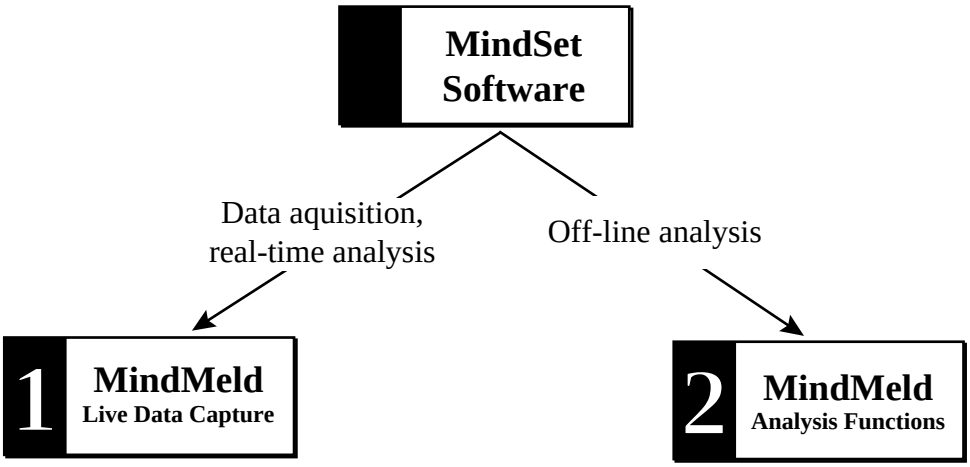
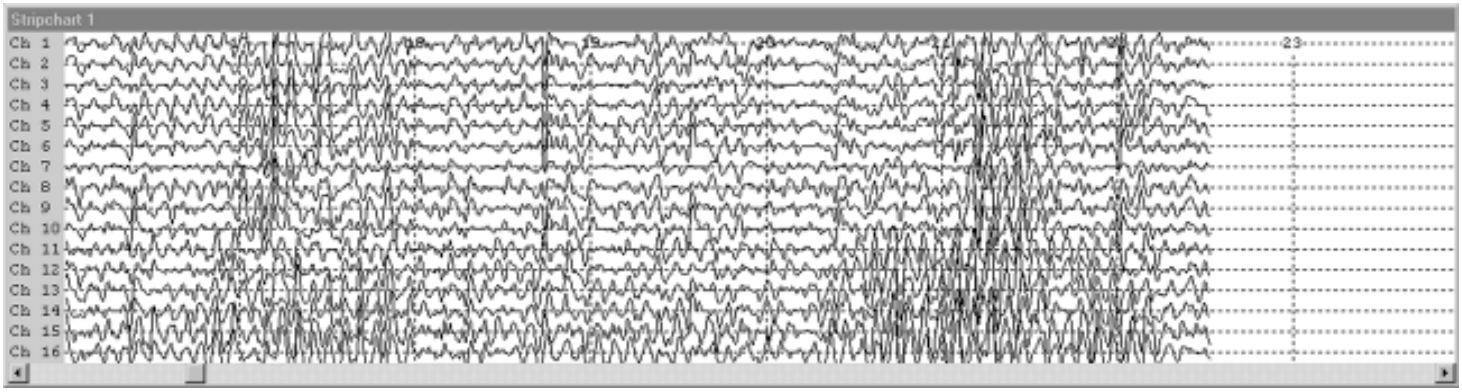
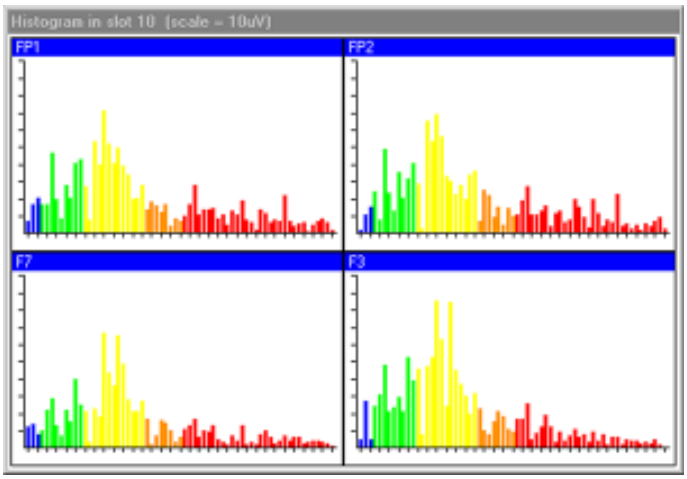
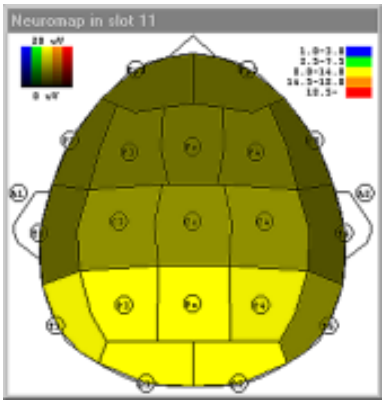
MindSet®

MindMeld Users Manual









NOLAN

NOLAN COMPUTER SYSTEMS, L.L.C.

MINDSET SOFTWARE USERS MANUAL

Software Version 1.0

for use with the

MINDSET Model MS-1000

NOLAN COMPUTER SYSTEMS, L.L.C. (NCS)
Mindset Software Users Manual
Software Version 1.0 November 2001

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RESPONSIBILITY OF THE USER

This product and its components can work properly only if it is implemented and maintained as provided by the instructions in this manual and the hardware manual for the MS-1000. In case of any failure, the product should not be used until completely repaired by an authorized distributor. The owner of this product is responsible for any failure in the operation caused by ill use or inappropriate maintenance, or due to repairs made by persons not authorized by NCS.

Users are responsible for the implementation and use of this product.

NOTE

Table of Contents

MINDSET SOFTWARE USERS MANUAL

1 INTRODUCTION

Welcome to the Mindset application software known as MindMeld. The Mindset hardware and MindMeld software combine to provide you with powerful electroencephalography (EEG) data capture and analysis techniques. These capabilities were formerly available only to hospitals, universities and other deep pocketed institutions due to their complexity and expense.

The MindMeld software is divided into two separate sub-applications:

- *MindMeld Live Data Capture (LDC)* is used for data acquisition and real-time data analysis. MindMeld captures and analyzes live EEG data. Various tools within MindMeld are implemented by a *scheme* methodology used for selecting and connecting the tools together. One tool allows you to save data to your hard drive for off-line analysis. The sample pre-configured schemes illustrate proper tool configurations. You can design and save new schemes to focus on your particular area of interest.
- *MindMeld Analysis Functions (AF)* is used for off-line analysis of a patient s session, also known as replay . After the EEG data has been captured and saved to disk with MindMeld LDC, the tools in MindMeld AF can be applied to the data to provide an overall interpretation of the patient s session. One very useful option in MindMeld AF allows you to remove artifacts and other invalid data prior to sending the data through the analysis tools, thereby improving diagnostic accuracy.

1.1 ASSUMPTIONS AND CONVENTIONS OF THIS MANUAL

This manual assumes you are familiar with the operation of your Personal Computer (PC) and your Windows operating system (O/S). You should know how to insert a Compact Disc — Read-only Memory (CD-ROM) disc and start an application program, use your mouse to select objects on the screen and to implement the basic capabilities of a graphical user interface (GUI). If you have questions about these basic operations, refer to your PC s hardware manuals, Windows manuals or on-line Help.

This manual uses the term *System* to mean the combination of the MindMeld applications, an electro-cap, and the Mindset MS-1000 hardware appropriately configured to acquire and analyze EEGs. The Mindset Calibrator hardware is an optional hardware/software instrument for measuring the frequency alignment of your Mindset. Calibrator details are in Appendix B.

This typeface is used to draw your attention to information that is of particular importance.

This symbol $\rightarrow$ is used to mean the GUI process of selecting from the main menu thru the required option; for example, *Scheme* $\rightarrow$ *Edit Scheme*.

This manual does not attempt to cover all the dialog boxes and information/error messages that appear as you use MindMeld. Follow the on-screen prompts to acknowledge the message/dialog or to complete the operation.

Information shown in the various MindMeld windows in this document is for example purposes only.

NOTE:	There are some comments and graphics in this document that allude to capabilities that are not included in this release. These capabilities will be present in a later software release.

2 SOFTWARE INSTALLATION

This section instructs you on how to install the MindMeld software which is distributed on CD-ROM. Floppy disks are available upon request.

2.1 MINIMUM REQUIREMENTS

Before beginning, ensure that your PC meets the following minimum requirements:

- a Pentium class or equivalent central processing unit (CPU). For optimum real-time performance, *a 200 Mega-Hertz (MHz) Pentium (or faster) is recommended*.
- Windows 95 or later O/S, *or* Windows NT 4.0 or later O/S.
- at least 32 megabytes of Random Access Memory (RAM).
- at least 20 megabytes of available hard drive space.
- at least a video graphics adapter (VGA) class video adapter. An accelerated graphics adapter greatly enhances real-time neuromapping display performance.
- a Windows compliant Small Computer Systems Interface (SCSI) adapter and cable.
- a printer installed with a Windows printer driver.

2.2 PREPARATION AND INSTALLATION

Ensure that there are no other application programs running on your PC. If there are, first save any work in these applications and then quit them.

Insert the CD-ROM disc into your CD-ROM drive, the MindMeld installer program should start automatically. If not, open the icon representing your CD-ROM drive and double-click on the install file. Then follow the on-screen instructions.

Once installation is completed, a directory named MindMeld is created on your hard drive containing the following items:

- the MindMeld Live Data Capture (LDC) and MindMeld Analysis Functions (AF) applications
- Sample Scheme subdirectory containing some sample pre-configured schemes (.em2 files)
- Sample Data subdirectory containing some sample EEG files.

All of the required software is now on your PC and ready to run.

2.3 STARTING MINDMELD

Start MindMeld by:

- navigating to the MindMeld folder and double-clicking your required MindMeld application:
  - MindMeld2.exe for MindMeld LDC
    or
  - MindMeld Analysis.exe for MindMeld AF

or

- navigating to the MindMeld folder and double-clicking on an .em2 scheme file.

Additionally, you can configure your PC to start a MindMeld application by:

- incorporating MindMeld on your Windows taskbar; select the MindMeld folder from the Programs listing, then select MindMeld LDC or MindMeld AF.
- creating shortcuts to place the MindMeld icons on your Windows desktop.

Once started, the selected MindMeld main window is displayed. If you started MindMeld by double-clicking a scheme file, the selected scheme is automatically loaded and displayed.

Ensure that you have only a single copy of each MindMeld application running since a Windows O/S does allow multiple copies of an application to be open.

2.4 SYSTEM CHECK-OUT

These instructions are intended as a System check-out procedure only. They are not intended to convey any details of the tools or setting-up schemes.

If you have not already done so, follow the instructions in the Mindset Hardware Manual to prepare the hardware.

With the Mindset hardware connected and turned-on, and MindMeld running for this check-out procedure, you are accessing a pre-configured scheme consisting of two tools, the MS-1000 and the Stripchart. *With the scheme operating*, the Stripchart tool displays the raw data stream from the Mindset hardware much as a paper stripchart instrument does.

Mindset/MindMeld Check-out Procedure Instructions

User Action	***Result/Comments***
Access *Scheme* → *Load*.	The Select the Scheme window displays.
Navigate to your MindMeld folder.	
Navigate to your Sample Scheme subdirectory.	
Select the sample Stripchart.em2 scheme.	The MindMeld LDC main window displays.
Access *Scheme* → *Start Scheme* or click the Start button if you have the toolbar toggled on.	*You should see Mindset s SCSI light illuminate*. This indicates that Mindset is sampling and sending data to MindMeld. If the SCSI light does not illuminate, check to ensure that Mindset is installed correctly and the power is on. Follow instructions in the Mindset Hardware Manual.
Lightly tap your fingers on Mindset s input jacks.	Observe the results of this tapping on the stripchart s traces.
Access *Scheme* → *Stop Scheme* or click the Stop button if you have the toolbar toggled on.	*Observe that Mindset s SCSI light goes out*.

Try starting and stopping the scheme several times. When you are finished, make sure the scheme is stopped.

At this point, you have started the MindMeld application and verified that the Mindset hardware is connected and operating correctly.

3 MINDMELD CONCEPTS

The following section instructs you on the basic concepts of data capture and how to use the MindMeld GUI.

3.1 BASIC MINDMELD CONCEPTS

MindMeld is used for both live EEG data capture and recorded playback of data through a variety of visual analysis tools. These tools are selected and configured using a methodology referred to as *schemes*. A MindMeld scheme is the way to specify which tools you want to use, how each tool is configured and how the tools are connected to one another. Each tool is described in detail in the next section.

You can use one of the pre-configured (see Appendix C for a listing) schemes, edit them to suit your particular requirements or create new ones. Once created, a scheme can be saved as a file and reused later. You can recognize scheme files by their .em2 suffix.

MindMeld data are handled internally as either *streaming* or *array*.

3.1.1 Streaming Data

Streaming data are the raw data collected from the Mindset hardware. These are the type of data seen on a stripchart. *Each datum is a 16 bit binary value representing the amplitude of the EEG signal at a specific point in time*.

For example, if Mindset s sampling rate is set to 256 samples per second (SPS), there are 256 of these 16 bit values collected every second from each channel. Since Mindset has 16 channels, the total number of samples collected in one second is *`256 SPS X 16 channels = 4,096 samples`*. (Each datum sample contains 16 bits.)

Streaming data are fed from the MS-1000 tool into the:

- *Stripchart tool* for visualization of the raw EEG signals.
- *FFT (Fast Fourier Transform) tool*. As its name implies, this tool performs an FFT on the streaming data to break the signal into its individual frequency components.

3.1.2 Array Data

Once processed by the FFT tool, raw data are now *array data* since they are *handled in two dimensional arrays (frequency vs. amplitude*). Amplitude is measured in Mindset/MindMeld from peak-to-peak in microvolts (V).

Several tools (e.g., Compressed Spectral Array, Histogram and Neuromap) require array data as their input since they perform analysis using the frequency components of the EEG signals.

Keep these two types of data in mind when you are creating or editing your schemes.

4 THE MINDMELD LIVE DATA CAPTURE APPLICATION

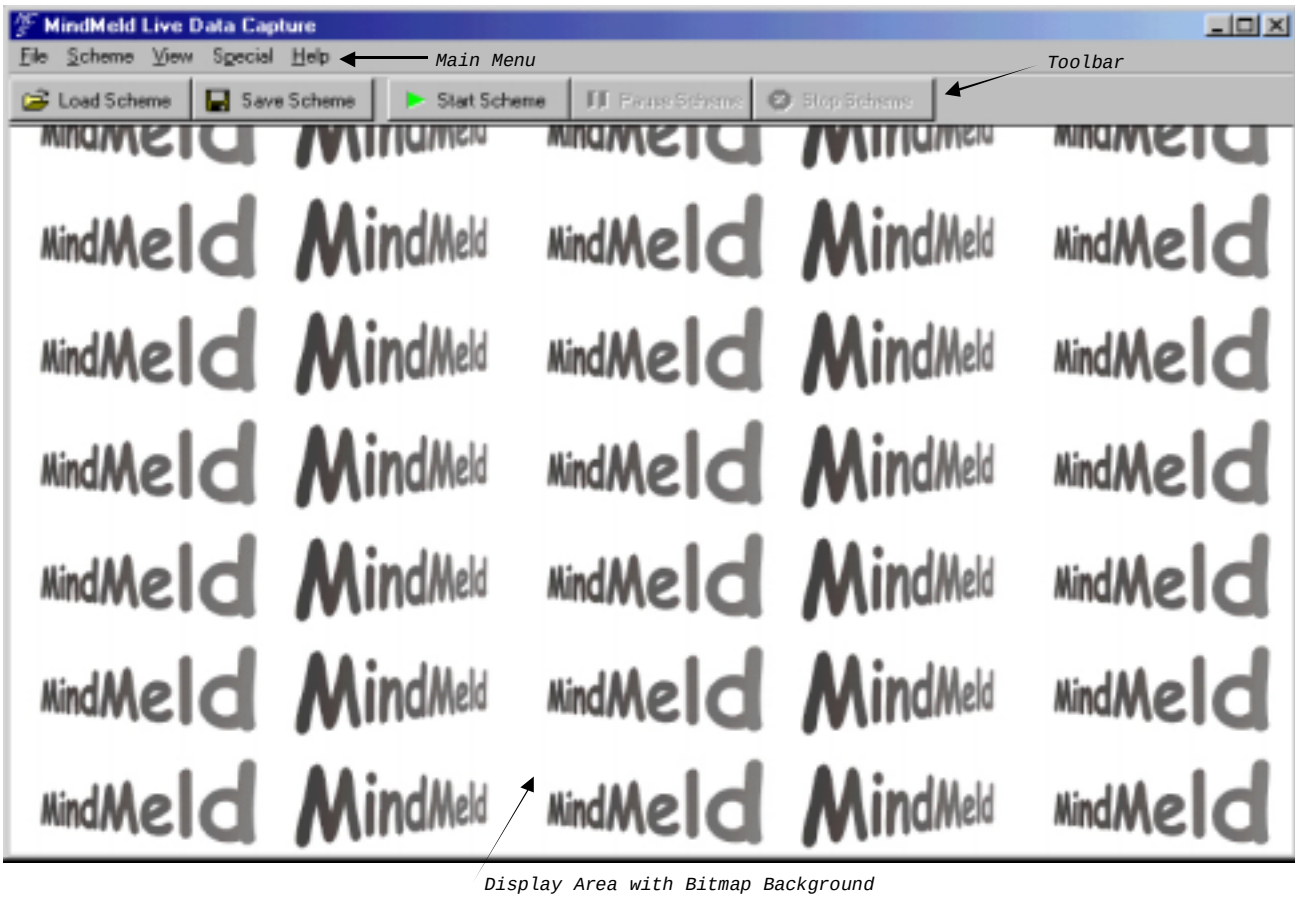
MindMeld Live Data Capture (LDC) is the process of obtaining the original raw data from your patient and saving it to your hard drive if required.

4.1 MINDMELD LIVE DATA CAPTURE MAIN WINDOW

These paragraphs describe how to use MindMeld LDC s main window from the perspective of the GUI (menu options, toolbar and window controls).

4.1.1 MindMeld Live Data Capture Main Window Controls

The MindMeld LDC main window contains a main menu, a toolbar and a display area. Buttons in the *toolbar* are shortcuts for selecting the most frequently used menu options. The *display area* is where scheme tools are placed.



The MindMeld LDC Main Window

File Menu

File → Exit

Quits the MindMeld LDC application. You are prompted to save any open files.

Scheme Menu

Scheme → Start Scheme

Starts a scheme. MindMeld acquires live data from the Mindset hardware for presentation in the selected tools. *If you configured the Storage tool* (refer to paragraph 4.3.2 for additional details) *to save the raw EEG data for later replay, the specified file is opened when the scheme is started.*

Scheme → Pause Scheme

Pauses current scheme operation. If the scheme is already paused, restarts the scheme. When you pause and restart a scheme, new data are appended to the end of the existing data file. *If you configured the Storage tool* (refer to paragraph 4.3.2 for additional details) *to save the raw EEG data for later replay, the specified file remains open when the scheme is paused.*

Scheme → Stop Scheme

Stops the scheme. If you configured the Storage tool (refer to paragraph 4.3.2 for additional details) to save the raw EEG data for later replay, the specified file is closed when the scheme is stopped. *Each time you stop a scheme, the corresponding EEG data file is closed. If you subsequently restart the scheme, a new .bin or .eeg file is created and the base file name is appended with a sequential number. For example; filename1.bin, filename2.bin, etc.*

Scheme → Edit Scheme

Presents the Create/Edit Scheme window to create a new scheme or to modify a selected scheme. Refer to paragraph 5.1 for detailed information.

Scheme → Show Tools

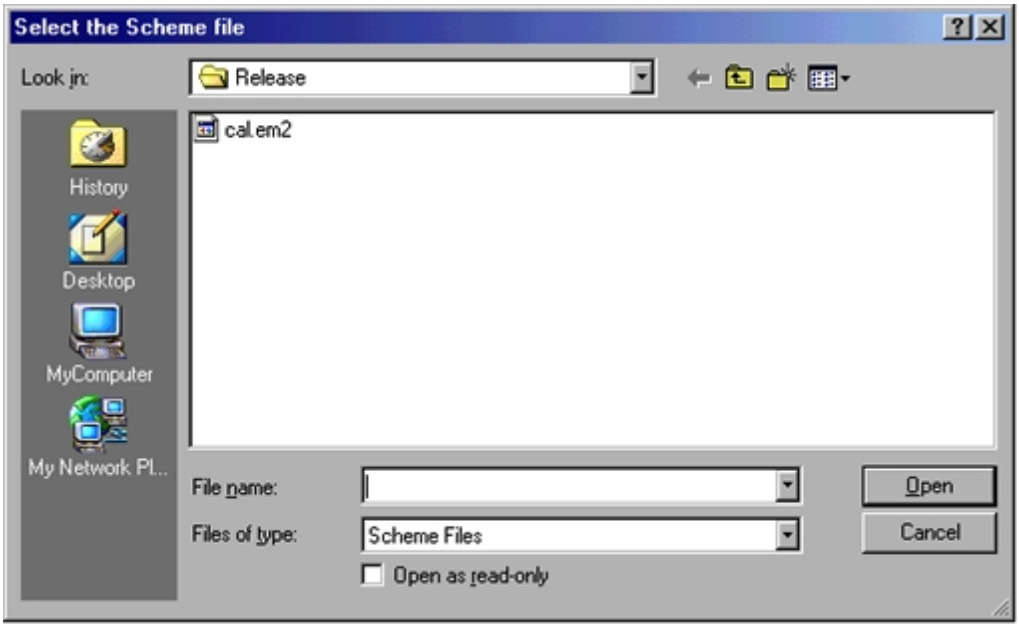
Displays the tools from the currently selected scheme in the display area. Use this menu option to redisplay hidden tools. (Tools are discussed in paragraphs 4.2 and 4.3.)

Scheme → Hide Tools

Removes all tool windows from the display area.

Scheme → Load Scheme

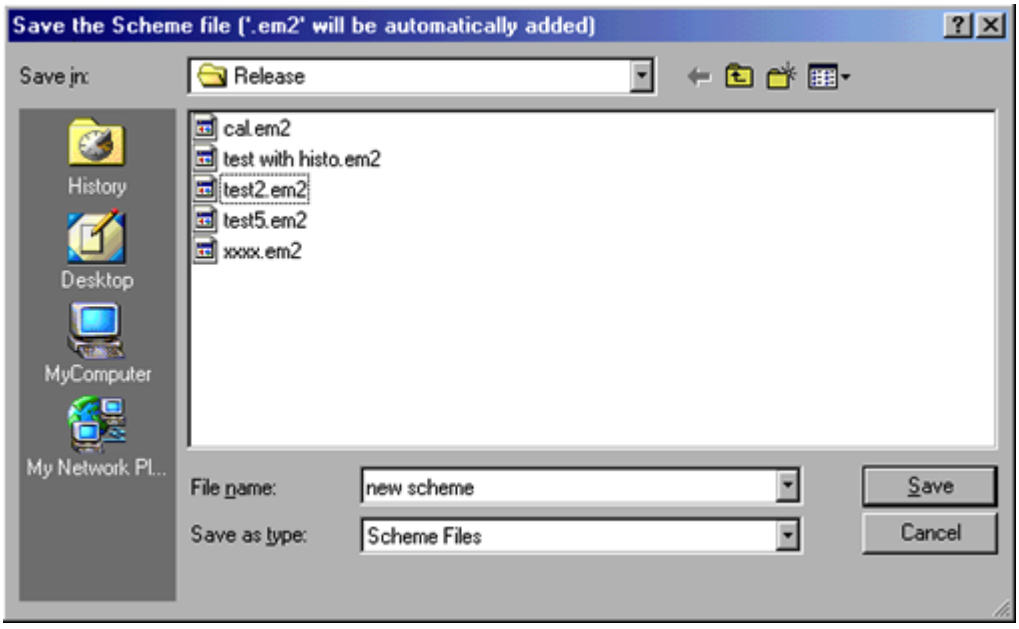
Opens a standard Window s file selection window titled Select the Scheme file to select previously created and saved schemes. Schemes have the .em2 file extension. Select the scheme to load and click Open. The selected scheme displays with its appropriate tools. Any previously loaded scheme is closed.



Select the Scheme File Window

Scheme → Save Scheme

Opens a standard Window O/S file selection window titled Save the Scheme file to save the scheme currently under development. *The scheme must first be Accepted in the Create/Edit Scheme window* (refer to paragraph 5.1). Enter a name in the File name: field. The .em2 file extension is automatically appended when you click Save.



Save the Scheme File Window

View Menu

View → Toggle the Toolbar

Use this option to show or hide (i.e., *toggle*) the toolbar.

The *toolbar* contains the following buttons which correspond to several Scheme menu options described in detail above. Some buttons are grayed-out until their function is appropriate.

- Load Scheme: displays the Select the Scheme File window to select the scheme to open.
- Save Scheme: displays the Save the Scheme File window to save an Accepted scheme.
- Start Scheme: starts the scheme (i.e., data acquisition).
- Pause Scheme: pauses or restarts the scheme (i.e., data acquisition).
- Stop Scheme: stops the scheme (i.e., data acquisition).

Special Menu

Special → Calibrate

This option refers to the optional Calibrator hardware. When your Mindset hardware is calibrated, scalers (multipliers) are determined for each channel and saved in your PC s System Registry. Refer to Appendix B for additional details.

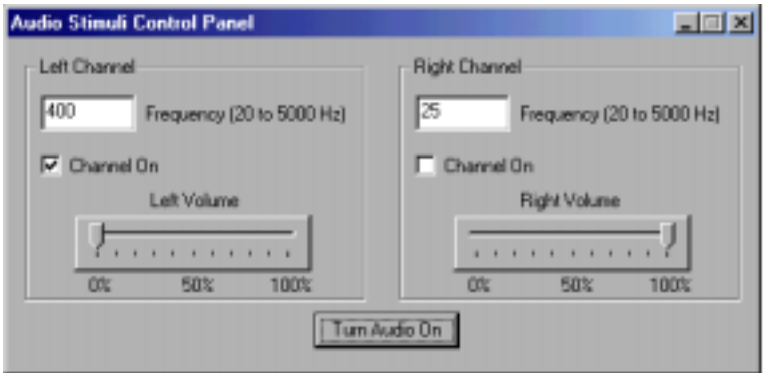
Special → Use Calibration Scalers

Applies the calibration scaler values to incoming raw data prior to displaying the data in any tool window(s). Refer to Appendix B for additional details.

Special → Audio Panel

The Audio Stimuli Control Panel provides audio stimuli to a patient while an EEG is in progress. *To use this feature you must have a sound card capable of pulse code modulation (PCM) audio*. Most sound cards support this capability.

It is best to provide audio stimulation using a Nolan Computer Systems, L.L.C. (NCS) Echofone product (details are at www.echofone.com). The piezo-electrodes on the Echofone device permit precise placement for high frequency injection, beat modulation and bone conduction. You can also use regular stereo headphones plugged directly into your sound card and placed on your patient.



Audio Stimuli Control Panel

The left and right channel panes control the frequency and volume of the sound sine-wave. A channel is on if a checkmark appears in the "Channel On" box. To turn the channel off, click in the "Channel On" check box to remove the checkmark. To turn the channel back on, click in the check box again.

- Enter a frequency from 20 Hz to 5000 Hz.
- Adjust each channel s volume using the slide control.

To start the audio, click the "Turn Audio On" button. This button acts as a toggle to turn audio the on and off. When audio is on, the text in the button changes to "Turn Audio Off".

Help Menu
Help → About MindMeld
Displays information about MindMeld LDC, including the software version number. The About window also has a button to *toggle on or off the background MindMeld bitmap shown on the main window*.

Other MindMeld LDC Main Window Capabilities
In the MindMeld LDC main window, *right-click on any displayed tool window to show a pop-up menu*.

- Hide Window: removes that individual tool window. (All displayed tool windows are removed simultaneously using the *Scheme → Hide* option.)
- Edit Scheme: displays the Create/Edit Scheme window.

Tool windows that display streaming and array data can be resized. Other windows; such as the Storage Tool window, are fixed in size.

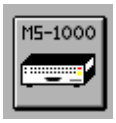
Once a scheme is established, each individual tool window can be moved around within the MindMeld LDC main window. Move/resize the tool window(s) into position before you start a scheme. Tool window size(s) and position(s) are preserved when a scheme is saved.

4.2 MINDMELD LIVE DATA CAPTURE TOOLS OVERVIEW

The remainder of this section describes each MindMeld LDC tool. These tools interact with each other and with the Mindset hardware to provide various types of visualization and analysis information. What follows first is a short description of each tool and a graphic of its icon is shown. Then each tool and its properties is explained in detail. Since the tools interact, it is necessary to have a basic familiarity with all the tools before providing an in-depth presentation of each tool.

The tools are discussed in the order they appear in the Create/Edit Scheme window (refer to paragraph 5.1).

Mindset 1 MS-1000 Tool Overview



The Mindset 1 MS-1000 acquisition tool *communicates with and controls the MS-1000 hardware*. Selections within this tool set hardware parameters such as Mindset s SCSI identification (ID) number and the sampling rate. In this tool you also specify montage channel label assignments.

Storage Tool Overview

The Storage Tool saves live EEG data to a file on your hard disk drive. Live EEG data is not saved for later replay and analysis unless a *named save file* is specified in this tool.

Stripchart Tool Overview

The Stripchart tool *presents an EEG data stream just like an old fashioned paper stripchart machine*. You can configure the Stripchart tool to display any or all sixteen channels, change the displayed amplitude and set the horizontal time scale. You can also specify the arrangement of the displayed channels.

Fast Fourier Transform (FFT) Tool Overview

This tool *accepts a raw data stream as input*, performs an FFT on the data and *outputs a data array* (a signal which has been decomposed into its frequency and amplitude components.)

Averager Tool Overview

The Averager tool *accepts array data* as input and averages these data together over a specified number of spectra. This is handy for filtering out brief transients in the data in order to visualize longer-term trends.

Histogram Tool Overview

The Histogram tool *accepts array data* as input and outputs these data to a histogram. Use a histogram to visualize the frequency and amplitude components of the EEG signal.

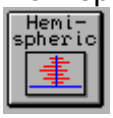
Neuromapper Tool Overview

The Neuromapper tool *accepts array data* as input and outputs these data to a neuromap, a color-coded display of brainwave activity by frequency and amplitude superimposed onto a stylized drawing of a patient s head.

Compressed Spectral Array (CSA) Tool Overview

The CSA tool *accepts array data* as input and outputs these data to a CSA Tool window to observe how the frequency and amplitude components of an EEG signal develop over time. This is handy for visually spotting trends in the data.

Hemispheric Tool Overview



The Hemispheric tool *accepts array data* as input and outputs these data to a hemispheric display which graphically shows brain wave activity by band on each brain hemisphere.

4.3 TOOLS IN DETAIL

Each tool has a primary properties window in which the tool is configured. Several tools have additional subwindows for setting other tool parameters. All of the configuration options are discussed in the paragraphs below. Following each tool s properties discussion, its corresponding window is covered.

Right-clicking on an activated tool icon in the Create/Edit Scheme window displays that tool s properties window. Refer to paragraph 5.1 for additional details.

MindMeld constrains the data entry fields so that you cannot enter improbable values.

Data Presentation

- If you invoked the *Special → Use Calibration Scalers* to the incoming raw data, scaled data is shown in the appropriate tool window(s).
- If you did not invoke the *Special → Use Calibration Scalers* to the incoming raw data, un-scaled data is shown in the appropriate tool window(s).

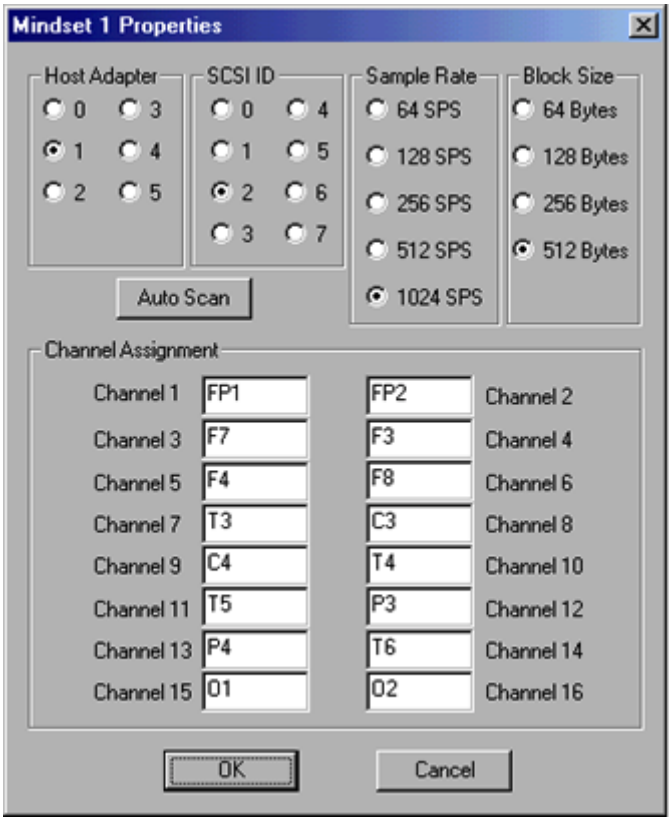
Additional details on calibrated data are discussed in Appendix B.

4.3.1 Mindset 1 MS-1000 Tool

The Mindset 1 MS-1000 data acquisition tool is used *to communicate with and control the MS-1000 hardware*. Data are collected from the hardware and made ready to interact with the other tools.

The Mindset 1 term identifies which Mindset is connected to your PC.

This tool is automatically activated in the Create/Edit Scheme window since the Mindset hardware is a required component for schemes to function. Right-clicking the MS-1000 tool icon displays the Mindset 1 Tool Properties window.



The Mindset 1 Tool Properties Window

Host Adapter pane: set the host adapter number for your Mindset. Also review the Auto Scan button discussion below.

SCSI ID pane: when you installed your Mindset hardware, you specified a unique SCSI identification (ID) number. Ensure that the number in this pane matches the SCSI ID number of your Mindset hardware. If the numbers are not the same, MindMeld is unable to communicate with Mindset. Also review the Auto Scan button discussion below.

Auto Scan button: click the Auto Scan button to have MindMeld search for the Mindset hardware. *If the Mindset hardware is found, the host adapter and SCSI ID numbers are set with the appropriate numbers*.

Sample Rate pane: Mindset hardware is able to sample at 64, 128, 256, 512 and 1024 samples per second (SPS). (Refer to paragraph 3.1.1 for additional details.) A sample rate of 256 SPS is sufficient for most EEG requirements. Use higher sample rates to more accurately capture the patient s data. *Note that a high sample rate results in a very large data file.*

Block Size pane: the default value is 512 bytes per block. The Block Size setting is provided to help eliminate SCSI bus noise which may intrude onto the EEG data. *You should not have to reset the Block Size unless you suspect that SCSI bus noise is showing up in the data*.

With some SCSI cards the noise is more pronounced. In general, if a SCSI card draws its termination power from Mindset, the noise is more likely to show up. *It is always best to connect Mindset as the only device on your SCSI bus chain*. The SCSI card in your PC should be supplying the termination power. If this is your setup, you can turn Mindset s termination power off and remove the termination block (refer to the Mindset Hardware Manual). These steps may eliminate the noise problem.

Depending upon several factors (such as sample rate, SCSI bus termination, SCSI bus configuration, etc.), it is possible for SCSI bus noise to intrude upon EEG data. This noise usually shows up as a spurious 2, 4, 8, 16 or 32 Hertz (Hz) signal. This is because MindMeld may be transferring data from Mindset at these intervals and the SCSI bus then has heavy activity. The SCSI bus noise is best seen by taking a minute or two of data without any other connections (i.e., an electro-cap, etc.) to Mindset s front panel. If you observe such noise, try setting the Block Size to a smaller value. This forces MindMeld to access Mindset at a higher rate because the same amount of data is transferred each second. The idea is to make this access rate higher than 32 Hz, thus moving it out of Mindset s passband. For example, assume that you are sampling at 256 SPS and the SCSI block transfer size is set to 512 bytes. Every second, there are 8,192 bytes of data transferred across the SCSI bus:

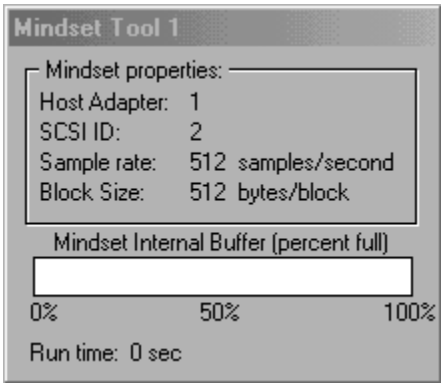
256 samples/second x 2 bytes/sample x 16 channels = 8,192 bytes/second.

Since MindMeld grabs these data in 512 byte blocks (the SCSI Block Size), the access frequency from MindMeld to Mindset is 8,192 512 = 16 accesses per second. Under some circumstances this may show up as a spurious 16 Hz signal in the EEG data. In the above example, if you were to reset the Block Size to 256 bytes from 512, the access rate would be forced to double to 32 accesses per second, thus moving the noise signal to the upper end of the passband. Refer to the Mindset Hardware Manual for further discussion.

Channel Label Assignment pane: channel label assignment mapping depicts which Mindset input channel is connected to which montage point of the Electro-cap. Some of the tools use the labels entered here as default labels on their windows. *This version of MindMeld assumes the default linked-ear montage for all neuromapping.*

All the information set in the Mindset 1 MS-1000 Tool Properties window is saved when you click OK to save a scheme.

When any scheme is invoked, the Mindset Tool 1 window automatically displays. The Mindset Tool 1 window title also identifies the Mindset hardware model number (currently the MS-1000) which was used in the data capture process and the number of channels available on that hardware.



Mindset Tool 1 Window

Mindset properties pane: your selected properties are listed.

Mindset Internal Buffer (percent full) bar: this progress bar fills to alert you to Mindset s internal buffer usage. The progress bar is:

- *green* when the buffer is less than 59% full
- *yellow* between 60 - 79%
- *red* at 80%.

If the buffer overflows, the scheme stops and an error dialog box alerts you to use fewer tools in the scheme or a slower sample rate. This is not likely occur on PCs faster than 400 MHz.

Run time: provides the elapsed time that this scheme has been running. Pausing the scheme continues to run the clock after the scheme is restarted; while stopping the scheme resets the clock.

4.3.2 Storage Tool

The Storage tool saves live EEG data to a file. Live EEG data is not saved to your hard disk drive for later replay and analysis unless a *named save file* is specified in the Storage tool. To save live incoming data to a file, specify a file name and file/folder location. *Data are saved into the named file when you subsequently start the scheme*.

- If you invoked the *Special → Use Calibration Scalers* to the incoming raw data, the scaled data is saved using the Storage tool.
- If you did not invoke the *Special → Use Calibration Scalers* to the incoming raw data, the un-scaled data is saved using the Storage tool.

Data File Formats

MindMeld saves data in one of two file formats:

- the *.eeg format* is provided for compatibility with the previous Mindlab/Wavelab software.
- the *.bin format* is the new format and will be used with future Mindset products.

A .bin or .eeg extension is automatically appended to your file name, depending on the file format selected in the Save as type: field.

Starting, Pausing, Stopping a Scheme

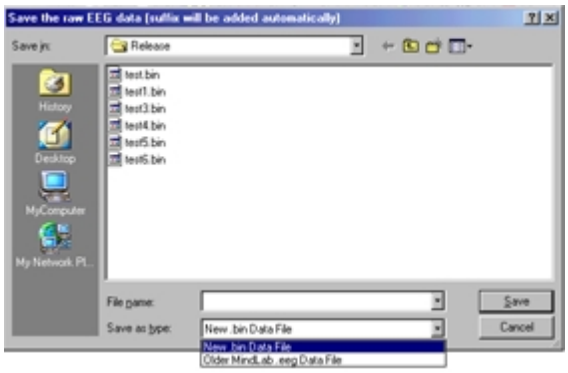
Data are saved into the named file on your hard disk drive when you *start* a scheme.

If you *pause and restart* a scheme, EEG data continues to accumulate in the same .bin or .eeg file.

The specified file is closed when the scheme is stopped. *Each time you stop a scheme, the EEG data file is closed. When you subsequently restart the scheme, a new .bin or .eeg file is created and the base file name is appended with a sequential number.* For example; filename1.bin, filename2.bin, etc. The initial file remains intact and accessible for replay.

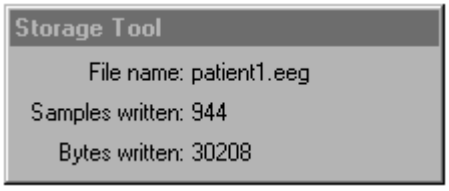
(Return to paragraph 4.1.1 for information on starting, pausing, stopping and restarting schemes.)

Right-clicking the Storage tool icon in the Create/Edit Scheme window displays the standard Windows O/S save file window. For MindMeld purposes, this window is titled Save the raw EEG data (suffix will be added automatically) and represents the Storage Tool Properties window.



Storage Tool Properties Window

When any scheme is invoked for which you indicated on-line storage, the Storage Tool window automatically displays.



Storage Tool Window

File name: shows the previously entered file name for this scheme.

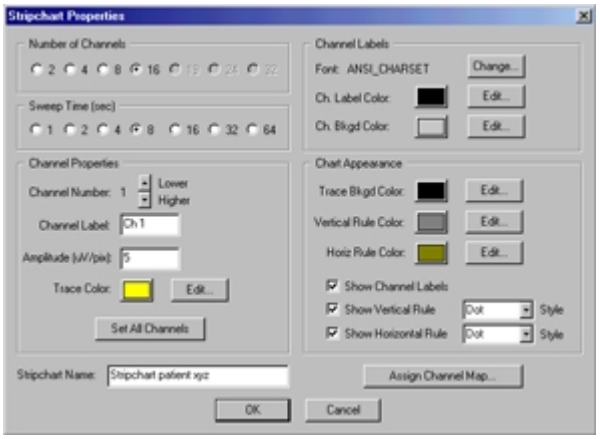
Samples written: the number of data samples that this scheme has accumulated. For the MS-1000, each data sample is 32 bytes (`16 channels x 2 bytes/channel`).

Bytes written: the total number of bytes accumulated in the file since the scheme has been running.

4.3.3 Stripchart Tool

The Stripchart tool presents a raw EEG data stream just like a paper stripchart machine. The EEG data is live, raw data during a data capture session *or* file data during an off-line analysis session. *Stripchart data are presented in real-time* during a live data capture session. For this reason, in the Create/Edit Scheme window discussed later, you can only connect a Stripchart tool directly from the MS-1000 tool to receive streaming data, you cannot connect it to any other tool.

The Stripchart Tool Properties window is used to set the attributes of the display when the Stripchart tool is part of a scheme. You can have two Stripchart tools running at one time, each with a different configuration. Stripchart tool(s) are invoked in the Create/Edit Scheme window by right-clicking on the Stripchart tool icon.



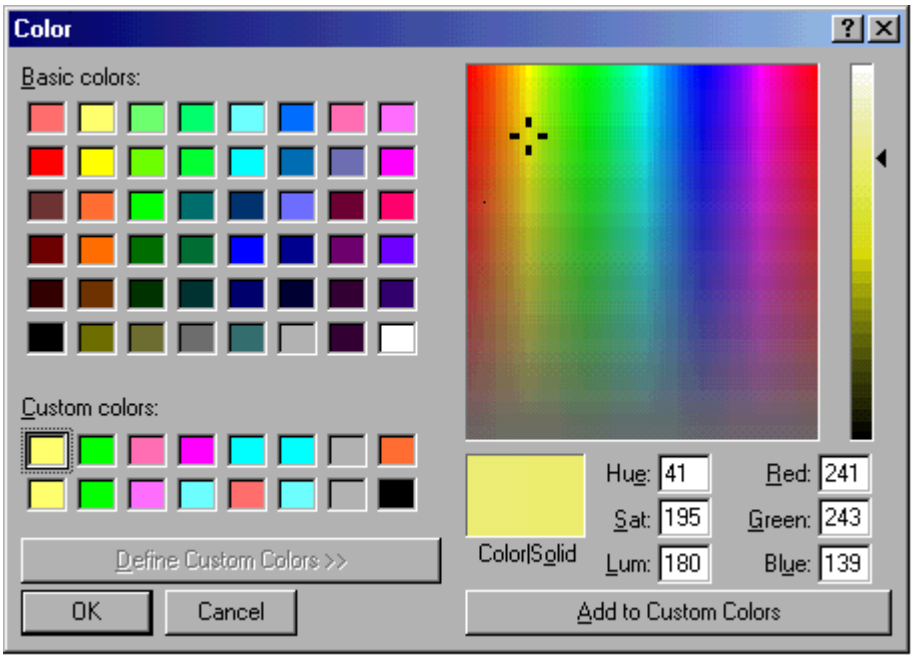
Stripchart Tool Properties Window

Number of Channels: set the number of channels to display. *The default is all 16 channels*. If you display less than 16 channels, all trace data still accumulates to the save file named in the Storage tool, if invoked.

Sweep Time (sec): set the amount of time for the traces to sweep across the entire window. For example, setting the sweep to 16 accumulates 16 seconds of data on the screen. *The default is 8 seconds*.

Channel Properties pane: set unique information about each channel or make all of the channels the same configuration.

- Channel Number: select the desired channel number by accessing the up/down arrows.
- Channel Label: enter your preferred label text for this channel number.
- Amplitude (V/pix): set the displayed amplitude in microvolts per pixel (V/pix). *This number represents the number of microvolts required to cause the traces to vary by one vertical pixel*. For example, setting 5 V/pix means that 1 vertical screen pixel represents 5 microvolts of signal.
  - The *lower* the V/pix number, the larger the displayed signal amplitude; that is, the *display is more sensitive*.
  - The *higher* the V/pix number, the lower the displayed amplitude; that is, the *display is less sensitive*.
- Trace Color: click the Edit button to access the standard Windows O/S Color window to select the color for the channel s tracing on the displayed stripchart.



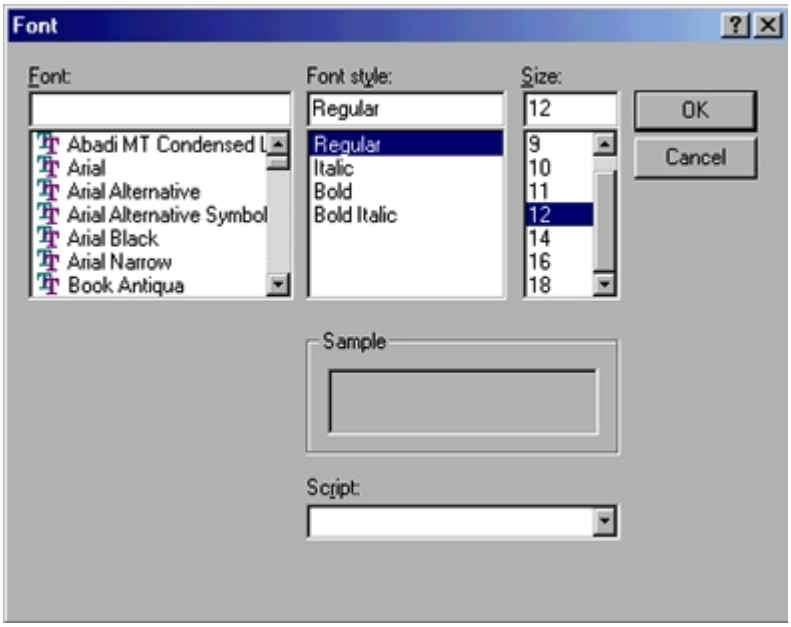
Windows O/S Color Window

- Set All Channels: clicking this button sets all 16 channels to the same parameters (i.e., amplitude and trace color) as the selected channel.

Stripchart Name: assign a name to this stripchart in the data entry field.

Channel Labels pane: these options effect the display of the channel labels (refer to the Channel Properties pane discussion above) on the stripchart. *Be aware that certain color combinations for the label text and background color are visually more readable than others*.

- Font ANSI_CHARSET: click the Change button to access the standard Windows O/S Font window to select the font for the channel label. The American National Standards Institute character set (ANSI_CHARSET) is the default font.

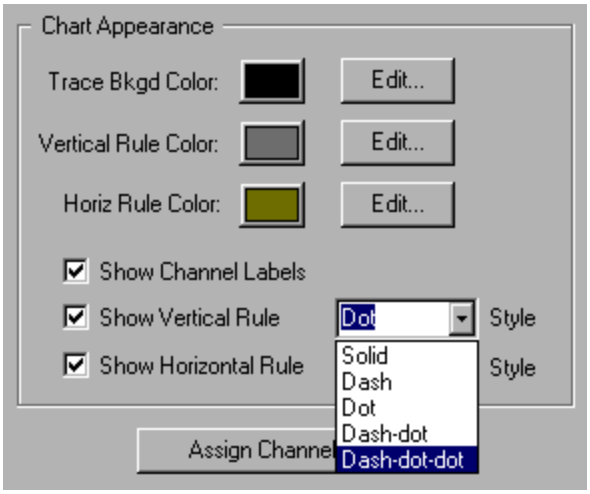


Windows O/S Font Selection Window

- Ch. Label Color: click the Edit button to access the standard Windows O/S Color window to select the *color for the channel label s text*.
- Ch. Bkgd. Color: click the Edit button to access the standard Windows O/S Color window to select the *background color for the channel label*.

Chart Appearance pane: these options effect the appearance of the trace data on the stripchart. *Be aware that certain color combinations of trace, ruler and background color are visually more readable than others.* (Refer to the Channel Properties pane discussion above for setting color information.)

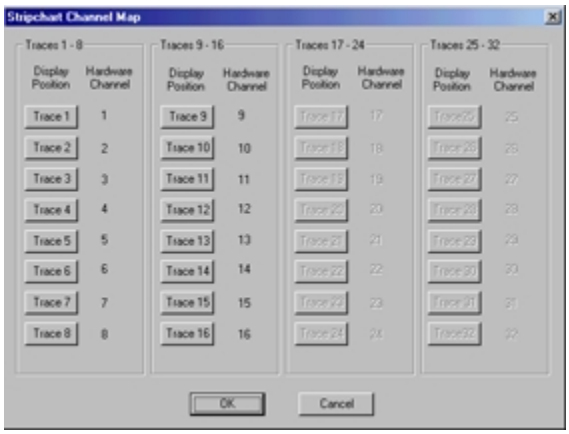
- Trace Bkgd. Color: click the Edit button to access the standard Windows O/S Color window to select the *color for the background on the stripchart.* (When printing a stripchart you may want to have a white background to save time and ink or toner.)
- Vertical Rule Color: click the Edit button to access the standard Windows O/S Color window to select the *color for the vertical rule* displayed on the stripchart.
- Horiz. Rule Color: click the Edit button to access the standard Windows O/S Color window to select the *color for the horizontal rule* displayed on the stripchart.
- Show Channel Labels: click in the check box to show channel labels on the displayed stripchart. Uncheck this box remove channel labels.
- Show Vertical Rule: *each vertical rule represents one second of time*. Click in the check box to show vertical rules on the stripchart. Use the pull-down option to select the rule style. Uncheck this box to remove vertical rules.



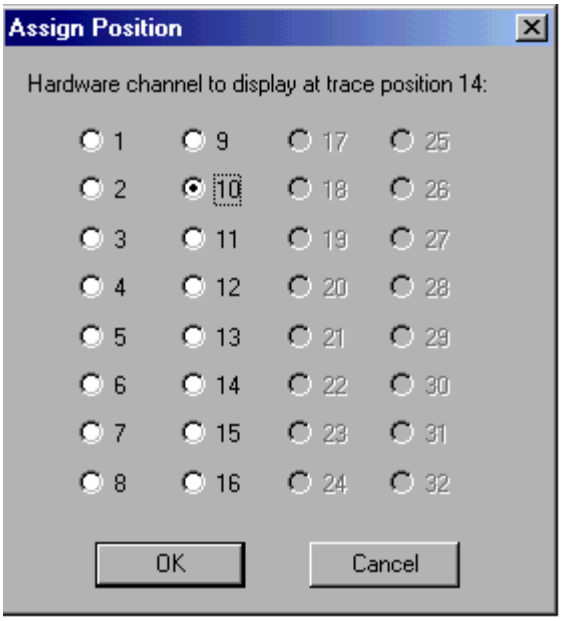
Stripchart Tool Properties Chart Appearance Pane

- Show Horizontal Rule: click in the check box to show horizontal rules on the stripchart. Use the pull-down option to select the rule style. Uncheck this box to remove horizontal rules.

Assign Channel Map : displays the Stripchart Channel Map window. In this window, select the channel s trace display position to correspond with each hardware channel for the stripchart. This becomes useful if you are observing fewer than 16 channels on the stripchart. *Clicking on each numbered Trace button* displays the Assign Position window in which to select any hardware channel to show at the selected trace display position on the stripchart. You may set all traces to the same hardware channel.



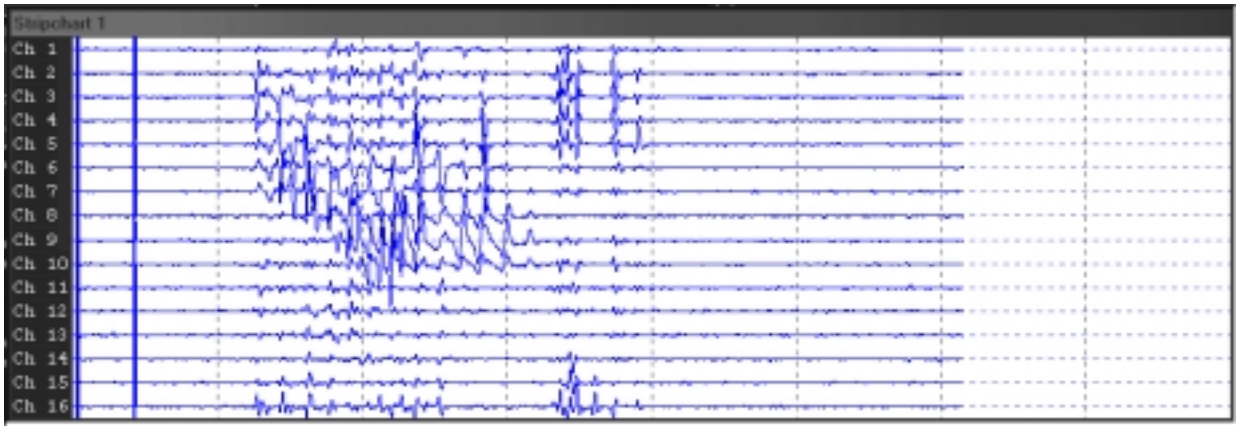
Stripchart Channel Map Window



Stripchart Trace Assign Position Window

All the information set in the Stripchart Tool Properties window is saved when you save a scheme.

When any scheme is invoked for which you indicated a stripchart(s), Stripchart tool window(s) automatically display with the appropriate properties. The window title indicates which slot position(s) (i.e., Stripchart 1 and Stripchart 2) are being displayed. Refer to paragraph 5.1 for a discussion on reference slots.



Stripchart Tool Window

4.3.4 Fast Fourier Transform (FFT) Tool

The FFT tool is used to break an incoming signal into its individual frequencies that make up that signal. This tool *accepts a raw EEG data stream as input and outputs a data array*. This array is two dimensional, made up of specific frequencies and the amplitude of those frequencies. Several of MindMeld s tools use this *near real-time array data* as their input.

A rigorous discussion of FFT analysis and usage is beyond the scope of this manual. The following discussion is somewhat simplified and is intended to help you select from among the FFT tool parameters. For further details, see the FFT Properties 3.5 application program included on the MindMeld distribution disc.

FFT Epoch Length

This is the number of samples that the FFT uses in performing the transform. It is in effect the time record for the FFT. In general, a longer epoch results in a more accurate FFT output (especially at lower frequencies) but at the cost of increased processing time. *MindMeld uses a 128 sample epoch with a 0.5 Hz resolution*.

FFT Overlap

The overlap percentage specifies how much the epoch (or data blocks) are to be run together. The Fourier transform prefers the data be in one large continuous stream. In reality, this stream must be broken up into blocks (epochs) of finite size. This introduces adverse spectral effects; such as, phase errors, ringing and spectral leakage. To help overcome these effects, techniques referred to as windowing (refer to the next set of paragraphs) and block overlap are used. Overlapping the blocks helps the FFT average out certain effects and increases the rate at which the display can be updated.

For example, assume the time record is at two second intervals. MindMeld would have to wait for the entire time record to be captured before performing the FFT. The display would then be updated at two second intervals. Using overlap, data from the previous block are used to compute the FFT and MindMeld does not have to wait for the entire time record before transforming it. Hence, the display is updated faster. This is true up to a certain point, depending on the processing power of your PC.

A higher overlap percentage results in more transforms having to be performed each second and your PC may not be fast enough to do this while handling all of the other processing tasks. *MindMeld uses an overlap percentage of 75%.*

FFT Windows

Think of an FFT window as a filter through which data are passed prior to computing the FFT. FFT windows are used to reduce certain spectral effects caused by performing the FFT on finite data sets. *The incoming signal is likely not be periodic within the time record, thus causing phase errors*. Also, if a signal s frequency is not precisely on a frequency bin (0.5 Hz for Mindset/MindMeld), the signal may smear across two or more frequency bins. An FFT window tapers the data to zero at each endpoint which forces it to be periodic within the time record. The different FFT window shapes determine just how the edges are tapered (steeply or gradually).

In the following discussion, the term "*frequency bin*" refers to each of the 128 frequencies (0.5 Hz to 64 Hz at 0.5 Hz intervals) computed by the MindMeld FFT. The term *selectivity* refers to the ability of the FFT to distinguish signals which are close together in frequency.

- Rectangular
  This is not an FFT window (i.e., filter) at all. *The FFT is computed on the raw data.* With the rectangular window, a signal that is exactly on a frequency bin shows as a single line in the histogram tool because it is exactly periodic within the time record. *Only those frequencies which are exactly on the frequency bins show with the proper amplitude and frequency in the histogram (and other tools which accept their input from the FFT tool)*. If a frequency is between bins, it smears out and effects every bin of the spectrum. For this reason, the Rectangular window is not a good option for general EEG purposes.

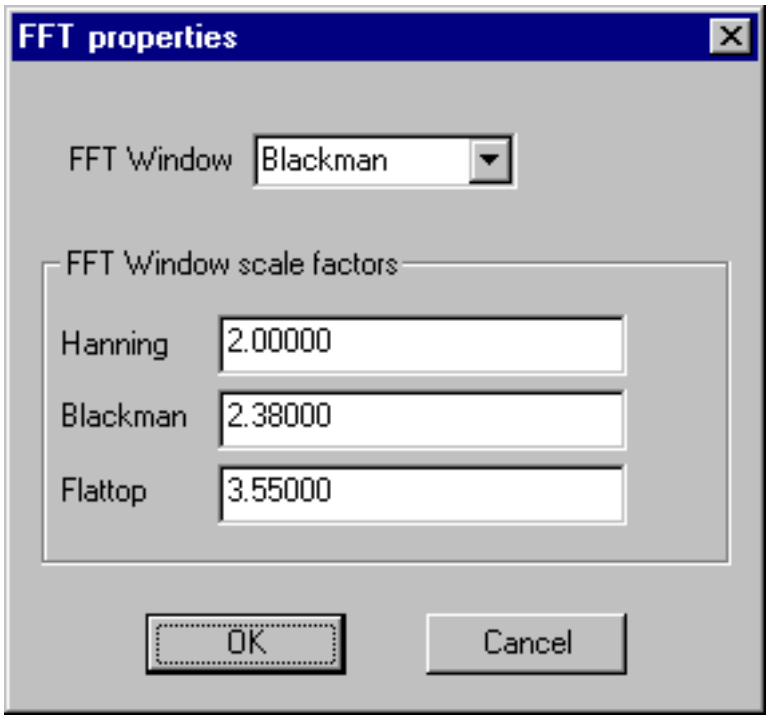
  Since the Mindset Calibrator injects a precise 16 Hz signal into the Mindset, the special calibration scheme contains an FFT tool using the Rectangular window option.

- Hanning
  The Hanning window has an amplitude variation of about 1.5 dB (decibel) for signals between bins and provides fairly good selectivity. *The Hanning window limits the performance of the FFT when two signals are very close together in frequency but different in amplitude*.

- Blackman
  The Blackman window is a very good window to use with the Mindset. It has better accuracy than the Hanning, very good selectivity and fast filter rolloff. Signals close together can be resolved even when their amplitudes differ to a large degree.

- Flattop
  The Flattop window improves on the amplitude accuracy of the Hanning window. The Flattop window s between bin amplitude variation is about .02 dB but its selectivity is a bit less precise. The Flattop window has a wide passband and very steep rolloff characteristics. *Therefore, signals appear wide but do not leak across the entire spectrum*.

Use the FFT Tool Properties window to set the FFT tool s parameters. FFT tool(s) are invoked in the Create/Edit Scheme window by right-clicking on the FFT tool icon.



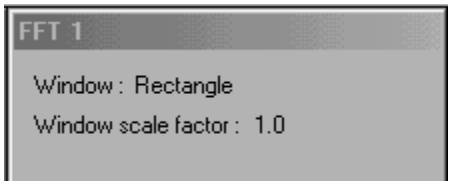
FFT Tool Properties Window

FFT Window: select the type: Rectangular, Hanning, Blackman or Flattop from the pull-down menu option.

FFT Window scale factors pane: enter the scale (i.e., weighting) values you want. *These are multipliers used to bring the resulting amplitude signals into compliance with other databases that you may be using*. Also, since the different FFT window types result in a reduction of the actual signal amplitude, these factors are used to bring the displayed amplitude up to the true amplitude. *The values shown in the above figure are calibrated values determined by injecting a signal of known frequency and amplitude into the Mindset and observing the FFT output.*

All the information set in the FFT Tool Properties window is saved when you save a scheme.

When any scheme is invoked for which you indicated an FFT, the FFT Tool window automatically displays with your selected properties listed. The window title indicates which slot position(s) (i.e., FFT 1 and FFT 2) are being displayed. Refer to paragraph 5.1 for a discussion on reference slots.



FFT Tool Window

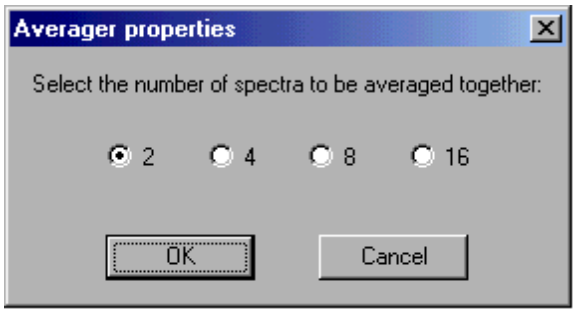
4.3.5 Averager Tool

The Averager tool *takes FFT array data as input* and *averages these data over time*. *Brief transients are smoothed out*. This facilitates visualizing long-term trends in the data.

Because of this averaging, *the data display within tool window(s) connected to the Averager tool are initially delayed and slower in comparison* to a Stripchart tool which takes data directly in real-time.

Outputs from the FFT to be averaged together before being displayed are selectable from 2 to 16 spectra. *A spectra is one output of a sample block (i.e., 128 samples in length) from the FFT*. The higher the number of spectra to be averaged, the smoother any rapid transitions (e.g., artifacts) display on-screen.

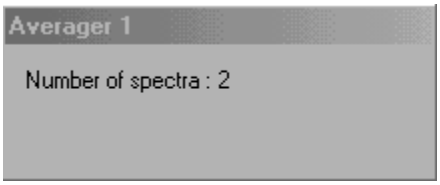
Averager parameters are set in the Averager Tool Properties window. Averager tool(s) are invoked in the Create/Edit Scheme window by right-clicking on the Averager tool icon.



Averager Tool Properties Window

All the information set in the Averager Tool Properties window is saved when you save a scheme.

When any scheme is invoked for which you indicated an Averager, the Averager Tool window automatically displays with your spectra selection shown. The window title indicates which slot position(s) (i.e., Averager 1 and Averager 2) are being displayed. Refer to paragraph 5.1 for a discussion on reference slots.

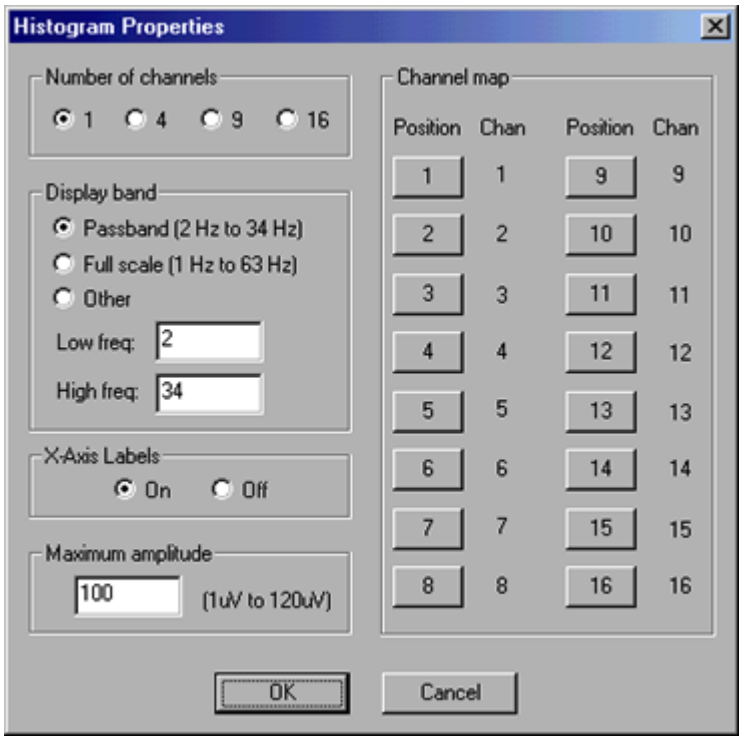


Averager Tool Window

4.3.6 Histogram Tool

The Histogram tool permits visualization of spectral EEG data (the frequency and amplitude components of the EEG signal). It *accepts FFT array data from the FFT tool or Averager tool and outputs these data to a histogram*.

Histogram parameters are set in the Histogram Tool Properties window. Histogram tool(s) are invoked in the Create/Edit Scheme window by right-clicking on the Histogram tool icon.



Histogram Tool Properties Window

Number of channels pane: set the number of channels to be displayed. *If you display less than 16 channels, all data still accumulates to the save file named in the Storage tool, if invoked.*

Display band pane: determines the frequencies that are displayed. You can limit the amount of data displayed by selecting a narrower range of frequencies. *Each bar in a histogram represents the amplitude of signals which fall within that band*. For example, if you select the Passband option, the amplitude of the bar varies in accordance with frequencies in the 2 Hz to 34 Hz range.

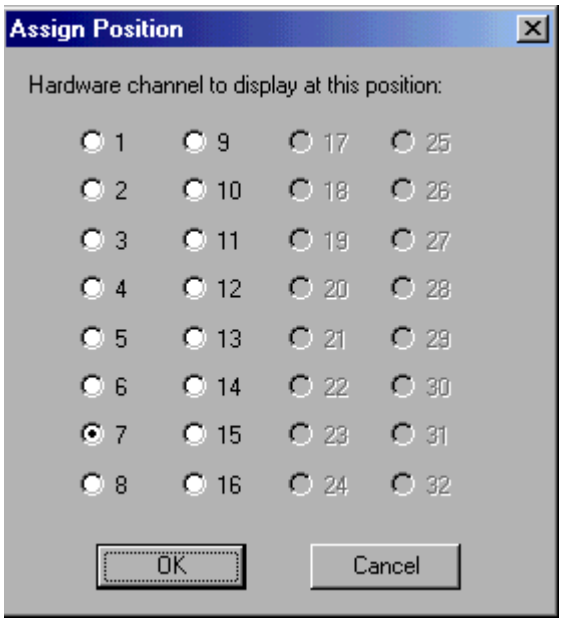
Select fixed parameters (Passband or Full scale) for the range of frequencies to be displayed *or* customize the range by selecting Other.

- Passband (2 Hz to 34 Hz): click to display the listed frequencies.
- Full scale (1 Hz to 63 Hz): click to display the listed frequencies.
- Other: click to specify your custom range between 1 Hz and 63 Hz:
  - Low freq: enter the lowest frequency to be displayed.
  - High freq: enter the highest frequency to be displayed.

X-Axis Labels pane: select whether the X-axis labels are displayed.

Maximum amplitude pane: enter the maximum vertical amplitude that can be displayed. The amplitude may be from 1 V to 120 V.

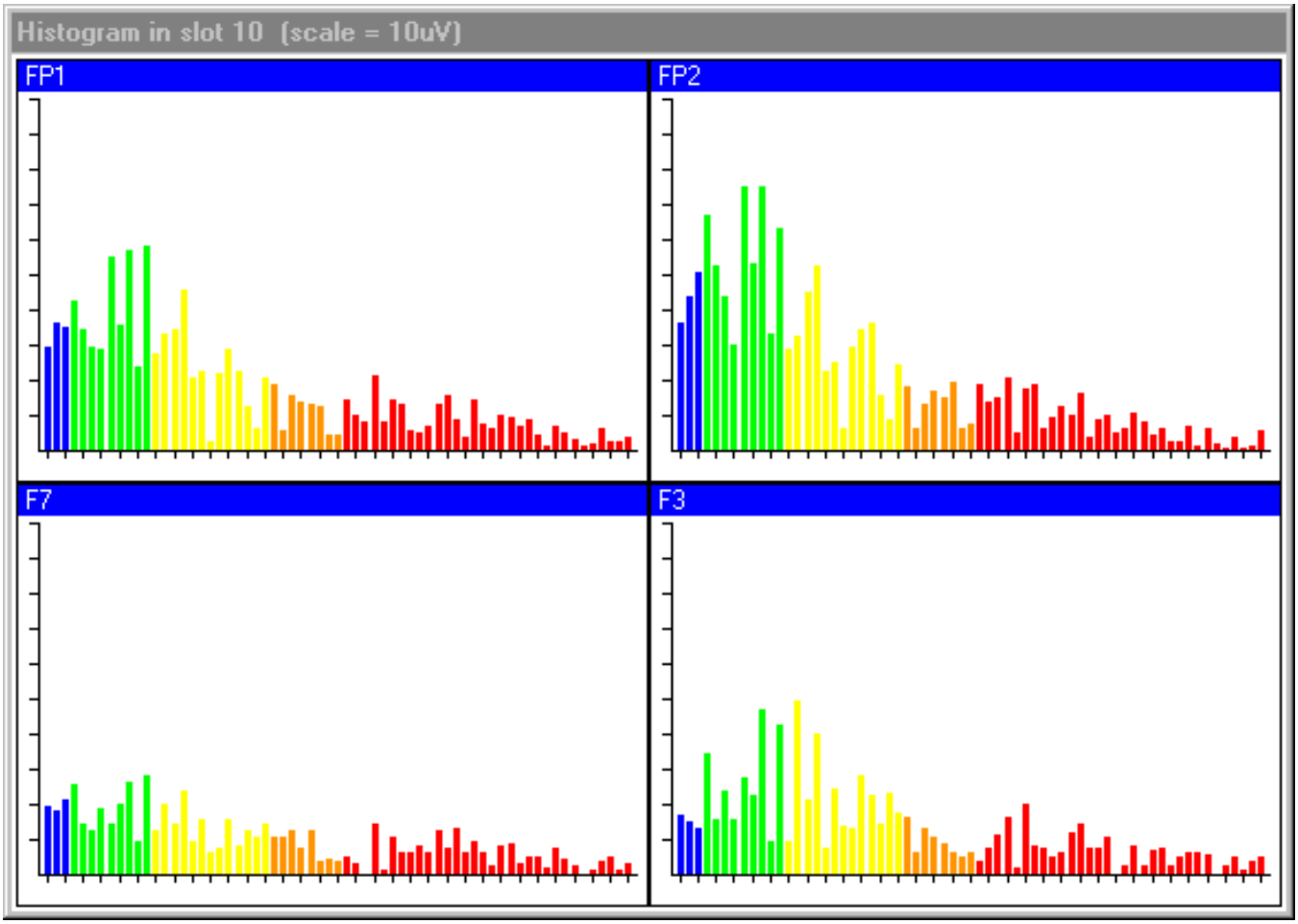
Channel Map pane: select the channel s display position to correspond with each hardware channel for the displayed histogram. *Clicking on each numbered Position button displays the Assign Position window* in which to select the hardware channel to show at the selected numbered display position.



Assign Position Window for Histogram Tool

All the information set in the Histogram Tool Properties Window is saved when you save a scheme.

When any scheme is invoked for which you indicated a histogram, the histogram automatically displays with the appropriate properties shown. The Histogram Tool window title identifies the reference slot (refer to paragraph 5.1) and maximum voltage (from your Maximum amplitude selection above) for this histogram. *The vertical scale is in microvolts with 10 divisions marked.* Histogram colors are fixed for each band.



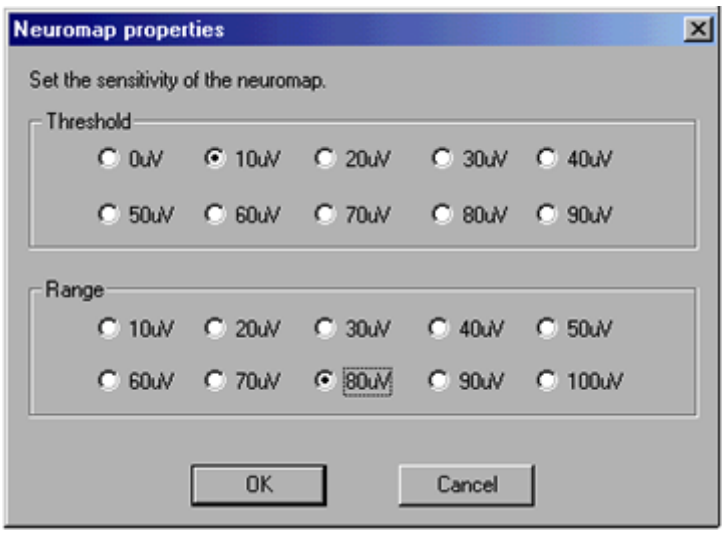
Histogram Tool Window (4 Channel Example)

4.3.7 Neuromapper Tool

The Neuromapper tool enhances *visualization of spectral EEG data as a neuromap*. Neuromaps are helpful for visualizing localized EEG information. The various EEG waveforms are color-coded and shown at their respective electrode sites on a stylized drawing of a patient s head. *You can have several Neuromap tool windows open simultaneously, each displaying a different frequency band*.

The Neuromapper tool *accepts array data from the FFT tool or Averager tool* and outputs these data to a composite neuromap. That is, all frequency bands and amplitudes are shown on the same neuropmap.

Neuromap parameters are set in the Neuromap Tool Properties window. Neuromap tool(s) are invoked in the Create/Edit Scheme window by right-clicking on the Neuromap tool icon.



Neuromap Tool Properties Window

Threshold pane: select the threshold for the brightness of the display. *This amplitude represents the lowest signal amplitude which displays*. Any input amplitudes below this level display in black.

Range pane: set the range (sensitivity) of the neuromap. *A setting of 20 V means that it takes 20 V of signal (above the threshold setting) to illuminate the neuromap at the brightest colors*. The Range setting is added to the Threshold setting to determine the overall amplitude range that is displayed.

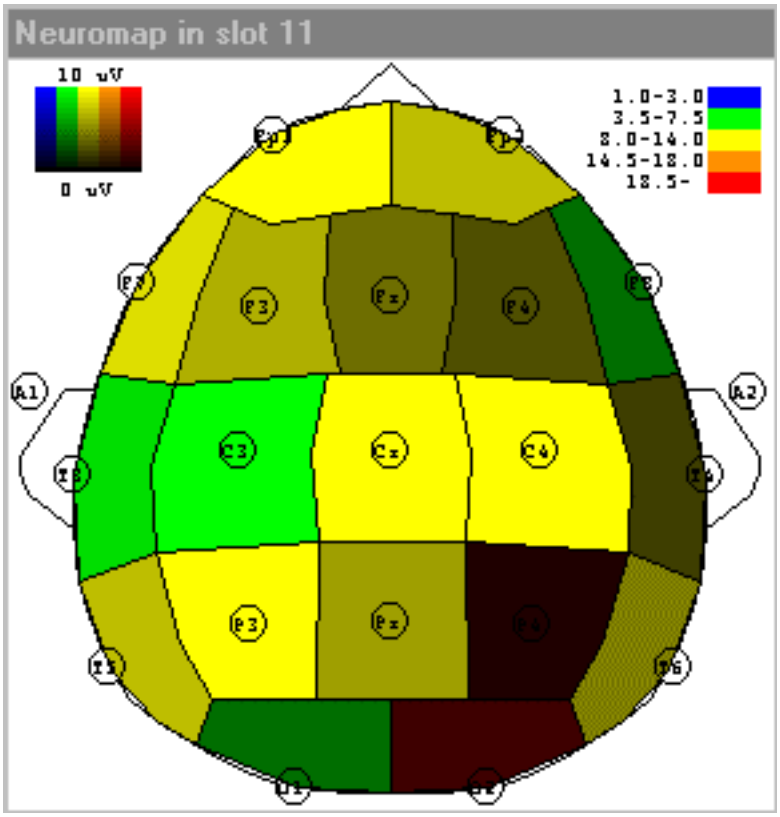
For example, selecting a Threshold of 10 V and a Range of 80 V means that signal amplitudes less than 10 V are shown as black and signal amplitudes of 90 V and above are shown at full illumination.

All the information set in the Neuromap Tool Properties window is saved when you save a scheme.

When any scheme is invoked for which you indicated a neuromap, a neuromap automatically displays with the appropriate properties. The Neuromap Tool window title identifies its reference slot (refer to paragraph 5.1). The legends are:

- Left-side: display scale in microvolts based on your tool property settings.
- Right-side: band colors are pre-set to the following:

Band Frequency (Hz)	*Color*
Delta 1.0 — 3.0	Blue
Theta 3.5 - 7.5	Green
Alpha 1 8.0 — 14.0	Yellow
Alpha 2 14.5 — 18.0	Orange
Beta 18.5 — 40.0	Red



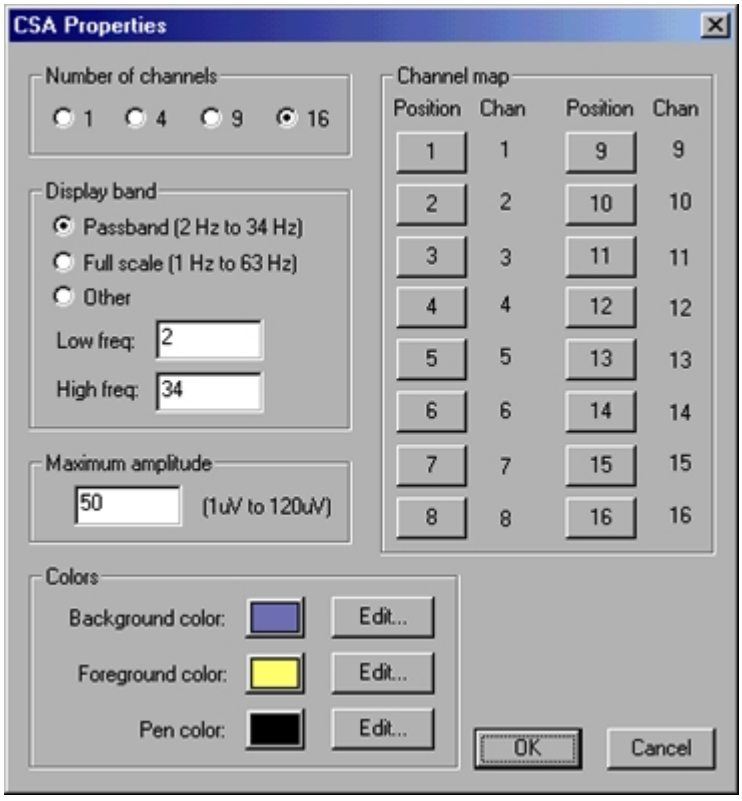
Neuromap Tool Window

4.3.8 Compressed Spectral Array (CSA) Tool

The Compressed Spectral Array (CSA) tool permits *visualization of spectral EEG data over time*. The data are displayed with *frequency* along the horizontal (X) axis, *amplitude* in microvolts along the vertical (Y) axis and *time* along the diagonal (Z) axis. (Refer to the CSA Tool window figure below.)

The CSA tool *accepts array data from the FFT tool or Averager tool* and outputs these data to a CSA tool window.

CSA parameters are set in the CSA Tool Properties window. CSA tool(s) are invoked in the Create/Edit Scheme window by right-clicking on the CSA tool icon.



CSA Tool Properties Window

Number of channels pane: set the number of channels to be displayed. *If you display less than 16 channels, all data still accumulates to the save file named in the Storage tool, if invoked*.

Display band pane: determines the frequencies that are displayed. You can limit the amount of data displayed by selecting a narrower range of frequencies. Each trace in a CSA tool window represents the amplitude of signals which fall within that band. For example, if you select the Passband option, the amplitude of the trace varies in accordance with frequencies in the 2 Hz to 34 Hz range.

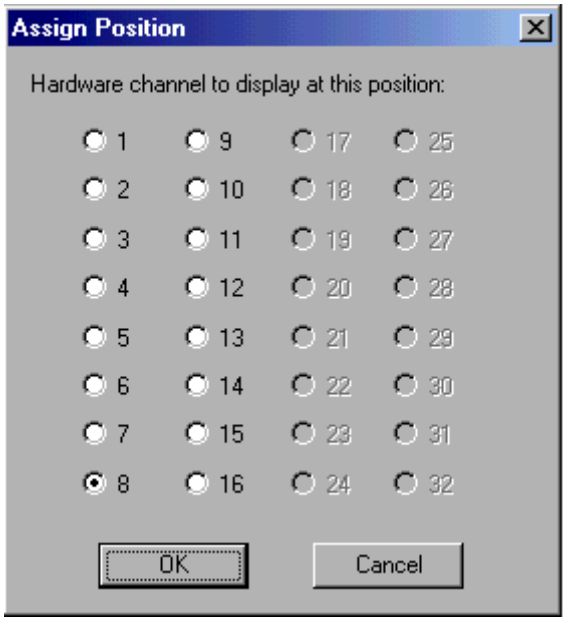
Select fixed parameters (Passband or Full scale) for the range of frequencies to be displayed *or* customize the range by selecting Other.

- Passband (2 Hz to 34 Hz): click to display the listed frequencies.
- Full scale (1 Hz to 63 Hz): click to display the listed frequencies.
- Other: click to specify your custom range between 1 Hz and 63 Hz:
  - Low freq: enter the lowest frequency to be displayed.
  - High freq: enter the highest frequency to be displayed.

Maximum amplitude pane: enter the maximum vertical amplitude that can be displayed. The amplitude may be from 1 V to 120 V.

Colors pane: click the Edit button to access the standard Windows O/S Color window (refer to the Channel Properties pane discussion in paragraph 4.3.3) to select the background, foreground and pen colors for a CSA tool. *Be aware that certain color combinations for the foreground and background color are visually more readable than others.*

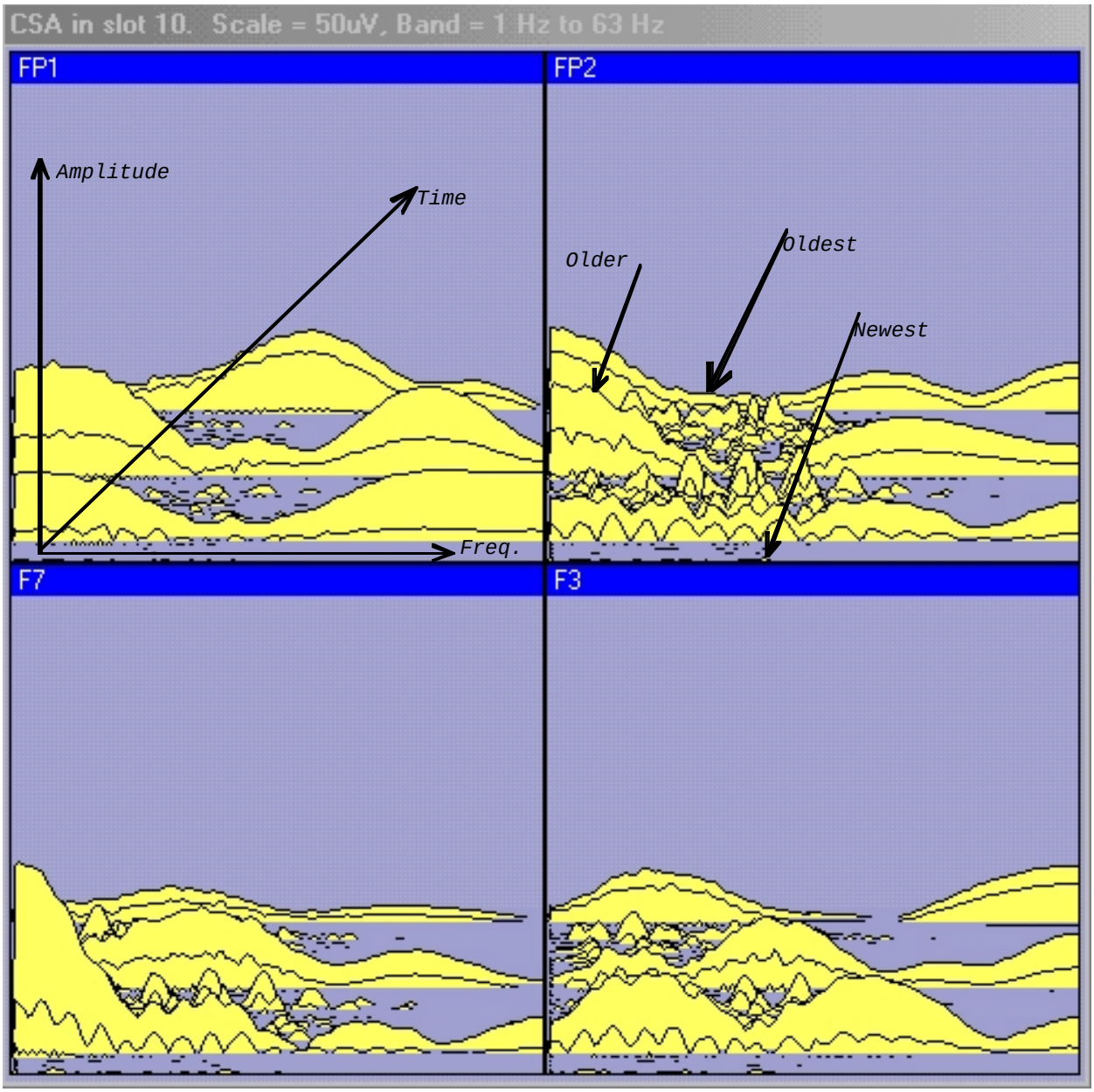
Channel map pane: select the display position to correspond with each hardware channel. *Clicking on each numbered Position button displays the Assign Position window* in which to select the hardware channel to show at the selected numbered display position.



Assign Position Window for CSA Tool

All the information set in the CSA Tool Properties window is saved when you save a scheme.

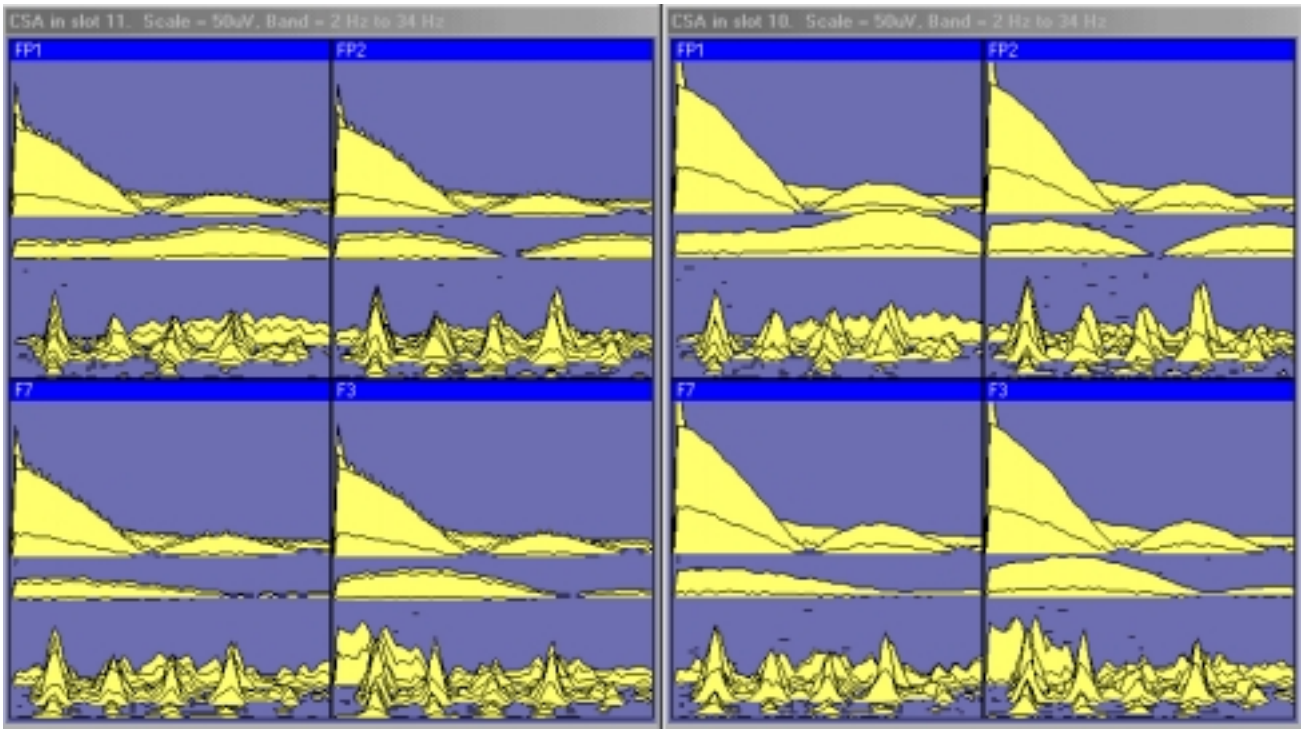
When any scheme is invoked for which you indicated a CSA, the CSA tool window automatically displays with the appropriate properties shown. The CSA tool window title identifies the reference slot (refer to paragraph 5.1), maximum amplitude (i.e., the vertical scale) for the scale and frequency band (i.e., the horizontal scale) information for this CSA.



CSA Tool Window (4 Channel Example)

If you select a Histogram tool and a CSA tool, and place these windows side-by-side on-screen, you can see the frequency and amplitude of the histogram reflected as the front-most time-line within the CSA Tool window.

The CSA tool presents the best visualization of the difference between real-time FFT tool array data (refer to paragraph 3.1.1) and Averager tool near-real-time data (refer to paragraph 3.1.2) input. Although the graphic below is small, you should be able to *detect the slower presentation and smoothing effects of the Averager tool on the CSA tool display*.

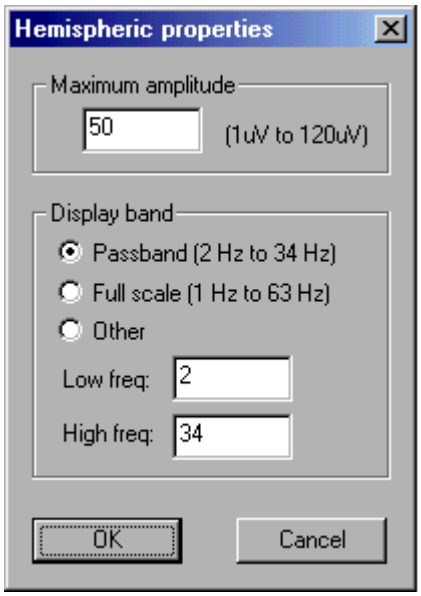


Comparison of FFT Tool and Averager Tool Effects on a CSA Tool

4.3.9 Hemispheric Tool

The Hemispheric tool presents a stylized version of brain wave activity by band on each brain hemisphere. The Hemispheric tool *accepts array data* as input and outputs these data to a hemispheric display.

Hemispheric parameters are set in the Hemispheric Tool Properties window. Hemispheric tool(s) are invoked in the Create/Edit Scheme window by right-clicking on the Hemispheric tool icon.



Hemispheric Tool Properties Window

Maximum amplitude pane: enter the maximum vertical amplitude from 1 V to 120 V to displayed.
Display band pane: determines the range of frequencies that are displayed. You can limit the amount of data displayed by selecting a narrower range of frequencies. Each bar in a hemispheric display represents the amplitude of signals which fall within that band. For example, if you set 1 for the low frequency and 2 for the high frequency, the amplitude of the bar varies in accordance with frequencies in the 1 Hz to 2 Hz range.

Select fixed parameters (Passband or Full scale) for the range of frequencies to be displayed *or* customize the range by selecting Other.

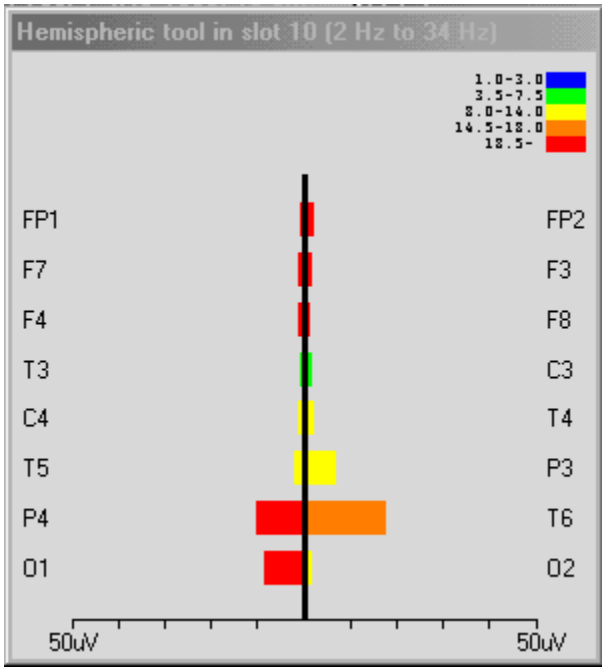
- Passband (2 Hz to 34 Hz): click to display the listed frequencies.
- Full scale (1 Hz to 63 Hz): click to display the listed frequencies.
- Other: click to specify your custom range between 1 Hz and 63 Hz:
  - Low freq: enter the lowest frequency to be displayed.
  - High freq: enter the highest frequency to be displayed.

All the information set in the Hemispheric Tool Properties window is saved when you save a scheme.

When any scheme is invoked for which you indicated a hemispheric presentation, a Hemispheric tool window automatically displays with the appropriate properties shown. The Hemispheric Tool window title identifies the reference slot (refer to paragraph 5.1) and frequency band information for this presentation. (The color legend is the same as for a Neuromapper tool window.) Band colors are pre-set to the following:

Band Frequency (Hz)	*Color*
Delta 1.0 — 3.0	Blue
Theta 3.5 - 7.5	Green
Alpha 1 8.0 — 14.0	Yellow
Alpha 2 14.5 — 18.0	Orange
Beta 18.5 — 40.0	Red

The electrode labels/positions (set in the MS-1000 Tool Properties window; refer to paragraph 4.3.1) are shown along the vertical sides with the maximum amplitude shown on the bottom axis. The vertical centerline represents the division between the right- and left-brain hemispheres.



Hemispheric Tool Window

5 CREATE/EDIT/RUN A MINDMELD LIVE DATA CAPTURE SCHEME

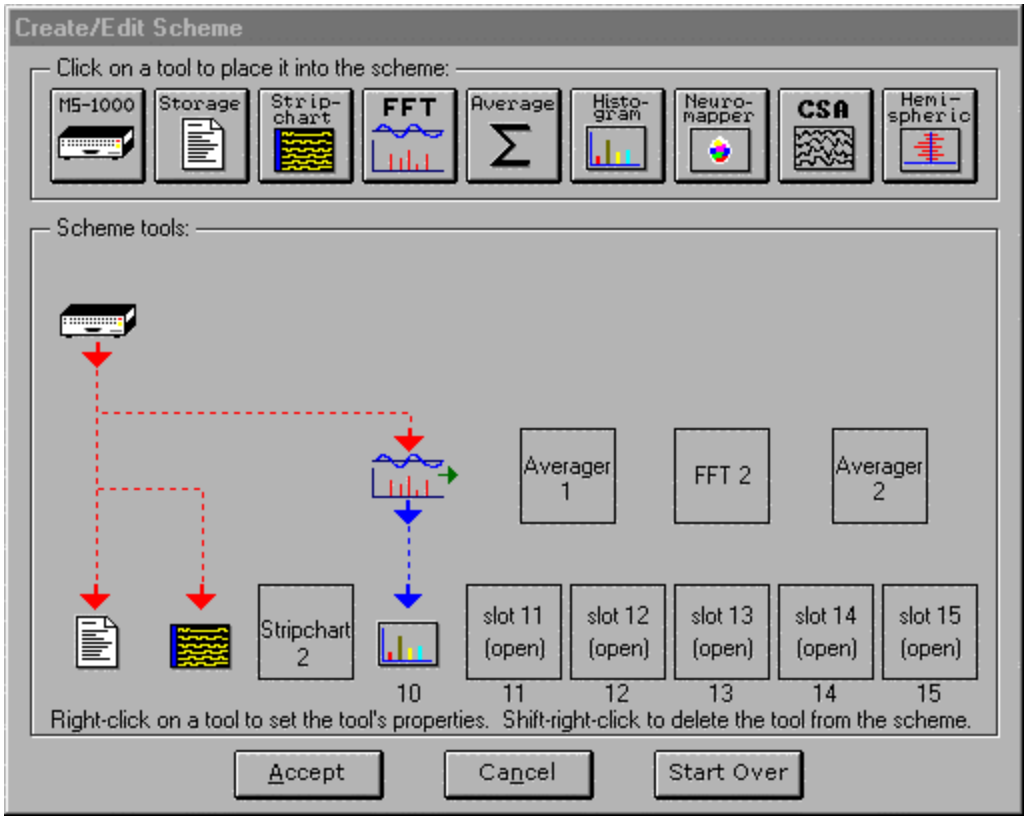
Creating and editing a MindMeld LDC scheme consists of linking the various tools together to display your acquired EEG data. This section explains the method used to select and connect tools into a scheme. A scheme may have from two to all of the tools within it.

Running a scheme is the process of live data capture of a patient s EEG information.

5.1 USING THE CREATE/EDIT SCHEME WINDOW

Schemes are temporary until they are saved. You can run an unsaved scheme, but if you make any changes, the scheme must be re-established the next time you want to use it.

Use *Scheme Menu → Edit Scheme* to display the Create/Edit Scheme window.



Create/Edit Scheme Window

Click on a tool to place it into the scheme pane: these are the icons for the 9 tools. You must always *click on a tool s icon first to select it*, then the icon the shows in its appropriate location(s) in the Scheme tools: pane of the window. Tools do not have to be selected in icon order.

The *MS-1000 tool is automatically selected* since the MS-1000 hardware must always be controlled by the MindMeld software in any scheme.

You can select a number of different tools or select the same tool several times setting each invocation of that tool s parameters differently.

Scheme tools pane: some tools, like the Stripchart have assigned *slots (reference points for the scheme connections)*. Other tools, like the Neuromapper, fill from slots 10 — 15 as they are selected.

Tools must be connected together to indicate how data is to flow between the various tools. The *colored data flow arrows indicate which tools can be connected*. To connect the tools, left-click on the source tool (it highlights) and drag the cursor to the destination tool. When the destination tool highlights, release the mouse button.

- *Red* arrow: hardware, data storage and streaming data tool connections.
- *Blue* arrow: array data connections.
- *Green* arrow: array data from the FFT to Averager tool connection.

The Create/Edit Scheme window has embedded controls which prevent you from making improper connections. Once the tools are properly connected, an appropriately colored dotted-line displays the connection. If an improper connection is attempted, the color-coded dotted-line does not show.

If you try to connect a second input to any tool, an error dialog box displays.

Buttons:

- Accept: click when your scheme is appropriately configured. *You must Accept a scheme first before you can Save it.* (Refer to paragraph 4.1.1.) If you Save a scheme before it has been Accept(ed), you are saving the scheme currently displayed in the display scheme area of the MindMeld LDC main window instead of the scheme you are creating/editing in the Create/Edit Scheme window.
- Cancel: *click to close* the Create/Edit Scheme window. A confirmation dialog box displays:
  - click Yes to close the Create/Edit Scheme window, nothing is saved
    or
  - click No to return to the Create/Edit Scheme window.
- Start Over: *click to restore the Create/Edit Scheme window to its unconnected state*. A confirmation dialog box displays:
  - click Yes to unconnect the scheme
    or
  - click No to return to the current scheme.

If you click Start Over and then click Accept, you clear the MindMeld LDC main window.

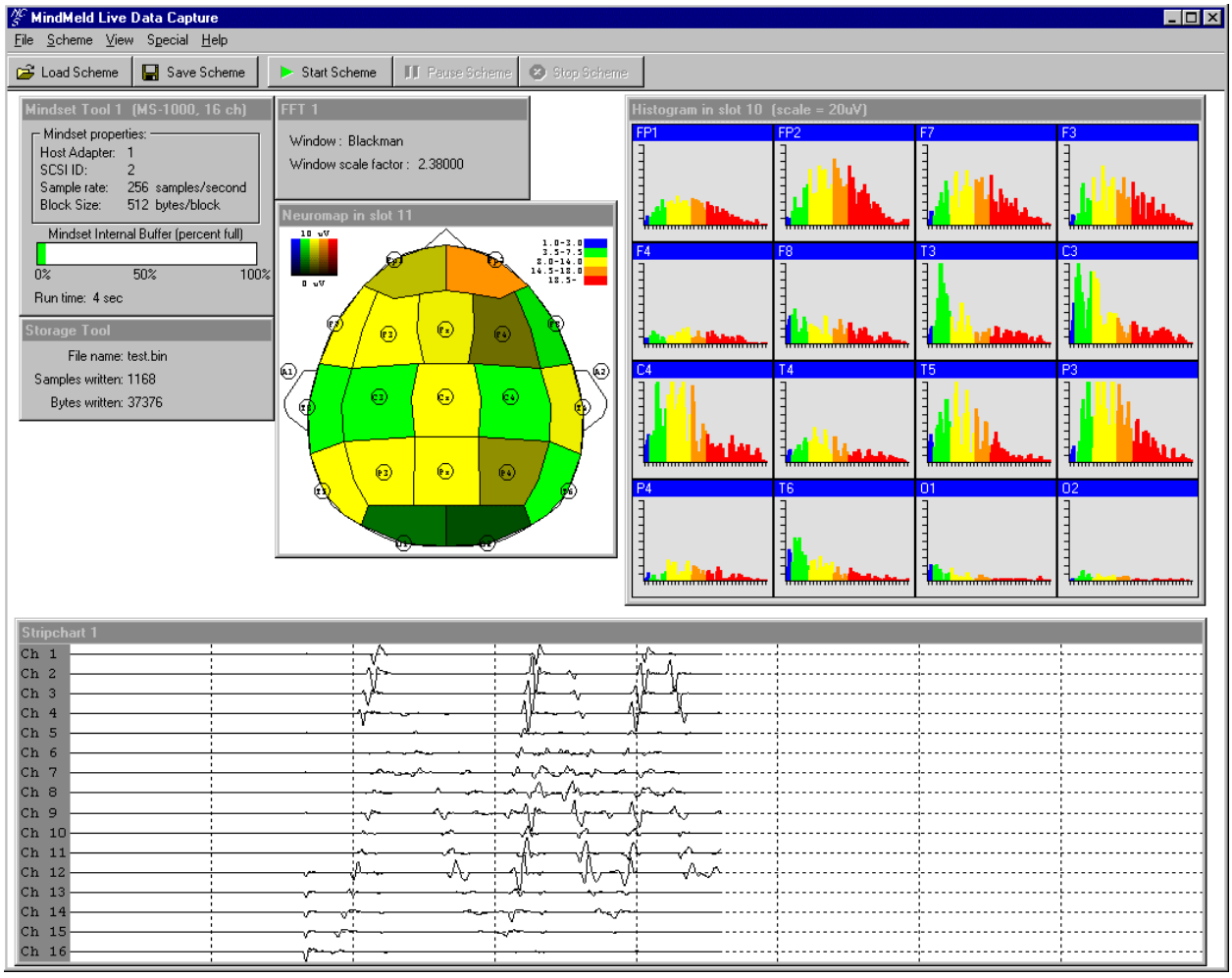
<u>Other MindMeld LDC Window Capabilities</u>
Right-click on a tool icon to access its tool properties window.

If you need to delete a selected tool, Shift & right-click on a tool icon to remove it from the current scheme.

5.2 RUNNING A SCHEME

Once you have a scheme created or edited, the Mindset is on-line and your patient is properly prepared, click the toolbar Start Scheme icon or invoke *Scheme* → *Start Scheme* to begin the EEG data capture process. The tool windows display with live data and data is recorded to your hard drive if the Storage tool is part of that scheme s configuration.

Allow the System to acquire data as long as necessary to obtain an acceptable amount of data for analysis and diagnosis.



MindMeld LDC Main Window with Scheme Tools Displayed

6 THE MINDMELD ANALYSIS FUNCTIONS APPLICATION

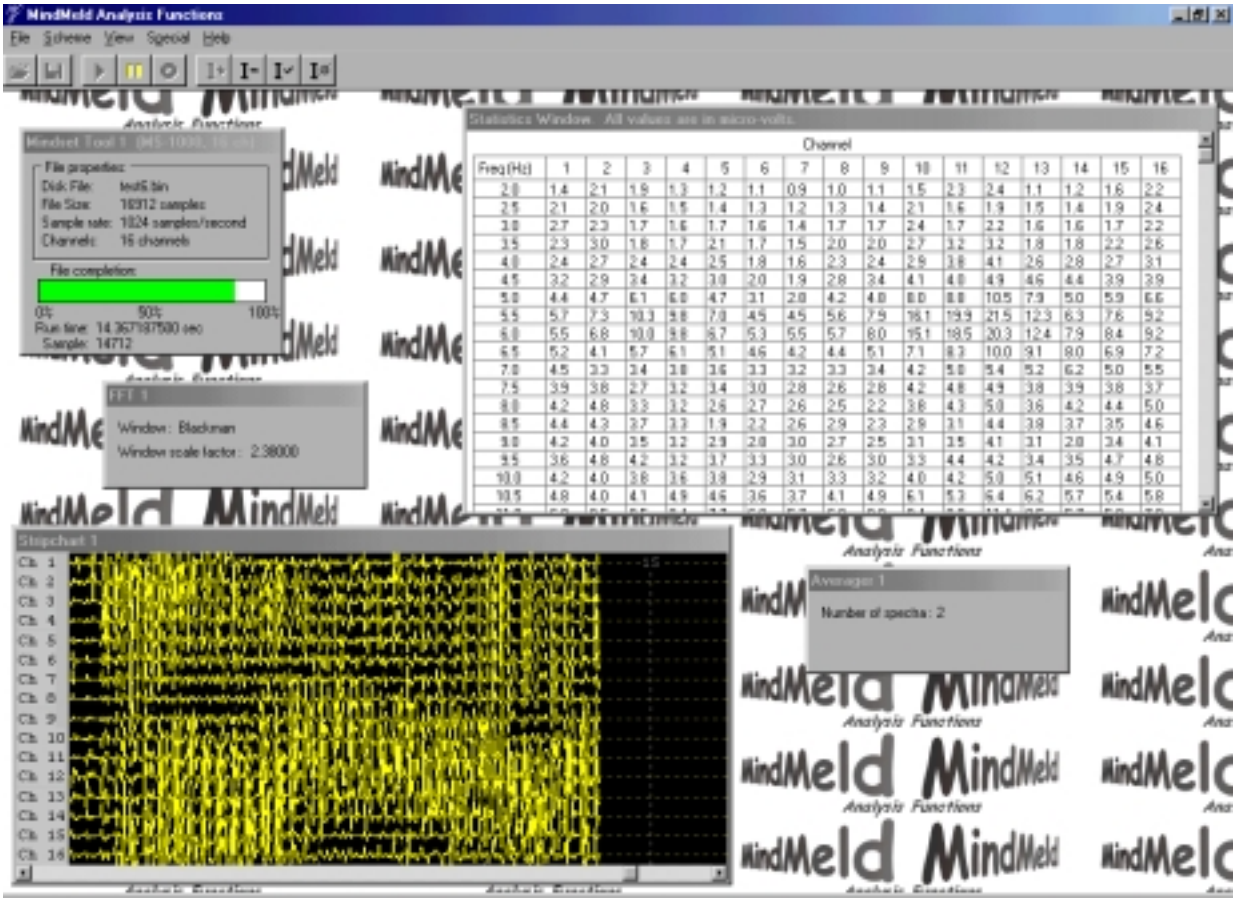
The *MindMeld Analysis Functions (AF)* is used for whole session, off-line analysis. This process is often called replay . After EEG data has been captured and saved to your hard drive with MindMeld LDC, the tools in MindMeld AF are applied to the data to provide an overall interpretation of the patient s session.

When a data file is captured, it likely contains various artifacts; such as, eye and muscle movement, responses to unintended stimuli, etc. In MindMeld AF you can remove these artifacts from the statistical and analysis tool s calculations and displays. These artifact removal sections are called Ignore Regions (IR). *The data is never removed from the actual EEG data file, it is only deleted from calculations and presentations*.

6.1 MINDMELD ANALYSIS FUNCTIONS MAIN WINDOW CONTROLS

The MindMeld AF main window contains a main menu, a toolbar and a display area.

Many of these menu and toolbar options are the same as from the MindMeld LDC main window. They are all repeated here, however, for continuity in this discussion.



MindMeld AF Main Window with Scheme Running

File Menu

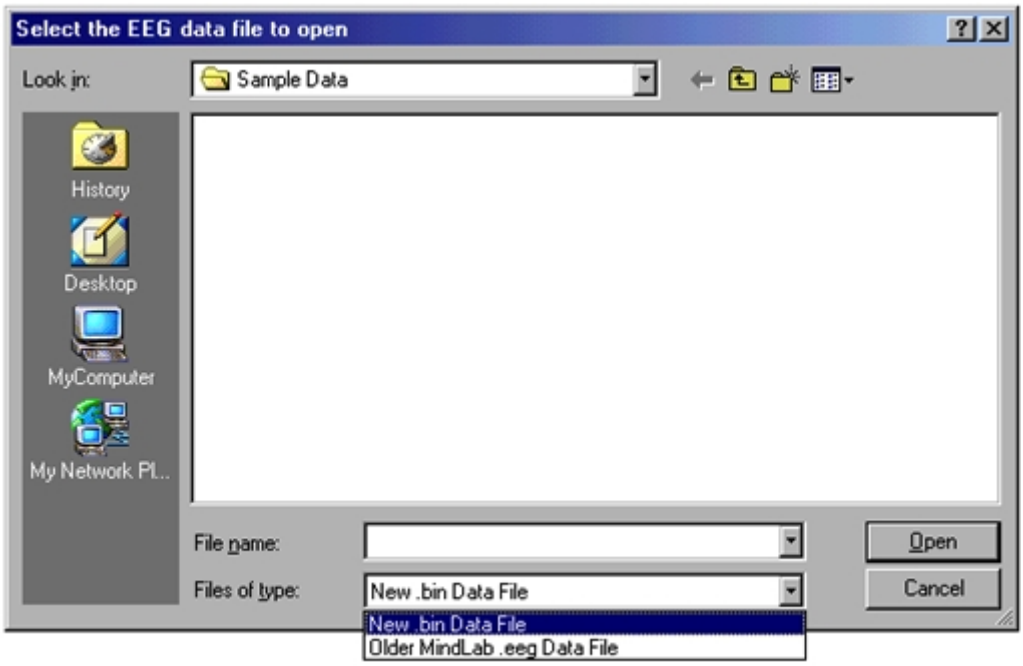
File → Open File

Presents the standard Windows O/S file selection window titled Select the EEG data file to open to select a saved EEG data file for replay. *These are the data files created during a MindMeld live data capture process when the Storage tool is selected and configured as part of a scheme*. MindMeld data files have a *.bin* (the MindMeld file format) or *.eeg* (the previous Mindlab/Wavelab file format) file extension.

(Refer to the Storage tool discussion in paragraph 4.3.2 for details on the impact of starting and stopping a scheme as it relates to file names.)

Select the .bin or .eeg file to load and click Open.

- The *file data shows within a selected (previously saved) scheme or within a newly created (unsaved) scheme*. Any previously replayed data file is closed.
  or
- If you have not selected or created a scheme at this point, the EEG data is not shown until a scheme is loaded.



Select the EEG Data File To Open Window

File → Close EEG File

If Ignore Regions (IRs) have been selected or changed during this replay and you select this option, a confirmation dialog displays asking whether to Save the changed IR? Click Yes to save the IR information for the next replay, click No to disregard saving the IR information.

File → Page Setup
This option presents the standard Windows O/S Page Setup window to set your printed page parameters.

Windows O/S Page Setup Window

File → Exit
Quits the MindMeld AF application. You are prompted to save any open files that reflect changed schemes or IRs.

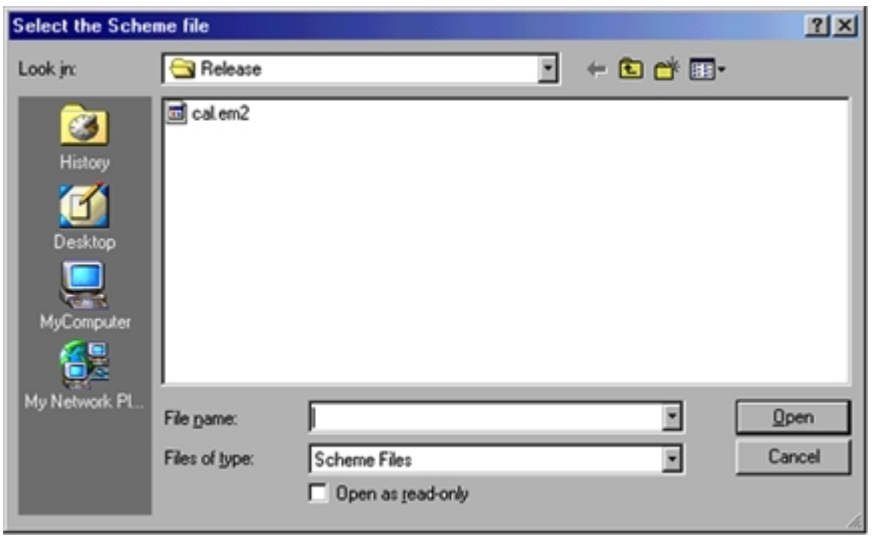
Scheme Menu
Scheme → Start Scheme
Starts a replay scheme with the selected data file. A replay starts from the time shown in the Stripchart 1 Tool window. *Use the scrollbar in the Stripchart 1 Tool window to indicate your preferred start time*. Refer to paragraph 6.2.4 for additional details.

After your file is loaded and replayed, the Statistics window remains on-screen and does not re-set (i.e., zeroize) until you start the same or another scheme with the current or a different EEG file. The Mindset Tool 1 window remains on-screen with the selected file name shown in its File properties: pane.
Scheme → Pause Scheme
Pauses the current replay. If the scheme is already paused, restarts the scheme.
Scheme → Stop Scheme
Stops the replay.
Scheme → Edit Scheme
Presents the Create/Edit Scheme window to allow a new scheme to be created or to modify the current scheme. Refer to paragraph 5.1 for detailed information.
Scheme → Show Tools
Displays the Statistics window and other MindMeld AF tool(s) windows for the current scheme.
Scheme → Hide Tools
Removes the Statistics window and the MindMeld AF tool(s) windows from the main window.

Scheme → Load Scheme

Opens the standard Windows O/S file selection window titled Select the Scheme file to select previously saved schemes. Select the scheme to load and click Open. The scheme displays with the appropriate tools. Any scheme already loaded is closed.

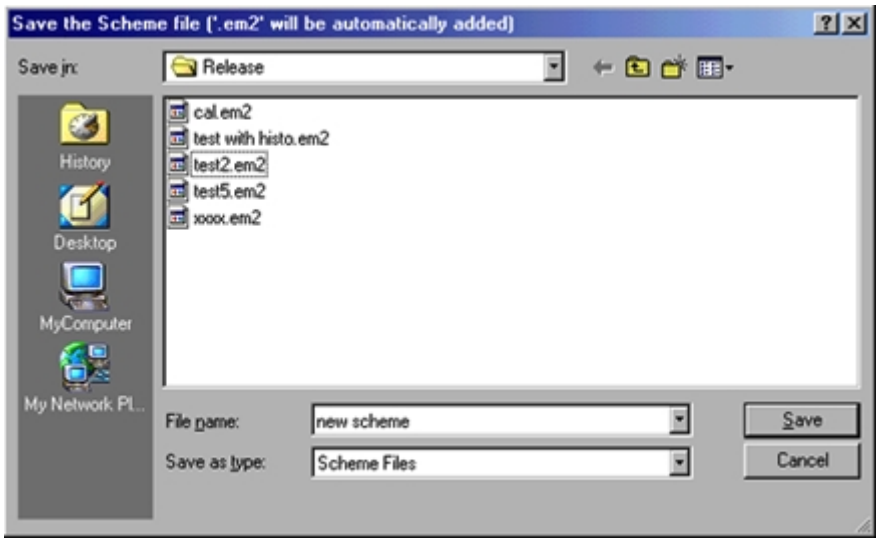
- If you already selected a data file to replay, data shows in the tool windows.
- If you have not selected a data file to replay, access *File → Open File* now. Refer to the *File → Open File* discussion above for additional details.



Select the Scheme File Window

Scheme → Save Scheme

Opens the standard Windows O/S file save window titled Save the Scheme file to save the scheme under development. *The scheme must first be Accepted in the Create/Edit Scheme window* (refer to paragraph 5.1). Enter a name in the File name: field, the .em2 file extension is automatically appended when you click the Save button.



Save the Scheme File Window

View Menu
Use this option to show or hide (i.e., *toggle*) the toolbar display.

MindMeld AF Toolbar

The *toolbar* contains the following buttons which correspond to several Scheme and Special menu options described in paragraphs above or below. Some buttons are grayed-out until their function is appropriate.

- Open Scheme: displays the Select the Scheme File window to select the scheme to open.
- Save Scheme: displays the Save the Scheme file window to save the scheme under development.
- Start Scheme: starts the scheme (i.e., the replay).
- Pause Scheme: pauses or restarts the scheme (i.e., the replay).
- Stop Scheme: stops the scheme (i.e., the replay).
- Add to Ignore Regions: refer to Special Menu discussion below.
- Remove from Ignore Regions: refer to Special Menu discussion below.
- Respect Ignore Regions: refer to Special Menu discussion below.
- Clear Ignore Regions: refer to Special Menu discussion below.

Special Menu
Special → Use Calibration Scalers
This option refers to the optional Calibrator hardware. When the Mindset hardware is calibrated, scalers (multipliers) are determined for each channel and saved in your PC s System Registry. When checked, this menu option indicates that the scalers are to be used to adjust the data before it is passed to any tools.

If you already invoked *Special → Use Calibration Scalers* when you acquired the EEG data using MindMeld LDC, invoking this same option (*Special → Use Calibration Scalers*) in MindMeld AF has no effect. In other words, the data is not re-calibrated a second time. Additional details are provided in Appendix B.
Special → Run at Full Speed
Runs the data replay at actual speed. If you are using a slower PC (200 MHz or less) and the EEG data being played back was sampled at 1024 samples/second, your PC may be sluggish and not respond to input commands. If this is the case, play the file back at half-speed or slower.
Special → Run at Half Speed
Runs the data replay at 1/2 the actual speed.
Special → Run at Quarter Speed
Runs the data replay at 1/4 the actual speed.
Special → Run at Eighth Speed
Runs the data replay at 1/8th the actual speed.

Special → Add to Ignore Regions

Ignore Regions are selected by *left-clicking within the Stripchart 1 tool and dragging your cursor to the right or left over the data to be disregarded* in calculating Statistic window values and in tool displays. (The EEG data within an IR are not eliminated from the source .bin or .eeg data file.) As you drag your mouse over the data to be ignored, it highlights as visual feedback. (If you make a mistake and do not want to include your highlighted data in the Ignore Regions, simply click in the Stripchart 1 Tool window and the highlighted region returns to its configured background color.)

To set your selected data as an IR, invoke *Special → Add to Ignore Regions* or click the Add to Ignore Regions toolbar button. The highlighted portion shows with a red background as a visual indication that it is an IR.

Adding to an existing IR means to left-click and drag the mouse to/from a red IR to expand it, then click the Add to IR toolbar button or invoke *Special → Add to Ignore Regions* to include the new data.

As an EEG data file is replayed, *data within Ignore Regions are not included in any calculations and corresponding tool windows within that scheme*.

Ignore Region(s) are saved with the source EEG data files when you select *File → Close EEG File*.

Special → Remove from Ignore Regions

Click the Remove from IR toolbar button or invoke *Special → Remove from Ignore Regions*. A small scissors icon displays, mouse to the required IR, then left-click within an existing IR. The data display returns to its original color from a red background.

Special → Respect Ignore Regions

This option toggles the ability to *exclude* (i.e., *respect*) IR(s) when calculating Statistic window values and tool window displays. When the Respect Ignore Regions menu option or button on the toolbar is not showing a checkmark, data within IR(s) are included in scheme calculations.

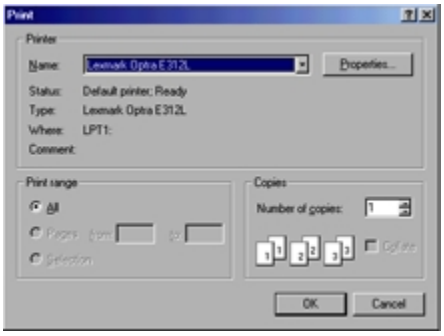
Special → Clear Ignore Regions

All IR(s) are erased from the display. The actual EEG data remains in the file.

Help Menu
Help → About MindMeld
Displays information about MindMeld AF, including the software version number. The About window also has a button to toggle on or off the background MindMeld bitmap shown on the main window.

Other MindMeld AF Window Capabilities
In any displayed tool window, *right-click to access a pop-up menu*.

- Hide Window: removes that tool window.
- Edit Scheme: displays the Create/Edit Scheme window.
- Print This Window: displays the standard Windows O/S Print window to print this tool window.



Windows O/S Print Window

MindMeld AF main and tool windows can be moved and resized in the same manner as MindMeld LDC windows.

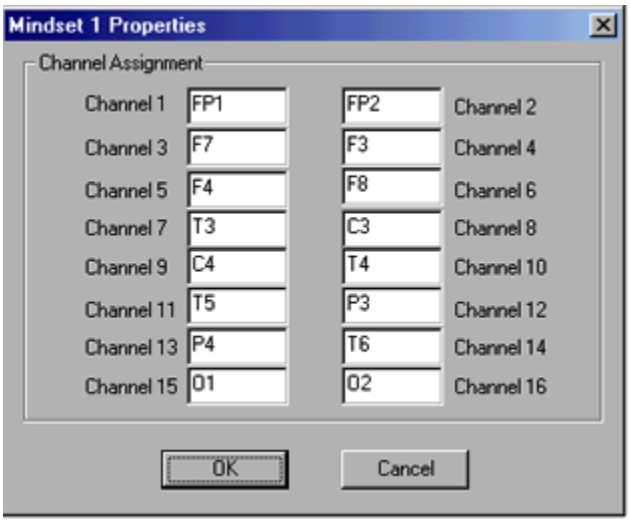
6.2 MINDMELD ANALYSIS FUNCTIONS: CREATE/EDIT/REPLAY SCHEME

MindMeld AF capabilities for creating and editing a scheme are similar to the MindMeld LDC process for creating and editing a scheme. The run/replay scheme capabilities are identical between the two applications except for the use of Stripchart 1 as discussed below.

In the following discussion, only differences between the two applications are addressed.

6.2.1 MindMeld Analysis Functions Mindset 1 Tool Properties

Within MindMeld AF, the Mindset 1 Tool Properties window only allows you to set channel label assignments. The remainder of the properties are retained from the original scheme.

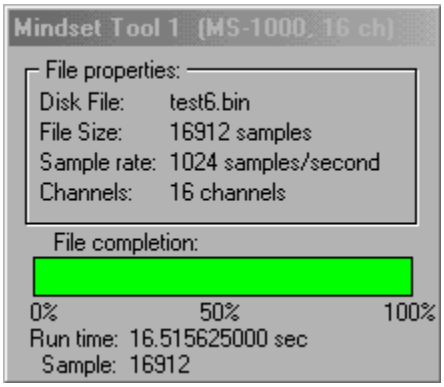


MindMeld AF Mindset 1 Tool Properties Window

Channel Assignment pane: channel label assignment mapping depicts which Mindset input channel is connected to which montage point of the Electro-cap. *This version of MindMeld assumes the default linked-ear montage for all neuromapping.*

All the information set in the Mindset 1 Tool Properties window is saved when you click OK to save a scheme.

When any scheme is invoked, the Mindset Tool 1 window automatically displays. The window title also identifies the Mindset hardware model number (currently the MS-1000) which was used in the data capture process and the number of channels available on that hardware.



MindMeld AF Mindset Tool 1 Window

File properties pane: reflects information from the original scheme configuration and the selected file. (Refer to paragraph 4.3.1.)

- Disk File: None (if a data file has not yet been selected) *or* the name of the selected .bin or .eeg file.
- File Size: the number of samples in the selected .bin or .eeg file.
- Sample rate: the sample rate at which the selected .bin or .eeg file was obtained.

- Channels: the number of channels in use when the selected .bin or .eeg file was obtained.

File completion bar: the progress bar uses green fill to mark the pace of the replay.

Run time: shows the *elapsed time of the replay in seconds* up to 9 decimal places. The precision of this time information is 1 divided by the sample rate (SR); that is, 1 ÷ SR. For example, if the SR is 256, then each sample takes 1 ÷ 256^{th} of a second (or .00390625) to occur. When sample number 204 occurs, the elapsed Run time is 204 X .00398625 or .796875 seconds.

Sample: shows the *total number of samples* displayed since the start of the replay.

6.2.2 MindMeld Analysis Functions Statistics Window

The Statistics window automatically displays in the MindMeld AF main window. After the first file is loaded and replayed, the Statistics window does not re-set (i.e., zeroize) itself until you start a scheme with the currently selected file. (Refer to the *File → Open File* discussion in paragraph 6.1.) (If you are running MindMeld on a slower CPU, there may be a slight delay before values show in the Statistics window.)

> **NOTE:** In order to calculate Statistics values, *the MS-1000 tool must be connected to the FFT 1 tool* in the corresponding Create/Edit Scheme window.

The Statistics Window. Values are micro-volts peak-to-peak presents a table that contains the amplitude value from peak-to-peak at that time in the data file replay. At the bottom of the table, summary statistics for *Minimum*, *Maximum*, *Delta* and *Average* amplitude are calculated. The Delta row shows the difference between the Maximum and Minimum values.

You can start statistical calculations from any point within the EEG data file. Use the horizontal scroll bar on the Stripchart 1 tool window to scroll to the desired time position and then start the scheme. *Thus, you can calculate the statistics for any portion or all of a patient s session*. Refer to paragraph 6.2.4 below for additional details.

Statistics Window. Values are micro-volts peak-to-peak.

	Channel															
Freq (Hz)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MindMeld AF Statistics Window (Upper Portion)

Statistics Window. Values are micro-volts peak-to-peak.

32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Delta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

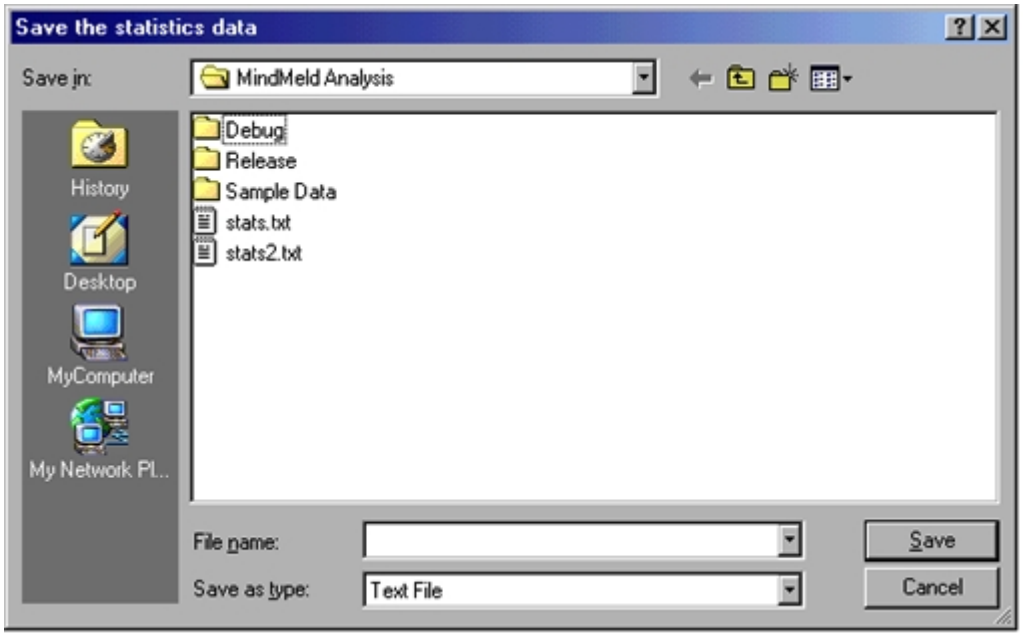
MindMeld AF Statistics Window (Lower Portion)

NOTE:	If you are running MindMeld on a PC with a slower CPU (less than 400 MHz) and the sample rate on the replay data file is at 1024, there may be a processing *delay* in the window displays and your ability to mouse and move/resize tool windows may be impaired while Statistic window values are calculated. In this instance, use *Special → Run at Half Speed* to minimize these processing delays.

Other Statistics Window Capabilities

In the Statistics window, *right-click to access a pop-up menu*.

- Hide Window: removes the Statistics window.
- Edit Scheme: displays the Create/Edit Scheme window.
- Print This Window: displays the standard Windows O/S Page Setup window the first time this pop-up menu is invoked during a MindMeld AF session to set your printed page parameters. (That is, whenever you exit and restart MindMeld AF, the Windows O/S Page Setup window displays the first time you select this Print This Window pop-up menu option.) Click OK to display the standard Windows O/S Print window. Thereafter, only the Print window displays to invoke printing the Statistics window.
- Dump to File: displays a Save the statistics data window. This is a standard Windows O/S save file window to save an EEG data file, allowing you to save this statistical data as a tab de-limited text file to be opened and printed in Microsoft Word, WordPad or Notepad, etc. Statistics window data can also be saved and imported into spreadsheet or database applications for follow-on data manipulation. (EEG file data is only saved as a text file.)



MindMeld AF Save the Statistics Data Window

6.2.3 MindMeld Analysis Functions Storage Tool

The Storage tool is not available when using MindMeld AF.

6.2.4 MindMeld Analysis Functions Stripchart Tool

In MindMeld AF, the Stripchart 1 tool has special importance. *The horizontal scroll bar on the Stripchart 1 Tool window controls the position within an EEG data file from which data are played-back and Ignore Regions are set*.

Once an EEG file is open for playback, use the scroll bar to move (in one second increments) to the desired position within the file. *When the scheme is started (Scheme → Start Scheme), playback begins at the time position shown on this stripchart*.

6.2.5 MindMeld Analysis Functions Remaining Tools

The other tools and their windows remain the same as those in the MindMeld LDC function, as discussed in paragraph 4.3.

Appendix A

Acronyms and Glossary

.bin	data file extension for new MindMeld files
.eeg	data file extension for older Mindlab/Wavelab files
.em2	MindMeld scheme file extension
.reg	Windows O/S RegEdit file extension
ADC	Analog-to-Digital Converter
ANSI	American National Standards Institute
CD-ROM	Compact Disc — Read-only Memory
CPU	Central Processing Unit
CSA	Compressed Spectral Array
dB	decibel
EEG	electroencephalography
FDA	Food and Drug Administration
FFT	Fast Fourier Transform
GUI	Graphical User Interface
Hz	Hertz
ID	Identification
IR	Ignore Region
MindMeld AF	MindMeld Analysis Functions application
MindMeld LDC	MindMeld Live Data Capture application
MHz	Mega-Hertz
MS-1000	Mindset hardware model
NCS	Nolan Computer Systems, L.L.C.
PC	Personal Computer
PCM	Pulse Code Modulation
RAM	Random Access Memory
RegEdit	Windows O/S Registry Edit program
O/S	Computer Operating System
SCSI	Small Computer Systems Interface
SPS	Samples per Second
SR	Sample Rate
V	Microvolts
V/pix	Microvolts per Pixel
VGA	Video Graphics Adapter card
X-axis	the horizontal axis
Y-axis	the vertical axis
Z-axis	the diagonal axis, representing *time*
$	represents hexadecimal values

Appendix B

Using the Mindset Calibrator

B.1 INTRODUCTION

The *optional* Mindset Calibrator is a hardware device used in combination with the Mindset MS-1000 hardware and the MindMeld program. The calibrator injects a precise 16 Hz, 50 V signal simultaneously into all 16 Mindset channels. This calibration signal is read by the MindMeld LDC program and is used to calculate a correction factor (a *scaler*) for each channel to bring that channel to the signal norm.

Why is this necessary? Component manufacturing tolerances may cause amplifier gain to vary slightly among each channel and may cause the absolute gain of any individual amplifier to change with age. By injecting a known signal into the channels, a correction factor can be calculated for each channel to compensate for these changes. The scalers are saved in your PC s System Registry so that the MindMeld program can access and apply them.

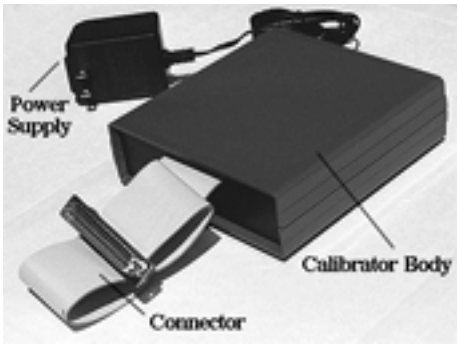
If you intend to use Mindset with different PCs, access the Window s Registry Edit (RegEdit.exe) program to export the scaler data in a .reg file to your other PC s System Registry. The scaler data is in the *HKEY_CURRENT_USER → Software → NCS Programs → MindMeld* folder. Consult with your local System/Network Administrator or Windows documentation for additional information on the RegEdit program. *Alternatively*, the Mindset calibration process may be performed with each PC.

It is recommended that you calibrate your Mindset every six months or whenever readings indicate that a calibration correction may be necessary.

In this Appendix, a dollar sign ($) is used to represent hexadecimal values.

B.1.1 PARTS IDENTIFICATION

Your Mindset Calibrator is completely self-contained. The following illustration provides parts identification.



The Mindset Calibrator

B.1.2 THE CALIBRATION PROCESS

It is assumed that at this point you have read the body of this documentation to familiarize yourself with the MindMeld applications, terminology and conventions of this document.

B.1.2.1 Calibration Overview

A special calibration scheme named *calibrate.em2* is included on the floppy disk provided with the Mindset Calibrator. Use this scheme during calibration by copying it to your hard drive.

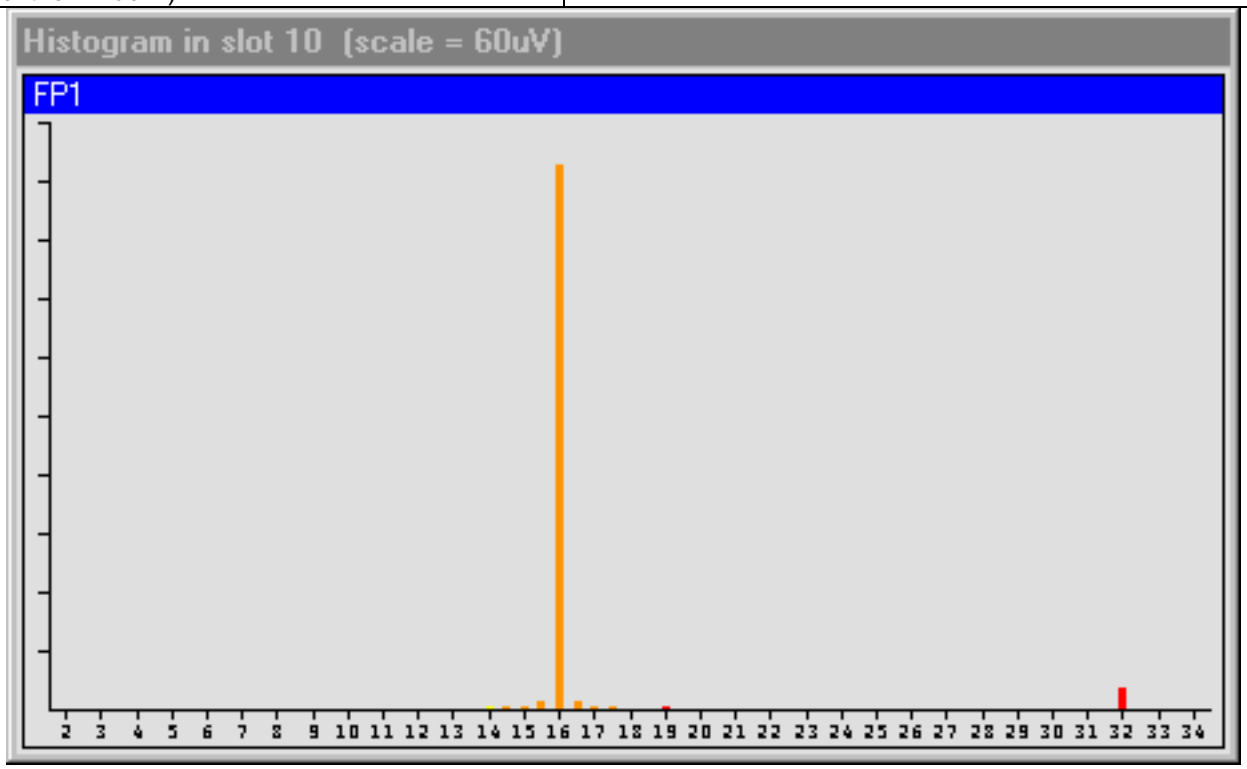
To calibrate your Mindset MS-1000, connect the calibrator to Mindset s expansion connector and run the special calibration scheme. Initially, this scheme provides verification that the calibrator is functioning properly. Secondly, it performs the actual calibration. When calibration is complete, quit the MindMeld application to save the calibration data into your PC s System Registry.

B.1.2.2 The Calibration Process Instructions

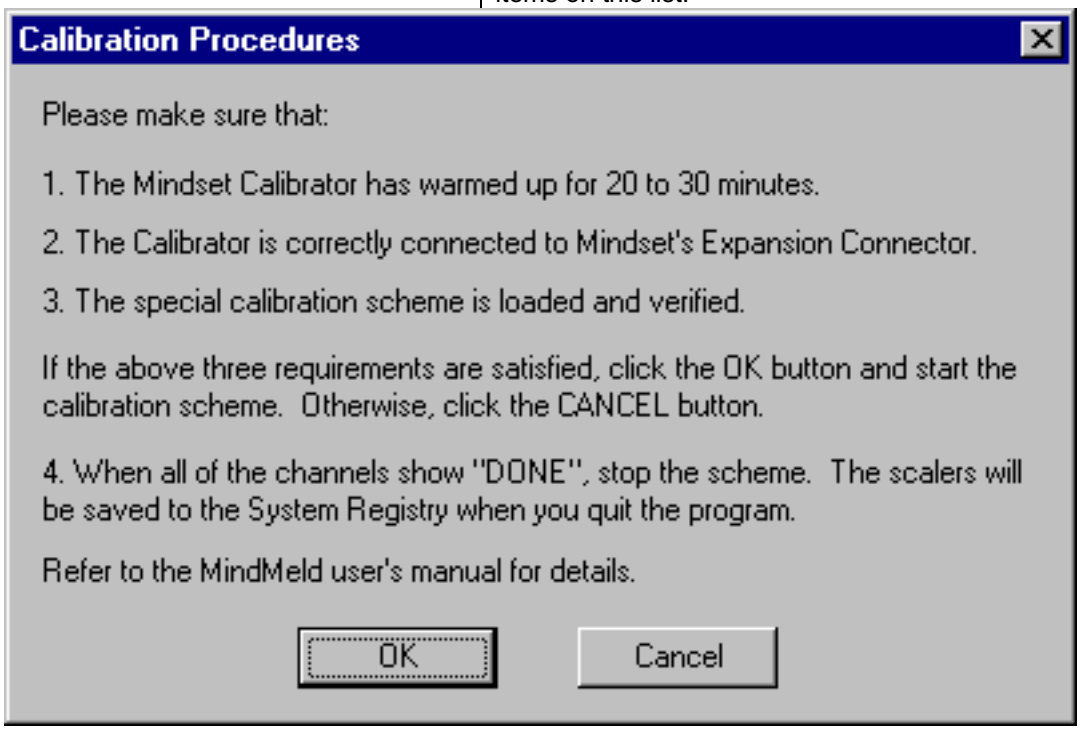
CALIBRATION PROCESS INSTRUCTIONS

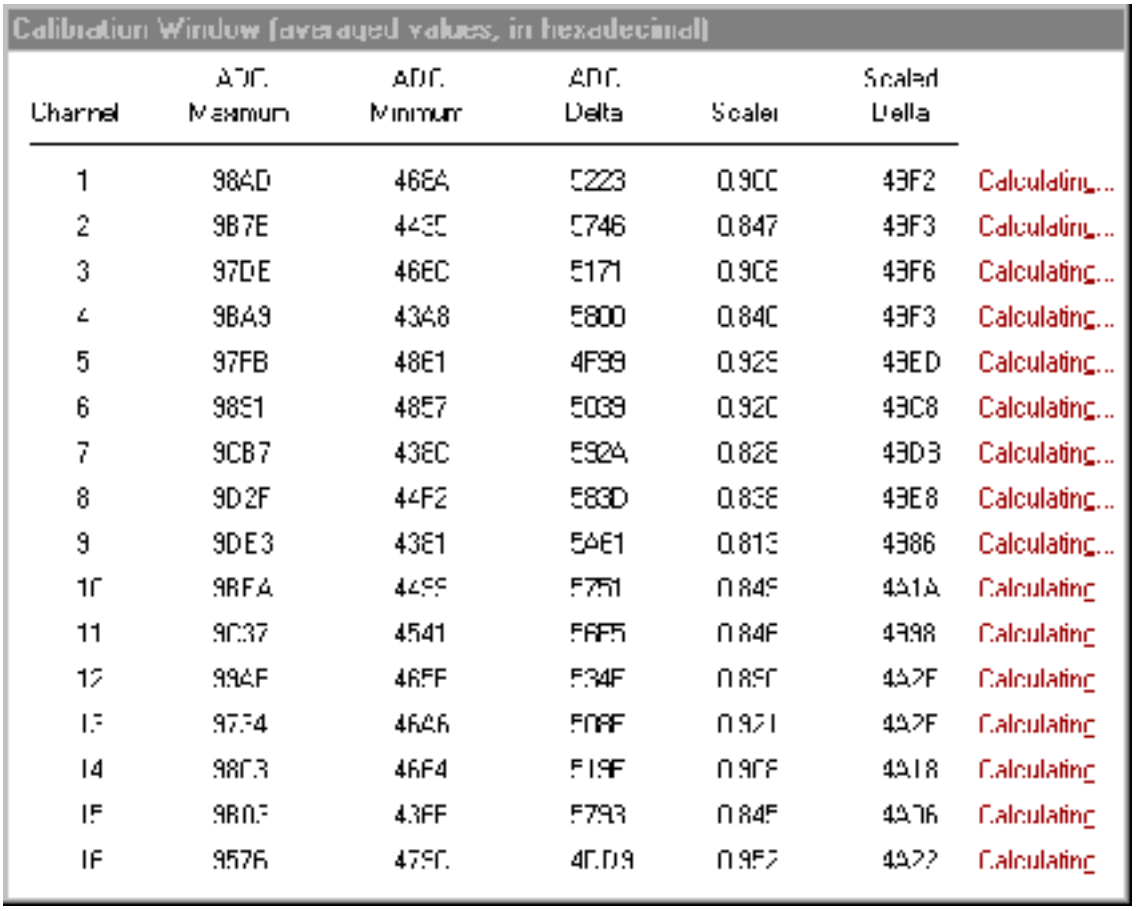
User Action	***Results/Comments***
Warm-up Your Calibrator	
Turn on your Calibrator at least 20-to-30 minutes prior to conducting this calibration process.	*The Calibrator must be completely warm before using.* At this point in the process, the Calibrator can be turned-on without connecting it to your Mindset. (Or the Calibrator can be turned-on and connected to your Mindset now following the directions in the next two steps.)
Remove External Devices	
Remove any devices (Electro-cap, etc.) connected to your Mindset s input jacks.	When calibrating your Mindset, *the Calibrator must be the only device connected during this process.*
Connect Your Calibrator	
Connect your warmed-up Calibrator to Mindset s expansion connector. (If it is attached, first remove the Montage Selector.)	The Calibrator can be connected to your Mindset while power is on for both the Calibrator and for Mindset. (In other words, there is no need to turn off Mindset s power when connecting the Calibrator.)
The Calibration Process: Verify the Calibrator	
Start MindMeld LDC.	Refer to paragraph 2.3.
Load → Scheme → calibrate.em2. • If necessary, copy the special calibration scheme from the floppy disk to your hard drive. • If necessary, resize the MindMeld LDC main window and/or move the Stripchart tool window so you can view all 16 channels.	Refer to paragraph 4.1.1.
Start → Scheme.	
Observe the Stripchart tool.	Since an identical signal is injected into all 16 channels, the stripchart should appear as follows:

	• If the stripchart does not appear as in the above illustration, turn off the Calibrator's power for 5 seconds and turn it back on. • If the stripchart still does not appear as in the above illustration, call NCS for technical assistance, or disconnect and return the Calibrator to your distributor or NCS.
Observe the Histogram tool. (If necessary, resize the MindMeld LDC main window and/or move the Histogram tool window to view the entire window.)	The histogram should appear as shown in the illustration below. (Refer to paragraph B.1.3 below for additional information.)

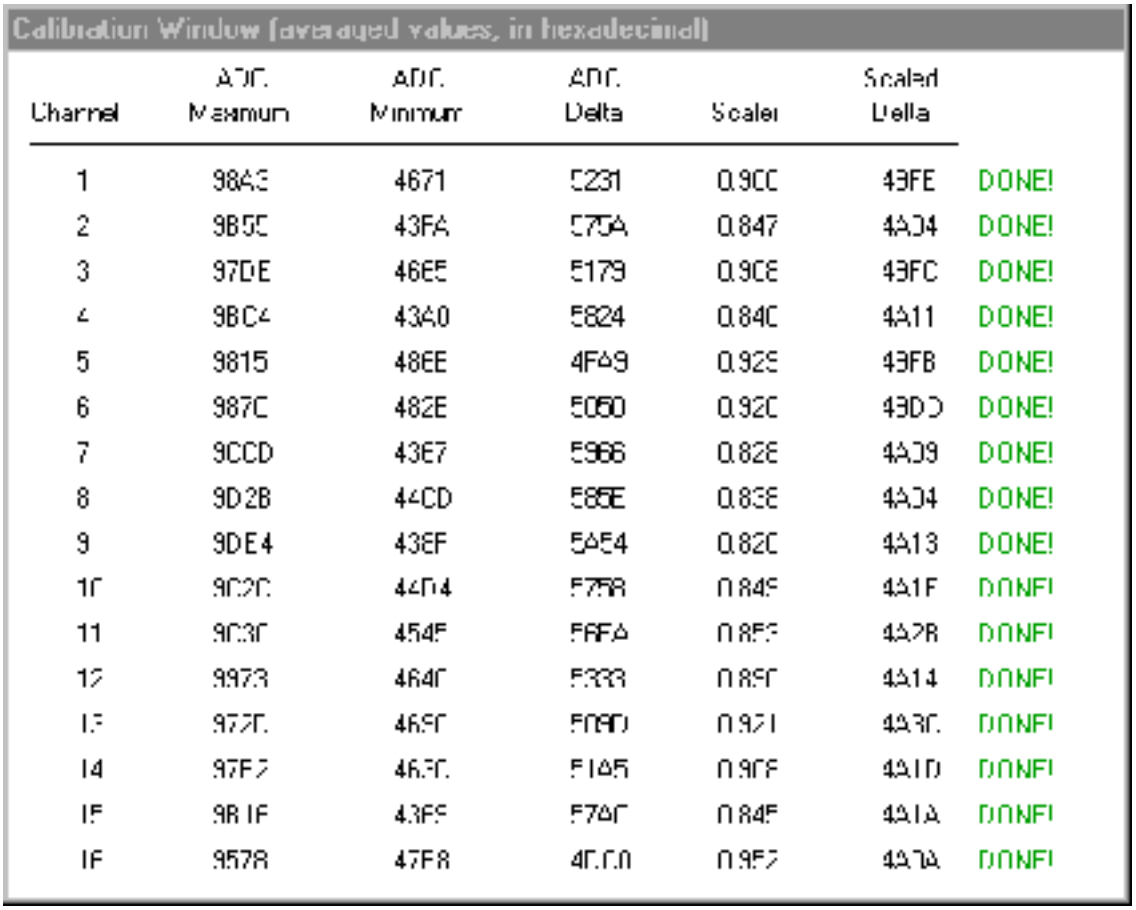


If your Stripchart and Histogram tool windows properly match these illustrations, *Stop → Scheme*.	At this point, your Calibrator appears to be functioning properly.
The Calibration Process: Calculate Calibration Scalers	
Select *Special → Calibrate*, the Calibration Procedures dialog box displays.	This *dialog presents a summary of the entire calibration process*. You have already completed the first three

	items on this list. 
If you are *satisfied* that the Calibrator is operating properly, click OK in the Calibration Procedures dialog box. *or* If you are *not satisfied* that the Calibrator is operating properly *or if you have not implemented any of the above steps*, click CANCEL in the Calibration Procedures dialog box.	If you clicked CANCEL, initiate or repeat as necessary the steps in this Calibration Process Instructions table. If any problems persist, call NCS for technical assistance, or disconnect and return the Calibrator to your distributor or NCS.
Start → *Scheme*.	You are re-starting the special calibration scheme (calibrate.em2). The Calibration Window displays the calibration s progress. The meaning of the numbers in the Calibration Window are explained below. As the scheme runs, the word "Calculating..." shows in the far right column.



Allow the scheme to run until "DONE!" shows next to all 16 channels.	



Calibration Window (averaged values, in hexadecimal)

Channel	ADC Maximum	ADC Minimum	ADC Delta	Scaler	Scaled Delta	
1	98A3	4671	5231	0.9CC	49FE	DONE!
2	9B5C	43FA	5756	0.847	4AD4	DONE!
3	97DE	46E5	5179	0.9CE	49FC	DONE!
4	9BC4	43A0	5824	0.84C	4A11	DONE!
5	9815	48EE	4F49	0.92E	49FB	DONE!
6	987C	482E	5050	0.92C	49DC	DONE!
7	9CCD	43E7	5966	0.82E	4AD9	DONE!
8	9D2B	44CD	585E	0.83E	4AD4	DONE!
9	9DE4	43EF	5AE4	0.82C	4A13	DONE!
10	9C2C	44D4	5758	0.84E	4A1F	DONE!
11	9C3C	454E	5AFA	0.8E6	4A2B	DONE!
12	9973	464C	5333	0.89C	4A14	DONE!
13	977C	469C	50E0	0.971	4A3C	DONE!
14	97E7	463C	5185	0.9CE	4A1D	DONE!
15	9B1E	43E6	5780	0.84E	4A1A	DONE!
16	9578	47E8	4D90	0.9E7	4A3A	DONE!

Stop → Scheme.	That's it! Your Mindset is calibrated. When you quit the MindMeld LDC application, the scalers are automatically saved into your PC s System Registry.
Quit and restart the MindMeld program to implement the calibration scalers.	

B.1.2.3 Calibration Window Details

The columns in the Calibration Window (return to the figures in the Calibration Process Instruction table) are described below. Each horizontal row represents the data for one channel. *A dollar sign ($) is used to represent hexadecimal values.*

Channel

The *hardware channel number* shows in this first column.

ADC Maximum and ADC Minimum

As the calibration signal is read from the Mindset hardware, these numbers are the *averaged peak (high and low) values* as reported by Mindset s 16-bit analog-to-digital converter (ADC). The no signal (zero) position is set to $7000.

ADC Delta

This number is the *averaged difference between the ADC Maximum and ADC Minimum values*. Since there are rounding errors involved, the difference may not be exactly ADC Maximum minus ADC Minimum.

Scaler

For the Mindset hardware, a 50 V signal should produce an average (nominal) ADC Delta of $4A25 plus or minus about $95. If the calculated ADC Delta is above or below this nominal value, the scaler is adjusted to bring the ADC Delta to the nominal value.

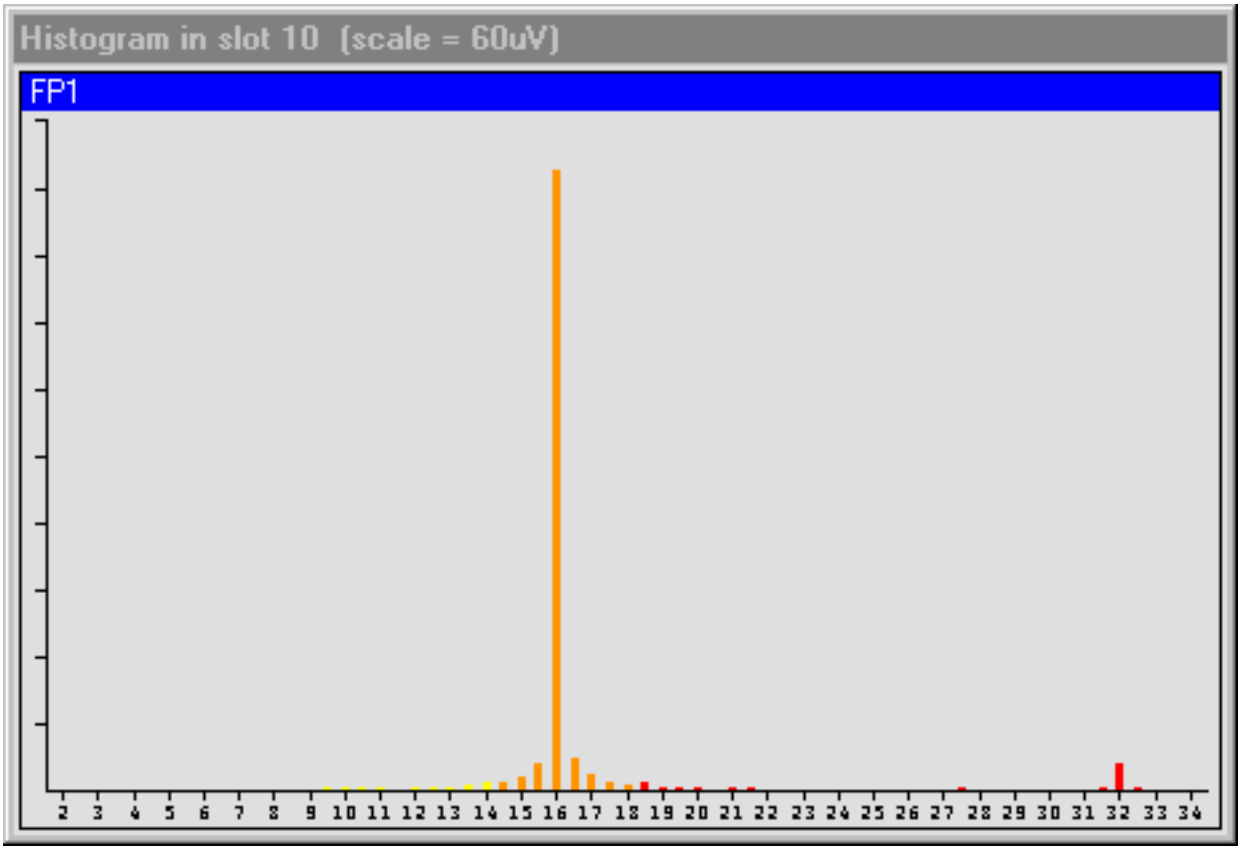
Scaled Delta
The Scaled ADC Delta is the ADC Delta value with the Scaler value applied. When the scaled data falls within the nominal range, the channel is calibrated and the word "DONE!" appears in the Progress column.

Progress Column
This column indicates the status of the calibration:

- As calibration proceeds, the word "*Calculating* " appears next to each channel s information.
- When a channel has been calibrated, this text changes to "*DONE!*".
- If any channel is too far out of specification, the words "Out of range" appear to identify a faulty channel. If Out of range appears for any channel, your Mindset hardware should be returned to your distributor or NCS for repair.

B.1.3 Anomalous Readings from the Calibrator

If the calibrator is not fully warmed up, you may observe some spectral energy in the frequencies around 16 Hz as shown in the following graphic:



Histogram Tool with Spectral Energy at 16 Hz

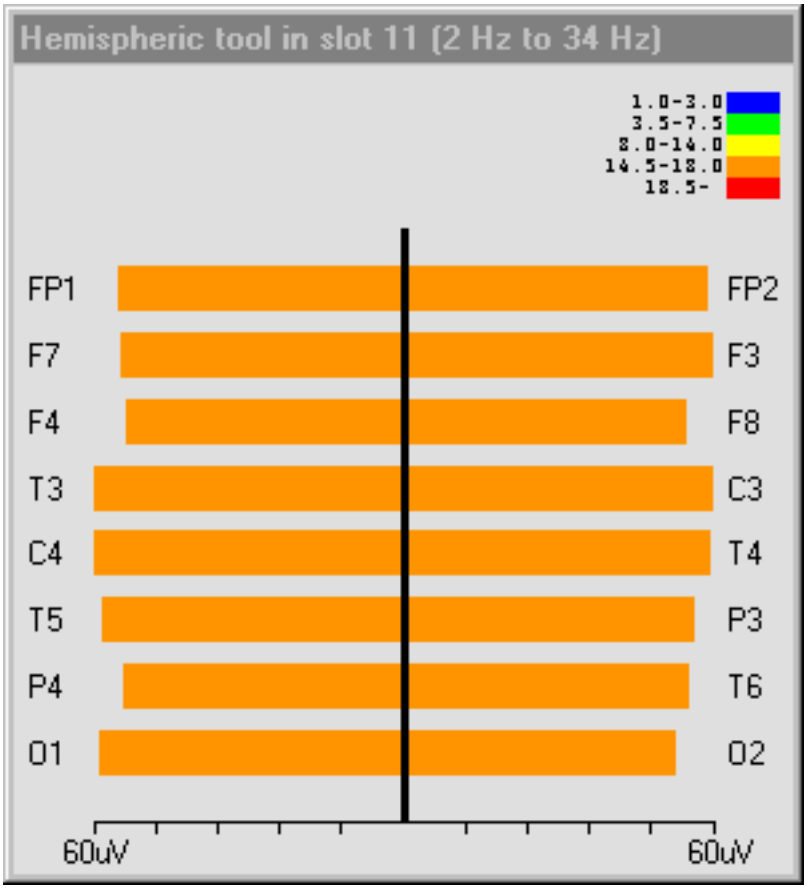
A small amount (5 V or less) of energy in frequencies around 16 Hz is to be expected. *If this energy exceeds about 10 V when the calibrator is fully warmed up, the calibrator requires adjustment and should be returned to your distributor or NCS*.

B.1.4 Application of Scaler Data

MindMeld LDC and AF use the scalers to correct the raw or saved EEG data prior to sending it to their tools. To demonstrate the value of using calibration, below are two graphics of a Hemispheric Tool window in MindMeld AF. Both windows display 50 V calibration data

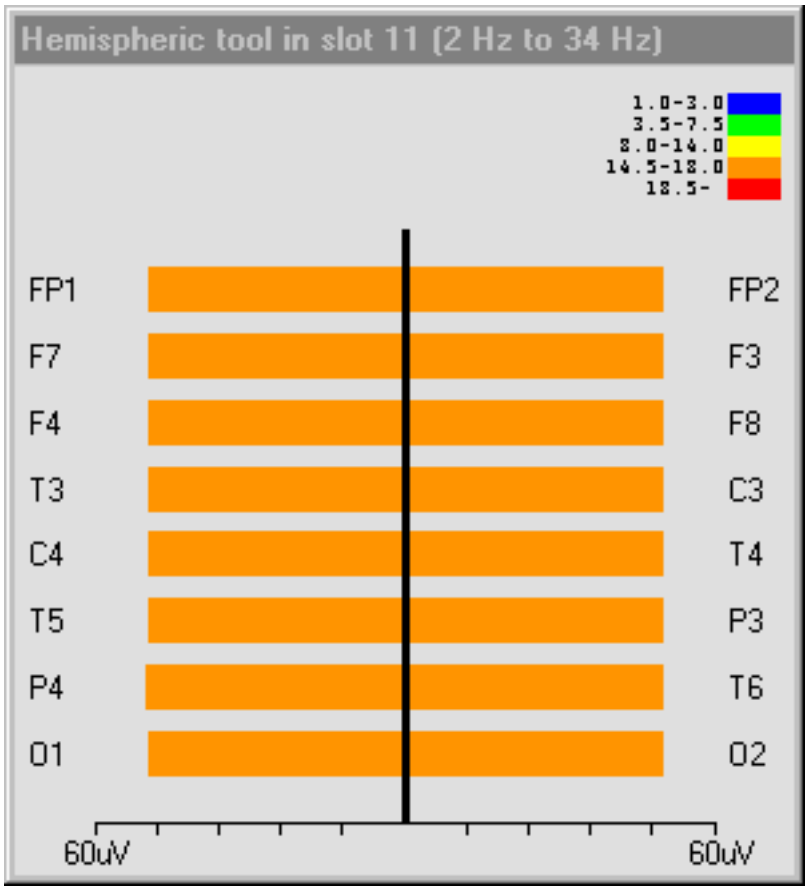
captured with a typical production Mindset MS-1000; the first graphic displays the data without scalers applied, the second graphic displays the data with scalers applied.

This first graphic (i.e., Hemispheric Tool Data *without* Scalers Applied) shows the data without using the scalers, *note the slight differences in channel gains*. *Special → Use Calibration Scalers* was not invoked.



Hemispheric Tool Data *without* Scalers Applied

This second graphic (i.e., Hemispheric Tool Data *with* Scalers Applied) shows the data using the scalers, *channel differences are corrected. Special → Use Calibration Scalers* was invoked.



Hemispheric Tool Data *with* Scalers Applied

Appendix C

Listing of Pre-configured Schemes

The following pre-configured schemes are included on your CD-ROM. You are encouraged to experiment with these schemes (you may wish to make a copy of the scheme first and modify the copy). Adjust tool parameters and observe the result(s). Add new tools to the scheme and connect them by clicking and dragging your mouse from tool to tool. See Section 5 for details.

You can restore any scheme to its original settings by copying that scheme from the supplied CD-ROM to your hard drive.

Histo&Neuro.em2 - Histogram & Neuromap tools. The streaming data are run through an FFT using a Blackman window.

- The Mindset tool is set to 256 samples/second with a SCSI block size of 512 bytes.
- The Neuromap tool is set with a threshold of 0 micro-volts and a range of 100 micro-volts.
- The Histogram tool is set to 16 channels, 2 Hz to 34 Hz and 50 micro-volt maximum displayed amplitude.

Histogram.em2 - Histogram tool. The streaming data are run through an FFT using a Blackman window.

- The Histogram tool is set to 16 channels, 2 Hz to 34 Hz with x-axis labels on and a 50 micro-volt maximum displayed amplitude.

Strip&CSA.em2 - Stripchart and Compressed Spectral Array (CSA) tools. Streaming data are sent to the CSA tool through an FFT using a Blackman window and averaged 8 times through the Averager tool.

- The Stripchart tool is set to 16 channels with an 8 second sweep and 5 micro-volts/pixel.
- The CSA tool is set to 16 channels, 2 Hz to 34 Hz and 50 micro-volt maximum displayed amplitude.

Strip&Neuromap.em2 - Stripchart and Neuromap Tools. Streaming data are sent to the Neuromap tool through an FFT using a Blackman window.

- The Stripchart tool is set to 16 channels, 8 second sweep time and 5 micro-volts/pixel.
- The Neuromap tool is set to a threshold of 0 micro-volts and a range of 100 micro-volts.

Stripchart.em2 - Stripchart Tool.

- The Stripchart Tool is set to display 16 channels with an 8 second sweep. The vertical sensitivity is set to 5 micro-volts/pixel.