

# Proteus Tutorials

## I. Creating a Proteus Session: The Basics

In this tutorial we'll create, edit, save and download a session into Proteus. If you haven't already installed at least Version 1.7 of the Proteus Editor and Operating System, please do so before starting, as we will be discussing some features only found in that release.

The process of creating and editing a new session includes the following basic steps:

- 1) Create and name a New File
- 2) Insert segment(s) into that file
- 3) Edit each segment
- 4) Test segments in realtime using PC mode (optional)
- 5) Save the finished session
- 6) Transfer it to Proteus, alone or as part of an Album.

**1. Create and name a new file.** Follow these steps:

- a. Open Proteus Session Editor, and click on the New File button. A single segment will appear at the bottom of the screen.
- b. Save your session by clicking the Save File button, typing in a filename, and selecting (if necessary) the directory folder that the session will be stored in.

**2. Insert segment(s) into the session.** Click the Insert Segment button. All Proteus sessions require at least two segments in order to allow both "soft on" and "soft off" to be used. The settings you see are arbitrary. However, each time you insert a new segment, it will contain the same values as the segment which precedes the insertion point. Your new segment will be inserted below the heavy black horizontal line; this always appears below the currently selected segment. You select a segment by clicking your mouse on it; it changes color when you do this as an additional cue.

**3. Edit each segment.** This is where things get more complicated, because there are so many options available to you. The following is a brief guide to what they are and how to use them. But first, a brief review of what a segment is.

A *segment* is the basic organizational unit of the session. It can be run for one second or many minutes, and is bounded by the light/sound pulse rates and brightness levels at the beginning and at the end of the segment. For example, suppose you have constructed a twenty second segment with the following parameters:

Red light *pulse rate* starts at 7.83 hz and ends at 40.0 hz;

Red light *brightness* starts at 2 (low brightness) and ends at 15 (maximum brightness);

Green light *pulse rate* starts at 40.0 hz and ends at 7.83 hz;

Green light *brightness* starts at 7 (middle brightness) and ends at 7.

*[Note: the red channel is called "LFO 1" and the green one "LFO 2"; this is because you can use other color combinations with Proteus, such as red + blue.]*

The Proteus software automatically calculates all of the values in between the starting and ending values as a linear ramp.

***Segment Parameters.*** Each segment can have a variety of other parameters assigned to it:

Sound Pitch. Use this to tune the audio waveform. Frequency range is from 40.0 to 600.0 hz, and it can smoothly ramp from one pitch to another during the segment.

Time. Use this to control how long the segment will run for.

Light Frames and Sound Active checkboxes. These control whether the sound and light are active during the selected segment.

Soft On and Soft Off checkboxes. Determines whether the currently selected segment will run through a "soft on" or "soft off" phase; this can be set independently for both light(frames) and sound. You cannot include both soft on and soft off in a single segment.

Bin. Beat. Check this box if you want the selected segment to include binaural beats. This works best when the audio waveform is a sine wave; this is Sound Table 1 if you are using the tables which were preloaded into Proteus at the factory.

Dual LFOs. Check this box if you want to assign different pulse rates to the two color channels. If you leave this unchecked, Proteus will automatically assign Channel 1 frequency information to channel 2. However, you will still be able to control Channel 1 and 2 brightness information independently. Leave this box

unchecked if you want the frequencies to be locked together—it will save you some time.

Sync. This checkbox is only available if you have *not* checked the Dual LFOs box. That is, it only works when the two channels are frequency-locked together. If you select this feature, then the lights will alternate between the two colors (red-green-red-green...) every pulse. Use this to create especially vivid visuals, or if you are using monochrome lightframes it will alternate left/right.

Do Spcl LF1, etc. These are “supplemental” commands, which allow even finer control of certain parameters than normally available; they can be only be used with fixed rather than varying frequencies, and will be described in detail in a later tutorial.

No BioFd Ctrl. If you have inserted a biofeedback segment into your session, but don't want it to affect a specific segment, then check this box.

Sound Table. Last—but by no means least—are the Sound Table selection boxes. The first table is a sine wave (pure tone with no harmonics), which is what you should use for binaural beats. The other tables include a sampler of other “tone colors”.

*[Note: A later tutorial will describe how to create and use your own sound tables (sometimes called “wavetables”).]*

**4. Test segments in real time.** One of the most powerful features of the Proteus Editor program is its real time preview capability. This basically gives you the fast feedback and control you would expect with a PC-resident system, together with the portability of the very compact Proteus. With the “View Realtime” command you can preview a single segment, or group of segments, or the entire program. You can also quickly toggle between the Start and Finish parameters. Here's the sequence of events:

1. Connect Proteus to your PC and select the serial port you're using if you haven't already done so (using the Serial Port popdown menu)
2. Turn Proteus on and press the Mode (middle) button until the display reads PC
3. Select a segment to preview by clicking on it once (or select several segments by clicking on the first and while holding the button down, dragging the mouse pointer over all of the segments you wish to select).
4. Click on the “View Realtime” button; this will cause several new buttons to appear on the upper right side of the Session Editor window (Run Segment, Run Segments, Run Session, and Cancel). Select an appropriate one. A bar appears at the top left, showing you which segment in the selected segment group (if this is what you've chosen to do) is being run. You can cancel the preview at any time.

**Tip:** Once you've run a segment you can click on the Start or Finish portion of any segment and Proteus will immediately "play" those parameters. (Actually, Proteus "crossfades" between sound tables at the boundary between segments to smooth the transition between them)

**5. Save the finished session.** Once you're through experimenting, simply select File/Save As and type in a filename. Now you're ready to transfer it into Proteus.

**6. Transfer it to Proteus.** The example I'm going to give here is how to transfer a single session into the User memory bank; we'll get into albums and how they work in a later tutorial. Here are the steps:

- a. Be sure Proteus is in DL mode.
- b. Open the Session Manager (by clicking the Session Mangr. Button)
- c. Click on Open New Album, then select the session you've just created
- d. Click Add To List; the session name should now appear in the right window (the large one underneath Album Name)
- e. Select Send To User Area. The session data will now transfer to the User Area as U01.

That's all there is to it! You're ready to run the session you've just downloaded.

**Note:** remember that whenever you download any number of programs into either the Program or User memory bank, it will erase any programs currently residing in that bank. We prefer to leave the default session bank in the Pxx (Program) bank, and to transfer the ones we're experimenting with into the Uxx (User) bank.

With the addition of the User memory area, the total number of programs you can store in Proteus increases to 199!

## II: Working with Modes.

**Note:** *The features described below refer to version 2.0 or later of the Proteus Operating System.*

**Proteus Modes.** If you have not yet explored the various modes available in Proteus, or have recently updated your operating system to version 2.0 or later, this brief tutorial will review the operating modes available to you.

**Modes** are the various ways in which Proteus can function. Much of the power of the three-button interface is due to this ability to quickly select the features associated with each mode.

Pressing the middle ('mode') button steps through the various functions described in the table below.

Mode	Name	Function
<b>Pxx</b>	<i>Program</i> memory bank	One of two separate program storage areas. Proteus ships with fifty sessions stored in this area, numbered P00 – P49.
<b>Uxx</b>	<i>User</i> memory bank	A second internal memory area, recommended for storage of sessions you've created yourself, downloaded from the Internet, etc.
<b>Usr</b>	User (manual) mode	Use this mode to select individual frequencies by hand.
<b>PC</b>	PC (personal computer) mode	Use this mode if you are creating your own programs on a PC and would like to preview them in real time. Also used when Proteus is being controlled by a biofeedback device, such as ThoughtStream.
<b>AS</b>	AudioStrobe mode	Use this to play AudioStrobe <sup>R</sup> encoded audio (CD's, etc.) through Proteus.
<b>DL</b>	Download mode	For downloading firmware (OS) upgrades and session(s).

Here's a description of how each of the modes operate:

## Pxx

1. Press the **Mode Select** (middle) button until the display reads "Pxx", where "xx" is a number between 01 and 99. (Program 00 is permanently set as the "random" program).
2. Select a session by pressing the **bottom** button. A single press causes the display to increment one step at a time, while pressing and holding it causes the display to increment automatically. Notice that the rate at which the session number is displayed speeds up when you hold the button down.
3. TIP: you can cause the display to *decrement* rather than increment if you press the **Start** (top) button together with the **bottom** button. Be sure you press and hold the **bottom** button first then press the top button.
4. Press the **Start** (top) button to start a session.

## Uxx

1. Press the **Mode Select** (middle) button until the display reads "Uxx", where "xx" is a number between 00 and 99.

**Note:** If there are no sessions stored in the Uxx area or if they have been overwritten by a download to the "Pxx" area the Proteus will not display the "Uxx" mode.

2. Select a session by pressing the **bottom** button. A single press causes the display to increment one step at a time, while pressing and holding causes the display to increment automatically. Notice that the rate at which the session number is displayed increases as you hold the button down.
3. TIP: you can cause the display to *decrement* rather than increment if you press the **Start** (top) button together with the **bottom** button. Be sure you press and hold the **bottom** button first then press the top button.
4. Press the **Start** (top) button to start a session.

## USr

Use this mode to manually select and run specific frequencies without the use of a PC connection.

1. Press the **Mode Select** button until the display shows "Usr".
2. Press the **Start/Stop** (top) button once. The light and sound will begin an eight second soft-on sequence. If you press it *twice* the soft-on sequence will be skipped and the session will begin at full brightness and volume.

At this point, the lights and sound will run steadily at whatever frequency is shown in the display. If you'd like to change to another pulse rate, or between on/off and left/right modes, do this:

3. Press and hold the select key to increment the current flash rate in 0.1 hz increments.

TIP: you can cause the display to *decrement* rather than increment if you press the **Start** (top) button together with the **bottom** button. Be sure you press and hold the **bottom** button first then press the top button.

4. Press the mode/pause key to toggle between LightFrame+audio on/off and left/right. If the left and right decimals on the display are flashing left/right, then so are the lights and sound.

Note: While in *user mode* you can also adjust the LightFrame color mode or switch between external audio and digital data input.

5. You can change the audio pitch by holding down the middle and bottom buttons at the same time. The pitch will increase to 400 Hz then shut off for one second before starting over at 40 Hz. The pause is for those people who want to use external audio without any internal sound.

## PC

This powerful feature, introduced with the release of version 1.6 of the Proteus operating system, is used for two primary functions: real-time preview of sessions you are editing with Proteus Editor, and for setting Proteus to be controlled via biofeedback (initialu, ThoughtStream). To use this mode, just press Mode Select until PC is displayed, and follow the instructions in your software documentation for proper use of this mode.

## AS

AudioStrobe<sup>R</sup> is one of the most powerful features included in Proteus. When you select this mode, any AudioStrobe-encoded compact disc will control the LightFrames, allowing precise synchronization between the lights and the audio on the disc.

We've included an AudioStrobe sampler CD with your system, and suggest that you explore this disc to gain a clear idea of what it is capable of. Contact your dealer for more information about the various available titles.

Tip: for best results, connect the Proteus audio input to the line output on your CD player. Then plug your headphones into the headphone jack on your CD player. Eliminating the audio path through Proteus improves the audio quality of your experience.

To use AudioStrobe:

1. Press the **Mode Select** (middle) button until the display reads "AS".
2. Connect your audio source (CD player or PC) to the AUX input on the lower right side of Proteus.
3. Start your CD and settle back! Use the volume control on your CD player to adjust the audio volume; light brightness is adjusted as usual via the top right control knob on Proteus.

## dL

Use this mode to download sessions and operating system upgrades into Proteus. You will always know if data is actually making its way into the system because the display digits will rapidly change during download.

To use this mode, select it by pressing the **Mode Select** button. Then follow the instructions included with the reference guide included with the operating system version you are currently using.

## Tutorial: Using the *Randomize* feature with Proteus Editor

The Random Options feature of Proteus Editor allows you to select a group of segments within a session (or even the entire session) and automatically and randomly vary certain of the segment parameters within ranges you've set. Some of the applications for this feature include:

- Quickly creating novel, visually interesting stimulation paradigms
- Varying the precise stimulation frequency within a target band (for example, alpha)
- Creating broadband stimulation protocols for overall activation (this approach is called "Brain Brightening" by Dr. Thomas Budzynski)

This tutorial will describe how to create your own randomly-varied programs, using the above three applications as examples.

You can access the Random Options via the Utilities menu. Two menu items are available: Randomize Selected Segments, and Edit Random Preferences. The first step in creating a program with randomized parameters is to select which of the parameters will be affected. Choices available include Channel 1 (red light) and 2 (green or blue light) frequency range and brightness, audio pitch, and segment time. In every case you choose maximum and minimum values, which set the range within the randomization will take place. An important detail is that the light frequencies are varied in one-tenth hertz increments; this is important when the goal is to stimulate a particular frequency range (for example, the 13-15 hz "peak performance" frequency range) since the most effective stimulation frequency for a give person is not likely to happen to be an integer.

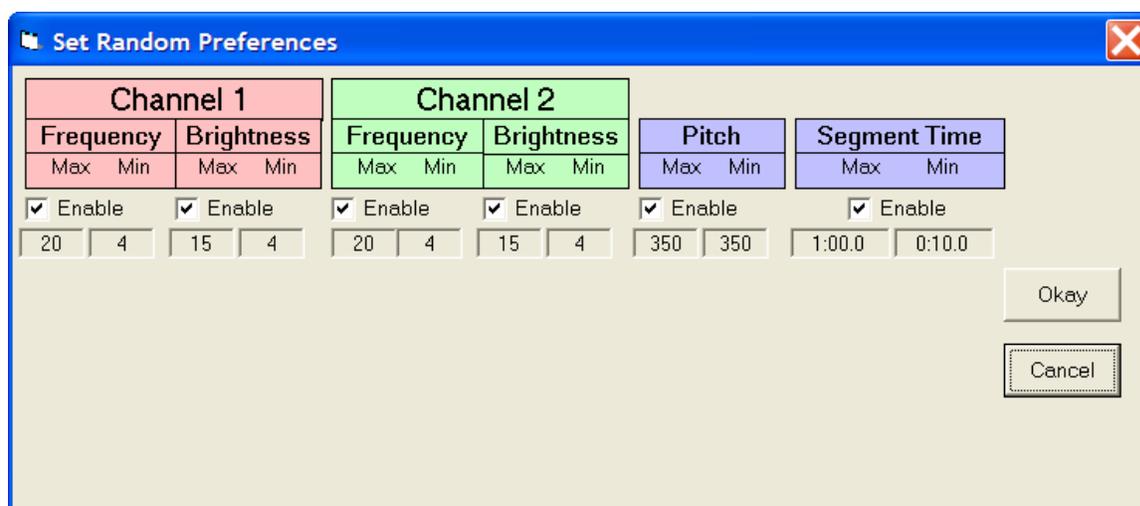


Figure 1: the Set Random Preferences menu choices, accessed via Utilities/Random Options.

Notice also that each parameter has a check box associated with it, so you don't have to randomize all of the parameters in order to use this function.

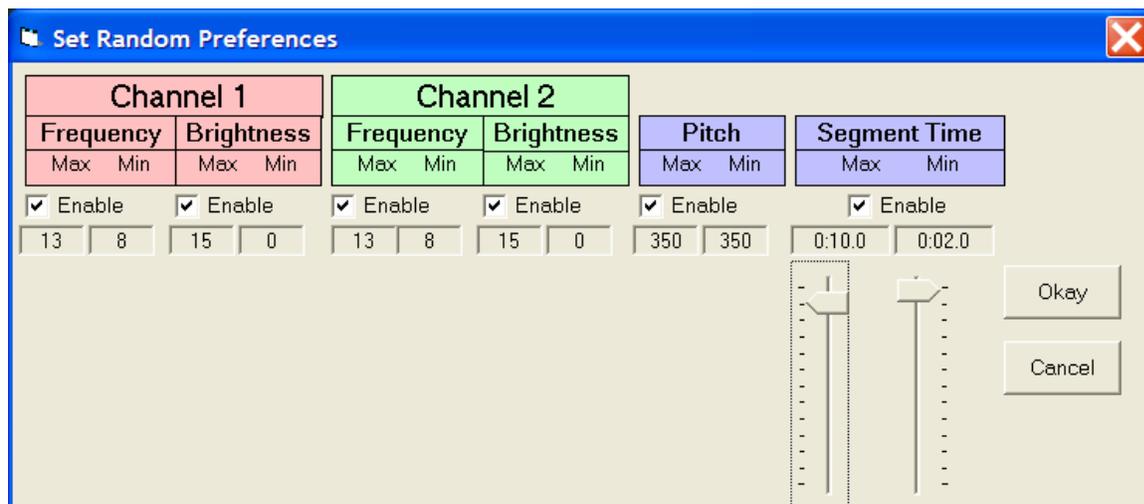
### ***Example 1: exploring visual imagery***

In this exercise we'll create a 50 segment session with a broad range of visual stimulation frequencies—but all are within the 8 to 13 hz range within which the most interesting “patterns” seem to appear.

**Step 1: Create a new file.** Do this either by clicking the “New File” button on the button bar at the top of the Proteus Editor screen; using File/New; or pressing F1. When the dialog box asking how many segments for the session appears, enter 50.

**Step 2: Select all segments.** Do this either via Edit/Select All or by pressing Ctrl-A.

**Step 3: Set the Random Preferences.** Utilities/Random Options/Edit Random Preferences takes you there. Once this dialog box is open, set it up to look like this:



When you click on one of the numbers in the bottom set of display boxes, controls will appear (in the above example, I've clicked on the Segment Time max. length box, the number 10.0). You can change values either by left-click-dragging on the sliders, or clicking on a slider to select it and using the up and down arrow keys to move it along in small increments. Although in this example both channels are set to a maximum frequency of 13 hz, there is no particular reason why you should not set it to, for example, 13.3 hz.

When you are done, click Okay. You're ready to create your first randomized session.

**Step 4: Create a new session.** Left-click the New File button, and enter 100 for the number of segments in the session. Next, select Edit/Select/All (or Ctrl-A) to select all the segments for randomization. Finally, choose Utilities/Random Options/Randomize Selected Segments (or Ctrl-R). Notice what has happened to the values entered into the various segments. Each time you Randomize Selected Segments all (more precisely, nearly all) of the numbers will change to new values.

**Step 5: Save the session.** Finally, save the session in preparation for uploading to the Proteus using the File/Save As (or Shift-F3) and save it into a folder, preferably a subfolder of the Proteus Editor. Try randomizing these 100 segments again several times, saving each with a new name; this way, you can collect them into an album and upload a group of them to the Proteus for later experimentation.

Variations:

- Open the Edit Random Preferences dialog box again and change the minimum and maximum times—for example, to between 4 and 15 seconds.
- Select the first 50 segments (by left-clicking in the “1” Segment Number box and dragging downwards until the first 50 segments are highlighted) and randomize them with one set of times, then change the times in the Edit Random Preferences dialog, select the second 50 segments, and randomize those.
- Set the Channel 1 frequency range to a slightly different set of values than Channel 2; for example, 8.5 to 12.5 hz.
- Set Channel 2 (green or blue) to vary between brightness levels 9 and 12, while Channel 1 varies between 0 and 15.

When running a visualization session created in this manner, notice when the visuals are especially interesting, then take your glasses off and notice where you are in the program time. You can then locate which segment was running by clicking through the segments while watching the Time To End of Selected Segment box at the bottom right of the Proteus Editor main window.

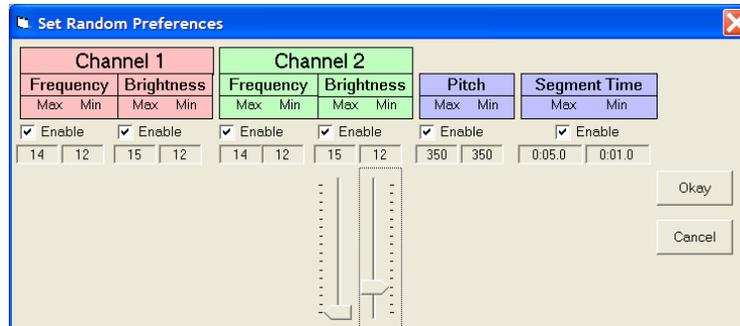
In this way you can begin constructing “libraries” of visual effects—segments which are especially powerful or visually interesting.

### ***Exercise 2: Varying frequencies within a target band***

In this exercise we'll create a program which varies only within a limited frequency range—high alpha (in this case, 12-14 hz). This is a range which some researchers have correlated with enhanced cognitive performance, so it is possible that increasing the amplitude in this range could lead to enhanced cognitive performance.

Also, let's set the brightness range fairly high—since our goal here is stimulation rather than visualization. Try starting with 12-15 for the brightness range for both colors; the reason for not simply setting them both to maximum is that some variation in brightness can increase overall attention, as the brain automatically increases attention when sensory stimulation changes noticeably. Also, set the segment times to shorter intervals—say, one to five seconds per segment. This will allow more rapid activation of networks close to one another in resonant frequency.

Here's how the Random Settings should appear:



Repeat the session creation process described above, using these settings. You should end up with a screen that looks something like this:

Segment No.	Time	Channel 1		Channel 2		Audio Pitch					
		Frequency	Brightness	Frequency	Brightness	Start	Finish				
1	0:01.0	12.3	12.8	15	13	13.5	13.6	13	13	350	350
2	0:03.5	12.2	12.7	13	14	12.3	13.3	13	15	350	350
3	0:03.0	12.1	13.2	14	15	13.9	12	14	13	350	350
4	0:02.0	13.7	12.2	15	14	13.5	12.5	13	12	350	350
5	0:04.5	12.7	12.3	13	12	13.9	13.8	12	13	350	350
6	0:01.0	12	13.5	14	14	13.4	13.3	13	13	350	350
7	0:02.0	13	12.6	14	14	13.1	12.8	14	13	350	350
8	0:03.5	12.9	12.7	15	13	12.3	13.2	12	12	350	350
9	0:03.5	12.4	12.5	12	12	12.1	12.6	13	14	350	350
10	0:02.5	13	13.6	14	14	12	13.4	14	14	350	350
11	0:02.5	13	12.5	14	15	12.7	13.5	13	14	350	350
12	0:02.5	13.2	13.1	15	14	13.4	13.8	13	13	350	350
13	0:01.0	13.5	12.7	12	14	13.9	12.6	15	13	350	350

Session Name: 12 to 14 hz stimulation 1.PR2  
Time to end of selected Segment: 00:00:01  
Total Session Time: 00:04:35

Notice that the total session time in this case is only 4 minutes 35 seconds long—you might find experimentation with short sessions like this beneficial, since it is usually much easier to find an extra five minutes for a session during the day than, say, half an hour!

Variations:

- Change the segment time range to longer periods—say, 2 to 8 seconds—while keeping the total number of segments at 100.
- Change the segment time range to shorter periods, such as 0.5 to 2 seconds—but this time create a session with 400 segments.
- Narrow or broaden the frequency range. For example, set the frequencies to 12.5 and 13.5 hz. Notice how you feel during and after this session and compare it to the earlier 12 to 14 hz example. Does one of them make you feel better than the other? Compare a 12.5 to 13.5 hz session to another set to 13.5 to 14.5 hz. Which one makes you feel more alert?