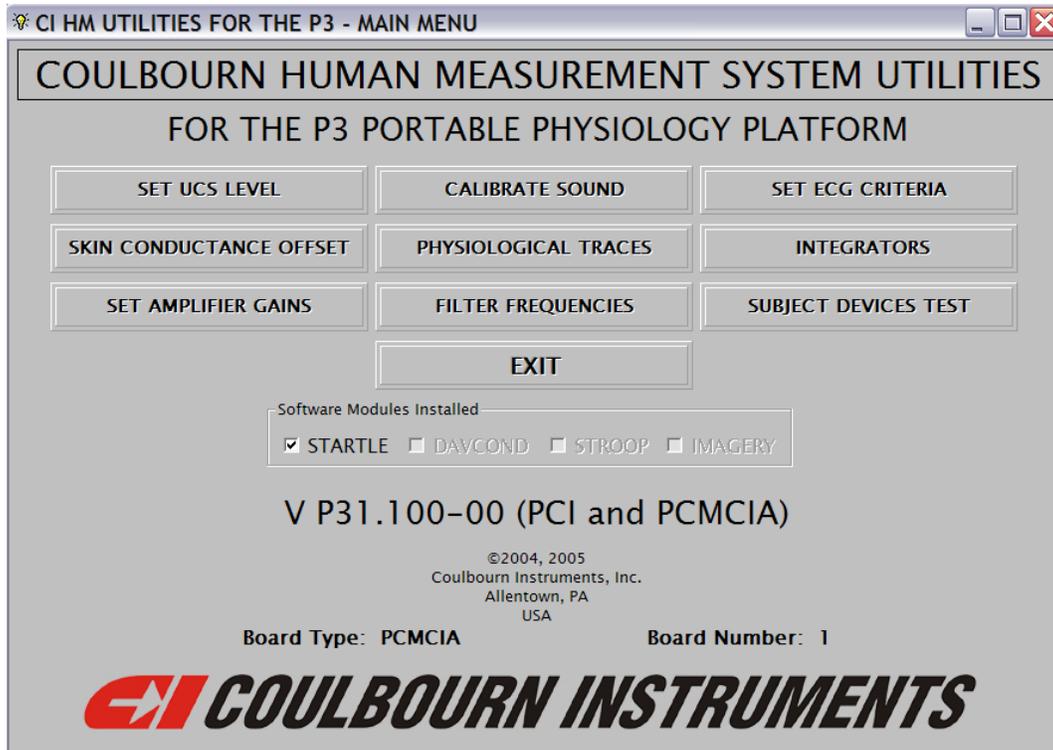


# COULBOURN HUMAN MEASUREMENT SYSTEM SOFTWARE FOR THE PORTABLE PHYSIOLOGY PLATFORM



## UTILITIES USERS' GUIDE

(HMS-500-P3)

**COULBOURN INSTRUMENTS**



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## Software Installation

Install the software by running the SETUP.EXE file on the distribution CD. Accept all the default options offered by the setup program. The P3 Utilities will be installed in the Program Files folder in a subfolder titled P3HMUTIL.

Start the application by running P3HMUTIL.EXE.

After the P3 Utilities software has been successfully loaded, the main menu shown on the cover page of this guide will be displayed. Note that this process may take several seconds since the interface board is detected and initialized at this time. The board type (PCI or PCMCIA) and the board number are shown at the bottom of this screen; the software used to install and configure the interface board assigns the board number.

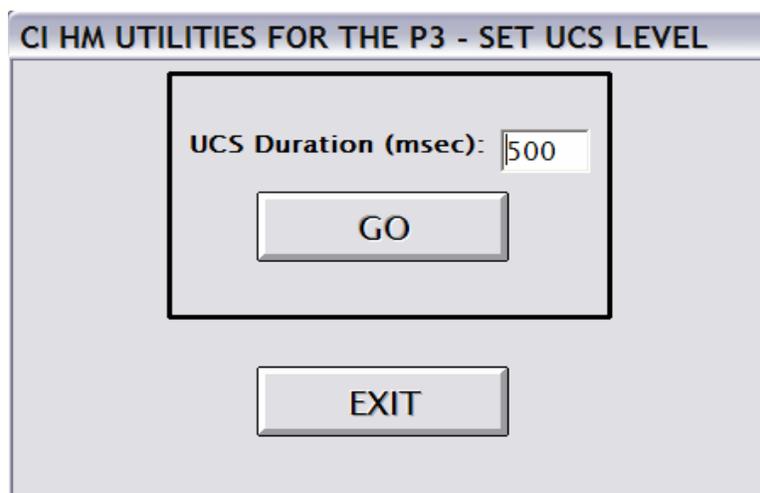
The Utilities program also detects which modules of the Human Measurement System are installed. In the example shown, only the Startle module is present. The Differential Aversive Conditioning, Stroop, and Script-Driven Imagery components are not available. As parameters are specified in the Utilities program, the appropriate entries will be made in the folders corresponding to the installed applications. If entries in the Utilities should not cause changes in the other modules, uncheck the option box associated with the application to be left unaffected.

The remainder of this guide will discuss each of the options presented in the main menu of the Utilities program.

### Set UCS Level

Aversive stimuli are used in the Differential Aversive Conditioning module and may, at the user's discretion, be used in the Startle module.

This option is provided to allow the user to set the intensity at which the UCS will be presented. The program will show the screen illustrated below when this option is selected.



Enter the stimulus duration in the text box and click the GO control. The program will enable stimulus output 3 on the P3 for the specified duration. Make adjustments in the stimulus presentation device as required. When a satisfactory level has been achieved, click the EXIT control to return to the main menu.

### Skin Conductance Offset

It is often desirable to apply an offset to the basal skin conductance level. This adjustment may be used in cases in which subjects display unusually high conductance levels (in order to anticipate changes which might exceed the range of the coupler) or to set up the coupler to accommodate a broad sample of subjects without further adjustment. The figure below is the screen for this option.

**CI HM UTILITIES FOR THE P3 - SCR SUBJECT OFFSET**

1. Remove SKIN CONDUCTANCE electrode cable from P3.
2. Set COUPLING switch to DC.
3. Set CAL/REF switch to RUN.
4. Select COUPLER SENSITIVITY to match hardware setting.
5. Click on BEGIN and adjust BALANCE control to achieve desired offset.

**Coupler Sensitivity**

10  50  100  500  1000

500

Offset is now:

**BEGIN** **WRITE** **CANCEL**

Prior to making adjustments to the offset, follow the instructions on the screen. Remove the skin conductance cable from the P3 input, set the COUPLING switch to DC, set the CAL/REF switch to RUN, select the desired COUPLER SENSITIVITY on the P3, and select the same sensitivity in the software by selecting the appropriate option button on the screen.

Click the BEGIN control to initiate sampling. A circular flashing symbol on the screen indicates that sampling is in progress.

Turn the BALANCE control on the P3 clockwise to decrease the offset and counterclockwise to increase the offset. The program will display the current offset (in  $\mu$ Siemens) based on the position of the BALANCE control and the selected sensitivity. You will note that as the BALANCE control is turned counterclockwise the offset will increase up to a point (this point will depend upon the sensitivity) and will not change further as the control is turned more. The control should not be turned beyond the point at which the offset ceases to change. If this happens, turn the control clockwise and adjust it so that the offset is at its maximum.

The figure below shows the maximum offset that may be applied when the sensitivity is set to 500 mV per  $\mu$ Siemens since the maximum (negative) voltage that can be added is -10V.

The screenshot shows a software window titled "CI HM UTILITIES FOR THE P3 - SCR SUBJECT OFFSET". Inside the window, there is a list of five instructions: 1. Remove SKIN CONDUCTANCE electrode cable from P3. 2. Set COUPLING switch to DC. 3. Set CAL/REF switch to RUN. 4. Select COUPLER SENSITIVITY to match hardware setting. 5. Click on BEGIN and adjust BALANCE control to achieve desired offset. Below the instructions, there is a section for "Coupler Sensitivity" with radio buttons for 10, 50, 100, 500, and 1000. The 500 option is selected. Below this, a text box displays the value "500". Further down, the text "Offset is now:" is followed by a text box containing "20.00" and a solid black circle. At the bottom of the window, there are three buttons: "BEGIN", "WRITE" (which is highlighted with a dashed border), and "CANCEL".

When the desired offset has been achieved, click the WRITE control and the program will write the offset value into the folders for the appropriate applications.

Click the CANCEL control to return to the main menu.

## Set Amplifier Gains

The gains for each of the four bioamplifiers included in the P3 are independently programmable. Select this option to set the gains. The screen below will be displayed.

**CI HM UTILITIES FOR THE P3 - BIOAMP GAIN SETTINGS**

**Bioamp Gain Settings**

**Channel 1**  
 500  1K  5K  10K  50K

**Channel 2**  
 500  1K  5K  10K  50K

**Channel 3**  
 500  1K  5K  10K  50K

**Channel 4**  
 500  1K  5K  10K  50K

**WRITE**

**OK**

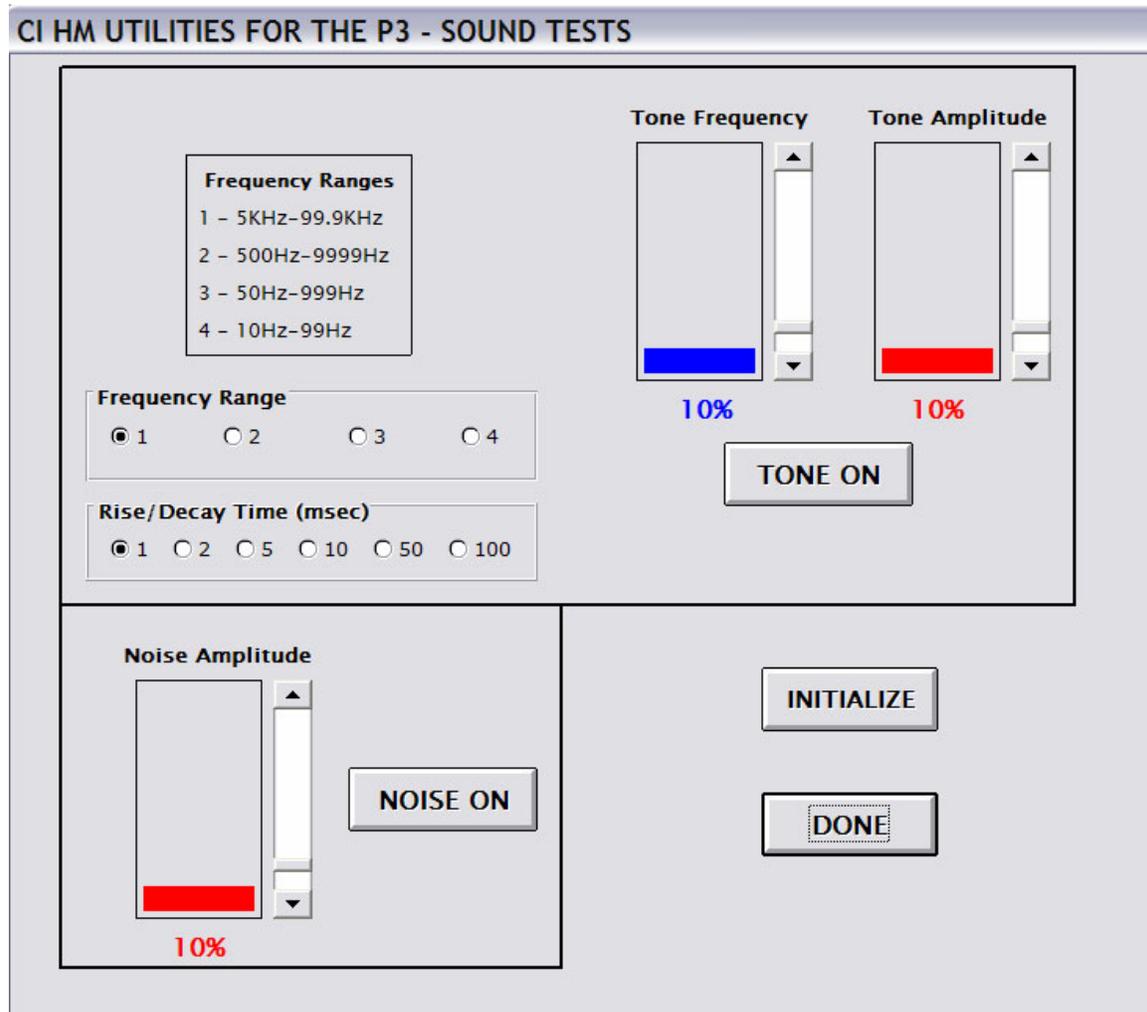
Select the desired gain for each of the bioamplifiers, then click the WRITE control to record the settings in the folder for the Utilities and the folders for each installed application.

Click the OK control to return to the main menu.

## Calibrate Sound

The P3 includes a tone generator with programmable amplitude, frequency, and rise/decay time; a white noise generator with programmable amplitude is also provided. An audio power amplifier is also included so that the P3 can drive headphones and loudspeakers directly.

Audio outputs must be calibrated in conjunction with the transducer that will be used. Calibration routines are included for tones and white noise. When the Calibrate Sound option is selected, the screen below will be shown.



To calibrate tone output, first select the frequency range by clicking the appropriate option button and select a rise/decay time. Enable the tone output by clicking on the TONE ON control (its caption will then change to TONE OFF). Adjust the frequency by sliding the Tone Frequency slide control or by clicking on the up/down arrows. Tone amplitude is analogously controlled by the Tone Amplitude controls. Disable the tone by clicking the TONE OFF control.

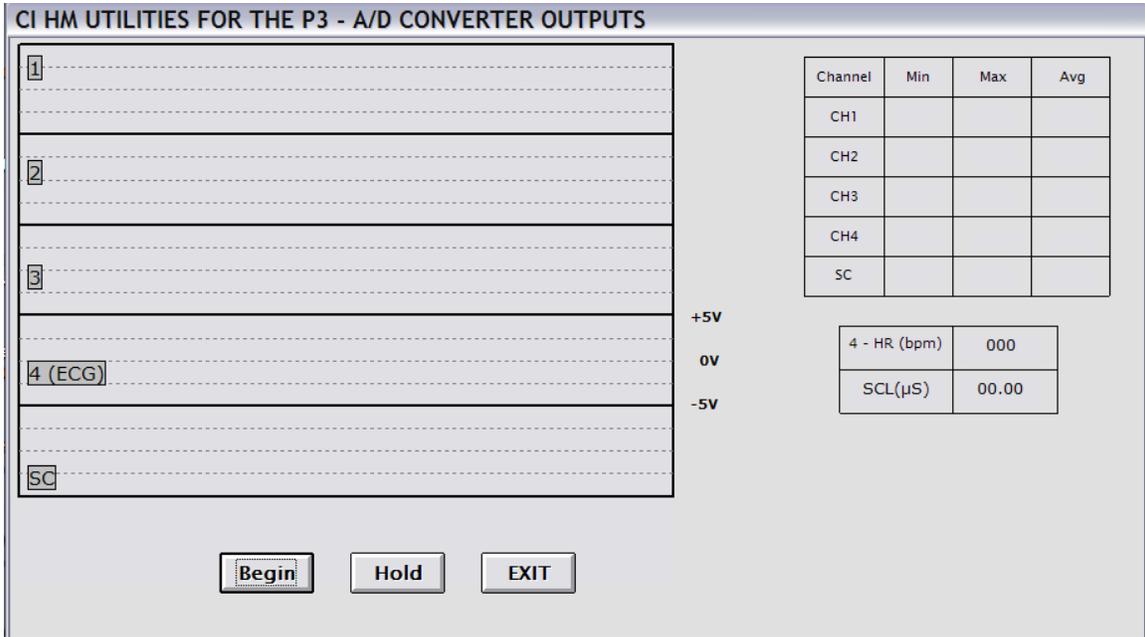
Enable noise output by clicking the NOISE ON control (its caption will then change to NOISE OFF). Noise amplitude is adjusted by the Noise Amplitude slider and the up/down arrows. Disable noise by clicking the NOISE OFF control. Note that tone and noise may be enabled simultaneously.

The INITIALIZE control is provided to return all values to their initial states. This will also be the case each time the Calibrate Sounds routine is invoked.

Click the DONE control to return to the main menu.

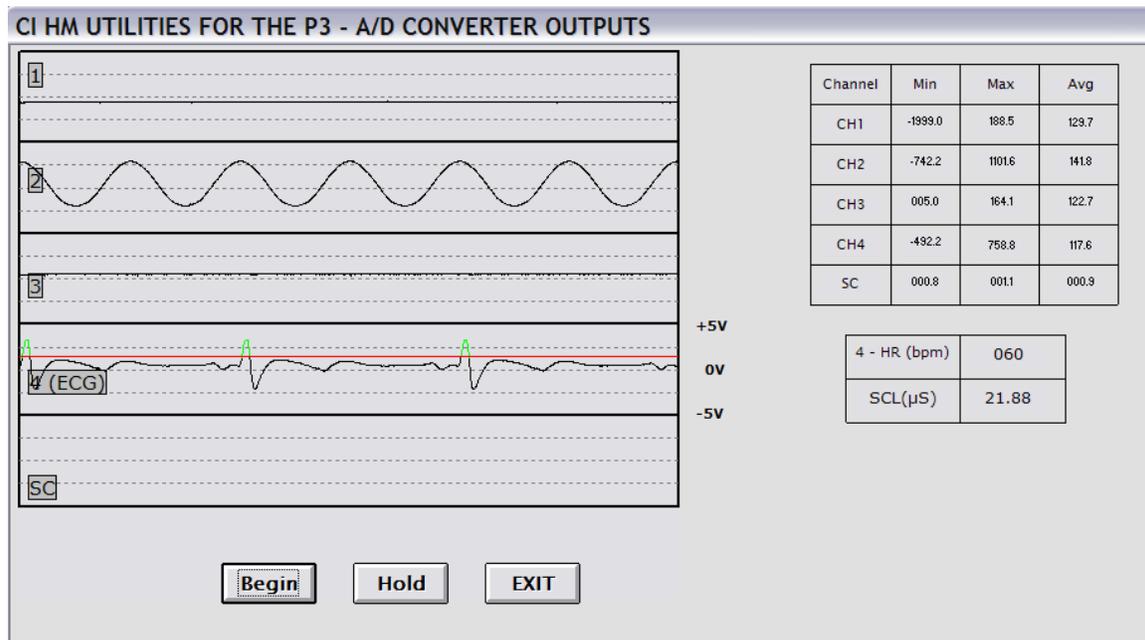
### Physiological Traces

This option is provided to allow the user to check electrode placement and integrity as well as amplifier/integrator settings. The screen below is shown when this menu item is selected.



The numbers 1 through 4 correspond to the four bioamplifier channels of the P3; note that Channel 4 is the preferred ECG channel and that the displayed heart rate will be based on activity on this channel. The SC channel displays the output of the skin conductance coupler.

Click on the Begin control to initiate sampling. Data will be collected on all channels for 3 seconds after which the display will be updated. The next illustration shows the screen following a sampling interval.



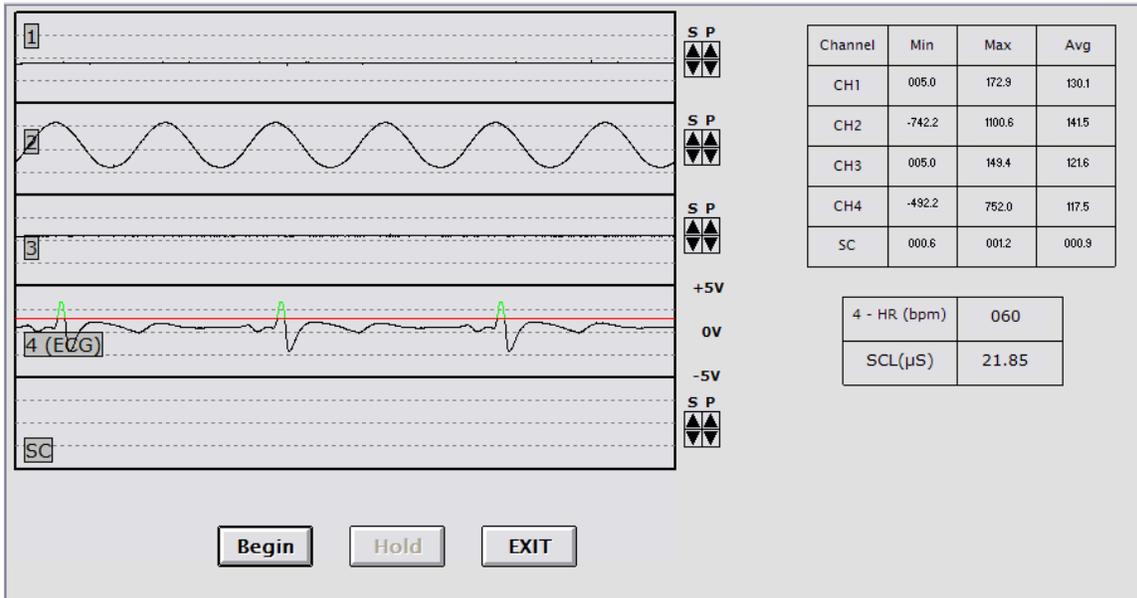
The input to Channel 2 is a sine wave at 120 Hz, and the input to Channel 4 is a 1 Hz simulated ECG waveform. Note the red horizontal line in the ECG strip and that the waveform is green when its value exceeds that specified by the red line. The line represents a criterion voltage set by the user (more about this below) and this value is used to detect the “beginning” of an ECG cycle. The times between positive-going crossings of this criterion are used to calculate inter-beat intervals and the IBIs are averaged to calculate the heart rate.

The values in the grid in the upper right part of the screen are minimum, maximum, and average voltages (in mV) observed on each channel during the most recent sampling period.

The smaller grid contains the average heart rate and skin conductance level.

The Hold control is used to “freeze” the information on the screen and to provide access to additional controls which allow altering the appearance of the traces on the display. The next illustration shows the screen after the Hold control has been clicked.

## CI HM UTILITIES FOR THE P3 - A/D CONVERTER OUTPUTS



The spin buttons to the right of Channels 1,2,3 and SC are used to adjust the sensitivity and position of the traces. These changes affect only the ways in which the data are displayed; no changes to hardware settings are made. The spin-up buttons increase sensitivity and move the traces up on the screen; the spin down buttons decrease sensitivity and move the traces down on the screen. Clicking the Begin control will remove the spin button controls and reinitiate sampling.

Click the EXIT control to return to the main menu.

### Filter Frequencies

Each of the bioamplifiers is equipped with filters which allow the amplifiers to pass the selected input frequencies. As is shown on the next page, low cutoff (high pass) and high cutoff (low pass) frequencies are selected for each channel. Note that there is a separate Write control for each channel. When the Write control is clicked, values for the filters for the selected channel are written into the folders for installed applications as well as into the Utilities folder. Choosing "OPEN" for the low cutoff will result in setting the low cutoff frequency to the setting of the AMPLIFIER COUPLING selected on the P3.

Click the OK control to return to the main menu.

## CI HM UTILITIES FOR THE P3 - BIOAMP FILTER SETTINGS

Bioamp Filter Settings			
Channel	Low Cutoff (High Pass) Setting	High Cutoff (Low Pass) Setting	
1	Low Cutoff (High Pass, Hz) <input checked="" type="radio"/> Open <input type="radio"/> 8 <input type="radio"/> 13 <input type="radio"/> 90 <input type="radio"/> 150	High Cutoff (Low Pass, Hz) <input type="radio"/> 13 <input type="radio"/> 40 <input type="radio"/> 150 <input type="radio"/> 1K <input checked="" type="radio"/> 3K	<input type="button" value="WRITE"/>
2	Low Cutoff (High Pass, Hz) <input checked="" type="radio"/> Open <input type="radio"/> 8 <input type="radio"/> 13 <input type="radio"/> 90 <input type="radio"/> 150	High Cutoff (Low Pass, Hz) <input type="radio"/> 13 <input type="radio"/> 40 <input type="radio"/> 150 <input type="radio"/> 1K <input checked="" type="radio"/> 3K	<input type="button" value="WRITE"/>
3	Low Cutoff (High Pass, Hz) <input checked="" type="radio"/> Open <input type="radio"/> 8 <input type="radio"/> 13 <input type="radio"/> 90 <input type="radio"/> 150	High Cutoff (Low Pass, Hz) <input type="radio"/> 13 <input type="radio"/> 40 <input type="radio"/> 150 <input type="radio"/> 1K <input checked="" type="radio"/> 3K	<input type="button" value="WRITE"/>
4	Low Cutoff (High Pass, Hz) <input checked="" type="radio"/> Open <input type="radio"/> 8 <input type="radio"/> 13 <input type="radio"/> 90 <input type="radio"/> 150	High Cutoff (Low Pass, Hz) <input type="radio"/> 13 <input type="radio"/> 40 <input type="radio"/> 150 <input type="radio"/> 1K <input checked="" type="radio"/> 3K	<input type="button" value="WRITE"/>

### Set ECG Criteria

As was noted above (under Physiological Traces), the user sets the criteria that determine the definition of an ECG cycle. These criteria are entered on the screen shown below.

### CI HM UTILITIES FOR THE P3 - ECG CRITERIA

Minimum Acceptable IBI:	<input type="text" value="400"/>
Maximum Acceptable IBI:	<input type="text" value="2000"/>
Criterion Voltage:	<input type="text" value="1.5"/>

To eliminate artifact, the user specifies the minimum and maximum values which will be allowed for inter-beat intervals. These are specified in milliseconds. In the example, heart rates below 30 BPM (2000 msec IBI) and above 150 BPM (400 msec IBI) will be considered artifact and not included in the IBI data. To determine the desired value based on BPM simply divide 60000 by the desired BPM. Additionally, the user enters the criterion voltage used to detect the onset of an ECG cycle. This voltage should be selected based upon the data displayed in the Physiological Traces routines.

The Write control will record the selected criteria in the appropriate applications folders as well as in the Utilities folder.

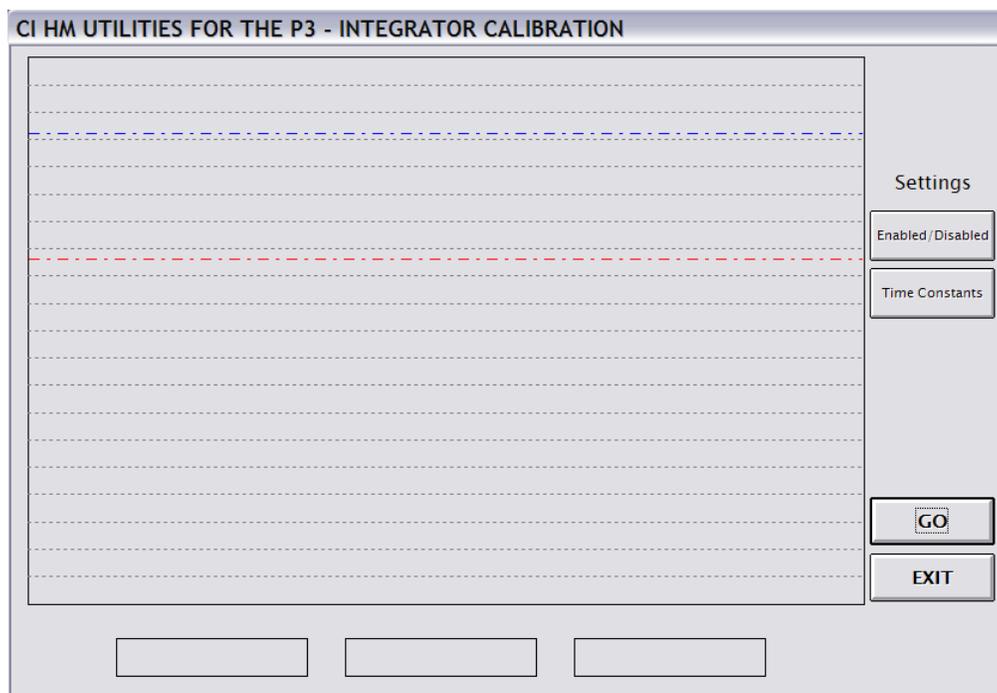
Click the DONE control to return to the main menu.

### Integrators

The P3 includes integrators for each of the bioamplifiers. In all of the Human Measurement System applications, data are digitized at 1 KHz. While this rate is sufficiently fast for many physiological modalities, some (EMG, for example) are better sampled after integration. The integrators are of the contour-following type, i.e. their outputs are proportional to the area under the curve formed by the signal being sampled. Also note that when signals are integrated they are also rectified; "area under the curve" therefore includes both the positive and negative portions of bipolar signals.

The integrators for each channel may be enabled or disabled and the time constant of integration may be separately specified for each channel.

The illustration below is the first screen displayed by the Integrators option.



Click the Enabled/Disabled control to display the screen shown here.

**CI HM UTILITIES FOR THE P3 - ENABLE / DISABLE INTEGRATORS**

**Enable/Disable Integrators**

**Channel 1**  
 Enable     Disable

**Channel 2**  
 Enable     Disable

**Channel 3**  
 Enable     Disable

**Channel 4**  
 Enable     Disable

**WRITE**

**OK**

The WRITE control will record the enabled/disabled states of the integrators in all installed applications and in the Utilities folder. Click the OK control to return to the main integrator screen.

The Time Constants control leads to the next screen shown. Select the appropriate time constant for each channel and click the WRITE control for that channel to record the integrator time constant for all installed applications and the Utilities folder.

The Integrator Test Channel is provided to demonstrate the effects of varying time constants. It will be discussed further below.

## CI HM UTILITIES FOR THE P3 - INTEGRATOR TIME CONSTANTS

**Integrator Time Constants (msec)**

<b>Channel 1</b> <input type="radio"/> 10 <input type="radio"/> 50 <input checked="" type="radio"/> 100 <input type="radio"/> 200 <input type="radio"/> 300	<b>WRITE</b>
<b>Channel 2</b> <input checked="" type="radio"/> 10 <input type="radio"/> 50 <input type="radio"/> 100 <input type="radio"/> 200 <input type="radio"/> 300	<b>WRITE</b>
<b>Channel 3</b> <input type="radio"/> 10 <input type="radio"/> 50 <input checked="" type="radio"/> 100 <input type="radio"/> 200 <input type="radio"/> 300	<b>WRITE</b>
<b>Channel 4</b> <input type="radio"/> 10 <input type="radio"/> 50 <input checked="" type="radio"/> 100 <input type="radio"/> 200 <input type="radio"/> 300	<b>WRITE</b>
<b>Integrator Test Channel</b> <input type="radio"/> 10 <input type="radio"/> 50 <input checked="" type="radio"/> 100 <input type="radio"/> 200 <input type="radio"/> 300	<b>WRITE</b>

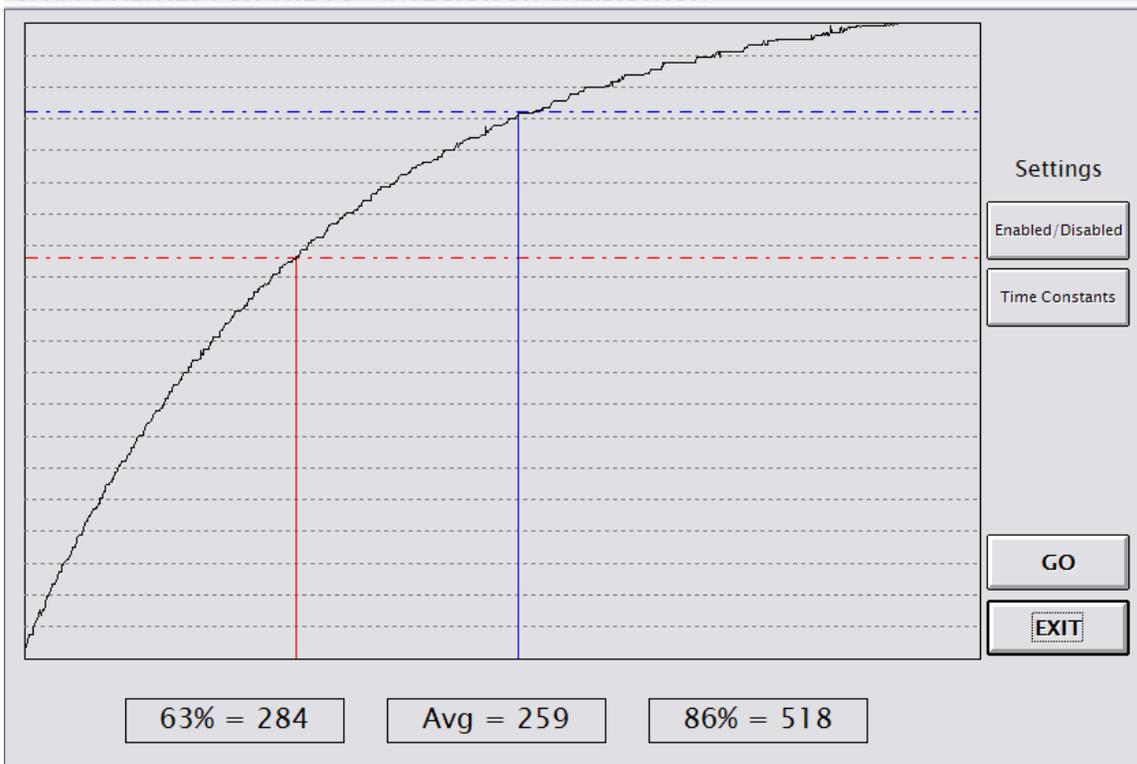
**OK**

Click the OK control to return to the main Integrators screen.

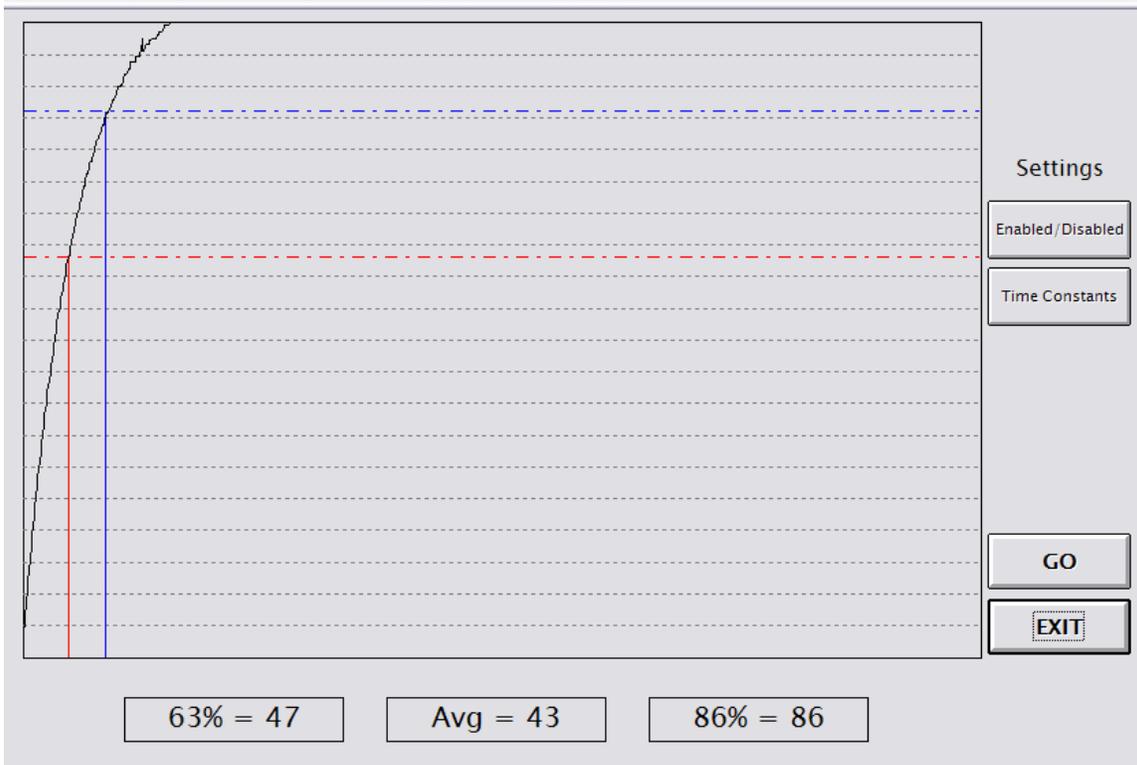
Click the GO control on the main Integrators screen to begin sampling of the integrator test channel.

The screens on the next page show the effect of integration on a square wave of 1 Volt amplitude. The first shows a relatively long integration time, and the second a shorter integration time. Note that integrating “smoothes” the square wave more as the integration time increases; the shorter the integration time, the more closely the shape of the original waveform is approximated.

### CI HM UTILITIES FOR THE P3 - INTEGRATOR CALIBRATION



### CI HM UTILITIES FOR THE P3 - INTEGRATOR CALIBRATION



Click the EXIT control to return to the main menu.

## Subject Devices Test

In several applications included in the Human Measurement System, external devices are employed to present stimuli or to control experiment conditions. For example, a second monitor may be turned on and off or a second mouse may be enabled or disabled. This option allows the user to test the status of these devices.

The monitor and mouse outputs are stimulus outputs 1 and 2 of the P3. Clicking the respective ON controls will turn these outputs on, and they will remain on until the appropriate OFF control is clicked. The UCS output (stimulus output 3) will be turned on for 500 msec each time its ON control is clicked. The LED indicators on the P3 will be green when outputs are on and red when they are off.

Click the EXIT control to return to the main menu.

