MotorMonitor

Users Manual
Version 7.01

S-723-002

26 September, 2023

Applies to:
Software Build 20131-08

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CHAPTER 1
INTRODUCTION,
MOTORMONITOR DESCRIPTION,
SOFTWARE & HARDWARE INSTALLATION

1.1 INTRODUCTION

Congratulations on your purchase of a ***MotorMonitor*** system and thank you for choosing ***Kinder Scientific*** for your behavioral testing needs. Whether you've purchased a Cage Rack, Open Field, Rat Place Preference, Elevated Plus Maze, "T" Maze, Large Animal Open Field, Forced Swim, Radial Arm Maze, Zero Maze, Rotometer or even a custom system built to your specifications, all systems are designed with ample features and for years of service. One important feature of the ***MotorMonitor*** software is its ability to run all our activity systems. You have only one software package to learn even if you have multiple types of systems!

1.2 MOTORMONITOR *Description*

MotorMonitor has been designed to put data in your hands as quickly as possible. Default settings, Templates, file storage, and user definable output files have all been designed with flexibility and keystroke reduction in mind. Detailed explanations for these features are provided later, but first let's look at the basic steps of running the system.

Basic Steps:

1. Fill in session information screen.
2. Run the data collection session.
3. Reduce the collected data for export.

Once you have learned how to set up the system, it is really that simple.

The manual is divided into three chapters as follows:

- Chapter 1 – Introduction, MotorMonitor Description, and Software & Hardware Installation.
- Chapter 2 – Using Basic Features.
- Chapter 3 – Using Advanced Features.

We suggest that you read through Using Basic Features first and follow it up by running a few "dry run" sessions where you break beams with your hand. Once you are familiar with the basic concepts then read Using Advanced Features to gain an understanding of all the features ***MotorMonitor*** provides.

MotorMonitor records animal activity with a dedicated microprocessor and infrared photobeam technology. As the subject moves it breaks photobeams on an X/Y grid. These beam breaks are recorded by the dedicated microprocessor located in the control chassis. The collected data is then transmitted via serial communication to the host PC. Additional photobeams can be used to record special "events" such as rearings, holepokes, lever presses or custom events. During data collection, the system records the time, beam number and whether the beam was blocked or cleared. The system uses ***post session*** analysis schemes, i.e., no data analyses are performed during runtime. This provides the opportunity to re-analyze data with different parameters. In other words, you can reset all parameters (except the session length) and re-analyze the original data file(s) to acquire a new view of the data.

Figure 1-1 is a simplified block diagram. Your system may have a cage rack, high density, open field, plus maze or forced swim enclosure, but the setup will be similar.

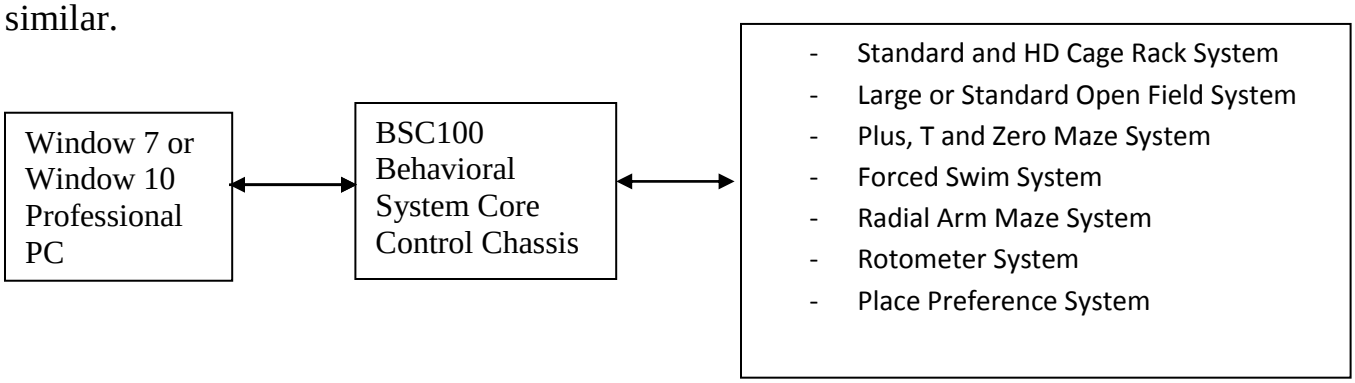


Figure 1-1. MotorMonitor Simplified Block Diagram

1.3 SOFTWARE INSTALLATION

NOTE

You *must* have administrator privileges to install the software.

1.3.1 System Requirements

- Microsoft® Windows™ 7 Professional, or Microsoft® Windows™ 10 Professional. (Home version not supported).
- Processor spec minimums – Dual Core 2.66GHz, 2MB L2 Cache, 1066FSB
- 2 GB RAM.
- 100GB Hard drive.
- At least one available serial COMM port on the PC.
- 19inch Monitor with 1280x1024 resolution.

NOTE

- Microsoft® Windows™ 95, 98, 2000, XP, NT, ME, and IBM OS/2 are not supported.

- Serial to USB adapters are not supported.

- System must have screen savers and Anti-Virus programs disabled during data collection.

- Auto updates and other software applications must not be run during data collection.

- System power saving settings must be set to ensure there is no interruption of hard drive during data collection.

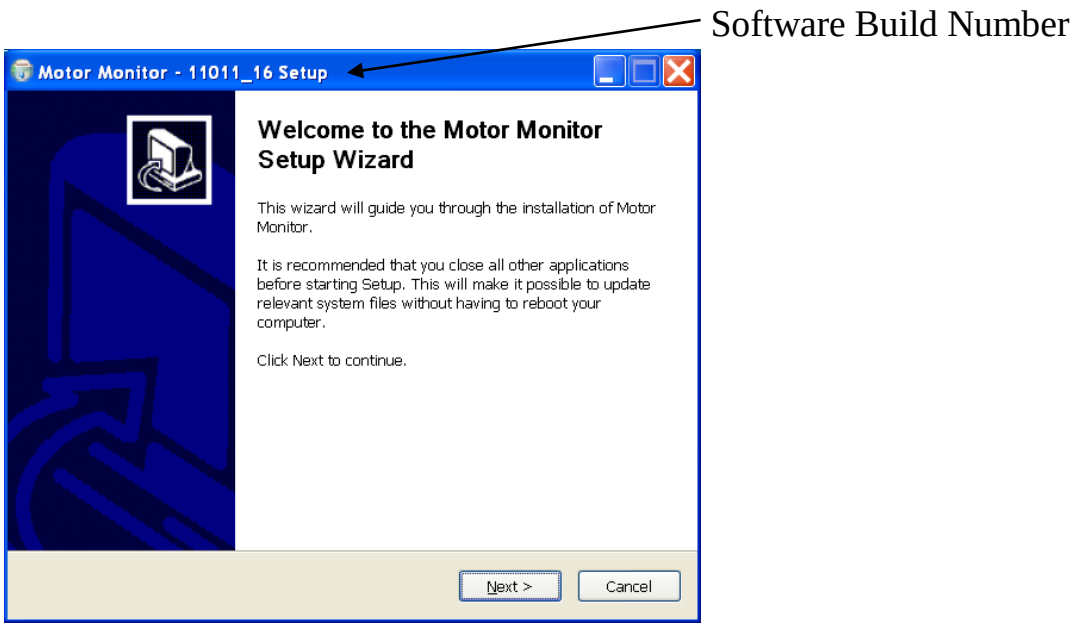
1.3.2 Installation Preparation

- Close all programs and turn off virus protection software to prevent installation conflicts.

- If you are upgrading from an earlier version of MotorMonitor, you must uninstall the earlier version using the **Remove Program** feature in the **Control Panel**. Existing session files, configuration files, data files, etc., will not be affected by uninstall, but the current build will save files to new folders and files will use new extensions.

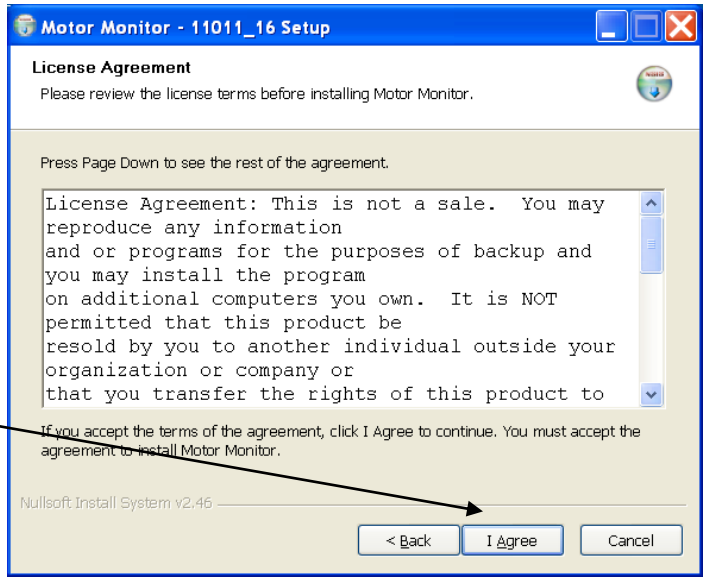
1.3.3 Installation

1. Insert the provided MotorMonitor S/W CD into the CD-ROM drive.
2. The installation uses an AUTORUN feature and will open the window shown below:

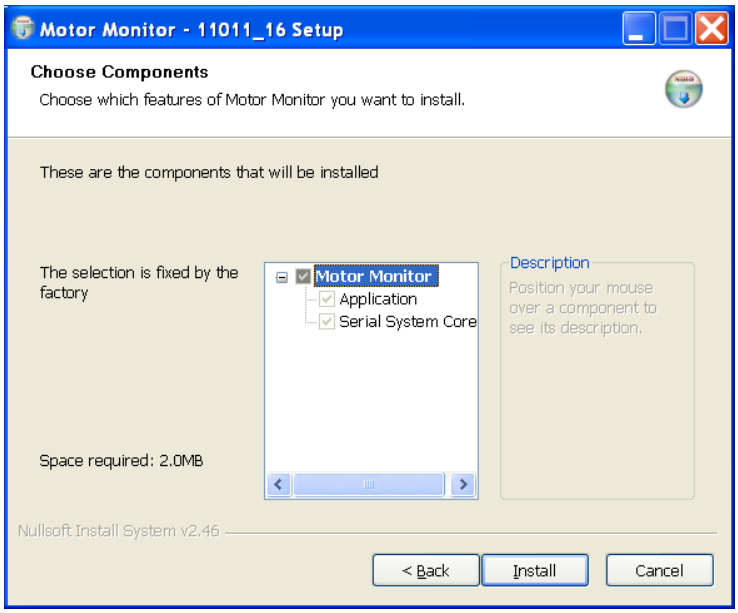


Click Next. The following Window will appear:

You must check the "I Agree" box before you can proceed.

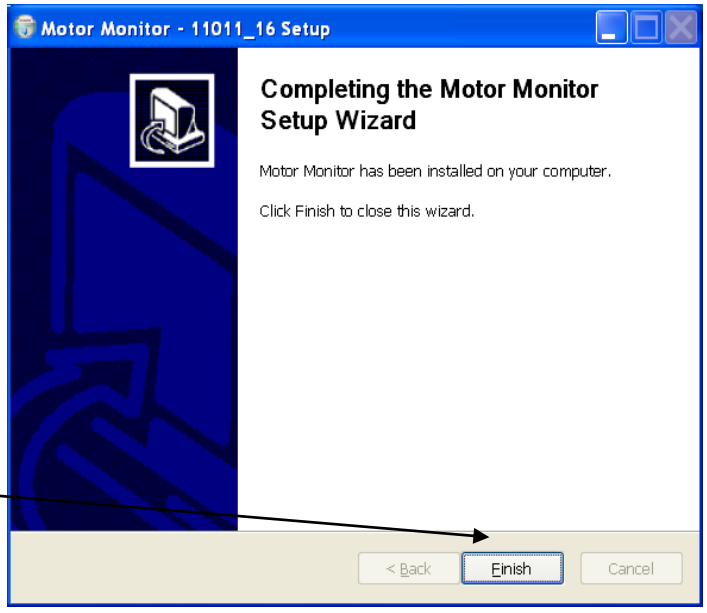


Read through the License Agreement and click the "accept" box. The following Window will appear:



For GLP installations proceed to the *MotorMonitorGLP Installation Guide.* If you have purchased any option software such as PlayBack, HotSpots, etc, they will be displayed here and automatically installed. Click *Install*. The Window shown below will appear next when software is successfully installed.

Click *Finish* to close the software Installation process.



1.4 Hardware Assembly and Installation

The following paragraphs describe how to assemble and setup the hardware, and how to connect to the host PC.

1.5 Unpacking the Hardware

Use care when removing the hardware from its shipping container to prevent damage to any protruding connectors, controls, or indicators. Although the components are thoroughly inspected mechanically and electrically before packing for shipment, they must be inspected upon receipt for damage in transit.

1. Make sure each item on the packing list is included with the shipment.
2. Inspect all items for dents, chips and heavy scratches (gouges). Check for broken or bent connectors, controls, and indicators. Photographs of damage may be helpful in substantiating subsequent claims. *Kinder Scientific* insures all shipments for damage.

1.6 Reshipment Procedure

If a component is to be reshipped after receipt, use of the original shipping container and packing materials is recommended.

1.7 Returned Equipment with Warranty or Damage Claims

If a component is damaged in transit or does not operate as specified when received, notify the carrier and *Kinder Scientific* customer service immediately by calling 1-858-679-1515. Make sure you get a Service Work Order (SWO) number prior to returning any equipment. Please attach a tag or form that includes the SWO number, your company's name, address, person to contact, and telephone number. A short description of the damage or problem will also be helpful.

1.8 Equipment Description – MotorMonitor Systems

The features of the ***MotorMonitor*** systems are as follows:

- The ***MotorMonitor*** systems are high-resolution photo beam systems equipped with onboard intelligent circuitry.
- The ***Behavioral System Core Control Chassis (BSC100)*** provides the interface between the host computer and the ***MotorMonitor System***. Up to eight ***Stations*** can be connected to the ***BSC100 Control Chassis.***
- The power supply provides power for the ***BSC100 Control Chassis.***
- Depending upon the type of ***MotorMonitor System*** used and options selected, up to 40 stations can be connected to the host PC using one or more ***Behavioral System Core Expansion Chassis (BSC100EXP).*** This is described in the following list.

1. The following systems can have a maximum of 32 stations connected to the host PC using one Control Chassis and three Expansion Chassis, depending upon included options.

- Large Open Field
- Standard 16 x16 Open Field
- Elevated Plus Maze
- Rat "T" Maze
- Forced Swim

2. The following systems can have a maximum of 40 stations connected, depending upon included options, to the host PC using one Control Chassis and four Expansion Chassis.

- 7 x 15 High Density Cage Rack

- Rat Place Preference
- Zero maze
- Rotometer

3. The Radial Arm system can have a maximum of 16 stations connected to the host PC using one Control Chassis and one Expansion Chassis.

1.9 Control Chassis & Expansion Chassis

As with all *Kinder Scientific* systems, the **Behavioral System Core (BSC100)**, programmed with the ***MotorMonitor scanner version*** Control Chassis has it's own separate embedded microprocessor controller. This architecture provides a stable partition between the data collection effort and the host PC. This greatly enhances the process of real-time data collection within the Windows 7/10 Professional platforms. Communication between the Control Chassis' embedded controller and the PC's Windows platform is via an RS232 serial port.

Each Behavioral System Core Chassis is capable of monitoring up to eight stations using a single PC. This capability is increased with the addition of up to four Expansion Chassis. Depending upon the configuration, a single PC can monitor 8, 16, 24, 32 or 40 stations. In addition, should the serial connection between the BSC100 and the computer be interrupted during session data collection, the BSC100 will continue to collect up to 1 hour of raw data, to be retrieved and automatically uploaded to the host application upon re-establishment of the serial connection.

1.9.1 BSC100 Behavioral Core System Control Chassis

The ***Behavioral System Core (BSC100)*** Control Chassis is designed to work with all MotorMonitor Series products. Each control chassis is capable of monitoring up to eight stations. An example of the Control Chassis front panel is shown in Figure 1-2.

Figure 1-2. Behavioral Core System Control Chassis

1.9.2 BSC100EXP Behavioral Core Expansion Chassis Each

BSC100EXP Expansion Chassis provides the connections for an additional eight stations. Each Expansion Chassis is programmed for using the Selector Switch on the Side of the unit as follows:

- Switch position 1, selects stations 9 through 16.
- Switch position 2, selects stations 17 through 24.
- Switch position 3, selects stations 25 through 32.
- Switch position 4, selects stations 33 through 40.

1.10. System Interconnection

NOTE

The PC you will be using *must have* an available serial port. Preferably Comm 1, although Comm ports 1 through 6 can be selected depending on the PC type.

1. First, make sure all power is turned off before making any connections.
2. Connect the serial cable between the host PC to the ***Com Port*** serial connector located on the front side of the BSC100 Control Chassis. .
3. Connect the IEEE 1284 DB25 I/O cable from the Control Chassis to each of the ***MotorMonitor*** system stations 1 through 8, starting with Control Chassis connector number 1.

   NOTE: (Refer to appropriate MotorMonitor Manual Addendum for your System Application, eg. Open Field, Cage Rack, Plus Maze etc.)

4. If you are connecting additional frames using the Expansion Chassis, make sure the ENABLE OUT cable from the BSC100 Control Chassis is connected to ENABLE IN on the Expansion Chassis and the SIGNAL OUT cable from the Control Chassis is connected to SIGNAL IN on the Expansion Chassis using an IEEE 1284 DB25 I/O cable for each. Make sure you follow this same convention if you are connecting additional Expansion Chassis.

5. Once all of the cable connections have been made connect the power supply to the Control Chassis ***Power*** DIN connector located on the rear of the unit and to the power source. If additional Expansion Chassis are installed, each Expansion Chassis will have its own power supply also connected to the ***Power*** DIN connector. Make sure these power supplies are connected and plugged into the power source as well.

6. Turn on the computer and all the power supplies (each power supply has its own on/off switch).

1.11 Setting the Comm Port

You must select a Comm port in order for the ***MotorMonitor*** software to communicate with the hardware you just installed. You can select from Comm 1 to Comm 6 depending on your PC. Setting the Comm port is accomplished as follows:

1. Turn on the PC and open the MotorMonitor program. A screen similar to the one shown in Figure 1-3 will appear.

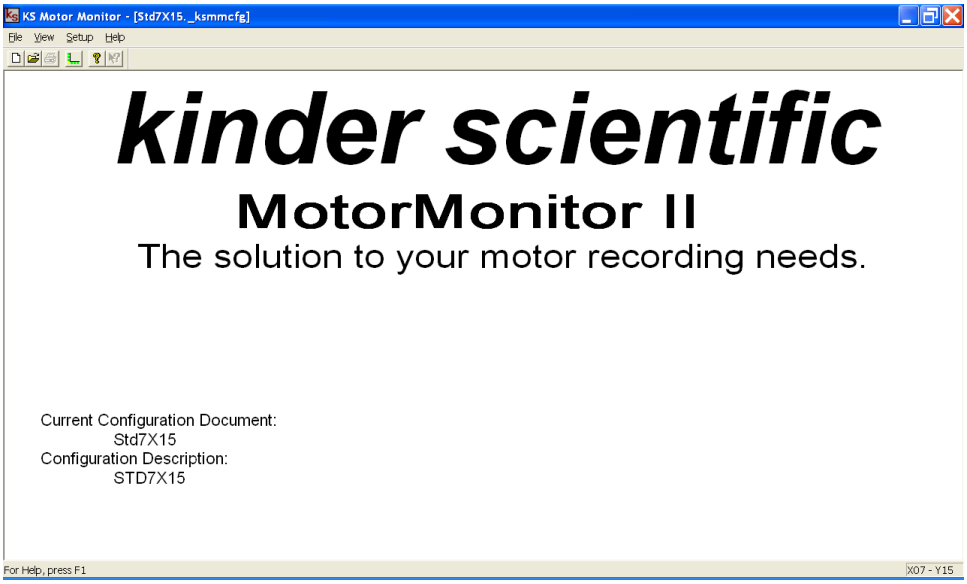


Figure 1-3. MotorMonitor Start Up Screen

2. Select the **Setup** pull-down menu. Click on **Concentrator Link**. Select a Comm Port and Click **OK**. This is shown in Figure 1-4.

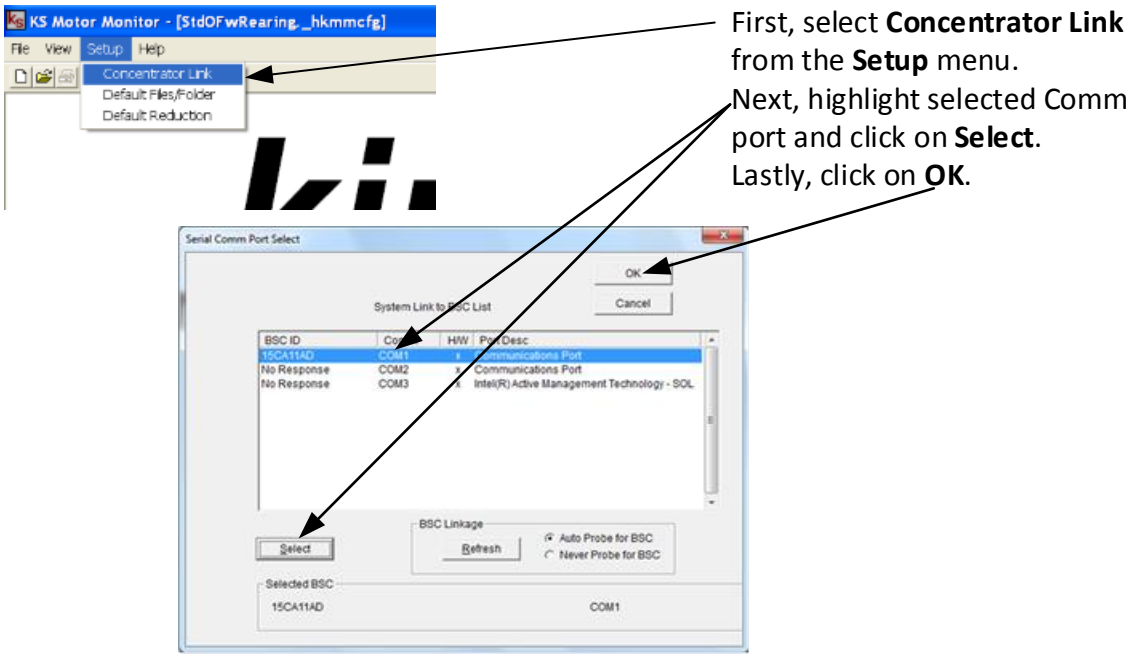


Figure 1-4. Selecting the Comm Port

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CHAPTER 2
USING BASIC FEATURES

2.1 Understanding Session Data Files

The end goal is to collect activity data on each subject and place those data into Session Data files. Session Data files contain user information such as the operator's name, animal number, sex, including a variety of user-entered information.

A session cannot be run until a unique Session Data file is created for that session. Session Templates, Configuration files, Saved Session files, user information, and the collected data are used when creating a Session Data file. These files are discussed in detail in Chapter 3, ***Using Advanced Features***.

A unique Session Data file is created each time a session is run and all data are stored in a proprietary format where the data is not readable by the user (i.e., raw data).

It is this Session Data file (raw data plus the default template) that is used when performing a *file reduction*. The results of a file reduction are user-readable, analyzed data presented in a spreadsheet or statistical format. How to perform a file reduction is discussed later in this chapter.

The default location for Session Data files is: **C:\Kinder Scientific Data\MotorMonitor\Files**. You can use this location until you are familiar with all the workings of ***MotorMonitor***.

2.1.1 Running a Session

To run a session perform the following steps.

1. Turn on the PC and open the MotorMonitor program. A screen similar to the one shown in Figure 2-1 will appear.

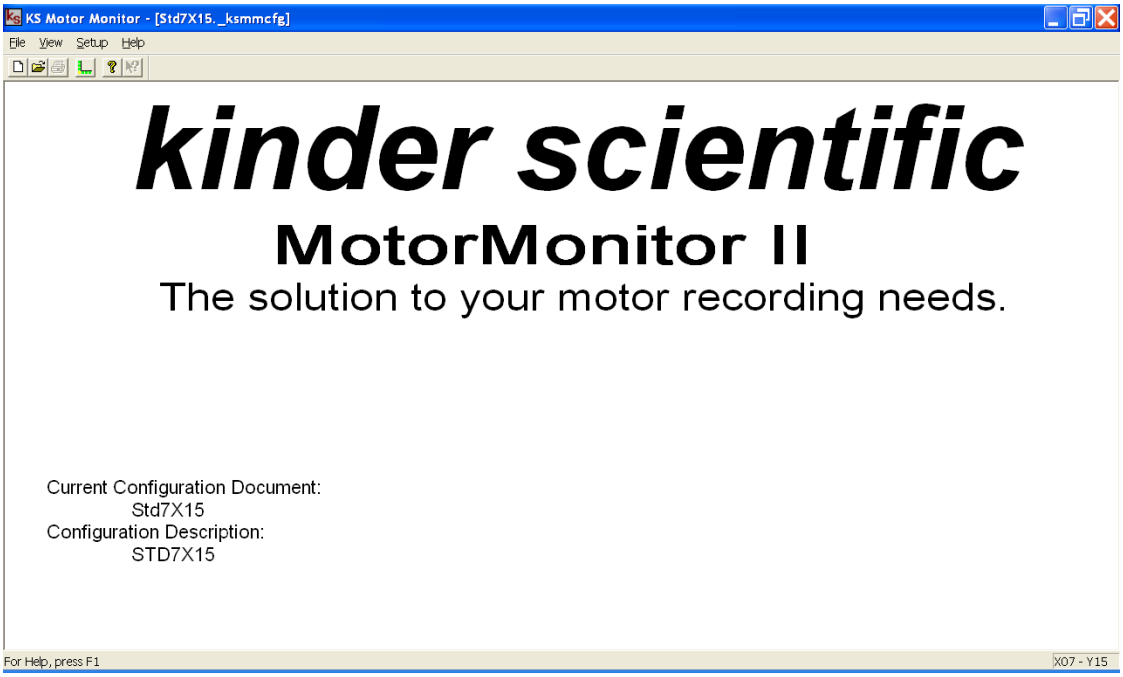


Figure 2-1. MotorMonitor Start Up Screen

2. Select **New** (the white sheet on the tool bar), and then, **Session**. A screen similar to the one shown in Figure 2-2 will appear.

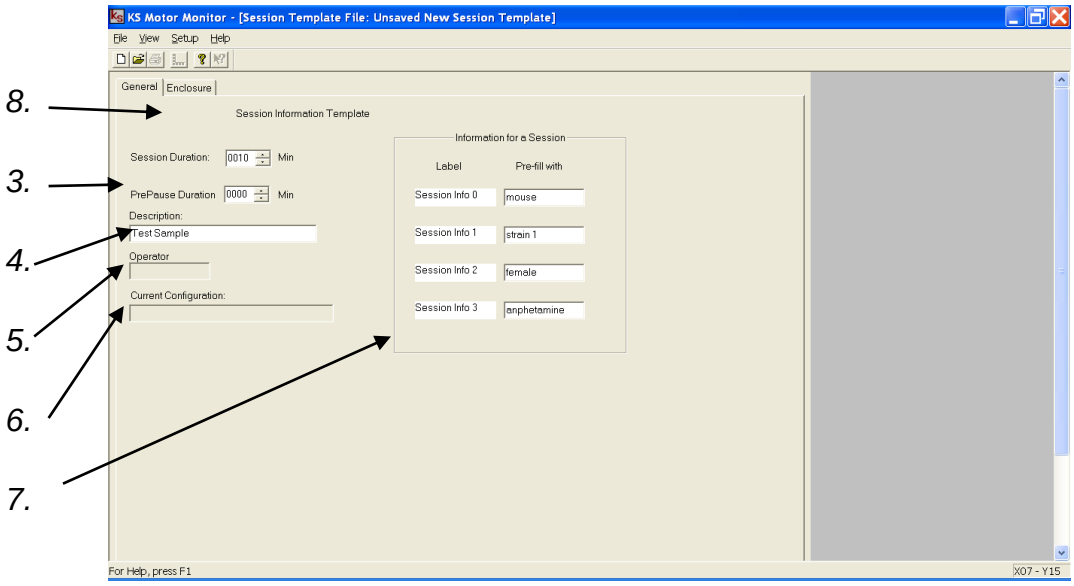


Figure 2-2. Session Screen - General Tab

3. For **Duration:** Enter the total amount of time for the session.

4. For **Pre Pause**: Enter the time you desire to run before the pause period. (This feature is normally used when test subject requires dosing with two drugs for one session. Example - The test subject is dosed with a substance at the beginning of a 60 minute session. You have selected a 30 minute pre-pause time. The session pauses at 30 minute point, you remove subject for dosing with a counteracting substance, place the subject back in the enclosure, press the start switch and the session continues to run for an additional 30 minutes). Session will run continuously after start if pre-pause time is set to 0 minutes. The Pre Pause feature requires that the Enclosure Start Method be set to "Start Button Only". (Refer to figure 2-3).

5. For **Description:** Enter the session description.

6. For **Operator:** Enter the name of the person running the session.

NOTE

If you are running the GLP configuration of ***MotorMonitor***, the operator's name is entered automatically.

7. For **Information for a Session**, Enter the session label information.

8. Select the **Enclosure** tab. A screen similar to the one shown in Figure 2-3 will appear.

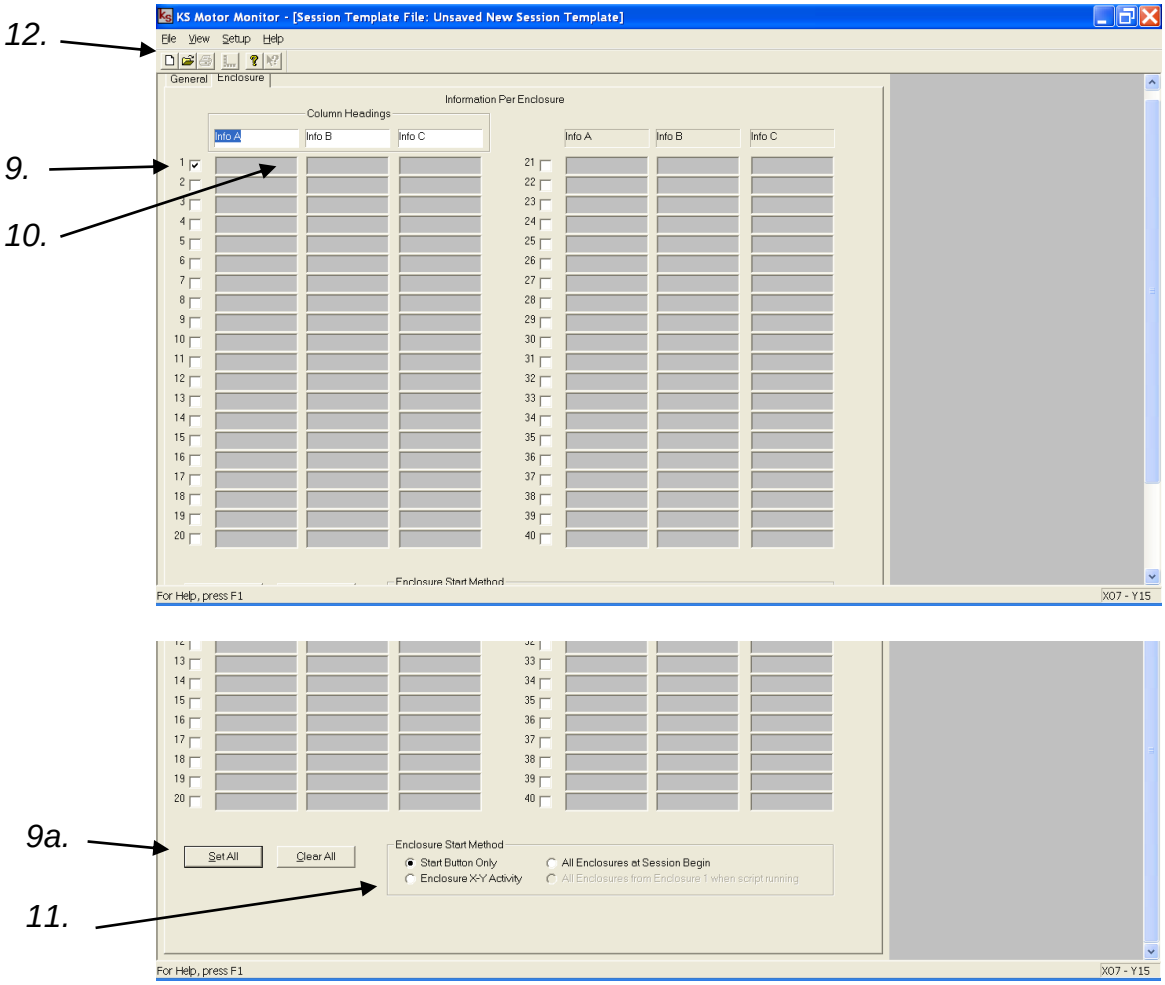


Figure 2-3 . Session Screen - Enclosure Tab

9. and 9a. Click on each enclosure to be used in the session. Use the Set all and clear all buttons to aid in your selection.

10. For **Information Per Enclosure** enter animal specific information. (see section 3.2.5 for importing subject information).

NOTE

Two parameters must have entries before running a session. These are **Duration** (step 3), and **Enclosure** selection (step 8). There must be an entry made for session duration, and at least one enclosure must be selected before a session can be run. If either parameter is blank, a session cannot be started.

11. Select the desired Start Method:

- Start Switch, use start switch for each station after loading test subject.
- Enclosure XY activity, starts session as soon as beam breaks are detected.
- All Enclosures at Session begin, session starts as soon as diagnostics finish successfully.
- All Enclosures from Enclosure 1 when Script running. (Only used when Optional Scripts version of MotorMonitor Software is purchased). This feature allows starting all enclosures with the Enclosure one start switch at the same time.

12. If you want to save this session for running later, select the **File** menu, then select **Save As**. A screen will appear as shown in Figure 2-4.

NOTE

A Saved Session file is a complete session file with the exception of the collected data. These files can be used for new sessions when some or all of the information remains constant.

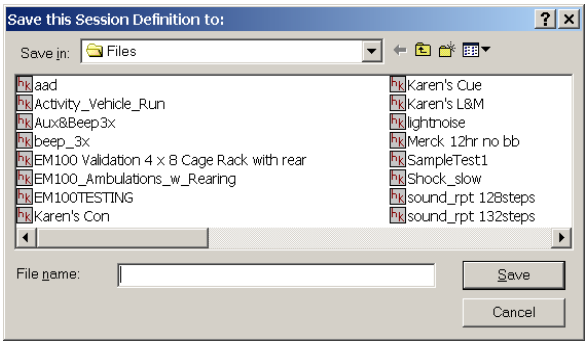


Figure 2-4. Naming a Saved Session File

13. Click on the yellow chevrons located on the tool bar (Figure 2-3). A screen will appear as shown in Figure 2-5 asking you to enter a file name for the raw data file.

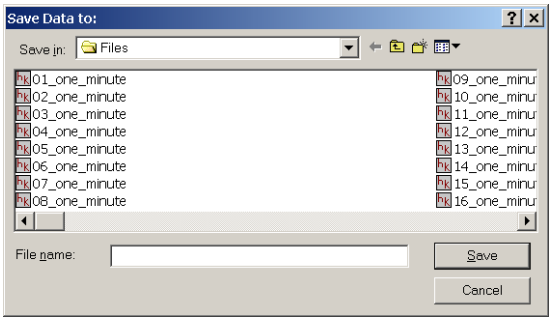


Figure 2-5. Naming the Raw Data File

14. Enter the desired file name and then click on **Save**. You will be prompted as shown in Figure 2-6 to start the session. Click on **Yes**.

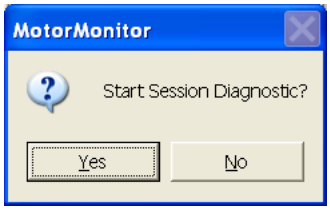


Figure 2-6. Start Session Diagnostics

15. Next, a diagnostic is performed (Figure 2-7) before running the session. *Make sure* there is nothing located inside the frame that can block any beams. If this happens, the diagnostic will fail. You will have to remove whatever was causing the failure and then return to step 11.

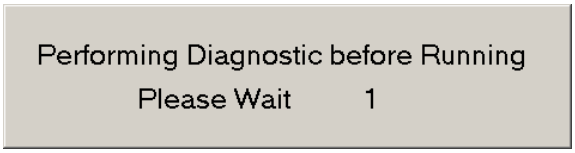
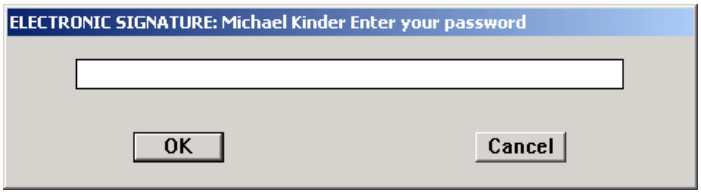


Figure 2-7. Diagnostic Running Screen

16. If you are running a GLP version you will need to enter your password as a confirmation of an electronic signature. The screen below will appear.



17. Next, the upper level runtime screen (Figure 2-8) will appear on the display. The upper level runtime screen provides the status for each enclosure. One enclosure was used in this example.

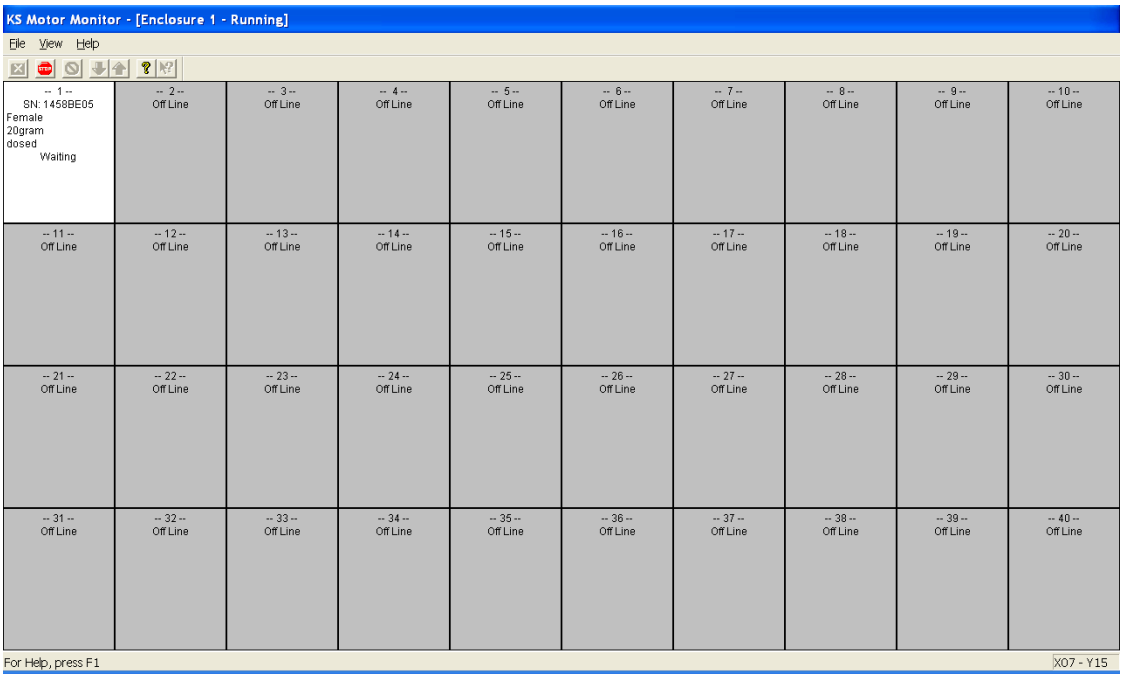


Figure 2-8. Upper-Level Runtime Screen

NOTE

The number of enclosures appearing on the Upper-Level Runtime Screen depends upon the maximum number of enclosures allowed for the selected configuration. For example, the 16 x 16 Open-Field system can have a maximum of 32 enclosures, the Cage Rack system can have a maximum of 40 enclosures, the PlusMaze system can have a maximum of 32 enclosures, and the Forced Swim system can have a maximum of 32 enclosures. (Refer to Section 1, para 1.8).

18. Refer to Figure 2-8 and double-click on the white backlit field. The lower-level runtime screen will appear similar to the one shown in Figure 2-9. You can modify the appearance of this display from the selections on the **View** menu by selecting **Show Grid** and/or **Show XY-Sw. Centroid, Points** and **Oval** are used to modify the appearance of the circle that represents the test subject. Take some time and activate each of these during a session to see how each one changes the display. These tools do not change the data in any way; they simply provide alternate views of the subject's movements during runtime. The tan dot in the lower left represents the animals' current centroid, i.e., the calculated center of the animal based on all beams broken. The green squares represent each x and y beam currently blocked.

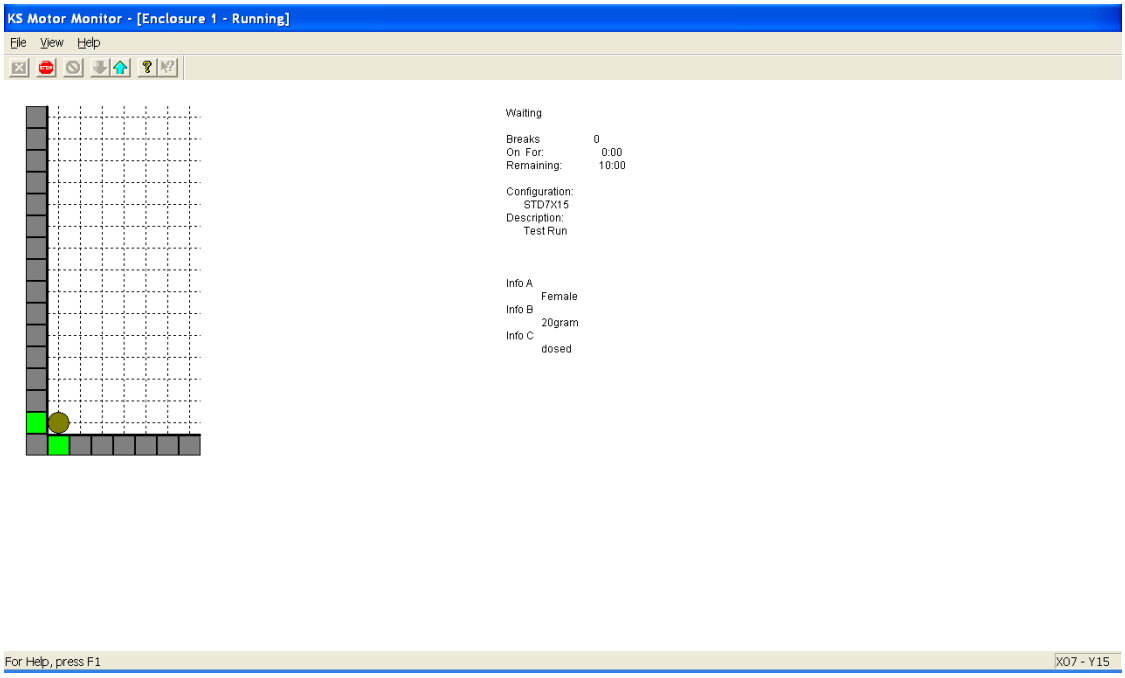


Figure 2-9. Lower-Level Runtime Screen

19. Place the animals in the enclosure and press the start button located on the front of the enclosure. Each enclosure will collect data independently and will display a **Done** message when completed. This allows you to inject animals and start enclosures independently. Once all enclosures display **Done**, close the session by clicking **File** and **Close**. If you close (abort) the session before all enclosures display **Done,** the data file will contain all beam information up to the point the session was aborted. We cannot guarantee capture of information of aborted session because there is a possibility that if an abort occurs exactly when the system is writing to the file some or all data may be lost or corrupted.

20. For Sessions that have a Pre Pause time selected you will see the following screen when the session is paused (See Figure 2-10). This screen only appears if a Pre-pause time was selected when session was created. (See section 2.1.1 para. 4)

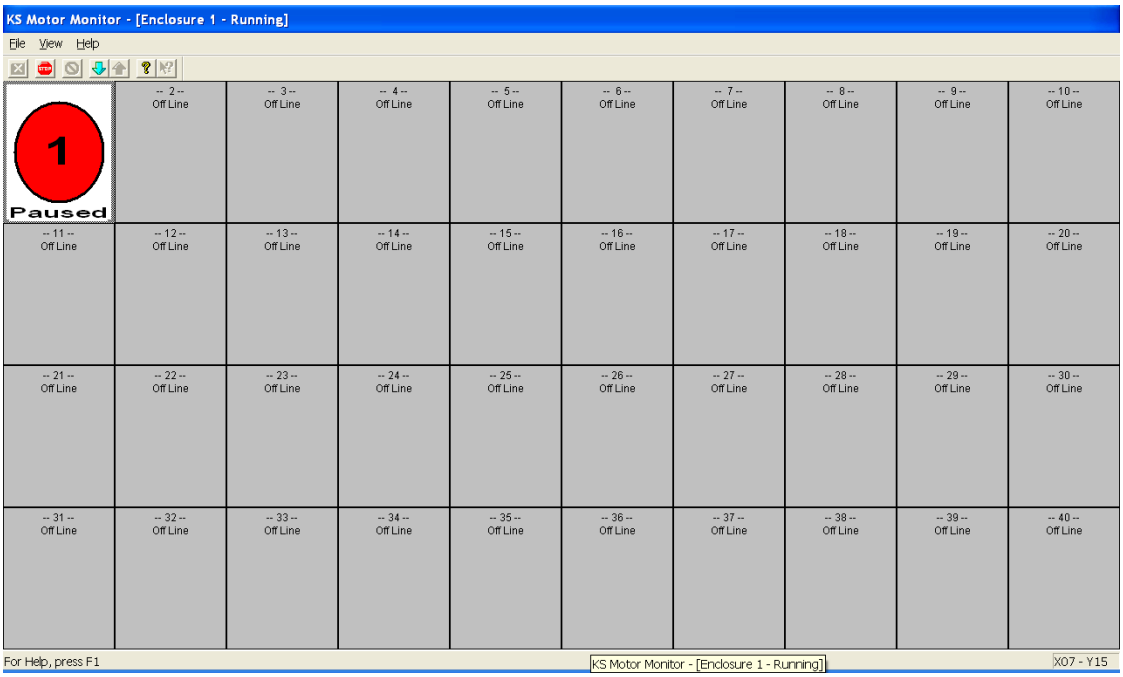


Figure 2-10. Paused Runtime Screen

21. The session example used the 7 x 15 High Density Cage Rack frame. If you have a different system, the program operates the same way, but displays your system configuration. Primarily there will be a different number of displayed beams. For example, Open Field and Plus Maze systems have 16 x16 beams and any possible number of event beams (such as rearing, edge pokes for plus mazes, etc.). For low-density cage-rack systems there are 4 x 8 or beams.

2.2 Understanding Data Reduction or what to do with the collected data

Once a session is finished, you will need to see the results of the collected data. This is accomplished by funneling any variety of data files into one reduction file. The resulting reduction file will then contain all the requested measures. It is a comma-delimited file specifically set up for easy export into spreadsheets or statistical programs such as Excel.

Our export files use Standard Data File formats, i.e., an ASCII file type accepted by the most popular programs. There are four basic steps to data reduction.

1. Select Desired Measures
2. Select the Files for Reduction
3. Set Interval and other analysis parameters
4. Name the Output File.

2.2.1 Reducing Data

To reduce a data file perform the following steps.

NOTE

You must select at least one zone to receive any zone metrics

1. Select **New**, then **Reduce**. The display will appear similar to the one shown in Figure 2-11.

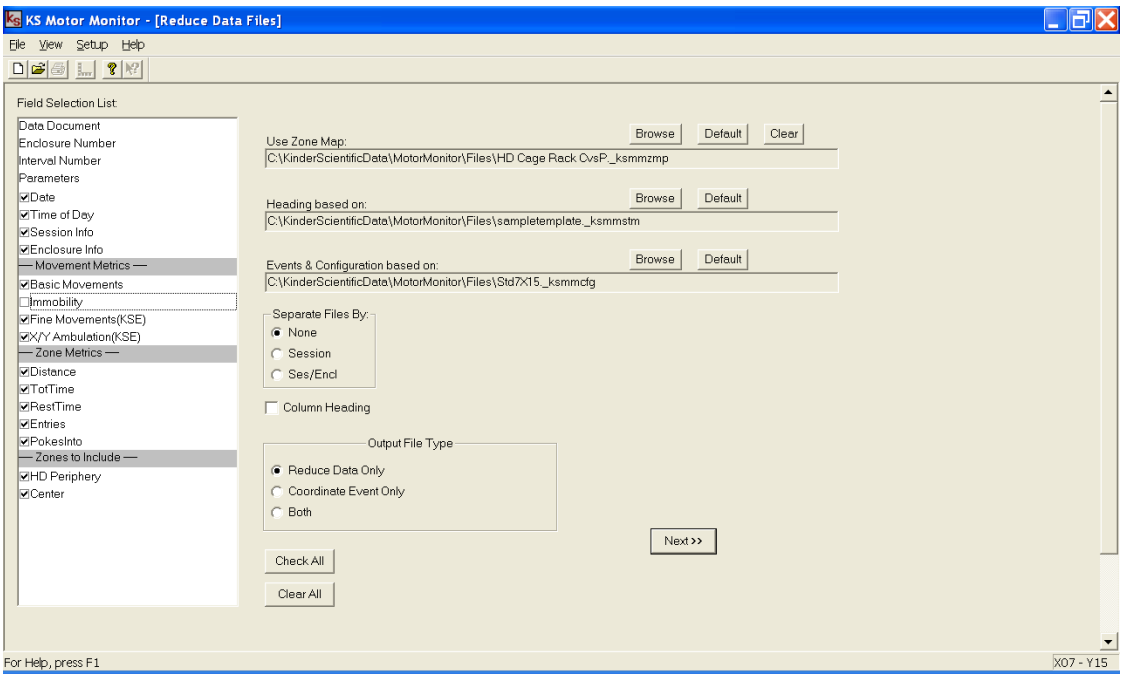
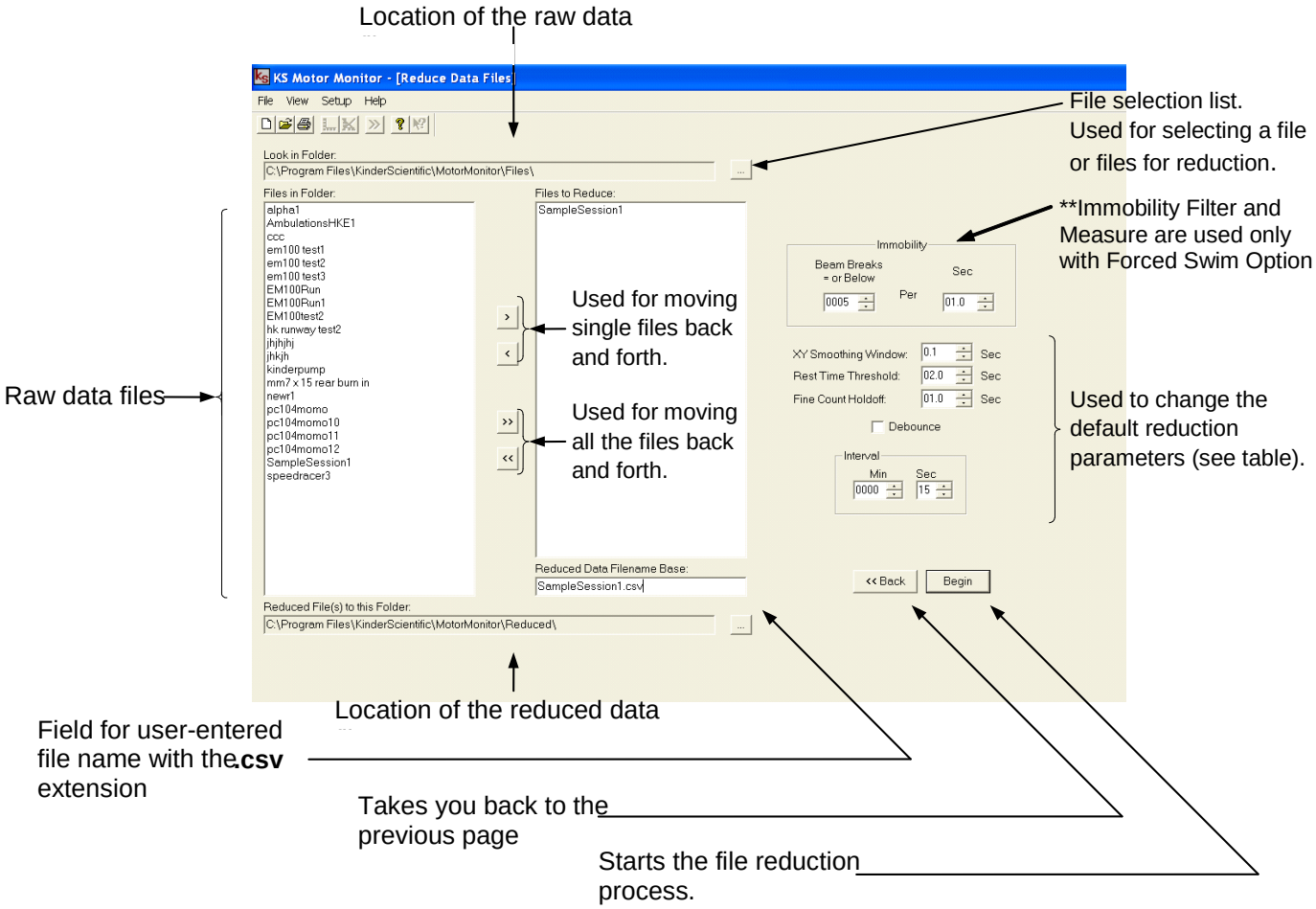


Figure 2-11. File Reduction "Reduce Fields" Screen

2. Check all boxes except **Immobility**. Immobility is only used with the Forced Swim Option. Although not required for a reduction, we recommend the **Column Heading** box is checked. This parameter causes the first line of the output file to show the title of each of the output columns. Note about output File type, Coordinate Event outputs raw event files, and are *not* applicable to GLP Studies.

3. Select **Next**. The display will appear similar to the one shown in Figure 2-12.



Default Reduction

Parameter	Purpose
X Y Smoothing Window	Distance correction
Rest Time Threshold	Establishes what "at rest" means
Fine Count Holdoff	Sets max rate counter can increment
Debounce*	Helps eliminate electrical noise
Interval	Time slice for a session
Immobility*	Eslablishes what level of movement during selected time is Immobile.

*Normally set to off (not checked) – *See Using Advanced Features*
**Immobility - used only for Rat Forced *Swim Testing.*

Figure 2-12. File Reduction "Reduce Files" Screen

4. Select the file or files you want to include in the reduction. To select a file, either double-click on each file to move it to the selection list or click once on each file to highlight it, and then click the single right chevron. The double chevrons move all files to and from the selection list. You can select as many as you like with one word of caution, it's a good idea to select only files with the same session length.

NOTE

If files of different session lengths are used you will receive complaints from the software.

5. Next, set the **Interval** you want to use. This parameter determines the width of the time slice you want the data divided into. For example, you might have a one-hour test you want divided into 10-minute data intervals. Set the interval to 10 minutes and zero seconds.

6. Enter the file name in the **Reduced Data Filename Base** field making sure you add **.csv** as the file extension. Although optional, this can be particularly helpful if you are using a program such as Excel.

7. Click on **Begin**. The system creates an output file and places it in the Reduced directory.

8. Click **File** then **Close** and you will return to the main Window. You are now able to import that file into your spreadsheet or statistical program.

9. Open Excel and then open the file you just saved. The data will appear similar to Figure 2-13.

Document	Encl	Interval	Parameters	Date	Time	Session Info 1
SampleSession1	1	1	NI010200100000150100005	20060803	155259	User info space
SampleSession1	1	2	NI010200100000150100005	20060803	155314	User info space
SampleSession1	1	3	NI010200100000150100005	20060803	155329	User info space
SampleSession1	1	4	NI010200100000150100005	20060803	155344	User info space

Session Info 2	Session Info 3	Session Info 4	Animal #	Group/Sex	Dose Level	Session Info 5
for up to four	separate	fields	123456	StudyA/male	1mg/kg	for up to four
for up to four	separate	fields	123456	StudyA/male	1mg/kg	for up to four
for up to four	separate	fields	123456	StudyA/male	1mg/kg	for up to four
for up to four	separate	fields	123456	StudyA/male	1mg/kg	for up to four

Session Info 6	X Ambulation(KSE)	Y Ambulation(KSE)	Periphery<Distance(in)>
separate	61	80	153
separate	33	28	64
separate	0	0	0
separate	1	0	3

Periphery<TotTime(sec)>	Periphery<RestTime(sec)>	Periphery<Entries>	Periphery<PokesInto>
15	0	0	0
15	9.8	0	0
15	15	0	0
15	15	0	0

Center<Distance(in)>	Center<TotTime(sec)>	Center<RestTime(sec)>	Center<Entries>	Center<PokesInto>
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

Figure 2-13. Excel Reduced Data File Example

NOTE

The example shown in Figure 2-13 is the result of a validation session using the EM100 Photo Beam Validation System.

The headings and data provided by the reduced data file readouts are fairly straightforward with the possible exception of the **Parameters** column. This information reflects the settings of the **Default Reduction Parameters** screen. These settings also appear on the second page of the **Reduce Data Files** screen (except **Distance Units**) and can be modified for an individual file reduction session. The **Default Reduction Parameters** screen can be accessed by selecting the **Setup** pull-down menu and then selecting **Default Reduction**. An example of this screen and a description of what the **Parameters** heading means are described in Figure 2-14. Also, you can exclude the Parameters column from the Reduced Data file readout by un-checking the box labeled **Include Parameters Column.** Immobility and Auto Reduce settings are included the column.

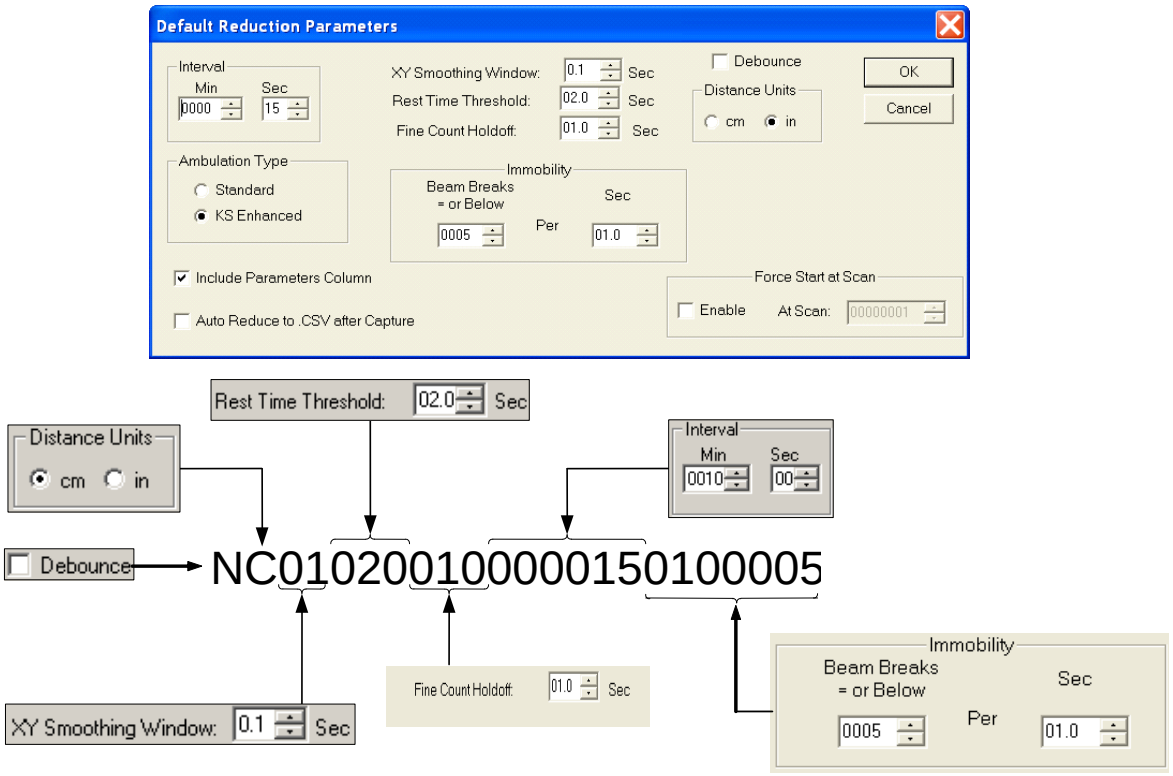


Figure 2-14. Default Reduction Parameters Description

- *Debounce: N=Not Selected, D= Debounce selected.*
- *Distance Units: I = Inches, C= Centimeters.*

- *XY Smoothing Window: 01 = 0.1 Seconds.*
- *Rest Time Threshold: 020 = 2.0 Seconds.*
- *Fine Count Holdoff: 010=01.0 Seconds.*
- *Interval: 000015 = 0000 Minutes, 15 Seconds.*
- *Immobility: 0100005 = 0005 beam breaks or less per 01.0 Seconds.*

NOTE: Forced Start at Scan feature enables the option of allowing the reduction of data at a predetermined number of beam breaks, only used if an enclosure did not have the start switch pressed accidentally at the beginning of the session. Normally would not be used.

2.2.1.1 Ambulation Type The other parameter on the **Default Reduction Parameters** screen is **Ambulation Type**. When **HK Enhanced** is selected, the software becomes much more discriminatory when dealing with the difference between ambulation and fine movement. The definitions of these two movement metrics can be found in the glossary, but are repeated here as part of this description.

Ambulation

A measure used to express larger animal movements, i.e., the subject changed its entire body position on the grid. A brief description of the algorithm follows: an ambulation occurs when a new beam block occurs *and* the anchor beam for that dimension is released (cleared) before the new beam. The anchor beam is the lowest beam blocked in that dimension. For example, if X2, X3 & X4 are blocked and then X5 is blocked, the new beam break at X5 will be counted as an ambulation if X2 is cleared first. Otherwise, the break at X5 is recorded as a fine movement. By definition, the animal must relocate its whole

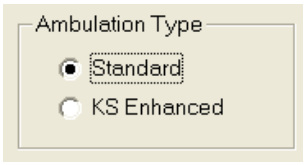
body to cause an ambulation count. X and Y ambulations are reported separately.

Fine Movement

A measure used to express smaller animal movements, i.e., the subject changes a beam status but the change does not fit the definition of an ambulation. One example would be a single beam changing status while no other beams changed status. There are more complex Fine Movements such as head weaves. For example, if an animal is repeatedly moving its head from left to right and back again; it could alternately break beams on the left and right sides of its head. Fine Movements are used to report movements such as grooming and/or head movements. The Fine Movement counter is incremented because of the Beam status change ***not*** meeting the Ambulation algorithm. That is, there is no specific test for Fine Movements.

While the previous statement is still true, the Ambulation algorithm is now capable of making a more informed decision as to what is and what is not an ambulation. An example of this is provided using the EM100 Photo Beam Validation System. The EM100 creates Ambulations using an activity vehicle moving in a predetermined path. Fine Movements are created using a stationary beam interrupter. The EM100 is designed so that these two movement metrics *cannot* occur simultaneously.

Figure 2-15 shows movement metrics from the same data file. A file reduction was performed with **Standard** as the selected **Ambulation Type** and then repeated with **KS Enhanced** selected. Note that in the first, third, and fifth intervals of the **Standard** reduction that even though the activity vehicle was providing all of the beam breaks, about one-third of the beam breaks were defined as fine movements. With **KS Enhanced** selected for the file reduction, the data is much more accurate.



Basic Movements	Fine Movements	X Ambulations	Y Ambulations
7679	1970	2858	2851
210	210	0	0
7681	1961	2862	2858
210	209	0	1
7680	1949	2867	2864
209	209	0	0

Basic Movements	Fine Movements(HKE)	X Ambulations(HKE)	Y Ambulations(HKE)
7679	1	3839	3839
210	210	0	0
7681	1	3840	3840
210	209	0	1
7680	1	3840	3840
209	209	0	0

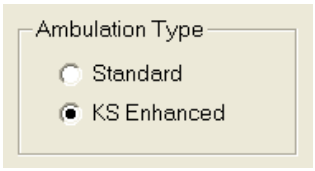


Figure 2-15. Ambulation Type Selection Examples

2.2.2. Understanding Reduced Files and Zone Maps There are two measurement types available for data reduction. These are Movement Metrics and Zone Metrics. Zone metrics are the result of an optional zone map included with the collected data. A zone map is not required for data reduction and, if not included the Zone Metrics fields will not appear on the screen. This is shown in Figure 2-16.

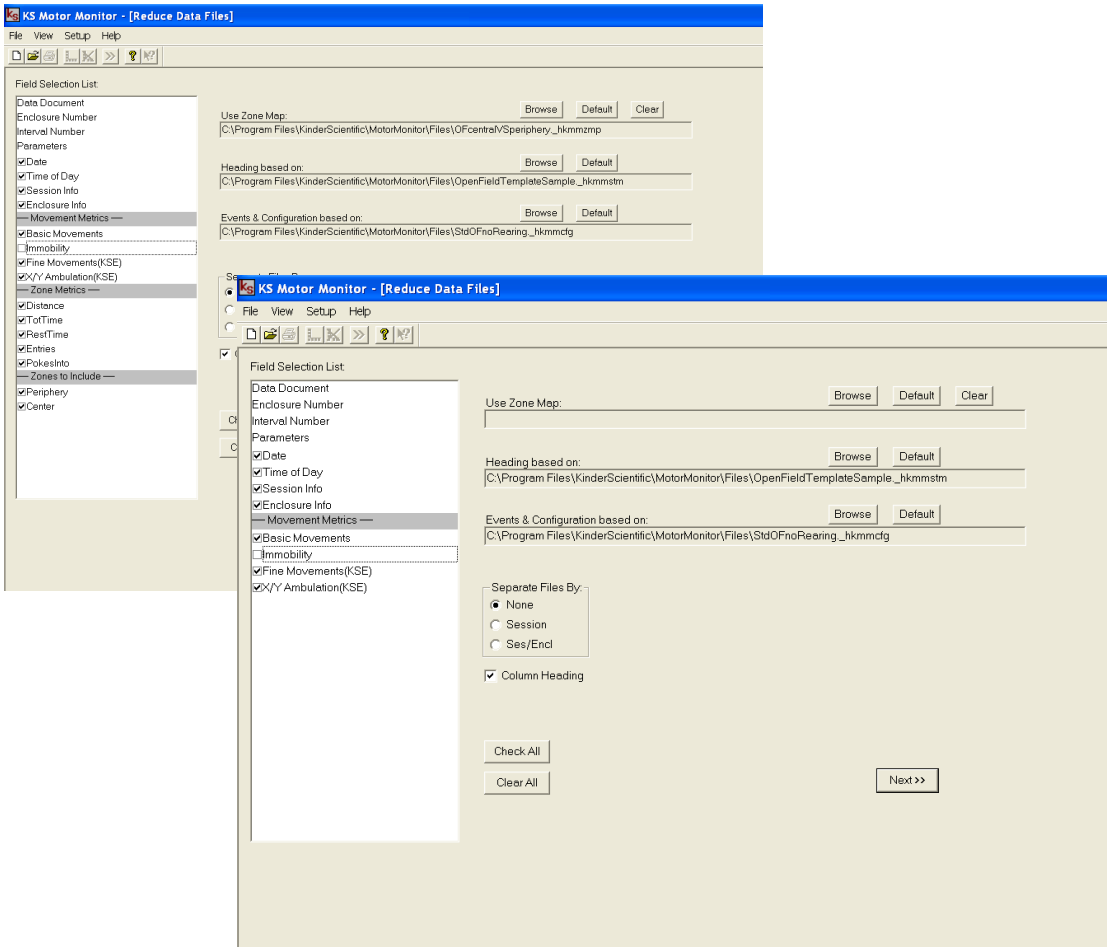


Figure 2-16. Reduce Fields Screen With and Without a Selected Zone Map

During data reduction, zone metrics are included in the reduced output file according to the zones defined in the active zone map. Distance, Total Time, Rest Time, Entries, and Pokes Into zones are all calculated per zone/per interval. You must select at least one zone in the **Zones to Include** field for any zone metrics to appear in the output file.

Typically, zone maps are created by the user to fit a specific test. When ***MotorMonitor*** was installed, a sample zone map was included as the default and will be used for data reduction until another one is created. The sample zone map is provided for reference only and may or may not provide any meaningful data.

You can view the current zone map by clicking on **File, Open,** and then **Zone Map**. A selection screen similar to Figure 2-17 will appear.

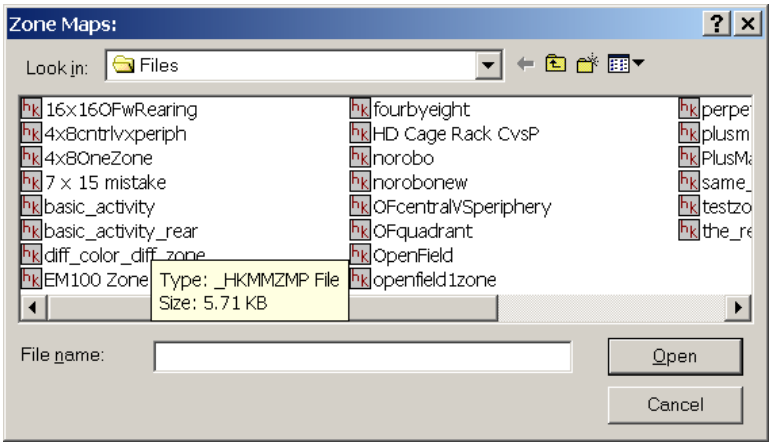


Figure 2-17. Zone Map Selection Screen

MotorMonitor will display a selection window containing only the factory sample map until you create more of your own. To create or modify zone maps see ***Using Advanced Features***.

Figure 2-18 is the zone map used for the data reduction example shown in Figure 2-13.

NOTE

All of the functions in this chapter are described in detail in Chapter 3, ***Using Advanced Features***.

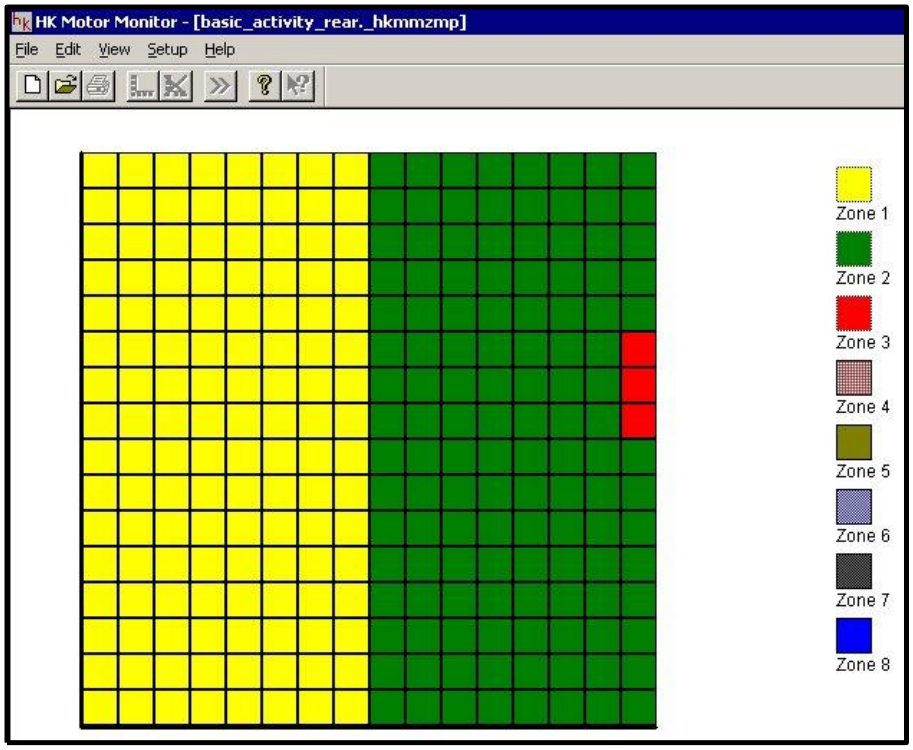


Figure 2-18. Sample Zone Map

CHAPTER 3
USING ADVANCED FEATURES

3.1 Introduction

This chapter is broken into four parts. **General Setup Issues** describes ***MotorMonitor's*** file handler, how to setup file locations, how to setup Default settings, and how to take advantage of the keystroke reduction features. The next part, **Advanced Data Reduction Techniques,** describes the types of measures available and how to take advantage of them. The third part, **System Diagnostics**, provides some insight into how advanced diagnostics work and how they can help you troubleshoot your system in case of a problem. The fourth part, **Printing Session Information**, describes how to print session setup information.

3.2 General Setup Issues

3.2.1 Using MotorMonitor's File Handler A special approach has been used to simplify the user's efforts when handling ***MotorMonitor*** files. The approach centers on file extensions. Table 3-1 lists all file types and their file extensions.

Table 3-1. MotorMonitor File Types and File Extensions

File Type	Extension	Description
Session	._ksmmdat	The Raw data file from a session.
Saved Session	._ksmmses	A session file saved for later use.
Session Template	._ksmmstm	A file used to pre-fill the session input screen.
Zone Map	._ksmmzmp	A file used during data reduction to partition data.
Configuration	._ksmmcfg	A file created by the factory to configure hardware (typically cannot be changed by user).

Important: Older versions of application software used a different file extension structure, specifically "._hkmmdat, ._hkmmses, ._hkmmstm, ._hkmmzmp, and ._hkmmcfg". For using older files created using these extensions on the software build versions applicable to this manual, simply rename the file using the extensions listed in table 3.1, above. (e.g. , 123456._hkmmdat renamed to 123456._ksmmdat)

MotorMonitor displays only the files related to the selected function. For example, if you are loading a different zone map for data analysis only the files with the extension **._ksmmzmp** will be displayed. However, only the file names (without the extension) are displayed. The file names will only be zone map files. This approach removes the clutter of unrelated files for each task, i.e., only the selected file-types are displayed even though other files (of other file types) may exist in the same folder.

3.2.2 Browse Buttons While stepping through the various ***MotorMonitor*** screens you will encounter a small button with three dots inside. This button is used to represent the browse button. Simply click on the button and you will invoke a Windows-type browse feature.

3.2.3 Setting Default Files/Folders You can customize your system by configuring the default settings to your specific needs. To set the defaults click on **Setup**, then click on **Default Files/Folder**. A menu will appear as shown in Figure 3-1.

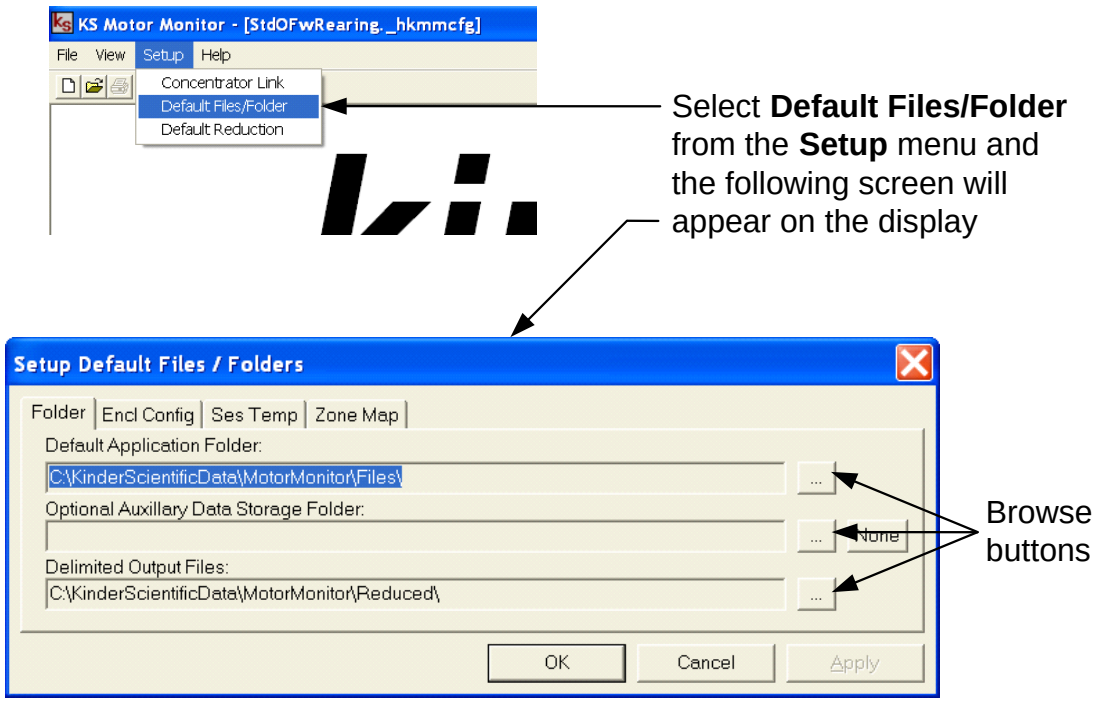


Figure 3-1. Setup Default Files/Folders Menu

3.2.3.1 Folder Tab - Default Application Folder This field determines where ***MotorMonitor*** stores the raw data files (refer to Figure 3-1). You can use this setting to store each study in a different directory. However, if you change the directory for each study, you must change this default each time you start a new study. To change the directory, click on the browse button at the end of the field. This is how the browse button appears (most of the time) throughout ***MotorMonitor***.

3.2.3.2 Folder Tab - Optional Auxiliary Data Storage Folder This is a Part 11 and data security feature. This feature provides a redundant raw data file to be stored automatically at the end of each session. It is most commonly used as a way to provide a copy of the raw data to a network. Simply provide the path where you want the extra file to be stored. If this default is left empty, the system will only store on the local drive. If the secondary drive is not available or has a failure during a session, this feature will not prevent the collection of the data for a session. Instead, it will provide a message indicating the secondary site was not available and then it's up to the user to make the file manually available when the secondary drive is functioning.

3.2.3.3 Folder Tab – Delimited Output Files This field determines where ***MotorMonitor*** will store the reduced data files (refer to Figure 3-1).

3.2.3.4 Encl Config Tab - Default Configuration File This file is normally set when your system is installed and never changed (Figure 3-2). The only reason to change this default is if you purchase an option later that would require a change to the configuration file or if you are running two different activity systems on the same computer. Please contact the factory before changing anything in this file.

CAUTION

Altering the Configuration file can cause the system to malfunction.

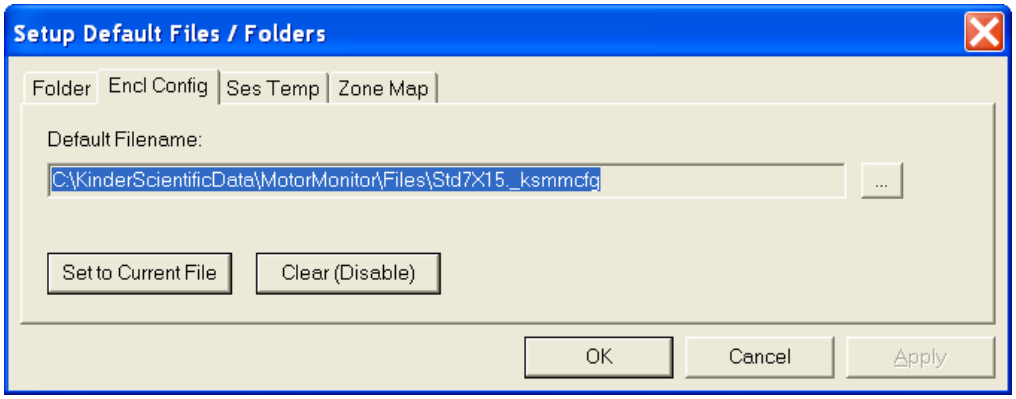


Figure 3-2. Encl Config Tab

3.2.3.5 Ses Temp Tab - Default Session Template File The Session Template file is the first thing that appears on the display when you start a new session. Basically, the file contains common parameter settings and user information fields that are set automatically when you start a new session. This file is used as a basic fill in the blank routine for those items that you may commonly set with one value (for at least one study). You can change this setting each time you want a different template to automatically load its values into new session headers. Session Template files are described in detail in paragraph 3.3.4 of this chapter.

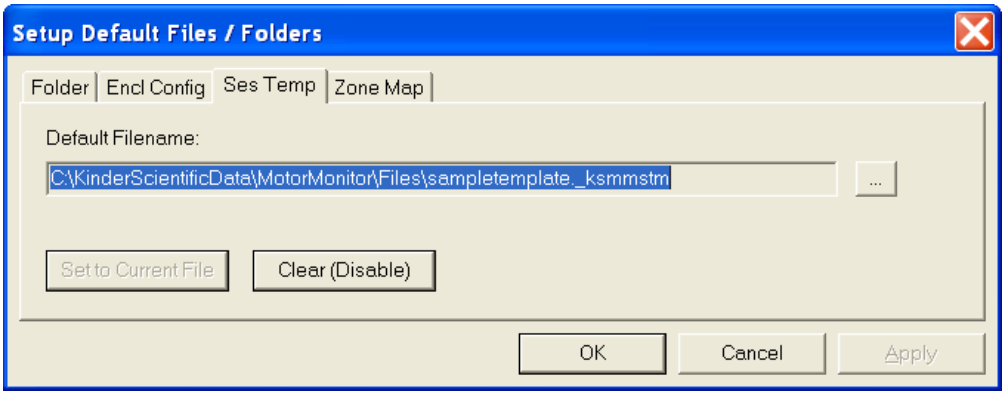


Figure 3-3. Ses Temp Tab

3.2.3.6 Zone Map Tab - Default Zone Map File This field is repeated on the first data reduction screen. You can change this file each time you want a different zone map for use during post processing. Setting the default zone map only pre-fills the field on the first reduction screen to this selection. It does not force this file as the only choice. You may change the zone map during data reduction by clicking the browse button on the reduction screen and changing it to a different one.

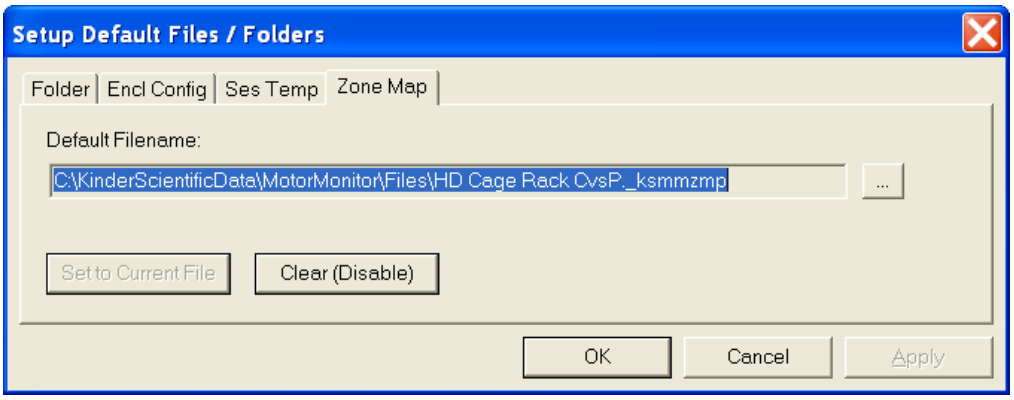


Figure 3-4. Zone Map Tab

3.2.4 Setting Default Reduction Parameters To access the Default Reduction Parameters screen click on **Setup** and then **Default Reduction**. This is shown in Figure 3-5. These fields (except **Distance Units**) are repeated on the second data reduction screen. Entering values into these fields from this screen pre-fills the fields on the second data reduction screen (another keystroke reduction feature). You can change these settings from the second data reduction screen on a case-by-case manner. It is important to remember that the software "remembers" the settings used in the most recent reduction effort and uses those settings on the subsequent reduction effort. This allows the user to "set" parameters and use them on all subsequent reduction efforts without the need of re-typing those parameters.

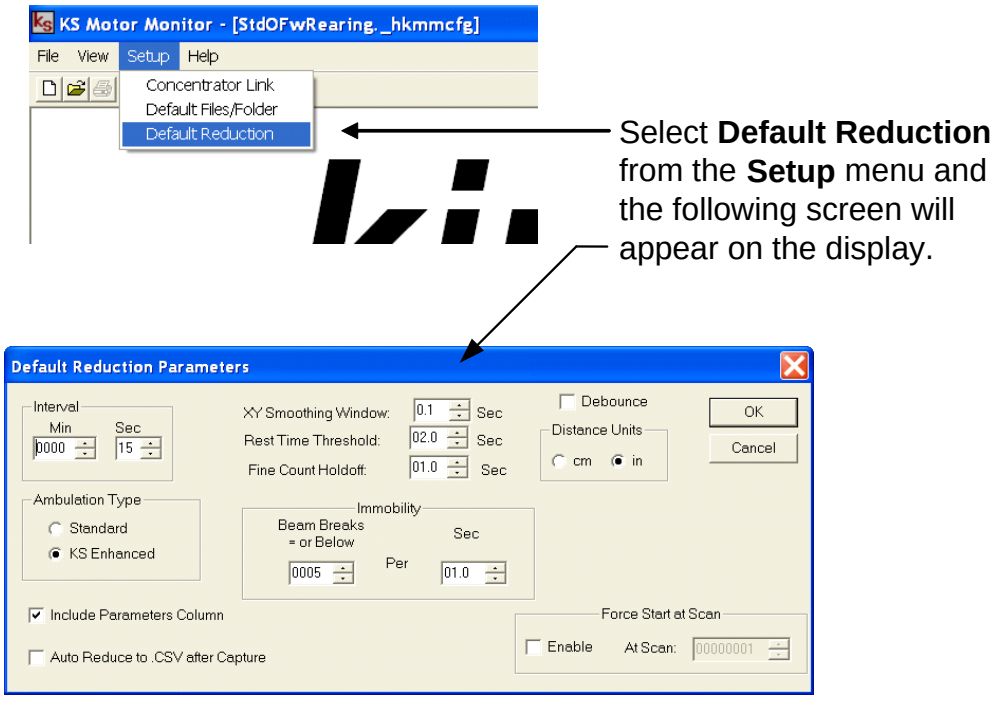


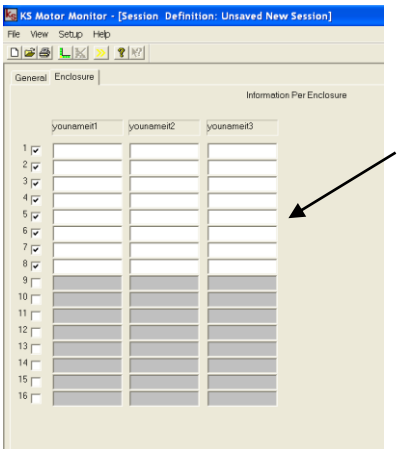
Figure 3-5. Default Reduction Parameters Screen

As a starting reference, set the **XY Smoothing Window** to 0.1 second, **Rest Time Threshold** to 2.0 seconds and **Fine Count Holdoff** to 00.0. Fine count holdoff is used for animals with extremely high amounts of small movements such as non-ambulatory stereotypic movements. The **KS Enhanced** Ambulation Type is recommended as it contains an improvement to the ambulation algorithm. The **Immobility** filters are not relevant to systems except Forced Swim stations. We suggest you have the **Debounce** filter *not* checked. The **Debounce** filter forces all beam breaks of less than 100 milliseconds to be ignored.

Auto Reduce option is specifically designed to help GLP labs reduce keystroke entry errors. When this box is checked, the software will automatically reduce the current session using the same base filename as the raw data file. The reduction will be based on the current (last used settings) parameters. The reduced file will be placed in the path set in the *Default Files Folder* for *Delimited Output Files.* Forced scan at start is only used if the start switch was not pressed at beginning of session to allow emergency data reduction.

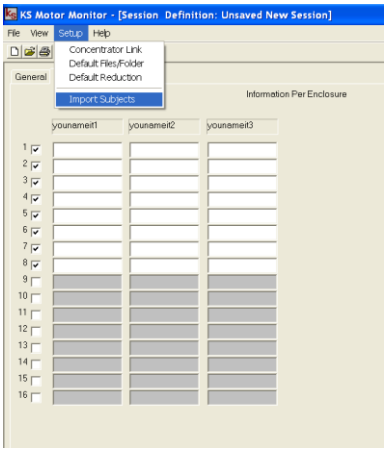
3.2.5 Importing Subject Information

There are three text fields which can be used to store important information for each subject. These fields can be either be manually typed in, as described in section 2.1.1, or the user may import one or more of the three columns of data from an existing text file. When you either open a new *Session* or create a new *Session*, you can enter animal information by clicking on the *Enclosure* tab. A screen similar to the one below will appear.



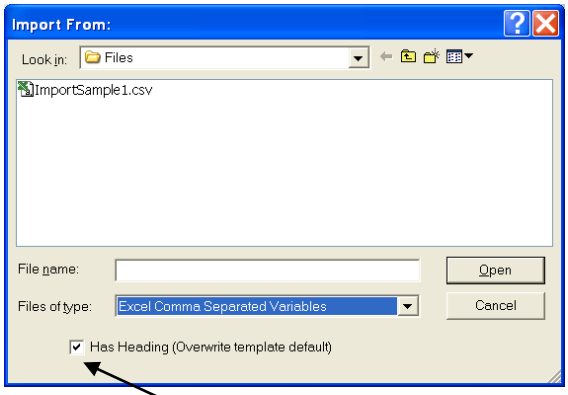
Manual entries can be made for each subject on this screen.

Alternatively, you may choose to *Import Subjects* information. Consider the following example:



Click on *Setup* the *Import Subjects* to import information from a text file.

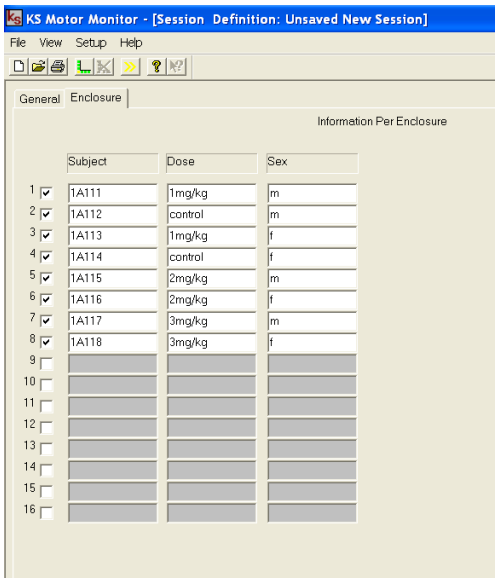
A screen similar to the one below will appear.



The file *ImportSample1.csv* is an ASCII comma delimited file containing the following information:

Subject,Dose,Sex
1A111,1mg/kg,m
1A112,control,m
1A113,1mg/kg,f
1A114,control,f
1A115,2mg/kg,m
1A116,2mg/kg,f
1A117,3mg/kg,m
1A118,3mg/kg,f

By clicking on a particular file the software will automatically import the subject information from that file into the appropriate fields in the session *Enclosure* screen. In our example the Session *Enclosure* window will appear as shown below:



In our example we also were able to change the name of the column headings by having the first row of the import file include the desired names and also telling the software by clicking the box for *Has Heading.*

3.3 ADVANCED DATA REDUCTION TECHNIQUES

3.3.1 Controlling the Output File The first of the two screens used in data reduction determines all measurement variables (**Movement Metrics, Zone Metrics, Zones to Include,** etc.) to be included with a reduced session file (Figure 3-6). The second screen (Figure 3-7) determines which file or files to reduce and where they are to be stored.

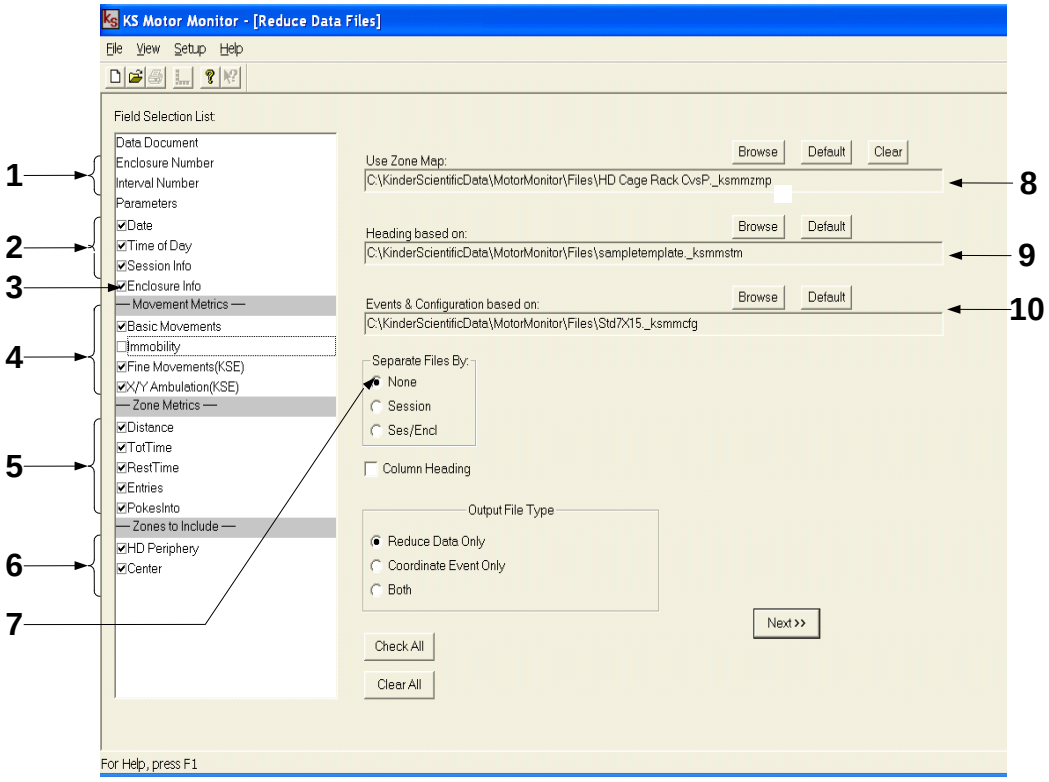


Figure 3-6. File Reduction "Reduced Fields" Screen

Please refer to the Glossary for definitions for all measures.

1. The **Enclosure Number** and **Interval Number** are always included in the output file.

2. Check these boxes to include the **Date, Time of Day,** and **Session Info** fields in the output file.

3. Check **Enclosure Info** to include the three individual (or less depending on the template setup) information fields.

4. **Movement Metrics** Check **Fine Movements** and/or **X/Y Ambulations**. While ***MotorMonitor*** contains a set of very advanced features, it is still sometimes useful to report simple beam breaks. To export a total of simple beam breaks, select fine movements only. Do not select any other measures.

5. **Zone Metrics** Check which of the zone metrics you want.

6. **Zones to Include** Choose which zones to be analyzed and included in the output file.

7. **Separate Files By** You can have a single file reduction (**None**), one file for each session (**Session**) or a file for every enclosure (**Ses/Encl**).

8. **Use Zone Map:** Select which zone map you want used for analysis. You can also create a different zone map and re-run the data reduction routine using the same data files. Remember, choosing a different zone map changes the current reduction effort. The results for the **Zone Metrics** and **Zones to Include** fields are calculated using the selected zone map as a reference.

NOTE

If the **USE ZONE MAP** field is empty (cleared), the **Zone Metrics** and **Zones to Include** fields will not appear on the **Field Selection List**.

9. You need to tell the system which template to use during data reduction for heading information. You can also select an original data file for this function. To do this, click on Browse, then click the down arrow on **Files of Type** then select **Within a Data File**. Select from the list provided.

10. If this field is empty, use the **Browse** button to locate and select the proper configuration file.

3.3.2 Selecting Files for Reduction

You can select any number of files for reduction and have the resulting data placed into a single file. To do this click on the desired files one at a time until you have all desired files highlighted and then click the right chevron. This will add the selected files to the **Files to Reduce** list.

The files that were selected in this example are shown in Figure 3-7, in the **Files to Reduce** list. Another way to create the list is double click each file. Each double click automatically moves that file to the **Files to Reduce** list. If you make a mistake and move a file that you actually do not want on the list, simply click on the file in the list and then click the left chevron. The two double chevrons move all files back and fourth. These features are described in Figure 3-7 and the references that follow.

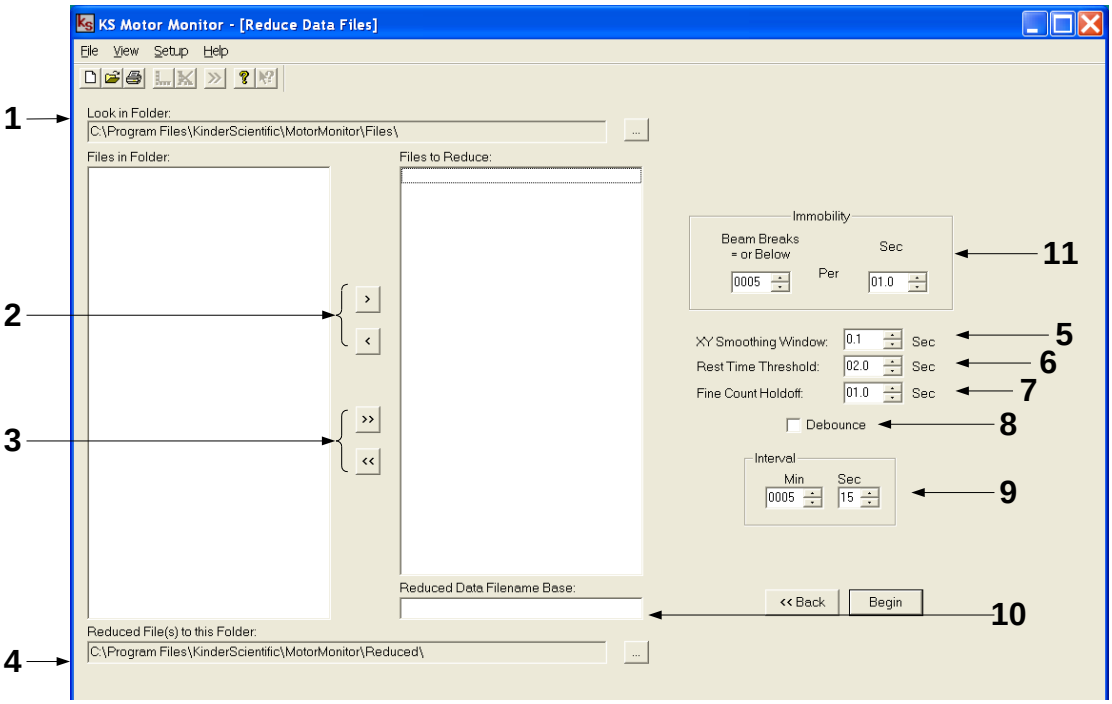


Figure 3-7. File Reduction "Reduced Files" Screen

1. **Look in Folder:** This is where the source files for reduction come from. If you have created multiple folders for file management purposes you will need to tell the software where to look for the data files you want to reduce. To do this click on the browse button at the end of the **Look in Folder** field and select the appropriate path.

2. **Left/Right Single Chevrons.** Used to move *single* or *selected* files back and forth.

3. **Left/Right Double Chevrons.** Used to move *all* the files back and forth.

4. **Reduced File(s) to this Folder:** This is the output file destination. You can direct the output file to any folder or drive you desire, including network drives. The easiest way to do this is to use the browse button and select the desired folder. This is because the path must be exact.

5. **XY Smoothing Window:** This parameter corrects for errors in distance caused by system data collection speed. Since data is collected every 50 milliseconds, it appears that the animal does not travel in straight diagonals, i.e., the path will always fall on the grid lines of the photobeams. This is because the odds that the animal broke both dimensions on the same data collection sample are extremely low. Therefore, setting this parameter will correct this error. We suggest you begin with 0.1 seconds. Because plus maze systems do not allow diagonal travel by design, and this parameter will not offer anything meaningful for that system.

6. **Rest Time Threshold:** There are three time related measures that provide great insight into an animal's behavior. These are rest time, active time and total time in zone. While there is not a direct output of active time, it is simply the difference between the Rest Time and Total Time. The question is, what does "at rest" mean? Alternatively, how long does an animal sit still to consider them "at rest." If you set it to 2 seconds then an animal must not move it's centroid for 2 full seconds before any time is added to the rest-time counter. Everything, including the 2 seconds, will also be added to the counter until the centroid position changes. Remember, this measure is based on the centroid, not simple beam breaks. Accordingly, the animal could break the same beam repeatedly and still be considered "at rest."

7. **Fine Count Holdoff:** As described in the glossary, any beam break that is not an Ambulation is a Fine Movement. The point of these two measures is to differentiate a beam break that results from the animal relocating it's entire body and ones such as grooming, head weaves, tail flicks, etc. Sometimes it can be useful to filter the Fine Movements to ignore high frequency counts caused by activities such as scratching. If you want every beam break to register, make sure you set this to zero.

8. **Debounce.** This is somewhat of an artifact from the developing years of motor activity. When set on it simply ignores any beam break that is not at least 101 milliseconds long. We suggest that unless you have a particular reason to use this you should leave it off.

9. **Interval.** This parameter determines the length of the time slice you want used for data reduction. For example, if you have a one-hour test and you want to slice the data into 12 equal parts you would set this parameter to 5 minutes. One word of caution, this parameter must divide evenly into the total test time. If you set the interval to something not evenly divisible into the total time, the remaining data will be truncated, i.e., it will not be placed in the output file.

10. **Reduced Data Filename Base:** This is where you give the reduced file a name. Remember to add the **.csv** extension to the file name. You can send the output file to any drive and folder location your computer has access to, including network drives.

11. **Immobility:** This filter and its related measure are only used for the Forced Swim option and generally used for rats, not mice. The filter is used to ignore all beam breaks the subject uses during treading. Since mice can float and generally do not tread the filter and measure are not intended for mice. At good starting point for the filter is 5 breaks in 1 second.

3.3.3 Creating a New Zone Map To create a new zone map, click on **New**, then **Zone Map** from the **File** menu. Next, you will be asked if you want the map to be based on the current configuration (Figure 3-8). If you have only one configuration, or if the correct configuration is active, then click on **Yes**. The question is asked because there can be more than one configuration type. For example, you might have both a cage rack and a plus maze system on one computer.

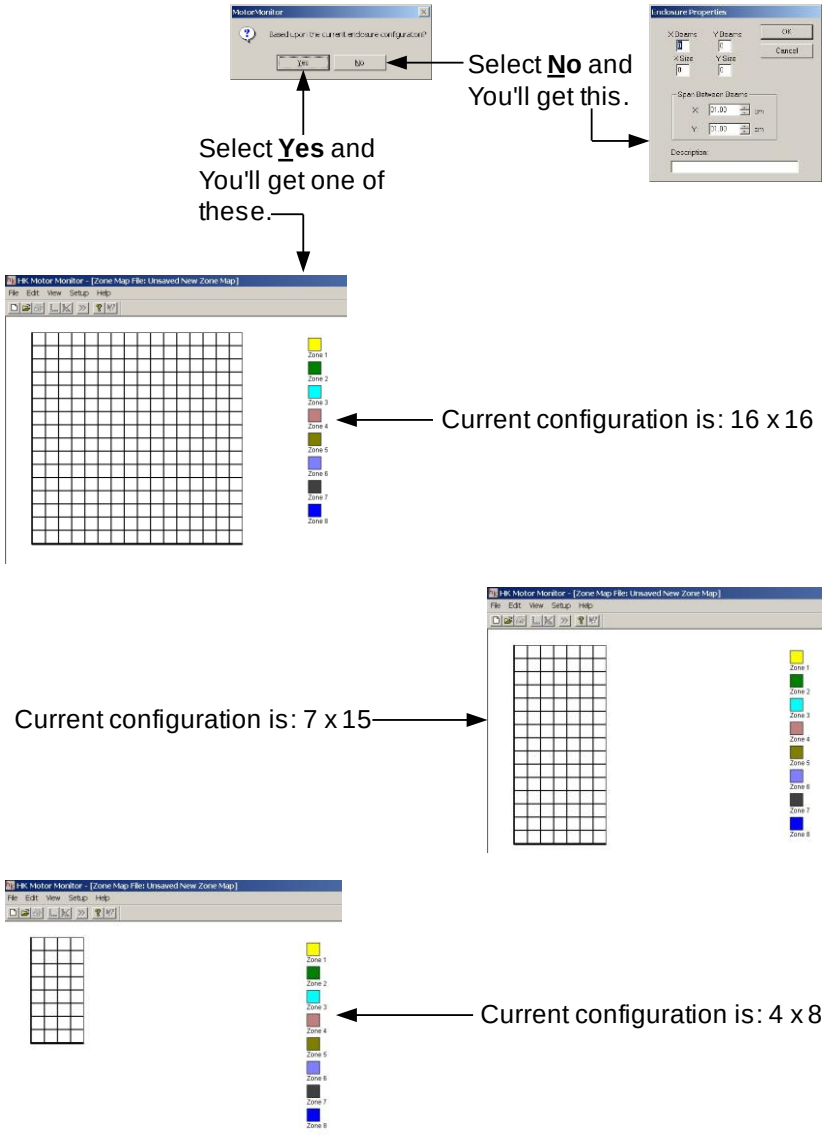


Figure 3-8. Starting a New Zone Map

To use **Select Area,** click on **Edit** and then **Select Area**. Place the mouse in the upper left of the desired area and while holding down on the left mouse button drag the mouse to the lower right and release the mouse button. This selects all blocks. After releasing the mouse button, the entire set of blocks will be highlighted with gray outlines. This indicates the software is waiting for you to assign a zone color to those blocks.

Using **Select Each** works in a similar manner except it selects one block at a time. To use **Select Each,** click on **Edit** and then **Select Each**. Place the mouse in the

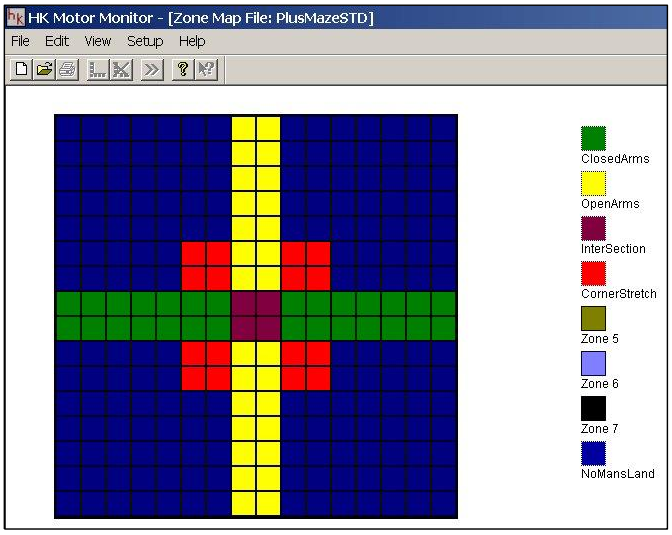


Figure 3-9. Elevated Plus Maze System Zone Map Example

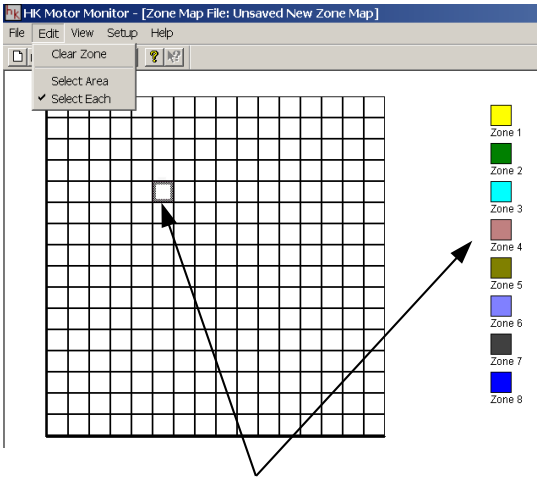
desired block and left-click. The selected block will be highlighted with a gray outline. This indicates the software is waiting for you to assign a zone color to the selected block.

In a zone map, each color represents a zone, even if the blocks are not contiguous. For example, the zone map in Figure 3-9 was created for the Elevated Plus Maze system. Even though all but one zone is non-contiguous, ***MotorMonitor*** treats each color as one zone. However, until colors are assigned to the zones, the map is meaningless.

Assigning all blocks to a zone is not required. If a block is not assigned to a zone, there will be no data available for those blocks.

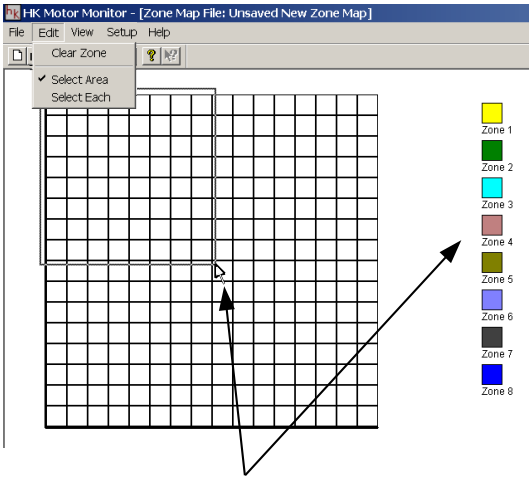
Use these tools to create a zone map. Figure 3-10 shows you how to do this.

Select Each



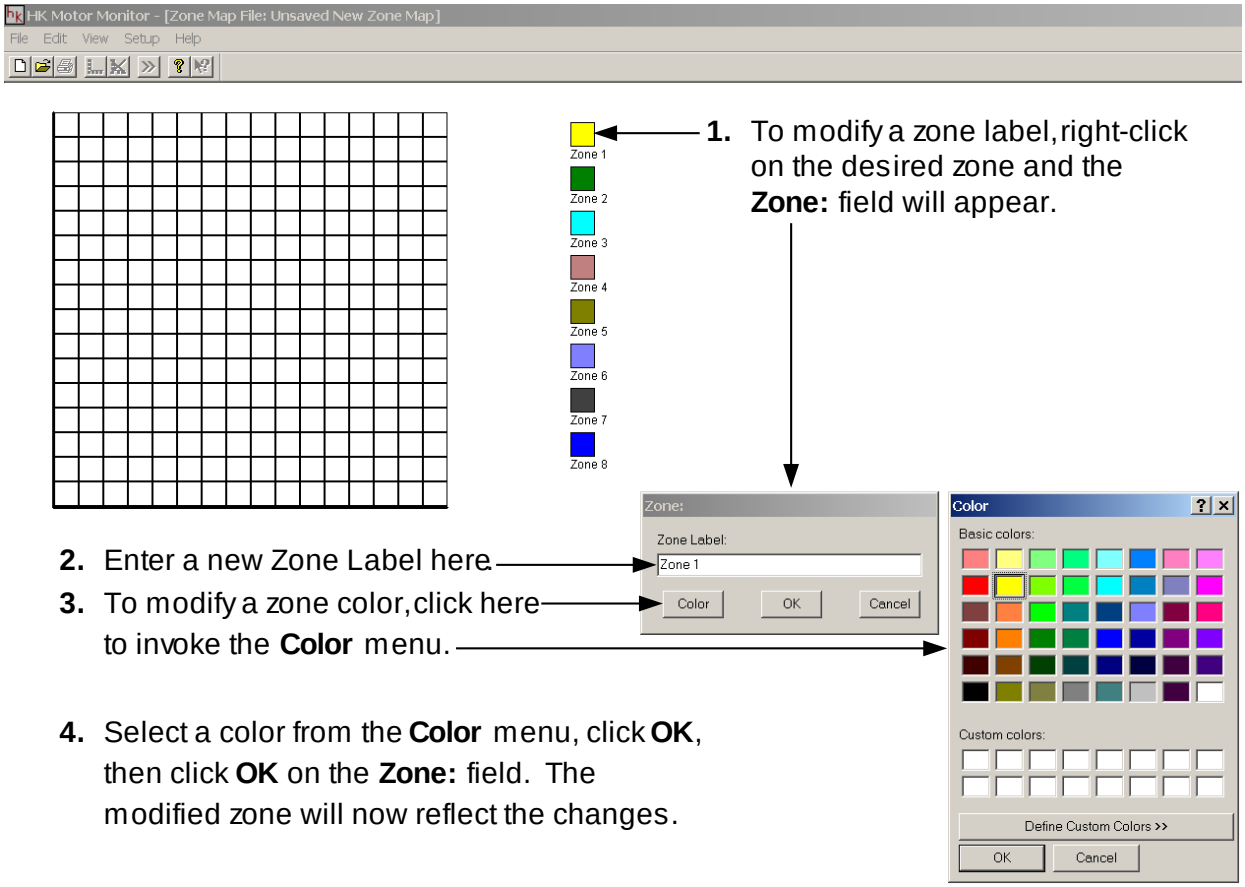
For **Select Each**, select individual square(s), then click on the desired zone.

Select Area



For **Select Area**, left-click and drag mouse pointer over the desired area, then click on the desired zone.

Modifying Zone Labels and Colors



1. To modify a zone label, right-click on the desired zone and the **Zone:** field will appear.
2. Enter a new Zone Label here.
3. To modify a zone color, click here to invoke the **Color** menu.
4. Select a color from the **Color** menu, click **OK**, then click **OK** on the **Zone:** field. The modified zone will now reflect the changes.

Figure 3-10. Creating a New Zone Map

3.3.4 Session Template Files If no default session template is selected, the first thing that appears on the display when a new session is selected is the session screen with blank information fields. A session template file consists of a session screen pre-filled with specific session information and then saved as a *session template* file. The primary purpose of a Session Template is naming the column headings for the output files. The secondary purpose is keystroke reduction. Keystroke reduction minimizes redundant data entry therefore limiting the incidence of entry errors and wasted data entry time. A Template file helps you:

1. Pre-fill the Description Field
2. Choose the number of Session Information Fields (up to four).
3. Name the Session Information Field Labels
4. Pre-fill Session Fields (optional)
5. Set Session Duration
6. Choose enclosures to be used
7. Choose the number of Enclosure (Subject) Information Fields (up to three)
8. Name the Enclosure Information Fields

The default session template file is set by accessing the **Ses Temp** tab of the **Default Files/Folders** menu and then selecting a session template file. This is shown in Figure 3-11. The selected default session template file will appear whenever a new session is started.

NOTE

This does not apply when opening a Saved Session. When opening a Saved Session the column headings are determined by the Session Template File that was used when the Saved Session was created.

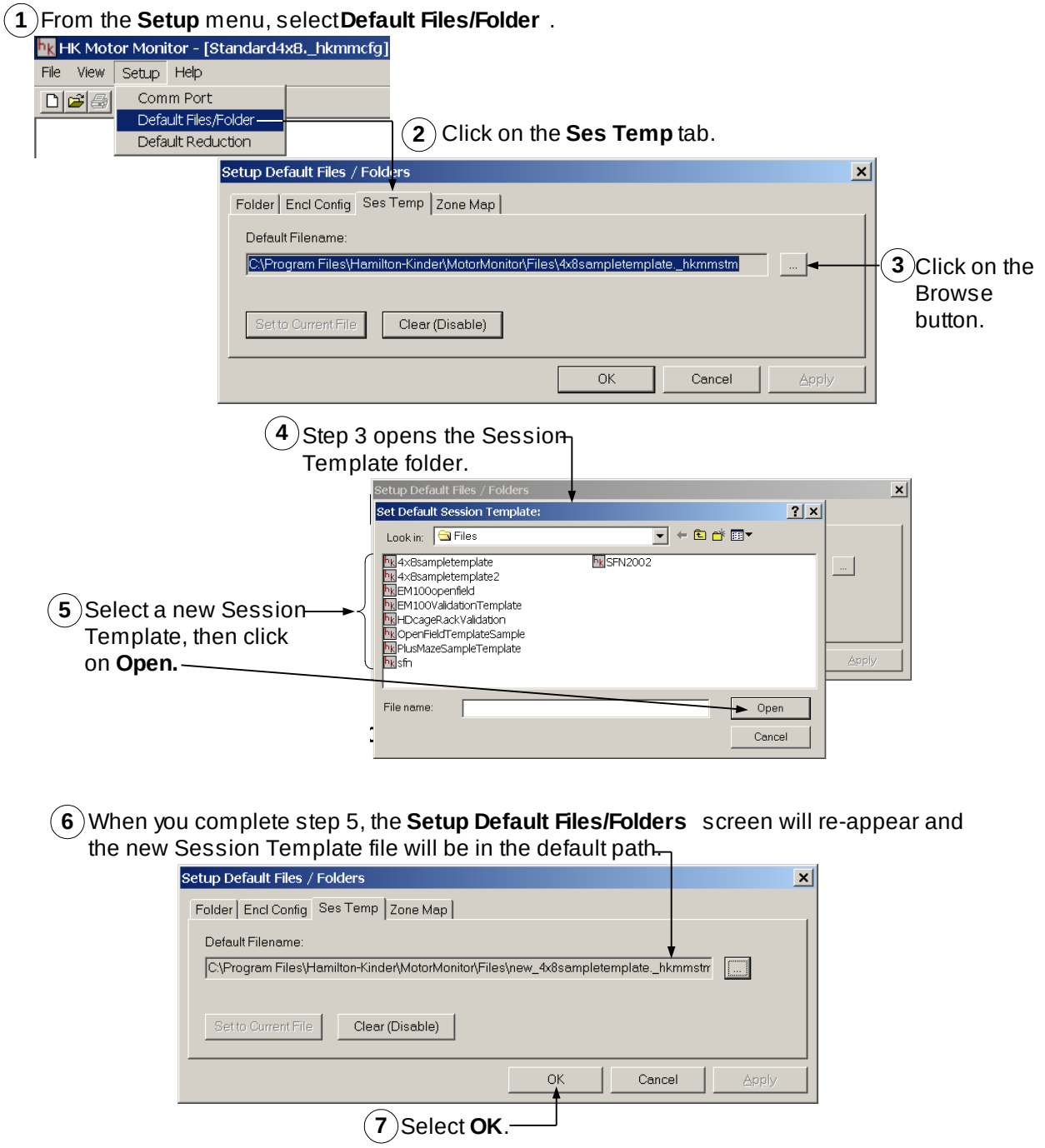


Figure 3-11. Selecting the Session Template Default File

3.3.4.1 Modifying Existing Template Files To modify an existing template file, click on **Open**, then **Template** from the **File** menu. The session template folder will appear on the display. Once a file has been modified, it can be saved under its existing file name or saved as a new file.

3.3.4.2 Creating New Session Template Files The following steps provide an example for creating a new Session Template.

1. Click on **New**, then **Template** from the **File** menu. A blank Session Template similar to the one described in Figure 3-12, will appear.

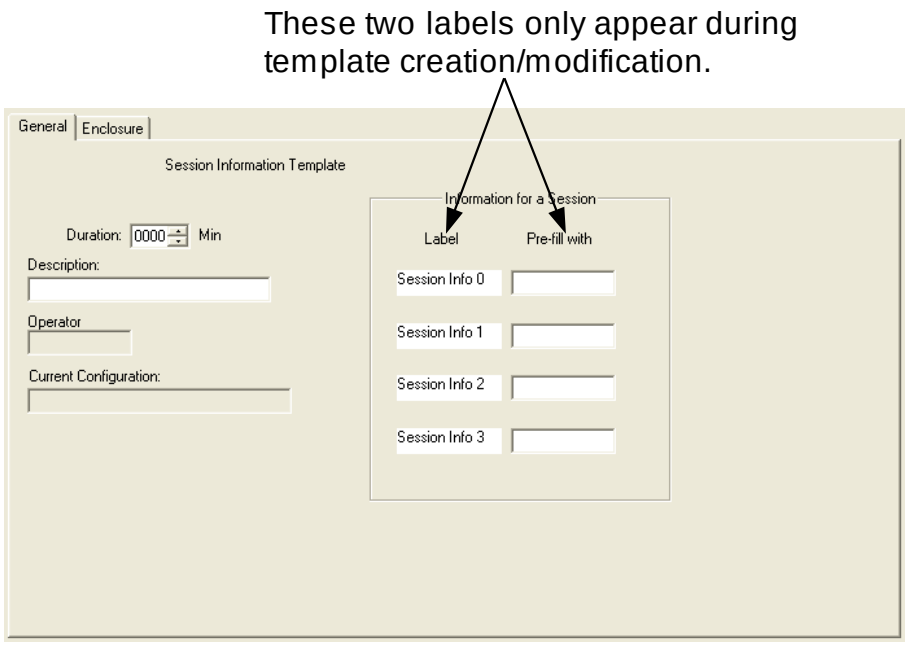


Figure 3-12. New Session Template

2. Modify the display as describe in Figure 3-13.

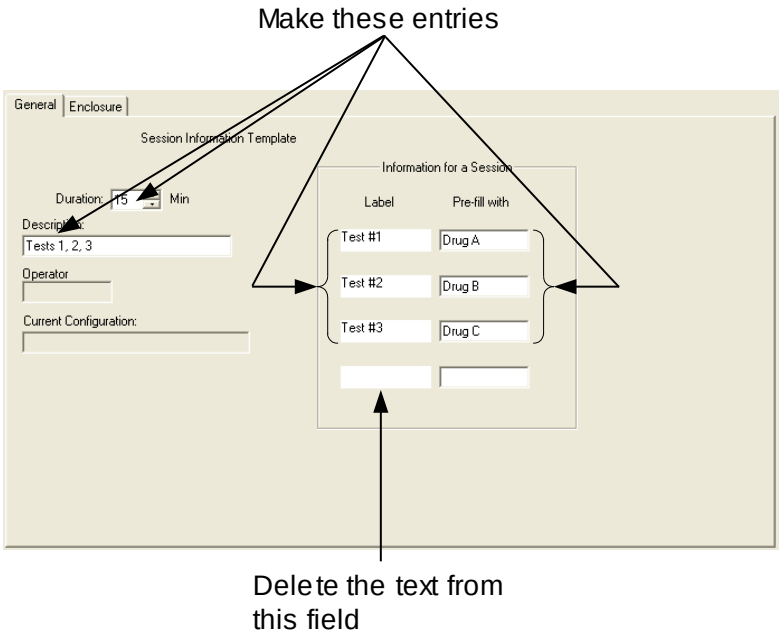


*Figure 3-13. Modifying the **General** Tab on the Template Screen*

19. Click on the **Enclosure** tab. A screen similar to Figure 3-14 will appear. Modify the display as described in the figure.

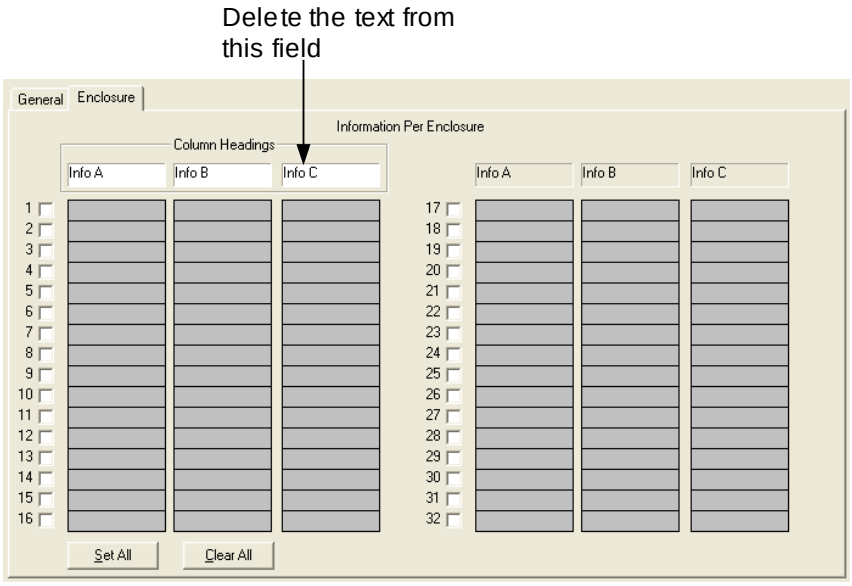


*Figure 3-14. Modifying the **Enclosure** Tab on the Template Screen*

4. From the **File** menu select **Save As…** then give the template a unique name that will give you a clue to its original purpose. For the example the name **testtemplate** was selected for this example.

5. From the **File** menu select **Close.**

6. From the **Setup** menu select **Default Files/Folders**. Click on the **Ses Temp** tab, then click on the browse button.

7. Select the desired template from the **Default Session Template** folder. For this example the file named **testtemplate** was selected. Click on **OK** to make this file the default session template file.

8. From the **File** menu select **New,** then **Session**. The display will appear as shown in Figure 3-15. Note that the field where the text was deleted in step 2 is no longer present.

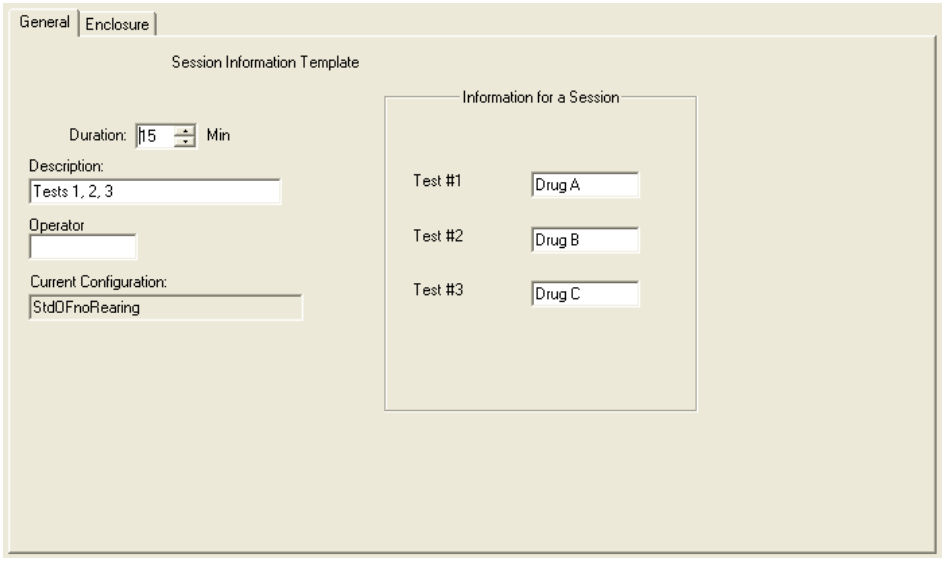


Figure 3-15. New Session Template Screen Reflecting the Default Sample Template

9. Click on the **Enclosure** tab. A screen similar to Figure 3-16 will appear. Note that the field where the text was deleted in step 3 is blank and the column is no longer present.

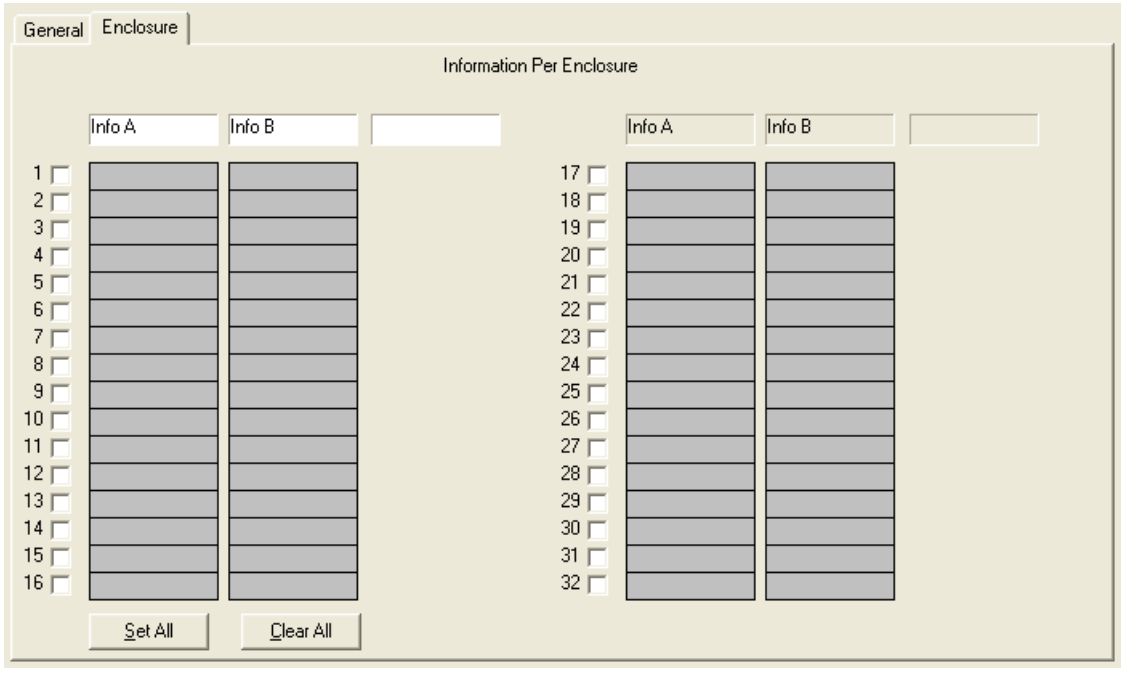


Figure 3-16. New Session Screen Enclosure Tab Example

10. Once this example is set as the default template all new sessions will open with this template until a new default template is selected or the default tab is cleared (turned off).

3.3.4.3 Creating and Using Saved Session Files A Saved Session file is a complete session file with the exception of collected data. The purpose of Saved Session files is similar to Default Template Files. The difference is Saved Session files also include the individual enclosure information (up to three fields). These files can be used when running the same animals over or when some or all of the information fields remain constant. To create a Saved Session file simply create a new session and before running the session click on **File** and **Save As**. Then enter a unique file name for future use. You can then run the Saved Session as many times as you like. Just remember to do a **Save As** to give each session its own unique name when asked. There is no "default" Saved Session file. To use a Saved Session click on **File**, Session, and a list of all Saved Sessions will appear. Select the desired saved session, then click on **Open**. The Saved Session will open and appear as if you had just entered it. Before you do anything else, select **Save As** and assign a new name to prevent overwriting the original. It is now ready to run.

3.4 SYSTEM DIAGNOSTICS

3.4.1 Understanding and Troubleshooting Diagnostic Failures

MotorMonitor comes equipped with the industry's only true auto-diagnostics. This automatic diagnostic runs before each session and performs extensive tests on the photobeam pairs and their supporting circuitry. If the system detects a failure during these tests, you will not be able to proceed until the failure is resolved. There are two ways to resolve a failure; you must either correct the failure or remove the failed enclosure from service. If there is a diagnostic failure, a screen similar to Figure 3-17 will appear. Green and red are the only colors used for diagnostics. Green indicates passing diagnostics and red indicates a diagnostic failure.

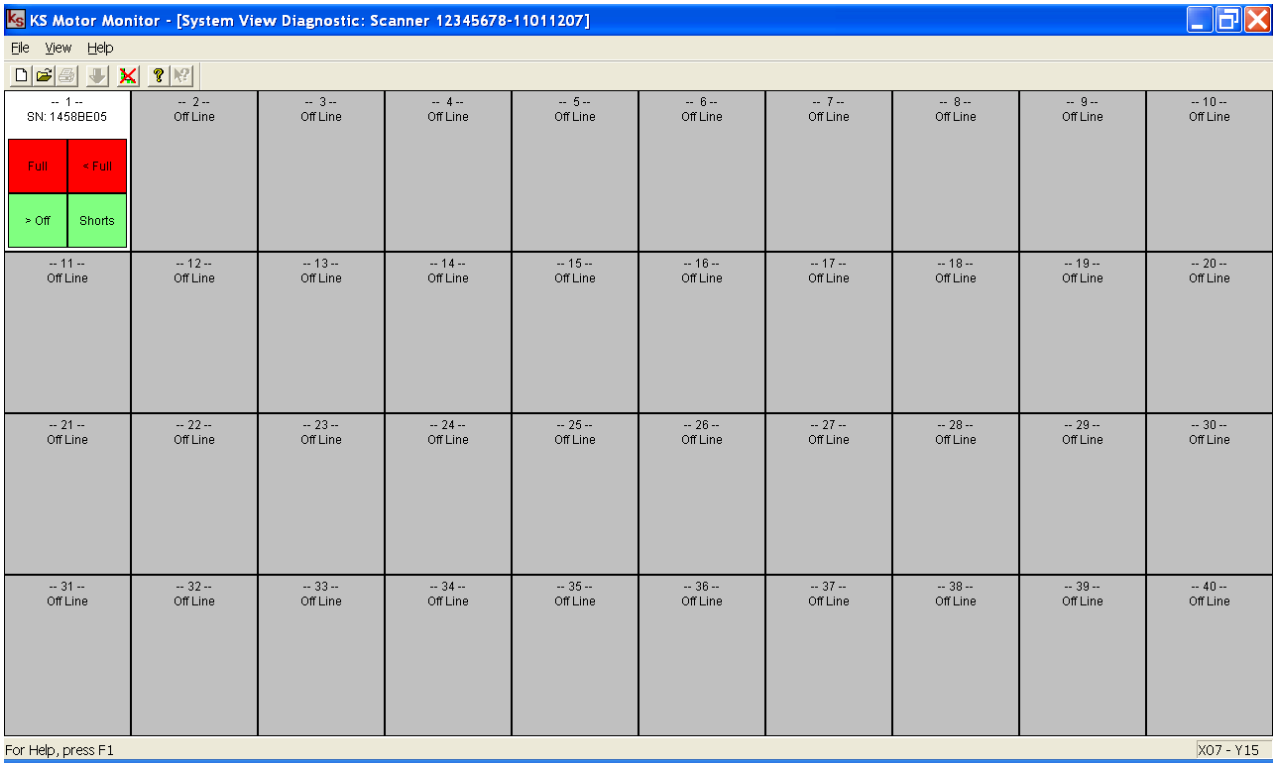


Figure 3-17. Upper Level Diagnostic Screen

This is the "upper" level diagnostics screen. As you can see, it displays all possible enclosures for the system, even those that are not connected. For each connected enclosure, five different tests are performed as follows:

1. **Full & <Full** (all tests)
2. **Full** (full power)
3. **<Full** (less than full power performance)
4. **>Off** (Very low power)
5. **Off** (shorts)

If any of these tests fail, a diagnostic failure warning is generated. You can try to resolve the issue by entering manual diagnostics to determine the problem. The most common problem is a blocked beam, usually an animal in the enclosure. This is the failure shown in Figure 3-17. In this case, the two upper tests (**Full** and **<Full**) are red. This is the normal failure indication for a blocked beam and is easily resolved by removing the obstacle from the enclosure and then re-starting the session. If only one of these blocks is red, contact the factory.

You can run manual diagnostics to determine the failure and restart the session. Once you have resolved the failure, you can restart the session by clicking on the double yellow chevrons again. The system will run the auto-diagnostics again and, assuming the failure has been resolved, the session will be re-started.

In addition, a "lower" level diagnostic screen provides more detail on any particular enclosure. To reach this screen, place the mouse over the "test blocks" for the desired enclosure and double click the mouse. A display, similar to Figure 3-18, will appear on the screen.

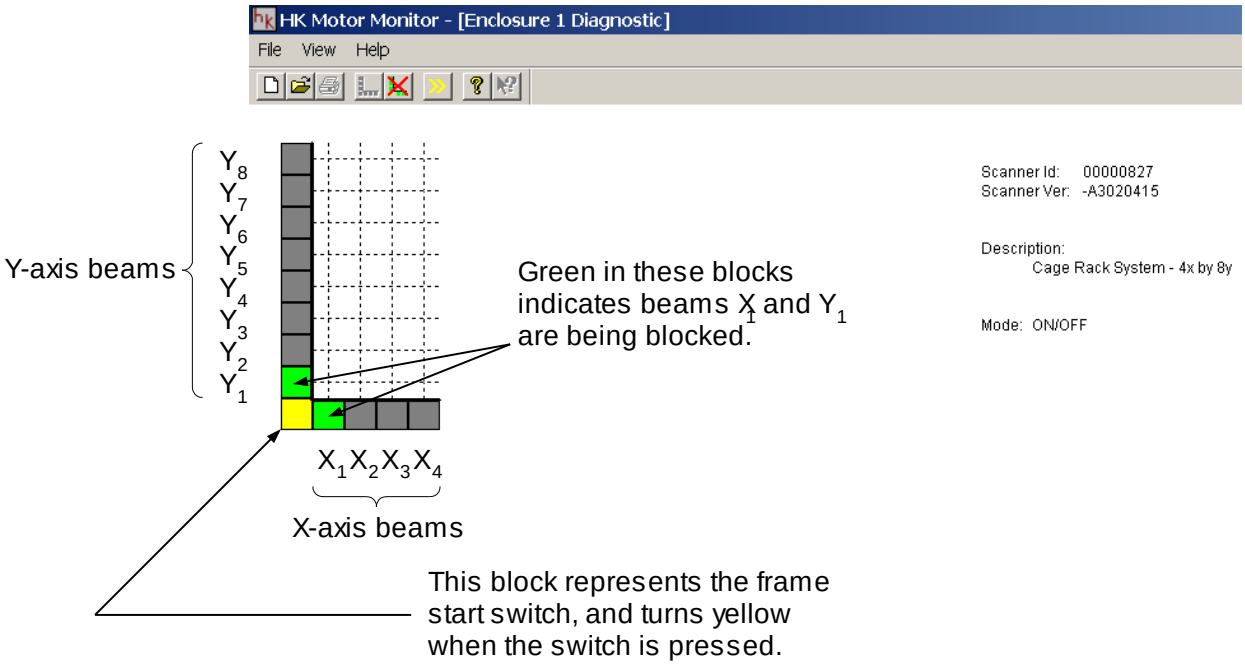
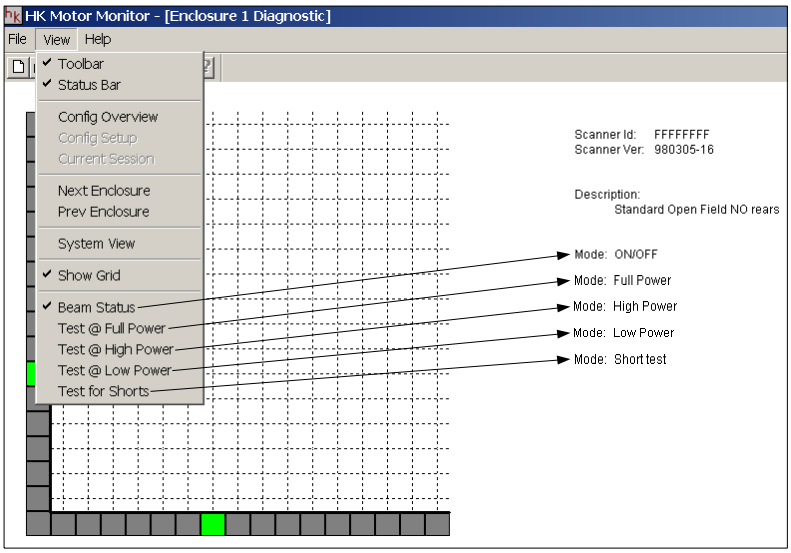


Figure 3-18. Lower Level Diagnostic Screen

The green blocks indicate that something is blocking those beams. The corner block is always the start switch and when pressed will turn yellow. The blocks to the right of the start switch are the X beams and are numbered from 1 to *n*, left to right respectively. The beams located above the start switch are the Y beams and are numbered similarly with Y_1 being located closest to the start switch. In this case, the beams X_1 and Y_1 are blocked.

3.4.2 Using Manual Diagnostics While ***MotorMonitor*** automatically runs a very sophisticated and complete diagnostics before each session, it is still useful to have access to manual diagnostics. To manually start the auto-diagnostics, click on the green "L" on the tool bar.

If a diagnostic failure has occurred, the **View** menu on the lower level diagnostic screen will have each individual diagnostic test available for selection. These are the same five tests described for the upper level diagnostics, with different names. If a single test is selected, it will run, continuously, until terminated by the operator. Figure 3-19 provides an illustration of the menu and a comparison chart relating the upper level tests with the lower level tests.



Upper Level Test	Equivalent Lower Level Test
Full & **<Full**	**Beam Status (All Tests)**
Full	**Test @ Full Power**
<Full	**Test @ High Power**
>Off	**Test @ Low Power**
Off	**Test for Shorts**

*Figure 3-19. Lower Level Diagnostic Screen **View** Menu*

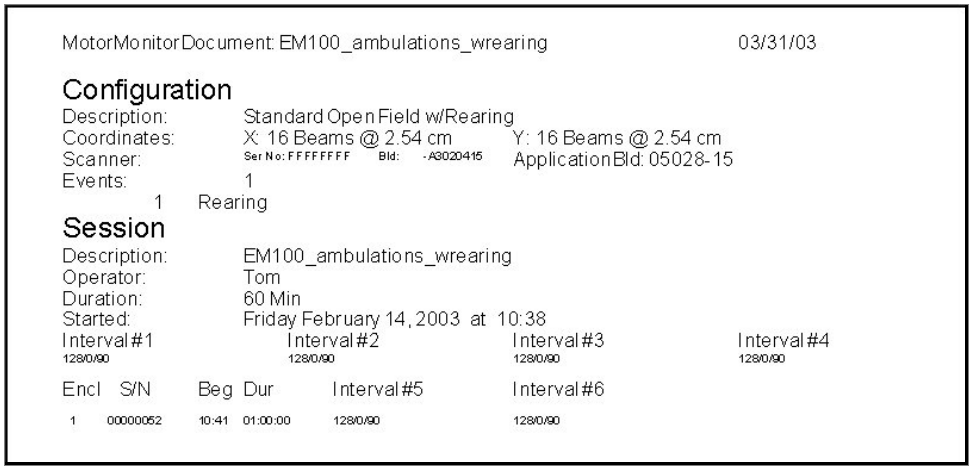
3.5 GLP CONSIDERATIONS

3.5.1 Printing Session Information

Most labs require some type of audit trail containing electronic signatures and much more. To help with this requirement ***MotorMonitor*** products have all related information stored in the raw data file. The configuration used, information input, operators name and more are included in each raw data file. While in the data reduction menu you can obtain a printout of an individual session as follows:

1. Go to the second data reduction screen.
2. Select the individual session in question from the **Files in Folder** list.
3. Move the file into the **Files to Reduce** list.
4. Click on the **File** pull-down menu and then click on **Print**.

An example of a session printout is provided in Figure 3-20.


MotorMonitor Document: EM100_ambulations_wrearing 03/31/03

Configuration

Description: Standard Open Field w/Rearing
Coordinates: X: 16 Beams @ 2.54 cm Y: 16 Beams @ 2.54 cm
Scanner: Ser No: FFFFFFFF Bld: -A3020415 Application Bld: 05028-15
Events: 1
1 Rearing

Session

Description: EM100_ambulations_wrearing
Operator: Tom
Duration: 60 Min
Started: Friday February 14, 2003 at 10:38

Interval #1	Interval #2	Interval #3	Interval #4
128/0/90	128/0/90	128/0/90	128/0/90

Encl	S/N	Beg	Dur	Interval #5	Interval #6
1	00000052	10:41	01:00:00	128/0/90	128/0/90

Figure 3-20. Session Printout Example

3.5.2 Microsoft® Windows™ Requirements for *MotorMonitor*

MotorMonitor was designed to run on Windows™ 7 Pro and Windows™ 10. The software will *not* run on Windows™ 95 and 98 and we no longer support Windows NT, XP, and 2000. However, the software should perform properly on a Windows NT network environment.

APPENDIX A
MOTORMONITOR™ OPTIONS
MM100 - HOTSPOTS™ GRAPHIC COMPARATOR
MM200 - OVERTIME™ GRAPHIC COMPARATOR
MM300 - PLAYBACK MODULE

A.1 INTRODUCTION

These options increase the power of the MotorMonitor system adding different, in-depth views of captured data, and as a standard feature with the EM100 Photo Beam Validation System, add an additional dimension to validation script creation.

HotSpots is used to acquire instant, graphical comparisons of session results eliminating the need for making assumptions with zone maps. This allows you to generate a zone map based on actual activity. Data can be displayed from a single enclosure or from an enclosure ensemble allowing you to visually compare animals or groups.

OverTime is for viewing changes in activity over a specified period of time. Zone metrics (distance, total time, rest time entries, and pokesinto) can be charted for multiple zones. You can see how an animal or ensembles of animals change as time changes. This allows establishing baseline expectations as well as displaying a view of the changes that a drug causes over time.

PlayBack allows you to view the path of an animal as if you are watching a video. This is, essentially, a graphic depiction of animal activity for an entire session.

The examples used in this appendix were generated using the EM100 Photo Beam Validation System. All the examples use the same zone map, configuration file, data file, template file, and reduced-file data.

A.2 HotSpots™

HotSpots is an activity gradient display where red represents the hottest activity area and blue the coldest. Activity concentrations that fall between the two extremes follow the color spectrum between red and blue.

A.2.1 Starting HotSpots

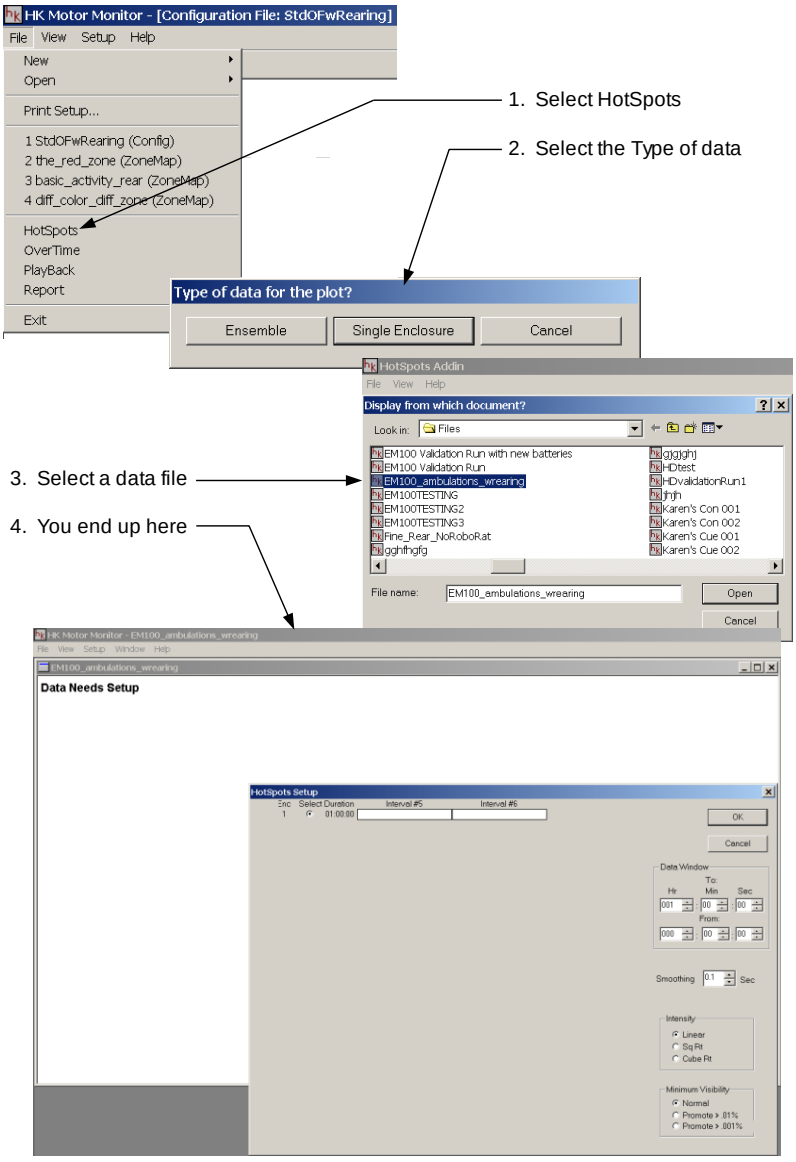


Figure A-1. Starting HotSpots

The next thing is to select **OK** from the **HotSpots Setup** Screen. Figure A-2 is the resulting display based on the selected file and the settings from the **HotSpots Setup** screen in Figure A-1.

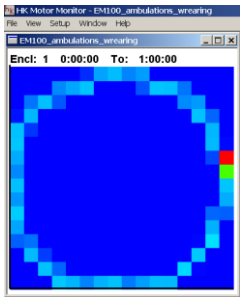
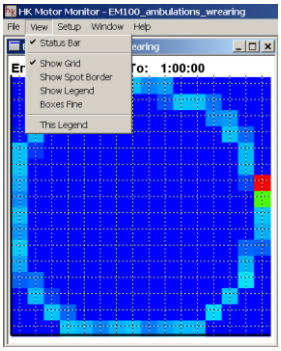


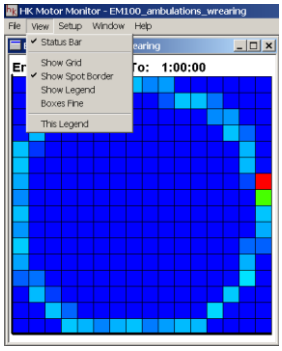
Figure A-2. Initial HotSpots Display

There are several ways to view the data. Figure A-3 provides examples of each of the **View** menu selections.



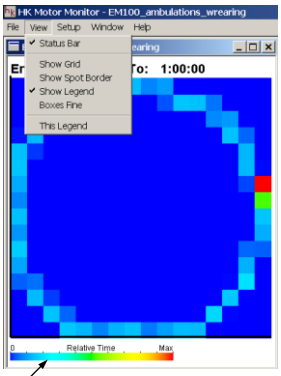
Show Grid example

The grid lines represent the center of the photobeams

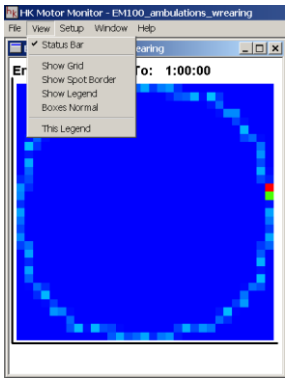


Show Spot Border example

The border lines represent the left and right edges of the photobeams



Show Legend example



Boxes Fine example. Note that the selection now reads: **Boxes Normal**

*Figure A-3. HotSpots **View** Menu Examples*

Figure A-4 shows examples of each of the **Intensity** selections from the **Setup** screen. **HotSpots** normalizes all activity data to "1" in time and position where "1"(red) represents maximum activity and "0" (blue) represents no activity. The **Sq Rt** (square root) and **Cube Rt** (cube root) **Intensity** selections allow you to elevate activity occurring between "0" and "1" to the baseline. Even though the EM100 (the test subject for these examples) does not provide the random, erratic behavior encountered by a live subject (its not supposed to), you can still see the differences in intensity provided by these selections in the display examples.

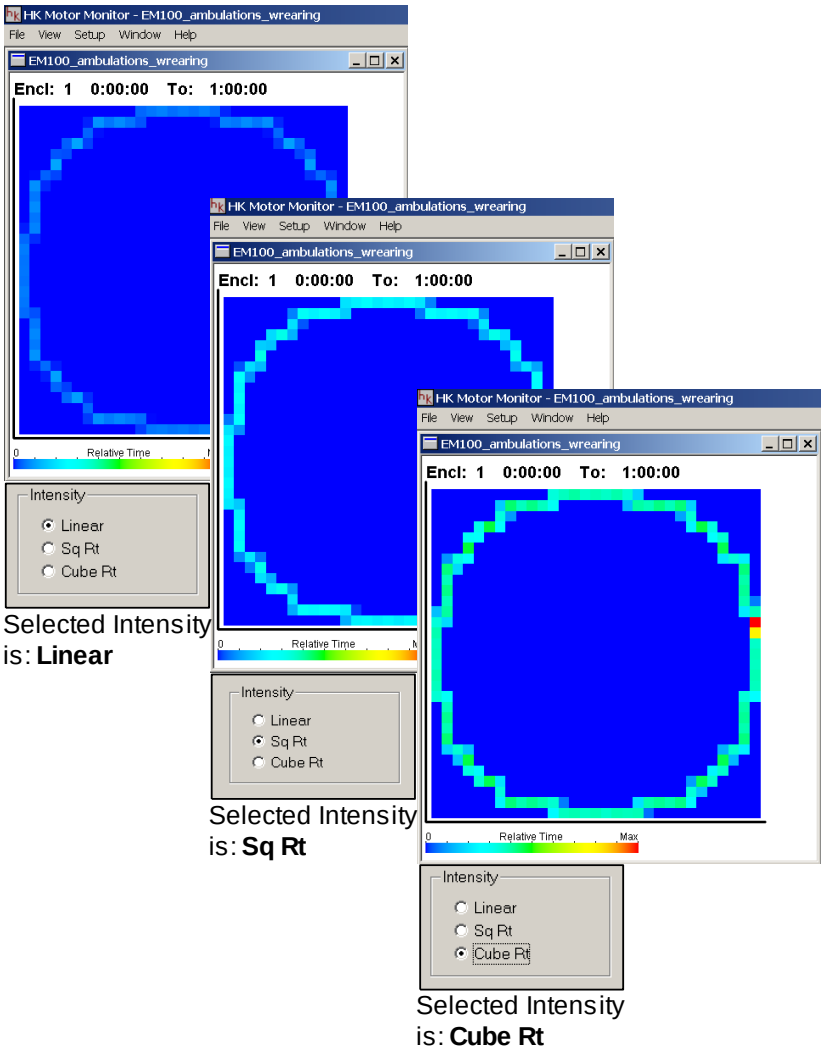


Figure A-4. ***Intensity*** *Selections From the* ***Setup*** *Screen*

Figure A-5 shows examples of each of the **Minimum Visibility** selections from the **Setup** screen. These selections enhance the visibility of the test subject's movements occurring less than 0.01% or 0.001% of the total test time.

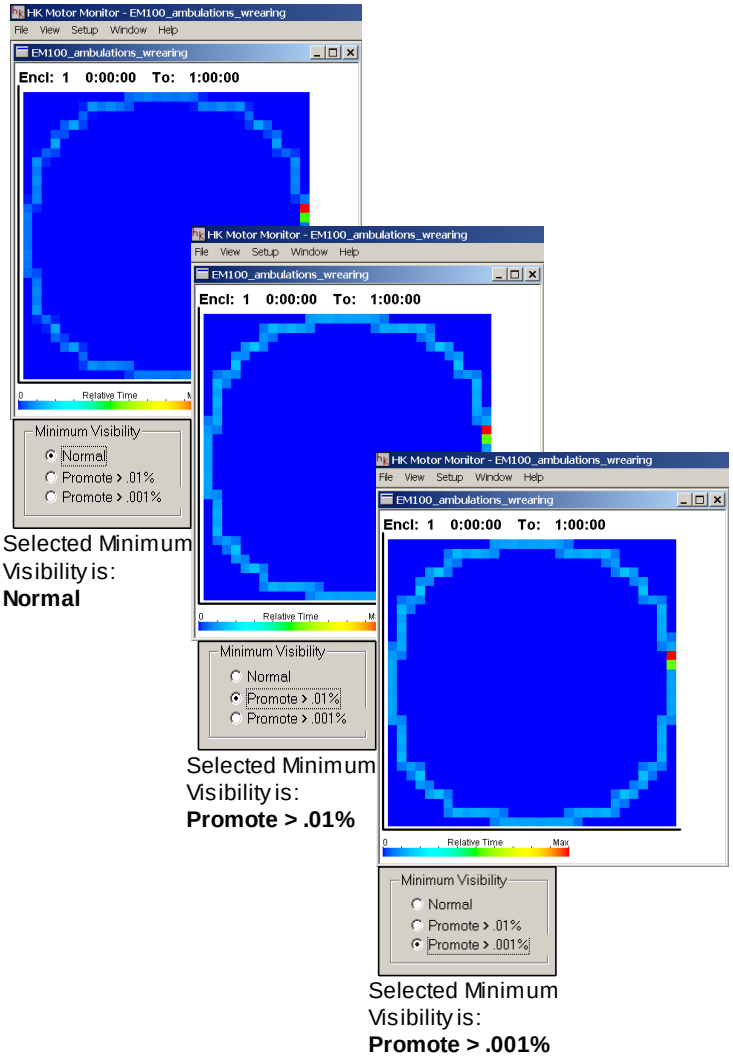


Figure A-5. ***Minimum Visibility*** *Selections From the* ***Setup*** *Screen*

A.3 OVERTIME ™

This option allows you to view changes in activity over time. You can chart zone metrics (total time, rest time, distance, etc.) for multiple zones. View how an animal or ensembles of animals change as time changes. This allows establishing baseline expectations as well as displaying a view of the changes that a drug causes over time.

A.3.1 Starting OverTime

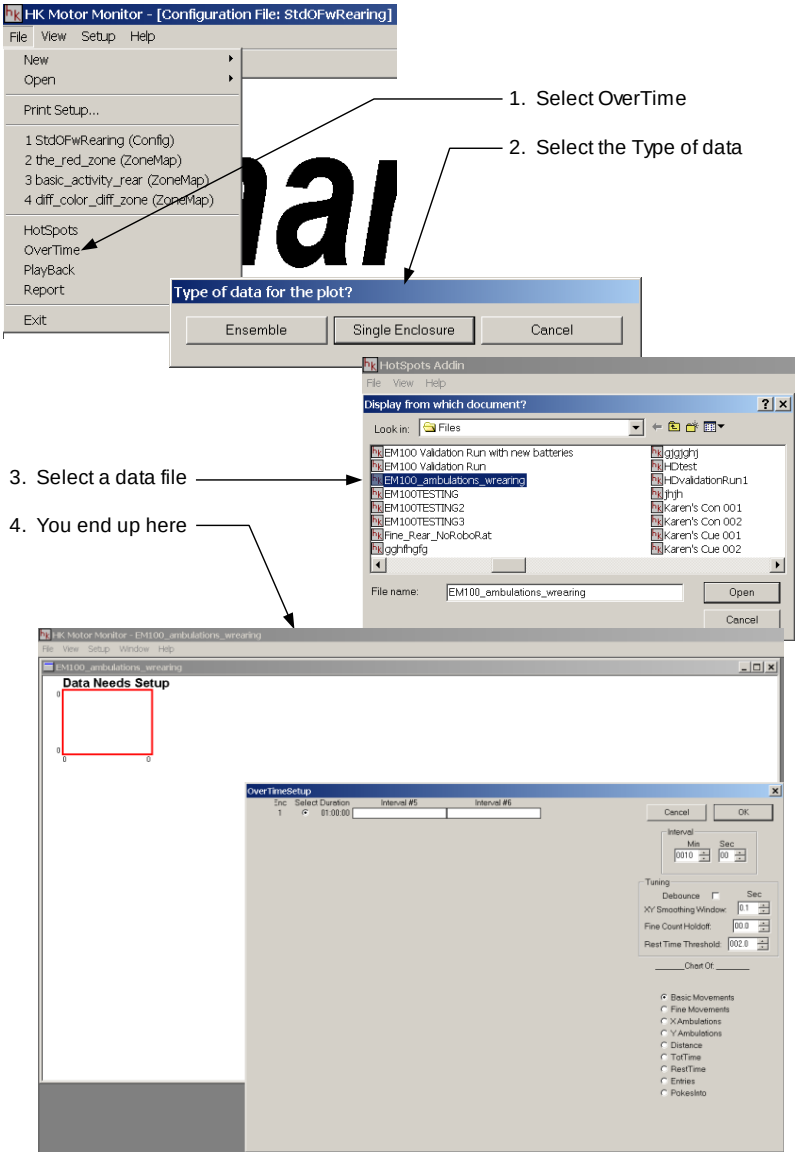


Figure A-6. Starting OverTime

Figure A-7 is an overtime example reflecting the results of a validation session.

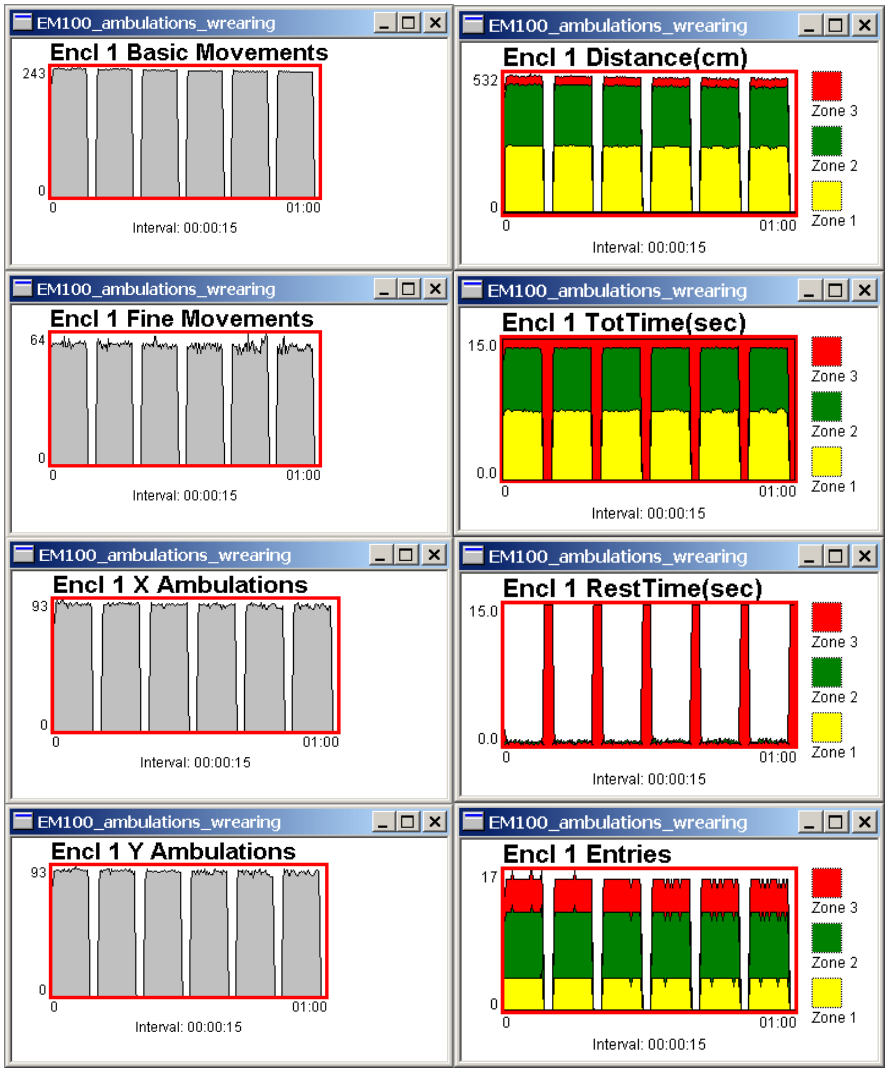


Figure A-7. Overtime Examples

A.4 PLAYBACK

This option allows you to view the path of an animal, or the EM100 Activity Vehicle as if you are watching a video. This is, essentially, a recording of animal or Activity Vehicle movement for an entire session.

A.4.1 Starting PlayBack

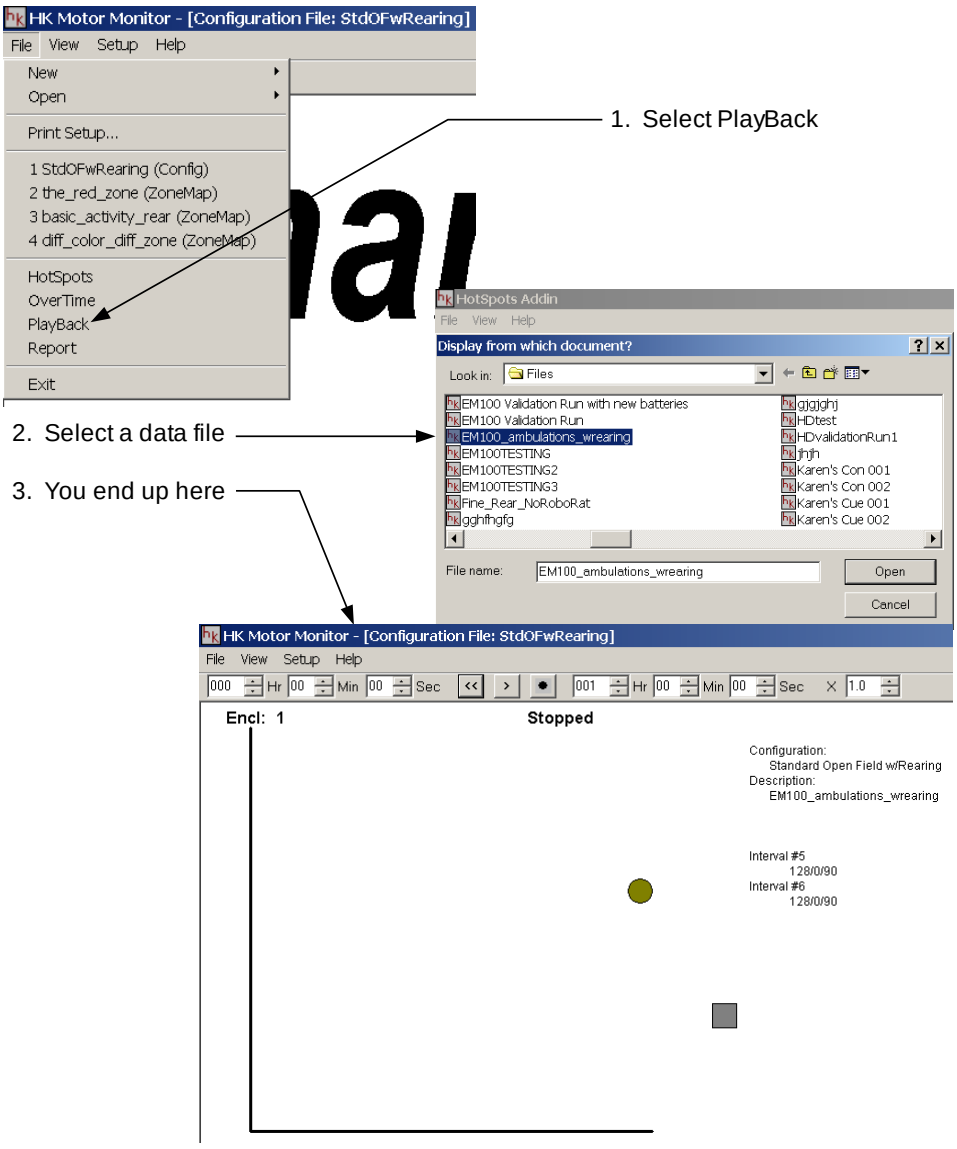
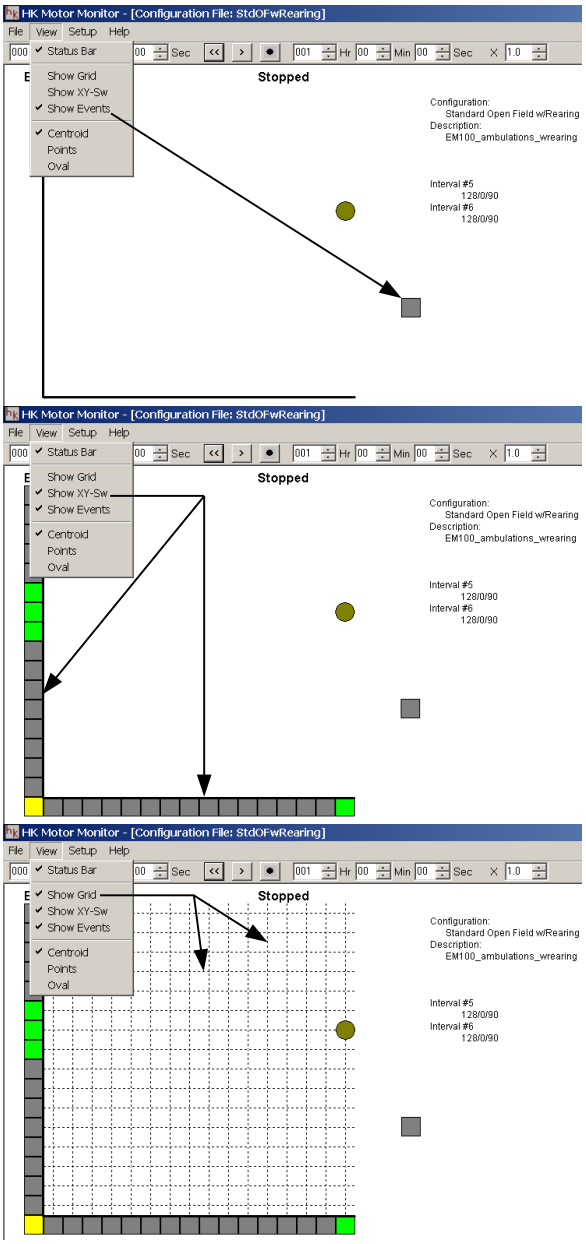


Figure A-8. Starting PlayBack

A.4.2 PlayBack View Menu There are three selections on the **View** menu that provide visual aids for viewing session data during Playback. Figure A-9 is a brief description of these selections.



Show Events

The *event* depicted for this test is rearing. Since the rearing beam interrupter is located on the rearing frame (which is located above the activity frame), the event indication is placed outside the graph area. The graph is for the activity frame. Note that while PlayBack is running, this indicator changes color (flashes) at the same rate the rearing beam interrupter was activated during the session.

Show XY-Sw

The horizontal and vertical blocks for this selection represent the X and Y axis beams on the activity frame.

Show Grid

The resulting grid for this selection represents the*center* of the X and Y axis beams on the activity frame.

*Figure A-9. **View** Menu **Show** Selections*

There are three selections on the **View** menu for depicting the shape of the test subject. These three selections are **Centroid**, **Points**, and **Oval**. In this example the subject is the EM100 Activity Vehicle. Its actual size is the same as the red zone shown in these examples. An example of each selection is provided in Figure A-10.

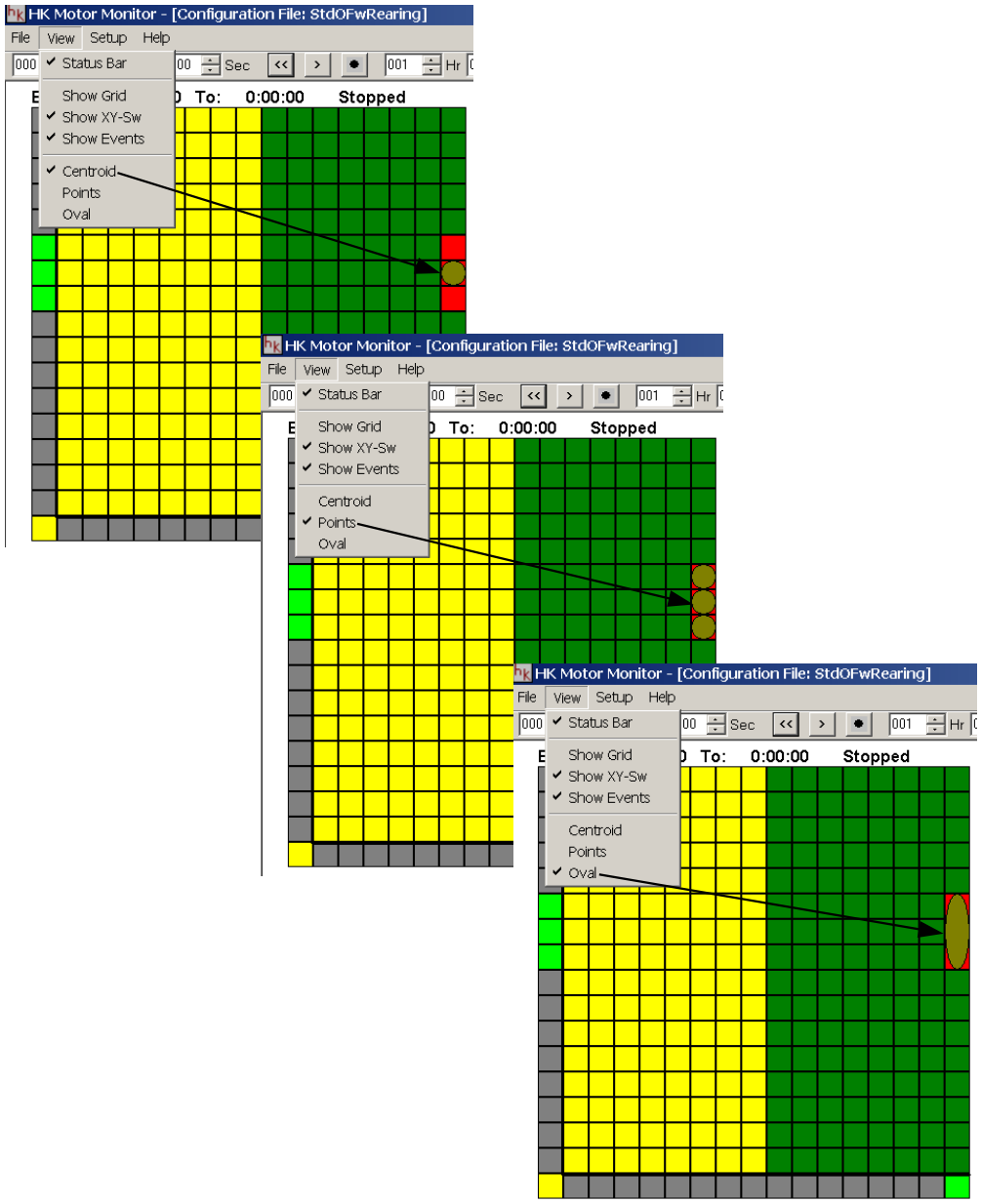


Figure A-10. ***View*** *Menu* ***Shape*** *Selections*

A.4.3 PlayBack Setup Menu – Overlay Zone Map As shown in Figure A-11, you can overlay the zone map used for this session and see activity relative to the areas of interest.

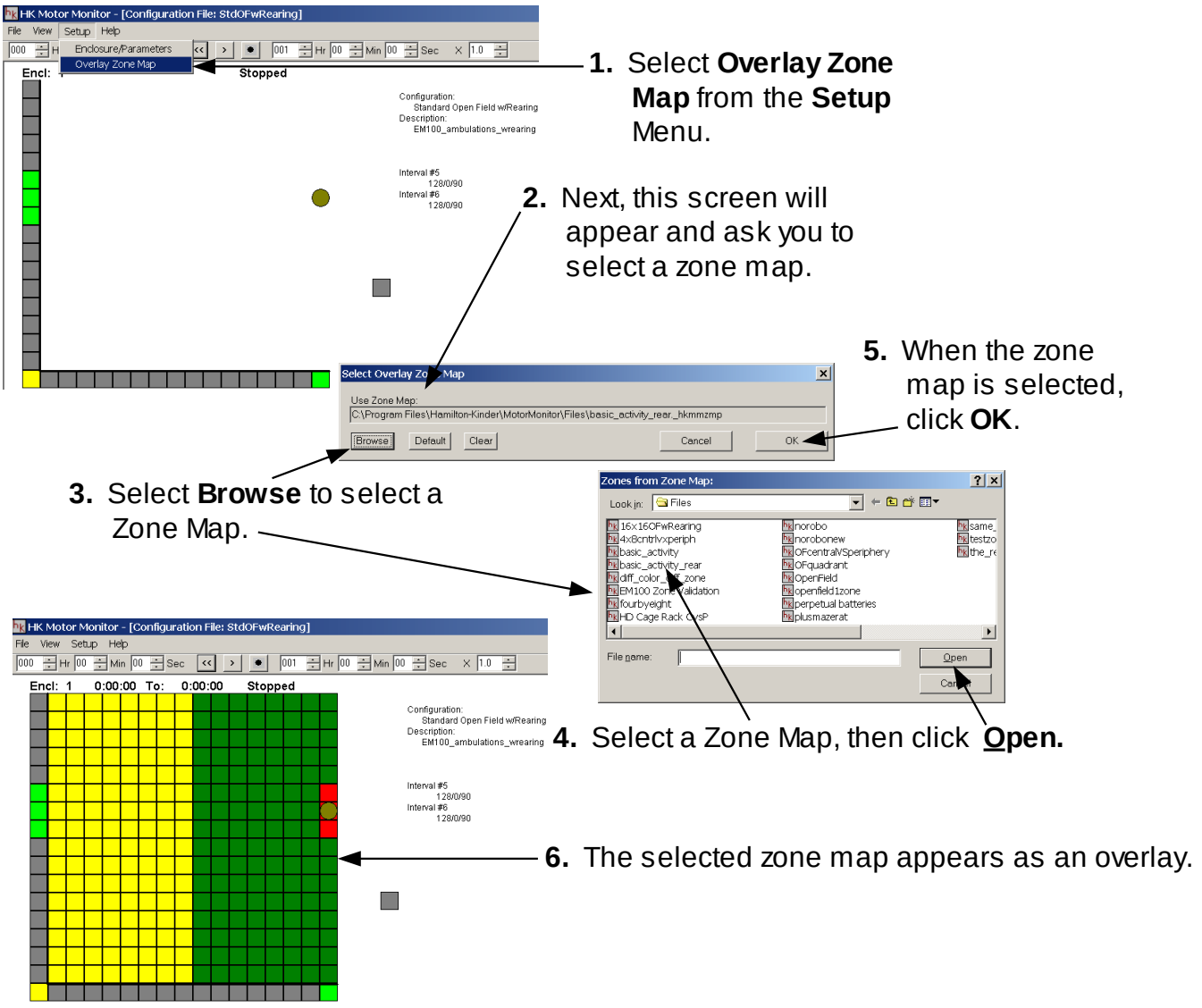
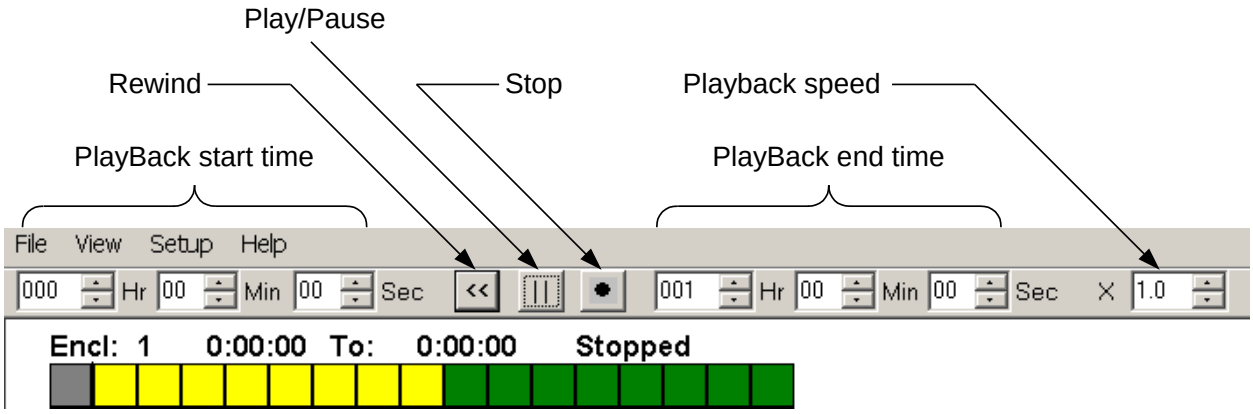


Figure A-11. Zone Map Overlay Example

A.4.4. PlayBack Time Selection You can set the time sliding clocks (Figure A-12) to view a time-slice within the session, or the entire session, and trace the path of the subject and print the results. Another feature, playback speed, allows you to speed up or slow down the playback function. The playback speed range is from 0.1 to 4.0 in 0.1 increments where 1.0 represents the real-time speed of the test subject.



NOTE

This example shows the start and end times for the entire one-hour session. You can select any time-slice within the session. Remember, when you select a starting time within the session, the subject will be placed where it was at that point in time. The same is true for the end time.

Figure A-12. PlayBack Time Selection

A.4.5 Enclosure/Parameters – PlayBack Setup Screen Figure A-13 is an example of the Playback Setup screen.

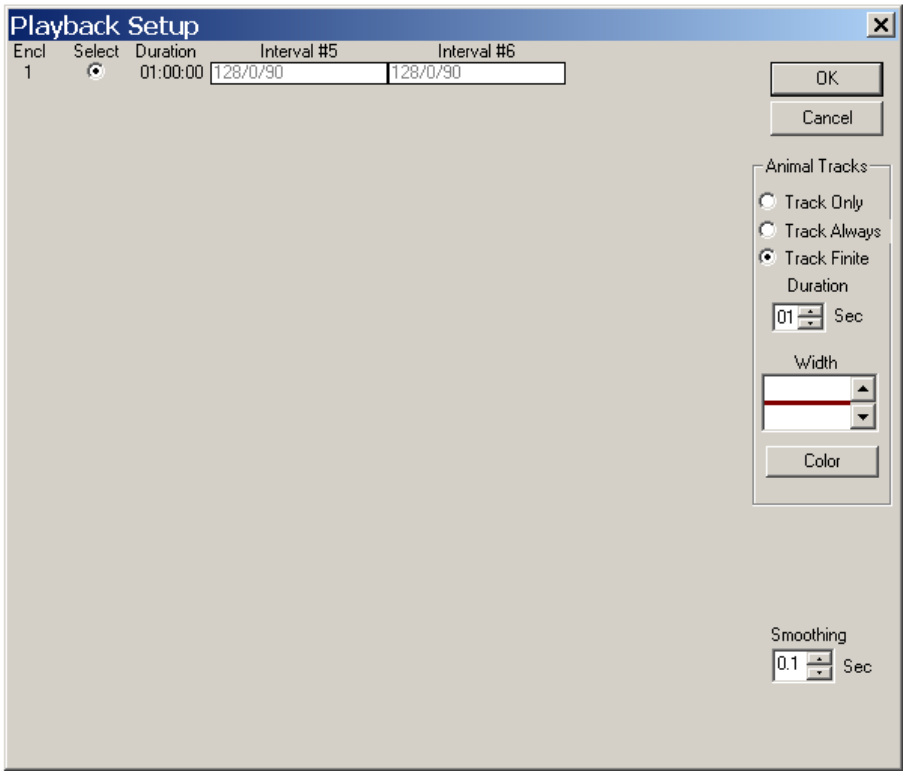


Figure A-13. ***Playback Setup*** *Screen*

Animal Tracks defines the "length of the tail," in seconds, and how the tail is displayed during playback.

Displaying the tail from **Animal Tracks** is accomplished as follows:

1. First, make sure **Centroid** is selected from the **View** menu. **Animal Tracks** only works with **Centroid**.

2. Next, the duration of the tail, in seconds, must be selected or no tail will appear (for **Track Always** and **Track Finite**) when playback is started. Duration can only be set when **Track Finite** is selected. However the duration setting, once made, applies to both **Track Always** and **Track Finite**.

3. Select **Track Finite** to set the duration and then select the desired Animal Tracks.

4. Select the width of the track using the up/down arrows from the **Width** field.

5. The **Color** button brings up the color palette allowing you to select the color of the track.

Track Only – Track Only (Figure A-14) displays the end results of all the subjects' movements during the selected time-slice.

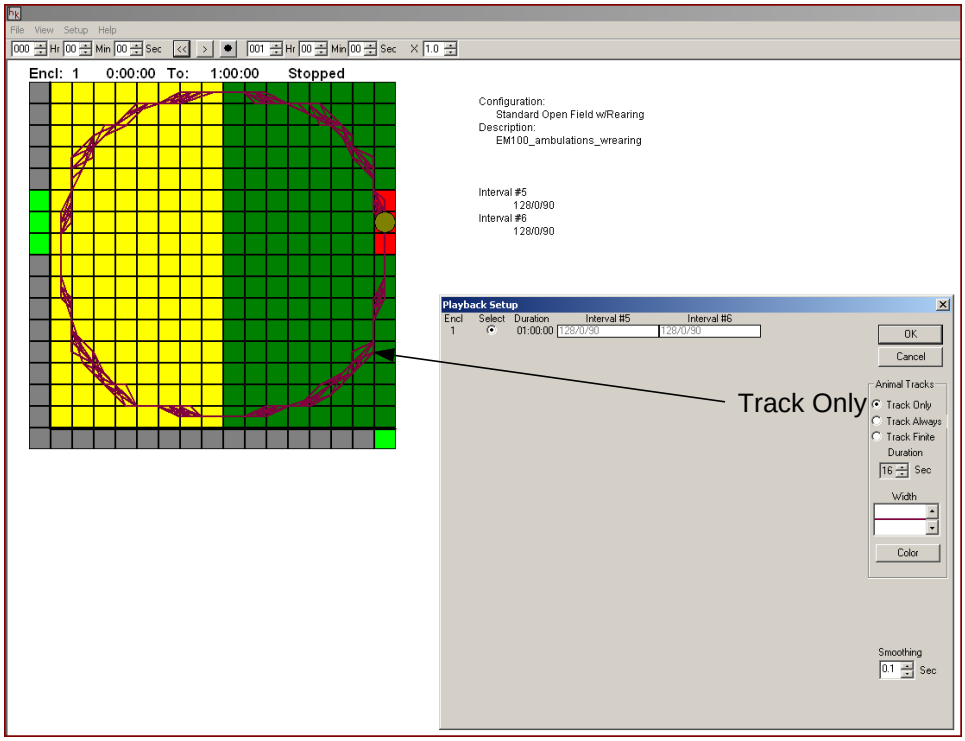


Figure A-14. Track Only Example

Track Always – Track Always (Figure A-15) ends-up being the same as Track Only except all the subjects' movements are visually reproduced during the selected time-slice.

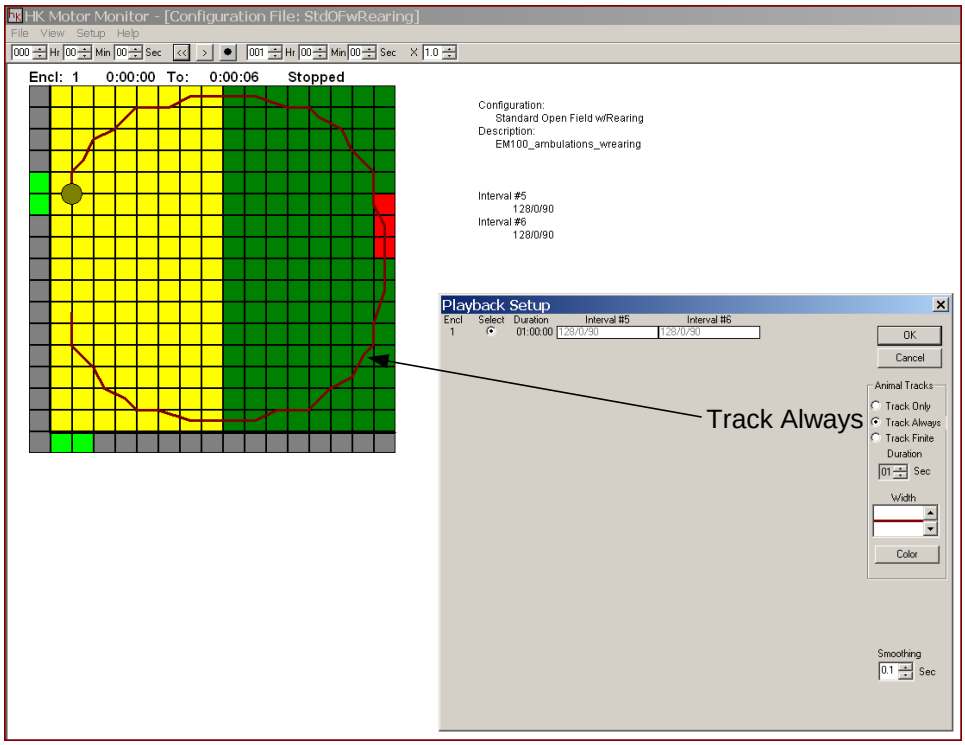


Figure A-15. Track Always Example

Track Finite – All the subjects' movements are visually reproduced during the selected time-slice just as they are with Track Always. The difference is that the "tail" does not leave a permanent trace on the display. The length of the tail is determined by the selected duration (Figure A-16).

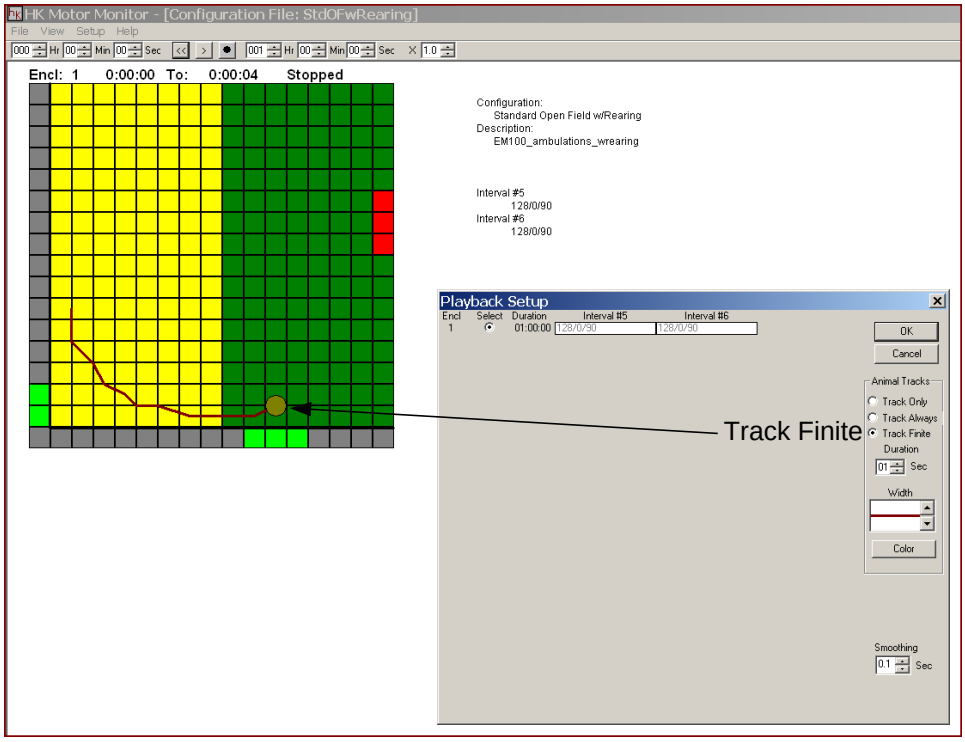


Figure A-16. Track Finite Example

APPENDIX B
SAMPLE ZONE MAPS

B.1 INTRODUCTION

The following zone map samples are provided as a convenience to familiarize you with using zone maps.

B.1.1 16 X 16 STANDARD OPEN FIELD CAGE RACK – CENTER VERSUS PERIPHERY

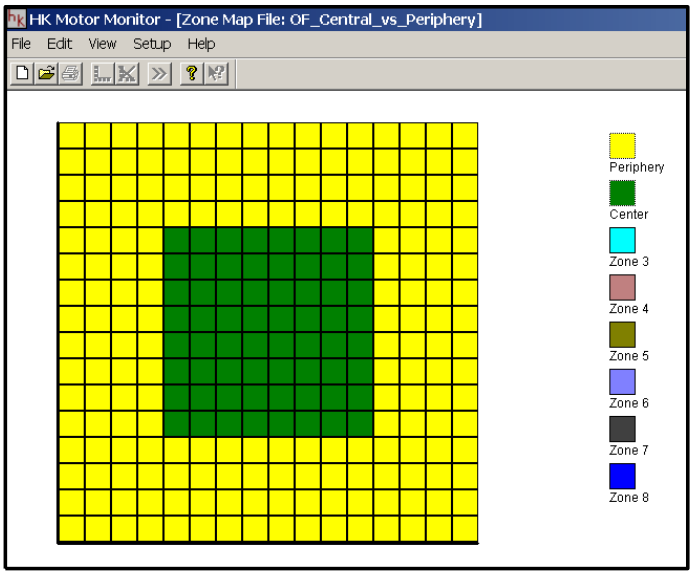


Figure B-1. 16 x 16 Standard Open Field – Center vs. Periphery

B.1.2 16 x 16 Standard Plus Maze Zone Map Notice the dark red Corner Stretch zone. This captures the behavior of the subject stretching into the open arms but not actually entering it. This technique differs from a poke into the open arm from the intersection zone. The corner stretch is one type of Stretch Attend Posture (SAP).

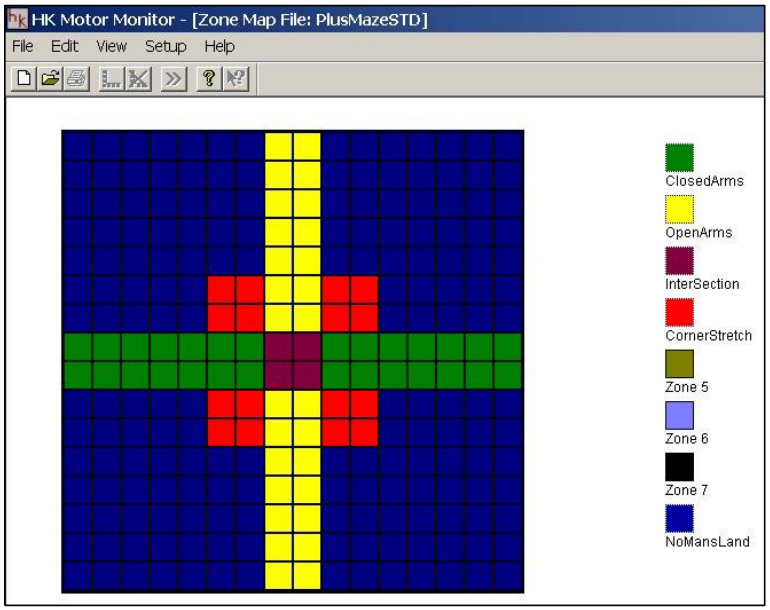


Figure B-2. 16 x 16 Standard Plus Maze Zone Map

B.1.3 7 x 15 High Density Cage Rack – Center versus Periphery

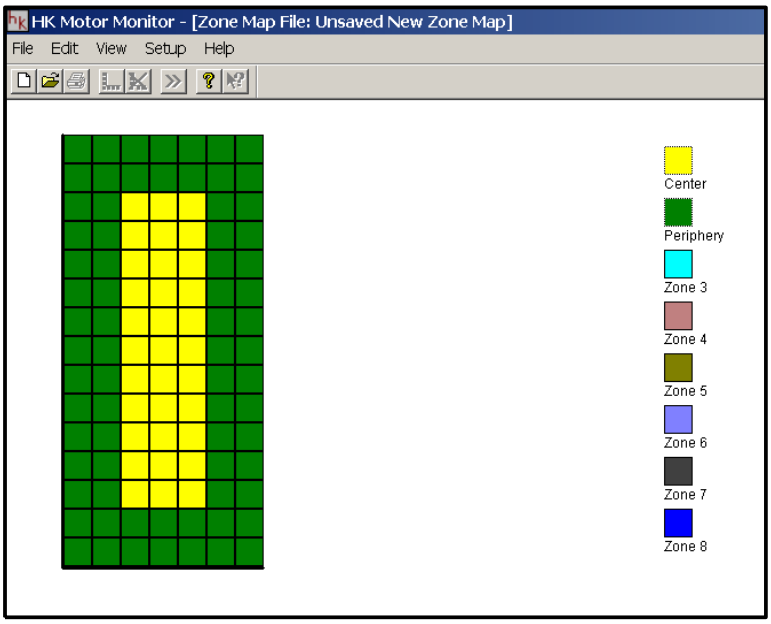


Figure B-3. 7 x 15 High Density Cage Rack – Center vs. Periphery

GLOSSARY

Anchor Beam

A beam assignment made by the Ambulation algorithm. There is only one Anchor Beam for each dimension, i.e., there is one X Anchor Beam and one Y Anchor Beam. The Anchor Beam is set at the beginning of the session as the lowest numbered beam blocked in the dimension. For example, if X2, X3, & X4 are blocked then X2 is the X Anchor Beam. As the animal makes Ambulations, the Anchor Beam is reset. That is, the Anchor Beam changes only when the current Anchor Beam is cleared.

Ambulation

A measure used to express larger animal movements, i.e., the subject changed its entire body position on the grid. A brief description of the algorithm follows: an ambulation occurs when a new beam block occurs *and* the anchor beam for that dimension is released (cleared) before the new beam. The anchor beam is the lowest beam blocked in that dimension. For example, if X2, X3 & X4 are blocked and then X5 is blocked, the new beam break at X5 will be counted as an ambulation if X2 is cleared first. Otherwise, the break at X5 is recorded as a fine movement. By definition, the animal must relocate its whole body to cause an ambulation count. X and Y ambulations are reported separately.

Basic Movement

This measure is the simple tally of *all* horizontal beams in your system. The algorithm is a very simple one; the *Basic Movement* counter is incremented upon each new Beam block. When the beam (or switch) is cleared is irrelevant.

Beam Break

This is the occurrence of a photobeam pair being blocked. The opposite of Beam Cleared.

Beam Cleared

Normal condition when there is no obstruction between the Light Emitting Diode (LED) and the Phototransistor. The opposite of Beam Break.

Centroid

The calculated center of the animal based on beam breaks. As an example if beams X3, 4, & 5 or broken and Y1 & 2 are broken, the subject's centroid is calculated as X4, Y2.5

Debounce

A software tool used to eliminate any erroneous beam breaks caused from electrical power line noises. The system collects data samples every 50 milliseconds. When Debounce is on, there must be at least two consecutive breaks before the break is actually registered. Typically we recommend having Debounce set to off, i.e., debounce is not checked.

Default Files/Folder

A set of related system files and folders that are loaded when the MotorMonitor software is first initiated. There are two folder locations; the application folder that contains the Enclosure configuration, Session template, and Zone map and all raw session data files and output reduction files folder that contains all reduced output files. Additionally you can set the Enclosure configuration, Session template, and Zone map files the system defaults to.

Enclosure Configuration

A file containing a translation table defining the location and purpose of each beam used in the system. These files are factory set. There is typically only one such file per system. If more than one configuration file is needed, then the user can create enclosure configuration files to fit his or her specific needs. However, enclosure configuration file creation requires administrative privileges.

Fine Movement

A measure used to express smaller animal movements, i.e., the subject changes a beam status but the change does not fit the definition of an ambulation. One example would be a single beam changing status while no other beams changed status. There are more complex Fine Movements such as head weaves. For example, if an animal is repeatedly moving its head from left to right and back again; it could alternately break beams on the left and right sides of its head. Fine Movements are used to report movements such as grooming and/or head movements. The Fine Movement counter is incremented because of the Beam status change ***not*** meeting the Ambulation algorithm. That is, there is no specific test for Fine Movements.

Fine Count Holdoff

A parameter used to reduce erroneously high counts because the animal is sitting just on the edge of a beam. Photobeams are analog devices, therefore, you can partially block a beam and with the slightest movement cause the beam to alternate between cleared and blocked. If such a situation is occurring, you can set this variable higher to reduce its affect on the data. That is, fine movements will be incremented at no higher rate than one per n seconds, where n is the setting of the fine count holdoff.

Interval

A user-defined time partition used during data analysis. Each data reduction effort results in data being sectioned into time "intervals." In this way, a user can study measures for each of the intervals reported.

NOTE

It is very important to remember that the system does not report partial intervals, i.e., any time slice less than a complete interval will have NO data reported in the output reduction file.

Output Reduction File

This file is created by funneling any variety of data files into one reduction file. The resulting reduction file will then contain all the requested measures. It is a comma-delimited file especially set up for easy export into spreadsheets or statistical programs.

Pre Pause

Provides a pause within a Session. Normally used when test subject requires dosing with two drugs for one session.

Rest Time Threshold

Provides the user the ability to define what "at rest" means. The setting determines whether an individual scan (50 milliseconds) is added to the Total Rest Time.

Consider the following sequence:

1. The Rest Time Threshold is set to 1 second.
2. All Beam Breaks are followed by an X or Y Beam Break in less than one second.

This example results in the Total Rest Time Counter reporting zero seconds.

Alternatively, consider this sequence:

1. The Rest Time Threshold is set to 1 second.
2. One Beam Break is followed by 1.2 seconds before the next X or Y Beam Break.
3. A second Beam Break is followed by 2.5 seconds before the next X or Y Beam Break.

This example results in the Total Rest Time Counter reporting 3.7 seconds.

In other words the Total Rest Time counter tallies all pauses of activity that last for at least the value of the Rest Time Threshold setting.

Session

A complete data collection sequence for all enclosures listed in a single-session data file. Put simply, the data collected from a single press of the start button of each enclosure selected for that session.

Session File

A binary file containing all the header information entered by the user including duration, session parameters, enclosure information, and the actual beam break information that occurred during the session.

Session Template

A file containing commonly used header information. The user can create a variety of session template files and store them away for repeated later use. This is a time saving technique to help save the user from repetitive typing of commonly used information. Typically contains duration, session description, session information labels and data, and enclosure information labels and data.

Total Rest Time

The total amount of time the animal remained inactive (change any beam status) as defined by Rest Time Threshold. Reported per zone per interval.

XY Smoothing

A parameter that affects distance traveled. Imagine the animal is traveling at exactly a 45-degree path across an open field. Theoretically, the system should draw a line 45-degree angle to the X and Y dimensions. However, a problem arises because the system takes samples every 50 milliseconds. It is highly unlikely that the animal will break both the X and the Y dimensions at precisely the same time. Without some adjustment the system will believe that the animal commuted in only one dimension at a time and therefore cause the distance to be erroneously high. To compensate for this we have established a parameter called smoothing. The system waits for the amount of time set by the user (n seconds) before determining the next location to calculate the distance traveled. That is, the system waits for n seconds to see if the animal reaches (breaks a beam) in the other dimension.

Zone Map

An overlay created by the user to define areas of the enclosure for data analysis. A simple example would create four equal quadrants in an open field. Each zone will have data compiled for it during data reduction, i.e., information will be reported for time active vs. time at rest, distance traveled, entries, etc.