



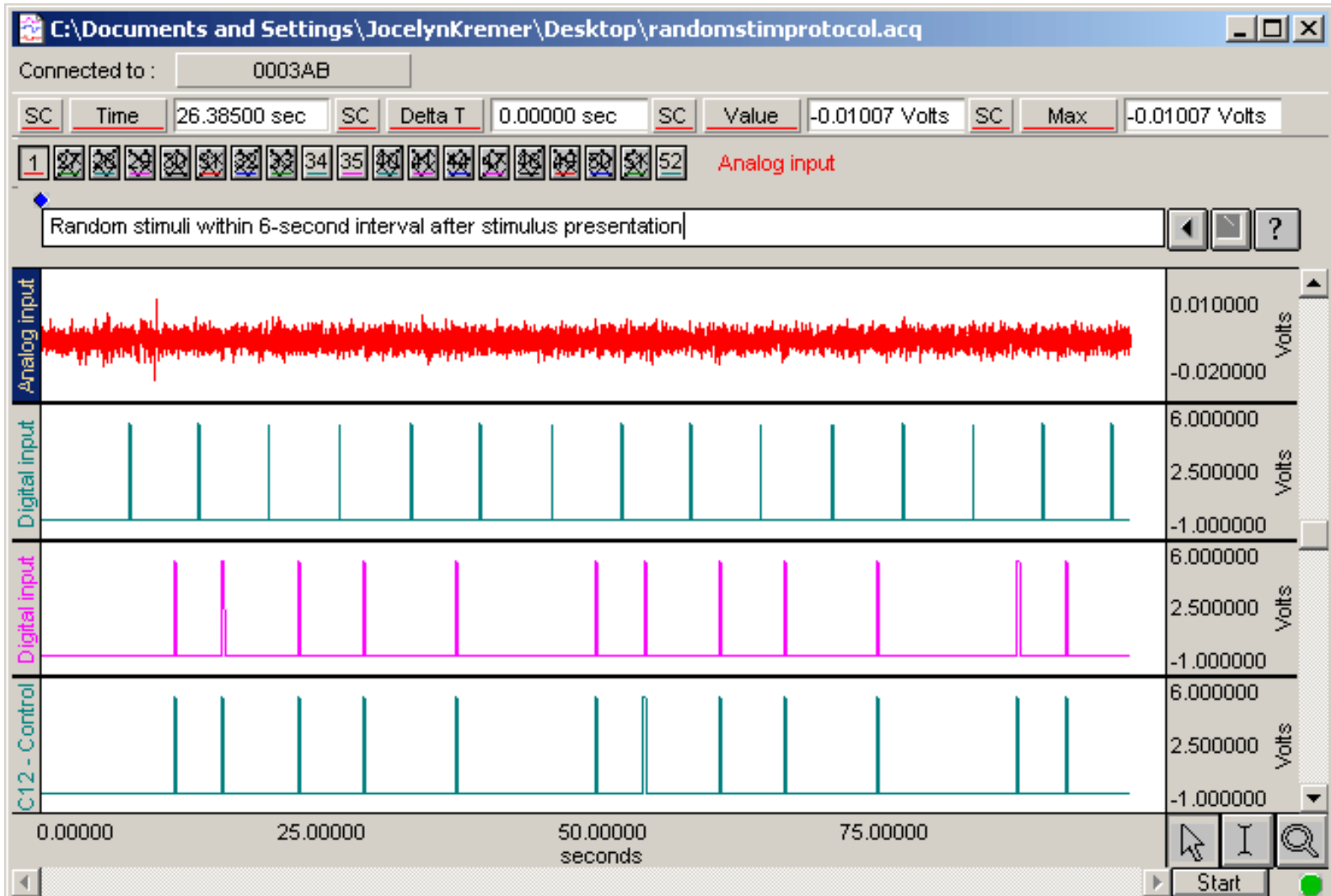
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Application Note AS-222

05.06.05

Pseudorandom Stimuli Following Stimulus Presentation



Overview

This Application Note explains how to generate pseudorandom stimuli during a stimulus presentation experiment.

- In this example, a random electrical shock is delivered within a 6-second window after an image is presented to a subject.
- This routine can be used with BIOPAC software and a variety of stimulus presentation programs, including **SuperLab**[®] (Cedrus), **E-Prime**[®] (Psychology Software Tools, Inc.), and **Presentation**[®]

(Neurobehavioral Systems).

- The routine can be modified to present random stimuli.

Setup

Hardware Setup

1. Hard-wire I/O 7 to I/O 15 as the control channel to deliver the stimuli.

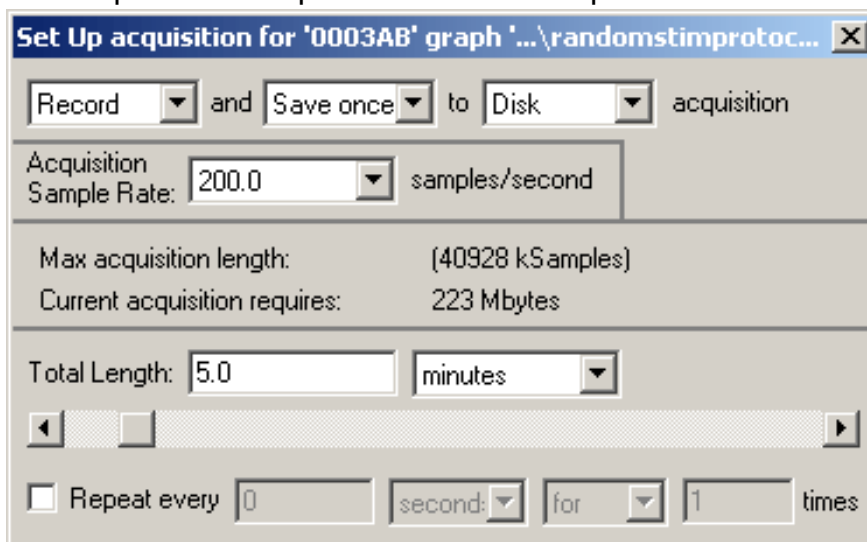
Software Setup

Overview

Digital I/O 8 to 12 will be used to generate the delay. The Equation Generator will be used to apply a weight corresponding to the required time interval (e.g. 0.25, 0.5, 1, 2, 3 seconds) to the I/O channels. The results will be added and peak amplitude will be measured using a predetermined time after stimulus presentation when the stimuli should be delivered (from zero to six in this example).

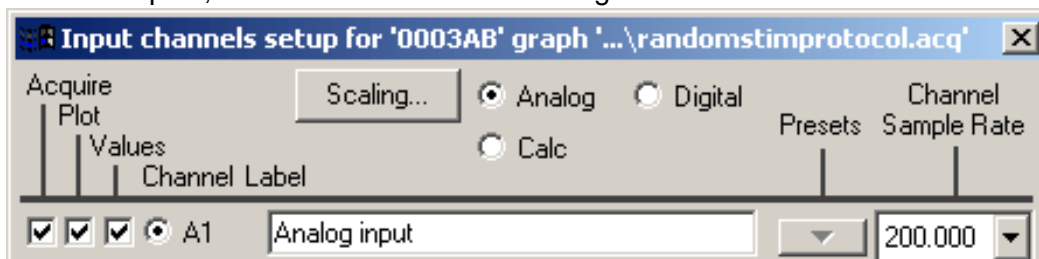
1. MP menu > Set Up Acquisition

Set Acquisition Sample Rate to 200 samples/second and Length to 5 minutes.



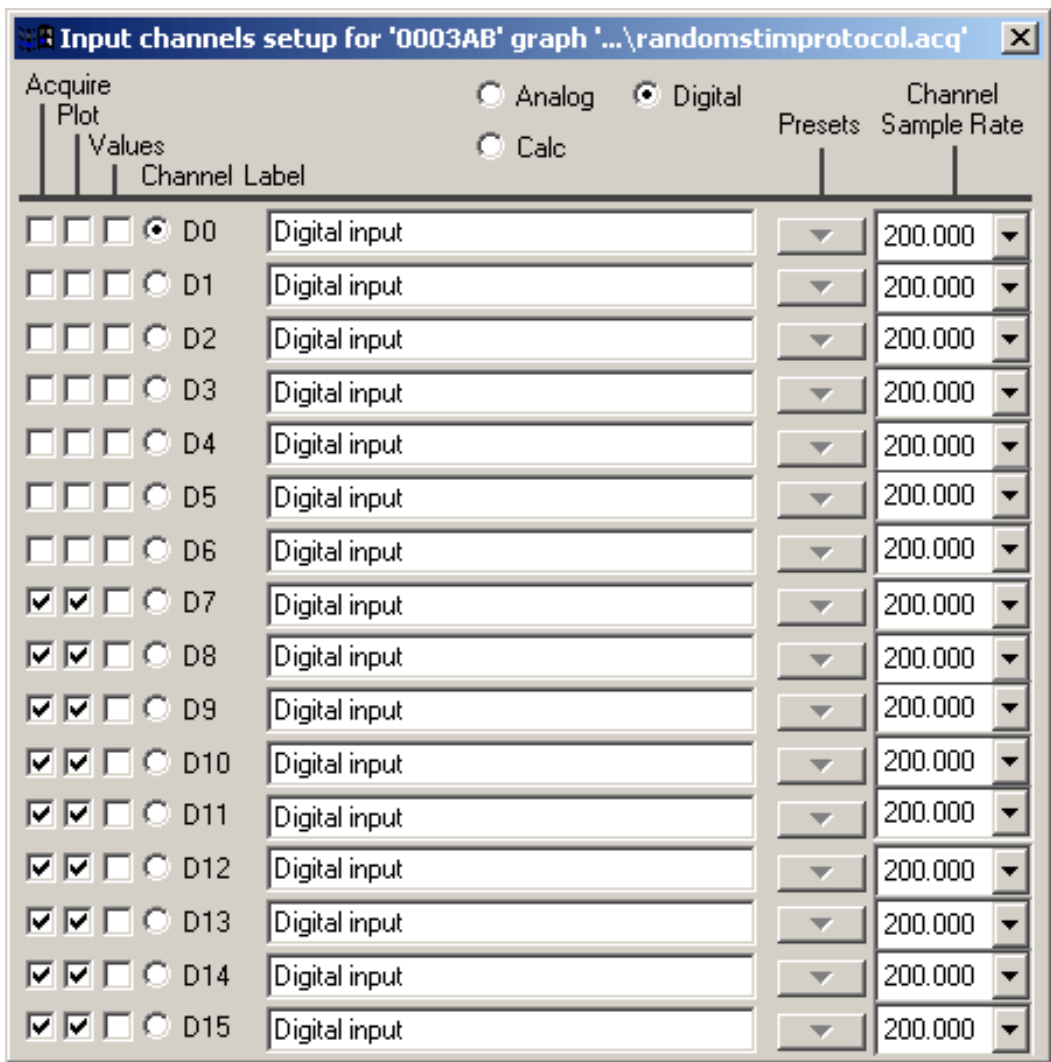
2. MP menu > Set up Channels: Analog

Select "Acquire," "Plot" and "Values" for Analog Channel A1.

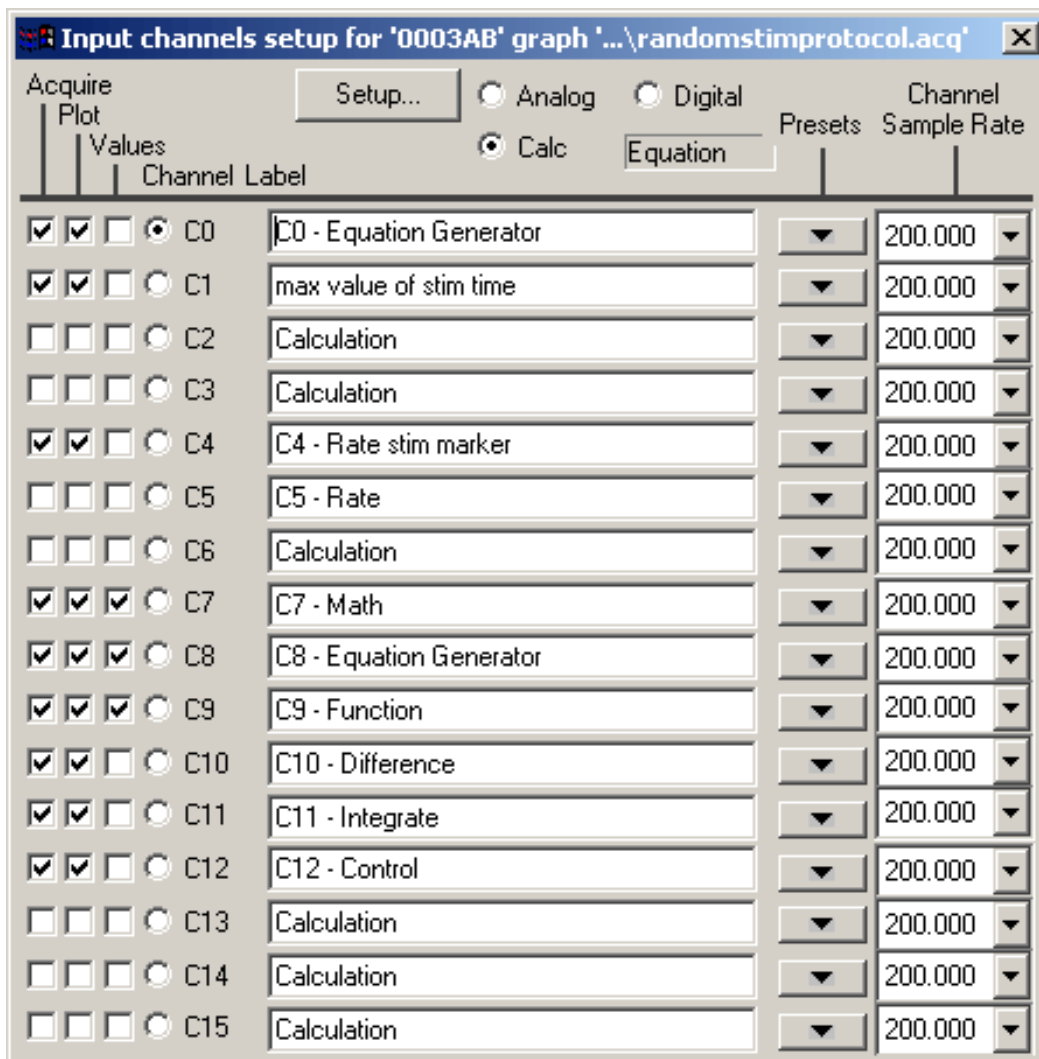


3. MP menu > Set up Channels: Digital

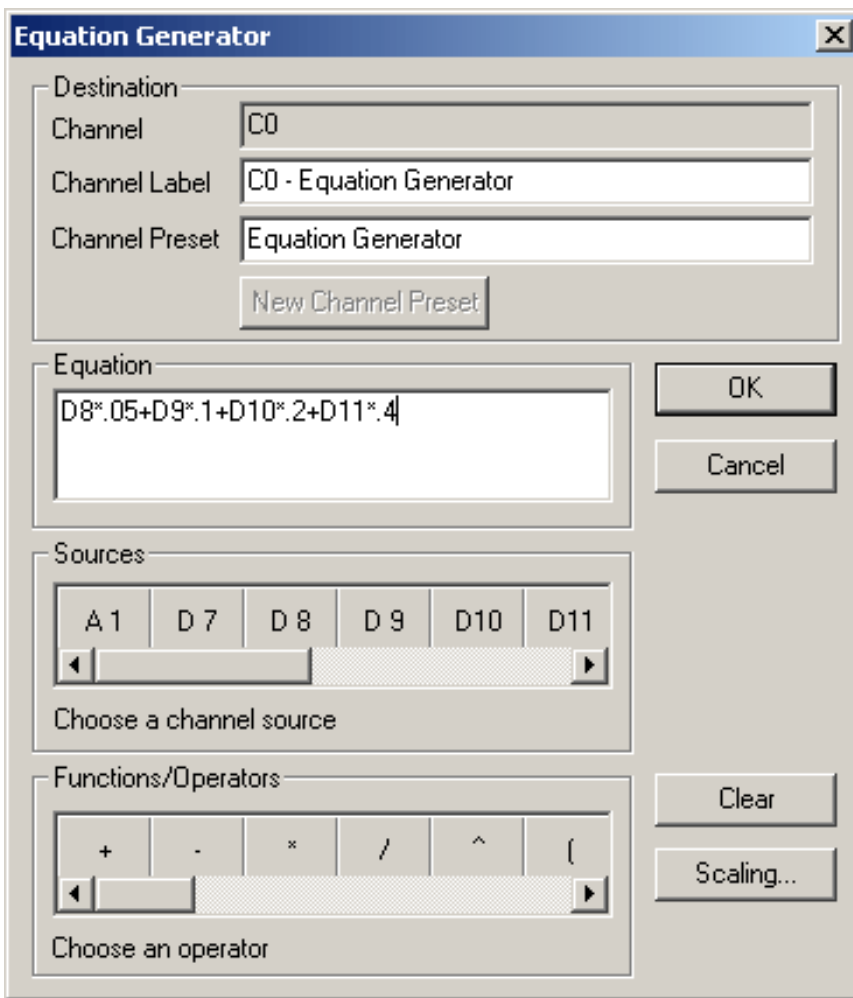
Select "Acquire" and "Plot" for Digital Channels D7 – D15.



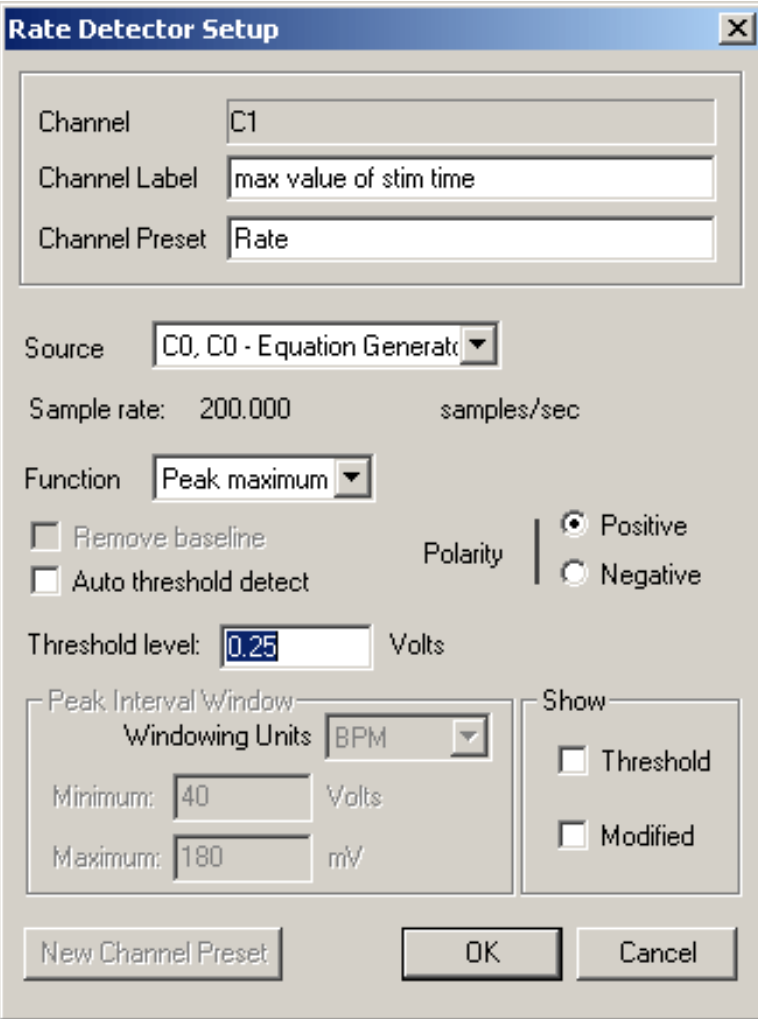
4. MP menu > Set up Channels: Calculation



- a. **C0** Apply a weight corresponding to the required time interval to I/O D8-D11.
Set Calculation Channel C0 to Equation Generator and enter an equation to apply the weighted values.



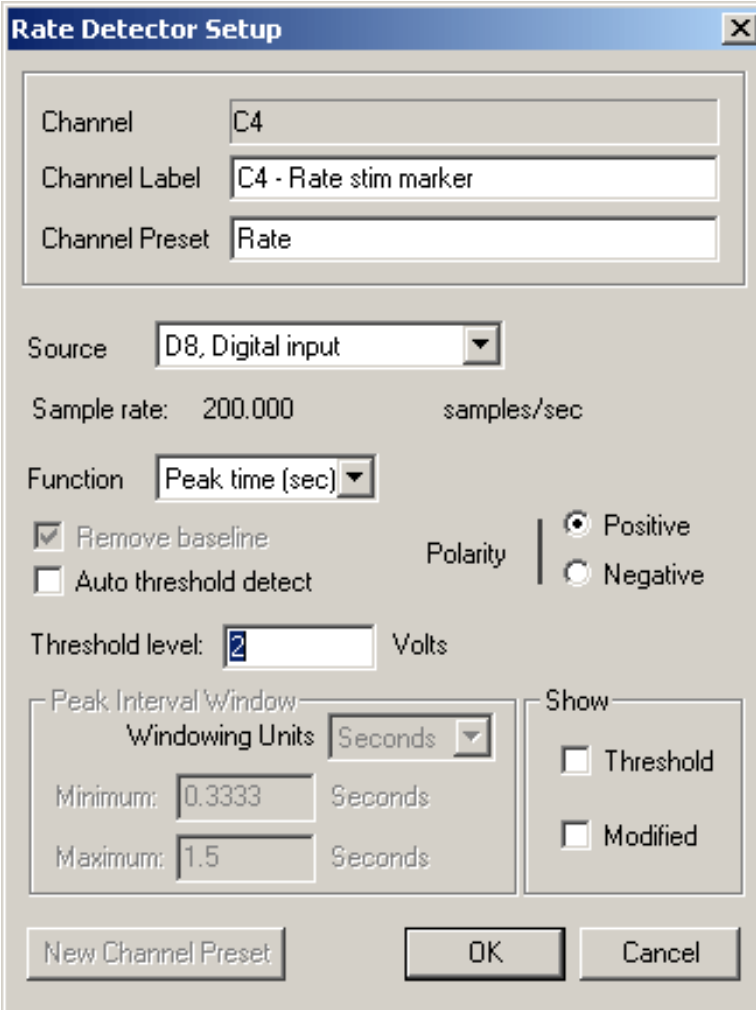
- b. **C1** Identify the maximum value of the weighted stimuli presentation.
 Set Calculation Channel C1 to Rate Detector > Function = Peak maximum



The image shows a 'Rate Detector Setup' dialog box with the following fields and options:

- Channel: C1
- Channel Label: max value of stim time
- Channel Preset: Rate
- Source: CO, CO - Equation Generat (dropdown)
- Sample rate: 200.000 samples/sec
- Function: Peak maximum (dropdown)
- Remove baseline
- Auto threshold detect
- Polarity: Positive, Negative
- Threshold level: 0.25 Volts
- Peak Interval Window:
 - Windowing Units: BPM (dropdown)
 - Minimum: 40 Volts
 - Maximum: 180 mV
- Show:
 - Threshold
 - Modified
- Buttons: New Channel Preset, OK, Cancel

- c. **C4** Extract the time of stimulus presentation.
Set Calculation Channel C4 to Rate Detector > Function = Peak time (sec)



Rate Detector Setup

Channel: C4
 Channel Label: C4 - Rate stim marker
 Channel Preset: Rate

Source: D8, Digital input
 Sample rate: 200.000 samples/sec

Function: Peak time (sec)

Remove baseline
 Auto threshold detect

Polarity: Positive
 Negative

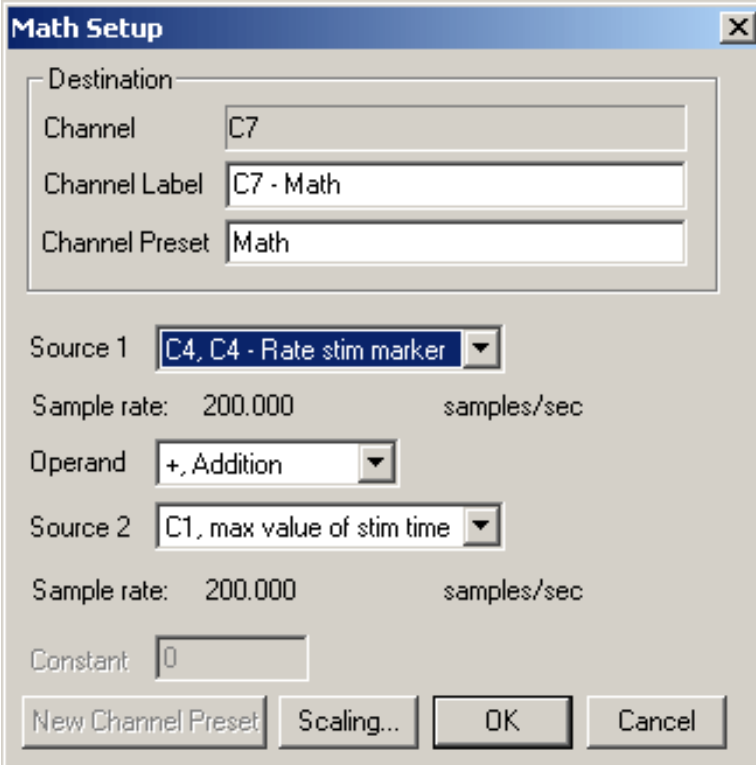
Threshold level: 2 Volts

Peak Interval Window:
 Windowing Units: Seconds
 Minimum: 0.3333 Seconds
 Maximum: 1.5 Seconds

Show:
 Threshold
 Modified

New Channel Preset OK Cancel

- d. **C7** Add the time of stimulus presentation to the interval required. Set Calculation Channel C7 to Math: C4 + C1



Math Setup

Destination:
 Channel: C7
 Channel Label: C7 - Math
 Channel Preset: Math

Source 1: C4, C4 - Rate stim marker
 Sample rate: 200.000 samples/sec

Operand: +, Addition

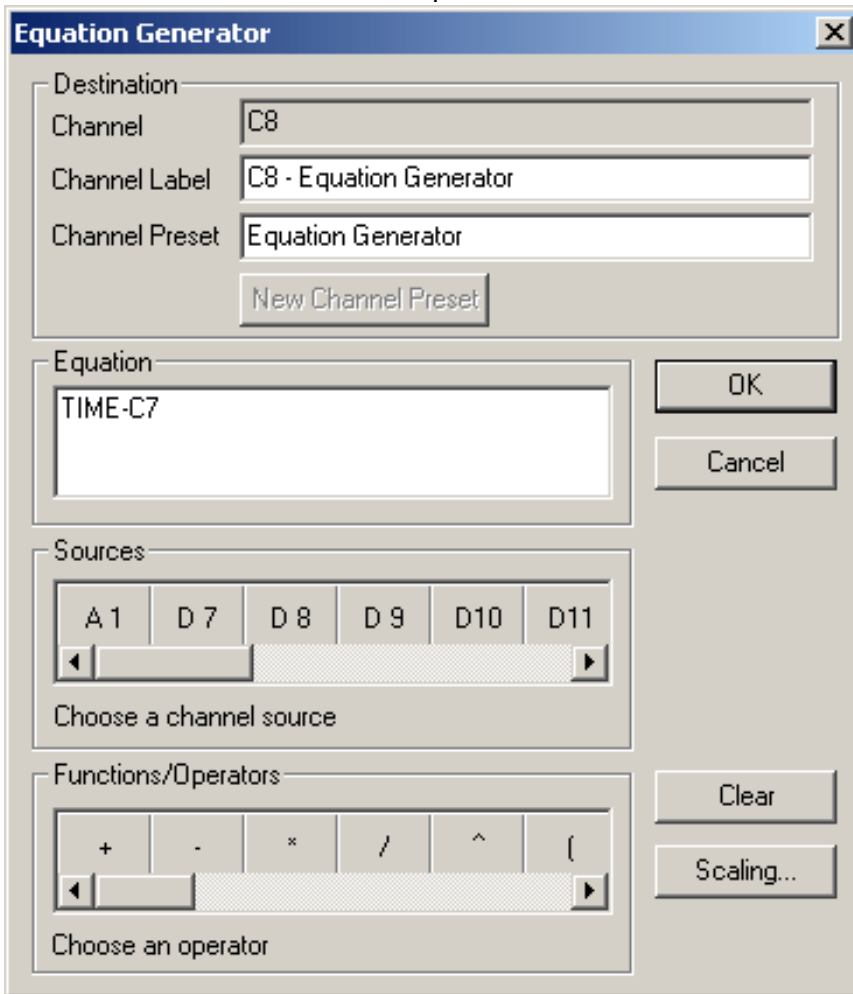
Source 2: C1, max value of stim time
 Sample rate: 200.000 samples/sec

Constant: 0

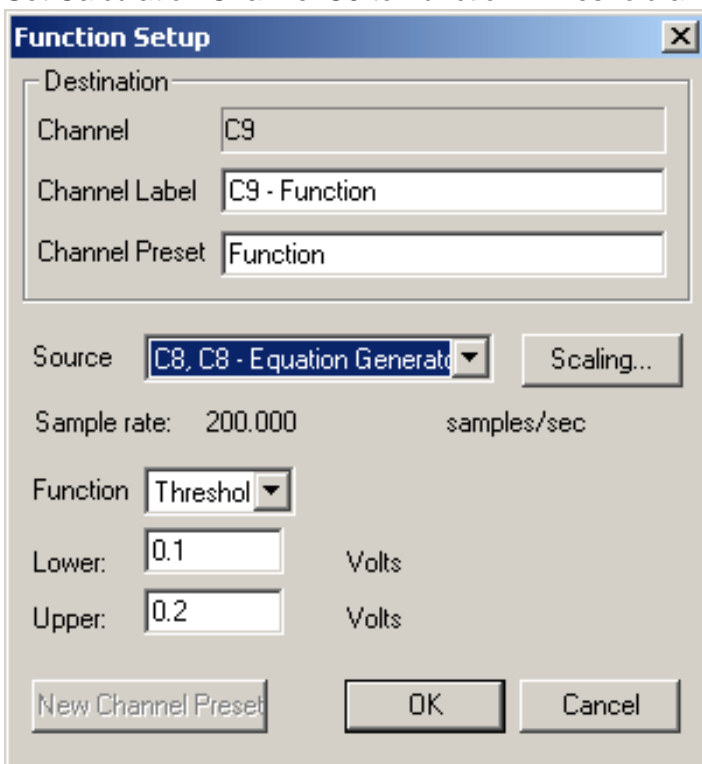
New Channel Preset Scaling... OK Cancel

- e. **C8** Subtract the current time from the time when the stimuli should be delivered; this function crosses zero at time of stimuli presentation.

Set Calculation Channel C8 to Equation Generator: Time-C7.



- f. **C9** Use the Threshold function (Transform > Function > Threshold) to establish an Integration of 40 samples at 200 Hz (this example uses a 200 msec stimuli). Set Calculation Channel C9 to Function: Threshold and set the upper and lower levels.



- g. Perform a one interval Difference on the Threshold result.

C10 Set Calculation Channel C10 to Difference: Source C9, Intervals 1

Difference Setup

Destination

Channel: C10

Channel Label: C10 - Difference

Channel Preset: Difference

Source: C9, C9 - Function

Sample rate: 200.000 samples/sec

Intervals between Samples: 1

New Channel Preset OK Cancel

- h. **C11** Integrate the result of C10 (this example uses a 200 msec stimuli).
Set Calculation Channel C11 to Integrate: Average over samples: 40 samples at 200 Hz

Integrate Setup

Destination

Channel: C11

Channel Label: C11 - Integrate

Channel Preset: Integrate

Source channel: C10, C10 - Difference

Sample rate: 200.000 samples/sec

Option

Average over samples Reset via channel

Samples: 40

Parameters

Rectify

Root mean square

Remove Baseline

Control Channel: A1, Analog input

Sample rate: 200.000 samples/sec

Reset thresholds

LOW: 0.00000 Volts

HIGH: 0.00000 Volts

Reset trigger

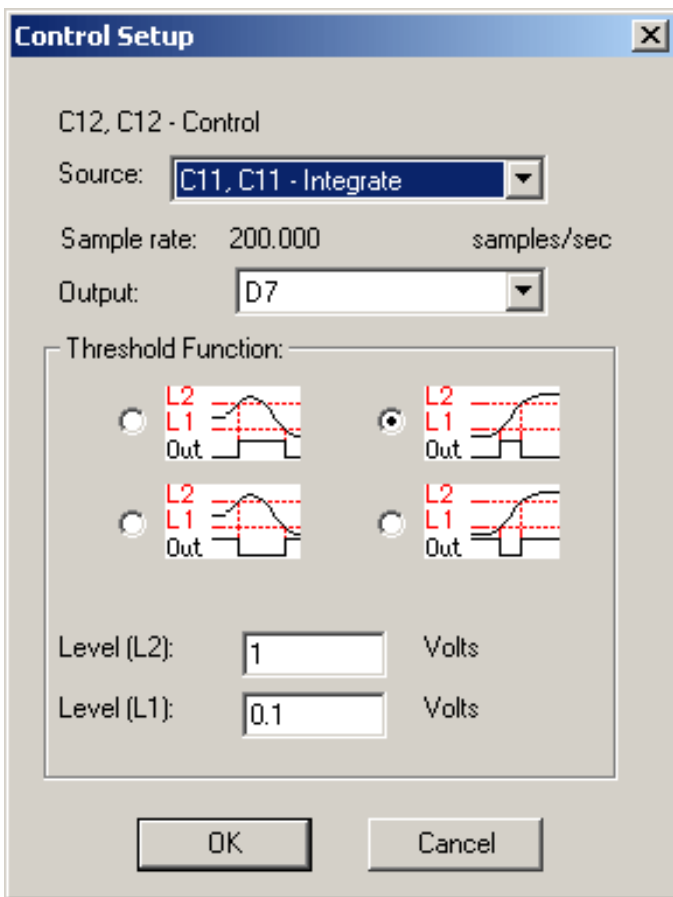
Positive Negative

Mean subtraction

Max cycle period: 1.00000 sec

New Channel Preset Cancel OK

- i. **C12** Direct the output to Digital I/O 7.
Set Calculation Channel C12 to Control > Output D7.
Adjust the Threshold function and Levels to determine when or if the stimuli will be presented.



5. Save the set up (File > Save As).

Recording

1. Press "Start" in the BIOPAC software window to begin acquiring data.



2. Press "Stop" in the BIOPAC software window to stop acquiring data.
3. Save the data (File > Save).

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