Interfacing the Thoughtstream with the Proteus

In order to interface the Thoughtstream with the Proteus the user must connect a stereo patch cord between the Thoughtstream “PC” jack and the Proteus “AUX” jack.

The light frames and headphones should be plugged into the appropriate Proteus jacks and the hand sensor plugged into the Thoughtstream “SENSOR” jack.

The interface will only work when the Proteus is in the “Uxx”, “Pxx”, “Usr” or “PC” modes and the input needs to be set to the “digital” mode.

The “digital” mode is indicated by a flashing middle decimal point on the Proteus display. The “PC” mode automatically sets this mode but the “Uxx”, “Pxx” and “Usr” modes can be toggled between “audio” and “digital” modes.

Set the input mode to “digital” by pressing the top and bottom key at the same time. When the middle decimal point is flashing the Proteus is expecting a digital data stream and the input “AUX” signal is blocked from the audio path. When the middle decimal point is off the input “AUX” signal will pass through the audio path and to the headphones.

Select the Proteus mode of choice by pressing the middle button.

Generally the “Uxx” mode would contain sessions designed specifically for biofeedback use, but the interface can be used to affect any session in the Proteus memory and can even run a stand alone biofeedback session.

Select the session of choice, when in “Pxx” and “Uxx” mode, by pressing the bottom button.

Once the two units are connected and the input mode is set to “digital” the user would start the Thoughtstream session by pressing the “START/STOP” button. While the probe is settling the user can start the “Proteus” session by pressing the top button.

Note … the stand alone session can be initiated by pressing the top two buttons at the same time. Note … If no Thoughtstream data is detected during any four second interval the stand alone session will be terminated.
There are two buffers in the Proteus associated with the biofeedback interface. The first is the “default” buffer that resides in FLASH RAM (non-volatile). It remains intact when the power is turned off but can be reprogrammed using the Proteus Session Editor. The second is the “working” buffer, in volatile RAM, which is actually used to translate Thoughtstream data and redirect the desired Proteus functions. When the Proteus is first turned on the “default” buffer is loaded into the “working” buffer so there is always something to reference if the Proteus detects Thoughtstream data.

If a “Uxx” or “Pxx” session is programmed with a biofeedback control segment, this control segment will be loaded into the “working” buffer and will remain until another biofeedback control segment is encountered or the unit is turned off and back on at which point the “default” buffer will be reloaded.

*The biofeedback control segment*

Right clicking on the “Edit Aux Segment” box located near the top of the Proteus Session Editor will bring up a screen similar to the one below.

There are six functions that can be controlled by the Thoughtstream.

- LFO #1 frequency
- LFO #1 brightness
- LFO #2 frequency
- LFO #2 brightness

***(LFO#1 will be the red LEDs and LFO#2 will be the green LEDs in the standard red/green light frames.***

Audio pitch
Audio volume
The Proteus functions are controlled by the “Control Sensor” settings. For the Thoughtstream the only settings that have any effect are the “EDR1” or “none” settings. The “EDR2” or “Temp_” settings are for forward compatibility of future products.

Each function has a Start and Finish value.

Each control sensor has a sensitivity setting (lower left of the panel). Again only the “EDR1” sensitivity setting has any effect when using the Thoughtstream.

The following describes how these various settings interact.

If the control sensor is set to “none” the Thoughtstream will have no effect on that function. If you are running a session then whatever is programmed into the segment will be run.
Also selecting anything but “EDR1” will have the same effect as “none”.

If “EDR1” is chosen as the control sensor then the following happens...

The first data packet that the Proteus receives from the Thoughtstream will contain a measurement for the skin-sensor resistance. This will be designated as the starting point and the Proteus will change the affected function values to the Start value in the biofeedback control segment.
Also, at this point the sensitivity setting is applied to the starting value to calculate a finish value. In the case above the EDR1 sensitivity is set at 61(%) so when the initial skin-sensor resistance has increased by 61% the Proteus will have changed the affected functions so they are running at their Finish values.
As an example ... once data is received from the Thoughtstream the Proteus will change the values of the LFO #1 frequency to 3 Hz, the LFO #1 brightness to 4 (0 being off and 15 being maximum brightness) and the LFO #2 brightness to 15. If the initial skin-sensor resistance were 100-kilo ohms and given the sensitivity of 61(%), then as the skin-sensor resistance increased towards 161-kilo ohms (100-kilo ohms * (1+0.61)) the Proteus would, in a linear fashion, change the values of the LFO #1 frequency to 18 Hz, the LFO #1 brightness to 13 and the LFO #2 brightness to 2.

* More Options!!!

It is often desirable to have the Thoughtstream running and connected to the Proteus but not affecting any Proteus functions. Each segment has a check box labeled “No BioFd Ctrl” in the lower right side of the “Segment Buffer” panel. If the box is checked then that segment of the session will run without any influence from the Thoughtstream. Note the default setting is this box is unchecked.

Resetting the Starting point.
If the user wishes to reset the starting point, that is, use the current skin-sensor resistance as the new start point, the user can press the middle “pause” button twice and the Proteus will accept the current skin-sensor resistance as the new starting value and recalculate the finish point. This is useful if things seem stuck and not responding.

Adding Biofeedback control segments into Proteus sessions.
Below is a simple biofeedback session. The first segment would be used to ‘settle’ the user. The “No BioFd Ctrl” would be checked so the Thoughtstream would have no effect on the first Proteus segment. The LEDs would start flashing at 18 Hz and over 5 minutes slow to 8 Hz. The sound pitch starts at 250 Hz and lowers to 150 Hz.

The second segment is to be used with the Thoughtstream. The “No BioFd Ctrl” would be cleared. It lasts for ten minutes. If a biofeedback segment weren’t added to the session (see below) then the default biofeedback segment would control the Proteus.

The third segment is used to ‘revitalize’ the user. Again, the “No BioFd Ctrl” would be checked so the Thoughtstream would have no effect on the third Proteus segment. Over three minutes the LEDs will ramp from 8 Hz to 18 Hz, with the sound doing a similar reversal of the first segment.

![Proteus Session Editor](image)

The user will probably want the Proteus to do things other than what is programmed in the ‘default’ biofeedback segment. By left clicking on the “Edit Aux Segment” box a window similar to the one below would appear.

In this instance the Thoughtstream (EDR1) controls all functions.
As the user’s skin-sensor resistance increased from the starting value to 106% (EDR1 sensitivity setting) greater the LEDs would change from 8 Hz to 4 Hz and the brightness of the LEDs would go from 15 (full brightness) to 2 (very low). The sound pitch would go from 150 Hz to 100 Hz and the Volume would go from 15 (Maximum volume) to a relative low volume of '2'.

Once the biofeedback segment is edited to the desired values the user would click on the “Insert Into Session Table” button and the segment would be inserted into the session.

Note that the biofeedback segment is inserted between the segments that have the heavy line between them, segments one and two in this case.

The data encoded in the biofeedback segment takes up the space of two regular segments and no details are shown in the session array. To reedit the biofeedback segment the user would click on any of the two lines and the biofeedback-editing window is opened with the current settings.
Note that when the biofeedback-editing window is open the user can send the values of the biofeedback segment to the Proteus. The Proteus must be connected to the PC, turned on and in the “PC” mode.

If the “Update the default settings” check box is not checked then the values are sent only to the “working” buffer in volatile RAM.

If the “Update the default settings” check box is checked then the values are sent to the “working” buffer and the “default” buffer in non-volatile RAM. These will become the default settings that are loaded when the unit is turned on.