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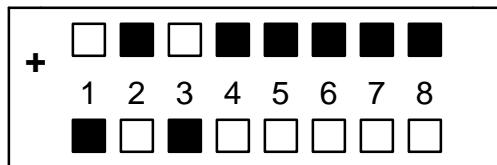
F1000: Installation

INSTALLATION IN COMPUTER

NOTE: Installation of the *F1000* main board requires removing the cover of your computer. If you are uncomfortable with the process we suggest enlisting the help of a friend or computer dealer.

Static electricity can damage sensitive components on the exposed main circuit board or internal circuits in the computer. When handling the board or working inside the computer always discharge any static electricity from your body by momentarily touching a grounded metal object.

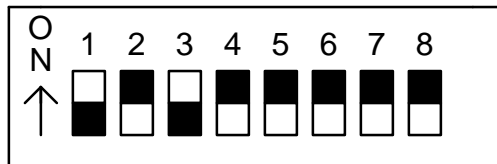
1. **Be sure the computer is turned off and disconnect the power cable.**
2. Disconnect any other cables that may interfere with removing the cover. Be sure to note where each is connected so that they can be reconnected properly.
3. Remove the computer cover.
4. Carefully remove the antistatic wrapping from the *F1000* main board.
5. Locate the DIP Switch located just above the gold connector. The switches were set properly before leaving the factory. However, they could have been disturbed during unwrapping. The switches should be set according to one of the following diagrams. The switch may one of two types as shown below.



Button Type Switch

Old Type

= Button pressed down



Lever Type Switch

= Position of lever

4. Identify an open ISA expansion slot in the computer. Most newer computers will have 1-3 ISA slots available. An ISA slot will have two connectors which match the gold connectors on the main board. Chose a slot which is not obstructed by components on the computer mother board. Remove the metal plate covering the opening associated with the slot by removing its screw..

Plug the *F1000* main board into the connector of the chosen expansion slot. Make sure that the board is seated firmly in the connectors. Center the main board bracket in the opening and secure it with a screw.

5. Install the cover on the computer.

***F1000*: Installation**

6. Install the plug on the flat cable from the *F1000* Preamp into the connector on the *F1000* main board. Press the plug firmly into the connector.

NOTE: The connector on the *F1000* main board is identical to the printer connector already on the computer. Be sure to choose the proper connector. The connector on the *F1000* has 2 pins blocked so that a printer cable cannot be connected to it. However, it is possible to connect the Preamp to the printer connector. No damage will result, but the system will be inoperative.

7. Connect the cable from your speaker system to the audio jack on the *F1000* main board. The audio jack is located next to the ribbon cable connector.

NOTE: The speakers must be plugged into the F1000 audio jack. The F1000 has its own sound system and does not use the computers sound card.

8. Apply power to the computer system. At this point the computer should start up as usual.

Software Installation

1. Beginning with software version 10.50 the installation is designed to be carried out under Windows 95/98/ME. We do not recommend operation under Windows NT or 2000.
2. Insert the *F1000* System Disk 1 in the **A:\ drive**.
3. From the Windows Desktop, select **Start** and then **Run**.
4. In the box type **a:biosetup** and press **<enter>**.
5. The installation program will evaluate the computer and report on any limitations.
6. Press **<enter>** to move to the next screen.
7. The installation program will check for previous installations of the *F1000* software in the computer.

If the installation program detects a previous installation of the current software it will offer to perform an update. The update will not affect any special setup files or data that exists in the system.

Reinstalling the same version software will “freshen” the current installation and is a good way to repair files corrupted by a hard disk problem.

8. The installation program will report its progress and ask for Disk 2 when needed. Remove Disk 1, insert Disk 2, and press **<enter>** to continue the installation.

The installation program will continue to report its progress.

If you purchased your *F1000* direct from Focused Technology, you can ignore the registration message. Otherwise, please let us know how to contact you by filling out the form.

9. Close the installation window by clicking on the **X** in the upper right corner of the window.

F1000: Installation

10. To install Windows icons for the F1000 Feedback System and The F1000 Setup File Editor, select **Start** and then **Run**.
11. In the box type **a:makeicon** and press <enter>.
12. Close the installation window by clicking on the **X** in the upper right corner of the window.
13. Look for 2 icons the Desktop labeled **F1000** and **F1000Set**. The icon looks like a small computer. Drag each to a convenient location on the Desktop. If the icon do not appear, try restarting Windows.
14. To install Windows icons for the F1000 Feedback System and The F1000 Setup File Editor, select **Start** and then **Run**.
15. Test the Main Board installation.
16. Select **Start** and then **Run**.
17. In the box type **c:\f1000b\sytest** and press <enter>.
18. The test should report:

Main Board Responding
Fast A/D Responding
Precision A/D Responding
Sound System Responding

If errors are indicated, recheck the installation of the **F1000** Main Board in the computer.

WARNING: Turn off the computer and unplug its power cable before removing the cover

In particular, check to see that the DIP switches are properly set and that the Main Board is seated in its socket. The system must pass this test in order to operate correctly. Contact Focused Technology if you are unable to resolve any problem.

19. Close the window by clicking on the **X** in the upper right corner of the window.

This ends the installation procedure. If you have a printer attached to your computer, refer to the System Control Screen section for instructions on selecting the proper printer driver. We suggest going through the tutorial in the **F1000** Manual to become familiar with the system.

F1000: Installation

Addendum

Warning

Use care in removing the wrist strap ground electrode from the snap connector. The snap tends to be tight the first few times the electrode is inserted and removed.

DO NOT PULL ON THE ELECTRODE to attempt to free it as the electrode material will tear. Use a thin screwdriver or knife blade to pry it out.

No Sound?

The *F1000* Main Board has its own sound system. A sound board can be installed in the computer to be used by other software without conflict with the *F1000*. However, the speakers to be used with the *F1000* must be plugged into the audio jack on the *F1000* Main Board, **NOT INTO THE SOUND CARD.**

Using Headphones with the *F1000*

The sound output jack of the *F1000* will not drive headphones directly. The easiest way to use headphones is to chose speakers which have a headphone jack.

Mouse Doesn't Work

Many computers are being supplied with only Windows mouse drivers installed. To function with the *F1000* (or any DOS application) a DOS mouse driver must be installed. Usually a disk is included with the mouse which allows installation of the mouse driver.

F1000: Installation

F1000 WARRANTY

Focused Technology warrants the ***F1000 Instrumentation System*** to be free from defects in workmanship and/or materials for a period one year from the date of original delivery. This warranty covers only defects arising from normal use and does not cover failures arising from misuse, abuse, accidents, neglect, modification, or repair by other than by Focused Technology. This warranty additionally does not cover disposable or wearout items such as electrode cables and probes except as noted below.

Electrode cables and temperature probes are warranted to be free from defects in workmanship and/or materials for a period of 90 days. Broken leads due to excessive force are not covered.

F1000 Tutorial: Startup

INTRODUCTION

This tutorial section is intended to provide a basic introduction to the **F1000** System. The operations illustrated do not attempt to provide instructions on the use of biofeedback.

STARTING THE F1000 SYSTEM

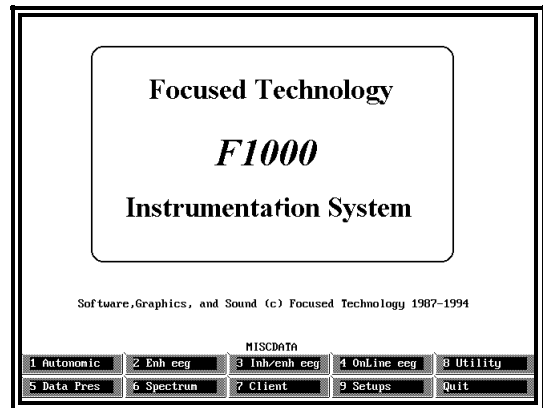
The **F1000** is normally started from the computer's DOS prompt. This should show on the screen as C:\>(or C:>).

To start the **F1000** System type **BIO2** and press the Enter key. The System Control Screen shown at the right will appear after a few moments.

SYSTEM CONTROL SCREEN

The System Control Screen provides access to the many features of the **F1000**. Selections can be made by clicking on the appropriate icon with the mouse, or by typing the number which appears in the icon.

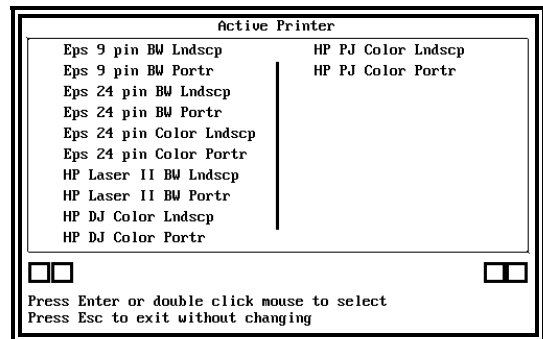
To start a subsystem simply press the indicated key on the computer keyboard.



SETTING PRINTER TYPE

The **F1000** needs to know what type of printer you have attached to your computer if you intend to print the graphic information produced by the Data Presentation subsystem.

To verify the currently selected printer select the *Utility* button while viewing the System Control Screen. A list of supported printers will appear. Use the keyboard arrow keys or mouse to select your printer. The printer selections include both portrait and landscape printing. The **F1000** remembers the printer selection until a change is made.



INTRODUCTION TO THE TUTORIAL

The following *Becoming Familiar* sections are intended as a tutorial rather than a system reference. The best way to become familiar with the system is follow along at the computer as you read these tutorials. Refer to the Keyboard Reference Chart as you follow the tutorials. Later the chart will be a reminder of the key to use for each action. To exit the System Control Screen press Q or using the mouse select Quit.

***F1000* Tutorial: Startup**

A Note About Static Electricity

Static electricity is generated by the friction of synthetic materials rubbing against each other. Clothing against furniture, shoes on carpet, etc. can generate charges in excess of 10,000 volts! Touching the face of the computer monitor can transfer a charge to your body. Discharging this voltage into a metal object produces a painful jolt! Discharging it into a sensitive electronic instrument can damage sensitive components or result in loss of data.

Regular use of an anti-static treatment on carpet and furniture will reduce or eliminate production of static charges at the source. Antistatic treatment is available in various forms from electronic suppliers or contact Focused Technology.

A static charge itself is not a problem unless it is discharged into a sensitive part of the equipment. One of the most effective approaches to control static electricity is to simply discharge it to a safe ground. Touch the metal part of an outlet strip, lamp, etc. and the charge is dissipated. Remember, though, that a new charge will be generated by moving around the room or in a chair.

The nature of EMG/EEG signals require special amplifiers which by their nature are susceptible to damage from static electricity. The *F1000* contains static protection circuitry which reduces the risk of damage, but the best protection is to avoid discharging an accumulated charge into the equipment. When the subject is connected to the *F1000*, a safe path is provided to continuously bleed off static charges generated by the subject's movements.

We recommend the following when making electrode connections:

1. The EMG or EEG electrode cable should not be plugged into the preamp until connections are complete.
2. Always connect the wrist strip ground first.
3. Touch a grounded metal object before plugging in the cables.
4. Plug the 3 lead cable into the preamplifier before the 2 lead cable. The 3 lead cable makes a ground connection which the *F1000* uses to remove and prevent static build up.
5. Always unplug the 3 lead cable last.
6. Avoid touching the monitor screen

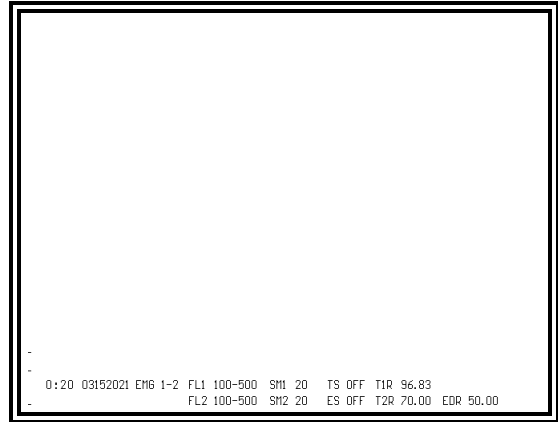
Temperature and EDR cables may be left plugged into the preamplifier if desired. As always, touching a metal object before handling the connected cables is good practice.

***F1000* Tutorial: Autonomic**

STARTING THE *F1000* AUTONOMIC FEEDBACK SYSTEM

The following tutorial sections will cover the operation of the individual autonomic feedback functions. Modalities covered will be temperature, EDR, and EMG.

Each of the tutorial sections assumes that the *F1000* Feedback System has been started in the autonomic mode. Select the *Autonomic* button from the System Control Screen. The empty feedback screen at the right will appear. The informational display at the bottom of the screen will be explained in each section of the tutorial.



F1000 Tutorial: Autonomic

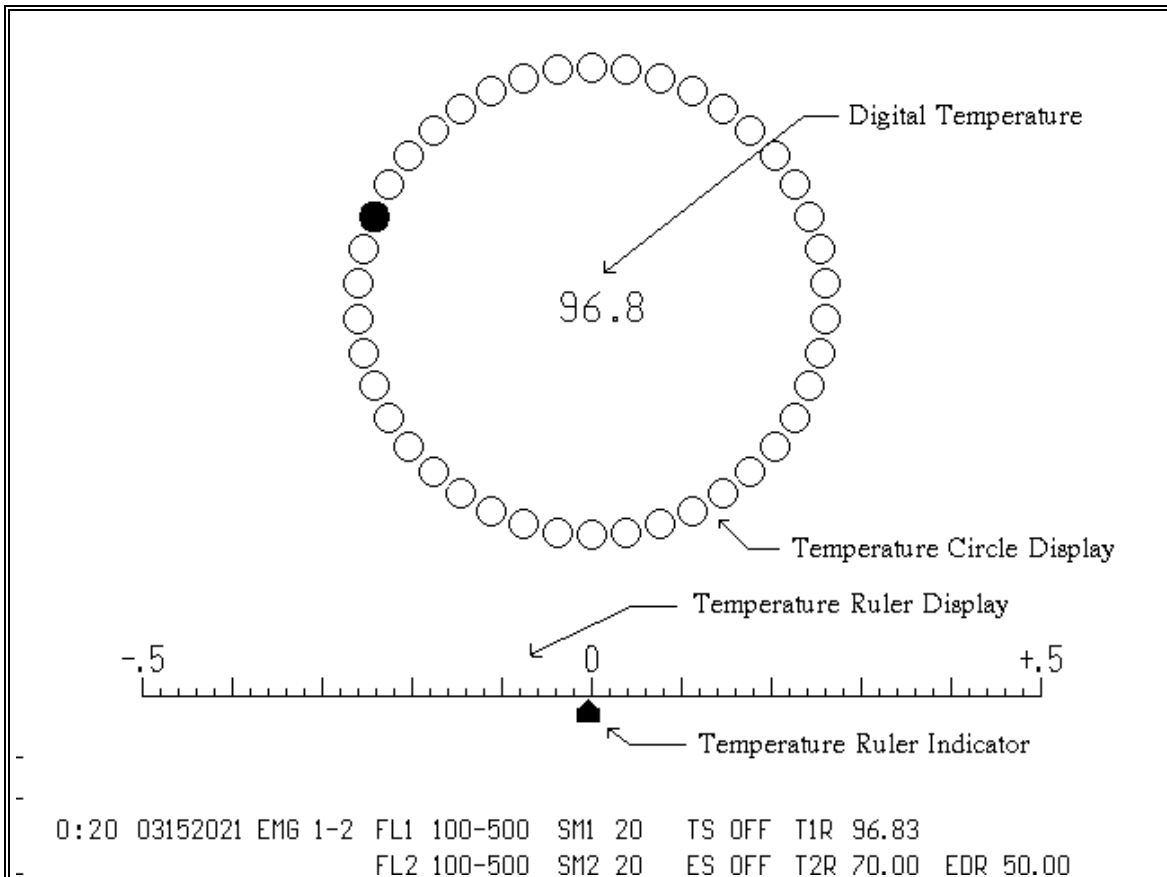
BECOMING FAMILIAR WITH THE TEMPERATURE SYSTEM

The temperature probe cable is intentionally made of a small gauge wire to prevent room temperature changes from affecting the accuracy of feedback. While the cable will withstand normal usage it is not designed for rough service.

At this time we will explore one of the two available temperature channels of the *F1000*.

Plug a temperature cable into the **Temperature 1** connector on the preamplifier panel and attach the probe to the subject's index finger tip with a strip of adhesive paper tape. The tape should not be so tight as to cut off circulation in the finger. Route the cable toward the subject's wrist securing it with a second small piece of tape.

Assuming the *F1000* has been started and is displaying the opening screen, press the **F9** key on the computer keyboard. A display similar to the following should appear.



The display is composed of three parts. Each part adds a dimension of its own to the feedback, and can be individually selected for display. Each display has been labeled in the view above but will not appear on the screen.

F1000 Tutorial: Autonomic

Digital Display

The digital display in the center of the circle indicates the current probe temperature. Press the **F6** key and note that the digital display is removed. Press the **F6** key again and the display returns. (Removing the digital display does not affect any of the other displays).

Circle Display

A large circle made up of small circles provides continuous feedback of small temperature changes. Notice that one circle is solid and that as temperature increases the solid circle moves clockwise. Each step represents a change of approximately 0.02 degree F. Press the **F5** and note that this display is removed. Press **F5** again and the circles return.

Ruler Display

Under the temperature circle is a ruler-like linear scale. This is the most sensitive feedback of temperature changes. Changes as small as 0.002 degree F can be observed. Immediately below the ruler line will be either a small block or an arrow. The reference point for the linear scale is automatically set to the current temperature when the system is started and any time it goes off scale. Also notice that the Temperature Reference indicator **T1R** shows the temperature which will bring the arrow to a zero reading. The arrow now shows changes from this reference temperature. Press the **F11** key to manually re-center the arrow. Press the **F1** key to deactivate automatic referencing.

Temperature Reference									
FL1	100-500	SM1	20	TS	OFF	T1R	96.83		
FL2	100-500	SM2	20	ES	OFF	T2R	70.00	EDR	50.00

Press the **F3** key and notice that the ruler scale changes to a 1.0 degree range. Each press of the **F3** key will increase the range. The **F2** key decreases the range. Pressing the **F4** key will alternately remove and restore the temperature ruler.

Sound

Sound feedback is also available in the temperature system. Press the **F8** key. Notice the Temperature Sound indicator **TS** shows 1- indicating that the sound is activated for channel 1, and as the filled circle display moves a bell-like sound will be generated. The pitch of the bell will lower with increasing temperature. If the temperature is changing slowly, a chord will also sound. Increasing temperature will cause the chord to waver or vibrate (tremolo). Press the **F7** key. Notice the Temperature Sound indicator **TS** shows 1+ indicating that the pitch of the bell now raises with increasing temperature. Press the **F8** key again to turn off the sound. The Temperature sound indicator will show OFF.

Temperature Sound									
FL1	100-500	SM1	20	TS	1-	T1R	96.83		
FL2	100-500	SM2	20	ES	OFF	T2R	70.00	EDR	50.00

Press the **F9** key. All temperature displays will be removed from the screen.

F1000 Tutorial: Autonomic

BECOMING FAMILIAR WITH THE EDR SYSTEM

Plug the EDR electrode cable into the EDR connector on the preamplifier panel. (Notice how the disposable electrodes have been trimmed. You will occasionally need to trim new electrodes to replace the ones supplied.) Assemble disposable electrodes and the Velcro hand band to the cable. Apply gel to the electrodes and place on the palm of the subject's hand.

Note: The EDR system is controlled by the "Alt function" keys on the computer keyboard. To select an Alt function, hold down the Alt key and press the "F.." key. For example to select <Alt> F9, hold down the Alt key and press the F9 key.

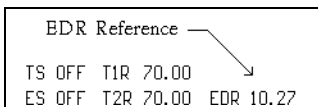
To display the EDR feedback system, press <Alt> F9. The display is composed of 2 parts, which can be individually selected.

Digital Display

The digital display at the bottom of the bar graph indicates the measured conductance in micro mhos. Use <Alt> F6 to control the digital display. Each press of the <Alt> F6 turns the display off and on. (Removing the digital display does not affect the bar graph).

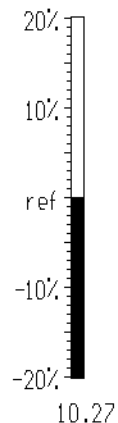
% Bar Graph

The % bar graph display provides feedback of changes in conductance relative to an EDR reference value. The % bar graph is automatically reference to the EDR reading at startup. (If the reading is changing rapidly, the bar graph may flash repeatedly as it references) Press the <alt F11> to manually set the reference point. Press <alt F1> to deactivate automatic referencing.



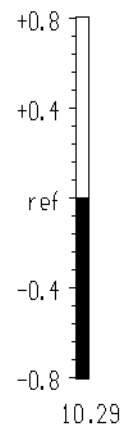
The EDR Reference indicator shows the EDR reading associated with the "ref" mark on the bar graph.

As the conductance changes, the bar graph indicates percent change from the reference. To change the EDR Bargraph Rang, Press <Alt> F2 for a lower range, and <Alt> F3 for a higher range. Press <Alt> F4 and note that the bar graph is removed. Press <Alt> F4 again and it returns.



Numeric Bar Graph

Press <Alt> F5 and observe that the EDR bar graph now indicates changes in conductance in micro mhos instead of percent <Alt> F2 and <Alt> F3 control the range. Press <Alt> F4 to return directly to the percent bar graph display.



F1000 Tutorial: Autonomic

EDR Sound

Press **<alt> F8** to activate the EDR sound feedback. (If the bargraph is not on the screen, press **<alt> F11** to return it to the reference) . As the bar graph moves up or down a "tom-tom" like sound will be heard. Decreasing conductance gives a slightly softer sound as well as a lower pitch. Pressing **<Alt> F8** again turns off the EDR sound.

EDR Sound							
FL1	100-500	SM1	20	TS	OFF	T1R	70.00
FL2	100-500	SM2	20	ES	ON	T2R	70.00

F1000 Tutorial: Autonomic

BECOMING FAMILIAR WITH THE EMG SYSTEM

The EMG system initial settings are chosen for general use.

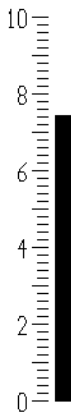
Two identical EMG channels are available. One channel must always use the 3 electrode cable supplied with the system to provide a ground connection to the subject. The second channel need only use a 2 electrode cable as it receives its ground from the first channel. It does not matter which EMG channel is used with the ground lead, or where on the subject's body the ground is placed. The ground lead is separated from the two active leads in the 3 lead EMG Cable.

EMG/EEG electrode cables should be unplugged from the preamplifier when not attached to a subject. Always plug in the 3 electrode cable first, and remove it last.

Snap the ground lead into the Wrist Strap Ground Electrode. Apply a small quantity of gel anywhere on the strap. Secure the strap around the subject's wrist. Snap a disposable electrode into each of the 2 active leads of the cable. Attach the electrode snap connectors to the Velcro headband, apply gel, and position over the frontalis muscle group (the muscles of the forehead). Use only enough gel to fill the cavity in each electrode. Avoid sliding the electrodes on the subject's skin. This may take some practice. Gel should never cover the skin between electrodes which would result in a bridge.

NOTE: The EMG is controlled by keys located on the numeric keypad of the keyboard. This is the group of keys located at the far right of the keyboard.

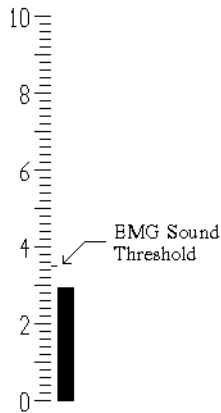
Plug the electrode cable into the EMG/EEG 1 connector on the preamplifier panel. Press the **Delete** key on the numeric keypad. An EMG bargraph display similar to the one shown here will appear on the left side of the screen. The bargraph may be all the way to the top indicating an off scale reading. The numbers on the scale indicate EMG levels in micro volts. The system default scale is 10 micro volts. Press the **right arrow** key on the numeric keypad and observe that the scale changes to 20 micro volts. Each press of the **right arrow** key moves to the next higher scale. Now press the **left arrow** key and notice that each press changes the display to a lower scale.



Set the EMG range so that the bargraph is showing near half scale. The actual range will depend on the subject's frontalis muscle activity. The bargraph will show constant activity and may go off scale when the subject talks or swallows. If the readings do not show activity or remain above 20 micro volts, check the electrodes to be sure they are filled with gel and in contact with the skin.

F1000 Tutorial: Autonomic

EMG Sound System



Press the "5" key on the numeric keypad (NOTE: this is the key between the 4 arrow keys). Notice that a small tic mark appears at 3.5 micro volts on the right side of the EMG scale. If the EMG bar is above the tic, a tone will be heard which changes in pitch as the bar height varies. This is the EMG sound feedback system. The tic mark indicates EMG sound threshold, the level at which sound feedback begins.

Press the **up arrow** key on the numeric keypad and observe that the threshold tic moves up the scale. Now press the **Page Up** key and notice that the tic moves in larger steps. The **down arrow** and **Page Dn** keys move the tic down the scale in a similar way.

Effective use of the EMG feedback system depends upon choosing the best combination of Range and Threshold. In general the most effective range is the lowest in which the bargraph stays on scale during the feedback training in progress. Occasional off scale readings during the subject's movement, swallowing, etc. can be ignored. Sound feedback is most pleasing when the tone pitch is low. The threshold setting affects the pitch for a given EMG bar height as well as the point at which sound begins. Try setting the threshold just below or just above the subject's average EMG level.

Parts of the EMG system are controlled by the "Shift Alt function" and "Shift Control function" keys on the computer keyboard. Select a <Shft Alt> function by pressing the "F.." key while simultaneously holding down the Shft key and the Alt key. Select a <Shft Ctrl> function by pressing the "F.." key while simultaneously holding down the Shft key and the Ctrl key.

EMG Smoothing

EMG smoothing affects how rapidly the bargraph responds to changes in EMG level. Set the EMG to the 20 micro volt range. Ask the subject to quickly tense and relax the frontalis muscle several times. Notice how fast the EMG bargraph moves up and down scale. Press <shft alt> F1. Now notice how fast the system responds to the same frontalis activity. Press <shft alt> F6. Again observe the response to tensing the frontalis muscle. The response is quite slow and indicates an average of several seconds. Press <shft alt> F3 to return to the normal smoothing.

The EMG Smoothing indicator at the bottom of the screen shows the smoothing value in effect. A higher number indicates more smoothing of the display. The <shft alt> F1, F2, F3, F4, F5 and F6 keys control the EMG smoothing. The default smoothing value of 20 works well for general use.

EMG Smoothing

SM1	20	TS	OFF	T1R	70.00
SM2	20	ES	OFF	T2R	70.00

F1000 Tutorial: Autonomic

EMG Filter System

Effective use of the EMG Filter System requires a knowledge of physiology. In general, however, the effect of varying the filtering of the EMG signal is to modify the area of measurement around the electrode site.

The <shft ctrl> **F1**, **F2**, **F3**, **F4**, **F5**, and **F6** keys each select a particular filter bandwidth, which is indicated on the EMG Filter indicator at the bottom of the screen. A list of the filters appears in the reference section of this manual and on the Keyboard Reference Chart. The filter selected by <shft ctrl> **F4** is selected when the system is started and represents a good compromise for general use.



EMG Channel 2

The second EMG channel is controlled by the same keys of the numeric keypad as channel 1 except that the <Alt> key is held down when selecting channel 2. Unplug the EMG 3 lead electrode cable from EMG/EEG 1 and plug into EMG/EEG 2. Press the <Alt> **Delete** key and notice that an EMG bargraph appears on the right side of the screen. Experiment with changing range and threshold as above. Remember to hold down the <Alt> key to control EMG channel 2. EMG channel 2 uses the same filter and smoothing as selected for channel 1.

USING MULTIPLE MODALITIES

Feedback of more than one modality is easily accomplished. Except for a few minor limitations, each system is added to the display as keys are pressed. Sound feedback from temperature, EDR, and EMG can be used simultaneously. Temperature and EMG sound can only be active for one channel of each modality. When using the startup display shown on page 2, there can only be one temperature channel on the screen at a time. However, additional screen display layouts allow both temperatures to appear. See the reference section of the manual for details.

MOVING ON

You are now familiar with the basic operation of the **F1000** Autonomic System. There are many more features available which take advantage of the sophisticated technology of the system. Each can be learned as the need arises. The reference section of this manual provides details. The following are some of the possibilities.

Alternate screen displays

EMG Filter options

Data logging and graphics

Temperature sound polarity

Sound volume control

F1000 Tutorial: Heart Rate/Respiration Option

Tutorial

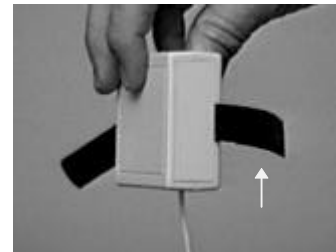
Introduction

The following tutorial will provide insight into the capabilities and use of the *F1000* Heart Rate/Respiration system screen. Additional information is provided in the reference and key chart sections.

Becoming Familiar with the Heart Rate/Respiration Screen

1. Plug the **F1000HR** Interface box into the expansion connector on the preamp box. Plug the two respiration transducers into the **Resp1** and **Resp2** jacks on the **F1000HR** interface.

2. The respiration straps consist of an elastic section with a short Velcro tab on one end and a longer section of Velcro on the other. Hold the respiration transducer as shown at the right. Notice that there are Velcro tabs extending out of each end of the transducer and the wire extends downward. Attach the short Velcro tab on the elastic strap to the Velcro tab shown with the arrow. The Velcro tabs should mate completely.



3. Place the transducer box over the subject's upper chest with the Velcro tabs exiting the box nearest the subject and the cable exiting downward. Wrap the elastic around the subjects back so as to circle the chest and attach to the other Velcro tab. Care should be taken not to allow the elastic band to become twisted. For now do not be concerned with the tension of the band. The satin backing on the Velcro should be next to the subject's clothing.



4. Repeat the above with the transducer attracted to the Resp2 jack, only placing the band around the abdominal area. Tight clothing or belts should be loosened to allow expansion.
5. Attach the wrist strap ground to one of the subject's wrists. Attach one disposable EMG electrode to the inside of each wrist. Using the 3 lead EMG cable connect the ground and active electrodes. Plug the 3 lead EMG cable into EMG channel 1. This site will be used to acquire the EKG signal for heart rate.
6. Attach the EDR electrodes to the subject's hand in the usual way and plug into the EDR connector.
7. Attach a temperature probe to the subject's finger and plug into temperature channel 1.
8. Position the subject for training. Reclining in a chair provides a good posture for relaxed respiration.
9. Select setup file **RESP2**. There is a slight delay before the screen becomes active. This is normal.
10. Position the subject for training. Reclining in a chair provides a good posture for relaxed respiration. Be sure the subject is comfortable before making the following adjustments.

***F1000* Tutorial: Heart Rate/Respiration Option**

11. Observe the red bar at the bottom of the screen and adjust the tightness of the chest band until the bar is approximately one half way across the screen. The bar will be following the chest expansion and contraction.
12. Repeat the above for the abdominal band while observing the green bar. The goal here is to set the bar to approximately same point as the red bar.
13. Note: Most of the following keys function as toggle switches. Pressing the key once activates a display or function. Pressing the key a second time deactivates it. Refer to the screen display in Fig 1 while trying each of these options.
14. Press the **<shft><ctrl> F11** key to activate the HR Test display. An EMG style scale will appear at the left side of the screen. The scale is permanently set to 250 uVolts. Notice that the status area at the bottom of the screen indicates **EMG:HR Test**. The bar should be pulsing in sync with the subject's heart beat. The actual value is not important as long as the pulse is distinct. Press the **<shft><ctrl> F11** key again to remove the display.
15. Press the **<shft> F1** key to activate the automatic respiration calibration. Ask the subject to take a deep abdominal breath followed by a deep chest breath. The threshold tics on the bars at the bottom of the screen will expand to encompass the extremes of expansion and contraction in each channel. Press the **<shft> F1** key again. The thresholds will be automatically set for proper display.
16. Press the **<shft> F4** key. Two expanding horizontal bars at the top of the screen will show chest and abdominal breathing.
17. Press the **<shft> F6** key. Average heart rate will appear above the bars. Average heart rate is smoothed to remove beat to beat variations.
18. Press the **<shft> F7** key. Heart rate variability will appear below the bar. Heart rate variability displays the variation of each beat from the average. The display will step to a new reading on each beat. An off scale step usually indicates arrhythmia such as a PVC.
19. Press the **<alt> F9** key to display EDR. See the EDR Tutorial for information on controlling the EDR display. **<alt> F7** activates an absolute value display not covered in the Tutorial.
20. Press the **F9** key to display temperature. This is the familiar circular temperature display, but without the ruler at the bottom. Each circle represents 0.02 deg F. Press the **F5** key to display the expanding circle temperature display. Each change in circle size represents 0.002 deg F.
21. Press the **Del** key to display EMG. The EMG signal is derived from EMG Channel 2 of the Preamp. We could use the 2 lead EMG cable to monitor EMG from anywhere on the body. For now press **<shft><ctrl> F12** and notice that the status display at the bottom of the screen shows **EMG:Chan 1**. This indicates that the EMG signal is derived from EMG Channel 1 which we have connected to the wrists. If the subject tenses the forearm muscles, the reading should increase. Too much tension here can interfere with the heart rate measurement. The EMG range can be changed with the right and left arrows keys on the numeric keypad.

***F1000* Tutorial: Heart Rate/Respiration Option**

22. We will now try the Paced Respiration Ball screen. Refer to Fig 2.
23. Press the **<shft> F5** key. The expanding bar display is replaced by the Paced Respiration Ball display. The heart rate variability display is removed from the screen. The moving ball bounces off each side of the window at the rate shown. The setting is in breaths per minute. Press **<shft> F2** to decrease and **<shft> F3** to increase the rate. The vertical position of the ball reflects the respiration measured in Resp channel 2. As the subject inhales/exhales the ball will rise/fall. The curve displayed in the window is a template to guide the subject's respiration rate. The curve also guides the pause time between breaths. The default curve uses 90% active breath and 10% pause. Try pressing **<shft> 1** through **5** to view the range of templates. The current rate and percent is shown just above the Paced Respiration Ball window.
24. Now ask the subject to "breathe" the ball along the curve. Start with an easy rate such as 8 BPM and 90%. If the subject has changed posture, it may be necessary to recalibrate using the **<shft> F1** key. This can easily be done any time during a session as the subject adapts to the training.
25. As in all the *F1000* screens, the data can be saved for analysis by pressing **<alt> S** and the screen closed by pressing **<alt> Q**.

Comments on Using the Heart Rate System

The heart rate information is derived from EKG "artifact" information in EMG channel 1. Filter A is set to a low frequency band which emphasizes the EKG pulse. The heart rate software automatically determines the best threshold to use in counting the time between pulses.

Any electrode placement which give a distinct EKG pulse can be used. The **Test HR** function provides a quick look at the filtered information and can be used to determine suitability of a particular placement. All that is required is that the bar graph show a distinct pulse which rises above other EMG signals.

The following is a list of some useful sites:

Site	Advantage	Disadvantage
Wrist to wrist	Easy access Can also be used to measure upper body tension from the same electrode site	EMG artifacts can affect HR measurement if subject is active
Bilateral Trapezius	Measures trapezius activity from same electrode site Can be useful in monitoring trapezius activity during respiration training	EMG artifacts can affect HR although not usually a problem Requires more intimate contact to attach electrodes
Bilateral Clavicle	Easy access through collar. Very little EMG artifact problems	Requires more intimate contact to attach electrodes
Vertical on Sternum	Allows vigorous activity without artifacts	Requires intimate contact to attach electrodes

***F1000* Tutorial: Heart Rate/Respiration Option**

Note that the same site can be used to acquire EMG information. This is accomplished by selecting **EMG: Chan 1** as the EMG source. EMG is measured in a 100-500 Hz filter which reduces the EKG artifact. It is also possible to use a separate electrode cable and electrodes to monitor EMG from an alternate site by selecting **EMG: Chan 2** as the EMG source.

The **Avg HR** display smoothes the beat to beat and RSA variations in the heart rate. The response is fast enough to follow biological changes in average heart rate, but is slow to respond if the display is already on the screen when the cable is attached. Simply pressing the <shft> **F6** key to turn the display off and on will reset the smoothing process to give a correct reading.

The **HR Variability** display shows the beat to beat variability from the average heart rate. For instance if the average rate is 70 beats/minute and an individual beat occurs at 75, then the variability will show +5. The variability by it's nature tends to jump with each beat. The most common variation is due to the respiratory sinus arrhythmia which increases on inhalation and decreases on exhalation. Another common occurrence is skipped beats or PVC's. These will display as an offscale reading going minus on a skipped beat and positive on a premature beat.

Comments on Using the Respiration System

The term "respiration" is actually a bit inaccurate in describing the measurement. An elastic band translates body circumference into force, which is applied to the respiration transducers. As the subject inhales, the chest and/or abdominal area expands. Of course anything else that causes the measured area to expand will result in apparent inhalation. This can be simply a change in posture, raising or lower the arms, bulging the abdomen etc. Tight fitting clothing or belts can restrict body expansion resulting in a low reading. Of course, the same things restrict breathing.

Keeping these things in mind, there are some things that can be done to improve measurements and feedback.

1. Position the subject in a semi-reclining position before making the final adjustments to the elastic bands.
2. Calibrate the respiration system just before starting training.
3. Watch the movement of the horizontal bars at the bottom of the screen during training. Activity should remain between the calibrate tic marks except when the subject takes an abnormal breath, coughs, etc. If the activity consistently goes outside the tics or is very small compared to their range, it is time to recalibrate.
4. When performing a calibration, direct the subject to breath in a way that is typical for the type of training you are going to do. For instance, if your objective is to deepen breathing, ask for a deep breath. On the other hand, to train gentle, paced breathing, just let the subject breath normally while calibrating.
5. For the very shallow breather it may be necessary to manually flex the elastic band yourself to set a calibrated goal.

The calibration system sets the range of both horizontal expanding bars to the same sensitivity. This allows a rough comparison of chest and abdominal breathing activity.

***F1000* Tutorial: Heart Rate/Respiration Option**

The Paced Breathing Ball display operates on respiration channel 2 only. The ball moves smoothly back and forth across the window at a calibrated rate. Rates of 3-20 breaths per minute are available. The expansion of the channel 2 elastic band causes the ball to rise in the window. A template curve guides the subject in the desired rate and type of breathing. Templates provide varying breath cycles. Following the 100% curve results in continuous breathing with no pause between exhalation and inhalation. The 30% curve results in inhale/exhale over 30% of the time and a pause of 70% before starting the next inhalation. Rates of 100%, 90%, 75%, 50%, and 30% are available. In general the lower percentages are not very useful with higher breath rates.

***F1000* Tutorial: EEG**

EEG CABLE AND ELECTRODES

The EEG cable is terminated in two 1mm pin jacks and one snap connector. The jacks are the active monitoring leads while the snap is ground. There is no distinction between the black and blue active monitoring leads. As with the EMG 3 lead cable, the ground lead is separate from the active leads. The supplied electrodes have matching pin plugs. The snap connector on the ground lead should be connected to the wrist strap ground.

The two 9mm disk electrodes can be used to monitor sites anywhere on the head. The ear clip electrode is used where one of the sites is an ear lobe. The wrist strap ground should be used to ground the subject. The larger surface area of the strap provides a superior ground connection to the often used ear electrode. Ground placement has no effect on the nature of the monitored signal.

There is considerable confusion over "monopolar" vs. "bipolar" monitoring of EEG signals. Electrical potentials always exist in reference to another point. Therefore it is helpful to visualize the area between the electrodes connected to the active leads as the part of the brain being monitored. If one of the active leads is connected to the earlobe, then the ear canal in effect becomes an electrode.

Electrode Application and Artifact Reduction

The EEG/EMG amplifiers used in the *F1000* are very forgiving of electrode contact resistance. In most cases only minimal preparation of the skin is necessary. Preparing the site with NuPrep to remove oil, hair spray, or mousse from the skin is usually all that is necessary. **There is no need to abraid the skin to get adequate contact.**

The most common artifacts encountered in EEG monitoring involve movement of the electrodes, cables, or subject. Power line interference common in EMG monitoring is of very little consequence in EEG.

- ? Electrode movement can be minimized by using a generous amount of 100 paste and eliminating as much hair as possible from under the electrode. Elastic or Velcro may help secure the electrode cable in place. Avoid placing the Velcro directly over the electrode. It is often helpful to clip the cables to the subject's collar using a hair clip to provide additional support for the cable. The unshielded parts of the active electrode cables are the most vulnerable to movement.
- ? Movement of the subject is difficult to prevent. Attention to the items already mentioned reduce secondary effects. Subject movement generates static charges which are discharged through the electrode interface and can produce artifacts. Static treatment of furniture and carpet can be helpful in reducing the level of static generation.
- ?? An often overlooked source of artifact is movement of another person near the subject. The static charge on the person's body can induce signals in the unshielded parts of the electrode cable. The *F1000* shielded cables greatly reduce artifacts from this source.

F1000 Tutorial: EEG

Bio-Potential EEG Electrode

The **Electro-Cap Bio-Potential Electrode** is supplied with *F1000* Systems. A recessed tin electrode reduces movement artifacts and the large surface area makes it easier to hold the electrode in place. A 1mm pin connection eliminates unshielded pigtail leads.

Using the Bio-Potential Electrode

Press **10-20 Paste** into the recessed cavity in the electrode until it appears in the small hole on the back of the electrode. Leave a liberal amount of paste on the face of the electrode and press it into place on the scalp. A small back and forth rotation will insure good contact. The 1mm pin plugs into the EEG 3 lead cable.

Example Hookup

The following will describe a hookup using the right ear and CZ placement. While this is a common placement, it is only used for illustration and not as a recommendation for any particular purpose.

1. Apply a small amount of Spectra Gel to the Wrist Strap Ground Electrode and apply it to the subject's wrist. For oily skin an alcohol wipe may be helpful. Note: the strap is conductive, the button directly under the snap connector may not be
2. Clean the right earlobe with NuPrep.
3. Add a generous amount of 10-20 Paste to an earclip electrode and snap it into place on the earlobe with the short lead hanging down.
4. Part the subject's hair to expose the scalp at CZ (very top of the head). We find that it is helpful to temporarily hold the hair out of the way with hair clips. Clean the scalp with NuPrep. If excess hair spray is present, especially the kind that imparts a stiff texture to the hair, it will need to be removed from the scalp.
5. Press 10-20 Paste into the recessed cavity of a Bio-Potential electrode until it appears in the small hole on the back of the electrode. Leave a liberal amount of paste on the face of the electrode and press it into place on the prepared scalp with the lead exiting to the right. Rotate the electrode gently back and forth to seat it in place.
6. Snap the ground lead of the 3 lead EEG Cable into the ground strap.
7. Carefully insert the lead of the ear clip into one of the pin jacks of the EEG Cable.
8. Carefully insert the lead of the Bio-Potential Electrode into the other pin jack of the EEG Cable.
9. Wrap the Velcro Headband or other elastic band around the subject's head to help support the cable leading to the CZ electrode. The band should go around the forehead and occipital regions. **Do not attempt to run it over the top of the head. Severe artifacts will result.**
10. Support the EEG Cable by clipping it to the subject's collar. Leave sufficient slack to allow for head movement.

***F1000* Tutorial: EEG**

11. Recheck the CZ electrode to make sure it is still in place and remove any hair clips left in the hair
12. Plug the EEG Cable into the Preamp Box
13. Use the Online EEG display to verify signal quality

F1000 Tutorial: EEG

ONLINE EEG SYSTEM

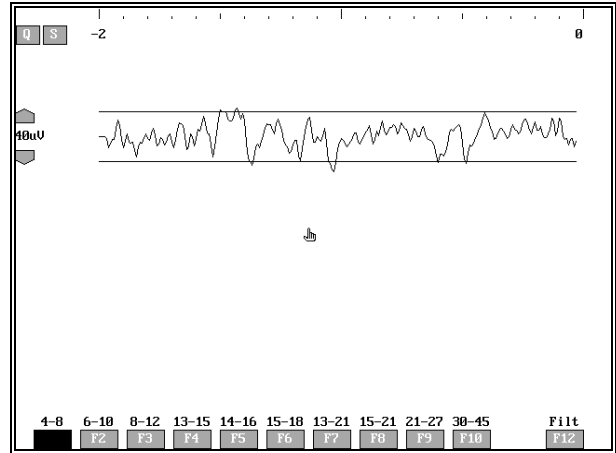
Introduction

The Online EEG System provides a means of viewing the raw signal waveform and spectrum of the EEG signal as it happens. These displays are useful in checking the signal for artifacts. They can also be used for a quick look at the general nature of the subject's EEG. The Online EEG System is not intended to be used for feedback or detailed analysis.

The Raw Waveform Display

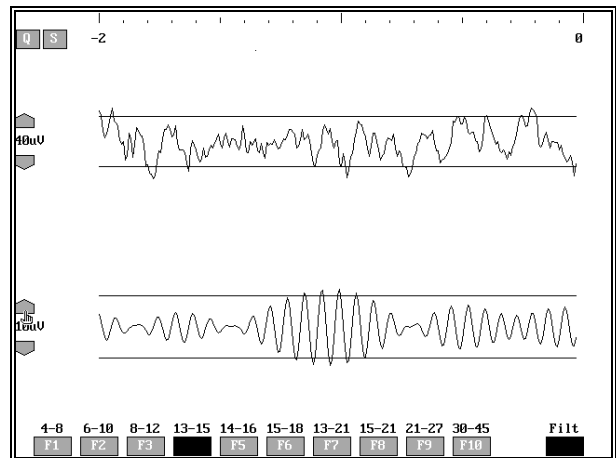
Connect the EEG system to a subject as described in the previous section.

Select “*Online eeg*” from the System Control Screen. The raw data display shown at the right will appear. The waveform may vary depending on the subject's EEG and the quality of the hookup. The lines above and below the “40uV” label indicate the calibration for 40 microvolts peak to peak. Press the “-” key on the numeric keypad or click on the down arrow icon to change the range to 20 microvolts. Press the “+” key on the numeric keypad or click on the up arrow icon to return to 40 microvolts. Two seconds of data are displayed on the screen. New data enters the display on the right and scrolls to the left.



Press the **F12** key to show filtered online data. The display at the right is showing the raw data (top) and 13-15 Hz component of (bottom waveform). The microvolt range can be changed by using the <alt> + or <alt>- keys. The up/down arrow icons can also be used.

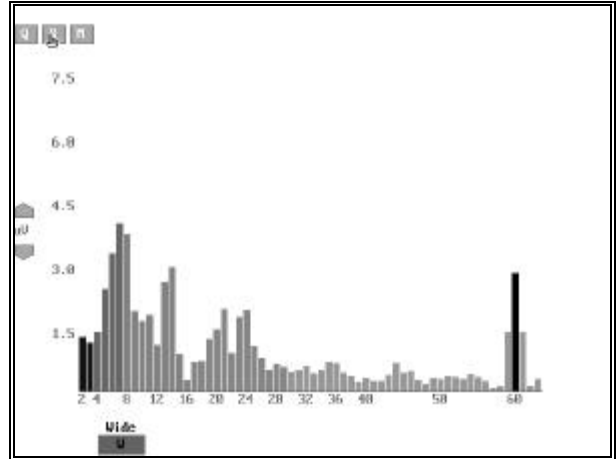
Note that the data is delayed on both waveforms when observing filtered data. This has no effect on feedback speed. It is an effect of the digital filters used in this display only.



F1000 Tutorial: EEG

The Spectrum Display

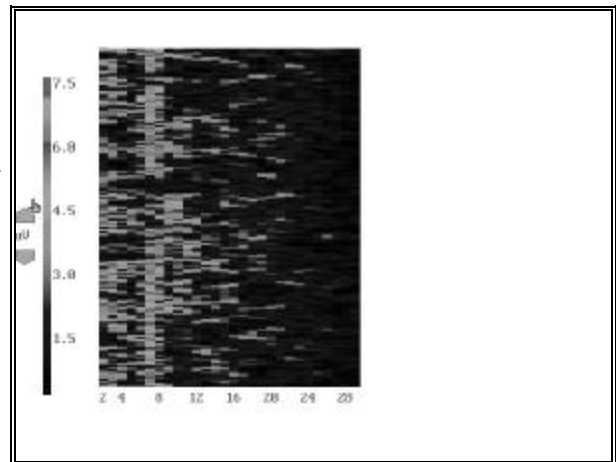
Press the “**S**” key or click on the **S** button to switch to the spectrum display. A display similar to the one shown at the right will appear. The spectrum may vary depending on the subject’s EEG and the quality of the hookup. The bars are colored to indicate each commonly defined EEG frequency range. A separate bar at 60 Hz is useful in evaluating the hookup for power line interference.. Press ‘**W**’ or click on the **W** button to show only 2- 30 Hz bars. Press ‘**T**’ to emphasize the Tansey frequencies.



The “**R**” key returns to the raw waveform display. Pressing **Q**” from either display will return to the System Control Screen

The Spectral Map

From the Spectral Display, press **M**” or click on the **M** icon to display the Map Display. This display uses color to display the spectrum over time. The display scrolls from the bottom of the screen. The microvolt color code is displayed on the bar at the left of the screen. Use the numeric pad +/- or up/down arrows to change the microvolt range. Changing the range will affect the color makeup of the display. Press the **spacebar** to freeze/unfreeze the display. Press <esc> to return to the spectrum display.

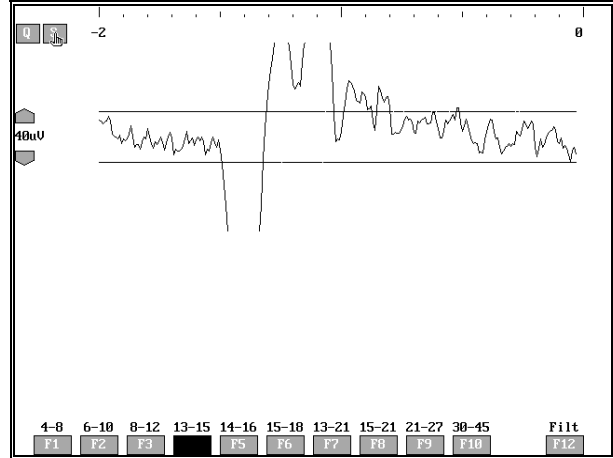


F1000 Tutorial: EEG

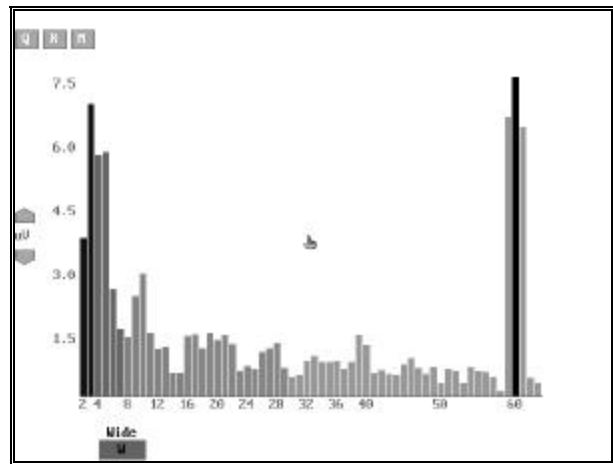
Evaluating Signal Quality

The displays in the previous sections illustrate good quality EEG signals. The following figures show how signal problems due to poor hookups appear on the various displays.

Electrode Movement Artifact usually results from a poorly secured cable which is causing the electrode to move when the subject's head is moved. The figures at the right show the effect of electrode movement on both raw and spectrum displays. Raw signal quality is normal either side of the large amplitude excursion. Movement artifacts affect the low frequency components of the spectrum more severely as illustrated in the spectrum display. Notice the large readings in the 24 Hz area.



60 Hz power line interference can also be seen in the spectrum display. While the EEG system will give acceptable feedback with a fairly large 60 Hz component, readings such as that shown here are an indication of poor electrode contact or a high interference level in the room. Readings under 5 uV can be ignored.



F1000 Tutorial: EEG

BECOMING FAMILIAR WITH THE EEG ENHANCE MODE SYSTEM

Introduction

The *F1000* EEG enhance mode system is similar in many ways to the EMG system. Bar graph displays are used to show EEG amplitude in selected filter bands and to set sound feedback thresholds. The main difference is in the audio feedback. As the EEG amplitude passes the threshold, sound increases in volume rather than pitch. Sound can be used on both filter channels simultaneously. The musical notes of the two channels are chosen to be pleasing when sounded together.

Using the EEG System

Clinical use of EEG is beyond the scope of this tutorial. The following exercise is not intended to show good EEG practice, but rather to give the new user a look at the options available.

A subject should be connected to the EEG system as described in the section **EEG Cable and Electrodes**.

From the System Startup Screen select the *Enh eeg* button.

The familiar biofeedback screen should appear in a few moments. Notice the filter display FLA-1 shows 4.0-8.0 (Theta) and FLB-1 shows 8.0-12.0 (Alpha). The save indicator will show EEG NO.

Press the **Delete** key. The left bar graph display appears and is showing the amount of EEG signal in the theta band. Press the **alt Delete>** key. The right bar graph appears and is showing the amount of alpha signal. The readings are in micro volts.

Press the **"5"** key on the numeric keypad. Notice the tic mark at the 3.5 micro volt level on the left bar graph. This is the sound threshold. Adjust the threshold with the **up arrow**, and **down arrow** keys. (The **Page Up** and **Page Down** keys can be used for larger movements). Notice that the theta tone comes on when the signal is above the threshold and increases in volume with the signal level. Now hold down the **alt>** key and press the **"5"** key on the numeric keypad. A tic mark appears on the right bar graph indicating sound threshold. Use the same keys as above while holding down the **alt>** key to adjust the threshold. Notice that the alpha tone comes on when the signal is above the threshold and increases in volume with the signal level. The pitch of the alpha tone is higher than the theta tone.

The *F1000* provides a wide selection of filter bands. Refer to the ***F1000* EEG Filter Chart** for other filter combinations. Notice that some of the selections allow use of EEG channel 2 as the source.

F1000 Tutorial: EEG

BECOMING FAMILIAR WITH THE INHIBIT/ENHANCED MODE SYSTEM

Introduction

The Inhibit/Enhance Mode System provides feedback based upon the combined criteria of the filter A signal amplitude being below its set threshold and filter B signal amplitude being above its set threshold. Visual feedback is provided by an oval window which turns green when criteria is met. Auditory feedback is a “bong” sound when the oval is fully green.

Using the EEG Inhibit/Enhance Mode System

Use the same electrode placement as in the previous section. From the System Startup Screen select the *Inh/enh* button. The familiar feedback screen will appear with a few exceptions. The screen background color is light gray and the amplitude bar graphs are already displayed.

The left bar graph shows the EEG signal level in filter FLA. The Right bar graph shows the EEG signal level in filter FLB1. Tic marks show thresholds in the respective filters.

Press the **End** key on the numeric keypad. The oval in the center of the screen shows criteria by turning green when the signal in filter A is below threshold (inhibit) and the signal in filter B is above threshold (enhance). As the subject progresses past criteria, the green becomes brighter. At full brilliance, the sound system produces a pleasant "bong".

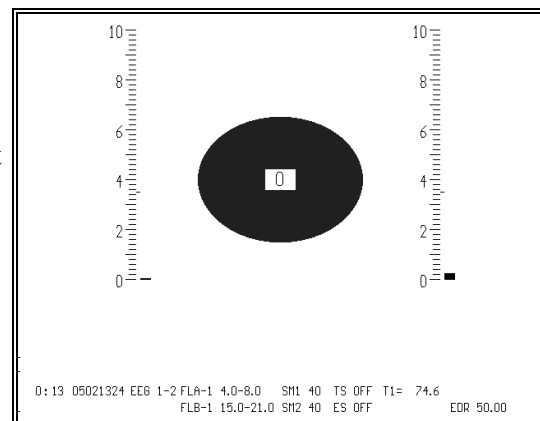
Adjust the filter A and filter B thresholds until the subject is achieving success approximately 50% of the time.

Hold down the **<alt>** key and press the **End** key. A criteria counter window appears in the center of the oval. The counter displays the number of times that criteria is maintained for at least 0.5 seconds. The counter can be reset at any time by pressing the **Home** key. The current count is recorded as an event.

The bar graph displays can be removed from the screen without affecting the feedback. Press the **Delete** key to toggle the bar graphs. The oval can also be toggled by pressing the **End** key.

Removing either or both does not interfere with data logging.

The criteria counter will remain on the screen when the oval is toggled OFF. This provides the ability to interrupt feedback while keeping the criteria counter visible. The counter can only be toggled OFF when the oval is ON.



F1000 Tutorial: EEG

Several alternate display modes which affect the color of the ellipse are available. They are selected using **<alt> 1, 2,3, 4 or 5**. the following table shows the options:

Key	Display Option
<alt> 1	Default green ellipse
<alt> 2	The oval shows Filter A above threshold as red and Filter B as green. When both are above threshold they combine to produce yellow. Criteria is met when the oval is full green as above indicating Filter A below and Filter B above threshold.
<alt>3	Same as <alt> 1 except the ellipse is colored red.
<alt>4	Same as <alt> 1 except the ellipse is colored blue.
<alt>5	Same as <alt> 1 except the ellipse is colored yellow.

An alternate setup file named **INHENH_L** provides the same options as above, but uses a large full screen ellipse on a black background.

F1000 Tutorial: EEG

BECOMING FAMILIAR WITH THE TANSEY & MIND AWARENESS DISPLAY SCREENS

Feedback Signal Filtering

Both the Tansey and Mind Awareness Training screens have the option of deriving feedback from a fast analog filter or an FFT based filter. Each has its advantages and disadvantages.

The analog filter gives a short response time, but has a wider bandwidth than the FFT. To maintain a more realistic signal level, the analog filter bandwidth is made proportional to the center frequency. Particularly in the MAT system this gives a more consistent feedback feel during sequencing.

The FFT filter has the advantage of giving a narrow bandwidth over the entire range of frequencies. In these screens, the bandwidth of the FFT filters are 1 Hz. The FFT based filter at 1 Hz bandwidth is approximately 4 times slower than the analog. While this is not a problem with using the visual display for verbal feedback as in Tansey's work, it has a major effect on true feedback learning.

The type of filter used can be selected with the **shft><ctrl> F12** key. The indicator in the status display will show the mode currently selected. Only the currently active feedback bar can use analog feedback. The remainder of the bars are FFT derived.

Effects of Computer Speed

If computer speed is sufficiently slow, the FFT calculations used to produce the bar display can slow feedback even when using the analog filter. Computer speed is checked each time the MAT system starts and if this condition is present all bars except the one being used for feedback is disabled. The **<ctrl> <shft> F11** key will turn the bars back on with a corresponding degradation of feedback.

Sound System

The sound is available on any one of the frequencies displayed. Sound comes on above threshold. The level increases and the sound becomes "richer" as the level increases.

Using the Tansey/ TansPlus Display Systems

Select the **Tansey** setup file from the setups menu. The meaning of most of the screen is obvious. The setup displays the 8 frequencies used by Tansey(1) as colored vertical bars. The sound EMG (100-500 Hz) and movement (2Hz) are shown as horizontal bars at the bottom of the display window. The usual status information is shown at the bottom of the screen. Temperature and EDR are available if hooked up.

The **TansPlus** setup displays 9 Hz and 24 Hz in addition to the 8 Tansey frequencies. An alternate sound is used in this setup. Keep in mind that the labels for each bar are arbitrary and should be interpreted with care.

F1000 Tutorial: EEG

Press **<alt> T** to access the **training timer**. A window will open and ask for a time. Enter a time between 1:00 and 60:00minutes. When ready to start press **<enter>**. Feedback sound will be activated and the word **Timer** will appear in the lower left corner of the screen. Set threshold and activate raw logging if desired. When the time expires, sound and raw logging will be turned off.

Press **<shft> F12** to activate **EMG inhibit**. The EMG label at the left of the EMG bar will be changed to red. When the EMG bar exceeds approximately one third of the screen (10uV), the screen border color changes to red and audio feedback is inhibited. Press **<shft> F12** again to turn off the EMG inhibit.

The usual data can be saved and reviewed including temperature. When reviewing amplitude data in the Data Presentation System, channel 1 is EMG and channel 2 is the filter bar. It is always derived from the analog filter even if feedback is from the FFT.

Key commands have been kept consistent with other displays where possible. Refer to the following summary for the key commands.

Num5	Toggle Sound OFF/ON
Num Up Arrow	Thresh Up Selected filter only
Num Dn Arrow	Thresh Down " "
Num PgUp	Thresh Up 10
Num PgDn	Thresh Down 10
	Note: Use Shift with any threshold key to set all thresholds simultaneously and to the same value
Num Rt Arrow	uvolt Range Up
Num Lt Arrow	uvolt Range Dn
ctrl shft F1-F8	Set Feedback filter to Bar 1-8
ctrl shft F11	Toggle FFT Bars OFF/ON
ctrl shft F12	Toggle Feedback Bar between FFT and Analog
<shft> F12	Toggle EMG Inhibit OFF/ON
alt N	Reset Session Count
alt S	Save Data
alt T	Toggles Training Timer
alt Q	Quit Session

F1000 Tutorial: EEG

Mind Awareness Training

Mind Awareness Training is based upon providing feedback of frequencies spread over the entire EEG spectrum in a random sequence. The threshold is automatically set for near 100% feedback. The feedback sound is designed to provide information through level and “richness”. The sound is identical for each frequency so does not convey information about the frequency being fed back.

The training works best eyes closed. A sequence interval of 10 or 15 seconds seems to work well although we sometimes use 30 seconds on the first session to allow time for the subject to sense each state. Total session time can range from 5 to 30 minutes or more.

There is no criteria or objective. The subject is only instructed to listen to the sounds. Feedback is too fast for cognitive processing and any attempt at setting an objective only seems to get in the way. The feedback information is conveyed in the nature and volume of the sound. Attempts at setting the threshold for less than 100% feedback have the effect of breaking the feedback loop.

Using the Mind Awareness Training System

Select one of the **MAT1** or **MAT2** setups from the setups menu. **MAT1** provides feedback on the 8 Tansey frequencies plus 24 Hz. **MAT2** adds 9 Hz to the frequency complement. The time period is determined by the dash number in the setup file name. For instance the setup file **MAT1_15** uses a time period of 15 seconds. The screen is similar to the Tansey except for the lack of EMG and movement bars. There are also two additional status indicators at the bottom of the screen. Press the **<end>** key to start the sequencer. The Seq indicator will show **On**. Press the **<Home>** key to enable the system. The Auto indicator will show **On**. Note that the automatic threshold cannot be enabled unless the sequencer is active. An offset can be added to the threshold using the **Up Arrow** or **Down Arrow** keys while automatic threshold is active. The offset value is shown by the AutoOfs indicator.

Training can also be started automatically by pressing **<alt> R** (run). This starts the auto sequencer, auto threshold, and turns on sound. After a 5 second pause to determine threshold, feedback starts.

Timed Training can be started by pressing **<alt> T**, and entering a time between 1:00 and 60:00 minutes. Press **<enter>** to start training. . When the time expires, sound and raw logging will be turned off. Training can also be terminated by pressing **<alt> T**.

F1000 Tutorial: EEG

Suggested Startup for MAT

1. Make the desired hookup. Temperature and EDR can be recorded if desired.
2. Select a **MAT1** or **MAT2** setup
3. Start training using **<alt> R** or **<alt> T**.
4. Adjust Auto Offset if necessary using **Up Arrow** or **Down Arrow** keys.
5. Start raw logging if desired using **<Insert>** key.
6. At end of session, if the training timer was not used, turn off sound using the **5** key.
7. Save any data by pressing the **<alt> S** key.
8. Quit by pressing the **<alt> Q** key.

MAT Key Commands

The MAT System uses the same keys as the Tansey. The following additional commands are available:

<alt> R	Autostart training (without timer)
<alt> T	Autostart training (with timer)
Num End	Toggle Seq OFF/ON
Num Home	Toggle Auto Thresh OFF/ON (only if Seq=ON)

If Auto Threshold is active then:

Num Up Arrow	Thresh Offset Up
Num Dn Arrow	Thresh Offset Down

The usual data can be saved and reviewed including temperature and EDR. EEG amplitude data cannot be saved in this mode as the constantly changing filter frequency would make it useless.

- (1) For information concerning the work of Tansey, address communications to
Michael A. Tansey, InSync Institute Inc, 194 Bywater Way, Somerville, NJ 08876

F1000 Tutorial: EEG

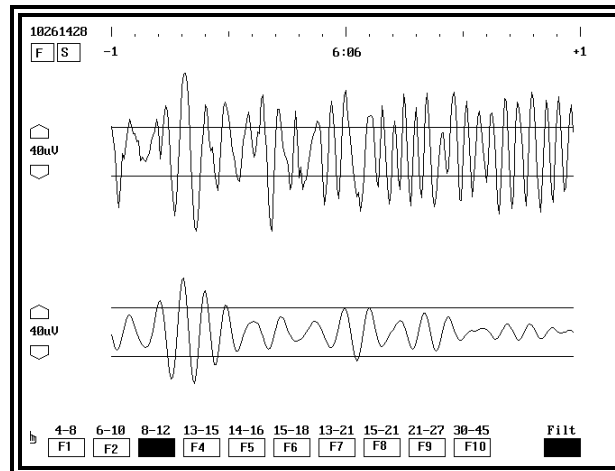
F1000 RAW DATA SYSTEM

Saving Raw Data

1. The *F1000* provides for logging of raw EEG data during a feedback session. The data are saved to the hard disk for later review.
2. Raw logging is only available for EEG data as determined by the setup file in use. If the indicator RL OFF appears in the display area at the bottom of the feedback screen, raw logging is available. Press the **insert** key and it will toggle the indicator between RL ON and RL OFF.
3. When raw logging is on, data is being saved in extended memory. It will be saved to the hard disk along with the other data at the end of the session. Raw data is saved at 128 samples/second and uses approximately 925K Bytes/Hour. The user can either save an entire session or turn logging off and on to take samples. Data will still be saved in one session file. Use **alt S** to save data as usual at the end of the session.

Analysis of Raw Data

1. Select Spectrum from the System Control Screen. The *F1000* Raw Data Display System Screen will appear with a list of raw data files for the active client.
2. Select a file using the mouse or keyboard. If no files are shown, be sure you have selected the desired client. Another common reason for missing raw data files is failure to turn raw logging on during the session.
3. The raw signal display appears. The figure at the right shows the optional filtered signal at the bottom of the screen.
4. To return to the file menu, select the *F* button.
5. Working the raw data is intuitive. Most commands are accessible through icons using the mouse. The following are the available options.



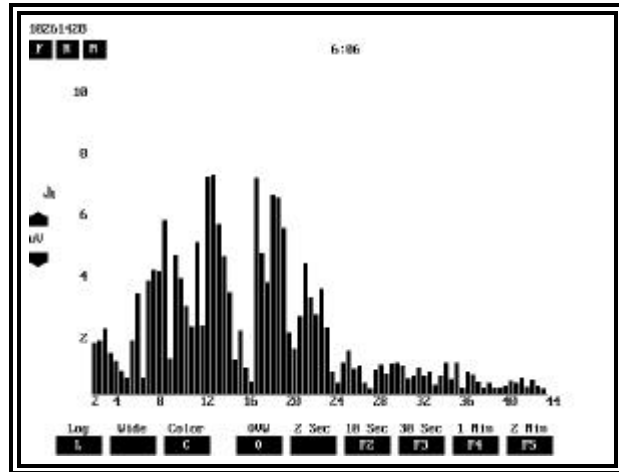
F1000 Tutorial: EEG

Right/Left Arrow keys	Move forward or backward through the file in 1/8 second steps. Hold down the key for contiguous scrolling. Scrolling will be much faster if the filtered waveform is not displayed
Shft Right/Left Arrow keys	Move forward or backward in time through file in 2 second steps.
Alt Right/Left Arrow keys	Move forward or backward through file to next event mark.
Ctrl Right/Left Arrow keys	Move forward or backward through file to start or end.
“G” key	Opens dialog box to select time to “Go To”.
Up/Down Arrow keys	Move raw trace up or down. Not available for the filtered trace.
F 12 key or left click on icon	Shows raw signal through selected filter. Note: Scrolling will be much slower when filtering is on. Turn off while moving through file for quicker response.
F1-F10 key or left click	Select filter
Plus or Minus key on numeric keypad or left click on arrow icons at uV indicator	Change scale of upper trace
Alt Plus or Alt Minus key on numeric keypad or left click on arrow icons at uV indicator	Change scale of lower trace
“S” or left click on S icon	Selects the Spectrum Display Screen
“F” or left click on F icon	Returns to the file select menu
Shift “P”	Starts a printout of the current display. A two tone beep indicates the printer is not ready. Check for On line, Power Off, or Paper Out

F1000 Tutorial: EEG

Spectrum Display

1. From the raw data display select **S** to show the spectrum display. The FFT spectrum is calculated on the 2 second data segment shown in the Raw Display Screen. The spectrum is a 256 point FFT performed on data acquired at 128 samples/sec.
2. The following options are available.



“L” key or left click on the Log icon	Toggles between linear and logarithmic amplitude scale
“W” key or left click on the Wide icon	Toggles display between 2- 32 Hz and 2 - 44 Hz spectral display
“C” key or left click on the Color icon	Provides a reference color bar for the Spectrum Map.
“O” key or left click on the OVW icon	Controls the way in which FFT averages are performed. If not selected, averages are computed on 2 second FFT samples. If selected, the average is computed on overlapping data windows. Note: When ON calculations take much longer to perform. Press the esc key to abort a calculation.
F1-F5 keys or left click on icon	Shows spectrum averages over indicated interval starting at the current indicated time. If there is insufficient data for the average, a message will appear on the screen.
Plus or Minus key on numeric keypad or left click on arrow icons at uV indicator	Changes the scale of the current display. The linear and log ranges are independently set.
“F” key or left click on the F icon	Returns to the file select menu
“R” key or left click on the R icon	Returns to the Raw Data Display Screen

F1000 Tutorial: EEG

“M” key or left click on M icon	Shows the Spectrum Map. See details below.
Shift “P”	Starts a printout of the current display. A two tone beep indicates the printer is not ready. Check for On Line, Power Off, or Paper Out.

Spectrum Map

The spectrum map is a color representation of the spectrum over time. The maximum time shown on one screen is 1 minute and 30 seconds and starts at the time shown on the Spectrum Screen. Spectral amplitude is represented by color with black the lowest and magenta the highest. The best way to visualize the color scheme is through the reference color bar on the spectrum display screen. Select the *Color* button to show the reference color bar.

It helps to scroll through part of the file while watching the height of the spectral bars. Adjust the microvolt range to keep most of the high bars on the screen. In some cases the log scale may give a better map.

The spectrum map cannot be printed at this time. It would use an excessive amount of printer ink to print.

The map calculations can be interrupted at any time by pressing the esc key. Pressing esc a second time will return to the spectrum screen. Pressing the space bar will start a new sweep where the last left off.

Hints for Use

The response speed of the filtered raw signal and the averaged spectrum display is greatly dependent on computer speed and is enhanced by a math coprocessor. It is particularly helpful on slower computers to turn off the filtered display while scrolling through a file. The same is true of the averaged spectrum display. It also helps to use the 2 second scrolling increments on slower machines. Using the “Go To” key to move directly to a time of interest also speeds things up.

Keep in mind that you can move quickly between the raw and spectrum screens to look at a different view of the same data segment. This helps to understand the makeup of spectral patterns and isolate artifacts.

Tutorial Using Sample Data

The sample data file is helpful in trying out the system. To view the sample file:

1. Start the system by typing BIO2.
2. Click on the *Client* button.
3. Click on the *Select* button.
4. From the Client List select Sample.

F1000 Tutorial: EEG

5. From the startup menu select *Spectrum*.
6. Select the file 10261428-93.
7. You are looking at a 2 second segment of the raw eeg signal centered at 30 seconds. The blue lines indicate the height of a 20 microvolt p/p signal.
8. Click on the up arrow above the 20uV indicator. You are now on the 40uV scale.
9. Press the right arrow on the numeric keypad. Each press moves over 1/8 seconds. Hold down the key for continuous scrolling.
10. Hold down the <Shift> key and press the **right arrow** on the numeric keypad. Each press moves over 2 seconds.
11. Press the “**G**” key on the keyboard. Enter 1:05 in the Time Box. Press enter and you move directly to 1:05.
12. Click on the *Filt* button or press the **F12** key. A filtered copy of the signal appears at the bottom of the screen.
13. Click on each of the filter keys **F1-F10**) to observe the signal in the indicated filter band. Use the range change arrow to increase or decrease the uV scale.
14. Click the *Filt* button to turn off the filtered trace.
15. Click on the *S* button or press the “**S**” key. You are now looking at a spectral display of the same time period.
16. Click on the *Wide* button or press the “**W**” key to see the extended spectrum. Use the uV arrows to change the scale.
17. Click on the *10 Sec* button or press **F2**. The display shows a 10 second average starting at the time shown at the top of the screen. The 30 sec, 1 min, and *admin* button perform successively longer averages. Depending on computer speed the longer periods may take quite a bite of time to complete. The uV indicator changes to calc during the process. Press esc to abort the calculation.
18. Be sure the *10 Sec* average is selected. Click on the *OVM* button or press “**O**”. The average is performed using overlapping FFT windows. Click on the *OVM* button or press “**O**” to return to normal averaging.
19. Click on the *M* button or press “**M**”. A color contour map will be generated showing approximately 1:30 seconds of data starting at the currently selected time. Press the <space bar> to generate the next segment.
20. Press <esc> to return to the Spectrum Screen. Click on the *Color* button or press “**C**” to display a color bar showing the color in relation to amplitude.
21. Press “**G**”. Enter 3:30. Again select the *M* button and observe the spectrum map of the sample. Notice the interesting pattern between 3:45 and 4:50.
22. You can now explore the raw signal, filtered raw, and spectrum related to the map. Simply note a time of interest on the map, return to the Spectrum Screen and use the “**G**” (Go To) key to locate the time.

***F1000* Tutorial: EEG**

23. Press <Shift> “P” to print the Raw Screen or Spectrum Screen. If the printer is set for portrait orientation, two screens can be printed on the same sheet. Some printers will require the paper be ejected after the last graph. Either press the Form Feed button on the printer or press <ctrl> “P”.
24. From any of the screens click on the F button or press the “F” key to return to the file menu.
25. From the file menu, press <esc> to return to the System Control Screen.

About the Sample File

The sample file, 10261428-93 was taken during enhancement mode feedback with a person having extensive meditation training and experience. Print the event log for this file to see the filter setting in use during the session.

F1000 Data Presentation

DATA PRESENTATION SYSTEM

To start the Data Presentation Subsystem, select '5' at the System Control Screen

Introduction

The process is self explanatory. Most of these selections can be made with a mouse if available. Pressing the <esc> key from anywhere in the program will return to the previous menu. Context sensitive help is available at the bottom of the screen. The autoscaling feature assures that a useable graph will be available when a file is first viewed.

Select a File

Select File from the opening menu. A list of files will appear. The files are sorted by name. Press the **END** key to access the last file. This will be the most recent and is an easy way to view a file at the end of a session.

01061045.d91	01071254.d91
01221405.d91	

Configure a Graph Layout

The following is a brief description of each selection on the layout screen:

- | | |
|------------------------|--|
| Plot Therm1 | Selects whether temperature channel 1 should be graphed. This selection is set to Y (yes) unless changed. |
| Plot Therm2 | Selects whether temperature channel 2 should be graphed. This selection is set to N (no) unless changed. |
| Min
(Therm) | Shows the lower scale of the temperature graph. The reading can be changed only if Auto is set to N . |
| Max
(Therm) | Shows the upper scale of the temperature graph. The reading can be changed only if Auto is set to N . |
| Auto
(Therm) | If set to Y , the scaling of the temperature graph will be automatically set to include the minimum and maximum temperature of both channels. If set to N , the user can set the scale manually. |
| Plot EDR | Selects whether EDR should be graphed. This selection is set to Y (yes) unless changed. |
| Min
(EDR) | Shows the lower scale of the EDR graph. The reading can be changed only if Auto is set to N . |
| Max
(EDR) | Shows the upper scale of the EDR graph. The reading can be changed only if Auto is set to N . |
| Auto
(EDR) | If set to Y , the scaling of the EDR graph will be automatically set. If set to N , the user can set the scale manually. |

F1000 Data Presentation

Plot HR	Selects whether heart rate should be graphed. The selection will be set to N unless heart rate was included in data.
Min (heart rate)	Shows lower scale of heart rate graph. The reading can be changed only if Auto is set to N .
Max (heart rate)	Shows upper scale of heart rate graph. The reading can be changed only if Auto is set to N .
Auto (heart rate)	If set to Y , the scaling of the heart rate graph will be automatically set. If set to N , the user can set the scale manually.
Smooth (heart rate)	Sets the amount of smoothing of the heart rate graph. Values range from 0: no smoothing to 6: maximum smoothing.
Plot Resp1	Selects whether respiration channel 1 should be graphed. The selection will be set to N unless respiration was included in data.
Plot Resp2	Selects whether respiration channel 2 should be graphed. The selection will be set to N unless respiration was included in data.
Scale (resp)	Sets the scale to plot respiration. The scale is in arbitrary units and is only used when Auto is set to Y . (See Auto below)
Auto (resp)	Auto has a different function for respiration. When Auto is set to Y , the minimum respiration value for each channel is positioned at the bottom of the graph. Inhalation then causes the curve to rise. The same scale value is applied to each channel so that comparisons can be made. When Auto is set to N , the data is graphed on an absolute scale of 0-100. The graph is useful in viewing the tension level of each respiration band.
Plot Filter A	Selects whether the output of Filter A should be graphed. The initial setting is determined by whether Filter A data was saved in the file. If no data is present, it will be set to N and cannot be changed.
Plot Filter B	Selects whether the output of Filter B should be graphed. The initial setting is determined by whether Filter B data was saved in the file. If no data is present, it will be set to N and cannot be changed.
Smoothing (Under Plot EMG2)	Adds smoothing to the EMG/EEG data.

F1000 Data Presentation

EMG Range (+/-)	Sets the scale of the EMGEEG graph. The initial setting is 100 Log. This is a logarithmic scale covering a range of 1 to 100 micro volts. To change the range, press the + or - key on the numeric keypad. The setting will cycle through its possible ranges.
Filter A Thresh Filter B Thresh	Provides a threshold for the percent time calculation shown on the data graph and statistics printout. The threshold is independent of the thresholds actually used during the session. Refer to the Event File printout to determine session thresholds.
Show Stats	Determines whether statistical information is shown at the top of each graph. Displaying statistics slows scrolling of the graphic screen especially on slower computers.
Time Start	Shows the starting time of the data graph in minutes. The initial setting is 0.0 minutes. When the starting time is changed, ending time is affected.
Time Period	Shows the time period of the data graph. The reading will always be the difference between Time Start and Time End. When the time period is changed, ending time is affected.
Time End	Shows the ending time of the data graph. The reading will always be the starting time plus time period. When the ending time is changed, time period is affected.

Viewing the Graph

Press the **F6** key to show the graph. To return to the setup screen press the **esc** key. If the Time Period has been set to view a detailed portion of the graph, pressing the **Left Arrow** or **Right Arrow** key on the numeric keypad will move the starting time of the graph by one half screen. Hold down the **shift** key while pressing the **Left Arrow** or **Right Arrow** will move the starting time by one full screen.

The statistical information shown at the top of each graph is as follows: M: mean; SD: standard deviation; V: coef of variability (100 X SD/mean)
%: percent time; @: above threshold.

Graph Layouts

The **F1000 Data Presentation System** allows saving six different layouts which specify how data will be graphed. Layouts can be saved either as a **Master Layout** or a **File Layout**. A Master Layout determines the default settings that will be used on each new file. A File Layout is specific to the file it is saved with. When a file is selected for viewing, the system first looks for a File Layout and uses it if it exists. If not then the system uses the Master Layout.

***F1000* Data Presentation**

The current layout number together with the words “Master Layout” or “File Layout” is shown on the upper left of the layout screen. To move between layout screens, press **<alt>** key plus the layout number desired. For example to view layout number 3 press **<alt>3**. Using a separate layout number for each graph makes it easy to move between views.

Press **F7** to save all six layouts to the disk. You will be asked to specify whether the layout is to be a Master or File type. There is also an option to delete the layout. This only works with File Layouts.

NOTE: The layouts can be changed while viewing a graph without the need to return to the layout screen. Simply use the same **<alt> layout number** key press.

Using a Mouse

If a Microsoft compatible mouse or trackball is installed on your computer, the **F1000** Presentation System will automatically allow its use.

Use the left button to select menu items. Yes/No answers can be made by repeatedly clicking on the selection. Clicking the right button is the same as pressing **<esc>** except when viewing a graph.

Printing Data

The printer type must be set from the System Control Screen. The graph will be printed in portrait or landscape orientation depending on printer ~~set~~tion.

The graph must be showing on the screen to print. Press **<shft> P** to print a graph. Depending on the computer system and printer type, graphics printing can take several minutes.

Printing Summary Statistics

Press the **F8** key from the setup screen to print summary statistics of the currently selected data. The first printout will include column headers. Additional printing will simply add the selected data to the summary.

As an example, assume that Temperature 1 is selected. Time Start is 0. Time End 30.0 minutes. Press **F8** to print statistics for 0 to 30 minutes. Column headers are printed. Now set Time End to 10.0 minutes. Pressing **F8** to add statistics for 0 to 10 minutes. Column headers are not printed. Repeat with Time Start set to 10.0 minutes adding statistics for 10 to 20 minutes.

Printing the Event Tracking File

Press the **F9** key from the setup screen to print the contents of the event tracking file. The entries in the file for 0:00 are the system conditions at startup or when **<alt> N** was ~~has~~ used.

NOTE: The times shown in the event log are in minutes:seconds, matching the format of the session clock on the feedback screens. The time shown on the data graphs is in minutes in a decimal format. For instance 1:30 in the event file corresponds to 1.5 minutes on the data graph. A future upgrade will make the formats consistent.

F1000 Reference:Client File Management

Client File Management

Introduction

The *F1000* Client File Management System provides a way to store, archive, and delete client data files.

The Client Management Screen

From the System Control Screen select the *Client* button. The options will appear. To return to the System Control Screen press <esc.>.

MISC DATA			
1 New	2 Select	3 Files	4 eXit

Creating a Client Directory

From the Client Management Screen select the *New* button. The client entry box shown at the right will appear. Enter the name or client code you would like to use. The entry is limited to 8 characters which can be letters, numbers, or the dash character. Press the <enter> key to accept or <esc> to cancel your entry. If you accept the new entry, it will become the active client for all other activities. The active client code appears on several of the button menus.

<input type="text"/>
Letters, Numbers and- only Enter to accept, Esc to cancel

Selecting a Client Directory

From the Client Management Screen select the *Client* button. The Client Select Screen will appear. Select a client using either the mouse or keyboard. Use the keyboard arrow keys to move to the desired selection and Press <enter> to select. The active client code will appear on several of the button menus.

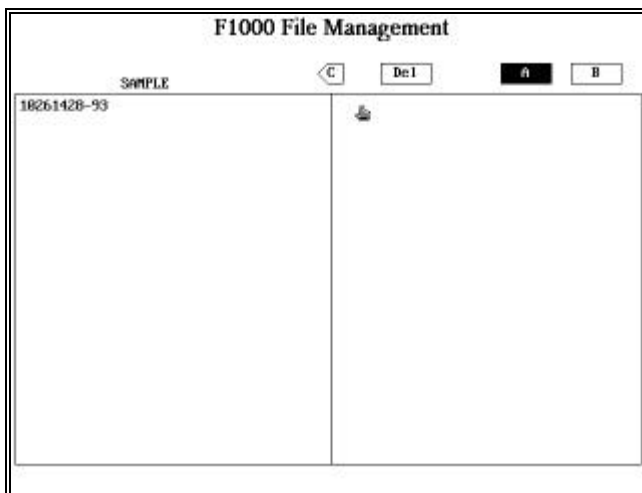
Choose Client Code	
MISCDATA	SAMPLE
<input type="checkbox"/>	<input type="checkbox"/>
Press Enter or double click mouse to select Press Esc to exit to menu	

If there are more entries than will fit on the screen, scroll arrows will appear in the small boxes at the left and right of the list. Click the mouse on an arrow to scroll to off screen selections.

F1000 Reference:Client File Management

Managing Client Files

From the Client Management Screen select the *Files* button. The *F1000* File Management Screen will appear. The left window contains data files for the active client. If the file contains raw EEG data, the letter “R” will be appended to the file name after the year. The right window contains files on the selected floppy drive. If a floppy drive has not been selected, the window will be empty and the copy arrow at top center of the screen will be red.



To select a floppy drive, insert a formatted floppy disk in either the A: or B: drive. Select the appropriate button for the desired drive.

Files can be selected in either window using the keyboard or mouse. Use the >Tab> key to move between windows. If a file in the right window is selected, the copy arrow now points left and the *Delete File* button moves to the right window. The disk space required by the selected file is shown at the bottom of its window. Space available on the destination drive is shown at the bottom of the other window. If sufficient space is not available to copy the file, the copy arrow changes to red.

Copying a File to a Floppy Disk

1. Select a file to copy.
2. Insert a formatted floppy in the desired drive. Select the drive.
3. If the copy arrow is white there is space for the file on the floppy disk. Select the copy arrow by pressing C on the keyboard or clicking on it with the mouse.
4. The message “Copying Files” will show until copy is complete. Depending on the size of the file, the process may take a bit.
5. When copy is complete, the file name will now be included in the destination list.

F1000 Reference:Client File Management

Deleting a File

Warning: A deleted file is gone forever. Be sure you have a copy of the valuable data before deleting it from the system.

1. Select a file to delete. Only the file in the selected window will be deleted.
2. Select the *Delete File* button by pressing the key or by clicking on it with the mouse.
3. A confirmation box will provide the following selections:
 - F to delete file
 - R to delete raw file only
 - N or esc for no action

Removing a Client from the System

<p>This operation deletes all files associated with the selected client code and then removes the client directory from the system. Be sure you have saved your data to floppy before selecting this operation.</p>
--

1. Select the *Del Client* button by holding down the <ctrl> key and pressing the key or by clicking on it with the mouse. This button only appears when a file in the left window is selected.
2. A confirmation box will ask “Delete Client and Files?” Press Y to continue. A second confirmation requires that you type the word YES in capital letters in order to complete the operation. Any other response aborts the process.
3. Upon completion, the MISCDATA client code is selected.

Note: The MISCDATA client code cannot be removed from the system.

Notes on Maintaining Client Files

1. Establish a separate client directory for each client. Allowing a large number of files to accumulate in the MISCDATA directory at the least makes it difficult to find files, and at worst can exceed the systems maximum file capacity.
2. When a client is no longer being seen, copy the files to floppy disk, and delete the client from the system.
3. Raw data requires large amounts of storage space. If the raw data is not needed, it can be removed from the file.

F1000 Reference: Saving Data

SAVING DATA

Introduction

With the exception of raw EEG, the *F1000* stores data in computer memory any time the system is active. Raw EEG logging must be specifically activated as described later. Data is stored regardless of which modalities appear on the screen. An event tracking file is also generated which stores the time and effect of all significant key presses. Approximately 60 minutes of data can be stored. The time clock which appears in the display area at the bottom of the screen shows time into the current session. The time shown here will correspond to the time shown on the graphs and in the event file

Starting a Session

Before starting a feedback system, select a client name from the Client Management System. Start the desired feedback system.

When ready to start data logging, press the **<alt>N** key to start a new session. The Session Time indicator in the display area resets to 0:00 and starts counting. The File Name indicator changes to show the name of the file which will be used to save the data. The file name is an 8 digit number which shows the date and time of the start of the session. The first two digits are the month, the next two the day, the next two the hour in 24 hours time, and the last two the minute.

Systems settings are logged to the event file and the Inhibit/Enhance Criteria Counter is set to zero. Up to 60 minutes of data can be saved in memory.

When space is full, the message T/E END (temperature/EDR end) and EMG END will appear in the display area. At this point the data logging will stop although the Session Time indicator will continue to count. The actual time for EMG will depend on the sample rate.

Raw Logging

Raw data can be logged from channel 1 of the EEG/EMG system. Currently raw logging is only available for EEG type data in the range of 245 Hz. The raw logging indicator will appear under the EEG/EMG indicator in the System Display Area if raw logging is available in the current Setup File. Press the **<Insert>** key to toggle raw logging ON or OFF. Raw logging can be turned ON and OFF a number of times during a session. All data will be saved in one file with the start/stop times logged in the Event File. If available, computer memory is exceeded, raw logging will automatically turn OFF, the indicator will show RL OFF, and cannot be turned ON.

Save the Data

At the end of the session press **<alt>S** to save the data to disk. The data currently in computer memory including raw data will be saved to disk. If T/E END or EMG END is not showing, data will continue to be added to the computer memory. If **<alt>S** is pressed again, the entire session will be saved under the existing file name.

***F1000* Reference: Saving Data**

A second option is to press<ctrl>**S**. Data will be saved as above, but the Session Time indicator will be reset to 0:00 and a new file name assigned. This allows another 60 minutes of storage. The effect is the same as pressing<alt>**S** followed by <alt>**N**.

Managing EMG/EEG Amplitude Data

EMG/EEG save status is shown in the display at the bottom of the feedback screen. The EMG label may be replaced by the EEG label. The label is only for convenience and does not affect the operation of the system in any wayPossible indications are:

Indicator Shows	Meaning
EMG NO	Only temperature and EDR are saved
EMG 1	EMG channel 1 is added to the saved data
EMG 2	EMG channel 2 is added to the saved data
EMG 1-2	EMG channels 1 and 2 are added to the saved data

The indicator will initially show EMG NO. If an EMG channel is selected for feedback, it will be added to the indicator. Pressing<alt>**E** sequences the indicator in the display area through the options. These settings determine which EMG channels will be saved and can be set any time before pressing<alt>**S**.

EMG data requires the largest amount of disk space for a given length of time. Disk space can be conserved by only saving data from the EMG channels in use.

Managing Raw Data

Typical raw data (sampled at 128 samples/second) require approximately 925K of disk storage for 1 hour of logging. Space can be conserved if raw logging is turned on only during significant portions of a session. Raw data segments are stored in the same data file and can easily be located.

Quit Warning

The *F1000* provides a warning if<alt>**Q** is pressed while significant unsaved data is stored in the computer. If more than 30 seconds have elapsed since data has been saved to disk, a warning message will be displayed showing the amount of unsaved data remaining and an opportunity to save it.

The Quit Warning is intended to act as a backup. We strongly suggest that <alt> S be used to save data before quitting to insure that data is not lost.

F1000 Reference: Setup Files

SETUP FILES

Introduction

Setup Files determine the characteristics of each *F1000* feedback screen. Some of the more important items are:

- ?? Color and position of graphics
- ?? Type of sound
- ?? The way signals are processed to derive feedback.
- ?? Filter frequencies available.
- ?? Smoothing available.
- ?? Default settings.

At present there is no way for the user to generate Setup Files. Future upgrades will provide this option.

Using Setup files

There are two ways to use setup files. The *Autonomic*, *enh EEG*, and *Inh/Enh* options on the opening screen are each associated with a setup file as follows:

Autonomic STD1

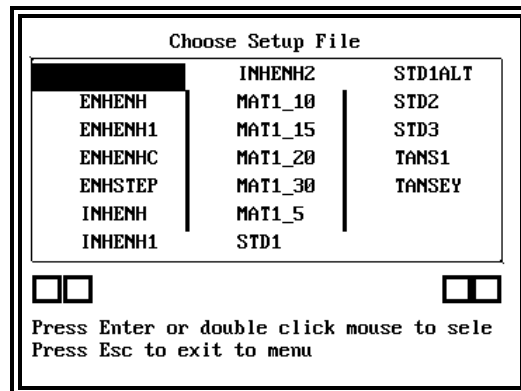
Enh eeg ENHENH

Inh/enh eeg INHENH

The second way is to select *Setups* from the System Control Screen. Select a setup file from the list to start the feedback system under its control.

Setup Files

We have included a number of setup files that we have found useful. They provide feedback designed to enhance the users awareness and self control. We make no claims as to their usefulness for any particular purpose. The following are descriptions of each.



STD1, STD1ALT, STD2, STD3, EMGBAL (Autonomic Mode)

STD1, STD2, and STD3 are simply versions of the standard Autonomic System with the temperature digital display set to higher resolution. STD2 provides 0.01 degree F. resolution, while STD3 provides 0.001 degree F. resolution. The latter illustrates the stability and sensitivity of the *F1000* temperature system. STD1ALT offers an alternate sound for the EMG channels. Sounds increase in level over threshold and can be used on both channels simultaneously.

F1000 Reference: Setup Files

EMGBAL is an EMG only display with the two bar graphs moved close together. It is useful where the two levels need to be compared.

All of the above setups provide the following filters:.

EMG Filters

Key (Use ShftCtrl)	Channel 1: Filter A			Channel 2: Filter B		
	Filter Band Pass(Hz)		Channel	Filter Band Pass(Hz)		Channel
F1	25.0	100.0	1	25.0	100.0	2
F2	25.0	500.0	1	25.0	500.0	2
F3	50.0	500.0	1	50.0	500.0	2
F4	100.0	500.0	1	100.0	500.0	2
F5	200.0	600.0	1	200.0	600.0	2
F6	400.0	600.0	1	400.0	600.0	2
F7	100.0	200.0	1	100.0	200.0	2
F11	50.0	70.0	1	70.0	90.0	1
F12	50.0	70.0	2	70.0	90.0	2

Both EMG channels are affected by the filter setting. The 100.0 Hz filter setting is a good compromise for general use and is selected at startup.

60 Hz Power Line Artifact Detection

The *F1000* provides for detection of 60 Hz power line interference. Using the **<ShftAlt> F11** filter selection shown above directs EMG channel 1 to 50.0-70.0 Hz and 70.0-90.0 Hz filters. The 50.0-70.0 Hz filter is sensitive to both EMG and power line information. The 70.0-90.0 filter is sensitive only to EMG signals.

To use the feature, press the **<ShftAlt> F11** key. Observe the Filter A and Filter B bar graph displays. If Filter A shows appreciably more signal there may be an interference problem. Readings will vary with individual subjects.

<ShftAlt> F12 provides the same option for EMG channel 2.

DISOC1 (EnhEnh Mode)

This is a single use setup file. Only Filter A is programmed and by default is set to 6.0-10.0 Hz. The system operates in enhance mode and uses channel 1. In this case, the sound has an unpleasant, “Wakeup” nature.

We have found it useful with persons who tend to “space out” during counseling.

F1000 Reference: Setup Files

ENHSTEP (EnhEnh Mode)

This setup file provides feedback for specific frequencies by overlapping Filter A and Filter B. The feedback system operates in enhance mode and uses channel 1. When the EEG energy is balanced between the two filters, both tones are on giving a pleasing harmonic effect. Balance most likely occurs when the dominant frequency is in the crossover area. The approach seems to work best when the thresholds are equal.

Suggested approach to training is to start at a crossover where the subject can achieve success 30-50% of the time. Then gradually move the crossover down in frequency. The pitch of the tones will change as the crossover is lowered.

ENHSTEP			
Filter Key (Use ShftCtrl)	Filter A	Filter B	Crossover
F1	4.1 - 6.1	5.9 - 7.9	6.0
F2	4.4 - 6.6	6.4 - 8.6	6.5
F3	4.8 - 7.1	6.9 - 9.2	7.0
F4	5.1 - 7.6	7.3 - 9.9	7.5
F5	5.4 - 8.1	7.9 - 10.6	8.0
F6	5.8 - 8.6	8.3 - 11.2	8.5
F7	6.1 - 9.1	8.9 - 11.9	9.0
F8	6.5 - 9.6	9.3 - 12.6	9.5
F9	6.8 - 10.1	9.9 - 13.3	10.0
F10	7.1 - 10.6	10.3 - 13.9	10.5
F11	7.5 - 11.1	10.9 - 14.6	11.0
F12	100 - 500		EMG

F1000 Reference: Setup Files

ENHENH, ENHENHC (Enhance Mode)

These setups provide audio feedback above threshold on both Filter A and Filter B. ENHENH can be selected from the System Control Screen. ENHENHC uses a blue bar graph for Filter A and a red bar graph for Filter B.

ENHENH, ENHENHC Filters

Key (Use ShftCtrl)	Enhance Filter A			Enhance Filter B		
	Filter Band Pass(Hz)		Channel	Filter Band Pass(Hz)		Channel
F1	4.0	8.0	1	8.0	12.0	1
F2	6.0	8.0	1	8.0	12.0	1
F3	4.0	8.0	1	13.0	15.0	1
F4	6.0	8.0	1	13.0	15.0	1
F5	8.0	12.0	1	13.0	15.0	1
F6	13.0	15.0	1	15.0	21.0	1
F7	6.0	10.0	1	6.0	10.0	2
F8	25.0	500.0	1	25.0	500.0	2
F9	50.0	500.0	1	50.0	500.0	2
F10	100.0	500.0	1	100.0	500.0	2

ENHENH1 (Enhance Mode)

This setup is provided for compatibility with earlier systems.

F1000 Reference: Setup Files

INHENH, INHENH2 (Inhibit/Enhance Mode)

This setup provides audio and visual feedback when Filter A is below threshold and Filter B is above threshold. INHENH can be selected from the System Control Screen.

INHENH2 is included for compatibility with earlier systems.

INHENH Filters

Key (Use ShftCtrl)	Inhibit Filter A			Enhance Filter B		
	Filter Band Pass(Hz)		Channel	Filter Band Pass(Hz)		Channel
F1	2.0	8.0	1	13.0	15.0	1
F2	4.0	7.0	1	13.0	15.0	1
F3	4.0	8.0	1	13.0	15.0	1
F4	2.0	8.0	1	15.0	18.0	1
F5	4.0	7.0	1	15.0	18.0	1
F6	4.0	8.0	1	15.0	18.0	1
F7	2.0	8.0	1	15.0	21.0	1
F8	4.0	7.0	1	15.0	21.0	1
F9	4.0	8.0	1	15.0	21.0	1
F10	100.0	500.0	1	13.0	15.0	1
F11	100.0	500.0	1	15.0	18.0	1
F12	100.0	500.0	1	15.0	21.0	1

INHENH2 Filters

Key (Use ShftCtrl)	Inhibit Filter A			Enhance Filter B		
	Filter Band Pass(Hz)		Channel	Filter Band Pass(Hz)		Channel
F1	2.0	8.0	1	13.0	15.0	1
F2	4.0	7.0	1	13.0	15.0	1
F3	4.0	8.0	1	13.0	15.0	1
F4	2.0	8.0	1	15.0	18.0	1
F5	4.0	7.0	1	15.0	18.0	1
F6	4.0	8.0	1	15.0	18.0	1
F7	2.0	8.0	1	15.0	21.0	1
F8	4.0	7.0	1	15.0	21.0	1
F9	4.0	8.0	1	15.0	21.0	1
F10	100.0	500.0	1	13.0	15.0	1
F11	100.0	500.0	1	15.0	21.0	1

F1000 Reference: Setup Files

SPEC4

The SPEC4 setup provides feedback of any one frequency band with the proportional sound above threshold used in the Tansey and Mind Awareness systems. The nature of the sound associated with each band is different. See the section on Tansey and TansPlus for further information on operation.

SPEC6

This setup provides SMR, beta, and focus (24 Hz) training using the same format as above.

SPEC7

This setup is not intended for subject training. It is provided to help gain insight into the relationship of the Tansey type frequencies to the conventional theta, alpha, SMR, and beta designations. The narrow Tansey type frequencies are shown as small bars imbedded in the larger frequency bands. The filter type is FFT to provide consistency across all the bars. The letters under the small bars are abbreviations for the following:

L	Let Be	5 Hz
V	Visual	7 Hz
D	Dissoc	9 Hz
T	Thought	10 Hz
A	Aware	12 Hz
H	Heavy	14 Hz
F	Feeling	16 Hz
S	Surface	20 Hz
foc	Focus	24 Hz
W	Warm	28 Hz

F1000 Reference: System Keys

System Keys

Key	Action
F12	Turns display area at bottom of screen OFF and ON.
<alt>Q	Quit! Exits the biofeedback system and prepares computer for other tasks.
NUM +/-	The plus and minus key on the numeric keypad control the system sound level. Holding down either key causes the volume level of all active sound feedbacks to increase or decrease. Three small dots at the lower left edge of the computer screen indicate the volume level. The center dot is current volume and move up and down with the setting.

Keys associated with data logging.

"1","2","3","4", spacebar	Pressing any of these keys logs an event to the event file. The keys can be used repeatedly and in any order to mark events.
Alt E	Selects which EMG channels to include in data save. Only affects data when saved to file so final selection can be made at end of session. Avoid saving unused EMG channels to save disk space.
Alt N	Reset data logging timer to start new session. Timer on screen will reset to 0:00 and continue counting. If more than 1 minute is on timer, the existing data is backed up to a temporary file. (This is only intended as a safety feature: see Alt R))
Alt R	Restores temporary file to normal file name. Use if data logging timer is inadvertently reset without saving data.
Alt S	Save data in memory to file name showing on screen. File name will change to "Saved" to confirm.
Ctrl S	Save data in memory to file name showing on screen. Resets counter and starts new session. New file name appears on screen.
<Ins>	Toggles raw data logging of/on.

F1000 Reference: System Keys

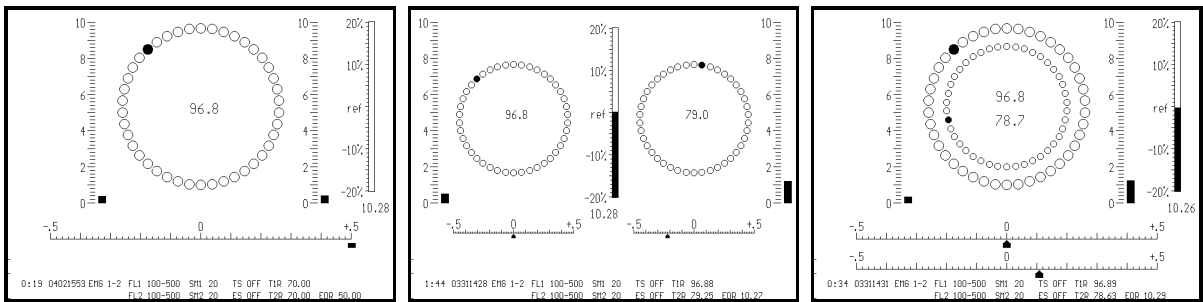
Temperature System

- NOTE:** 1. To display both temperature channels, you must be using alternate screens 2 or 3. Press <alt> 2 or <alt> 3.
2. To control temperature channel 2, hold down the <ctrl> key while pressing any or the keys below.

Key	Action
F1, F11	References the arrow of the temperature ruler to the current probe temperature. F11 initiates automatic reference.
F2	Changes the scale of the temperature ruler to a lower (more sensitive) range. The lowest range is +/-0.5 degrees F. The key has no effect if the range is already at its lowest range. The initial setting is +/-0.5 deg.
F3	Changes the scale of the temperature ruler to a higher (less sensitive) range. The highest range is +10 degrees F. The key has no effect if the range is already at its highest range.
F4	Toggles the temperature ruler display OFF and ON. Neither the range nor the reference are affected by this key. The initial setting is ON.
F5	Toggles the temperature circle display OFF and ON. The initial setting is ON.
F6	Toggles the temperature digital display OFF and ON. The initial setting is ON.
F7	Toggles the direction of the bell part of the temperature sound. The initial setting is for decreasing pitch with rising temperature.
F8	Toggles the temperature sound OFF and ON. Control is independent of any other modality sound feedback. Temperature sound is available even when the temperature circle is not on the screen. However, the master temperature system must be on (F9). Sound can only be active for one temperature channel. The initial setting is OFF.
F9	Toggles the entire temperature system OFF and ON. The system can be toggled ON and OFF without losing any of the existing settings. If screen mode 1 is selected, only one temperature system can be active at a time. In screen modes 2 and 3 both temperature systems can be used together. The initial setting is OFF for both channels.

F1000 Reference: System Keys

- <alt>1 Selects screen display 1. Either temperature 1 or temperature 2 can be selected for display.
- <alt>2 Selects screen display 2. Temperature channels 1 & 2 are displayed in scaled down size. EMG 1 & 2 are displayed full size at the far left and right respectively. EDR is centered between the temperatures.
- <alt>3 Selects screen display 3. Temperatures 1 and 2 are displayed as concentric circles with the delta scales and digital displays appearing one above the other. Temperature 1 is the larger circle. Displays are color keyed for identification.



EDR System

Key	Action
alt F1, alt F11	Sets the reference level of the EDR bar graph to the current EDR reading. Alt F11 initiates automatic reference
alt F2	Changes the scale of the EDR bar graph display to a lower (more sensitive) range. The lowest range is $\pm 4\%$ or ± 0.4 micromho. The key has no effect if the range is already at its lowest range. The initial setting is $\pm 20\%$.
alt F3	Changes the scale of the EDR bar graph display to a higher (less sensitive) range. The highest range is $\pm 100\%$ or ± 4.0 micromho. The key has no effect if the range is already at its highest range.
alt F4	Toggles the EDR bar graph percent (%) display OFF and ON. Neither the range nor the reference are affected by this key. If the micromho bar graph is active it is replaced by the % display. The initial setting is ON.
alt F5	Toggles the EDR bar graph micromho display OFF and ON. Neither the range nor the reference are affected by this key. If the % bar graph is active it is replaced by the micromho display. The initial setting is OFF.

F1000 Reference: System Keys

alt F6	Toggles the EDR digital display OFF and ON. The digital display shows the current conductance in micromhos. The initial setting is ON.
alt F7	Reserved for future use
alt F8	Toggles the EDR sound OFF and ON. Control is independent of any other modality's sound feedback. EDR sound is not active if the EDR bar graph is OFF. The initial setting is OFF.
alt F9	Toggles the entire EDR system OFF and ON. The system can be toggled ON and OFF without losing any of the existing settings.

EMG System

Key	Action
Del (Numeric Keypad)	Toggles EMG channel 1 system OFF and ON. The system can be toggled ON and OFF without losing any of the existing settings. The initial setting is OFF.
alt Del (Numeric Keypad)	Toggles EMG channel 2 system OFF and ON. The system can be toggled ON and OFF without losing any of the existing settings. The initial setting is OFF.

NOTE: The following keys in conjunction with the alt key control both EMG channels. Each key alone controls EMG channel 1. With the alt key they control EMG channel 2.
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Right Arrow	Changes the scale of the EMG bar graph display to a higher (less sensitive) range. The highest range is 500 microvolts. The key has no effect if the range is already at its highest range. The initial setting is 10.0 microvolts.
Left Arrow	Changes the scale of the EMG bar graph display to a lower (more sensitive) range. The lowest range is 5.0 microvolts. The key has no effect if the range is already at its lowest range.
Shift Arrow	The shift key in conjunction with either the right or left arrow key changes ranges on both EMG channels simultaneously. The channels do not need to be on the same range.
NUM 5	The center key (5) on the numeric keypad toggles EMG sound feedback OFF and ON. EMG sound can only be ON for one channel at a time. A small tic mark on the EMG scale indicates which channel if any is supplying sound feedback.
Up Arrow	Moves the sound threshold tic up the EMG bar graph scale. The threshold continues to move as long as the key is held down.

F1000 Reference: System Keys

PgUp	Moves the sound threshold tic up the EMG bar graph scale rapidly. The threshold continues to move as long as the key is held down.
Down Arrow	Moves the sound threshold tic down the EMG bar graph scale. The threshold continues to move as long as the key is held down.
PgDn	Moves the sound threshold tic down the EMG bar graph scale rapidly. The threshold continues to move as long as the key is held down.

EEG Enhance System

The EEG Enhance System operates in essentially the same way as the EMG System. The T1R temperature reference display is labeled T1= and continuously displays temperature 1.

NUM 5	EEG sound can be ON for both channels simultaneously. The sound volume changes above threshold.
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Inhibit/Enhance System

The Inhibit/Enhance System provides combined feedback. Filter A controls inhibit. Filter B controls enhance. The feedback ellipse changes to green when Filter A level is below threshold and Filter B is above threshold. The T1R temperature reference display is labeled T1= and continuously displays temperature 1

END	Toggles feedback ellipse OFF/ON
<alt> END	Toggles reward counter OFF/ON
HOME	Resets reward counter to zero. Logs reading to event file.
DEL	Toggles both bar graph displays OFF/ON. The bar graph display is necessary for feedback.
"5" key	Toggles sound feedback OFF/ON
<alt> 1 (default)	Sets green ellipse display
<alt> 2	Sets display where Filter A contributes red and Filter B contributes green to the ellipse.

F1000 Reference: Status Display

Status Display

10:23	01081302	EMG 1-2	FL1 100-500	SM1 20	TS OFF	T1R 91.24		
T/E END	EMG END	RL OFF	FL2 100-500	SM2 20	ES OFF	T2R 70.0	EDR 7.03	

The meaning of each is as follows.

10:23	Time since start of data logging
01081302	Name of current logging file. The name contains the date/time of start of logging in the formMMddhhmm.
EMG 1-2	Shows EMG channels that will be included in a data save. Possible indications are: EMG 1-2; EMG 1; EMG 2; EMG NO.
RL OFF	Shows state of Raw Logging. This display will only appear when raw logging is available.
FL1 100-500	EMG filter setting for channel 1
FL2 100-500	EMG filter setting for channel 2
SM1 20	EMG smoothing factor for channel 1
SM2 20	EMG smoothing factor for channel 2
TS OFF	Temperature sound. Other possible indications are TS 1 (Channel 1 sound ON with increasing temperature resulting in decreasing pitch); TS 1+ (same but pitch increases with temperature).
ES OFF	EDR sound. Only indications are OFF or ON.
T1R, T2R T1=, T2=	Current reference temperature for delta sound. If label is "T1=" then shows current temperature.
EDR	Current reference for EDR.
T/E END	End of temperature/EDR logging. Shows only after about 60 minutes.
EMG END	End of EMG logging. Time depends on EMG sample rate.