EXICOR® 250AT

BIREFRINGENCE MEASUREMENT SYSTEM

USER MANUAL

Hinds Instruments, Inc.
P/N: 010-0000-039 UM Rev 0

Software Version 4.1 Beta

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Operators' Safety Summary

The general safety information in this summary is for operators of the Exicor Birefringence Measurement System. Specific warnings and cautions may be found throughout the manual where they apply, but may not appear in this summary.

Terms

DANGER statements identify conditions or practices that will result in personal injury or loss of life.

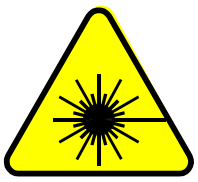
WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

NOTICE statements identify conditions or practices that are important in proper use of the equipment to get the expected results.

Labels

The following IEC/EN Logotype label is placed on the back panel and sample base plate. See #1 and #8 in figure S.2 .



The wording on this label is:

Caution, Laser Light. Avoid direct eye exposure. 5mW AT 633 nm. CDRH Class IIIa laser product. IEC/EN Class 3R Laser Product.

The system is marked with the following Protective Housing label on the back panel. See # 2 in figure S.2.

The wording on this label is:

Caution, Class 3R laser light when open. Avoid direct eye exposure.

The system is marked with the following Laser Light label on the upper front panel. See #3 in figure S.2.

The wording on this label is:

Avoid exposure, Laser light emitted from this aperture.

The X-Y-Motion Stage is marked in four places with the following Pinch Point label. See #'s 4-7 in figure S.2.

The wording on this label is:

Caution pinch point.

Power Source

This product is intended to operate from a power source that will not apply more than 250 volts rms between the supply conductors or between either the supply conductor and ground. A protective ground connection by way of the grounding connector in the power cord is essential for safe operation.

Use the Proper Power Cord

Use only the power cord and connector specified for your product to work with your local power outlets. Use only a power cord that is in good condition. See Chapter 1 for power cord configuration. Refer cord and connector changes to qualified service personnel.

Do Not Operate without Covers

To avoid personal injury, do not operate this product without all covers or panels installed.

Laser Safety

The light source contained in the Sample Scanning Module is a low power (CDRH Class IIIa, IEC Class 3R) Helium-Neon laser.

The laser is a fixed output device. No adjustments are possible.

The output from the Sample Scanning Module, after attenuation by the polarizer and the PEM, is typically less than 3.2 milliWatts (mW.)

The maximum power output directly from the laser, between the laser and the first optical element, is 5 mW at 633 nanometers (nm.)

2 to 5 mW levels of output power are to be found from the “laser pointers” used by lecturers and from a variety of surveying and construction instruments.

CAUTION

Avoid direct eye exposure to the beam and to reflections from shiny objects.

This or any other low power laser can cause a temporary inability to see clearly, much as is experienced by exposure to the flash of a camera.

Use of controls or adjustments or performance of procedures other than those specified herein, may result in hazardous laser light exposure.

Persons other than qualified maintenance personnel should not unnecessarily remove covers.

See Laser Safety labels on pages 1 and 2.

Studies of the safe level of exposure to low power lasers can be found in:

- *Standard for the Safe Use of Lasers,* ANSI Z136.1, Laser Institute of America, 407/380/1553.
- *Ocular Damage Thresholds for the Helium-Neon Laser,* Arch. Environ. Health, Vol. 20, Feb. 1970, Lt Col Paul W. Lappin, BSC, USAF, Brooks Air Force Base, Texas.
- *Laser Pointers and the Human Eye – A Clinicopathological Study*, Arch. Opthalmol, Vol. 118, Dec. 2000, Dennis M. Robertson, MD, et al., Dept. of Ophthalmology, Mayo Clinic, Rochester, Minn.

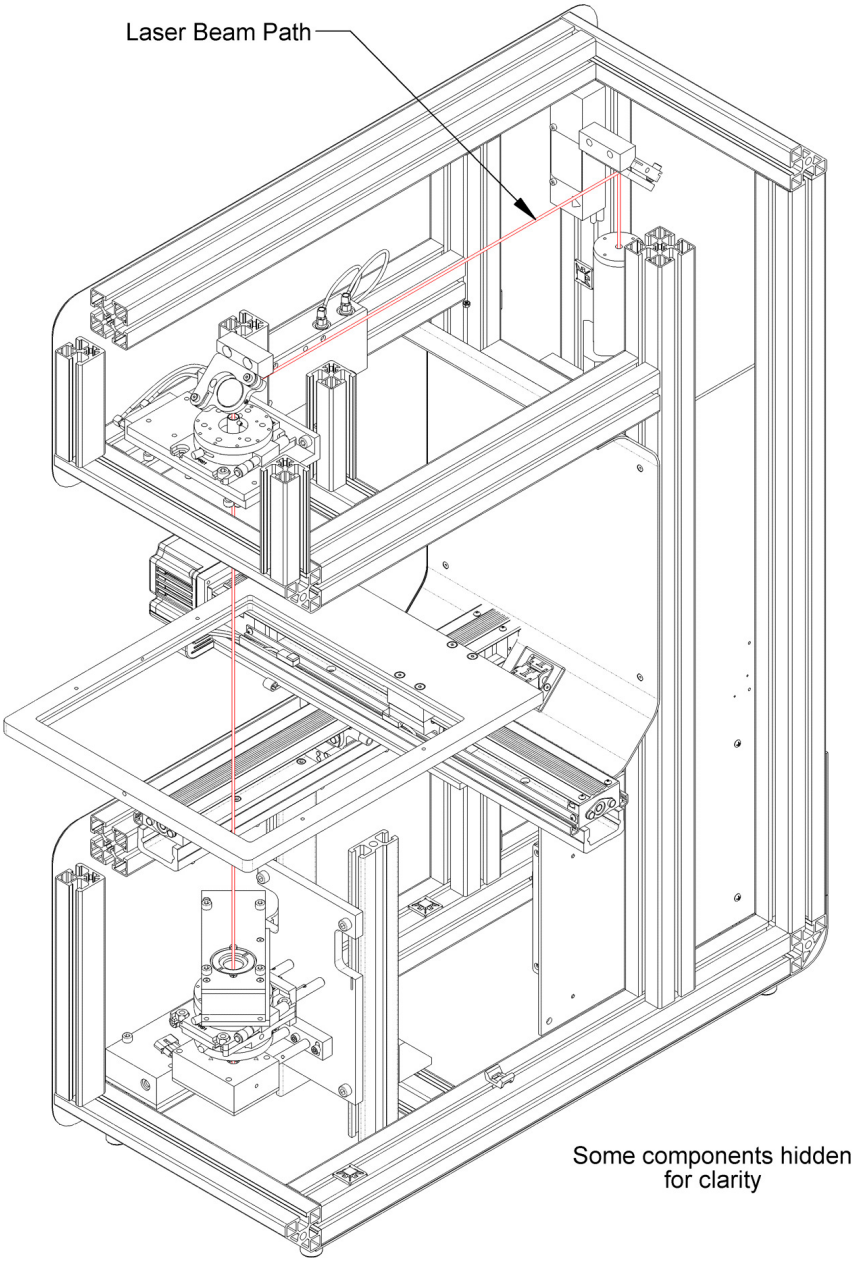


Figure S.1 Laser Beam Path

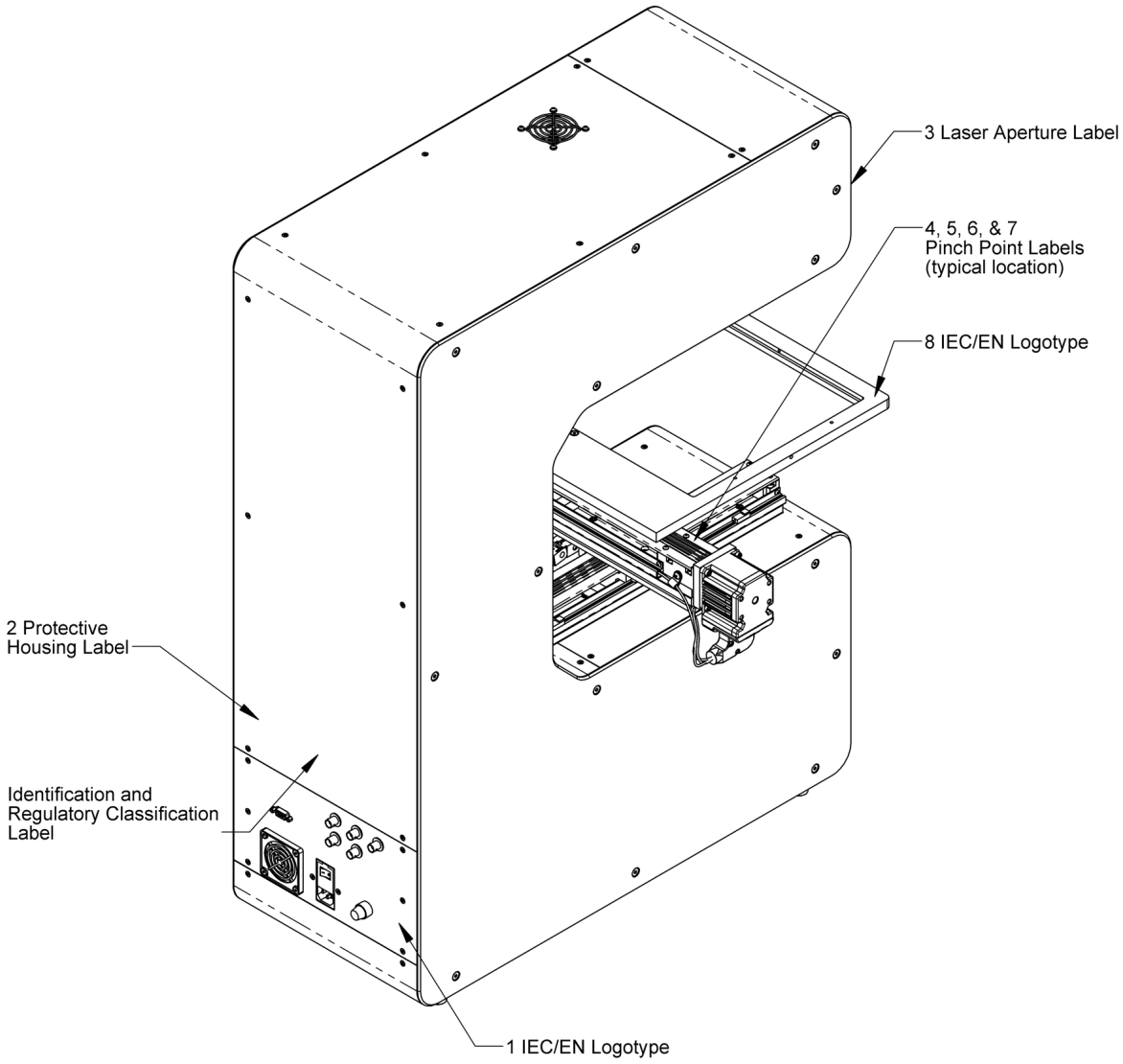


Figure S.2 Compliance Labeling

Mechanical Safety

When power is on, avoid contact with the X-Y-Motion Stage and its supports/tracks when it is in motion. Motion of the stage occurs during sample scanning and may occur during setup. Turn off power to the Exicor 250AT when replacing or making changes to the sample holder.

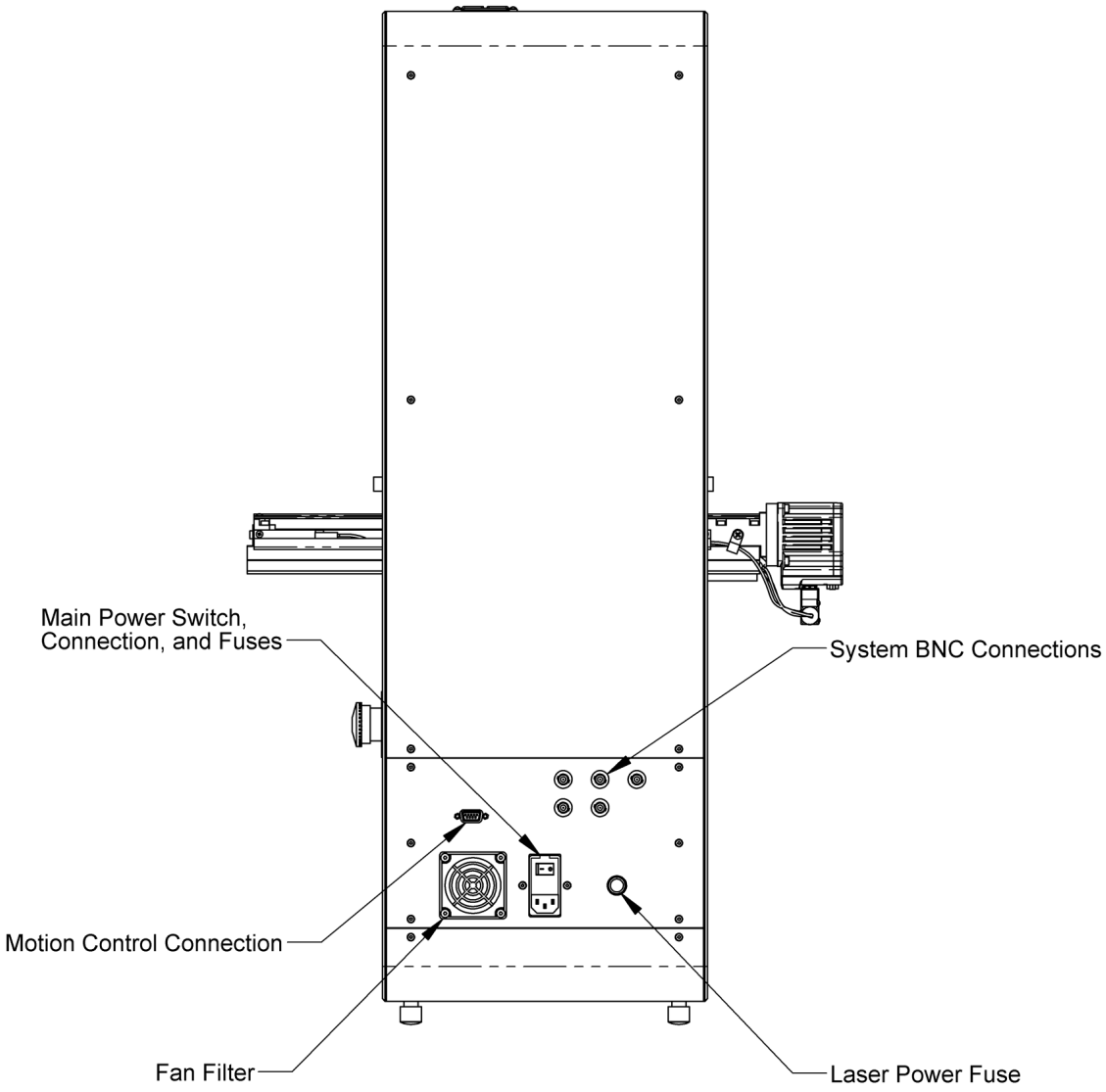


Figure S.3 Rear Panel Connections

Electrical Safety

Rear panel outlets, other than AC outlets, carry low voltage signals and controls. Typical voltages are 0 to 4 volts with none exceeding 24 volts.

The Exicor 250AT contains no user-serviceable components. Refer any maintenance or adjustment needs to Hinds Instruments, Inc.

Do not allow any liquids to get inside the equipment.

Maintenance of the other elements of the system should be referred to Hinds Instruments, Inc. or other trained personnel.

How to Use this Manual

If You Are a New User

If you have never used the Exicor 250AT Birefringence Measurement System before, use the following list to guide you through the manual:

1. Thoroughly read the safety information in the Operators' Safety Summary, beginning on page 1.
2. Confirm the proper input voltage setting for the PC is the same as your power outlet.
3. Read Chapters 1 and 2 so you understand the basic principles of the Exicor 250AT Birefringence Measurement System.
4. Turn to Chapter 3, "Software Interface," and review elements of the software interface such as Interactive Scan, Plot Area, Graph Type and other related displays and menus.
5. Turn to Chapter 4, "Operating the System," and review the task (such as configuring the system, performing an automatic scan, saving files or printing) that interests you.
6. Read the appendices as necessary.

If You Are an Experienced User

If you have already set up the Exicor 250AT Birefringence Measurement System and have used it before, use the following list to guide you through the manual:

1. Review the safety information in the Operators' Safety Summary, beginning on page 1.
2. Confirm the proper input voltage setting for the PC is the same as your power outlet.
3. Read the appendices as necessary.

1
Overview of the Exicor 250AT Birefringence Measurement System

The Exicor 250AT Birefringence Measurement System is an easy-to-use highly sensitive instrument for measuring the fast axis angular orientation and low-level magnitude of linear birefringence in optical materials. The system allows the user to run an area scan of a flat transmissive sample which creates a birefringence map of the sample.

Exicor 250AT Birefringence Measurement System Description

Listed below are the main components of the Exicor 250AT Birefringence Measurement System. See figure 1.1 on page 12.

- **System Scanning Module:** Includes the components for generating the modulated beam of light and detecting the light as it exits the sample. The individual components are:
  - He-Ne Laser – provides 633nm beam source.
  - 50 kHz PEM – provides controlled modulation of the beam polarization state.
  - 60 kHz PEM – provides controlled modulation of the beam polarization state.
  - Detector – one DET101 Detector for measurement of the beam polarization states. Signals from the detectors are used to determine the retardation (birefringence) and fast axis angular orientation of the sample under study.

- **Control System:** The control system is used to analyze the signal and to control the mechanical functionality of the system. The components of the Control System are:
  - Computer and Exicor software – Controls the movement of the sample during testing, calculates the results of each measurement point and files and communicates the measurement results.
  - Wave Form Capture Card – The computer contains a Wave Form Capture Card (WFCC) that collects and isolates the signals from the Detector Module.

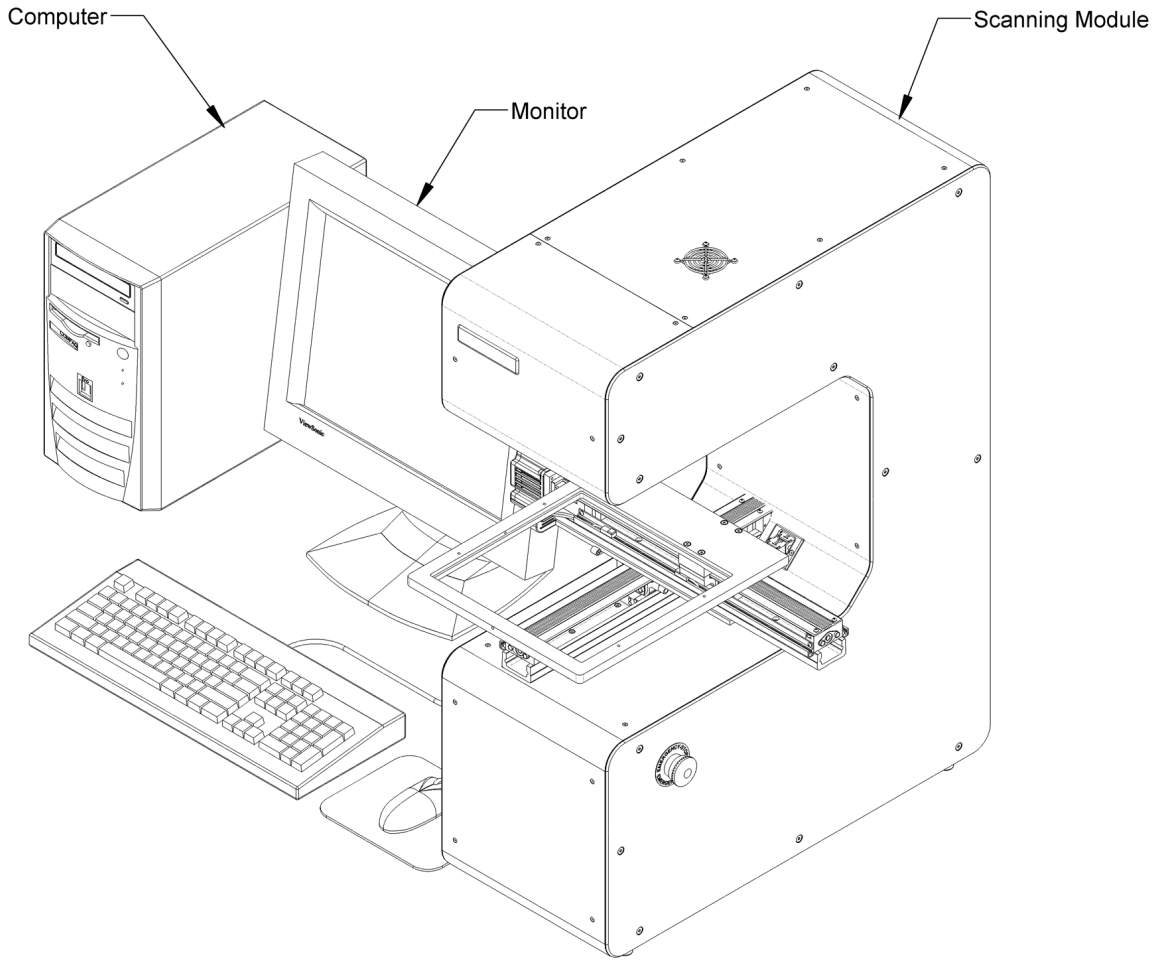


Figure 1.1 Exicor 250AT Main Components

General Dimensions

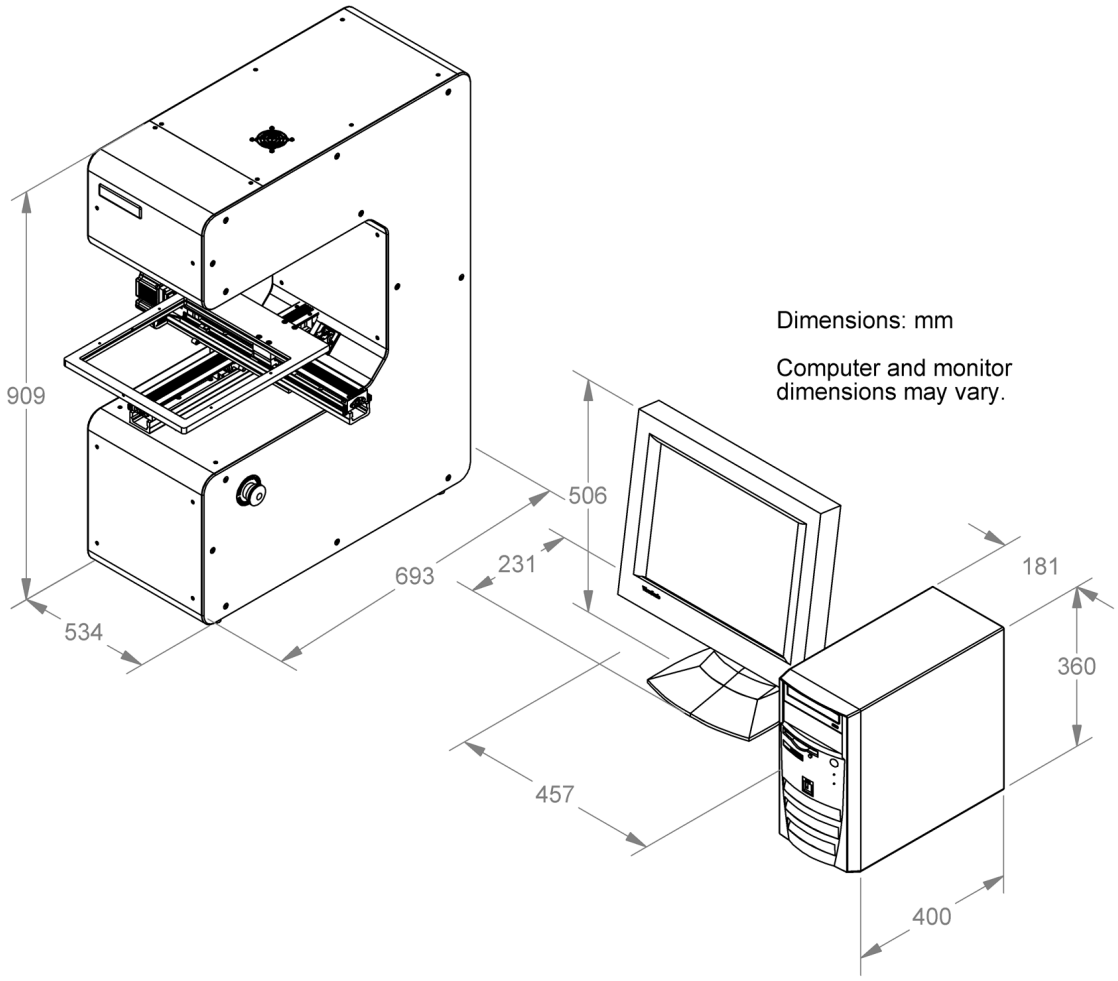


Figure 1.2 General Dimensions

2
Setup and First Time Operation

Calibration

The Exicor 250AT has been calibrated by Hinds Instruments, Inc. prior to shipment. The instrument should require no mechanical or optical adjustment for most applications.

- Experienced operators with special requirements should contact Hinds Instruments, Inc.

Exicor 250AT software

The Exicor 250AT Birefringence Measurement System was delivered with the software application installed.

Note: All systems sold by Hinds Instruments are currently installed and supported only through Hinds Instruments, Inc. and authorized dealers.

Turning the Exicor 250AT On and Off

The main power switch for the Exicor 250AT is located on the back of the System Scanning Module. Flipping the switch to the ON position will activate the scanning module. Be sure that the red button on the side of the scanning module is pulled Out. Power the system OFF with the switch located on the back of the system.

Emergency Switch

The red mushroom switch on the side of the scanning module serves as the EMERGENCY STOP or FF SWITCH (EMO). Pushing or striking this switch IN shuts off all power to the Exicor 250AT. This action will turn OFF the laser.

To restore power, pull the red button OUT.

Note: The computer and associated monitor are powered independently of the System Scanning Module. You must switch the computer ON when starting the system. Striking the EMO will not turn the PC or monitor off.

You may choose to leave the computer running even when the Exicor 250AT System Scanning Module Switch is turned off.

Fuse Types

The Exicor 250AT instrument has a total of three fuses. All three fuses are located at the back panel of the System Scanning Module. Two of these fusses are located at the main power input and the third is located at the laser fuse holder.

Main System Power Fuse (Qty 2)

Voltage	Fuse Rating	Hinds Part Number
100	5x20mm, 2.0A, 250V, SB	345-8000-033
115	5x20mm, 1.6A, 250V, SB	345-8000-029
230	5x20mm, 1.0A, 250V, SB	345-8000-028

Table 2.1 Main System Power Fuse

Laser Fuse

Voltage	Fuse Rating	Hinds Part Number
All	3.AG, T 250V/3.0A SB	345-8000-026

Table 2.2 Laser Fuse

Proper System Airflow

Airflow in the System Scanning Module enters through a filter element on the case back and exits through a fan on the case top. The airflow helps maintain a lower ambient temperature inside the case extending the life of the interior components.

3
Software Interface

This chapter describes the procedures needed to perform birefringence measurements on your samples, including the following topics:

- an overview of the Exicor 250AT software's graphical user interface
- configuring the system
- preparing to scan circular, rectangular and single-point
- performing an interactive scan
- performing an automatic scan (both circular and rectangular)
- working with data and data files
- printing files.

Overview of the Graphical User Interface

All operations (scanning, saving data, generating statistics, etc.) are carried out from the computer screen. Figure 3.1 shows the Exicor 250AT main window, after a circular scan has been completed.

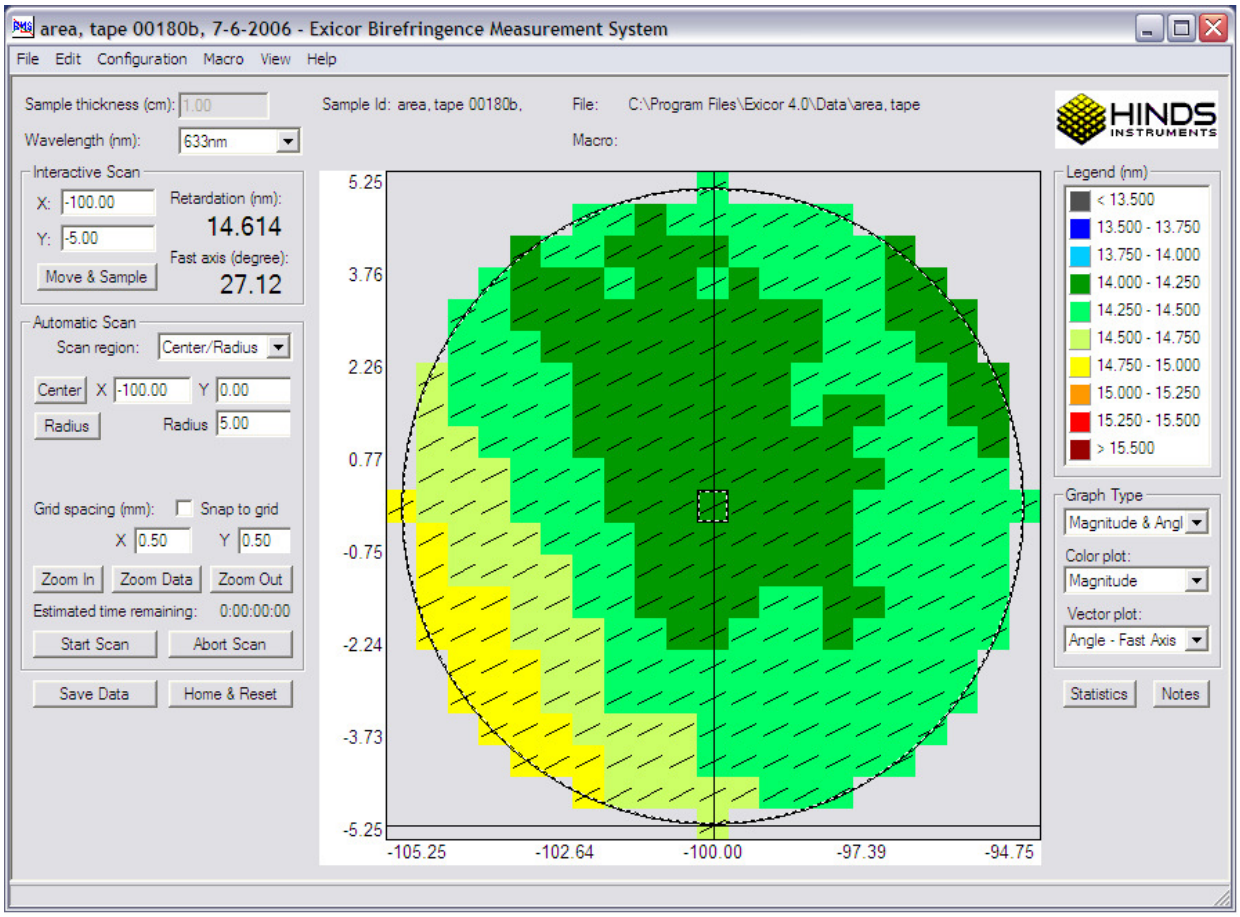


Figure 3.1 Exicor 250AT Main Window Showing a Completed Circular Scan

The birefringence plot, which is the graphical display of the scan data, appears in the central plot area. The format of your graph depends on the graph type you have selected.

Other buttons and panels in the window enable you to define the scan region, customize the scan, etc. Each area and button of this window is further explained in this chapter, under the appropriate task discussion.

Exicor menu bar

Figure 3.2 shows the Exicor menu bar, located at the top of the Exicor 250AT main window.

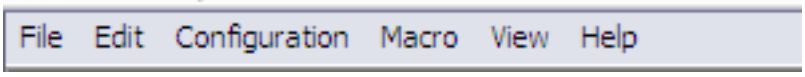


Figure 3.2 Exicor Menu Bar

Selecting one of these menu options using the mouse or shortcut key (<Alt> + <underscored letter>) reveals a sub-menu below the item. Select one of the sub-menu items using the mouse or shortcut key.

The menu bar offers the following choices:

File: offers choices related to new file, opening, saving, printing, and copying data files and exit.

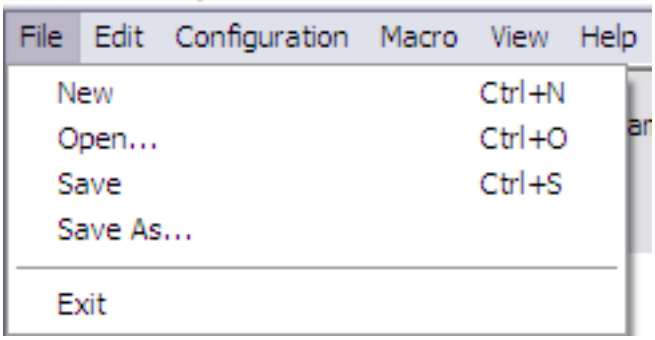


Figure 3.3 File Menu Option

Macro: offers choices related to loading, unloading, creating and editing macros.

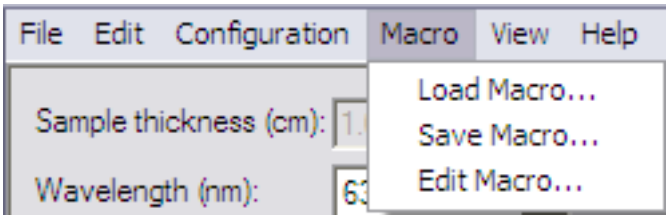


Figure 3.4 Macro Menu Option

Configuration: offers choices related to configuring system parameters, auto calibration settings and COM Port Settings.

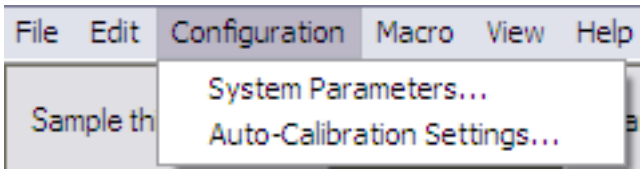


Figure 3.5 Configuration Menu Option

Help: accesses the online Help System and offers information on the currently installed version of the Exicor 250AT software..

Figure 3.6 Help Menu Option

File Identification

Figure 3.7 shows the file identification information, located at the top of the Exicor 250AT main window.

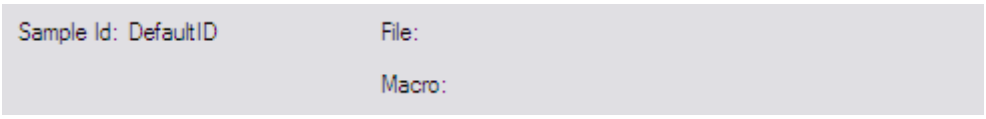


Figure 3.7 File Identification Information

The **Sample ID** field displays the sample ID associated with the open file. (See “Saving a File” on page 41 for more information on sample IDs.)

The **File** field, at the top of the Exicor 250AT main window, displays the filename of the current data file. If you have not yet scanned or loaded a file, the **File** field is empty.

The **Macro** field displays the macro currently loaded in memory. (See Chapter 7 beginning on page **Error! Bookmark not defined.** for information on using macros with the Exicor 250AT system.)

Interactive Scan

Figure 3.8 shows the Interactive Scan panel, located at the upper left-hand side of the Exicor 250AT main window.

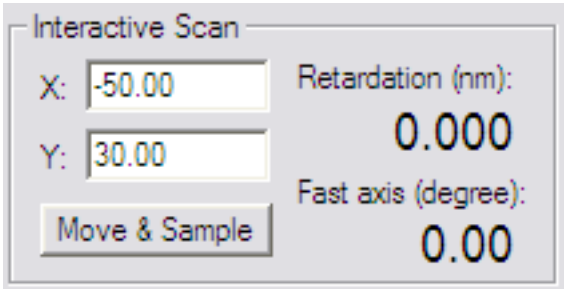


Figure 3.8 Interactive Scan Panel

The Interactive Scan panel is used for single-point measurements only. See Making Birefringence Measurements on page 30.

Automatic Scan

Figure 3.9 shows the Automatic Scan panel, located at the lower left-hand side of the Exicor 250AT main window. This panel is used to define area measurements. See Making Birefringence Measurements on page 30.

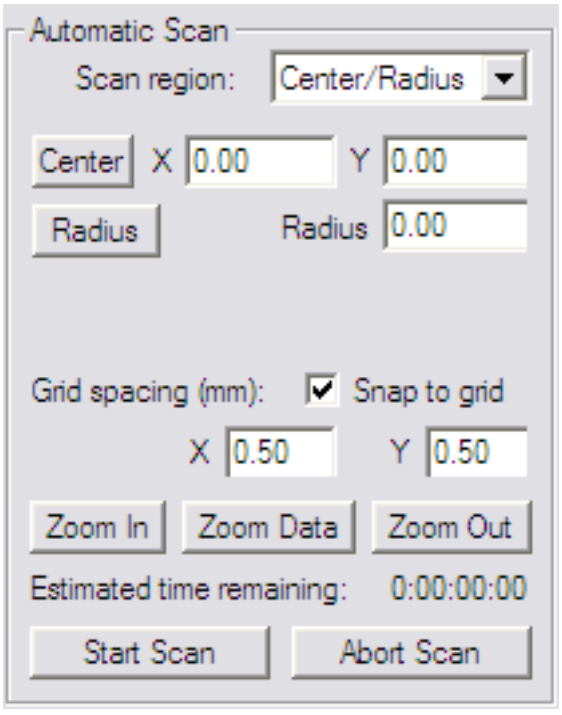


Figure 3.9 Automatic Scan Panel

The **Zoom In** button allows you to zoom in on a grid point or points. The **Zoom Data** button allows you to zoom in on the data from a completed scan. Click the **Zoom Out** button to return to the default display.

Birefringence Plot Area

Figure 3.10 shows the Birefringence Plot Area, located at the center of the Exicor 250AT main window.

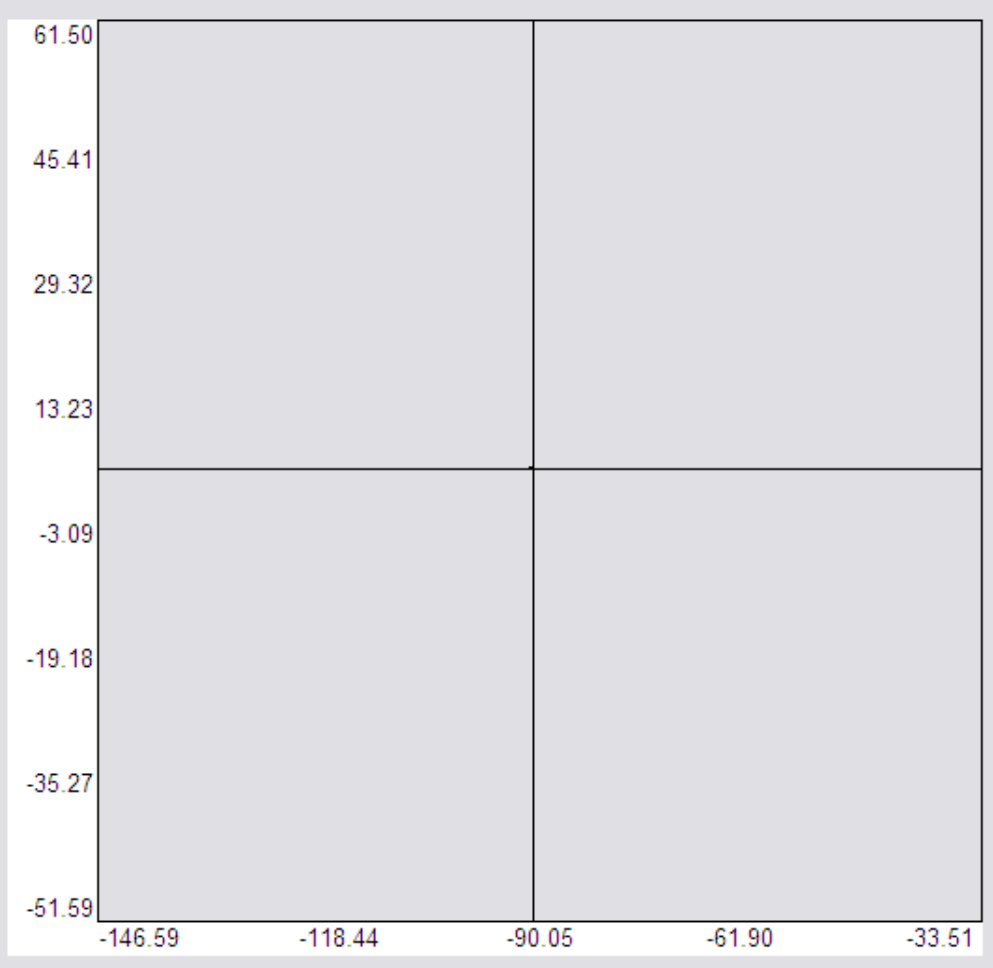


Figure 3.10 Birefringence Plot Area

The birefringence plot area is where the scan data is shown. Using a mouse, you can select a particular grid point in order to display the measured data in the Interactive Scan panel. If you select more than one grid point (by dragging the mouse), you can either outline an area for a new scan or you can zoom in on the area with the **Zoom In** button. The coordinates of the selected area are displayed in the Automatic Scan panel.

By double-clicking on a grid point, you command the system to move to that location and take a measurement (the same as clicking once and then clicking the Move & Sample button.) A cross-hair which represents the current stage position is displayed.

The default grid spacing is set at 1mm. If necessary, you can change the grid spacing and grid units. See “Changing the Grid Spacing” and “Changing the Stage Distance Units” on page 28 for more information.

Legend (nm)

Figure 3.11 shows the Legend, located at the upper right-hand side of the Exicor 250AT main window.

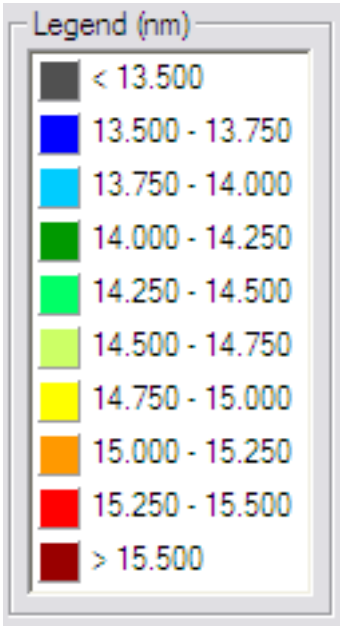


Figure 3.11 Legend Panel

The Legend describes the color key for the retardation magnitudes. You can change the colors associated with various ranges of birefringence magnitude data by double-clicking on and editing the legend.

Graph Type

Figure 3.12 shows the Graph Type, located at the lower right-hand side of the Exicor 250AT main window.

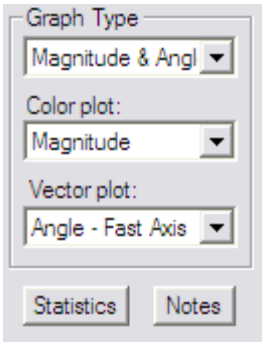


Figure 3.12 Graph Type

The Graph Type lists the various formats you can choose for displaying the results of a birefringence plot.

Other Displays

Figure 3.13 shows the Sample thickness and Light Source Wavelength, located at the upper left-hand side of the Exicor 250AT main window.

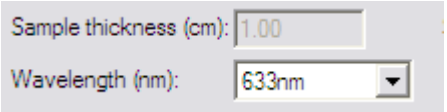


Figure 3.13 Sample thickness and Light Source Wavelength

Figure 3.14 shows the Save Data and Home & Reset, located at the lower left-hand side of the Exicor 250AT main window.

Clicking on the **Save Data** button opens a dialog box enabling the current data to be saved. Clicking on the **Home & Reset** button moves the X-Y-Motion Stage to the home position and resets the Exicor software and Lock-In Amplifier to their default values.

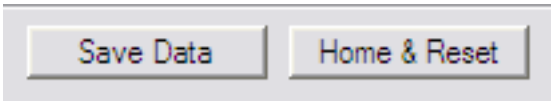


Figure 3.14 Save Data and Home& Reset.

Figure 3.15 shows the Statistics and Notes, located at the lower right-hand side of the Exicor 250AT main window.

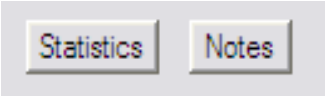


Figure 3.15 Statistics and Notes

Clicking on the **Statistics** button in the Exicor 250AT main window opens the Statistics dialog box. Clicking on the **Notes** button opens a dialog box enabling file or graph annotations to be added to the data file.

Configuring the System

You can adjust many aspects of the scanning process by changing various values and settings. Use Table 3.1 as a quick reference when changing system parameters.

This Parameter	Is Changed Here
Instrumental Constants	System Parameters dialog box
Offsets	System Parameters dialog box
Num Offset Samples	System Parameters dialog box
Birefringence Units	System Parameters dialog box
Sample Thickness	System Parameters dialog box
Stage Distance Units	System Parameters dialog box
Grid Spacing	System Parameters dialog box
Temperature Min, Max & Sample Interval	System Parameters dialog box
Relative Humidity Min, Max & Sample Interval	System Parameters dialog box
Magnitude Limits (Min & Max)	System Parameters dialog box
Stage Home Position Offset	System Parameters dialog box
Restore Factory Defaults	System Parameters dialog box
Enable Auto Calibration Settings	Auto-Calibration Settings dialog box
Change Auto-Calibration Location	Auto-Calibration Settings dialog box
COM Port Settings	Configure RS232 Ports dialog box

Table 3.1 Summary of Where to Change System Parameters

Systems Parameters

To access the System Parameters dialog box (shown in Figure 3.16), select **Configuration** --> **System Parameters** from the Exicor menu bar.

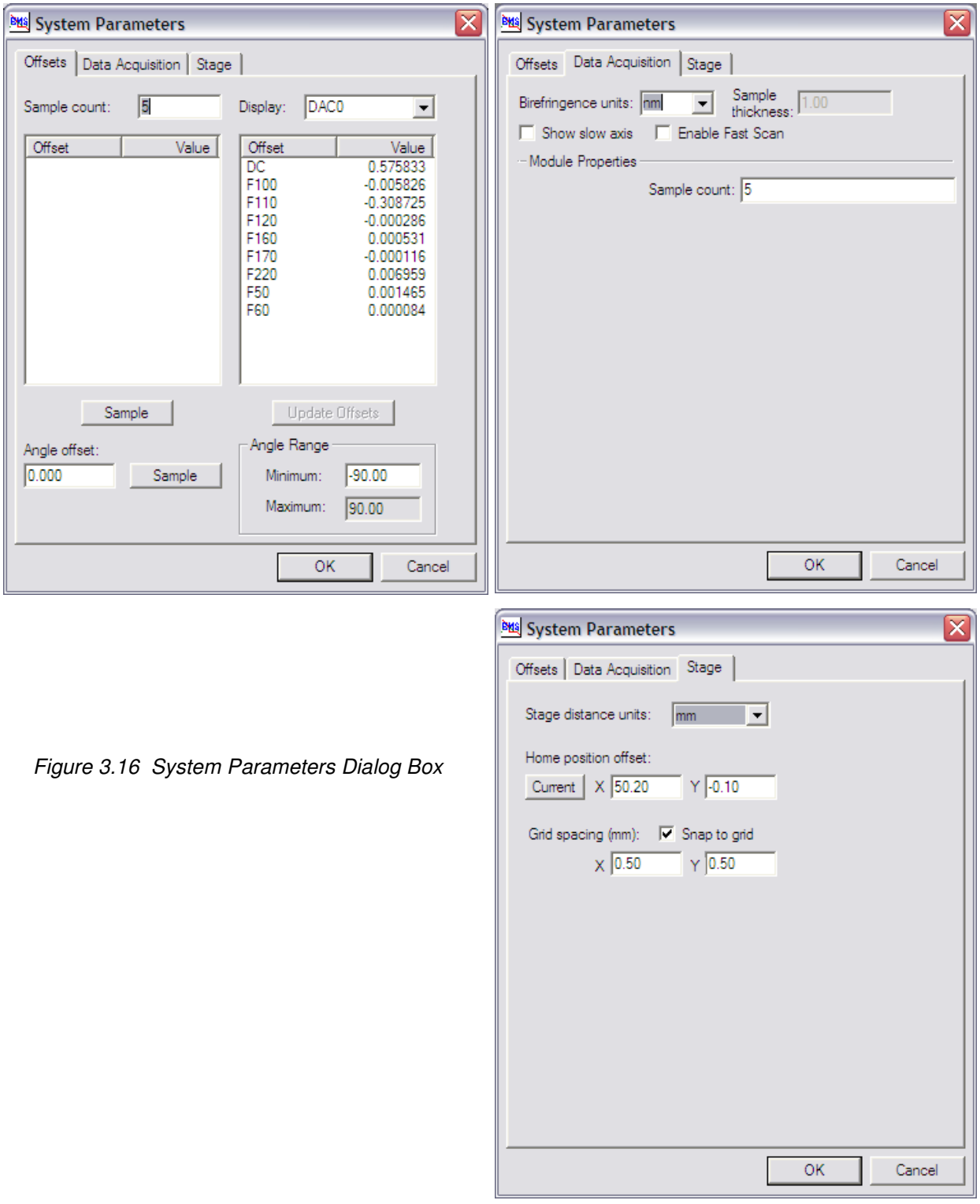


Figure 3.16 System Parameters Dialog Box

Use the System Parameters dialog box to view or change the following system parameters:

- Measure New Offsets
- Number of Samples (average) for Offset
- Birefringence Units
- Stage Distance Units
- Grid Spacing
- Magnitude Limits
- Stage Home Position Offset
- Sensitivity

Measure System Offset

To measure system offsets, follow these steps: .

1. Select **Configuration --> System Parameters** from the Exicor menu bar.
2. Make sure the beam is unobstructed (not passing through a sample).
3. Click on the **Sample** button.
4. Repeat sampling a number of times to ensure a stable reading.
5. After you have taken a measurement that is relatively typical (does not have a high deviation from your mean reading), click on the **Update Offsets** button.
6. Click **OK** to return to the Exicor 250AT main window.

Changing the Number of Samples

To change the number of sample averages taken for offset measurement, select **Configuration** --> **System Parameters** from the Exicor menu bar.

The **Num Samples** is located in the middle left of the System Parameters dialog box. Type the number of samples (typically >5).

Changing the Birefringence Units

To switch between magnitude of retardation and magnitude of birefringence, select **Configuration --> System Parameters** from the Exicor menu bar, then change the **Birefringence Units** field. The Birefringence Units field is located in the middle left area of the dialog box. Click on the ▼down arrow to select Birefringence Units.

Changing the Stage Distance Units

To change the distance units used in the birefringence plot area of the Exicor 250AT main window, select **Configuration** --> **System Parameters** from the Exicor menu bar. The **Stage Distance Units** field is located in the lower left corner of the System Parameters dialog box.

You can choose between

- millimeters (mm)
- centimeters (cm)
- inches (in).

The default is mm.

When you change the stage distance units (also known as grid units), the birefringence plot is redrawn and references to positions in the Interactive and Automatic Scan panels are updated when you close the System Parameters dialog box. The new units are reflected in the **Grid Spacing** field in the Exicor 250AT main window.

Changing the Grid Spacing

The default grid spacing in the birefringence plot area is 1mm. To change the grid spacing (step size of the X-Y-Motion Stage), select **Configuration** --> **System Parameters** from the Exicor menu bar.

The **Grid Spacing** field is located on the stage tab of the System Parameters dialog box.

The new grid spacing value does not take effect until you select **File** --> **New** or click on the **Start Scan** button and start the scan.

Stage Home Position Offset

The stage home position refers to the location where the stage moves to upon starting the Exicor software.

Click on the **Current** button to set the home position to the current stage X,Y coordinate or type the values into each box.

Auto-Calibration Settings

Use this dialog box to change the auto-calibration of the instrument offsets.

To access the Auto-Calibration Settings (shown in Figure 3.17), select **Configuration-->Auto-Calibration Settings** from the Exicor menu bar.

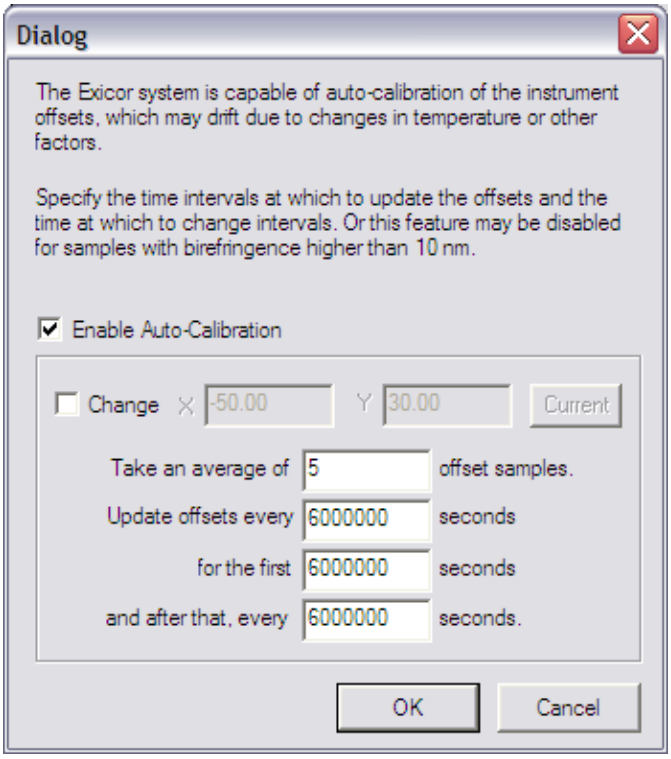


Figure 3.17 Auto Calibration Settings Dialog Box

Changing Frequency of Au to-Offsets

In order to access the auto calibration feature, check the **Enable Auto-Calibration** box. Choose how often auto-offsets are taken during data acquisition.

Changing Location of Auto-Offsets

To change the location for auto-offset, check the **Change Auto-Calibration Location** box.

Note: The auto-calibration location must be a position in the X-Y-Motion Stage where no sample is present and the beam is unobstructed (not passing through a sample). Once set, click **OK** to save settings.

Making Birefringence Measurements

The Exicor 250AT main window lets you perform two types of measurements:

Point Measurements are useful in the following situations:

- you are defining the boundary of a sample piece
- you want to display the measured values of a grid point on the birefringence plot
- you want to make an individual reading at a particular location.

Area Measurements are useful when you want to gather large amounts of data with minimal user attention. Area Measurements entail rectangular, circular and statistics. Measurements are stored in a user-specified file.

Performing a Point Measurement

Figure 3.20 shows the Interactive Scan panel, located on the left-hand side of the Exicor 250AT main window:

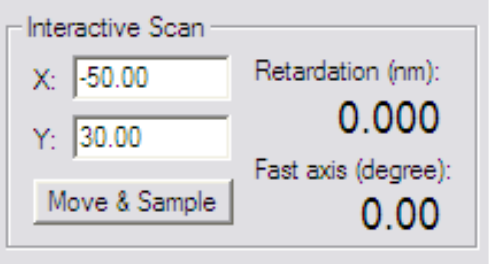


Figure 3.18 Interactive Scan Panel

The Interactive Scan panel is used for single-point measurements only. If you want to scan an entire region, use the Automatic Scan panel, as described later in this chapter.

To take a Single-Point measurement, use one of the following techniques:

- Double-click on the grid point at which you want to take a measurement. This moves the stage to the selected position and takes a measurement.
- Enter the X and Y coordinates of the grid point at which you want to take a measurement into the **X** and **Y** fields in the Interactive Scan panel, and then click on the **Move & Sample** button.
- Use the cursor keys on the keyboard to move the stage position (the X and Y fields are updated), and then click on the **Move & Sample** button.
-

Using any of these techniques, the results of the measurement are displayed in the **Retardation** and **Angle** fields in the Interactive Scan panel.

If the Retardation field reads “BLOCKED”, this means there is no light getting to the detector, the beam is blocked or the light signal is too weak.

Using Cursor Keys to Move the Stage Position

Table 3.2 shows how to use the arrow cursor keys to move the current stage position. The current stage position is displayed in the **X** and **Y** fields in the Interactive Scan panel.

Using this Key	Has this Effect
arrow keys by themselves	moves the stage 1 grid space.
CTRL plus arrow keys	moves the stage 10 grid spaces.
SHIFT plus arrow keys	moves the stage 1/10 of a grid space.

Table 3.2 Using Cursor Keys to Move the stage Position

Moving the stage position with the cursor keys does not take a measurement; to take a measurement, click on the **Move & Sample** button in the Interactive Scan panel (or see “Manual Rescan” below).

The current stage position is denoted by the cross-hair in the birefringence plot area and by the X & Y boxes of the Interactive Scan Panel.

Performing an Automatic Scan

Before you begin your scan, you must define a scan region, as discussed in the following section.

Defining a Scan Region

The scan region can be either circular defined by 3 points on the circumference, circular defined by a center and radius, or rectangular. Set the shape of the scan region by clicking on the down-arrow next to the **Scan Region** field in the Automatic Scan panel and select **Rectangular, Circular** or **Center/Radius**.

Defining a Rectangular Scan Region

When defining a Rectangular Scan Region, first click on the down-arrow next to **Scan Region** in the Automatic Scan panel and select **Rectangular**.

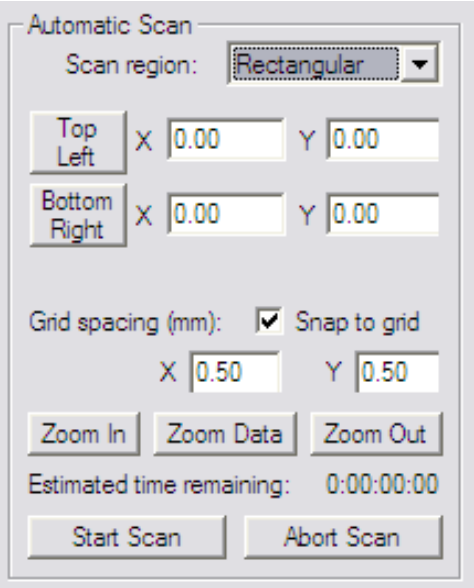


Figure 3.19 Automatic Scan Panel for Rectangular Scans

This method requires the user to find and enter the location of the **Upper Left** corner of the rectangular sample and the location of the **Lower Right** corner of the sample.

Clicking on the **Upper Left** or **Lower Right** button in the Automatic Scan panel sets that coordinate to the current stage position (denoted by the cross-hair on the graph).

Note: Grid spacing is changed within the System Parameters dialog box.

Defining a Circular Scan Region

When defining a Circular Scan Region, first, click on the down-arrow next to **Scan Region** in the Automatic Scan panel and select **Circular**.

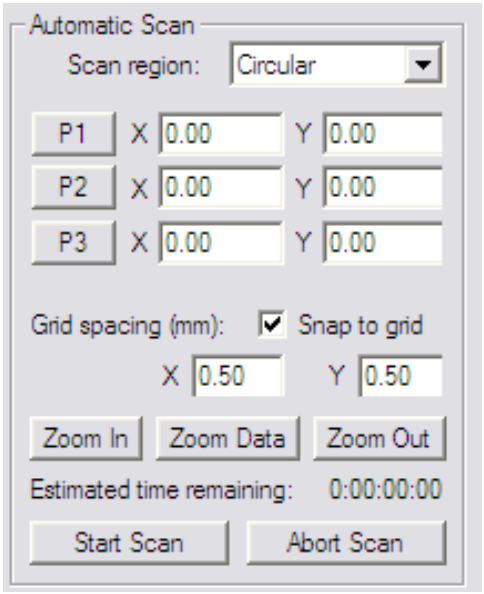


Figure 3.20 Automatic Scan Panel for Circular Scans

Note: When you select Circular from the Scan Region list, any loaded macro is unloaded from the Exicor 250AT program.

Double-click on a grid point in the birefringence plot area that lies on the perimeter of the circle you want to scan. Alternatively, use the arrow keys to move the sample position. Then click the **P1** button in the Automatic Scan panel. Repeat this procedure for the **P2** and **P3** buttons. Refer to page 46 for detailed information.

The grid points you choose for P1, P2, and P3 should all lie on the perimeter of the circle to be scanned. The coordinates for the three points are entered into the three X,Y fields and a circle is drawn that passes through all three points.

Note: Grid spacing is changed within the System Parameters dialog box.

Defining a Center/Radius Scan Region

When defining a Center/Radius Scan Region, first, click on the down-arrow next to **Scan Region** in the Automatic Scan panel and select **Center/Radius**.

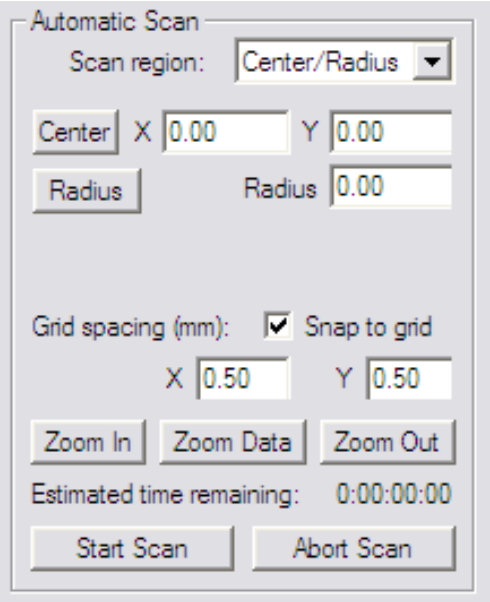


Figure 3.21 Automatic Scan Panel for Center/Radius Scans

This method requires the user to enter the center location of the circular sample and then enter the radius of the sample.

Click the **Center** button to use the current laser position as the center point coordinates.

> **Note:** Grid spacing is changed within the System Parameters dialog box.

Performing the Scan

Follow these steps to perform an automatic scan:

1. Define the scan region, as described previously.
2. Click on the **Start Scan** button.
3. After the hardware is ready to scan, the Confirm Scan Start dialog box appears as shown in figure 3.22 on the following page. Enter the sample ID, or leave it blank for “DefaultID”, as described later in this chapter. (You can save the data afterwards using a different sample ID.)

CAUTION

Use these tips for sample IDs to avoid overwriting existing data files:

- Enter a unique sample ID for each scan.
- Always have the sample ID match the filename.
- Avoid renaming files outside of the Exicor 250AT software application.

4. Click on **OK** to close the Confirm Scan Start dialog box.

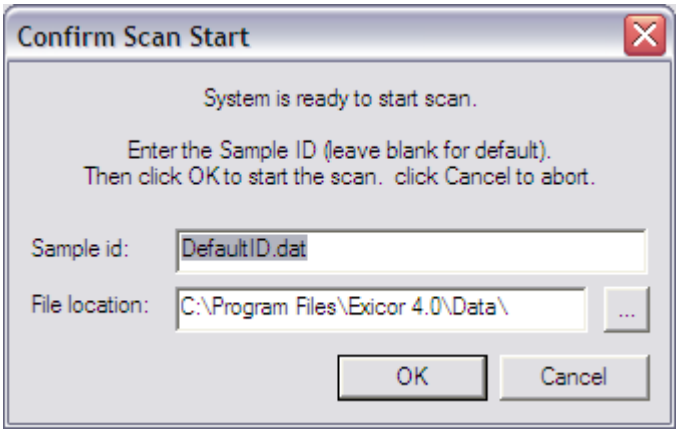


Figure 3.22 Confirm Scan Start

The automatic scanning process begins. The data will be taken in a serpentine fashion staring at the top of the sample. During scanning, you will notice periodic excursions of the X-Y-Motion Stage as the auto-calibration feature operates. The **Est. Time Remaining** field, within the scan panel, shows approximately how much time is left until the end of the current scan.

After the scan is complete, the data is saved automatically.

You can change the legend colors and values and enter annotations about the sample, as described in “Customizing Your Scan” later in this chapter.

If you have added annotations, need to change the sample ID, or have changed the legend colors or range settings for the file, you should save the data by clicking on the **Save Data** button. Enter the new sample ID when prompted if you want to change the sample ID. Then select the path and name of the file to which to save the data. (You can also select **File** ---> **Save** from the Exicor menu bar instead of using the **Save Data** button.)

Recovering from Errors

In case of a malfunction, click on the **Home & Reset** button, located in the lower left corner of the Exicor 250AT main window. This reinitializes your system and brings the X-Y-Motion Stage back to its origin.

You can also click the **Abort Scan** button, located to the right of the **Home & Reset** button in the Exicor 250AT main window. This stops the current scan. The scan should stop within 5 seconds (maximum timeout for communications problems).

Customizing Your Scan

The Exicor 250AT software offers several ways to customize your scan:

- legend panel
- file/graph annotations
- various types of graphs.

Customizing the Legend

To customize the legend used for a scan, use the Legend panel, located on the right side of the Exicor 250AT main window and shown in Figure 3.23.

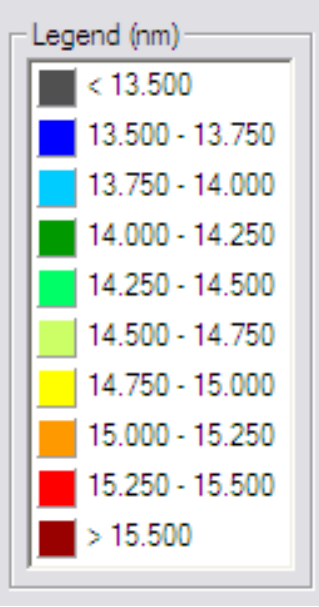


Figure 3.23 Legend Panel

The legend describes the color key for the retardation magnitudes. You can change the colors associated with various ranges of birefringence magnitude data by editing the legend.

Editing the Legend: Edit the legend by double-clicking in the Legend panel. This opens the Legend dialog box, shown Figure 3.24.

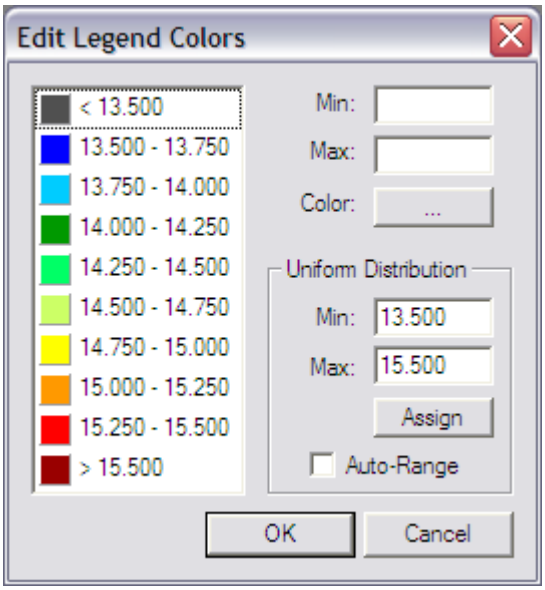


Figure 3.24 Legend Dialog Box

You may want to edit the legend if you are printing with a black-and-white printer, so that the colors are distinct. You can save various color schemes, so you can quickly switch between schemes.

To close the Legend dialog box and save your changes, click on **OK**. To exit without saving changes, click on **Cancel**.

Customizing Colors: Customize colors by clicking on the particular color within the Legend dialog box. When the color grid appears, select a new color by clicking on it. This applies the new color and closes the color grid. To close the color grid without making a selection, click anywhere except on a color.

To customize the colors even further, click on the **More** button below the color grid. This opens the Select Color dialog box, where you can adjust the RGB values for a color. When you are finished, click on **OK** in the Select Color dialog box.

Specifying Ranges for Colors: You can also specify minimum and maximum ranges for the retardation data by using the **Minimum** and **Maximum** fields in the Legend dialog box. The middle eight ranges are automatically evenly distributed between the maximum and minimum values.

Clicking on the **Auto-Range** button sets the minimum and maximum values such that the ranges are evenly distributed throughout the data set's range.

Saving Color Schemes: To save a set of colors as a distinct color scheme, click on the **To File** button in the **Save:** area in the Legend dialog box. This opens the Save dialog box, where you can specify the filename and folder.

To save your changes as the default color scheme, click on the **As Default** button in the **Save:** area.

Loading Color Schemes: To load a color scheme you have already saved, click on the **From File** button in the **Load:** area. This opens the Open dialog box, where you can select the file to load.

To restore the default legend that was shipped with your version of the Exicor 250AT Birefringence Measurement System, click on the **Default** button in the **Load:** area.

Choosing the Type of Graph to Display

The **Graph Type** list in the Exicor 250AT main window lists the various formats you can choose for a birefringence plot, as shown in Table 3.3.

Choose this Format	For this Purpose
Magnitude	if you are interested only in the magnitude of retardation displayed as a color-coded box for each data point. This is the fastest type of graph to generate.
Angle	if you are interested only in the fast axis angle.
Magnitude & Angle	if you want to graph both the magnitude and the angle of retardation.
Pass/Fail	if you want to display a color-coded box for each data point, where the color represents fail low, fail high, or pass, based on previously defined minimum and maximum values for each data point (see Chapter 6 for more information on macros).
Magnitude Surface	if you want a 3-D surface plot of the magnitude data.
Contour	if you want to overlay a contour plot of the magnitude data over another graph. Contours can be overlaid on any other graph type except Magnitude Surface.

Table 3.3 Available Graph Types

Generating Statistics for a Scan

Clicking on the **Statistics** button in the Exicor 250AT main window opens the Statistics dialog box, shown in Figure 3.28.

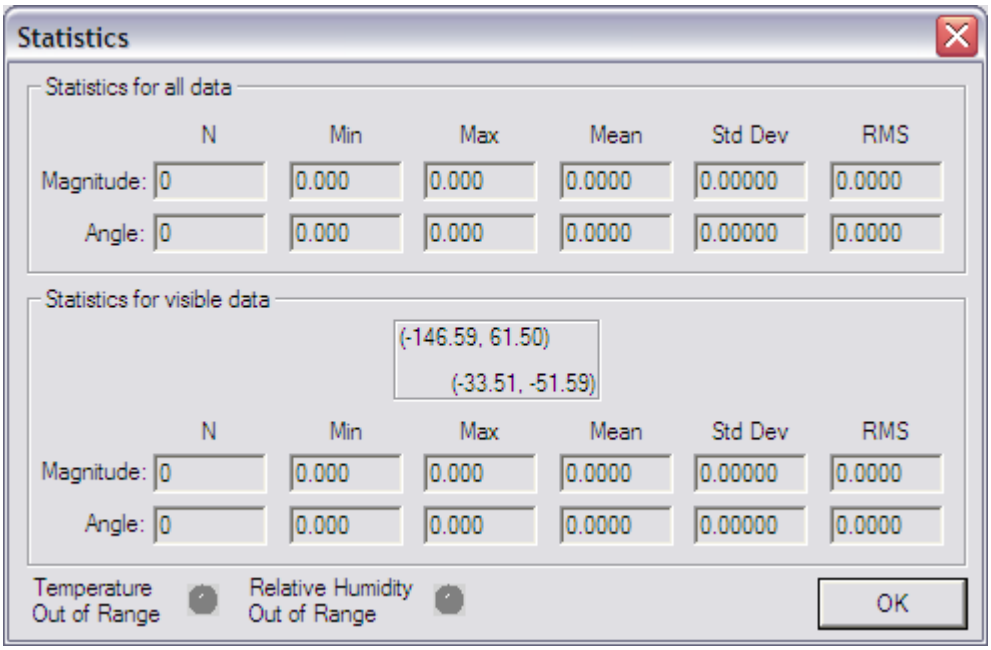


Figure 3.25 Statistics Dialog Box

This dialog box gives you the following information:

- N (number of data points)
- Min
- Max
- Mean
- Std Dev (standard deviation)
- RMS (root mean square)
- Temperature Out of Range
- Relative Humidity Out of Range

If you have zoomed in on a region, the Statistics dialog box displays statistics for both the zoomed data and the entire data set.

Click on **OK** to close the Statistics dialog box.

Saving, Opening and Copying Files

Note: File operations performed in the Exicor 250AT software must have a total path length less than 256 characters.

When to Re-save Your File

Although the Exicor 250AT software automatically saves your files, you should save your file again in the following situations:

- You have added annotations to the file.
- You have corrected the thickness of the sample. (You may have incorrectly entered the sample thickness before starting the scan.)
- You want to change the sample ID and filename or move the file to a different folder.
- You want to change the stage distance units in your data file.
- You want to change the legend colors or range settings associated with the file.

Using Sample IDs: Each file saved by the Exicor 250AT software contains a sample ID (which is usually the same as the filename).

The sample ID you enter when you save a file or start a scan can be up to 250 characters long. The following characters are not allowed in sample IDs:

\ * / “ | : < > ?

The sample ID associated with a file is shown in the **Sample ID** field in the Exicor 250AT main window.

CAUTION

Use these tips for sample IDs to avoid overwriting existing data files:

- Enter a unique sample ID for each scan.
- Always have the sample ID match the filename.
- Avoid renaming files outside of the Exicor 250AT software application.

Saving a File

When you select **File** --> **Save** from the Exicor menu bar, the Save dialog box appears, as shown in Figure 3.30.

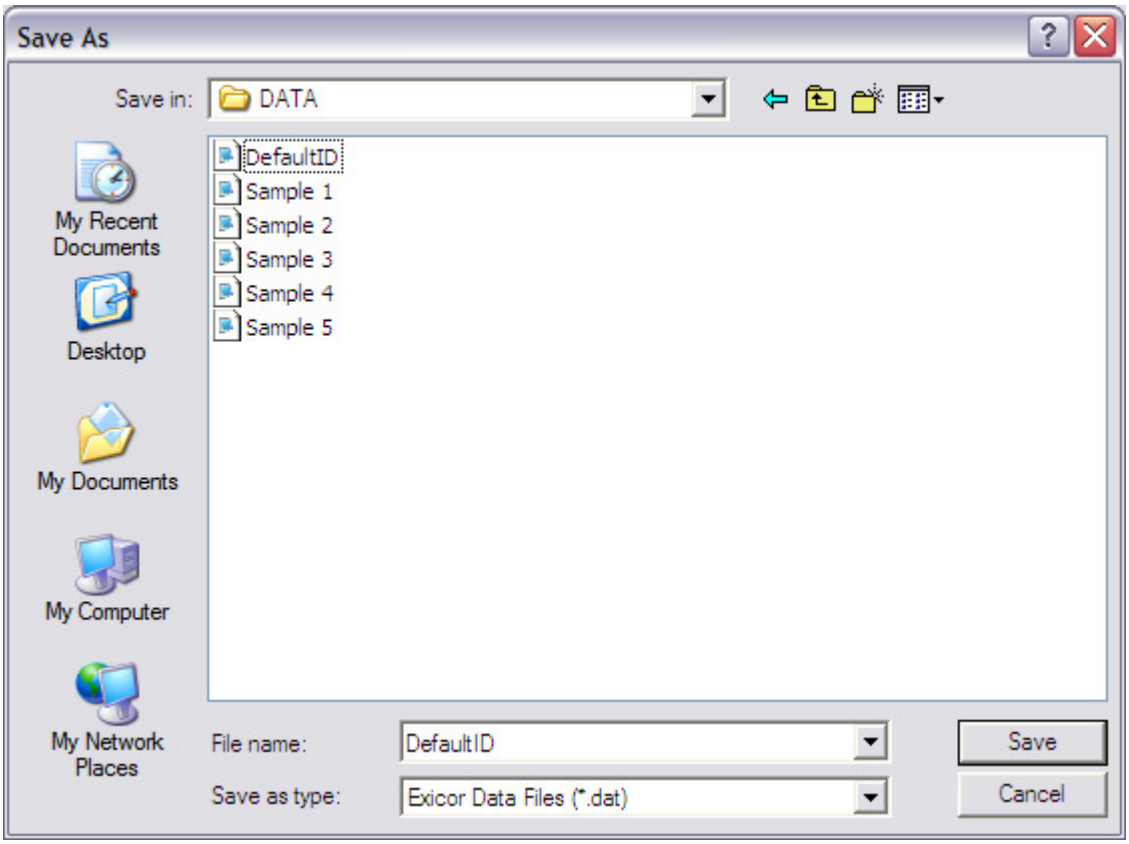


Figure 3.26 Save Dialog Box

Use this Save dialog box as you would any similar dialog box under Windows. The sample ID you enter is copied to the **File name** field; you can change the filename if you want. (Even if you change the filename, the original sample ID is saved with the file. This can lead to the file being overwritten, and is not recommended.)

By default, your data is saved in the .DAT format. The Exicor 250AT software can read only .DAT files. If you intend to share your data with other applications (such as Microsoft Excel), you may want to save the data in the .DMT format. To do so, click on the down-arrow next to the **Save as type** field in the Save dialog box, and select **DMT**. (See Appendix C for more information on file formats.)

The **Directory History** field remembers which folders you have saved files to so you can save files in the same folders later.

The Exicor 250AT software ensures that your data is stored even if your operating system becomes unstable. This feature is particularly important for large scans that may take several hours. Because of this, you do not normally need to take any action to save your data file. Your file has already been saved under the name of your sample ID in the current data folder.

CAUTION

Be careful not to overwrite other samples with the same name that you want to keep. This is one reason we recommend assigning a unique sample ID to each sample, or moving your sample later to a safe folder.

Note: Clicking on the Save Data button in the Interactive Scan panel in the Exicor 250AT main window is equivalent to choosing **File --> Save** from the Exicor menu bar.

Creating a New File

When you select **File --> New** from the Exicor menu bar, the following things happen:

- Any data and macros in memory are cleared.
- If the grid spacing setting has changed, any macro in memory is cleared.
- The new grid spacing setting is put into effect. This is the grid spacing used for selecting points and regions as well as for the scan grid spacing setting.
- The graph is zoomed out to show the entire stage area.

Note: Changing the grid spacing setting has no effect until you select File --> New or start a new scan.

Opening an Existing File

When you select **File** --> **Open** from the Exicor menu bar, the Open dialog box appears, as shown in Figure 3.31.

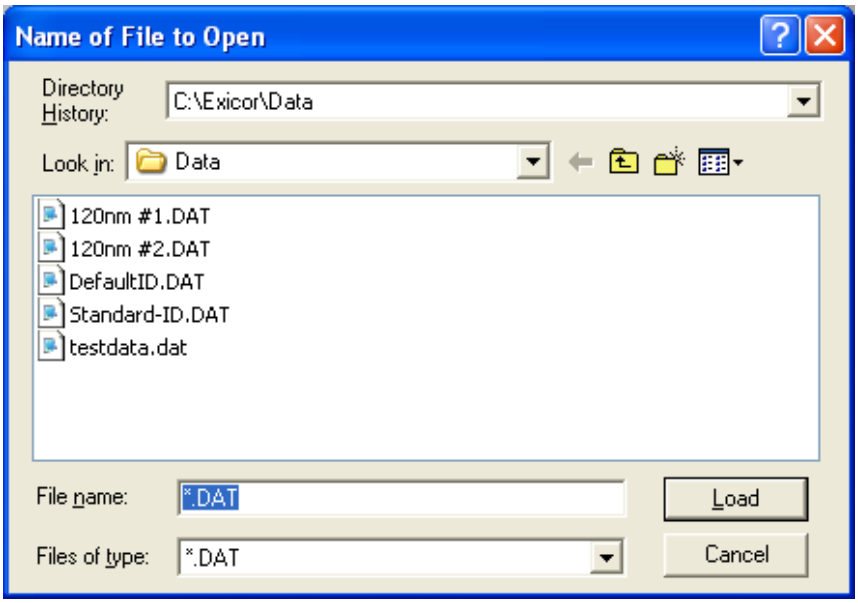


Figure 3.27 Open Dialog Box

Use this Open dialog box as you would any similar dialog box under Windows. When the **File name** field contains the name of the file you want to load, click on **Load**. The data file is loaded into the birefringence plot area of the Exicor 250AT main window.

Note: Exicor 250AT can read DAT files but not DMT files.

The **Directory History** field remembers what folders you have loaded files from, so you can load files from the same folders later.

Grid Size: When you load your data from disk, you cannot change the size of the grids of the data. When starting a new scan, the grid size that is in the **Grid Spacing** field in the Exicor 250AT main window is used.

Sample Thickness: If you change the sample thickness, the magnitude of birefringence is recalculated. The magnitude is expressed in nm/unit of thickness. Unlike the sensitivity and grid spacing, the thickness attribute can be changed and resaved with the file. Do not change the sample thickness unless the original thickness was incorrect.

4
Operating the System

WARNING

The Exicor 250AT Birefringence Measurement System uses a Helium-Neon laser, has some potential pinch points, and is operated at normal line voltage. The system has been designed, tested, and certified to ensure that it is capable of safe operation. To ensure continued safety, all operators should familiarize themselves with the Operators' Safety Summary section, beginning on page 1.

Using the Exicor 250AT Birefringence Measurement System for the First Time

WARNING

The Exicor 250AT Birefringence Measurement System uses a Helium-Neon laser as a light source. See the “Laser Safety” section of the Operators' Safety Summary, beginning on page 1.

For mechanical safety, power should be removed from the Exicor 250AT before making any changes to the X-Y-Motion Stage.

All potential operators should locate the red ON/OFF Switch on the side of the System Scanning Module (Main Power Switch.) Hitting this switch removes power from the Exicor 250AT motors and stops movement of the X-Y-Motion Stage.

System Initialization

Follow these steps to initialize the Exicor 250AT system:

1. Turn ON the main power to the Exicor 250AT by flipping the Main Power switch to the ON position. Be sure the Emergency Off (EMO) switch is not activated by pulling OUT the red power button located on the side of the Sample Scanning Module.
2. Turn ON the PC and Monitor. You must switch the computer on when starting the system.

   Note: You may choose to leave the computer running even when the Exicor 250AT System Scanning Module Switch is turned off.
3. Launch the software program by double clicking on the Exicor program icon on the computer desktop.

Upon system initialization, the following messages will appear:

Please wait until the following hardware is initialized:

- DAQ Cards
- Motion Controllers

If there are no errors during the initialization phase, the system will show a green indicator next to each item. If there is a problem, the indicator will be red and a code will be displayed in the Error Code box to the right of each line item. If all indicators are green, the system is now ready to begin making birefringence measurements.

If an error is witnessed during the initialization phase, see section 8 “Troubleshooting” on page 60 for system initialization errors.

Once the software is activated, the software will initialize the following:

- X-Y-Motion Stage (stage will move to the [0,0] home position)

Loading the Sample

With the computer and Exicor 250AT ON, follow these steps:

1. Place the sample holder into position on the X-Y-Motion Stage.
2. Mount a sample onto the sample holder. Make sure that the “Auto-cal “aperture is clear. This allows the auto-offset feature to function properly during the scan.
3. Move the X-Y-Motion Stage to the [0,0] position.

Circular Scan Using P1, P2, P3 Technique

This method is for determining a circular scan region using three points parameter along the perimeter of the sample.

1. Double-click on the **Exicor** icon on the computer desktop. The screen shown in Figure 4.1 appears.

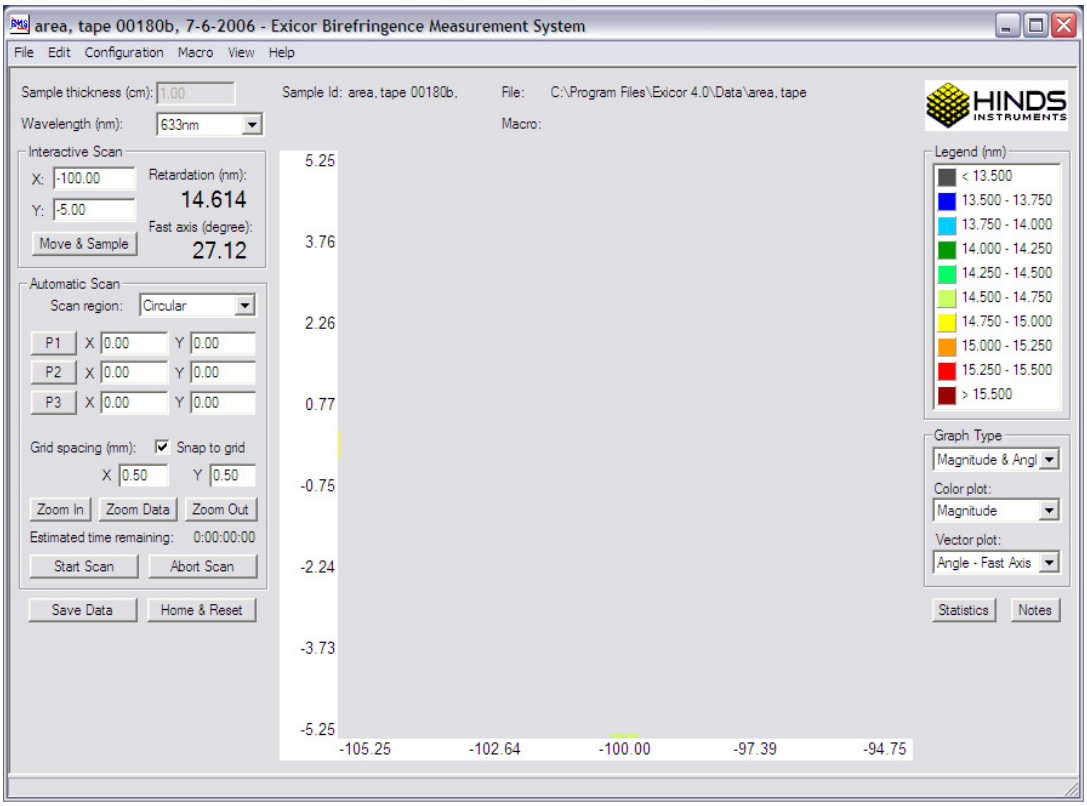


Figure 4.1 Exicor Main Window at Startup

2. Use the arrow keys on the keyboard to move the sample stage one grid spacing unit. Using the control key with the arrows magnifies the motion by 10 times. The stage moves opposite to the arrow direction, so think of the arrows as moving the laser with respect to your sample. Position the sample so the laser is centered at [0,0] over the scan region.

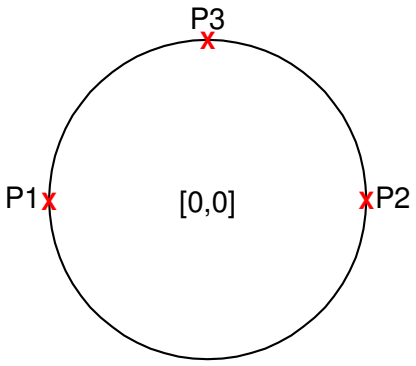


Figure 4.2 Circular Scan P1, P2, P3 points

3. Move the stage to find the left edge of the sample. The DC level will drop significantly, which means the beam is now located at the edge of the sample. Click on **P1** button in the Automatic Scan panel in the Exicor 250AT main window to set the first point.
4. Move the stage to find the opposite (right) edge of the sample and click on **P2** to set the second point.
5. Move the stage to the [-100,0] location and then move the stage to find the upper (top) edge of the sample and click on **P3** to set the third point. The circular scan region will appear in the Birefringence Plot area within the Exicor 250AT main window.

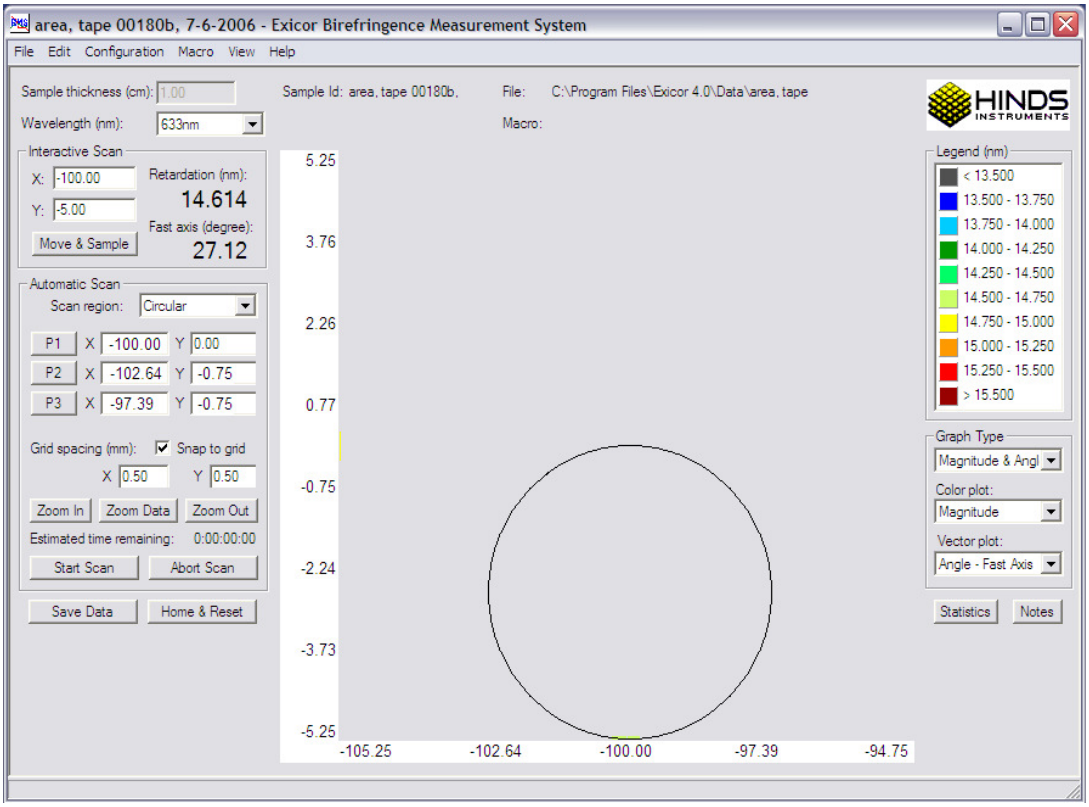


Figure 4.3 Circular Scan Region

6. Click on the **Start Scan** button. The dialog box shown in Figure 4.4 appears, prompting you for a sample ID. Enter a new sample ID or leave the field blank to accept the default sample ID, “DefaultID”.

   Note: Because the software uses the sample ID as the filename, if you do not create a new name, any file with the name DefaultID.DAT is replaced with your new data.

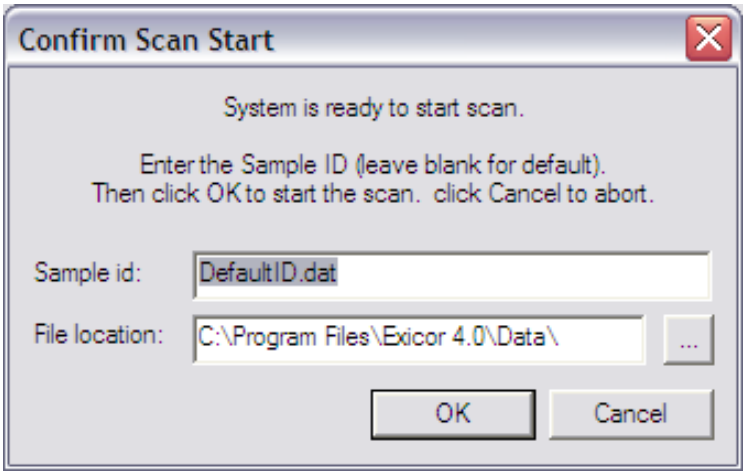


Figure 4.4 Confirm Scan Start Dialog Box

7. Click on the **OK** button in the Confirm Scan Start dialog box to begin the scan.

Scanning and auto-calibration start.

Once the scan starts, the data points will begin to appear as each point is measured. A screen similar to the one shown in Figure 4.5 will start to build. These are your results.

If there is less color variation than you expect, double click in the Legend panel and adjust the **color range**. See “Customizing The Legend” on page 36 for more information.

While the scan is in progress, you can adjust the color range or select Magnitude, Angle, Magnitude & Angle **or Pass/Fail** from the Graph Type list.

When the scan is complete, X-Y-Motion Stage movement ceases and the birefringence plot area of the Exicor 250AT main window shows the results of your scan, as shown in Figure 4.6.

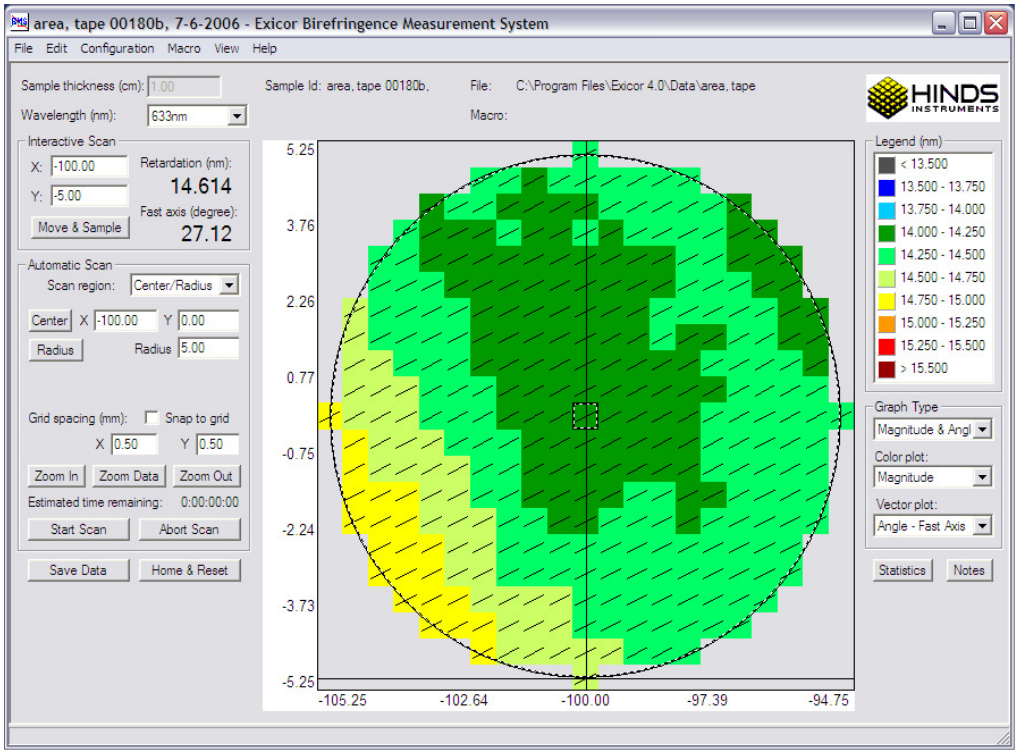


Figure 4.6 Completed Scan

Your data has been stored automatically under the sample ID that was entered in step 7. See Appendix C for more information on data formats.

To scan another sample using the same system configuration, mount the new sample and click on the **Start Scan** button. Enter a sample ID and click on **OK**. The process repeats with your new sample. You may wish to repeat steps 2 through 5, above, to change the scan boundary conditions to accommodate a different-sized test sample.

If you enter a new sample ID for your second sample, there are now two data sets stored automatically**. If you chose to use the default sample ID, the new data replaces the original data file saved as "default ID".**

The steps you have just performed are sufficient for most applications. See chapter 3 for other variations.

System Shutdown

1. Ensure the scan is complete or not in progress. If scan in progress, press the yellow **Abort Scan** button from the software interface.
2. Push IN the red power button on the System Control Module. All systems will shut down.

5
Maintenance and Cleaning

The Exicor 250AT requires very little maintenance.

Changing Cables and Opening Covers

Check periodically and whenever the system is moved or maintained, that the covers on the System Scanning Module are secured and tight fitting. Be certain that no unwanted laser light escapes from the enclosure.

Check periodically that interconnecting cables are free of sharp bends and cuts or abrasions.

For safety, the instrument housings should be opened only by trained and authorized maintenance personnel.

Persons changing the cables or opening the covers on the system must:

- Remove power to the system.
- Understand the purpose, connections and voltages at each cable connection internal to each housing.
- Be trained in and understand the hazards associated with laser light.
- Not allow eye exposure directly from laser light or any reflection of laser light from a mirror like surface.
- Understand the operation of the laser high-voltage connection and the shock hazard associated with the high voltage connection.

Fuse Types

For continued protection against fire, replace with same type and value of fuse.

The Exicor 250AT has two fuses mounted separately on the rear panel of the System Control Module (SCM.)

Voltage	Fuse Rating	Hinds Part Number
100	5x20mm, 2.0A, 250V, SB	345-8000-033
115	5x20mm, 1.6A, 250V, SB	345-8000-029
230	5x20mm, 0.8A, 250V, SB	345-8000-028

Laser Fuse

Voltage	Fuse Rating	Hinds Part Number
All	3.AG, T 250V/3.0A SB	345-8000-026

Table 5.1 Laser Fuse

X-Y-Motion Stage Maintenance

It is necessary to lubricate the ball screws of the X-Rail and Y-Rail assemblies. See figure 5.1 for lubrication locations.

CAUTION

Do not use/mix petroleum base grease with synthetic base grease at any time.

The lubrication grease type used is Shell Alvania RL2 (Hinds PN: 678-0000-003.)

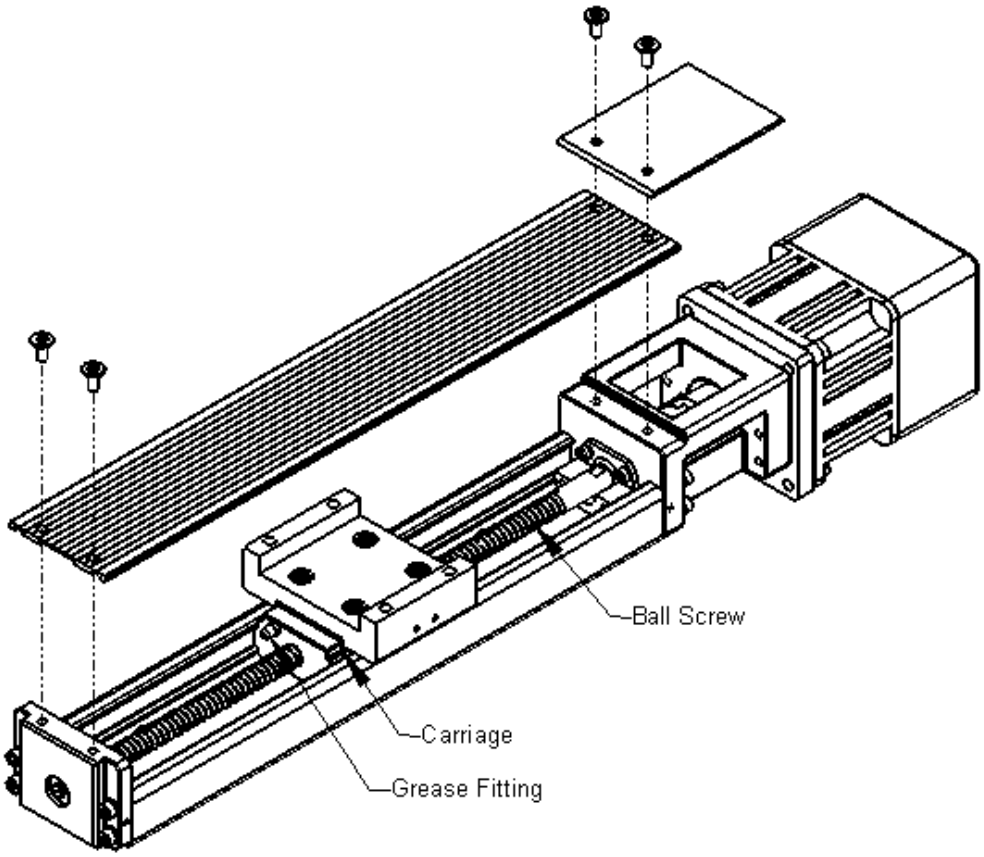


Figure 5.1 X-Rail & Y-Rail Lubrication

Ball Screws

Lubricate the two ball screws once per year or every 3000 hours of use. Lubrication schedule may vary depending on frequency of use.

Wipe screw down with a clean cloth. Move the carriage to one end of the rail. Apply grease utilizing the grease fittings located on the ends of the carriage until grease can be seen seeping out of both sides of the carriage near the ball screw. Move the carriage from one end of the rail to the other. Repeat this process as necessary until the entire length of the groove in the ball screw is lightly covered with grease.

Cleaning the Optics

Under normal operation, the optics do not require cleaning. Never clean or touch the optics when the system power is ON.

If a substance such as Index Matching fluid (coupling oil) drops into the detector aperture, the oil could coat the second PEM and cause a loss of signal at the detectors. If this occurs, clean the PEM with cotton swabs moistened with solvent. Wipe the surface gently while rotating the swab slowly. This action ensures that the contaminants are lifted away from the surface of the optic. See figure 5.2.

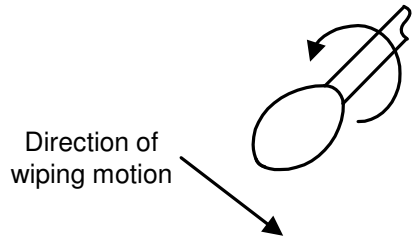


Figure 5.2 Direction of cotton swab wiping motion

Choose a solvent that will not soften or remove the locking indicator used to secure components. Isopropyl alcohol and mineral solvent are examples of suitable materials. Acetone, MEK or Toluol are unsuitable.

Cleaning the Cabinet

You can clean the exterior of the Exicor 250AT cabinet with an ammonia-based cleanser (such as Windex.)

CAUTION

To avoid electrical shock and equipment damage, do not allow any liquids to get inside the Exicor 250AT.

Do not clean the system with the power ON or while the system is plugged into the AC outlet.

6
Getting Help

Overview of the Exicor 250AT Help System

As shown in , you can contact Hinds Instruments Inc. Technical Support in several ways.

Method	Information
Telephone	Monday - Friday 8:00 AM to 4:00 PM PST (503) 690-2000
FAX	(503) 690-3000
Email	sales@hindsinstruments.com
World Wide Web	www.hindsinstruments.com for general information about Hinds Instruments, Inc. and the Hinds PEM www.exicor.com for information specific to the Exicor 193nm Birefringence Measurement System
U.S. Mail	Hinds Instruments, Inc. 3175 NW Aloclek Dr. Hillsboro, Oregon 97124-7135

Table 6.1 Contacting Technical Support

When contacting Hinds Instruments for technical support, have the following Exicor 250AT information available:

- Model name
- Serial number
- Problem symptom

7
Troubleshooting

Diagnosing Common Errors

Table 8.1 lists some errors you may encounter, and suggestions on how to interpret or fix the error.

Errors		Interpretation or Fix
1	Birefringence = -1 in data file. Shows 'Output Overload' in Interactive Scan Retardation box.	When the measurement shows birefringence = -1, the Lock-In Amplifier is in output overload and the lock-in sensitivity setting needs to be decreased. For example, if the sample measurement shows an 'Output Overload' for a sensitivity of 10 mV, try decreasing the sensitivity to 100 mV.
2	Birefringence = -2 in data file. Show 'REF UNLOCK' in Interactive Scan Retardation box.	This indicates the Lock-In Amplifier lost the reference signal from the PEM and was therefore unable to obtain an accurate reading. Make sure the REF TTL is connected properly.
3	Birefringence = -0.04 in data file. Shows 'Blocked' in Interactive Scan Retardation box, -0.04 in data file.	When the measurement shows birefringence = -0.04, the optical signal path is blocked and insufficient light is reaching the detectors. Dense samples can cause this result, as can samples which cause deviation to the beam path. Place a piece of white paper in the beam path to make sure the laser is on. If the Exicor 250AT is on but the laser is off, contact Hinds Instruments, Inc.
4	Data point is grey and Retardation box shows "blocked"	- high signal absorption from sample - blocked beam
5	Software encounters error during initialization of motion controllers, Temperature Sensors or Humidity Sensors	- Bad cable or connection - Some hardware is turned off - Restart program
6	X-Y-Motion Stage will not move	- Bad cable or hitting end of travel limit. - Turn off motor power, push stage to center, turn on power, restart software.
7	Software hangs during data scan	- Some hardware was turned off or disconnected. - Close program, restart program. - Turn off screen saver -WFCC has lost the Reference Signal
8	I see a message indicating a problem communicating with the motion controllers	Check that the 9-pin RS232 cable is connected properly between the PC and the Exicor 250AT Motor Cable connection. Check the COM port settings in the Exicor software.

Errors		Interpretation or Fix
11	I see a message indicating a problem communicating with the motion controllers	- Power motors on and off and restart software. - Run diagnostic test
12	When I enter a data point for the Upper Left (or Lower Right) fields in the Automatic Scan panel, the program changes the value and my scan becomes a line	The upper left coordinates (Xul, Yul) and lower right coordinates (Xlr, Ylr) must meet the following relationship to be valid: Xul <= Xlr and Yul >= Ylr.
13	My birefringence measurements are shown in nm/cm or nm/inch and I want data in nm	Select Configuration --> System Parameters from the Exicor menu bar. In the System Parameters dialog box, select nm as the value for the Birefringence Units field.

Table 8.1 Diagnosing Common Errors

Motion Controller Error Messages

When the software has problems communicating with the motion controller, it displays a message indicating there is an error.

Check the following:

3. COM port setting for the motion controllers. Verify that the motion controller is physically connected to the correct COM Port.
4. Serial cable connections.

If the problem persists, turn the Exicor 250AT off then back on and restart the Exicor software. If the errors still occur, contact Hinds Instruments, Inc. for support.

Other Error Messages

If the Exicor software displays an error message when trying to save data to a file, check factors relevant to the error message. For example, check that the file is not in use by another program and ensure that there is enough free space on the disk to which the file is being written.

A
Technical Specifications

Hardware Elements

The Exicor Birefringence Measurement System consists of three hardware elements:

- Exicor 250AT scanning modules
- Computer system.

Software Elements

The Exicor 250AT contains Exicor control and analysis software.

Power Requirements

The Exicor 250AT Sample Scanning Module is designed to operate on the following:

100/115/230V ~, 1.0/0.9/0.6A, 50/60Hz AC Power

The Exicor computer and monitor together require the following:

100-240 VAC, 4.2 Amps, 50/60 Hz AC Power (typical)

The Exicor 250AT System Scanning Module uses the following fuse types:

Voltage	Fuse Rating	Hinds Part Number
100	5x20mm, 2.0A, 250V, SB	345-8000-033
115	5x20mm, 1.6A, 250V, SB	345-8000-029
230	5x20mm, 0.8A, 250V, SB	345-8000-028

Laser Fuse

Voltage	Fuse Rating	Hinds Part Number
All	3.AG, T 250V/3.0A SB	345-8000-026

Table E.1 Laser Fuse

General Description

Integrated system to measure low-level strain birefringence in optically transparent samples up to 250mm x 250mm. An extensive system-specific operating software program provides the following:

- Graphical user interface
- Automated motion control of sample platform
- Manual control (through the program) of the sample platform
- Graphing of sample data on screen and print
- Reading sample data from file to graph
- File management and system initialization

Specifications

Retardation range:	0 - 300nm
Retardation resolution:	0.01nm
Retardation repeatability:	±0.05nm (Ret < 5nm) or ±1% (Ret > 5nm)
Instrument noise floor:	0.05nm (without sample)
Angular resolution:	0.1°
Angular repeatability:	±1° at Ret >= 5nm
Measurement time:	Less than 0.5 sec (typical)
Electrical Supply Req'd:	100-240VAC, 50-60 Hz, single phase
Software:	Exicor-AT Rev E3.9
X-Y-Motion Stage:	250mm x 250mm servo motor driven stage system
Maximum scan region:	250mm x 250mm
Maximum sample height:	250mm
Maximum sample weight:	7Kg
Computer System:	PC, Windows™ software, 17" LCD monitor
System Dimensions:	413mm (w) x 693mm (d) x 909mm (h)
Scanning Weight:	Less than 50 kHz, nominal
Wavelength:	632.8 nm
PEM 1 Modulation Frequency:	50 kHz, nominal
PEM 2 Modulation Frequency:	60 kHz, nominal
Measurement Spot size:	1 mm, nominal

Safety Feature:	Emergency OFF switch
WFCC:	Model 4020
Modulation System:	Hinds Instruments PEMLabs Technology^{SM} Ultra Low Birefringence Photoelastic Modulator

(1) Repeatability Conditions:

- System tests performed in a laboratory environment (temperature 20 ± 1C)
- Sample in a fixed position
- Machine stabilized for 1 hour with auto-offset time interval of 5 minutes
- Testing material: Polished, parallel-face optical element
- Variation applicable to above specifications is 3σ

(2) Noise Floor Conditions:

- System tests performed in a laboratory environment (temperature 20 ± 1C)
- No sample present
- Machine stabilized for 1 hour with auto-offset time interval of 5 minutes
- Average value

Software Features

X-Y-Motion Stage Movement under Manual Control ("Semi-Automatic")

(a) Basic Feature: Capability to move the X-Y-Motion Stage to desired coordinate position

(b) Other

- Manual reset button
- Manual home button

X-Y-Motion Stage Movement under Operating Software Control ("Automatic")

(a) Basic Feature: Scan the 250mm x 250mm area on a grid

(b) Macros

- Create Pre-set scan patterns
- Set Pass/Fail criteria
- Define scan regions for multiple samples

(c) Other

- Allows user adjustment of grid spacing and measurement area for scans
- Calculates scan time required
- Detects that stage has moved to the correct position without errors

Measurement Features

- Color coded bitmap displaying retardation of sample
- Adjustable sensitivity
- Retardation measurements in absolute measurements (nm) or normalized to thickness (nm/cm)
- Automatic display of retardation magnitude and/or angle

Graphing

- Color coded bitmap displaying retardation of sample
- Plot displaying orientation of retardation
- Surface plot indicating magnitude of birefringence
- Save and print: graphs and numeric readouts with user commenting capability
- Copy and paste graph to MS Office applications
- Zoom In/Out

User Features

- Display options: retardation value and angular plot together or separately
- System identification
- Abort button
- Error messaging for incorrect stage position, attempts to travel outside stage limits, and stalls
- Real-time measurement display updates
- Help files and error message
- Data saved in .DAT and .DMT files using plain text tab-delimitated format

E
Exicor ® 250AT Limited Warranty

Hinds Instruments, Inc. warrants the Exicor ® 250AT Birefringence measurement System to be free from defects in materials and/or workmanship for (1) year from the date of delivery, subject to the provisions contained herein. Hinds' warranty shall extend to the original purchaser only and shall be limited to factory repair or replacement of defective parts.

Exclusions

This warranty does not cover normal maintenance, damage resulting from improper use or repair, or abuse by the user. This warranty extends only to repair or replacement, and shall in no event extend to consequential damages. In the event of user repair or replacement, this warranty shall cover neither the advisability of the repair undertaken, nor the sufficiency of the repair itself.

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This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

Reference section 6 (Getting Help) on page 57 for contacting technical support.

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