RAM Optical Instrumentation

RAM

A Quality Vision International Company

eBx™

Fast Start Guide

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The software described in this manual is based in part on the work of the Independent JPEG Group.

Sixth Printing 10-2009 Part Number 795050

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1. Introduction

1.1 Overview

This *Fast Start Guide* explains how to create and use eBx routines. It describes:

- User interface design
- Available software tools
- How to get started
- How to set up a part for measurement
- How to measure/construct features
- How to create/edit/run a routine
- How to output measurements

This manual is current with version 4.2.x of the eBx software and is meant to be a quick overview. It is not intended as a substitute for more detailed documentation such as the *eBx Reference Guide* (P/N 795051) and *eBx on-line Help*, or for eBx training.

1.2 Technical Support and Customer Service

RAM Optical Instrumentation, Inc.

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1175 North Street
Rochester, NY 14621, USA

- Toll Free Support: 877-764-6397
- Email: *sales@ramoptical.com*
- Internet: *www.ramoptical.com*

1.3 Related Documentation

- *eBx Reference Guide* (P/N 795051)

1.4 Documentation Conventions

To help you locate, interpret, enter or select information easily, this manual uses consistent visual cues and standard text formats. The documentation conventions are explained in the following table.

Type Style or Symbol	Used for	Examples and Explanations
Bold or *italic*	• Emphasized words	• Do **not** repeat this step • Select the *highest* magnification level
Bold, sans-serif typeface	• Commands to be typed • Keys to be pressed • Menu items to be selected • Buttons to be pressed	• Type **exit** • Type the following command, then press **Enter** • Select **Reset** from the **System** pull-down menu • Press the **Stop** button
Initial caps	• Proper nouns • Product names • Sections, figures	• Use the Measure Circle function • eBx • See Section 3
ALL CAPS	• Acronyms	• ASCII; RAM

1.5 Software Security

Since you have a license to operate the system software (you do not own it), system operation requires a software security dongle and associated license file. The software will operate only if these two security components are in place.

The software security dongle is a hardware security device that prevents unauthorized use of protected software and its options. The dongle is shipped with the manufactured system or with separately-purchased software updates and options. The dongle has a corresponding license file for each protected application.

The license file contains information pertinent to the options that are enabled on your system, and is created for use with the dongle that has been programmed specifically for your system.

The dongle must be securely plugged into an addressable USB port on the system computer, and its accompanying license file(s) must be present in a specific directory.

You cannot launch and use the software when either the dongle or license file is not present. In the absence of a properly programmed dongle, or its accompanying license file, the system displays appropriate error messages that inform you that the application or option is not enabled, that the dongle is not addressable, or that the dongle or license file could not be found (note the error message that appears and then refer to *Troubleshooting Software Security* in the *eBx Reference Guide*).

A new license file (not dongle) is required for each major release of the applications and options that it is supplied for (for example, eBx Rev. 3, eBx Rev. 4, etc.).

Note: The dongle will enable only the associated maintenance and minor releases. This means that a minor release (for example, revision 3.01) will run with the dongle issued for its major release (for example, revision 3).

Note: Refer to *Troubleshooting Software Security* in the *eBx Reference Guide* (P/N 795051) if you have trouble accessing software that is protected with the software security dongle and license file.

Note: To ensure the software has full access to the required license file, do not deny read or write permission to the C:\Program Files\QVI\QVI License Manager\License Files directory or any files in this directory.

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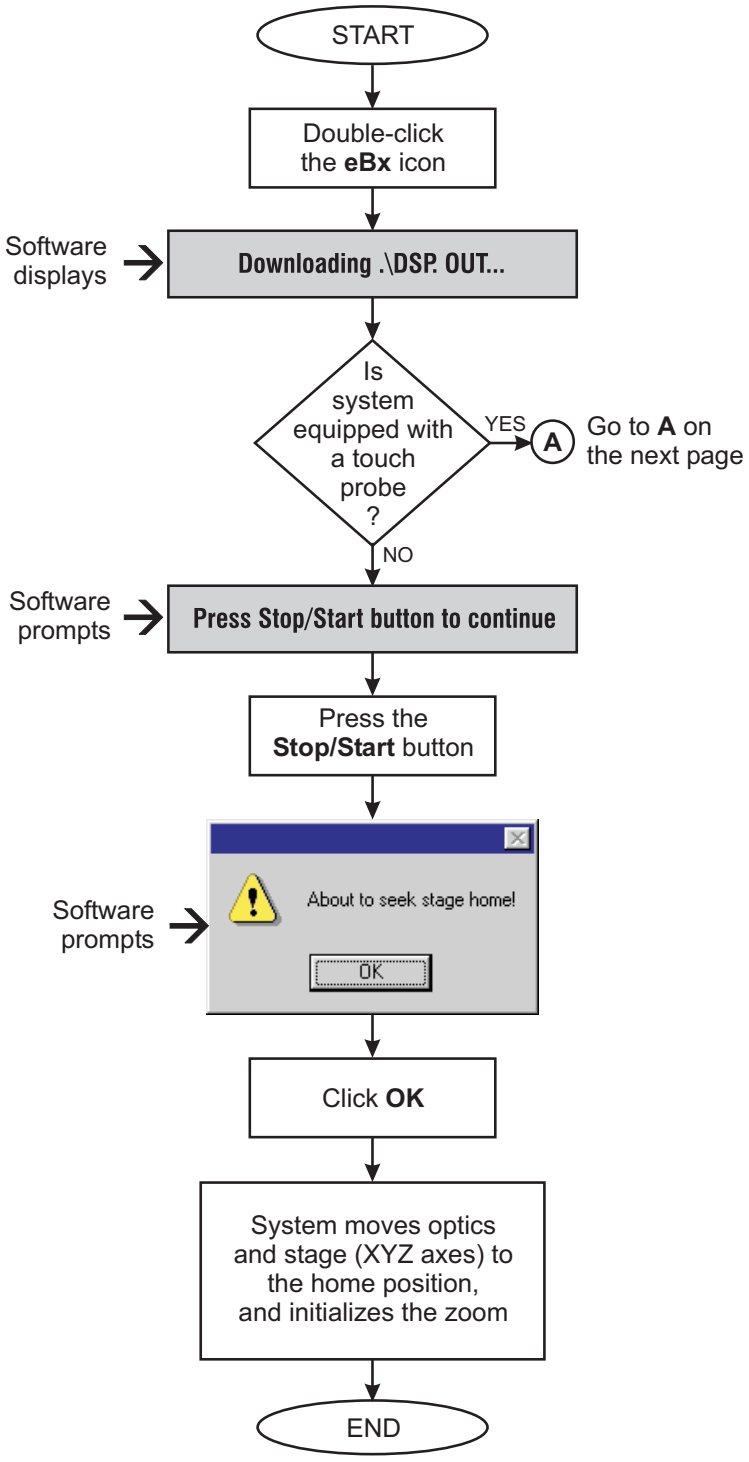
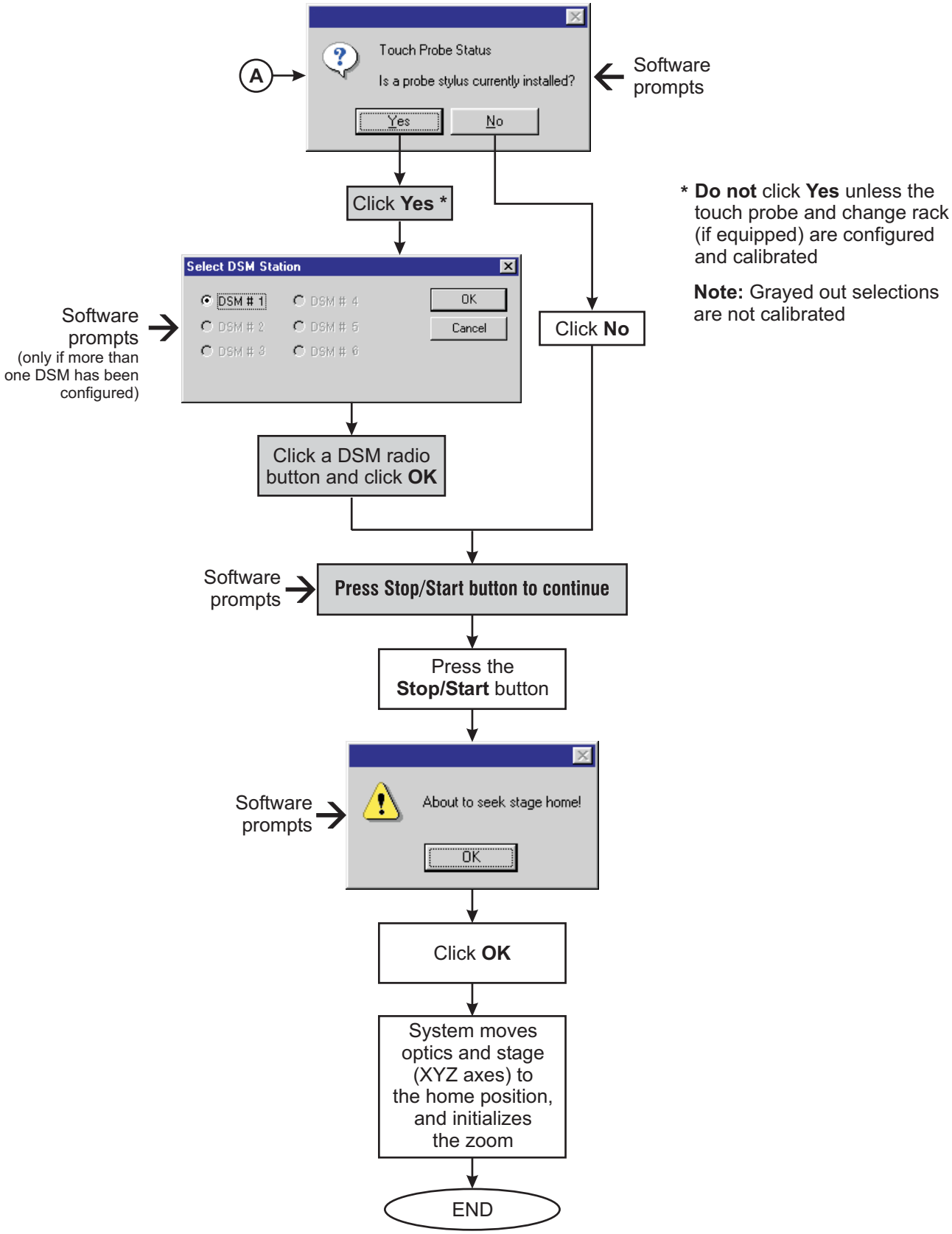
2. Launching the Software





* **Do not** click **Yes** unless the touch probe and change rack (if equipped) are configured and calibrated

Note: Grayed out selections are not calibrated

3. User Interface

3.1 Mouse Controls

Use the mouse to move the cursor to the desired location. Press the left button once and release it to select an item. For example, when you select Targets in the main menu, the Targets menu appears. Then you can select a menu item.

Note: Do not configure the mouse buttons to do other functions because this may interrupt the operation of the measurement software.

3.1.1 Mouse Functions in the Image Window

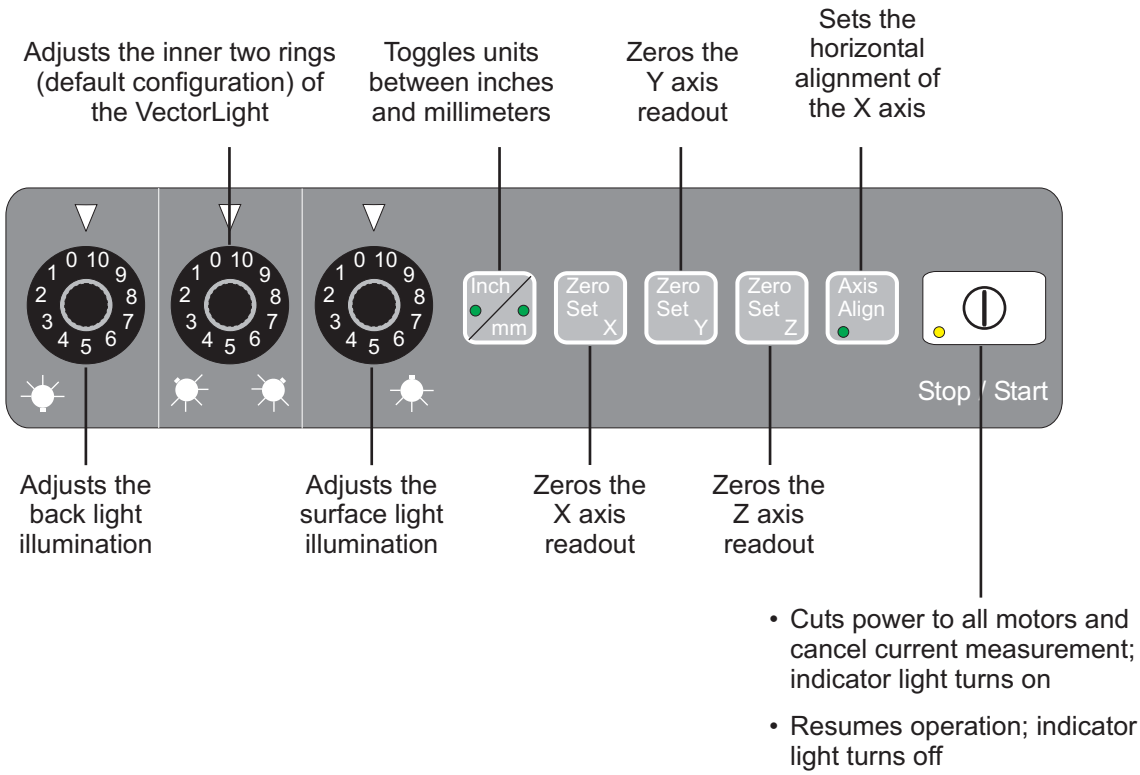
To…	Do this....
Change the size of the displayed tool or target	1. Position the mouse cursor in the Image window. 2. Press and hold the left mouse button while dragging the border of the displayed tool or target. 3. Release the left mouse button when finished.
Fine adjust the stage position	1. Position the mouse cursor in the Image window. 2. Press and hold the right mouse button while moving the mouse. 3. Release the right mouse button when finished.
Move the stage (requires 3-button mouse)	1. Position the mouse cursor in the Image window. 2. Press and hold the middle mouse button while moving the mouse cursor away from the center of the Image window. The stage moves faster as you move the cursor farther from the center of the Image window. 3. Release the middle mouse button when finished.

To…	Do this....
Raise or lower the Z axis assembly (requires 3-button mouse)	1. Position the mouse cursor in the Image window. 2. Press and hold the **Ctrl** key on the keyboard 3. Press and hold the middle mouse button while moving the mouse cursor toward the top or bottom of the Image window. The Z axis moves faster as you move the cursor farther from the center of the Image window. 4. Release the middle mouse button and the Ctrl key when finished. **Note:** If the mouse is equipped with a scroll wheel, you can raise and lower the Z axis by rotating the wheel.

3.1.2 Mouse Functions in the Model Window

Button	Function
Left	• Click to select features or icons • Hold the button down and drag the mouse up to zoom the entire model up • Hold the button down and drag the mouse down to zoom the entire model down • Zoom in on a specific area by holding the button and key down and dragging the cursor diagonally to draw a box around the desired area
Middle (if equipped)	• Pan (move) the entire model in any direction by holding the button down and moving the cursor in the desired direction
Right	• Rotate the entire model around the view origin by holding the button down and moving the cursor: – Left/right to rotate the model around the Z axis – Up or down to rotate the model about the horizontal screen axis

3.2 Front Panel Controls



Notes:

1. Similar controls are available in the software user interface. See *Digital Readout (DRO) Window* on page 3-14 and *Software Illumination Controls* on page 3-19 for more information.
2. Turning an illumination control knob on the front panel automatically adjusts the corresponding illumination control dial in the software user interface, but not vice versa.

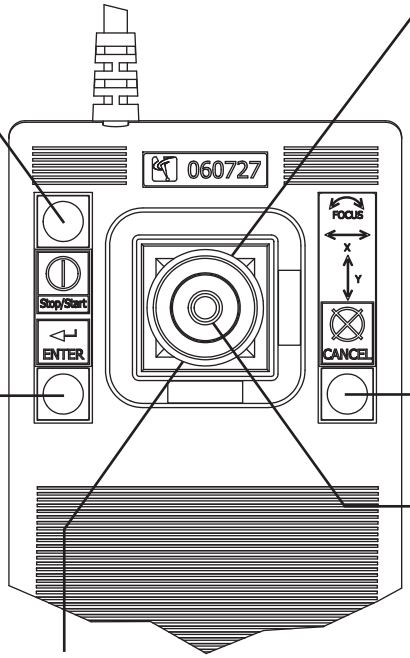
3.3 Joystick Controls

Press **Stop / Start** to:

- Stop all stage motion and put the system in Stop mode
- Take the system out of Stop mode and resume normal operation

Press **Enter** to accept a measured point

(used only with manual targets, focus tool and strong edge finder)



- To raise the Z-axis assembly and change the focus, twist the knob to the right (clockwise)
- To lower the Z-axis assembly and change the focus, twist the knob to the left (counterclockwise)

Press **Cancel** to delete a measured point

To change the magnification, press and hold the button on top of the joystick while twisting the joystick knob

To move the stage:

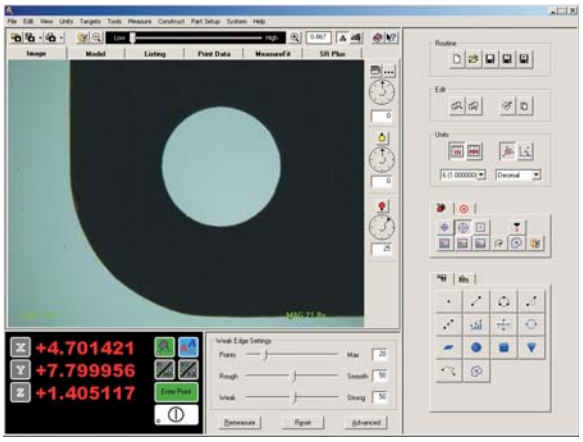
- Move the lever to the **left** or **right** to drive along the X axis
- Move the lever **up** or **down** to drive along the Y axis
- Increase the speed by moving the lever farther from the center

3.4 Screen Layouts

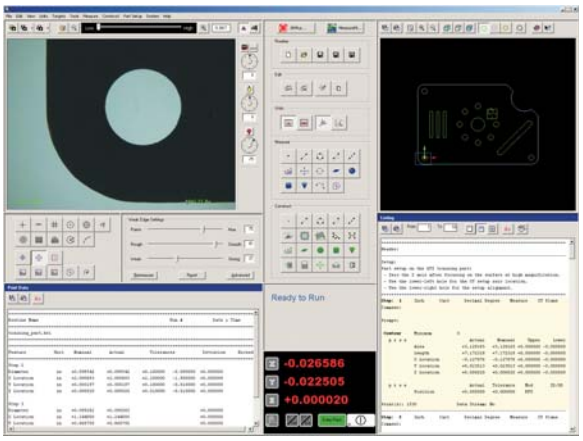
eBx supports three user interface types depending on how the software is configured and the type and resolution of the system monitor(s). The screen layout varies depending on how the user interface is configured:

Note: Widescreen monitor support for the Single Monitor User Interface and Dual Monitor User Interface is only available in eBx version 3.5 or higher.

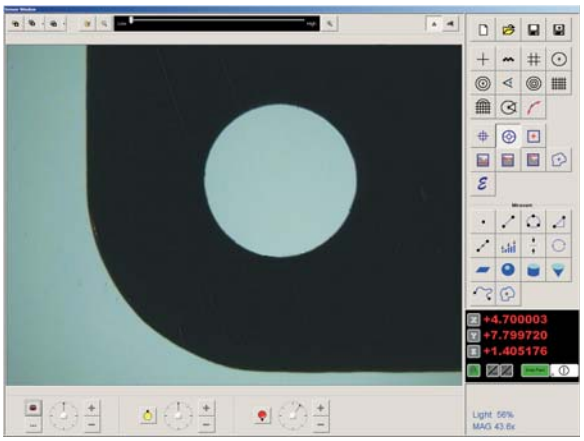
- **Standard User Interface**—traditional tabbed interface, already familiar to users who currently have version 1 or version 2 of the software. This interface will only display on the screen at 1024 x 768 pixel resolution, regardless of the current screen resolution.

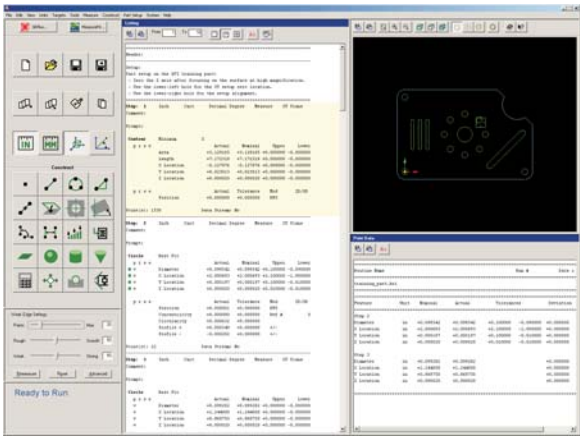


- **Single Monitor User Interface** (optional)— displays all the tools and windows at the same time on a single screen. This user interface requires a monitor capable of:
  - 1600 x 1200 pixel resolution [4:3 aspect ratio monitors]
  - 1680 x 1050 pixel resolution [16:10 aspect ratio monitors]
  - 1920 x 1080 pixel resolution [16:9 aspect ratio monitors]



- **Dual Monitor User Interface** (optional)—separates the tools, controls, and windows onto two video monitors. One monitor displays the Image window, illumination controls, File icons, Manual Target icons, Automatic Tool icons, Measure icons, and DRO window. The second monitor displays the Model window, main menu, File icons, Edit icons, Unit icons, Construct icons, Tool & Target Settings window, Print Data window, and Listing window. Some windows can be resized and moved. This user interface requires two monitors capable of:
  - 1600 x 1200 pixel resolution [4:3 aspect ratio monitors]
  - 1680 x 1050 pixel resolution [16:10 aspect ratio monitors]
  - 1920 x 1080 pixel resolution [16:9 aspect ratio monitors]





Note: The screen layout for the Dual Monitor User Interface varies slightly depending on the aspect ratio of the monitors used. For example, when using 4:3 aspect ratio monitors, the illumination controls appear below the Image window. However, when using 16:10 or 16:9 aspect ratio monitors the illumination controls appear on the right-hand side of the Image window.

3.4.1 Standard User Interface

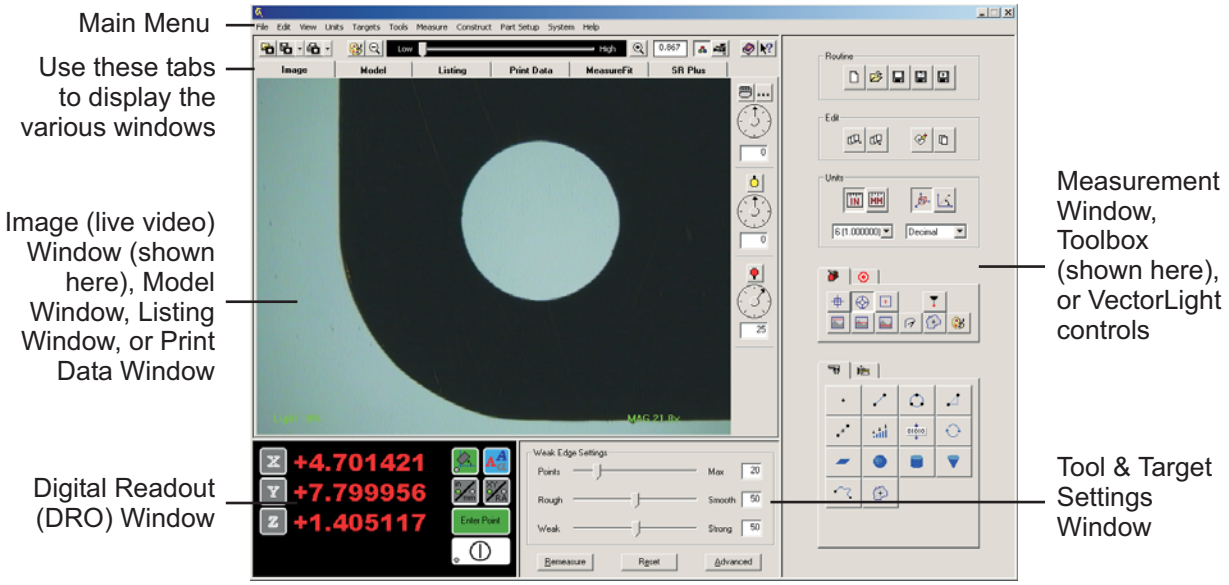


Figure 3-1. Screen Layout - Standard User Interface

3.4.2 Single Monitor User Interface (Optional)

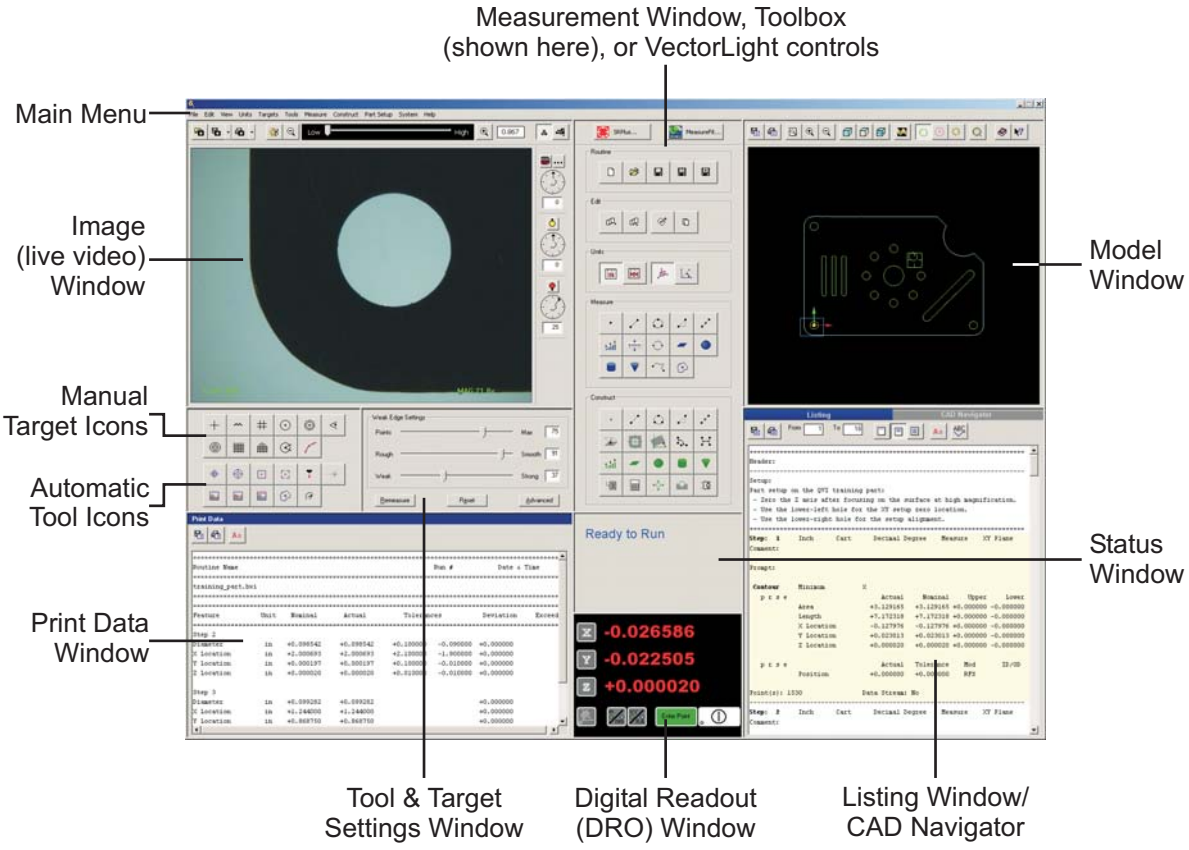


Figure 3-2. Screen Layout - Single Monitor User Interface

3.4.3 Dual Monitor User Interface (Optional)

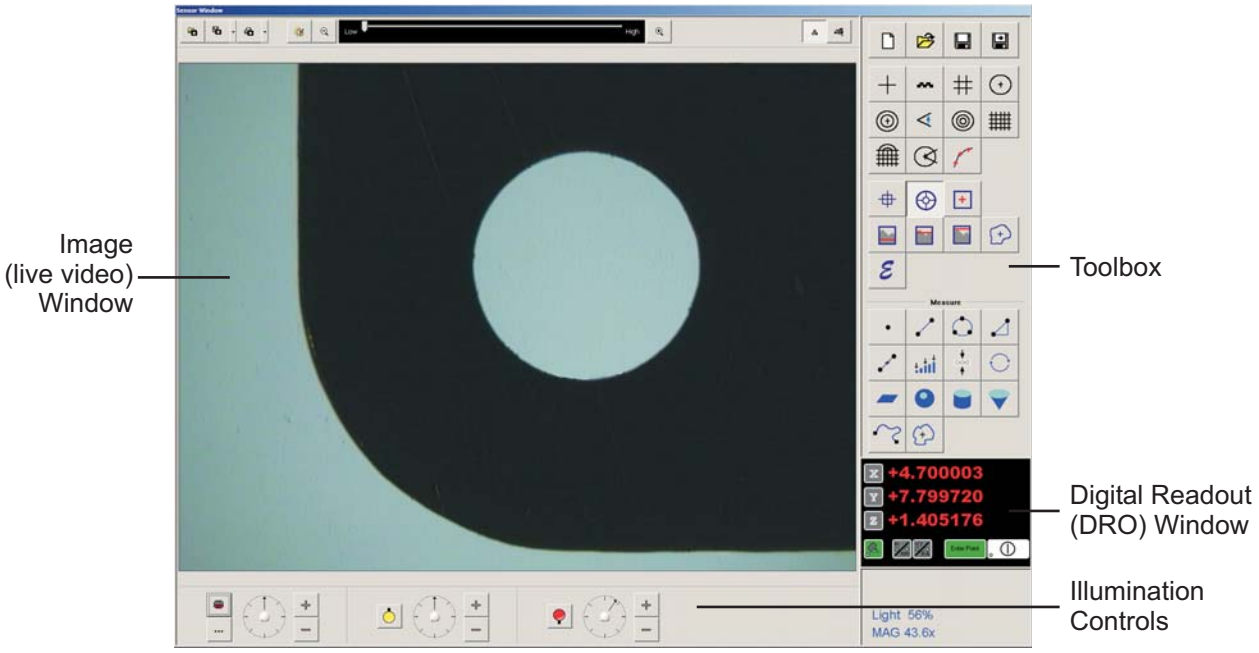


Figure 3-3.
Screen Layout (4:3 Aspect Ratio Monitor Shown) - Dual Monitor User Interface (Monitor 1)

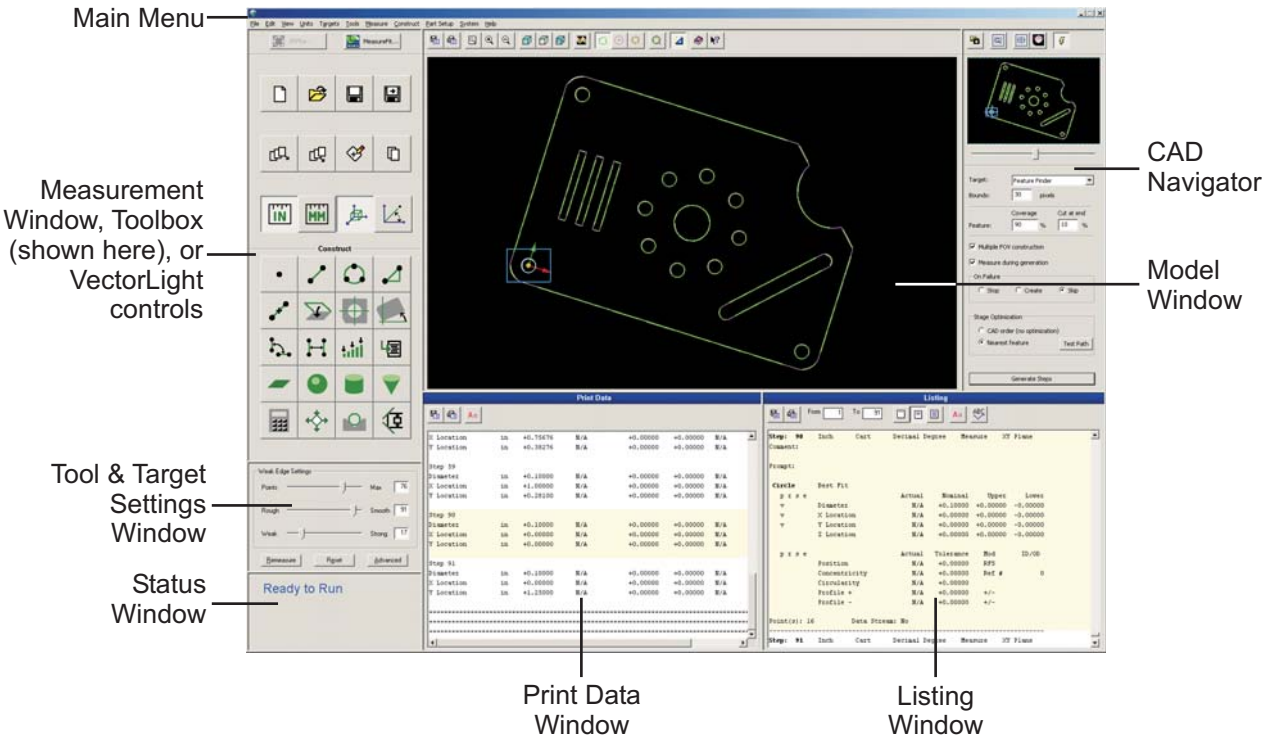
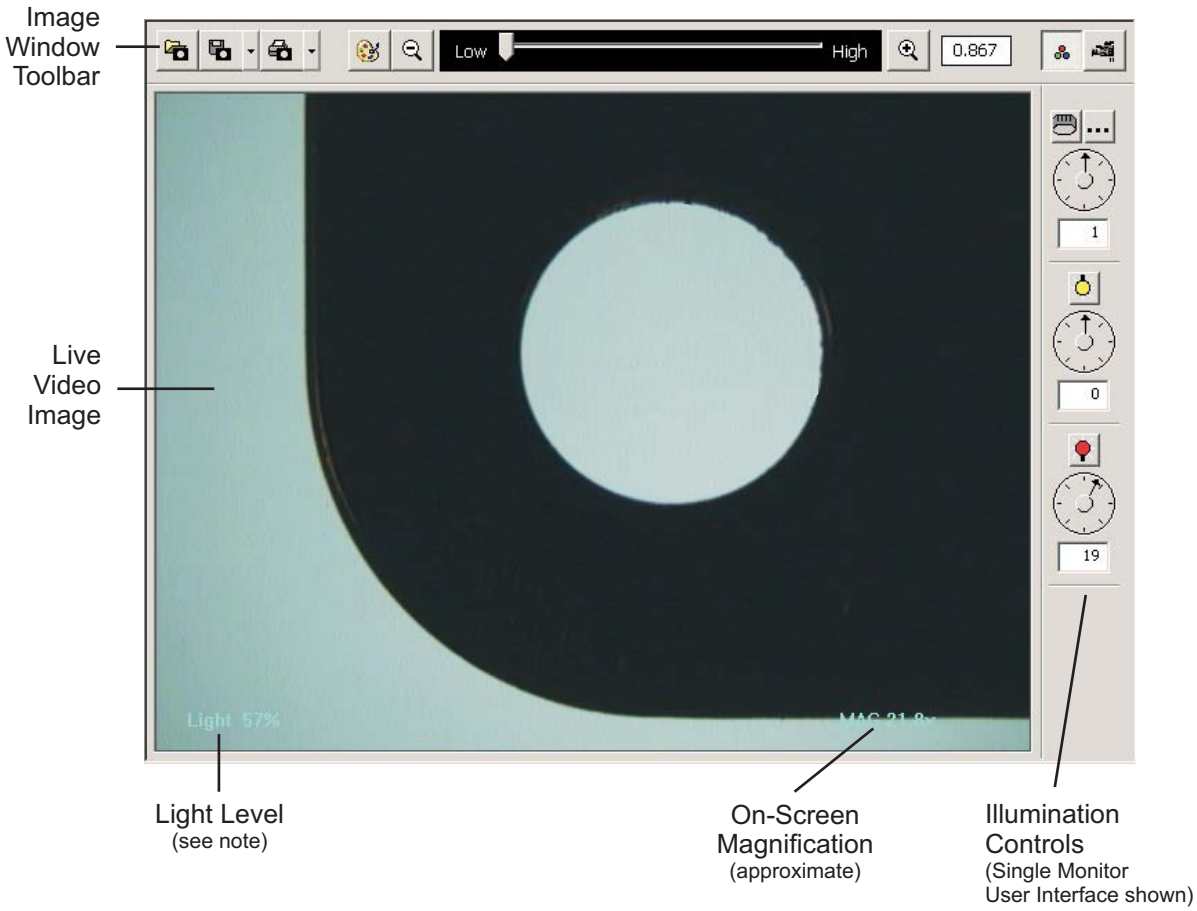


Figure 3-4.
Screen Layout (4:3 Aspect Ratio Monitor Shown) - Dual Monitor User Interface (Monitor 2)

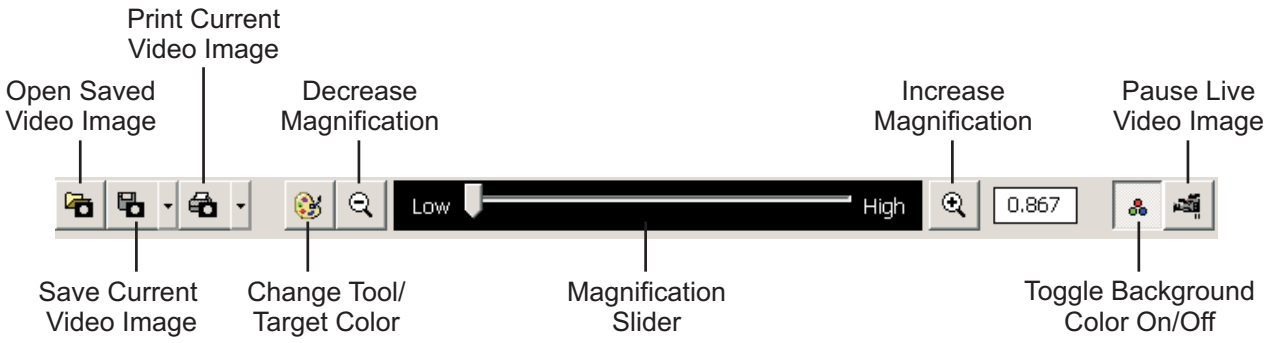
3.5 Image Window

The Image window shows the live video image of the part.



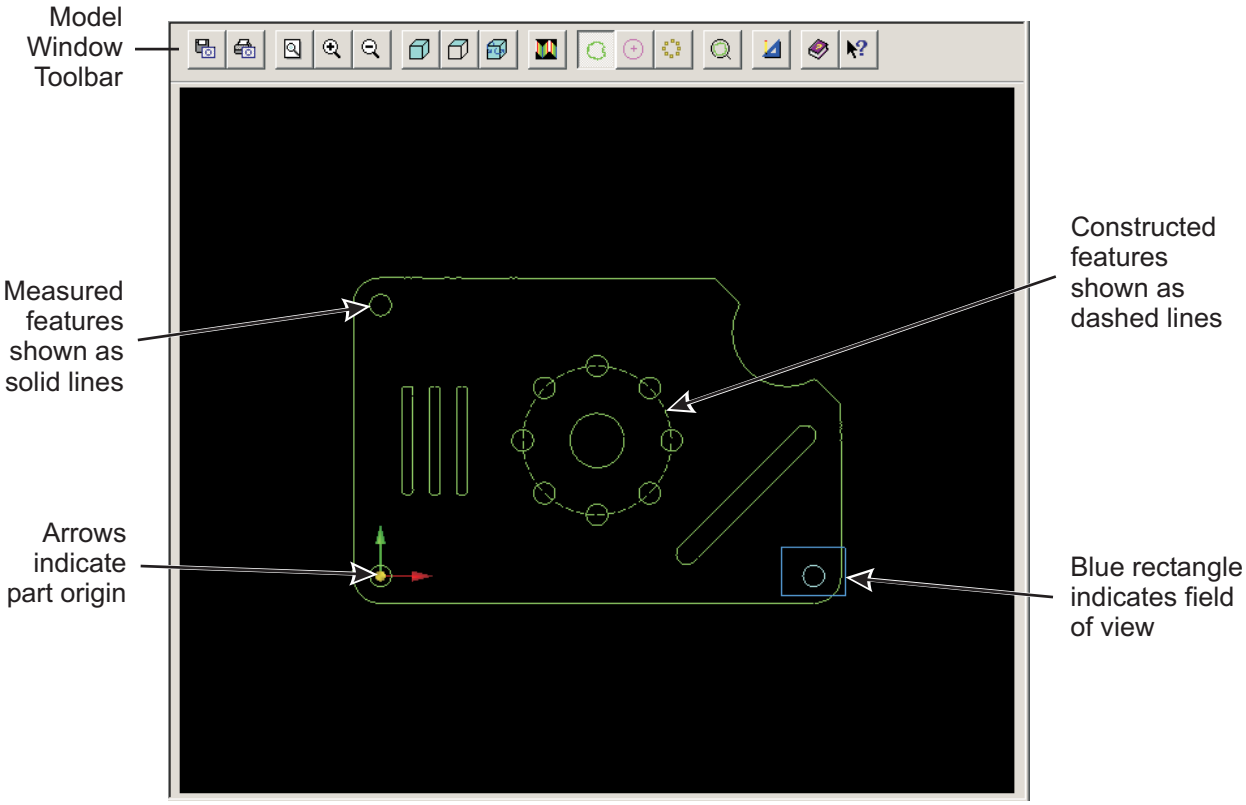
Note: The light level is measured at the mouse cursor location in the Image window. When using any of the edge analysis tools, a light level of approximately 45% is recommended.

Image Window Toolbar

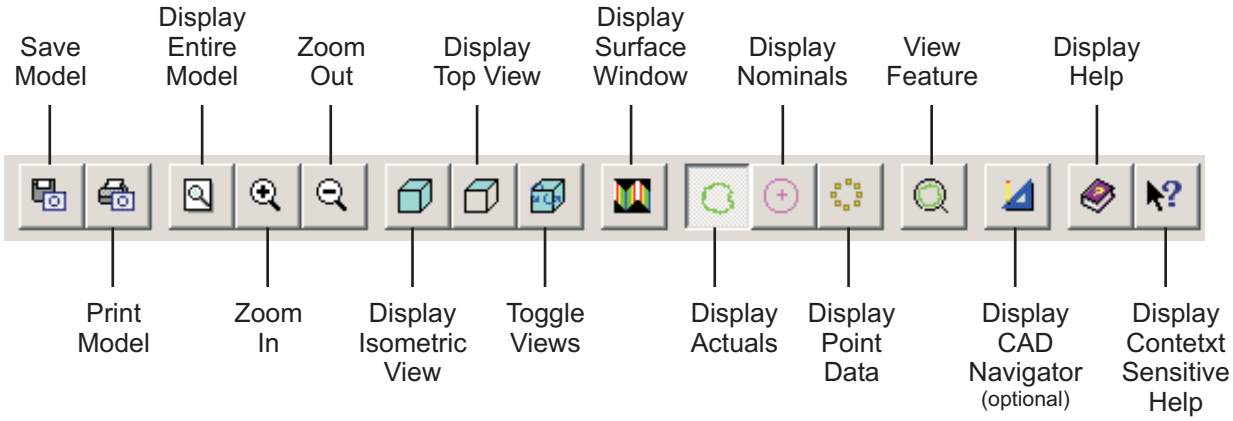


3.6 Model Window

The Model window displays a CAD-like sketch of the measured and constructed features. The model is always drawn to reflect the current datum system.

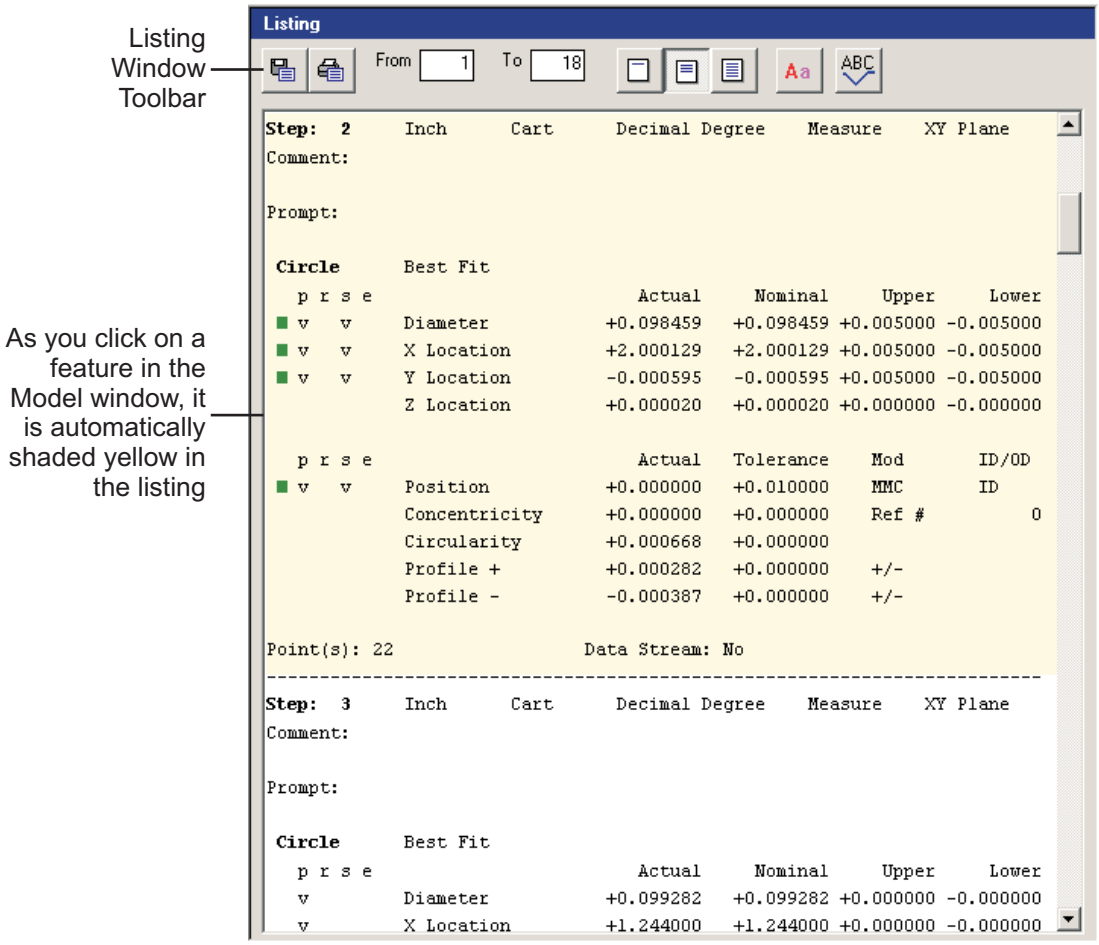


Model Window Toolbar

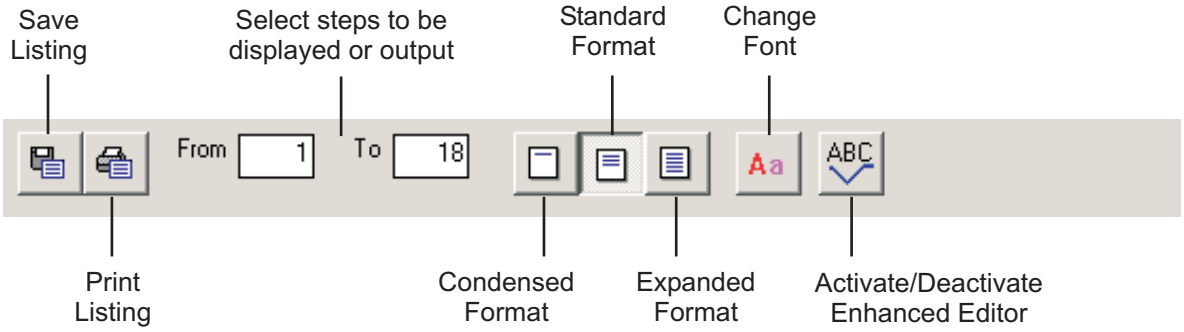


3.7 Listing Window

The Listing window displays all of the steps in the current routine.



Listing Window Toolbar

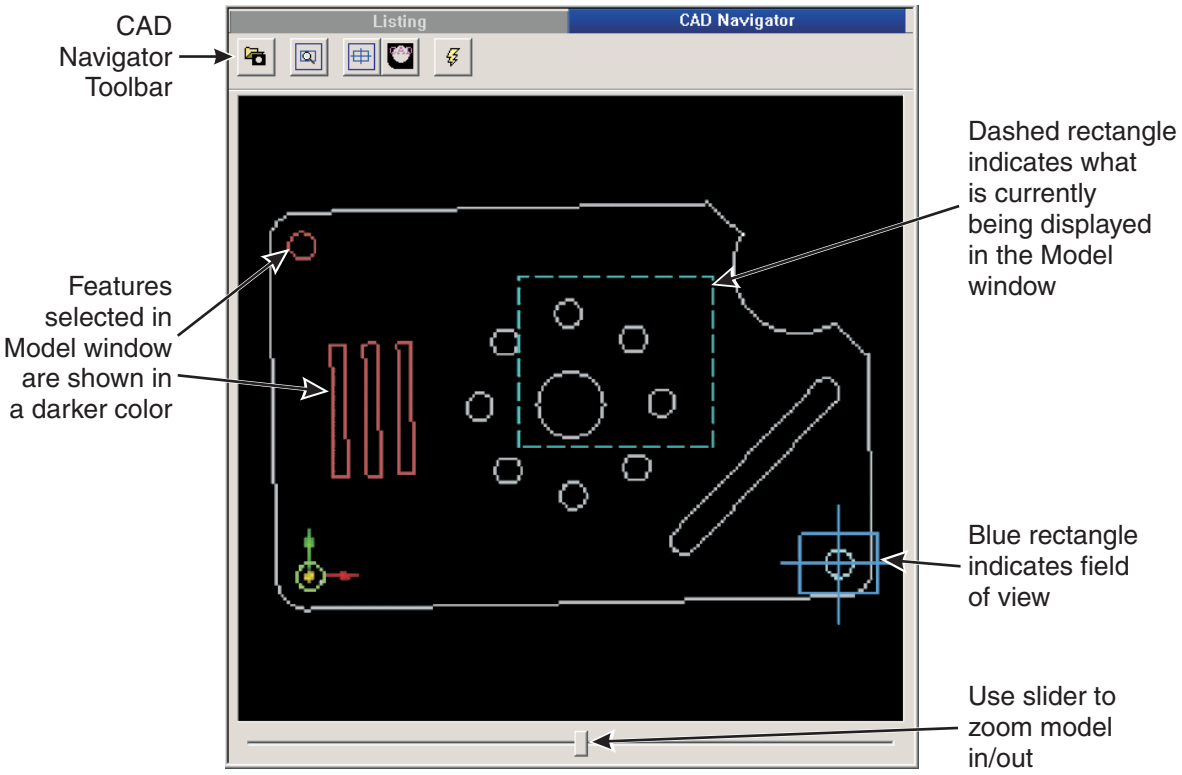


3.8 CAD Navigator (Optional)

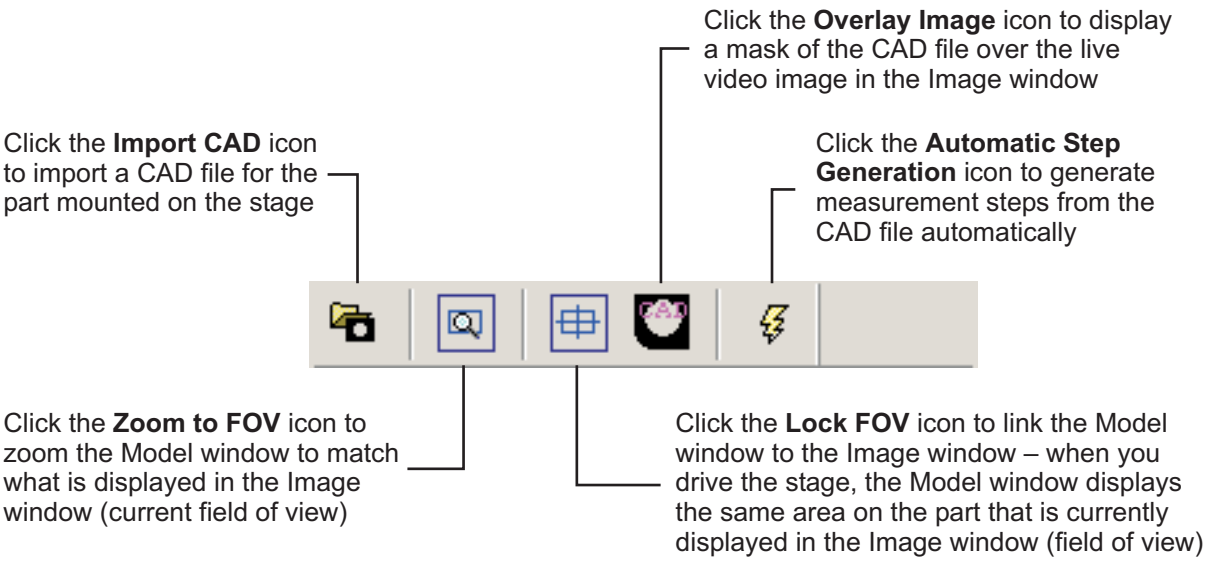
Click  in the Model Window toolbar or click the CAD Navigator tab (Single Monitor User Interface) to display the optional CAD Navigator, which is dynamically linked to the Model window. Use the CAD Navigator to import a CAD file and generate measurement steps automatically.

Notes:

1. The CAD Navigator is only available if the system is configured to display the Single Monitor User Interface or Dual Monitor User Interface.
2. Refer to Section 8 for more information about the CAD Navigator.

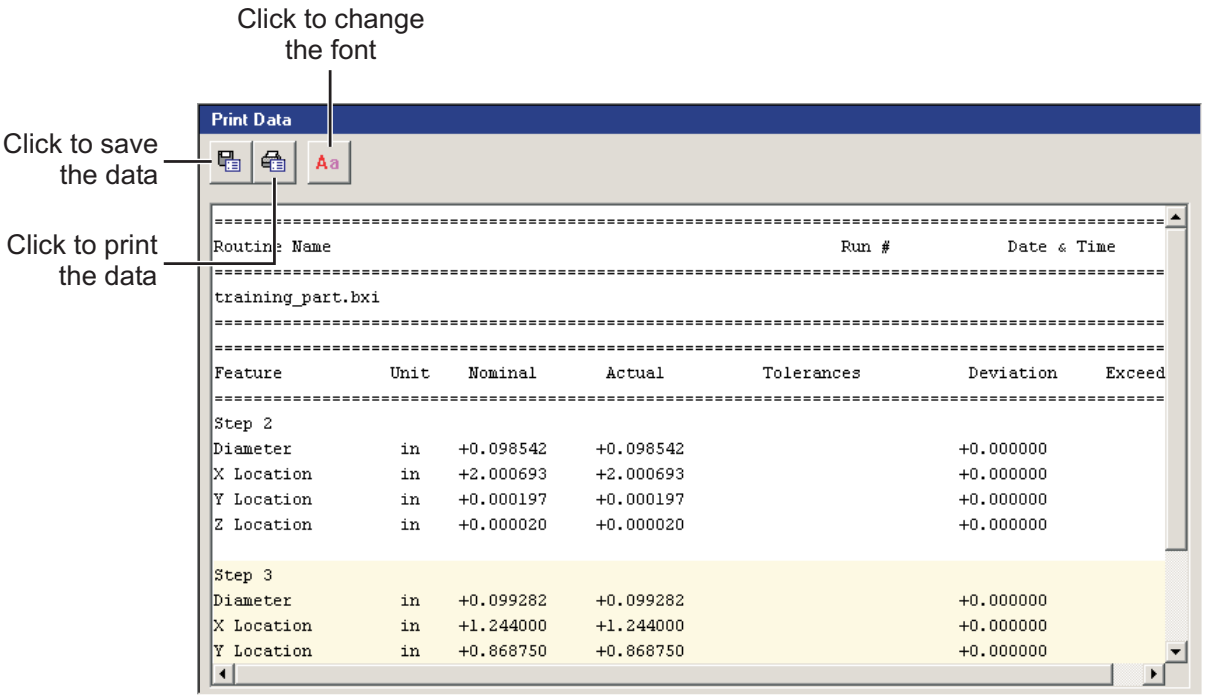


CAD Navigator Toolbar



3.9 Print Data Window

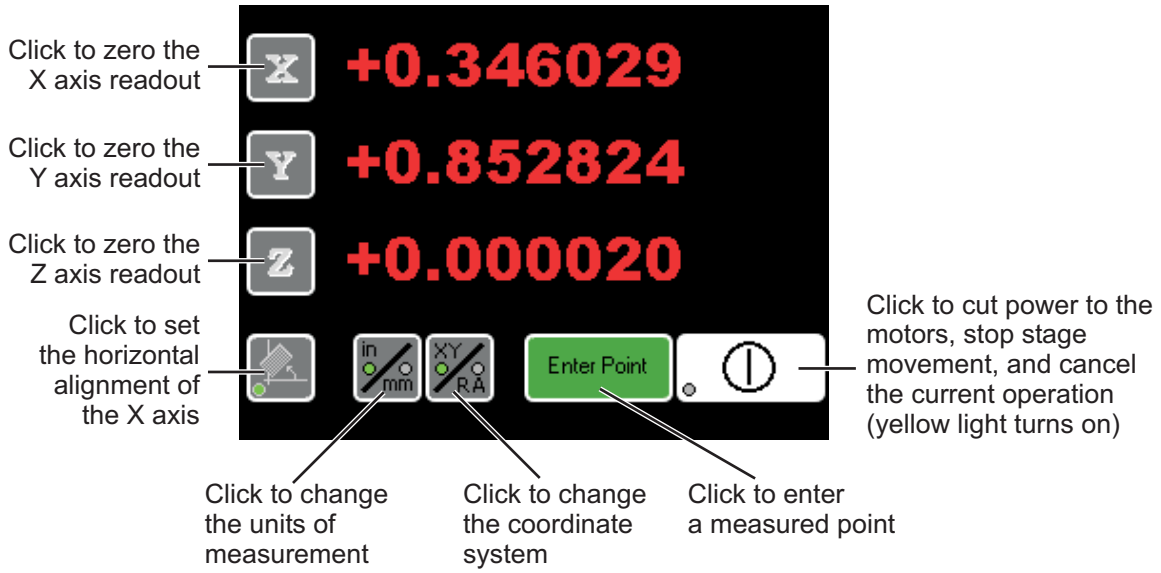
The Print Data window displays the measurement results that were selected for output in the measurement step.



3.10 Digital Readout (DRO) Window

The DRO window shows the following information:

- Current location of the stage (centerline intersection in the Image window)—the location is reported in the X, Y, and Z axes (or R, A, ad Z axes if polar coordinates are selected)
- Whether the axis alignment is activated (indicated by a green light)
- Current units of measurement and coordinate system (indicated by a green light)
- Whether the system is in Stop Mode (indicated by a yellow light on the Stop/Start button)—the stage and Z axis transport cannot be moved when the light is on

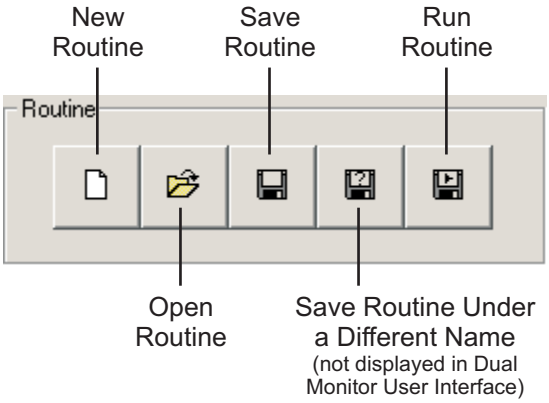


3.11 Toolbox

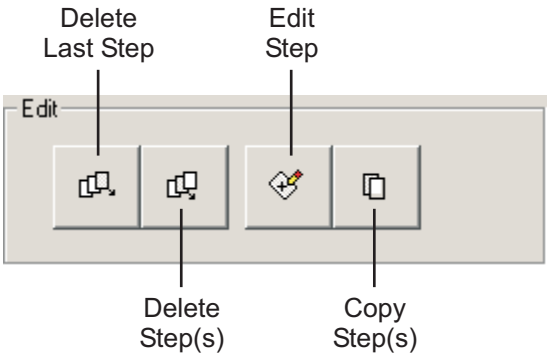
The toolbox includes icons in related functional groups that correspond to the functions in the File, Edit, Units, Targets, Tools, Measure, and Construct menus.

Note: The appearance of the toolbox and the location of the toolbox icons varies depending on how the user interface is configured.

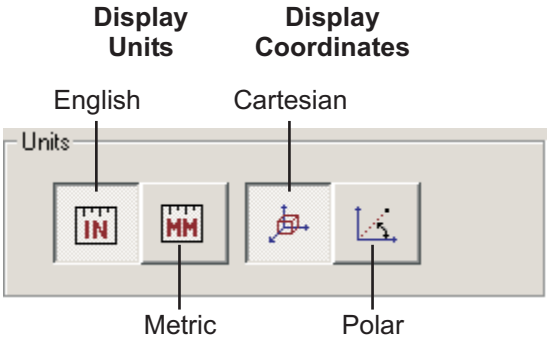
3.11.1 Measurement Routine Icons



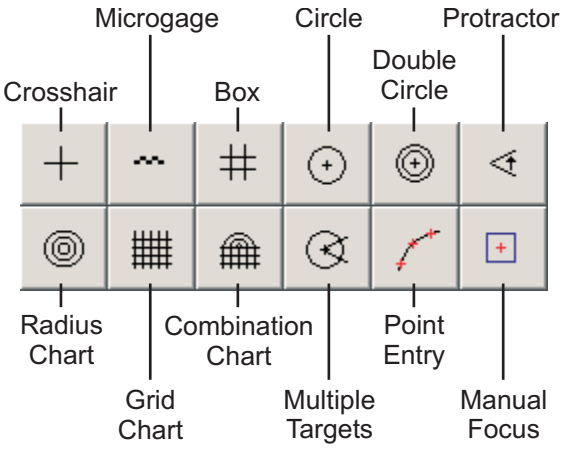
3.11.2 Routine Editing Icons



3.11.3 Measurement Units Icons

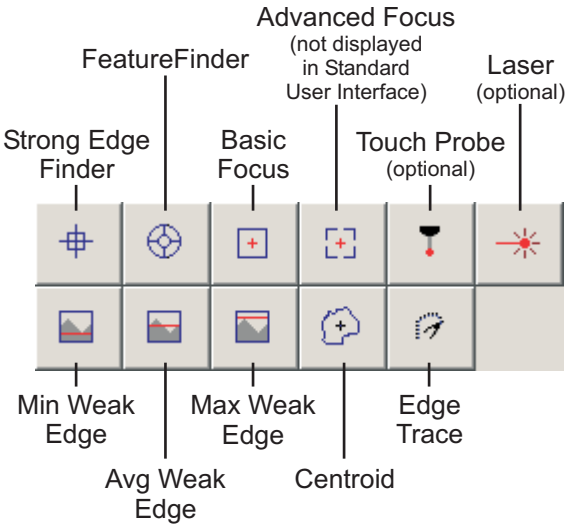


3.11.4 Alignment Target Icons



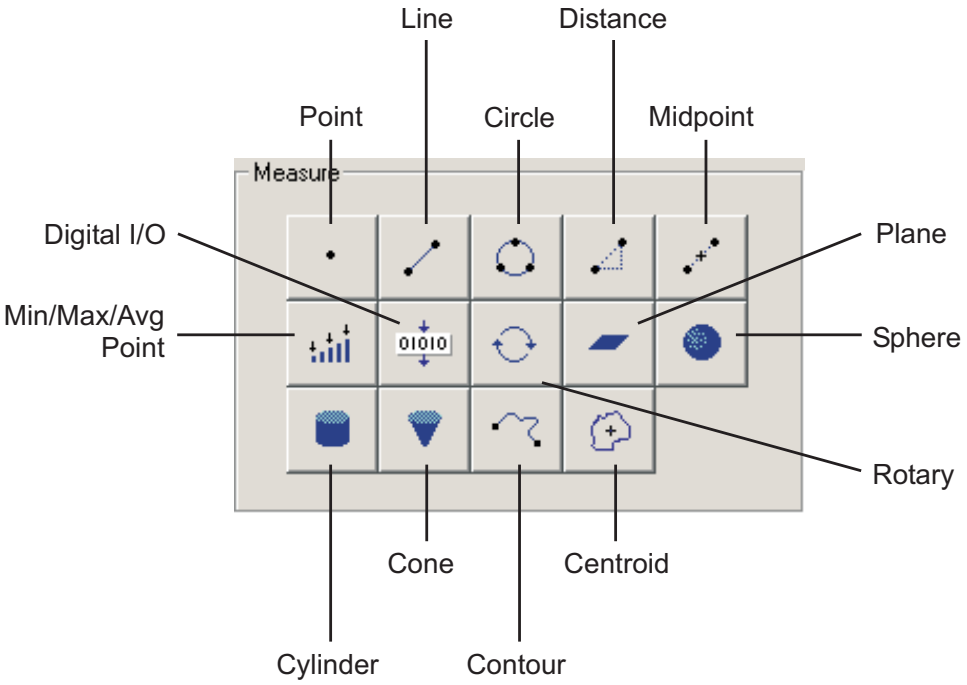
Click icon to select target

3.11.5 Automatic Tool Icons

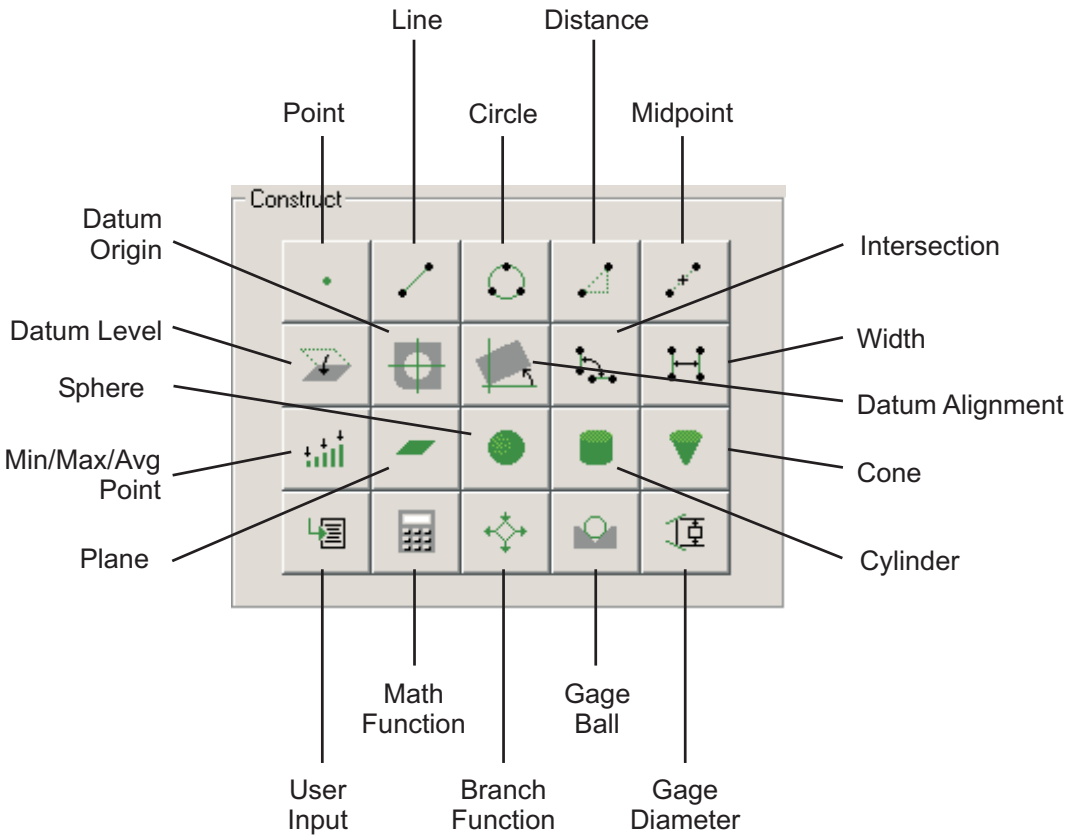


Click icon to select tool

3.11.6 Measurement Icons



3.11.7 Construction Icons



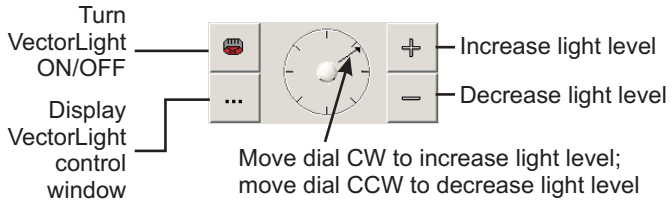
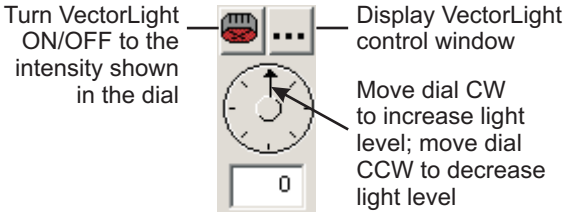
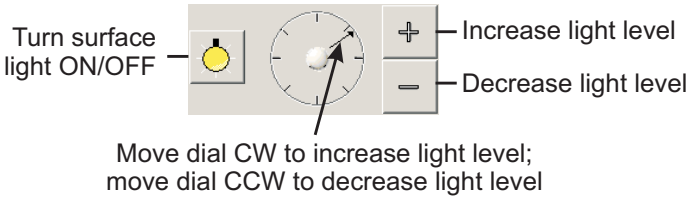
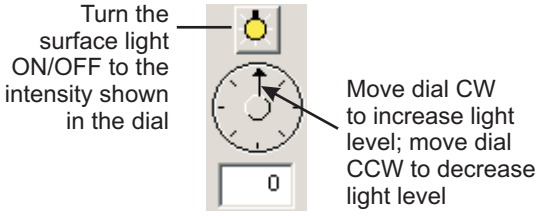
3.12 Tool & Target Settings Window

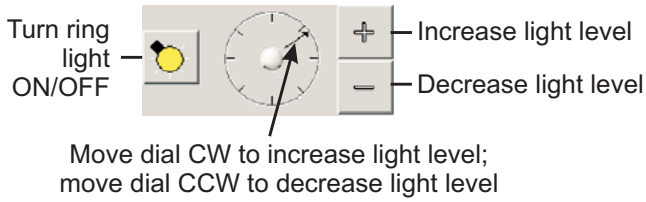
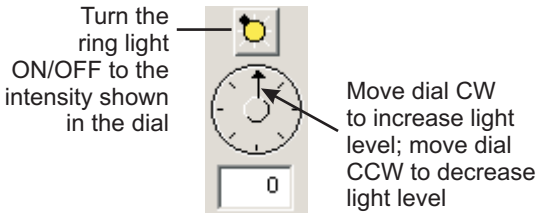
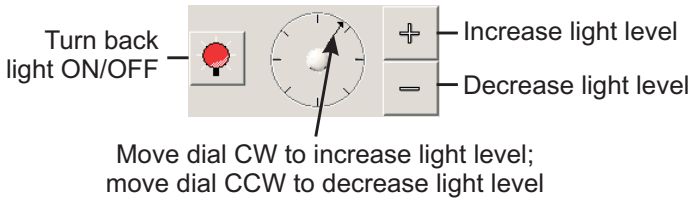
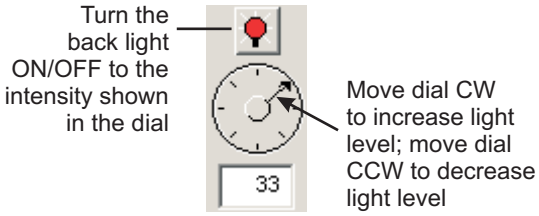
The Tool & Target Settings window displays settings for the selected tool or target and the appearance of the window varies accordingly. For example, the image on the right shows the settings for the weak edge analysis tools.

Notes:

1. To display the settings for a different tool or target, select the desired tool or target, or right-click in the Tool & Target Settings window and select the desired tool or target.
2. See the *eBx Reference Guide* (P/N 795051) for information about the settings for each tool and target.

3.13 Software Illumination Controls

Illumination Source	Screen Layout	Illumination Controls
VectorLight	• Dual Monitor User Interface (4:3 aspect ratio)	
	• Standard User Interface • Single Monitor User Interface • Dual Monitor User Interface (16:10 or 16:9 aspect ratio)	
Surface Light	• Dual Monitor User Interface (4:3 aspect ratio)	
	• Standard User Interface • Single Monitor User Interface • Dual Monitor User Interface (16:10 or 16:9 aspect ratio)	

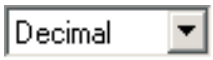
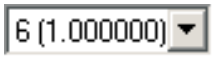
Illumination Source	Screen Layout	Illumination Controls
Ring light (by default, this controls the inner two rings of the VectorLight)	• Dual Monitor User Interface (4:3 aspect ratio)	
	• Standard User Interface • Single Monitor User Interface • Dual Monitor User Interface (16:10 or 16:9 aspect ratio)	
Back Light	• Dual Monitor User Interface (4:3 aspect ratio)	
	• Standard User Interface • Single Monitor User Interface • Dual Monitor User Interface (16:10 or 16:9 aspect ratio)	

Notes:

1. The software illumination controls perform the same function as the illumination control knobs on the front panel.
2. Turning an illumination control knob on the front panel automatically adjusts the corresponding illumination control dial in the software user interface, but not vice versa.

4. Getting Started

4.1 Selecting the Units and Coordinates

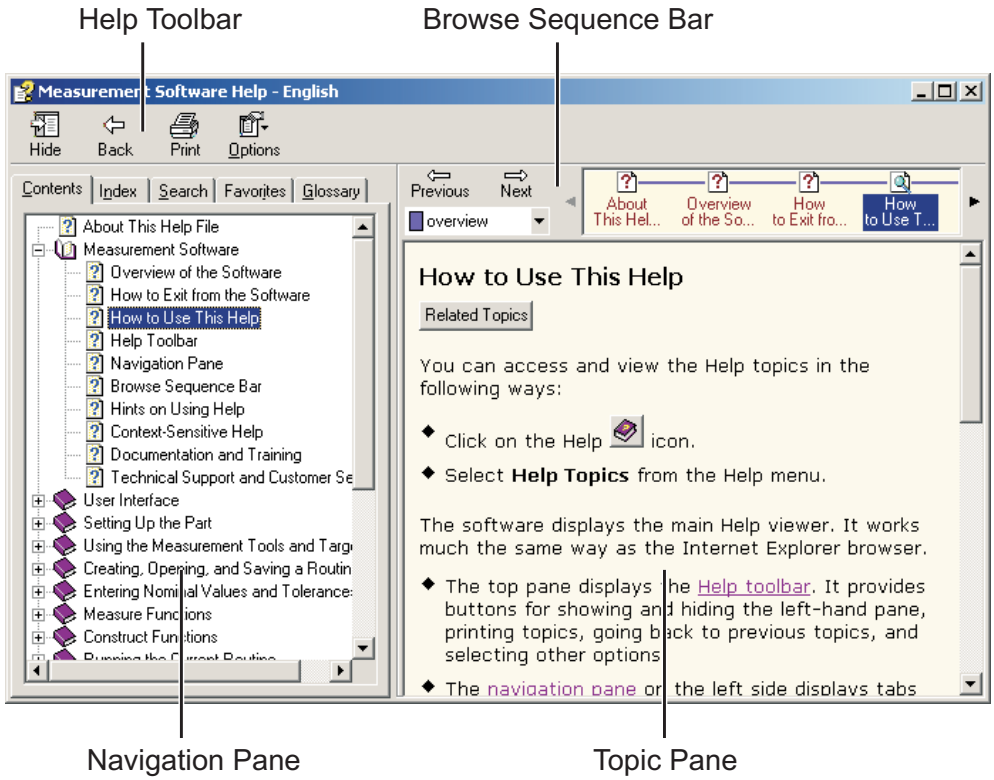
Click this icon…	To display and use...
	English Units
	Metric Units
	Cartesian coordinates
	Polar coordinates
 (Standard User Interface Only)	Angular units
 (Standard User Interface Only)	More digits Fewer digits

4.2 Accessing and Using the Software Online Help

The eBx software online Help includes topics that describe software functions in detail, its proper use, and information for specific dialog boxes and windows.

Click  to access the software online Help.

4.2.1 Using the Software Online Help



The software online Help works in a browser format.

- The top pane displays the Help toolbar, which provides icons for showing and hiding the left-hand pane, printing topics, going back to previous topics, and selecting other options.
- The navigation pane on the left side displays tabs for the Contents, Index, Search, Favorites, and Glossary functions.

- The topic pane on the right side displays topic content. If it does not fit into one window, use the scroll bar on the right to view the rest of the text.
  - You can jump to any topic that is shown in blue simply by clicking on the hyperlink. The color changes to indicate that the topic has already been viewed.
  - The selected book or page at the left is synchronized with the active topic on the right.
- The browse sequence bar appears above the topic pane on the right.
- The default setting is to keep the Help viewer open when you go back to using the software. This enables you to view a Help topic and use the software at the same time, for example, when you want to follow a step-by-step procedure.
  - You can move the Help window by clicking in its title bar and dragging it to the desired location.
  - You can change the size of the Help window by dragging its corners to the desired size.
  - The navigation pane is displayed as soon as you select the Help window again.

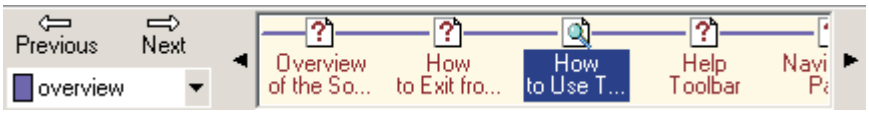
Note: There is also context sensitive Help, which you can view within the measurement software.

Help Toolbar

The top pane of the Help viewer displays the Help toolbar icons.

- Click the **Hide** icon to hide the navigation pane. If it is hidden, click this icon to show the pane and tabs.
- Click the **Back** icon to go back to the previous topic.
- Click the **Print** icon to display the Print dialog for printing topics.
- Click the **Options** icon to display a drop-down menu of options. For example, you can select whether or not to highlight search text.

Browse Sequence Bar

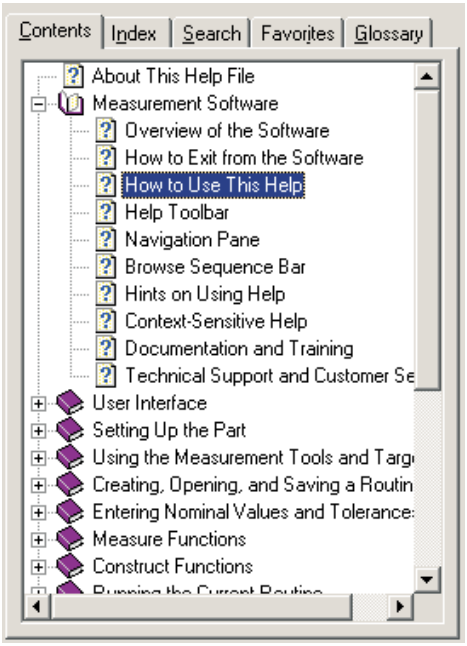


The browse sequence bar appears above the topic pane on the right. Each browse sequence contains topics related to a specific function.

- To display the topics in a browse sequence, click on the arrow next to the drop-down list and select the desired browse sequence. The topics are displayed on the right side of the bar.
- To view a specific topic in the selected browse sequence, click on the topic.
- To see all the topics in the browse sequence, click on the Previous or Next arrows.

Navigation Pane

The online Help navigation pane displays tabs for the Contents, Index, Search, and Favorites functions.



- **Contents** tab: Displays the list of main Help topics, represented by icons of closed books. Double-click on the desired topic to "open" the book and view a list of subtopics. Then double-click on the desired topic to view it in the topic pane.
- **Index** tab: Displays the list of all the index keyword entries. Use the scroll bar to search for the desired topic or type the word you are looking for in the field at the top. Then double-click on the desired topic to view it in the topic pane.
- **Search** tab: Type the search word or term that you are looking for. Then click the **List Topics** button to display the topics that contain the word. To view a specific topic, click on the title and then click the **Display** button.
- **Favorites** tab: Displays the topics added to the Favorites list. To add the displayed topic to this list, place the cursor in the topics list, click the right mouse button, and select **Add** from the pop-up menu.
- **Glossary** tab: Displays a list of glossary terms with their definitions at the bottom of the pane.

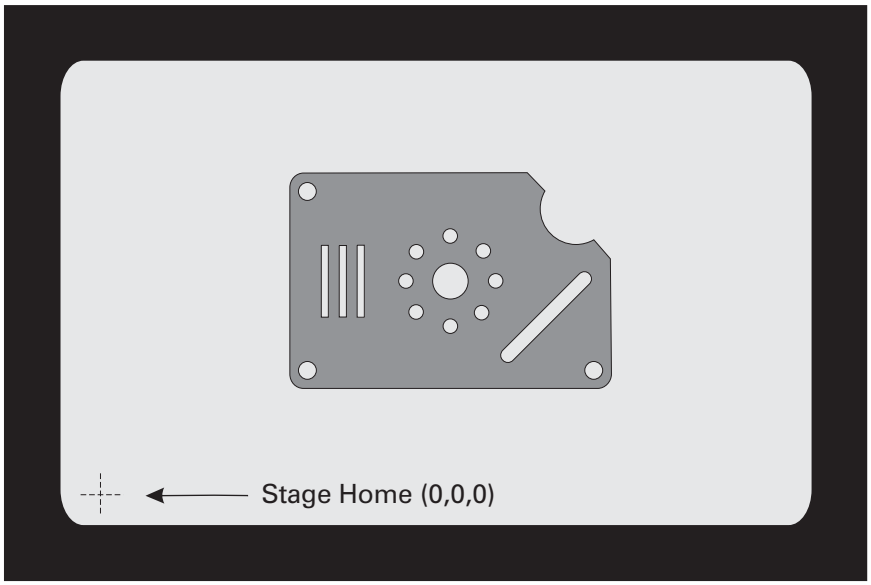
4.2.2 Using the Context Sensitive Help

Context-sensitive Help refers to information that you can display from a particular location in the software.

There are two types of context-sensitive Help:

- **Dialog Box Help**, which displays the specific Help topic associated with the displayed dialog box or measurement window.
  - To view this help, click the **Help** button in the dialog box (if it has this button) or press the **F1** key while the dialog box or measurement window is displayed.
  - This also allows you to navigate to other topics within the Help file.
- **What's This? Help**, which displays a popup Help topic for a field, tab, button, etc. The popup topics provide definitions and usage tips for the fields in the dialog box.
  - To view this help, click  in the toolbar of the displayed window, or click  in the title bar of the dialog box or window, and then click a field to display a definition for that field.
  - Click anywhere on the screen to close the popup window.

4.3 Staging a Part and Viewing Part Features



1. Clear the stage of any obstructions.
2. If the part (for example, the QVI training part) does not fit under the optics, twist the joystick knob clockwise to raise the Z axis transport.
3. Mount the part securely on the stage.
4. Select **System** / **Reset** to clear any previous measurements and clear any previous XYZ zero settings.
5. If necessary, zoom to the lowest magnification using the Zoom slider.
6. Position the mouse cursor in a backlit area of the Image window and observe the light indicator in the lower-left corner of the Image window (Standard/Single Monitor User Interface) or the lower-right corner of the left screen (Dual Monitor User Interface) as you increase the backlight intensity to approximately 45%.
7. Use the joystick to move the stage so an edge of the part appears in the center of the Image window.
8. Twist the joystick knob to manually focus the edge.

Notes:

1. After powering up the system, the coordinates and location of the part are based on the stage home position.
2. You can position the part anywhere on the stage or in any fixture.

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5. Tools & Targets

5.1 Overview

This section describes how to use the following automatic tools and manual alignment targets:

- FeatureFinder
- Average Weak Edge Point
- Minimum Weak Edge Point
- Maximum Weak Edge Point
- Strong Edge Finder
- Edge Trace
- Basic Focus
- Crosshair
- Box
- Circle
- Manual Focus

Note: Only the most commonly used tools and targets are described in this section. For information about other tools and targets, see the *eBx Reference Guide* (P/N 795051) or the eBx online Help.

5.2 Edge Analysis Tools

Icon	Displays this Tool…	Description
	FeatureFinder	• Used to measure curved or straight edges • Automatically measures the selected geometric shape after you specify the points • The feature must be in the field of view
	Average Weak Edge Point	• Used to measure any kind of edge, especially low-contrast, ragged edges • Used to measure edges of features that are larger than the field of the view • Automatically finds and measures a point on an edge within the user-defined search area
	Minimum Weak Edge Point	
	Maximum Weak Edge Point	
	Strong Edge Finder	• Used to find one point on a high-contrast, smooth edge • Automatically finds the edge at the point where you placed the cursor
	Edge Trace	• Used to measure many points on a line, arc, circle, Min/Max/Avg feature, or an irregular contour on strong edges • Automatically traces the edge(s) of features lying in a plane • Entire feature does not need to be in the field of view

5.2.1 Using the FeatureFinder Tool

Use the FeatureFinder tool to measure a circle, an arc, or a straight line.

Note: See the *eBx Reference Guide* (P/N 795051) for information about using the settings that appear in the Tool & Target Settings window when the FeatureFinder tool is selected.

To Measure a Circle or an Arc:

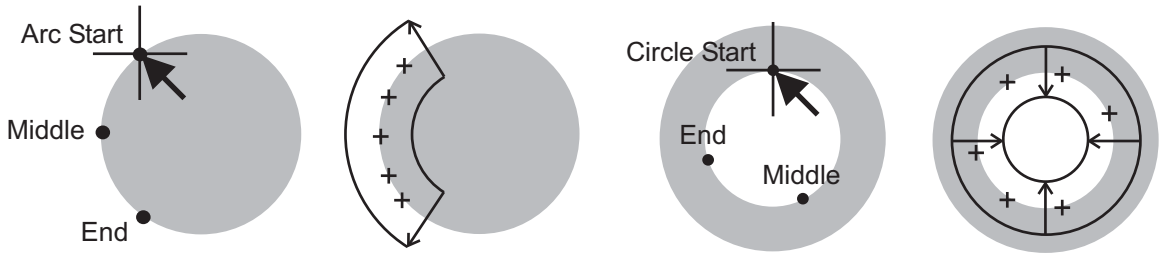
1. Position the desired feature in the field of view.
2. Adjust the backlight illumination for sufficient contrast.
3. Focus the edge.
4. Click  to display the FeatureFinder tool.
5. Click on the first point where you want to start measuring.

   The first point is displayed as either "Arc Start" or "Circle Start." Click on the first point again to toggle between "Arc Start" and "Circle Start."
6. Click on the second point.

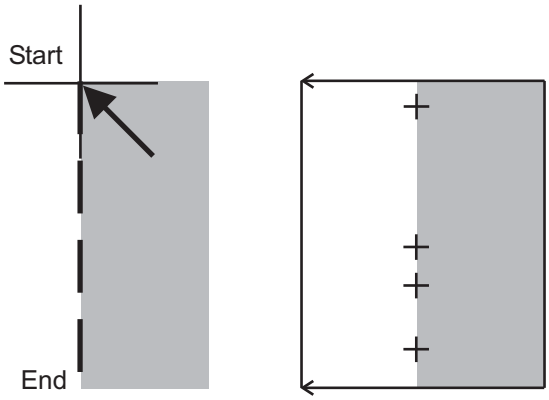
   The "Middle" point is displayed.
7. Click on the third and final point.

   The "End" point is displayed.

   The software analyzes the edge and displays the search area and the points it found within the search area.



To Measure a Straight Line:



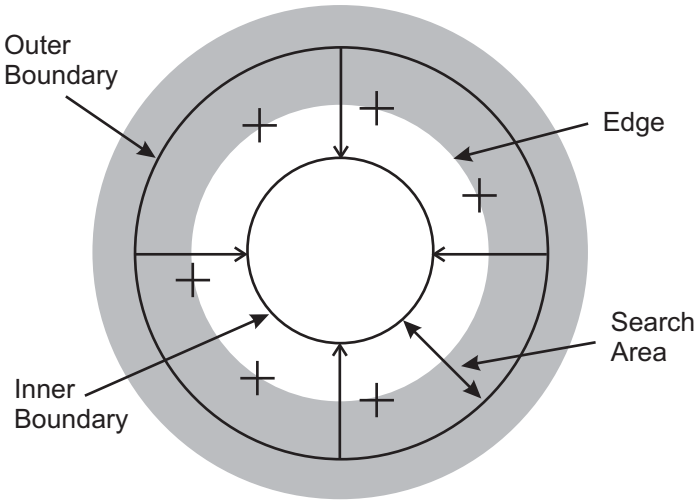
1. Position the desired feature in the field of view.
2. Adjust the backlight illumination for sufficient contrast.
3. Focus the edge.
4. Click  to display the FeatureFinder tool.
5. Click and hold the left mouse button on the first point where you want to start measuring.
6. Drag the "rubber band" along the edge.
7. Release the left mouse button at the second (end) point.

   The software analyzes the edge and displays the search area and the points it found within the search area.

To Change the FeatureFinder Search Area:

The FeatureFinder tool only measures within its search area.

- **Edge**—The line or curve in the middle of the search area. After the edge analysis, the software displays the points along the edge.
- **Inner boundary**—The smaller of the two boundaries.
- **Outer boundary**—The larger of the two boundaries.
- **Search area**—The area between the inner and outer boundaries.



To change the size of the FeatureFinder search area:

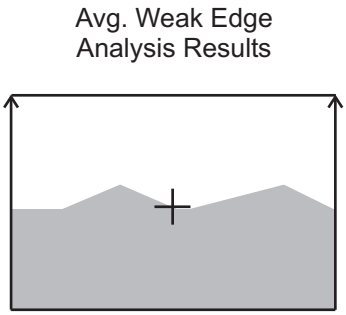
1. Click and hold the left mouse button on the inner or outer boundary.
2. Move (drag) the inner or outer boundary and release the left mouse button.
3. Click the **Remeasure** button in the Tool & Target Settings window to remeasure the feature.

Notes:

1. Both the inner and outer boundaries move together in opposite directions. For example, the search area increases as you drag the inner boundary away from the edge; the search area decreases as you drag the inner boundary toward the edge.
2. You must click the Remeasure button in the Tool & Target Settings window for the changes to take affect.
3. When the measurement becomes a step in the part routine, the size and location of the FeatureFinder search area will be duplicated when the routine is run.

5.2.2 Using the Weak Edge Point Tool

1. Position the desired feature in the field of view.
2. Adjust the backlight illumination for sufficient contrast.
3. Focus the edge.
4. Click the appropriate icon to display the desired Weak Edge Point tool:



   - Click  to display the **Average Weak Edge Point** tool
   - Click  to display the **Minimum Weak Edge Point** tool
   - Click  to display the **Maximum Weak Edge Point** tool
5. Click and hold the left mouse button at the beginning of the search area.
6. Drag the "rubber band" along the edge and release the button at the end of the search area.

   The software analyzes the edge and displays the search area and the point it found within the search area.

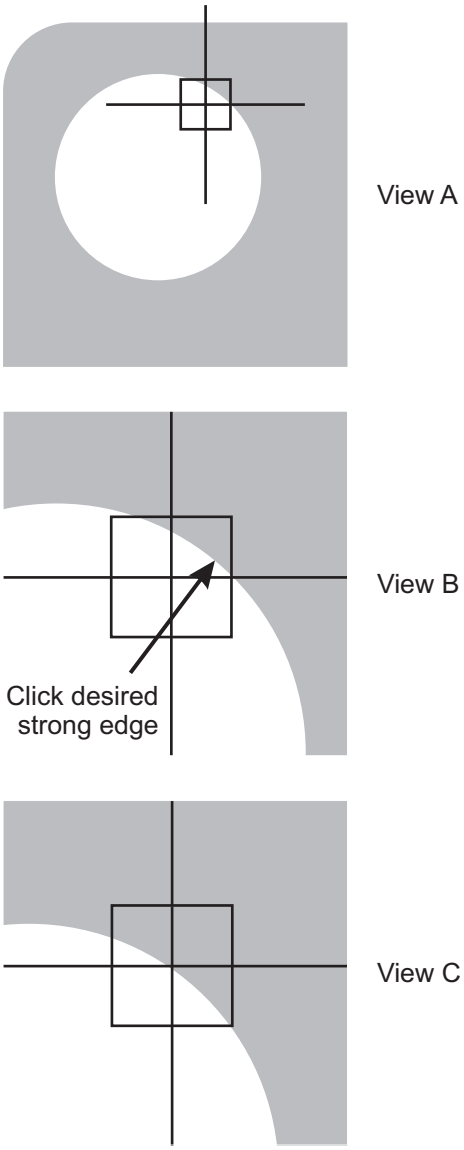
Note: See the *eBx Reference Guide* (P/N 795051) for information about using the settings that appear in the Tool & Target Settings window when a Weak Edge Point tool is selected.

5.2.3 Using the Strong Edge Finder Tool

Using this tool causes the XY transports to move.

1. Click  to display the **Strong Edge Finder** tool.
2. Position the desired feature in the field of view, inside the Strong Edge Finder target (View A).
3. Adjust the backlight illumination for sufficient contrast and focus the edge.
4. Click the desired strong edge (View B).

   The system drives the stage until the found edge appears at the intersection of the crosshairs in the center of the Strong Edge Finder target (View C) and automatically enters the point.

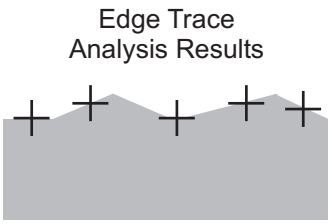


Note: See the *eBx Reference Guide* (P/N 795051) for information about using the settings that appear in the Tool & Target Settings window when the Strong Edge Finder tool is selected.

5.2.4 Using the Edge Trace Tool

Using this tool causes the XY transports to move.

1. Position the desired edge in the field of view (the entire edge does not have to fit in the field of view).
2. Adjust the backlight illumination for sufficient contrast and focus the edge.



3. Click  to display the **Edge Trace** tool.
4. Perform the edge trace by doing one of the following:
   - Specify the start point and immediately activate the edge trace—double-click on the start point. The system traces the edge until it returns to the start point or reaches the maximum number of points.
   - Specify a start point and an end point—click on the start point and then double-click on the end point (or click the Trace button) to activate the trace.
     - If you want to specify an end point that is not in the field of view, move the stage so the desired end point location appears in the Image window.
     - If you want to change the end point, double-click on the new end point location to activate the trace.
   - Specify the start point and end point as described above, and indicate the direction and size of the search area when the start point dot and box are displayed.
     - To change the size of the search area, click and hold the left mouse button anywhere on the box and drag the box to the desired size. Then release the mouse button.
     - To indicate the direction of the edge trace, click and hold the left mouse button on the start point and drag the rubber band arrow in the desired direction. Then release the mouse button.

Notes:

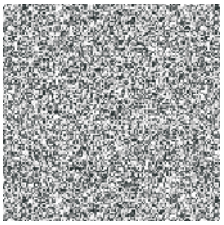
1. To stop the edge trace before it finishes, press the **Stop/Start** button.
2. See the *eBx Reference Guide* (P/N 795051) for information about using the settings that appear in the Tool & Target Settings window when the Edge Trace tool is selected.

5.3 Using the Basic Focus Tool

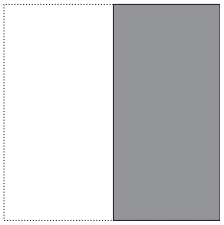
Use the Basic Focus tool to measure the Z axis position of a focus point on the surface or edge.

Using this tool causes the Z axis transport to move.

1. Position the desired edge or surface in the field of view.
2. Move the Zoom slider to the far right to zoom to the highest magnification.
3. Adjust the illumination and manually focus the edge or surface.
   - Use backlight illumination when focusing on an edge
   - Use surface illumination when focusing on a surface



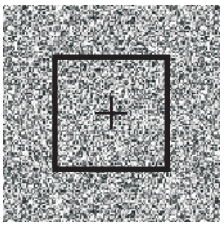
Surface



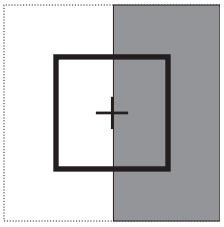
Edge

4. Click  to display the **Basic Focus** tool.
5. Click anywhere in the Image window.

   The system performs an autofocus, displays a green cross in the center of the focus box, produces a "beep" sound (if configured), and automatically measures a point.
6. Click **OK** to accept the measurement, or click **Cancel** to cancel it.



Surface



Edge

Note: See the *eBx Reference Guide* (P/N 795051) for information about using the settings that appear in the Tool & Target Settings window when the Basic Focus tool is selected.

5.4 Manual Alignment Targets

The manual alignment targets are primarily used to align features and can be used to manually measure features. The target is fixed in the center of the field of view so the part can be moved relative to it.

These are the most commonly-used manual alignment targets:

Icon	Displays this Target...	Description
	Crosshair	• Used to align edges to center of the Image window (field of view)
	Box	• Used to align square or rectangular features to the center of the Image window (field of view)
	Circle	• Used to align circular features to the center of the Image window (field of view)
	Manual Focus	• Used to focus an edge or surface automatically. It cannot be used to measure a point. The Manual Focus target analyzes image data from several Z axis positions and calculates the Z axis position that would yield the best focus, or highest contrast. The image must be approximately in focus and must have sufficient contrast in order for the autofocus operation to succeed.

Note: See the *eBx Reference Guide* (P/N 795051) for information about using the settings that appear in the Tool & Target Settings window for the selected manual alignment target.

To Change the Target Size

1. Click and hold the left mouse button on the edge of the target.
2. Drag the edge of the target in or out until it lines up with the feature.
3. Release the left mouse button.

5.5 Changing the Tool & Target Color

1. Select the desired tool or target.

2. Click  in the Image Window toolbar.
3. Select the desired color.

Note: The selected color becomes the default color until you change it again.

---

6. Setting Up the Part

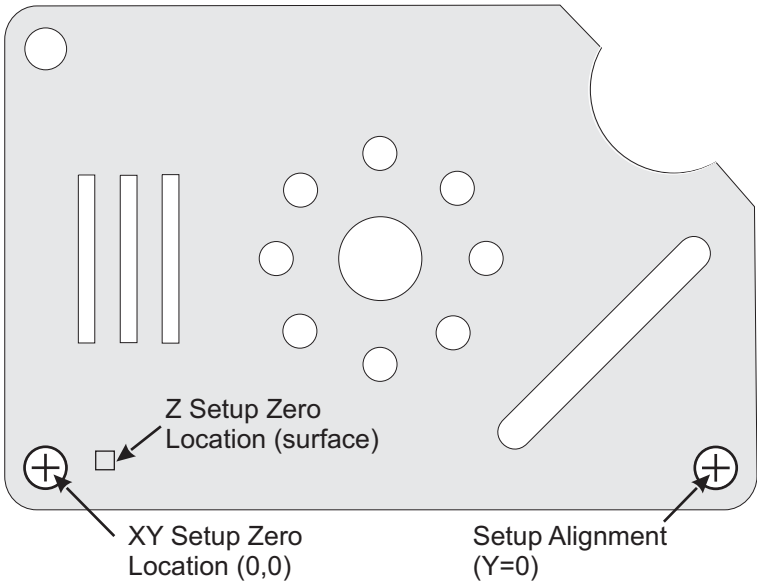
6.1 Overview

Part setup is a manual and visual procedure that:

- Tells the system where the part or fixture is located on the stage. It sets the Z axis to 0 and the XY axes to (0,0) at the respective locations of the selected features. The XY location also becomes the pivot point for XY axis alignment.
- Tells the system how the part is oriented relative to the system's XY axes stage travel. For example, this rotates the coordinate system about the setup zero location such that the X axis passes through the location of the selected feature. The setup alignment also compensates for any misalignment between the part and the stage axes.

Part setup is done after staging the part and before you begin to create a routine, open a routine, or run a routine. When you complete the part setup, the setup zero location (Zero X, Y and Z) and alignment are based on part features (shown below) or fixture rather than on the stage home position.

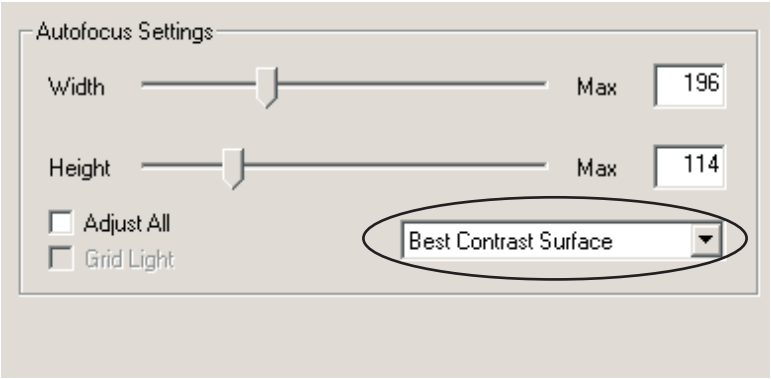
Part setup lets you run a routine to measure the same or identical part at another location on the stage. The routine will run no matter where the part is placed, as long as the part setup uses the same setup zero location and setup alignment.



6.2 Defining the Z Setup Zero Location

Note: It is important to define the Z setup zero location to zero the Z axis. In this procedure, the Z setup zero location will be on the surface the QVI training part, near the lower-left hole.

1. Mount and secure the training part on the stage, below the optics.
2. Increase the surface illumination to approximately **45%**.
3. Use the joystick to move the stage so the surface near the lower-left hole appears in the Image window.
4. Zoom to the highest magnification using the Zoom slider; adjust the illumination if necessary.
5. Twist the joystick knob to manually focus on the surface of the training part.
6. Click  to select the **Manual Focus** target.
7. Verify that **Best Contrast Surface** is selected in the Focus Mode list in the Autofocus Settings window.



8. Click anywhere in the Image window.

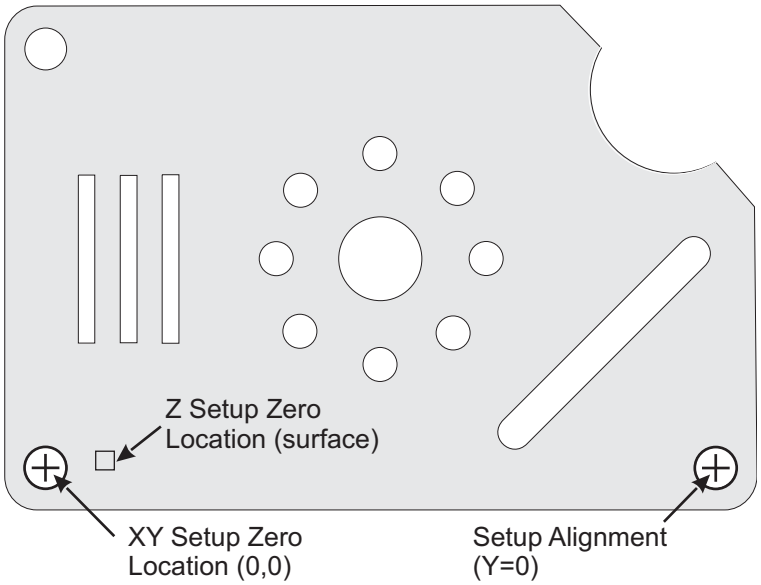
   The system performs an autofocus, displays a green cross in the center of the focus box and produces a "beep" sound (if configured for sound).

9. Click  in the DRO window to zero the Z axis readout.

6.3 Defining the XY Setup Zero Location & Axis Alignment

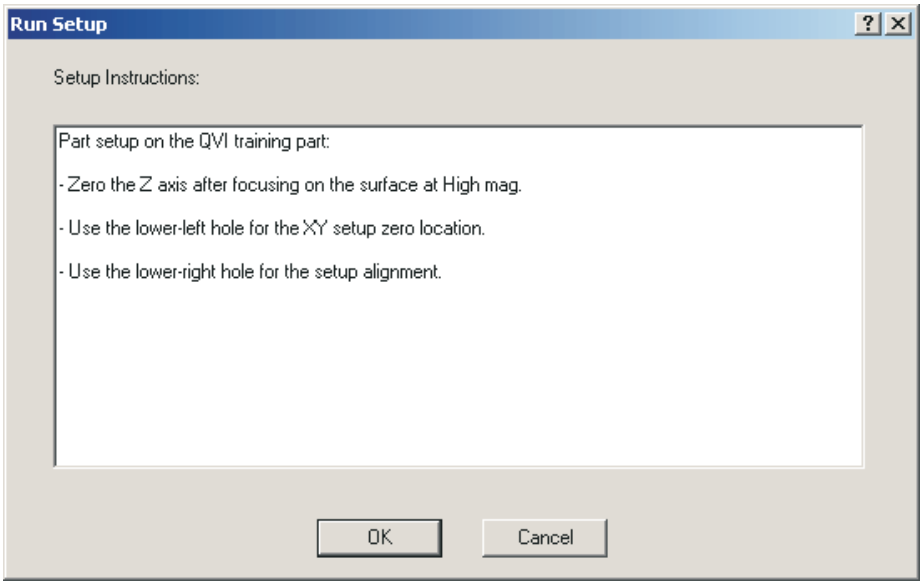
Note: After defining the Z setup zero location, define the XY setup zero location and align the part. In this procedure, the lower-left hole in the training part will be used for the XY setup zero location and the lower-right hole will be used for the axis alignment.

1. Zoom to the lowest magnification using the Zoom slider.
2. Turn off the surface light and increase the backlight illumination to **45%**.
3. Use the joystick to move the stage so the lower-left hole appears in the Image window.
4. Twist the joystick knob to manually focus the lower-left hole of the training part; adjust the illumination if necessary.
5. Click  to select the **Circle** target.
6. Use the joystick to move the stage so the lower-left hole in the training part is centered within the Circle target. If necessary, adjust the size of the target to match the size of the hole.
7. Click  and  in the DRO window to zero the X and Y axis readouts.
8. Use the joystick to move the stage so the lower-right hole in the training part is centered within the Circle target.
9. Click  in the DRO window to align the coordinate system to the part.



6.4 Part Setup Instructions

Select **Part Setup** / **Setup Instructions** to display a dialog box in which you can enter or view specific instructions for setting the part. For example, you can specify the location, orientation and alignment of the part, or explain how to begin measuring the part.



7. Defining Datums

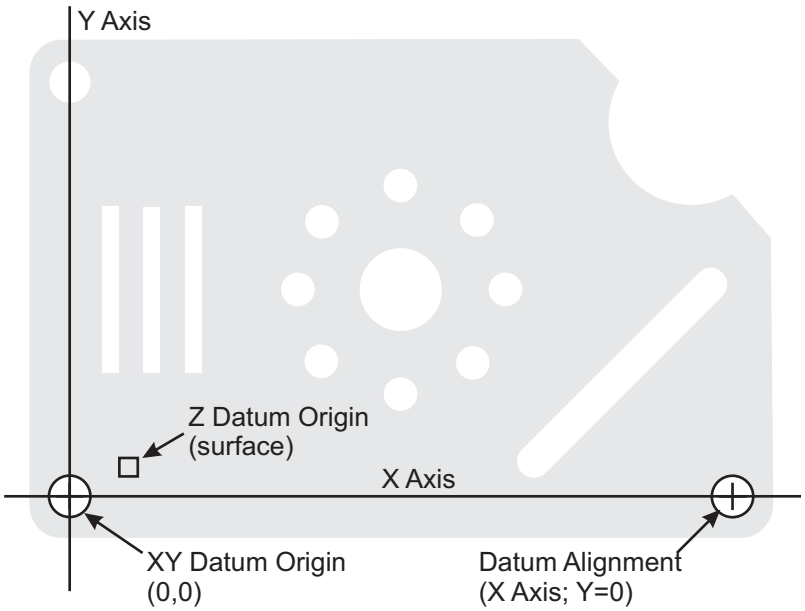
7.1 Overview

A datum is a theoretically exact plane, point, or axis from which a dimensional measurement is made. Defining datums typically helps with measuring features according to blueprint specifications.

Datums define the location and orientation of a part within a routine. Datums are constructed within a routine from previously-measured or previously-constructed features.

All routines should have the datum features and the datum steps **at the beginning of the routine**, regardless of how the part is set up. The datum origin and datum alignment in a routine consist of the following functions:

- Measure a point on the surface. Set the Z axis to zero.
- Measure or construct a feature and then define the XY datum origin (0,0).
- Measure or construct a feature and then define the datum alignment point.



The instructions in this section use features on the training part and assume that:

- The part has been set up (described in Section 6)
- There are no other measurement steps in the routine (select **File** / **New**)
- The procedures are performed in order

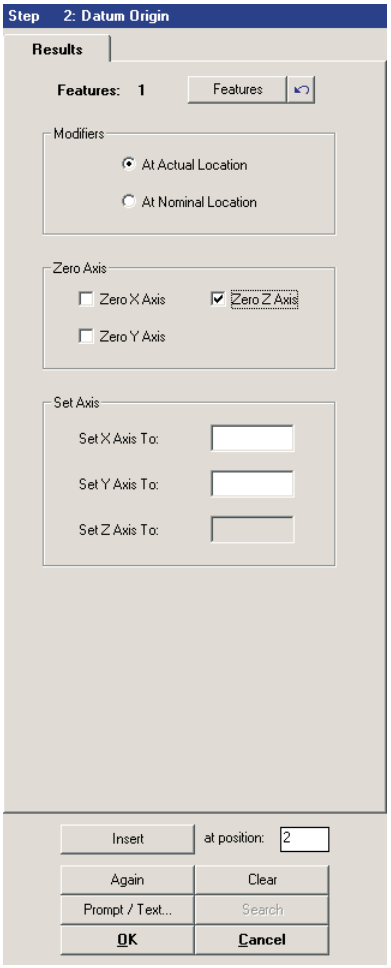
7.2 Defining a Z Datum Origin

1. Use the joystick to drive the stage so the surface near the lower-left hole appears in the Image window.
2. Increase the surface illumination to approximately **45%**.
3. Zoom to the highest magnification using the Zoom slider; adjust the surface illumination if necessary.
4. Twist the joystick knob to manually focus on the surface of the training part.
5. Click  to select the **Basic Focus** target.
6. Verify that **Best Contrast Surface** is selected in the Focus Mode list in the Autofocus Settings window.
7. Click anywhere in the Image window.

   The system performs an autofocus at that point, displays a green cross in the center of the focus box, produces a "beep" sound (if configured), automatically measures a point.

8. Click  to select the **Construct Datum Origin** function.
9. Click the measured point in the Model window.
10. Select the **Zero Z Axis** check box.
11. Click **OK** in the Measurement window to complete the construction.

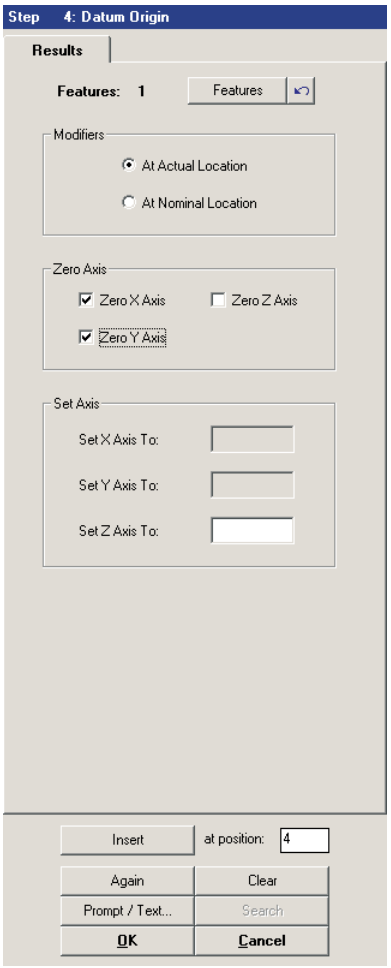
    This sets the Z axis to zero at the actual measured location of the focus point.



7.3 Defining an XY Datum Origin

1. Zoom to the lowest magnification using the Zoom slider.
2. Use the joystick to move the stage so the lower-left hole in the training part appears in the Image window.
3. Turn off the surface illumination and adjust the backlight illumination to approximately **45%**.
4. Manually focus the lower-left hole and adjust the backlight illumination if necessary.
5. Click  to select the **FeatureFinder** tool.
6. Use the FeatureFinder tool to measure the lower-left hole in the training part.
7. Press **Enter** on the joystick to complete the measurement.
8. Click  to select the **Construct Datum Origin** function.
9. Click on the measured circle (lower-left hole) in the Model window.
10. Select the **Zero X Axis** and **Zero Y Axis** check boxes.
11. Click the **OK** button to complete the construction.

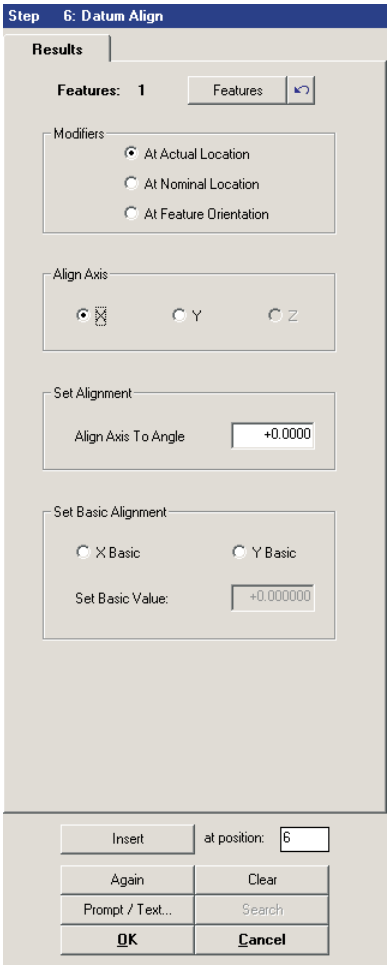
    This sets the datum origin (0,0) at the actual measured center of the lower-left hole.



7.4 Defining the Axis Alignment

1. Use the joystick to move the stage so the lower-right hole in the training part appears in the Image window.
2. If necessary, manually focus the lower-right hole and adjust the backlight illumination.
3. Use the FeatureFinder tool to measure the lower-right hole in the training part.
4. Press **Enter** on the joystick to complete the measurement.
5. Click  to select the **Construct Datum Align** function.
6. Click on the measured circle (lower-right hole) in the Model window.
7. Click the **Align X Axis** radio button.
8. Click the **OK** button to complete the construction.

   This rotates the coordinate system and aligns it to the part.



8. Using the CAD Navigator

8.1 Overview

Use the optional CAD Navigator to import a CAD file, and then generate measurement steps automatically. Nominal values for the measured features are automatically imported from the CAD file.

The CAD Navigator supports the following two-dimensional CAD file types:

- DXF (standard)
- IGES (optional)
- Gerber (optional)
- Excellon (optional)
- HPGL (optional)

Notes:

1. The CAD Navigator is an optional software tool. Contact your local authorized RAM Sales Representative for more information.
2. CAD files contain lines, arcs, and circles. Additional feature relationships (for example, widths and lengths) required for complete inspection need to be constructed after the feature steps are automatically generated.
3. The CAD Navigator is only available if the system is configured to display the Single Monitor User Interface or Dual Monitor User Interface.

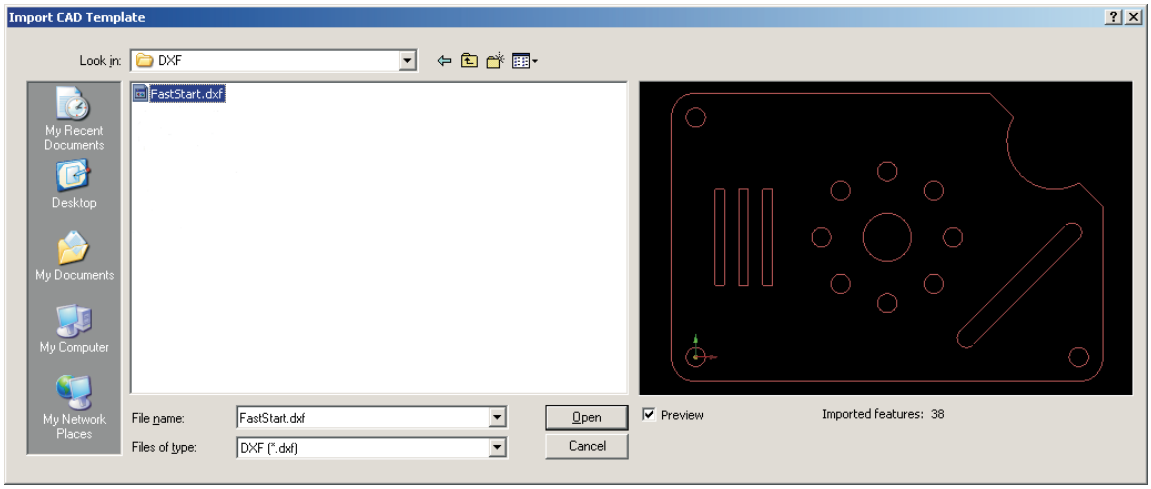
This section describes how to import a CAD file and generate measurement steps from a CAD file.

Note: Both procedures in this section use the QVI Training Part. It is assumed that the part is mounted securely on the stage and the manual part setup (described in Section 6) has been done.

8.2 Importing a CAD File

1. Select **File** / **Import CAD** from the main menu.

   The Import CAD Template window appears.

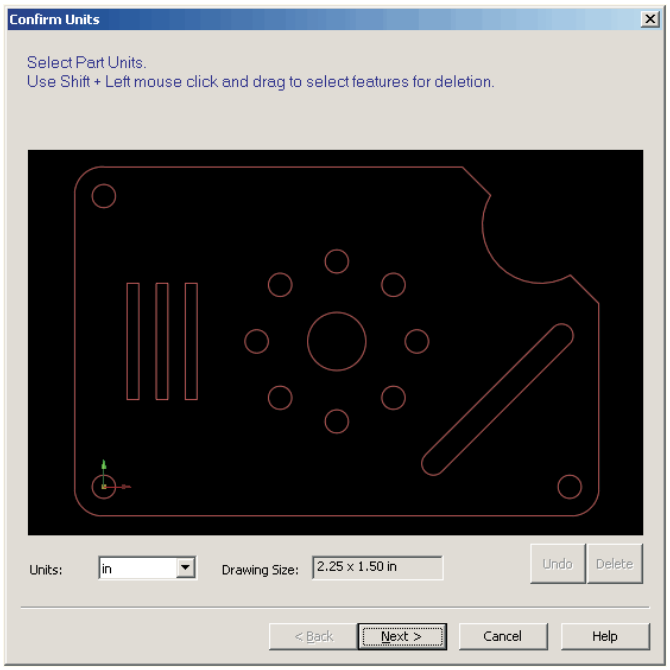


2. Browse for and select the desired CAD file (for example, FastStart.dxf), which can be in any folder on your computer or network.

   - To view the CAD file before actually opening it, select the **Preview** check box.
   - To specify the type of CAD file you want to import, select the desired file type in the **Files of type** drop-down list.

3. After selecting the CAD file you want to import, click Open.

   The Confirm Units window appears.



4. In the Units drop-down list, select the measurement units (inches or millimeters) used in the CAD file.
5. [Optional] Press and hold the **Shift** key on the keyboard, and then click the feature(s) you want to delete. When finished, release the Shift key and click **Delete**.

Notes:

1. To zoom in/out, press the left mouse button while dragging the mouse up/down.
2. To pan the CAD model, press the middle mouse button while dragging the mouse in the desired direction.
3. To rotate the CAD model, press the right mouse button while dragging the mouse in the desired direction.
4. If you select a feature by mistake, press and hold the **Shift** key on the keyboard, and then click the feature(s) you want to unselect.

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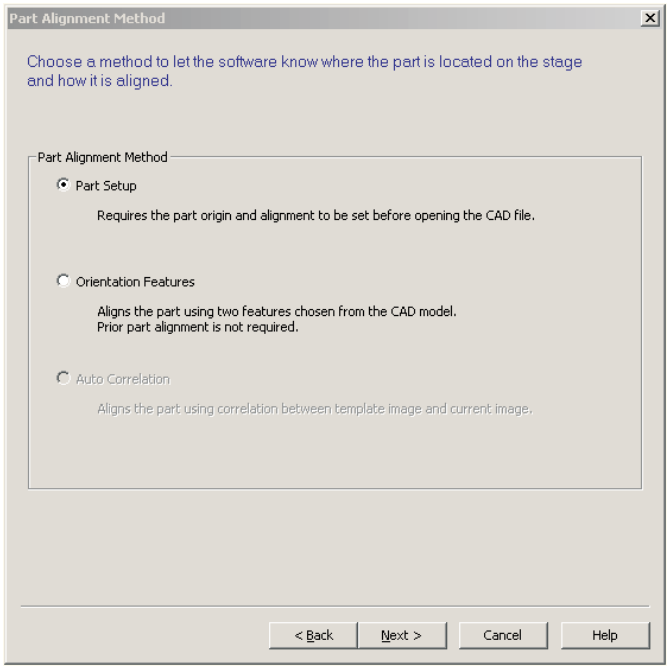
6. After selecting the measurement units and deleting any unwanted features, click **Next**.

   The Part Alignment Method window appears.



7. Specify how you want to indicate where the part is located on the worktable and how it is aligned by selecting the desired part alignment method.

   - **Part Setup** — Specify the features that were used to align the part manually on the worktable. This method assumes you manually aligned the part before starting the CAD import process.
   - **Orientation Features** — Specify two features that you want to use to orient the part on the worktable to the CAD model. This method assumes you did not manually align the part before starting the CAD import process.

8. Click **Next**.

   Depending on the selected part alignment method, either the Part Setup or Orientation Features window appears.

9. If you selected the Part Setup part alignment method, do the following:

   a. Position the mouse cursor over the feature you want to use to set the XYZ origin (for example, use the lower-left hole in the training part).

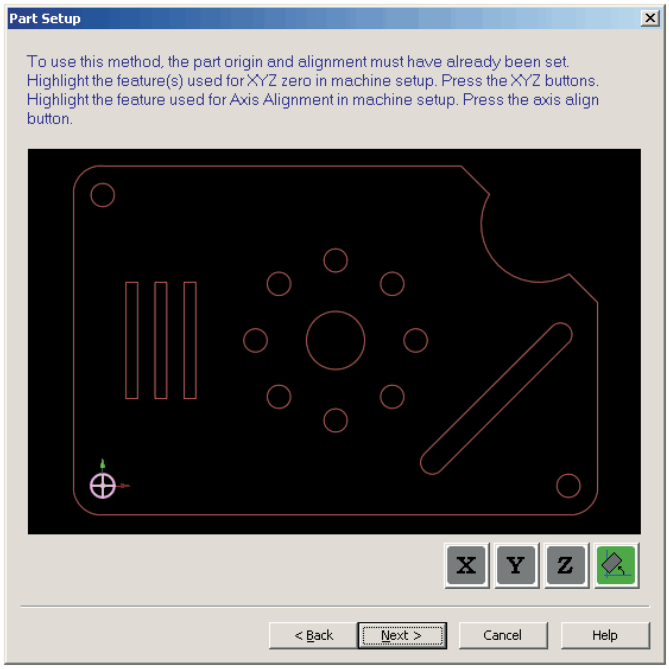
   b. Move the mouse cursor until a white cross appears. Then click the left mouse button to select the feature. The feature changes color.

   c. Click  ,  , and  to set the XYZ origin at the selected feature. The color of the feature changes to yellow.

   d. Position the mouse cursor over the feature you want to use to set the axis alignment (for example, use the lower-right hole in the training part).

   e. Move the mouse cursor until a white cross appears. Then click the left mouse button to select the feature. The feature changes color.

   f. Click  to set the axis alignment at the selected feature. The color of the feature changes to green.



10. If you selected the Orientation Features part alignment method, do the following:

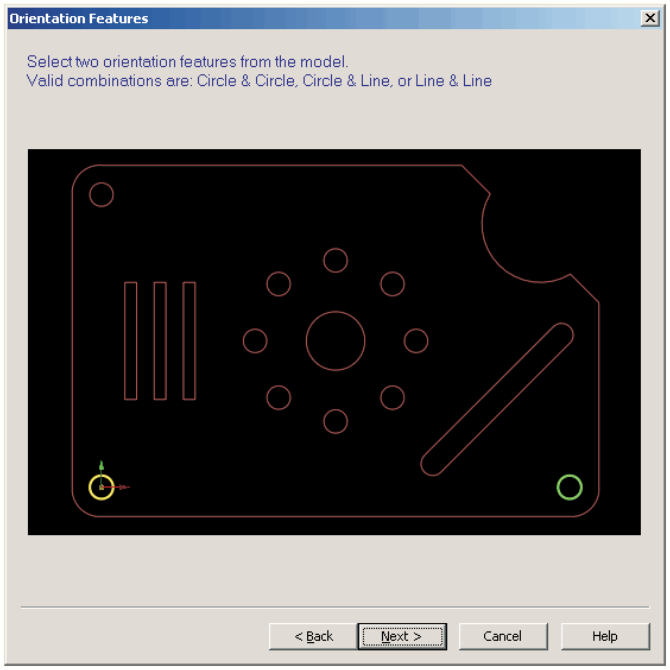
    a. Position the mouse cursor over the feature you want to use to set the XYZ origin (for example, use the lower-left hole in the QVI training part).

    b. Press the left mouse button to select the feature. The color of the feature changes to yellow.

    c. Position the mouse cursor over the feature you want to use to set the axis alignment (for example, use the lower-right hole in the QVI training part).

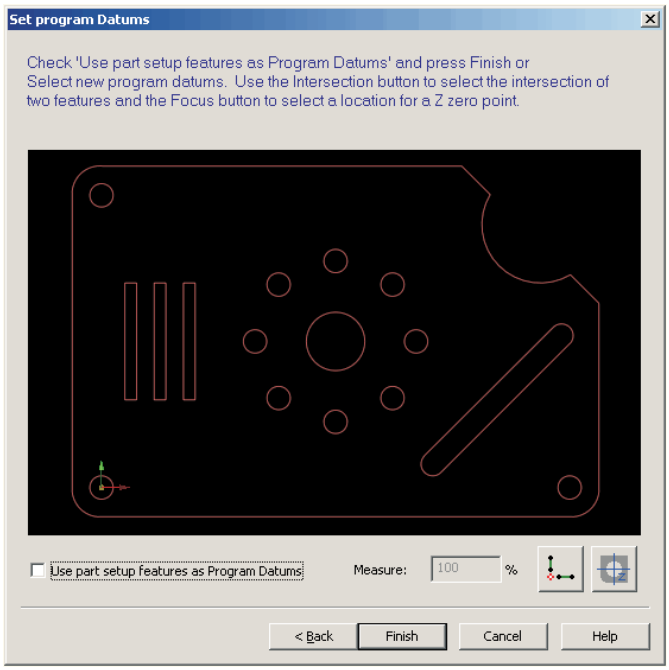
    d. Press the left mouse button to select the feature. The color of the feature changes to green.

Note: Valid orientation features include circles, arcs, and lines. Any combination of the three can be used.



11. Click **Next**.

    The Set Program Datums window appears.



12. [Optional] Click  , and then click any point on the CAD model to create a Z datum origin at that location.
13. [Optional] Specify the features you want to use to create XY datum origin and datum alignment steps by doing one of the following.
    - Select the **Use part setup features as Program Datums** check box to create datum origin and datum alignment steps automatically using the features selected for part alignment. Use the percent box to indicate what percentage of each datum feature should be measured if the feature is larger than the field of view (the default is 100%).
    - Select the feature you want to use for the XY datum origin, and then select the feature you want to use for the datum alignment.
      - To select a circle, arc, or line, verify the Intersection icon is not "pushed in" and then click the desired feature(s) in the CAD model. Use the percent box to indicate what percentage of each datum feature should be measured if the feature is larger than the field of view (the default is 100%).
      - To select an intersection, click  and then click the two features that make up the intersection. When finished, click the Intersection icon again.

14. Click **Finish** to import the CAD file.

    - If you selected **Part Setup** as the part alignment method and you selected datum features in Step 12 and/or Step 13, the system measures the features used to define the datum features, and then constructs datum features from those features. This completes the CAD import process.
    - If you selected **Orientation Features** as the part alignment method, the first orientation feature blinks in the Model window. Perform the next step to continue the CAD import process.

15. If the first orientation feature is a circle or line that fits within the field of view, use the joystick to drive the stage so the feature appears in the Image window, within the measurement area of the displayed tool. Then click **Measure** in the Setup orientation features window.

    If the first orientation feature is a circle or arc that is larger than the field of view, use the joystick to drive the stage so the feature appears in the center of the Image window. Then select three points on the circle or arc by clicking them in the Image window.

16. Click **Next** in the Setup orientation features window.

    The second orientation feature blinks in the Model window.

17. If the second orientation feature is a circle or line that fits within the field of view, use the joystick to drive the stage so the feature appears in the Image window, within the measurement area of the displayed tool. Then click **Measure** in the Setup orientation features window.

    If the second orientation feature is a circle or arc that is larger than the field of view, use the joystick to drive the stage so the feature appears in the center of the Image window. Then select three points on the circle or arc by clicking them in the Image window.

18. Click **Finish**.

    If you selected datum features in Step 12 and/or Step 13, the system measures the features used to define the datum features, and then constructs datum features from those features. This completes the CAD import process.

8.3 Generating Measurement Steps from a CAD File

1. Set the magnification and illumination to the desired levels.

2. Click  in the CAD Navigator toolbar.

3. Change the desired settings in the Automatic Step Generation window. Refer to the *Automatic Step Generation Window* topic in the *eBx Reference Guide* (P/N 795051) for a detailed description of the various settings in the Automatic Step Generation window.

Note: Click **Test Path** to view the path the system will take to measure the selected features.

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4. Select the feature(s) you want to measure (by default, all features are selected).
   - To select a single feature, click the desired feature in the Model window.
   - To select multiple features, do either of the following:
     - Press and hold the **Shift** key on the keyboard while clicking the desired features in the Model window. When finished, release the Shift key.
     - Press and hold the **Ctrl** key on the keyboard while dragging the mouse to "draw" a box around the desired features in the Model window. When finished, release the Ctrl key.

Note: If you select a feature by mistake, press and hold the **Shift** key on the keyboard, and then click the feature(s) you want to unselect.

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5. After changing the desired settings and selecting the desired feature(s), click **Generate Steps** to measure the selected features using the specified tool, and current magnification and illumination.

   The software adds the measurement steps to the measurement routine automatically.

6. [Single Monitor User Interface only] When finished, click  in the Model window toolbar.

Note: The CAD model is saved with the measurement routine, so you can create additional steps whenever the routine is open.

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9. Creating a Routine

9.1 Overview

This section describes how to:

- Create a routine (from the part or CAD file)
- Understand measurement results in a step
- Enter nominal values and tolerances
- Save a routine
- Open a routine

9.2 Creating a Routine

You can create a measurement routine in either of the following ways:

- **Manually** by measuring features on the part.
- **Automatically** by importing a CAD file and using it to generate measurement steps.

Note: The CAD Navigator is an optional software tool. Contact your local authorized RAM Sales Representative for more information.

9.2.1 Creating a Routine from a Part (Manual)

1. Mount the desired part securely on the stage (described on page 4-6).
2. Select the desired units and coordinates (described on page 4-1).
3. Perform the manual part setup (described in Section 6).
4. Measure the datum features and define the Z datum origin, XY datum origin, and axis alignment (described in Section 7).
5. Measure and/or construct features (described in Sections 10 and 11).
6. Enter nominal values and tolerances (described on page 9-4).
7. Save the routine often (described on page 9-5).
8. Periodically run the routine to verify your work and the measurement results (described on page 12-1).

9.2.2 Creating a Routine from a CAD File (Automatic)

1. Mount the desired part securely on the stage (described on page 4-6).
2. Perform the manual part setup (described in Section 6).
3. Import the CAD file (described on page 8-2) for the part mounted on the stage.
4. Automatically generate measurement steps from the CAD file (described on page 8-9).
5. Measure and/or construct additional features (described in Sections 10 and 11).
6. Enter tolerances (described on page 9-4).

Note: Nominal values are imported from the CAD file automatically.

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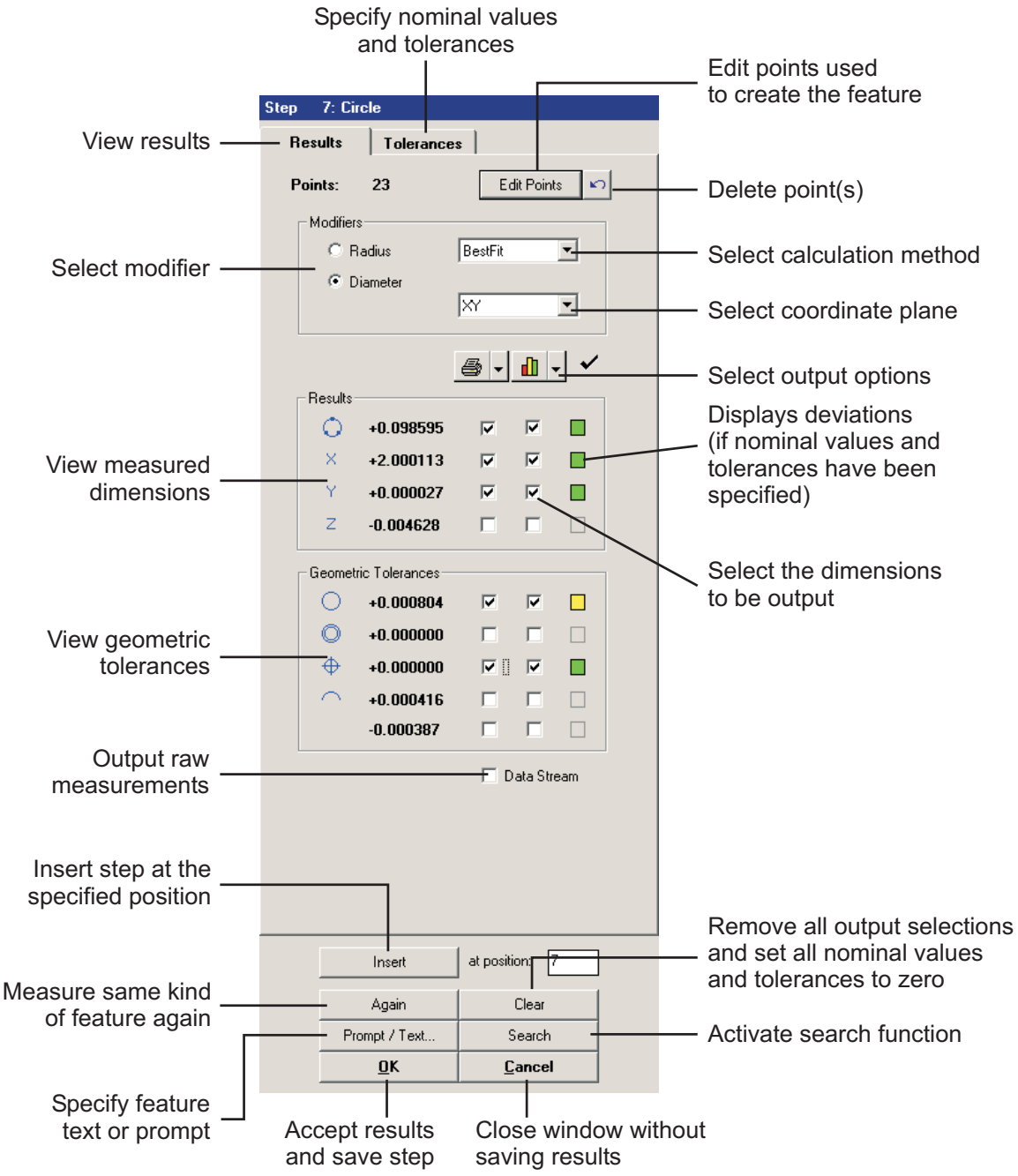
7. Save the routine often (described on page 9-5).
8. Periodically run the routine to verify your work and the measurement results (described on page 12-1).

9.3 Understanding Measurement Results in a Step

Measurement results provide a way for you to evaluate the measurements and make the necessary decisions about the part being measured. After measuring or constructing a feature, measurement results appear in the Measurement window. The results include the number of points measured (or features selected), the actual dimensions, and the geometric tolerances.



9.4 Entering Nominal Values and Tolerances

Enter nominal values and tolerances to determine the quality of the part being measured. Although you can enter them before or after you measure a feature, we recommend that you measure the feature first and then enter the nominal values and tolerances.

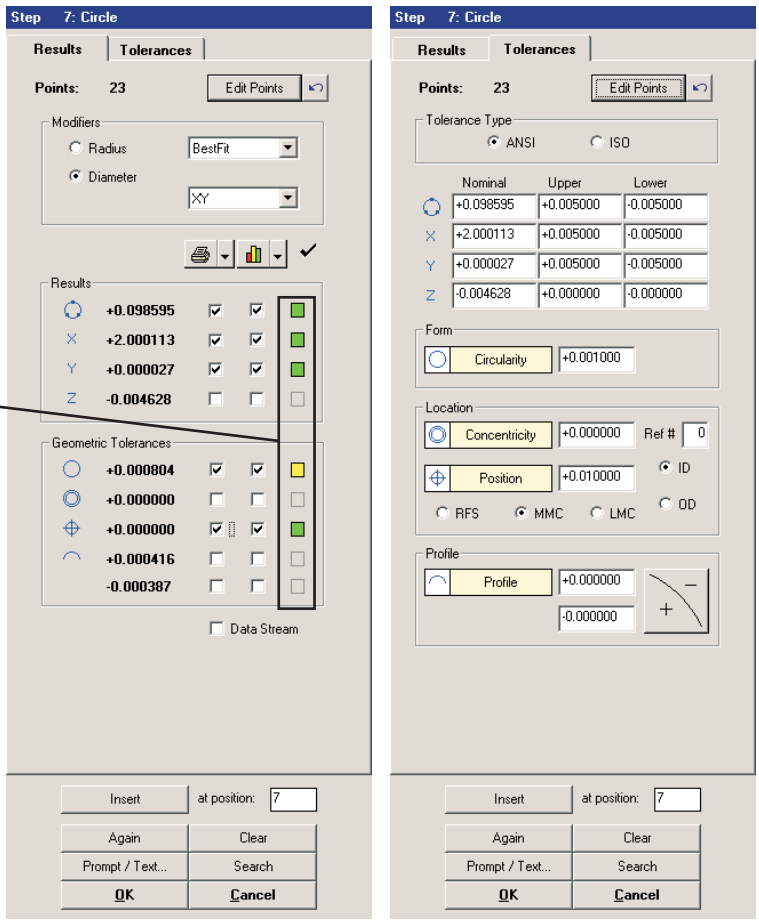
Notes:

1. Tolerances are carried forward to the next measurement of the same kind of feature; you do not need to re-enter the tolerances.
2. You can also use the Enhanced Editor to enter nominal values and tolerances. See *Using the Enhanced Editor to Change a Step* on page 14-6 for more information.

1. Measure a feature.
2. Click the **Tolerances** tab in the Measurement window.
3. Enter the desired nominal values and tolerances.
4. Click the **Results** tab to view the measurement results.

   The software calculates the deviations between the measured and nominal values and displays the deviations (pass/fail indicator) under the check mark in the Measurement window.

   - Green—in tolerance
   - Yellow—in tolerance but using 75% or more of the tolerance band
   - Red—out of tolerance
5. Click the **OK** button to save the step in the routine.



9.5 Saving a Routine

1. Click  .

   The standard Windows Save As dialog box appears.
2. Type a unique name for the routine in the **File name** box; change the directory if necessary.
3. Click the **Save** button to save the current routine in the specified directory.

9.6 Opening a Routine

1. Click  .

   The standard Windows Open dialog box appears.
2. Browse for the desired routine and do one of the following to open it:
   - Type the name of the routine in the **File name** box and click the **Open** button.
   - Double-click on the routine file name.

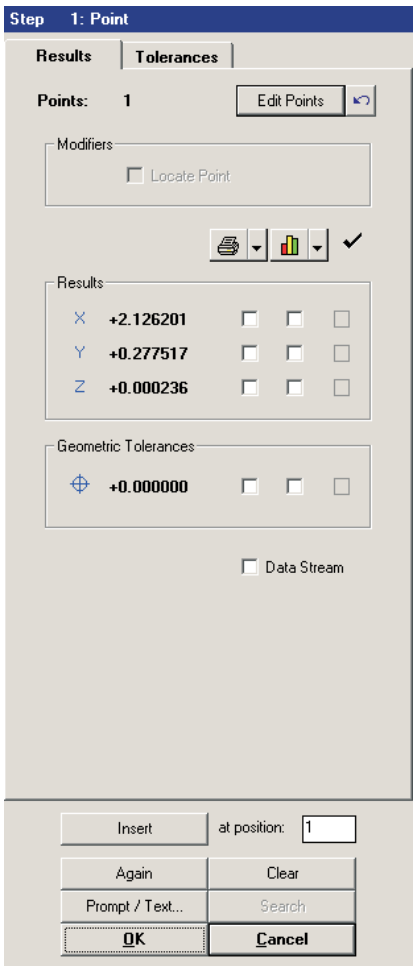
10. Measuring Features

10.1 Measuring a Point

To Measure a Point with a Weak Edge Point Tool:

1. Click the appropriate icon to display the desired Weak Edge Point tool:
   - Click  to display the **Average Weak Edge Point** tool
   - Click  to display the **Minimum Weak Edge Point** tool
   - Click  to display the **Maximum Weak Edge Point** tool
2. Click and hold the left mouse button at the beginning of the search area.
3. Drag the "rubber band" along the edge and release the button at the end of the search area.

   The software analyzes the edge and displays the search area and the point it found within the search area.
4. [Optional] Select the desired output options and the dimensions to be output.
5. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.



6. Press **Enter** on the joystick or click **OK** in the Measurement window to complete the step.

To Measure a Point with the Strong Edge Finder Tool:

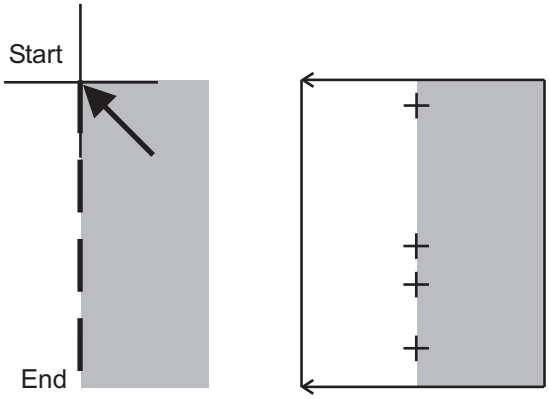
1. Click  to display the **Strong Edge Finder** tool.

2. Click  to select the **Measure Point** function.
3. Click on the desired point on the edge.

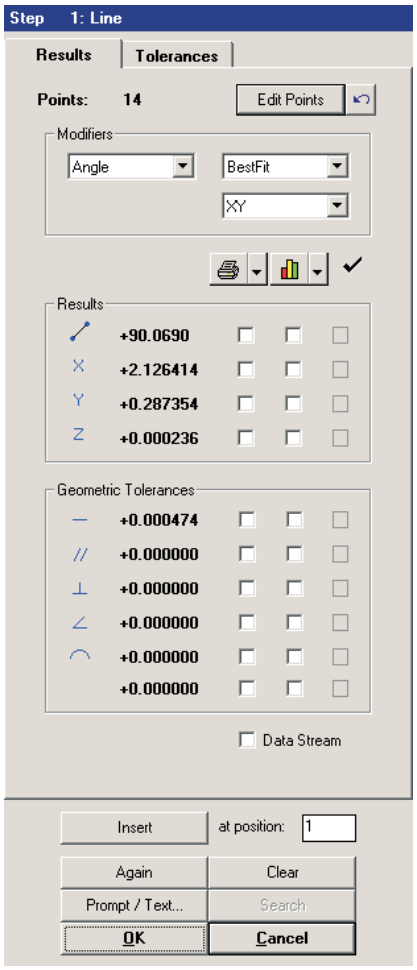
   The system automatically moves the stage so the point appears at the intersection of the crosshairs.
4. [Optional] Select the desired output options and the dimensions to be output.
5. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.
6. Press **Enter** on the joystick or click the **OK** button in the Measurement window to complete the step.

10.2 Measuring a Line

1. Click  to display the **FeatureFinder** tool.
2. Click and hold the left mouse button on the first point where you want to start measuring.
3. Drag the "rubber band" along the edge.
4. Release the left mouse button at the second (end) point.



   - The software analyzes the edge and displays the search area and the points it found within the search area.
   - Measurement results appear in the Measurement window
5. [Optional] Select the desired output options and the dimensions to be output.
6. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.
7. Press **Enter** on the joystick or click the **OK** button in the Measurement window to complete the step.

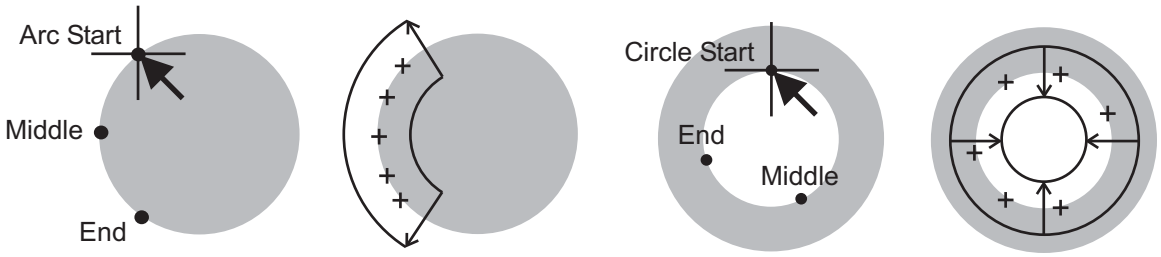


10.3 Measuring a Circle or Arc

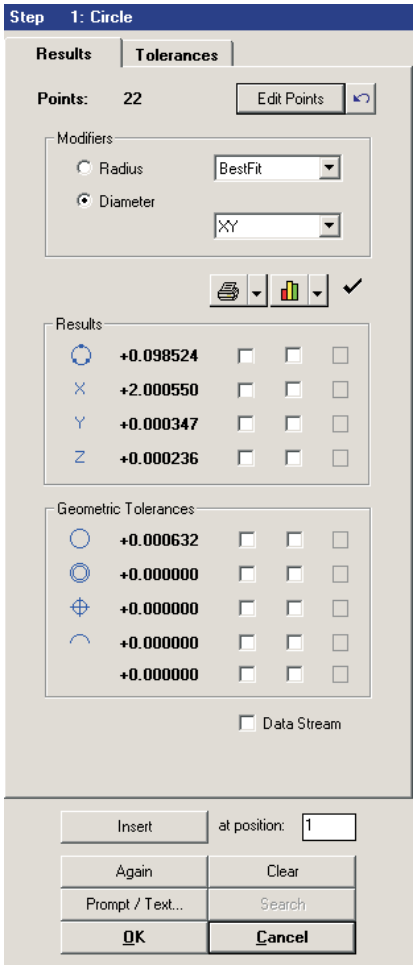
1. Click  to display the **FeatureFinder** tool.
2. Click on the first point where you want to start measuring.

   The first point is displayed as either "Arc Start" or "Circle Start."

   - If "Arc Start" appears and you want to measure a circle, click on the first point again to display "Circle Start"
   - If "Circle Start" appears and you want to measure an arc, click on the first point again to display "Arc Start"



3. Click on the second point.
4. Click on the third and final point.
   - The software analyzes the edge and displays the search area and the points it found within the search area.
   - Measurement results appear in the Measurement window.



Note: It is recommended that points 2 and 3 be spaced far apart.

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5. [Optional] Select the desired output options and the dimensions to be output.
6. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.
7. Press **Enter** on the joystick or click the **OK** button in the Measurement window to complete the step.

10.4 Measuring a Plane

1. Click  to display the **Basic Focus** tool.

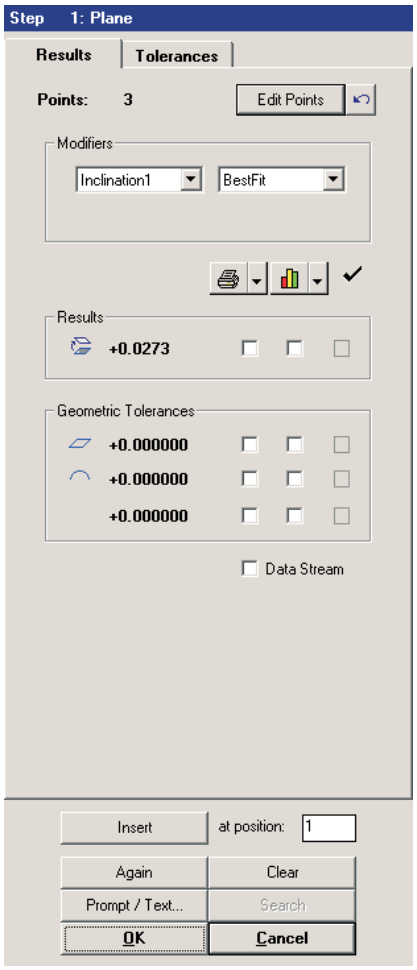
2. Click  to select the **Measure Plane** function.
3. Increase the surface illumination to approximately 45%.
4. Use the joystick to move stage so the first focus point (on the surface of the part) appears in the Image window.
5. Zoom to the highest magnification and adjust the illumination if necessary.
6. Twist the joystick knob to manually focus the surface.
7. Click anywhere in the Image window to perform an autofocus on the surface of the part.
8. Move the stage so the second focus point appears in the Image window.

Note: Make sure all points lie in the same plane and are not too close to one another or to edges/features that may be out of the plane.

---

9. Click anywhere in the Image window to perform another autofocus on the surface of the part.
10. Repeat Steps 8 and 9 to record a third focus point.

    Measurement results appear in the Measurement window after the minimum number of the focus points (three) have been entered.
11. [Optional] Select the desired output options and the dimensions to be output.
12. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.
13. Press **Enter** on the joystick or click the **OK** button in the Measurement window to complete the step.



11. Constructing Features

11.1 Overview

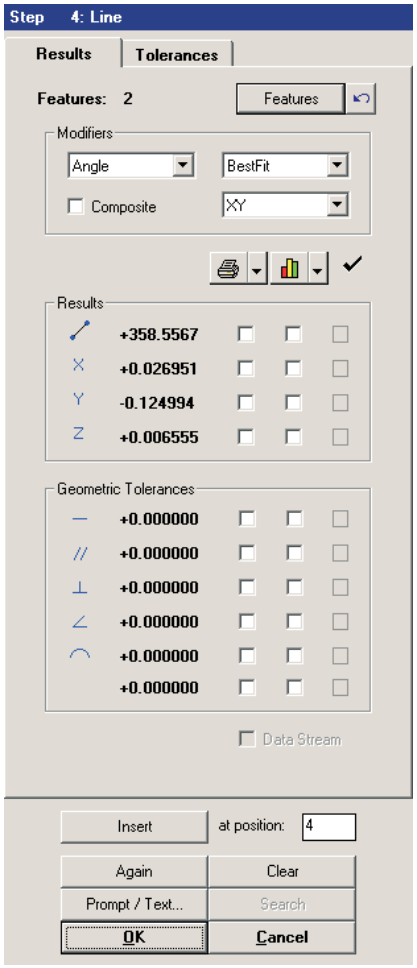
Construction functions take measured points or features and connect/compare them to determine dimensional or angular relationships.

11.2 Constructing a Line

1. Click  to select the **Construct Line** function.
2. Select the first feature to be used in the construction by clicking on it in the Model window or by double-clicking on it in the Listing window.

   The feature appears in a contrasting color.
3. Repeat Step 2 to select the second feature to be used in the construction.

   After selecting the minimum number of features, construction results appear in the Measurement window.
4. [Optional] Select the **Composite** check box to construct a composite line.
5. [Optional] Select the desired output options and the dimensions to be output.
6. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.
7. Press **Enter** on the joystick or click the **OK** button in the Measurement window to complete the step.

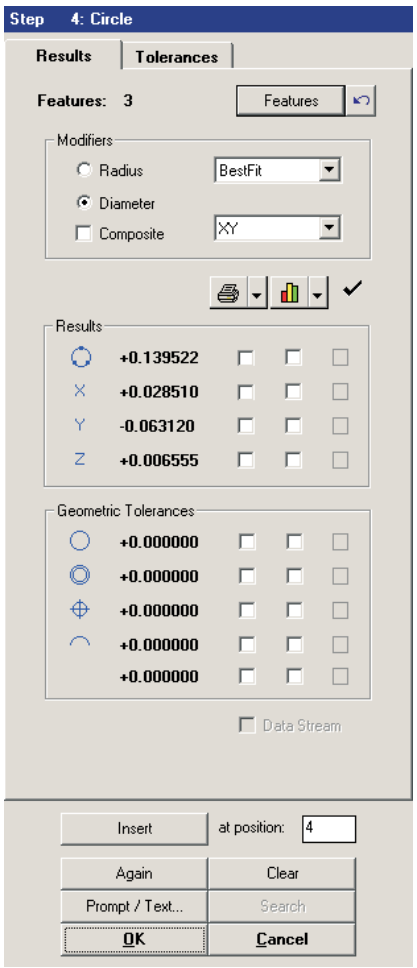


Note: The constructed line appears in the Model window as a dashed line.

11.3 Constructing a Circle

1. Click  to select the **Construct Circle** function.
2. Select the first feature to be used in the construction by clicking on it in the Model window or by double-clicking on it in the Listing window.

   The feature appears in a contrasting color.
3. Repeat Step 2 to select the second and third features to be used in the construction.
4. After selecting the minimum number of features, construction results appear in the Measurement window.
5. [Optional] Select the **Composite** check box to construct a composite circle.
6. [Optional] Select the desired output options and the dimensions to be output.
7. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.
8. Press **Enter** on the joystick or click the **OK** button in the Measurement window to complete the step.



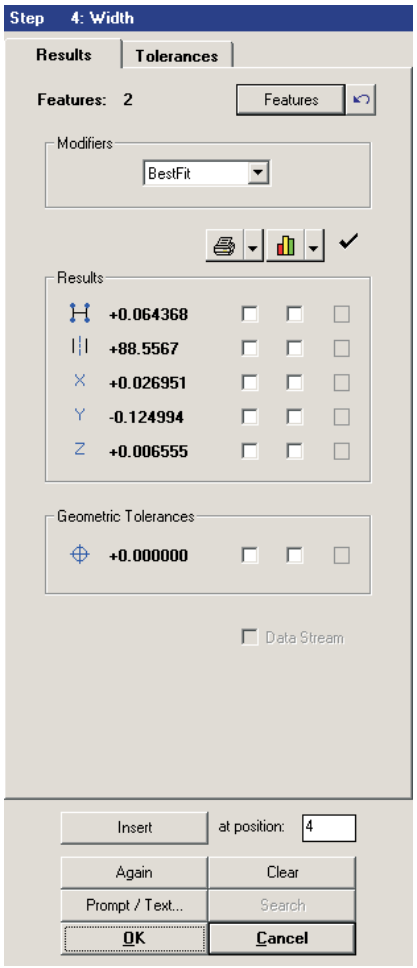
Note: The constructed circle appears in the Model window with dashed lines.

11.4 Constructing a Width

1. Click  to select the **Construct Width** function.
2. Select the first feature to be used in the construction by clicking on it in the Model window or by double-clicking on it in the Listing window.

   The feature appears in a contrasting color.
3. Repeat Step 2 to select the second feature to be used in the construction.

   After selecting the minimum number of features, construction results appear in the Measurement window.
4. [Optional] Select the desired output options and the dimensions to be output.
5. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.
6. Press **Enter** on the joystick or click the **OK** button in the Measurement window to complete the step.

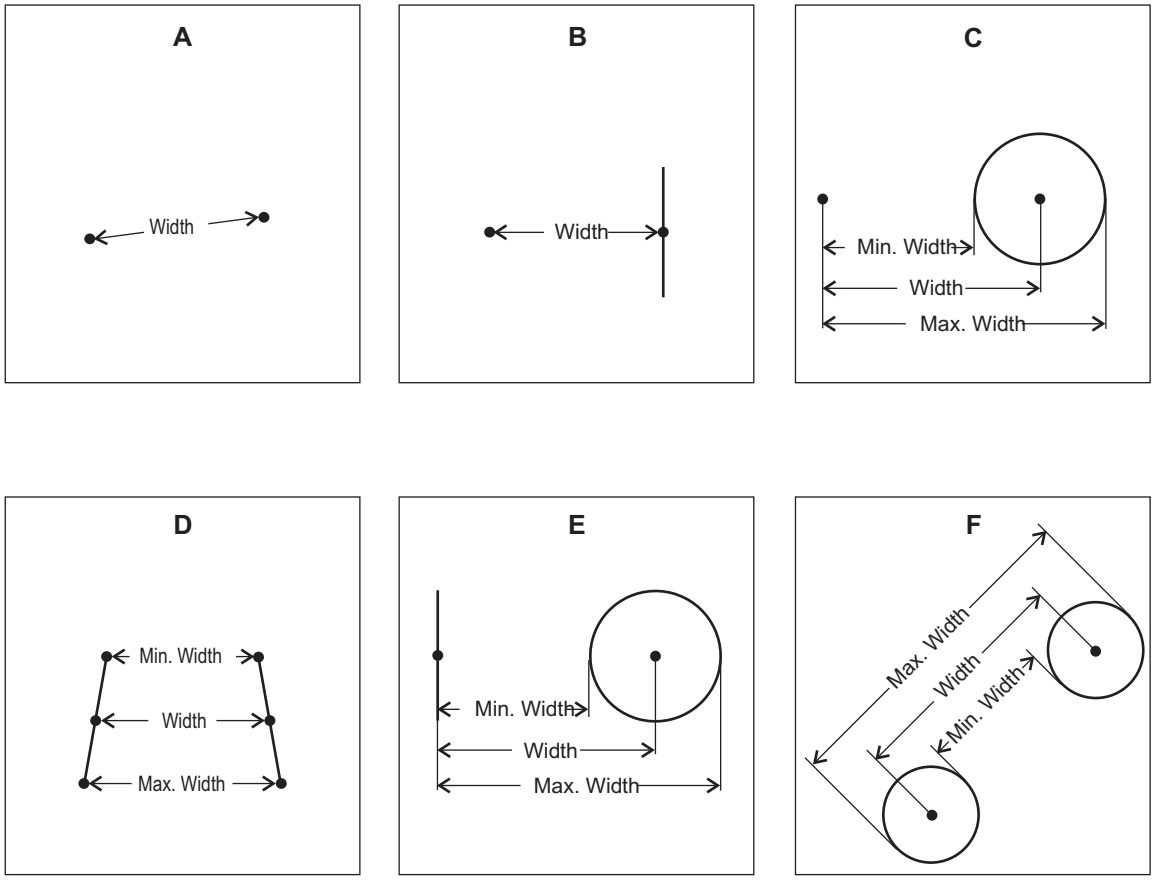


Note: The constructed width appears in the Model window as a cross.

Example: Width Between Features

The illustration below shows the different kinds of widths you can construct.

- (A) Width between two points
- (B) Width between a point and a line—the location of the width lies at the midpoint of the imaginary perpendicular line from the point to the line
- (C) Width between a point and a circle
- (D) Width between two lines—the width is calculated as a perpendicular between two best-fit lines
- (E) Width between a line and a circle—the location of the width lies at the midpoint of the imaginary perpendicular line from the center of the circle to the line
- (F) Width between two circles

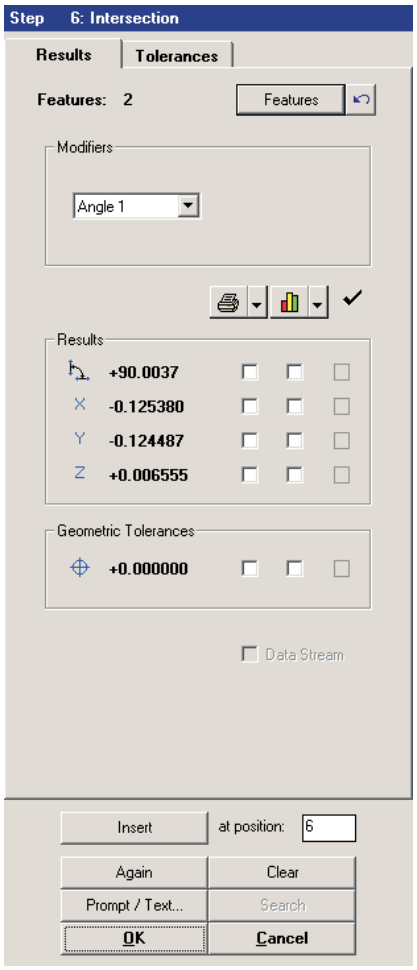


11.5 Constructing an Intersection

1. Click  to select the **Construct Intersection** function.
2. Select the first feature to be used in the construction by clicking on it in the Model window or by double-clicking on it in the Listing window.

   The feature appears in a contrasting color.
3. Repeat Step 2 to select the second feature to be used in the construction.

   - If there is only one intersection, the construction results appear in the Measurement window after the second feature is selected.
   - If there are two intersections (for example, between a line and a circle), the system drives the stage to the first intersection and it appears as a small triangle in the Model window. To display the other intersection, click the **2 of 2** radio button.
4. [Optional] Select the desired output options and the dimensions to be output.
5. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.
6. Press **Enter** on the joystick or click the **OK** button in the Measurement window to complete the step.

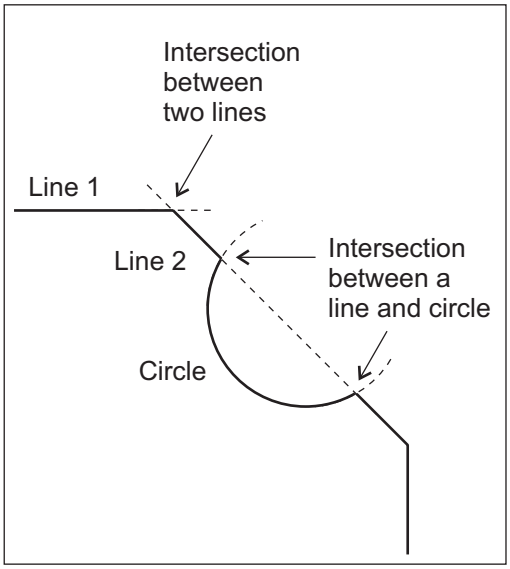


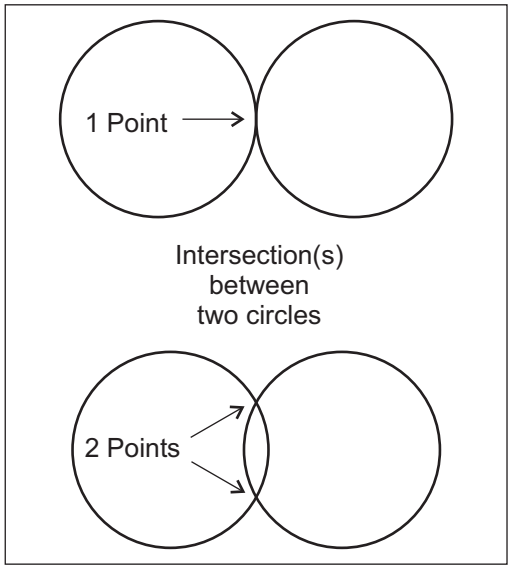
Note: The constructed intersection appears in the Model window as a cross.

Example: Intersection Points Between Features

The illustration below shows the different kinds of intersections you can construct.

- Intersection between two lines (reports the angle between the two lines)
- Intersection between a line and a circle (reports one or two points)
- One or two intersections between two circles (reports one or two points)



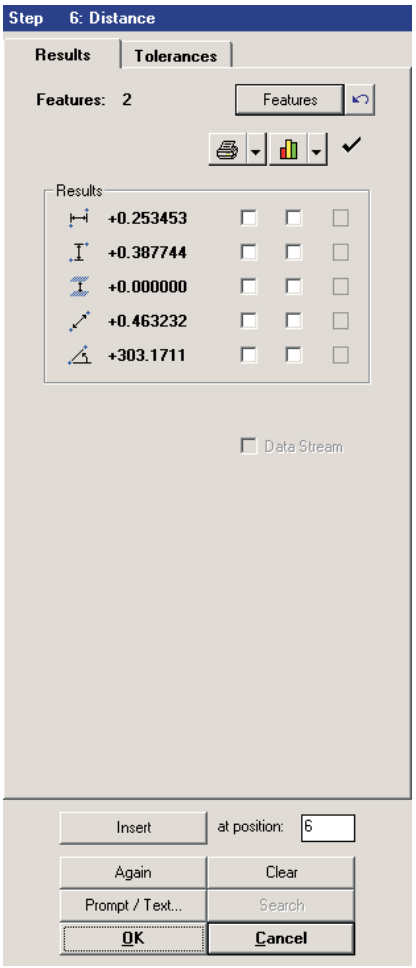


11.6 Constructing a Distance

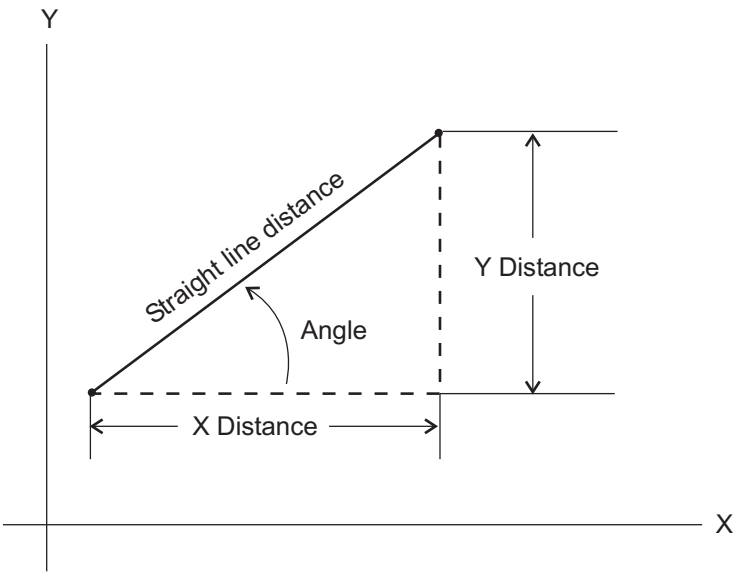
1. Click  to select the **Construct Distance** function.
2. Select the first feature to be used in the construction by clicking on it in the Model window or by double-clicking on it in the Listing window.

   The feature appears in a contrasting color.
3. Repeat Step 2 to select the second feature to be used in the construction.

   After selecting the minimum number of features, construction results appear in the Measurement window.
4. [Optional] Select the desired output options and the dimensions to be output.
5. [Optional] Click the **Tolerances** tab and enter nominal values and tolerances.
6. Press **Enter** on the joystick or click the **OK** button in the Measurement window to complete the step.

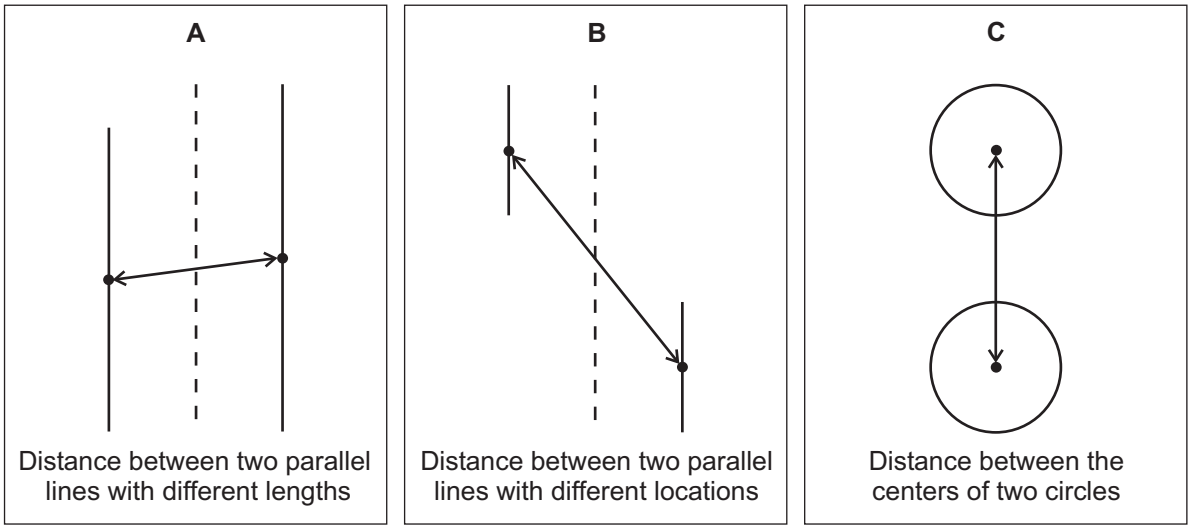


Note: The constructed distance does not appear in the Model window.



Example: Distance Between Features

In the following examples, the straight-line distance is calculated between the midpoints of lines and the centers of circles.



12. Running a Routine

12.1 Overview

After creating an eBx routine, you need to run it to check if it measures the features properly. You also need to understand the run options and overrides that can be selected, and know how to stop a routine in mid-run.

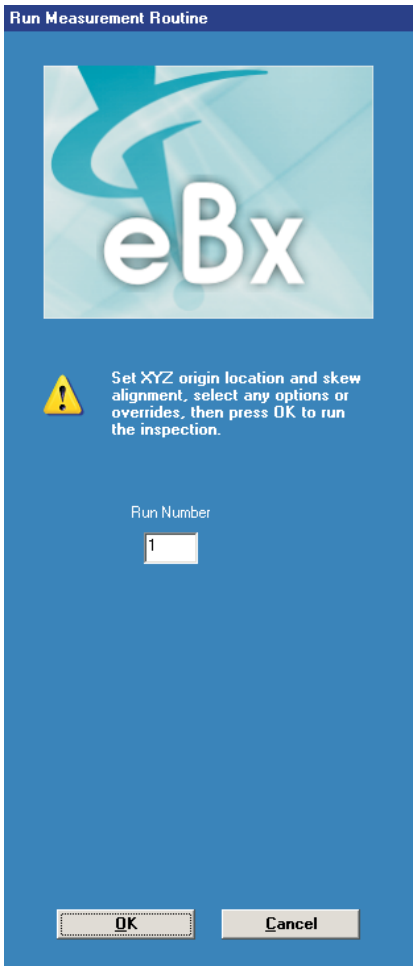
To run the current routine, click  .

The Run Routine window displays instructions to do the part setup. You can access the run options, overrides, setup instructions, and report header/footer information in the Part Setup menu.

If you did the setup, the path is clear to the first feature (or port if it was measured with the touch probe), and you want to use the default options, click the **OK** button.

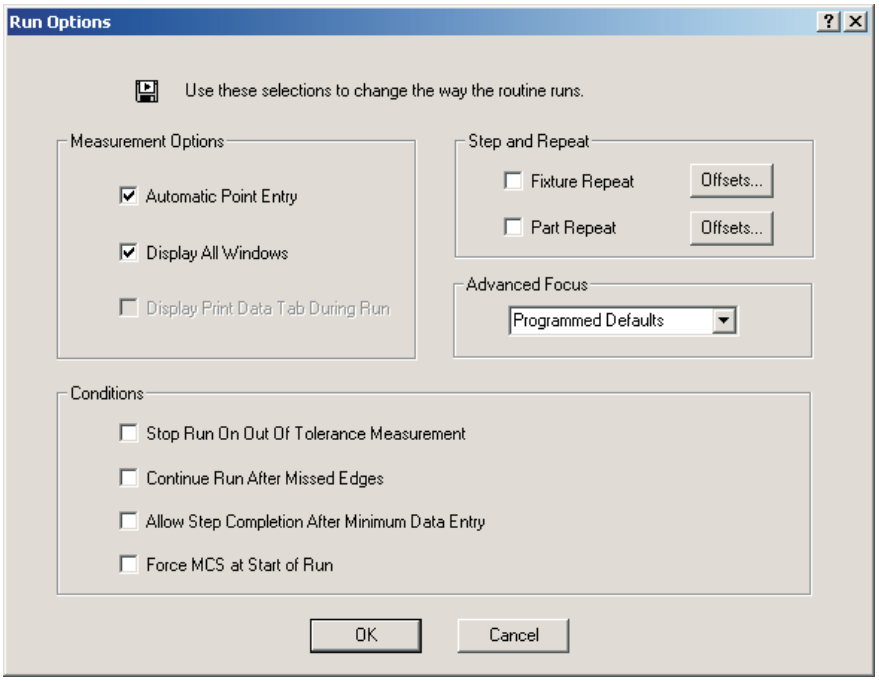
The routine runs through every step displaying the measurements that you did. If you measured any features manually, the system stops at each measurement point; you must locate the edge or feature and press Enter on the joystick to accept the position and continue running the routine.

If the setup (described in Section 6) is not correct for the current part, do it now before clicking the OK button.



12.2 Routine Run Options

Select **Part Setup** / **Run Options** to specify certain settings when you run the routine.



12.2.1 Measurement Options

You can select any of the following measurement options:

- **Automatic Point Entry.** This activates the automatic entry of Strong Edge Finder and FeatureFinder points.
- **Display All Windows.** This allows you to display or not display the Measurement and Model windows during the routine run. The routine runs slightly faster if you do not display the windows.
- **Display Print Data Tab During Run.** This displays the print data output in the Image window area during the run. If a measured feature fails, the software will display the Image window until the step is completed and then it will redisplay the print data output.

12.2.2 Step and Repeat Options

Two options enable you to measure multiple samples of the same part in a fixture.

- **Fixture repeat** is used to measure parts where the fixture may have empty cavities and uneven offsets.
- **Part repeat** is used to measure equally spaced parts in a fixture.

Note: Fixture Repeat and Part Repeat are mutually exclusive. You can select one option or the other but not both at the same time.

12.2.3 Run Conditions

You can select any of the following run conditions:

- **Stop Run On Out of Tolerance Measurement.** If this condition is checked, the system stops the run if a feature is out of tolerance and puts up a confirming window so you can stop the run.
- **Continue Run After Missed Edges.** When the software encounters a missed strong edge or a focus fails during the run, it displays a warning message and waits for you to select a valid edge or redo the focus to continue the run. For missed weak edge features or points, the system prompts you to change the run to Step Edit.

  This condition instructs the software not to display any message and wait for user input. The software continues with the next point in the feature. You can stop the run on missed tolerance features if you selected the **Stop Run on Out of Tolerance Measurement** run condition.
- **Allow Step Completion After Minimum Data Entry.** This option is available for measurements that use manual alignment targets. It allows you to end the measurement during the run after the software has processed the minimum number of points for the feature, regardless of how many points were originally entered. With this option, the calculation is based only on the points actually measured and entered. The remaining points will be retained in the routine but they will not be used in the calculations. This condition works only if the Display Windows option is ON.
- **Force MCS at Start of Run.** This option clears the current PCS or SCS and resets the system coordinates to MCS, as necessary, when you select Run or Step Edit. It is assumed that the routine was created in MCS.

12.3 Run Override Options

Select **Part Setup** / **Run Overrides**, to display a dialog box with the run override options that were used last.

Click on a tab to display the desired override options.

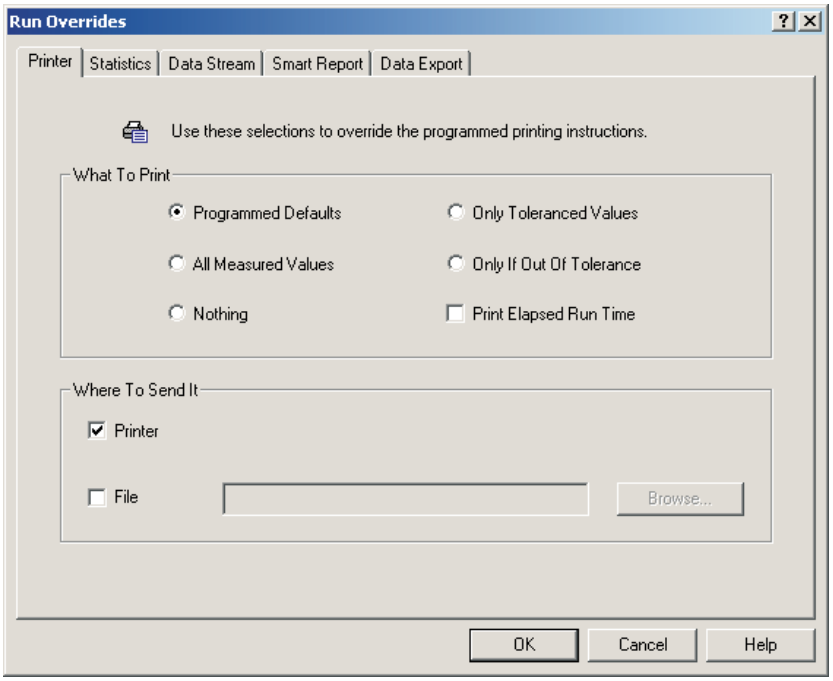
When the system displays the selected override options, each option has a radio button or a check box next to it.

- If the option has a check box next to it, select the check box to select that option; clear the check box to deselect the option. You can select as many options as you want.
- If the option has a radio button next to it, you can select only one of the options in the group because they are mutually exclusive. For example, for Statistics Override, you can select only Programmed Defaults, All Measured Values, or Nothing.

Printer Override Options

The options listed here override any Printer settings for the dimensions or measurements in the individual steps. You can select any of these options when you begin to run the routine.

The selected values will be output to the Print Data Destinations.



- **Programmed Defaults.** This uses the Print settings in the steps.
- **All Measured Values**. All dimensions and measurements are sent to the printer.
- **Nothing.** No dimensions or measurements are sent to the printer.
- **Only Toleranced Values.** Only those dimensions and measurements that have nominal values and tolerances are sent to the printer.
- **Only if Out of Tolerance.** Only those dimensions and measurements that are out of tolerance are sent to the printer.
- **Print Elapsed Run Time.** If this option is checked, the software prints the elapsed time for the run of the routine.

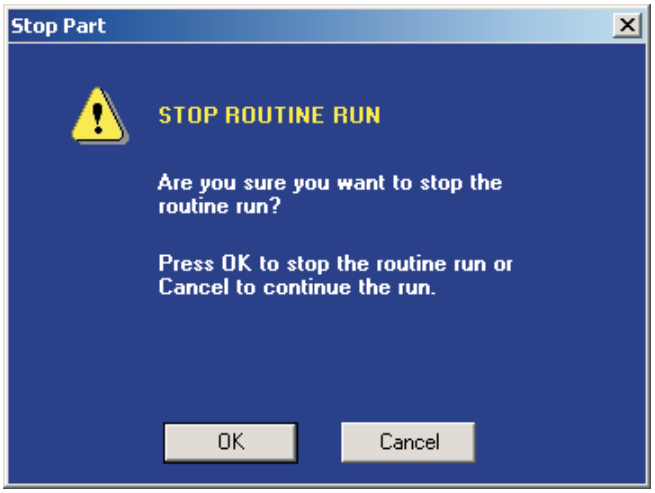
You can specify two destinations for the print data (when you select dimensions and click on the Printer icon in the step):

- **Printer** (this is the default setting).
  - When you are creating or editing a routine or the routine is in step edit mode, the checked dimensions are sent to the Print Data Output.
  - When you run the routine, the checked dimensions are sent directly to the printer and printed when the run is completed.
- **Print to File.** This overrides the printer. Any values checked for Print are sent to a file rather than to the data printer.
  - When you check this box, you can type the name of a new or existing file. The default file type is PRT. If you click on the Browse button, the software displays the standard "Save As" dialog box where you can change the path and file name.
  - The software overwrites the data if you use the same file each time you run the routine.
  - The override is turned off whenever you select System / Reset, File / New, or File / Open.

12.4 Stopping a Routine

Stop the routine at any time by pressing the **Stop/Start** button on the joystick (or control panel).

The software immediately stops stage movement, stops at the measurement that was in progress, and displays the following prompt:



To stop the run, click the **OK** button. Then click **OK** in response to the displayed prompt.

To resume the run, click the **Cancel** button.

Note: After pressing the Stop/Start button, the software also turns on the yellow indicator light on the Stop/Start button in the DRO window. The stage, Z axis slide, focus, and zoom lens cannot be moved as long as the yellow indicator light is On. You must press the Stop/Start button on the joystick (or control panel) again to resume the run. This also turns off the yellow indicator light.

---

13. Outputting Measurement Results

13.1 Overview

After measuring or constructing a feature, measurement/construction results appear in the Measurement window. The default setting is to display the measurements and not to output the measurement/construction results.

This section describes:

- Measurement output options and destinations
- How to output measurement results
- Print data output
- How to interpret measurement results sent to a printer

13.2 Measurement Output Options and Destinations

You can output measurement/construction results to up to four destinations, which are shown on the measurement output icons. However, only two destinations are displayed at the same time.

The measurement results can be output in the following ways after you select the destinations and the dimensions to be output:

- Print data (when you select dimensions to be printed in a step) can be sent to the printer, and/or a print file, based on the destinations selected in the *Printer Override Options* (described in Section 12).
  - You can indicate whether data is to be printed during the creation of a routine or in step edit mode in the *Print Data Configuration* (described in the *eBx Reference Guide*).
  - The data is output to the selected destinations when you run the routine.
  - If you want to print the data on the attached data printer, you can click on the Printer icon itself.
- Sent to a statistics file when the step is created or when you run the routine (depending on the Statistics Override Options)
- Sent to a file for Report Output when you run the routine
- Sent to a file for Data Export when you run the routine
- Sent to a data stream file when you run the routine
- Displayed in the Routine Listing on the screen when the step is created and when you run the routine. This includes the actual measurements and specified nominal and tolerance values, but does not include the deviations. (See the *Routine Listing Toolbar* topic in the *eBx Reference Guide* for more details.)

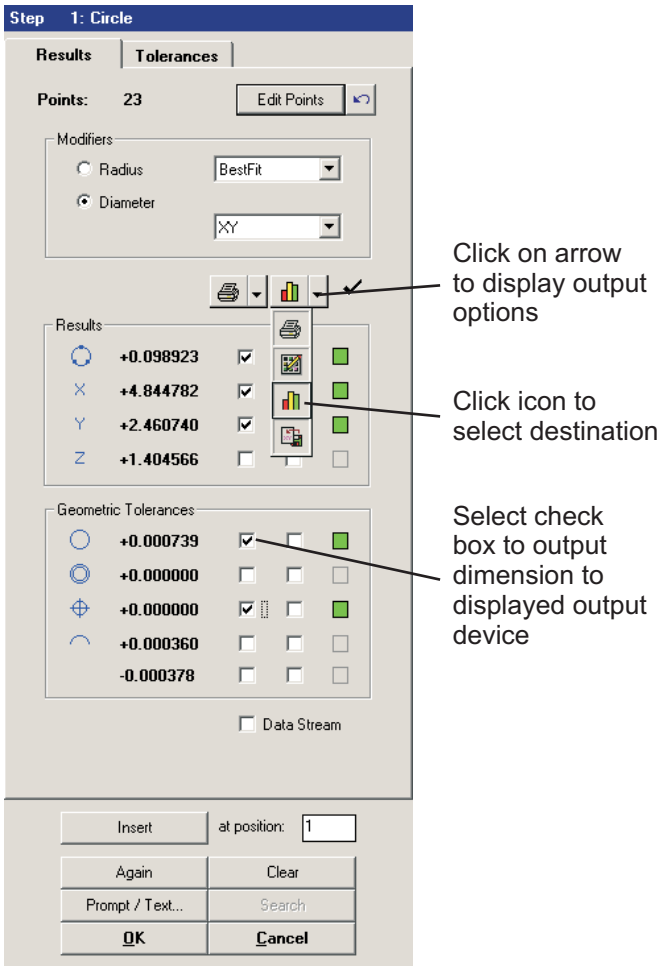
13.3 Outputting Measurement Results

Access the Measurement window for the desired step.

Click on the **arrow** next to the destination icon and click on the desired destination icon from the drop-down list. This clears all the check boxes for the current destination but it does not clear the checked boxes for any previously- selected destinations.

Select the **check box** next to the desired measurement(s) under the destination icon to select the measurement(s) for output.

For print data, click on the printer icon itself **only if** you want to output the measurements to the print data output or to a print file during the routine creation mode (before it is run).



- If you selected Printer in the Printer Override Options, the software immediately places the selected measurements in the print data output. It is assumed that "Print during create" is selected in the Print Data Configuration.
- If you selected File in the Printer Override Options, the software immediately sends the measurements to the print file.

Click the **OK** button at the bottom of the window or press **Enter** on the joystick to close the Measurement window.

The selected measurement results are output to the selected destination(s) when the routine is run.

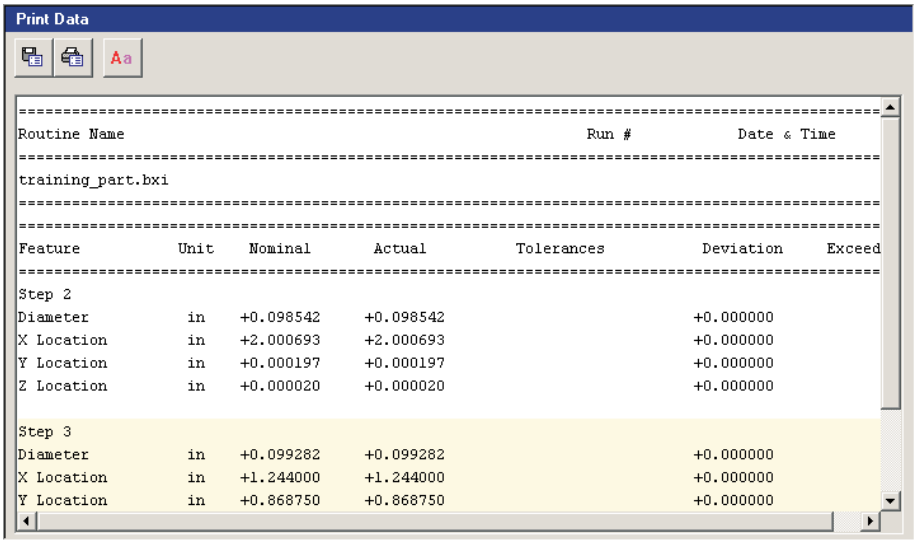
Note: You can also use the Enhanced Editor to specify the output options. See *Using the Enhanced Editor to Change a Step* on page 14-6 for more information.

13.4 Print Data Output

The Print Data window displays the dimensions that were output to a printer in a measurement step. This includes the actual measurements, specified nominal values and tolerances, and deviations.

This window acts as a temporary location for the print data output. You can output the data to the printer or to a file using the Print Data toolbar.

The dimensions are sent to this window during the creation, editing, and step edit modes when Printer and/or Print Data Tab are selected in the Printer Override Options (described in Section 12) and Print During Create is On in Print Data Configuration (described in the *eBx Reference Guide*).



When you run the routine:

- The software clears this area at the start of the run. It does not clear the area if the routine is run again with the Part Repeat or Fixture Repeat run options.
- The software sends the print data to this area.
- [Standard User Interface] The software displays this window instead of the Image and Model windows if Display Print Data Tab During Run is selected in the Run Options.

At the end of the run, the software sends the data to the printer if Printer was selected in the Printer Override Options. Otherwise, click  to print the data.

13.5 Understanding Measurement Results Sent to a Printer

All measurements sent to a printer or print file are output in a report format. This includes the name of the routine, run number, and date and time at the beginning of the report along with page numbers at the top of every page. If you entered a report heading (see Section 10 in the *eBx Reference Guide*), it also appears at the beginning of the report.

For each step, the report lists the step number, any comment (report text) that you entered, and the units, nominal values, tolerances, and deviations of each feature in the step.

```
================================================================================
Feature      Unit   Nominal     Actual      Tolerances      Deviation   Exceeded
================================================================================
Step 5 - Upper-left hole measurement
Diameter      in  +00.10000  +00.09943  +0.00300  -0.00300  -00.00057    -
X Location    in  +00.00000  -00.00007                      -00.00007
Y Location    in  +01.25000  +01.25015                      +00.00015
Position      in             +00.00033  +0.00743           +00.00033    +
```

The Exceeded column uses + and - signs to indicate where the actual value falls in relation to the nominal and the upper and lower tolerances. A number in the column indicates that the actual value has exceeded the tolerance. The number represents the deviation from the nominal, minus the associated tolerance. The number is calculated as follows:

Actual Value - Nominal = Deviation

Deviation - Associated Tolerance = Number in the Exceeded Column

Sign	Meaning
(blank)	A deviation is not calculated because tolerances are not specified.
+	The deviation is between the nominal (0) and 25% of the upper tolerance.
+ +	The deviation is between 26% and 50% of the upper tolerance.
+ + +	The deviation is between 51% and 75% of the upper tolerance.
+ + + +	The deviation is between 76% and 100% of the upper tolerance.

Sign	Meaning
-	The deviation is between the nominal (0) and 25% of the lower tolerance.
- -	The deviation is between 26% and 50% of the lower tolerance.
- - -	The deviation is between 51% and 75% of the lower tolerance.
- - - -	The deviation is between 76% and 100% of the lower tolerance.

14. Editing a Routine

14.1 Overview

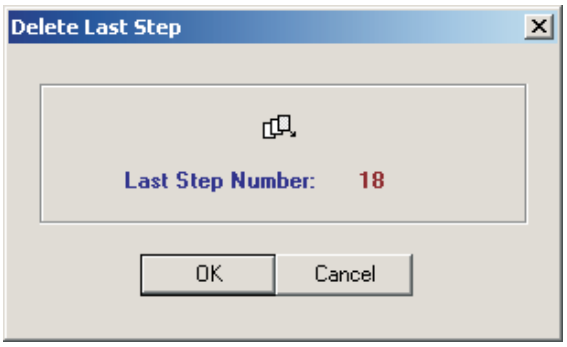
This section describes how to:

- Delete the last step
- Insert a step
- Delete a step
- Change a step
- Copy a step

14.2 Deleting the Last Step

1. Click  .

   The following confirmation prompt appears:



2. Click **OK** to delete the last step that was completed in the routine.

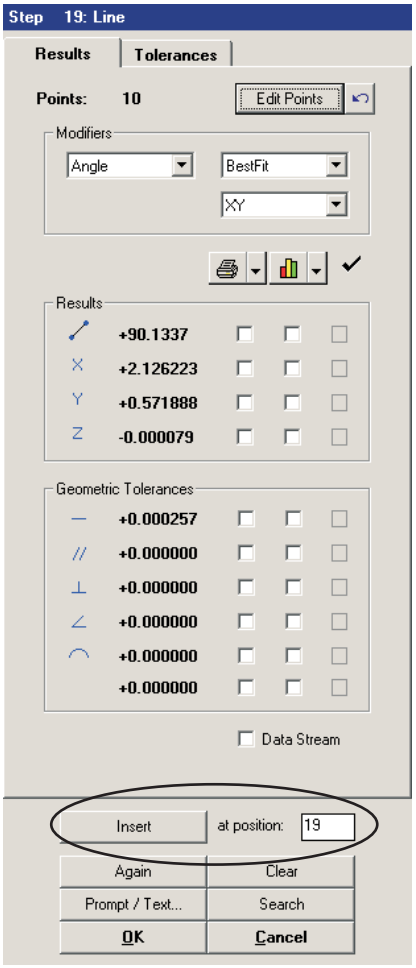
Note: You can use this function more than once. For example, to delete the last three steps in the routine, use this function three times in a row.

14.3 Inserting a Step

Note: You can insert a step anywhere in the routine. The software increments the step numbers that follow the inserted step.

1. Measure or construct a feature, as described in Sections 10 and 11.
2. Locate the **at position** box in the Measurement window and enter the position in the routine where you want the new step to be inserted. For example, if you want the new step to be the new Step 4, type 4 in the at position box.
3. Click the **Insert** button.

   The software adds the new step to the routine at the specified position and all the steps that follow the inserted step are renumbered. For example, if you insert a new step at position 4, the new step becomes Step 4, the old Step 4 becomes Step 5, the old Step 5 becomes Step 6, etc.



14.4 Deleting a Step

1. Click  .

   The software displays a prompt for the step number(s) in the Measurement window.

2. Specify the beginning step number by doing one of the following:
   - Type the desired number in the **From** box.
   - Click on the desired feature in the Model window.
3. If you only want to delete one step, leave the **To Step** box empty and go to Step 5.
4. If you want to delete two or more steps or a range of steps, repeat Step 2 to specify the ending step number in the **To Step** box.
5. Click **OK**.

   The following appears:

6. Click **OK** to delete the specified feature(s).

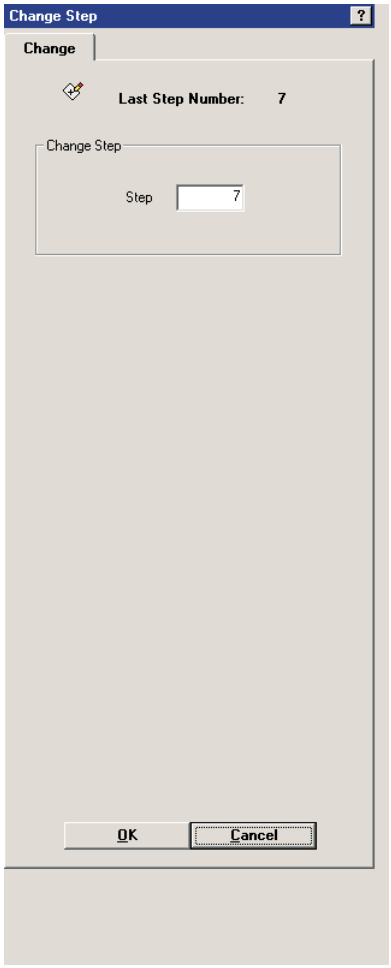
Be careful when deleting a step that is part of a constructed feature. If deleting a step invalidates a constructed feature (the feature no longer has the required number of reference features to calculate a geometry), the software displays a message indicated that the constructed feature must be deleted or modified.

Be careful when deleting a step that contains a datum. This could invalidate other measurements.

14.5 Changing a Step

You can change a step in many different ways. For example, you can:

- Add, change or remove points or features that were used to measure or construct a feature
- Re-measure or change the feature using different tools, targets, units, magnification, or light settings
- Add, change or remove nominal and tolerance values for a feature by clicking on the Tolerances tab
- Change the output options and destinations in the Measurement window. For example:
  - For Print, you can change or add to the nominal and actual values sent to the printer by placing a check mark in front of at least one value.
  - For Statistics, you can change or add to the actual values sent to the designated port or file by placing a check mark in front of at least one value. If you specify a file, a window displays allowing you to create a new file or access an existing file.



14.5.1 Using the Edit Step Mode to Change a Step

1. Do one of the following:
   - Click on the desired feature in the Model window.
   - Click  and specify the step number in one of the following ways:
     - Type the desired Step number in the Step box.
     - Click on the desired feature in the Model window.

     Then click the **OK** button. (To quit the Edit Step Mode, click the **Cancel** button.)

After selecting the desired feature, the software does the following depending on how the feature was measured:

- If the feature was measured optically, the system:
  - Displays the measurement results in the Measurement window and the video image in the Image window.
  - Adjusts the magnification and illumination used to measure the feature.
  - May display a prompt to move the stage. If you respond Yes, the system moves the optics and the stage to the location where the feature was measured.
- If the measured feature is a plane or sphere the system does not move the stage.
- If the feature was constructed or measured with a touch probe, the system displays the Model window and the measurement results in the Measurement window. It does not move the stage.

2. Change the feature as desired just as if you were creating the step.
3. Click the **OK** button.

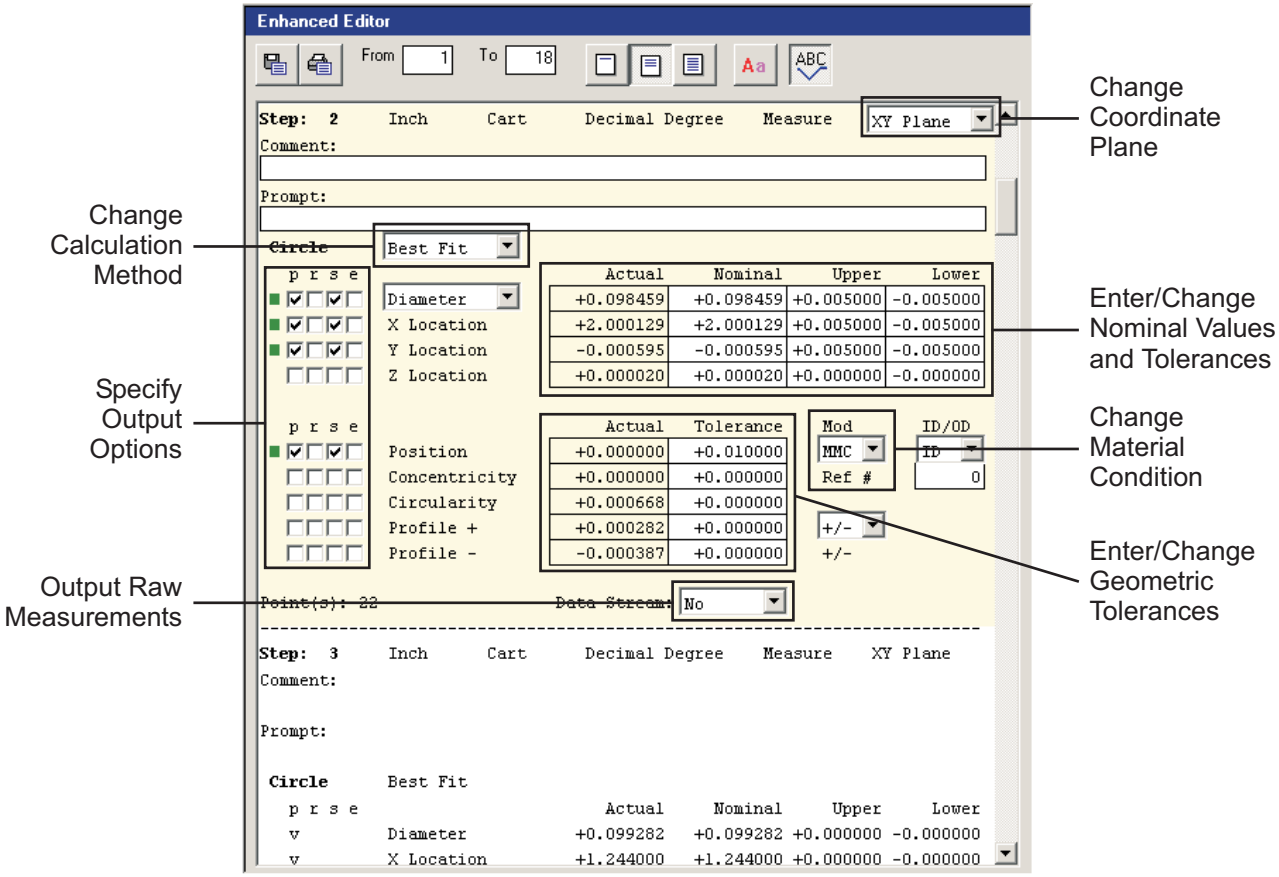
Notes:

1. If you are editing the points of a step, it is recommended that you install the correct sensor that was used to create the feature in the step being edited. This prevents unexpected stage motion which may cause the optics or touch probe to crash into the part. For example, if the feature was measured with a touch probe, you must make sure the touch probe is enabled.
2. If you change a step that was measured with a rotary indexer, make sure that the part is rotated to the same position where the feature was measured during the creation of the routine.

14.5.2 Using the Enhanced Editor to Change a Step

Use the Enhanced Editor to edit a step directly in the Listing window instead of using the Edit Step Mode to make changes in the Measurement window.

To activate the Enhanced Editor, click  in the Listing Window toolbar. Then click on the desired step in the Enhanced Editor and make the desired changes.



Note: The Enhanced Editor is synchronized with the Model window and Print Data window—the Model window and Print Data window are automatically updated whenever you make changes in the Enhanced Editor.

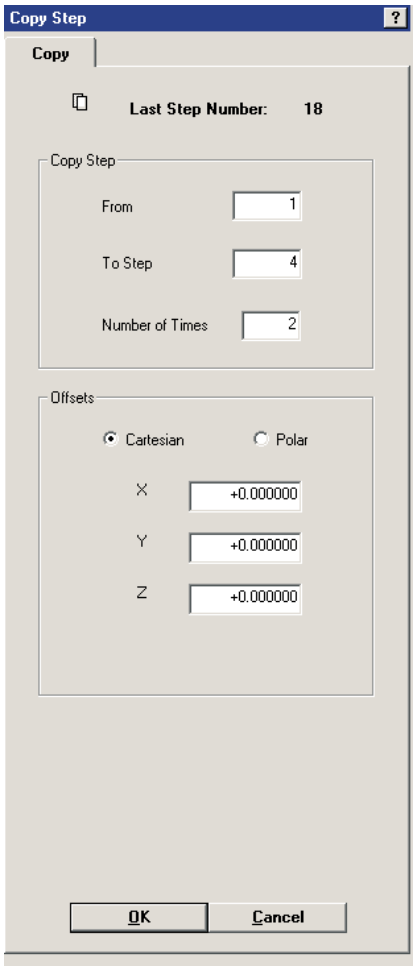
14.6 Copying a Step

Note: If a part has many features with the same characteristics (geometry, size, tolerances, output options, etc.), you can use the Copy function to quickly add the features to the routine. You can copy one or more steps at a time.

1. Click  .

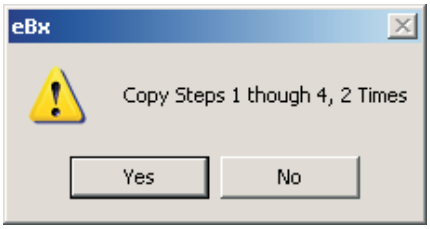
   The software displays a prompt for the step number(s) in the Measurement window.

2. Specify the beginning step number by doing one of the following:
   - Type the desired number in the **From** box.
   - Click on the desired feature in the Model window.
   - Double-click on the desired feature in the Listing window.
3. Repeat Step 2 to specify the ending step number in the **To Step** box.
4. Use the **Number Of Times** box to specify the number of times you want to copy the selected feature(s).
5. Select **Cartesian** (default) or **Polar** coordinates by clicking the appropriate radio button.
6. Enter an offset (XYZ or RAZ coordinates). If you do not specify an offset, zeros are assumed. Offsets are added to the nominal coordinates of each copied step. All offsets are relative to the **current** datum setup.



7. Click **OK**.

   The following appears:



8. Click the **Yes** button to copy the selected feature(s).

   The software displays the copied feature(s) in the Model window.

15. Configuration Settings

15.1 Overview

Configuration settings (parameters) affect the general performance of the system.

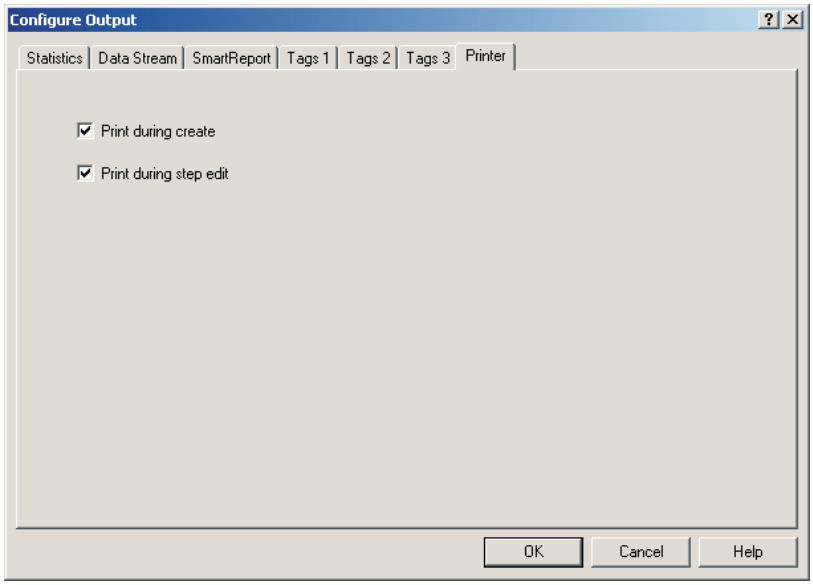
Note: See the *eBx Reference Guide* (P/N 795051) for information about other software configuration settings.

15.2 Configuring Print Data Output

Select **System** / **Configuration** / **Output** and click the **Printer** tab to change the print data output configuration.

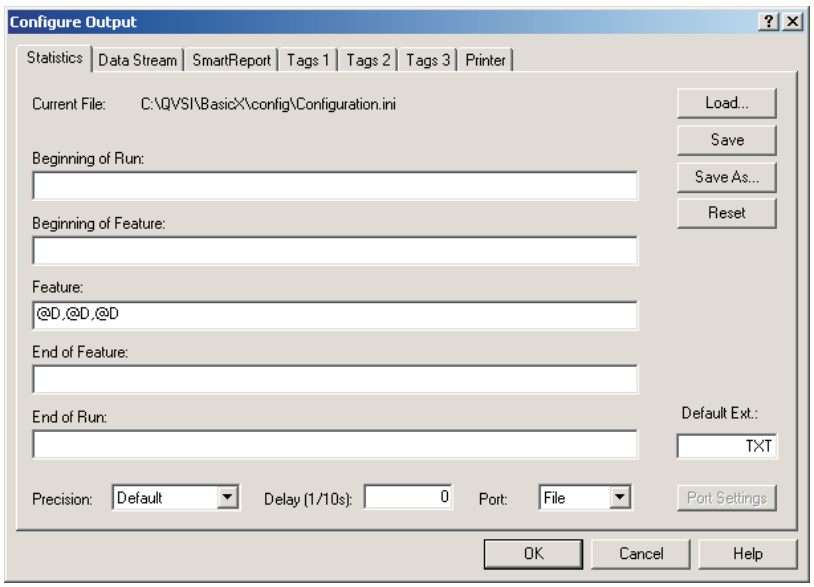
- To print measurements while creating a routine, select the **Print during create** check box.
- To print measurements during Step Edit, select the **Print during step edit** check box.
- To refrain from printing measurements in either case, do not select either check box.

Note: The data printed during run mode is based on the selected printer override options (described in Section 12).



15.3 Configuring Statistics Output

Select **System** / **Configuration** / **Output** and click the **Statistics** tab to display or change the statistics output configuration.



The name of the file from which the configuration is loaded is shown at the top. This can be either:

- The default configuration, which is defined in the Statistics section of the CONFIGURATION.INI file. You can use the default configuration with any routine that you create. The software loads the defaults into temporary memory when you start creating a new routine.
- The configuration that you have defined and saved in a separate file. Each routine can have its own statistics output configuration file. Different routines can also share the same statistics configuration data file.

You can also configure the following:

- The **default file name extension** for the statistical data, which is TXT. To change it, highlight the extension and type the desired extension.
- **Delay**, which is used to pause the system **after** the statistics value has been transmitted to allow additional processing time. The value entered is in tenths of seconds. For example, to add a 30 second delay, enter 300.
- **Destination**, which can be a file or output device connected to a serial port. See the *Statistics Output Options and Destinations* topic on the next page for more information.

You can save/load the statistics output configuration in the following ways:

- Click the **Save** button to save the configuration data currently in memory and close the dialog box. The data is saved in the file whose name is displayed at the top of the dialog box (or the default file if a name is not displayed).
- Click the **Save As** button to save the configuration data in a new file and close the dialog box. The default file extension is INI and the default folder is CONFIG.
- Click the **Load** button to open a different statistics configuration file and load the data into temporary memory. The system displays an appropriate message if you try to load an invalid file.
- Click the **Reset** button to reload the default data that are in the CONFIGURATION.INI file (in the C:\QVSI\BASICX\CONFIG folder).

When you click the **OK** button, the software will use the data currently in memory. If you changed any of the data but you did not save it, the software displays a confirmation prompt and asks if you want to continue without saving the data.

If you click the **Cancel** button, the software closes the dialog box and continues to use the statistics data that were in memory before you made any changes or loaded another file.

Statistics Output Options and Destinations

You can output the statistics measurements in the following ways, based on the statistics output configuration and statistics templates:

- Send the data to a printer, data collector or other output device connected to the serial (COM) port. If you select a serial port, the software displays a **Port Settings** button. You can click on this button to configure the port.
- Save the data in a file. If you send data to a file, it will not go to the output device. The system prompts you for a statistics file name as described in the topic *How to Output Measurement Results to a Statistics File* in Section 11 of the *eBx Reference Guide*.

To select the destination, select **File** or the desired serial port from the drop-down list.

When you create a routine, the statistics data is first sent to a temporary file, C:\QVSI\BASICX\TEMP.STA. This file contains **all** the features sent during the **creation** of the routine and the **most** recent run of the routine. The system copies the data to the specified statistics file only **after** the run is completed. If the run is not completed for any reason, you can access the statistics data of the completed steps in the TEMP.STA file.

16. Measurement Tips

16.1 Overview

This section provides tips for:

- Performing faster measurements and routine runs
- Performing more repeatable and accurate measurements
- Entering nominal values and tolerances

16.2 Tips for Faster Measurements and Routine Runs

- Plan the order in which the features from the blueprint are measured and minimize stage movements between feature measurements.
- If you are using the Strong Edge Finder tool, reduce the number of points to be measured for a given feature.
- Turn Display All Windows to Off in the routine run options and turn the audio Pass signals to Off in **System** / **Configuration** / **Sound**.
- Avoid unnecessary magnification changes when creating a routine; change to another magnification only when it is necessary to do so.

16.3 Tips for More Repeatable and Accurate Measurements

- Always measure and set datums within the routine; do not depend on just the manual setup. Be sure to set the Z datum using a focus point and always set the Z datum at the highest magnification.
- To ensure maximum repeatability when doing Z axis measurements with focus points, make sure that all the autofocus measurements in the routine use:
  - The **same magnification** (highest magnification using Maximum Contrast is recommended).
  - The **same light source**. This should be the light source that provides the highest contrast. For example, use surface illumination and do an autofocus on a surface or back light illumination to measure an edge.
  - The **same brightness** (light level).
- Edges and surfaces are located more accurately and repeatably at higher magnification settings. This is because the depth of field decreases as the magnification increases.
- Reset the Z axis to zero in a datum step (re-establish the Z datum) after you change the magnification and/or light source, if you plan to do Z axis measurements.
- Surface illumination and high magnification are recommended for:
  - Critical Z-axis measurements
  - Thick parts
  - Cylindrical parts
- The image may appear distorted or fuzzy (wall effect) when measuring thick, highly polished parts using profile illumination. It is recommended that you fixture the part above the stage glass to eliminate the wall effect.
- When using FeatureFinder, be precise in placing the selection points on the edge.
- When measuring difficult weak edges, use the weak edge weighting factors to "fine-tune" which points should be included in a measurement.
- Pay attention to the light level for each measurement. Light below 45% or above 70% can reduce accuracy and repeatability.
- Make sure that the parts to be measured are clean.

16.4 Tips for Entering Nominal Values and Tolerances

When entering nominal values and tolerances, keep the following in mind:

- You do not need to enter leading zeros (i.e., to the left of the decimal point) unless you are making changes.
- It is not necessary to enter the positive (+) sign. However, a negative (-) sign is necessary when required.
- You do not enter signs for ANSI tolerance values. However, they appear on the printed report (upper is +; lower is -).

Notes:

1. If you do not enter nominal and tolerance values for a feature, no deviations are reported. If you want to specify zero as a nominal value or tolerance, go to the Tolerances window, enter the values, and click on OK. This will accept the zeros as valid nominal and tolerance values.
2. You can change the nominal and tolerance values at any time.
3. For similar features, the system "carries forward" the previous tolerance information from one feature to the next.
4. When you first do the measurement, the software inserts the actual measured values in the nominal feature size and location fields (it does not enter any values in the tolerance fields). This allows you to see the signs and enter the correct signs for the nominal values. For example, if the measurement results show an angle that is negative (for example, -45°), you must also enter the nominal as a negative value. This also reduces the amount of typing because you only need to change some of the values rather than enter all of them.

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