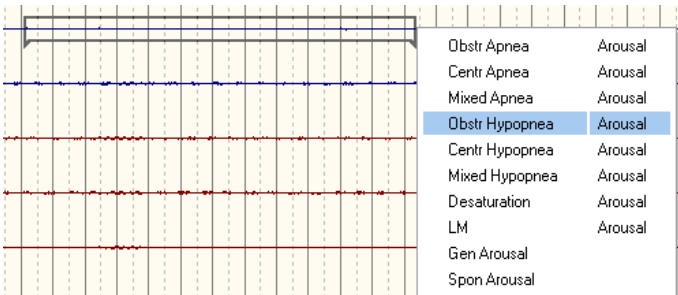
The Arousal is not associated to a channel and, therefore, is placed at the top of the signal area.
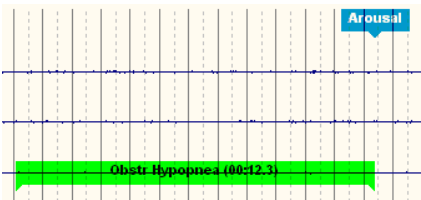
Reviewing cEEG data

Reader

When a cEEG data file is opened in Reader, all of the markers in that file are converted to **Selection Marker** events. Selection Marker events are in the default **Prune** template and will be pruned when the Prune template is used.

Modifying Reader pane duration events

Reader

1. Right-click on the **event marker** and choose **Resize** from the popup menu. The cursor changes into a pointing hand.

2. Position the pointing hand over the desired end point.

3. Click the mouse button.

Event marking shortcuts on the Recorder pane

Recorder

The first 16 events in a palette are assigned a shortcut, starting with the function keys **F3 - F10** and then **SHIFT + F3 – F10**. You can adjust the order of the events in the *Event Palette* Editor.

Assigning the shortcut keys

1. Click on **Protocol** on the Menu bar.

2. Click on **Palettes** at the bottom of the Montage Editor window.

3. Use the >>/<< buttons to move event types from one column to another.

4. Use the **Up/Down** buttons to organize the events in the *Event Types in the Palette* pane. The first (top) event will be assigned to the shortcut **F3** button automatically, the second to **F4**, etc.

Automatic Recorder event markers

Recorder   Hyperventilation, Photic, and Reaction Time event markers are inserted automatically into the Recorder EEG pane when these tools are used from the **Tools** menu.

The system can be configured to insert a High Impedance event marker when the impedance crosses a predefined threshold.

Event editor

Recorder and Reader   Create custom event markers using the **Event Type Editor**.

Also See:*Event Type Editor* in the *Settings* chapter.

Event Palettes editor

Recorder and Reader   An event palette is the set of events available to you at any time. You can create custom event palettes to use for different types of recordings.

Also See:*Event Palette Editor* in the *Settings* chapter.

Setting the Event Markers appearance

Recorder and Reader   You can choose how you want to display a Event marker.

1. Click on **Tools > Options > Display tab**.

2. Click on the **Event Draw Mode** menu box.

3. Click on the desired appearance you want the Event markers displayed: Fill, Border, Mixed (Fill and Border), Text Only, or Hide from display.

4. Finish making any other settings.

5. Click **OK**.

Displaying Event markers between signals

You can display Event markers above the signals rather than on top of the signals.

1. Click on **Tools > Options > Display tab**.

2. Check the **Place Events Between Signals** checkbox.

Additional marker notes

In addition to the 'normal' Annotations described, you can:

- Insert an event that is not locked to a specific trace. The event is displayed at the top of the EEG display area.

- Attach an event to a disabled trace.

- Create events that span over segment breaks or montage changes.

Marking EEG events using Paper Clips

Recorder and Reader   While recording or reviewing EEG data, you can label notable events to be saved for future reference. Placing a paper clip creates a graphical image of the EEG display in the context (montage) with which it was created. When generating a report, paper clipped EEG images can be selected for printing.

NOTE: Paper clipped areas cannot overlap. Box Cursors are suppressed on the page containing a Paper Clip.

Setting up for Paper Clips

1. Click on **Settings**.

    - or -

    Click on **Protocol > Settings**.

2. Click on **Events** at the bottom of the *Montage Editor* panel.

3. Click on **Paper Clip** from the Event Types pane.

4. You now can choose to have the Paper Clip marker displayed placed as a nonduration type event centered at the top of the EEG page or span the entire page of EEG as a duration type event.

    Check the **Duration Event** checkbox to choose the Duration type event, leave the **Duration Event** checkbox empty to choose Nonduration (**Transient**) type events. Regardless of your choice, the entire page of displayed EEG will be selected.

5. Click on the **Save** button.

6. Click on **Settings**.

    - or -

    Click on **Protocol > Settings**.

7. Click on **Palettes** at the bottom of the *Montage Editor* panel.

8. Click on **Paper Clip** in the Event Types pane.

9. Click on the **>>** button.

10. If you want to relocate Paper Clip in the list, click on the **Up** button.

11. Click on **Save**.

12. Click on **Close**.

Saving a page of EEG using Paper Clips

Recorder and Reader

1. To save a page of EEG displayed on the screen display, click on **Paper Clip** from the *Event Marker* palette.

   The currently displayed page of EEG is saved.

Paper Clips out of context

Reader

If any of display settings (e.g., Montage) are changed after a Paper Clip is created, the system alerts you to a mismatch by changing the Box Cursor into a Duration marker, which is displayed at the top of the screen with "not in context" added to the label as shown below.

Box Cursor-Snore-Ref (not in context) (00:03,3)
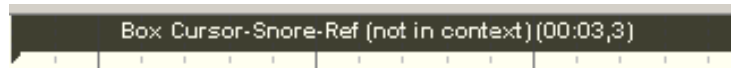
Not all properties stored in the montage are used to determine if an event is in context.

Properties that **are included** in comparison between 'in context' and 'not in context:'

- Filter settings
- Display type
- Baseline
- Polarity
- Special

Properties that **are not included** in comparison between 'in context' and 'not in context:'

- Audio
- Sensitivity
- Deflection
- Color
- Numeric settings
- Graticule settings

Annotating the EEG

Creating annotations in the Recorder pane

Recorder   You can place annotations on the EEG in the **Recorder** pane while recording EEG.

Reader   You can place annotations in the **Reader** pane (including prune events) to a study currently being acquired, which you are accessing from a Reader station on the local area network or in the split Reader/Recorder display.

Placing annotations

Recorder and Reader   1. Click on **Annotation** or **Annotate** in the Recorder's *Event* palette to the right of the Recorder pane.

2. Position the **Hand pointer** over the feature you want to annotate and click the left mouse button.

3. If creating a **Duration Annotation**, click once more at the **end point** of the annotation.

4. Type in the desired **annotation** and click **OK**.

Annotating (editing) markers

Annotating (editing) markers in the <u>Recorder</u> pane

This procedure adds an annotation to a marker you have just created in the Recorder pane. You can also use this procedure to edit an annotation.

1. Click on the **marker** you want to annotate (edit).

2. Type in the **annotation**.

3. Click on the **OK** button.

   - or -

1. Right-click on the **marker** > **Annotation** and type in the **annotation**.

2. Click on the **OK** button.

   When you view the annotated marker in the Reader pane, the marker and its annotation will be displayed as shown below.

Transient event annotation   **Duration event annotation**

Annotating (editing) markers in the <u>Reader</u> pane

This procedure adds an annotation to a marker you just created in the Reader pane. You can also use this procedure to edit an annotation.

1. Double-click on the **marker** you want to annotate (edit).

2. Type in the **annotation**.

3. Click on the **OK** button.

   - or -

1. Right-click on the **marker** > **Annotation** and type in the **annotation**.

2. Click on the **OK** button.

   When you view the annotated marker in the Reader pane, the marker and its annotation will be displayed as shown below.

Nonduration event annotation   **Duration event annotation**

Editing Box Cursor annotations

Reader
1. Right-click on the **Box Cursor** you want to edit.
2. In the Event Annotation dialog, replace the existing **annotation** if one exists.
3. Click **OK**.

Annotating Frequency Graticule markers

Reader
1. Click on the **Freq.** button or click on **Tools > Frequency Graticule**.
2. Draw a **box** around the event you want to mark.
3. On the Frequency Graticule dialog, type in the **annotation**.
4. Click on the **Save Events** button. The annotation appears inside the Frequency Graticule marker.

Editing Frequency Graticule annotations

Reader
1. Double-click on the **Frequency Graticule**.
2. On the Frequency Graticule dialog, replace the existing **annotation**.
3. Click on the **Save Events** button. The annotation appears inside the Frequency Graticule marker.

Annotating Prune markers

Reader
You can annotate a Prune marker with additional labeling after the marker has been placed. The additional text will be displayed in the Event List as well as in the prune selection marker. The markers will be saved with the exam.

1. After pruning, right-click on the **Prune** marker.
2. Click on **Annotation**
3. Type in the desired **annotation**.
4. Click **OK**.

6 Performing measurements

Legends

Note that in the left column you will see *Recorder*, *Reader*, or *Recorder and Reader*. These help identify whether the topic applies to the Recorder or Reader or both.

Blank page.

Channel cursors

Reader only

Channel Cursors allow you to measure the time and voltage values of:

- a **single point** on a trace. Measurements are made with reference to the start of the recording (time) and the baseline (voltage).

  - or -

- the differential time and voltage value between **two points** on the trace. The first point you select becomes the reference point.

Cursors are saved with the record unless they were deleted, **or** the record being viewed is read-only (including EEG-To-Go), **or** the cursors were not saved in a review session.

Measuring the time and amplitude of a single point on a trace

1. Right-click on the **label** of the trace on which you want to measure.
2. Click on **Selected Traces > Show Only Selected**.
3. Adjust the **sensitivity** and **timebase** for the best view.
4. Click on the **Cursor** Cursor button **or** click on **Tools > Channel Cursors**. The mouse pointer changes to a **crosshair** symbol.
5. Click on the **EEG feature** you want to measure.

   The time at which the point was acquired and its voltage amplitude are displayed.
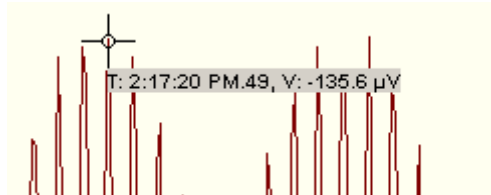
6. Right-click on the **Channel Cursor**. If you want to edit the annotation, you can do so using the *Edit Annotation* dialog.
7. Click on **Save Event** from the pop-up menu if you want to save that measurement point.
8. You can now drag the Channel Cursor to other points of interest on the trace.

Measuring time and amplitude differential between two points on a waveform

1. Right-click on the **label** of the trace on which you want to measure.

2. Click on **Selected Traces > Show Only Selected**.

3. Adjust the **sensitivity** and **timebase** as necessary for the best view.

4. Click on the **Cursor** ⟡ Cursor button **or** click on **Tools > Channel Cursors**. The mouse pointer changes to a crosshair symbol.

5. Click on the **EEG feature** you want to serve as the **Reference point**.

6. Click on the **second point** of the trace you want to measure.

7. The time and voltage differential between the **Reference point** and the **second point** are displayed.

dT: 160 [ms], dV: 50.5 µV
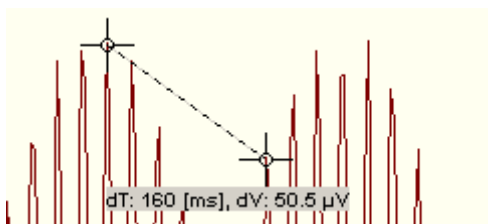
8. Right-click on either of the **Channel Cursors**. If you want to edit the annotation, you can do so using the *Edit Annotation* dialog.

9. Click on **Save Event** from the pop-up menu to save the measurement points.

Removing a Channel Cursor

1. Click on the **Channel Cursor**, hold down the left mouse button and then press the **Esc** key.

   - or -

   Right-click on the **Channel Cursor** and then click on **Delete** from the pop-up menu.

Fine tuning a Channel Cursor

To fine tune the position of a placed cursor:

1. Click on the **Zoom** [Zoom] button.

2. Position the **Zoom cursor** over the area you want to enlarge and then hold down the Left mouse button while dragging the mouse to create a box around the area of interest.

3. Release the mouse button when finished. The selected area is enlarged.

4. Drag the Channel Cursor along the trace until it is over the desired point on the EEG trace.

NOTE: You can drag the Cursor **only to the end of the current display**; there is no "auto-scroll" to the next page.

5. Release the mouse button.

6. To unzoom the EEG, click on the **Zoom** [Zoom] button again.

Printing

The EEG trace print will include the channel cursors and measurement values in the same manner they appear on the screen display depending on the current montage.

NOTE: If the measured values are displayed via the tooltip (mouse pointer hovering over a Channel Cursor), they will not be included in the print out.

Reports

Channel Cursors are not included in reports.

Box cursors

NOTE: Paper clipped areas cannot overlap. Box Cursor measurements are suppressed on the page on which a Paper Clip has been placed.

Box Cursors provide a variety of features:

- Box Cursors display the **time difference** between the left and right sides of the Box Cursor.
- The system by default identifies the Box Cursor with the nearest channel label annotation. You can edit the default annotation.
- The display settings (montage, sensitivity, filters, etc.) are kept along with the EEG enclosed by the Box Cursor.
- If an event is inserted when the system is in the "As Recorded" mode, the event is marked as "As Recorded." If not in the "As Recorded" mode, all the parameters set in the Montage Editor are stored, as well as all the channel control parameters; deflection, sensitivity, low cut filter, high cut filter, and notch filter. The number of channels and paper speed are not stored.
- Clicking on a Box Cursor event in the *Event List* panel will display the Box Cursor centered on the screen display. If the Box Cursor is too long to fit entirely on the screen display, the start of the Box Cursor will be displayed.
- You can expand the Box Cursor to include multiple traces by dragging an edge of the Box Cursor.
- Box Cursor measurements are included in any report that includes Box Cursor data.
- Box Cursors can be deleted from the screen display by right-clicking on the Box Cursor and then selecting **Delete** from the menu.

Creating a Box Cursor

1. Click on the **Box Cursor** [Box Cur.] button **or** click on **Tools > Box Cursor**.

2. Hold down the left mouse button and drag the mouse until the desired EEG is enclosed by the Box Cursor.

3. If you wish to save the Box Cursor you just created, right-click the mouse button and then click on **Save Event**. An Annotation dialog appears displaying the label of the nearest channel. You can accept the default label or edit the annotation as desired. Also, the duration, frequency and amplitude of the enclosed EEG is displayed next to the Box Cursor when the mouse pointer is hovered over the Box Cursor.
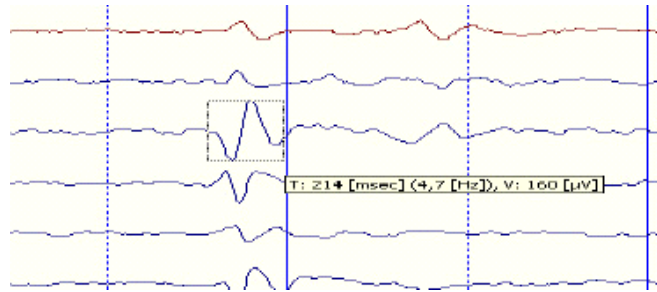
NOTE: If you change the montage/view (e.g., resize the window, etc.) before you click on **OK** (step 4), the Box Cursor will be removed.

4. Click on **OK**. The montage, sensitivity, filters, etc. are saved along with the Box Cursor and EEG data.

    You can now edit the default Box Cursor identifier if you wish.

Also See: *Editing a Box Cursor annotation* later in this chapter.
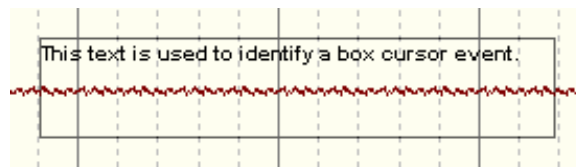
Out of context Box Cursors

If after placing the Box Cursor(s) you change the display settings (e.g., Montage, sensitivity, etc.), the system alerts you to a mismatch by appending **Duration markers** with "not in context" as shown below.
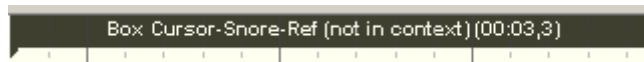
To display the Box Cursor(s) with the original context used when the Box Cursors were placed:

1. Right-click on the **Box Cursor**.

2. Click on **Switch to Context** from the pop-up menu. The original Montage returns.

   - or -

1. Right-click on the **trace label** area.

2. Click on **As Recorded**.

Deleting a Box Cursor

1. Right-click on the **Box Cursor**.

2. Click on **Delete**.

Moving a Box Cursor

1. Right-click on the **Box Cursor**.

2. Click on **Move**. The mouse pointer changes to a **Hand** symbol.

3. Move the **Hand** to the location where you want to move the left side of the Box Cursor.

4. Click the left mouse button. The left side of the Box Cursor moves to the location of the Hand.

Resizing a Box Cursor	1. Move the mouse pointer over the left or right **edge** of the Box Cursor. The pointer changes into a left - right arrow symbol.

2. Hold down the left cursor button and drag the edge of the box cursor until it is resized as desired and then release the mouse button.

   - or -

1. Since there is no auto-scrolling, this procedure lets you create a box cursor that crosses over to the next page of EEG, right-click on the **Box Cursor**.

2. Click on **Resize** from the pop-up menu. The mouse pointer changes to a **Hand**

   symbol.

3. Scroll to the next page of EEG and then position the **Hand** over the location to which you want the EEG trace to expand.

4. Click the left mouse button. The Box Cursor expands to the selected point

Resizing the Box Cursor to the right

When you resize a Box Cursor to the **right**, the left side of the Cursor remains locked at its current location while the right side of the Cursor moves to the **Hand**.

Figure 1: Box Cursor to be resized.
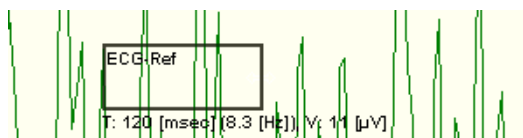
Left edge of Box Cursor
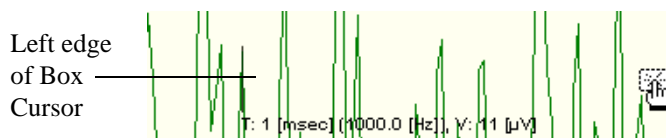
Figure 2: Hand icon positioned to where the right edge of the Box Cursor is to move.
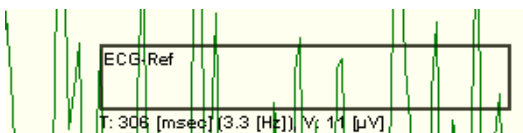
Figure 3: The right edge of the Box Cursor has now been relocated.

NicoletOne

Resizing the Box Cursor to the left

When you resize the Box Cursor to the **left**, the left side of the Box Cursor moves to the location of the **Hand** symbol and the right edge of the Box Cursor moves to the previous location of the left side of the Box Cursor

Figure 1: Box Cursor to be resized.

Left edge of Box Cursor
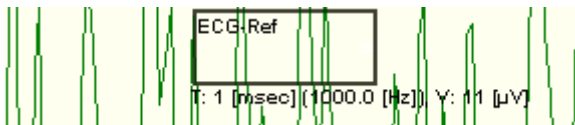
Figure 2: Hand icon has been moved to where the right side of the Box Cursor is to move.
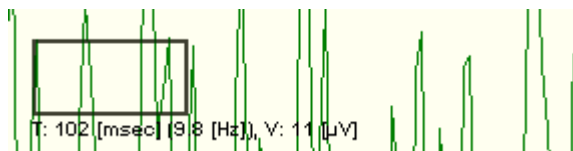
Figure 3: The right side of the Box Cursor has now been moved to the location of the Hand pointer.

Annotating a Box Cursor	1. Right-click on the **Box Cursor**.
	2. Click on **Annotate**.
	3. Type in the desired **annotation**.
	4. Click **OK**.

Editing a Box Cursor annotation	1. Right-click on the **Box Cursor**.
	2. Click on **Annotate**.
	3. Edit the existing **annotation** as desired.
	4. Click **OK**.

Viewing the beginning/ ending of a Box Cursor

If the Box Cursor is too large to view both sides of the Box Cursor, you can quickly bring the out of view side into view.

1. Right-click on the **Box Cursor**.

2. Click on **Go to Begin** or **Go to End** from the pop-up menu. The out of view beginning (or ending) of the Box Cursor is brought into view on the screen display.

Frequency graticule (Spectral analysis)

Exception: Frequency Graticule is not available in vEEG.

The Frequency Graticule function lets you perform a Spectral Analysis of the recorded EEG.

- The dominate frequency and mean amplitude of the selected EEG is displayed automatically on the *Frequency Graticule* panel.

- The frequency spectrum for each channel's EEG can be displayed by enclosing the desired EEG for each channel while keeping the *Frequency Graticule* panel displayed.

- You can select and measure EEG contained within a frequency spectra you selected earlier and display the new frequency values.

- The frequency spectrum can be annotated from the *Frequency Graticule* panel.

- The peak frequency is identified by a vertical line on the graph. You can drag the vertical line to another frequency.

- The spectral analysis of the selected area is displayed in a graph. The graph can display multiple selections.
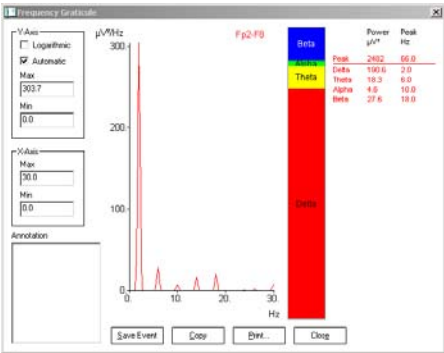
Frequency Graticule Panel

Performing a Spectral Analysis

1. Click on the **Frequency Graticule** button ![Freq.] **or** click on **Tools > Frequency Graticule**.

2. Drag the **Frequency Graticule tool** along a trace on the EEG display.

   The *Frequency Graticule* panel appears.
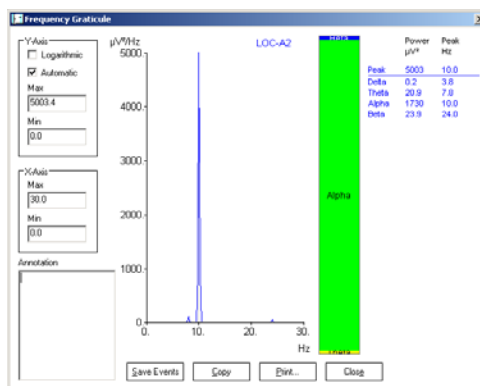
3. To measure another frequency, drag the **vertical line** to the desired location.

4. To choose the Y-axis scaling automatically, check the **Automatic** checkbox.

5. Click the **Logarithmic** checkbox to view the frequencies in that mode.

6. Set the **X-axis scaling** if necessary for the best view.

7. To annotate the Frequency marker, type in the **annotation**. You can also annotate the marker by right-clicking on the **Frequency Marker** and then clicking on **Annotation**.

8. To display the Frequency marker over the area captured by the Frequency Graticule you drew in step 2 (see below), click on the **Save Events** button.

NOTE: A Frequency marker will also be inserted into the *Event List* palette.

Frequency (00:12,7) Peak: 10.0 Hz Power: 4724.4 µV²/Hz

9. Click **Close**.
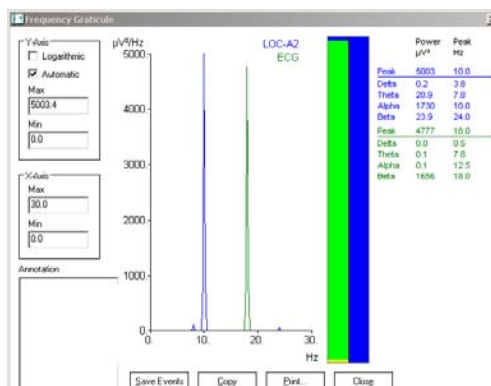
Recalling frequency graticule data for display	You can display a previously saved Frequency Graticule.

1. Double-click on the **Frequency marker**.

    - or -

1. Right-click on the **Frequency marker**.

2. From the pop-up menu, click on **Review Spectrum**.

Dismissing the Frequency Graticule tool	To return to the normal paging cursor.

1. Click the **Frequency Graticule** Freq. button a second time to return to the regular paging cursor.

    - or -

    Click on **Tools > Frequency Graticule**.

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7 Alerts

Legend   This chapter is for the **Recorder** only.

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Event alerts

Event alerts notify you when specific, user defined events selected from the *Edit Settings* palette events occur. You can also select which type of notification method you want to use when an event occurs.

The Alert template is a part of the protocol.

IMPORTANT:Alerts are NOT intended to perform an Alarm function or to substitute for the use of a vital signs monitoring device in any application.

The available notification methods are:

- Play WAV file
- Run Program
- Send Email via the run program option using Producer Basic.
- Alert Window
- Digital Out
- You can include Alert Events in the Windows Application Log.

Playing an alert sound

When an event occurs, the system attempts to run the user-selected WAV file for that event type in the "Open" edit box. The alert will play in a continuous loop until it is silenced. The alert will also sound at the Central Monitor and Remote Control applications if they are connected to the Recorder system.

Selecting a WAV file

1. Click on the **Settings** [Settings] button or click on **Protocol > Settings**.

2. Click on **Alerts** at the bottom of the *Montage Editor* palette.

3. Click on the **Event Type** listed in the left column to which you want to assign a sound.

4. Click on the move to right (**>>**) button. The selected event moves to the Event Types in the Protocol column.

5. Click on the **Event** you want to trigger a sound.

6. In the *Select Action(s)* section, check **Play Sound**.

7. Click the **Browse** button. The Sounds folder opens.

8. Click on the **WAV file** you want assigned to the selected event.

9. Click on the **Open** button.

10. Click **Save**.

Silencing an alert	A prompt *"Press **F12** to cancel the alert"* is displayed on the Recorder's status bar (and the Central Monitor and Remote Control applications if they are connected to the Recorder system) when an alert is triggered.

1. To silence the alert, press the **F12 key.**

   - or -

   If the Event Alert pop-up is displayed, click the **OK** button.

Displaying the Event Alert dialog

When an event triggers an alert, an Alert dialog containing the name of the event type and the time the event occurred is displayed. If another event that would cause an Alert dialog to appear occurs <u>before</u> the dialog is closed, the dialog is reused. The **Back** and **Next** buttons allow you to review alert events.
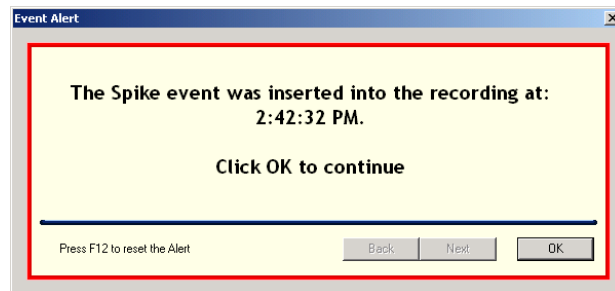
1. To display an Event Alert window, check the **Alert Window** checkbox on the *Alert Settings* editor palette.

2. Click **Save**.

Running an Event Alert Executable program

When an event triggers an alert, you can choose to run an executable program assigned for that specific event type. The program can be an executable file name or a file of a registered document type (in which case the registered handler is used to open the document).

1. To run an executable program, check the **Run Program** checkbox on the *Alert Settings* editor palette.

2. Click on the **Browse** button.

3. Locate and select the **executable program** you want to use when an Event triggers an alert.

4. Click **Save**.

Generating an Event Alert digital out signal

A digital output on the USB interface board can be triggered for an output for 10 seconds when an Alert Event occurs. Refer to the Nicolet Service Manual for the pinout.

1. To generate a digital output, check the **Generate Output** checkbox on the *Alert Settings* editor palette.

2. Click **Save**.

Adding an Event Alert to the Application Log

You can choose to add an Event Alert to the Windows Application Log.

1. Check the **Add to Application Log** checkbox on the *Alert Settings* editor palette.

2. Click **Save**.

Central Monitor Alert Options

LTM installations with Central Monitor can be set to sound a repeating or single alert, and be enabled to silence alerts on the Recorder from the Central Monitor.

Requirements	• Recorder with LTM license
	• Central Monitor

Dismissing alerts on the Recorder from Central Monitor

You can choose to dismiss alerts on the Recorder from the Central Monitor.

1. Click on **Edit > Preferences > Alerts**.

2. Check the **Reset Recorder Machine Alert** checkbox.

Choosing repeating or single alerts

You can choose between a single alert or repeating alert that sounds until it is silenced.

The setting you choose on the Central Monitor is applied to any Remote systems on the network, too.

1. Click on the **Settings** Settings button or click on **Protocol > Settings**.

2. Click on **Alerts** at the bottom of the *Montage Editor* palette.

3. For a repeating alert, check the **Repeat Sound Until Rest** checkbox (default).

   For a single alert, uncheck the checkbox.

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8 Archiving

Legend   This chapter is for the **Reader** only

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Before you start

EEG and Video can be archived to various storage media, including DVD+RW, CD R/W, and other removable media devices. Contact your distributor for a list of available options.

NOTE: When you first receive your NicoletOne system, check the Archive paths and set them as necessary.

Archiving with NicVue

Archiving with NicVue is covered in the NicVue online User Guide (click on **Help** in NicVue). The rest of this chapter covers archiving with Study Room.

Archiving with Study Room

Setting up the archive paths

All drives being used as Archive devices must be explicitly shared.

IMPORTANT: The "default share" found in the **Disk Properties > Sharing** dialog is NOT adequate. Click **New Share** to share the drive.

1. In Nicolet Study Room, click on **Tools > Administration Center**.
2. On the **Devices** tab, click **Add Device**.

3. Using the **Browse** button, look for the appropriate disk drive. Select the **drive** and click **OK**. The drive letter will vary depending on the number of drives in the PC.

4. Select the **type of media** in the Type box.
5. Check the **Read** and **Write** boxes.
6. Select the **Use Media Capacity** option.
7. Type a **name** into the Name box.
8. Repeat the above process for any other devices (drives) that may be used for archiving. Remember to include any devices on networked systems.

Archiving to DVD

There are three steps to the Archiving procedure for DVD.

1. Each time you archive to DVDRAM or DVD+RW, start by formatting the DVD media.
2. Move the EEG record to the **Archive List** tab in Study Room**.**
3. Archive your EEG files directly onto the DVD media.

Formatting DVDRAM and DVD+RW media

You need to do this each time your start using a new DVD disk.

1. Insert a blank DVD+RW into the drive to start the HP DLA software.

    - or -

    Start the software from the **Start** menu on the taskbar.
2. Click **Format**.
3. Click **Next**.
4. Type a **name** for the disk.
5. Click **Next**. The disk will format in 2 to 3 minutes.

NOTE: Please note the handling and usage instructions printed on the insert accompanying the HP DVD-RW media.

Archiving EEG files to DVD

1. Move the EEG files to the **Archive list** tab in the Study Room.
2. Select a **file** and click the **Archive** button.
3. Check **Remove Local Copies** if you do not want to keep a local copy of the file. Check **Archive Video** if you want the video archived (only seen if video has been recorded).
4. Click **OK**.
5. Select the **Device** from the list in the *Insert Medium* dialog.
6. Click **OK**.
7. Type in the **name** that will be used to label the disk; e.g., Disk 001 or November EEGs.
8. Click **OK**.

You have now created the name that will be used to track where the EEG files are stored. A message will appear reminding you to label the disk itself with this name.

Subsequent EEGs

When subsequent EEGs are selected for archiving, follow the same steps as above. Instead of the Enter Media Name box being shown, a message will be displayed asking if you want to use the inserted medium.

When the disk is full or there is not sufficient space to store the next EEG file to be archived, a warning message is displayed. Insert a new disk to continue archiving. You are prompted for a new media name the first time a disk is used.

Archiving to CD R/W

1. Move the EEG file to the **Archive** tab in the Study Room.
2. Click on **Archive** to move it onto the temporary Archive folder.
3. Write the EEG files to a CD using third-party software.
4. Verify that the EEG files are accessible from the CD.
5. Delete the contents of the Archive folder.

Archiving EEG files to CD

1. Move the EEG files to the **Archive List** tab in the Study Room.
2. Select a **file** and click the **Archive** button.
3. If you do not want to keep a local copy of the file, check **Remove Local Copies**.
4. If video has been recorded and you want it archived, check **Archive Video**.
5. Click **OK**.
6. Select the **CD R/W Device** from the list on the *Insert Medium* dialog.
7. Click **OK**.
8. In the *Enter Media Name* dialog, type in the **name** that will be used to label the media.
9. Click **OK**.

You have now created the name that will be used to track where the EEG files are stored. A message will appear reminding you to label the disk with this name.

The EEG file has now been moved to a temporary folder called **Archive**. When subsequent EEGs are selected for archiving, follow the same steps as above. Instead of the *Enter Media Name* box being shown, a message will be displayed asking if you want to use the inserted medium.

If the archive folder has reached the line previously set and there is not sufficient space to store the next EEG file to be archived, a warning message will appear.

Writing EEG files from the Archive folder to CD	To archive these EEG files onto CD media:

1. Run the third-party software provided with the system and follow the instructions provided with the software.

2. When the CD burn is complete, check that the EEG files can be opened from the CD.

3. Empty the Archive folder in preparation for the next set of files to be archived. To do this,

   a. Go to **Explorer**.

   b. Click the **Archive** folder on the CD drive.

   c. Delete the contents, but **<u>NOT</u>** the Archive folder itself.

Retrieving archived records	The archive process removes the EEG data file (and video, if recorded) from the hard disk of the PC, thus freeing up storage space. While the patient details are no longer visible within Study Room, they can be accessed at any time using the **search functions** within the Study Room. If the files need to be viewed, the patient details will provide information on which media they are contained.

To view the files:

1. Insert the appropriate media into the PC.

2. Click **Review**.

9

Viewing Overview information related to EEG

Legends

Note that in the left column you will see *Recorder*, *Reader*, *or Recorder and Reader*. These help identify whether the topic applies to the Recorder or Reader or both.

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Overview pane

Recorder and Reader The Overview allows you to quickly locate interesting parts of the recording. The Overview uses a time scale that is (usually) much larger than the one used in the Reader window. Overviews are displayed below the toolbar.

The Overview consists of these various components:

Overview Pane	Recorder	Reader
Time scale: Can show either the time of day or elapsed time from the beginning of the recording.	x	x
Hypnogram: The sleep hypnogram is a graphic representation of the sleep stages.	x	x
Events: Displays events present in the recording.	x	x
Video: Displays video information.	x	x
Body Position: Displays the patient's body position.	x	x
Sleep Events: Shows sleep events as they occur.	x	x
Zoom: Used to select a part of interest in the recording.		x
Trends: The results of a trend analysis are displayed.		x
SaO2: Oxygen Saturation.	x	x
Heart Rate: Shows heart rate.		x
CPAP		x
Manual O2	x	x
Numerical Events	x	x
Manual Sleep Treatment	x	x
Cross Correlation Trend: Manually identify REM sleep epochs		x
Review Progress: Displays a Reviewed EEG and a Reviewed Video bar showing which of the data has been reviewed. Unreviewed is white, reviewed is pink.		x

During a recording the Overview eventually fills up with data. When the amount of recorded data is equal to the zoom duration, the Overviews (including time scale) are shifted to the left to make room for new data. The trends generated during the recording are written to the EEG file.

The Overview settings are stored in the protocol. This includes which components are visible, type of time scale, zoom bar configuration, grid line settings, axis settings and the height of the Overview.

Changing the color of the Overview Marker

Recorder and Reader

You can change the color of the Overview Marker (the vertical line that shows the current location in the EEG record). However, since the Overview Marker is transparent, darker colors (i.e., black, blue, dark blue) are displayed as gray.

1. Click on **Tools > Options > Display** tab.
2. Click on the **Overview Marker Color** show menu ▾ button.
3. Click on the desired **color**.
4. Click on **Apply** to view your selection.
5. Click **Save**.

Floating the Overview window

Recorder and Reader

You can drag and resize an Overview window as desired on the screen display or change the vertical height of the pane for the optimum viewing.

1. Click on **View > Overview > Float**.
   - or -
   Right-click anywhere on the **Overview** pane and then click on **Float Overview.**

2. You now can drag and resize the Overview pane as desired.

Resizing the height of a locked Overview pane

Recorder and Reader

1. Position the mouse pointer over the **Moveable Split Bar** separating the EEG display pane(s) and the Locked Overview pane until the pointer changes into a double-bar icon with arrows.

2. Press and hold down the left mouse button and drag the mouse vertically until the desired display size is reached and release the mouse button.

Resizing a floating Overview pane

Recorder and Reader

1. With the Overview pane displayed, click on **View > Overview > Float**. A checkmark appears to the left of the **Float** menu option.
2. The displayed pane(s) turn into a single floating pane.
3. Position the mouse pointer over an edge of the floating pane until a double-ended arrow icon appears.
4. Click and then drag the mouse until the desired size of the pane is reached.
5. Release the mouse button.

Reordering Overview panes

Recorder and Reader

You can reorder the position of Trends, Hypnogram, and Trace overviews.

1. Click on the **label** of the Overview pane you want to move and hold down the mouse button. The mouse pointer will turn into an up/down arrow head icon.
2. Drag the Overview pane up or down and then release the mouse button.

Saving the Overview pane elements in a protocol

Recorder and Reader

You may save the selected Overview pane elements in a new protocol. Then, the next time you launch the application, the Overview pane will be displayed in the same location and size as when the application was exited.

1. After selecting the elements you want displayed in the Overview pane, click on **Protocol > Save As**.
2. In the **Save As** panel, type in the desired **Protocol label** you want assigned and then click on **OK**. The newly created Protocol is added to the Protocol menu.

Other options available on the Overview submenu

Label Bar

Recorder and Reader

1. Click on the **Overview** ⊡ᵒᵛᵉʳᵛⁱᵉʷ button or click on **View > Overview**.

2. Click on **Label Bar** to show the name of each displayed overview at the left edge of the overview.

   - or -

1. Right-click on the **left edge** of the Overview.

2. Click on **Label Bar**.

Gridlines

Recorder and Reader

1. Click on **View > Overview > Gridlines** to display a grid of vertical lines in the background of the Overview pane.

2. Click on one of the **time** intervals between gridlines options. **Auto** sets the time between the gridlines automatically. Click on **Off** to remove the gridlines.

   - or -

1. Right-click on the **Overview** pane.

2. Click on **Properties > Gridlines**.

3. Click on one of the **time** intervals between gridlines options. **Auto** sets the time between the gridlines automatically. Click on **Off** to remove the gridlines.

Lock Recent

Recorder and Monitor

1. Click on **View > Overview > Lock Recent** to lock the overview into always showing the most recent duration. The duration is selected on the **Overview** submenu.

   - or -

1. Right-click on the **Overview** pane.

2. Click on **Lock Recent**.

Time Scale

Recorder and Reader   The Time Scale overview marks the time of the recording and functions as an advanced scrollbar. Drag the thumb markers to scroll to a specific part of the recording.

| 00:00:00 | 00:02:00 | 00:04:00 | 00:06:00 | 00:08:00 | 00:10:00 |
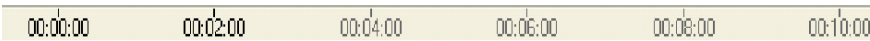
One of the following methods of marking the time can be used:

Time of day	The absolute time when the recording was made.
Elapsed time	Beginning at 0 when the recording starts and ignoring delays between segment stop and start.

1. Right-click on the **Overview**.

2. Click on the **method** you want from the pop-up menu.

Video Bar

Recorder and Reader   A horizontal line indicates that video is available for the recorded data. If the cursor is placed over the line, a tool tip appears displaying information about the video segment (start time and duration).

Video line

4 ⌐

00:00   00:30
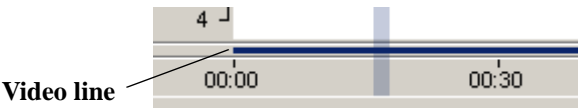
1. Click on **View > Overview > Video**.

   - or -

1. Right-click on the **Overview** pane.

2. Click on **Video**.

Zoom Bar

Recorder and Reader   You can drag and resize the Zoom bar to locate interesting parts of the recording. By increasing (decreasing) it's length, a larger (smaller) part of the recording is visible in the overview. If you click to the left (right) of a reduced Zoom bar, the bar jumps one whole length in that direction. When dragging or resizing the Zoom bar, a tool tip appears displaying the Zoom bar's position in the recording and it's length.

1. Drag either end of the **zoom bar** to shorten it and decrease the amount of the recording displayed in the Overview.

2. Click and drag on the middle of the **Zoom bar** to move it right or left to the part of the recording you want to view. While dragging or resizing the Zoom bar, a tool tip appears displaying its position in the recording and its length.

Zoom Bar Duration

Recorder and Reader   1. Click on **View > Overview > Duration**.

   - or -

1. Right-click on a **Overview** pane.

2. Click on **Duration**.

   • **Full Scale**: The zoom bar duration equals the recording duration so the overview displays data for the whole recording.

   • **Predefined values for zoom duration**: 10, 20, 30 min; 1, 2, 8, 12, 24 hours.

   • **6 cm/hour/30 cm/hour**. Duration dependent on screen size:

   • **Custom**: Valid custom values are between 1 and 1440 minutes (whole numbers only).

NOTE: Selecting a duration other than **Full Scale** activates the Zoom bar. Hiding the zoom bar switches to Full Scale mode.

Review Progress Overview

You can have the system show you which parts of the EEG and Video (if applicable) has been reviewed already by turning on the Review Progress feature. This feature is displayed in the Overview and identifies which pages and video sections have been reviewed using colored bars. White portions of the bars indicate the related content has not yet been reviewed. Pink sections of the Video Progress Bar show sections that have been reviewed.

NOTE: This does not apply to forward/backward autoplay mode reviews. Also, Review Progress **must be turned** on for this feature to track and record which portions of the EEG has been reviewed.

---

1.   Click on **View > Overview > Review Progress > Show**.

To **reset** the Reviewed Video bar and Reviewed EEG bar to the 'not reviewed state:'

1.   Click on **View > Overview > Review Progress > Reset**.

Events Overview

Recorder and Reader   The Event overview shows a graph with color-coded bars indicating the time of all events, including user-defined events from the event palette, or automatically inserted events such as Hyperventilation and Photic events.The events appear either as vertical lines (non-duration events) or horizontal lines (duration events). The length of the horizontal line reflects the actual duration of the event. The line color corresponds to the event's type color.

If the mouse is placed close to an event, a tool tip appears displaying information about that event. By clicking on the mouse, the thumb marker moves to the beginning of the event.

Body Position Overview

Recorder and Reader   The Body Position overview summarizes the various body positions the patient may assume during the exam.

The Body Position overview gives a quick visual picture of body position changes.
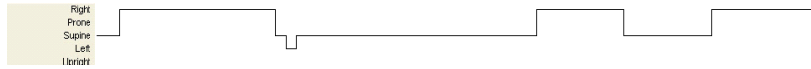
The body position events can be inserted manually or automatically, based on the parameters set in the **Detections Settings** editor palette. The overview is generated from these events.

Also See: *Automatic Detections* in the Sleep Analysis chapter.

Sleep Events Overview

Recorder and Reader   The Sleep Event overview shows tic marks for Apnea, Hypopnea, Desaturation, Heart Rate, PLM, and Arousal events.

1.   Click on the **tic marks** to display the corresponding traces.

Heart Rate, SaO2, and CPAP Overviews

Reader

Oxygen Saturation, Heart Rate, and CPAP can be displayed in the Reader as trace overviews, making it easy to see the progress over the whole recording or a selected duration.

The following table shows the default upper and lower bounds for each overview type, but these values can be changed by right-clicking on the **overview** and choosing **Trends > Scaling**.

Overview	Unit	Lower	Upper
SaO2	%	80	100
Heart Rate	bpm	40	120
CPAP	cmH2O	0	20

Trend Overview

Recorder and Reader   The results of a trend analysis can be displayed as an overview. Click a **point** on the Trend Overview to jump to that point in the Reader window.
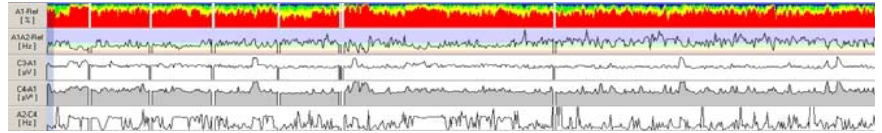
- Click on and drag the **trend labels** to reorder the placement of the trends.
- Move the mouse over a trend to display a tool tip with the actual value of the trend trace.
- Move the mouse over the trend label to display the type of trend.
- Drag the lower edge of each trend to resize them.

1. Right-click a **Trend Overview** and then left-click on **Properties** to display a popup menu with two options:

   Scaling: The Scaling option allows you to change the minimum and maximum values of the vertical axis of the trend, which are stored in the current Trend template.

   Special: Choose Special to toggle the Special flag on or off. Trends that are marked as Special are not affected by the *Trend* palette.

NOTE: To display the Trend Overview, a Trend Template must be part of the currently selected protocol. See the *Edit Settings and Options Dialogs* chapter for information on protocols and how to use the Trend Editor to create a Trend template.

NOTE: Trend Analysis is an optional feature.

Saving a Trend to file

Reader

You can save and retrieve Trends in Reader. When the Trend was saved and by whom (defined by who is currently logged in as a user) is saved with the file. Saved Trend templates are **not** removed when pruning a file.

1. Click on **View > Trends**.

2. Click on the **Trend** you want to save to file.

3. Click on the **Save Trend** button ⬛ or click on **File > Save Selected Trends**.

4. Click on **View > Trends** and note that the Trend listed in the submenu that you save

   to file now has a disk icon 💾 before it identifying that the Trend has been saved.

NOTE: If you change the display settings for a saved Trend template on the Trend Editor panel and then save those changes, the Trend template will reflect those changes.

Reviewing a saved Trend file

Reader

You can open and review a saved Trend in Reader.

1. Click on **View > Trends**.

2. Trends listed in the submenu that have been saved are identified with a disk icon 💾 before it.

3. Click on the saved **Trend** that you want to review.

4. With the Trend you selected now displayed in the Overview, click on **View > Trends**

   and note that the saved Trend you are viewing has a red checkmark 💾 in front of it.

Deleting a saved Trend file

Reader

You can delete a saved Trend in the same manner as an unsaved Trend via the Trend Editor panel. Please refer to *Edit Settings and Options Dialogs chapter > Trend Editor* section.

Printing Trends

Recorder and Reader   To print all or part of the Trends:

1. Click on **File > Print Trends**.

2. Choose the **duration** you want to print from the **View > Overview** submenu. **- or -** Right-click on the **overview** and select a **duration** from the pop-up menu.

3. Slide the **zoom bar** to the desired location.

4. Click on **File > Print Preview Trends** to show how many pages the printing will require. To reduce the number of pages, choose a longer duration.

NOTE: Click on **File > Page Setup Trends** to set the page size and access your printer setup.

Review Progress Overview

You can have the system show you which parts of the EEG has been reviewed already by turning on the Review Progress feature. This feature is displayed in the Overview and identifies which pages of the Reviewed EEG using black bars.

NOTE: This does not apply to forward/backward autoplay mode reviews. Also, Review Progress **must be turned** on for this feature to track and record which portions of the EEG has been reviewed.

1. Click on **View > Overview > Review Progress**.

    - or -

    Right-click on a **Overview** pane and then click on **Review Progress**.

2. Click on **Duration**.

3. To reset the Review Progress, click on **View > Overview > Review Progress > Reset**.

Hypnogram Overview

Recorder and Reader   The sleep hypnogram is a graphic representation of the sleep stages.
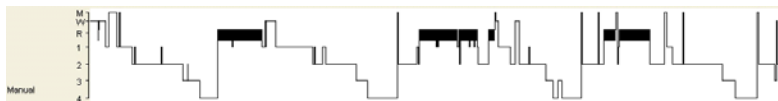
1. In the **Reader**, if the test has been scored more than once, use the *Sleep Score Manager* panel to select the **hypnogram** you want to display.

2. Check **Compare Hypnograms** to display all hypnograms simultaneously.

3. Change the order of the displayed hypnograms by dragging the label area up or down.
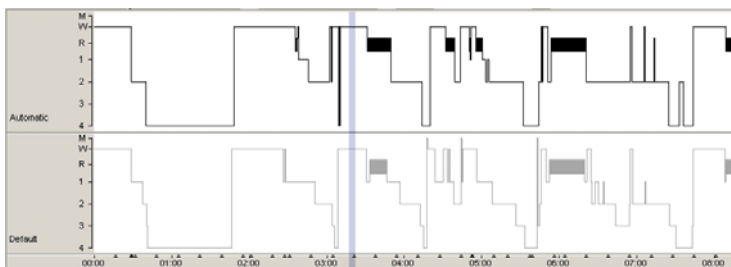
To define the vertical display order for the available sleep stage levels (M, W, R, 1, 2, 3, 4) of the hypnogram display:

1. Click on the toolbar **Settings** Settings icon.

   - or -

   Click on **Protocol > Settings > Misc**.

2. On the Sleep Settings pane, click on the **sleep stage level** you want to move.

NOTE: Click on the **Up** or **Down** button until the sleep stage level is located as desired.

Overview Grids

Turning the Overview grid on/off

Recorder and Reader

You can apply a grid for Trend, SaO2, Heart Rate, and CPAP only. Each trace can have its own unique grid.

1. Right-click on the **Overview pane** on which you want to display a grid.

2. Click on **Properties > Grid > On**.

Setting the grid scaling

Recorder and Reader

This procedure sets the scaling for the Overview grid.

1. Right-click on the **Overview pane** grid.

2. Click on **Properties > Grid > Scaling**.

3. Type in the desired **Maximum** and **Minimum** scale values.

4. Click **OK**.

Setting the grid scaling and gridline increments

Recorder and Reader

1. Right-click on the **Overview pane** grid.

2. Click on **Properties > Grid > Grid**.

3. Type in the desired **Maximum** and **Minimum** scale values.

4. Type in the **Increment** value for the gridlines between the Maximum and Minimum limits.
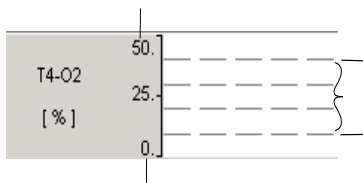
Displaying gridlines in the Overview pane

Recorder and Reader

1. In the Overview pane, right-click on the **signal** on which you want to display the gridlines and then click on **Grid > Grid...**.

2. Click on **View > Overview > Gridlines**.

3. Select the desired **time interval** between gridlines.
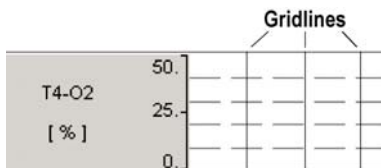
Viewing Logarithmic grids

Recorder and Reader

1. Display the *Trends* panel on the right side of the screen display (**View > Panel > Trends**).

2. Check the **Logarithmic** box.

3. Repeat to turn off the Logarithmic function.

Enabling BST (Brain Symmetry Trend)

The Brain Symmetry Trend (BST) feature requires the Trends function to be licensed before it can be used.

The NicoletOne software uses an algorithm to quantify the symmetry in the EEG between hemispheres in a single value referred to as BST. The algorithm selects fixed predefined number of channel pairs for the calculation automatically. and fixed filter settings. Unavailable channel pairs or pairs that were not recorded are not included in the calculations. The Active Sensor, Low Cut and High Cut filters are not selectable on the *Trend Editor* palette.

Editing the BST channel list

The predefined channel pairs can be edited to suit your needs.

1. Click on **Tools > Options > BST**.
2. Click on the **BST** tab.
3. Click on the Left Channel - **Active** show menu ▼ button and select the desired **channel**.
4. Click on the Left Channel - **Reference** show menu ▼ button and select the desired **channel**.
5. Click on the Right Channel - **Active** show menu ▼ button and select the desired **channel**.
6. Click on the Right Channel - **Reference** show menu ▼ button and select the desired **channel**.
7. Click **Add**.

    The settings are added to the table. Repeat as necessary.
8. Click **OK**.

NOTE: The NicoletOne must be restarted for your changes to take effect.

NOTE: It is NOT recommended to use the Calibration mode for validation of Brain Symmetry Trend calculations.

Viewing the BST results

1. Position the mouse pointer over the **Trend label area** to view a pop-up listing the channel pairs being used in the quantitative analysis.

Cross Correlation Trend

Reader

The Cross Correlation Trend overview in the **Reader** can be used to manually identify REM sleep epochs. It uses two EEG, EOG, Effort or EMG channels to calculate the cross correlation coefficient. The coefficient is defined from [**-1, 1**].

1	The two channels are perfectly correlated in the specified interval.
0	The two channels are not correlated at all in the specified interval.
-1	The two channels are perfectly correlated with opposite signs in the specified interval.

The following example shows how the cross correlation trend can help identify **REM sleep epochs**. The hypnogram shows the sleep scores made by the examining expert. The cross correlation trend displays the cross correlation between the **left EOG** and **right EOG**. The cross correlation is near **-1** when the patient is in **REM sleep**. The Cross Correlation trend and the two channels used to create the cross correlation are identified in the lower left corner of the Overview.

Manual

**Cross Correlation
EOG L-R**
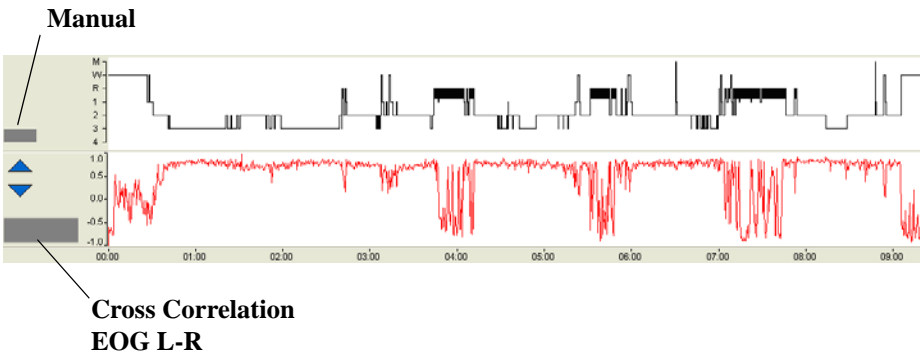
Creating a Cross Correlation Trend overview

1. Click on the **Settings** Settings button on the toolbar.

   - or -

   Click **Protocol > Settings**.

2. Click on the **Trend** link at the bottom of the panel to display the *Trend Editor* palette.

3. Click the **New** button to create a new sensor group.

4. Type in **Cross Correlation**.

5. Tab through the first line of the table on the right (or use the **arrow keys** to move around the table), typing in the information or clicking on the space to choose a selection from a drop-down list. As you fill in a line, a new line is added. Keep adding lines as needed.

6. When you are finished, click **Save**.

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10 Using the Control Panel

Legends

Note that in the left column you will see *Recorder*, *Reader*, or *Recorder and Reader*. These help identify whether the topic applies to the Recorder or Reader or both.

Blank page.

Using the Control Panel

Recorder and Reader   The Control Panel can be displayed on the right side of the Recorder and Reader panes in which you can display various palettes. These allow you quick and easy manipulation of various controls for the system.

Displaying the Control Panel

1. Choose one of the methods below:

Method 1	Method 2
Click **Panel**	Click **View > Panel > Show**

Removing the Control Panel

1. Choose one of the methods below:

Method 1	Method 2	Method 3
Click on the **Close** (**X**) button in the upper right corner of the Panel	Click **View > Panel > Show**	Right-click on the Panel's **Title Bar** and then click on **Hide Panel**.

Displaying palettes

You can choose to display the following Control Panel palettes.

Control Panel Palette	Recorder	Reader
Amplitude Map	-	X
Band Power Map	-	X
Calculated Values*	X	X
Coherence Map	-	X
Camera Control	X	-
Cortical Stim	X	-
Event Filter	-	X
Event List	X	X
Format	X	X
Hyperventilation	X	-
Montage View	X	X
MSLT*	X	-
Photic	X	-
Reaction Time Stimulator	X	-
Remote Video	-	X
Review Format	X	-
Review Video	X	X
Sleep Score Manager		X
Sleep Staging*	X	X
Sleep Treatment	X	-
Stopwatch	X	-
Trends*	X	X
Video	X	-

*** *Licensed options.*

The list of individual parts of the Panel on the **View >Panel** submenu varies depending on the settings configurations and whether hardware such as a video camera or photic stimulator is connected to the computer.

1. To choose a palette for display, choose one of the methods below:.

Method 1	Method 2
Click **Panel**	Click **View > Panel > Show**

2. Click on (checkmark) the **palette** you want displayed.

3. Choose one of the options below:

Method 1	Method 2
Repeat step 2 for each additional palette you want to view.	Right-click any where inside the **Panel**. A list of available panel items appears. Active items are marked with a checkmark.

4. Click on the **palette** you want to display.

NOTE: To remove a palette from the Panel, repeat either of the above procedures to remove the checkmark(s).

Minimizing the Palettes

You can minimize the palettes down to a menu option on the Control Panel:

1. Click on the palette's **Title Bar**.

2. To view the palette again, click on the listed **Palette's title**.

Click on the **Title Bar** to to minimize (hide) the Palette.

Click on a Palette **title** to view the Palette.
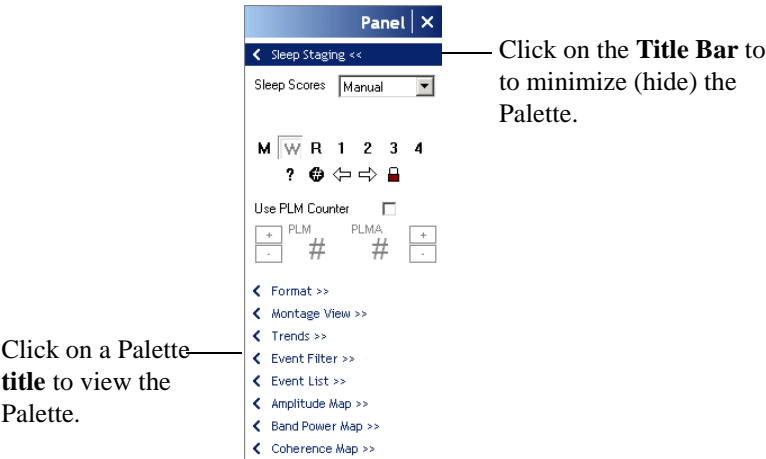
Floating a Palette

You can float a palette, which then can be dragged to any area on the screen display.

1. Click the **arrow** (<) button to the left of the palette's title bar in the Control Panel.

Docking a Palette back into the Control Panel

1. Choose one of the methods below:

Method 1	Method 2
Click the **arrow** (<) button to the left of the palette's title bar in the Control Panel.	Click the Palette's **Close** (**X**) button in the upper right corner of the floating palette.

The following Editor palettes are described in this chapter:

Editor Pallets	Recorder	Reader
Review Format		X
Hyperventilation	X	
Photic	X	
Event list	X	X
Reaction Time Stimulator	X	
Stopwatch	X	
Trends	X	X
Montage View	X	X
Video	X	
Review Video		X
Amplitude Map		X
Band Power Map		X
Coherence Map		X

The following Editor palettes are described in the Sleep Analysis chapter:

Editor Pallets	Recorder	Reader
Sleep Treatment	X	
Sleep Staging	X	X
Sleep Score Manager		X
Calculated Values	X	X
MLST	X	

The Cortical Stimulator option is described in the Cortical Stimulator chapter.

Format and Review Format Palettes

Recorder and Reader   You can create custom montages and quickly change between format settings. You can also save a group of settings as a protocol, so you can easily select the same protocol later for a similar type of recording.

The *Format* and the *Review Format* palettes are used to quickly switch formatting and apply filters.

Changing Montages

Montaging is about describing and calculating a linear mapping from the raw, acquired data. You can create a custom montage with the Montage Editor containing specified channels with defined properties, such as filters or display type.

You can quickly switch between montages by using the **Montage Selector** in the *Format* palette, or by choosing one on the **Format** menu.

1. Display the *Format* palette in the Control Panel on the right side of the Recorder and/ or Reader pane(s).

2. Click on the **Montage** show menu arrow and then click on the **Montage** you want to use.

3. Apply a new **timebase** by selecting one from the drop down menu or create a custom timebase by choosing **Format Menu > Timebase > Custom.** The timebase affects the scrolling speed of the trace display. You can also change the Timebase by clicking on the ⬚⬚ .buttons.

4. Select a **sensitivity setting** from the drop down menu, or create a custom setting by choosing **Format > Sensitivity > Custom**. You can also change the Sensitivity by clicking on the ⬚⬚ buttons.

5. Set the **High Frequency Filter** by selecting a **value** from the drop down menu on the *Format* (*Review Format*) palette or from the **Format** menu, or select a custom value by choosing **Format Menu > High Cut > Custom**.

6. Set the **Low Frequency Filter** by selecting a **value** from the drop down menu on the *Format* (*Review Forma*t) palette or from the **Format** menu, or select a custom value by choosing **Format Menu > Low Cut > Custom**.

Adding a custom montage to the Format Palette	Add a custom montage to the Montage Selector by using the **Montage Editor**.
	Also See: *Montage Editor* in the *Edit Settings and Options* chapter.

Timebase (paper speed)

The time base control on the *Format* palette or the **Format > Timebase** has an effect on how fast the traces scroll by as they are being displayed on the EEG pane. In effect, this is the virtual paper speed. You can also use the **Slower Time Base** or **Faster Time Base**
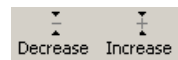
◁ Left   ▷ Right   buttons on the Reader toolbar.

You can set the time base to display millimeters per second or seconds per screen.

Also See: *View Settings* in the *Edit Settings and Options Dialog* chapter for information on how to do this.)

- If using **mm/sec**, a higher value appears to scroll faster.
- If using **sec/screen**, a lower value appears to scroll faster.

Sensitivity

Use the Sensitivity control on the *Format* palette, or from **Format > Sensitivity**, to select a **sensitivity setting** for all channels in the current montage not marked as Special. The sensitivity describes the number of microvolts in each millimeter or centimeter vertically on the display. You can also use the **Decrease Sensitivity** and **Increase Sensitivity**

Decrease   Increase   buttons on the Reader toolbar.

1. Select **Tools > Options > Regional** to select the unit of sensitivity.

High frequency filter

Select the High Cut Filter from the drop down menu, or from **Format > High Cut**, for all channels in the current montage not marked as **Special**.

Low frequency filter

Apply the Low Cut Filter from the drop down menu, or from **Format > Low Cut**, for all channels in the current montage not marked as **Special**.

Hyperventilation Palette

Recorder The *Hyperventilation* palette is a stopwatch to aid hyperventilation and is used to mark hyperventilation events. The event markers are inserted automatically into the trace display when the Hyperventilation tool is used.

▶	Starts Hyperventilation (HV) timing.
■	Starts Post Hyperventilation (HV) timing.
↩	Resets the timers.

1. Click **Start** to insert a "HV Start" duration event.

2. Click **Stop** to insert a "Post HV" duration event.

3. Click **Reset** to close any open HV event and reset the clock to 0.

The Photic Palette

Recorder

NOTE: A photic stimulator must be connected for this palette to be displayed.

The *Photic* palette is used to control the Nicolet Photic Stimulator.

• You can play a programmed photic sequence.

Also See:*Photic Editor* in the *Edit Settings and Options Dialog* chapter to program a new sequence.

- or -

• Select a single line of the sequence to play. In addition, you can press a button to manually administer a single photic flash.

An event marker is inserted automatically to mark photic stimulation events.

Playing a photic sequence or a line from the sequence

1. Select a **photic sequence** from the Sequence list.

2. Browse [...] to the line that you want the sequence to start on/play.

▶	Click the **Start** button to start the photic sequence; press again to stop.
▶	Click the **Photic Line** button to play the single line.
↰	Click the **Reset** button to set the sequence back to the beginning line. If you click **Reset** while the sequence is running, the sequence stops and resets.
☀	Click the **Flash** button to administer a single photic flash.

Event List Palette

Recorder and Reader   The Event List is a tool used for analyzing or editing a recording by its events.

Jump to Event   Click on any **event** in the event list and the trace display automatically jumps to that point in the recording.

If you scroll to a new page in the recording, the first event on that page is highlighted in the event list.

If a duration event of any type is clicked in the Event List or Event Overview, the event is centered on the screen display. If the duration event is too long to fit fully on the screen, the left edge of the event will be displayed as far to the left as possible.

Sort   The event list can be sorted by event name, time, or duration by clicking on the **column header** (Name, Time, Duration). Click the **header** a second time to reverse the order.

Reordering the column headers   You can reorder the column headers by clicking on and dragging a column header either left or right. For example, you can rearrange the headers from **Name** : **Time** : **Duration** to read **Time** : **Name** : **Duration** or in any other sequence you want to view them.

Delete   To delete events from the list (and the recording), select the **event** and press the **Delete** key on the keyboard, or right-click the mouse and choose **Delete** from the popup menu.

Print   Click the **Print** button ⏻ to print the currently visible list of events. The printed output includes:
- Test ID
- Patient name
- Logged on user
- Date and time of export

Export	Click **Export** [icon] to export the Event list to a text file (including the previous Event list).

Copy to Clipboard

Click **Copy to Clipboard** [icon] to copy the Event list to the Clipboard, which can then be pasted into your documents or reports.

Pasting the Event List into reports

You can paste the Event List into a report after copying it to the Clipboard.

1. From the report, click on **File > Paste**.

ToolTip

When the mouse is placed over an event in the *Event List* panel for more than one second, a tool tip appears. The tool tip displays the abbreviation of the event, annotation, duration, who created the event, and when the event was created.

Adding arousals to the Event List

You can add arousal events to sleep events.

1. Right-click on any of the following placed event markers.

   - Obstructive Apnea
   - Central Apnea
   - Mixed Apnea
   - Obstructive Hypopnea
   - Central Hypopnea
   - Mixed Hypopnea
   - LM (leg movement)
   - PLM (periodic leg movement)
   - Apnea
   - Hypopnea
   - Desaturation
   - Snoring

2. From the pop-up context menu, click on **Add Arousal**.

   The arousal event marker will be inserted at the end of the event and displayed at the top of the EEG display area. It will also be added to the *Event List* palette.

Reaction Time Stimulator Palette

Recorder

The Reaction Time Stimulator is used to measure a patient's reaction time. A stimulus is administered and the patient reacts by pressing a button. The amount of time between the stimulus and the reaction time is measured and an event with this information is inserted into the trace display.

▶	Administers a **single** stimulus manually.
▐▶	Administers **random** stimulation. Click again to stop.
⊣⊢	Administers stimulation **triggered** by a spike or the beginning of a seizure.

1. Select a **type of stimulation** from the list: **Photic**, **Audio**, or **External**. The external choice refers to an optional device, such as a sound generator, connected to the computer.

2. Press the **left** button to administer a single stimulus manually.

3. The **middle** button starts random stimulation. Press the button again to stop random stimulation.

4. The **right** button administers stimulation triggered by a spike or the beginning of a seizure.

Exception: Reaction time stimulator is not available in vEEG.

Stopwatch Palette

Recorder

The *Stopwatch* panel is intended to help EEG technicians perform tasks that require precise timing. A duration event is inserted to mark the use of the Stopwatch in the recording and includes an annotation and the time duration.

The time is displayed on the panel to the nearest 10th of a second.

1. Type the **annotation** in the space provided or select a previously typed **annotation** from the drop down list.

2. Click the ▶ button to start the timing.

3. Click the ▶ button again to stop timing.

Trends Palette

Recorder and Reader   The *Trends* palette is used to switch between Trend Templates and change the display of the Trend Overview.

The following display settings are read only for saved Trend templates:

- Time Resolution
- Trend Type
- Active Sensor
- Reference Sensor
- Label
- LowCut Filter
- HighCut Filter

NOTE: Trend Analysis is an optional feature and does not affect Trends marked as **Special**.

1.   Click on the **Trend** show menu ⏷ button and select a **Trend Template**. Trend Templates are created using the *Trend Editor* panel.

Also See: *Edit Settings and Options Dialog* chapter for information on the Trend Editor.

2.   **Duration** determines the length of time displayed at one time in the Trend Overview. This is similar to using the **Zoom Overview** to zoom in on part of a recording.

3.   Select a **trend type** from the list.

4.   Choose a **minimum** and **maximum envelope** in microvolts.

NOTE: This panel does not affect Trends marked as **Special**.

Exception: Trend Analysis is an optional feature.

Montage View Palette

Recorder and Reader   The *Montage View* palette provides a quick view of the current montage.

The following procedure allows you to view the numerical positions on the *Montage View* palette if not already visible.

Viewing the numerical positions of each channel

1. Click the **Float** [<] button (left side of the Montage title bar).
2. Drag a corner of the window to increase its size until you can view the numerical positions on each channel.
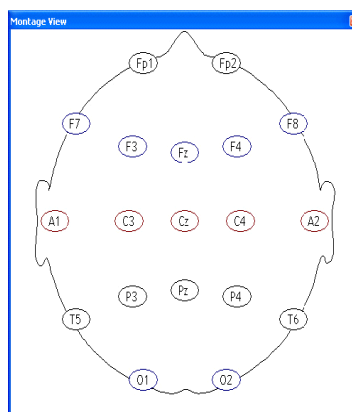
Video and Review Video Palettes

Recorder and Reader   The *Video* palette displays synchronous video as it is being captured/reviewed.

1. Click the **Float** [<] button (left side of the Video title bar) to display the video in a floating palette, in the same resolution used during the recording.

NOTE: A video card and camera must be connected for the *Recorder Video* palette to display the video. See the video card's accompanying documentation for instructions for capture settings.

Event Filter Palette

Reader

The Event Filter is used to hide specified events so that they can't be seen in the Event list, Overview or the Reader pane. Filtered events are not deleted, so they can be made visible again at any time.

To hide events, the Event Filter uses the properties of the individual events:

Category	(Checklist with 8 categories): All events of the unchecked categories are hidden when the filter is applied.
Priority	(Combobox with **High**, **Normal**, and **Low priority**): The events with lower priority than specified in the combobox will be hidden when the filter is applied.

User	(Combobox): Select from a list of users who have inserted events, or select **All**. All events that are not inserted by the specified user will be hidden when the filter is applied.
During	(Combobox): Selects which events will be visible when the filter is applied. **All** = Events inserted during Acquisition and Review. **Acquisition** = Only events inserted during Acquisition. **Review** = Only events inserted during Review.

|	
Auto Detected Only	(Checkbox): When the **System Detected Only** check box is checked, only detection events (Seizure, Spike, Heart Rate) that were inserted by the automated detections will be visible when the filter is applied.
Spike Sensitivity	(Slider): Use the **slider bar** on the *Event* panel to adjust the level of spike sensitivity. Use a lower spike sensitivity (move the slider to the left) to eliminate false positives, or use a higher sensitivity (move the slider to the right) to be sure as many spikes as possible are detected. **Note:** Spike detection is an optional feature.
Reset	(Arrow Toolbar button): Stop the filter, i.e., make all events visible.

Mapping palettes

Reader

Brain Mapping is one of the ways that the system displays EEG data. In a brain map, each electrode is depicted as a point on a circle representing the head. The value of each point is determined by the EEG data and the mapping method being used. Interpolation is used to gain a value for every point on the circle, which is then represented on the screen using color-coded scaling.

NOTE: Mapping is an optional feature.

Amplitude Map palette

The Amplitude Map is derived from one data point from each channel.

To choose a point to map, drag the **Vertical Marker** to a specific point in the trace display.
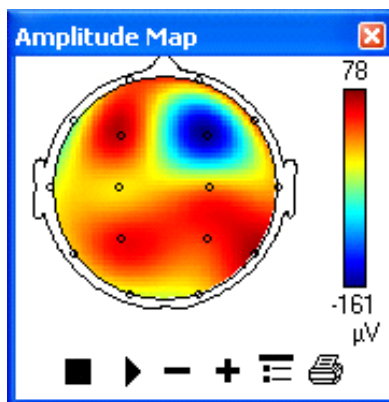
The Amplitude map can be "played" to show changes in a recording. The Vertical Marker moves along the trace display in sync as the map is played. The buttons at the bottom of the *Amplitude Map* panel indicate (from left to right): **Stop**, **Play**, **Step Backward**, **Step Forward**, **Properties**, and **Print**.

NOTE: Click on **Tools > Vertical Marker** to display the marker.

Amplitude Map settings

On the *Amplitude Map* panel, click on the **Properties** button to display a dialog box with these options:

Manual Scaling	Choose this to enter custom min/max values. The maximum selected value is mapped to the max color and the minimum value is mapped to the min color.
Automatic Scaling	The maximum and minimum values of the whole head are mapped to the min and max color.
Scalp Potential	First order difference operator applied to the voltage values.
Surface Current	Second order difference operator applied to the voltage values.
Linear Spline	Linear interpolation can be described by drawing a straight line between two points. The method used is a two-dimensional analog.
Thin Plate Spline	Thin Plate interpolation differs from linear in that it provides a smooth surface. This method has been shown to be well suited for evoked potentials.

NOTE: Set the maximum and minimum color using the **color-coding** tab of the Options dialog. Also see the *Edit Settings and Options Dialog* chapter for more information.

NOTE: Spline settings are shared between all maps. Additionally, the color-coding is also shared between the maps. Also see **Tools > Options > Color Coding**.

**Band Power
Map palette**

1. Click on **View > Pane > Band Power Map** display the maps.

    The Band Power map is calculated over an interval of time rather than on a point in time. All the data on the page currently viewed is used in the calculation.

2. Page to the location in the recording you want to map before displaying the Band Power maps.

    The power in each electrode over the time period is calculated and divided on the frequency bands, delta, theta, alpha and beta. A Fourier transformation is used in the calculation.
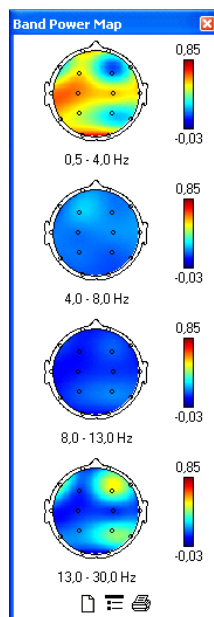
Click the **Properties** button to display a dialog box to set the following options:.

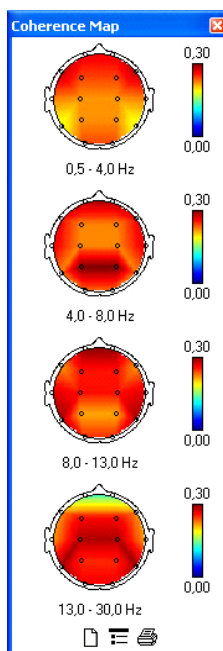|	
Manual Scaling	The maximum selected value is mapped to the max color and the minimum value is mapped to the min color.
Automatic Common Scaling	The global maximum and minimum values of the whole head and all the bands are mapped to the min and max colors.
Automatic Local Scaling	The maximum and minimum values of the whole head are mapped to the min and max color for each band individually.
Absolute Normalization	Means that no normalization is made.
Channel Relative Normalization	Each value has been divided by the sum of the values from all electrodes for the same band.
Band Relative Normalization	Means that the value for each electrode has been divided by the sum of the values from all bands for the electrode.
Linear Spline	Linear interpolation can be described by drawing a straight line between two points. The method used is a two-dimensional analog.
Thin Plate Spline	Thin Plate interpolation differs from linear in that it provides a smooth surface. This method has been shown to be well suited for evoked potentials.

Coherence Map palette

1. Click on **View > Panel > Coherence Map** to display the map.

Coherence maps are calculated over the time interval of one currently viewed page and are calculated on the frequency bands of delta, theta, alpha, and beta. The electrodes in the Coherence maps are analyzed in pairs. An electrode pair consists of an electrode and its corresponding electrode on the other side of the head, e.g., C4 and C3.

If the power spectrum in a frequency band is similar for the electrodes in a pair, the electrodes are given a value close to 0. If the power spectrum differs, the value will be close to 1.

Clicking the **Properties** button in *Coherence Maps* panel displays the same dialog as the Band Power Maps discussed earlier.

Video Control Palette

1. Click on a **Camera Direction** button and hold down the mouse button until the desired effect is reached and then release the mouse button.

2. Repeat step 1 as necessary until the camera is pointing in the desired direction.

Steps 4 through 9 are for a Sony camera only!

3. Click on the **Zoom** buttons until the desired zoom level is reached.

4. The pan/tilt speed of the camera can be controlled via Pan-Tilt Speed slider control.

5. To preset the position of the video camera, click on the **Set Presets** button.

6. There are three presets you can choose to use. Type in a **label** for the preset you want to use (or accept the 'Not Assigned' default).

7. Click on the corresponding **Set** button.

8. Click **OK**.

9. On the Video Control Palette, click on the **Go** button at any time to position the video camera automatically.

11 Edit Settings and Options Dialogs

Legends

Note that in the left column you will see *Recorder*, *Reader*, *or Recorder and Reader*. These help identify whether the topic applies to the Recorder or Reader or both.

Also see the following topics in the Marking Events and Annotations chapter.

- Assigning numerical values to an event
- Using numerical events

    - Creating a number event sensor

    - Placing numerical events on the EEG

    - Quick overview of numerical event values

- Setting a Quick Insert Duration
- Assigning an event to a specific sensor

Blank page.

Customizing the NicoletOne system

Customizing NicoletOne to suit your needs is easy.

The **Protocol > Setup** function combines settings into one convenient location in both the Recorder and the Reader (see the next 5 pages). You then can quickly select a protocol later with just two clicks (**Protocol > List of Protocols**).

The **Settings Editor** provides various palettes from which you can define/create templates, etc. that will be used as you operate the NicoletOne system (starts on page 7). The settings, in addition to View preferences, can be saved to a protocol. You then can quickly select a protocol later with just two clicks (**Protocol > List of Protocols**).

Grid/Strip/ Depth Electrodes

Please refer to the **Grid/Strip/Depth Electrodes** chapter for information on using the *Grid Editor* panel.

Creating a Protocol

The purpose of the protocol is to allow several different configurations, e.g., Routine EEG or Long-Term Monitoring (LTM), and to be able to switch between them with one menu selection. Each protocol is "global," so that if one user changes a protocol, it changes for all.

Selecting protocols

Recorder and Reader

Available protocols are listed at the bottom of the **Protocol** menu in both the Recorder and the Reader windows.

1. From the Menu bar, click on **Protocol**
2. Click on the desired **protocol** from the list at the bottom of the menu.   A checkmark indicates the active protocol.

Creating a new protocol

Recorder and Reader

1. Click on **Protocol > Save As**.
2. Give the new protocol a **name**.
3. Click **OK**. The new protocol now appears as the active protocol on the **Protocol** menu.
4. Click on **Settings** Settings.
5. Click on **Protocols** at the bottom of the *Settings* panel.
6. Make the desired changes to the **Protocol Editor**.

Also See: *Protocol Editor* in this chapter.

7. Click **Save**.

Modifying a protocol

Recorder

1. From the Menu bar, click on **Protocol** and then click on the **Protocol** you want to modify.

2. Click on **Settings** .

3. Click on **Protocols** at the bottom of the *Settings* panel.

4. Make the desired changes to the **Protocol Editor**.

5. Click **Save**.

Creating a Recorder Protocol

Protocols are typically defined first and then the remaining *Settings Editor* panels are defined as necessary. The Protocol will consist of an **Amplifier**, **Montage**, **Events**, optional **Trends**, **Alerts**, and **Detections**.

1. Click on **Protocol > Setup** to display the Protocol Setup dialog.

    If creating a new protocol from an existing one:

    a. Click on the **Protocol** show menu ▼ button at the top of the Protocol Setup dialog box.

    b. Click on the **Save a copy as...** button.

    c. Type in a **new name** and then click **OK**.

    d. Continue with step 2.

    If editing an existing protocol:

    a. Click on the **Protocol** show menu ▼ button.

    b. Continue with step 2.

There are six summaries on the *Protocol Setup* panel showing the current settings for various parameters/templates.

NOTE: You can turn on/off listed items by clicking on the associated **checkboxes**.

2. Click on the **Edit** button for the parameter/template you want to edit and refer to the instructions for that item in this chapter to choose your settings.

3. When finished, click on the **Back** button to return to the *Protocol Setup* panel.

4. Click on one of the three **Video** choices. For information on Selective Video, please refer to *Recording Selective Video* in this chapter.

5. Click on the **Apply to this exam** button to apply your changes temporarily to the current exam on your system. This does **not** save the new Protocol or your edits permanently.

    To **save** the protocol to all systems permanently, click on **Save for all systems** button. **Each system must be restarted to enable the new Protocol.**

6. Click **Close** ☒ in the upper right corner of the Control Panel.

Contents of a Recorder protocol

In Recorder, the following settings are saved to the Recording Protocol:

- Amplifier Setup
- Sensor Group (See *Sensor Groups in the Recorder* on the next page.)
- Montage (See *Sensor Groups in the Recorder* on the next page.)
- Trend Template
- Event Palette
- Alert Template
- Detection Template
- Photic Sequence
- Video Template
- Views
- Frequency Analysis
- File Format
- Format (Format panel or Format menu) The Notch setting is not saved.
- Panel and Overviews (View menu).

Creating a Reader Protocol

Protocols are typically defined first and then the remaining *Settings Editor* panels are defined as necessary. The Reader Protocol will consist of a **Montage** and an **Events Palette**.

1. Click on **Protocol > Setup** to display the Protocol Setup dialog.

    If creating a new protocol from an existing one:

    a. Click on the **Protocol** show menu ▼ button at the top of the Protocol Setup dialog box.
    b. Click on the **Save a copy as...** button. *Disabled on **Read Only** systems.*
    c. Type in a **new name** and then click **OK**.
    d. Continue with step 2.

    If editing an existing protocol:

    a. Click on the **Protocol** show menu ▼ button.
    b. Continue with step 2.

There are two summaries on the *Protocol Setup* panel showing the current settings for the *Montage* and the *Events* Editor panels.

2. Click on the **Edit** button for the parameter/template you want to edit and refer to the instructions for that item in this chapter to choose your settings.

3. When finished, click on the **Back** button to return to the *Protocol Setup* panel.

4. Click on the **Apply to this exam** button to apply your changes temporarily to the current exam on your system. This does **not save** the new Protocol or your edits permanently. *Disabled on **Read Only** systems.*

    To **save** the protocol to all systems permanently, click on **Save for all systems** button. *Disabled on **Read Only** systems.*

NOTE: Each system must be restarted for the new Protocol to be used.

---

5. Click **Close** ☒ in the upper right corner of the Control Panel.

Contents of a Reader protocol

In the Reader, the following settings are saved to the protocol:

- Event Palette
- Prune Template
- Montage Set
- Montage
- Trend Template
- Views
- Frequency Analysis
- Panel
- Overviews

Using the Settings editor

Recorder and Reader

Display the Settings Editor panel

1. Click on the **Settings** Settings button.

   - or -

   Click **Protocol > Settings**.

2. Click on the **links** at the bottom of the *Settings Editor* panel to display the desired Editor panel. For example, click on **Events** to display the *Event Type* Editor panel.

NOTE: The settings available from the Recorder and Reader differ slightly from each other. Additionally, some of the settings described in this chapter are optional features and may not appear in the version of the software you are using.

General instructions

Tables in the settings editors are often filled in a way similar to using Microsoft Excel. The following keys provide these functions**:**

Tab key	Moves across a row in the table.
Enter key	Moves down a column in the table.
Arrow keys	Move in any direction in the table.
Right-click	Deletes or inserts a line (select multiple lines to delete all at once).
Spacebar	Fills in a checkbox, combo box or field.

Alternatively, you can click on most any **field** in the table to make entries. As you fill in a row of a table, a new blank line is created automatically.

The Settings editor toolbar

Many of the settings editors have an editable list of configurations with the following buttons located at the bottom of the Editor panel:

$$\text{\large 🗋 🗅 ✗ A ↑ ↓}$$

Some editor dialogs will not contain all (if any) of the above buttons depending on the Editor panel you are viewing.

The buttons are:

New	Create a new configuration. Type in a name for the configuration, then fill in the required information as needed.
Duplicate	Duplicate the selected Editor configuration. Use this if you want to create a new configuration with only slight changes. Give the new configuration a name, then edit only the items you want to change.
Delete ✗	Delete a configuration from the Editor list.
Rename A	Highlights the name so you can type in a new one.
Move up ↑ ↓ **Move down**	Moves the selected name up/down on the list.

Sensor editor

Recorder and Reader   With the Sensor Editor, you can create groups of sensors, each containing a specified number and type of sensor. The sensor group can then be used to create amplifier setups, montages, and trend templates.

Sensor groups in the Recorder

The sensor group that is used for recording is not determined directly by the protocol. Instead, each amplifier setup specifies a sensor group to use, and the sensor group specified by the amplifier setup selected by the protocol is the one that is used.

Each montage and trend template specifies a sensor group with which it is to be used. Only those montages and trend templates specifying the current sensor group can be selected.

As the selection of an amplifier setup thus has a major impact on the protocol, the system never selects amplifier setups without consulting the user. A protocol must therefore always specify a valid amplifier setup. To enforce this, all protocols that use a given amplifier setup are automatically deleted when that amplifier setup is deleted. Deleting a sensor group also deletes all amplifier setups that use that sensor group, and thus all protocols that use those amplifier setups.

Multiple sensor groups

To use a 10-10 electrode placement system or Grid electrodes:

1. Check the **Enable Multiple Sensor Groups** checkbox found in **Tools > Options > Misc tab**.

    You now can select a **sensor group** in the following dialogs:
    - Sensor Editor
    - Montage Editor
    - Amplifier Setup
    - Trend Editor
    - Calculated Channels

Display the Sensor Editor panel

1. See *Using the Settings Editor* earlier in this chapter.

Creating a new sensor group

2. Click **New** . An empty table appears, which you will fill in now.
    - or -

    Click on the **template** you want to edit and then click on **Duplicate** .

3. Type in a **name** for the group.

4. Tab through the first line of the table on the right (or use the **arrow keys** to move around the table), type in the information or click on the space to choose a selection from a drop-down list. As you fill in a line, a new line is added. Keep adding lines as needed.

5. Click **Save**.

Calculated Channels Editor

While montage channels are usually made of one or two sensors depending on whether unipolar or bipolar sensors are used, average and source montages make use of more than two channels to make up a montage channel. The Calculated Channels editor is used to define how these signals are calculated. The Calculated Channels editor is also used when data processing is necessary to calculate a channel based on some other channel. An example of this is when pulse rate is calculated from the EKG. The calculated channels have connections to sensors in the way that a calculated channel must be of a valid sensor type.

Exception: Defining of new calculated channels is not available in vEEG.

Display the Calculated Editor panel

See *Using the Settings Editor* earlier in this chapter.

To create a calculated channel

The following generated sensor types are supported:

- EEG
- Pulse
- R-R Interval
- Burst Sup. Ratio (Burst Suppresion Ratio)
- Burst Rate
- Inter Burst Interval
- RMS
- CPAP
- IPAP
- EPAP
- O2
- Burst Sup. Status (Burst Suppresion Status)
- Burst Sup. NLEO (Burst Suppresion **N**on**L**inear **E**nergy **O**perator)
- Ext DC

Creating an EEG calculation

A combination of several EEG channels can be calculated. The weights are normalized to a sum of 1 when the settings are saved. If a channel is **not** turned on in the **Amplifier Setup** settings editor, it is skipped in the calculation.

1. Click **New** .
   - or -
   Click on the **channel** in the Calculated Channels list you want to edit and then click **Duplicate** .
2. Type in a **name** for the Calculated Channel.
3. Choose **EEG** from the Type list.
4. Choose the **default color** to be assigned to each calculated sensor.
5. To calculate the mean of all the EEG sensors in the Sensor group, click on the **Average Sensor** button.

   To have the Laplacian reference sensor calculated automatically, click on the **Laplacian Sensor** button. You can select a channel and have the Laplacian reference sensor calculated automatically. You can also include and exclude sensors in the Laplacian reference sensor and have the weights for the remaining sensors in the average calculated automatically.
6. Select the **electrodes** on the image you want to include in the calculation.
7. Click on the **Weight** field for the electrode you want to edit and type in the desired weight. Default = 1.00.
8. Click **Save**.
9. Click on **Montage** at the bottom of the Calculated Channels editor panel.
10. If you want to create a new montage, click **New** and type in a **name** for the montage.
11. In the Active column, double-click on the bottom most (empty) **Active** field.
12. Select the **calculated channel** you created in step 2.
13. Click **Save**.
14. Click **Close**.

| Creating a Pulse calculation | Calculates the heart rate of the patient (in beats per minute) from an EKG signal. The heart rate is calculated while recording and the results are saved to the file as a data channel. The output channel can be treated like any other signal, and can thus be displayed in the trace display or as a trend. It can also be used as an input for heart rate detection. |

1. Click **New** .

   - or -

   Click on the **template** in the Calculated Channels list you want to edit and then click on **Duplicate** .

2. Type in a **name** for the channel.

3. Choose **Pulse** from the Type list.

4. Choose the **default color** to be assigned to each calculated sensor.

5. Choose the sensor **Definition**.

6. In the Montage Editor, select the **sensor** in the Montage, and choose **Numerical** as the Display Type. The beats per minute are displayed numerically on the trace display.

NOTE: This procedure can also be used for the remaining sensor types selectable from the **Types** menu (step 3 above).

Creating an Average Sensor

You do not have to calculate Sensor weights by yourself when all of the selected sensors have the same weight because normalization will be done later or automatically by the software.

You can create an Average Sensor using two methods.

Method 1

1. If no Sensor has been selected, click the **Average Sensor** button.

   All of the EEG sensors are selected and their weights are set to 1.0.

Method 2

1. Select a Sensor from the list (or select an old calculated sensor).

2. Click the **Average Sensor** button.

   All of the weights of the selected Sensors are set to 1.0.

Creating a
Laplacian
Sensor

When you select the sensors that will be used to calculate the Reference sensor, the correct
weights are calculated depending on the distance, on the scalp, from the Lapacian sensor.

Lapacian sensor can only be calculated from sensors that have coordinates (located on the
head and not on the sides).

1. Select a **Sensor**.
2. Click on the **Laplacian Sensor** button.

    The selected sensor turns **red** and can not be deselected. The Calculated Channels
    Editor is now in the Laplacian Mode.

Amplifier Setup editor

Recorder only

Display the Amplifier Setup Editor panel

See *Using the Settings Editor* earlier in this chapter.

Loading a Default Amplifier Setup template

1. Click on the **Load Default** button.

   The current default template is loaded.

Editing the Amplifier Setup Editor panel

1. Click on the **Amplifier** show menu ▼ button and select the desired amplifier.

2. Click on the **Common Sampling Rate** show menu ▼ button and select the **sampling rate** that will be assigned automatically when appropriate. See the next page for information.

3. Use the **arrow** keys (or the **Tab** key) to scroll through the channels and select or type in the desired **values**.

   - **Input**: Channel labeled as you want it to appear in the software.
   - **On**: Means data will be acquired for this channel.
   - **Sensor**: Position of the electrode on the head.
   - **Sample Rate**: Common: The sampling rate selected in the Common Sampling Rate field.

4. Type in the **Calibration Period**.

5. Type in the **Calibration Level**.

6. Select a **Sensor Group** and a **Device** from the selectors.

7. To make your settings the new default, click on **Save Default**.

8. Click **Save**.

Default amplifier setup settings

Recorder only

The default Amplifier Setup settings are generated automatically based on the last used settings. The default is useful when changing amplifiers, thus eliminating the need to redefine the sensor inputs. You then can edit the amplifier settings, as necessary.

Each sensor (and its on/off status and sampling rate) will be placed in the first compatible input. For example, the first input with the same Bipolar status (True or False) and the same Type (AC, DC or Trigger).

If **Bipolar sensors** are placed in an input that is a Bipolar master, a slave input is added automatically.

For sensors that have individual sample rate settings, the sample rate will be checked against the valid sample rates for the new amplifier. Any invalid sample rates will be set to the **Common** setting of the new amplifier.

See the following examples on the following page.

Example of switching from a M24 amplifier to a C16 amplifier.

Figure 1: Example M24 Amplifier sample rates.

Figure 2: Example sample rates after switching to a C16 Amplifier.

Montage editor

Recorder and Reader

Display the
Montage Editor
panel

See *Using the Settings Editor* earlier in this chapter.

Creating a new
montage

1. The Montage Editor is displayed by default. If another Editor panel is already being view, click **Montage** at the bottom of the panel.

2. Click **New** . An empty table appears, which you will fill in now.
   - or -

   Click on the **template** you want to edit and then click on **Duplicate** .

NOTE: If you are editing an existing template, simply click on the table field you want to change and then make your edits.

---

3. Type in a new **name** for the template.

4. Select a **Montage** from the list.

5. Click on the **Reference Mode** show menu button and click on the desired **Montage Reference type**.

6. Click on the **Select View** show menu button and then select which view you want to use while selecting the electrode labels.

7. On the Edit Montage table, click on the **Active box** for Input #1.

NOTE: If you make a mistake, click on the box where the mistake occurred, then click on the correct electrode label and continue on.

---

8.   Choose <u>one</u> of the methods below:

Method 1	Method 2
On the graphical label view, click on the electrode **label** you want to assign to the #1 **Active** input.	Click on the #1 Active input show menu ![dropdown] button and select the electrode **label** you want assigned to the #1 **Active** input**.**

NOTE: If you want to insert a blank space to separate groupings of electrode labels, type in the word **Space** for the Active input.

9.   The selection appears in the table and the remaining line is filled automatically. If you want to make any changes to the automatic selections, double-click on the **Active**, **Reference**, **Color**, **Display Type**, or **Polarity** field and make your choice.

10. If you want to create your own label for the input, click on the box below **Label** and type in your customized label.

11. If you want to mark this input as **Special**, which has its own unique settings, check the **Special** checkbox. Please see the next page for instructions on setting up Special channels.

12. If you want to enable audio recordings for playback during review, click on the **Audio** checkbox.

13. Repeat steps 7 through 12 to assign the remaining lines of electrode labels.

14. Click **Save**.

Setting up Special channels

Special channels ignore global parameter changes such as changing the Sensitivity. Special channels are identified by a colored rectangle to the right of the trace label. Normal channels have a diamond shaped color symbol.

After clicking on a **Special** checkbox from the *Montage Editor* panel, a dialog box for that electrode label appears.

1. Type in a **Sensitivity** value.

2. Type in a **High Cut** filter value.

3. Type in a **Low Cut** filter value.

4. Type in a **Deflection** value. Deflection describes the vertical measurement of a trace before it is cut off.

5. Type in a **Baseline** value. Baseline defines the level at which the trace(s) are drawn on the screen display. You can move the selected traces vertically on the screen display.

Setting up for Numerical displays

If the Display Type for the channel has been set to display **numerical values**,

a. Click on the **Update Period** show menu ▼ button and select the period of time between each numerical value display.

b. Click on the **Decimal Places** show menu ▼ button and select how many decimal places with which the numerical values are displayed.

6. Return to *step 11* on the previous page for the next electrode label.

Importing a Montage

To import an existing Montage:

1. Click on the **Import** button.
2. Browse to and select the **Montage**.

Exporting a Montage

To export a Montage for recall at a later time (NicoletOne systems version 5.6 and later save exported Montages with a **.mon** extension.

1. Click on the **Export** button.
2. Browse to the desired **location** in which you want to save the Montage.

Montage Sets editor

Recorder and Reader with exceptions

The Montage Sets editor is used to create a set of montages. Only montages from the selected set will appear in the montage list box (on the panel in the Recorder and on the toolbar in the Reader). The montages in the selected set are also mapped to the montage buttons on the Recorder toolbar and the keyboard shortcut keys, **Ctrl** + **1** to **Ctrl** + **9**.

Creating the set works in the same way as creating an Event palette in the *Palette* editor.

Display the Montage Sets Editor panel

See *Using the Settings Editor* earlier in this chapter.

## Creating a new Montage Set

Reader only

1. Click on the **Sensor Group** show menu ▾ button and then click on the desired **Sensor Group**.

Recorder and Reader

2. Click the **New** .
   - or -
   Click on the **template** you want to edit and then click on **Duplicate** .

3. Click on a **montage** from the Montages list in the center.

4. Click on the **move right arrow** button .

5. Repeat steps 4 and 5 for each additional Montage you want to add to the set.

6. Click **Save** for permanent use.

Reordering the montage set list

Recorder and Reader

1. Select the **montage** from the 'Montages in Set' list.

2. Use the **Up** and **Down** buttons to change the order of the selected montage.

Removing a montage from the set

Recorder and Reader

1. Select the **montage** from the 'Montages in Set' list.

2. Click the **left arrow** to move it back to the Montage list on the left.

Photic editor

Recorder only

Display the Photic Editor panel	See *Using the Settings Editor* earlier in this chapter.

Creating a new Photic sequence

This procedure creates a custom photic sequence for use in the *Photic* Panel.

1. Click the **New** .
   - or -

   Click on the **template** you want to edit and then click on **Duplicate** .

2. Press **Tab**, then type in a value for **Frequency** in the first line.

3. Press **Tab** again to advance to the **Duration** and **Luminance** columns, and then press **Tab** again to advance to the next line in the sequence.

4. Repeat steps 2 and 3 as necessary.

5. Click **Save**.

Trends Editor

Recorder and Reader

Display the Trends Editor panel

See *Using the Settings Editor* earlier in this chapter.

NOTE: If any of the Trends were saved to file (please see the *Viewing Overview Information Related to EEG* chapter), a ![icon] icon is displayed in front of the Trend Template name(s) in the Trend Templates list.

NOTE: If you change the display settings for a saved Trend template on the Trend Editor panel and then save those changes, the Trend template will reflect those changes.

Creating a new Trend template

1. Click the **New** ![icon].

   - or -

   Click on the **template** you want to edit and then click on **Duplicate** ![icon].

2. Click inside the Time Resolution value entry box and type in the desire **Time Resolution**.

3. Click on the **Tabs** ![icon] show menu button and select the **number of tabs** you want to use to display the trends.

4. Click below the **Trend Type** column heading to display a drop down menu.

5. Click on the desired **Trend Type** from the menu.

6. Press the **Tab** key (or click on any **white space** on the Editor panel) and either accept the default settings or double-click on the field(s) you want to edit and enter your choice(s).

NOTE: Only the **Label** field can be edited when **BST** (Brain Symmetry Trend) is selected as the Trend type.

7. Click below the **last** Trend Type field you just finished creating to add the next Trend Type.

8. Repeat steps 4 - 6 as necessary.

9. Click **Save**.

About Trends   The following Trends are supported:

Frequency-based:

- Total Power
- Relative Band Power
- Absolute Band Power
- Spectrogram
- Median Frequency
- Peak Frequency
- Spectral Edge
- Frequency Ratios
- Alpha to Beta/Delta
- Alpha Variability
- RMS
- Cross Correlation
- BST
- Heart rate and R-R internal
- aEEG

Time-based:

- Envelope
- Generic Trend

| Frequency based trends | The **first eight trends** in the above list are based on spectral computation and are affected by the frequency settings. |

Also See: *Frequency Analysis Editor* in this chapter).

The **last two trends** in the above list are time-based.

The frequency-based trends are defined as follows:

Total Power

The total power is defined as the (normalized) area under the power spectrum "curve". In this case there is a close relationship between the time and frequency domains: let x_i denote sample number i and f_j the power spectrum estimate at frequency bin j, then Parseval's theorem states that $\text{sum}(x_k^2) = \text{sum}(f_j)$.

Relative Band Power

The power in each frequency band (typically delta, theta, alpha, and beta) is computed by summing up the corresponding area under the power spectrum "curve." The total power computation is a special case of band power computations where there is only one frequency band, which spans the interval $[0, S/2]$ where S is the sampling rate.

Absolute Band Power

This trend shows the power in each of the defined frequency bands (typically delta, theta, alpha, and beta).

Spectrogram

The Spectrogram trend shows the power spectrum of the signal. The color-coding specified in the **Tools > Options > Color Coding** dialog represents the power spectrum. The vertical axis shows frequency as defined by the bands in the frequency editor. The power can be scaled using the **trend scaling** tools. The tools are accessed by right-clicking on the **trend** overview and choosing **Scaling** from the popup menu, or by clicking the **vertical axis arrows**.

Median Frequency

The Median Frequency is the frequency at the point where there is equal power below and above.

Peak Frequency

The peak frequency corresponds to the frequency bin with the largest amplitude. In the example above the peak frequency is close to 0 Hz.

Spectral Edge

The spectral edge corresponds to the frequency bin fse, where:

sum {j = 1...fse} (fj) <= a * Ftot: fj is the power in bin j, $0 < a <= 1$ and Ftot is the total power. In the example above, the spectral edge is 14.5 Hz when **a** = 0.95 (95% spectral edge). The spectral edge parameter, **a** can be configured via the "Misc" property page available by clicking on **Tools > Options** from the main menu.

Frequency Ratios

This group of trends shows ratios between power in different frequency bands. The following ratios are provided:

- alpha: beta
- alpha: delta
- alpha + beta): delta [the Delta Ratio]

Where (for example) alpha: beta is the ratio between power in the alpha band and power in the beta band.

Time based trends

Time based trends are defined as follows:

Envelope

The Envelope trend shows the numerically largest sample from a block of EEG data. Blocks of one second are used so the trend is updated once every second.

Generic Trend

The generic trend displays (raw) data from DC-value sensors (e.g., SaO_2 and Pulse sensors). The rate at which trends are updated is dependent on the Trend Editor used.

Exception: Trend Analysis is an optional feature.

Deleting saved/unsaved Trends

Saved Trends can be deleted in Reader only. Unsaved Trends can be deleted in either Reader or Recorder.

1. Click on the **Trend** listed in the Trend Templates pane on the Trend Editor panel that you want to delete.

2. Click on the **Delete** icon ✕ at the bottom of the Trend Templates pane.

Read only Trend display settings

The following display settings are read only for saved Trend templates:

- Time Resolution
- Trend Type
- Active Sensor
- Reference Sensor
- Label
- LowCut Filter
- HighCut Filter

Video editor

Recorder only

Display the
Video Editor
panel

1. See *Using the Settings Editor* earlier in this chapter.

Creating a new
video setup

2. Choose one of the options below.

Click on No Video	Click on Full Video	Click on Selective Video
Video is disabled. Perform step 4.	Remains recording until stopped manually. Perform steps 3 and 4.	Saves video only when certain events occur. Perform step 3 and then go to *Selective video* on this page.

3. **Media File Duration** sets the maximum file length in minutes.
4. Click **Save**.

Selective video

Selective video allows you to save video only when certain events occur.

1. From the Events list column, click the **events** on to select them and then click the **right arrow** button to move them to the Selected Events column.

NOTE: To select multiple Events, hold down the **Shift** key or **Ctrl** key on the keyboard while making your selections.

---

2. Click an **event** on the Selected Events column to select it.
3. Type in the number of seconds before and after the event you want the video to be saved to disk.
4. Click **Save**.

Alert editor

Recorder only

Alerts are used to notify you when special events occur. A set of alerts is selected and saved to an Alert Template that can be saved to the Recording Protocol.

The alert can be an email notification, sound alert or the start of a specified application. The method of notification can be applied to each event in the alert template separately and the notification can be added to the Application Log.

Display the Alert Settings Editor panel

1. See *Using the Settings Editor* earlier in this chapter.

2. Click the **Event Types** to select them and then click the **right arrow** button to move them to the Event Types in Protocol column.

NOTE: To select multiple Events, hold down the **Shift** key or **Ctrl** key on the keyboard while making your selections.

---

3. If you check **Play Sound**, click **Browse** to select the **sound file** you want played. See the next page for additional information.

4. If you check **Run Program**, click **Browse** to select the **application** you want started.

5. **Send Email** via the run program option using Producer Basic as the application.

6. Check **Alert Window** if you want a pop-up to be displayed.

7. Check **Digital Out** if you want to output a digital signal.

8. Check **Add to Application Log** if you want to save the notification to the log.

9. Click **Save**.

Play a sound
(Alert)

The Play a Sound feature is used to notify you when special events occur. A set of alerts can be selected and saved to an Alert Template, which, in turn, can be saved to the Recording Protocol.

When a special event occurs, the system will sound a single tone beep (i.e., beep on/beep off) for a duration of 10 seconds. You can choose to play the alert continuously. A prompt will appear on the screen display with instructions on how to silence the alert.

The alert is effective at all locations where the audible alert will be played (e.g., Nurses Station via the Central Monitor application). The locations at which the alert sounds can be silenced independently of any other locations (e.g., the alert can be silenced in the Patient's Room but left sounding in the Nurses Station). To silence the Alert, press the **F12** key on the keyboard.

NOTE: Dismissing any visual alert dialog at any location will also cancel the continuous audible alert.

Event Type editor

Recorder and Reader Use the Event Type Editor (click **Events** in the **Settings** window) to create, edit or delete custom events. New events are added to the configuration database where they are available for use in event palettes. Each event contains user-specified characteristics that aid in locating and sorting placed events. There is also a space to type in a description that can be used for reference.

Display the Event Type Editor panel

1. See *Using the Settings Editor* earlier in this chapter.

Creating a new event type

2. Click the **New** button.

3. Type in a new **name** for the event (8 letters or less).

4. Click on the **Color** show menu button and then click on the **color** with which you want the Event Marker displayed.

5. Click on the **Category** show menu button and then click on the **category** you want assigned to the new event. Events can be sorted and filtered in the Reader by category using the Event Filter pane in the Control Panel.

Also See: *Event Filter* in the *Reader* chapter for more information on filtering events).

6. Click on the **Priority field** show menu button and then click on the desired priority. Events can be sorted and filtered in the Reader by priority using the Event Filter pane in the Control Panel.

7. When using the Quick Insert feature for inserting events on the EEG, you can place the assigned Duration event at a predefined default duration using a single click.

   a. From the Event Types list, select the **duration event** to which you want to assign a duration.

   b. Enter the default **duration** (in seconds) into the Quick Insert Duration box.

8. The **Predefined** checkbox is disabled because the selected event has been defined by the NicoletOne system.

9. Checkmark the **Changeable** checkbox if you want to allow the newly created event to be moved or deleted after it has been placed on the EEG display.

10. Checkmark the **Duration Event** checkbox if the event lasts over a period of time, such as a seizure.

11. Checkmark the **Annotation Event** if you want the Annotation dialog box to appear automatically when you place the selected Event Marker on the EEG.

12. If you do not want the default description, type in your own **description** of the event, which is displayed in a popup window when the mouse pointer is hovered over the

    Event Marker in the Event Palette .

13. Checkmark the **Context Event** checkbox if you want the events to preserve the recorder settings when the events are placed .

    IMPORTANT: Enabling Context Event increases the storage requirements significantly.

14. Click **Save**.

15. Click **Close**.

Creating Context Events

You can create events that preserve the recorder settings when the events are placed (similar as for the Box Cursor, Frequency Gradicule, and Paper Clip event types).

Context events preserve the recorder settings when those events are placed.

Once a context maker has been placed on the EEG, it will always remain as a context marker, even after turning context off for that marker.

Likewise, a noncontext marker placed on the EEG will always remain as a noncontext marker, even after if you turn that marker into a context marker.

1. Display the **Event Type Editor** panel. See *Using the Settings Editor* earlier in this chapter.
2. Select the **Event Type** you want to turn into a Context Event.
3. Checkmark the **Context Event** checkbox.
4. Click **Save**.
5. Click **Close**.

IMPORTANT: Enabling Context Event increases the storage requirements significantly.

Editing an Event Type

1. Select an **Event Type** from the list in the *Event Type Editor* panel.
2. While the **name** is highlighted, change the settings as previously described in *Creating a new event type*.
3. Click **Save**.

Renaming an Event Type

1. Highlight the **Event Type** in the list in the *Event Type Editor* panel.
2. Click on the **Rename** A icon and type in the new **name**.
3. Click **Save**.

Deleting an Event Type

NOTE: The system comes with pre-defined events, which can be edited but not deleted.

Event Palette editor

Recorder and Reader   An event palette is a set of events available to you in a recording session. A palette can contain any number of events from the configuration database (see *Editing events*, above, to add new events to the database), and individual events can be used in more than one palette.

Display the Event Palette Editor panel

See *Using the Settings Editor* earlier in this chapter.

Creating a new event palette

1. Click the **New** 📄 icon.
   - or -

   Click on the **template** you want to edit and then click on **Duplicate** 📄.
2. Type in a new **name** for the palette.
3. Select an **event** from the list of available events.

NOTE: To select multiple Events, hold down the **Shift** key or **Ctrl** key on the keyboard while making your selections.

---

4. Click the ⟫ button to move the selected events to the *Event Type in Palette* list.
5. When finished creating the palette, click the **Save** button to save the changes.

NOTE: The two Description fields are defined in the Events Type Editor.

Changing the event size

1. Select the **size** with which you want event to be displayed in the Event Palette from the Event Size list box.

Assigning event shortcuts

Shortcut keys are assigned according to the order of the Event in the Palette. The first event has the shortcut key **F3**, the second **F4** until **F10**, then **SHIFT** + **F2** to **SHIFT** + **F12**. If there are more than 19 events in the Palette, these Events have no shortcut key assigned to them.

Reordering the event list	1. Highlight the **Event Type** in the Event Types in Palette list you want to relocate.
	2. Click on the **Up** or **Down** buttons to move the selected Event Type.

Adding/ deleting events the Event palette	1. Highlight the **name** in the Palettes list.
	2. To **add new events** to the palette, select them from the Event Types in Palette list, and click the **>>** button.
	3. To **remove events** from the palette, select them from the Event Types in Palette list, and click the **<<** button.
	4. Click **Save**.

View Settings editor

Recorder and Reader   This dialog is used to change the appearance of the trace display of the Recorder and
                          Reader panes.

Display the View Settings Editor panel

1. See *Using the Settings Editor* earlier in this chapter.

Timebase

2. Choose between **millimeters per second** or **seconds per screen**.

Page Color

3. Click to select a **background color** from the list, or to create your own custom background color.
4. Label Bar
5. Check the **Label Bar** checkbox to display the trace label background bar on the left side of the EEG display.

Event Palette

6. Check the **Event Palette** checkbox to display the list of events on the right side of the EEG display from which you can choose to mark the EEG.

NOTE: You can also click on **View > Event Palette** to display/remove the Event Palette.

Montage Name As Watermark

7. Check the **Montage Name As Watermark** checkbox to display the current montage in the background of the EEG display.
8. Check the **Events to Top** checkbox if you want the Event markers displayed on top of the EEG trace. This will hide that portion of the trace on which the Event Marker rests. Unchecking the checkbox moves the Event Marker behind the trace allowing you to view the whole EEG trace.

Lock Display to Epoch

Check the Lock Display to Epoch to lock the Reader EEG display to the epoch.

9. Check the **Lock Display to Epoch** to lock the Reader EEG display to the epoch.

Show Sleep
Stage

1. Click the **Show Sleep Stage** to view the sleep stages.

Sleep Stage
Style

1. Check the **Show Sleep Stage** checkbox to display the Sleep Stages as they occur.
2. Click on the Sleep stage style box and choose whether you want the Sleep Stage displayed centered as a watermark on the EEG display or displayed at the bottom of

Previous Epoch   Current Epoch   Subsequent Epoch

W PRONE 4   1 PRONE 5   2 PRONE 6

Centered   Bottom

the EEG display.

Also See:*Sleep Stage Styles* in the Sleep Analysis chapter for additional information regarding this option.

Gridlines

The first list is to select the **number of seconds between each major gridline**. The second list is to select the **number of minor gridlines between each major gridlines**.

1. Click on the **Seconds between major gridlines** box and enter the time period between the gridlines.
2. Click on the **Minor gridlines between major gridlines** Up/Down arrow buttons to choose how many gridlines you want displayed between the Major gridlines (or type in the number).
3. Choose a **style** and **color** for the major and minor gridlines.
4. Click **Save**.

Detections Settings editor

Recorder and Reader   Use the *Detection Settings* Editor panel to configure which detections you want the recorder to perform during recording.

Display the
Detections
Settings Editor
panel

1. See *Using the Settings Editor* earlier in this chapter.

Creating a new
Detection
template

2. Click the **New** .
    - or -

    Click on the **template** you want to edit and then click on **Duplicate** .

3. Select the **detections** you want included in the template by checking the checkboxes on the Detections list.

4. To adjust the settings for each detection type, checkmark the desired **Detections** label.

5. Fill in the settings in the box on the right side of the dialog.

6. Choose a **montage** from the list, or checkmark **Use Display Montage**.

7. Click **Save**.

Reordering the
Detection
templates list

You can move the new template to the desired location in the Detection Templates list.

1. Click on the **template** you want to move.

2. Click on the **Move Up** or **Move Down** ↑ ↓ icon.

PLM (Periodic Limb Movement) and PLMA (Periodic Limb Movement with Arousal)

The default settings are:

Parameter	Default
Channels	empty
Amplitude Threshold	3
Minimum Limb Movement Duration	.05 seconds
Maximum Limb Movement Duration	5 seconds
Maximum Limb Movements in Series	4
Minimum Duration Between Movement in Series	4 seconds
Maximum Duration Between Movement in Series	90 seconds

Sleep Staging

The default settings are:

Parameter	Active Default	Reference Default
Model File	empty	
Use Default Channels	Checked	
EEG Channel	empty	empty
EEG Channel 1	empty	empty
EEG Channel 2	empty	empty
EMG	empty	N/A
Threshold	65	6.5

Body Position

The default settings are:

Parameter	Default
Prone Level	12700 uV
Supine level	10100 uV
Left Level	7320 uV
Right Level	14700 uV
Upright Level	4940 uV
Minimum Duration	10 seconds

Heart rate detection

The first channel of type PULSE is used in Heart Rate detection. The pulse rate is based on values (beats per minute) from a sensor of type PULSE (digital heart rate sensor). A Bradycardia duration event is opened when the rate drops below the threshold specified in the Heart Rate settings (default 50 bpm) and closed if the rate exceeds that threshold again. The same applies to the Tachycardia event (default 120 bpm).

The range for both Bradycardia and Tachycardia is 1 to 255 bpm.

Exception: Heart Rate Detection is not available in vEEG.

The default settings are:

Parameter	Default
Bradycardia	50 bpm
Tachycardia	120 bpm

Spike
detection

Spike and Sharp Waves (SSW) are detected through a sequential pattern recognition technique. The signal is first broken down into simple sections. A test of these allows for the initial rejection of a large proportion of the data (the rejected sections have a high probability of not containing any epileptic activity). The sections that are kept are tested in a more refined matter and possibly rejected. The analysis proceeds in this fashion, making more and more refined measurements on less and less data. This allows for both fast processing and detailed analysis of meaningful sections.

The Spike detection inserts a Spike event for those traces that form SSW conforming to the parameters specified in the Spike settings. The traces immediately become highlighted.

Exception: Spike and Seizure detections are optional features.

The default settings are:

Parameter	Default
Amplitude Threshold	4
Minimum Duration	35 Milliseconds
Spike Sensitivity	50

Desaturation detection

A slight decrease in alveolar ventilation is normal during sleep, manifested as a 5- to 6-mm Hg increase in Pa_{CO2} and a slightly greater decrease in Pa_{O2}. These changes are greater in patients with COPD than in healthy persons. In many COPD patients, Pa_{O2} during the awake state is on the shoulder of the oxyhemoglobin dissociation curve, so O_2 desaturation during sleep is much greater than in healthy persons. The decrease in Pa_{O2} level is greatest during rapid eye movement (REM) sleep, especially as the night progresses, perhaps due to retention of secretions and worsening of ventilation/perfusion relationships. Patients with COPD may have hypopnea, but episodes of apnea are no more common than in healthy persons. The quality of sleep is impaired. Severe nocturnal hypoxemia is associated with erythrocytosis, pulmonary hypertension, and an increase in ventricular ectopy, with ECG changes (i.e., prolonged QT interval, ST-T depression, and bundle branch block).

The default settings are:

Parameter	Default
Minimum Fall	2%
Max. Secs. in Fall	120 seconds
Max. Secs. Stopped	20 seconds
Minimum Fall Rate	0.1%/second
Maximum Fall Rate	5%/second
Minimum Rise Rate	1%/second
Maximum Rise Rate	5%/second

Apnea detection

Sleep apnea can be obstructive (upper airway blockage despite airflow drive), central (decreased respiratory center output), or mixed. The most common cause is airway obstruction. Rarely, sleep apnea is due to primary brain stem medullary failure caused by neurologic medullary depression, which may result from poliomyelitis, tumors of the posterior fossa, or Ondine's curse--idiopathic failure of central (brain stem) breathing control in which patients may breathe insufficiently or not at all except when fully awake. Mixed apnea starts as central apnea, quickly followed by thoracoabdominal movements and upper airway obstruction. Mixed apnea occurs more often than central but less often than obstructive apnea.

The default settings are:

Parameter	Default
Minimum Duration	10 seconds
Apnea Threshold	20%
Hypopnea Threshold	50%
Airflow Channel	Airflow
Use respiratory effort to discriminate between obstructive, mixed and central apneas	Checked
Respiratory Effort	Chest
Use SaO2 with detection	Unchecked
Desatruration occurs within	no value
Minimum desaturation	no value

Burst Suppression detection

A burst fulfills all of the seizure pattern detection criteria, but the EEG following the burst is very similar to the EEG preceding the burst. Bursts are typically not wanted.

The default settings are:

Parameter	State	Default
Suppressed EEG	On	95%
High Burst Rate	On	8 brst/min
Low Burst Rate	On	2 brst/min
IBI	On	30 sec

Seizure detection

This detection is used to identify seizures that include sustained paroxysmal rhythmic activity (SPRA) with a fundamental frequency between 3 Hz and 20 Hz.When a seizure is detected that conforms to the parameters specified in the Seizure Detection settings, a duration event is inserted automatically into the recording for the duration of the detection.

The default settings are:

Parameter	Default
Amplitude Threshold	4
Max. Frequency	20 Hz
Min Frequency	3.4 Hz
Max. Coeff of Variation	60%
Epoch Length	2 Seconds

| Threshold detection | This detection occurs when the threshold of a specified channel meets the parameters you select on the Threshold Detection palette. |

Parameter	Function
Sensor	Defines which input channel you want to monitor.
Lower Bound	Lower threshold level. When the signal rises over that value, the selected event will be inserted into the recording.
Upper Bound	Upper threshold level. When the signal drops below that value, the selected event will be inserted into the recording.
Minimum Duration	The length of time that the signal must stay between the Lower and Upper Bounds to qualify as a valid threshold detection.
Event Type	The type of event you want inserted when a Threshold Detection is qualified as valid.

1. Click on the **Sensor** show menu ▼ button and then click on the **Sensor** you want to monitor.

   - or -

   Type in the **Sensor** you want to monitor**.**

2. Type in the **Lower boundary** and **Upper boundary** values. You may also select to use the moving average.

3. Click on the **Event Type** show menu ▼ button.

4. Click on the **type of event** you want inserted into the recording.

5. Click **Add** to add this threshold detection parameters to the template.

6. Repeat *steps 2 through 5* as necessary.

7. Click **OK**.

Frequency Analysis editor

Recorder and Reader

Display the Frequency Analysis Editor panel	1. See *Using the Settings Editor* earlier in this chapter.

Editing the Frequency Analysis Editor	2. Select a **Frequency Resolution**.
	3. Select a **Spectral Edge percentage**. See below for information.
	4. Select a **Detrend Setting**.
	5. Select a **Window Type**. See below for information.

The power spectrum of the data is calculated using **Fast Fourier Transformation** [FFT].

Also See: *Performing Measurements* chapter.

Spectral Edge percentage	The EEG is divided into data blocks. Each data block is transformed individually. The overall spectrum is calculated by averaging the spectrum from each block. Large blocks give higher frequency resolution, but small blocks give more accurate results.

Window type	Several window types are supported, including Parzen, Hanning, Hamming, Exact Blackman, Rectangular, and Welch.

Overlap Blocks	If the **Overlap Blocks** option is selected, the blocks overlap by half to help reduce noise in the results.

Frequency bands	The default values are shown in the *Frequency Analysis* Editor panel.
	1. Tab to scroll through the table to edit the settings **- or -** Double-click on the setting you want to edit.
	2. Click **Save**.

Miscellaneous Settings editor

*Recorder only with
exceptions*

**Display the
Miscellaneous
Settings Editor
panel**

1. See *Using the Settings Editor* earlier in this chapter.

**Test
Impedance on
Montage
Change**

2. Check the **Automatic Impedance Test on Montage Change** checkbox to test the
    electrode impedances each time you change to a different Montage.

**Continuous
Electrode Test**

3. Check the **Continuous Electrode Test** checkbox to check impedance continuously
    during a recording.
4. Enter the maximum **Interference Tolerance** limit in uV.

Also See: *Continuous Electrode Test* in the *Recorder* chapter.

File Settings

5. Choose the desired **file type** from the File Format drop-down list.

Splitting long recordings into multiple files (optional)

You can split the recording into multiple files at a specified time every 24 hours or at the end of a specified file duration.

Splitting the recording at a specified file duration

    a. Click on the **Maximum File Duration** radio button.

    b. Select the **file duration** after which that file will be closed and a new file will record the EEG/Video.

    c. Click **Save**.

    d. Click **Close**.

Splitting the recording at a specified time

    a. Click on the **Start New File** at radio button.

    b. Select the **time of day** (AM or PM) that you want to close the current file and create a new file to record the EEG/Video.

    c. Click **Save**.

    d. Click **Close**.

Sleep Settings

6. Click on the **Sleep Study** checkbox to perform a Sleep Study.

Recorder and Reader   7. Click on either **Adult** or **Infant** buttons to choose the sleep staging.

Recorder and Reader   8. If you want to reorganize the sequence with which the stages are listed, highlight the **stage** you want to move in the list and then click on the **Up** or **Down** buttons as necessary to arrange them in the desired order.

Recorder and Reader   9. Click on the **Use PLM Counter** to enable the PLM (Periodic Limb Movement) and PLMA (Periodic Limb Movement with Arousal) counter.

Recorder only   10. Click on **Score in Review Pane** to enable scoring.

NOTE: For **Manual** scoring, the following controls are activated. See the *Using the Control Panel* chapter.

ADULT		INFANT	
M W R 1 2 3 4		M W A1 A2 I Q	
? ⊕ ⇦ ⇨ 🔒		? ⊕ ⇦ ⇨ 🔒	
M	Movement	**M**	Movement
W	Awake	**W**	Awake
R	REM	**A1**	Active after wakefulness
1	Stage 1	**A2**	Active after quiet sleep
2	Stage 2	**I**	Indeterminate
3	Stage 3	**Q**	Quiet
4	Stage 4	**?**	Unsure
?	Unsure		

Prune Settings editor

Recorder and Reader   You can prune EEG (in Reader or from the Reader pane on the Recorder window) down to the events and/or the part that you would like to keep. The selected Prune Template will be the one used when pruning a test with the **Prune Preview** command on the **View** menu or the **Prune** toolbar button.

Display the Miscellaneous Settings Editor panel

1. See *Using the Settings Editor* earlier in this chapter.

Creating a new Prune template

2. Click the **New** .

   - or -

   Click on the **template** you want to edit and then click on **Duplicate** .

3. Type in a **name** for the new template.

4. If desired, check **Prune Video Only** to keep all EEG traces.

5. Select **events** that you want to keep from the event list on the left and move them to the list on the right using the **right arrow** button (remove them again using the **left arrow** button).

6. Select an **event** in the right event list to fill in how many seconds before and after the event you want to keep in the pruned recording.

7. Click **Save** to save the changes.

Annotating Prune markers

Also See: *Annotating Prune Markers* in the Marking and Annotating chapter.

Organize Protocol editor

Recorder and Read with exceptions

The Protocol can consist of the following:

Item	Recorder	Reader
Event Palette	X	X
Montage Set	X	X
Montage	X	X
Trend Template (option)	X	X
Photic Sequence	X	
Detection Template (option)	X	
Prune Template		X

Display the Organize Protocol Settings Editor panel

1. See *Using the Settings Editor* earlier in this chapter.

Creating a new protocol

2. Click **New** . An empty table appears, which you will fill in now.
   - or -

   Click on the **template** you want to edit and then click on **Duplicate** .

3. Type in the desired **label** for the new protocol.

Selecting the amplifier type

Recorder only

4. Click on the **Amplifier Type** list box.

5. Click on the **amplifier type** you will be using to acquire data.

Setting up Vital Signs

Recorder only

Exceptions	⚠ **WARNING** Vital Signs coming from Intellivue must be used **only on a Panel PC**.
Display the Organize Protocol Settings Editor panel	1. See *Using the Settings Editor* earlier in this chapter.
Create the Vital Signs settings	2. Click on the **Monitor** show menu ▾ button.
	3. Click on the **Monitor** you will be using.
	4. Click on the input's **On** checkbox to enable that input.
	5. Double-click on the **Sensor field**.
	6. Click on the **Sensor field** show ▾ menu button.
	7. Click on the **Sensor** you want to use for that input.
	8. Click on the **Sampling Rate** to accept the system default.
	9. Repeat steps 4 through 8 for each remaining input you want to use.
	10. Click **Save**.

Options dialog

Recorder and Read with exceptions

You can select various program-wide settings from a single dialog box.

Display the Options dialog

Recorder and Reader

1. Click on **Tools > Options** to open the **Options** dialog.

Miscellaneous tab

1. Make the following settings/selections as desired.
   - Envelope Trend - Amplitude Profile Level
   - Reports - Use Microsoft Word for report editing
   - Lock Computer - Block the display when computer is locked
   - SaO2 Threshold
   - Enable Multiple Sensor Groups
   - Use AASM sleep stages
   - Disable default sleep scoring
   - Enable Sleep Check Dialog
   - View the Patient Properties and Test Properties (Classic View) dialogs or the Exam Properties dialog (Tabbed View) from the **File** pulldown menu. See *Patient and Test Properties Dialog* in the **Shared Functions** chapter.

Frequency Graticule tab

Reader

1. Check the **All Graphs in one Window** to enable.

Screen Size tab

2. Open this tab to adjust your LCD monitor's horizontal/vertical ratio.

Regional tab

1. Select the **unit for Sensitivity** and **Low Cut filter**.
2. Choose the **Notch Frequency** in Hz.
3. Select **Weight & Height Units**.
4. Select **Language**.

Color coding tab

Color-coding defines the way numerical values are mapped to color. You can choose **color schemes** as well as the **beginning** and **end colors**.

The available color schemes are **Rainbow**, **Heat**, **Red-Blue**, and **Grayscale**. The Steps list box adjusts the amount of variation between the maximum and minimum colors.

Paths tab

Click on the Paths tab to define the destination paths for the:

- Report Templates
- Model Files
- Pruned Files
- NicVue only - Include patient name in folder names
- Remaining Data Info files

Display tab

Click on the **Display** tab to set up how you want various elements of the screen display to be applied:

- Event Marker Height
- Event Draw Mode (Fill, Border, Mixed, Text Only, Hide)
- Print Line weight (Normal, Dark, Darker, Darkest)
- High resolution for the trace display
- Place Events Between Signals (when checked, event markers are displayed half way between the trace and the previous trace)
- Label width
- Label font
- Use Fixed Font Size (checkmark and type in the font size with which you want the trace labels displayed. If unchecked, the system determines the best font size to use.)

Reader only
- Check the **Force Video During Fast Playback** checkbox if you want the video to display page-by-page in sync with the EEG during fast playback.
- To display the trends to the right of the EEG display, rather than above the EEG display, click on the **Right** radio button. Changing this setting requires a system restart to take effect.

Acquisition tab

Recorder only

NOTE: All edits on this tab require a Recorder program restart.

1. Click on the **DCM** show menu ▼ button and select the recording media.

2. Click on the **Path** Browse ⬚ button and select a **location** for the Recording Area.

3. Type in a **Default File Name**, which will be used if you do not enter a name.

4. Select a **Work Area**.

5. To record video even if the amplifier is disconnected, check the **Acquire video while amplifier is disconnected** checkbox.

6. Type in a value for the **Maximum EEG file size** (approximately 50 MB to 1,000,000 MB). When this value is reached, the file will close and a new file will take over recording.

7. To show the Impedance Test when the system is started, check the **Startup while in Impedance mode** checkbox.

NOTE: The **Startup** checkbox is not displayed/disabled if the Monitor is not licensed or you do not have Administrative privileges.

Powerloss Recovery tab

Recorder only

You can setup the system to alert a specified person upon the loss of power to the system.

1. Type in the **Domain** of the person you want notified.

2. Type in the **User Name**.

3. Type in the **Password**

4. Click on the **Enable Power Loss Recovery** checkbox to enable this feature.

12 Video

Legends

Note that in the left column you will see *Recorder, Reader, or Recorder and Reader*. These help identify whether the topic applies to the Recorder or Reader or both.

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Configuring the Video Camera

Your NicoletOne system can be configured with several different video cameras. You will need to select which one you are using as well as choose from several other options.

1. Click on **Video > Camera Selection**.

2. Click on the **radio button** corresponding to the video camera connected to your system.

3. Click on the **Primary Camera** show menu ▼ button.

NOTE: If a Panasonic camera was selected in step 2, the Primary Camera control will be disabled.

---

4. Click on the **primary camera** from the list of cameras on the network.

5. If the Sony camera is being used for ICU monitoring, check the **Invert Camera Controls** checkbox.

NOTE: If a Panasonic camera was selected in step 2, the Invert Camera Controls will be disabled.

---

6. Click **OK**.

Focusing the Panasonic box video camera after replacing it

If the Panasonic box video camera was replaced (or the camera requires refocusing), perform the following steps.

1. On the rear of the video camera, press and hold down the **ABF/Menu** button for at least 2 seconds.

2. Point the camera at an object approximately **10 feet** away.

3. Manually adjust the **Zoom** and **Focus** rings at the front of the camera lens for the best image.

4. Momentarily press the **ABF/Menu** button to auto focus the camera lens. The camera is now ready for use.

Video recording

Recorder

Digital video stored using the Selective Video feature is synchronized to its related EEG. You can specify the video duration before an event trigger as well as the duration after the event trigger.

If the amplifier is disconnected from the system, the digital video will continue recording. Either no EEG data will be displayed or the inputs will be displayed as flat lines to indicate no amplifier is connected to the system.

NOTE: The system must be recording and storing data to disk.

Also See: *Video Settings* in the *Edit Settings and Options Dialog* chapter for information on the *Video Editor* panel contents.

Starting synchronous video recordings

1. From the **View** menu, display the *Video* panel in the Control Panel at the right side of the screen display.

2. Click on the **Video** button [Video] .
    - or -
    Click on **Video > Save Video**.

NOTE: Click the **Video** button a second time to stop recording video.

3. Click on **Video > Save Video** to save the video whenever EEG is saved.

Adjusting the video parameters

1. Click on **Video > Video Source**.

    You can set the Video Source Control comprised of the Source (type of camera), Standard (European - PAL or American - NTSC). You can also set the Brightness, Contrast, Color Saturation, and Color Hue for the optimum video image recordings. Video already stored to disk will not be affected.

NOTE: These should not need to be changed after installation and setup.

Setting the Video Capture Format settings

1. Click on **Video > Format** to set the Capture Dimensions (if you want to flip the image) and choose the **Data Format/Compression** mode.

NOTE: These should not need to be changed after installation and setup.

| Video > Compression | 1. Click on **Video > Compression** to set up the Audio Format, Video Compression, and Video Configuration parameters. |

NOTE: These should not need to be changed after installation and setup.

| Video > Review Video | 1. Click on **Review Video** to display/hide the *Review Video* palette in the Control Panel display on the right side of the Recorder window. |

Zooming/ unzooming the video

You can zoom/unzoom the video digitally on the screen display.

1. Click on the image of the video you want to zoom; the selected portion of the image is centered in the palette and the image is enlarged. To return to the original unzoomed image, right-click on the video image.

- or -

Recorder

Click on the **Magnifying Glass** button and draw a box around the portion of the video image you want to enlarge; the selected image inside the box is enlarged. To return to the original unzoomed image, click on the Magnifying Glass button.

2. Repeat to zoom in again.

Selective video

Use **Selective Video** when you want to record video only when specific events occur (e.g., a seizure).

Recorder

Also See: *Video Settings* in the *Edit Settings and Options Dialog* chapter for information on specifying events.

1. Click on the **Selective** button Selective .

- or -

Click on **Video > Selective Video**.

Video capture

Recorder

Toolbar buttons

- Save Video.
- Selective video storage. Selective Video is available only if **Selective Video** is selected on the *Video Editor* panel (**Protocol > Settings > Video**).

Video menu

- Save Video
- Selective video storage
- Video Source (driver dialog)
- Video Format (driver dialog)
- Camera setup
- Compression
- Review Video

Pan/Tilt/Zoom functions

Recorder

If the Panasonic Pan/Tilt/Zoom camera is being used, the controls for Pan, Tilt and Zoom are available. This is in a form of a toolbar displayed below the Video window on the *Video* palette. This control toolbar is displayed as part of the video window, which is showing live (streaming) video from a data recording: i.e., a user performing remote review of video or remote control of the Recorder system, can control the cameras. When multiple video windows are open, control of the camera is given to the user that most recently activated the control.

The buttons are:
- **Left**: Turn camera eye counterclockwise.
- **Up**: Turn camera eye up.
- **Down**: Turn camera eye down.
- **Right**: Turn camera eye clockwise.
- **+Zoom in**.
- **-Zoom out**.

Dialogs   Most video drivers provide dialogs to adjust video settings. These dialogs are various depending on the driver. The driver can provide some (or all) of the following dialogs: *format*, *source* and *display*.

For example: Most format dialogs provide adjustments for

- Data format and/or compression mode (PAL8, RGBH, RGBT and others).
- Capture dimensions (160x120, 320x240,... and custom).

Source dialogs provide:

- Video source (composite, S-Video, MXC and others).
- Video standard (NTSC or PAL).
- Equipment (camera or VCR) and/or
- Picture adjustments (brightness, contrast... etc.).

The video capture feature provides a compression dialog containing:

- Video compression selection (codec installation dependent).
- Compression Quality (codec dependent, ≥ 0).
- Key frame selection (codec dependent, ≥ 0).
- Frame rate selection (15, 20, 25 or 30 fps).
- Configure button (compressor dependent).
- About button (compressor dependent).
- Audio format. All variations of the following:
    a. 8000, 11025, 22050 and 44100 Hz
    b. 8 or 16 bit
    c. Mono or Stereo

Video settings

Recorder   The video settings dialog provides the following features for the full video capture (not selective, see *Selective Video* for additional features):

- Type of video storage: No video, Full video, Selective Video.
- Setting the maximum file length in minutes (≥ 1).
- Various selective video settings.

Long time video recordings

Recorder   To prevent files from becoming too large after many hours of recording, the files are divided into smaller pieces (files). These files are, by default, approximately 15 minutes long, but the length can be changed. In long time recording, the time that it takes to end a recording on one file and start the next file takes a few seconds, but that, of course, depends on systems and compressors. The files are, by tradition, are named *nrvaxyzw.avi*, where x, y, z and w are hex numbers.

Video compression and capture rates

Recorder   Only the video part can be compressed with software and hardware compression. However, hardware compression and software compression cannot be used simultaneously. The **video capture default rate** is 25 frames per second (fps). The **audio capture default** rate is 44.100 kHz, 16 bit and in stereo - that's about 172 kb/sec.

Video Review

View > Overview > Video

Recorder and Reader

A horizontal line can be displayed in the Overview, which indicates video is being recorded or video is available for review. If the mouse is placed over the line, a tool tip appears displaying the start and duration of the video segment.

Video bar
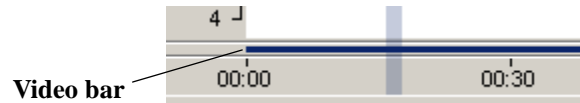
1. Click on **View > Overview > Video** to display the Video overview pane.

   - or -

   Right-click on a displayed **Overview** pane and then click on **Video** from the pop-up menu.

Paging speed and video

If the EEG playback speed exceeds the highest supported video play back speed, the video window will display the video frame at the position of the video cursor for the currently displayed page.

The Review Progress bar

Reader

You can display a Reviewed Video bar and a Reviewed EEG bar to show which portions of the Video and EEG recordings have been reviewed. Sections of the Video Review Progress bar containing video is colored **white**; reviewed sections of the bar are colored **pink**. If you search to a page of EEG, a tick mark is placed at the location of the static video frame on the Review Vidio bar.

1. Click on **View > Overview > Review Progress > Show**.

To reset the Reviewed Video and Reviewed EEG bar to the <u>not</u> reviewed state:

1. Click on **View > Overview > Review Progress > Reset**.

The Video Review Palette

Displaying the Video Panel

1. Click on the **Panel** [Panel] button on the toolbar.

   - or -

   Click on **View > Panel > Show**.

Displaying the Video Reader Palette

2. Click on **View > Panel** > **Review Video** from the menu.

The *Review Video* palette appears, which can be used immediately for reviewing recorded video while still actively recording the patient. The buttons along the bottom of the *Review Video* palette represent (from left to right):

Stop, **Play**, **Step Back One Frame**, **Step Forward One Frame**, **Zoom In** by dragging a selected area, and a slider (if the *Review Video* palette is floating and enlarged) to change the **Review Speed** by dragging the slider bar right to increase the speed or left to decrease the speed.

Normal palette controls   Floating and enlarged palette controls

If the *Video* palette is floating, drag a corner of the *Video* palette to resize it as desired.

Also See: The *Using the Control Panel* chapter for instructions on floating a palette.

You can scroll to a specific point in the video by dragging the vertical time marker to a point on the trace display.

1. Choose **Tools > Vertical Marker** to display the marker. When the video is played, the Vertical Marker moves along the trace display in sync.

Toggling the Video Review between floating and fixed

Click on the **Video** ![Video button] button to toggle between a docked *Video Review* palette in the Control Panel and a floating *Video Review* palette located and sized the same as when the palette was docked back into the Control Panel.

Lock Step Video

The recorded video will be displayed in either of two modes as determined by the system. The video can be played forward or backwards.

- **Full motion** video synchronized with the recorded EEG.
  The system chooses this mode when the EEG playback is at a rate **less than or equal** to the fastest full motion playback speed of the video.

- **Single frame** of video per page.
  The system chooses this mode when the EEG playback rate **exceeds** the maximum full motion playback speed of the video.

NOTE: The audio portion of the recorded video will play back only at **1X** or **2X** forward playback speed.

Remote Video

Remote video is available in remote control and online review (only if video is being recorded on the Recorder system). A new panel item is added to the Reader and Remote Control Recorder systems when remote video is available. A **Video** button and **Video** menu are enabled in the Remote Control Recorder system.

NOTE: Online Review and Remote Control of Video is enabled only if the test is opened from NicVue or Study Room.

Toolbar buttons

- **Save Video** (Remote control Recording)
- **Selective Video Storage** (Remote control Recording

One of three selections is available: **No video**, **Save Video** and **Selective Video**. Selective Video is only available if the selected video scheme is of the **Selective Video** type.

Also See: *Video Capture* for more details.

Video preview palette

Video preview is a *Panel* palette. The *Video* palette is visible if and only if video was captured with the EEG. The size of the video image is width of the Panel times height, which is calculated from the ratio of the real video image size (most often 4:3).

NOTE: Online Review is only available if properly licensed on the Reader dongle.

Pan/Tilt/Zoom

The *Remote Video* panel item is named "Video" when in Remote Control and "Remote Video" when in Online Review.

Remote Video utilizes the camera control panel for **pan/tilt/zoom** controls (See *Video Capture*). When using a camera that does not have pan/tilt/ zoom possibilities, the pan/tilt/ zoom controls are disabled.

Video audio

When the **Audio** button is checked, the audio recorded by the Recorder system is played back on the remote computer, synchronized with the video image.

13 EEGToGo

Legend

This chapter is for Reader only.

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EEGToGo

EEGToGo lets you send an unlimited number of digital data files to other medical professionals without requiring any additional software on the destination computer. EEGToGo can be opened in Reader.

Basically, this software generates a single executable data file that contains both the raw data and a limited version of the Reader Software Package.

This package supports both digital EEG and digital video data files as well as copying original files or selections of a data file.

Requirements for use
Reader Software **MUST** be licensed on any computer that intends to have EEGToGo loaded.

| Features of EEGToGo files | The reviewer of an EEGToGo recording can: |

- Change settings for all of the channels; filter settings, sensitivities, number of channels displayed, timebase and montage.
- The EEGToGo recording may be registered with the NicVue database.
- Change settings for individual channels, which includes; the trace color, baseline, polarity, display type as well as the above changes.
- Have full control over paging or playing the EEG and Video.
- Limited patient information.
- View the Event List.
- Print Event list.
- Use cursors to make measurements.
- Print EEGToGo files from EEGToGo and from EEG Viewer.
- EEGToGo files can be opened in Reader.

Restriction of EEGToGo data files

- The EEGToGo recording can not be registered with the Study Room database.
- Detection software packages may not be used.
- Reporting is not possible.
- Full patient information and exam information is not available.
- Impedance may not be displayed.
- The EEGToGo file is a read only file and no changes can be saved to the file.

Installing EEGToGo

Creating a new
folder for
EEGToGo data
files

NOTE: It is recommended that a new folder and "short cut" icon be created on the Windows Desktop of the computer that will be generating the EEGToGo data files at the time of installation.

1. Click on the **Start > Programs > Accessories > Windows Explorer.**
2. Click on the **My Computer** folder.
3. Double-click on the **Local Disk (D:)** folder.
4. Double-click on the **Nicolet** folder.
5. Select **File > New > Folder**.
6. Name the new folder **EEGToGo**.

Creating a
shortcut for
EEGToGo data
files

1. Right-click on the **EEGToGo** folder.
2. Select **Create Shortcut**.
3. Right-click on the **shortcut folder** and select **Cut**.
4. Click the **Close** (**X**) button in the upper right corner of the Explorer window to close **Explorer** and then right-click on the **desktop**.
5. Select **Paste** and the shortcut will appear on the desktop.

Creating EEGToGo Data files

1. Open **NicVue**.

2. Double-click on the **exam**.

   - or -

   Highlight the **exam** and then click on **Exam > Review**.

3. Define segments of the recording using the **Prune** icon function, or go to step 4 if you are saving the entire data file.

4. Click on **File > Save to EEGToGo Archive**.

5. Select the **Nicolet** folder.

6. Double-click on the **EEGToGo** folder to open it.

7. Type in a **file name**.

8. You can choose to
   - Include Video
   - Remove Patient Information
   - Include Reports
   - Choose the Language
   - Register the file with NicVue
   - Password Protect

9. Click **Save**.

14 Sleep Analysis

Legends

Note that in the left column you will see *Recorder, Reader, or Recorder and Reader*. These help identify whether the topic applies to the Recorder or Reader or both.

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Introduction

NicoletOne has an option for a full-featured sleep analysis program including manual sleep staging, a range of automatic analyses, reports and calibration of external devices such as oximeters and CPAPs.

License required

A Natus Neurology Incorporated license is required to use the Sleep Analysis program.

Numerical displays

Recorder and Reader   You can choose to set the selected channel(s) to display only a trace, a trace with numerical values, or numerical values only.

Also See: *Shared Functions* chapter.

Sleep Stage styles

Recorder and Reader You can choose to display the Sleep Stage markers at the bottom (Figures 1 and 2) of the EEG display area or centered (Figures 3 and 4) in the Reader EEG display area.

Previous Epoch   **Current Epoch**   **Subsequent Epoch**
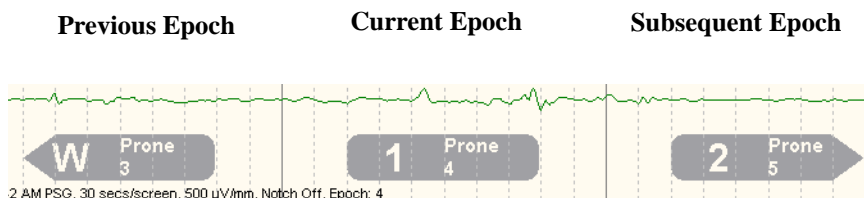
Figure 1: If there is not enough room to include information for the

and subsequent epochs, the arrow points are removed. The arrows are displayed only if the epoch boundary also lies on the displayed page boundary.

Sleep Stage   **Body**
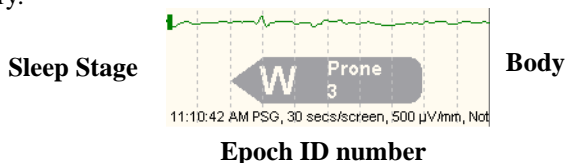
Epoch ID number

Figure 2: Sleep Stage markers styles when **Bottom** watermarks are selected.

Figure 3: Sleep Stage markers styles (M, W, R, 1, 2, 3, 4, and ?) when **Centered** watermarks are selected.
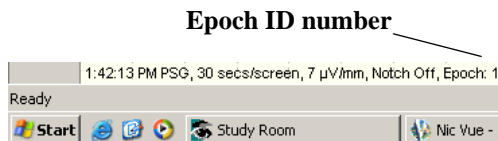
Epoch ID number

Figure 4: The Epoch ID number is displayed in the bottom left section of the EEG display when **Centered** is selected.

1. Click on the **Settings** ⊞ Settings icon or click on **Protocol > Settings** > **View**.
2. Click on the **Sleep Stage style** settings box.
3. Choose either **Bottom** or **Centered**.
4. Click **Save**.

NicoletOne body position calibration

Body position settings

The voltages for the body positions and the minimum duration for each position are user definable in the Detections Settings editor. The upper and lower limits (the midline between voltages) are then calculated for each position.

It is necessary to measure these values for each body position sensor:

1. Connect the sensor to the input you plan to use on the amplifier.

2. Enable the body position sensor in the Amplifier Setup editor for the input you plan to use.

3. Create a montage that includes the body position sensor and displays the values numerically.

4. Turn the sensor to each side and type in the output voltages in the Body Position Settings pane on the Detection Settings editor panel as appropriate.

Manual body position events

Body position events can also be inserted manually using Body Position event markers.

NicoletOne settings/calibrations

1. Connect the sensor.

   Plug the Body Position Phono into the amplifier transducer connector.

   - For V32, use the DC input on the amplifier labeled **Ch32**.
   - For C Series, the connector on the analog cable (085-461001) labeled **I/P 0-3**.The 3.5mm male will need to use the adapter cable (085-464300) for the interface into the BNC connector of the analog cable ("I/P 0-3").

2. Confirm the Body Position sensor **Name** and **Type** in the Sensor editor.

   a. Click on the **Settings** button.

   b. Click on **Sensors** at the bottom of the Editor panel.

   c. Confirm the sensor **Name** and **Type**.

SaO2	SaO2	🟩 Green	Unknown
Pulse	Pulse	🟩 Green	Unknown
Body Pos	Position	🟩 Green	Unknown
Photic	Photic	🟥 Red	Unknown
EVENT	Event	⬛ Black	Unknown

   d. Click **Save**.

3. Turn on the sensor input in the Amplifier editor panel.

V32 amplifier

   a. Click on **Amplifier** at the bottom of the Editor window.

   b. Click on the **VEEG 32** check box.

   c. Double-click on the **empty field** in the Sensor column to the right of the check box you just checked.

   d. Click on **Body Pos** from the drop-down menu.

   e. Click **Save**.

C-series amplifier

a. Click on **Amplifier** at the bottom of the Editor window.

b. Click on the DC input **AI 1**, **2**, **3**, or **4** check box for the Body Position cable connection. See the Cable Key below. It needs to match the same input connector on the cable (085-461001).

Cable Key	
I/F 0	AI 1
I/F 1	AI 2
I/F 2	AI 3
I/F 3	AI 4

c. Double-click on the **empty field** in the Sensor column to the right of the check box you just checked.

d. Click on **Body Pos** from the drop-down menu.

e. Click **Save**.

4. Add the body position channel in the Montage editor panel.

a. Click on **Montage** at the bottom of the Editor window.

b. Double-click on the empty field at the bottom of the **Active** column.

c. Click on the Show Menu ▼ button.

d. Click on **Body Pos**.

e. Click anywhere on the newly assigned **Body Position line**. If the Body Pos pop up does not appear, check the Body Pos **Special** checkbox and repeat this step.

f. On the Body Pos pop up, set the parameters as desired.

g. Click anywhere on the **Montage pane** to close the pop up.

h. Uncheck the Body Pos **Special** checkbox.

i. Click on the Body Pos. **Display Type** field and choose to display the output as numerical or as a trace.

j. Check or uncheck the Body Pos. **Special** checkbox as desired.

k. Click **Save**.

5. Enter the sensor's typical signal amplitude values and verify the output voltage.

   a. Click on **Detections** at the bottom of the Editor window.

   b. Click on **Sleep** in the Detection Templates pane.

   c. Click on **Body Position** in the Detections pane.

   d. Enter the **amplitude values** in the Body Position Settings pane.

   e. Click **Save**.

6. Verify the sleep positions.

   a. Turn the sensor to each side for the prone, supine, left, right and upright positions.

7. Connect the Airflow and Snore leads.

   a. Connect the **Airflow lead**s to the selected polygraph AC jackbox inputs.

   b. Connect the **Snore leads** to the selected polygraph AC jackbox inputs.

   c. Install the airflow sensor cannula onto the patient and insert the cannula tips into the nares.

   d. Place the cannula tubing over the patient's ears and chin.

   e. Slide the cinch tubing toward the neck to a comfortable fit and secure the cannula into position as needed using surgical tape.

It is extremely important that the cannula sensor tips do not become blocked off during installation or recording.

   f. Plug the sensor cannula safety filter into the input of the PTAF Lite sensor module with a slight twist to make a secure connection.

g. Adjust the polygraph settings as shown below. These settings are recommended starting points. Polygraph and patient variables can significantly influence the settings.

Polygraph & PTAF Lite settings	Airflow	Snore
High Frequency Filter	5Hz or higher	70Hz or higher
Low Frequency Filter (Time constant)	0.05Hz or lower (3 sec. or longer)	10Hz or lower (0.015 sec. or longer)
Sampling Rate	10 Hz or higher	70Hz or higher
Sensitivity	50uV/mm	50uV/mm
PTAF Lite Hi/Lo Switch	Adjust for optimal signal amplitude	Adjust for optimal signal amplitude
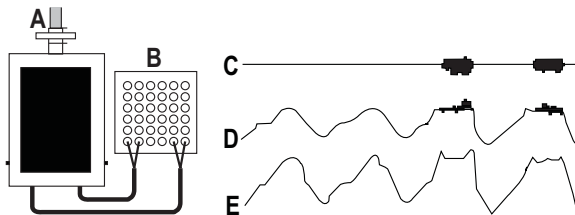
A: Input from filtered Airflow Sensor cannula.

B: Polygraph AC Input box.

C: Snore Output.

D: Airflow output, filtered to allow snore.

E: Airflow output, filtered to eliminate snore.

8. Select the desired **detections** and **parameters**.

   a. Make your selections from the Detection Settings editor.

   b. Click **Save**.

9. Select the desired **sleep staging**.

   a. Click on **Misc**. at the bottom of the Editor window.

   a. Select the desired sleep staging.

   b. Click **Save**.

10. Setup the **Review** and **Live** panes.

   a. Click on **View** at the bottom of the Editor window.

   b. From the View Settings editor, select the desired settings for both the **Review** and **Live** panes.

   c. Click **Save**.

   d. Click **Close**.

Sleep settings

Recorder and Reader   Sleep Settings are found in the **Miscellaneous Editor** panel.

1.   Click on the **Settings** Settings button in the toolbar.

   - or -

   Click on **Protocol > Settings**.

2.   Click on **Misc** at the bottom of the *Editor* panel.

Reader   ## Activating the Sleep mode

To enable the sleep scoring features, the Recorder must be in the Sleep Mode.

3.   Check the **Sleep Study** checkbox on the *Miscellaneous Edito*r panel to activate the sleep mode.

Recorder and Reader   ## Selecting AASM sleep stages
When enabled, AASM scoring is saved to the local machine registry.

1.   Click on **Tools > Options > Misc tab**.

2.   Click on **Use AASM sleep stages (Requires App Restart)**.

3.   Restart the NicoletOne application to activate AASM Sleep Stages.

   The AASM scoring is now functional with the Sleep Staging palette in the Control Panel, the Sleep Watermark and Hypnogram Overview.

Recorder and Reader ## Selecting Adult or Infant Sleep Stages

You can select whether to use **Adult** or **Infant Sleep Stage**. This will change the contents of the *Sleep Staging* panel. See *Selecting AASM sleep stages* to enable AASM sleep stages.

1. Click on **Settings** Settings .

2. Ensure **Sleep Study** is checked.

3. Click **Adult** or **Infant** as desired.

4. You can rearrange the order of the sleep stages by clicking on the **stage** you want to move and then clicking on the **Up** or **Down** buttons.

5. Check **Use PLM Counter** if desired.

Recorder only 6. Check **Score in Review Pane** if desired.

7. After making changes to the Sleep Settings, click **Save** to save the changes to the protocol.

Reader ## Convert to sleep

If the test was not in the Sleep Mode when a test was recorded, the test can still be scored in the Reader.

1. Click on **File > Convert to Sleep**.

Adult or Infant sleep stages

AASM Sleep Staging Support

AASM Sleep stages can be displayed in the Sleep Staging Palette in the Control Panel as listed below to meet AASM recommendations.

Adult: W, N1, N2, N3, R

Infant: W, N1, N2, N3, N, R
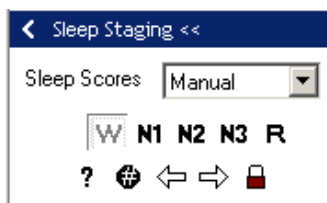
AASM Adult Sleep Staging   Previous Adult Sleep Staging
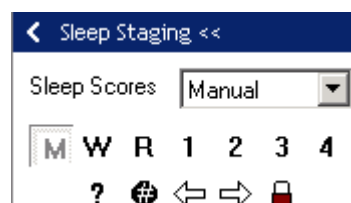
Adult Sleep Staging palettes
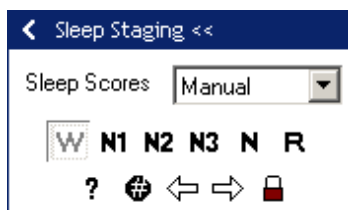
AASM Infant Sleep Staging   Previous Infant Sleep Staging
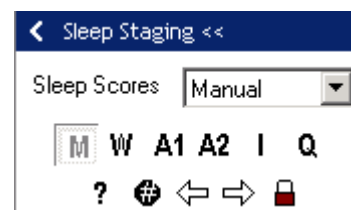
Infant Sleep Staging palettes

Requirements

- Sleep License

The AASM **adult and infant sleep stages** below are available in the Sleep Staging Palette in the Control Panel on the right side of the screen display.

Adult	AASM Adult Stage	Infant	AASM Infant Stage
W	Wake	W	Wake
N1	Non-REM 1 Sleep – R&K Stage 1	N1	Movement
N2	Non-REM 2 Sleep – R&K Stage 2	N2	Active after wakefulness
N3	Non-REM 3 Sleep – R&K Stages 3 & 4	N3	Active after quiet sleep
R	REM Sleep – R&K Stage REM	N	Indeterminate
?	Unsure	R	Quiet
		?	Unsure

Exams that have been scored with earlier (non-AASM) sleep stages are interpreted by the following current rules:

Earlier Adult	AASM Adult	Earlier Infant	AASM Infant
W	W	M	W
1	N1	W	W
2	N2	A1	N1
3	N3	A2	N2
4	N3	I	N
?	?	Q	R
		?	?

Sleep scoring

Recorder and Reader   NicoletOne is equipped to handle manual sleep scoring. A test can be scored while recording in real time and in the live Reader during split screen acquisition, or in Reader alone. The test can also be scored multiple times in the Nicolet Reader. Several sleep scores can be displayed simultaneously in a hypnogram overview.

Default Sleep Scoring Option

When enabled, Default Sleep Scoring uses the sleep score of the previous epoch for the sleep score of the current epoch when that epoch begins. When disabled, epochs that are being recorded assume a "?" score instead of the previous epoch's score.

Requirements

- Sleep License
- Exam recorded as a "Sleep" exam

⟨!⟩**CAUTION Once this feature is disabled, it can only be enabled again via the registery. Please be sure you want to disable this feature before continuing. If disabled and you want to enable it again, please DO NOT attempt to enable this feature yourself which may void your warranty; contact Natus neurology Incorporated Customer Support.**

Disabling Default Sleep Scoring

To disable Default Sleep Scoring:

1. Click on **Tools > Options**.
2. Check the **Disable default sleep scoring (Requires App Restart)** check box.
3. Close the NicoletOne application.
4. Restart the application.

Manual scoring in the Recorder

Scoring in the Recorder window also appears in the Reader window during split screen acquisiton.

To score the test manually in the Recorder:

1. Display the *Sleep Staging* panel (**View > Panel > Sleep Staging**).

2. Choose **Manual** from the Sleep Score list to score the test completely manually.

3. Press the appropriate **Sleep Stage** button to insert the sleep stage into the recording.

4. Use the **Pound Symbol** button to hide/show the sleep stage watermark in the Reader window.

5. The **Lock** button is used to lock the display to a single 30-second epoch.

6. Use the mouse or **Page Up/Page Down** to scroll the Reader window to the next or previous sleep stage.

The order in which the stage buttons are displayed on the panel is determined by the order you have chosen to display the sleep changes on the hypnogram screen display. See 'Hypnogram' later in this chapter for more information.

Shortcut keys

You can also use the **number keypad** on the keyboard to insert sleep stages. Following are the shortcut keys for the adult and infant sleep stages:

*   **Adults:** 0 = W, 1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = R, 6 = M, 9 =?
*   **Infants:** 0 = W, 6 = M, 1 = AS1, 2 = AS2, 3 = I, 4 = Q, 9 =?

Reader

Manual scoring in the Reader

Scoring in the Reader window also appears in the Recorder window during split screen acquisiton.

In the Nicolet Reader, the test can be manually scored multiple times. To create a new sleep score:

1. Open the *Sleep Score Manager* panel (**View > Panel > Sleep Score Manager**, or right click the **Panel** and choose **Sleep Score Manager** from the list).

2. Click the **New** icon (bottom left) and type a **name** for the sleep score.

3. Score the test as described earlier using the *Sleep Staging* panel or the corresponding **shortcut keys**.

NOTE: If the test was scored manually in the Recorder, the manual sleep score will be named "manual" when the test is opened in the Reader.

Reader

Comparing Hypnograms

In the Nicolet Reader, you can compare Hypnograms in the Overview.

1. Open the *Sleep Score Manager* panel (**View > Panel > Sleep Score Manager**, or right click the **Panel** and choose **Sleep Score Manager** from the list).

2. Check the **Compare Hypnograms** check box.

Reader

Filtering Events by the Scorer

In the Nicolet Reader, you can filter events according to a scorer.

1. Open the *Sleep Score Manager* panel (**View > Panel > Sleep Score Manager**, or right click the **Panel** and choose **Sleep Score Manager** from the list).

2. Check the **Filter Events by Scorer** check box.

Automatic detections

Recorder and Reader Parameters for the automatic analysis described in the following section are defined in the **Detections Settings** editor (**Protocol > Settings > Protocols**). Event Markers are inserted automatically into the trace display when one of the selected events occurs.

The available detections in the Detections Settings editor are listed below.

- PLM
- Body Position
- Heart Rate
- Spike
- Desaturation
- Apnea
- Burst Suppression
- Seizure

Displaying the *Detections Settings* editor panel

1. Click on the **Settings** button.

    - or -

    Click on **Protocol > Settings**.

2. Click on **Detections** located at the bottom of the *Editor* panel.

Enabling an automatic detection type

1. Click on the **checkbox** for detection type you want to enable.

    The checkmarks indicate which detections will be active in the currently selected Detections template.

2. Configure the individual settings for the selected detection type.

3. Repeat for each additional detection you want to enable.

Disabling an automatic detection type

1. Click on the Detection type's **checkbox** to remove the checkmark.

Apnea/Hypopnea

The system inserts apnea and hypopnea events automatically based on parameters that you define in the *Detections Settings* editor. If a respiratory effort sensor is used, the apnea/hypopnea is further classified as obstructive, central, or mixed.

NOTE: The respiratory effort signal must have the same sampling rate as the airflow signal.

Minimum Duration

The minimum duration in seconds of the apnea/hypopnea to trigger an event. Valid range is 1-120 seconds.

Apnea Threshold

The minimum percent of background amplitude that triggers an apnea event. Valid range is 1-98%.

Hypopnea Threshold

The minimum percent of background amplitude that trigger a hypopnea event. It must be larger than the apnea threshold and less than or equal to 99%.

Airflow Channel

Select the **sensor** used to record the airflow signal.

Respiratory Effort

Check the checkbox if respiratory effort is being recorded and select the relevant **sensor** used to record the respiratory effort signal.

SaO2 Association

Check the checkbox to mark apnea events only when desaturation occurs. Specify the **valid time limit** in seconds in which the desaturation should occur after the apnea begins. Specify the **valid percentage of desaturation** necessary to record the apnea.

Desaturation

The system detects desaturation from a SaO2 channel and inserts an event marker into the trace display (and into the Sleep Event Overview) for the duration of the desaturation. The following table shows the default parameters in the Detection Settings editor. These values can be adjusted by typing in a new value in the spaces provided.

Desaturation Settings	Default
Minimum Fall	2%
Max. Secs. in Fall	120 seconds
Max. Secs. Stopped	20 seconds
Minimum Fall Rate	0.1%/second
Maximum Fall Rate	5%/second
Minimum Rise Rate	1%/second
Maximum Rise Rate	5%/second

Recorder and Reader Heart rate

Bradycardia and Tachycardia events are detected from a Pulse sensor type obtained from a pulse oximeter or by calibrating a pulse sensor from an EKG signal. The Arrhythmia event uses a type R-R interval sensor. A duration event is automatically inserted for the duration of these events.

The following chart shows the default thresholds and the valid range for each event type:**n**

Heart Rate Event	Default Threshold	Valid Range
Bradycardia	50 bpm	1-255 bpm
Tachycardia	120 bpm	1-255 bpm
Arrhythmia3	30%	0-100%

NOTE: The value for bradycardia must be lower than the value for tachycardia.

Recorder and Reader PLM (Periodic Limb Movements)

Periodic Limb Movements are detected by a signal from a PLM sensor attached to the patient. A duration event is inserted for the duration of the detected movement.

Marking systems

Either the standard PLM marking system or the PLM Counter system can be selected for any sleep study.

PLM event markers are ignored when in the PLM Counter mode. Likewise, PLM Counters are ignored when in the Standard PLM marking mode.

PLM counter

You can increment/decrement a counter at the bottom of the *Sleep Staging* palette in the Control Panel on the right side of the EEG display for Periodic Limb Movement (PLM) events with arousal (PLMA) for each epoch in a sleep study.

1. Click on the **Settings** ⬚ Settings button.

    - or -

    Click on **Protocol > Settings**.

2. Click on **Misc** at the bottom of the *Editor* dialog.

3. Check the **Use PLM Counter** checkbox.

    The PLM and PLMA counters are now displayed on the Sleep Staging palette.

Adult Sleep Staging   Infant Sleep Staging
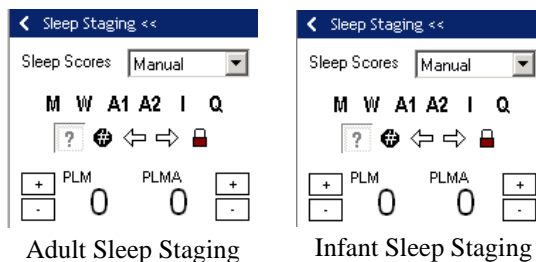
4. Click on the **+** or **-** buttons to increment or decrement the PLM and PLMA counters.

    - or -

    Left click on the PLM or PLMA **counter number** to increment the setting or right click on the **number** to decrement the setting.

PLM and PLMA Counter Sleep Stage Markers

The number of Periodic Limb Movement (PLM) and Periodic Limb Movement with associated Arousal (PLMA) events that occurred in each epoch are shown in the Sleep Stage Markers for that epoch and the Sleep Event Overview.

Epochs containing PLM or PLMA values greater than zero are represented by a vertical indicator bar on the Sleep Events Overview.

The Sleep Stage Markers and Sleep Events Overview displays update when the PLM or PLMA values are changed.

The number of events appears on the extreme right side of the Sleep Stage Markers as shown below.
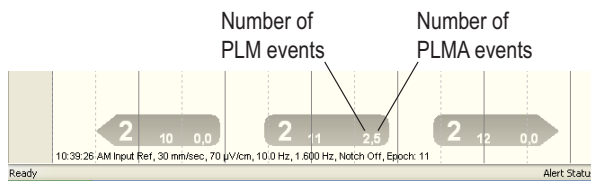
Additionally, each epoch is marked at its beginning in the Sleep Events overview if a PLM or PLMA event occurs during that epoch.

Recorder and Reader Requirements

- Sleep license
- Exam converted to or recorded as a "Sleep" exam

<table>
<tr><td>*Recorder and Reader*</td><td>Setting up the Sleep Stage markers</td></tr>
</table>

1. From the **Acquisition** window:

    a. Click on **Settings** .
    b. At the bottom of the Settings Editor panel, click on **Misc**.
    c. Check the **Use PLM Counter** and **Score in Review Pane** boxes.

2. From the **Review** window:

    a. Click on **Settings** .
    b. At the bottom of the Settings Editor panel, click on **View**.
    c. Check the **Show Sleep Stage** box.
    d. Click on the **Sleep Stage Style** show menu button and then click on **Bottom** from the drop down list.

<table>
<tr><td>*Recorder and Reader*</td><td>Display the Sleep Events Overview pane</td></tr>
</table>

To display the Sleep Events Overview pane in the Overview window,

1. Click on **View > Overview > Sleep Events**.

2. Repeat step 1 for any other Overview panes you may want displayed.

<table>
<tr><td>*Recorder and Reader*</td><td>Selecting the number of events for the current epoch</td></tr>
</table>

1. Display the **Sleep Staging** palette in the Control Panel (**View > Panel > Sleep Staging**).

2. Click on the + or **-** buttons until the desired **number of PLM and PLMA events** are selected.

    The Sleep Event markers and Overview update automatically.

AHI and RDI values

The system provides you with a value for the "running" AHI or RDI any time during the recording of a sleep exam. It will include all periods of data that have been staged.

• **AHI: Apnea/Hypopnea Index** - The number of apneas and hypopneas.

• **RDI: Respiratory Disturbance Index** - Includes all respiratory events.

The value for the running Apnea-Hypopnea Index reflects the data recorded throughout the entire sleep record, as defined by the current scoring criteria, up to the last completed and staged sleep epoch during data acquisition.

The AHI and RDI values are displayed in the Status Bar (RDI is illustrated below). The first value is for the non-treatment section and the value in parentheses is the value for the treatment section.
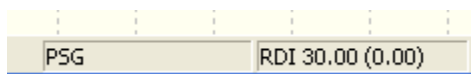
To enable the RDI (AHI) counters to display values other than (00.00),

1. Insert a **Start PSG** or a non-treatment (or treatment) event where the system should start counting apnea/hyperpnoea events.

2. Score the Sleep Hypnogram with epochs. Apneas are counted only from epochs, where the stage is 1, 2, 3, 4, R (REM), M (Movement).

3. Insert **Apnea** or **Hypopea event**s into the recording.

Default criteria

The default *Detection Settings* Editor criteria are shown in the following table.

Also See: *Edit Settings and Options Dialogs* chapter for instructions on how to display the *PLM Settings* pane.

PLM Settings	Default
Amplitude Threshold	3
Minimum Limb Movement Duration	0.5 seconds
Maximum Limb Movement Duration	5 seconds
Minimum Movements in Series	4
Minimum Duration Between Movements in Series	4 seconds
Maximum Duration Between Movements in Series	90 seconds

In this example, the signal is filtered using specially designed filters. Baseline amplitude is calculated using moving average. The algorithm waits for the amplitude to raise 3 times the value of the baseline amplitude (threshold) for at least 0.5 seconds and a maximum of 5 seconds (min/max limb movement duration). For a PLM to be marked, this must happen at least 4 times (minimum movement in series) for at least 4 seconds (minimum duration between movement in series), but no more than 90 seconds between bursts (maximum duration between movement in series). In this case all the detected bursts are marked with a PLM event.

Body position

The system supports DC body position sensors. These sensors give a different output voltage for different body positions. When body position is changed, one of the following events is inserted: Prone, Supine, Left, Right or Upright.

NOTE: Some body position sensors give greater output than the dynamic range of the Nicolet nEEG and LTM amplifier. In this case, use the **R1 input** on the side of the amplifier, which scales down the signal.

Body position settings

The voltages for the body positions and the minimum duration for each position are user definable in the Detections Settings editor. The upper and lower limits (the midline between voltages) are then calculated for each position. The following graphic shows the default values.

It is necessary to measure these values for each body position sensor. To do so, follow these steps:

1. Connect the **sensor** to the input you plan to use on the amplifier.
2. Enable the **body position sensor** in the *Amplifier Setup* editor on the input you plan to use.
3. Create a **montage** that includes the body position sensor and displays the values numerically.
4. Turn the **sensor** to each side and write the output voltage in the Body Position Settings window as appropriate.

Manual Body Position Events

Body position events can also be inserted manually using the **Body Position** event markers.

MSLT

Recorder

The *MSLT* palette (**View > Panel > MSLT**) is provided to assist Multiple Sleep Latency tests. It helps keep track of the time from Lights Off to Sleep Onset and from Sleep Onset to when the patient is woken up again.

- Click the **Light Bulb** icon to insert the Lights Off event and start the top timer.
- Click the **ZZZ** ᶻᶻᶻ icon to insert a Sleep Onset event and start the bottom timer.
- The **Reset** icon resets both clocks, making the system ready for the next nap.

The Lights Off event and the Sleep Onset event can be manually moved afterwards in the Reader pane or in the Reader application to ensure accurate results in the report.

Sleep overviews

Recorder and Reader   The system has several clickable overviews to graphically display the progress of sleep analysis over the entire recording or a selected duration. Following is a list of the available overviews:

Recorder and Reader   • Hypnogram

Recorder and Reader   • Body Position

Recorder and Reader   • Sleep Events

Recorder and Reader   • Manual Sleep Treatment

Recorder and Reader   • Manual 02

Reader   • SaO2

Reader   • Heart Rate

Reader   • CPAP

These overviews work just like other overviews in the system.

Also See: *Overview Window* chapter for full descriptions on the Sleep overviews.

Sleep treatment

Recorder PAP devices, such as CPAP (Continuous Positive Applied Pressure) and BiPAP (Bi-level Positive Airway Pressure), along with supplementary oxygen are used as a treatment for sleep apneas. Pressure is applied to the patient's mouth and nose to prevent apneas. CPAP/BiPAP titration is used to estimate how much pressure needs to be applied to prevent apneas. This is often done in split night studies, where the CPAP/BiPAP is only used during the latter half of the night and apnea frequency between the two halves is compared in the split night report.

Also See: *Sleep Reports* later in this chapter for more details.

Also See: *Using the Control Panel* chapter for instructions on displaying the Sleep Treatment palette.

NOTE: This feature requires the Sleep Option license.

Sleep Treatment palette

Recorder The Sleep Treatment palette is used to insert CPAP/BiPAP/EPAP and supplementary oxygen treatment into the recording. The inserted values are included in the sleep report.

Enabling the Sleep Treatment palette

Recorder To enable the *Sleep Treatment* panel, calculated channels for each treatment device must be defined in the *Calculated Channels* editor palette and added to the Protocol.

NOTE: Channels are already created by default in the PSG protocol.

Also See: *Calculated Channels* in the *Edit Settings and Options Dialog* chapter.

Inserting the Sleep Treatment channels

Recorder To insert the treatment channels into the recording:

5. If you need to change the value or turn off a treatment during the recording, select the **new value** (or **Off**).

Sleep treatment level displayed in the Sleep Watermark

Recorder The Sleep Treatment level, when inserted manually via the Sleep Treatment panel, is displayed in the Sleep Watermark.

Sleep Treatment values

Recorder The following value ranges are used in the *Sleep Treatment* panel:

- **CPAP, IPAP and EPAP**: The value range is 1 to 20 cm H20 in whole number increments, or Off.

- **O2 Supplementary Oxygen**: The value range is 0.5 to 5 in half number increments, or Off.

Editing manually entered Sleep Treatment values

The Reader and Recorder software allows you to change Sleep Treatment values that were entered manually while recording. This is useful if an error was made while entering the Sleep Treatment level because you can add, move or delete a value in Reader.

The following sleep treatment values, when entered manually, can be edited or deleted after they have been selected from the Sleep Treatment overview panel:

- CPAP
- O2
- IPAP
- EPAP
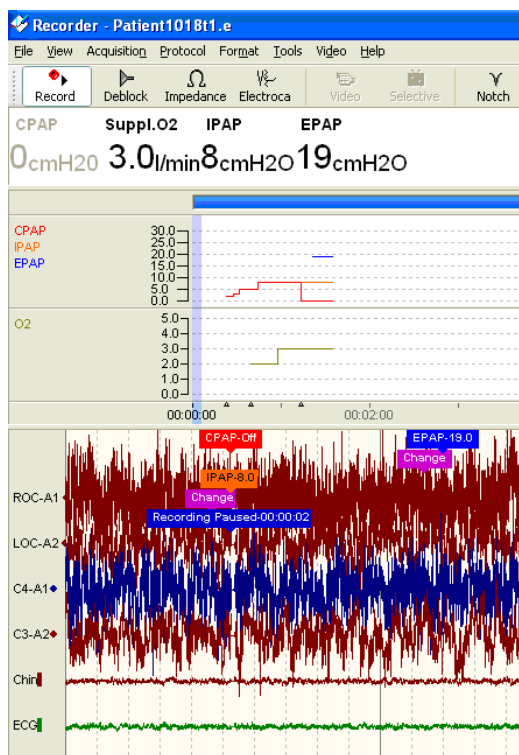
You cannot resize the Sleep Treatment overview panel vertically.

CPAP, **IPAP**, and **EPAP** are displayed on the same overview panel. Values are plotting using the same color with which the corresponding event displayed. The range of these three values in the overview panel is 0.0 to 30.0.

O2 is displayed on its own overview panel using the color with which the O2 event is displayed. The range of the O2 overview panel is 0.0 to 5.0.

Selecting a value from the Sleep Treatment panel inserts the corresponding event into the exam record.

1. To display the **CPAP**, **IPAP**, and **EPAP** overview panels, click on **View > Overview > Manual Sleep Treatment**.

2. To display the **O2** overview panel, click on **View > Overview > Manual O2**.

3. To edit a value stored in an event, right-click on a **CPAP**, **IPAP**, **EPAP**, or **O2** event and select **Edit Value** from the pop-up menu.

4. From the drop down menu, which contains the same values as the Sleep Treatment Panel for the corresponding treatment, edit the value as desired.

5. You can also delete a CPAP, IPAP, EPAP, or O2 event to remove a Sleep Treatment value.

NicoletOne

Auto-filling the Sleep Check panel

The Recorder can display the auto-fill Sleep Check panel automatically at a preset interval that allows the system to record the Sleep Check data to the exam recording. The fields are filled automatically when the panel is displayed.
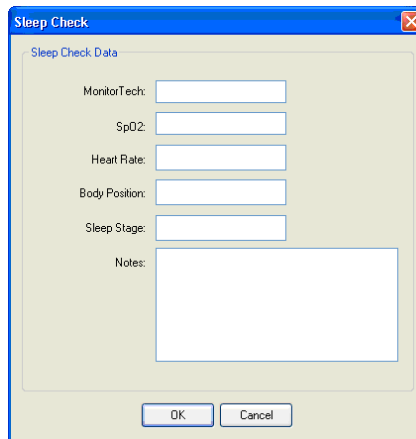
Requirements

- Sleep License
- Exam converted or recorded as a "Sleep" exam

Displaying the Sleep Check panel

1. Click on **Tools > Options**.

2. Click on the **Misc.** tab.

3. Check the **Enable Sleep Check Dialog every __ minutes** checkbox.

4. Type in how long an **interval** you want (in minutes) between the Sleep Check panel is displayed automatically.

   After the preset interval has elapsed, the system displays the Sleep Check panel.

                                                                                    2020-04-28

The Sleep Check panel has six edit boxes:

Edit boxes	The first five edit boxes are filled automatically by the following rules
MonitorTech	Initially blank and then filled with the last-entered text
SpO2	Min and Max values since the last check
Heart Rate	Min and Max values since the last check
Body Position	All positions since the last sleep check; positions separated by a comma
Sleep Stage	All sleep stages since the last sleep check
Notes	Manually filled with additional information/observations

You may edit the Edit boxes prior to inserting the Sleep Check data into the record.

Data inserted from the edit boxes is combined into the event's annotation field.

The duration of the Sleep Check event represents the latency between the time the Sleep Check panel is displayed and the time it is committed by clicking on the panel's **OK** button.

If the Sleep Check data is not committed before the next preset interval occurs, the newer Sleep Check form is discarded and the uncommitted form remains displayed.

1. To insert the Sleep Check data into the exam record, click on the **OK** button.

Sleep reports

The system generates six types of sleep reports, Comprehensive PSG, Concise PSG, Split Night, Polysomnography, Multiple Sleep Latency Test, and a Sleep Referral report.

The sleep report is generated from the Nicolet Reader by selecting the **report type** from the **Tools > Create Report** submenu. The report is automatically displayed in a separate Report Editor application. The report can be edited, saved to the patient's document folder or printed using standard file and edit menu items, or by pressing the toolbar buttons for these commands.

1.   Choose **Tools > Organize Reports** to view, edit, rename, or delete reports.

Sleep report events

There are two event markers, Start PSG and Stop PSG, that can be inserted into the recording to delineate the duration of the Comprehensive PSG, Concise PSG, Sleep Referral, and Split Night reports. To generate a Splite Night report, two sets of Start PSG and Stop PSG events must be inserted into the recording. To remove artifacts from the Heart Rate and SaO2 sections of the reports, place an artifact event over the sections of Heart Rate or SaO2 data that is not desired. The event must be placed over the Heart Rate or SaO2. See the following figure for an example.
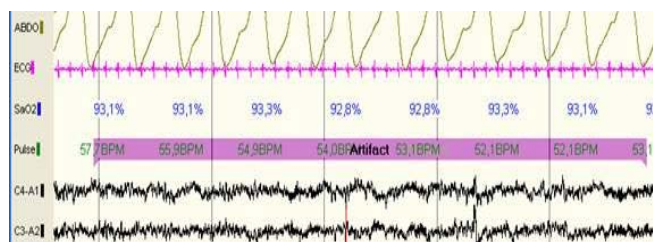
PSG report

The PSG report provides the following summaries:

- EtCO2 Summary, which includes End Tidal CO2
- Periodic Leg Movements Summary
- Sleep Treatment Summary

Polysomnography reports

The Polysomnography report provides the following summaries:
- Patient/Test Information
- Hypnogram
- Sleep Summary
- Sleep Stages
- Heart Rate Summary
- Respiratory Summary
- Respiratory – Sleep Stage
- Respiratory – Body Position
- Arousals
- SaO2 Summary
- SaO2 Statistics
- Summary
- Sleep Overview (image)

Multiple sleep latency reports

The MSLT report provides the following summaries:
- Patient/Test Information
- Number of Naps
- Min, max, and mean Sleep Latency
- Min, max, and mean REM Latency

For every nap:
- Sleep Latency
- REM Latency
- REM duration
- Number of REM episodes

Sleep referral

The Polysomnography report provides the following summaries:
- Patient/Test Information
- Hypnogram
- Sleep Summary
- Sleep Stages
- Conclusion (an editable area to be filled in after report generation)

External sensor calibration

In many cases the value of interest from the analog input is not the voltage. An example is oxygen saturation where the saturation is in percentages. To convert the voltage into the desired unit, it is necessary to provide the system with some information. This can be done manually by providing the **Conversion Factor** and **Offset** that satisfy the formula:

Value = Conversion factor x voltage + Offset

Where the voltage is in millivolts.

Example: An oximeter gives out 1000 mV for 100% and 0 mV for 80%. Then the conversion factor should be 0.02 and the offset 80%.

90% = 0.02%/mV x 500 mV + 80%

This can also been done in a semi-automatic way. Then the program, based on measurements, calculates the Conversion factor and offset. To calibrate a device, follow these steps:

1. Connect the device to one of the analog inputs on the interface board or a poly input on the amplifier.
2. Open the Sensor Editor and create a **new sensor** or select an **existing one**.
3. Click on the **Calibrate** button.
4. Select the appropriate **input** from the drop down list.
5. Check the **Assume Zero Offset** box if it is expected that 0 volts equals 0 units.
6. Configure the device for a high value output.
7. Press the **Read** button (under the High field) to input the voltage value into the system.
8. Enter the equivalent unit value for the device into the High field, e.g., the number of BPM for a heart rate device.
9. Repeat steps 6-8 for a low value if relevant (see step 5).
10. Click the **Update** button.
11. Click the **Save** button at the bottom of the *Sensor Editor* palette to save the new sensor with its calibrated settings.

Calculated Values

The Calculated Values panel displays several key values from the Comprehensive Polysomnography report, which are updated periodically while acquisition takes place. These values are helpful to sleep technicians for determining if and when to begin treatment (**View > Panel > Calculated Values**).

NOTE: Calculated Values was formerly labeled Apnea/Hypopnea Index.

Requirements

- Sleep License
- Exam recorded as a "Sleep" exam
- Recording has started, and a "Start PSG" event has been added to the exam.

The Calculated Panel allows the display of report values in Recorder. The following values can be included:

Calculated Panel Item	Description
AHI	The total number of Apneas or Hypopneas.
AHI – NREM, Back	The number of Apneas or Hypopneas during non-REM sleep, while in the supine position.
AHI – NREM, Off Back	The number of Apneas or Hypopneas during non-REM sleep, while not in the supine position.
AHI – REM, Back	The number of Apneas or Hypopneas during REM sleep, while in the supine position.
AHI – REM, Off Back	The number of Apneas or Hypopneas during REM sleep, while not in the supine position.
Arousals (breathing)/hr - RDI	The average number of breathing-related arousal events per hour.
Sleep Time (total)	Total minutes of sleep time computed from each scored epoch.
Sleep Time Back	Total minutes spent in the supine position.
Sleep Time OffBack	Total minutes spent in positions other than supine.
Sleep Time REM	Total minutes spent in REM sleep (stage R).

The Calculated Panel values are calculated identically to the corresponding Sleep Report values. The values update approximately every 30 seconds.

Inter-Rater Reliability (IRR) Analysis tools

Inter-Rater Reliability (IRR) is based on making a quantitative comparison between scorers of sleep diagnostic studies.

Requirements

- Sleep License
- Exam converted to or recorded as a "Sleep" exam

File export includes an option to export sleep study data to a Comma Separated Values (csv) formatted file.

You can choose which of the following items you want to include in the exported file.

- Sleep Epoch numbers
- Sleep Stage for each epoch (W, N1, N2, N3, R, 1, 2, 3, 4)
- Apneas (number per epoch)
  - Central
  - Mixed
  - Obstructed
  - Apnea
- Hypopneas (number per epoch)
  - Central
  - Mixed
  - Obstructed
  - Hypopnea
- RERAs (number per epoch)
- PLMs (number per epoch)
- PLMAs (number per epoch)
- LMs (number per epoch)
- Arousals (number per epoch)
  - General Arousal
  - Spontaneous Arousal
  - Arousal
- Desaturations

Marking events as Sleep Events

1. Click on **Protocol > Settings > Events**.

2. Click on the **Category** show menu ▼ button.

3. Click on **Sleep**.

4. Click on **OK**.

During export, there is an option to include or exclude each of the items listed earlier in the resulting file.

Events categorized as "Sleep Score" through the Events Settings Editor. Sleep Score events are associated with a sleep score session in the Sleep Score Manager. The active session at the time the event is inserted becomes the associated session.

Events generated by automatic detectors are associated to the "Automatic" sleep score session.

Events associated with a sleep score session are visible only if the associated session is the active session in the Sleep Score Manager.

PLM counters are optionally associated with sleep score sessions in the Sleep Score Manager.

Deleting a sleep score session from the Sleep Score Manager also deletes all of its associated events.

The following events are categorized as Sleep Score events:

Apnea	Centr Hypopnea	Mixed Apnea	PVC
Arousal	Desaturation	Mixed Hypopnea	RERA
Arrhythmia	Gen Arousal	Obstr Apnea	Spon Arousal
Bradycardia	Hypopnea	Obstr Hypopnea	Tachycardia
Centr Apnea	LM	PLM	

The currently selected Sleep Scorer is displayed in the Sleep Staging palette in the Control Panel and will not necessarily be highlighted on the Sleep Score Manager. When an event categorized as a Sleep Score event is added to an exam, it is associated with the currently selected sleep scorer. Switching from one scorer to another with hide/show events as appropriate if the **Filter Events by Scorer** check box is checked. If the Event Filter is set to hide all Sleep Score events, then all Sleep Score events will be hidden.

NOTE: Deleting a Sleep Scorer from the Sleep Score Manager will delete all Sleep Score events associated with that score. Merging exams will remove any associations between events and the scorers.

Exporting Sleep Study data to a CSV file

1. Click on **File > Export** to display the Export dialog.
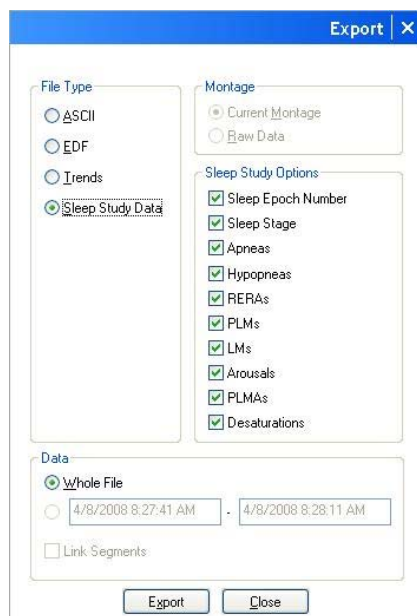
2. Click on the **Sleep Study Data** radio button.

3. Check each Sleep Study Option for which you want that data to be included in the Comma Separated Values (csv) formatted export file.

4. Click on **Export**.

15

EEG Viewer

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EEG Viewer

The EEG Viewer is a simple EEG Reader program intended to be distributed freely. It has very limited functionality compared to the Reader.

The functionality is:

- Reader EEG files. Automatic Paging and Manual Paging.
- Reader EEG in different Montages. Montage selection is limited to the Montage Set used during a recording. Files recorded with previous versions of the system only offer the montages that were used during a recording.
- Change filters.
- Reader Video Synchronized to the EEG.
- Reader Events Using Trace Display, Event list or Event Overview.
- Change Sensitivity and Paper speed, toggle Notch filter.
- Reader Patient and Test information.
- Reader Hypnogram.
- Review "As Recorded" Trends.

File handling

File handling in EEG Viewer is limited to "Open." When starting, a *File Open* dialog is displayed and a file must be selected to continue. A new file can be opened at any time using the **Open** command.

The EEG Viewer can read native Nervus/NicoletOne files (.e and .eeg) as well as EDF+ files.

Usage summary

The EEG Viewer will be used mainly in three circumstances:

- On a Nervus site, it can be installed on computers rarely used for EEG Reader, but still there are some times you may need to quickly review selected files.
- On a doctor's home computer where there is a need for quick EEG review.
- On a non-Nervus site, an EEG Viewer can be used to review NicoletOne files from a colleague to give a second opinion.

Hardware / Software requirements

The EEG Viewer runs on Windows 2000 or Windows XP.

Menus

File:

Open	**Open a file for review.**
Patient Properties	Review Patient Properties (Classic View).
Test Properties	Review Test Properties (Classic View).
Exam Properties	Review Exam Properties (Tabbed View).
(Recent File list)	
Exit	

View:

Toolbar	Toggle Toolbar.
Status Bar	Toggle Status Bar.
Panel	Toggle Panel.
Overview	Toggle Overview.
Trends	Toggle "As Recorded" Trends. Default is on.
Hypnogram	Submenu with "On" and a list of all sleep scores if more than one.

Navigate:

Play Forward	Play forward automatically.
Play Backward	Play backward automatically.
Next Page	Page one page forward.
Previous Page	Page one page backward.
Go To End	Go to end of file.
Go To Beginning	Go to beginning of file.

Format:

As Recorded	Puts Viewer in As Recorded Mode.
Montage (submenu)	A list of all Montages available. This is dependent on EEG file.
Time Base	Choose Timebase from list: 6, 8, 10, 15, 30, 60, and 120, 240.
Sensitivity	Choose Sensitivity from list: 10, 20, 30, 50, 70, 100, 200, 300, 500, 700, 1000, 2000, and 5000.
Deflection	Choose Deflection from list: 10, 20, 30, 50, 100, 200, 300, 500, and 1000.
High Cut	Choose High Cut from list: off, 15, 30, 35, 40, 50, 60, 70, 100.
Low Cut	Choose Low Cut from list: off, 0.016, 0.16, 0.3, 0.5, 1, 1,6, 2, 3, and 5.
Notch	Toggle Notch filter.

Tools:

Options	Display Tools *Options* dialog.

Help:

About the EEG Viewer	Display *About EEG Viewer* dialog.

Toolbar

Open	Open file for review.
Left	Play forward automatically.
Right	Play backward automatically.
Decrease	Decrease Sensitivity to next item in the list.
Increase	Increase Sensitivity to next item in the list.
Slower	Decrease Paper speed to next item in the list.
Faster	Increase Paper speed to next item in the list.
Notch	Toggle Notch filter.
Panel	Toggle Panel.

Trace display

The Trace display is the main window of the EEG Viewer. It allows you to view and page through the Recording.

Overview

The Overview is comprised of the *Event* overview and the time scale. It is always in full scale, Elapsed time mode and no customizing is available. It can contain "As Recorded" trends and Hypnogram.

Panel

There are three panel-items:

Reduced Format. Only Timebase and Sensitivity are available.
Event List
Video Play

No customization of the Panel is available.

Options dialog

Screen size

Width. An integer in the range 50 - 5000.
Height. An integer in the range 50 - 5000.
Sensitivity Unit. Select "µV/am" or "µV/mm".
Low Cut Unit. Select "Hz" or "Seconds".
Notch Frequency. Select "50 Hz" or "60 Hz".

About box

Copyright Information.

Copyright owner is Natus Neurology Incorporated, 1999-2013

Installation

The EEG Viewer has an installation program separate to the main installation program. It is Windows Installer based.

16 Central Monitor

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The Central Monitor

Exception: Central Monitor is only available with LTM and Sleep.

Specifying Monitor network settings

The first time Central Monitor is started, the *Network Settings* window will be displayed. From inside this window, you can specify where to store settings that this and other Central Monitor Systems use to identify NicoletOne Systems on your network.

Monitor automatic startup

Factory installations of Nicolet Central Monitor add a shortcut to the Windows Startup folder. Whenever windows is started, an instance of Nicolet Central Monitor also starts. If you want to disable this behavior, simply delete the shortcut from the windows startup folder by:

1. Click **Start > All Programs > Startup**.

2. Right-click **Central Monitor**.

3. Select **Delete**.

To restore the Automatic startup, copy the Nicolet Central Monitor shortcut into the startup folder. Use the following steps to restore automatic startup.

1. Right-click the **Central Monitor** shortcut on your desktop and select copy.

2. Click **Start > All Programs**.

3. Select **Open.**

4. Right-click anywhere on the opened Startup folder and select **Paste**.

Using the Nicolet Central Monitor

Nicolet Central Monitor is designed with a simple user interface that can typically be run without user intervention. When an recording begins in a room that is assigned to a panel in Central Monitor, the panel automatically connects and begins monitoring. When an recording has been completed, the Central Monitor automatically disconnects and waits until the next recording begins.

Collapsing/expanding panes

In certain cases, you may want to view exam data differently than the default view panel layout. Each of the three main view panel items: **Events**, **EEG**, and **Video**, can be collapsed and expanded by left-clicking the caption area. The lower-left exam shown in the image on the preceding page shows the Events and EEG panel items collapsed and the Video panel item expanded. On the upper-right examination, the Events and Video panel items are collapsed and the EEG panel item is expanded. Notice that on the upper-right examination, the Video panel item caption is grayed out. This indicates that Video is not available for this examination, as would occur if digital video was not present on the Recorder system being monitored.

Resizing the panel items

In addition to collapsing and expanding panel items, you may manually resize the panel items by moving the mouse to the area between two expanded panel items and dragging the separator left and right. Central Monitor remembers the proportional positions of the individual panel items and applies them accordingly if the window is resized or a panel item is collapsed. Please note, these display settings are temporary and exist only for the duration of the examination.

Bringing an exam into full screen display

By double-clicking the patient information caption, you can bring an examination into full-screen mode.

Alerts (Alert Strip)

Should any alerts occur during the full-screen mode, the Alert strip is displayed at the top of the screen display.

| Remote software control of the camera | For systems that are equipped with a software-controllable camera, the strip of arrow buttons below the video display allows remote software control of the camera's pan, tilt, and zoom. |

| Audio | The **Speaker** button on the strip of arrows is used to toggle the audio on and off for each of the monitored examinations. You may have audio activated or deactivated for any or all monitored systems simultaneously; Central Monitor will Multiplex the active audio streams. |

NOTE: Avoid monitoring a single examination in more than one panel from within a single Central Monitor system. Doing so may have an adverse affect on system performance.

The Central Data file

The Central Data file allows you to label the Nicolet systems on your network with meaningful "friendly" names that are easy for staff to identify. Often, computer names must accord to network polices and, over time, certain systems may be moved, renamed or replaced. By mapping a friendly name of a system, such as "Room 101" or "Mobile Unit A," it is easier to quickly locate a system under the watch of the Nicolet Central Monitor.

In order to create these labels for your systems, you must first tell Central Monitor where to store them. To specify a location for the Central Data File to keep these labels:

1. Click **Browse** .

    The "Browse For Folder" window allows you to select a network shared folder in which your Central Data file will reside. If a central Data file already exists at this location, Central Monitor loads the data it contains. If the files does not yet exist, Central Monitor creates one in the specified location. Using this technique, you can share the network settings between multiple central Monitor systems.

    After you have selected a **location**, you can begin to add your systems to the Central Data File.

2. Click **Add new**.

    The *Browse for Folder* window appears; however, this time, you are instructed to select a computer on your network. You can then supply the **label** for the newly added system.

    When you have added all the system you want to monitor:

3. Click **OK** to run the main Central Monitor application. You can, at any time, return to the *Network Settings* editor and modify these settings should your network configuration change.

4. After the initial setup, the *Network Settings* editor can be found under the **Edit > Network Settings...** menu from within the main Central Monitor application.

Assigning systems to the Central Monitor panels

After Nicolet Central Monitor starts up, you can assign your Nicolet system to the Central Monitor view panels through the *Preferences* editor. **Choose Edit > Preferences...** menu to display the Preferences editor (see the following example).
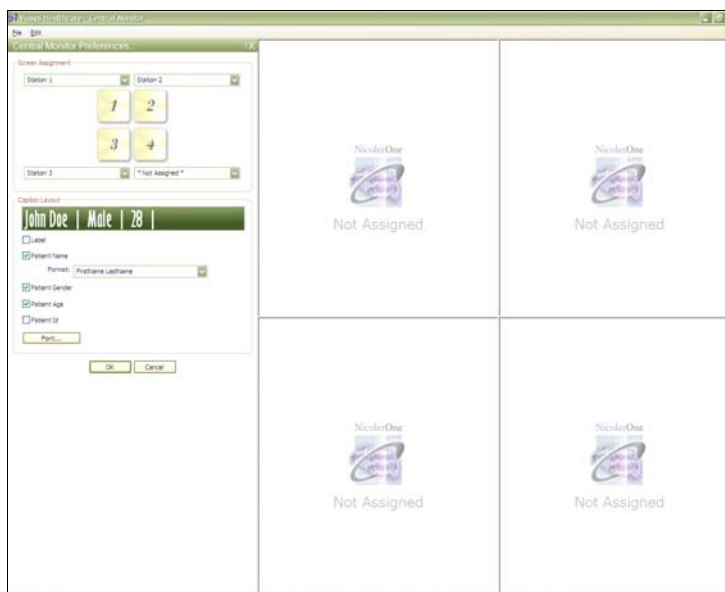
The "Screen Assignment" section of the *Preferences* editor contains four selection controls. Inside these controls, you will find the labels that you supplied for your system in the *Network Settings* editor. By choosing a friendly name, you are telling Nicolet Central Monitor that you want the chosen system to be monitored inside the panel corresponding to that selection control.

If you have less than four systems, Nicolet Central Monitor automatically optimizes the use of screen space for your configuration. For example, if you are monitoring only one system, Central Monitor uses the entire screen to display the single system. In this case, it doesn't matter which selection control you have assigned, Central Monitor takes the first assigned control and monitors it accordingly. If you have two systems, Central Monitor finds (following the numerical order depicted in the panel graphic of the editor), will be on top, the second will be on the bottom. When monitoring three systems, Central Monitor leaves a panel with the "Not Assigned" indicator in view.

1. Inside the "Caption Layout" section of the *Preferences* editor, you can decide how you would like Nicolet Central Monitor to display exam-specific information for each actively monitored exam. By checking one of the boxes, you are telling Central Monitor to show the corresponding information.

2. In addition, there is a selection control that allows you to specify how the patient's name should be formatted. This selection is only meaningful if the **Patient Name** checkbox is checked.

3. Lastly, you can select the font you would like Central Monitor to use for the exam specific information by clicking the **Font...** button. Nicolet Central Monitor will adjust the height of the panel caption automatically to match the chosen font.

4. When you are finished, click **OK**. Nicolet Central Monitor then starts connecting to the systems you have specified. If there are no currently active exams, the panel displays the "Disconnected, Please Stand By" indicator.

   The image below shows a central monitor actively monitoring two systems and waiting to connect to a third system.

17

Grid/Strip/Depth Electrodes

Legends

Note that in the left column you will see *Recorder*, *Reader*, *or Recorder and Reader*. These help identify whether the topic applies to the Recorder or Reader or both.

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Grid/Strip/Depth electrodes

Recorder   You can define one or more implanted grid(s), strip(s), or depth electrode(s) for use in an exam. The predefined list of grid/strip/depth includes all electrodes intended for long term monitoring of epilepsy. All electrode definitions are stored with the exam's EEG data. The report will include the locations of the implanted electrodes grid.

> **NOTE:** The number of electrodes on an individual implanted electrode grid can not exceed 64 electrodes.

Using the Grid/Strip Editor

The Grid/Strip Editor allows you to create sensor, amplifier inputs, and montages based on specific grid strips and/or depth electrodes.

IMPORTANT: **Make sure you save your most frequently used input file in case an error occurs before continuing. To do this:**

1. Start the EEG acquisition software and load your most commonly used protocol.

2. Click on the **Edit Settings** button.

3. Click on **Amplifier** at the bottom of the Montage Editor panel.

4. From the Amplifier Setup Editor panel, look at the **inputs** to ensure these are the ones most commonly used. If not, select a different protocol.

5. When you see the inputs you want, click the **Save Default** button.

6. Click **Close**.

7. When prompted if the changes should be saved, click **Yes** (**OK**).

If at a later time the inputs should need to be retrieved, click **Load Default** on the Amplifier Setup Editor panel.

Grid/Strip electrodes

You can define the following parameters, which will be saved for review purposes:

- Number of electrode rows.
- Number of electrodes in each row (columns).
- Shape of the grid/strip
- Position of the grid/strip on the brain.
- Naming convention for the electrodes in the grid/strip.
- Numbering of the electrodes in the grid/strip.

Depth electrodes

You can define the following parameters, which will be saved for review purposes:

- Number of electrode contacts.
- Position of the grid/strip with the patient's brain.
- Naming convention for the electrodes in the grid.
- Definition of the numbering references of the electrode contacts.

Once defined, the system assigns the grid/strip/depth electrodes to the amplifier channels automatically, starting with the electrode you select on the Implanted *Grid Editor* panel. The system will also create a **referential montage** automatically to reflect the order of the implant electrodes assigned to the amplifier inputs. The referential montage will be named **Implant Referential**. You can assign the implant electrodes to any EEG input from the amplifier as EEG sensor inputs via the *Montage Editor* panel after the implant electrodes have been defined and saved.

Reports

Reports will include the location of any implanted electrode grids in the skull.

Displaying the Grid and Strip Editor panel

1. Click on the **Settings** Settings button and then on **Grid/Strip** at the bottom of the **Editor** panel.

    - or -

    Click on **Protocol > Settings** and then on **Grid/Strip** at the bottom of the **Editor** panel.

Creating a new Grid protocol (option A)

This procedure creates a new, undefined Grid protocol.

1. Click on the **Edit** button. This displays the *Grid and Strip Definition Editor* panel.

See: Please continue with **Creating/Editing a Grid protocol** on the next page.

Loading a previously used grid setup (option B)

This procedure will load a previously used grid setup (an EEG data file), which you can use immediately or edit to create a new grid setup.

1. Click on the **Load** button.
2. Locate and double-click on the **Protocol file** you want to load, or select the file you want to load and click on the **Open** button.
3. A dialog will appear warning you that the current Grid definitions (if any) will be deleted and replaced with the selected Grid definitions if you continue. Click on **Yes** to continue, or on **No** to exit and keep the current Edit definitions.

    - If you want to edit the selected Grid protocol settings, click on the **Edit** button. This will display the *Grid and Strip Definition Editor* panel.
    - If you want to use the Grid protocol without any changes to it, click on the **Save** button. The selected Grid protocol is now ready for use.

See: Please continue with **Creating/Editing a Grid protocol** on the next page.

Creating/Editing a Grid protocol

1. Click on the **Edit Settings** button.

2. Click on **Protocols** at the bottom of the Montage Editor panel.

3. Click on the **New** icon in the lower left corner of the Organize Protocols Editor panel.

4. In the Protocols list, type in a generic 'GridStrip' **name** to start the Grid/Strip Protocol creation.

NOTE: This is only a protocol you will use to create your custom/new Grid/Strip Protocol. The purpose of this is to preserve and protect your other protocols. Once it is created, you will save it with a new, unique name such as the patient's name or procedure name.

5. Click **Save**.

Constructing the Grid/Strip Editor

IMPORTANT: There is no industry standard for grid and strip electrode numbering. It is your responsibility to verify that the grid layout and numbering match for all selected implants.

6. Using the Grid/Strip Protocol you created above, click on **Grid/Strip** at the bottom of the Edit Settings panel.

7. To select an appropriate brain image view, click on the **View** arrow buttons. It is recommended to select the brain image view prior to selecting the grid strips.

Build a list of Grid/Strips that might be used during the procedure

8. Click the **Edit** button on the upper right area of this panel.

9. From the Grid/Strip Definition Editor dialog, click on the **Edit List** button.

10. From the Grid List Editor panel, click on the **Generic Implant Examples** show menu ▼ button.

11. Click on the **Grid/Strip** you intend to use.

12. A graphic of the selected grid is displayed. If this is the grid you want, click on the **Add** button in the middle of this panel.

13. Repeat steps 8 through 12 for each additional grid you want to add.

14. When finished adding electrodes, click **OK**.

15. If you intend to use any depth electrodes, be sure to include some one dimensional strips such as a 1x10.

Selecting Grid/Strips for a specific patient or procedure

16. From the Grid/Strip Definition Editor panel, click the **Implant List** show menu ▼ button.

17. Click on the **grid/strip** you want to use and then click on **Add**.

18. From the Implant Name Editor dialog, type in a **unique name** for the Grid/Strip, such as a brief description of the strip's location on the brain, and then click **OK**.

19. If you want to make a selected one dimensional Electrode into a Depth Electrode, check the **Depth** checkbox. When you return to the Grid/Strip Editor panel later, the Depth Electrodes will be identified on the brain image with a ⚠1 ⚠2, etc., and the Depth Electrode(s) images will appear below and on the brain image.

20. Repeat steps 16 through 19 for any other grid/strips you want to use.

21. The amplifier inputs start by default at Input #1. If you want the inputs to start at a different number, click on the **Assign First Electrode To Amplifier Input** show menu ▼ button and then click on the desired **starting input**.

22. Click **OK** at the bottom of the Grid/Strip Definition Editor panel.

Positioning the Grid/Strip(s)

23. To move a Grid/Strip, click and drag it to the desired location.

24. Right clicking a strip on the brain image view will allow you to rotate, scale, edit, delete, move to a different view, and label the selected Grid/Strip. The Label can be either the grid's numbering scheme ("Show Grid Inputs") or the channel (input) number ("Show Amp Inputs").

25. When the Grid/Strip(s) are to your satisfaction, click **Save**.

26. On the Montage Name dialog, type in a unique name for the new Montage. If you do not create a name, Implant Referential will be assigned by default.

27. If you want to apply this Montage immediately, leave the **Apply Montage** checkbox checked.

28. Click **OK**.

29. Click on **Montage** at the bottom of the Grid/Strip Editor panel to view the Montage Editor panel.

30. If you want to view the electrodes on the brain image, click on the **Select View** show menu ▼ button and click on **Implanted Grids**.

31. Click on the **View << or >>** buttons to scroll through the brain images to view the implanted grid(s).

32. When finished making your settings on the Montage Editor panel, click **Save**.

33. Click **Close** to return to the EEG screen display.

Saving the Grids/Strips as a new Protocol

34. From the EEG screen display, click on **Protocol > Save As**.

35. From the Save Protocol dialog, type in a unique name for the new **Protocol**.

    Hint: If this protocol will be reused for multiple surgical patients, enter a surgical procedure name. If the protocol is unique to the patient, use the patient's name.

36. Click **OK**.

    The new protocol is now listed in the **Protocol** menu.

NOTE: Can also save as a separate (grids, etc.) file.

Removing implants from a grid definition

The system updates the channel assignments automatically after removing an implant from a grid definition. Implants that are turned off (no check mark in the On column checkbox) are not depicted in the implant graphical display.

1. On the *Grid/Strip Definition Editor* panel, click on the **On** checkbox that corresponds to the implant you want to remove from the grid definition. The checkmark disappears.

Deleting an implanted electrode grid definition

The system reverts all channels to their default names after removing an implanted electrode grid definition.

1. On the *Grid and Strip Editor* panel, click on the **Implant** you want to remove.

2. Click on the **Remove** "X" button at the bottom of the *Grid and Strip Editor* panel.

   - or -

1. From the *Implant Editor* panel, right-click on the **Implant graphic**.

2. Click on **Delete**.

Reordering the implants list

1. On the Montage Editor panel, click on the **Implant** you want to move.

2. Click on the **Up** or **Down** button to move the Implant to the desired location in the list.

Renaming Grid electrodes

On the *Grid/Strip Definition Editor* panel, you can rename Grid electrodes as you wish.

Renaming a single Grid electrode

1. Click on the **Sensor name** in the Sensor Name column.
2. From the Implant Name Editor dialog, type in the desired **Prefix**, **Index**, and **Suffix** (maximum of 24 characters).
3. Click **OK**.

Renaming multiple Grid electrodes

1. Hold down the **Shift** key (sequential selections) or **Ctrl** key (nonsequential selections) and click on the **implant rows** you want to rename as a group.
2. Click on the last (bottom) **implant name** you selected in the Implant column.
3. Type in the desired **Prefix**, **Index**, and **Suffix** (maximum of 24 characters).
4. Click **OK**.

Choosing how electrode labels are displayed on the Grid view

On the *Grid/Strip Editor* panel, you can choose from three options on how you would like to view the electrodes. The setting carries over to all grids in all views.

1. Right-click on the **grid strip image** to display a drop down menu.
2. Click on **Labels**.

   None – Displays each grid electrode in a solid color.

   Show Grid Inputs – Displays the electrode index starting from one and equaling the number of electrodes for that grid.

   Show Amp Inputs – Displays the amplifier input index that the grid electrode with which it is currently associated.

Adjusting the Trace Label width

If you create a unique electrode name that is too long to fit in the Trace Label area at the left side of the screen display:

1. Click on **Tools > Options > Display tab**.

2. In the **Label width** field, type in a larger **value** and then click **Apply**.

3. Repeat step 2 until the desired Trace Label area is wide enough to view the entire label.

4. Click on **OK**.

Deleting an implant

1. From the *Grid/Strip Editor* panel, right-click on the **Implant** you want to delete.

2. Click on **Delete**.

Viewing the graphical depiction of the brain

You can select how you want the brain graphic to be displayed on the *Grid/Strip Editor* panel.

1. From the *Grid/Strip Editor* panel, click on the **View <<** or **>>** buttons until the desired view appears.
    - **Top** (superior view).
    - **Left** and **Right** side (sagittal view).
    - **Sagittal section medial view** (inside of right hemisphere as viewed from the left side).
    - **Sagittal section medial view** (inside of left hemisphere as viewed from the right side).
    - **Base** (inferior view).

Resizing the Grid and Strip electrode arrays

The Grid and Strip electrode arrays can be resized proportionally to match the patient's brain size.

1. Click on the Slider left or right Arrow buttons (or drag the **Slider** button) on the **Patient brain size (% of average adult)** control until the electrode array is proportional to the patient's brain size.

Positioning the grid/strip/ depth electrode

You can position the implant electrodes on the graphic depiction of the patient's brain.

1. Click on the **electrode** and hold down the mouse button while dragging the electrode to the desired location on the brain graphic. Release the mouse button.

Rotating an grid/strip/ depth electrode

You can rotate the implant electrodes on the graphic depiction of the patient's brain.

1. To rotate the electrode, right-click on the **electrode** and then click on **Rotate** from the pop-up menu.
2. From the *Grid Rotational Controls* panel, rotate the implant as desired using the rotate controls:
    - Transverse plane rotation
    - Sagittal plane rotation
    - Coronal plane rotation

Printing

Click on the **Print** button and then choose between a printed copy or PDF output.

Defining a Grid/Strip electrode as a Depth electrode

You can redefine a Grid or Strip electrode as a Depth electrode.

1. Click **Protocol > Settings** and then click on **Grid/Strip** at the bottom of the Editor panel.
2. Click the **Edit** button in the upper right of the Grid/Strip Editor window.
3. Select the electrode(s) you want to use.
4. Click on the **Add** button to enter your selection(s).
5. Check the **Depth** check box.
6. When finished with the Grid/Strip Editor, click on the **OK** button.

Depth electrodes placement indicators

A placement indicator for depth electrodes can be placed on the grid view and is represented by a number or symbol. The associated depth electrode is represented beside the grid view and is marked with a matching number or symbol to its placement indicator.

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18 Shared Functions

The functions described in this chapter apply to both the Recorder and Reader applications.

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Patient and Test properties dialog

Recorder and Reader   You can choose to view the properties using either the **Classic View** or the **Tabbed View**.

-------------- Classic Views: Patient and Test ------------- ------- Tabbed View ------

Choosing the Properties view

1. Click on **Tools > Options > Misc tab**.

2. From the Patient and Test Information Screens field, checkmark **Use Classic View (Requires App Restart)** to view the **Classic** view.

   - or -

   Remove the checkmark to view the **Tabbed** view.

Displaying the Classic Properties views

1. Click on **File > Patient Propertie**s.

   - or -

   Click on **File > Test Properties**.

2. You can switch between the two properties panels by clicking on the desired **properties** at the bottom of the displayed properties panel.

3. Edit as necessary.

4. Click **Save**.

5. Click **Close**.

Displaying the Tabbed Properties view

1. Click on **File > Exam Propertie**s to view the Tabbed Exam Properties dialog.

2. Edit as necessary.

3. Click **Save**.

4. Click **Close**.

Numerical displays

Recorder and Reader   You can choose to set the selected channel(s) to display only a trace, a trace with numerical values, or numerical values only.
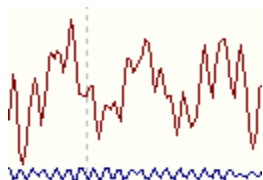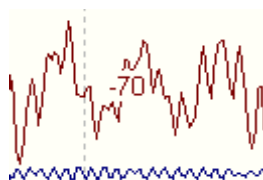
Trace only.   Trace and Numerical   Numerical only.
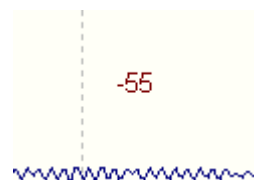
Setting a single trace

1. Right-click on the **label** of the trace you want to set.

2. Click on **Selected Trace(s) > Display Type**.

3. Click on the desired menu **option**.

Setting a string of multiple traces

1. Hold down the **Shift** key on the keyboard and click on the **first trace label** you want to include.

2. Click on the **last trace label** you want to include. The two selected traces as well as all of the other traces between the two labels become highlighted.

3. Release the **Ctrl** key and right-click on any of the **highlighted** trace labels.

4. Click on **Selected Trace(s) > Display Type**.

5. Click on the desired menu **option**.

Setting nonsequential traces

1. Hold down the **Ctrl** key on the keyboard.

2. Click on the trace **labels** you want to include.

3. Release the **Ctrl** key and right-click on any of the **highlighted** trace labels.

4. Click on **Selected Trace(s) > Display Type**.

5. Click on the desired menu **option**.

Choose how numerical values are displayed	You now can choose the period of time between numerical values, the number of decimal places for the values, and whether you want the values displayed with units of measurement.
	
	You can set the period of time between each display of the numerical values.
	
	1. Click on the **Settings** Settings button.
	
	   - or -
	
	   Click on **Protocol > Settings**.
	
	2. Click on the **trace** in the Label column you want to edit.

Select the Update Period	3. Click on the **Update Period(s)** show menu ▼ button. 4. Click on the desired **interval** between each numerical value.
Choose the number of Decimal Places	5. Click on the **Decimal Places** show menu ▼ button. 6. Click on how many **decimal places** to the right you want numerical values displayed (e.g., 0.1, 0.12).
Choose whether to display the measurement units	7. To display the numerical values with their units of measurement, click on the **Show Units** checkbox.

Configuring the display

Recorder and Reader

Setting individual channel control parameters

You can set individual channel parameters (e.g., sensitivity, HFF, LFF, etc.) and see the effects of those changes immediately.

1. Right-click on the **trace label** at the left side of the Recorder (Reader) pane.
2. Click on the **parameter** you want to edit.
3. Click on the desired **menu option**.

Setting multiple channel control parameters

You can set multiple channel parameters (e.g., sensitivity, HFF, LFF, etc.) and see the effects of those changes immediately.

1. While holding down the **Shift** key (or **Ctrl**) key on the keyboard, click on the trace labels you want to set.
2. Right-click on one of the highlighted trace **labels**.
3. Click on the **parameter** you want to edit.
4. Click on the desired **menu option**.

The Event palettes

Recorder and Reader   There are two event palettes that can be used to insert events into a recording.

Recorder
Event palette

The *Record Event* palette is displayed to the right side of the **Recorder EEG** pane that can be inserted into the Recorder EEG pane.

Display the
Record Event
palette

1.   Click on **View > Event Palette**.

Reader Event
palette

The *Reader Event* palette is displayed to the right of the **Reader EEG** pane and contains events that can be inserted into the Reader EEG pane in both the online and offline modes.

Display the
Reader Event
palette

1.   Click on **View > Event Palette** in Reader.

     - or -

2.   For the review Pane in Live Review, click on **View >Review Pane > Event Palette**.

Also See: *Events* section in the *Marking Events and Annotations* chapter for information on inserting events.

Also See: *Event Type Editor* section in the *Using Settings Editor and Options Dialog* chapter to create or modify event markers.

Also See: *Event Palette Editor* section in the *Using Settings Editor and Options Dialog* chapter to select or define a new palette of events.

The Context menu

Recorder and Reader   You can quickly change various parameters (sensitivity, deflection, baseline, etc.) as desired to obtain the desired results on the collected EEG.

1. Click on the **label(s)** of the trace(s) you want to set. If selecting multiple traces, hold down the **Shift** key (for consecutive traces) or the **Ctrl** key (for nonconsecutive traces).

2. Right-click on one of the selected (highlighted) traces.

3. From the pop-up menu you now can choose to set:

Multiple parameters from a dialog box

multiple parameters from a single dialog box (sensitivity, deflection, baseline, and filters).

a. Click on **Adjust Selected**.

b. Set the **parameters** to obtain the desired results.

c. Click **Close**.

Single parameters from a menu

single parameters from a menu (trace color, sensitivity, deflection, baseline, filters, polarity, display type, grid, hide or show selected traces).

a. Click on **Selected Traces**.

b. Click on the **parameter** you want to change.

c. Click on the **setting** you want to use.

All traces from a menu

all traces (sensitivity and filters).

a. Click on **All Traces**.

b. Click on the **parameter** you want to change.

c. Click on the **setting** you want to use.

Showing/hiding traces

Recorder and Reader   You can remove selected traces from the screen display or leave them displayed. The traces you select may be consecutive or nonconsecutive.

NOTE: Traces removed from the Recorder pane are also removed from the Reader pane when the Reader pane is in the **As Recorded** montage.

- To select **consecutive** traces, hold down the **Shift** key, click on the **first trace** you want to highlight, and then click on the **last trace** you want to highlight.
- To select **nonconsecutive** traces, hold down the **Ctrl** key and click on the individual **traces** you want to highlight.

IMPORTANT:If you select Protocol > Save, the currently displayed Montage will <u>overwrite</u> the original Montage and the hidden traces will be deleted from the Montage permanently.

1. Click on the **trace labels** you want to show (or hide).
2. Right-click anywhere in the **trace labels area**.
3. Click on **Hide Selected Traces** or **Format > Hide Selected Traces** (highlighted traces are removed from the display)

   - or -

   Click on **Show Selected Traces** or **Format > Show Selected Traces** (highlighted traces remain displayed).

Returning all traces for display   **IMPORTANT:If you select Protocol > Save, the currently displayed montage will overwrite the original Montage and the hidden traces will be deleted from the Montage permanently.**

1. Right-click anywhere in the **trace labels area**.
2. Click on **Show All Traces**.

   - or -

   Click on **Format > Show All Traces**.

Reordering the channels

Recorder and Reader   You can drag the trace labels on the left side of the display window and reorder the traces as desired. This feature is useful when you want to group traces of interest together for visual inspection.

You can group a continuous string of traces by holding down the Shift key, clicking on the trace labels and then dragging them to their new location.

If you hide traces (see *Showing/hiding traces* earlier in this chapter), reorder the displayed traces and then redisplay the hidden channels, the hidden channels will be displayed in their original positions.

Inserting an empty channel (space) in the EEG display

Recorder and Reader   You can insert an empty space in the Montage Editor, which will insert an empty channel in the EEG display. This is useful when you want to separate or group traces for display.

1. Click on the **Settings** ![Settings] button.

    - or -

    Click **Protocol > Settings**.

2. From the **Montage Editor** panel, click on the **channel** <u>above</u> which you want to insert an empty channel.

3. Click on the **Action** button.

4. Click on **Insert Space**.

5. If you want to change the default label "Space," click on the word **Space** in the **Label** column and type in the **new Label**.

6. Click **Apply** to view your changes.

7. Click **Save**.

Using the Calibration Bar

Recorder and Reader The Calibration Bar is used to make measurements when assessing EEG characteristics and will be printed with the EEG if it is displayed.

During split screen recording (Recorder/Reader), the Calibration Bar is always displayed in both windows when turned on. Each of the Calibration Bars' scaling and orientation can be set independently of each other.

Displaying the Calibration Bar

To display/hide the Calibration Bar:

1. Click on the **Calibration Bar** ⌐ button or click on **Tools > Calibration Bar**.

Moving the Calibration Bar

You can quickly move the bar over any portion of the waveforms.

1. Position the mouse cursor anywhere over the Calibration Bar until the cursor changes into a hand symbol.
2. Click and hold down the Left mouse button.
3. Drag the mouse until the Calibration Bar is over the waveform feature you want to measure and then release the mouse button.

Scaling the Calibration Bar

1. Position the mouse cursor anywhere over the calibration bar until the cursor changes into a hand symbol.
2. Right-click the mouse.
3. Click on **Width** or **Height**.
4. Click on the desired **units**.

Rotating the Calibration Bar

1. Position the mouse cursor anywhere over the calibration bar until the cursor changes into a hand symbol.
2. Right-click the mouse.
3. Click on **CW** to rotate the Calibration Bar 90 degrees clockwise or **CCW** to rotate the Calibration Bar 90 degrees counterclockwise.

Marking Special channels

NOTE: Special channels are not affected when changing settings such as the Sensitivity from the *Format* panel or the commands on the **Format** menu.

Special channels are identified by a colored rectangle indicator to the right of the trace label. Normal channels have a diamond shaped, colored indicator.
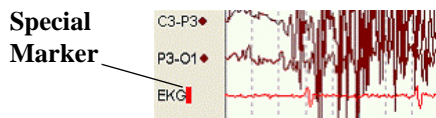
Figure 1: The bottom trace is marked as 'special.'

Marking a channel as Special

A channel is marked as **special** via any of the following three methods:

• Click on **Protocol > Settings > Montage** and then checking the **Special** checkbox on the *Montage Editor* palette.

- or -

• Right-click on the **trace label** and then click on **Selected Trace(s) > Special** from the pop-up menu.

- or -

• Right-click on the **trace label**, click on **Selected Trace(s)** from the pop-up menu and then change the **Sensitivity**, **Deflection**, **High Cut** or **Low Cut** filters settings. The new settings will not be saved into the current montage unless you choose **Save** in the Montage Editor window.

Removing a Special marker

If you remove the Special marker from a trace using either of the first two methods above, the trace will return to its original, 'pre-special' settings.

Carrying Special channels when changing the Montage

Recorder If a channel is marked as **Special** and you switch to a different Montage that uses the same Active and Reference electrodes as the original Montage, the Sensitivity, Deflection, and Filter settings will be carried over and applied to that trace. The trace in the new Montage will the also be marked as **Special**.

You can disable the Special Trace function (default is enabled).

1. Click on **Tools > Options > Misc** tab.
2. Uncheck the **Carry Special channels on Montage change** checkbox.

Customizing the toolbar

You can select which icons you want displayed on the Toolbar.

1. Click on **Tools > Options**.
2. Click on the **Customize Toolbar** tab.
3. Check the toolbar icon **labels** that you want displayed on the toolbar.
4. Click **OK**.

NOTE: The **Calibration** icon is disabled by default.

Toolbar icon images

The **Toolbar Icons** field shows two icons for the currently highlighted icon.

The **upper** icon illustrates an enabled (selected) icon.

The **lower** icon shows an example of a enabled (unselected) icon.

Producer Basic

You can e-mail, print, or save a .jpg file of the screen display from either the Recorder or Reader window.

Send Email

1. Enter the **Email destination** information.

2. To include additional Email recipients,

    a. Click on **Add Additional Recipients**.

    b. Type in the **Email destination**.

    c. Click the **Add Recipient** button.

    d. Repeat as necessary and then click **OK**.

3. Click the **Send Email** button.

Print Image

1. Click the **Print Image** button.

2. To view the captured screen display in more detail before printing,

    a. Click the **Maximize** button.

    b. Click the show menu button to the right of the **Magnifying** icon.

    c. Click the desire **magnifying value**.

3. When ready to print, click the **Printer** button.

Save Image

1. Click the **Save Image** button to create a **.jpg** image file.

2. Locate the **destination** to which you want to save the image.

3. If you do not want to use the default file name, type in the your own **file name**.

4. Click **Save**.

Setting the time format display

You can choose to display time in either the standard time (03:58:31) or in military time (15:58:31).

1. Click on **Start > Settings > Control Panel**.

2. Double-click on the **Regional and Language Options** icon.

3. From the **Regional Options** tab, click on the **Customize** button.

4. Click on the **Time** tab.

5. Click on the **Time format** show menu ▼ button.

6. Click on the desired **format**.
   - **h.mm.ss.tt**   3:58:31 AM, 10:03:22 PM   Standard
   - **hh.mm.ss.tt**   03:58:31 AM, 10:03:22 PM   Standard
   - **H.mm.ss**   1:58:31, 17:08:44   Military
   - **HH:mm.ss**   01:58:31, 17:08:44   Military

7. Click on **Apply** to view a sample of your setting.

8. Click **OK**.

9. Click **OK**.

10. Click on the **Close** ☒ button in the upper right corner of the Control Panel to close it.

Setting the Minimum Event Display Area

You can choose to allow extra space above the signal display area to keep annotations from interfering with viewing the signal data. This setting applies to both Reader and Recorder, in both the Live and Review views.

1. Click on **Tools > Options > Display tab**.

2. In the **Minimum Event Area** entry box, type in the desired space between Annotations and the first trace.

Forcing events to the top of the signal display area

You can force all events to be placed at the top of the signal area regardless of their association to specific channels.

1. Click on **Tools > Options > Display**.

2. Check **Force events to top**.

Changing the color of a trace being adjusted

You can change the color of the trace(s) for which you are adjusting the settings.

1. Click on the **Trace Label(s)** you want to adjust.

    Hold down the **Ctrl** key while clicking on the trace labels you want to select. Hold down the **Shift** key and click on the **first label** and then on the **last label** you want to adjust as well as all of the traces between those two labels.

2. Right-click on the **Trace Label** of the trace you want to adjust.

    The trace changes to a red color. If the trace was set to display in red, then it will change to a green color.

Show Flat lined signals over deflection limit

You can choose to have the tops and bottoms of signals that exceed the vertical deflection display limits to be drawn with a straight line. This feature is disabled by default.

1. Click on **Tools > Options > Display** tab.

2. Check the **Show Flat Trace on Deflection Limit** check box.

Printing from
Print Event
Markers

When printing from **Print Markers** inserted into the EEG, right-clicking on the **Print Marker** displays a popup with an option labeled **Switch to Context**. Switching to Context formats and prints the page of EEG according to the context when the **Print Marker** was inserted.

If two **Print Markers** were inserted on the same page of EEG, only the print marker that is in context will be printed.

1. Click on the **Settings** Settings button.

2. Click on **Events** at the bottom of the panel.

3. Click on **Print Marker** from the Event Types list.

4. Set up the Print Marker as desired.

5. Click **Save**.

6. Click on **Palettes** at the bottom of the Event Type Editor panel.

7. Click on **Print Marker** from the list of Event Types.

8. Click on the `>>` button to move the marker to the Event Types in Palette.

9. Click **Save**.

10. Click **Close**.

11. When you want to insert a Print command, click on **Print Marker** from the Event Panel to insert the "Start Print" command.

12. Click on **Print Marker** again to insert the "Stop Print" command.

19

v32 and v44 with an SPO2 Sensor

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General Introduction

NOTES

The v32 and v44 amplifiers are not intended for use in the immediate area of intravenous fluids.

The v32 is designed to work with the Nonin XPod and approved sensors.

The v44 amplifier is designed with Nonin's OEM III module and works with the same sensors as the v32 amplifier.

For the v32 amplifier, if the screen display reads 85% SpO_2 and 85 bpm, it is an indication that the XPOD cable may be damaged. If damaged, please replace the cable.

For the v44 amplifier, if the screen display reads 551 BPM and 0% SpO2, it is an indication of a possible short circuit of the sensor cable. Another condition could be an "out of track" condition.

For the v44 amplifier, the message "XPOD-Bad Signal" is displayed if the sensor is disconnected or damaged.

When using the HB5 headbox with the v44, pulse oximetry will be disabled.

If mains power loss occurs, desktop computer systems will not return to normal operation within 30 seconds. Therefore, pulse oximetry data shall be considered invalid until the software application notifies you that a valid signal has returned.

Pulse oximeter equipment measurements are statistically distributed. Only about two-thirds of pulse oximeter equipment measurements can be expected to fall within +/- Arms of the value measured by a CO-oximeter.

A functional tester cannot be used to assess the accuracy of a pulse oximeter probe or a pulse oximeter monitor.

If there is independent demonstration that a particular calibration curve is accurate for the combination of a pulse oximeter monitor and a pulse oximeter probe, then a functional test can measure the contribution of a monitor to the total error of a monitor/probe system. The functional tester can then measure how accurately a particular pulse oximeter monitor is reproducing that calibration curve.

Specifications

Oxygen Saturation Range 0 to 100%

Pulse Rate Range 18 to 260 pulses per minute

Measurement Wavelengths[1] Red - 660 Nanometers @ 3 mW nominal

Infrared - 910 Nanometers @ 3 mW nominal

Accuracy[2]

SpO_2 (70-100%) (+/-1 SD)[3]   No Motion

- Adults Pediatrics ±2 digits
- Neonates ±3 digits

Motion

- Adults Pediatrics ±2 digits
- Neonates ±3 digits

Low Perfusion

- Adults Pediatrics ±2 digits
- Neonates ±3 digits

Pulse Rate[4]   No Motion (18 to 260 pulse per minute)

- Adults Pediatrics ±2 digits
- Neonates

Motion

- Adults Pediatrics ±2 digits
- Neonates

Low Perfusion

- Adults Pediatrics ±2 digits
- Neonates

[1] Information about wavelength range can be useful to clinicians.

[2] All accuracy specifications are results determined by induced Hypoxia studies on healthy adult volunteers using the 8000AA Finger Clip Sensor.

[3] Standard Deviation (SD) is a statistical measure: up to 32% of the readings may fall outside these limits.

[4] Pulse rate accuracy is stated as the root-mean-square (rms) difference between paired pulse rate data recorded with the NONIN XPOD and a reference method.

Temperature

a.	Operating	+10°C to +35°C
b.	Non Operating	-10°C to +50°C

Humidity

a.	Operating	25 to 95% Noncondensing
b.	Non Operating	10 to 95% Noncondensing

Power Draw   60 mW - typical operating

Voltage Input   2 to 6 volts dc operating

Note: Sensor is not isolated from input voltage

Output Digital Signals   0 - 5 volts (nominally)

Patient Isolation   Meets IEC 60601-1 Dielectric withstand

Leakage Current   Not applicable

Dimensions   2.1" x 0.8" x 0.6" (53 x 20 x 15mm)

Weight   75g (including 6' cable and connector)

Ruggedness/immersion

a.	Shock	Per IEC 68-2-27
b.	Vibration	Mil-standard 810C, method 514-2

Nonin XPOD Fluid Spill Resistance IP33

Nonin SpO2 Sensors Temperature Do not exceed 41°C

Interference	Because of the proliferation of radio-frequency transmitting equipment and other sources of electrical noise in healthcare and other environments, it is possible that high levels of such interference due to close proximity or strength of a source might disrupt the performance of this device. Medical electrical equipment needs special precautions regarding EMC, and all equipment must be installed and put into service according to the EMC information specified in the *Electromagnetic Compatibility Reference Guide* provided on CD (part number 482-6387xx).
	Portable and mobile RF communications equipment can affect medical electrical equipment.
	Significant levels of dysfunctional hemoglobin, such as carboxyhemoglobin or methemoglobin, may affect the accuracy of the SpO_2 measurement.
	Cardiogreen and other intravascular dyes, depending on the concentration, may affect the accuracy of the SpO_2 measurement.
Oxygen saturation range (SpO_2)	• 0 to 100%
Oxygen Saturation Accuracy (+/-1 S.D.)*	• 70-100% ***** Standard Deviation is a statistical measure. Up to 32% of the readings may fall outside these limits.
Pulse Rate range	• 18 to 260 beats/min. (no motion) • 40 to 240 beats/min. (motion) • 40 to 240 beats/min. (low perfusion)
Data update period	Oxygen saturation values are stored in 1% increments in the range of 0 to 100%. Pulse rate is stored at 18 to 300 pulses per minute in increments of 1 pulse per minute in the interval from 18 to 200 pulses per minute, and increments of 2 pulses per minute in the interval from 201 to 300 pulses per minute.

Signal inadequacy

A "*Bad XPod Signal*" message will be displayed in at the top of the trace display area if the signal strength is inadequate.

1. Check the finger and amplifier connection.

No valid data received within 30 seconds

If no valid pulse or SpO_2 data occurs within 30 seconds, the following alert will be displayed on the host computer's screen display:

"*The application has not received valid pulse or SpO_2 data for at least 30 seconds. Please check the finger and amplifier connection.*"

1. Click on the **OK** button and check the connections.

XPod disconnected

If the XPod becomes disconnected, an alert will be displayed on the host computer's screen display:

"*It has been detected that the XPod sensor has become disconnected. Please reconnect the XPod sensor.*"

1. Click on the **OK** button .
2. Reconnect the XPod sensor.

NONIN Pulse Oximeter Sensors tested with EN9919

- **Finger Clip Sensors:** 8000AA-1, 8000AA-3, 8000AP-1, 8000AP-3
- **Flex Sensors:** 8000J-1, 8000J-3, 8008J, 8001J
- **Flexi-Form II Sensors:** 7000A, 7000P, 7000I, 7000N

Approved monitors

Only monitors sold by Natus Neurology Incorporated are approved for use. **Use of any other, unapproved monitors may result in patient injury.**

NOTE: The operator is responsible for checking the compatibility of the monitor, probe and cable before use. Incompatible components can result in degraded performance.

Patient sensor placements

The pulse oximeter sensors may be used on the patient's fingers, toes, or ears.

NOTE: Ear clip and reflectance pulse oximeter sensors are not recommended for pediatric or neonatal use. The accuracy of these types of sensors has not been established for pediatric or neonatal use.

Recommended maximum application time

Check the sensor application site **every 6 to 8 hours** to determine the positioning of the sensor and the circulation and skin sensitivity of the patient. Each patient's sensitivity to NONIN sensors may vary depending on the patient's medical status or the condition of their skin.

⚠ **WARNING** **Misapplication of a pulse oximeter probe with excessive pressure for prolonged periods of time can induce pressure injury.**

Toxity concerns

NONIN sensors meet the biocompatibility requirements of ISO 10993-1:2003 based on historical use of the materials in a specified role.

Maximum Temperature Possible at the Pulse Oximeter Probe-Tissue Interface

Conclusion from QATR 5093:

The OEM III Pulse Oximeter with 8000AA, 8000J, 7000A, 8000R, and 8000Q sensors surface temperatures did not exceed $41^{\circ}C$ for surfaces that come in contact with the patient, therefore meeting the requirement.

Sensor	Maximum Temperature Measured
8000AA	$35.95^{\circ}C$
8000J	$35.51^{\circ}C$
7000A	$36.16^{\circ}C$
8000R	$35.73^{\circ}C$
8000Q	$35.85^{\circ}C$

Test method used to measure the maximum temperature possible at the Pulse Oximeter probe-tissue interface

From QATR 5093:

Test description

Operate the device in an ambient temperature of 35°C.

Measure the temperature of the device surfaces, which are not intended to contact the patient. The presence of any temperature above 50°C should constitute failure of this test.

Measure the temperature of the device surfaces, which are likely to contact the patient in normal use. Any temperature above 41°C should constitute failure of this test.

Test procedure

1. Attach thermocouples to correct locations as stated in the above Equipment Setup Section 2.2.1.

2. Attach thermocouples to Agilent Model 34970A Data Logger.

3. Place the data logger outside the environmental test chamber and place the Units Under Test inside the test chamber.

4. Set the test chamber to 35°C and turn it on.

5. After the test is completed, remove the UUT's from the test chamber.

Recycling/ disposal

Please refer to the ***Additional Information and Safety Notes for Assorted Nicolet Brand Products Reference Guide*** on CD (part number 482-6387xx).

Additional information for the Pulse Oximeter

For power losses **less** than 30 seconds, all settings and patient data does not change.

For power losses **longer** than 30 seconds, a **Purple** bar will appear at the top of the screen display for the duration of the power loss.

The Pulse Oximeter does not include alarms. Abnormal operation (e.g., blank display) for Pulse Oximeter probe faults is indicated by an Event Bar at the top of the screen display with the words **Bad Xpod signal**.

If the SpO2 or pulse rate value display is potentially incorrect, this state is indicated by an Event Bar at the top of the screen display with the words **Bad Xpod signal**.

IMPORTANT: For the v32, if the Sp02 and pulse rate show 85% and 85 bpm, this is a potentially incorrect reading. Tests have shown that if there is a defective XPOD cable, the 85/85 scenario is possible. The operator should inspect (replace) the cable.

20

Nicolet Cortical Stimulator

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Stimulus Control Unit (SCU)

The Stimulus Control Unit is an electrical stimulator with built-in controls and display.

Figure 1: Stimulator Control Unit.

It provides isolated bi-phasic constant current capability and channel selection through a Stimulus Switching Unit (SSU). The Stimulus Control Unit can be used as a standalone device or used with Nicolet LTM system software for user interface operation as well with the ability to create electrode labels and annotations on the recorded EEG data. The Stimulus Control Unit connects to Nicolet LTM system via the RS232 serial port of the Acquisition system.

This chapter describes how to control the Stimulator Control Unit from the NicoletOne system. Please see the Nicolet Cortical Stimulator User Guide (269-621500) for instructions on using the Stimulator Control Unit controls.

⚠ **WARNING** **The patient can be stimulated even when not recording EEG. In this mode, data will not be recorded by the NicoletOne.**

NOTE: Central Monitor is not functional with the Nicolet Cortical Stimulator.

Summary of Cortical Stimulator panel controls

Setup	• Click on the **Setup** show menu button and choose between **Electrode** or **Probe** operation.
Pulse Freq.	Chooses the rate at which pulses are delivered. • Rate - measured in Hz, 50 Hz typical • Select the **Pulse Freq.** show menu button and then select the desired frequency of the pulse.
Pulse Dur.	Chooses the duration of the stimulus pulses. • Measured in µsec range 10 - 1000µsec • Select the **Pulse Dur.** show menu button and then select the desired duration of the pulse.
Train Dur.	Chooses the train duration. • Measured in seconds 5sec typical, or continuous for probe. • Select the **Train Dur.** show menu button and then select the desired duration of the train.
Electrode +	Selects the positive electrodes that will receive the stimulus. • Select the **Electrode +** show menu button and then select the **electrode** you want assigned as the **positive** electrode. • Select any recording channel pair (1-64 or 1-128) for stimulation.
Electrode -	Selects the negative electrodes that will receive the stimulus. • Select the **Electrode -** show menu button and then select the **electrode** you want assigned as the **negative** electrode. • Select any recording channel pair (1-64 or 1-128) for stimulation.
Set Stim.	Sets the **current level** applied to the patient. • Set level 0.1 – 15 mA (8 mA or less typical). • Use the **+1** and **-1** buttons to increment/decrement the setting by 1.
Check Stim.	Applies the selected stimulus to an internal load to verify correct operation.
Mark Channels	Marks the selected channels. • Places an ID tag on the EEG traces being stimulated. This key allows a small, internally generated signal to be applied to the stimulus output in order to check that the correct channels (electrodes) have been connected on the amplifier. When this feature is switched on, the LED adjacent to the **Mark Channel** key on the Cortical Stimulator Unit is illuminated.
Ictal Disrupt	Delivers a single stimulus pulse. • Repeats the first pulse in the train.
Start	Starts stimulation pulse delivery. • Deliver stimulation pulse, train or continuous.
Stop	Stops stimulation. • Interrupts train or continuous stimulation. Clicking this button should terminate any stimulation that is in progress. It is used to terminate stimulation at an earlier time than what has been set.

Remote system link

The Stimulus Control Unit may be connected to a NicoletOne system via the RS232 cortical stimulator interface cable and operated remotely from the NicoletOne system.

RS232 is a popular communications protocol for connecting data acquisition devices to computers. RS232 devices can be plugged straight into the computer's serial port (also known as the COM or Comms port).

Decoder Link and Stimulus

Stimulator Probe Connectors   **RS485 Port**
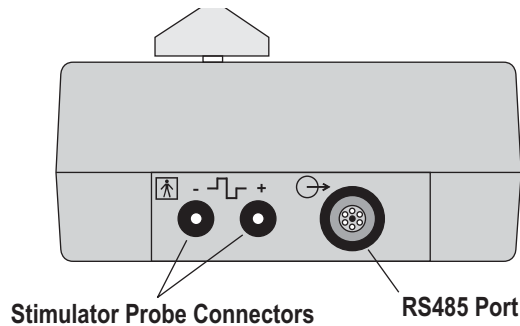
Figure 2:Stimulus Switching Unit top view.

The C64 Amp with Stimulus Switching Unit (SSU) receives serial communication commands from the Stimulus Control Unit (CSCU) via RS485 communications through the cortical stimulator cable.

C64SSU (Stimulus Switching Unit)

Figure 3: C64SSU

The Stimulus Switching Unit (SSU) interfaces with the C64 OR LTM amplifier and provides an electronic method of selecting electrode pairs to stimulate without disconnecting the electrodes from the amplifier, so that as soon as the amplifier recovers from overload, the ECoG (Electrocorticography) can be monitored for 'after discharges.'

Selecting the channels

The BCD selector switch position is read into the micro-processor, which communicates the position to the Stimulator Control Unit via the RS485 communications. Selector switch positions 0 and 7 are not used. The indicator LEDs that indicate the Selector Switch position are also used as an "Error Signal."
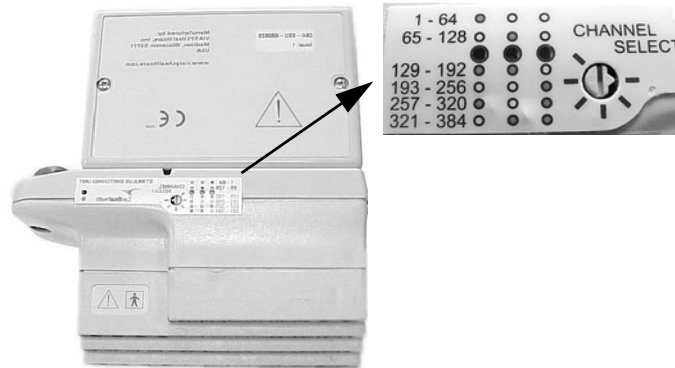
Error signal indication

When power is turned ON to the SSU, the LED Channel Select will indicate the number of channels. If there is faulty communication, ALL LEDs will flash, indicating an Error Signal.

Channel selector

The position of the Channel Selector is designated by the "groove" as shown below. The pointed part of the selector is NOT used to make selections.

Channel Selector
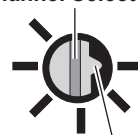
Not the Channel Selector

In the above example, channels 65-128 have been selected as shown on the next page.

Channel Selector key

The selector can turn clockwise or counter-clockwise. The arrow must be in the correct position relative to the groove to designate the correct channel selections.

When power is turned ON to the SSU, the LED Channel Select will indicate the number of channels. The **number of available channels** is considered selected when the pattern of lit LED(s) match the Channel Select Key Label.
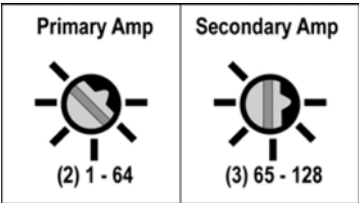
* **Null** is a non-legal position, which will result in an "Error Signal."

NicoletOne supports a maximum of 128 channels (dual C64 SSU Amp); i.e., two C64 Amps "daisy chained."

Channels	LED States		
1 - 64	ON	OFF	OFF
65 - 128	OFF	ON	OFF

Using the NicoletOne system to set the Cortical Stimulation parameters

IMPORTANT: If you are currently stimulating the patient and you would like to change any parameters, press the Stop button prior to making any changes other than the Stimulation level (Set Stim parameter).

Display the Cortical Stim panel

1. With the NicoletOne system running in the Recorder mode, click on **View > Panel > Cortical Stim** to display the Cortical Stim panel at the right side of the screen display.

Select the Grid/ Strip/Depth Electrodes

2. Define one or more implanted grid(s), strip(s), or depth electrode(s) for use in the exam. Please see the **Grid/Strip/Depth Electrodes** chapter in this guide for instructions.

Set up the parameters

3. **Setup** - Click on the **Setup** show menu button and then click on **Probe** or click on **Electrode** if using the Stimulus Switching Unit (SSU).

4. **Train Duration** - Click on the **Train Duration** button and then select the desired train duration: Units of **seconds** (5 seconds, typical) or **Continuous** if using a stimulator probe.

5. **Positive Electrode**s - Click on the **'Electrode +'** (Anode) show menu button ⯆ and then click on the desired **electrode number or label**.

6. **Negative Electrode**s - Click on the **'Electrode -'** (Cathode) show menu button ⯆ and then click on the desired **electrode number or label**.

⚠ **WARNING**

The applicable stimulation probe is the Natus Neurology Incorporated Bipolar Stimulation Probe with 2.2mm diameter tips. The applicable stimulation electrodes are any commercially available 2.3mm diameter Strip and Grid Electrodes. In the United States only, the stimulation electrodes and stimulation probes must have been cleared to market by the Food and Drug Administration (FDA).

7. **Pulse Freq** - To check the Pulse Frequency, click on the **Pulse Freq.** show menu button and ![dropdown] then select the desired pulse frequency rate (50 Hz, typical). The last selected setting becomes the startup default setting.

8. **Pulse Duration** - To set the Pulse Duration, click on the **Pulse Dur.** show menu button ![dropdown] and then select the desired pulse duration: **100 - 1000 uSec**. The last selected Duration setting becomes the startup default setting.

9. **Stimulation level** - At startup, the Stimulation level is set to 0.0 mA. Click on the **Set Stim** show menu button ![dropdown] and then select the desired stimulation level: **0 - 15 mA** (8 mA or less is typical). If the **Mode** or **Electrode +** or **Electrode -** are changed, the stimulation level will reset to 0.0 mA.

⚠ **WARNING**

Begin with a setting according to your laboratory protocol.

10. If you want to mark the channels prior to and after stimulation, click the **Mark Channels** button.

11. **Check Stim** - To check the Stimulator Integrity, click on the **Check Stim** button to check the integrity of the stimulator <u>without</u> stimulating the patient.

Using the Stim Map

1. Click on the **Show Stim Map** button to display the Stim Map dialog.

    The brain view and grid/strip(s) located on the brain that you selected using the Grid/Strip Editor is displayed in the Brain View pane.

    > To **Zoom In** on the Brain View, position the mouse pointer over a **grid/strip** on the brain image (the pointer will turn into a hand icon) and click the mouse button. Use the **Zoom Out** button to reduce the size of the Brain View.
    >
    > You can **drag the brain image** for the view you want by positioning the mouse pointer anywhere away from a grid/strip and then holding down the mouse button while moving the mouse.
    >
    > The << and >> buttons, which are used to scroll through the Brain View image options, are disabled because the brain view was selected earlier in step 2.

Creating Functional Annotations

2. To add **Functional Annotations** (Motor, Visual, Language, Sensory, and Other), click on the **pair of electrodes** in the Brain View pane that you want to annotate.

3. Click on the Functional Annotations **Add** button.

4. From the Edit Functional Annotation dialog, click on the **check box** for the annotation you want to create.

5. In the Comments pane, type in a brief **description** for the annotation.

6. Click on the **OK** button.

    A colored line appears connecting the two electrodes you selected earlier.

7. Repeat steps 2 through 6 for each additional annotation you want to use.

    > To **edit an annotation**, click on the annotation you want to edit and then click on the **Edit** button.
    >
    > To **delete an annotation**, click on the annotation you want to delete and then click on the **Delete** button.
    >
    > Double-clicking on an **annotation** will bring the associated pair of electrodes into focus.
    >
    > Double-clicking on a **Grid/Strip** listed in the Grid/Strip pane when multiple Grid/Strips are being used will bring that one into focus on the Brain Image.

Creating Ictal/
Inter-Ictal
Annotations

8. To add **Ictal/Inter-Ictal Annotations**, click on the **pair of electrodes** in the Brain View pane that you want to annotate.

9. Click on the Ictal/Inter-Ictal Annotations **Add** button.

10. Enter a **name** for the annotation in the Name text entry field.

11. Click on the **Color** show menu button and then click on the **color** you want to use to identify the electrodes you selected in step 8.

12. Click on the **OK** button.

    The two electrodes you selected in step 8 become filled with the selected color.

To **edit an annotation**, click on the annotation you want to edit and then click on the **Edit** button.

To **delete an annotation**, click on the nictitation you want to delete and then click on the **Delete** button.

Double-clicking on a **Grid/Strip** listed in the Grid/Strip pane when multiple Grid/ Strips are being used will bring that one into focus on the Brain Image.

Creating a Cortical Stimulator report

The Cortical Stimulator report is comprised of:
- Patient, Test and Personnel information
- Brain map(s)
- Test results
- A Description of the test
- A Conclusion for the test
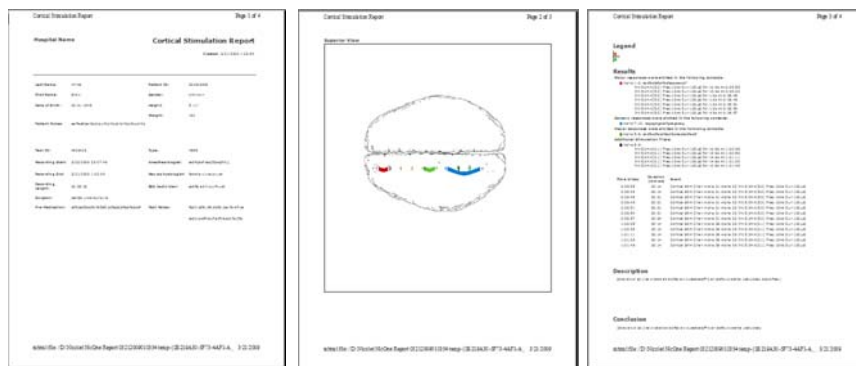
NOTE: Information contained in the report is editable.

The brain image provides a visual summary of all the patient responses, which electrodes were stimulated, draws functional annotations using colored lines, indicates interictal stimulations by coloring in the contact.

The Legend refers to Interictal Stimulations and the Results refers to Functional Responses. Functional Responses are indicated on the report according to type of response, motor, language, sensory, etc., and all parameters that elicited that type of response are listed.

The Other Responses field lists the ones that did not elicit a response.

The Comprehensive list includes every response and all associated parameter.

Creating a
Cortical
Stimulator
Report

1. From the Reader window, click **Tools > Create Report**.

2. Click **Cortical Stim** from the drop down menu.

3. Enter/edit any information in the report as necessary.

4. Click **File > Print Preview**.

5. If the page orientation is set for Portrait, click on the **Landscape** button in the Toolbar so that the brain image fits on the page properly.

6. Make any adjustments as necessary for the best printout.

7. Click on the **Printer icon** in the Toolbar.

8. Adjust the printer settings as necessary.

9. Click **Print**.

Troubleshooting the Stimulus Control Unit

Power cycle check

During power ON, verify LCD "Status."

    a.   The firmware version "LN80" should flash briefly.

    b.   When firmware is loaded, the Stimulus Control Unit will show "RDY."

Error Codes

Error Codes	Error Message
Error 20	Phase A pulse width too short.
Error 21	Phase B pulse width too short.
Error 22	Pulse frequency too short.
Error 23	Train duration too short.
Error 24	Stimulus current control voltage incorrect.
Error 25	One or more of the SSUs are not available/ready.
Error 26	Decoder(s) communication error.
Error 27	A decoder disconnect occurred.
Error 28	Stimulus current flowing when it shouldn't be.
Error 29	Unexpected Stim.
Error 30	Phase A pulse width too long.
Error 31	Phase B pulse width too long.
Error 32	Pulse frequency too high.
Error 33	Train duration too long.
Error 35	Unexpected monophasic pulse was delivered.
Error 48	CSCU Checksum incorrect.

Error codes 20-24 and 28-35	These codes cannot be adjusted by the user. When codes 20-24 and 28-35 appear, press the **Stop** [icon] button and then restart the test. If the error repeats, power off the Stimulus Control Unit, wait 30 seconds and then power the Stimulus Control Unit on again. If the error does not clear, there is a likely fault with the Stimulus Control Unit and it **SHOULD NOT BE USED**.

Error codes 25-27

These codes indicate a communication failure between the Stimulus Control Unit and the SSU.

    a. Verify the SSU is cabled properly.

    b. Verify the SSU activity LEDs to confirm it is receiving power.

    c. Check the channel selector for "Error" signal (ALL lights flashing on SSU) and that the correct channel LEDs are lit. If "Error" signal, reset the channel selector to the correct number of stimulating channels and / or power cycle the Stimulus Control unit - On / Off.

Error code 48

The checksum failure can occur when the logic inside the Stimulus Control Unit is getting improper values. A bad checksum may also show a blank LCD.

Power cycle the Stimulus Control Unit. If the problem repeats, the hardware has a serious problem and the Stimulus Control Unit should NOT BE USED.

Channel Select "Error" signal

When all LEDs are in a flashing state on the SSU, the selector may be in a "null" or non-ready position. Using a small flat blade screwdriver, reselect the correct channels position. If the "Error" signal does not clear after few seconds, then the Stimulus Control Unit may need to be power-cycled to reset the logic.

Symbols

A