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MOTRAK  
HEAD MOTION TRACKING SYSTEM  
PST-100722  
OPERATOR MANUAL





## **MoTrak® Head Motion Tracking System Operator Manual**

**PST-100724**

**Rev 6**

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*This manual describes the installation procedure for the MoTrak software. Please review the manual completely and thoroughly before beginning the system installation. Proper performance of this system is guaranteed only while the software is used in accordance to the enclosed instructions and safety guidelines.*

**The MoTrak® Head Motion Tracking System (PST-100722) is for research purposes only.**



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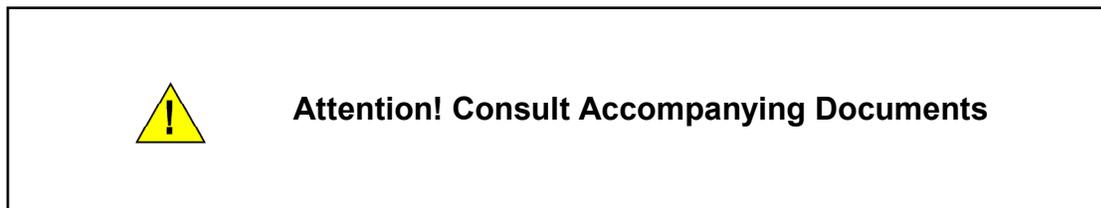
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# Chapter 1: Safety

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## 1.1 Safety Symbol

The following symbol will be used throughout this manual as a means to alert you to potential safety hazards on the accompanying equipment.



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Please **read all WARNINGS carefully and completely before continuing** with the assembly and use of the MRI Simulator.

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 **This product is not MRI compatible and is not for use in an MRI environment.**

 **This product produces a strong magnetic field. It can affect components that are sensitive to magnetic fields, E.G. Speakers.**

## Chapter 2: Introduction

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### 2.1 Overview

The goal of the MoTrak system is to train MRI candidates how to remain still for the duration of the MRI scan. If a participant moves too much during a scan, it can result in unusable data and wasted resources. In the simulator, the participant can simultaneously be habituated to a MRI environment, while being trained to remain still via biofeedback from the MoTrak system.

The MoTrak components consist of the MoTrak console, transmitter, and sensor. The sensor, which is worn on the participant's head, determines the position of the head in space relative to the transmitter. The sensor records angular rotations as well as positional displacements from an initially calibrated position. This information is displayed and logged by the program in real-time, allowing observation of head motion in an MRI simulator.

MoTrak offers researchers several additional benefits. The ability to specify a sound to be played when the cross hair leaves a specified circle of the active target, adjustable motion sensitivity for each target, and the third vector of motion that can be displayed as a rotation of the cross hair. Researchers may also put either of the targets or a movie on the User Display (visible to the participant), where the participant can receive visual feedback directly from the program about their motion.

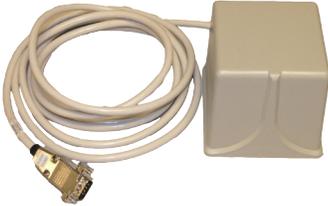
The pages that follow include the MoTrak hardware components, a hardware and software installation guide, and an orientation to the MoTrak software's features. We recommend you read the manual in its entirety before installing any hardware or software.

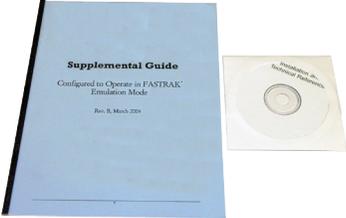


**This product is not MRI compatible and is not for use in an MRI environment.**

## 2.2 Hardware Components

The Equipment supplied for the MoTrak Head Motion Tracking System is composed of the items listed below. Please check that you have received all items and that none of them were damaged during shipping.

<p><b>MoTrak Console</b></p>	
<p><b>Transmitter</b></p>	
<p><b>Headbands</b>  <i>The headband is secured with plastic hooks that attach to the sensor. It is recommended that the Sensor be placed on the participant's forehead with the headband around the circumference of the participant's head.</i></p>	
<p><b>MoTrak Power Supply</b>          (100-240V)</p>	
<p><b>Sensor</b></p>	

<p><b>Fast Track CRT Sync Cable</b> (Not Used) <b>Note:</b> The CRT prevents the sensor from confusing the monitor <math>B_0</math> (beta knot, the abbreviation for magnetic field) with the transmitter <math>B_0</math>.</p>	
<p><b>10 Foot Serial Cable</b> <i>male to female</i></p>	
<p><b>25 Foot Serial Cable</b> <i>male to female</i></p>	
<p><b>20 Foot Cable Assembly, HD15</b> <i>male to male</i></p>	
<p><b>Manual, CD and Hardware Key</b></p>	
<p><b>Supplemental hardware manual and drivers</b></p>	

## 2.3 Hardware Installation

### 2.3.1 Assembly

In order for the MoTrak head motion monitoring system to function properly, it must be connected correctly. While the console unit is powered off the transmitter should be plugged into the XMTR port.

- 1) **Flip** the **front switch** on the MoTrak console to **STBY**.  
The light will be off.
- 2) **Plug** the **Transmitter** into the port **marked XMTR** on the **front** of the MoTrak console.

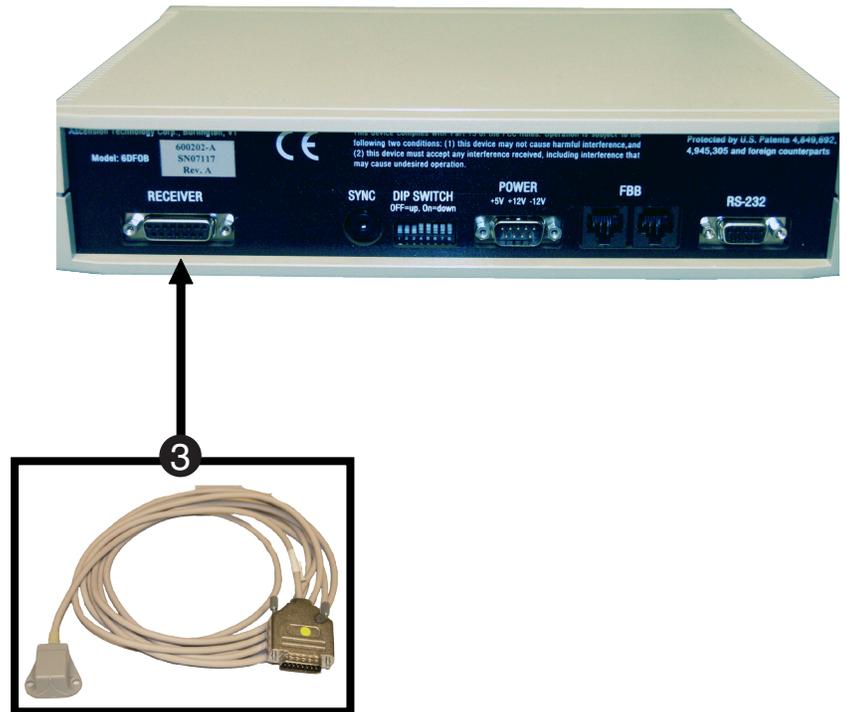


## 2.3 Hardware Installation

### 2.3.1 Assembly

Identify the Sensor, and plug it into the back of the console into the port labeled RECEIVER.

- 3) **Plug** the **Sensor** into the port **marked RECEIVER** on the **rear** of the console.



## 2.3 Hardware Installation

### 2.3.1 Assembly

Next connect the black cord to the power unit. Plug the power unit into the console.

4) **Connect** the **Power Supply** cable to the **Power Supply**.

5) **Plug** the **Power Supply** into the port **marked POWER** on the **rear** of the console.

**⚠ NOTE:** Do not plug the Power Supply cable into the wall at this time.

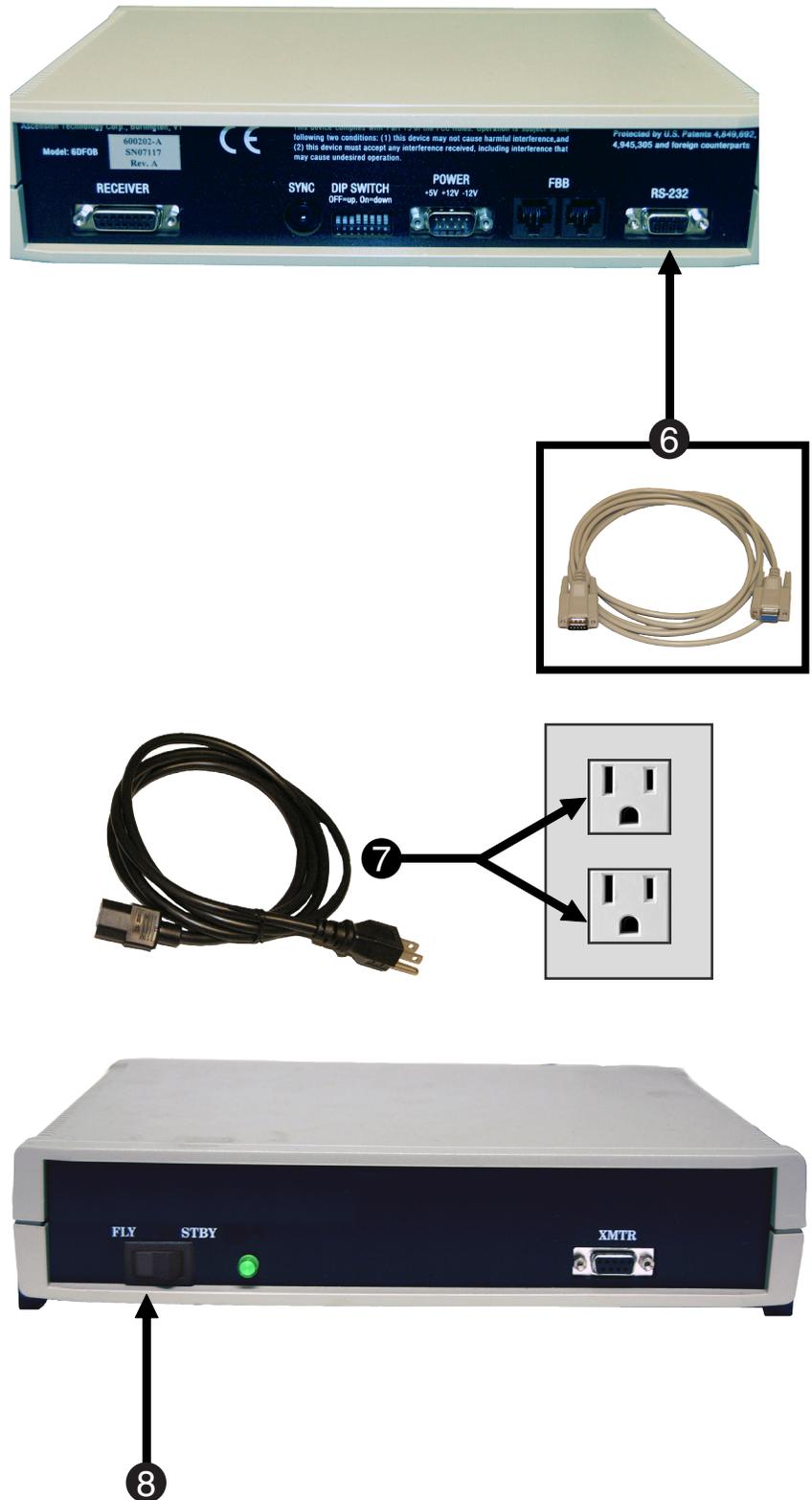


## 2.3 Hardware Installation

### 2.3.1 Assembly

The serial cable plugs into the back of the console into the port labeled RS-232. Once that is connected plug the power cord into an outlet, and flip the switch on the front of the console to fly.

- 6) **Plug** the **Serial Cable** into the port **marked RS-232** on the rear of the console.
- 7) **Plug** the **Power Supply** to the wall.
- 8) **Turn on** the console by **flipping** the front switch to **FLY**. The green light will be on.



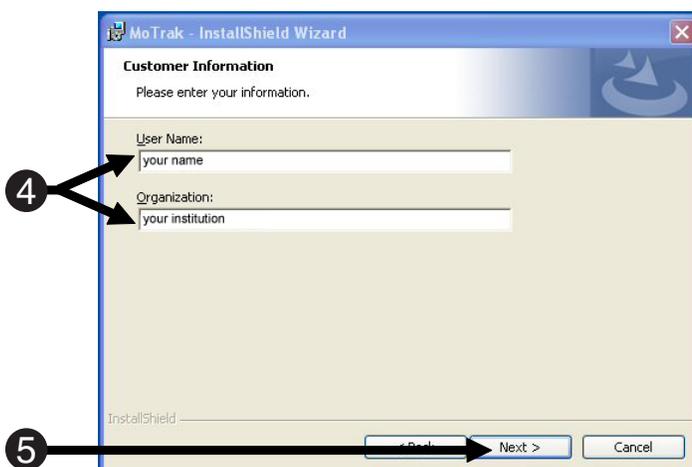
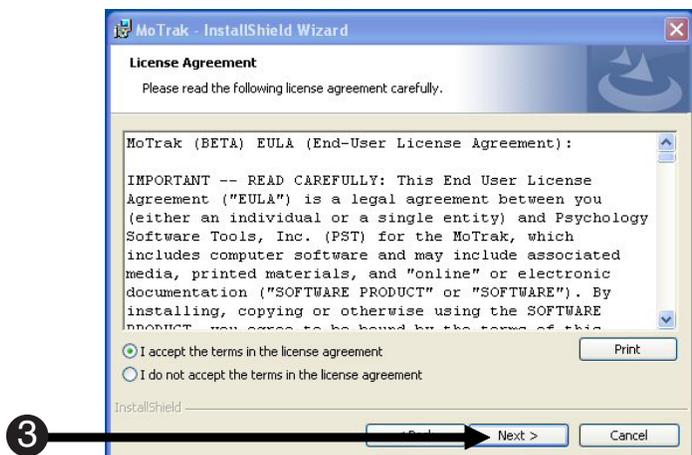
## 2.4 Software Installation

Before continuing, be sure that you have administrative rights to install this software on the computer. If you do not have administrative rights, you will be unable to install MoTrak. If you are unsure of your administrative privileges, contact your System Administrator.

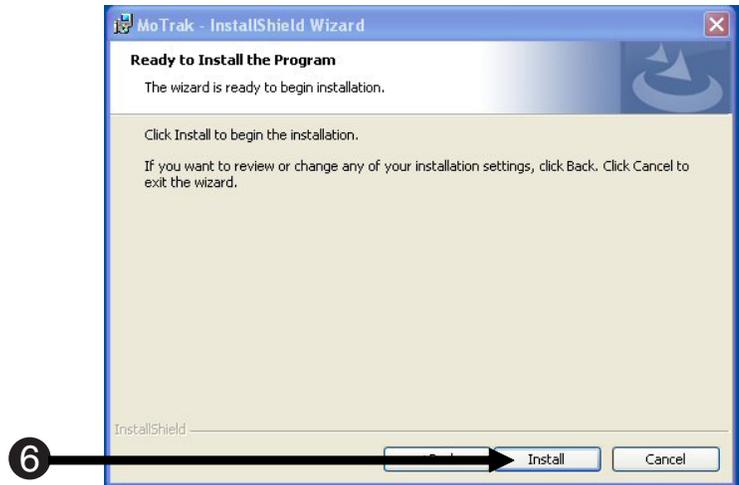
We recommend manually uninstalling any older versions of the MoTrak software before installing any updates.

**NOTE:** The version number on the following screen grabs may not correspond to the version number on your software.

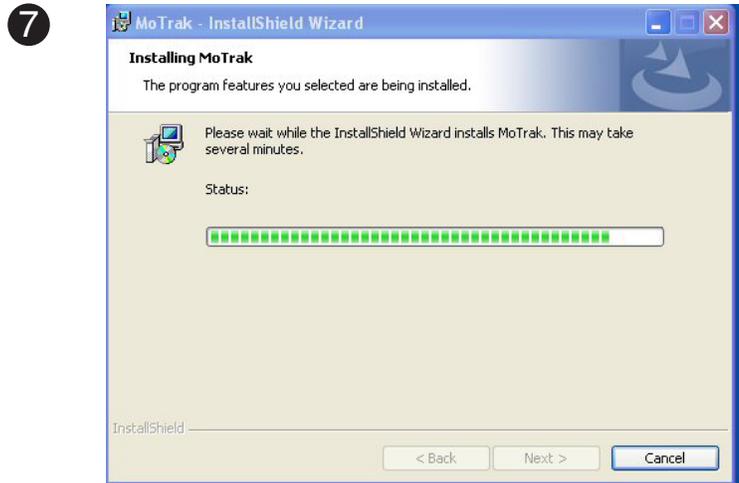
- 1) **Insert** the MoTrak installation CD into your CD-ROM drive. If the CD does not automatically start, **navigate** to your CD-ROM drive in Windows Explorer and open Setup.exe to launch the installation.
- 2) **Click “Next”** when you see the window.
- 3) **Please read** the **License Agreement** and make sure that you **agree completely** with the terms and conditions described in the **agreement** before proceeding. Once you have read the agreement, **click Next** to proceed with the installation.
- 4) **Specify** your **User Name** and **Organization** or check with your system administrator for appropriated information.
- 5) **Click Next** to continue the installation.



6) **Click Install** to begin the installation.



7) **Wait** for the installation to finish.



8) If MoTrak was installed properly, you will see the following window. **Click Finish** to complete the installation.



## Chapter 3: Before You Begin

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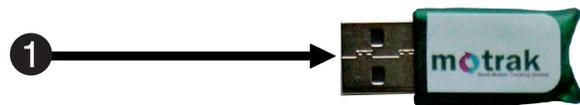
### 3.1 Setup Procedures

-  Connect the MoTrak Power Supply to the MoTrak console **BEFORE** plugging the Power Supply into a wall outlet or turning on a surge protector.  
If the MoTrak Power Supply is plugged into a wall outlet or a surge projector, connected it to a wall outlet, the crowbar safety mechanism will need to be reset.  
Unplug the Power Supply from the wall outlet or turn off the surge protector. Then connect the Power Supply to the MoTrak Console and then plug in the Power Supply to the wall outlet or turn on the surge protector.
  
-  The MoTrak hardware requires a five-minute warm up period. During this period, the MoTrak sensor will drift and the data will be inaccurate.
  
-  When the MoTrak hardware is not in use, make sure the switch is in the standby (STBY) position to prevent the hardware from overheating.

## 3.2 Hardware Key Validation

The MoTrak hardware key must be connected to your computer in order for MoTrak software to work. If the hardware key is disconnected, there is a **five use grace period**, before the hardware key must be reconnected to the computer. If the hardware key is not reconnected at this time, the MoTrak software will cease to work.

- 1) MoTrak hardware key
- 2) The following **error message** will appear if the grace period has expired.
- 3) **Insert** the hardware key and **click OK**, to **eliminate** the error message.



## Chapter 4: Getting Started

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### 4.1 General Controls

MoTrak's main controls are located at the top of the interface next to the file menu. Below is a brief explanation of each button's function. Additionally, the Movie Pause and Play Sound thresholds are defined for the Active Target. See the Options Form General Tab for more information.

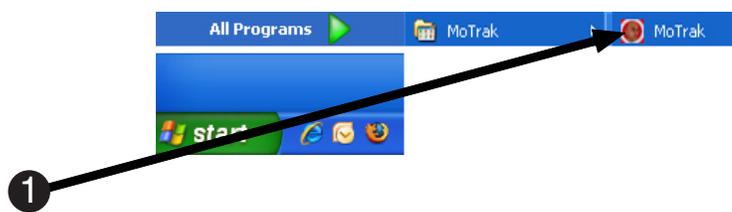


- 1) **Save Button:** Saves the current configuration and settings.
- 2) **Open Button:** Opens or loads a new or previously saved configuration.
- 3) **Run Button:** Starts the tracking.
- 4) **Center Button:** Resets the current cross hair position to zero.
- 5) **User Display Button:** Opens the User Display into a full screen mode.
- 6) **Options Button:** Opens the options window, which is discussed in detail in Chapter 6.
- 7) **User Display window:** Dictates which target is visible to the participant.
- 8) **Active Target window:** Selects the active target.

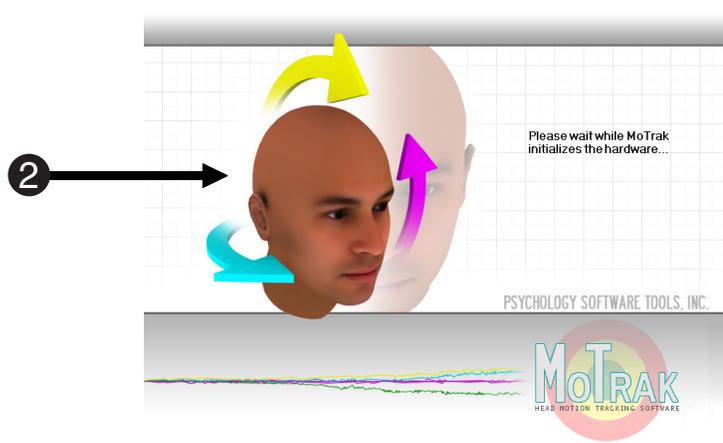
## 4.2 User Interface

After the system is connected properly, open the Motrak software via the start menu. If the system is connected incorrectly an error message will appear when the program begins (See Appendix A: Trouble Shooting Guide, **Page 58**).

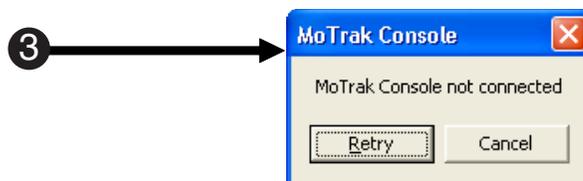
- 1) **Click** on the Windows Start menu, **select** Programs, and then **select** MoTrak. From the menu, **click** on MoTrak to launch the application.



- 2) When the program opens, it will check for the presence of the MoTrak hardware.



- 3) If MoTrak hardware is not connected, you will get a message box asking you to **“Retry”** or **“Cancel”**. Check if everything is plugged in properly and try starting the application again.



## 4.2 User Interface

After the program has opened successfully, you can begin tracking. Locate the running man in the menu and click the icon to begin recording. You will be prompted to save your data to a file select your choice, and then use the center button to zero the crosshairs.

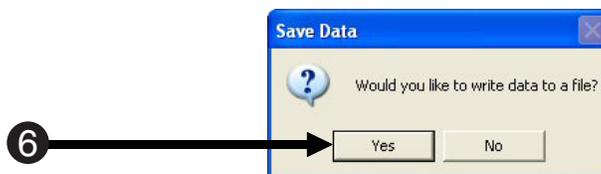
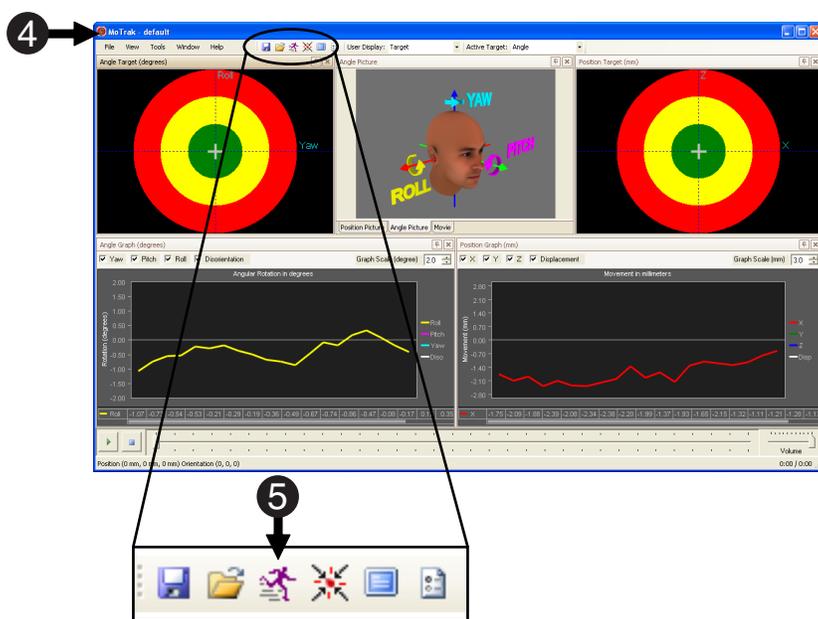
4) If everything is connected properly the program will start normally.

5) **Click** on the start tracking button to begin data collection.

6) **Click “Yes”** to save the data to a file.

**NOTE:** If you select “No”, you will still be able to use the software to monitor head motion. However, none of the session data will be sent to a file.

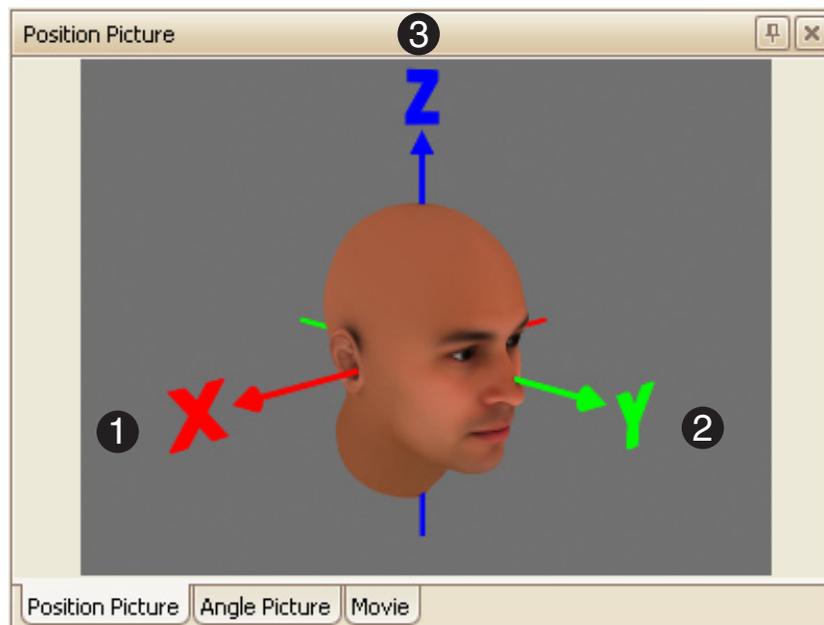
7) **Click the center button** to create a data file.



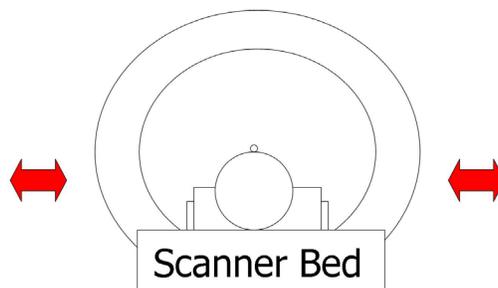
## Chapter 5: Coordinate System

### 5.1. Positional Coordinate System

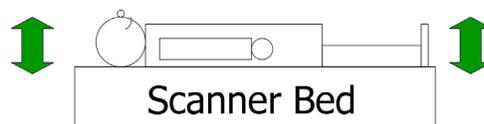
MoTrak uses the conventional MR coordinate system for X,Y,Z. This system is from the perspective of the MR technologist looking into the scanner at the person in a supine position.



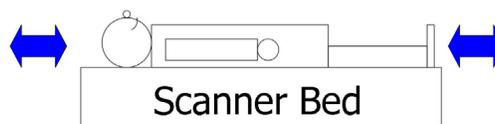
- 1) The **X-axis** runs L/R, R/L through a participant's shoulders.



- 2) The **Y-axis** runs through a participant's nose in the direction they are looking.

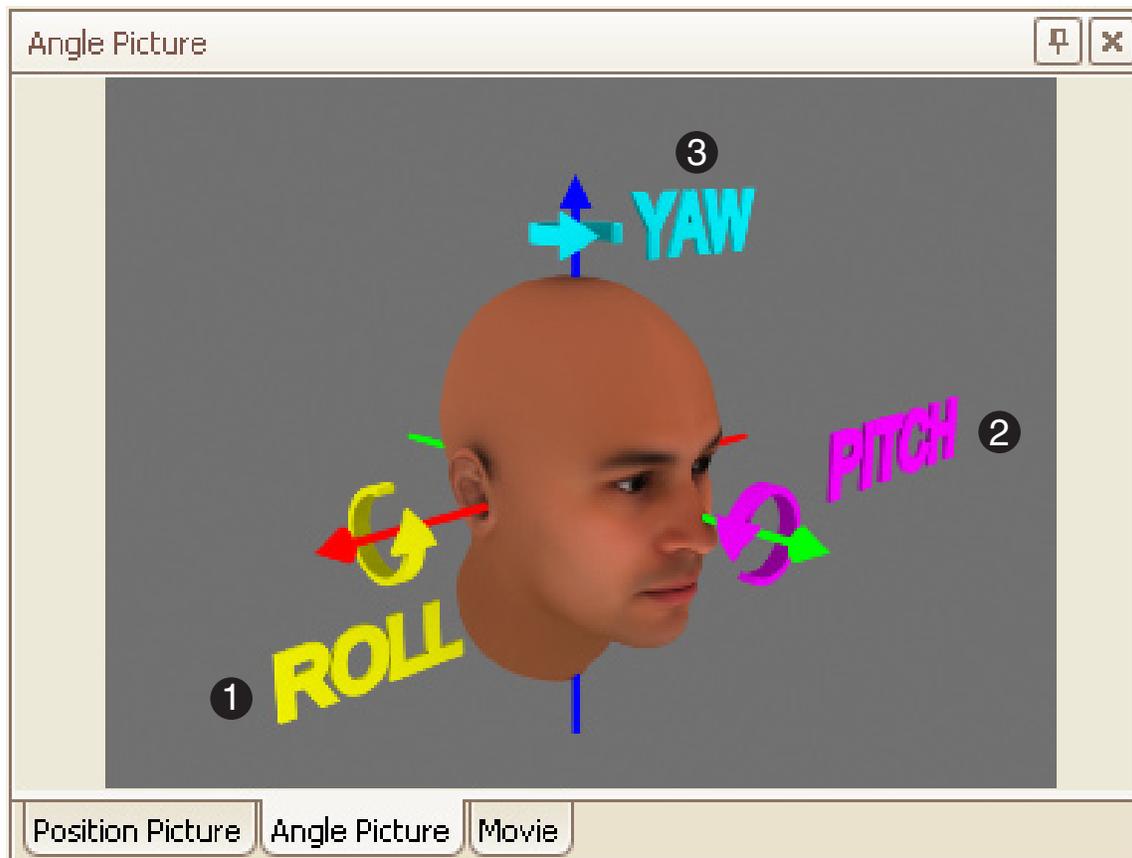


- 3) The **Z-axis** is along the spine.



## 5.2 Angular Coordinate System

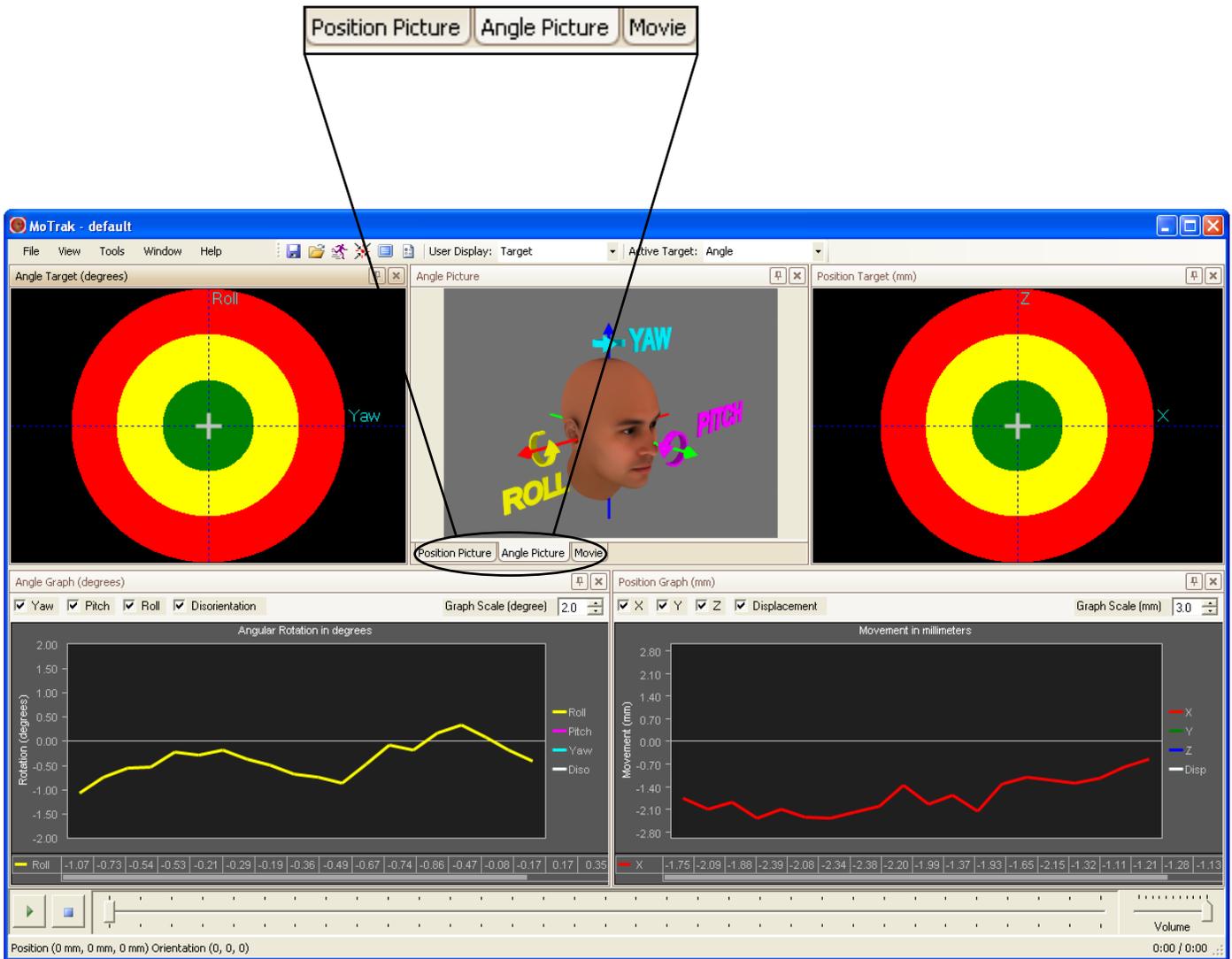
The angular motion is defined using roll, pitch, and yaw as described in the diagram below.



- 1) **Roll** is defined as a rotation about the X-axis.  
*A motion simulated by a "yes" head motion.*
- 2) **Pitch** is defined by a rotation about the Y-axis.  
*A motion simulated by tipping your head left to right.*
- 3) **Yaw** is defined by a rotation about the Z-axis.  
*A motion simulated by a "no" head motion.*

### 5.3 Coordinate System Reference Diagram

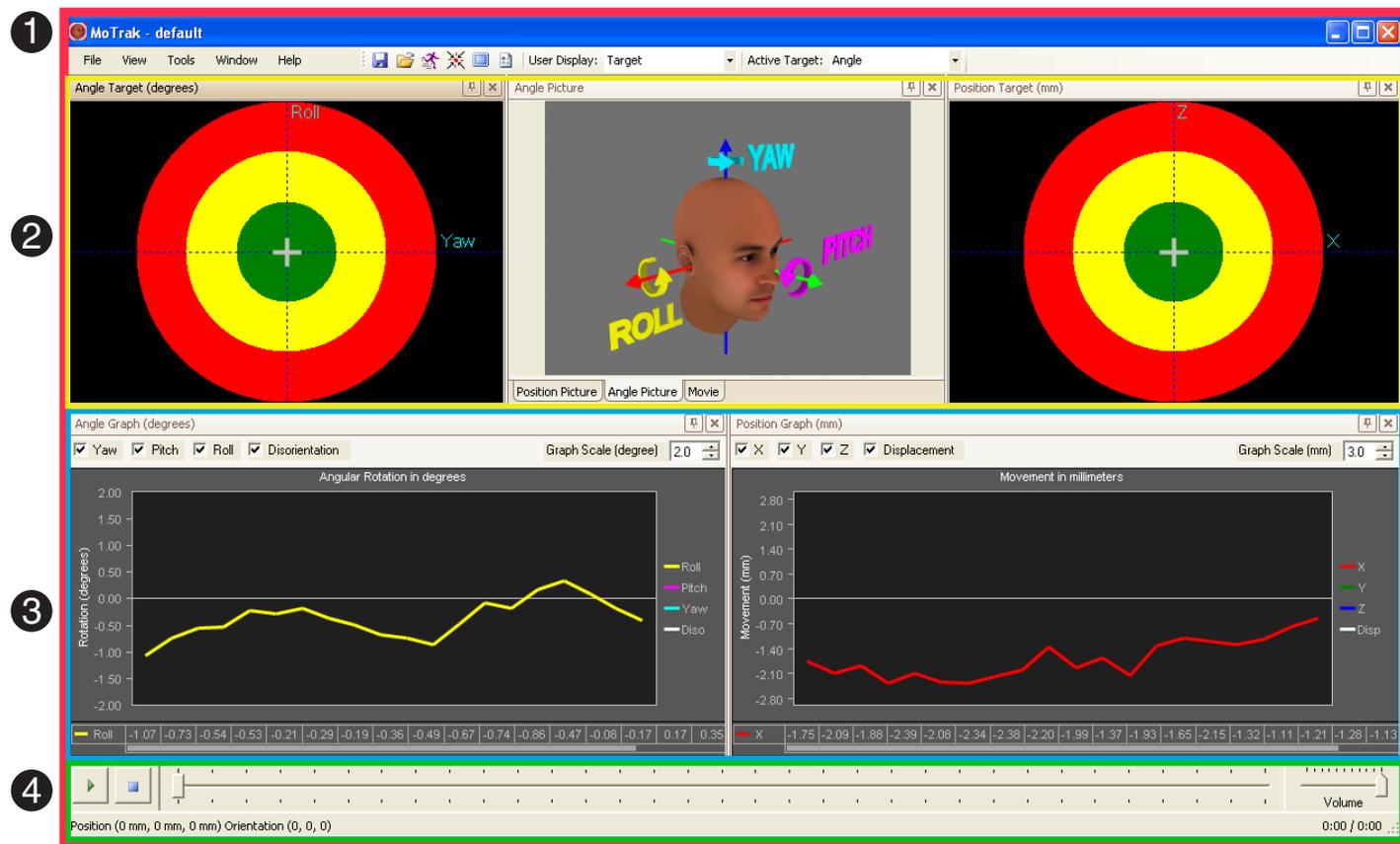
At any time during the experiment, a reference diagram of the position and angular motion can be brought up on the screen by clicking on the tabs in the highlighted window below.



# Chapter 6: User Interface

## 6.1 Overview

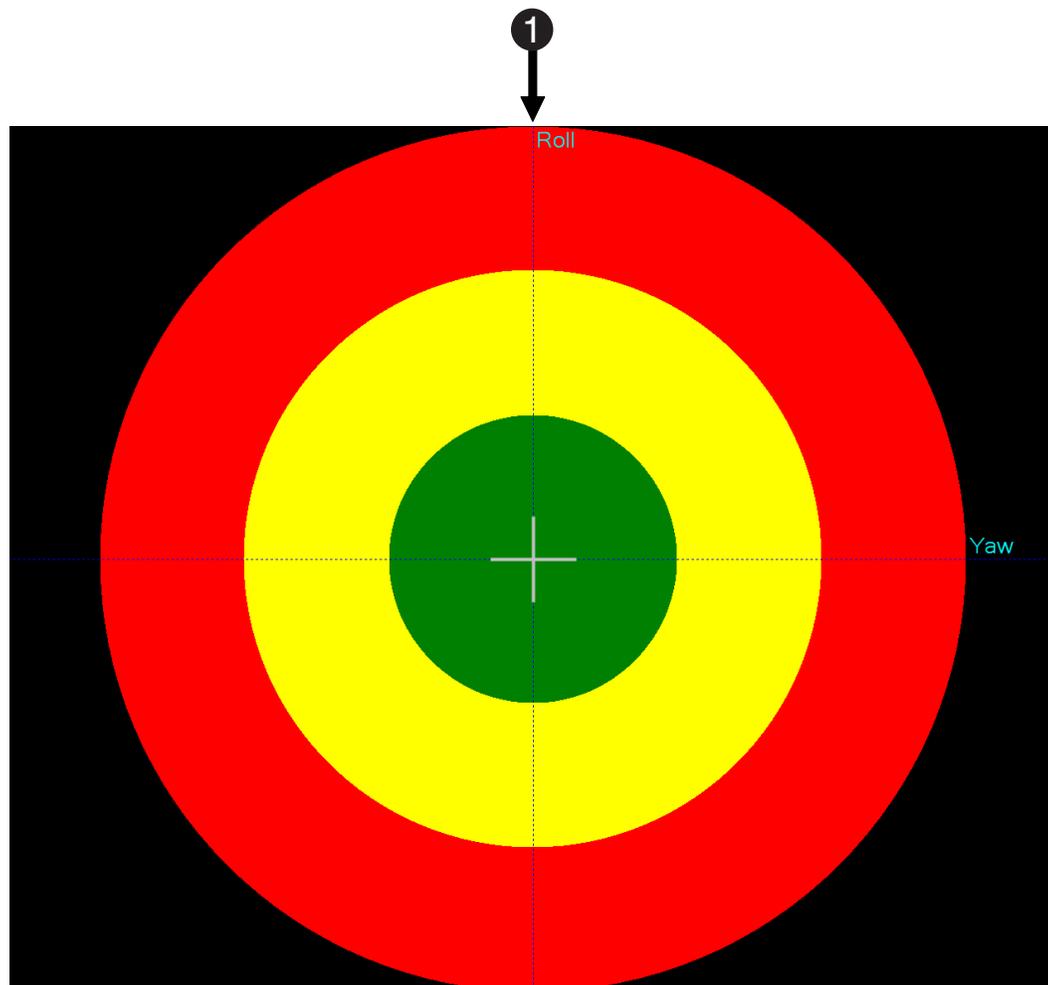
The interface consists of a primary and secondary view. In the primary view, a circular target displays a + or cross hair to allow you to visualize where the sensor is on the coordinate planes. There are two different targets displayed, positional and angular. In the secondary view, the motion is plotted via live graphs in both millimeters and degrees.



- 1) **Primary View:** Target and Movie Displays (See **Page 27**)
- 2) **Secondary View:** Graphic display of participant motion (See **Page 29**)
- 3) **Interface:** The MoTrak User Interface (See **Page 32**)
- 4) **Movie Controls:** Audio and Visual Displays (See **Page 33**)

## 6.1 Overview

The main interface also includes a participant display. The display can be used to train the participant to control their head motion. It can be configured to display a target (position or angle) or a movie.



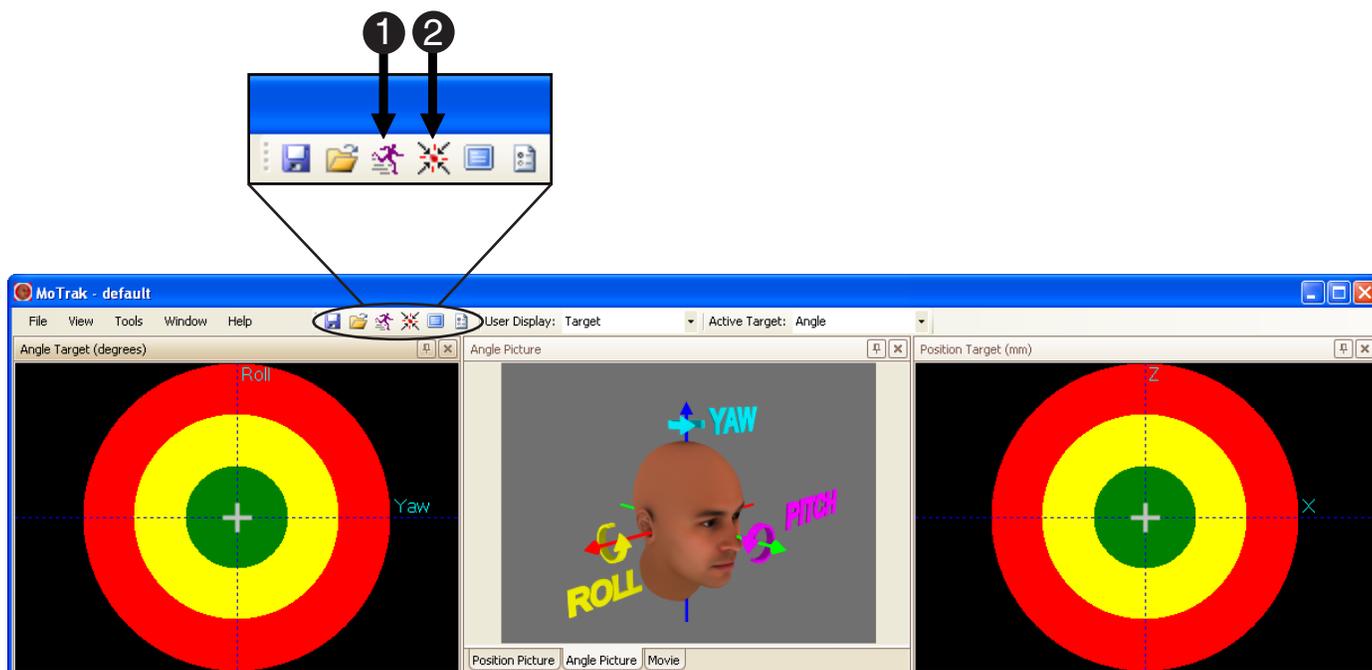
**1) Participant Display Target:**

This is the display that can be shown to the participant.

## 6.2 Primary View

The researcher can recalibrate or center the cross hair at any time so that the current position of the participant will be zero.

Clicking the zero button will tell the software to recalculate movement from the position of the sensor. Before zeroing the cross hair, instruct the participant to hold still.

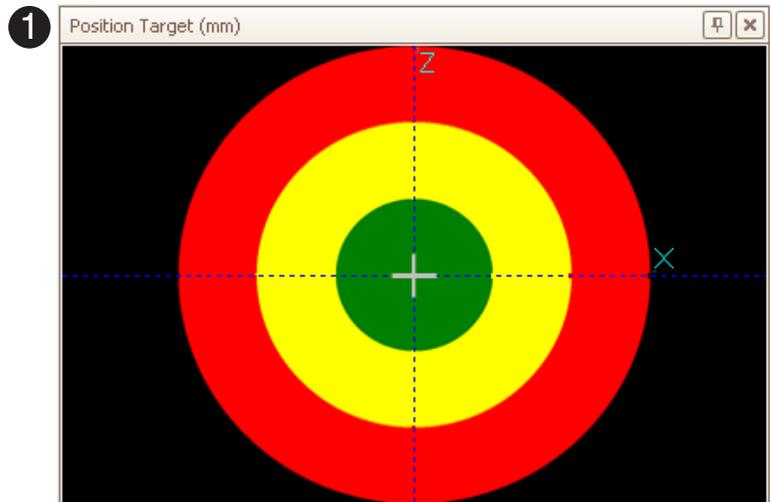


- 1) **Click** button to begin tracking.
- 2) **Click** button to recalibrate or center the cross hairs.

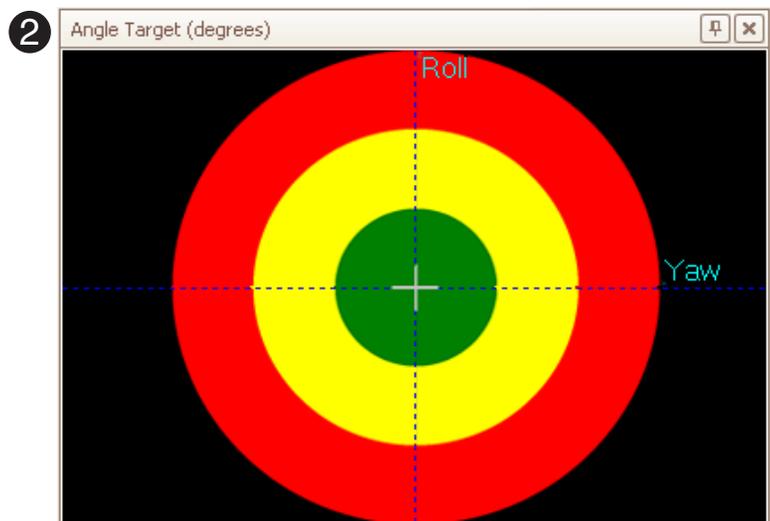
## 6.2 Primary View

The primary view consists of two targets and a movie display. The position angle and the movie displays are at the top of the interface. The researcher can visualize the participant's movement using the targets and also view the movie via the movie display.

1) Target that displays displacement in millimeters.



2) Target that displays angular rotation in degrees.



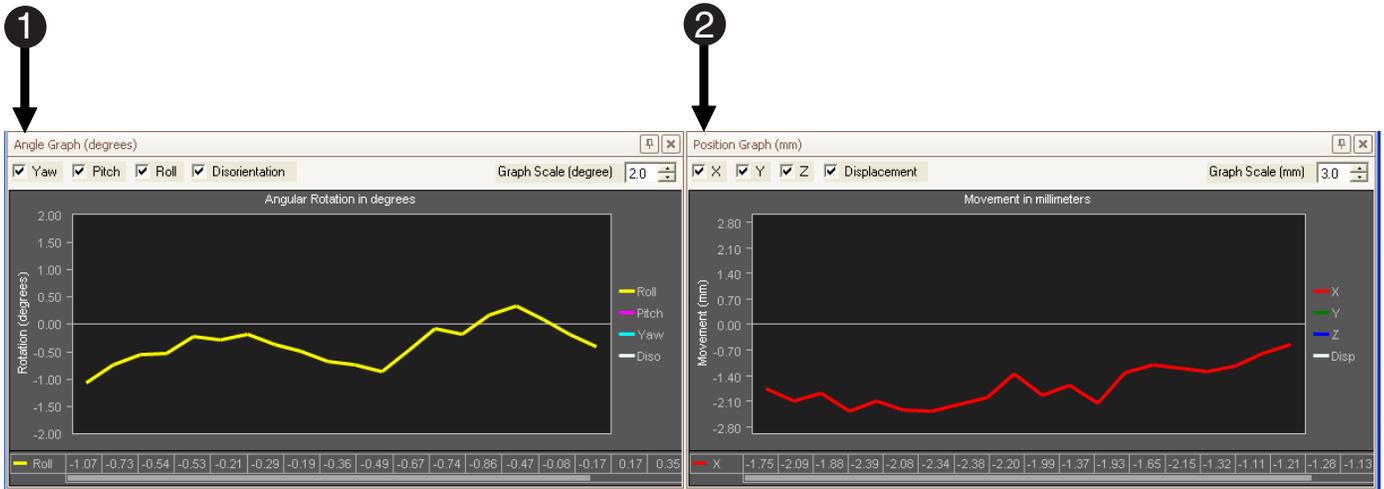
3) Displays the movie the participant sees while in the simulator when software is configured to play movie. (See **Page 43**).



### 6.3 Secondary View

The secondary view is a graphical interface that displays all three vectors of motion and the sum of the vectors.

This data is simultaneously written to a log file, which allows the data to be analyzed later. In addition, the log file records when the sample of data was taken, which circle the cross hair for both targets was in, and any events (i.e. re-zeroing the cross hairs).



1) Angle Graph

2) Position Graph

## 6.3 Secondary View

### 6.3.1 Position Graph

The Position Graph can be configured to show up to four axes; X,Y,Z and displacement. Displacement is the sum of the X,Y, and Z vectors. The graph scale can also be changed in increments of millimeters.

1) **Click** box to show specified axes, **uncheck** to hide axes.

2) **Click** arrows to **increase** or **decrease** the scale of the axes.

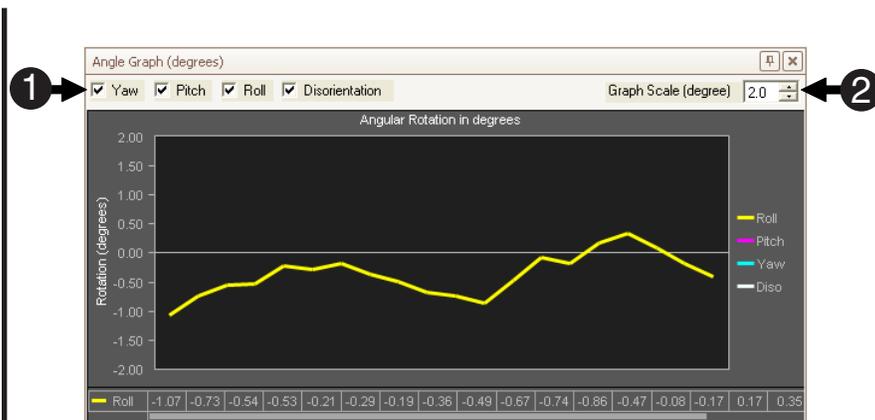


## 6.3 Secondary View

### 6.3.2 Angle Graph

The Angle Graph can also be configured to show up to four vectors; yaw, roll, pitch, and disorientation. Disorientation is the sum of the yaw, roll and pitch vectors. The graph scale can also be changed by increasing or decreasing the degrees per unit.

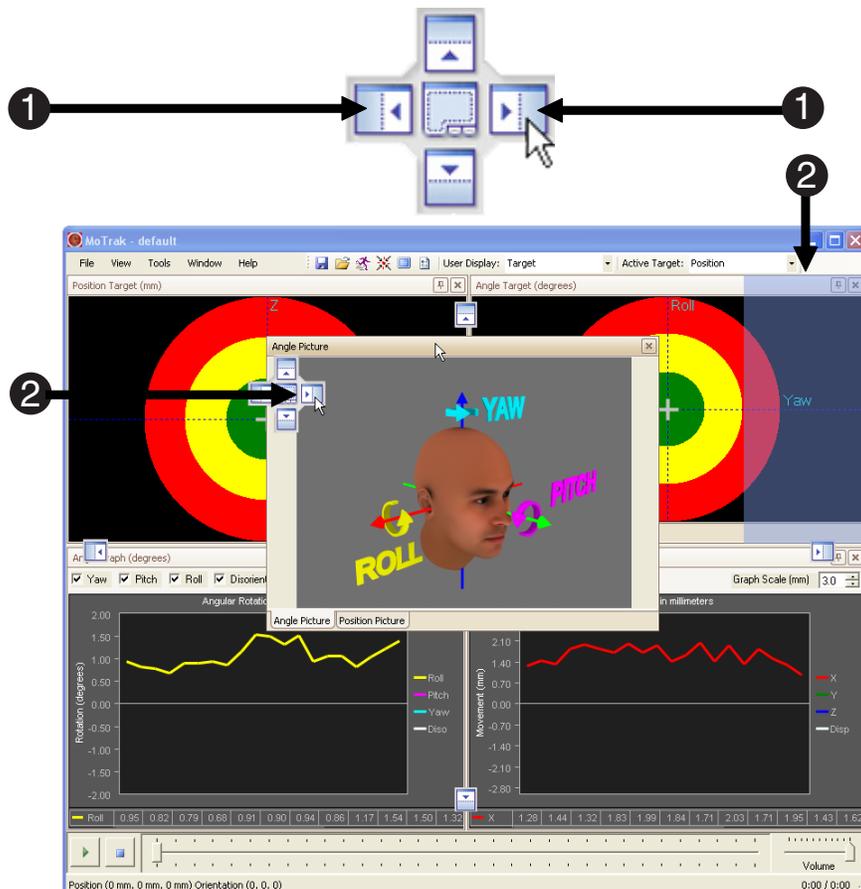
- 1) **Click** box to show specified vectors, **uncheck** to hide vectors.
  
- 2) **Click** arrows to **increase** or **decrease** the scale of the vectors.



## 6.4 Interface Configuration

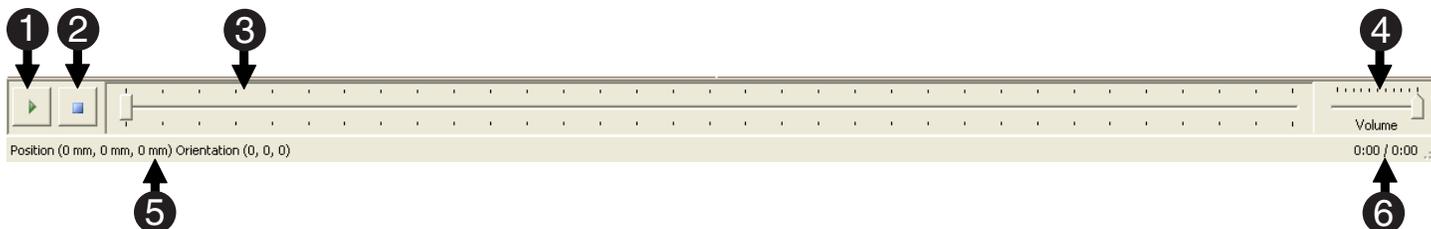
The software uses what is called a layout manager or DockPanel to display the user interface. Not unlike a boat dock, a DockPanel provides a place for elements of an interface to be moved arranged relative to each other. Elements or widgets can be rearranged in different configurations and docked to each other using drag and drop operations or by sizing the windows to fit.

- 1) **Click** on a **widget** to move it. Note that **light blue placement blocks** appear. Each individual **block** has a **blue highlighted portion** that **corresponds** with an **on-screen blue overlay**.
  
- 2) **Click** on the **highlighted portion** to **place** the **panel** either at the top, bottom, right, left or center of the window.
  
- 3) For example, we **moved** the **Angle Picture** panel into the **right panel**, **replacing** the **Angle Target** panel.



## 6.5 Movie Controls

The MoTrak movie controls are located at the bottom of the screen. They provide common audio/visual functionality along with sensor orientation information located at the bottom of the interface. Compatible file formats are .avi or .mpeg. The MoTrak software does not include a codec. The appropriate codec should be installed on the host machine before movie functionality is available.

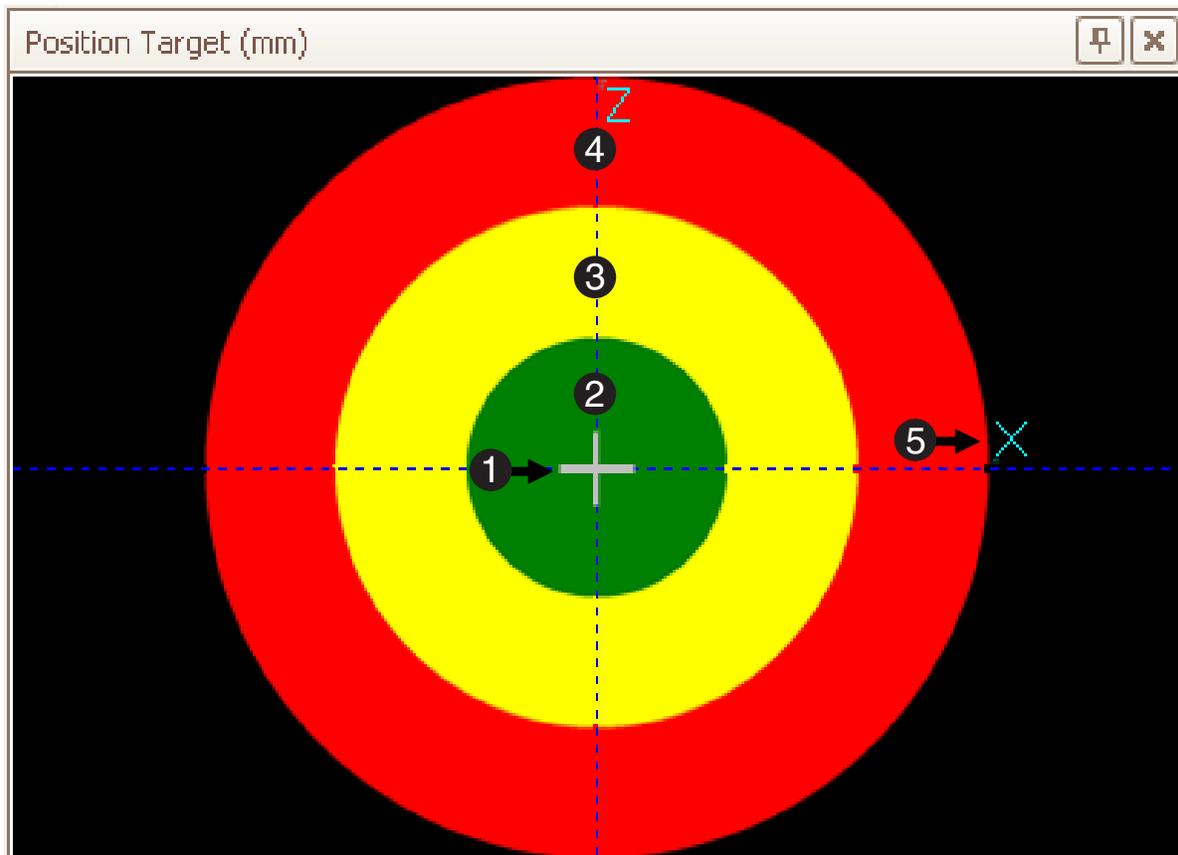


- 1) **Movie Play/Pause Button:** Plays or pauses a selected movie.
- 2) **Movie Stop Button:** Stops a movie once it was started.
- 3) **Position Seek Bar:** Allows the user to move toward the end or the beginning of the movie by sliding the button to the right or left respectively.
- 4) **Volume Control Bar:** Controls the volume level of the sound stimulus (movies or tones). Sliding the button to the right increases the volume.
- 5) **Status Bar:** Displays position and orientation of the sensor.
- 6) **Time Elapsed:** Shows the time elapsed and the total time of the movie.

 **NOTE:** More movie settings are located in the options dialog on **Page 43**.

## 6.6 Target Description

MoTrak displays two views for the information collected: the Primary view and the Secondary view. The picture below illustrates the translational or position target components in the primary view.



- 1) **Cross hair:** Represents the position of the sensor in space. The sensor is attached to the participant's hand.
- 2) **Inner Circle:** Motion within the inner, green circle representing an acceptable motion. **(Default Configuration)**
- 3) **Middle Circle:** Motion within the middle, yellow circle that representing an acceptable range, but approaching unaccepted motion. **(Default Configuration)**
- 4) **Outer Circle:** Motion within the outer, red circle representing an unacceptable motion. **(Default Configuration)**
- 5) **Axis Label:** Displays which axis, positional or angular that you will be viewing. In this instance, X and Z are displayed on the position target.

## 6.7 Target Function

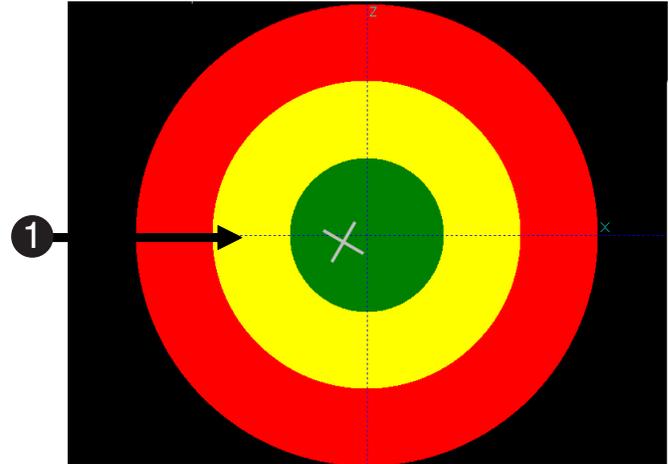
The cross hairs, “+” are displayed to the participant via the user display.

The participant will see the motion of the cross hairs and gradually learn to control their head motion. To aid in the learning process, the user is able to set a negative stimulus to occur when the cross hair leaves a specified circle. (See **Pages 43** and **44** for more details).

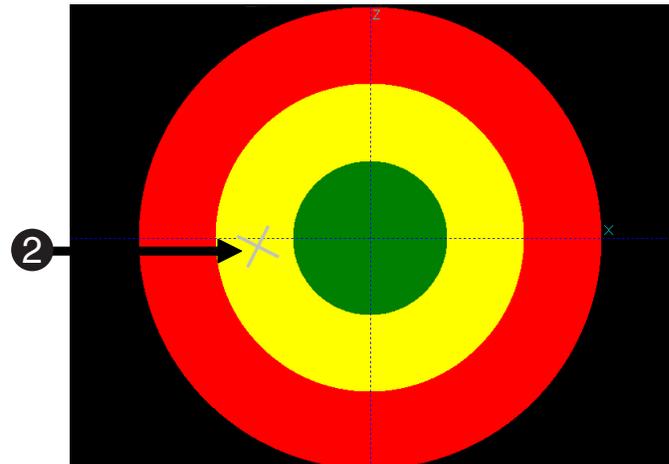
The size of these circles can also be configured to allow varying restrictions on motion.

This topic is discussed in more detail in Chapter 8: Target Options (**Page 45**).

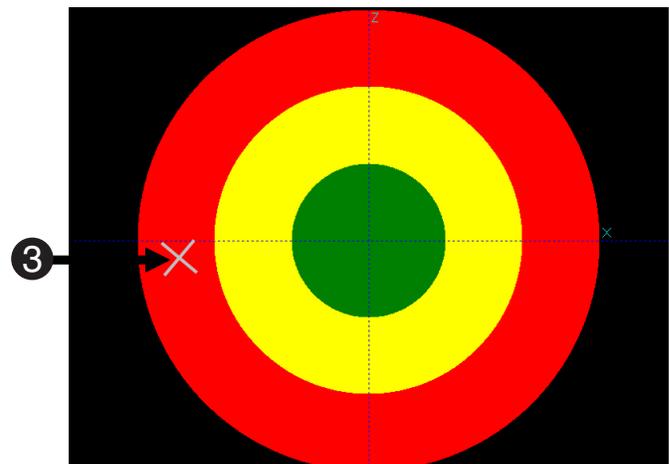
- 1) Head motion within the inner green circle is within the desired range by default.



- 2) Movement into the middle yellow circle is tolerable, but not optimal by default.



- 3) If the cross hair travels into the outer red circle the motion is considered excessive, and will be indicated to the participant via the chosen negative stimulus. Stimulus can be both auditory and visual. See **Pages 43** and **44** for more details.



**NOTE:** Since the target can only display two axes in two dimensions, the third axis dimension can optionally be displayed as a rotation of the cross hair.

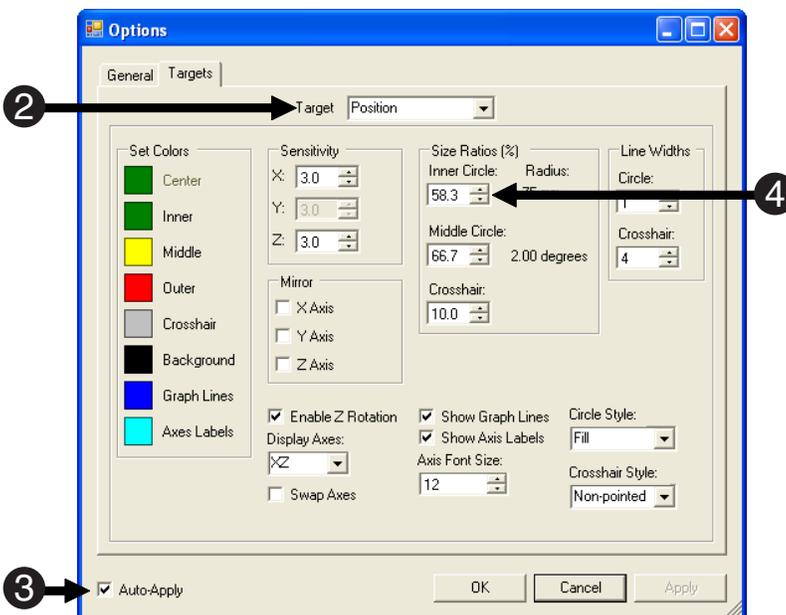
## 6.8 Target Configuration

The targets have many different parameters that can easily be changed in the Options menu. These settings apply to the targets in the primary display as well as the participant target. These settings are saved in configuration files, allowing a variety of configurations to be stored for later use.

1) **Click** the **Options** button in the Controls tool bar.



2) **Select** which **Target** you want to modify.



3) **Check** the **Auto Apply** box to see your changes while having the Options window open.

4) **Click** the **up/down** arrows to **increase/decrease** the **Size Ratio** area.  
(Compare this image to the image on the previous page)



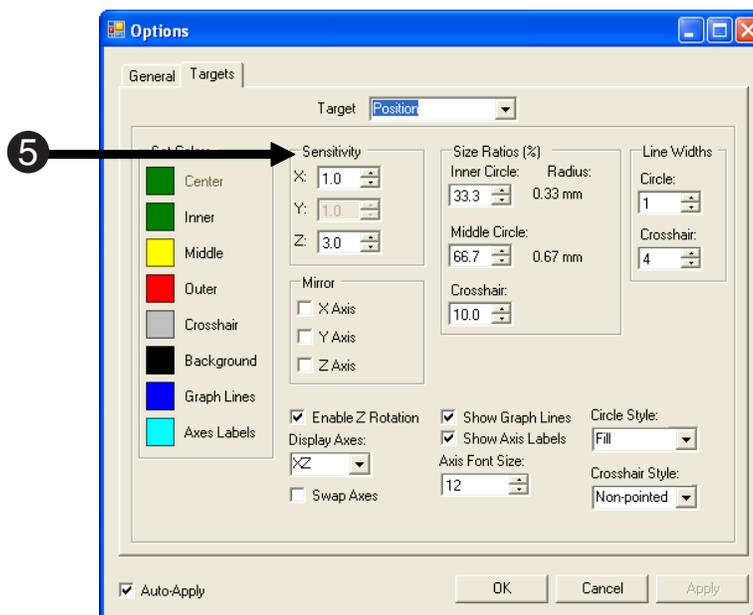
## 6.9 Target Configuration

Changing the sensitivity of the target allows the user to adjust the head motion tolerance. The sensitivity units are in millimeters. Changing the sensitivity of an axis also changes the radius of the circles.

- 5) **Click** the **up/down** arrows to **increase/decrease** the sensitivity of the cross hairs.

**NOTE:** You will not see the change in size on the display because it is equal across all the circles.

**NOTE:** The MoTrak Console has the following resolution:  
Positional .5mm @12" (30.5cm)  
Orientation .1 degrees @12" (30.5cm).



## 6.9 Target Configuration

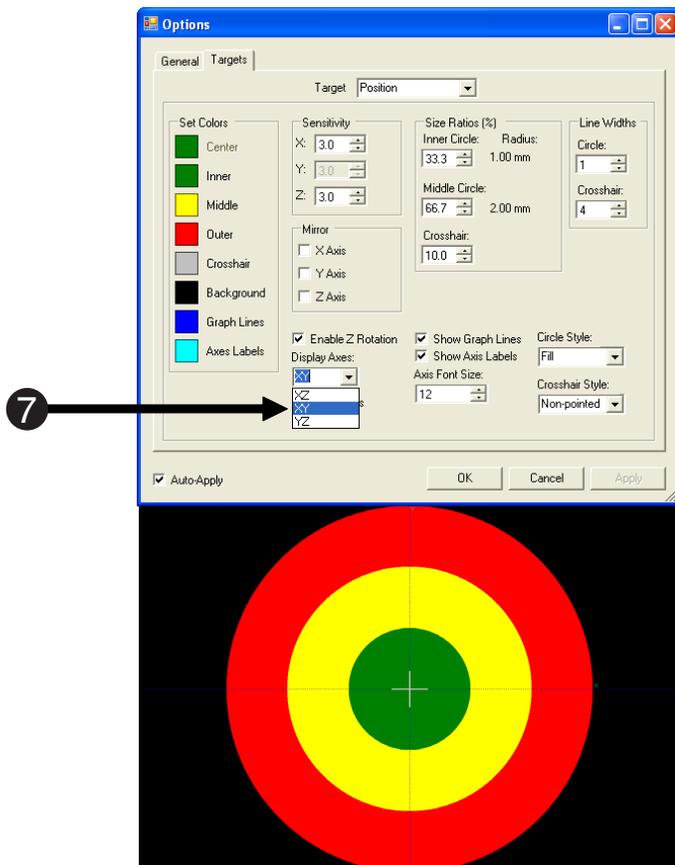
The target options allow the user to enable/disable the Z-axis display and choose what axes are displayed on the target.

- 6) To display the third axes, check the box for Enable Z Rotation.

The target is a two-dimensional representation of space, the third-dimension, Z. Z is represented by the rotation of the cross hairs.



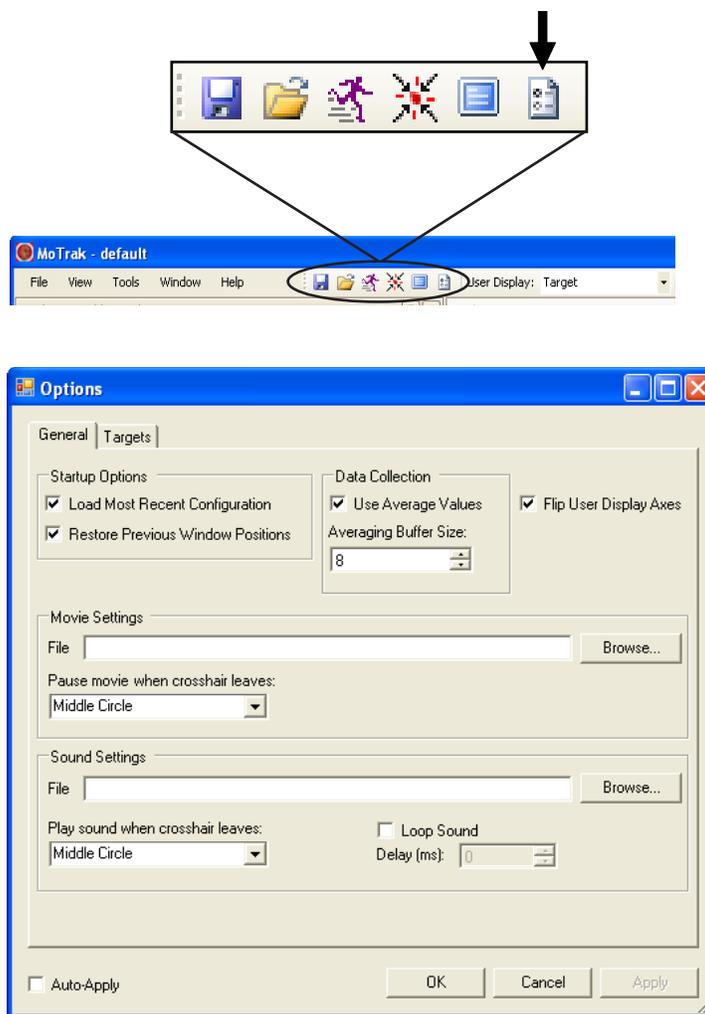
- 7) To change the axes visualized on the target, **click** on the drop down menu in the **Display Axes** area and select your preferred option.



## Chapter 7: General Options

### 7.1 Options General Tab

The Options General tab controls start up options, data collection, options, movie settings and sound settings. The Options General dialog can be accessed by pressing F9 or via Tools → Options. Below is a list of the options that will be described in detail in the following pages.



- 1) **Startup Options**
- 2) **Data Collection**
- 3) **Flip User Display Axes**
- 4) **Movie Controls**
- 5) **Sound Controls**

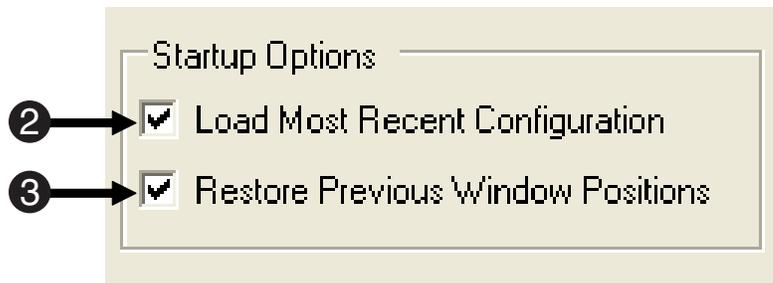
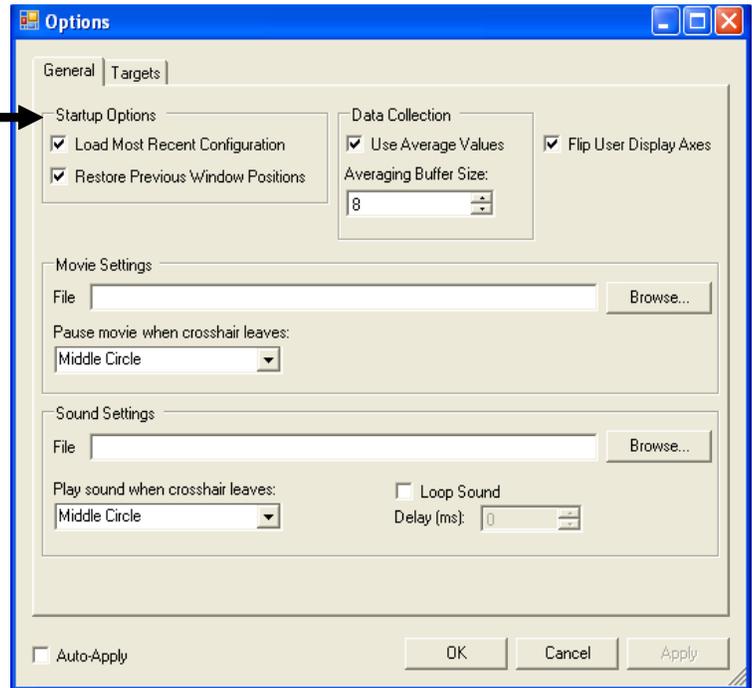
## 7.2 Startup Options

The Startup Options control actions the program performs immediately after it is opened. The MoTrak software is able to load the last used configuration file and remember where the windows were physically located on the monitor before the program was closed. This is useful if the same configuration is needed for multiple consecutive tests. Both options are active by default.

### 1) Startup Options

2) **Confirm** the **Load Most Recent Configuration** is **checked** to enable the configuration file to automatically be loaded.

3) **Confirm** the **Restore Previous Window Positions Box** is **checked** to enable MoTrak to remember the size and location of each window between use.



## 7.3 Data Collection Options

Data collection with the MoTrak is mostly an automated process. Before you begin tracking, the software prompts you to write the output data to a file. This data includes a current date, a timestamp, the X/Y/Z data for each sample, the Roll/Pitch/Yaw data for each sample, which circle the angle and position cross hair were in, and any zeroing events that occurred.

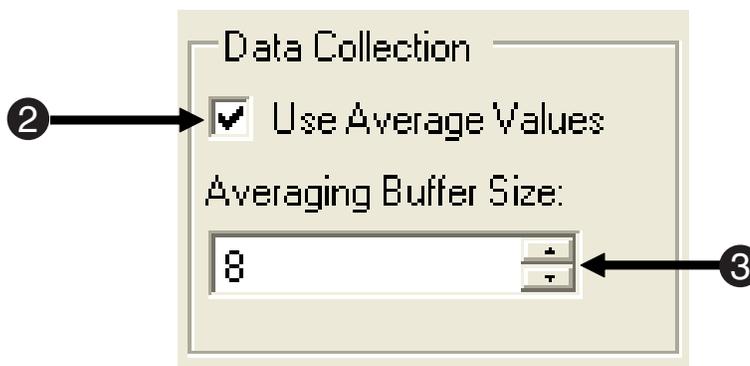
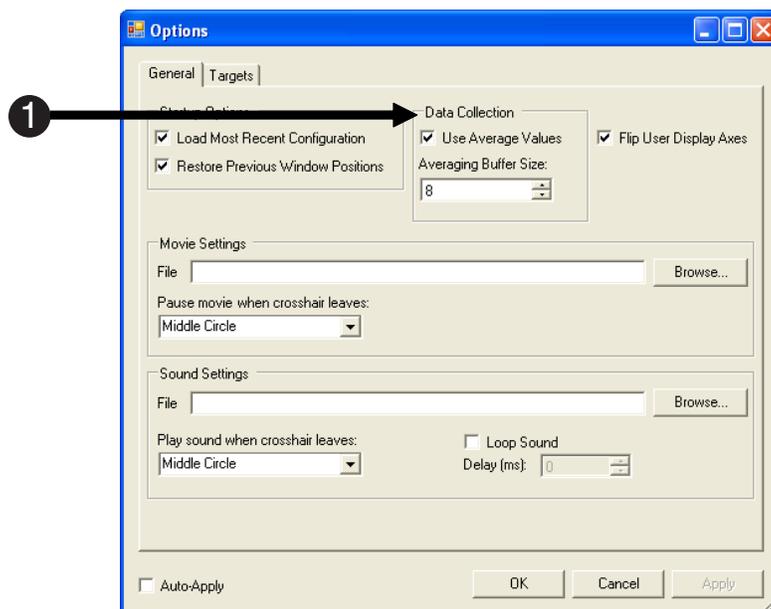
A file with the data will be saved to this location:

**...My Documents\PST\MoTrak\Logs**

The Data Collection Options control how the data is collected. The available options control if the data used to draw the cross hairs is smoothed and how many samples are used in the smoothing. Smoothing will display a steadier, more representative cross hair. The sampling rate is 103 Hz, so averaging eight samples will result in an approximate lag of 78ms. By default the feature is enabled and we use eight samples.

**⚠ NOTE:** *Decreasing the averaging too much will effect the accuracy of the cross hair display. This will impair the participant's ability to effectively use the cross hair as a visual cue to alter their head movements.*

- 1) **Data Collection Options**
- 2) **Confirm the Use Average Values** box is **checked** to enable smoothing.
- 3) **Click the arrow keys** to **increase** or **decrease** the number of samples used to smooth the motion of the cross hair.

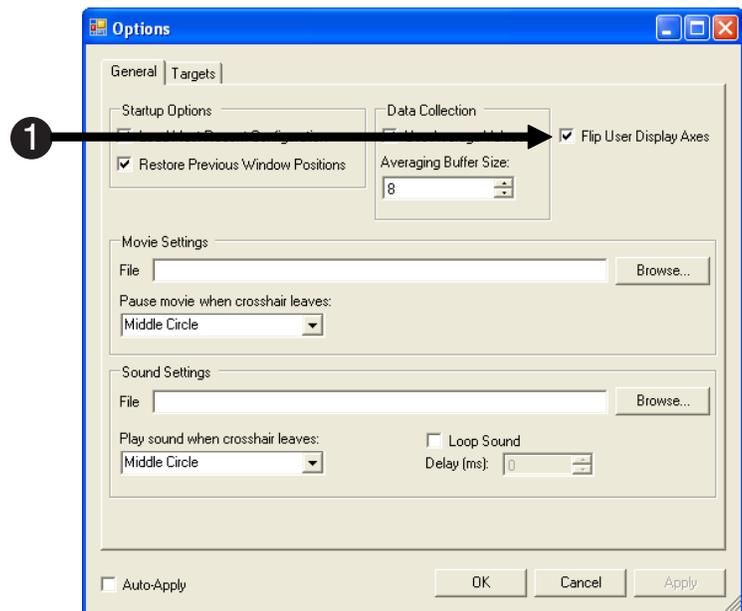


## 7.4 Flip User Display Axes

The Flip User Display Axes option causes the User Display, participant's view, and axes to be reversed with respect to the interface target. This effectively allows the researcher to see from the perspective of the participant while they are training. If the researcher needs to verbally direct the participant, the researcher will not have to alter the instructions for the participant.

If the participant moves to the left, the User Display's target's cross hairs move to the left. However, the researcher should see the main target's cross hairs moves to the right.

- 1) **Confirm Flip User Display Axes** is **checked** to enable feature.

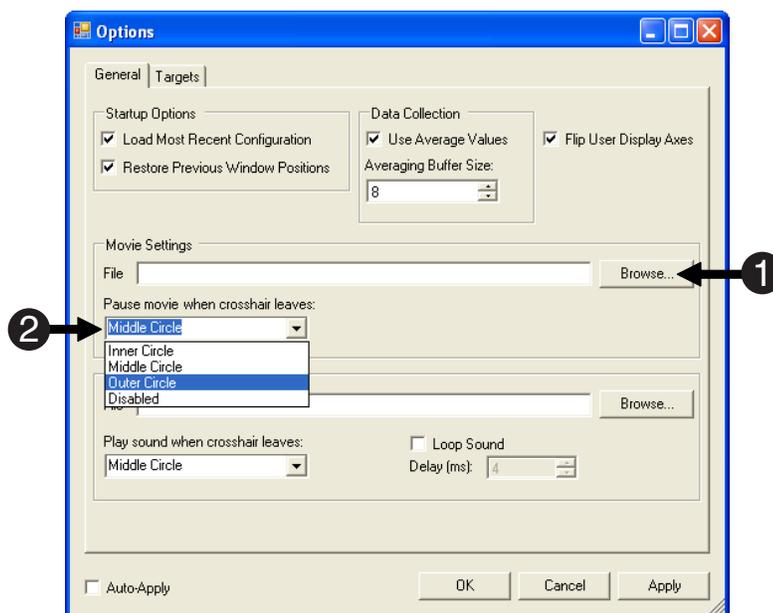


## 7.5 Movie Settings

The Movie Settings control what movie is played and when/if the movie is paused when the cross hairs leave a designated circle. The MoTrak software does not include a codec. The appropriate codec should be installed on the host machine before movie functionality is available.

If you can open the file in Windows Media Player it will likely work with the MoTrak software. The MoTrak software comes with one sample movie located at **C:\Program Files\MoTrak (for 64bit Vista x86, and C:\Program Files (x86)\MoTrak)**. The Pause function stops the movie when the cross hairs leave the specified circle, middle circle by default.

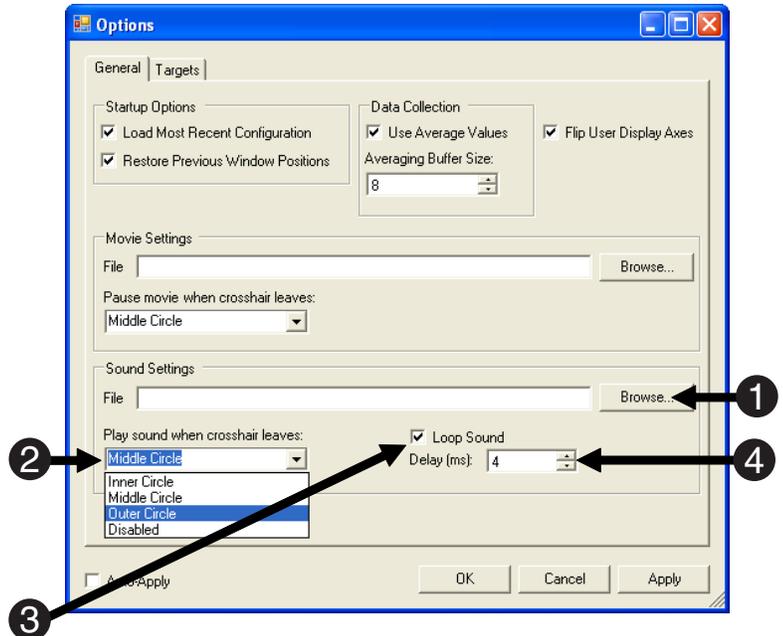
- 1) **Click Browse** to navigate to movie location.
- 2) **Select the desired Circle** via the drop down box. When the cross hairs leave the selected circle the movie will be paused.



## 7.6 Sound Controls

The Sound Settings control what sound is played and for how long when the cross hairs leave the designated circle. The compatible format for playing sound files via MoTrak is .wav.

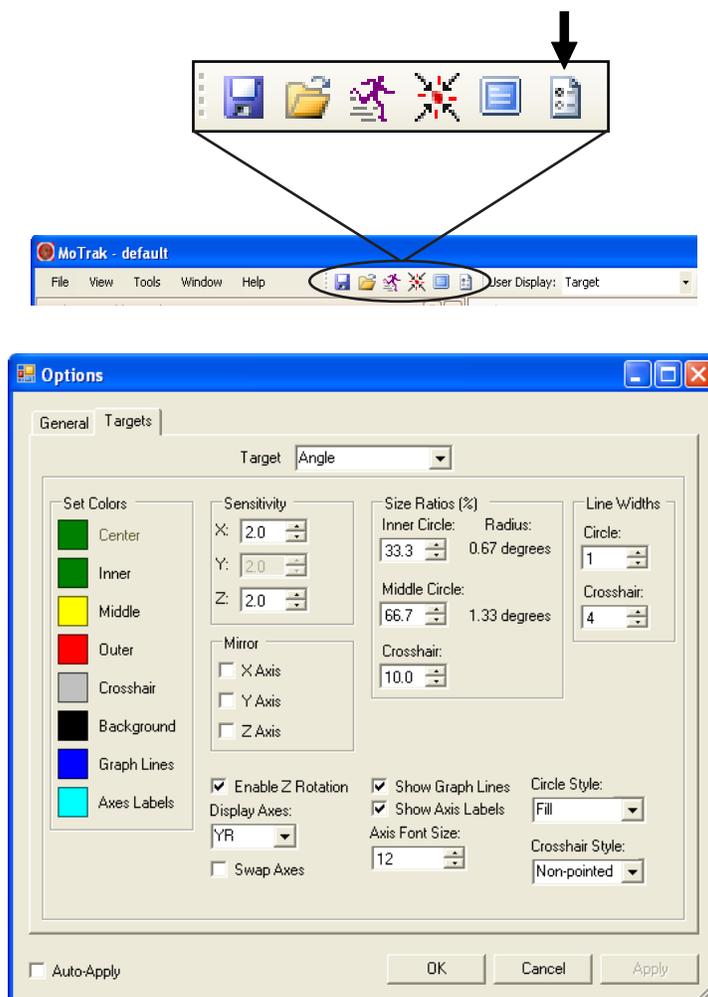
- 1) **Click Browse** to navigate to sound location.
- 2) **Select** the desired **Circle** via the drop down box. When the cross hairs leave the selected circle the movie will be paused.
- 3) **Check Loop Sound** to repeat the sound file.
- 4) **Click** the **arrow keys** next to the **Delay(ms)**: to **increase** or **decrease** the loop delay. The lower the number of milliseconds, the faster the sound will repeat.



## Chapter 8: Target Options

### 8.1 Options Target Tab

The Options Target tab controls the color, sensitivity, size ratios, line widths, axes mirroring and other target features. The Options Target dialog can be accessed by pressing F9 or via Tools → Options and clicking the Target tab. Below is a list of the options that will be described in detail in the following pages.

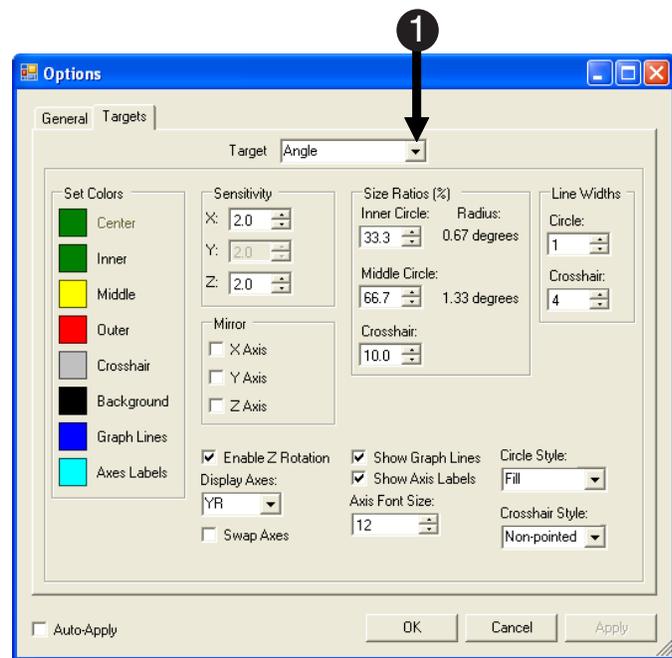


- 1) Target Selection
- 2) Target Sensitivity
- 3) Mirror
- 4) Size Ratios
- 5) Display Axes
- 6) Visual Display Controls

## 8.2 Target Selection

The Target Selection feature allows you to choose which target's configuration you would like to change. If you select the Angle target all changes you make will apply to the Angle target and likewise if you select the Position Target.

- 1) **Select** the desired target to be modified.

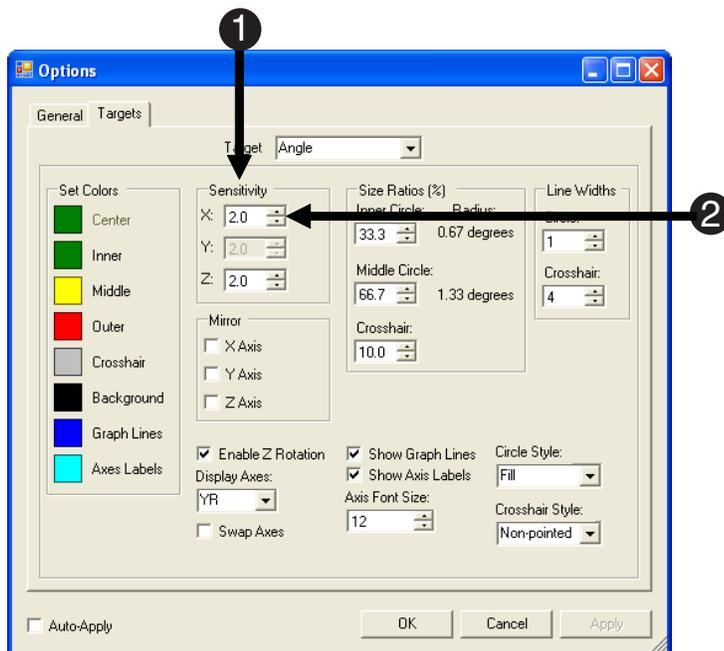


## 8.3 Target Sensitivity

The Sensitivity setting customizes the sensitivity of the target along each axis. In the case of positional targets, the sensitivity defines how many millimeters of motion will put the cross hair at the edge of the outer circle, assuming the other positions are held constant at 0. On the position target, the sensitivity is the radius of the entire circle. In the case of angular targets, the sensitivity defines how many degrees of motion will put the cross hair at the edge of the outer circle, assuming that the other angles are held constant at 0. The X and Y sensitivities for a given target are locked together, and cannot be changed independently. See next page for clarification.

1) **Sensitivity** settings location.

2) **Click** the arrow keys to **increase** or **decrease** sensitivity.



## 8.3 Target Sensitivity

### 8.3.1 Target Sensitivity Examples

The following examples attempt to clarify the concept of Target Sensitivity and the effect modifying it has on the of the cross hair relative to the target.

#### Explanation 1

A sensitivity of three millimeters (mm) along the X axis means that, for whatever position is displayed along X, a motion of three millimeters (mm) one way will put you at the edge of the outer circle, and a motion of three millimeters (mm) the other way will put you at the opposite edge.

#### Explanation 2

If the X and Y sensitivities are three, then a motion of  $(3 \text{ mm} * \sin(45)) = 2.1 \text{ mm}$  along both the X and Y axes will put us at the edge of the outer circle, but at a 45 degree angle. Note that the magnitude of this displacement vector is still 3mm.

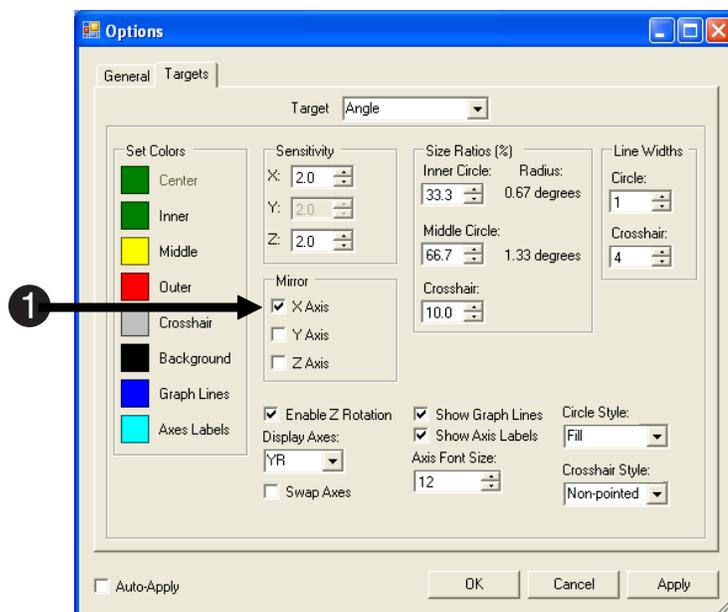
#### Explanation 3

In the case of angular targets, the sensitivity defines how many degrees of motion will put the cross hair at the edge of the outer circle, assuming that the other angles are held constant at 0. For example, a sensitivity of two degrees along the x-axis means that, for whatever angle is displayed along the x-axis, a motion of two degrees one way will put you at the edge of the outer circle, and a motion of two degrees the other way will put you at the opposite edge.

## 8.4 Mirror

The Mirror option switches the selected axis/es before displaying the axis/es on the target. The Mirroring is cumulative with the Flip User Display Axes option on the General tab. If you use the Flip User Display on the Position Target, and then mirror the X, Y, and Z-axes, the axes will be the same as when you started.

- 1) **Check** the box of the axis you wish to mirror.

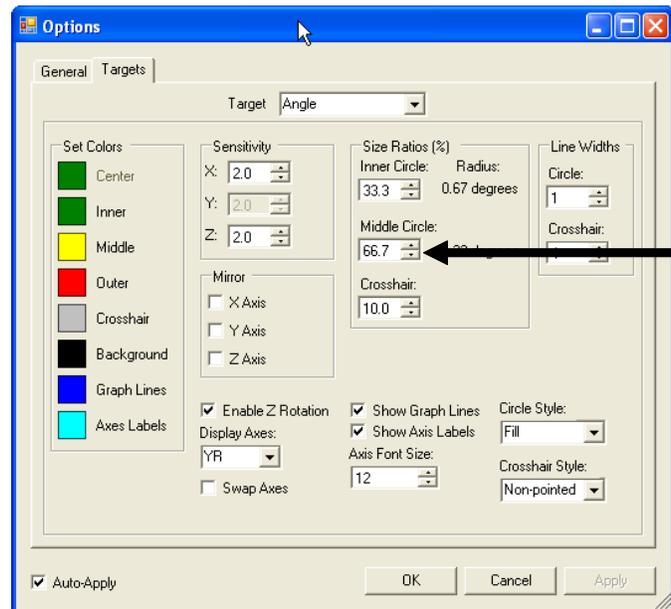


## 8.5 Size Ratios

The Size Ratio option defines the sizes of the inner circle, middle circle, and the cross hair, as a percentage of the radius of the outer circle. For example, if the inner circle ratio is 33.3%, then the inner circle will have one-third of the radius of the outer circle. For a sensitivity of 2.0 degrees, this means that the inner circle boundary represents 0.67 degrees of motion from the calibrated position. The radius of the circles is displayed in real-world units next to each circle's percentage.

**Tip:** Use Auto-Apply to see the circles change size in real-time while you adjust them.

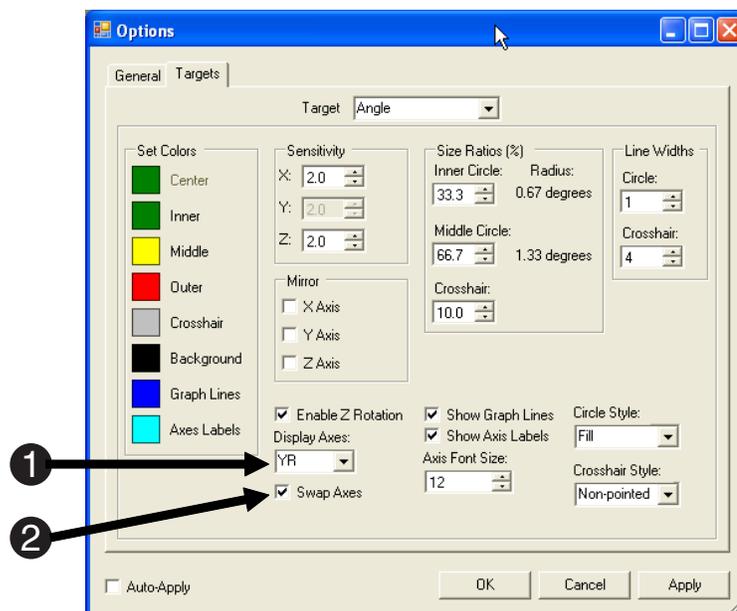
- 1) **Click** the **arrow keys** of the desired circle to **increase** or **decrease** the size ratio.



## 8.6 Display Axes

The Display Axes option determines which axes will be displayed on the user display. For explanation purposes, imagine a Cartesian coordinate system with both X and Y-axes. The first letter represents what is displayed X-axis of the Cartesian coordinate system, and the second letter represents what is on the Y-axis. The options for the Position target are X, Y, and Z, and the options for the Angle target are roll (R), pitch (P) and yaw (Y). The axes can also be swapped by click the Swap Axes check box.

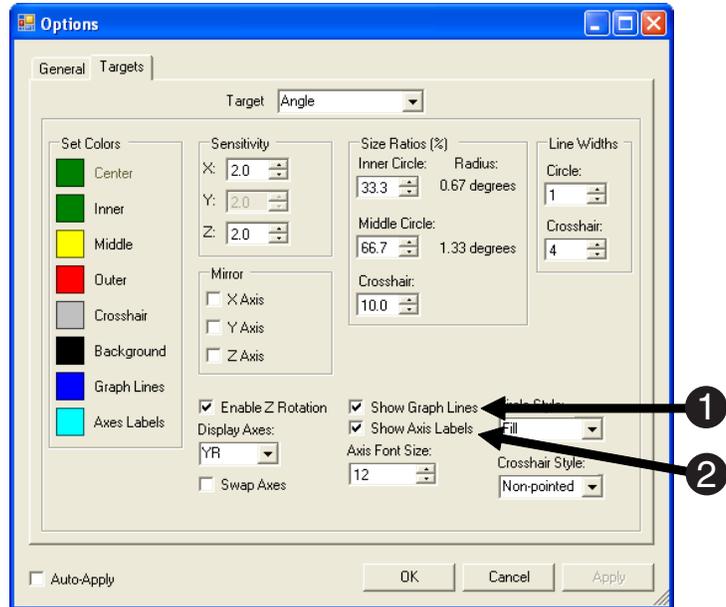
- 1) **Display Axes** determines which axes will be displayed on the user display. The first letter will be on the X-axis, and the second letter on the Y-axis.
- 2) **Click the Swap Axes** check box to change the order the selected axes are displayed on the selected target.



## 8.7 Visual Display Controls

Show Graph Lines and Show Axis Labels control the appearance of graph lines and axis labels on the target. These options are displayed by default.

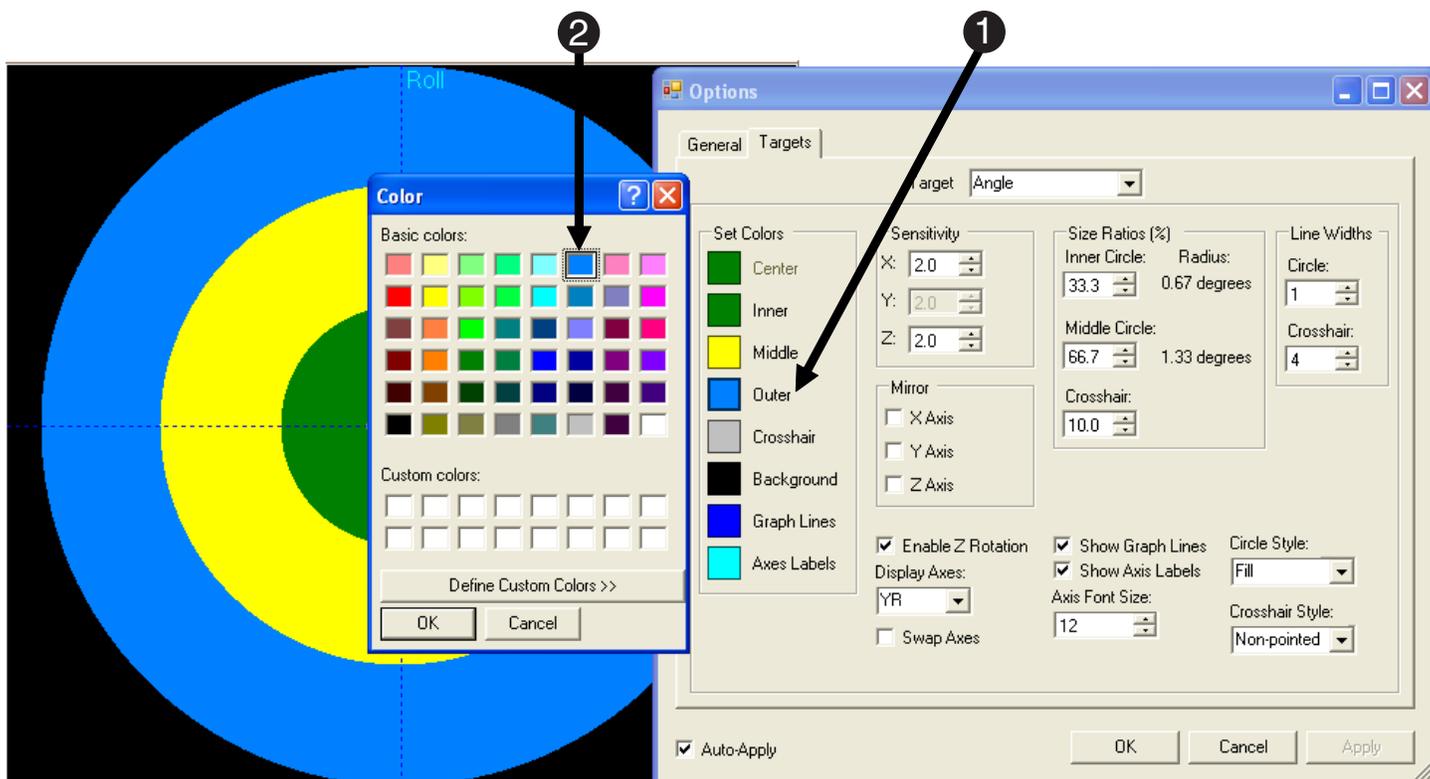
- 1) **Confirm** the **Show Graph Lines** box is **checked** to display graph lines.
- 2) **Confirm** the **Show Axis Labels** box is checked to display axis labels.
- 3) **Click** the **arrow keys** to **increase** or **decrease** the axis label font size as desired.



## 8.7 Visual Display Controls

### 8.7.1 Target Color

The Target Color feature allows you to change the color of the specified circle of the selected target.

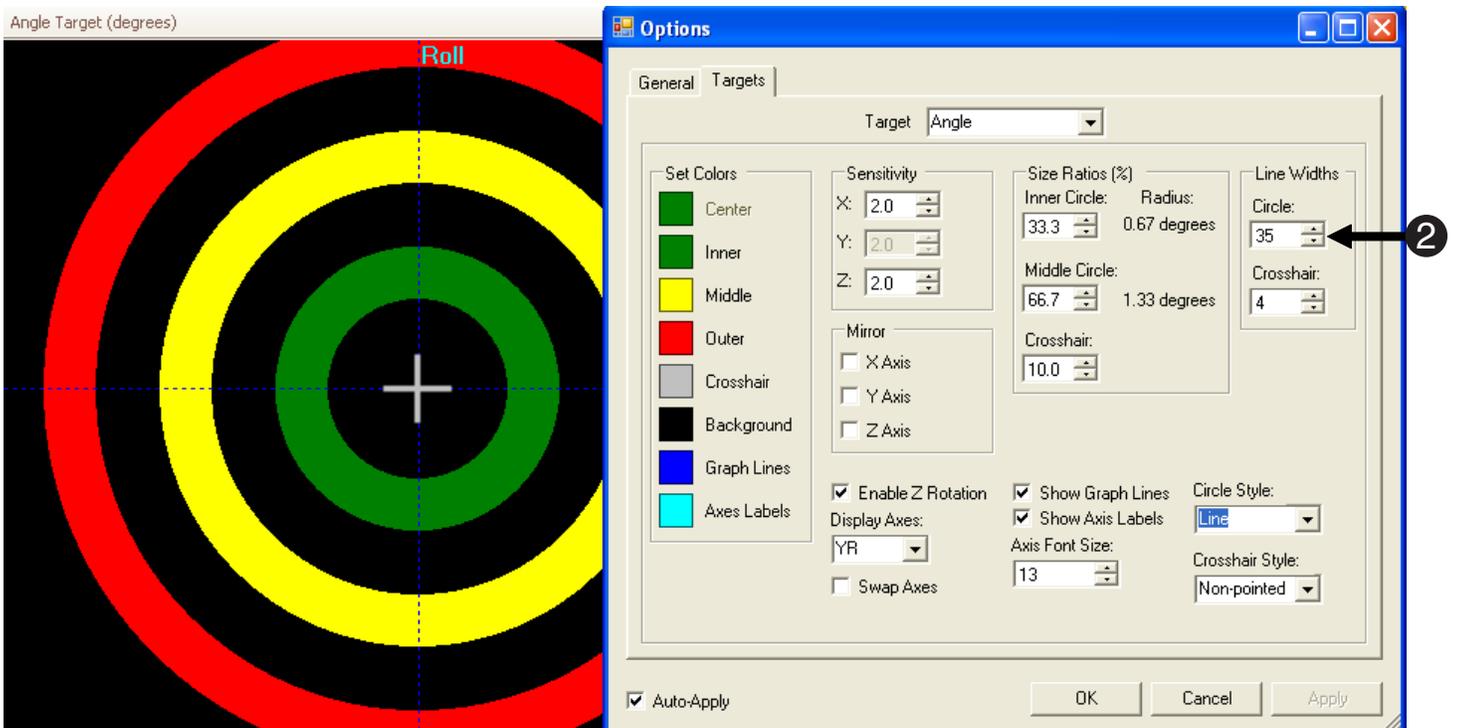
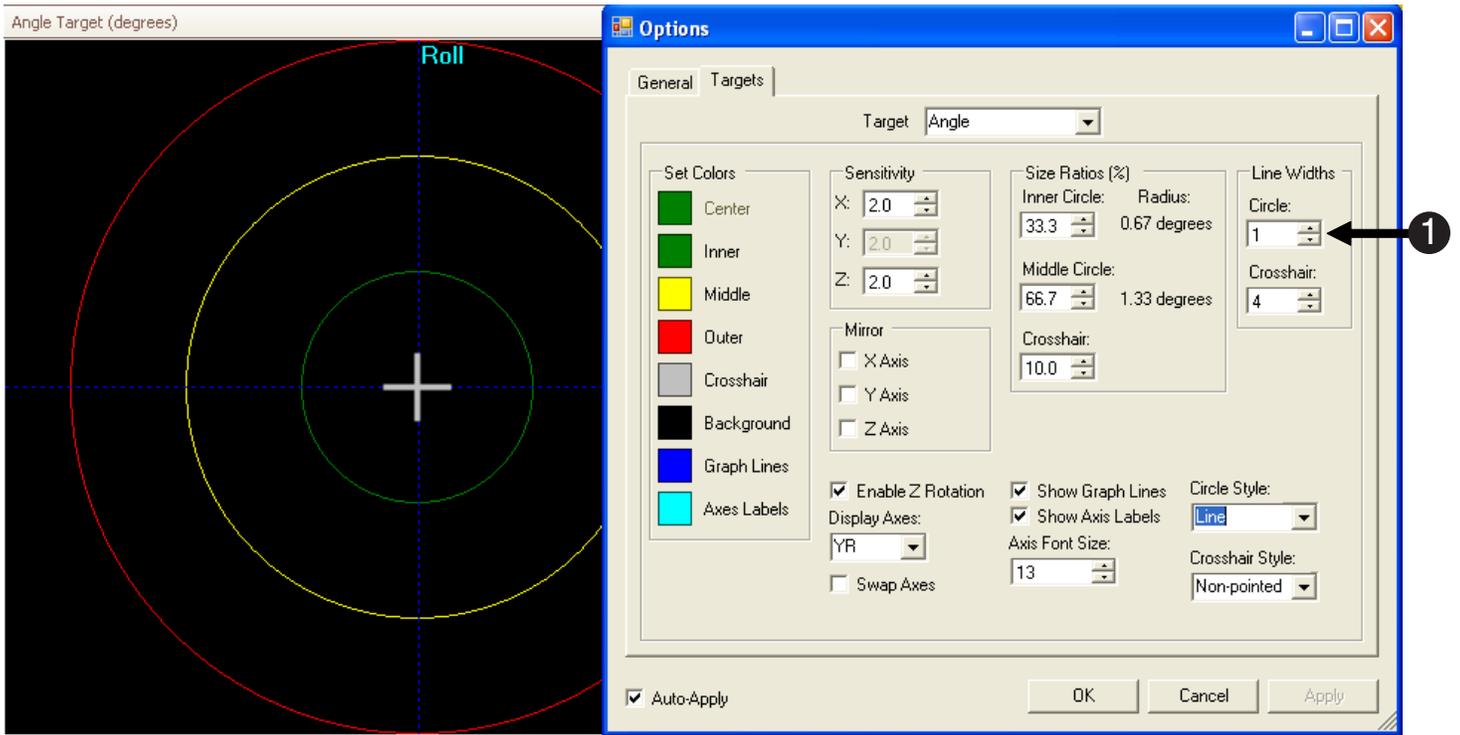


- 1) **Select** the **circle** to be modified.
- 2) **Chose** the **desired circle color**.

## 8.7 Visual Display Controls

### 8.7.2 Circle Line Width

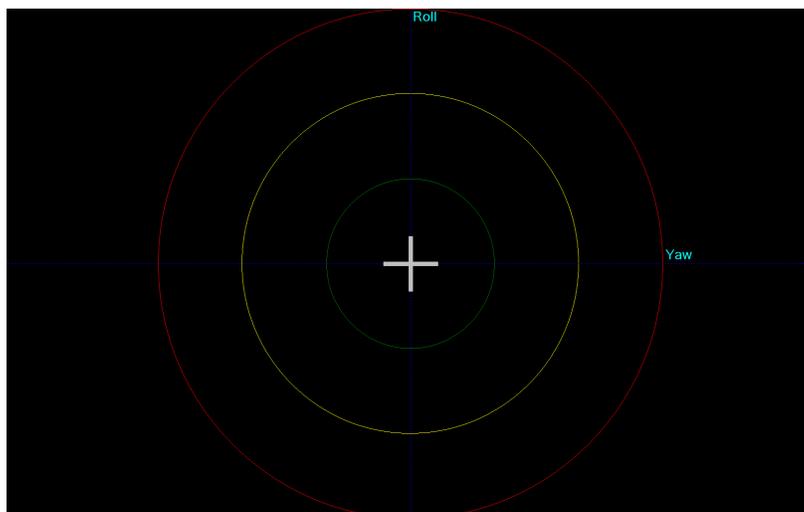
The circle line width only applies to the Line Circle Style. Below is an example of how increasing the line width affects the circle display properties.



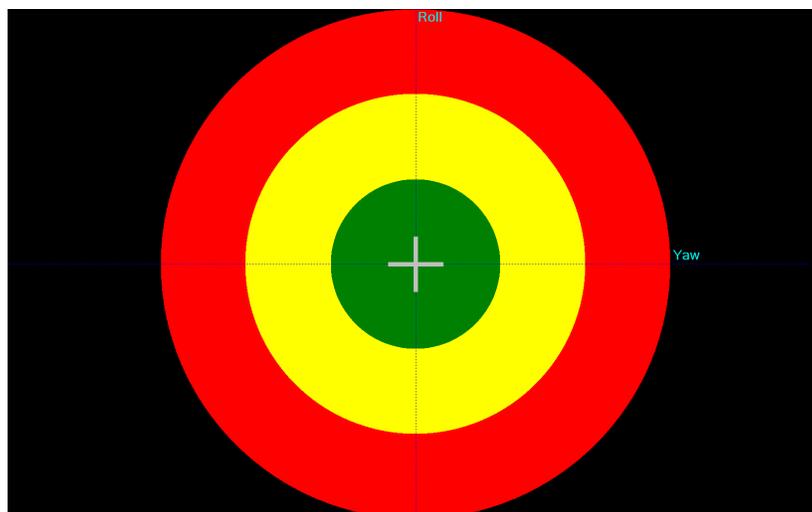
### 8.7.2.1 Circle styles:

There are three circle styles for the target to choose from (Line, Fill, and Gradient).

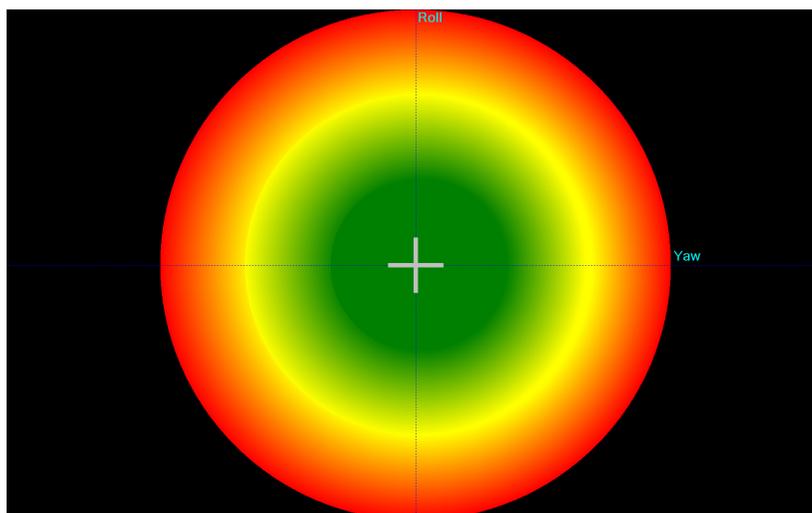
**Lines**



**Fill**



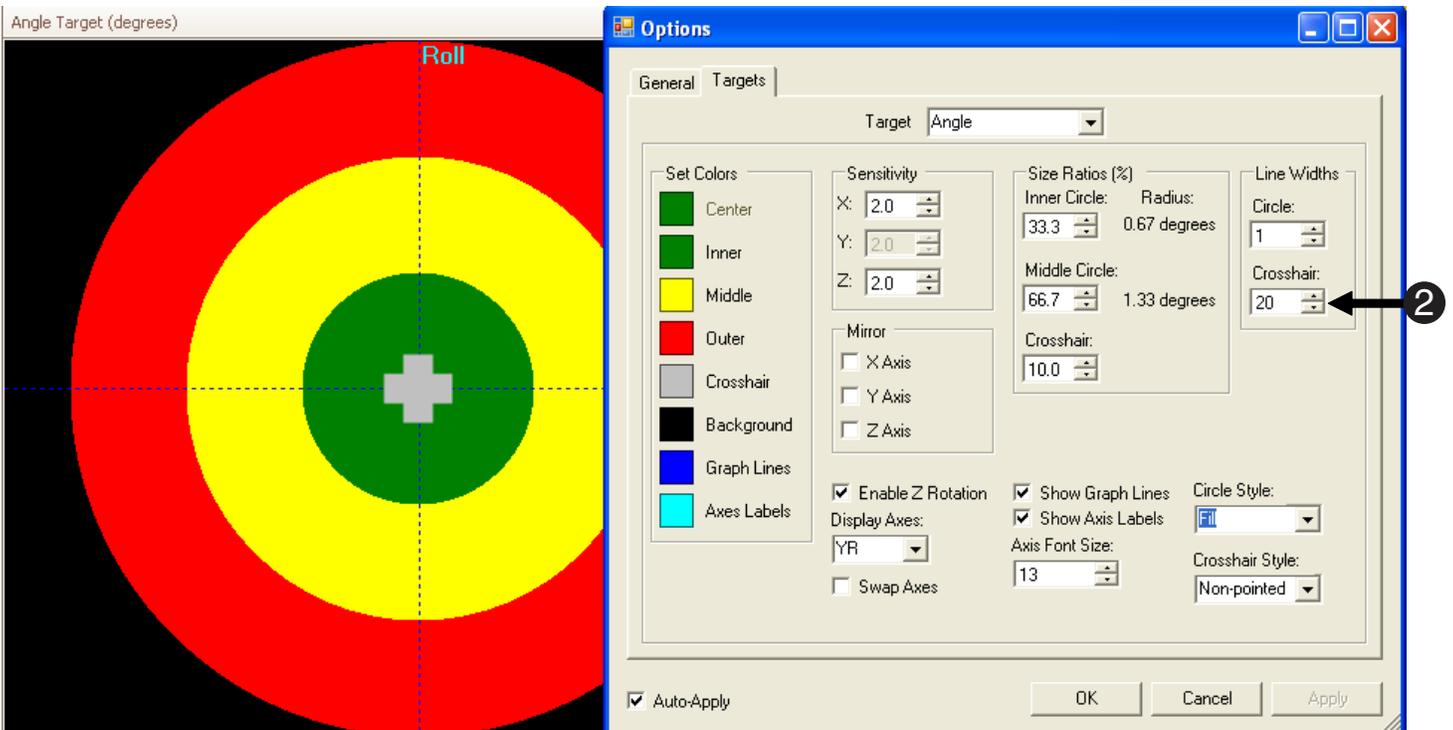
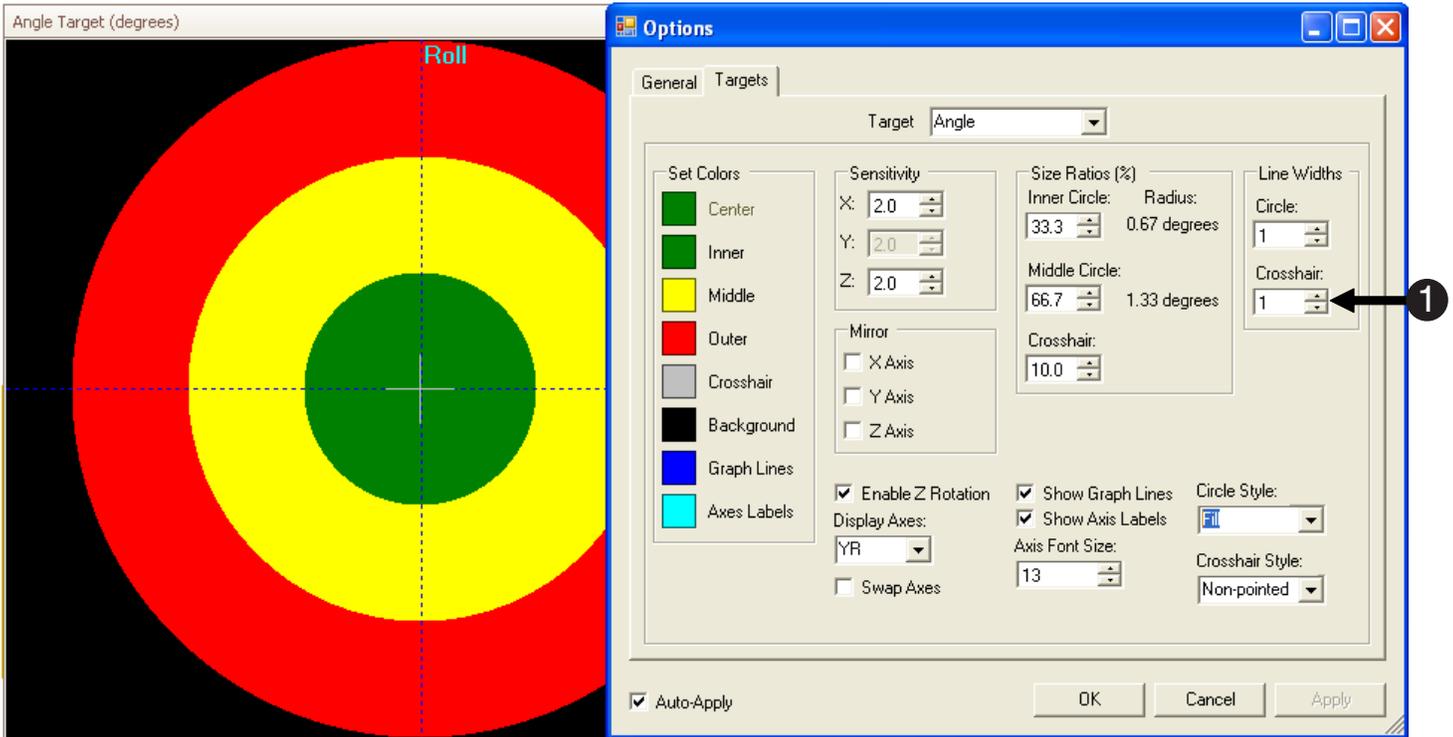
**Gradient**



## 8.7 Visual Display Controls

### 8.7.3 Cross hair Line Width

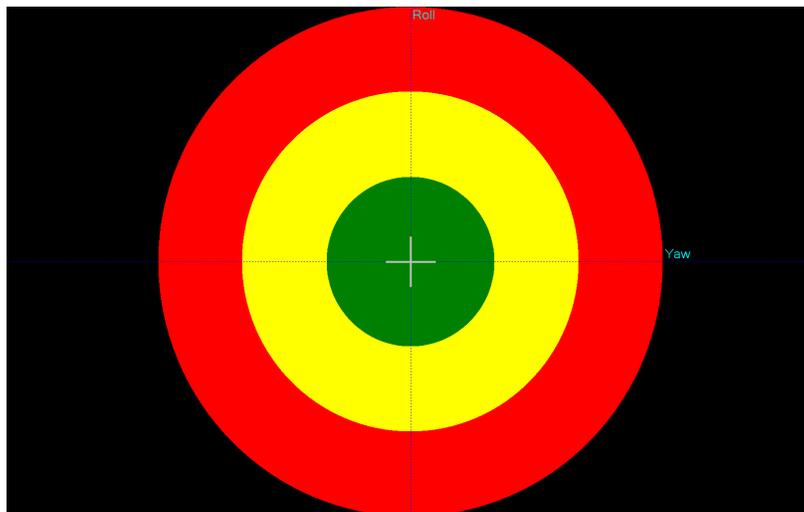
The cross hair line width applies to the Line Cross hair Style. Below is an example of how increasing the line width affects the cross hair display properties.



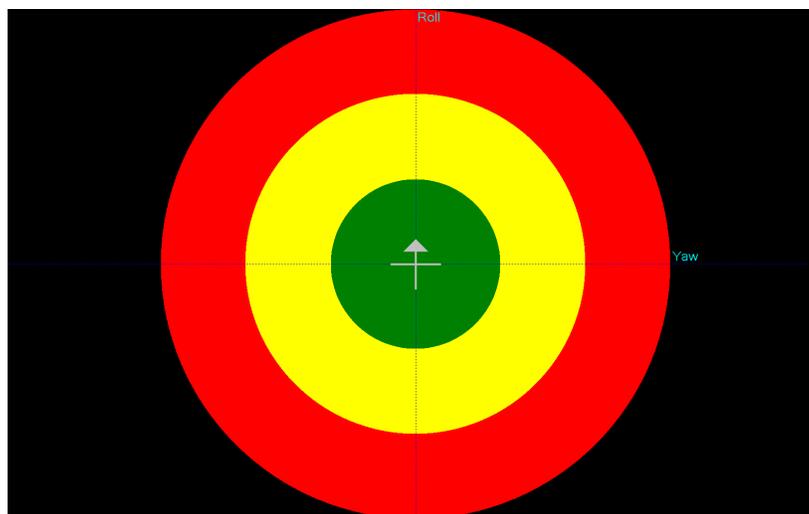
### 8.7.3.1. Cross hair styles:

There are three cross hair styles for the target to choose from (Non-pointed, Pointed, and Dot).

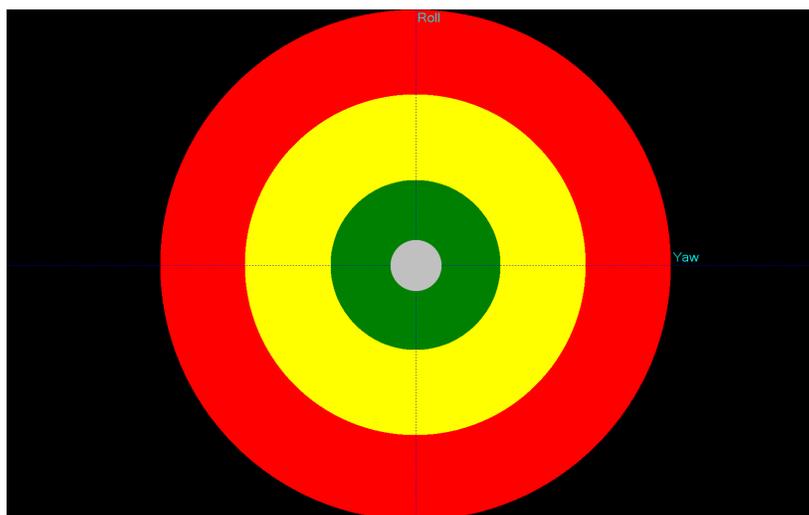
**Non-pointed**



**Pointed**



**Dot**



## Appendix A: Trouble Shooting Guide

### COM Port Settings

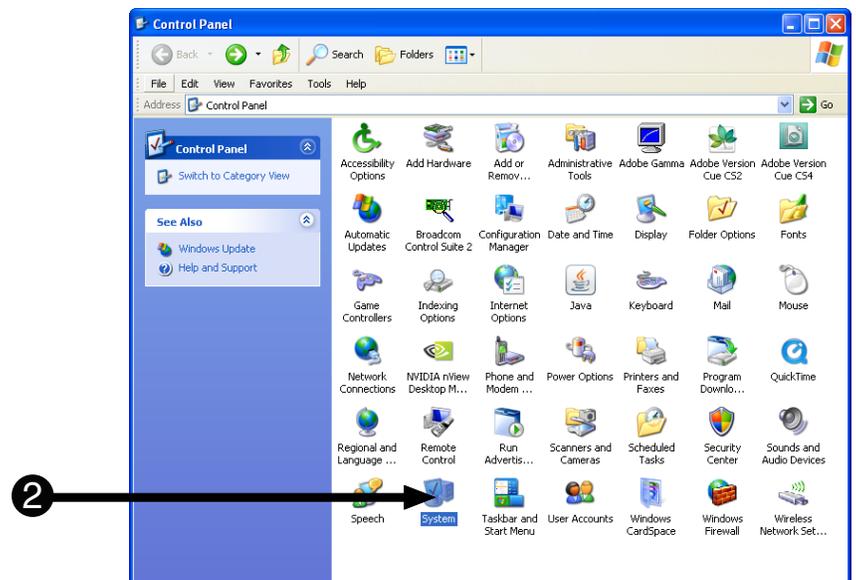
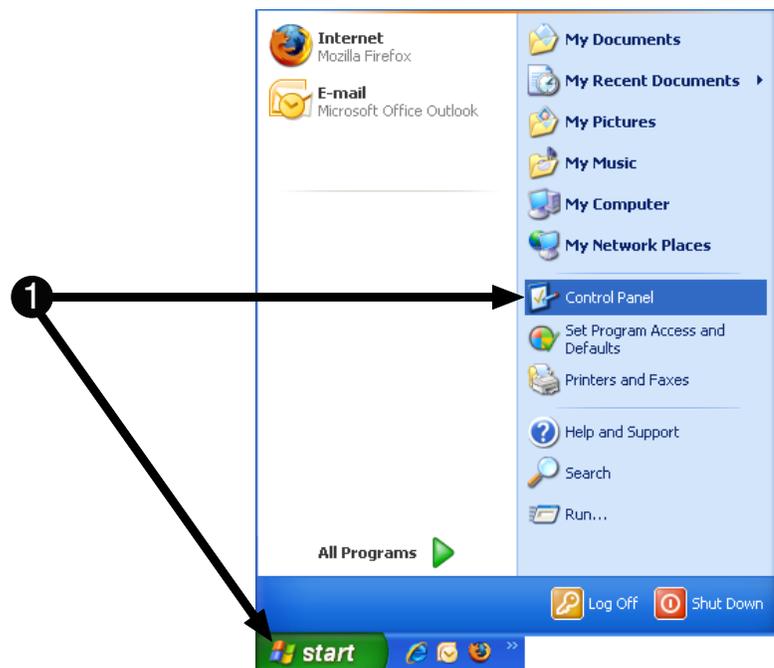
*Software unable to detect console: COM port specified incorrectly*

In order for MoTrak software to connect with the console, the COM port must be set properly. The serial port in the Device Manager must be set to COM1. The first step in determining if the setting match is to open the Device Manager.

**⚠ NOTE:** *This documentation was produced using Windows XP Professional. If you are unable to access the serial port properties on your machine in the manner detailed, contact your network administrator or other computer help personnel.*

1) **Go to the Start Menu and open the Control Panel.**

2) **Double click System.**



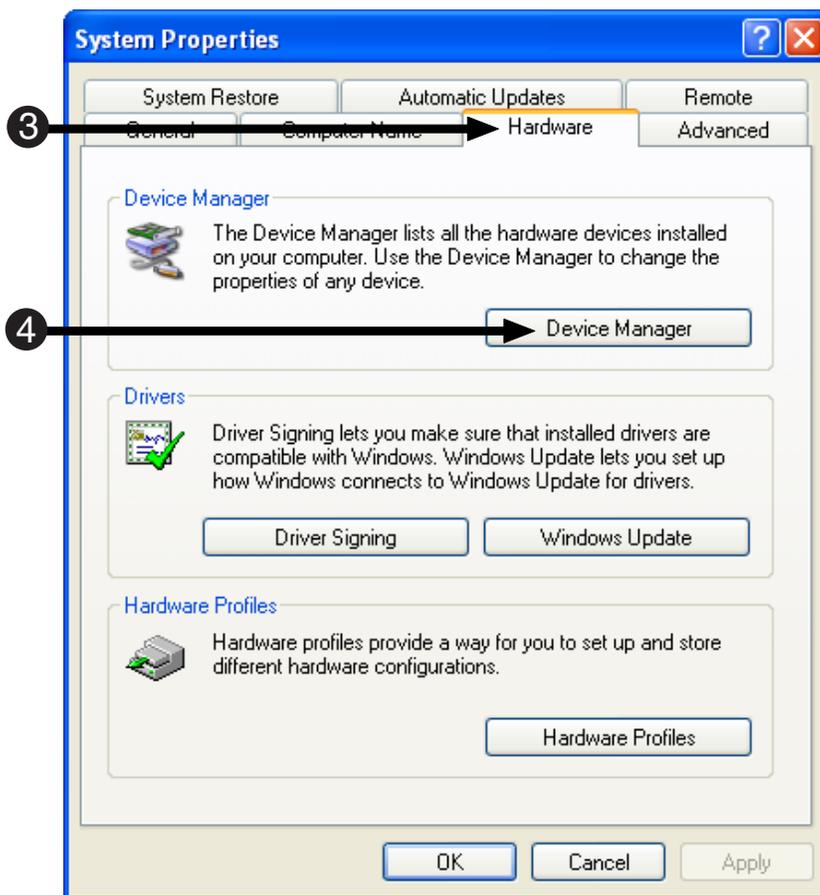
## COM Port Settings

*Software unable to detect console: COM port specified incorrectly*

In order for MoTrak software to connect with the console, the COM port must be set properly. The serial port in the Device Manager must be set to COM1. The first step in determining if the setting match is to open the Device Manager.

3) When the **System Properties** window opens, **select** the **Hardware** tab.

4) **Double click** on the **Device Manager** button.



## COM Port Settings

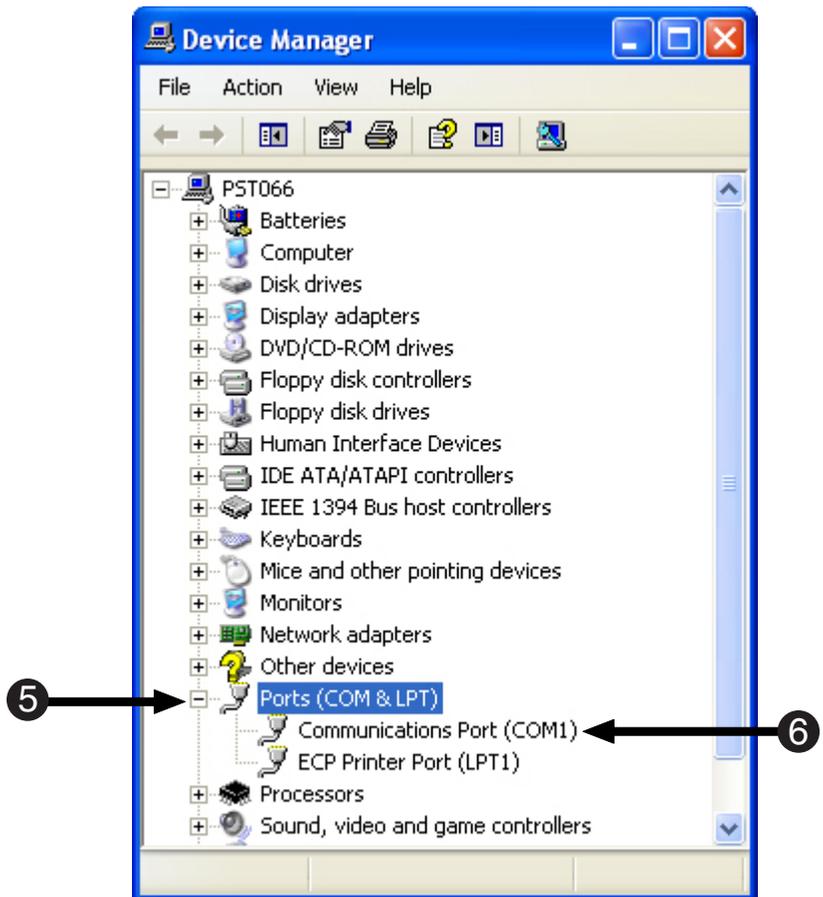
*Software unable to detect console: COM port specified incorrectly*

Once you have opened the Device Manager, you will need to locate the COM Ports. The assigned COM port is usually listed next to the device in parenthesis.

5) **Find Ports (COM & LPT)** and **click** on the **plus** button to expand the tree.

6) **Determine** which port is your **Serial Port**.

**⚠ NOTE:** *The ports listing may not be named the same as what is depicted in the screen shot. If you need assistance determining which port is your serial port, please contact your network administrator or computer help personnel.*



## COM Port Settings

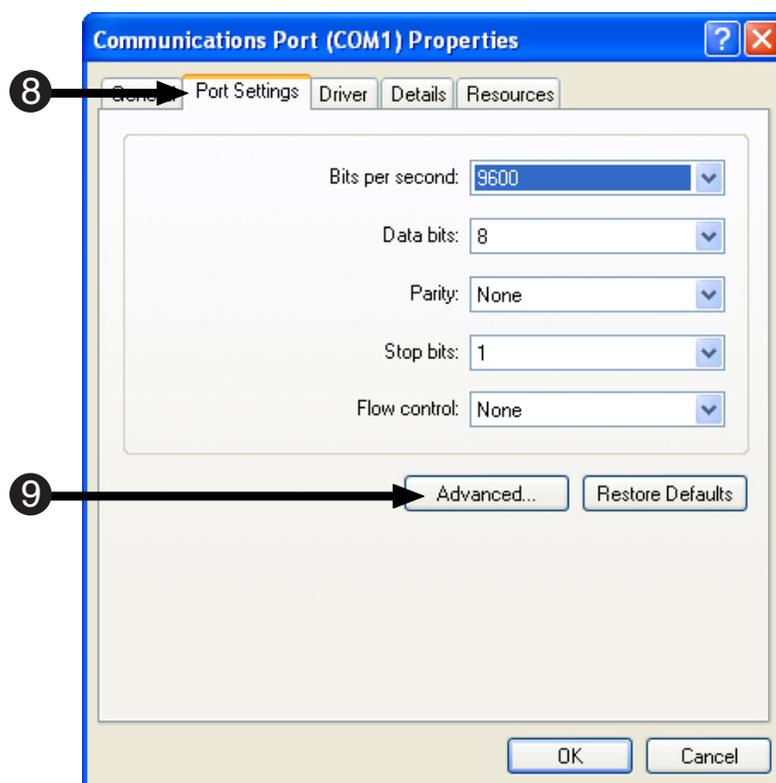
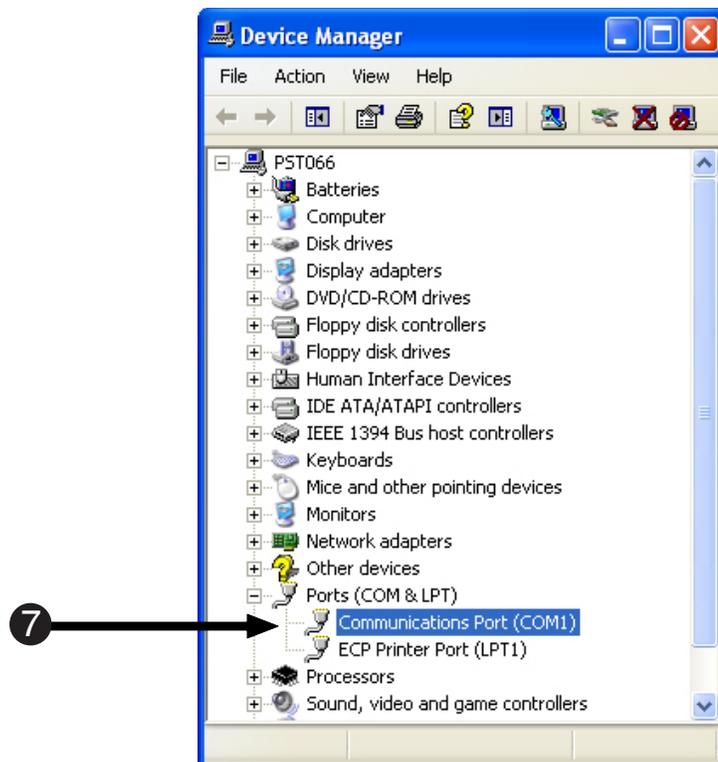
Software unable to detect console: COM port specified incorrectly

If your COM port is not set to 1, you will need to change the settings.

7) **Double click** the **Communications Port (COM1)** to open the **Serial Port (COM1) Properties** dialog.

8) **Go** to the **Port Settings** tab.

9) **Click** the **Advanced** button.

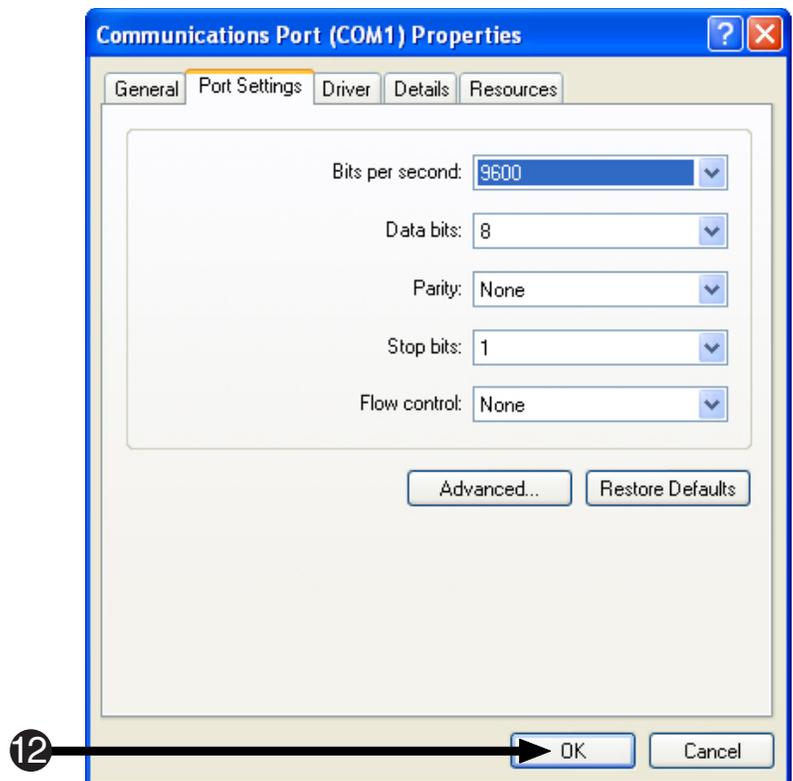
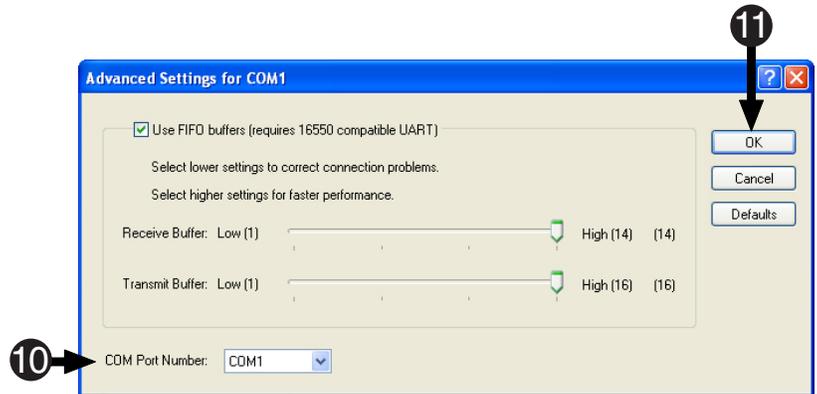


## COM Port Settings

Software unable to detect console: COM port specified incorrectly

If your COM port is not set to 1, you will need to change the settings.

- 10) **Set the COM Port Number to COM1.**
- 11) **Click OK** to close the **Advanced Properties** dialog.
- 12) **Click OK** to close **Port Properties** dialog.
- 13) **Close the Device Manager, System Properties and Control Panel** windows.
- 14) **Start the MoTrak software** to determine if the error persists.



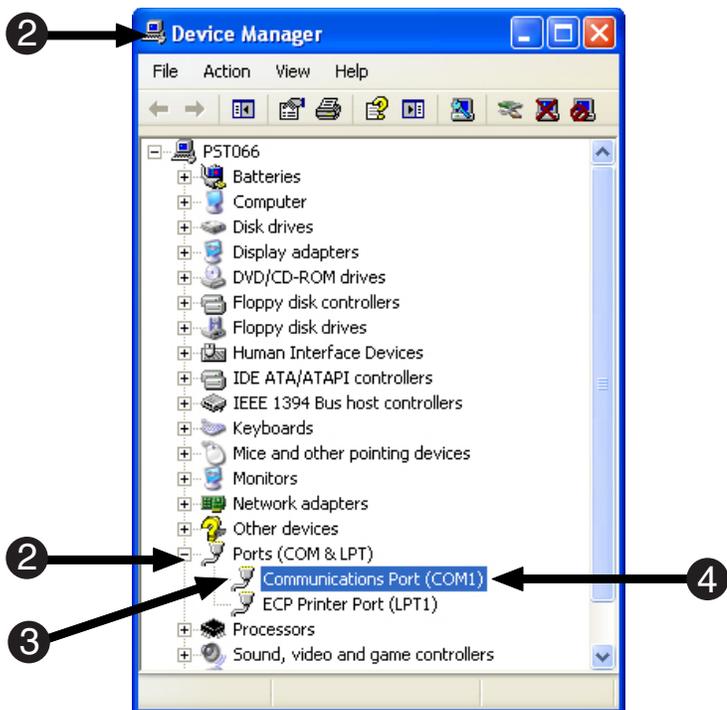
## Malfunctioning Serial Port

*Software unable to detect console: serial port specified incorrectly*

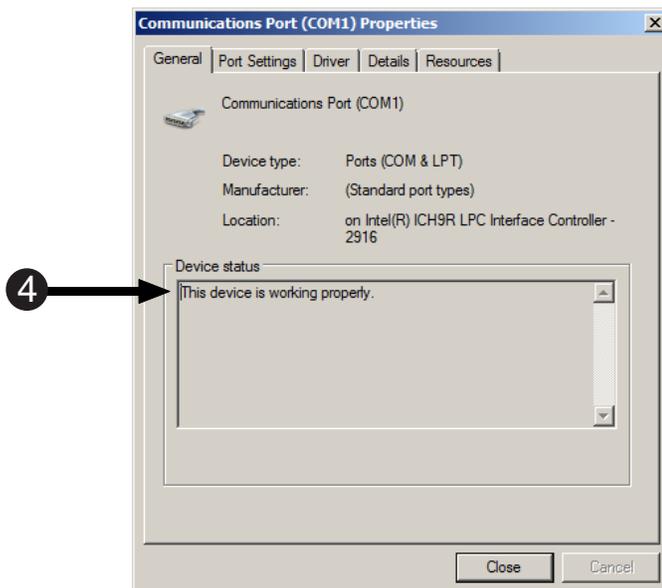
If you are having trouble getting the software to detect the hardware unit here are a few guidelines to follow:

**⚠ NOTE:** *This documentation was produced using Windows XP Professional. If you are unable to access the serial port properties on your machine in the manner detailed, contact your network administrator or other computer help personnel.*

- 1) **Go to the Start Menu and open the Control Panel.** (See Pages 58-62).
- 2) **Open the Device Manager and find Ports (COM & LPT) and click on the plus button to expand the tree.**
- 3) **Determine which port is your Serial Port.**
- 4) **Double click the Communications Port (COM1) to open the Serial Port (COM1) Properties dialog.**



**⚠ NOTE:** *If this status message indicates that your device is not working properly then proceed with the following steps.*



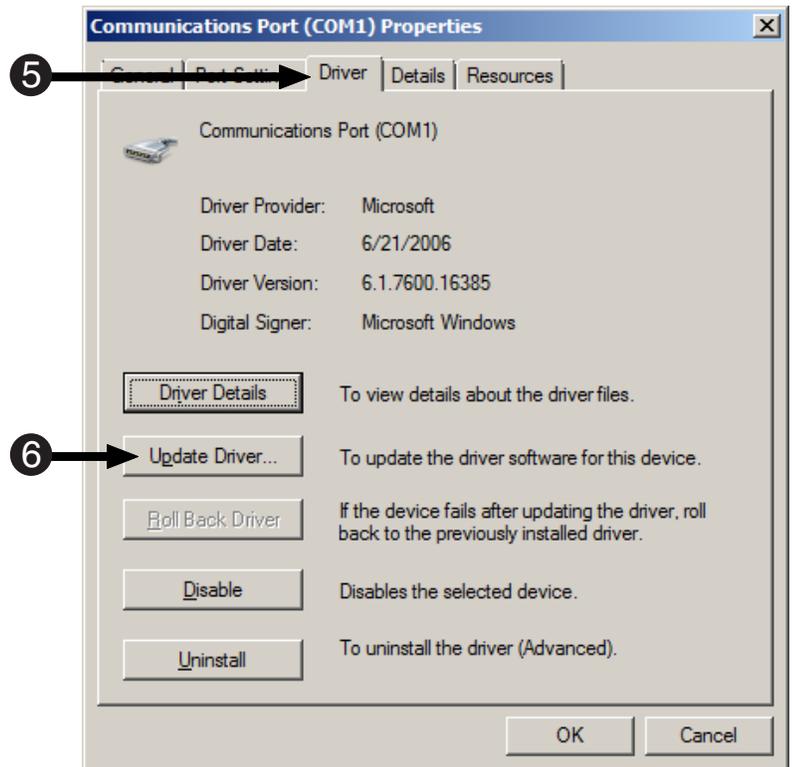
## Malfunctioning Serial Port

*Software unable to detect console: serial port specified incorrectly*

If you are having trouble getting the software to detect the hardware unit here are a few guidelines to follow:

5) **Go** to the **Driver Settings** tab.

6) **Click** the **Update Driver** button.



## Malfunctioning Serial Port

*Software unable to detect console: serial port specified incorrectly*

If you are having trouble getting the software to detect the hardware unit here are a few guidelines to follow:

7) **Click Search automatically for updated driver software.**

8) The computer will then search online for the most recent drivers for your device.

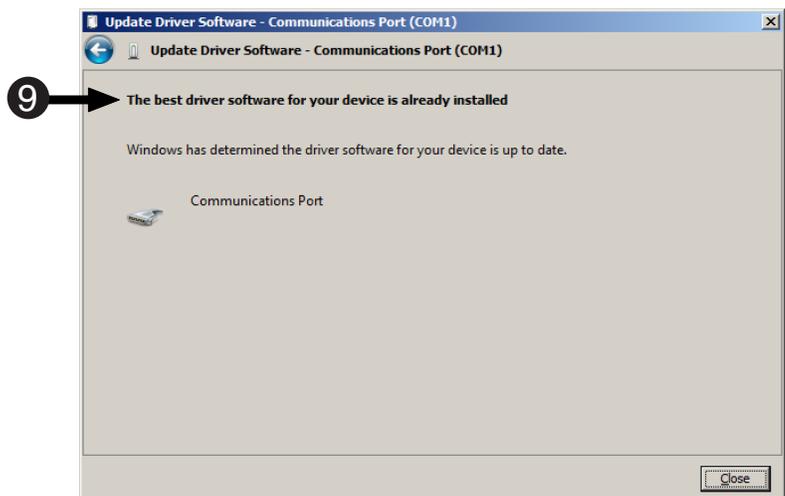
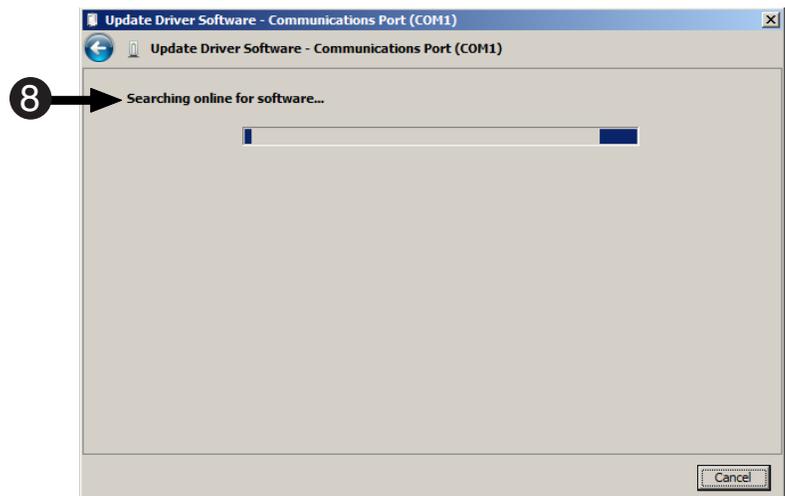
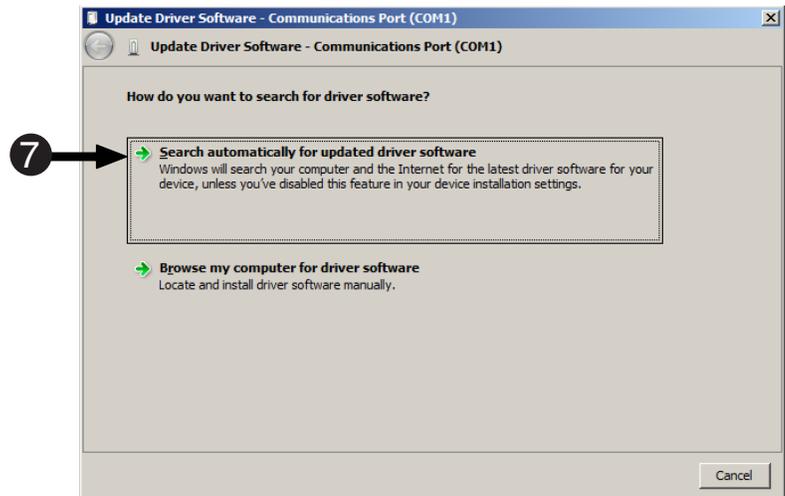
**⚠ NOTE:** *If your machine is not connected to the internet, or the computer cannot find the appropriate drivers contact your computer administrator.*

9) If the computer can find the drivers for your device, follow the instructions to install and update the drivers. If you encounter any errors or problems during this process, please contact your computer support personnel.

**⚠ NOTE:** *Screenshot will be different.*

10) **Restart** your computer.

11) **Start** the **MoTrak software** to determine if the error persists.



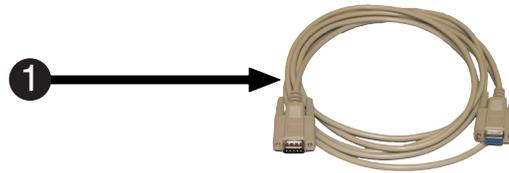
## Malfunctioning Serial Cable

*Software unable to detect console: serial cable malfunction*

If you are having trouble getting the software to detect the hardware unit here are a few guidelines to follow:

- 1) **Obtain** another **serial cable**.
- 2) **Connect** the new **serial cable** to your **computer** and the **MoTrak hardware**.
- 3) **Restart** your **computer**.
- 4) **Start** the **MoTrak software** to determine if the error persists.

**⚠ NOTE:** *If the error persists, it is likely there is another problem. Please consult the sections of the MoTrak trouble shooting guide.*



## Appendix B: Contact Information

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### For additional information or support



Contact us at  
Psychology Software Tools, Inc  
311 23rd Street Extension, Suite 200  
Sharpsburg, PA 15215-2821  
Phone: 412.449.0078  
Fax: 412.449.0079  
[www.pstnet.com](http://www.pstnet.com)

For product support and technical issues  
Please e-mail us at  
[\*\*info@pstnet.com\*\*](mailto:info@pstnet.com)

To report a medical emergency that is suspected to be caused by a  
MoTrak® Head Motion Tracking System failure call **412.449.0078** ext. **1441**.

For failure outside of normal business hours, please call **888.540.9664**.