The MicroMini Motionlogger Actigraph and Family of Single Sensor Recorders

User's Manual to Accompany Act Millennium version 3.5.0.0 and higher

Revision 3.0

Ambulatory Monitoring, Inc.
731 Saw Mill River Road
Ardsley, New York 10502

Phone: 914-693-9240
Fax: 914-693-6604
Toll Free: 1-800-341-0066
(available in most countries by accessing AT&T USA Direct®)

Website: www.ambulatory-monitoring.com
Email: info@ambualtory-monitoring.com

Introduction 4
Sensor types 4
Motionlogger® Actigraphy 4
Motionlogger® Modes of Operation 4
Light Sensor 6
Temperature Sensor 6
Sound Sensor 6
Battery Type 6
Fixed Battery 6
Rechargeable 7
Replaceable 7
Methods of Attachment 7
Simple Strap Back-Plate 7
The Faux-Watch Configuration 7
Pin Attachment 8
Plain 8
MicroMini Header Information 8
Wakeup Time and Date – future or immediate startup 8
ID Field - Identify oner Motionlogger data 8
Configuring ACT Millennium 8
Configuring Communications (Interface Type, Com Port and Baud Rate) 9
Configuring Actigraph Type 10
Configuring Battery Life Warning and Refusal Levels 11
Considerations for Rechargeable Battery MicroMinis 11
Operating the MicroMini Motionlogger Actigraph 12
MicroMini Initialization 12
Inserting the MicroMini into its Interface 18
Checking that the MicroMini is Running 20
MicroMini Data Download 20
MicroMini Battery Usage 23
Checking the MicroMini Battery Log 23
Conserving Battery Power 23
ACT Millennium Diagnostics 23
Loop Test 23
Hardware Installation of the Loop Tester Device 23
Using the Loop Tester Device with ACT2000 Windows Software 24
The MicroMini Charger (MMC) 24
MMC Operational Setup 25
More ACT Millennium 27
File Submenu 27
Opening a File 27
Saving an Motionlogger File 28
ACT Millennium Graphics 31
Page Navigation 33
Cursor Movement 34

Marker Manipulations 34
Zooming 35
Compression 40
Printing and Copying 42

Introduction

This section describes the various types of MicroMinis and the sensor characteristics of these single channel recorders. MicroMinis may be divided into groups based on the various sensor types and then physical configurations of attachment and battery power types

Sensor Types
Actigraph
Light
Temperature
Sound

Battery Types
Fixed
Rechargeable
Replaceable

Methods of Attachment
Simple strap back-plate
Faux Watch Style Bezel
Pin
Plain (no attachment)

Many combinations of the above are possible. With the notable exception that the 'Replaceable' style battery is a special case design with its own specific attachment method (see below).

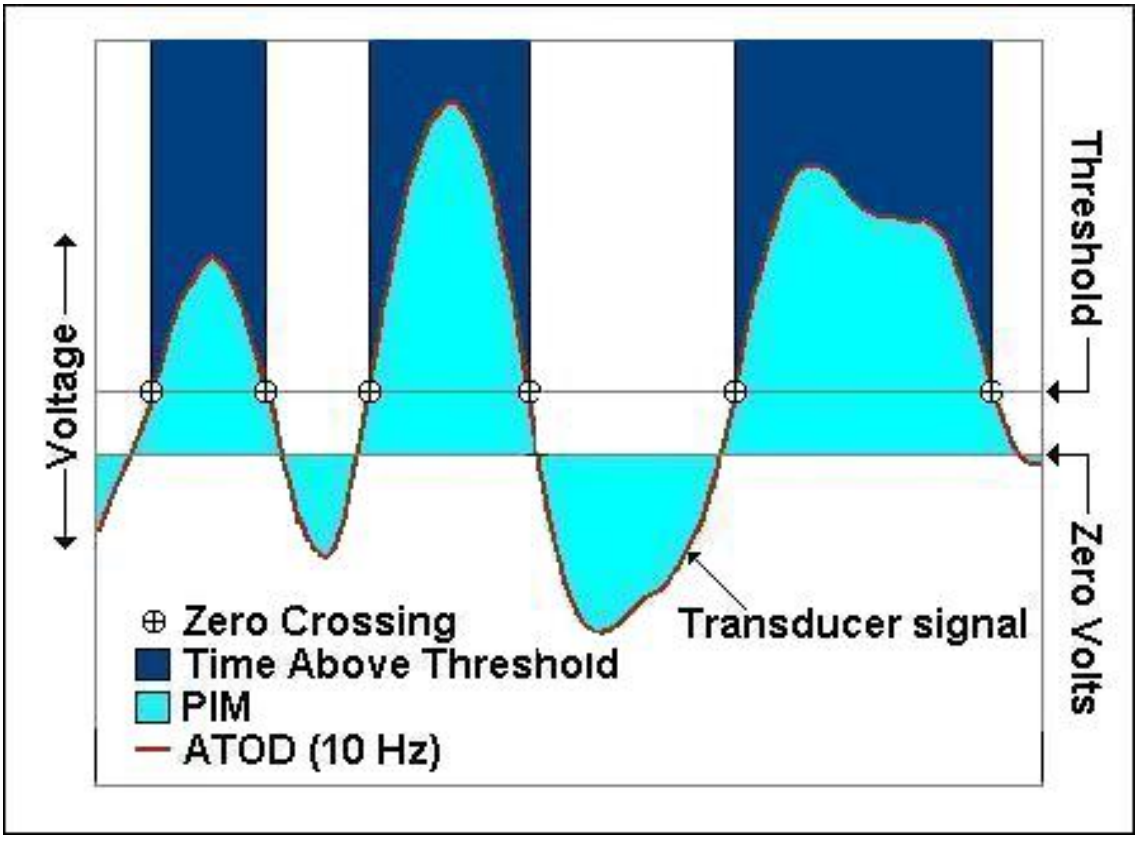
Sensor types

Motionlogger® Actigraphy

The Motionlogger utilizes a precision piezoelectric bimorph-ceramic cantilevered beam, which generates a voltage each time the actigraph is moved. That voltage is passed to the second essential element of the Motionlogger, the analog circuitry. Here the original signal is amplified, and filtered according to the 2-3 Hz bandpass filter. What is done with this conditioned signal depends on the mode of operation employed by the Motionlogger (see descriptions below). Derived information based on the mode of operation is accumulated over a fixed 1 minute time period know as an epoch before being stored in the memory of the device. Once memory is full, data collection stops. Memory is never overwritten unless the Motionlogger has been re-initialized.

Motionlogger® Modes of Operation

The conditioned analog activity signal can be processed in many different ways to provide information about the subject's motion. The MicroMini uses the most popular subset of all the possible Motionlogger modes of operation and can measure either frequency or intensity of motion. The following is a discussion of these modes:



Zero Crossing (ZC) Mode
The conditioned transducer signal is compared with a fixed sensitivity threshold. The number of times the signal voltage crosses the reference voltage is accumulated in temporary memory storage until the user-defined epoch length has transpired. If the time base of the above graph were a 1-minute epoch, then the value stored in memory for this epoch would be 6. *Zero Crossing is a measure of frequency of movement.*

Proportional Integrating Measure (PIM) Mode
A high-resolution (maximum value is 65,535) measurement of area under the rectified (absolute value) conditioned transducer signal is known as the PIM (Proportional Integrating Measure) Mode. *Proportional Integrating Measure is a measure of activity level or vigor of motion.*

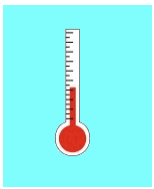
Which Mode is Right for My Application?
Historically, Zero Crossing was the most popular mode of operation because of its ability to estimate sleep with a high degree of accuracy. The bulk of the literature published to date has been using this mode of operation, particularly on the topic of sleep. Recent studies have shown that the great resolution of the PIM mode is at least as good, if not better, at evaluating sleep. Further, PIM mode has proven very useful in studies on energy expenditure and hyperactivity. AMI analysis software provides a validated sleep estimation for the LoPIM mode only.

Lo PIM and Hi PIM
HiPIM is a special mode of PIM where the gain of the original transducer signal is approximately doubled and is offered for use in investigations of activity where movements would be considered small by most human standards, i.e. premature infants, disabled, or otherwise immobilized subjects. *For the majority of human motion studies* ***LoPIM*** *is the recommended mode of operation.*

Light Sensor

The light sensor MicroMini can be ordered in one of two ranges. The Low range Light Data scaling is 0-1082 Lux, with 4.4 Lux increments. The High range Light Data scaling is 0-4000 Lux with increments of 16.26 Lux. Each recorded value is the average of eight readings per minute. The unit will record one value per minute for 22 days and 16 hours before going to low power mode. The light sensor is cosine corrected and has a photopic filter the sensor is used linearly and is independent of ambient temperature changes.

Temperature Sensor



The temperature sensor MicroMini is calibrated to register a range of 27.0 – 52.6 deg C, with 0.1 deg C increments. Each recorded value is the average of eight readings per minute. The unit will record one value per minute for 22 days and 16 hours before going to low power mode.

Sound Sensor

The sound level scaling is set to an arbitrary range of 0-255. The low range unit is very sensitive, for ambient sound (bedside, etc.) measurement. The high range unit is about 0.1 times as sensitive, but has 10 times the range, for contact microphone measurements. Each recorded value is the average of eight readings per minute. The unit will record one value per minute for 22 days and 16 hours before going to low power mode.

Battery Type

Fixed Battery

This configuration offers the highest degree of water tightness and is suitable for applications where swimming or other submersions, which may be several feet but of short duration, might occur. **NOTE: do not expose any MicroMini to prolonged (greater than 1 hour) continuous submersion. Call AMI for additional waterproofing techniques.** The plastic sealing the case has a certain permeability that would cause water to eventually diffuse inside. Fixed batteries have a 5-year shelf life and will provide approximately six months (4320 hours) of service. When a low battery indication is given, the unit should be returned to AMI for battery replacement. This battery type is compatible with all attachment types.

Rechargeable

These instruments can be identified by two gold charger pins located on the top plate. A fully recharged MM will run for 21 days, which also corresponds to the maximum amount of time necessary to fill memory. The rechargeable lithium battery will take 36-48 hours to fully recharge. Refer to the section on the recharger for more information. This battery type is compatible with all attachment types.

Replaceable

When the battery cover is properly tightened, this configuration offers the same high level of waterproofing as the fixed-battery configuration. This configuration provides its own means of attachment. The wrist-strap passes through the battery compartment cover plate that can be opened by means of 4 screws. While somewhat bigger and heavier than the two other battery types configurations, this unit has the advantage of the same long battery life (six month , 4320 hours of operation) and shelf life while allowing the convenience of allowing the user to replace the inexpensive coincell battery on his/her own. Refer to the section on battery replacement for more information.

Methods of Attachment

Simple Strap Back-Plate

This method provides the smallest and lightest configuration at 0.5oz (14g) and 1 inch (2.5 cm) diameter by .35 inch high (0.9cm). This method is compatible with either fixed or rechargeable batteries and all sensor types. When used in conjunction with a temperature sensor this configuration would record *ambient* temperature.

The Faux-Watch Configuration

This attachment method encloses the MicroMini in a watch type housing making the unit slightly heavier at 0.8 oz (23g). This attachment method allows the plastic shell a larger degree of protection by surrounding the circumference of the device with metal. The gently sloping profile of the face makes it less likely to be caught on things such as doorframes or furniture. A watch face graphic (others are possible) completes this unit making it almost undetectable to the casual observer. This attachment method is compatible with either fixed or rechargeable batteries and all sensor types. When used in conjunction with a temperature sensor this configuration would record *ambient* or *skin* temperature (depending on which way the sensor is installed).

Pin Attachment

This attachment style is used primarily with the light and sound sensors to allow the subject to attach the sensor to the clothes and register ambient conditions. This attachment method is compatible with either fixed or rechargeable batteries.

Plain

The sensors may be supplied without any means of attachment. Users may apply the sensors in any way they choose. This is particularly popular with the temperature modes that can be applied to the skin with various types of surgical tapes. Contact AMI for more information and recommendations.

MicroMini Header Information

The MicroMini features a fixed 1-minute epoch length, 32K of non-volatile memory for 22 days of data storage in Temperature, Light, Sound and Activity in Zero Crossing (ZC) mode and 11 days for activity in either of the PIM modes. "Non-volatile" means that even if the battery, which, can log up to 4000 hours of runtime, becomes exhausted the data remain intact. Data can be retrieved once the battery is replaced or recharged. In the case of fixed battery units being returned to the factory, please note in the packing materials that this unit contains unrecovered data.

-

The programming and use of the MicroMini can be compared to that of a VCR (Video Cassette Recorder). One specifies when it will start, how long it will run, and what type of information it will record.

The MicroMini collects data based on user-programmable header information. The following is a discussion of all the possible elements and options:

Wakeup Time and Date – future or immediate startup

All MicroMini models have the capability of immediate startup (within 3 minutes) or future startup. "Future" startup is useful when two or more MicroMinis are to start simultaneously. Remember, since MicroMinis synchronize with the time on ones computer's clock, it is important to make sure it is accurate. Also, time is expressed in military format (i.e. 1 PM is expressed as 13:00).

Common Problem: Improper use of Military (24 Hour) style time, either in the header or in setting the time of one's computer can result in 12-hour time discrepancies.

ID Field - Identify Motionlogger data

This is a field of 30 characters available for text entry. Use it to identify the test, group or subject.

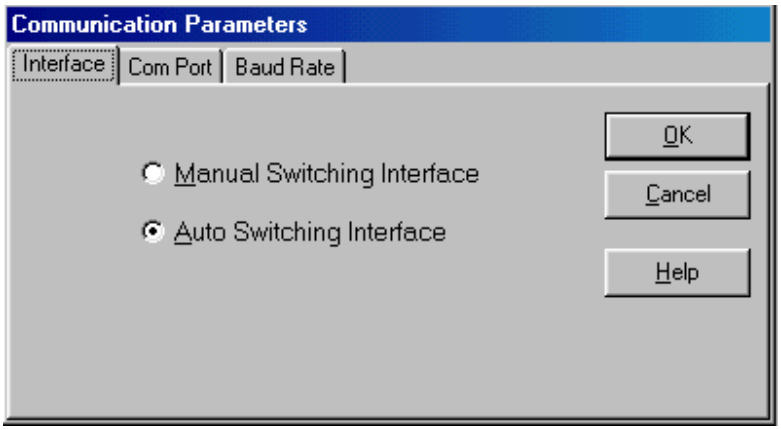
Configuring ACT Millennium

Before proceeding to initialize or download any MicroMinis, it would be a good idea to configure ACT Millennium to match one's existing hardware. This is accomplished by selecting items from the Configuration menu. In addition to editing one's configuration,

one can save the new configuration, load up one's last saved configuration, and reset one's configuration to the default values.

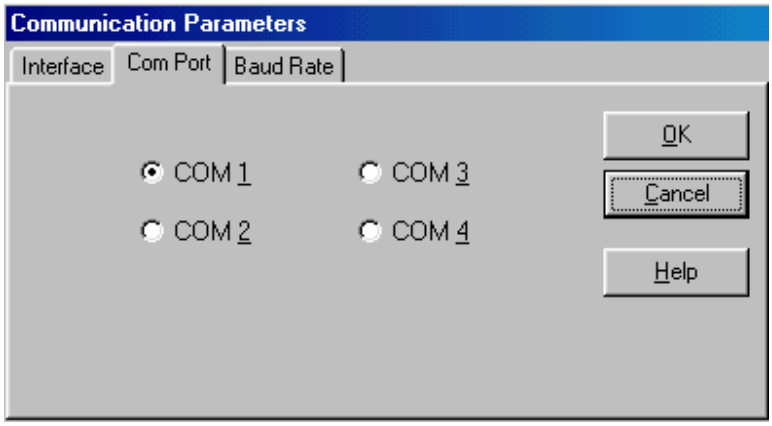
Configuring Communications (Interface Type, Com Port and Baud Rate)

The figure below shows the configuration window when the *Communications* item is selected:



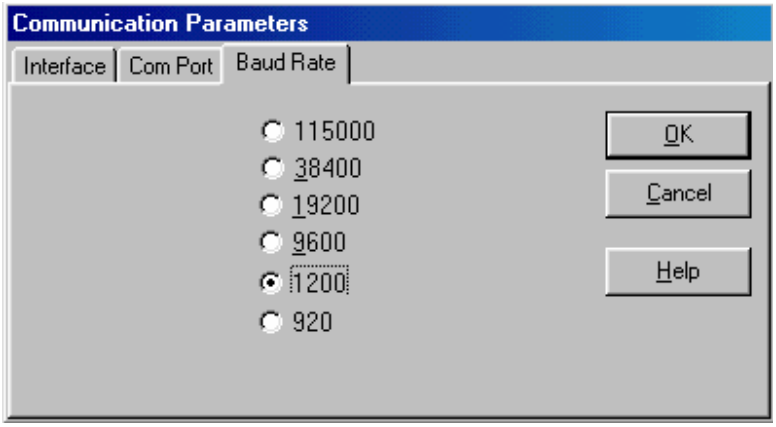
Notice the four tabs appearing at the top. These tabs permit one to select which configuration parameters need to be set. Choose the Interface type that matches one's hardware. All BASIC Motionloggers and SleepWatches are supplied with an Auto Switching Interface.

Pressing the Com Port Tab shows this selection:



Here is the serial port selection. Choose the computer port that one have (or will) attach one's interface unit to. Many computers and laptops sold these days have only on serial port available and it is COM1. So when in doubt choose this.

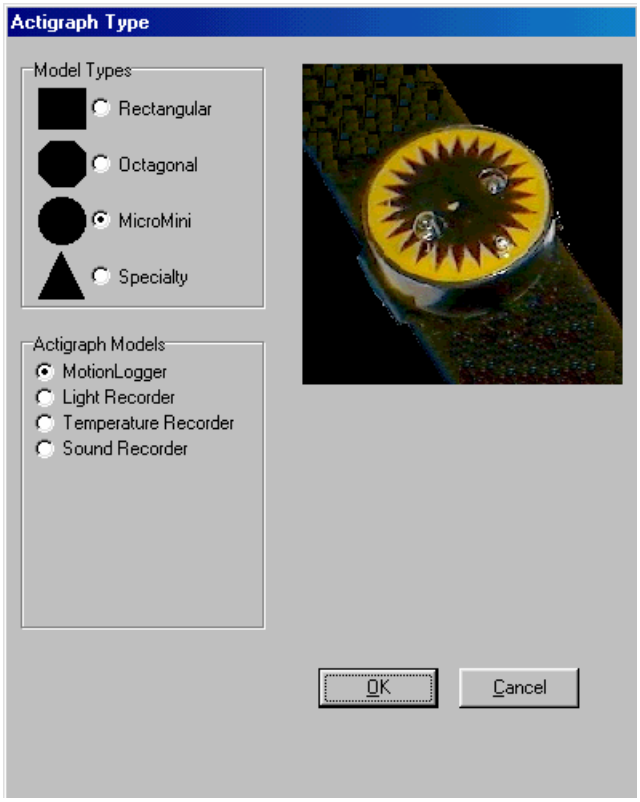
Selecting the Baud Rate Tab shows this screen:



Note that MicroMinis **require** 1200 Baud. This value is automatically set if MicroMini type has been chosen (see below).

Configuring Actigraph Type

While not all MicroMinis are necessarily actigraphs, this choice is used to configure the device default setting to MicroMini. From the Configuration menu, choosing *Actigraph Type* causes this screen to be displayed:

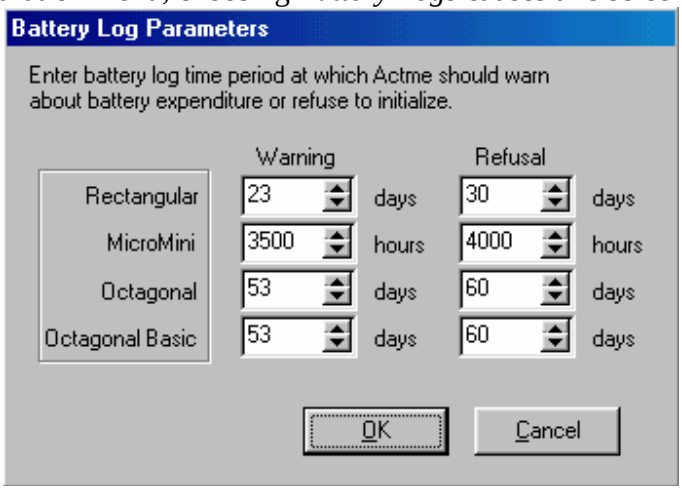


Under *Model Type* choose MicroMini. Then choose the type of device one plan to use. Please consult the original invoice or AMI if one are unsure about device type.

If one have more than 1 type of device to use, choose the one that will be used most frequently. Within the initialization process there will be an opportunity to make temporary modifications to this setting.

Configuring Battery Life Warning and Refusal Levels

From the Configuration menu, choosing *Battery Logs* causes this screen to be displayed:



"Battery Log Parameters" allows one to customize a warning level and refusal level for battery life. Making them as conservative as needed. During the initialization process, if the battery life has been exceeded then initialization will be refused until the devices battery has been changed or the refusal level has been increased. At the warning level one will be informed of the number of hours logged on the device's battery and remind the user about the approaching refusal level. One can ignore the warning levels and proceed with initialization or choose to change the battery at this time.

The MicroMini battery log settings above would be typical for fixed or field replaceable battery types, with a warning displayed so that one has time to purchase a new battery (field replaceable) or arrange to have the MicroMini returned to AMI (fixed battery).

Considerations for Rechargeable Battery MicroMinis

In the case of rechargeable batteries, one should consider one's typical usage profile when adjusting these configurations. For example if one typically uses the device for 4 days (96 hours) at a time then one should not initialize a MicroMini that has less than 96 hours of battery life left. A fully charged battery will power the unit for 22 days (the maximum amount of time necessary to fill memory) or 528 hours. So the refusal level should be (528-96) 432 hours. If one would like to be warned about the need to recharge at the penultimate initialization, then set the warning level to (432-96) 336 hours.

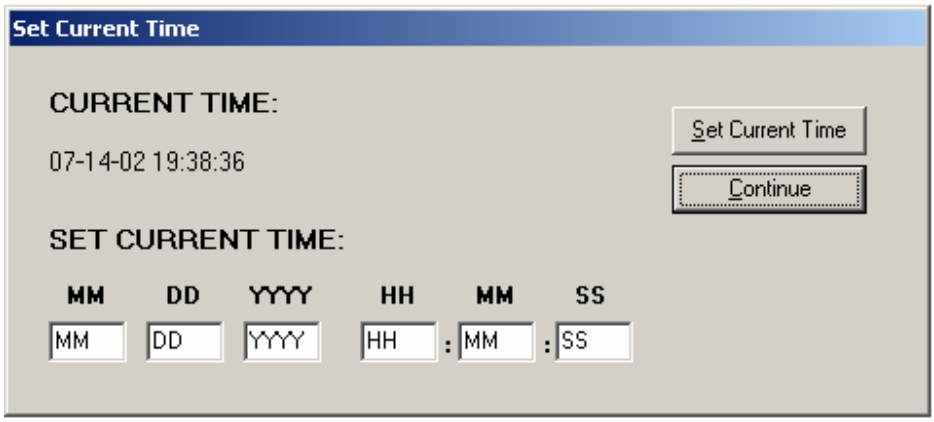
After completing the configuration settings, make sure that the configuration is saved. (Configuration: Save).

For temporary changes in configuration, one can click items on the status bar to bring up their corresponding configuration menu.

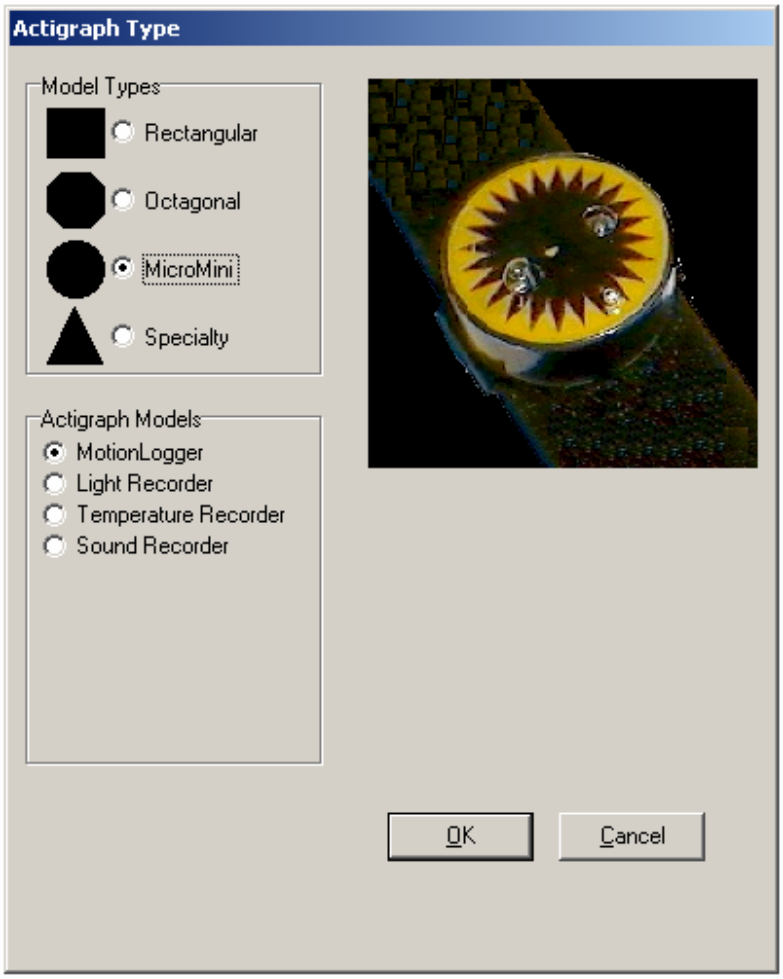
Operating the MicroMini Motionlogger Actigraph

MicroMini Initialization

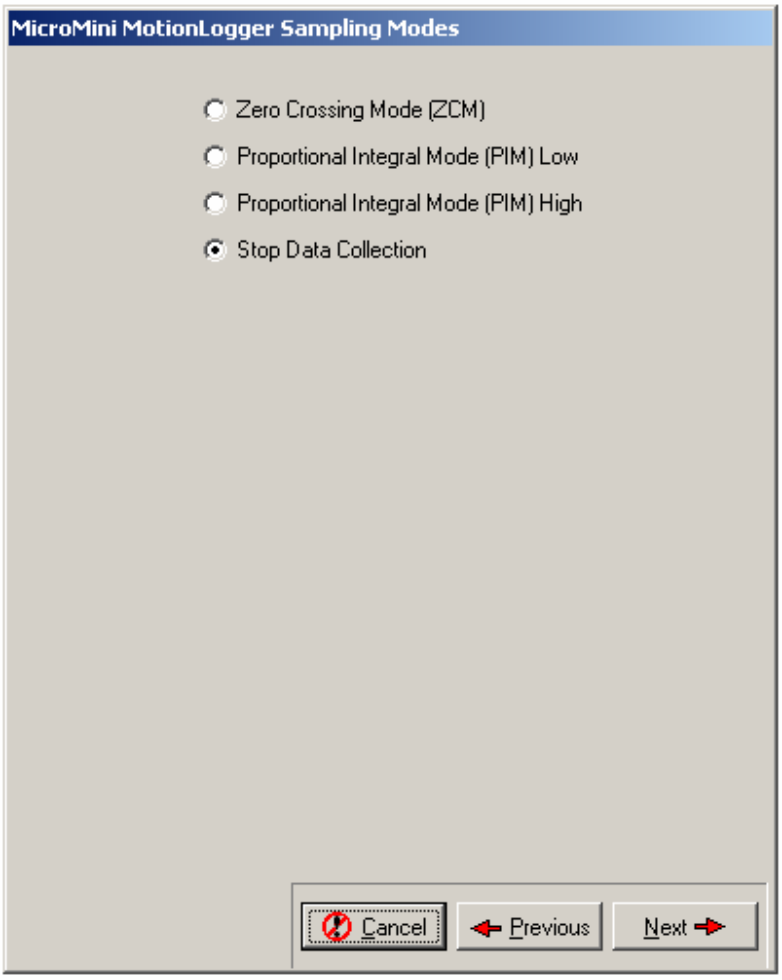
Select the Actigraph: Initialize menu item or simply click the button. Make sure that the MicroMini is in the Interface. The first dialog box to appear is shown in the figure below. This box permits one to correctly set the computer's time and date. Type in the correct month, day, year, hour, minutes and seconds using the tab key to move between fields. Then click the Set Current Time button to set the time. If the computer's time does not need adjustment, just click on the Continue button.



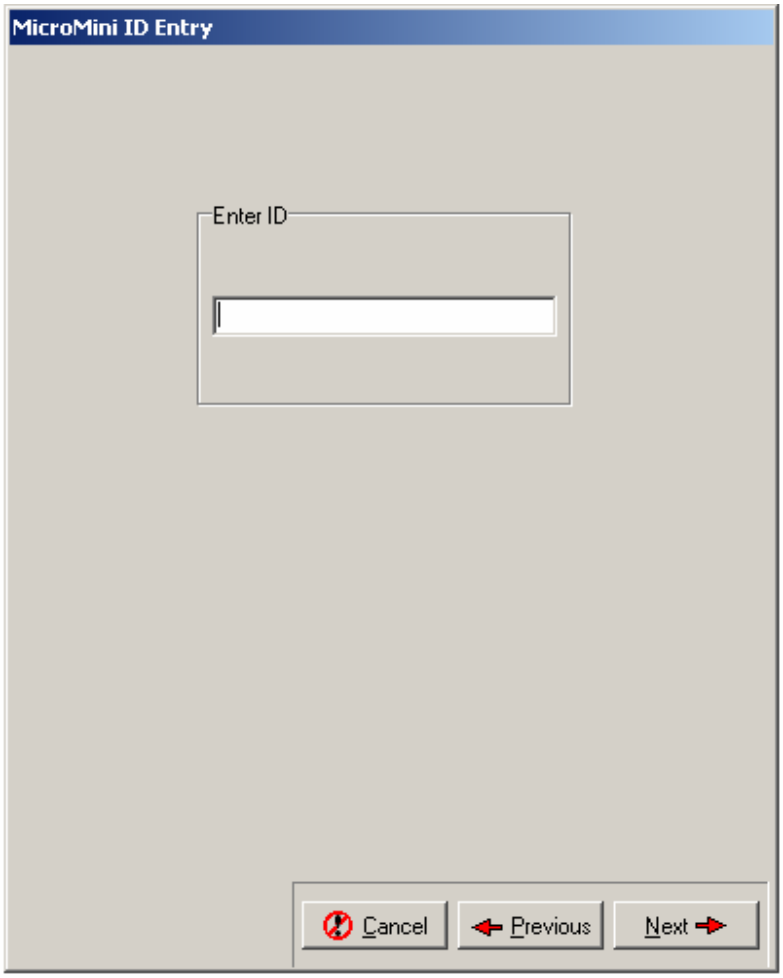
Now the Actigraph Type window is displayed as shown in the figure below. In the Model Types section, select the MicroMini. For activity monitoring select the MotionLogger from the Actigraph Models section. Otherwise choose Light Temperature or Sound. Click the OK button to proceed.



If Motionlogger was selected one is presented with the operational modes supported by the MicroMini Actigraph. Zero Crossing Mode (ZCM) and Proportional Integral Mode (PIM) can be selected. See the section on modes of operation earlier in the manual for a description of these modes. Stop Data Collection is used to put the Unit into a low power state (for storage). After choosing a mode, click Next button to continue.

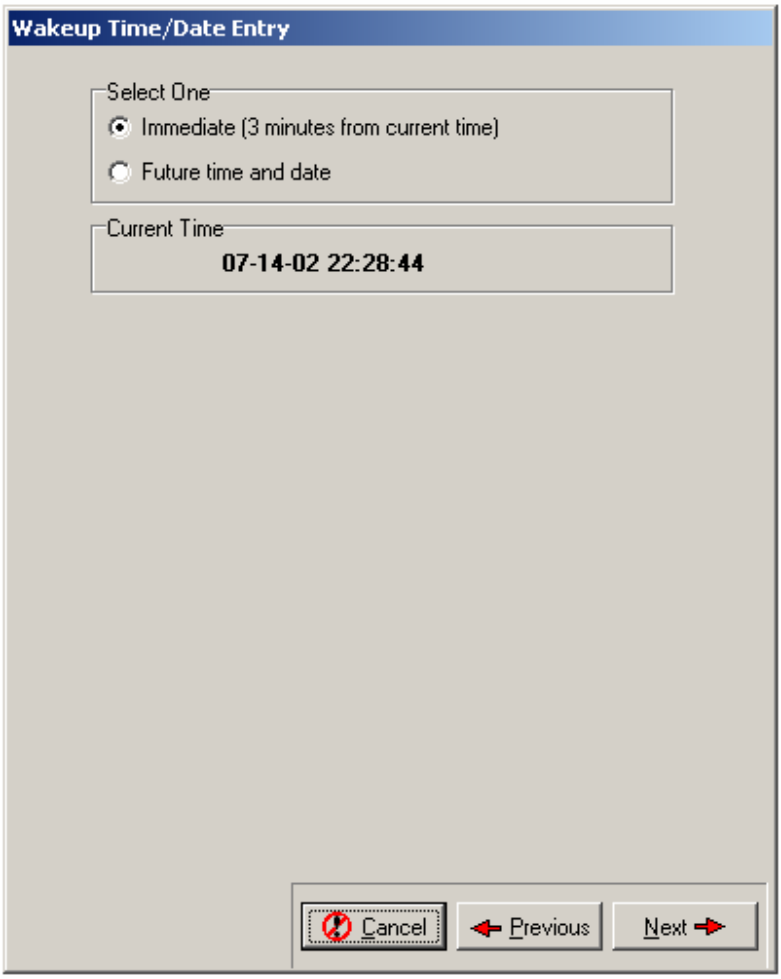


Next enter an ID for the MicroMini sampling session. The figure below shows the dialog box used to type in a MicroMini ID. After entering an ID, click the Next button to continue.

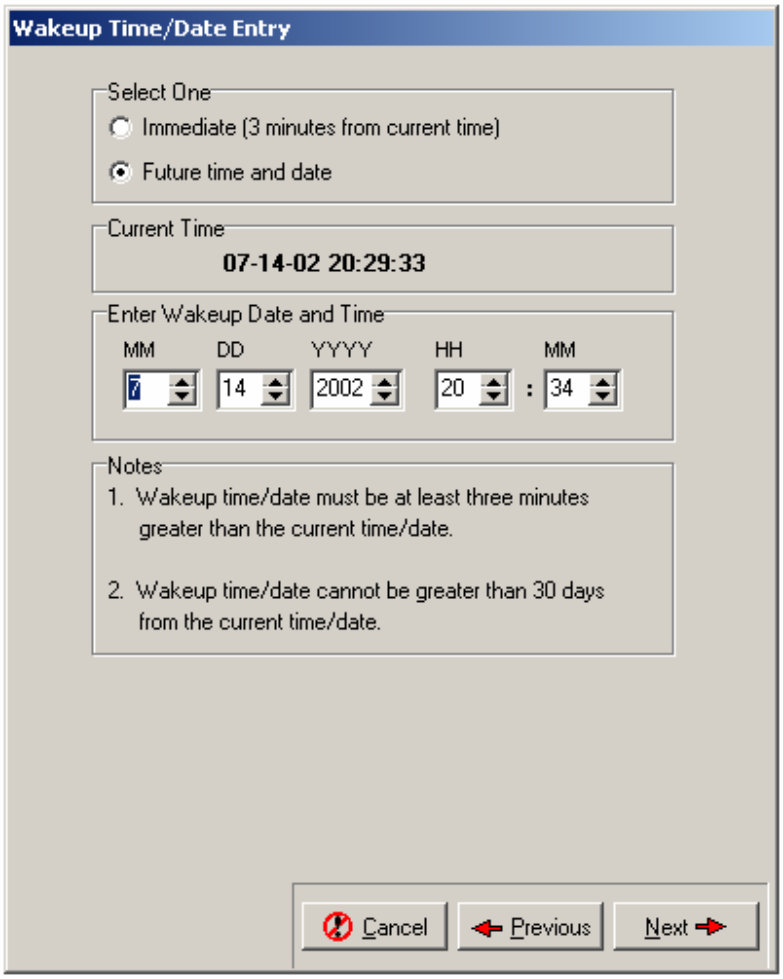


At this point it is necessary to decide whether the MicroMini will start immediately (within three minutes) or start at some future time. The Future startup feature is convenient when multiple MicroMinis are to be synchronized. The figure below shows the dialog box that is used to make that decision. Click on the startup condition desired and then click the Next button to continue.

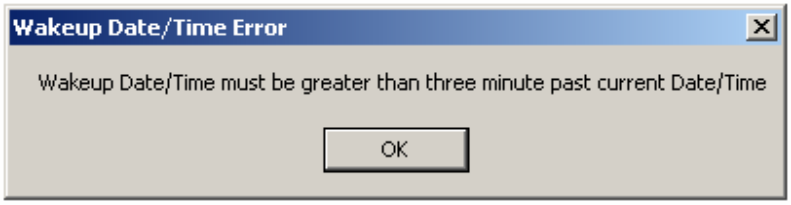
"Immediate' start ups automatically sets the startup time 3 minutes past the current time. to continue, click on the Next button (see figure below).



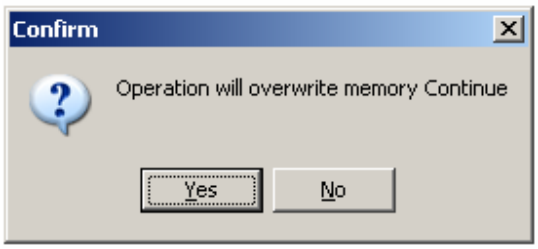
If a future start up condition is selected, one will be presented with the dialog box shown in the figure below. Enter in the month, day, year, hour and minute of the device should commence data collection. Time spent waiting for the startup time and date expend a very small amount of battery power which would be insignificant for delays of up to a week. Longer delays should be tested, particularly with rechargeable batteries, to make certain that a long delay does not impact recording time by shortening battery life. To continue, click on the Next button.



The Wakeup Time/Date cannot be greater than 30 days from the current Time/Date. If the Wakeup Time/Date is larger than 30 days from the current date the following message will be displayed as shown in the figure below. Clicking the OK button will take one back to the Wakeup Time/Date Entry form.

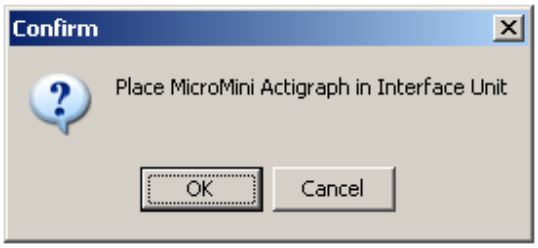


Since initialization erases any previous data, an Overwrite verification dialog box is displayed as shown in the figure below. If one are sure that one want to initialize the MicroMini click the YES button.



If one does not wish to initialize the MicroMini click the NO button. The following message will be displayed as shown in the figure below.

If the Yes button was chosen, the following message will be displayed as shown in the figure below. After inserting the MicroMini, click the OK button.

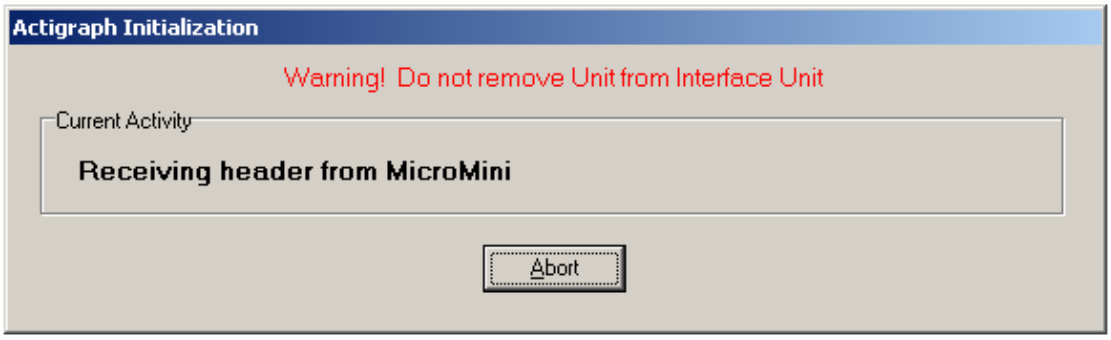


Inserting the MicroMini into its Interface

The MicroMini is placed face down in its receptacle. A small protrusion on the face of the MicroMini will fall into a corresponding hole in the receptacle when the optical sensors are properly aligned. Rotate the MicroMini in its receptacle until one feel the protrusion on the MicroMini fall into this hole in the receptacle.

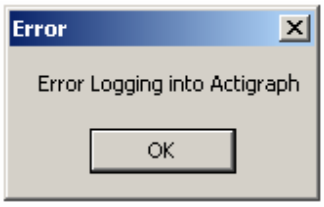
NOTE: The MicroMini uses an IR (infrared) communications technique. This technique is unaffected by normal fluorescent office lighting, but can be confounded by bright sunlight (direct or indirect). In environments where ambient light has a high IR content, it may be necessary to shade the Interface to enhance operation.

The window displayed below is the Actigraph Initialization form which shows the progress of the MicroMini's initialization process. Press the Abort button to stop the initialization process.

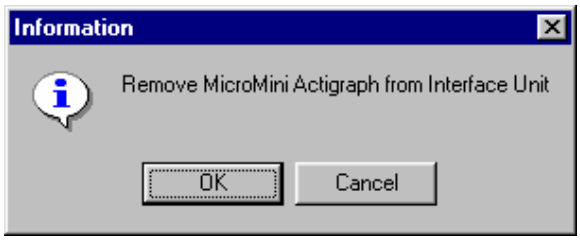


Clicking the Abort button will stop the MicroMini initialization and display the message shown in the figure below.

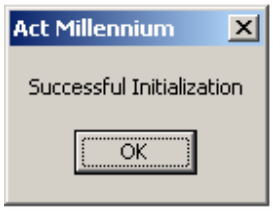
If the MicroMini is not in the Interface Unit or is inserted incorrectly into the Interface the following message will be displayed as in the figure below. Place the MicroMini into the Interface Unit and click the OK button.



At the completion of the initialization process the software will instruct one to remove the MicroMini. Do so and click the OK button (see figure below).

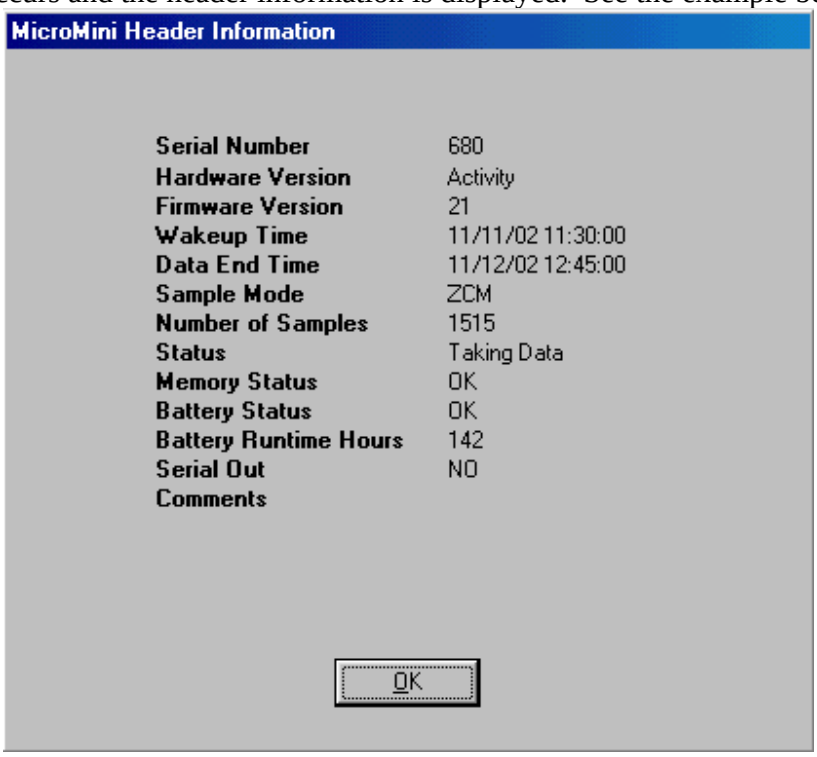


If the MicroMini is initialized successfully, then the dialog box shown in the figure below is displayed. One may now remove the MicroMini and begin using it.



Checking that the MicroMini is Running

While the MicroMini lacks the audible and visual feedback of other AMI products one can with the aid of the interface/computer and software verify that the device is running/collecting without stopping the device from running. From the Diagnostics menu choose "MicroMini Diagnostics" and then "Download Header." A very short download occurs and the header information is displayed. See the example below:

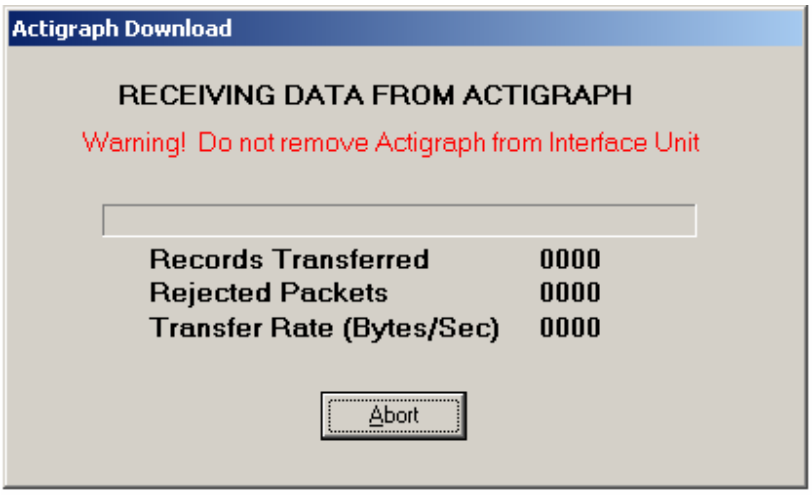


Notice that the "status" field indicates that the device is taking data and that the battery level is OK. The number of hours registered in the battery log is also displayed. One is given the opportunity to save this header information, but it is not necessary. Simply remove the MicroMini from the interface and it will continue to collect data. If a time delay has not been completed yet the "Status" field would indicate, "delaying."

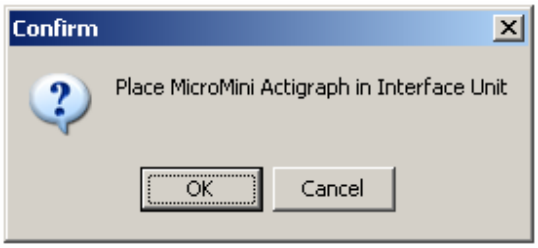
MicroMini Data Download

When downloading a MicroMini Actigraph select the Actigraph: Download menu item or simply click the button. After a few seconds the MicroMini Actigraph will start downloading automatically (see the figure below). Remember that the data is traveling at

1200 baud (about 120 bytes per second, the limit of the low-cost optical downloading technique). This means that it could take as long a 4-5 minutes for a full download. So be patient. One can watch the progress of the download on this form or stop the transfer by clicking the Abort button.

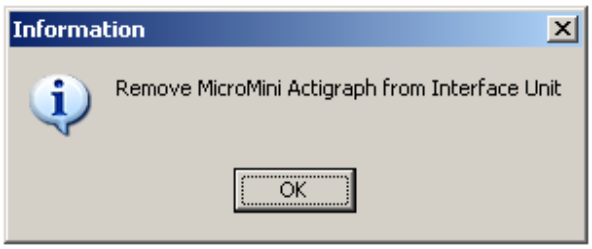


The message shown below will be presented. After inserting the MicroMini, click the OK button.



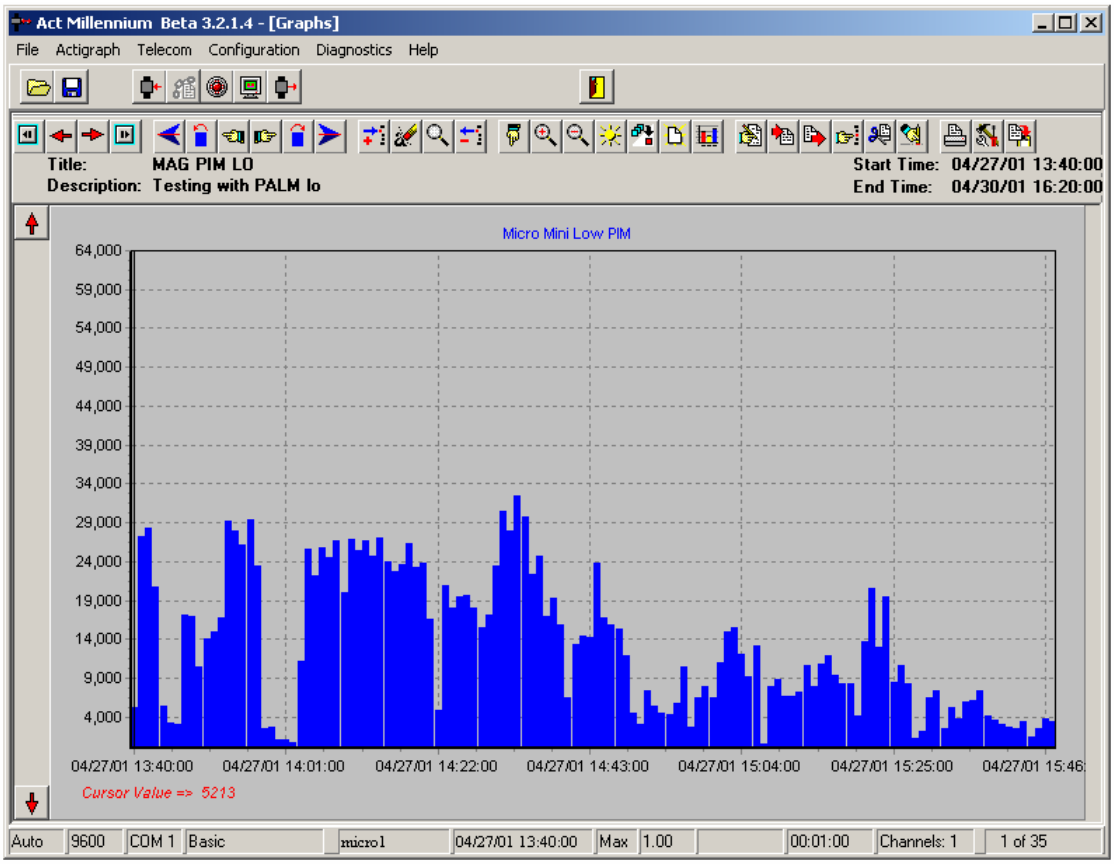
Clicking the Abort button will stop the MicroMini download and display the message as shown in the figure below.

If the MicroMini download is terminated or successfully completed, the following message prompting the removal of the MicroMini from the Interface Unit will be displayed:



After a successful download, one will be prompted to save the data in memory as shown in the figure below.

After completing the download process, a graphical representation of the data is presented as shown in the figure below.



NOTE: The MicroMini uses an IR (infrared) communications technique. This technique is unaffected by normal fluorescent office lighting, but can be confounded by bright sunlight (direct or indirect). In environments where ambient light has a high IR content, it may be necessary to shade the Interface to enhance operation.

MicroMini Battery Usage

The MicroMini with fixed or field replaceable batteries will provide approximately 6 months (4320 hours) of operational runtime. MicroMinis with rechargeable batteries will run 22 days (corresponding to the maximum amount of time necessary to fill memory).

Checking the MicroMini Battery Log

Whenever a MicroMini is downloaded the MicroMini Header Information is presented. Battery Runtime Hours is a field presented in that header. Alternately, the latest downloaded data file has the Battery Runtime Hours at the time the MicroMini was downloaded. This information is presented whenever a saved file is opened. Any time a file is open the information can be displayed via the File/Summary command.

Conserving Battery Power

Initialization provides for 22 days of Zero-Crossing, light, temperature, or sound collection (11 days of Hi or Lo PIM) and data collection continues until memory is full even if data has been downloaded. In order to place the MicroMini into a power conservation state (more important for units with fixed batteries that must be returned for factory battery replacement) one must re-initialize the MicroMini with a "Stop Data Collection" mode of operation after one has successfully retrieved collected data. Otherwise data collection will continue, utilizing the battery, until the memory is full.

ACT Millennium Diagnostics

Except for functions specifically designated in this manual such as the LOOP TEST, diagnostic features should not be used without consultation with AMI technical staff.

Loop Test

A small loop test device is provided as a convenient way to establish that a computer's communications port is working and that it will support your MicroMini serial interface. This device is used as a substitute for the loop test button provided in some our actigraph interfaces and will be used whenever activation of the LOOP button or switch is called for in the software instructions.

Hardware Installation of the Loop Tester Device

1) Insert the female end of the provided RS232 computer cable into Communications Port of your computer that you wish to use. Act Millennium supports Com Ports 1-4.
2) Insert Loop tester into other (male) end of the RS232 cable.
3) Turn on computer power. The LED indicator on the com-port tester device will illuminate RED.

Using the Loop Tester Device with ACT2000 Windows Software

1) Be sure that the software is properly configured for the hardware you are using. Go to the CONFIGURATION menu and make certain that the hardware port chosen is the one your RS232 cable is *physically* connected to.
2) Go to the DIAGNOSTIC Menu and choose Loop Test. The program will instruct you to "Insure that the Loop Reset Button is held throughout the test." If your Loop Tester Device is connected as described above, ignore this instruction and click OK. A window will be presented indicating "Loop Test Successful", while the red LED turns **GREEN** indicating correct hardware handshaking necessary for interfaces of the Automatic Switching type.
3) If the LED does not change over to Green during the loop test then communication port chosen might not be acceptable for controlling an Automatic type Mini Motionlogger interface.

If the Loop Test is unsuccessful and you are certain that the COM Port chosen matches physical port to which the RS232 cable is connected, then try another Communications Port. If none of the Com Ports of your computer pass this test, it may be necessary for you to contact your computer professional.

The MicroMini Charger (MMC)

The automatic battery charger designed to recharge MicroMini instruments (Actigraphy, Light, Sound, Temperature). Rechargeable MicroMinis can be identified by two gold charger pins located on the top plate. A fully recharged MM will run for 21 days, which also corresponds to memory full for most modes of operation. The rechargeable lithium battery will take 36-48 hours to fully recharge.

Rechargeable MicroMini Light Recorder

MicroMini Charger

The MMC can charge 4 MicroMinis of any sensor type simultaneously. The charging process is fully automated, and meets the battery manufacturer requirements for a charger. Specifically, the charger is designed to prevent overcharging regardless how long the MicroMini stays in the charger. The charger status LED's will change from Red to Green when the battery is fully charged. A Green light means that the MicroMini battery log is reset. It is not necessary to remove the MM at this time. After a short period, the charger will resume charging and the Red LED will switch on. It will be frequently observed that the Green and Red LED slowly switch back and forth. This is referred to as a trickle charge which keeps the battery peaked but does not over charge it. MicroMinis do not need to remain in the charger, however, and can remain on the shelf until needed. One may 'top off' the battery if desired by placing the MicroMini back in the charger for a short time before initialization until the Green LED illuminates.

Note that unless the Green LED lights the MicroMini Battery log is NOT reset. Act Millennium's battery log system, when properly configured, is designed to prevent initialization of MicroMinis with insufficient battery capacity. Care should be taken to allow sufficient battery charging between usages. However, in circumstances where sufficient time is not available for a full charge the battery log watchdog system may be temporarily overridden (Go to Configuration/Battery Log and change the "Refusal" level to say 600 hours) to allow initialization. Care should be taken since there is no way of telling for certain how long a partially charged MicroMini will run.

MMC Operational Setup

Use only the wall adapter provided or one with the same voltage/current specifications, 9 volt at 300microAmps max. Examine the charger compartments and notice the smallest hole just above the notch. Now look at the MicroMini and notice the protruding index pin. Study the picture above, and notice that the stainless strap holder slot is nearly horizontal. Hold the MicroMini firmly, and position the device such that the index pin

will align with the charger notch when lowered, while holding it about 1 inch above the compartment. Be prepared for a magnet to grab the MicroMini, and lower slowly. Rotate the MicroMini left and right a little and feel for the index pin dropping in the charger index hole. The Red LED will light when the index pin is properly indexed, indicating the MicroMini is electrically connected to the charger contact pins.

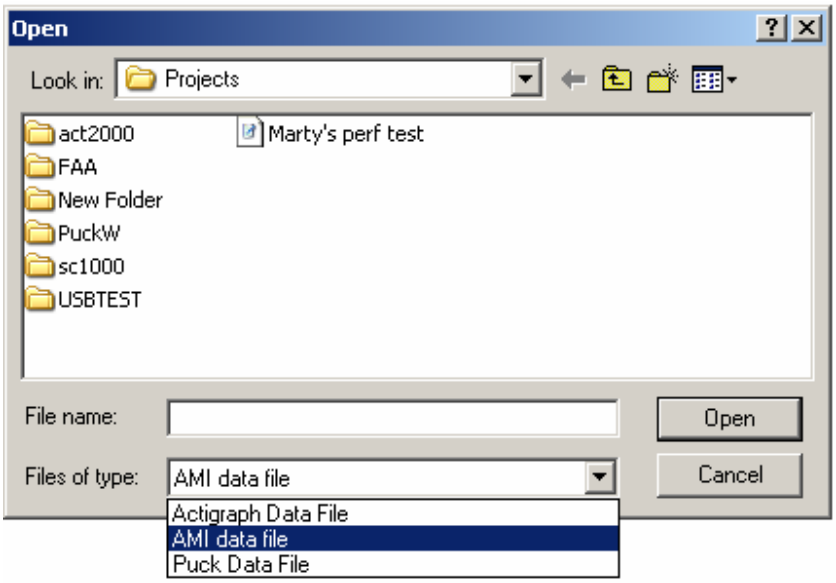
More ACT Millennium

File Submenu

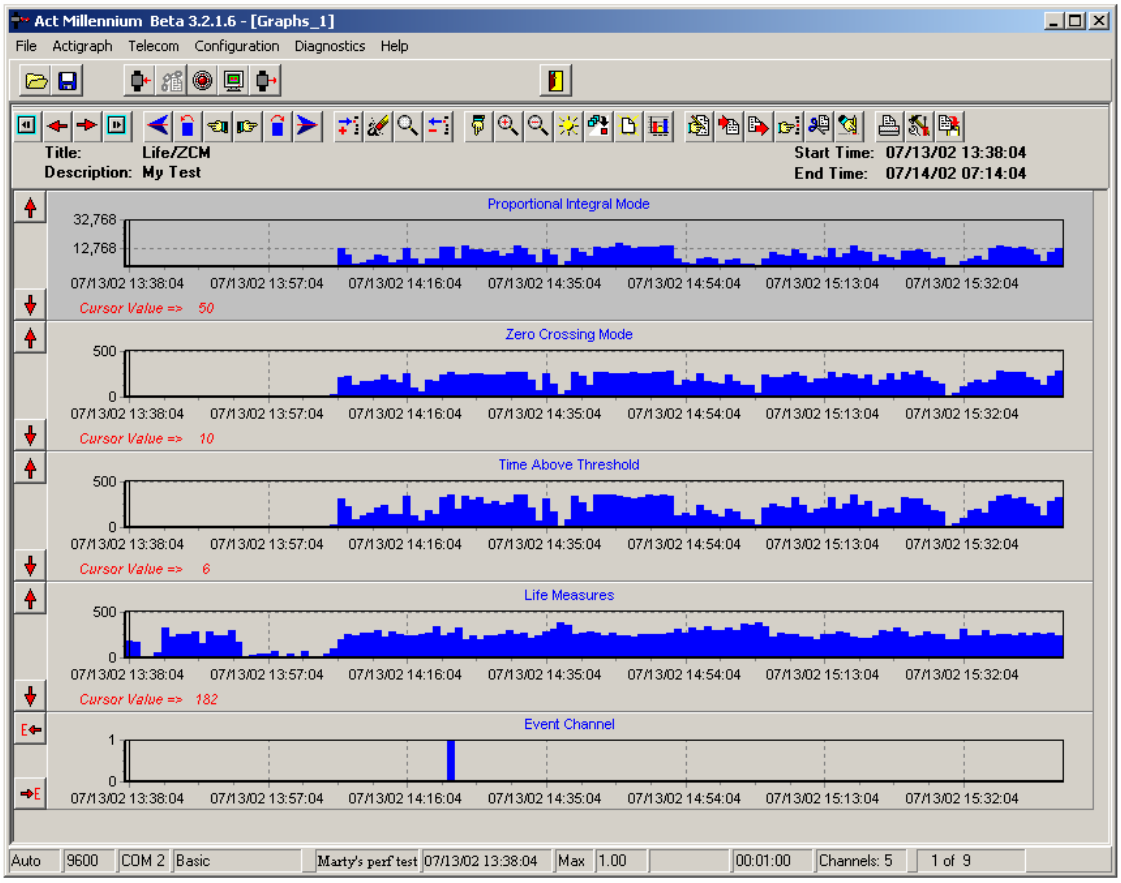
The File submenu contains items that permit one to open, save, and print Actigraph files. An exit item is also included in this submenu to leave the program. Actigraph submenu contains items that permit one to initialize and download Actigraphs. The Telecom menu permits one to have direct communication with the Actigraph (this feature does not apply to the MicroMini). The Configuration menu permits one to make various ACT Millennium setup changes such as Baud Rate, Communication Port, Actigraph type, and Interface type. The Diagnostics submenu contains items that permit one to perform testing operations on the Actigraph and Interface Unit.

Opening a File

To open a file with ACT Millennium, simply select File: Open from the menu or click the button from the Toolbar. An Open dialog box as shown in the figure below should appear which will permit one to choose a file to open. Notice that the option of changing the file type. Currently ACT Millennium supports DAT and AMI file formats. Both version 3 and 4 AMI files can be read with this software. One can either double-click the desired file or single-click it and click the Open button on the dialog box to open the file.

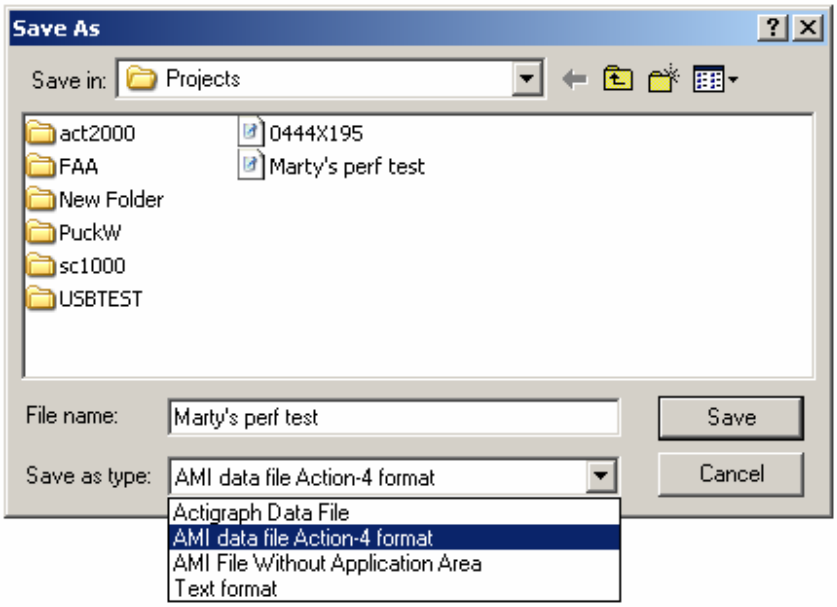


Upon the successful opening of an Actigraph file, ACT Millennium will display a graphical representation of the data as shown in the figure below.



Saving an Motionlogger File

After downloading or opening an Actigraph file, one can save it by selecting the File: Save menu item or by simply clicking the button on the Toolbar. ACT Millennium responds by displaying the Save As file dialog window as shown in the figure below.



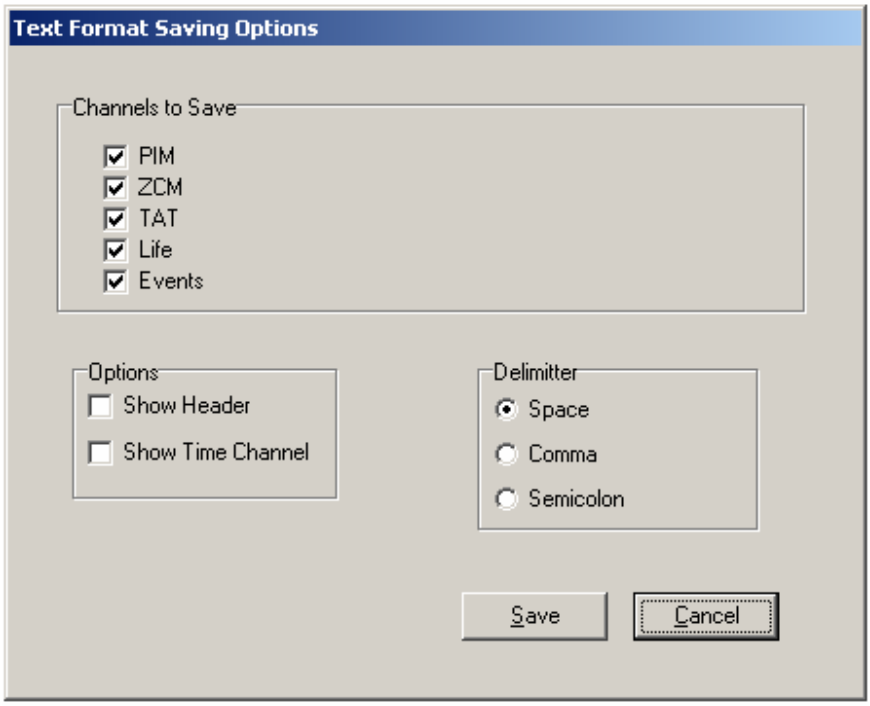
As with the Open file dialog window, one has the choice of selecting one of the following ways to save a file:

* DAT file format
* AMI file format
* Text file format

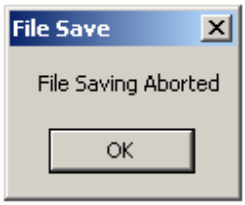
The DAT file format is the original unpacked file format used by Ambulatory Monitoring, Inc. It is an obsolete format and is retained for compatibility with older software.

The Text file format permits the user to store Actigraphy data as ASCII text. This is useful for exporting Actigraphy files into analysis packages such as MathCad or Excel. Upon selecting the Text format ACT Millennium displays the form as shown in the figure below.

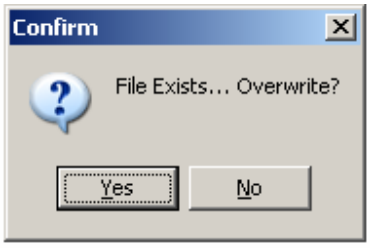
This form permits the user to choose which Channels to Save, Options and which data delimiter to use.



Click on the Cancel button to abort the saving process. The following message will be displayed as shown in the figure below.

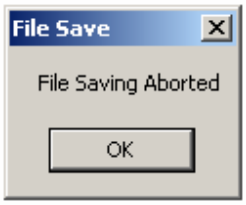


By clicking on the Save button one will be saving the Actigraphy data as a text file. If the file already exists the following message will be displayed as shown in the figure below.



Clicking the Yes button will overwrite the existing file and the following message will be displayed as shown in the figure below.

Clicking the No button will abort the saving process and the following message will be displayed as shown in the figure below.

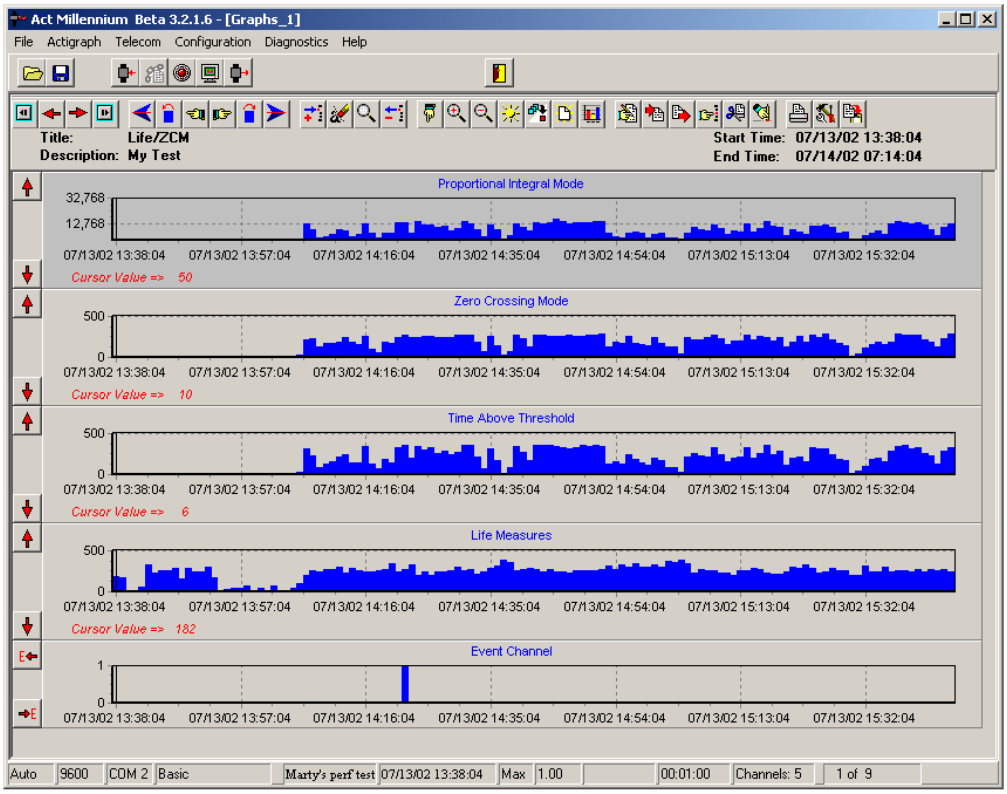


ACT Millennium Graphics

Upon successful data download or after loading a file, a graphical presentation of data will appear on the computer screen. These graphics are designed to allow the user to visually inspect data. For in-depth data analysis, the user is directed to Action-W for (clinical sleep studies) or Action4 for circadian or more general statistical and mathematical processing.

To illustrate the capabilities of the graphics in ACT Millennium, open the sample file SAMPLE.DAT included in the installation.

Click or select File: Open and choose SAMPLE.DAT. After presenting header information from the selected file, the graphical presentation will appear.

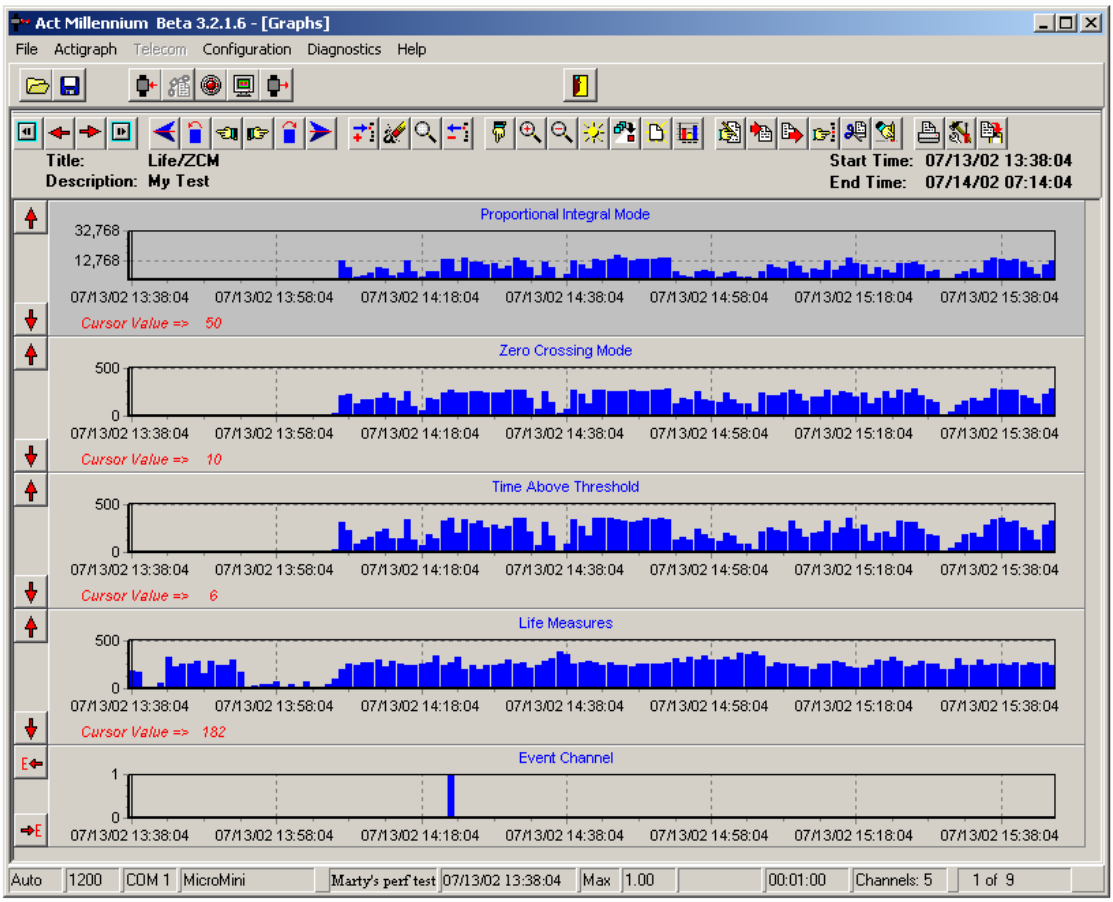


To the left of the graph are four values associated with the data at the current cursor position. The cursor is the thin black vertical bar that appears in each graph and which responds to mouse clicks by moving. Cursor navigation will be discussed in a later section. At the top of the graph the Mode, Serial number, ID, Start Time, End Time, Epoch Length, Event mode and Compression are displayed as the heading.

Notice that we have five separate graphs displayed: Proportional Integral Mode, Zero Crossing Mode, Time Above Threshold, Life Measures and Event Channel as shown in the figure below.

Notice that the first four graphs have the and keys. These buttons are used for scaling the graph.

One may also notice that the last graph (Event Channel) have the and keys. These buttons are used to search backward and forward for Events.



When compressing data for display onto a computer screen two methods can be utilized. One may display the maximum value of an epoch that occurs within the time range of a displayed histogram or one may display the average epoch value.

By default ACT Millennium limits the initial number of histograms to 128. This means that a day's worth of data would have to be compressed by a little over 11 to 1. (Each histogram would contain 11 epochs). ACT Millennium permits the user to change the number of histograms up to 1024 per page. This sometimes helps with graphic details but will cause slower screen updates and some corruptions to the graph.

ACT Millennium permits one to change the page width, compression technique and compression ratio in order to optimize data viewing. The lower right corner of the heading shows the compression type and ratio that can be changed by simply clicking on them (explained later).

Page Navigation

These keys are used to page through the Actigraph file. The button or the Home key

places the graph in the beginning of the data file. The buttons (Page Up and Page Down keys) permit one to page through the Actigraphy data like one were paging through a word processing document. The button (or the End key) will place the graph at the end of the data file.

Cursor Movement

The cursor is a vertical line associated with each graph used to isolate individual epochs and their values.

The and buttons with the Left and Right arrow keys move the cursor one epoch to the left or right. Notice the cursor time should change in response to the operation. Additionally, the values to the left of the graphs should change as well. These values are the data stored in the epoch at that cursor position. An important note, if one is viewing data that is compressed, the cursor will not move one histogram position per keystroke. If the compression ratio is 2:1 then it will take two key presses to move the cursor one histogram. Remember there is not always a 1:1 ratio between a histograms and epochs. In compressed graphs the Next button provide a faster way of moving cursors.

The and buttons with the <Shift> Left and Right arrow keys move the cursor exactly one histogram to the left or right. This will change the cursor time as well as the cursor values to reflect the new position. If the compression is 1:1, these buttons operate exactly like the previous two (one epoch).

The and buttons with the <Control> Left and Right arrow keys move the cursor 10% of the current graphics window to the left and right. These keys are useful to quickly move the through the graph.

In addition, clicking the mouse on a histogram will cause the cursor to be moved to that location.

Marker Manipulations

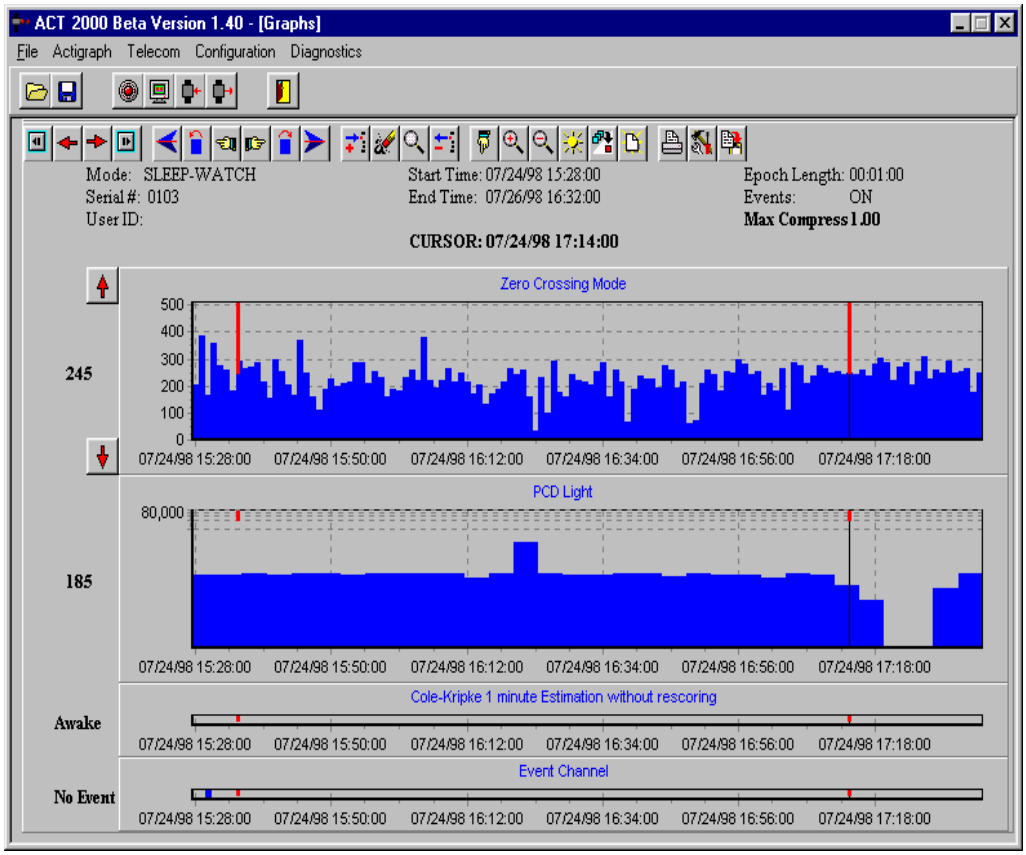
Markers are used to select areas of the graph for later zooming. Red vertical lines extending partially down the graph display markers.

The button or Insert key causes a marker to be placed at the current cursor position. A maximum of two markers can be inserted.

The button or <Control-M> key clears all markers

The button or <Control-Z> keys zooms the graph to the marker values

The button or Delete key causes the marker at the cursor location to be deleted.

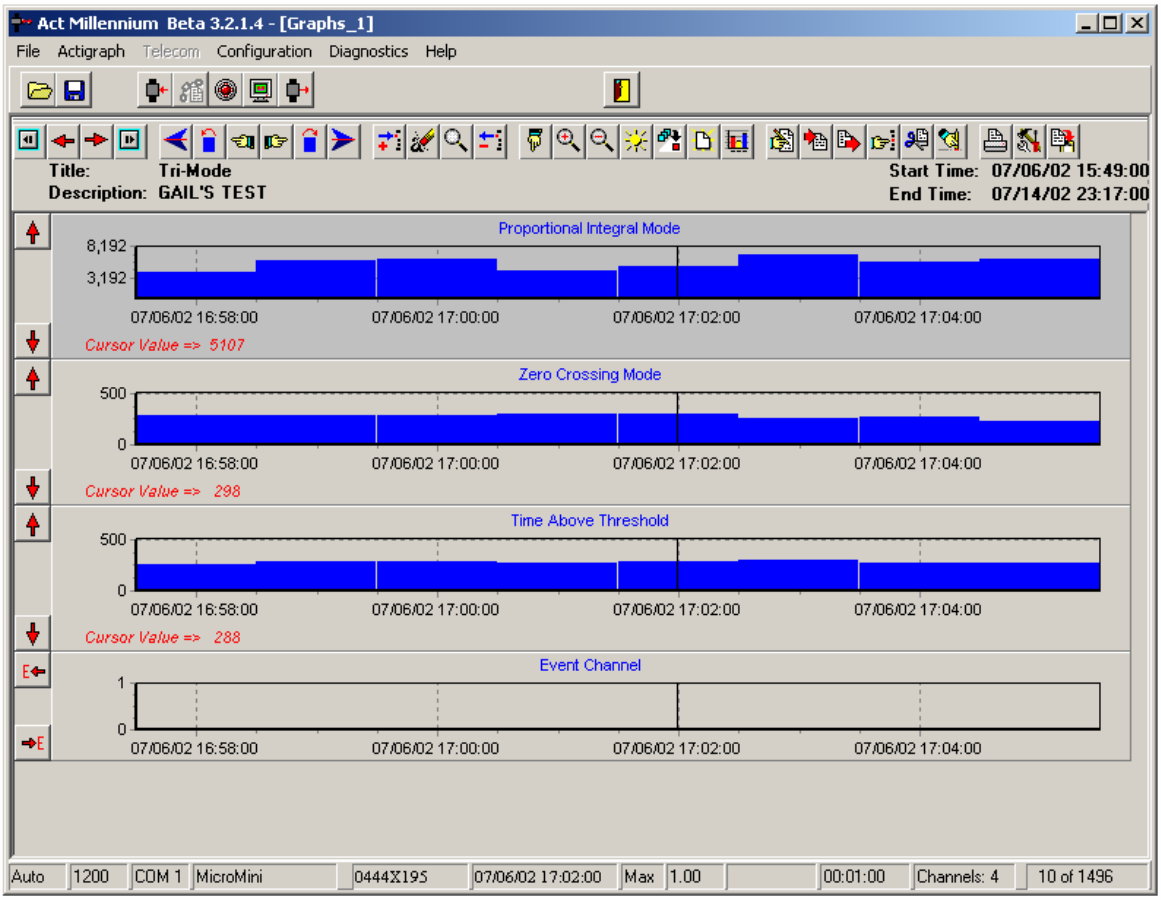


Zooming

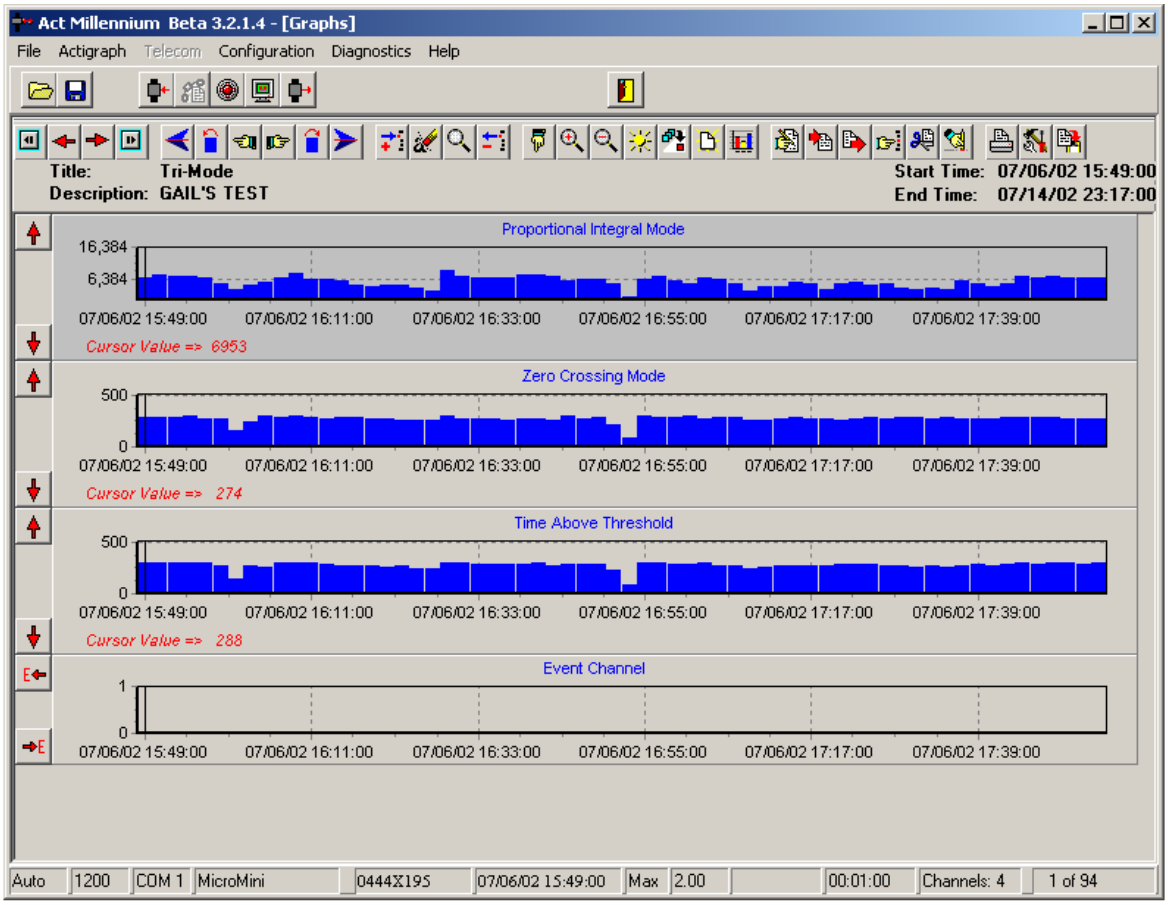
Zooming permits one to change the page size (in epochs) of the graphics screen. The compression ratio gets changed to reflect the current resolution setting (more later).

The button permits one to reposition the start of the page to the location of cursor.

After repositioning, the starting location is now at 7/24/98 16:26:00.

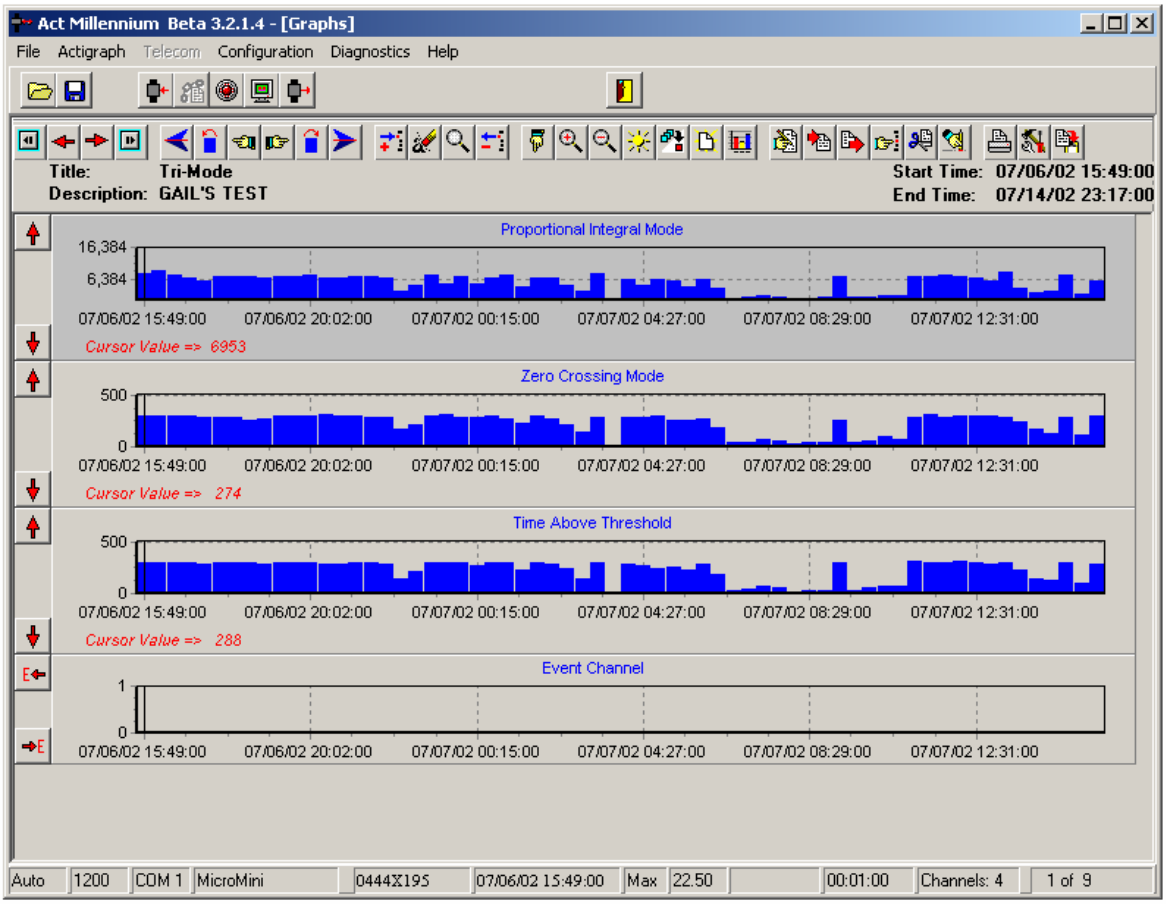


The and buttons with the + and - keys permit one to zoom in and out of graphs by a factor of two. ACT Millennium attempts to center the new graph on the last cursor position. Note that the compression ratio should change based on the number of epochs being displayed.



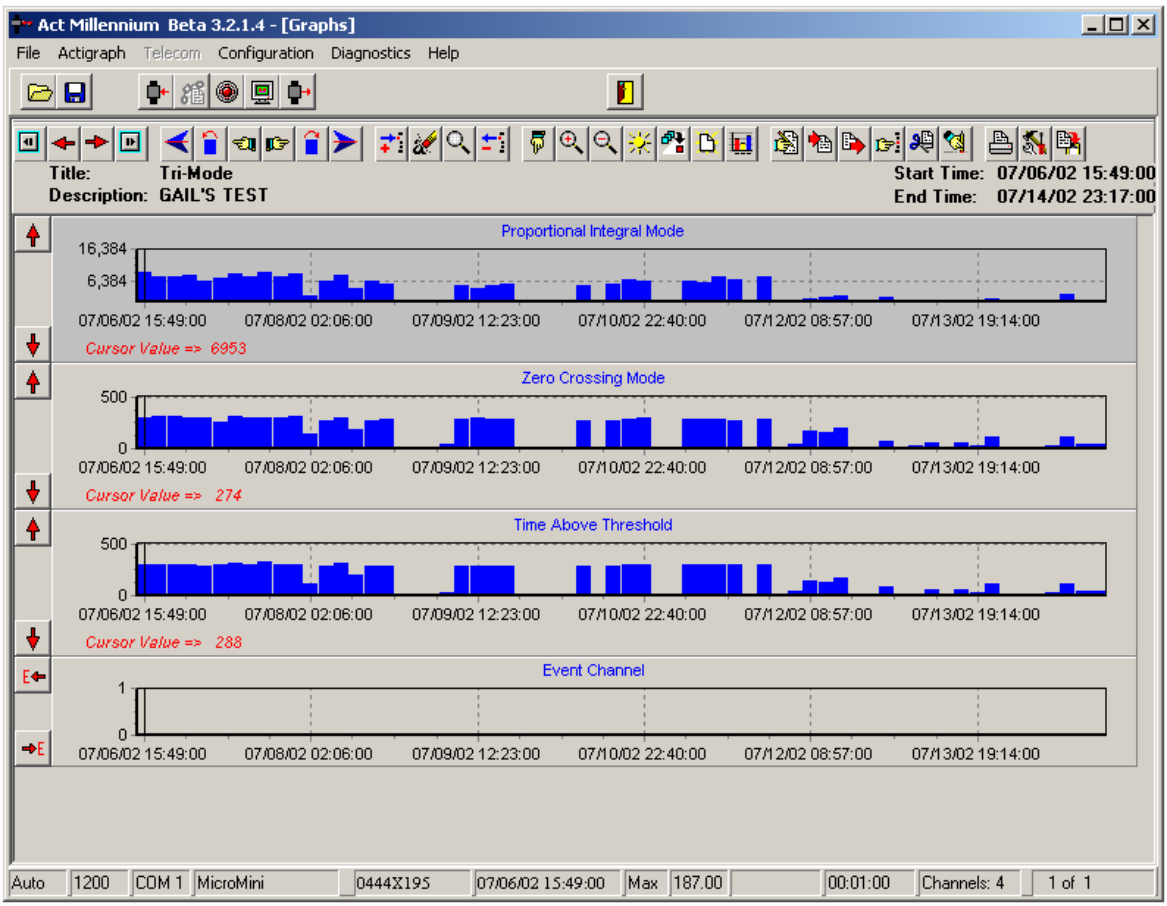
The button or <Control> D keys displays an entire day's worth of data on one page.

Note that the compression ratio has changed due to the increased number of epochs displayed.



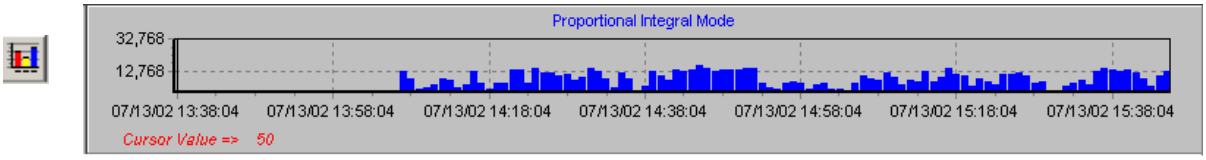
The button with the <Control> V keys permits the user to display all the epoch data on one graph.

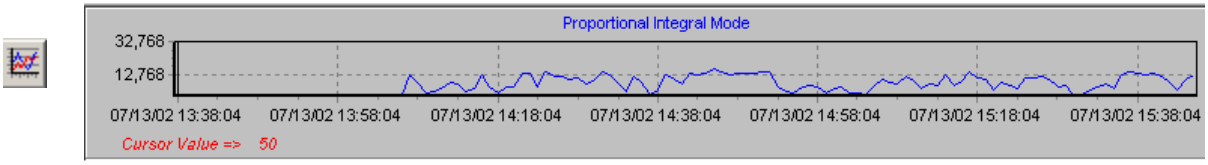
Note that the compression ratio will change based upon the increased number of epochs.



The button with <Control> R simply resets the graph and displays it with original settings (128 epochs per page).

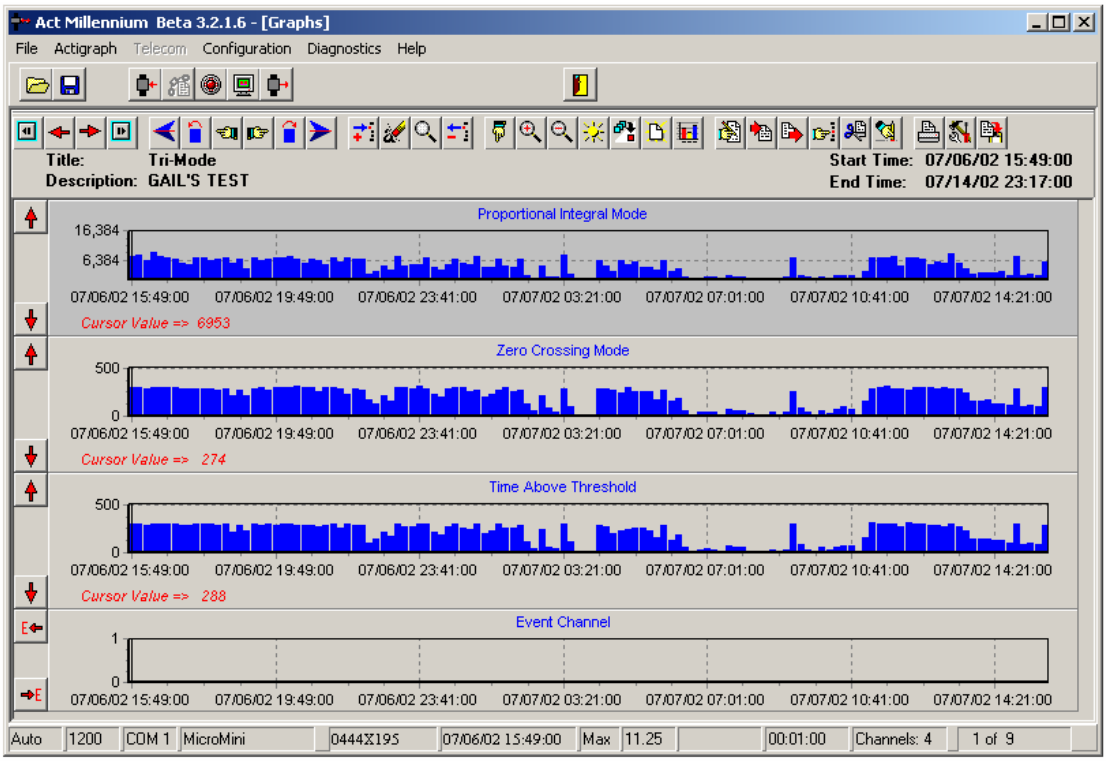
The and buttons permit one to choose which style of graph one want to view.



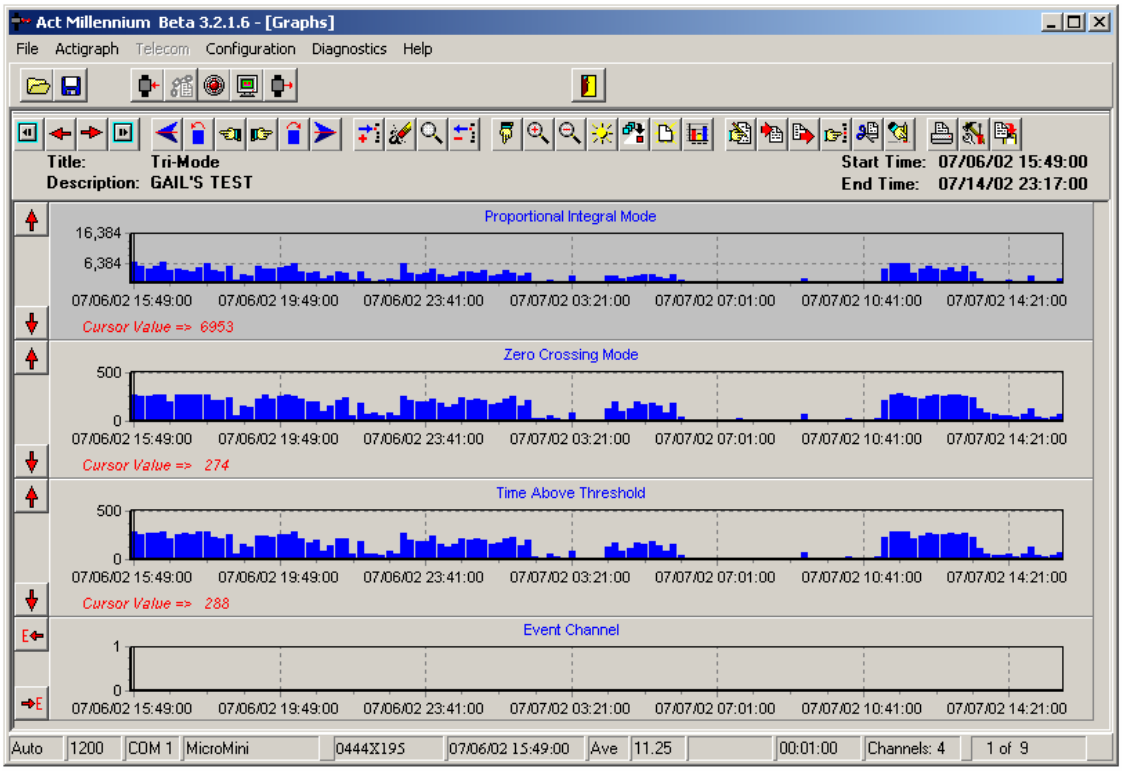


Compression

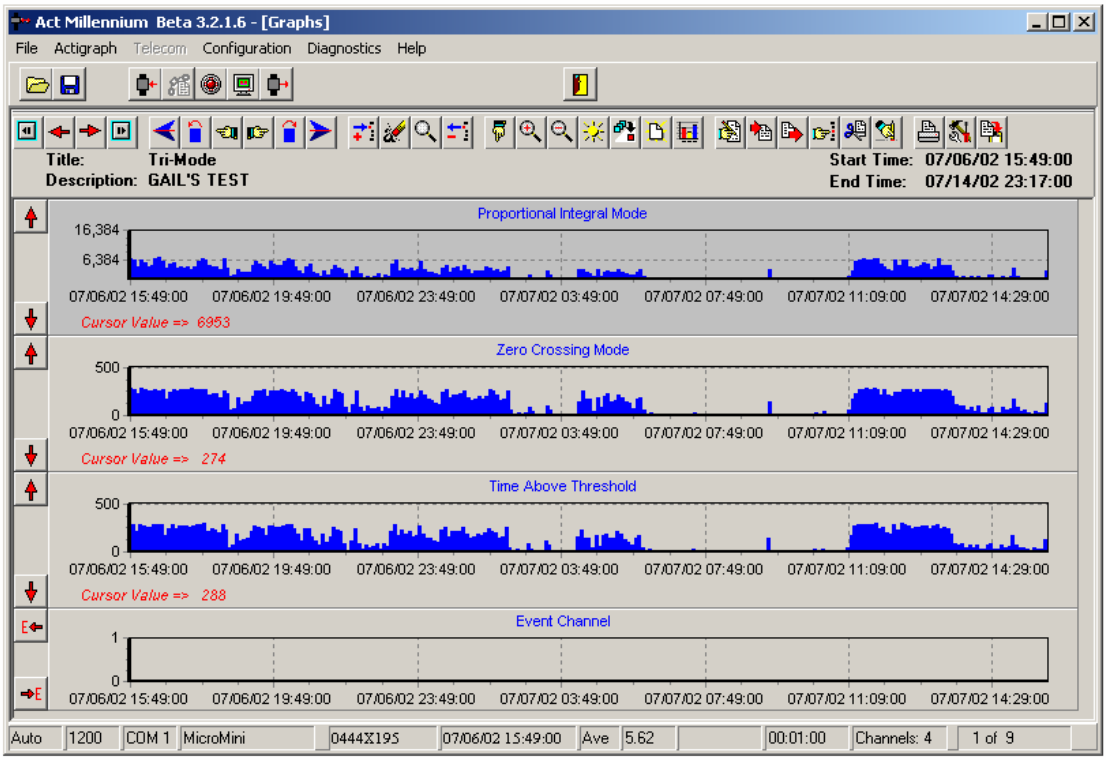
Clicking on the **Max Compress** label located on the status bar will switch the compression mode to average.



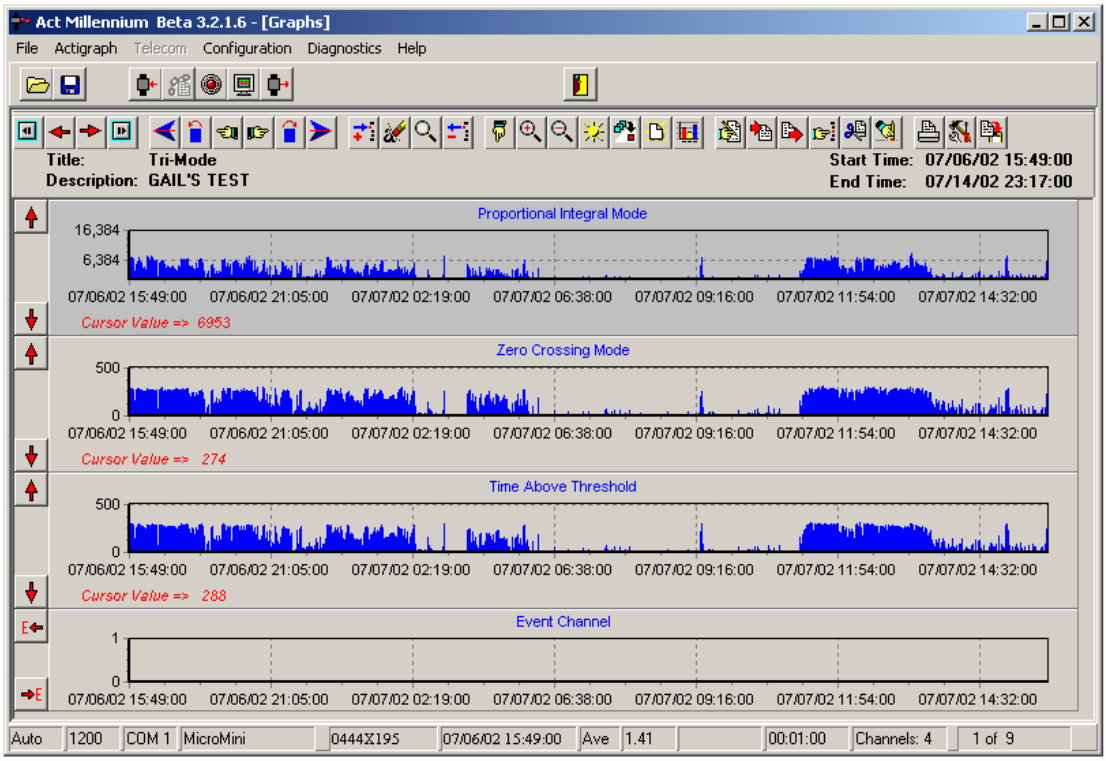
Notice the label now displays Ave Compress as shown in the figure below. The overall graph appears to have lower values since we are now using average values rather than maximum values to compress our epochs.



Pressing the compression value label (11.25) will double the number of histograms displayed as shown in the figure below.



Now we are using 256 epochs per page, the compression ratio has dropped to 5.62. One can see that the graph looks a little rough. This is because the histograms are overlapping each other. Clicking the ratio label 2 more times for the finest resolution (1024 epochs per page) as shown in the figure below.



Clicking on the ratio label (now 1.41) will restore the graph to full compression (11.25).

Printing and Copying

The above Icons represent, respectively, print, print setup and copy to clipboard. These functions should be self-explanatory to Windows users. For further explanation please consult the Windows manual.