

VMS

Fast Start Guide

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About This Manual

Welcome!

Quality Vision International, Inc. (QVI) has produced this Fast Start Guide as part of its ongoing effort to provide users with useful, comprehensive documentation. This manual has been developed using documentation standards and a design that enhances readability and makes information easier to find.

NOTE: This manual is current with version 9.x.x of the VMS software.

Section	Description
Getting Started	Describes how to start the software, stage a part and view part features, change the measurement units and coordinates, and access the VMS Help system.
User Interface	Describes the software user interface and joystick controls.
Basics	Describes how to open a program, run a program, and stop a program.
Finders	Describes the commonly used finders available in the VMS software.
Part Alignment	Describes how to define a Part Coordinate System (PCS).
Feature Measurements	Describes how to measure common features.
Feature Constructions	Describes how to construct common features from previously measured or constructed features.
Part Programming	Describes how to create a measurement program, output measurement results, edit a program, and create a sample program to measure the QVI training part.
Reference Information	Describes the software security dongle and license file.

Technical Support

For more information about technical support and customer service for your QVI product, contact the QVI channel partner or the QVI division that provided your QVI system.

NOTE: Contact information for technical support is on the serial number label on your QVI system.

QVI offers customer service and technical support contracts tailored to meet your specific needs and to protect the value of your investment.

Getting Started

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- 1. Double-click the VMS application icon on the Windows Desktop.
- 2. When the following prompt appears, verify the system is not in E-Stop Mode and then press the Stop / Start button(s) on the joystick.

Attention!	×
Please make sure the E-Stop is off, then press the start/stop button(s) on the joystick.	

Zeroing the Stage

- 1. Verify the stage path is clear.
- 2. In the Stage and Lights window, click Zero Stage to zero the stages.

The system drives the X, Y, and Z transports to their home positions.

NOTE: If the Stage and Lights window is not displayed, select the **Windows** ribbon, and then select the **Stage and Lights** check box.

- 1. Select the **Setup** ribbon, and then select **Measurement** in the Options section.
- 2. In the Units section of the Measurement Options dialog box, select the desired units of measurement by selecting the appropriate option.

Measurement Options									
Precision 🧧 🚖	📃 A <u>u</u> to-run	Remove Outlier	s 0.00 Sigma						
📃 Output Point D	Output Point Data								
Best-Fit Method:	Standard	•	Onits Millimeters						
📃 <u>A</u> uto-Measure	If Out Of Tole	rance Angle Format	Microns						
Places 8 🚔	Ontinue	Oecimal	🔘 <u>I</u> nches						
	○ Abort	🔘 Deg-Min-Sea	e 🔘 Mils						
Distance	- Tolerance Limit	s Position Tolerance	1D Position						
	Plus/Minus	Oiametric	Coordinate						
) <u>3</u> D (XYZ)	© Min/Ma <u>x</u>	🔘 Radial	🔘 Zone						
Inspections			Circle/Arc						
Point: 📃 P	osition		© <u>2</u> D 💿 <u>3</u> D						
Line: 📃 F	'osition 🛛 🔲 Ang	le 📃 Straightness	Oircle Diam						
Circle/Arc: 📃 F	'osition 🛛 📃 Diar	neter 📃 Roundness	🔘 Circle Rad						
Slot/Tab: 📃 A	ngle 📃 Wid	th	🔘 Arc Diam						
Plane: 📃 A	ngle 📃 Flatr	ness	Arc Rad						
Ellipse:	osition 📃 Ang	le 📃 Area							
■ M	lajor Axis 📃 Mino	or Axis 📃 Eccentricity	UK						
Distance: 🔳 🗙	Y Z		Cancel						

3. Click **OK** to save the changes and close the dialog box.

- 1. Verify the stage glass is clean.
- 2. Clear the stage of any obstructions.
- 3. Place the desired part on the stage so it is level (see warnings about stage load capacity and stage glass in your system hardware documentation).
- 4. Secure the part to the stage so it will not move when the stage moves.
- 5. Switch to low magnification (if applicable) to make it easier to locate features.
- 6. Turn on the appropriate light source in the Stage and Lights window (see Stage and Lights Window on page 2-12).
 - To view an edge, use backlight illumination
 - To view a surface, use coaxial illumination
- 7. Using the joystick, drive the transports so the desired edge or surface appears in the Video window.
- 8. Adjust the illumination as required.
- 9. Using the joystick, raise or lower the Z-axis assembly to focus the image.

Setting the Lower Z Travel Limit

- 1. Select the **Setup** ribbon, and then select **Z** Limit in the Basic section.
- 2. Using the joystick, raise or lower the Z-axis assembly to the desired lower limit position.
- 3. Click **OK** in the displayed dialog box to set the lower limit and prevent Z from moving below the current point until the limit is changed again.



Accessing the VMS Help System

Select Help > Contents to access the VMS Help system.

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Screen Layout



Figure 2-1: Default Screen Layout (Operator View)

The VMS ribbons at the top of the screen provide access to all of the functions in the VMS software. The ribbons replace the menus found in previous versions of the software.

You can control which ribbons are displayed by selecting the desired option in the Menus section on the Setup ribbon.

Restricted

(
	Windows	Setup		
	Stage and Lights	Measurement System	Lens Calibration	Restricted
	Z Limit	Result Control User	Laser Calibration 💌	Standard
		Colors		Advanced
l	Basic	Options	Calibration	Menus

Standard

9	Align	Create Feature	Progr	am	Edit	Win	dows	Setup
Stage a Z Limit	nd Lights	Measurement Result Control	nent System Lens Calibration ontrol User Laser Calibration -		Restric Standa	rd		
В	Basic Options		C	alibratio	n	Men	us	

Advanced

9	Align	Create Feature	Progra	am Edit	t Tole	rance	Windows	Setup
Stage a	nd Lights	Measurement	System	Lens Calib	ration	Restricte	d	
Z Limit		Result Control	User	Laser Calib	ration 👻	Standard	t i	
		Colors				Advance	d	
В	asic	Options		Calibr	ation	Menus	;	

VMS Toolbar



Program Control Icons



Measurement Icons



Programming Icons





4 Found edge points (cyan)

Video Window Toolbar





The Features window shows all the measured and constructed features.

Current stage location

2 Yellow — Selected feature

Blue — Feature not selected or inspected

Green — All measured attributes passed inspection

5 Red — One or more measured attributes failed inspection

Right-click in the Features window to access the following options:

- Stage View displays a graphical representation of the stage
- Part View (shown above) displays a graphical representation of the part being measured
- Set Zoom Factor specifies the magnification factor
- Set Mouse Z sets the Z coordinate that is used when you move the stage using the mouse in the Features window
- Inverse Zoom changes the appearance of the zoom box
- Select All Features selects all the features in the Features window
- Delete Selected Features deletes all selected features
- Print Part prints a drawing of the Features window in Part View
- Auto-build steps for Features inserts a measurement step in the program for each select feature

The Results window displays measurement results and other related messages, such as information from general output steps in the program.

Results						
Program: Company: VmsVersion: 8.0.1.30		03:35:4 User:	2 PM Friday	/, February Mach	01, 2013 dine: P25013	3011523
Part Name: Comment:		Part #		Lot	#	
P/F Measurement	Deviation	Actual	Nominal	- Tol	+ Tol	U
Pass C2 Diameter	0.00000	2.59509	2.59509	0.00000	0.00000	м
Pass C2 X Position	0.00000	163.39441	163.39441	0.00000	0.00000	м
Pass C2 Y Position	0.00000	52.66843	52.66843	0.00000	0.00000	М
Pass C3 Diameter	0.00000	2.58710	2.58710	0.00000	0.00000	М
Pass C3 X Position	0.00000	154.91984	154.91984	0.00000	0.00000	м
Pass C3 Y Position	0.00000	61.33989	61.33989	0.00000	0.00000	м
1						

Right-click in the Results window to access the following options:

- Copy copies the selected text
- Clear deletes all the displayed text
- · Select All selects all the displayed text

The Measurement Steps window shows all the steps in the program, in the order the system will perform them to measure the part.

The steps can be displayed as text, as 3D blocks (shown below), or in a tree view. To change the view, right-click in the Measurement Steps window and select the desired option.

When displayed as 3D blocks, the steps have the following characteristics:

- Colors and stacking appearance show different levels in the program, indicating which steps in the program are contained in or controlled by other steps in the program
- · Each block includes a brief description of the step
- The color on the top surface of each block changes to indicate special conditions:
 - Black with White text indicates the step has been selected
 - **Bright Green** indicates the next step in the program when you pause the program
 - Dark Green indicates the selected step is the next step in the program

🗄 Measurement Steps	×
	-
Program Main	
Align Define 'PCS1'	
Measure Circle 'C1'	
Measure Circle 'C2'	
Measure Point 'P1'	
Construct Best Fit Plane 'S1' Using C1, C2, P1	Ε
Construct Best Fit Line 'L1' Using C1, C2	
Define Align PCS 'PCS1' Using S1, L1, C1	
Align Use 'PCS1' As Default DRF	
Measure Circle 'C3'	
Measure Circle 'C4'	
Measure Circle 'C5'	
Measure Circle 'C6'	
Measure Circle C7	
Measure Circle Co	
Measure Circle (C10)	
Measure Circle 'C11'	
Measure Line 'L2'	
Measure Line 'L3'	
Measure Line 'L4'	
Measure Line 'L5'	Ŧ
	▶

• Red with Black Text indicates the selected step is being edited

Select the **Windows** ribbon, and then select the **Digital Read Out** check box to display the DRO window, which shows the XYZ coordinates and the direct distance from zero (square root of the sum of squares of X, Y, and Z) of the center of the field-of-view.

NOTE: When you close the DRO window, the digital readout reappears at the bottom of the screen (see Figure 2-1 on page 2-2).



The title bar of the DRO window displays the coordinate mode:

- MCS (abs.) the coordinates are displayed in relation to the stage using the Machine Coordinate System (MCS) and in relation to an absolute coordinate system (abs.)
- MCS (rel.) the coordinates are displayed in relation to the stage using the Machine Coordinate System (MCS) and in a coordinate system that is relative to a chosen point on the stage or part (rel.)
- PCS (abs.) the coordinates are displayed in relation to the part using the Part Coordinate System (PCS) and in relation to an absolute coordinate system (abs.)
- PCS (rel.) the coordinates are displayed in relation to the part using the Part Coordinate System (PCS) and in a coordinate system that is relative to a chosen point on the stage or part (rel.)

Right-click in the DRO window to access the following options:

- Zero DRO zeros the digital readouts
- Show MCS displays the coordinates using the Machine Coordinate System (MCS)
- Show PCS displays the coordinates using the Part Coordinate System (PCS)

Click

^y on the <u>VMS Toolbar</u> to display the Stage and Lights window.

Controls on the Stage tab include:

- Zero Stage button: Zeros the stages
- Set Home button: Sets the home position
- **Go Home** button: Drives the stages to the home position
- Slow and Fast! options: Controls stage response to joystick deflection
- **Discrete** box: Controls the distance the stage will move when you hold down Ctrl while using the joystick

	📑 Stage and Lights 🛛 🗖 💌
	Stage Lights/Optics
	?
1	Joystick Mode Slow Fast! Discrete (Ctrl+Move) 1.0000 Millimeters Go Home

Controls on the Lights/Optics tab include:

- AGC check box: Turns on automatic gain control
- Gain slider: Sets the camera sensitivity
- Frame Integration drop-down list: Controls how many times the exposure time is multiplied
- Magnification drop-down list: Changes the magnification (if applicable)
- Use Joystick Light Knobs check box: Enables the light control knobs on the joystick
- **Coax Light** slider: Adjusts the intensity of the coaxial light (direct illumination)
- **Ring Light** slider: Adjusts the light intensity in the four quadrants of the programmable ring light
 - Use the **All** slider to adjust all four quadrants equally

😨 Stage and Lights 🛛 🗖 🔍
Stage Lights/Optics
AGC 🗌 Gain 👂 🖓
Frame Integration 1
Magnification 1.0x -
Use Joystick Light Knobs
Coax Light 0 🔸 📄 🔹 🕨
🔲 Grid
Ring Light
Backlight 0 < _ >

- Use the Ring Width slider (not shown in the above image) to control the number of rings that are on (systems with a multi-ring programmable ring light)
- Use the **R**, **G**, **B**, and **All** buttons to use Red, Green, Blue, and White light, respectively (systems with a multi-color programmable ring light)
- Use the **Position** slider to adjust the Z position of the illuminator (systems with a motorized programmable ring light)
- Backlight slider: Adjusts the intensity of the LED backlight
- **Test Strobe** button: Turns on the strobe lights for a few seconds so you can see what the video image will look like when strobing is on

NOTE: The optimum light level varies depending on the part and the type of lighting used. When measuring features, try using different light levels.

Select the **Windows** ribbon, and then select the **Object Names** check box to display the Object Names window, which displays a list of all the features that have been measured and constructed.

NOTE: The software displays the Object Names window automatically when you select a construct function.

Use the Object Names window to add features to a step by selecting the feature from the list and clicking **Select**.

🕖 Object Names 📃 📼 💌
Procedure: Main Object Name:
DefaultTol C1 C2 C3 C4 C5
Type: Circle Dim 1 Dim Dim Dim Parameter
Add Delete Select Find

Joystick Controls

To move	Do this
Along the X axis	Move the joystick lever right (positive X) and left (negative X)
Along the Y axis	Move the joystick lever forward (positive Y) and back (negative Y)
Along the Z axis	Rotate the knob on top of the joystick to the left (counterclockwise) to raise (positive Z) the optics, and rotate the knob to the right (clockwise) to lower (negative Z) the optics



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QVI

on the VMS Toolbar (or press Ctrl+O). 1. Click

- 2. In the standard Windows Open dialog box, browse for the desired routine and do either of the following to open it:
 - Type the name of the routine in the File Name box and click Open (or press Enter).
 - Double-click the program you want to open.

NOTE: You do not need a measurement program in order to measure a part; you can simply mount a part on the stage or in a fixture and start measuring features.

Running a Measurement Program



If the part or fixture has been moved since the last run (different stage location), be sure to edit the steps used to define the part alignment before running the program. See Editing a Program on page 8-5.

To run	Do this
The program from the beginning	1. Click (or press Ctrl+R) to reset the program.
	2. Click (or press F5) to run the program.
The program from a	 Select the step to you want to start at by clicking it in the Measurement Steps window.
specific step	2. Click (or press Ctrl+G) to jump to the selected step.
	 Click (or press F5) to run the program from the selected step.
A single step in the program	 Select the step you want to run by clicking it in the Measurement Steps window.
	2. Click (or press F8) to run the selected step only.

Stopping a Measurement Program

You can stop a measurement program at any time by clicking on the VMS Toolbar, by pressing Ctrl+Break, or by pressing one of the system E-Stops.

Finders

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Arc Edge Finder Parameters	4-13
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Crosshair Finder Parameters	4-14
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Using the Blob Finder	4-17
Blob Finder Parameters	4-18

Finders are on-screen tools used to collect point data for measuring features on parts. Select a finder in the Video window that is similar to the shape of the feature you want to measure. For example, select the Line Edge Finder to measure a straight edge or select the Arc Edge Finder to measure a curved edge. Each finder returns (finds) one or more points from the feature on the part. These returned points help you measure parts using the measurement programs that you create.

You can rotate, resize, and move finders to help you measure a feature. The flexibility and accuracy of the finders is an important part of the accurate measurement capability of the VMS software.

Types of Finders

lcon	Displays this Finder…	Description
ø	Arc Edge Finder	Defines all points on a radius
۲	Circle Edge Finder	Defines all points on a circle
•••	Single Point Edge Finder	Defines a single point on an edge
Ē	Line Edge Finder	Defines multiple points along a straight or slightly curved edge
Ш.	Line Width Edge Finder	Defines multiple points along two parallel straight edges
函	Blob Finder	Locates regular or irregular shapes by finding connected sets of pixels within a given brightness range
+	Crosshair Finder	Defines a single point
	Autofocus Finder	Finds the optimal focus point

NOTE: This manual describes the most commonly used finders. For information about other finders available in VMS, see the VMS Help System for more information.

Cause	What to Do
Dirty stage glass	Clean the stage glass before staging a part
Part moved during stage move	Secure the part to the stage or in a fixture so it will not move when the stage moves
Improper illumination	Increase or decrease the light level as required
Feature is out of focus	Focus the feature before running the finder
Finder does not match the feature	Manipulate the finder so it matches the curve and orientation of the feature — especially important when using the Arc Edge Finder
Finder is too close to the edge of the field of view	Reposition the feature and finder near the center or the Video window
Incorrect finder parameters	Change finder parameters as required

- 1. Position an edge in the Video window.
- 2. Adjust the backlight illumination for sufficient contrast and focus the edge.
- 3. Click on the Video window toolbar to display the Single Point Edge finder.
- 4. Resize, rotate, and/or reposition the finder over the feature so the center handle is on the edge and the arrow points from light to dark.

	То	Do this
	Rotate the finder	Right-click either outside handle (^A) while dragging the mouse.
	Resize the finder	Click either outside handle (A) while dragging the mouse.
	Move the finder	Click the center handle $(\begin{smallmatrix} {\sf B}\end{smallmatrix})$ while dragging the mouse.
		∠⊐ Ctrl + ← ⊄ = = ⊂ Ctrl + → ⊂ = →
A	B	Ctrl + ↑ ☐ Ctrl + ↓ ☐

NOTE: Use the Ctrl key and arrow keys to rotate the finder quickly as shown.

- 5. If necessary, change the desired Point (1D) Edge Finder parameters (described next).
- 6. Double-click in the Video window to run the finder.

Click on the Video window toolbar to display parameters for the selected finder. If necessary, click **Basic** in the 1D Edge Finder dialog box to display the following basic parameters:

- Position parameters
 - Center X and Center Y specify the X location and Y location of the center handle in the finder with respect to the center of the field of view — to center the finder in the Video window, set each of these to 0
 - Length specifies the size in scan direction, perpendicular to the edge
 - Width specifies the size perpendicular to the scan direction, parallel to the edge
 - Angle specifies the angle (in degrees) of rotation of the finder 0 represents no rotation, and all other values up to 359 rotate the finder to the left (counterclockwise direction)
 - Select the Pixel Based Finder option to display the finder position and AOI dimensions in number of pixels or the Real Unit Finder option to display the finder position and AOI dimensions in millimeters
- Edge parameters
 - Edge Select specifies which edge will be used during edge detection
 1st edge, Last edge, or Strongest edge
 - Edge Polarity specifies the polarity of the edge used during edge detection — Rising edge (dark-to-light), Falling edge (light-to-dark), or Both

😲 1D Edge Finder		- • •		
Position Center <u>X</u>	0		Defaul <u>t</u>	
<u>L</u> ength	250 🚔 <u>W</u> idth 9	-	Advanced	
<u>A</u> ngle	0		<u>T</u> each	
Pixel Based Finder C Real Unit Finder Run				
Edge Select © 1st © Last © Strongest			OK	
Polarity <u>Rising</u> <u>Falling</u> <u>B</u> oth			Cancel	
Save Points In Feature				
© Add	🔿 Replace			

NOTE: Click Advanced to view additional parameters.

- 1. Position a straight edge in the Video window.
- 2. Adjust the backlight illumination for sufficient contrast and focus the edge.
- 3. Click on the Video window toolbar to display the Line Edge finder.
- 4. Resize, rotate, and/or reposition the finder over the feature so the center handle is on the edge and the arrow points from light to dark.





NOTE: Use the Ctrl key and arrow keys to rotate the finder quickly as shown.

- 5. If necessary, change the desired Line Edge finder parameters (described next).
- 6. Double-click in the Video window to run the finder.

Click on the Video window toolbar to display parameters for the selected finder. If necessary, click **Basic** in the 2D Edge Finder dialog box to display the following basic parameters:

- Position parameters
 - Center X and Center Y specify the X location and Y location of the center handle in the finder with respect to the center of the field of view — to center the finder in the Video window, set each of these to 0
 - Length specifies the size in scan direction, perpendicular to the edge
 - Width specifies the size perpendicular to the scan direction, parallel to the edge
 - Angle specifies the angle (in degrees) of rotation of the finder 0 represents no rotation, and all other values up to 359 rotate the finder to the left (counterclockwise direction)
 - Select the Pixel Based Finder option to display the finder position and AOI dimensions in number of pixels or the Real Unit Finder option to display the finder position and AOI dimensions in millimeters
- Edge parameters
 - Edge Select specifies which edge will be used during edge detection
 1st edge, Last edge, or Strongest edge
 - Edge Polarity specifies the polarity of the edge used during edge detection — Rising edge (dark-to-light), Falling edge (light-to-dark), or Both

👎 2D Edge F		ж		
Position Center <u>X</u>	45	Defau	ıl <u>t</u>	
<u>L</u> ength	179 🚔 <u>W</u> idth 1265	- Advanc	ced	
<u>A</u> ngle	269 🚖	<u>T</u> eac	h	
Pixel Based Finder C Real Unit Finder Run				
Edge Select © 1	OK			
Polarity 🔘 I	Cance	el		
Save Points In				
⊙ Add 《) Replace			

NOTE: Click Advanced to view additional parameters.

Using the Line Width Edge Finder

- 1. Position two parallel straight edges in the Video window.
- 2. Adjust the backlight illumination for sufficient contrast and focus the edge.
- 3. Click on the Video window toolbar to display the Line Width Edge finder.
- 4. Resize, rotate, and/or reposition the finder so it is over the two desired edges.

То	Do this
Rotate the finder	Right-click any outside handle (A) while dragging the mouse.
Resize the finder	Click any outside handle (A) while dragging the mouse.
Move the finder	Click the center handle (^B) while dragging the mouse.
Resize the inner boundaries	Click the appropriate inside handle (C or D) while dragging the mouse.



NOTE: Use the Ctrl key and arrow keys to rotate the finder quickly as shown.

- 5. If necessary, change the desired Line Width Edge finder parameters (described next).
- 6. Double-click in the Video window to run the finder.

Click on the Video window toolbar to display parameters for the selected finder. If necessary, click **Basic** in the Line Width Edge Finder dialog box to display the following basic parameters:

- Position parameters
 - Center X and Center Y specify the X location and Y location of the center handle in the finder with respect to the center of the field of view — to center the finder in the Video window, set each of these to 0
 - Length specifies the size in scan direction, perpendicular to the edge
 - Width specifies the size perpendicular to the scan direction, parallel to the edge
 - L1 and L2 specify the size of the first and second search areas
 - Angle specifies the angle (in degrees) of rotation of the finder 0 represents no rotation, and all other values up to 359 rotate the finder to the left (counterclockwise direction)
 - Select the **Pixel Based Finder** option to display the finder position and AOI dimensions in number of pixels or the **Real Unit Finder** option to display the finder position and AOI dimensions in millimeters
- Edge parameters
 - Edge Select specifies which edge will be used during edge detection
 1st edge, Last edge, or Strongest edge
 - Edge Polarity specifies the polarity of the edge used during edge detection — Rising edge (dark-to-light), Falling edge (light-to-dark), or Both



NOTE: Click Advanced to view additional parameters.
- 1. Position a circular feature in the Video window.
- 2. Adjust the backlight illumination for sufficient contrast and focus the edge.
- 3. Click on the Video window toolbar to display the Circle Edge finder.
- 4. Position the inner circle of the finder inside the feature and the outer circle outside the feature; resize and/or reposition the finder if necessary.

То	Do this
Adjust the radius of the outer circle	Click the outer circle handle (A) while dragging the mouse.
Adjust the radius of the inner circle	Click the inner circle handle (B) while dragging the mouse.
Move the finder	Click the center handle (C) while dragging the mouse.



- 5. If necessary, change the desired Circle Edge finder parameters (described next).
- 6. Double-click in the Video window to run the finder.

Click on the Video window toolbar to display parameters for the selected finder. If necessary, click **Basic** in the Circular Edge Finder dialog box to display the following basic parameters.

- Position parameters
 - Center X and Center Y specify the X location and Y location of the center handle in the finder with respect to the center of the field of view — to center the finder in the Video window, set each of these to 0
 - Inner Rad and Outer Rad specify the radius of the inner circle and the radius of the outer circle
 - Select the **Pixel Based Finder** option to display the finder position and AOI dimensions in number of pixels or the **Real Unit Finder** option to display the finder position and AOI dimensions in millimeters
- Edge parameters
 - Edge Select specifies which edge will be used during edge detection
 1st edge (counted from inner diameter to outer diameter), Last edge, or Strongest edge
 - Edge Polarity specifies the polarity of the edge used during edge detection — Rising edge (dark-to-light), Falling edge (light-to-dark), or Both

👎 Circular I	Edge Finder				• 💌
Position		7			Default
Center X	0	Center <u>Y</u>	0	÷	
Inner Rad	50 🌲	Outer Rad	150	*	Advanced
Pixel Ba	Pixel Based Finder Real Unit Finder				<u>T</u> each
Edan	Educ				Ru <u>n</u>
Select <u>1</u> st Last <u>Strongest</u>				ОК	
Polarity 🔘	<u>R</u> ising © <u>F</u> a	lling	h		Close

NOTE: Click Advanced to view additional parameters.

- 1. Position an arc in the Video window.
- 2. Adjust the backlight illumination for sufficient contrast and focus the edge.
- 3. Click on the Video window toolbar to display the Arc Edge finder.
- 4. Resize, rotate, and/or reposition the Arc Edge finder so it matches the curve of the feature you want to measure.

То	Do this
Rotate the finder	Right-click either inside handle $(\begin{array}{c} A \\ B \end{array})$ or the center handle $(\begin{array}{c} B \\ B \end{array})$ while dragging the mouse.
Adjust the radius of the finder	Right-click any outside handle (^C) while dragging the mouse.
Move the finder	Click center handle (B) while dragging the mouse.
Resize the finder	Click any outside handle (^{C)}) while dragging the mouse.
Adjust the outer radius only	Click outer radius handle (D) while dragging the mouse.
Adjust the inner radius only	Click inner radius handle (E) while dragging the mouse.



NOTE: Use the Ctrl key and arrow keys to rotate the finder quickly as shown.

- 5. If necessary, change the desired Arc Edge finder parameters (described next).
- 6. Double-click in the Video window to run the finder.

Click on the Video window toolbar to display parameters for the selected finder. If necessary, click **Basic** in the Arc Edge Finder dialog box to display the following basic parameters.

- Position parameters
 - Center X and Center Y specify the X location and Y location of the center handle in the finder with respect to the center of the field of view — to center the finder in the Video window, set each of these to 0
 - Inner Rad and Outer Rad specify the radius of the inner arc and the radius of the outer arc
 - Start Ang specifies the angle of rotation of the first edge of the finder
 - End Ang specifies the angle of rotation of the second edge of the finder
 - Select the **Pixel Based Finder** option to display the finder position and AOI dimensions in number of pixels or the **Real Unit Finder** option to display the finder position and AOI dimensions in millimeters
- Edge parameters
 - Edge Select specifies which edge will be used during edge detection
 1st edge (counted from inner diameter to outer diameter), Last edge, or Strongest edge
 - Edge Polarity specifies the polarity of the edge used during edge detection — Rising edge (dark-to-light), Falling edge (light-to-dark), or Both

👎 Arc Edge	Finder				
Position			-		Default
Center <u>X</u>	-175	🗧 Center <u>Y</u>	0	÷	
Inner Rad	100	🔶 Outer Rad	250	· · · · · · · · · · · · · · · · · · ·	Advanced
Start <u>A</u> ng	315	🚖 End Ang	45	-	<u>T</u> each
Pixel Based Finder Real Unit Finde					Ru <u>n</u>
Edge					ОК
Select Ist Last Select Close					Close
Polarity 🔘 <u>R</u> ising 🔘 <u>F</u> alling 🔘 <u>B</u> oth					Close

NOTE: Click Advanced to view additional parameters.

- 1. Position an edge in the Video window.
- 2. Adjust the backlight illumination for sufficient contrast and focus the edge.
- 3. Click on the Video window toolbar to display the Crosshair finder.
- 4. Click the center of the finder and drag the mouse to position the finder in the desired location in the Video window.
- If necessary, change the desired Crosshair finder parameters (described below).
- 6. Double-click in the Video window to run the finder.

Crosshair Finder Parameters

Click on the Video window toolbar to display parameters for the selected finder. If necessary, click **Basic** in the Crosshair Finder dialog box to display the following basic parameters.

- Center X and Center Y specify the X location and Y location of the center handle in the finder with respect to the center of the field of view — to center the finder in the Video window, set each of these to 0
- Select the Pixel Based Finder option to display the finder position in number of pixels or select the Real Unit Finder option to display the finder position in millimeters

🖓 Crosshai	ir Finder		- • •
Position Center <u>X</u>	0	Center <u>Y</u>	0
Pixel Ba	ised Finder	🔘 Real U	Init Finder
Advanced	Ru <u>n</u>	ОК	Close

NOTE: Click Advanced to view additional parameters.

Using the Autofocus Finder

- 1. Position a surface or edge in the center of the Video window.
- 2. Switch to high magnification (if applicable), and reposition the surface or edge as required.
- 3. Using the appropriate sliders in the Stage and Lights window, adjust the illumination.
 - Use backlight illumination to focus an edge.
 - Use coaxial light or PRL illumination to focus a surface.
- 4. Using the joystick, raise or lower the optical assembly to manually focus (by eye) the edge or surface displayed in the Video window.
- 5. Click on the Video window toolbar to display the Autofocus finder.
- 6. Based on the image displayed in the Video window, select the appropriate focus type in the Autofocus parameters dialog box.

Click	To perform
	an edge focus on a backlit, vertical edge
	an edge focus on a backlit, horizontal edge
	a surface focus on a textured surface
	a grid focus on a smooth surface (only available on systems equipped with the optional grid projector)
Ψ	a laser focus on a surface (only available on systems equipped with the optional TTL laser)

- 7. If necessary, resize the Autofocus finder by dragging the edge or corner of the finder graphic to the desired rectangular size.
- 8. If necessary, change the desired Autofocus finder parameters (described next).
- 9. Double-click in the Video window to run the finder.

Click on the Video window toolbar to display parameters for the selected finder. If necessary, click **Basic** in the Autofocus Finder dialog box to display the following basic parameters.

- Focus Type (see the table in Step 6 on the previous page)
- Position parameters
 - Use the Center X and Center Y boxes to change the center location of the finder
 - Use the Length and Width boxes to resize the finder
 - Select the Pixel Based Finder option to display the finder position and AOI dimensions in number of pixels or the Real Unit Finder option to display the finder position and AOI dimensions in millimeters
- Distance specifies the distance the system will move in Z to obtain the optimal focus (see illustration)



- Point density increases or decreases the number of data points used to calculate the Z position during an autofocus
- Select the Keep with edge finder check box to include an automatic focus for any finder

📀 Textured	I Surface Autof	ocus			- • 💌
Focus Type			Ų		
Position					Auto Set
Center X	0 ≑	Center <u>Y</u>	0	* *	Auto See
<u>L</u> ength	601 ≑	<u>W</u> idth	438	*	Ad <u>v</u> anced
Pixel Ba	Pixel Based Finder Real Unit Finder Run				
Distance	Distance 5.0000 mm				
Point dens	Point density 500 🚔 percent				
179 data p	179 data points, 10.5 seconds per pass Cancel				
✓ Keep with edge finder ✓ Software					

NOTE: Click Advanced to view additional parameters.

- 1. Position the desired features in the Video window.
- 2. Adjust the illumination and focus the features.
- 3. Click on the Video window toolbar to display the Blob finder.
- 4. Resize, rotate, and/or reposition the finder so it is entirely over the desired features.

То	Do this
Rotate the finder	Right-click any outside handle (^A) while dragging the mouse.
Resize the finder	Click any outside handle (A) while dragging the mouse.
Move the finder	Click the center handle $(\begin{tabular}{c} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$



- 5. If necessary, change the desired Blob finder parameters (described next).
- 6. Double-click in the Video window to run the finder.

NOTE: Since the Blob finder returns more than one feature result, it requires a special Blob Analysis step that extracts the feature results into an array of Blob features. See the VMS Help System for more information.

Click on the Video window toolbar to display parameters for the selected finder. If necessary, click **Basic** in the Blob Finder dialog box to display the following basic parameters:

- Position parameters
 - Center X and Center Y specify the X location and Y location of the center handle in the finder with respect to the center of the field of view — to center the finder in the Video window, set each of these to 0
 - Length and Width specify the size of the finder
 - Angle specifies the angle (in degrees) of rotation of the finder 0 represents no rotation, and all other values up to 359 rotate the finder to the left (counterclockwise direction)
 - Select the **Pixel Based Finder** option to display the finder position and AOI dimensions in number of pixels or the **Real Unit Finder** option to display the finder position and AOI dimensions in millimeters
- Blob parameters
 - Min Area and Max Area specify the minimum and maximum blob size (in pixels) that will be included in the results
 - **Automatic** threshold mode analyzes the selected area of the image and chooses a threshold based on the histogram
 - Manual threshold mode allows you to set the minimum and maximum brightness value
 - Polarity specifies whether the blobs are the light or dark objects in the Video window

👎 Blob Fin	der 📃	. • 💌
Position		
Center <u>X</u>	0 Center Y 0	Defaul <u>t</u>
<u>L</u> ength	200 🚔 <u>W</u> idth 200 🚔	Advanced
<u>A</u> ngle	0	D iagnostics
Pixel Ba	ased Finde 💿 Real Unit Finder	Run
Blob Para	meters	
Min Area	þ Max Area 499968	OK
Threshold	Mode Automatic 👻	Close
Polarity	Light on Dark 👻	

NOTE: Click Advanced to view additional parameters.

Part Alignment

About Part Alignment	5-2
Creating an Alignment Block	5-3
Measuring Reference Features (C1, C2, and P1)	5-3
Defining the Reference Plane (S1)	5-7
Defining the Reference Line (L1)	5-8
Setting Part Tilt, Part Rotation, and Part Origin	5-10

Part alignment allows you to run a program to measure the same or identical part at another location on the stage. The program will run no matter where the part is located, as long as you specify the reference feature locations first.

Part alignment involves the following basic steps:

- 1. Create an alignment block (see page 5-3).
- 2. Measure reference features (see page 5-3).
- 3. Define a reference plane (see page 5-7).
- 4. Define a reference line (see page 5-8).
- 5. Set the part tilt, part rotation, and part origin (see page 5-10).

In this section, we will use the QVI training part to demonstrate this process. Use the following illustration for reference.



Figure 5-1: Reference Features Used for Part Alignment

- 1. Select **New** in the VMS File menu (or press Ctrl+N).
- 2. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Plane-Line-Point (3D)**.



The software adds four alignment steps to the Measurement Steps window. The steps define the start and end of the current part coordinate system.

	Measurement Steps
P	rogram Main
	Align Define 'PCS1'
	Define Align PCS 'PCS1'
	Align Use 'PCS1' As Default DRF
K	Align End

Measuring Reference Features (C1, C2, and P1)

- 1. Place and secure the QVI training part on the stage in the orientation shown in Figure 5-1 on page 5-2.
- Switch to low magnification (if applicable) and increase the backlight illumination.
- 3. Using the joystick, drive the transports to position the **lower-left hole** in the Video window.
- 4. Adjust the backlight illumination for sufficient contrast and focus the edge.

5. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Measure FOV**.



- 6. Position and/or resize the Circle Edge finder over the lower-left hole so the inner circle of the finder is completely inside the hole and the outer circle is completely outside the hole.
- 7. Double-click in the Video window to run the Circle Edge finder and measure the lower-left hole.
- 8. Click on the Video window toolbar to accept the finder and save it in the measurement step this enables the OK button in the Measure Circle dialog box.

<i>(</i>				
ノ Measure Ci	ircle (1 Edge F	inder)		
Name C1		ОК	Cancel	Run Options
	Nominal	Actual Mi	Tolerance nu: Zone Plus	Deviation In/Out
<u>X</u> Pos				
Δ <u>Υ</u> Pos				
<u>Z</u> Pos				
XY <u>P</u> os				
Diameter				
Rou <u>n</u> dnes	s.,			
R <u>u</u> nout				
<u>Concentrici</u>	ity.			
This Circle is o	derived from:			
Fin	oder 1			

9. In the Measure Circle dialog box, click **OK** to add the step to the program.



- 10. Using the joystick, drive the transports to position the **lower-right hole** in the Video window.
- 11. Repeat Steps 5 through 9 to measure the lower-right hole and add the step to the program.

E	Measurement Steps
P	rogram Main
	Align Define 'PC S1'
	Measure Circle 'C1'
	Measure Circle 'C2'
	Define Align PCS 'PCS1'
	Align Use 'PCS1' As Default DRF
k	

- 12. Using the joystick, drive the transports to position the **surface near the upper-left hole** in the Video window.
- 13. Switch to high magnification (if applicable) and increase the coaxial illumination.
- 14. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Measure Z**.



- 15. In the Autofocus Settings dialog box, click
- 16. Double-click in the Video window to run the finder and measure the point.
- 17. Click finder and save it in the measurement step this enables the OK button in the Measure Point dialog box.

🧹 Measure Po	oint (1 Edge Fi	nder)			• 💌
Name P1		OK	Cancel	<u>R</u> un	Options
	Nominal	Actual	Tolerance Zone	Deviation	In/Out
<u>X</u> Pos]
<u>Υ</u> Pos]
<u>Z</u> Pos]
🔲 🛛 XY <u>P</u> os]
This Point is d	lerived from:				
Fin	der 1				

18. In the Measure Point dialog box, click **OK** to add the step to the program.

E	š N	Aeasurement Steps
F	ro	gram Main
	Α	lign Define 'PC S1'
		Measure Circle 'C1'
		Measure Circle 'C2'
		Measure Point 'P1'
		Define Align PCS 'PCS1'
	А	lign Use 'PCS1' As Default DRF
	Α	lign End
	~	

- 1. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select Construct.



2. Select circle C1 in the Object Names dialog box, and then click Select.

🔨 Object Names	- • •
Procedure: Main	Advanced
Object Name:	
DefaultTol C1 C2 P1 PCS1 S1	
Type: Plane	-
Dim 1 📩 Dim	Parameter
Add Delete S	elect Find

3. Repeat Step 2 to select circle C2 and point P1 — this enables the OK button in the Construct Plane dialog box.

🖌 Construct Best Fit Plane Using C1, C2, P1 📃 🖃 🔜				
Name S1			Cancel	<u>R</u> un <u>O</u> ptions
	Nominal	Actual	Tolerance Minu: Zone Plus	Deviation In/Out
Angle		0.10127		
E Flatness		0.00000		
Parallelism				In
This Plane is d	erived from	:		
\bigcirc	\bigcirc	+		
C1	C2	P1		

4. Click **OK** in the Construct Plane dialog box to add the step to the program.

T
2'
r <mark>s</mark>
t Plane 'S1' Using C1, C2, P1
PCS1'

Defining the Reference Line (L1)

1. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Construct**.



2. Select circle C1 in the Object Names dialog box, and then click Select.

🕖 Object Names	- • •
Procedure: Main	Advanced
Object Name:	
DefaultTol C1 C2 L1 P1 PCS1 S1	* III +
Type: Line	
Dim 1 Dim Dim	ect <u>F</u> ind

3. Repeat Step 2 to select circle **C2** — this enables the OK button in the Construct Line dialog box.

ノ Construct I	Best Fit Line	Using C1, C2		
Name 11		ОК	Cancel	Run Options
	Nominal	Actual	Tolerance Minu: Zone Plus	Deviation In/Out
Angle		-0.21893		
Straightne	255	0.00000		
Angularity	/			
Perpendicu	larity			
Para <u>l</u> lelisr	n			
Endpoints				
This Line is de	rived from:			
0	\bigcirc			
Cl	C2			

4. Click **OK** in the Construct Plane dialog box to add the step to the program.

E	Measurement Steps
Pr	Align Define 'PCS1'
	Measure Circle 'C1' Measure Circle 'C2' Measure Point 'P1'
	Construct Best Fit Plane 'S1' Using C1, C2, P1 Construct Best Fit Line 'L1' Using C1, C2
	Define Align PCS 'PCS1'

- 1. In the Align 3D dialog box, do the following:
 - In the **Tilt** section, select **S1** (the constructed plane) in the **Plane** list to set the tilt of the part.
 - In the **Rotation** section, select **L1** (the constructed line) in the **Line** list. Also, select the **X axis** option to set line L1 as the X-axis datum for the part.
 - In the Origin section, select C1 (the measured lower-left hole) in the Point list. Then select the Enable X, Y, and Z check boxes to set the center point of the circle as the X, Y, and Z zero point.

📀 Align 3D		- • •
Tilt (XY Plane) Plane:	Name PCS1	OK Cancel Offsets
Rotation Line: L1 • X Axis () Y Axis	Point: CI \checkmark Enable: $\bigvee \underline{X} \bigvee \underline{Y} \bigvee \underline{Z}$	 X 0.0 Y 0.0 Z 0.0 θ 0.0

2. Click **OK** to save the changes and close the dialog box.

The Measurement Steps window should now look similar to the following:

🗄 Measurement Steps
Program Main Align Define 'PCS1' Measure Circle 'C1' Measure Circle 'C2' Measure Point 'P1' Construct Best Fit Plane 'S1' Using C1, C2, P1 Construct Best Fit Line 'L1' Using C1, C2 Define Align PCS 'PCS1' Using S1, L1, C1 Align Use 'PCS1' As Default DRF Align End

Steps inserted between Align Use and Align End will use the PCS1 alignment block.

Feature Measurements

Preliminary Steps for Measuring a Feature	6-2
Measuring a Point	6-2
Measuring a Line that Fits in the Field of View	6-5
Measuring a Line that is Larger than the Field of View	6-7
Measuring an Arc that Fits in the Field of View	6-10
Measuring an Arc that is Larger than the Field of View	6-13
Measuring a Circle that Fits in the Field of View	6-16
Measuring a Circle that is Larger than the Field of View	6-19
Measuring a Plane	6-22
Measuring a Distance	6-24

- 1. Place and secure the part on the stage.
- 2. Using the joystick, drive the transports so the desired feature appears in the Video window.
- Adjust the illumination as required (see <u>Stage and Lights Window</u> on page 2-12).
- 4. Focus the feature (see Using the Autofocus Finder on page 4-15).

Measuring a Point

- 1. Perform the preliminary steps outlined above.
- 2. Click the arrow directly to the right of \checkmark on the <u>VMS Toolbar</u>, and select one of the following:
 - Measure FOV to measure the XY location of a single point
 - Measure Z to measure the Z location of a single point



3. **[Measure FOV]** Click on the Video window toolbar to display the Point Edge finder if it is not already displayed.

[Measure Z] Click on the Video window toolbar to display the Autofocus Finder if it is not already displayed.

- 4. Position the finder over the feature (see <u>Using the Single Point Edge Finder</u> on page 4-4 or <u>Using the Autofocus Finder</u> on page 4-15 for more information).
- 5. Double-click in the Video window to run the finder and measure the point.
- 6. Click finder and save it in the step.

7. Specify the attributes to display in the results output by selecting the appropriate check boxes in the Measure Point dialog box.

🥜 Measure Po	oint (1 Edge Fi	inder)			• 💌
Name P1		OK	Cancel	<u>R</u> un	Options
	Nominal	Actual	Tolerance Zone	Deviation	In/Out
□ <u>X</u> Pos					
Δ <u>Υ</u> Pos					
<u>Z</u> Pos					
🗆 🛛 XY <u>P</u> os					
This Point is d	erived from:				
Fin	der 1				

- 8. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 9. [Optional] Click **Options** to change the desired point measurement options; click **OK** to save the changes and close the dialog box.

Point Measurement Options					
Precision 5 🚔 DRF	default (system)	Construct		•	
 If Out Of Tolerance <u>©</u> <u>C</u>ontinue <u>∩</u> <u>Ab</u>ort <u>G</u>o To Step: 	🔲 <u>A</u> uto-Measur	Best-Fit Meth Position Toleranc Diametric	oc Standard e 1D Position © Coordinate	•	
0 Tolerance Limits	Units Millimeter	Point Data	Output	ОК	
Min/Max	 Microns Inches Mils 	🔲 Da <u>t</u> um		Cancel	

10. Click **OK** in the Measure Point dialog box to add the step to the program and display it in the Measurement Steps window.



Figure 6-1: Measuring a Point (FOV)



Figure 6-2: Measuring a Point (Z)

- 1. Perform the preliminary steps on page 6-2.
- 2. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Measure**.



- 3. Click on the Video window toolbar to display the Line Edge finder if it is not already displayed.
- 4. Position the finder over the feature (see <u>Using the Line Edge Finder</u> on page 4-6 for more information).
- 5. Double-click in the Video window to run the finder and measure the line.
- 6. Click finder and save it in the step.
- 7. Specify the attributes to display in the results output by selecting the appropriate check boxes in the Measure Line dialog box.

🧹 Measure Line (1 Edge Find	der)		
Name L2	ОК	Cancel	Run Options
Nominal	Actual Mi	Tolerance nu: Zone Plus	Deviation In/Out
Angle			
Straightness			
Angularity			
Perpendicularity			
Para <u>l</u> lelism			
Endpoints			
This Line is derived from:			
Finder 1			

8. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.

9. [Optional] Click **Options** to change the desired line measurement options; click **OK** to save the changes and close the dialog box.



10. Click **OK** in the Measure Line dialog box to add the step to the program and display it in the Measurement Steps window.



Figure 6-3: Measuring a Line that Fits in the Field of View

- 1. Perform the preliminary steps on page 6-2.
- 2. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Measure**.



- 3. Click on the Video window toolbar to display the Line Edge finder if it is not already displayed.
- 4. Position the finder over one end of the feature (see <u>Using the Line Edge</u> <u>Finder</u> on page 4-6 for more information).
- 5. Double-click in the Video window to run the finder and measure the line.
- 6. Click finder and save it in the step.
- 7. Using the joystick, drive the transports so the opposite end of the feature appears in the Video window.
- 8. Repeat Steps 4 through 6 to measure the opposite end of the feature.

9. Specify the attributes to display in the results output by selecting the appropriate check boxes in the Measure Line dialog box.

ノ Measure Line (2 Edge Fi	nders)	
Name 3	OK Cancel	Run Options
Nominal	Actual Tolerance Minu: Zone P	Deviation In/Out lus
Angle		
Straightness		
Angularity		
Perpendicularity		
Parallelism		
Endpoints		
This Line is derived from:		
Finder 1	Finder 2	

- 10. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 11. Click Options.
- 12. In the Line Measurement Options dialog box, select the **Auto-Measure** check box and specify the number of **Places** to run the finder (the default is 8).

Line Measurement Options					
Precision 5 🚔 DRF	default (system)	Construc		•	
If Out Of Tolerance	Auto-Measur	Best-Fit Meth	or Standard	•	
 <u>○</u> Continue ○ Abort ○ Go To Step: 	Places 8 🚔	Position Tolerance Diametric Radial	 1D Position O Coordinate Zone 	Work Plane	
0 Tolerance Limits	Units <u>M</u> illimeter:	Point Data	utput	⊙ YZ	
	 Microns Inches Mils 	Da<u>t</u>um Remove Outlier	0.00 Sigma	Cancel	

- 13. [Optional] Change any other desired options.
- 14. Click **OK** to save the changes and close the dialog box.
- 15. Click **Run** in the Measure Line dialog box to measure the entire line.
- 16. Click **OK** to add the step to the program and display it in the Measurement Steps window.



Figure 6-4: Measuring a Line that is Larger than the Field of View

- 1. Perform the preliminary steps on page 6-2.
- 2. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Measure FOV**.



- 3. Click on the Video window toolbar to display the Arc Edge finder if it is not already displayed.
- 4. Position the finder over the feature (see <u>Using the Arc Edge Finder</u> on page 4-12 for more information).
- 5. Double-click in the Video window to run the finder and measure the arc.
- 6. Click for the Video window toolbar to accept the finder and save it in the step.

7. Specify the attributes to display in the results output by selecting the appropriate check boxes in the Measure Arc dialog box.

nteasure Arc (1 Edge Fin	der)		- • •
Name A1	ОК	Cancel	Run Options
Nominal	Actual	Tolerance	Deviation In/Out
Start Angle	١	Ainu: Zone Plus	
End Angle			
□ <u>X</u> Pos			
<u>Y</u> Pos			
□ <u>Z</u> Pos			
XY <u>P</u> os			
Radius			
Rou <u>n</u> dness			
Runout			
oncentricity.			
This Arc is derived from:			
Ender 1			
Finder 1			

- 8. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 9. [Optional] Click **Options** to change the desired arc measurement options; click **OK** to save the changes and close the dialog box.

Arc Measurement Options					
Precision 5 🚔 DRF	default (system)	- Construc		•	
If Out Of Tolerance	Auto-Measur	Best-Fit Meth	or Standard	•	
 ● <u>C</u>ontinue ○ <u>Ab</u>ort ○ <u>G</u>o To Step: 0 	Places 8	 Position Tolerance Diametric Radial 	 1D Position © Coordinate © Zone 	Arc <u>2</u> D <u>3</u> D <u>D</u> iameter	
Tolerance Limits	Units <u>M</u> illimeter: Microns <u>I</u> nches Mils	Point Data	utput (Hole)	Madrus OK In) Cancel	

10. Click **OK** in the Measure Arc dialog box to add the step to the program and display it in the Measurement Steps window.



Figure 6-5: Measuring an Arc that Fits in the Field of View

- 1. Perform the preliminary steps on page 6-2.
- 2. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Measure NonFOV**.



- 3. Click on the Video window toolbar to display the Arc Edge finder if it is not already displayed.
- 4. Position the finder over one end of the feature (see <u>Using the Arc Edge Finder</u> on page 4-12 for more information).
- 5. Double-click in the Video window to run the finder and measure the arc.
- 6. Click finder and save it in the step.
- 7. Using the joystick, drive the transports so the opposite end of the feature appears in the Video window.
- 8. Repeat Steps 4 through 6 to measure the opposite end of the feature.

9. Specify the attributes to display in the results output by selecting the appropriate check boxes in the Measure Arc dialog box.

🗸 Measure Arc	(2 Edge Find	ers)			- • •	Ì
Name A1		ОК	Cancel	<u>R</u> ur	<u>O</u> ptions.	
1	Nominal	Actual	Tolerance	e D	eviation In/O	ut
Start Angle			Minu: Zone	Plus		
End Angle						
Δ <u>X</u> Pos						
□ <u>Y</u> Pos						
□ <u>Z</u> Pos						
XY Pos						
R <u>a</u> dius						
Rou <u>n</u> dness						
R <u>u</u> nout						
<u>Concentricity</u>						
This Arc is derive	ed from:					
P						
Finde	er 1		Finder 2			

- 10. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 11. Click **Options**.
- 12. In the Arc Measurement Options dialog box, select the **Auto-Measure** check box and specify the number of **Places** to run the finder (the default is 8).

Arc Measurement Options							
Precision 5 🚔 DRF default (system) 🔹 🗆 Construc							
If Out Of Tolerance	✓ <u>A</u> uto-Measur	Best-Fit Meth	o Standard	•			
 <u>C</u>ontinue <u>Ab</u>ort <u>G</u>o To Step: 	Places 8 🚔	Position Tolerance Diametric Radial	 D Position Coordinate Zone 	Arc 2D <u>3</u> D Diameter Radius			
 Tolerance Limits <u>P</u>lus/Minu	 Millimeter: Microns Inches Mils 	Point Data	utput (Hole)	OK OK Cancel			

- 13. [Optional] Change any other desired options.
- 14. Click **OK** to save the changes and close the dialog box.
- 15. Click Run in the Measure Arc dialog box to measure the entire arc.
- 16. Click **OK** in the Measure Arc dialog box to add the step to the program and display it in the Measurement Steps window.





- 1. Perform the preliminary steps on page 6-2.
- 2. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Measure FOV**.



- 3. Click on the Video window toolbar to display the Circle Edge finder if it is not already displayed.
- 4. Position the finder over the feature (see <u>Using the Circle Edge Finder</u> on page 4-10 for more information).
- 5. Double-click in the Video window to run the finder and measure the circle.
- 6. Click finder and save it in the step.

7. Specify the attributes to display in the results output by selecting the appropriate check boxes in the Measure Circle dialog box.

🧹 Measure Ci	rcle (1 Edge F	inder)		- • •
Name C9		ОК	Cancel	Run Options
	Nominal	Actual	Tolerance	Deviation In/Out
		MI	nu: Zone Plus	
<u>X</u> Pos				
<u>Y</u> Pos				
<u>Z</u> Pos				
XY <u>P</u> os				
Diameter				
Rou <u>n</u> dnes	s			
R <u>u</u> nout				
Concentrici	ty.			
This Circle is o	derived from:			
	\bigcirc			
Fin	der 1			

- 8. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 9. [Optional] Click **Options** to change the desired circle measurement options; click **OK** to save the changes and close the dialog box.

Circle Measurement Options					
Precision 5 🚔 DRF	default (system)	Construct		•	
If Out Of Tolerance	Auto-Measur	Best-Fit Meth	oc Standard	•	
Ontinue	Places 8 🚔	-Position Toleranc	e 1D Position	Circle	
Co To Story	Eocus All	Oiametric	Coordinate	© <u>2</u> D ⊚ <u>3</u> D	
0 0 10 Step:		Radial	Zone	Diameter	
	Units	Point Data		© <u>R</u> adius	
Tolerance Limits	Millimeter:	<u>К</u> еер	<u>D</u> utput		
Ius/Minu	Microns	Datum @ Inner	(Hala) @ Outer (I		
○ Min/Max	Inches	Datum O Inner		Cancel	
	Mils	Remove Outlier	0.00 Sigma		

10. Click **OK** in the Measure Circle dialog box to add the step to the program and display it in the Measurement Steps window.


Figure 6-7: Measuring a Circle that Fits in the Field of View

- 1. Perform the preliminary steps on page 6-2.
- 2. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Measure NonFOV**.



- 3. Click in the Video window toolbar to display the Line Edge finder if it is not already displayed.
- 4. Position the finder over the edge of the feature (see <u>Using the Line Edge</u> <u>Finder</u> on page 4-6 for more information).
- 5. Double-click in the Video window to run the finder and measure the edge.
- Click finder and save it in the step.
- 7. Using the joystick, drive the transports to position another part of the feature in the Video window.

NOTE: When measuring a circle that is larger than the field of view, we recommend placing three finders (spaced as far apart as possible) on the feature.

- 8. Repeat Steps 4 through 6 to measure the feature.
- 9. Repeat Steps 7 and 8 to measure a third part of the feature.

10. Specify the attributes to display in the results output by selecting the appropriate check boxes in the Measure Circle dialog box.

ノ Measure Ci	🖌 Measure Circle (3 Edge Finders)					
Name C12		ОК	Cancel	Run Options		
	Nominal	Actual	Tolerance	Deviation In/Out		
			Minu: Zone Plus			
<u>X</u> Pos						
Δ <u>Υ</u> Pos						
<u>Z</u> Pos						
XY <u>P</u> os						
Diameter						
Rou <u>n</u> dnes	s					
R <u>u</u> nout						
<u>Concentrici</u>	ty.					
This Circle is o	derived from:					
Fin	der 1		Finder 2	Finder		
•		III		4		

- 11. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 12. Click Options.
- In the Circle Measurement Options dialog box, select the Auto-Measure check box and specify the number of Places to run the finder (the default is 8).

Circle Measurement Options				
Precision 5 🚔 DRF	default (system)	Construc Best-Fit Metho	or Standard	• •
 <u>Continue</u> <u>Ab</u>ort <u>G</u>o To Step: 	Eocus All	 Position Tolerance Diametric Radial 	 1D Position Ocoordinate Zone 	Circle ○ <u>2</u> D
Tolerance Limits	Units <u>Millimeter:</u> Microns	Point Data	utput	© <u>R</u> adius
© Min/Ma <u>x</u>	 Inches Mils 	Datum © Inner	(Hole) © <u>O</u> uter (P 0.00 Sigma	Pin] Cancel

- 14. [Optional] Change any other desired options.
- 15. Click **OK** to save the changes and close the dialog box.
- 16. Click **Run** in the Measure Circle dialog box to measure the entire circle.

17. Click **OK** in the Measure Circle dialog box to add the measurement to the program and display it in the Measurement Steps window.



Figure 6-8: Measuring a Circle that is Larger than the Field of the View

- 1. Perform the preliminary steps on page 6-2.
- 2. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Measure**.



3. Click on the Video window toolbar to display the Autofocus Finder if it is not already displayed.

- 4. Using the joystick, drive the transports to position the first focus point in the Video window; adjust the illumination if necessary.
- 5. Manually focus (by eye) the surface.
- 6. In the displayed Autofocus dialog box, click to select surface focus mode.
- 7. Double-click in the Video window to run the finder and measure the focus point.
- 8. Click finder and save it in the step.
- 9. Repeat Steps 4 through 8 to measure the second and third focus points. Click **OK** in the Autofocus finder dialog box when finished.

10. Specify the attributes to display in the results output by selecting the appropriate check boxes in the Measure Plane dialog box.

🧹 Measure Pl	🖊 Measure Plane (3 Edge Finders)					
Name S2		ОК	Cancel	Run Options		
	Nominal	Actual	Tolerance	Deviation In/Out		
Angle			nu: zone Plus			
Flatness						
Parallelisr	n			In		
This Plane is o	lerived from:					
Fin	der 1	Fi	nder 2	Finder		
•				- +		

- 11. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 12. [Optional] Click **Options** to change the desired plane measurement options; click **OK** to save the changes and close the dialog box.

Plane Measurement O Precision 5 ⇒ DRF If Out Of Tolerance <u>©</u> <u>C</u> ontinue <u>Ab</u> ort <u>G</u> o To Step: 0	Detions default (system) Units Millimeter: Microns Inches Mils	Construct Best-Fit Methor Stand Tolerance Limits Plus/Minu: Min/Max	dard	• •
Point Data	itput	🔲 Da <u>t</u> um	OK	Cancel

13. Click **OK** in the Measure Plane dialog box to add the step to the program and display it in the Measurement Steps window.

1. Click on the VMS Toolbar.

- 2. Select the two features you want to use in the measurement by doing one of the following:
 - Select the desired features in the From and To lists in the Measure Distance dialog box
 - Click the desired features in the Features window
 - Select the desired features in the Object Names window
- 3. Specify the attributes to display in the results output by selecting the appropriate check boxes in the Measure Distance dialog box.

<u>```</u>					
🗸 Measure Distance From C1 To C2 🛛 🗖 🖻 💌					
Name D1		ОК	Can	icel	<u>R</u> un Options
From C1	▼ <=	> To C2	-		
	Nominal	Actual	Toler	ance	Deviation In/Out
			Minus	Plus	
□ <u>X</u>		1.99906			
<u> </u>		0.00000			
<u> </u>		0.00000			
<u>Р</u> -Р ХҮ		1.99906			

- 4. [Optional] Enter nominal values and tolerances in the Nominal and Tolerance Zone boxes.
- 5. [Optional] Click Options to change the desired distance measurement options; click OK to save the changes and close the dialog box.

Distance Measuremen	t Options	×			
Precision 5 🖨 DRF default (system) 🔻					
If Out Of Tolerance	Units				
Ontinue	Millimeter:				
Abort	Microns				
O To Step:	Inches				
0	Mils				
Tolerance Limits	2D (XY)	OK			

6. Click OK in the Measure Distance dialog box to add the step to the program and display it in the Measurement Steps window.

Feature Constructions

Constructing a Line	7-2
Constructing an Arc	7-4
Constructing a Circle	7-6
Constructing a Plane	7-8

1. Click the arrow directly to the right of on the VMS Toolbar, and select Construct.



- 2. Select the first feature you want to use in the construction by clicking it in the Features window (feature color changes to yellow) or by selecting it in the Object Names window.
- 3. Repeat Step 2 to select the second feature you want to use in the construction.
- 4. Specify the attributes you want to display in the results output by selecting the appropriate check boxes in the Construct Line dialog box.

ノ Construct E	Best Fit Line	Using C3, C7		
Name 1		OK	Cancel	<u>R</u> un <u>O</u> ptions
	Nominal	Actual	Tolerance Minu: Zone Plu	Deviation In/Out
Angle		-0.21893		
<u>Straightne</u>	255	0.00000		
Angularity	/			
Perpendicu	larity			
Para <u>l</u> lelisr	n			
<u>Endpoints</u>				
This Line is de	rived from:			
0	\bigcirc			
G	C7			

5. [Optional] Click **Options** to change any of the line construction options; click **OK** to save the changes and close the dialog box.

Line Construction Options					
Precision 5 🚔 DRF	default (system)			•	
If Out Of Tolerance		Best-Fit Metho	D (
 <u>C</u>ontinue A<u>b</u>ort <u>G</u>o To Step: 		 Position Tolerance Diametric Radial 	1D Position © Coordinate © Zone	Work Plane XY XZ	
Tolerance Limits	Units <u>Millimeter</u> :	Point Data	utput		
Min/Max	 Inches Mils 	Datum Remove Outlier	0.00 Sigma	Cancel	

- 6. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 7. Click **OK** in the Construct Line dialog box to add the step to the program and display it in the Measurement Steps window.



Figure 7-1: Constructing a Line from Two Circles

- 1. Click the arrow directly to the right of **Construct**.
- on the VMS Toolbar, and select



- 2. Select the first feature you want to use in the construction by clicking it in the Features window (feature color changes to yellow) or by selecting it in the Object Names window.
- 3. Repeat Step 2 to select the second and third features you want to use in the construction.
- 4. Specify the attributes you want to display in the results output by selecting the appropriate check boxes in the Construct Arc dialog box.

🖌 Construct Best Fit Arc Using C3, C4, C5						
Name A1		ОК	Cancel	Run Options		
	Nominal	Actual	Tolerance	Deviation In/Out		
Start Angle		-125.82103	Minu: Zone Plus			
End Angle		-53.17569				
<u>X</u> Pos		0.97230		0.00000		
Δ <u>Υ</u> Pos		0.73926		0.00000		
<u>Z</u> Pos		-0.00709		0.00000		
XY <u>P</u> os				0.00000		
R <u>a</u> dius		0.42620				
Rou <u>n</u> dness	s	0.00000				
R <u>u</u> nout						
Oncentricit	ty.					
This Arc is der	ived from:					
0	0	\bigcirc				
C3	C4	C5				

5. [Optional] Click **Options** to change any of the arc construction options; click **OK** to save the changes and close the dialog box.

Arc Construction Options					
Precision 5 🚔 DRF	default (system)			•	
If Out Of Tolerance		Best-Fit Meth Position Tolerance Diametric Radial	1D Position Ocordinate Zone	Arc 2D 3D Diameter	
0 Tolerance Limits Plus/Minu:	Units <u>Millimeter</u> : Microns	Point Data	utput	<u>R</u> adius	
⊘ Min/Ma <u>x</u>	© <u>I</u> nches © Mils	Da <u>t</u> um O I <u>n</u> ner	(Hole) (Hole) (P	Cancel	

- 6. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 7. Click **OK** in the Construct Arc dialog box to add the step to the program and display it in the Measurement Steps window.



Figure 7-2: Constructing an Arc from Three Circles

1. Click the arrow directly to the right of on the <u>VMS Toolbar</u>, and select **Construct**.



- 2. Select the first feature you want to use in the construction by clicking it in the Features window (feature color changes to yellow) or by selecting it in the Object Names window.
- 3. Repeat Step 2 to select the second and third features you want to use in the construction.
- 4. Specify the attributes you want to display in the results output by selecting the appropriate check boxes in the Construct Circle dialog box.

🖌 Construct Best Fit Circle Using C4, C6, C8						
Name C14		ОК	Cancel	Run Options		
	Nominal	Actual	Tolerance	Deviation In/Out		
			Minu: Zone Plus			
<u>X</u> Pos		0.99319		0.00000		
<u>Y</u> Pos		0.65156		0.00000		
<u>Z</u> Pos		-0.00815		0.00000		
XY <u>P</u> os				0.00000		
Diameter		0.67009				
Rou <u>n</u> dness		0.00423				
R <u>u</u> nout						
<u>Concentricit</u>	y.					
This Circle is de	erived from	:				
	\cap	\cap				
	\cup	\cup				
C4	C6	C8				

5. [Optional] Click **Options** to change any of the line construction options; click **OK** to save the changes and close the dialog box.

Circle Construction Options					
Precision 5 🚔 DRF	default (system)	✓ Construct ✓		•	
 If Out Of Tolerance <u>C</u>ontinue Abort 		Best-Fit Meth	or 1D Position —	Circle	
© <u>G</u> o To Step:	Diametric Radial	Coordinate Ordenate	 <u>2</u>D <u>D</u>iameter <u>R</u>adius 		
Tolerance Limits O Plus/Minu:	 <u>M</u>illimeter: Microns 		utput	ОК	
© Min/Ma <u>x</u>	 Inches Mils 	Datum O Inner	(Hole) © <u>O</u> uter (P 0.00 Sigma	in] Cancel	

- 6. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 7. Click **OK** in the Construct Line dialog box to add the step to the program and display it in the Measurement Steps window.



Figure 7-3: Constructing a Circle from Three Circles

- 1. Click the arrow directly to the right of **Construct**.
- on the VMS Toolbar, and select



- 2. Select the first feature you want to use in the construction by clicking it in the Features window (feature color changes to yellow) or by selecting it in the Object Names window.
- 3. Repeat Step 2 to select the second and third features you want to use in the construction.
- 4. Specify the attributes you want to display in the results output by selecting the appropriate check boxes in the Construct Plane dialog box.

🖌 Construct Best Fit Plane Using C1, C2, P1 📃 🔲 🔤				
Name S1		ОК	Cancel	<u>R</u> un <u>O</u> ptions
	Nominal	Actual	Tolerance Minu: Zone Plu	Deviation In/Out
Angle		0.10127		
Elatness		0.00000		
Parallelisn	n			In
This Plane is d	lerived from	:		
\bigcirc	\bigcirc	+		
а	C2	P1		

5. [Optional] Click **Options** to change any of the plane construction options; click **OK** to save the changes and close the dialog box.

Plane Construction Options					
Precision 👂 🚔 DRF	default (system)	▼ Construct		-	
If Out Of Tolerance	Units <u>M</u> illimeter: <u>Microns</u> <u>Inches</u> Mils	Best-Fit Methor Tolerance Limits <u>Plus/Minu</u> <u>Min/Max</u>		~	
Point Data	itput	🔲 Da <u>t</u> um	ОК	Cancel	

- 6. [Optional] Enter nominal values and tolerances in the **Nominal** and **Tolerance Zone** boxes.
- 7. Click **OK** in the Construct Plane dialog box to add the step to the program and display it in the Measurement Steps window.

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Part Programming

Programming a Step	8-2
Creating a Program	8-2
Saving a Program	8-2
Outputting Measurement Results	8-3
Editing a Program	8-5
Creating a Sample Program	8-9

- 1. Display a feature in the Video window.
- 2. Select the desired geometry from the VMS toolbar.
- 3. Position the finder over the feature.
- 4. Run the finder.
- 5. Save the finder in the step.
- 6. Save the step in the program.

Creating a Program

Before creating a program:

- 1. Zero the stage (described on page 1-2).
- 2. Make sure the part is mounted securely on the stage, the part image appears clearly in the Video window, and the part image is focused (described on page 1-4).
- 3. Select the units of measurement (described on page 1-3).
- 4. [Optional] Set the lower Z travel limit (described on page 1-4).

To create a program:

- 1. Select New in the VMS File menu (or press Ctrl+N).
- Select System Alignment and/or define the Part Alignment (described on page 5-3).
- 3. Measure and/or construct features.
- 4. Specify output options (described on page 8-3).
- 5. Save the program (described on page 8-2)
- Run the program periodically to check the measurements (described on page 3-2).

Saving a Program

- 1. Click on the <u>VMS Toolbar</u> (or press Ctrl+S).
- 2. In the standard Windows Save As dialog box, type a unique name for the routine. You can also change the folder if you want.
- 3. Click Save.

You can output measurement results to any of the following:

- Printer
- Text file
- Microsoft® Excel worksheet

To specify the results output options:

- 1. Select the **Setup** ribbon, and then select **Results Control** in the Options section.
- 2. In the Results Control dialog box, select the results you want to output by selecting the appropriate check boxes in the Format / Order section.

NOTE: The order in which you select the check boxes determines the order in which the columns will appear in the output. The current order appears at the bottom of the Results Control dialog box.

Results Control		
Format / Order	Edit Results Header OK Cancel	
Default	Print Mode Text File Output	Excel Output
📝 Pass / Fail	No Printout O Not Save Results	O Not Output
📝 Measurement	Print by Line Prompt for Name	Prompt for Name
Deviation	Print by Page Append Results File	Workbook path Browse
Actual	Print by Part	
V Nominal	V Print Header Print Feature Drawing	Worksheet
 ✓ - Tolerance ✓ + Tolerance 	Results Directory Browse	
🔽 Units	CA	Append
Out of Tolerance	Point Data File XYZDataFile.txt	
	Results Format	
P/F Measurement	Deviation Actual Nominal -Tol +Tol U	

3. To include header information with the output results, select the **Print Header** check box.

To change the header information, click **Edit Results Header** and make the desired changes. When finished, click **OK** to save the changes.

4. To include a drawing of the part in the output, select the **Print Feature Drawing** check box.

- 5. Select the Print Mode by selecting one of the following options:
 - No Printout results are not sent to a printer
 - Print by line sends the specified results to the printer after each line of results is generated; this option is only applicable if a dot-matrix printer is used
 - **Print by Page** sends the specified results to the printer after each full page of results is generated
 - **Print by Part** sends the specified results to the printer after the results for an entire part are generated
- 6. Specify the Text File Output mode by selecting one of the following options:
 - Do not Save Results results are not sent to a file
 - **Prompt for Name** the software displays a prompt for a file name before sending the results to the specified output file
 - Append Results File the software appends the specified results to the existing data in the specified output file

NOTE: To change the output results folder, click **Browse** and select the desired folder.

- 7. Specify the Excel Output mode by selecting one of the following options:
 - Do not output results are not sent to an Excel worksheet
 - Output to Excel results are sent to the specified Excel worksheet

NOTES:

- To change the workbook path, click **Browse** and select the desired Excel workbook.
- To specify a worksheet in the workbook, type its name in the Worksheet box
- 8. Click **OK** to save the changes and close the Results Control dialog box.

This section describes the following:

- Editing a Step
- Editing a Finder Location
- Deleting Steps
- Copying Steps
- Inserting Steps
- Moving Steps

Editing a Step

- 1. Double-click the desired step in the Measurement Steps window to display the measurement or construction dialog box for that step.
- 2. Make the desired changes and click **OK**.

NOTES:

- To edit a finder used in the step, double-click anywhere on the thumbnail for the finder, and then perform Steps 3 through 7 in Editing a Finder Location on page 8-6.
- In the header of the dialog box, the software indicates the number of finders used in the step.

🖌 Measure Line (2 Edge Finders) 👘 💼 📼				
Name L1		ОК	Cancel	Run Options
	Nominal	Actual	Tolerance Minu: Zone Plus	Deviation In/Out
Angle		-0.38318		
<u>Straightne</u>	ss	0.07188		
Angularity.				
Perpendicul	arity			
Para <u>l</u> lelism	.			
Endpoints.				
This Line is der	rived from:			
Find	ler 1		Finder 2	

Editing a Finder Location

- 1. Right-click the desired step in the Measurement Steps window, select **Edit Finder**, and then select the finder you want to edit.
- 2. Verify the stage path is clear, and then click **Yes** in response to the displayed message.
 - The transports move to the saved finder location
 - · The finder appears in the Video window
 - The feature measurement dialog box appears (finder thumbnail is highlighted)



3. Click No in response to the following message:

Caution!	23
Do you want to run the finder?	
Yes No	

- 4. If the finder is not properly aligned to the feature, drive the transports and/or reposition the finder to align the finder.
- 5. Double-click in the Video window to run the finder and remeasure the feature.
- 6. Click finder and save it in the step.
- 7. Click **OK** in the feature measurement dialog box to accept the changes and save the step; click Cancel to discard the changes.

1. Select the desired step(s) in the Measurement Steps window.

To select	Do this
A single step	Click the desired step.
Multiple steps, in sequence	Click the first step in the sequence, and then hold down Shift as you click the last step in the sequence.

- 2. Right-click in the Measurement Steps window, and select **Delete**.
- 3. Click **Yes** in response to the displayed message to delete the selected step (s).

Delete	83
Delete the selected step(s)?	
Yes <u>N</u> o	

Copying Steps

1. Select the desired step(s) in the Measurement Steps window.

To select…	Do this
A single step	Click the desired step.
Multiple steps, in sequence	Click the first step in the sequence, and then hold down Shift as you click the last step in the sequence.

- 2. Right-click in the Measurement Steps window, and select Copy.
- 3. See <u>Inserting Steps</u> on page 8-8 for information on how to insert the copied steps into the program.

- 1. Select the step you want the added steps to follow by clicking it in the Measurement Steps window.
- 2. To insert one or more steps, do either of the following:
 - Measure or construct additional features.
 - Right-click in the Measurement Steps window and select **Paste** to insert any copied step(s).

Moving Steps

1. Select the desired step(s) in the Measurement Steps window.

To select	Do this
A single step	Click the desired step.
Multiple steps, in sequence	Click the first step in the sequence, and then hold down Shift as you click the last step in the sequence.

- 2. Right-click in the Measurement Steps window, and select Cut.
- Click the desired step in the Measurement Steps window that you want the cut step(s) to follow.
- 4. Right-click in the Measurement Steps window, and select **Paste**.

This section describes how to measure the QVI training part. The measurements are based on the dimension drawing shown on the next page.

Detailed information as to which functions and features you should use is described with the specific measurements, including the dimensions you should look for to verify the measurements were done properly.

As you measure features, be sure to specify the nominal values and tolerances that are shown in the dimension drawing.

Perform the following procedures to create a sample program:

- 1. Set Up the Part and Define the Part Alignment
- 2. Measure and Construct Features
- 3. Specify Output Options
- 4. Edit the Program
- 5. Run the Program and View the Results

NOTES:

- In this sample program, you will measure all of the features first, followed by constructing features from measured features. When you create your own measurement programs you can measure and construct features in whichever order is most suitable for you.
- This sample program was created on a system configured with dual magnification optics and a 1X front lens installed.

The QVI training part (P/N 790012) is a stamped metal part most suitable for measurement of its two dimensional features using backlit video. It is provided for testing and self training.



XX [XX] = in [mm]

Unless otherwise specified:

- X.XXX dimension tolerance: ± .005 [0.125]
- X.XX dimension tolerance: ± .01 [0.25]
- Angular dimension tolerance: ± 1°

Set Up the Part and Define the Part Alignment

- 1. Verify that there are no obstructions in the stage path, and then click **Zero Stage** in the Stage and Lights window to zero the stage.
- 2. Place and secure the QVI training part on the stage, in the orientation shown on page 8-10.
- 3. Using the joystick, drive the transports so the bottom edge of the part appears in the Video window.
 - Adjust the intensity of the backlight so there is sufficient contrast.
 - Raise or lower the Z-axis assembly until the image is sharp and focused.
- 4. Select the **Setup** ribbon, and then select **Measurement** in the Options section.
- 5. In the Units section of the Measurement Options dialog box, select the **Inches** option.
- 6. Click **OK** to close the Measurement Options dialog box.
- 7. Click on the Video window toolbar, and focus the bottom edge of the part.
- 8. Select New in the VMS File menu (or press Ctrl+N).
- 9. Define the Part Coordinate System (PCS).
 - a. Create an alignment block (described on page 5-3).
 - b. Measure the lower-left hole (C1), the lower-right hole (C2), and a point (P1) near the upper-left hole (described on page 5-3).
 - c. Define a reference plane (S1) using C1, C2, and P1 (described on page 5-7).
 - d. Define a reference line (L1) using C1 and C2 (described on page 5-8).
 - e. Set the part tilt, part rotation, and part origin (described on page 5-10).
- 10. Click on the <u>VMS Toolbar</u> (or press Ctrl+S) to save your work.

Measure and Construct Features

1. Use this table to perform the first set of measurements.

Measurement	Function	Feature	Dimension
Right edge	Measure	Line (L2)	Angle = 90°
Rounded slot edge	Measure	Line (L3)	Angle = 45°
Rounded slot edge	Measure	Line (L4)	Angle = 45°
Rounded slot corner	Measure FOV	Arc (A1)	Radius = .050"
Rounded slot corner	Measure FOV	Arc (A2)	Radius = .050"
Distance between slot corners	—	Distance (D1)	.875"
Distance between slot edges	_	Distance (D2)	.100"
Lower slanted edge	Measure	Line (L5)	Angle = 45°
Semicircle on the right	Measure Non FOV	Arc (A3)	Radius = .250"
Upper slanted edge	Measure	Line (L6)	Angle = 45°
Top edge	Measure	Line (L7)	Y = 1.375"
Upper-left hole	Measure FOV	Circle (C3)	Diameter = .100"
Upper-left corner	Measure FOV	Arc (A4)	Radius = .120"
Left edge	Measure	Line (L8)	X =125"
Lower-left corner	Measure FOV	Arc (A5)	Radius = .120"
Bottom edge	Measure	Line (L9)	Y =0125"
Lower-right corner	Measure FOV	Arc (A6)	Radius = .120"

2. Click on the <u>VMS Toolbar</u> (or press Ctrl+S) to save your work.

3. Use this table to perform the second set of measurements.

Measurement	Function	Feature	Dimension
Top edge of left slot	Measure	Line (L10)	Y = .875"
Left edge of left slot	Measure	Line (L11)	X = .100"
Bottom edge of left slot	Measure	Line (L12)	Y = .375"
Right edge of left slot	Measure	Line (L13)	X = .150"
Top edge of middle slot	Measure	Line (L14)	Y = .875"
Left edge of middle slot	Measure	Line (L15)	X = .225"
Bottom edge of middle slot	Measure	Line (L16)	Y = .375"
Right edge of middle slot	Measure	Line (L17)	X = .275"
Top edge of right slot	Measure	Line (L18)	Y = .875"
Left edge of right slot	Measure	Line (L19)	X = .350"
Bottom edge of right slot	Measure	Line (L20)	Y = .375"
Right edge of right slot	Measure	Line (L21)	X = .400"

4. Click on the <u>VMS Toolbar</u> (or press Ctrl+S) to save your work.

5. Use this table to perform the third set of measurements.

Measurement	Function	Feature	Dimension
Large in the middle of the part	Measure Non FOV	Circle (C4)	Diameter = .250"
Small hole (1) next to large hole	Measure FOV	Circle (C5)	Diameter = .100"
Small hole (2) next to large hole	Measure FOV	Circle (C6)	Diameter = .100"
Small hole (3) next to large hole	Measure FOV	Circle (C7)	Diameter = .100"
Small hole (4) next to large hole	Measure FOV	Circle (C8)	Diameter = .100"
Small hole (5) next to large hole	Measure FOV	Circle (C9)	Diameter = .100"
Small hole (6) next to large hole	Measure FOV	Circle (C10)	Diameter = .100"
Small hole (7) next to large hole	Measure FOV	Circle (C11)	Diameter = .100"
Small hole (8) next to large hole	Measure FOV	Circle (C12)	Diameter = .100"
Bolt circle using C5, C6, C7, C8, C9, C10, C11, and C12	Construct	Circle (C13)	

6. Click on the <u>VMS Toolbar</u> (or press Ctrl+S) to save your work.

Specify Output Options

- 1. Select the **Results** ribbon, and then select **Results Control** in the Options section to display the Results Control dialog box.
- 2. In the Format / Order section, select the following check boxes:
 - Pass / Fail
 - Measurement
 - Deviation
 - Actual
 - Nominal
 - Tolerance
 - + Tolerance
 - Units

Results Control			X
Format / Order	Edit Results Head	er OK Cancel	
Default Pass / Fail Measurement Deviation Actual	Print Mode No Printout Print by Line Print by Page Print by Part	Text File Output O Do Not Save Results Prompt for Name Append Results File	Excel Output O Do Not Output Prompt for Name Workbook path Browse
 ✓ Nominal ✓ Tolerance ✓ + Tolerance 	Print Header Results Directory	Print Feature Drawing Browse	Worksheet
✓ Units Out of Tolerance	C:\ Point Data File XY2	ZD ataFile.txt	Append
	Results Format		
P/F Measurement	Deviation Actual N	ominal -Tol +Tol U	

- 3. Click Edit Results Header and enter the appropriate header information.
- 4. Click **OK** in the Edit Results Header dialog box.
- 5. Select the **Print Header** check box.
- 6. If a printer is connected to the system, select the **Print by Part** option in the Print Mode section to output the measurement results to a printer. Otherwise, select the **No Printout** option.
- Select the Prompt for Name option in the Text File Output section to output the measurement results to a text file. Then click Browse and create a folder on the C: drive named "QVI_Training_Part".
- 8. Click **OK** to save the output settings.

Edit the Program

This procedure describes how to edit the finder locations for the reference features used to define the part alignment.

- 1. Move the training part to a different location on the stage to simulate placing an identical part at another stage location. Be sure to resecure the part to the stage.
- Right-click circle C1 in the Measurement Steps window, and select Edit Finder > Circle Finder.
- 3. Verify the stage path is clear, and then click **Yes** in response to the following prompt.



The transports move to the saved finder location and the finder appears in the Video window.

4. Click No in response to the following prompt:



- 5. Using the joystick, drive the transports to align the lower-left hole to the finder.
- 6. Double-click in the Video window to run the finder and remeasure the feature.
- 7. Click ✓ on the Video window toolbar to accept the finder and save it in the step.
- 8. Click **OK** in the feature measurement dialog box to save the step.
- Right-click circle C2 in the Measurement Steps window, and select Edit Finder > Circle Finder.
- 10. Repeat Steps 3 and 4.

- 11. Using the joystick, drive the transports to align the lower-right hole to the finder.
- 12. Repeat Steps 6 through 8 to edit the finder location, remeasure the feature, and save the step.
- Right-click point P1 in the Measurement Steps window, and select Edit Finder > Autofocus.
- 14. Repeat Steps 3 and 4.
- 15. Using the joystick, drive the transports to position the surface of the part in the Video window; adjust the illumination if necessary.
- 16. Repeat Steps 6 through 8 to edit the finder location, remeasure the feature, and save the step.

Run the Program and View the Results

- 1. Click on the <u>VMS Toolbar</u> (or press Ctrl+R) to reset the program.
- 2. Click (or press F5) to run the program.

The system does the following:

- Measures the training part by following the steps in the program
- Displays the results in the Results window
- · Sends the measurement results to the printer (if specified)
- · Sends the measurement results to the specified output file
- 3. View the results and verify the accuracy of the measurements by checking them against the dimension drawing on page 8-10.

Reference Information

Software Security	A-2
Software Security Dongle	A-2
License File	A-3
Troubleshooting Software Security	


Your license to operate the VMS software requires both a <u>software security dongle</u> and associated <u>license file</u>. The software will only work if these two security components are in place.

NOTES:

- Refer to <u>Troubleshooting Software Security</u> if you have trouble accessing protected software.
- 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 folder or any files in this folder.
- With the purchase of your QVI system you receive a limited license to the measurement software. Measurement software licenses must be periodically renewed. Renewal is free, and the process is simple. Visit <u>www.qvii.com/renew</u> or contact the QVI channel partner or the QVI division that provided your QVI product to renew the license prior to expiration. Be sure to renew by the renewal date to avoid downtime.
- Do not change the date or time on the system controller to an earlier date or time. If you must change the time, close the software first. Then wait the same length of time that you adjusted the clock before restarting the software. If you start the software before the appropriate length of time has elapsed, you may be unable to use the software and you may need a new license file. For users in the GMT +6 or greater time zones, we recommend changing the time zone instead of the time. Contact the QVI channel partner or the QVI division that provided your QVI system for more information.

Software Security Dongle

The software security dongle is a hardware device that prevents unauthorized use of the software and its options. The dongle is attached to the machine and it is programmed at the factory to enable customer-specific applications and software options that you are authorized to use. It is shipped with the manufactured system or with separately purchased software updates and options.

The dongle must be securely plugged into an addressable USB port on the system controller, and its accompanying license file must be in a specific folder.

NOTE: The dongle will enable only the associated maintenance and minor releases. This means that a minor release (for example, version 1.1) will run with the dongle issued for its major release (for example, version 1). Each <u>software security dongle</u> has a corresponding license file. The license file contains information about the options enabled on your system, and it can only be used with the dongle that has been programmed specifically for your system.

A new license file (not dongle) is required for each major release of the applications and options that it is supplied for (for example, version 1).

Troubleshooting Software Security

If you have trouble accessing software that is protected by the <u>software security</u> dongle and <u>license file</u>, the system displays the messages listed below.

 If you attempt to initialize protected software that is not enabled by the connected dongle, the following message appears:

The application you are trying to access is not enabled for use, contact QVI customer service.

 If you attempt to initialize protected software when the dongle is disconnected, the following message appears:

The application you are trying to access requires the presence of a security dongle that cannot be found. Make sure the dongle supplied with the software is securely seated in an addressable USB port and try again.

 If you attempt to initialize protected software when the license file is absent, the following message appears:

The application you are trying to access requires the presence of a license file that cannot be found. Make sure the license file supplied with the software is installed on the system controller and try again.

 If the dongle is disconnected while the application is running, the application will pause and display the following message:

Please put the QVI dongle in the USB port.

Certain applications and options may continue to operate even if the security dongle is disconnected. In these cases, you are allowed to save any open part routines. However, the *File / New* and *File / Open* functions are disabled and you will receive an error message if you attempt to use either of these functions. To continue normal operation, reinsert or reseat the dongle and click **Retry**.

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

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