42 Aero Camino
Goleta, CA 93117
Ph (805) 685-0066
Fax (805) 685-0067
www.biopac.com
info@biopac.com

BIOPAC Systems, Inc.

Application Note #AS-211
EEG Analysis with Acq*Knowledge*

The Acq*Knowledge* software will record EEG data, filter the data into the specific bandwidths for Alpha, Theta, Beta and Delta, and display the results on-line. Often, researchers also need to **quantify the activity in each band**.

This Application Note provides a useful technique for analyzing EEG signals and quantifying the activity in each band. This note will explain how to:

(1) Integrate the alpha wave EEG data to get a better view of alpha wave activity.

(2) Identify where the integrated data crosses certain threshold values.

(3) Measure the amount of time that was spent in a heightened alpha state and count the number of times that the subject entered the state.

This note describes the procedure for working off-line with a saved data file, but you can also perform these functions online (as noted at each step).

The examples in this note use a raw EEG signal taken from a human subject and filtered to show the Alpha wave activity.

1. **Duplicate the Alpha signal**.

- Performing functions on a duplicated waveform—and labeling it—can help you keep track and compare the transformations you make to the signal. As you step through this process, duplicate and label each successive waveform.

   a. Select the waveform you wish to duplicate.

   b. Choose **Edit>Select All**.

   c. Choose **Edit>Duplicate Waveform**.

   d. Re-label the duplicated waveform by clicking on its name

and adding identifying label info to the dialog.

2. **Integrate the alpha wave EEG data**.

- This will assist in the analysis process by providing a better view of the alpha wave activity.

    a.   Select the duplicated EEG Alpha waveform.

    b.   Choose **Transform>Integrate**.

    c.   Set the following Integrate options: Average over samples; Samples: 30; Rectify.

    d.   Click OK.

- The following screen shot shows the raw EEG, Alpha wave EEG and the **Integrated EEG Alpha** (highlighted).
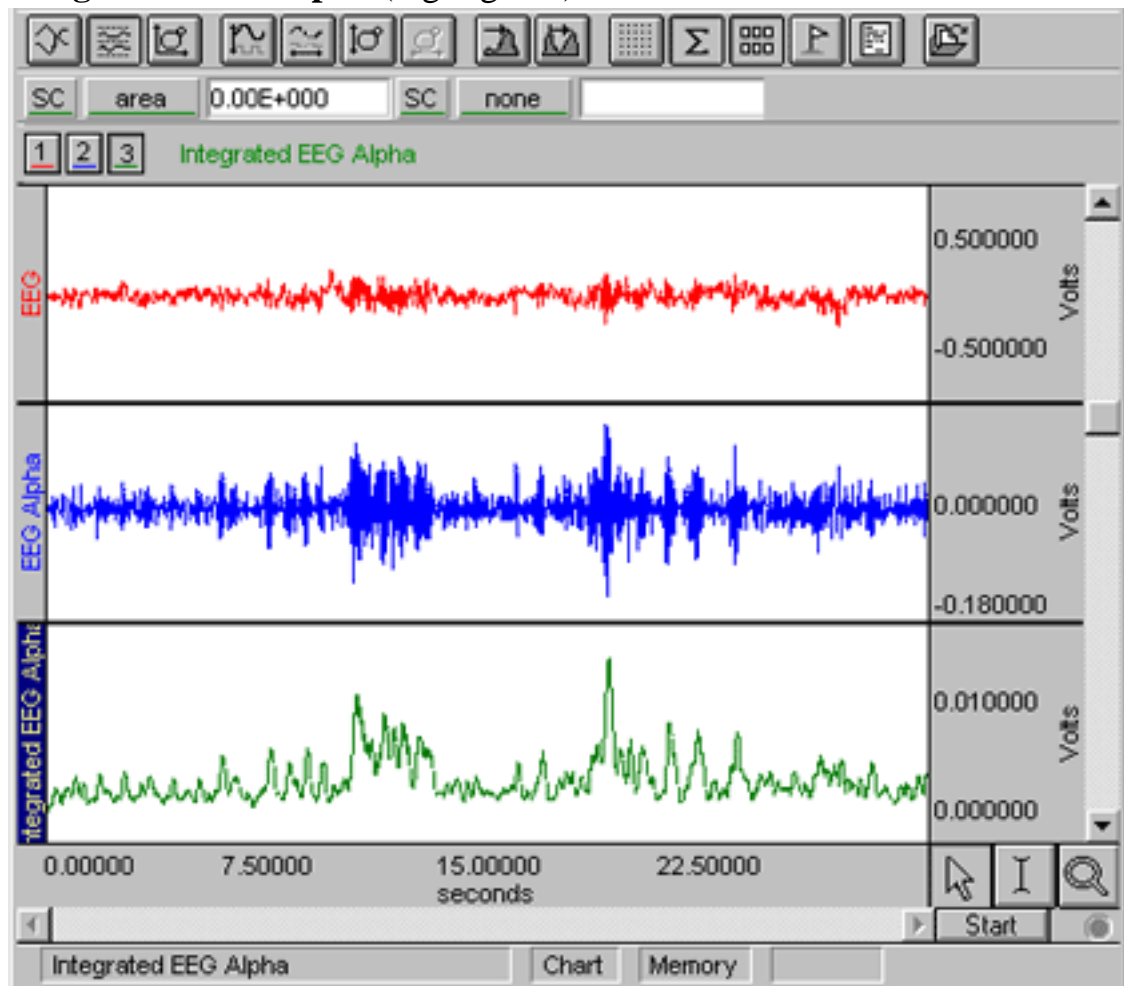
- This function is also available as an on-line calculation in the MP menu >Setup Channels dialog.

3. **Use the Threshold function**.

- Threshold will identify when the integrated data crosses certain levels. This function requires two thresholds that the signal must cross. Once the data crosses the first threshold the signal will go to 1 volt and stay high until the signal crosses the second threshold. The resultant waveform will be a series of square waves where the Integrated Alpha EEG data crossed the thresholds.

    a. Duplicate the Integrated EEG Alpha channel.

    b. Select the duplicated Integrated EEG Alpha waveform.

    c. Choose **Edit Menu>Select All**.

    d. Choose **Transform>Math functions>Threshold**.

    e. In the Threshold dialog box, enter low and high values appropriate to your signal.

    f. Click OK.

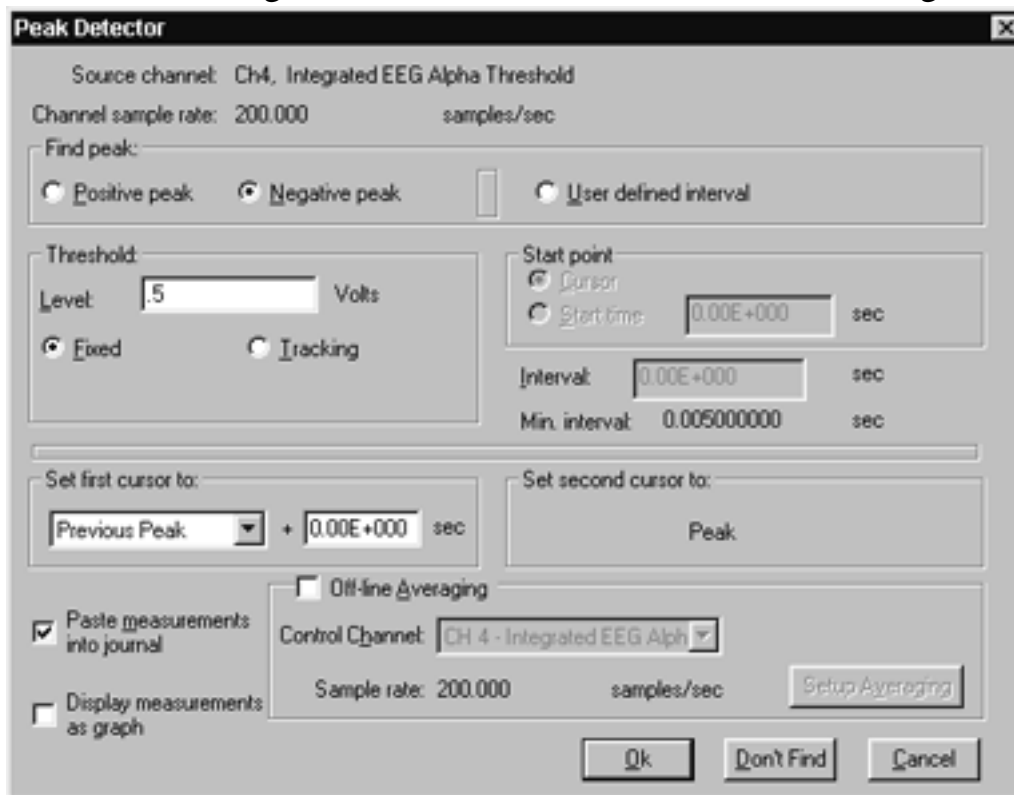- The following screen shot shows the result of the Threshold function.
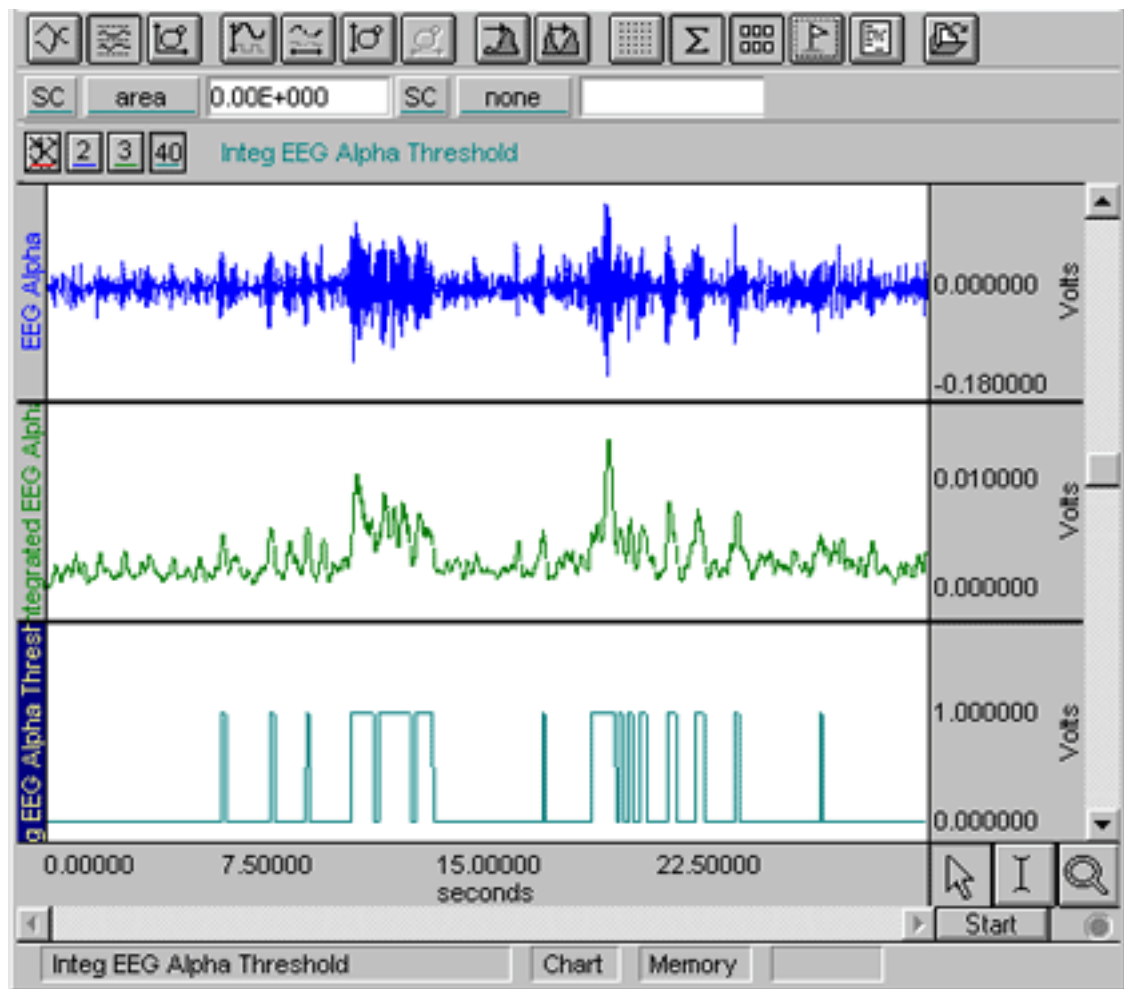
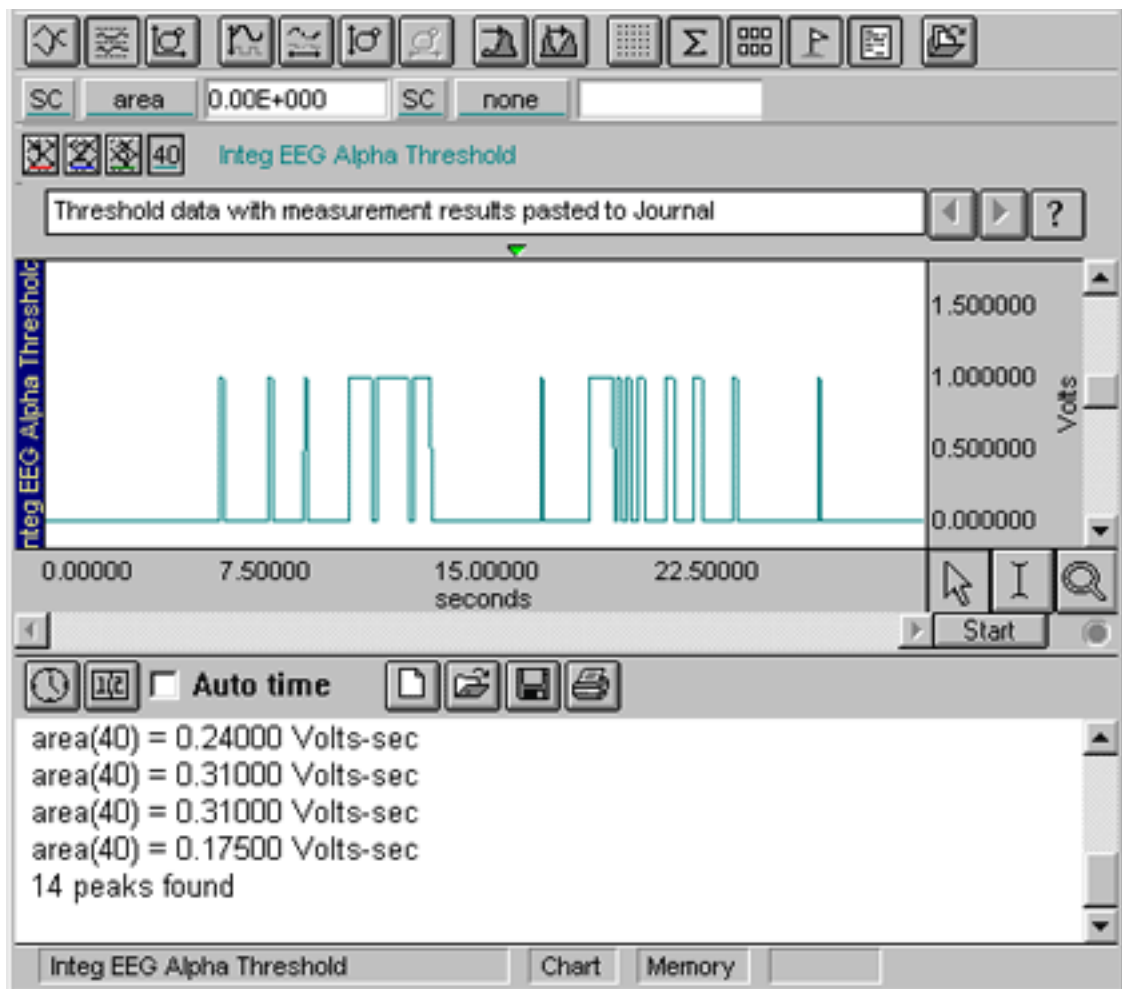- The Threshold function is also available as an on-line calculation under the MP menu >Setup Channels dialog.

4. **Quantify the EEG Threshold data automatically**.

- You may also measure particular areas of the signal and paste the specific measurement into the journal.

    a. Set a pull-down measurement for **Area**.

    b. Choose **Transform>Find peak**.

    c. Set Peak Detector options to measure the area under each of the threshold crossings and to paste the results into the Journal file with the total count:
    Find Peak: Negative
    Threshold: Fixed
    Threshold Level: appropriate for your data.
    Click in "**Paste measurements into Journal.**"

    d. Click OK.

- • The following screen shot shows the Peak Detector dialog box.

Peak Detector ☒

Source channel: Ch4, Integrated EEG Alpha Threshold

Channel sample rate: 200.000   samples/sec

Find peak:

○ Positive peak   ⦿ Negative peak   ○ User defined interval

Threshold:

Level: .5   Volts

⦿ Fixed   ○ Tracking

Start point

⦿ Cursor

○ Start time   0.00E+000   sec

Interval: 0.00E+000   sec

Min. interval: 0.005000000   sec

Set first cursor to:

Previous Peak ▼ + 0.00E+000 sec

Set second cursor to:

Peak

☐ Off-line Averaging

☑ Paste measurements into journal

Control Channel: CH 4 - Integrated EEG Alph ▼

Sample rate: 200.000   samples/sec   Setup Averaging

☐ Display measurements as graph

[Ok]   [Don't Find]   [Cancel]

- • The measurements in your journal will reflect the times the subject entered the heightened alpha state. The following screen shot shows the Journal file with the resultant Find Peak data.

- The Area function is also available on-line under the MP menu>Setup Channels>Rate Calculation.

5. **Quantify the EEG Threshold data manually**.

- You will use an Area measurement and the Find peak function to measure the amount of time that was spent in a heightened alpha state and count the number of times the subject entered the state.

    a. Set a pull-down measurement for **Area**.

    b. Choose the Cursor Tool.

    c. Select the area you wish to measure.

    d. Choose Edit>Journal>Paste Measurement.

- Following is a screen shot of a selected area and journal entry.
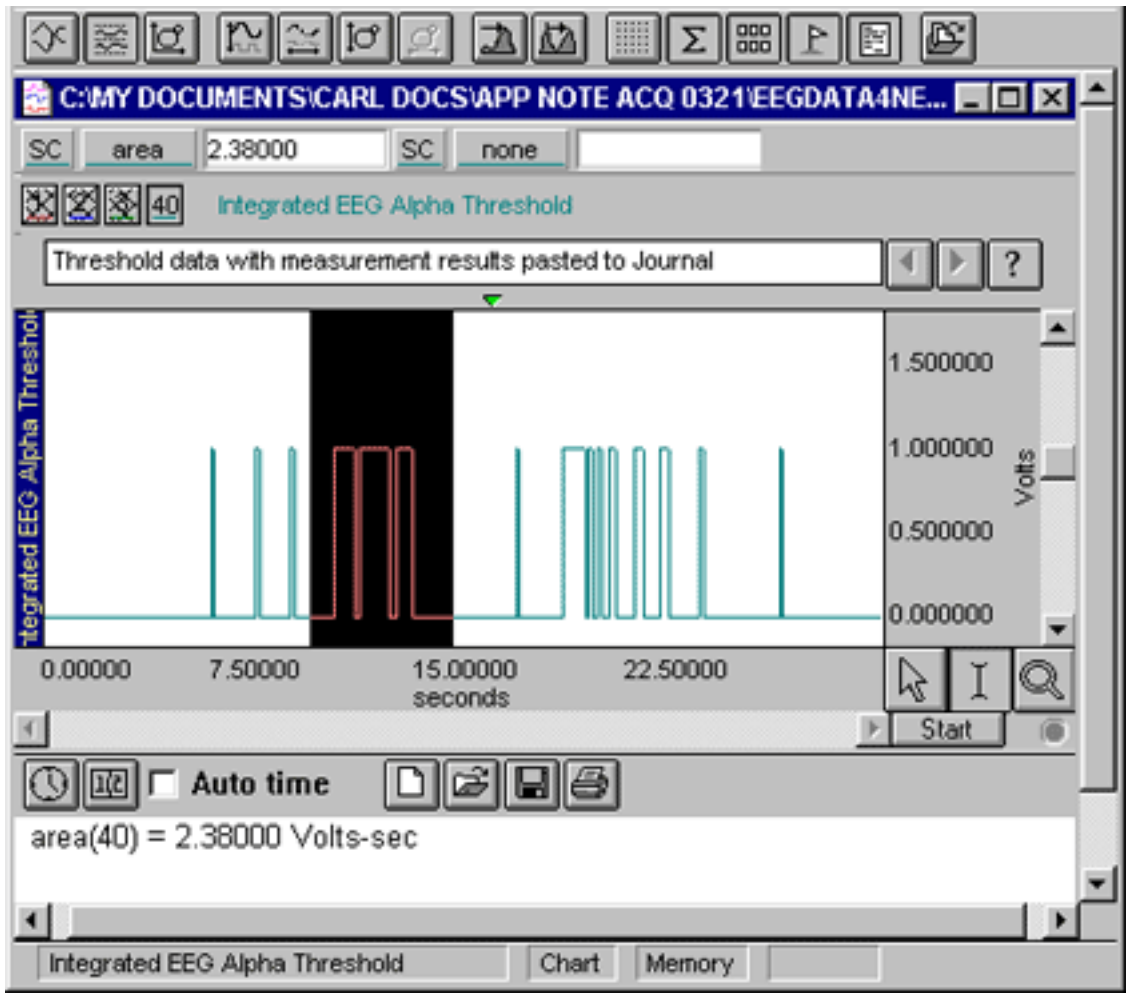
Return To Application Note Menu