4

Basic Operation

Chapter 4 describes the basic operation of the *AlphaStep Development Series* profiler instrument and software. Included in this section are powering up the instrument, loading and unloading a sample, viewing and positioning with the video system and measuring a profile.

Powering up the Instrument

To start up the *AlphaStep Development Series* profiler System, do the following:

1. Verify that the system power cord is plugged in.

2. Verify the computer and monitor are powered on. If not, press the Power button. Wait until the Windows Operating System is fully loaded, showing the desktop, before continuing on to the next step.

3. Turn on the power to the profiler on the back panel. Wait at least 10 seconds before running the profiler software to allow the Stage and computer to establish the USB connection.

4. Double-click on the icon located on the Windows Desktop.

    The Main application screen is displayed with a dialogue box asking to "Home the System" before moving on, at the screen prompt, Left Click the Yes button to continue. The system will move the sample stage and measurement head stage to their home positions.

    NOTE

    If "No" is selected the system will not home and the controls will be inactive.

5. A dialogue box appears with a message stating "Homing is complete". Left Click on the OK button to continue.

6. The system is now ready to use.

Loading the Sample

Loading a sample is a straightforward process. There is a process for the manual AlphaStep D-500 instruments and a motorized process for the AlphaStep D-600 instruments.

Loading the sample using the manual stage (AlphaStep D-500):

1. Open the sample stage cover and place the sample on the stage table or precision locater.

Note: If you are using the precision locater, it is normally used in the 0 position

2. Using the finger dials, manually move the stage so the sample is moved under the video camera.

3. When you have roughly placed the sample under the camera, use the Z Stage controls to lower the stylus until you can see the stylus and sample in the *Video Window.*

Note: Do not bring the stylus down too quickly or you may crash the stylus into your sample surface and damage one or both of them.

4. Use the finger stage controls one at a time to fine position the sample under the stylus ready for a measurement.

Loading the sample using the motorized stage (AlphaStep D-600 only):

Note: Look to see that the stylus is not engaged or too close to the sample surface before proceeding further.

1. If the stage is not already at the sample load position (closest to the operator and out from under the stylus), Left Click on the *Load Positions* button on the *Control Panel* Tab and use one of the preset stage positions or manually use the X-Y stage controls to move the sample stage out from under the stylus so you can safely load a sample, (see Figure 4-1).

2. After the stage moves to its forward *Load position* a message will appear on screen telling the user the stage is at the home position. Press the *Enter* or Left Click the *OK* button to continue.

3. Open the sample stage cover and place the sample on the stage table or precision locator.

Note: If you are using the precision locater, it is normally used in the 0 position.

4. (*Optional*) Engage the vacuum switch, Left Click on the Vacuum radio button located on the Main software screen in the Z Stage controls panel, as shown in Figure 4-1. Users may find the vacuum unnecessary for their sample and can skip this step.

5. Move the stage in the Y+ direction using the X-Y Stage controls until the sample is positioned under the measurement head. The user can see roughly how close the sample is with the naked eye.

6. Use the X-Y controls to position the sample for a measurement (see positioning in X-Y below for more detailed description of using the X-Y controls).
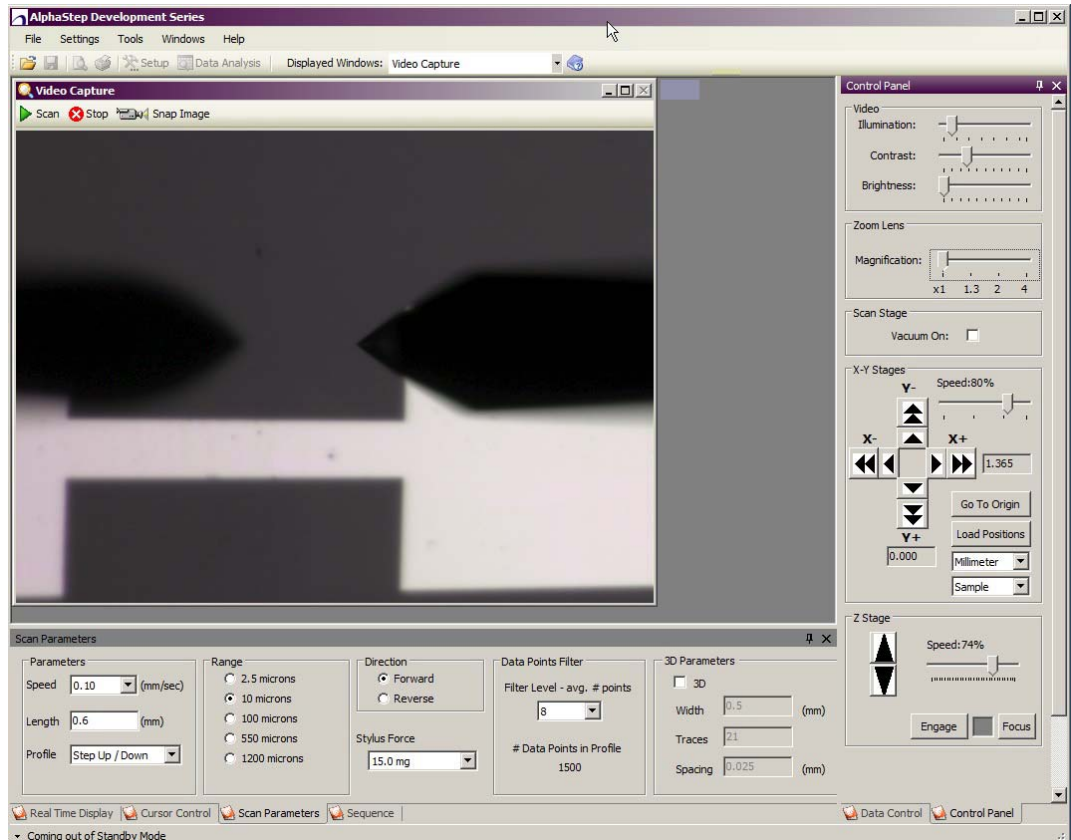
7. Close the sample stage door cover.

NOTE

Be sure that the measurement head is above the sample and clearly above the surface in the Video window or by using the naked eye to see that the tip is off the sample surface before closing the stage door cover.

Figure 4-1   Load Positions Video Capture

Control Panel Tab

The Control Panel Tab has all of the motor stage controls. This Tab is where the user turns on or off the vacuum, adjusts video for brightness and contrast, adjusts magnification of the camera, move the stylus up and down when making adjustments for setting up a measurement location and moving the sample sage.

The Control Panel Tab can be set as a Window or Hidden. The Hide mode causes the Tab to collapse along the right side of the Application Window and not be visible. To see the Tab again, the user moves the cursor over to the right edge of the Window and the Tab will appear again until the cursor is moved off the Tab.

Video Controls And Zoom

The Video controls are divided into two groups:

Video – These controls adjust the view in the Video Window. The video camera has a built in light level adjustment that will try to compensate for high light levels. This will affect the dynamic range of the contrast and brightness controls.

Illumination - The *Illumination* slider bar adjusts an LED light located on the Pivot assembly. Sliding the bar to the right makes the light brighter.

Note: Leaving the light on high is a heat source and may cause the sample to heat up over extended time.

Contrast - The *Contrast* slider bar adjusts the video camera and video card contrast. Sliding the bar to the right increases the contrast level.

Brightness - The *Brightness* slider bar adjusts the video camera and video card brightness level. Sliding the bar to the right increases the brightness level.

Zoom Lens – These controls adjust the digital zoom in the video camera. There are four digital zoom magnifications: 1x, 1.3x, 2x and 4x.

Figure 4-2   Control Panel Tab
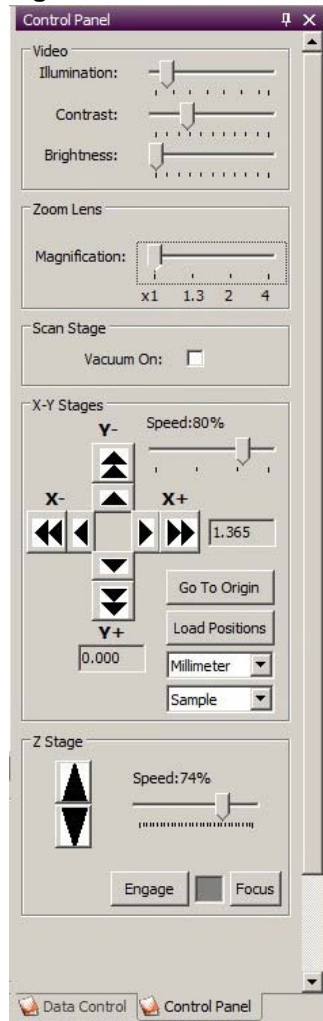
Viewing the stylus in the Video Window

The *AlphaStep Development Series* profiler measurement head integrates a high-resolution adjustable video camera. The video camera focus is set so that the stylus tip is always in focus. The user must move the Z stage to bring the sample into the field of view and focus of the stylus. Once the sample has been loaded and the stage moved beneath the measurement head, the sample is visible in the *Video* window of the main software screen as shown in Figure 4-1 above. Using the *Video* window, the user can position the sample to the place of interest to start take a scan. The sample motion consists of two parts:

• Z motion - motion of the measurement head up and down

• X-Y motion - motion of the sample stage left and right, and back and forward

Stage Positioning

The user can control the X-Y stage position and Z Stage up and down motion of the measurement head using the mouse cursor, Left Click the arrow control for the intended direction. (rotation) Motion (rotation of the stage or sample) is controlled manually by the user (Note: AlphaStep D-600 only).

X-Y Stages - The X-Y Stage control consists of four double arrows, representing the right and left X motion of the stage and the forward and back Y motion of the stage. The current stage coordinates are displayed next to the double arrows of X+ and Y+. Each arrow direction also has a single inner arrow that is 50% of the large arrow speed. A slider bar controls the speed of the X-Y motion. Moving the slider control to the right increases the speed of the stage motion. The arrow directions correspond with the video display frame of reference.

Unit display selection - This switches the display of the of XY stage position in unit of Millimeter or Inch.

Display reference - this switches the reference of the display. Instrument uses the back of the XY stage as 0,0. Sample uses the center of the XY stage as 0,0.

Speed Bar – This slider control adjusts the speed for all the X-Y arrow buttons. Moving the slider to the right increases the speed for each button.

Go to Origin - This button moves the XY stage to pre-defined origin position of the stage. The user can define any position of the XY stage as the origin position.

Load Positions – This button opens the Load Position Control. This Control allows the user to move the stage to pre-saved stage locations and to save stage locations for future use.

Z Stage - The Z Stage controls consist of two arrows, and a speed bar control. The Z stage moves the stylus up and down. It is necessary to move the stylus close to the sample surface to be able to see the stylus and the sample surface in the Video Window as can be seen in Figure 4-1.

Arrow Buttons – Pressing the up or down arrow moves the Z stage up or down respectively. The slider bar sets the speed of the stage motion.

Speed Bar – This slider control adjusts the speed for the two Z arrow buttons. Moving the slider to the right increases the speed for each button.

Engage – This button will automatically lower the Z stage at a safe speed until it detects the sample surface and stops.

Focus - This button will automatically lower the Z stage at a safe speed until it detects the sample surface and stop. The difference between Focus and Engage is that Focus uses the fixed setting regardless of the Scan Parameters Setting, but Engage uses the current Scan Parameters Setting

Using the Stage controls

To control the stage motion:

Left Click over the double arrow direction in which you wish to move. Hold down the mouse button to continuously move in the chosen direction.

Left Click the single inner arrow to move at half the speed of the large arrow pointing in the same direction. Hold down the mouse button to continuously move in the chosen direction.

To adjust the Stage speed of motion, Left Click the slider bar. Hold down the mouse button and move the mouse to the right to speed up the motion and to the left to slow down the motion.

Left Click on the slider bar arrows and holding down the button also slides the speed control bar in the corresponding direction (see Figure 4-2).

Engaging the Stylus

There are two methods to engage the stylus onto the sample surface: using the *Engage* button located on the Z stage control panel (see Figure 4-2), and pressing the *Scan* button in the *Video Window* (see Figure 4-1).

Using the *Engage* button:

1. Once the stylus is positioned over the sample, Left Click the Engage button in the Z Stage control panel and Left Click once. The *profiler* will automatically bring the stylus down onto the sample surface and stop.

2. If the stylus is not positioned correctly on the sample to make a measurement, Left Click on the Z-stage up arrow to move the stylus off the sample surface, and reposition the sample then re-engage the stylus.

Figure 4-3   Stylus Near Sample Surface
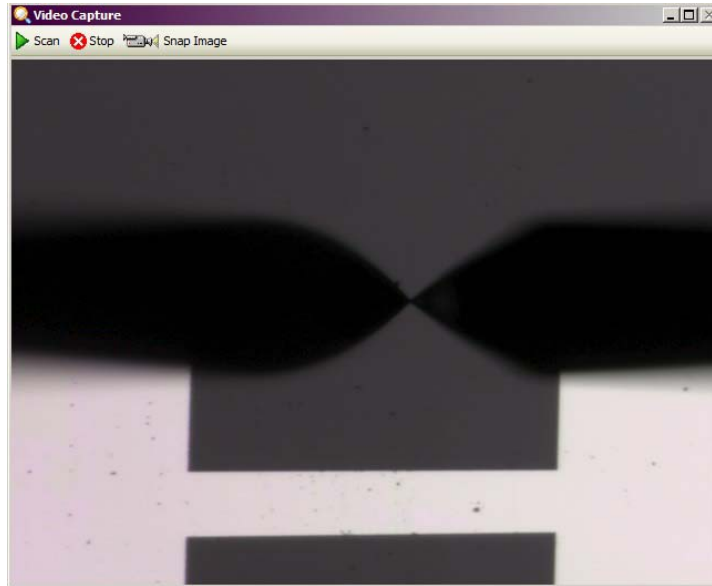
NOTE

Always raise the stylus off the sample surface before moving the sample to a different location. Failing to lift the stylus off the surface before moving the X-Y stage can damage the stylus and the sample.

Using the Scan button:

1. Once the stylus is positioned over the sample, Press the Scan button located in the *Video* window of the *Main* software screen. Once the Scan button is pressed the instrument will automatically engage the stylus on the sample surface and begin the scan. To Cancel the *Engage* or *Scan* the user can press the *Cancel* button located next to the Scan button in the *Video Window*.
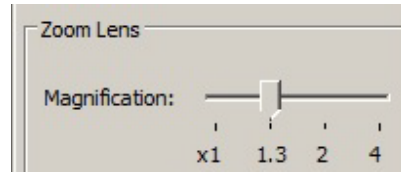
NOTE

Remember to raise the stylus off the sample surface and home the scan stage before repositioning the sample.

Magnifying the Sample Image

Figure 4-4   Lens Magnification Control

The user can magnify the sample video image to see more detail or make it easier to get a specific feature location. This zoom function is a digital zoom, and there are four zoom factors: 1x, 1.3x, 2x and 4x. After the zoom factor is selected, the software stores the factor for future usage.

Profiling a Sample

Getting a profile using the *AlphaStep Development Series* profiler is a very simple and straightforward process. Once the user understands what settings to choose for the Scan Parameters there is little else to getting scan data. The steps are as follows:

1. Load the sample

2. Position the sample under the video camera and focus on the area of interest

3. Press the Scan button. For 3D scans, the user will need to select a directory and input the file name after press the Scan button. After scan finishes, the 3D results are automatically saved.

4. Display the Profile. For 3D scans, after the scan finishes, Apex will automatically open with the scan image.

5. Save the results

Loading the Sample:

Follow the instructions for the appropriate profiler instrument, manual or motorized models in "Loading the Sample" above.

1. Open the stage cover

2. Place the sample on the stage. Align the sample so that the profile will be along the path of interest.

Note: The profile is scanned along the Y stage direction. The default direction is from the back to the front of the instrument, the –Y direction.

Position the Sample:

Follow the instructions for the appropriate profiler instrument, manual or motorized models in "Control Panel Tab" on page -52.

1. Either manually or with the motor controls, move the sample stage so the sample is under the video camera.

2. When you have roughly placed the sample under the camera, use the Z *Stage* controls to lower the stylus until you can see the stylus and sample in the *Video Window*.

NOTE

Do not bring the stylus down too quickly or you may crash the stylus into your sample surface and damage one or both of them.

3. Use the fine position controls, either manual or motorized depending on the profiler model, to adjust the sample under the stylus until it is in position ready for a measurement.

Set Scan Parameters:

Follow the instructions for choosing the appropriate Scan Parameters. See "Scan Parameter Tab" on page -37 more detailed information.

1. Select the Scan Parameter Tab on the bottom portion to be visible.

2. Select the scan parameters appropriate for the measurement

Press Scan Button:
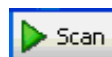
▶ Scan

1. Press the *Scan Button* located in the upper left corner of the *Video Capture Window*. For 3D scans, the software will ask the user to select the folder and input a file name for the 3D scan. The 3D scan result will be automatically stored after the scan finishes.

2. The stylus automatically lowers towards the sample surface until it engages the sample surface.

3. If the user does not Abort the scan by Pressing the Cancel button, the instrument will automatically begin the scan. The *Real Time Display* will show the profile as it is scanned.

4. When the scan is completed, the stylus lifts off the sample surface, the stage returns to its starting position above the start-of-scan location, and the *Data Display* window is opened with the profile plotted in dimensioned coordinates (see Figure 4-7). For 3D scans, the scan result is automatically open in Apex.

Display the Data:

For 2D scans, the profile is automatically displayed in a new Data Window after the scan is completed. For 3D scans, the final results will be automatically opened in Apex. The profile is ready for further analysis.

Save the 2D Profile:

1. From the Data Window Open the File drop-down Menu

2. Select Save *Data File* or Save As *Data File.* A dialogue box will appear.

3. Type the name of the file you want to save in the dialogue box and press enter.

Note: The AlphaStep Development Series profiler Application can be set to automatically save a profile after each scan. A description of the Auto File Name function is given in Chapter 3, "Description of Features," on page 19.

Profiling from a Scan Recipe

To profile a sample, the instrument moves the scan stage beneath the measurement head while the stylus rests on the sample. The up and down movement of the stylus is detected by a laser and provides the profile data.

The *Setup File* screen specifies how the stage moves and how the data is to be analyzed. The *Scan Parameters* Tab displays the settings for the scan speed, scan length, scan range, stylus force, maximum number of data points, and the profile type (only available on 100um and larger scan ranges).

"Scan Parameter Tab" on page 37 describes the technique for changing the scan parameters. Parameters should be changed, if needed, before initiating a scan. For this section, it is assumed that the scan parameters are already correctly set (see Chapter 3, "Description of Features", "Setting Scan Parameters" on page 37 for a description of the setup parameters).

Loading a Scan Script

The *Scan Scripts* are saved in a default directory in the *AlphaStep Development Series* profiler Application folder. In the software directory there is a Setup folder. All the scan scripts and sequence scripts are saved in this folder unless the user manually chooses another location.

Note: It is not recommended to use a different folder location for saving the Scripts.

To view *Scan Script* parameters you first have to load a *Scan Script*:

1. Application Window select the File drop-down menu

2. Select the *Load Scan Script*

3. A *Windows File Dialogue* box opens to the default directory.

4. Select the Scan Script you wish to view

5. The Scan Script parameters are automatically entered into the Scan Parameter Tab fields.

6. Review the Scan Parameter values and make changes if necessary before starting a scan.

To start Scan:

.

1. Press the *Scan* button located on the *Video Capture* Window.

2. The stylus descends to engage the sample surface. The Real Time Scan *Display* (located on the *Main* software screen below the *Video* image window) shows a trace as it is generated.

3. When the scan is completed, the stylus lifts, the stage returns to its starting position above the start-of-scan location, and the *Data Display* window is opened with the profile plotted in dimensioned coordinates (see Figure 4-8). 3D scan result is automatically opened in Apex.

Note: The trace runs off scale or is not horizontal, refer to "Manual Stage Leveling" on page 65.

To abort a scan:

There are two ways to stop a scan once it is started; Press the Stop button on the top left corner of the Video Window or Press ESC on the keyboard.
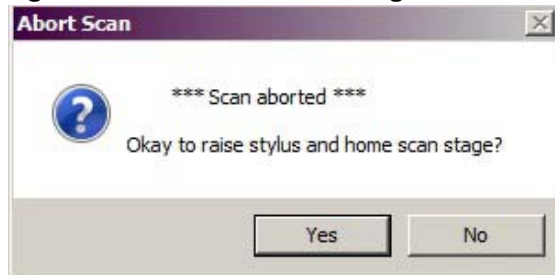

NOTE

The scan can only be stopped after the stylus is engaged and the stylus has started moving.

After pressing the *Stop* button or the *ESC* key on the keyboard a message will be displayed asking the user "Scan aborted. Okay to raise the stylus and home the scan stage?"

Figure 4-5   Abort Scan Message Box

If you choose "No", to lift the stylus off the sample surface:

• Left Click on the Z Control panel "up" arrow. Click once to disengage the tip off the sample surface then raise the Z stage up a short distance to allow safe positioning of the sample under the stylus tip.

• Make sure that in the video view *and/or visually*, the tip is clearly above the sample surface.

Reading the Cursors, Saving, and Printing Data

Figure 4-6   Sample Data Window
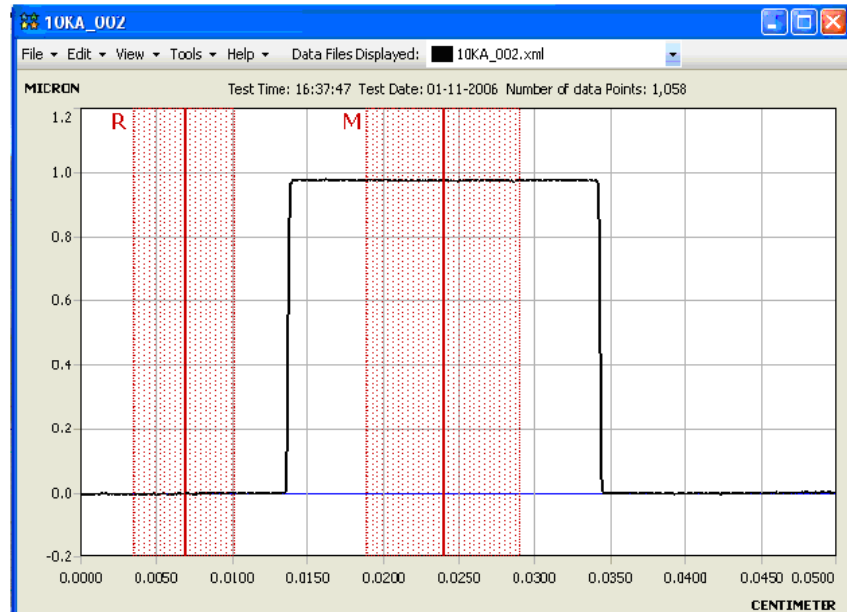
After the scan is taken, a new *Data* Window displays the profile. The profile appears in the graph display; the *Data Control* Tab is automatically opened along the right side of the Application Window. The Data Control Tab displays the cursor information and leveling controls (more detailed description of the Data Control Tab is given in).

Reading the Cursors

The Cursor positions are displayed in real-time in the Data Control Tab. There are always a set of Primary cursors displayed in a Data Window, the Reference and *Measurement* cursors (R and M respectively).

To Move The Cursors:

• To move the R cursor, position the mouse on the R cursor, Left Click and hold the button. Move the mouse right or left to reposition the cursor in a desired location.

• To move the M cursor, position the mouse on the M cursor, Left Click and hold the button. Move the mouse right or left to reposition the cursor in a desired location.

• The Delta Width and Delta Height calculate the difference or X distance between the two cursors and the difference or Z height respectively where the cursors intersect the profile.

The *Delta Width* - The horizontal distance between the R and M cursors (See Figure 4.7) along the X axis.

The *Delta Height* – The vertical distance between the R and M cursors (See Figure 4.7) where they intersect the profile along the Z-axis.

Figure 4-7   Data Control Tab with Cursor Information
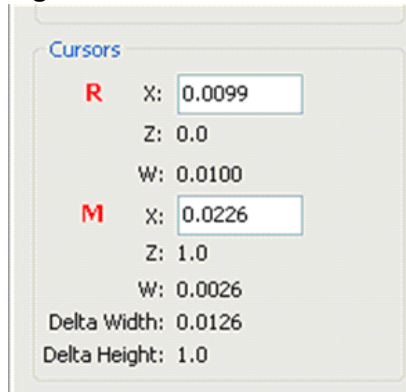
Printing Data

1. From the Data Window, Left Click the File drop-down menu.

2. Left Click on *Print Graph. A Standard Windows Print Dialogue* box opens.

3. Select a printer and make any necessary changes to the printer settings before continuing.

4. Press the *Print* button

5. The current view of the profile data is sent to the default printer.

**Note: You can also review the profile before printing in the Print Preview page.**

Saving Data

1. From the Data Window, Left Click the *File* drop-down menu.

2. Left Click on *Save Data File*. A dialogue box will appear.

3. Type the name of the file you want to save in the dialogue box and press *Return*.

Manual Stage Leveling

Figure 4-8   Front View Of Stage With Tilt Control Knob

**Stage Tilt
Adjustment Knob**
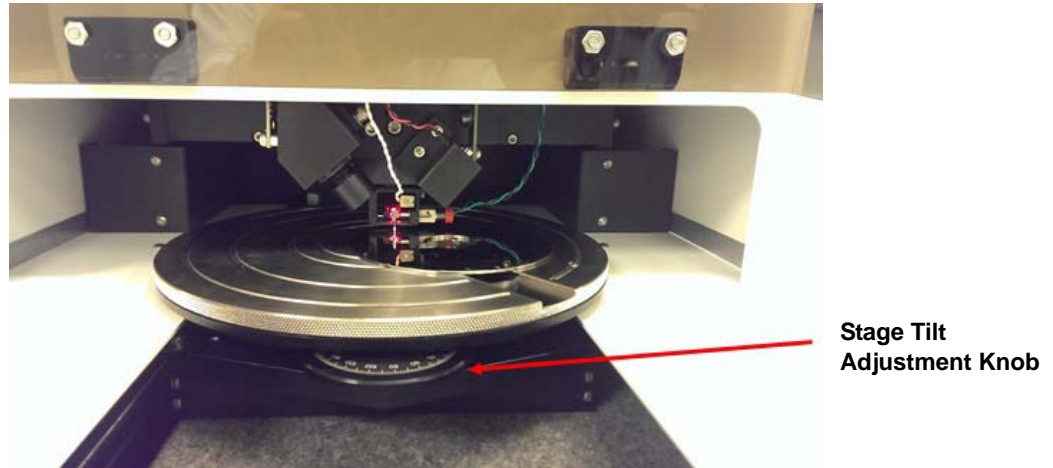
When making profile measurements toward the front or back of the stage, you may notice a significant tilt so that the profile displayed in the Real Time Scan Display window is at a severe diagonal or even clipped by moving off scale (getting clipped). This can be adjusted with the tilt adjustment. The stage has an adjustment along the scan direction. This adjustment dial changes the tilt along the Y-axis (toward or away from the front door panel of the stage). Below is a description for adjusting the stage in the case of the profile that tilts uphill.

Note: It is assumed that in the description that the sample being measured is placed in the center of the stage.

The stage tilt adjustment knob is in the front of the sample stage see Figure 4-8 above).

• Turning the knob clockwise moves the front of the stage up.

• Turning the knob counter-clockwise front of the stage down.

Adjusting stage tilt using the *Real Time Scan Display*:

Position the stage and measurement head to take a scan.

Scan a sample.

Watch the Profile trace in the *Real Time Scan Display* window.

Adjust the Stage tilt using the following:

• If the profile is tilting upwards from left to right, turn the adjustment knob in the clockwise direction to level the scan, counter clockwise if the profile is tilting downward.