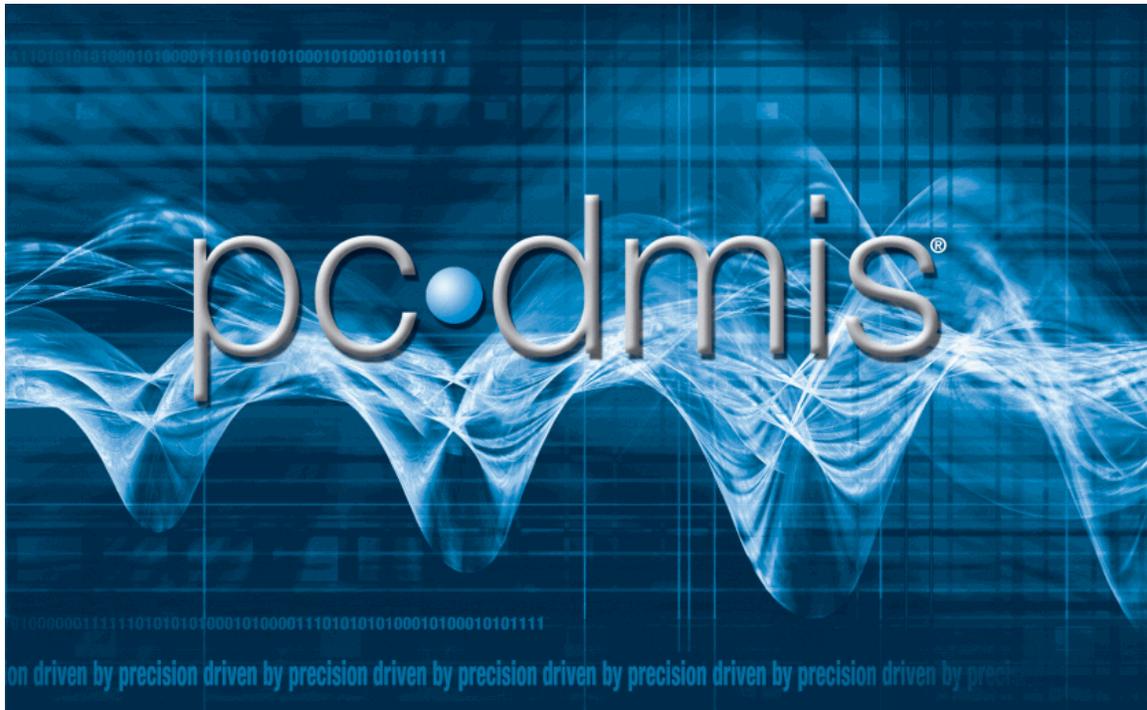

PC-DMIS Vision Manual

For PC-DMIS 2010



By Wilcox Associates, Inc.

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PC-DMIS for Windows version 4.0 and beyond uses a free, open source package called lp_solve (or lpsolve) that is distributed under the GNU lesser general public license (LGPL).

lpsolve citation data

Description: Open source (Mixed-Integer) Linear Programming system

Language: Multi-platform, pure ANSI C / POSIX source code, Lex/Yacc based parsing

Official name: lp_solve (alternatively lpsolve)

Release data: Version 5.1.0.0 dated 1 May 2004

Co-developers: Michel Berkelaar, Kjell Eikland, Peter Notebaert

License terms: GNU LGPL (Lesser General Public License)

Citation policy: General references as per LGPL

Module specific references as specified therein

You can get this package from:

http://groups.yahoo.com/group/lp_solve/

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Using PC-DMIS Vision

PC-DMIS Vision: Introduction



This manual documents how to use PC-DMIS Vision with your optical measuring system to measure features on a part. Vision probes provide a quick way to collect many measured points for a single feature. This non-contact probing method can also be used to measure certain types of "flat" features. For example, a circuit board could have an overlay of a different color to the main circuit board. A contact probe running over the part won't detect the feature. However, using a Vision probe you could easily "capture" the feature.

PC-DMIS Vision will let you prepare a part program in either offline or online modes. The CAD Camera functionality gives you the versatility to run this program in either mode.

PC-DMIS Vision supports these hardware configurations:

- [ROI DCC machines](#) – Onyx, Datastar, and OMIS II-III product lines
- [TESA Visio product line](#) – Visio 1, Visio 300 Manual + DCC including Touch Probe, Visio 500 and Visio 200.
- [Mycrona machines](#) – Red, Silver & Blue Lines, including Touch Probe Systems, Dual Z Axis & rotary table machines, Point Laser and Mahr & Werth (via retrofit).
- [QVI/OGP](#) – All PC Based models (Smartscope, Quest, Flash, Zip, etc)
- [CMM-V](#) – Vision camera on a CMM wrist. Available for LEITZ firmware CMMs.
- [B&S Optiv](#)

In addition, many other machine types can be supported by using a generic Metronics interface. Installation may require some PC hardware upgrades.

The main topics in this manual include:

- [Factors for Measuring with PC-DMIS Vision](#)
- [Understanding Targets in PC-DMIS Vision](#)
- [Getting Started](#)
- [Calibrating Vision Probes](#)
- [Setting Machine Options](#)
- [Using the Graphics Display Window in PC-DMIS Vision](#)
- [Using the Probe Toolbox in PC-DMIS Vision](#)
- [Using Vision Gages](#)
- [Creating Alignments](#)
- [Measuring Auto Features with a Vision Probe](#)
- [Using AutoTune Execution](#)
- [Using On Error Commands](#)
- [Using the Image Capture Command](#)

These appendices are also available:

- [Appendix A: Troubleshooting PC-DMIS Vision](#)
- [Appendix B: Adding a Ring Tool](#)
- [Appendix C: Using the NC-100 Video Probe](#)

Use this manual in conjunction with the main *PC-DMIS reference manual* if you come across something in the software that isn't covered here.

Factors for Measuring with PC-DMIS Vision

There are three basic elements that should be considered while measuring with PC-DMIS Vision. These factors will dramatically affect the measurement accuracy or repeatability that you can achieve.

1. [Lighting](#)
2. [Magnification](#)
3. [Edge Quality](#)

Lighting

If you can't see the product you can't measure it. Lighting is perhaps the most fundamental factor when measuring with Vision probes. It is also the FIRST parameter to enable when measuring an edge.

The type of lighting, the intensity and the mixture of lighting sources can have significant effect on the accuracy of your Vision system. Where possible, use only sub-stage lighting, as it will reduce the amount of texture on the surface and improve edge detection performance.

You can "[Calibrate Illumination](#)" and make needed adjustments via the "[Probe Toolbox: Illumination tab](#)" to ensure proper lighting for measurement.

Magnification

Changing the magnification will directly affect the accuracy of the result you're going to achieve. In some cases, the entire measurement process can be done at a single magnification level, however it is quite common that the level of magnification be changed depending on the feature type, size and accuracy requirements. PC-DMIS Vision makes adjustments to accommodate changes in magnification.

Focus accuracy is particularly affected by magnification. Higher magnification allows you to obtain higher focus accuracy. Measurements in Z are almost always done at the highest level of magnification.

Magnification is calibrated through "[Field of View Calibration](#)" and adjusted for optimal measurement of your feature via the "[Probe Toolbox: Magnification tab](#)".

Edge Quality

The quality of the edge has a direct effect on the quality of the measured result. By adjusting the edge quality tools, PC-DMIS Vision may be able to improve any imperfections that might exist for the viewed edge of the feature you are measuring.

Some things that are done to improve image quality include:

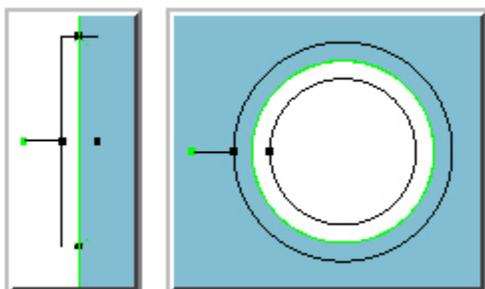
- Ensuring that targets are sized to contain ideally just the target edge you're trying to measure.

- Using ring lights (if available) to ensure the edge is lit up as sharp and in high contrast as possible.
- Clever filtration and sample measurements can allow you to achieve a desired result.

Using the "[Probe Toolbox: Hit Targets tab](#)", you can limit the data that is included for the measured feature.

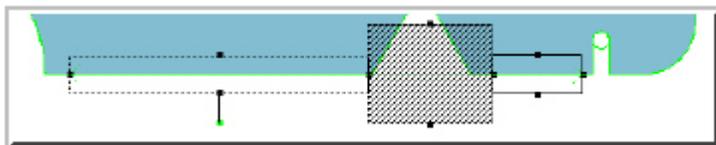
Understanding Targets in PC-DMIS Vision

In PC-DMIS Vision, you position targets on a feature to acquire measured points. The type of target used is automatically chosen based on the feature being measured. In the example below, measuring a line feature uses a rectangular shaped target. Measuring a circle feature uses a doughnut shaped target.



Line and Circle Target Examples

Features can be measured by one or more targets. In the example below, the line is measured with 3 targets where the middle target is not being used to collect data.



Example of line being measured using three targets

The size of the feature to measure determines the span of the target. For example, a small circle that fits inside of the FOV can be measured with a single target, where a larger circle that exceeds the FOV would require multiple targets to span its circumference. After selecting the Auto Feature to be measured, the targets are created by:

1. Selecting a feature from the CAD model.
2. Manually entering the nominal values.
3. Creating Target anchor points.

More information is available in the "[Measuring Auto Features with a Vision Probe](#)" topic.

Getting Started

There are a few basic steps that you should take to verify that your system has been properly prepared before using PC-DMIS Vision with your Vision machine.

Note: You will get the best measurement results if your optical measuring system is setup in a dimly lit room that doesn't have a lot of uncovered windows or bright lights with little temperature variation.

Follows these steps to get started with PC-DMIS Vision:

Step 1: Install and Launch PC-DMIS Vision

Before working with your optical measuring system, ensure that PC-DMIS Vision has been properly installed on your computer system.

To install PC-DMIS Vision:

1. Attach your portlock programmed with the **Vision** option to your computer. You must also have the correct Vision probe type from the **Vision Type** drop-down box programmed. The portlock settings must be selected prior to installing PC-DMIS to ensure that the needed Vision components will be installed. Please contact your PC-DMIS software distributor if your portlock has not been properly configured.
2. Install PC-DMIS. During the initial PC-DMIS install process, you will be prompted to install Frame Grabber software. See the "[Frame Grabber](#)" topic for more information.
3. Verify that specific calibration tests have been completed for your Vision machine. These tests should already have been completed by a trained technician. You can verify that your machine is ready by confirming the following files reside on your computer system located in the root directory where you installed PC-DMIS:
 - ***.ilc:** Files that have a .ilc extension are created during the calibration process of your machine's lamps. They store the illumination calibration data for each lamp and optics lens combination.
 - ***.ocf, *.mcf and *.fvc:** These files are created during the calibration of your machine's optics. They store the calibration data needed to map pixel size to real world units and correct for optical parcentrality/parfocality errors.
 - **Comp.dat:** This file is created during the calibration of your machine's stage, storing the calibrations for position on the X, Y and Z axis.

These calibration files may or may not exist and are not prerequisite to running PC-DMIS Vision. If this is a new install, then the files will not exist. As calibrations are executed inside of PC-DMIS, these files will be created.

CAUTION: Do not, under any circumstances, alter these files. A trained service technician must make any calibration adjustments to these areas of the system.

4. Start PC-DMIS in online mode by selecting **Start | (All) Programs | PC-DMIS for Windows | Online**.
5. Open an existing part program, or create a new one. If you create a new part program the **Probe Utilities** dialog box appears.

Step 2: Home your System

Once you have started PC-DMIS Vision you are ready to home your system.

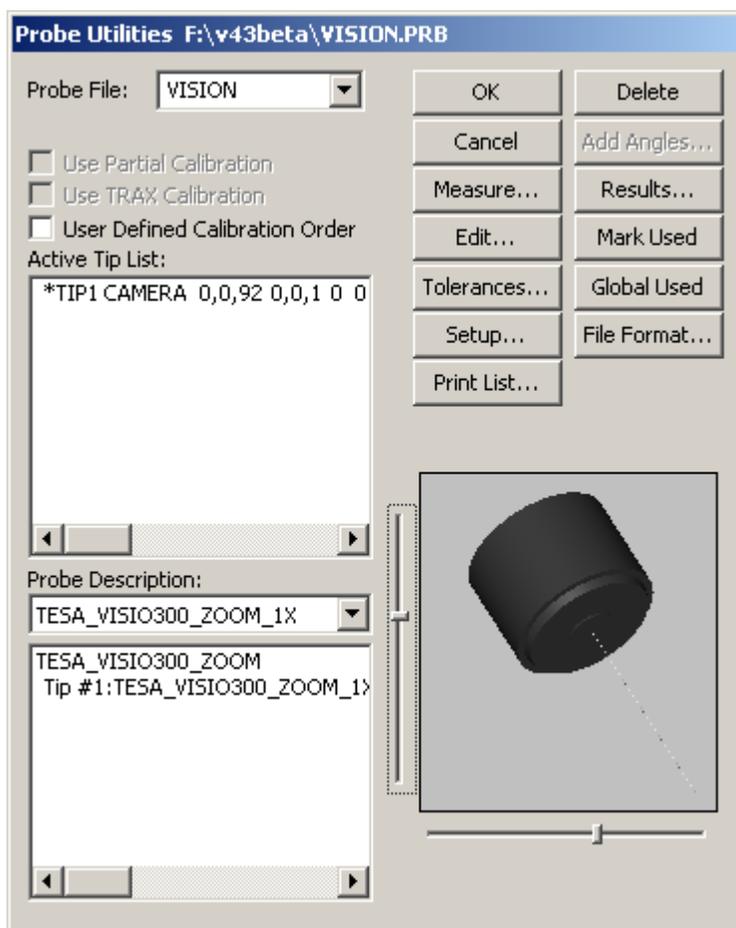
You need to home your system before proceeding in order to find the encoder's zero position of the machine's scales. Methods for homing may vary from system to system, although most DCC Vision systems will automatically home on startup. If you need additional information on homing your specific system, consult the documentation that came with your Vision machine.

Step 3: Create a Vision Probe File

If your probe (camera) type has not yet been defined you will need to use the **Probe Utilities** dialog box to create a probe file.

To create a new probe file for your Vision probe:

1. Select the **Insert | Hardware Definition | Probe** menu option. The **Probe Utilities** dialog box appears. (This dialog will automatically appear whenever you create a new part program.)



Probe Utilities dialog box

2. Type a **Probe File** name that best describes your Vision probe.
3. High-light: **No probe defined**
4. Select the appropriate probe from the **Probe Description** drop-down list.
5. As needed, select additional components in the same manner for "empty connections" until your probe definition is complete. The defined tip will be displayed in the **Active Tip List** when completed.
6. Notice the probe image is no longer displayed. This is usually desirable so it does not obstruct the view of the part as you are measuring. However, You can enable the display of probe components by double-clicking on the probe component to open the **Edit Probe Component** dialog box. Select the check box next to **Draw this component**.

For additional information on defining probes, see the "Defining Hardware" chapter in the main PC-DMIS reference manual.

Step 4: Edit the Vision Tip

Once you have created a Vision tip, you can edit the probe data for the selected tip by selecting **Edit** from the **Probe Utilities** dialog box. Default values are provided according to the defined probe. This opens the **Edit Probe Data** dialog box.

Tip ID:	<input type="text" value="TIP1"/>	OK	
DMIS Label:	<input type="text"/>	Cancel	
X Center:	<input type="text" value="0"/>	Shank I:	<input type="text" value="0"/>
Y Center:	<input type="text" value="0"/>	Shank J:	<input type="text" value="0"/>
Z Center:	<input type="text" value="92"/>	Shank K:	<input type="text" value="1"/>
Lens Mag:	<input type="text" value="1"/>		
Camera ID:	<input type="text" value="0"/>	CCD Pixel Size:	<input type="text" value="0.008500"/>
Min FOV:	<input type="text" value="1.5"/>	Max FOV:	<input type="text" value="8.4"/>
Min NA:	<input type="text" value="-1"/>	Max NA:	<input type="text" value="-1"/>
CCD Width:	<input type="text" value="640"/>	CCD Height:	<input type="text" value="480"/>
CCD Center X:	<input type="text" value="320"/>	CCD Center Y:	<input type="text" value="240"/>
CCD Gutter (T):	<input type="text" value="3"/>	CCD Gutter (B):	<input type="text" value="3"/>
CCD Gutter (L):	<input type="text" value="3"/>	CCD Gutter (R):	<input type="text" value="3"/>
Calibration Date:	<input type="text" value="Unknown"/>	Calibration Time:	<input type="text" value="Unknown"/>
Focus			
Up Delay:	<input type="text" value="0.000000"/>	Latency:	<input type="text" value="-999999.C"/>
Down Delay:	<input type="text" value="0.000000"/>	Frames/Second:	<input type="text" value="0.000000"/>
Depth:	Frame Width	Focus Depth	
Nickname:	<input type="text"/>		

Edit Probe Data dialog box for Vision tips

You can edit or view the following values for your Vision tip as needed according to the defined Vision probe:

Tip ID: Displays the Tip ID for the presented probe data

DMIS Label: This box displays the DMIS label. When importing DMIS files, PC-DMIS uses this value to identify any SNSDEF statement inside the imported DMIS file.

XYZ Center: Center of the focal point of the camera. This is updated by the "[Calibrate Probe Offset](#)", so that the camera and touch probe are in the same reference system.

Shank IJK: These three values provide the optical vector for the direction that the optical lens is pointing.

Lens Mag: Displays the magnification of the defined probe lens.

Camera ID: Allows you to provide an ID for the camera that you are using. For dual camera support, an integer indicates whether this tip gets its image from Frame Grabber camera input 0 or 1.

CCD Pixel Size: Pixel size at which image data is evaluated. Smaller values indicate a higher resolution for image capturing.

Min FOV: This value allows adjust the minimum allowable field of view size.

Max FOV: This value allows adjust the maximum allowable field of view size.

Min NA: This value allows you to provide the minimum allowable numerical aperture.

Max NA: This value allows you to provide the maximum allowable numerical aperture.



The NA is commonly printed on microscope objective lenses and used by the software to estimate appropriate focus ranges. The undefined value is -1.

CCD Width: Provides the width of the video frame of your optical device.

CCD Height: Provides the height of the video frame of your optical device.

CCD Center X: Provides the optical center along X for the video frame.

CCD Center Y: Provides the optical center along Y for the video frame.



CDD Width, Height, and Center XY are used and updated when calibrating the optical center of your Vision probe. See "[Calibrate Optical Center](#)"

CCD Gutter (TBLR): These values provide the number of top (T) and bottom (B) rows and left (L) and right (R) columns (in pixels) around the edge of the camera image that should be avoided during calibration and measurement. Some cameras show "dead pixels" in this area.

Calibration Date: Displays the date that your Vision tip was calibrated.

Calibration Time: Displays the time that your Vision tip was calibrated.

Focus Area

Up Delay: Approximate time delay in seconds for focus motion to start and stabilize when focus motion is positive or up.

Latency: Average time in seconds between when the stage position and the video frame data are recorded.

Down Delay: Approximate time delay in seconds for focus motion to start and stabilize when focus motion is negative or down.

Frames/Second: Measured frames per second during focus.

Depth: Table of the field of view X dimension size and the corresponding depth of field factor.

Nickname: User defined name given to the tip.

Step 5: Perform Calibrations

Before you begin measuring with your Vision probe, in most cases it is necessary to perform the various calibration procedures on your machine. This includes:

- [Optical Center](#)
- [Optics](#)
- [Illumination](#)
- [Probe Offset](#)

See the "[Calibrating Vision Probes](#)" topic for information on calibrating your Vision probe. Also see "Calibrating the Vision Stage" for information on Vision stage calibrations.

Step 6: Modify Machine Options

Now that you have created your Vision probe file and edited the tip data for that probe you are ready to modify the machine options. The machine options control the various aspects of working with a Vision Machine.

To edit Vision machine options:

1. Select the **Edit | Preferences | Machine Interface Setup** menu option to open the **Machine Interface Setup** dialog box.
2. Adjust the values as described in the "[Setting Machine Options](#)" chapter.

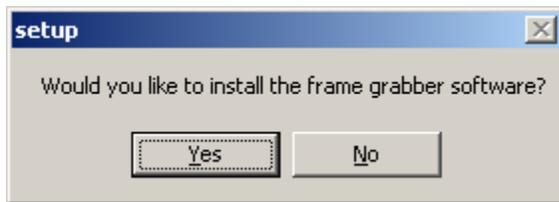
Frame Grabber

A **Frame Grabber** is a PC board that converts an analog video signal to a digital signal. This creates individual pictures or frames that can then be retrieved and analyzed by software. PC-DMIS Vision supports multiple Frame Grabbers as the video data input. The live image from your analog camera is provided via the Frame Grabber to the Live View in PC-DMIS. Newer digital cameras act as a combined camera and frame grabber since they already provide the video image data in digital form.

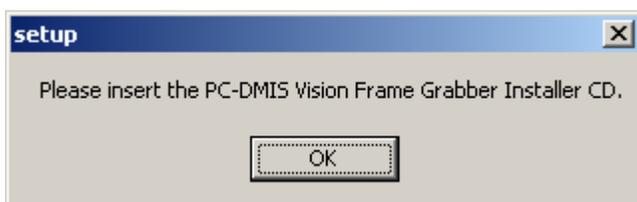


Digital cameras also require that specific software for your camera is installed to interface with PC-DMIS Vision.

When your portlock is programmed with the **Vision** option and no frame grabber software has been installed, you will be prompted to install Frame Grabber software.



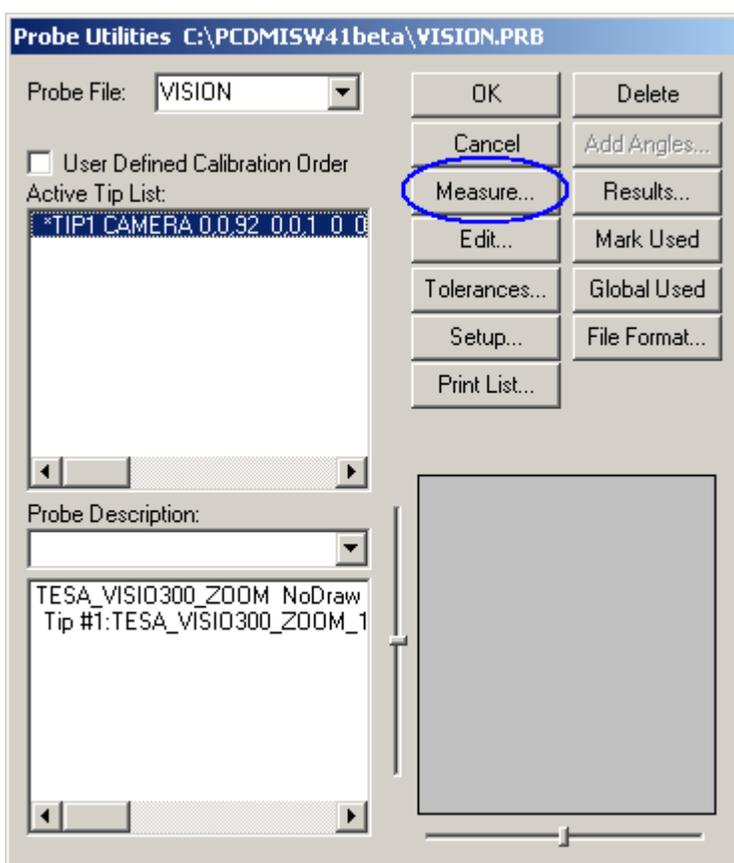
Click **Yes** to continue or **No** to skip Frame Grabber installation. You will be prompted to insert the installer CD.



Click **OK**, once you have inserted the installer CD or you would like to browse for the Installer executable (SetupFramegrabber.exe). After locating SetupFramegrabber.exe, run the program, select your framegrabber from the list, and follow the instructions to install the Frame Grabber software.

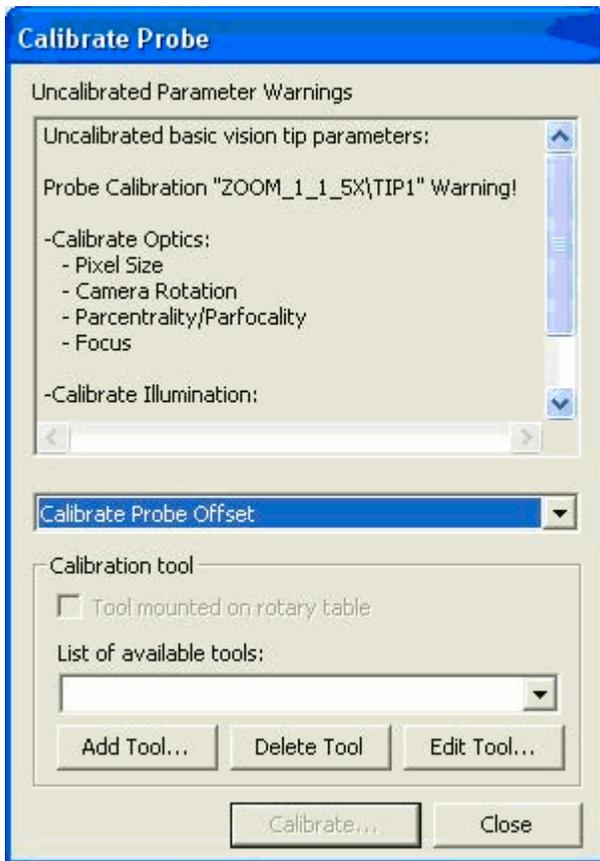
Calibrating Vision Probes

Calibration for your Vision probe is accomplished from the **Probe Utilities** dialog box. In most cases, each of the calibrations should be completed before you can begin measuring with your Vision probe. To access this dialog box, select a probe that has already been added from the **Edit Window** and click **F9** or select the **Insert | Hardware Definition | Probe** menu item.



Probe Utilities dialog box - Vision Probe specified

Define the Vision probe with the needed components, select the tip from the **Active Tip List**, and then click **Measure** to access the **Calibrate Probe** dialog box



Calibrate Probe dialog box

The **Calibrate Probe** dialog box allows you select and perform the following calibrations, which should be calibrated in the order listed below:

- [Calibrate Optical Center](#)
- [Calibrate Optics](#)
- [Calibrate Illumination](#)
- [Calibrate Probe Offset](#)

Note: For some calibrations (Probe Offset and Illumination) the pixel size must be calibrated first. If not, the **Calibrate...** button will be disabled and a warning message will appear in the dialog box. See "Pixel Size" under the "[Calibrate Optics](#)" topic.

Calibrate Optical Center

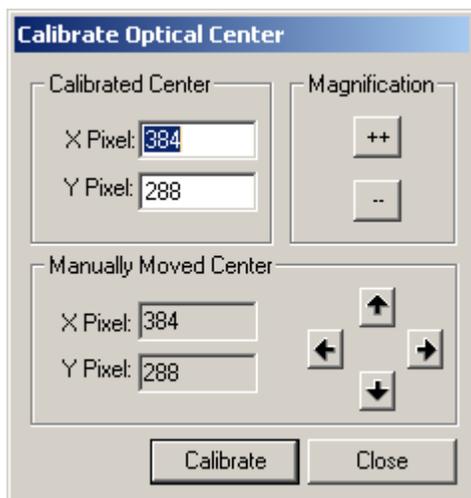
This procedure calibrates the optical center position of a zoom cell. The optical center is the point in the camera field of view where a feature does not move laterally as the cell zooms. This location information keeps the image view stable as the magnification is changed and minimizes measurement error between features at different magnifications. The optics hardware should be assembled so as to keep this location near the center of the field of view to allow maximum field of view utilization. The optical center calibration is to fine tune the position location is software. Note that it is desirable to measure related features at the same magnification. A zoom cell that changes magnification without a lateral shift in the image is said to be parcentric. A zoom cell that changes magnification without a change in focus is said to be parfocal.

No physical change takes place in the video camera or stage in any way. Any changes you make will appear only in the **Live View** of the Graphics Display window.

Note: Open the **Probe Toolbox** dialog box, select the **Gage** tab, and select the cross-hair gage before you begin to calibrate the Optical Center. This will display the cross-hair gage in the **Live View**.

To calibrate the optical center:

1. Select **Calibrate Optical Center** from the drop-down list on the **Calibrate Probe** dialog box.
2. Click **Calibrate**. The **Calibrate Optical Center** dialog box is opened.



Calibrate Optical Center dialog box

3. Specify the **Calibrated Center**. PC-DMIS Vision supports any size of Video Frame, though the most common are **640 X 480** and **768 X 576** pixels. Edit the values in the **X** and **Y Pixel** boxes to adjust the position of the optical center of the video frame.

Caution: Your service technician has set the initial displayed values. If you make any physical changes to the optics or camera relative to the optics, the optical center values will need to be re-evaluated.

4. Click the **++** button to go to the highest magnification level. With the lens completely zoomed in, you may need to adjust the lighting to see clearly.
5. Identify a small dust particle, and manually move the stage so the center of the cross hair coincides with the dust particle.
6. Click the **--** button to go to the lowest magnification level. With the lens completely zoomed out, you may need to adjust the lighting to see clearly.
7. If the center of the **Cross Hair** does not coincide with the "dust", click the arrows in the **Manually Moved Center** area to align the **Cross Hair** with the "dust". After the "dust" is aligned, repeat steps 4 through 7.
8. When the result is acceptable (when there is no perceivable shift or the shift is less than one pixel when going from high magnification to low magnification), Click **Calibrate** to update the **Calibrated Center** values with the manually adjusted values.
9. Click **Close** when *par-centricity* has been established.

Calibrate Optics

This option calibrates the optics on the system. Four separate calibrations are supported (depending on hardware and calibration artifact available):

- **Pixel Size:** This calibrates the size of the field of view throughout the zoom cell's magnification (mag) range or with a given optic's configuration. Follow the manufacturer's guidelines on optical calibration

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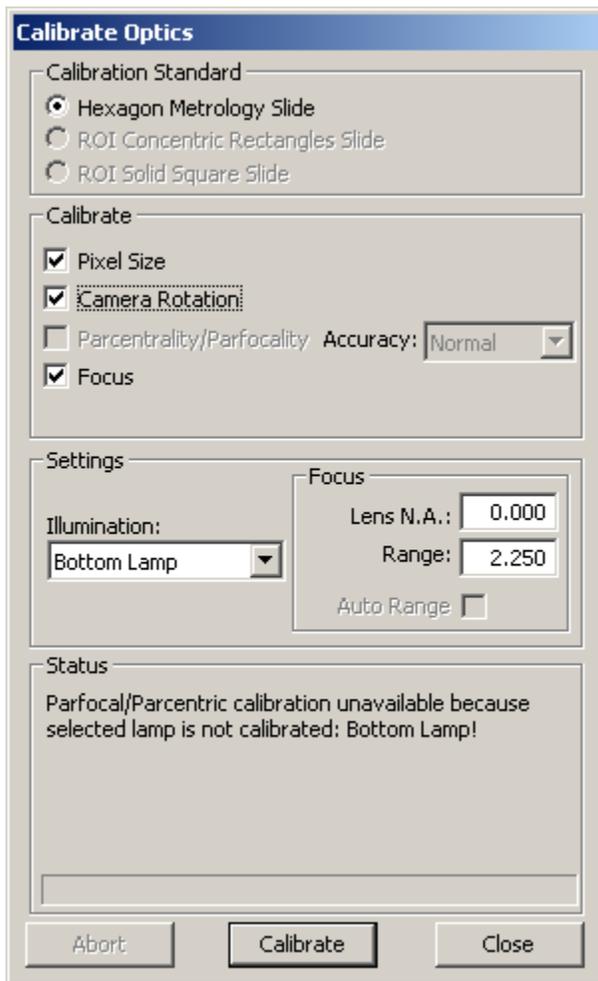
intervals. You will need to recalibrate the optical magnification any time the zoom cell or microscope is altered (such as when it is sent in for repair).

- **Camera Rotation:** This calibrates the rotation of the camera to the stage, and removes any rotation. This is particularly evident on CMM-V systems.
- **Parcentrality/Parfocality:** This calibration ensures that the center of the lens and the center of the field-of-view are aligned. This option is only available if the following are true:
 - You are using a zoom lens.
 - The selected lamp has previously been calibrated. See "[Calibrate Illumination](#)".
 - Pixel Size calibration must also be selected.
- **Focus:** Focus Depth and Latency are calibrated through a series of focus adjustments at various magnification levels.

Note: If your zoom cell automatically calibrates, then you won't need to perform a specific magnification calibration. Instead, you will receive a message that the calibration is done as needed.

To calibrate the optics:

1. Select **Calibrate Optics** from the drop-down list on the **Calibrate Probe** dialog box.
2. Click **Calibrate**. The **Calibrate Optics** dialog box appears.



Calibrate Optics dialog box

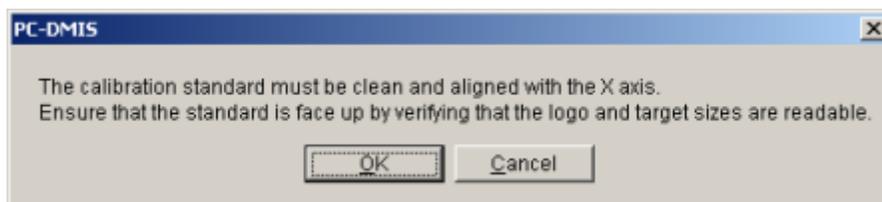
Important: Do not move the calibration standard throughout the calibration process.

3. Select the option button in the **Calibration Standard** area that corresponds to the type of calibration standard you received with your system. Supported standards include:
 - **Hexagon Metrology Slide**
 - **ROI Concentric Rectangle Slide** (ROI machine only)
 - **ROI Solid Square Slide** (ROI machine only)

4. Select the needed options from the **Calibrate** area:
 - **Pixel Size:** Calibrates the pixel size at different magnification to determine the size of a measured feature.
 - **Camera Rotation:** This option allows PC-DMIS Vision to determine if there is any rotation in the camera relative to the stage and makes the needed adjustments.
 - **Parcentrality/Parfocality:** When this option is selected, the parcentrality/parfocality will be calibrated the Pixel Size calibration. This process replaces the need for doing a Optical Center calibration. This option is only available when using the Hexagon Metrology Slide and when your machine is using a zoom lens. Use the "[Calibrate Optical Center](#)" option for machines using a fixed (non-zoom) lens.
 - **Accuracy:** There are two methods for calibrating Parfocality/Parcentrality. **Normal** will do the calibration on the same rectangles that were used for the FOV (pixel size) calibration and is quicker to do. **High** will do the calibration on the concentric circles on the calibration standard. This will give better quality results, but will take longer to perform.
 - **Focus:** This option will perform focus calibration for depth and latency.

5. Select the Calibration Settings:
 - **Illumination:** Select the **Illumination** source. Calibration is usually best done using bottom/sub stage lighting as the edge contrast is sharper. Select **<Current>** to use current illumination settings and not change the illumination during calibration. CMM-V can now use its ring light, and will default to that light source.
 - **Focus - Lens N.A:** Specify the numeric aperture (N.A.) of the current lens if known, otherwise leave this box blank. This value allows the calibration program to optimize the focus used during the calibration.
 - **Focus - Range:** Specify the focus range if no numeric aperture is given. This provides the range over which the focus will be done.
 - **Auto Range:** Select this check box to auto calculate best range to use for focus. This option may not be available on all systems!

6. Click the **Calibrate** button. A message box appears stating that your calibration standard must be clean and aligned with the X axis. You must also ensure that the standard is face up.

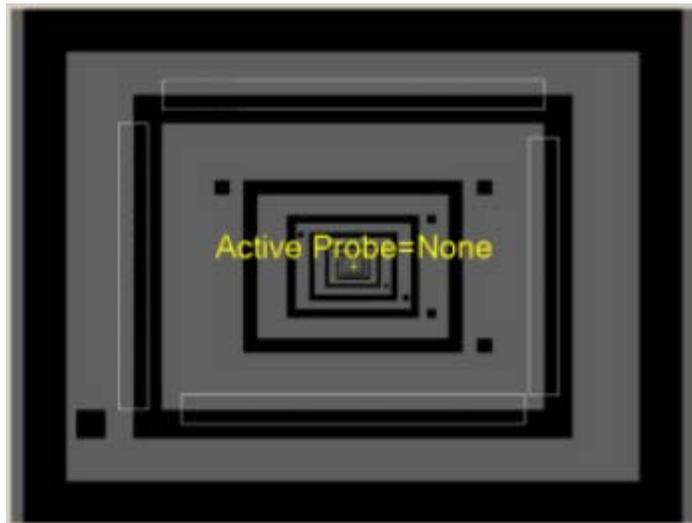


Caution: Although the calibration processing employs noise and dirt rejection techniques, a dirty calibration standard may trigger calibration failures or yield less accurate measurement values. Be sure to clean any dust, dirt, fingerprints, or other material from the calibration standard's glass portion. A mild non-depositing cleaning solution, such as rubbing alcohol, and a soft, lint-free cloth are commonly used. Be sure to also clean the stage glass where you will place the calibration standard. For proper cleaning techniques, refer to your hardware documentation. If the stage carrying the glass standard will move during the calibration sequence, you should gently hold the standard to the stage with clay or putty.

7. Place the calibration artifact on the stage so the length of the standard runs along the X axis of the machine. For the ROI slides, ensure that the larger targets are on the left (-X direction) and the smaller targets on the right (+X direction). Verify the alignment with the X axis by watching the horizontal line on the standard while traversing the stage X axis. The line should remain in the field of view and ideally very near center.
8. Click the **OK** button. Additional messages appear requesting that you center the target.
9. Place a target so that it completely fits within the camera's view. This target should be roughly centered within the field of view and focused. The focus does not need to be optimal, just a good starting place for the software focus process.
10. Click the **OK** button and if you have a DCC machine, it will automatically focus on the target. If you have a manual machine it will ask you to focus on the target.
11. Use the manual controls to move the optical measuring system until you roughly center the rectangle or square calibration standard in the field of view. PC-DMIS determines the target size based on your optics.

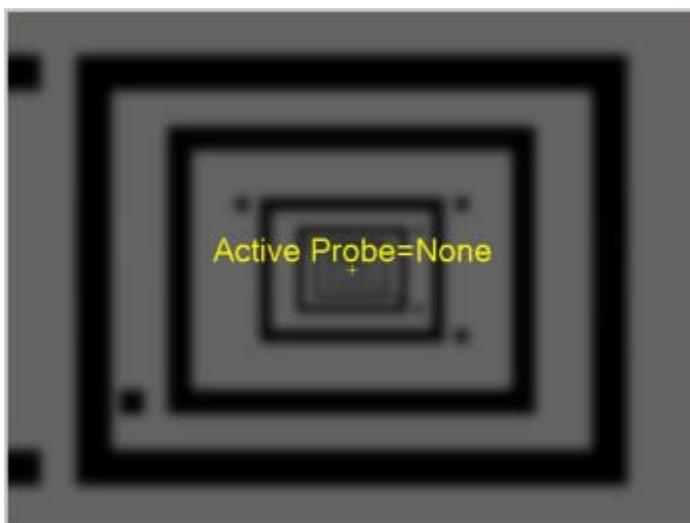
Important: Do not change the Z position or the focus during the rest of the calibration procedure.

12. Click the **OK** button after you have centered the target. The calibration routine will automatically proceed as follows based on the calibration options selected:
 - *If the machine supports DCC illumination control*, and an illumination lamp has been selected in the Illumination field, PC-DMIS Vision performs a lighting grayscale adjustment where it measures the target (or series of targets) across the range of magnifications.
 - *If the system has Manual Illumination control*, you will be prompted to increase or decrease the illumination level as required.
 - *If **Pixel Size** has been selected*, the system moves to the next target as needed, or on a manual-only stage, PC-DMIS Vision prompts you to move to the next target. When it prompts you for manual movement of the stage, you should make the X and Y values displayed in the message box as close to zero as possible. This process continues, until sufficient target measurements have been taken.



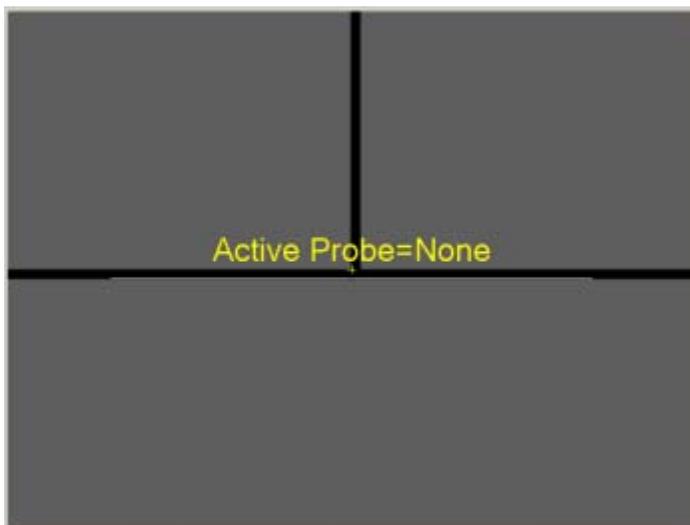
Pixel Size Calibration

- *If the **Normal Accuracy Parcentrality/Parfocality** option has been selected*, PC-DMIS Vision will perform Parcentrality/Parfocality calibration on the same rectangles used for the Pixel size calibration.
- *If **Focus** has been selected*, the system moves in and out of focus at various levels of magnification. Focus calibrations are done to determine Focus Depth and Focus Latency.



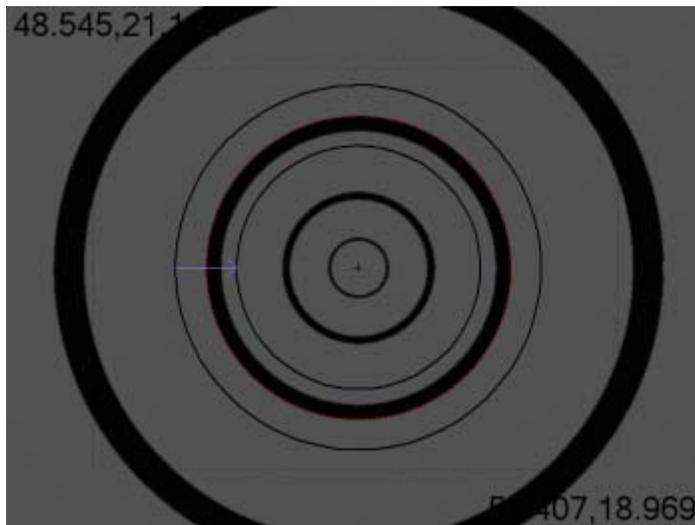
Focus Calibration

- If the **Camera Rotation** option has been selected, PC-DMIS Vision will measure the line at the bottom of the slide at different positions a number of times so we can identify the camera to stage rotation. If the rotation angle calculated is greater than 5 degrees, a warning will be displayed indicating that the hardware should be physically adjusted to make the angle smaller. It will allow you to still apply the calibration to compensate, but it's recommended to get the physical wrist/camera adjusted to the stage. This option is only available when using the Hexagon Metrology Slide.



Camera Rotation Calibration

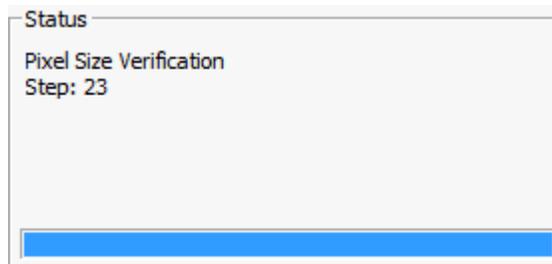
- If the **High Accuracy Parcentrality/Parfocality** option has been selected, PC-DMIS Vision will ask you to "Align the Hexagon Standard Concentric Circle in Target". Align the circle as depicted in the image below and click **OK**.



Target centered on Concentric Circles of Hexagon Standard

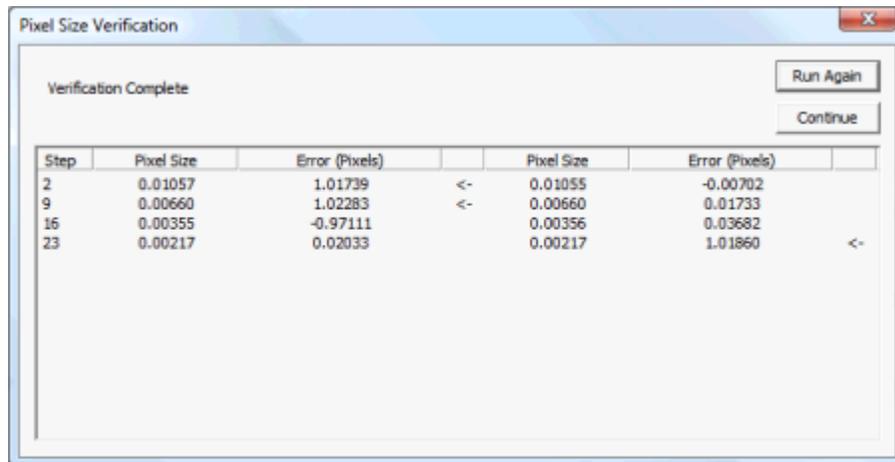
The Calibration Process will continue by focusing and taking a series of measurements at different magnification levels. This will establish that the optical center and focal depth coincide through the focal range (i.e that if you focus and then measure a circle at one magnification, it will give the same XYZ position at another magnification).

13. Near the end of calibration, PC-DMIS will generate and run a series of dynamic part programs in the background in order to perform a basic verification that measures a subset of the calibration data. As each target is measured in these part programs, the **Status** area on the **Calibrate Optics** dialog box will update its message to show the step number.



Status Message Showing Pixel Size and Error

14. When the pixel verification finishes, PC-DMIS may display a **Verification Complete** dialog box. This dialog box appears only if a verification data point is out of tolerance. The dialog box contains columns showing the different steps that were measured, the pixel size and errors. A <- symbol to the right of the error value indicates the error is larger than the specified tolerance.



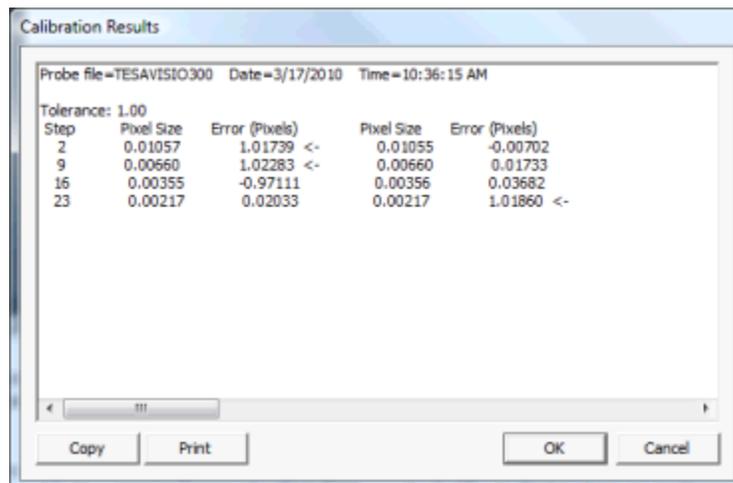
Verification Complete dialog box

If this dialog box appears, you can choose to run the verification again, by clicking **Run Again**. This will help determine if any errors were simply anomalies in the verification. If the verification fails multiple times, try re-running the entire pixel size calibration. If both the calibration and the verification fail repeatedly, contact your machine service representative.

You can click the **Continue** to accept the results of the verification.

Note: The **ProbeCal** section of the PC-DMIS Settings Editor contains registry entries that affect the pixel size calibration.

- Click the **Close** button to close the **Calibrate Optics** dialog box. The results of the calibration are also written to the **Calibration Results** dialog box so you can view the results of the calibration later if needed by clicking the **Results** button on the **Probe Utilities** dialog box:



Calibration Results dialog box

You have now calibrated the Field of View. Repeat this process for each lens you wish to use on the machine.

CMM-V Note: On a CMM-V camera, you just need to calibrate the FOV for the A0B0 wrist angle. You may wish to place some reflective white paper on the CMM table under the "Calibration Artifact Holder" (Part Num. CALB-0001). The "Calibration Artifact Holder" includes a glass slide (CALB-0002) and a ring gage (CALB-0003) used for calibration of the CMM-V camera.

Calibrate Illumination

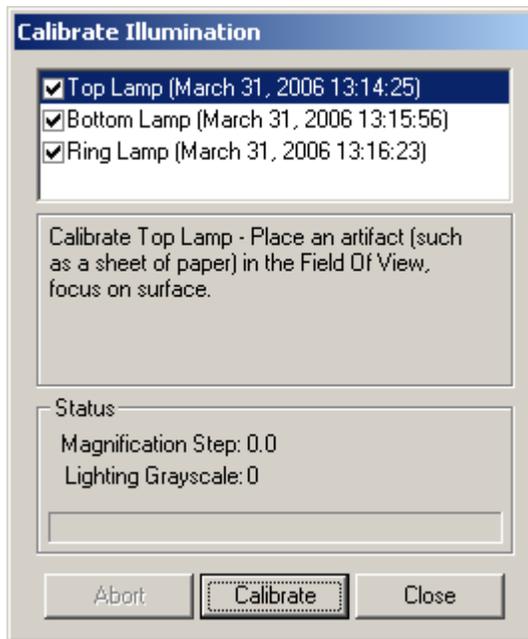
This calibration procedure allows you to calibrate the lamps for your machine. Lamp calibration ensures that the illumination range is linear, and that changing magnification on zoom cells will not significantly change the illumination on the part within the capability of the hardware.

You should calibrate your optical system's lighting at these times:

- Whenever you change or replace a lamp you should recalibrate that lamp.
- Whenever you have a significant change to the lighting within the room.
- Periodically throughout the life of the lamp.
- When you change a brightness or gain setting on the camera.
- When the optics are replaced.
- When the zoom cell is repaired.
- When the camera is replaced.
- Prior to calibrating Parcentrality/Parfocality when you "[Calibrate Optics](#)" since this is required for this calibration.

To calibrate lamps:

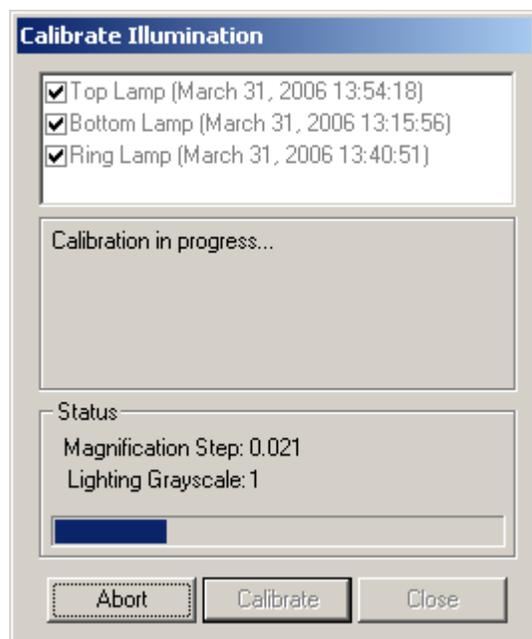
1. Select **Calibrate Illumination** from the drop-down list on the **Calibrate Probe** dialog box.
2. Click **Calibrate**. The **Calibrate Illumination** dialog box appears with the calibration date for each lamp is shown in parenthesis.



Calibrate Illumination dialog box

3. Select the check box next to the lamp that needs to be calibrated.
4. Prepare for calibration as directed according to the lamp type:
 - **Sub-stage** (bottom/profile) lamps require the stage to be cleared during calibration, with the image focused on the stage.

- **Top** (surface/ring) lamps require an artifact or piece of paper to be in the Field of View, with the image focused on the surface.
6. Click **Calibrate**. The calibration process begins. The process takes several minutes.
- During calibration on systems with a zoom cell, PC-DMIS Vision selects different magnifications for illumination measurement as indicated by the **Magnification Step** value. This value displays the current magnification and corresponds to the value displayed in the **Magnification** tab of the **Probe Toolbox**.
 - The calibration also sets the illumination intensity corresponding to the different commanded illumination values at different magnifications. The **Lighting Grayscale** indicates the intensity of this illumination. The values range from 0 (black) to 100 (white).



Calibration Illumination - In Progress

- Once the calibration is complete the **Calibrate Illumination** dialog box displays the new date for the calibrated lamp.
7. Click the **Close** button or complete steps 3 through 5 to calibrate another lamp.
8. The **Abort** button is only available during a calibration. This button stops the calibration, aborts any data collected during the process, and reinstates any pre-existing calibration files for the current lamp.

Calibrate Probe Offset

This calibration procedure allows you to determine the probe offset for your Vision probe. PC-DMIS Vision also allows you to calibrate multi-sensor configurations with different probe tip types. For example, a Vision probe and Contact probe are measured against the same tool(s) to establish a common offset frame of reference. The calibrated offset values for each tip are cross-referenced in relation to a common tool, such as a ring gage or sphere. See the "[Relationship of Tips and Tools](#)" topic for more information.

Calibrating tip types (be they all contact or a mix of contact, vision, and laser) against a common tool or standard allows measurements taken with one tip to be used with measurements taken by a different tip.

Probe Offset Calibration is used when:

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- You have a touch probe and video probe on your measuring system.
- You have multiple video probes with different magnifications (e.g. a 1X and a 2X lens).

It does not matter which probe type you calibrate first, though on a CMM, you would usually calibrate the Touch Probe first. During calibration of the second probe you must answer **No** to the question, 'Has the qualification tool been moved or has the Machine Zero point changed?'.

Once the tool position on stage is known and the probe tip offset has been calibrated once from the **Probe Utilities** dialog box, an AutoCalibrate Active Probe step can be added in the part program to calibrate the probe offset as part of a part program. As with a contact probe, the AutoCalibrate execution for a Vision probe will be based on the specified parameter set.

See the "[A Note on Probe Definitions](#)" and "[Considerations for Vision probes](#)" topics for more information on Vision probes.

Note: Probe tip offset calibration has been expanded to support calibrating the contact probe and vision probe offset using a sphere or ring tool. The usage follows the general rules for tip offset and diameter calibration.

Before you begin Vision probe calibration, be sure to calibrate the [optical center](#) (if a zoom cell), [field of view](#), and [illumination](#) for your Vision probe. In this example we will use a ring tool for measurement.

To calibrate the Vision probe offset:

1. Identify a Z measurement point of the face of the ring. The position of this point is defined in machine coordinates and is relative to the top center of the ring gage bore. This can be done using the "[Probe Toolbox: Gage tab](#)". These values are used when adding a ring tool.
2. Select **Calibrate Probe Offset** from the drop-down list on the **Calibrate Vision Probe** dialog box.
3. Select the needed tool from the **List of Available Tools** or click **Add** to define a new tool.

For Example: A 20mm ring tool might be specified with the following values:

- **Tool ID:** 20mm Ring
- **Tool Type:** RING
- **Diameter:** 20
- **Z Point Offset X:** 15
- **Z Point Offset Y:** 0
- **Z Point Offset Z:** 0
- **Datum Depth Start:** 1 (to accommodate the chamfer on the ring bore)
- **Datum Depth End:** 14
- **Focus Offset:** -0.5 (provides distance in Z from the top surface to the bore circle focus height)

See "[Appendix B: Adding a Ring Tool](#)".

4. Click **Calibrate**. This opens the **Calibrate Probe Offset** dialog box.

5. Set the following parameters as needed.

Operation Mode: Select either the **Default Mode** to use the default values of **User Defined** to alter the values.

Motion: **Man+DCC** mode requires that 3 manual points be taken at the start of the sequence whether or not you indicate that the tool position has changed. The remaining points will be taken automatically. **DCC** mode takes all points automatically unless you indicate that the tool has moved.

Start Angle: Angle in degrees in a Cartesian coordinate system as seen when looking down or $-Z$. A start angle of zero would be aligned to the $+X$. A start angle of 90 would be aligned to the $+Y$ axis. Default value is 0

End Angle: Angle in degrees in a Cartesian coordinate system as seen when looking down or $-Z$. An end angle of zero would be aligned to the $+X$. An end angle of 90 would be aligned to the $+Y$ axis. Default value is 359.

Note: The Start and End Angle specified here are different than the angle used for the contact probe and a sphere tool, which relates to the angle from the sphere equator to the pole.

Magnification: This option allows you to set the magnification to the 'Maximum' setting or use the **<Current>** magnification. To ensure the highest accuracy, you should use the 'Maximum' magnification to calibrate the vision probe offset. 'Maximum' is the default setting.

Coverage: Select the percentage from the drop-down list that will define what portion of the zone will be included for measurement. Default is 10%.

Note: The start angle, end angle, and Coverage percentage together will define the location and size of the vision measurement targets around the circle. For larger circle sizes and higher optical

magnifications, significant speed improvement can be achieved by reducing the Coverage percentage. See the " [Sample Vision Circle Targets for Calibrate Probe Offset Parameters](#)" topic.

Z Samples: The number of Z samples that will be taken to compute the Z position. Default is 5.

Illumination XY: indicates which illumination source to use for the XY measurements. Normally bottom or substage illumination is used for ring gage bore edge. This value can also be set to **<Current>** to use the current illumination settings.

Illumination Z: indicates which illumination source to use for the Z measurements. Normally top or ring for ring gage surface. This value can also be set to **<Current>** to use the current illumination settings.

Note: Using **<Current>** for either of the illumination settings includes whether bulbs are on or off for Ring lamps.

Tip: If you find illumination settings that work well for calibration, create an illumination Quick Set, so that these settings can be quickly recalled.

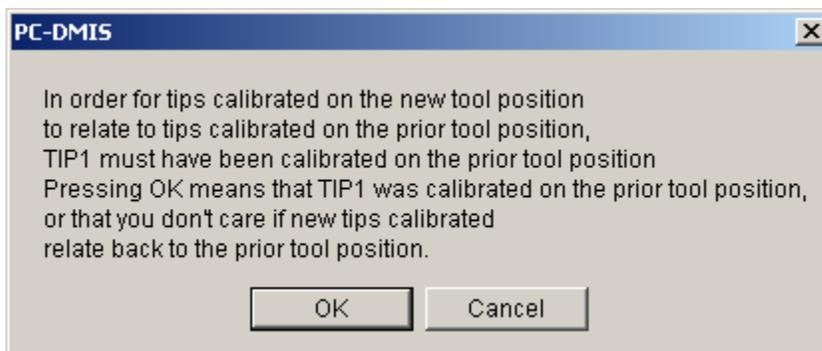
Parameter Sets: Allows you to create, save, and use saved sets for your Vision probe. This information is saved as part of the probe file and includes the settings for your Vision probe. This parameter set can be retrieved for later calibrations, including the auto-calibration part program feature.

To create your own named parameter sets:

- Modify any parameters on the **Calibrate Probe Offset** dialog box.
 - From the **Parameter Sets** area, type a name for the new parameter set in the **Name** box and click **Save**. PC-DMIS displays a message telling you that your new parameter set has been created. You can easily delete a saved parameter set by selecting it and clicking **Delete**.
6. Click **Calibrate**.
 7. Select **Yes** if PC-DMIS has not measured the actual tool location on the stage. Select **No** if the tool has already been measured with a different probe type.



8. Click **OK** on reminder that tip must be calibrated.



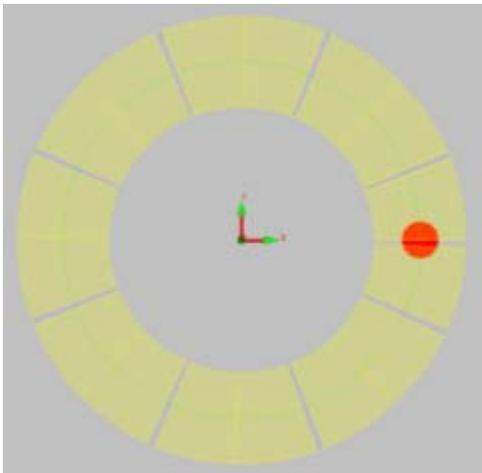
9. If the tool has moved or **Man+DCC** motion is selected, take the 3 manual cross hair points evenly around the top of the datum bore circle, adjusting the stage position, including focus, as needed. The remainder of the calibration sequence will execute automatically. It will focus on the bore top edge, measure the bore circle, move to the Z focus offset relative to the bore, and do the Z position focus measurements. The probe tip offset data will be updated with the measured offset based on the ring tool measurement. This measurement will determine the XYZ location of the tool on the stage if the tool was said to have moved.

Sample Vision Circle Targets for Calibrate Probe Offset Parameters

The filled or cross hatched areas in the following examples in the circle target indicates where no edge measurements will be taken.

Example 1

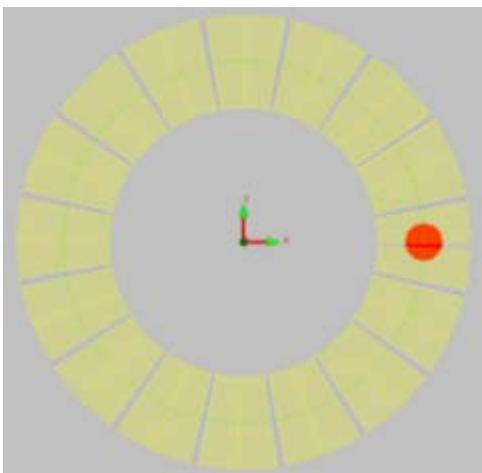
This example is more suitable for larger ring diameters and higher magnification optics where execution speed is to be kept low.



Target pattern start angle of 0, end angle of 358, and 5% coverage

Example 2

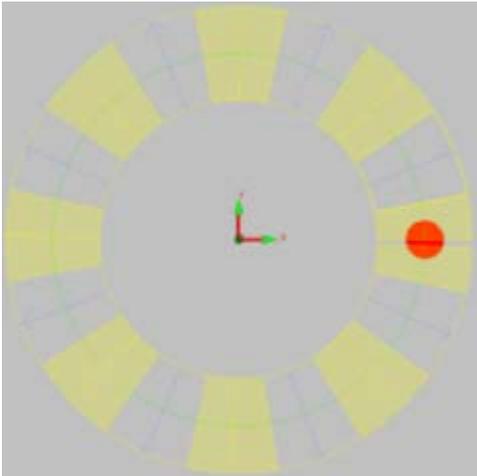
This example is more suitable for larger ring diameters and higher magnification optics where longer execution speed is acceptable for a more repeatable measurement.



Target pattern start angle of 0, end angle of 358, and 10% coverage

Example 3

This example is more suitable for smaller ring diameters and medium to lower magnification optics.



Target pattern start angle of 0, end angle of 358, and 50% coverage

Contact Probe Offset

Calibrating the Contact probe offset using the same tool that was used to calibrate your Vision probe establishes a common offset frame of reference.

To calibrate the Contact probe offset:

1. Select the **Insert | Hardware Definition | Probe** menu item.
2. Define the contact probe and tip in the **Probe Utilities** dialog box.
3. Select **Measure**. to open the **Measure Probe** dialog box.
4. Specify the following values in the **Measure Probe** dialog box:
 - **Motion:** Man+DCC
 - **Type of Operation:** Calibrate Tips
 - **Calibration Mode:** User Defined
 - **Start Angle:** 0
 - **End Angle:** 359
 - **List of Available Tools:** 20mm Ring (Select the same tool as was used for determining the Vision probe offset)
5. Select **Measure**. When asked if the tool has moved, click **No** this time. This tells PC-DMIS that it does know the actual tool location on the stage.
6. Click **OK** on the tip reminder message box.
7. A message box will prompt you to take 1 hit on the tool face below or in the -Y direction from the bore center. Select **OK** and then take the contact point. The calibration routine will then do a course bore measurement, a face plane measurement, a more precise bore measurement, and then Z offset point measurements.

Now both probes have measured the tool and have offset values based on the same tool position data.

CMM-V Probe Offset

To calibrate a CMM-V probe offset, do the following:

1. Create a touch probe with all the angles at which measurements will be taken with your CMM-V vision probe.

Note: Your touch probe must be a star probe with at least 3 tips.

2. Calibrate all specified touch probe angles on a sphere.
3. Measure the A0B0 touch probe angle on a ring gage.
4. Measure the A0B0 video probe on the same ring gage, answering “No” when asked if the tool has moved.
5. Click **Add Angles** when you have the CMM-V probe selected. Rather than showing the standard Add Angles dialog, it will prompt you with a list of touch probes.
6. Select the touch probe you have calibrated on the sphere, and press **OK**. PC-DMIS Vision will automatically add those angles and calibrations to your CMM-V video probe.

Relationship of Tips and Tools

The probe tip offset calibration is based on the position of the tool on the stage. When a tip is calibrated and the tool is said to have moved, the tool position on the stage is determined based on the tip offset. If the tip has not yet been calibrated, then the nominal tip offset from the probe.dat data is used.

It may be important to maintain a common frame of reference for the tip offset calibrations. When multiple tips are calibrated using a common tool, the tips have the same offset frame of reference. This frame of reference can be extended to a second tool by saying the second tool moved and doing a tip offset calibration with a tip calibrated on the first tool. Feature locations measured with tips in the same frame of reference should yield the same answer (within the equipment measurement capability). If you calibrate a tip on a tool that is not in the same frame of reference and do not say the tool moved, the tip calibration frame of reference is changed to the tool. Features measured with tips calibrated in different frames of reference may yield the dramatically different answers.

Consider a new system where no probes or tools have been calibrated where a sphere and a ring tool are used for tip calibration. Calibrate the contact probe using the sphere tool and say the tool moved. Then calibrate the same contact probe on the ring gage and say the tool moved. The two calibrations for the contact probe tip establish the reference between the tools and the contact probe tip. Now, calibrate the vision probe tip on the ring gage. The contact probe tip and vision probe tip will now have the same offset calibration frame of reference. The offset calibrations of the two probes with the two tools are linked because the probe that had its offset calibrated on the sphere tool was calibrated on the ring tool when the ring tool was said to have moved. Because the ring tool was said to have moved (or its position is unknown), when the contact probe tip was calibrated using the ring tool, the position of the ring tool on the stage was determined based on the contact probe tip's measured offset. The contact probe tip's offset was used to determine the stage position of both tools and then the vision probe offset was based on the stage position of one of these tools.

The two probe tips would not be cross referenced if the contact probe tip had been calibrated on the sphere tool and then the vision probe tip had been calibrated on the ring. If the contact probe tip were calibrated on the sphere tool, the vision probe tip calibrated on the ring tool, and then the contact probe calibrated on the ring tool, the two probe tips would be in the same frame of reference, but this would be a different frame of reference than the sphere tool or any probe tips previously calibrated on the sphere tool. This is because the vision probe tip was used to determine the ring tool's position when it was said to have moved, but the vision probe tip had not been calibrated on the sphere tool. The contact tips frame of reference was changed to match the ring tool. To maintain the linkage of tips across tools, whenever a tool is said to have moved (which also means a tool whose position is unknown), the calibration tip used on the just moved tool must be in the frame of reference of the first tool.

You can only calibrate the bottom tip of a star tip contact probe on the ring gage. A sphere tool or a sphere tool in combination with a ring gage can be used to provide cross referencing between the probe star tips and the vision probe. Normally this cross referencing would be done by calibrating all contact probe star tips on

the sphere tool. Then calibrate the bottom tip on the ring tool saying that the tool had moved. Then calibrate the vision probe(s) on the ring tool. You can then calibrate contact tips on the sphere tool and vision probes on the ring tool.

A Note on Probe Definitions

When PC-DMIS calibrates the Vision probe in DCC mode, it uses existing measurement data or, if that is not available, the nominal values from the probe definition. PC-DMIS stores standard probe definitions in the probe.dat file, whereas machine specific probe definitions can be created in the usrprobe.dat file. Probe.dat files may be deleted or replaced during a PC-DMIS uninstall or version upgrade installation, but the usrprobe.dat file will not be deleted or replaced.

Since the positioning tolerances to have the tool in the field of view and in focus for high magnification systems can be very small, creating data in the usrprobe.dat provides a means for fine tuning the default probe attributes. Machine specific default tip offset values may be necessary to provide the more accurate nominal offset information.

Considerations for Vision Probes

Contact probe hardware tends to be an assembly of well defined mechanical components (probe mount point, probe body, probe module, probe tip) with predictable mount point and nominal tip offsets where position variances can be handled by the probing motion. However, Vision probes are normally less predictable, as they often have non-standard mounting hardware, variances in the working distances, hardware adjustment or calibration, etc. Because of this, it may be more difficult to find the desired target with probing motion. The vision probe does not scan the way contact probes do, so the variances are more noticeable.

Some machines may also have adjustable probe mounts that make the probe position unpredictable in the default probe.dat definitions. Because of such tight tolerances from higher magnifications or machine variances, you may need to do a manual+DCC execution the first time the probe offset is calibrated on a new probe tip, even if the tool position is known. This will provide high quality measured offset data for subsequent tip offset calibration sequences, as the measured tip offset will be used instead of the nominal.

Unlike most CMMs, most vision multi-sensor machines do not have a single standard end of arm probe mount. Instead they have a Z column that provides a proprietary mount for the optics and a standard mount for the touch probe. In order to define the nominal probe offset values with accurate relative offsets, an adaptor component will often be used in the probe.dat or usrprobe.dat definition. This adaptor defines the offset between the machine probe reference point (such as end of ARM) and the probe. For example, if you were to select the zoom cell lens face as your reference point, you would need an adaptor component that defined the offset distance from the zoom cell lens face to the touch probe mount point. Then to define a touch probe, you would select the adaptor, then the probe (such as a TP200), then the stylus. When done the nominal probe offset between the vision probe and the contact probe would approximate the hardware.

Setting Machine Options

Select the **Edit | Preferences | Machine Interface Setup** menu option. The **Machine Options** dialog box appears. The tabs displayed in this dialog box may vary depending on the type of optical machine you have, and whether you're running online or offline, but a typical optical machine would allow you to:

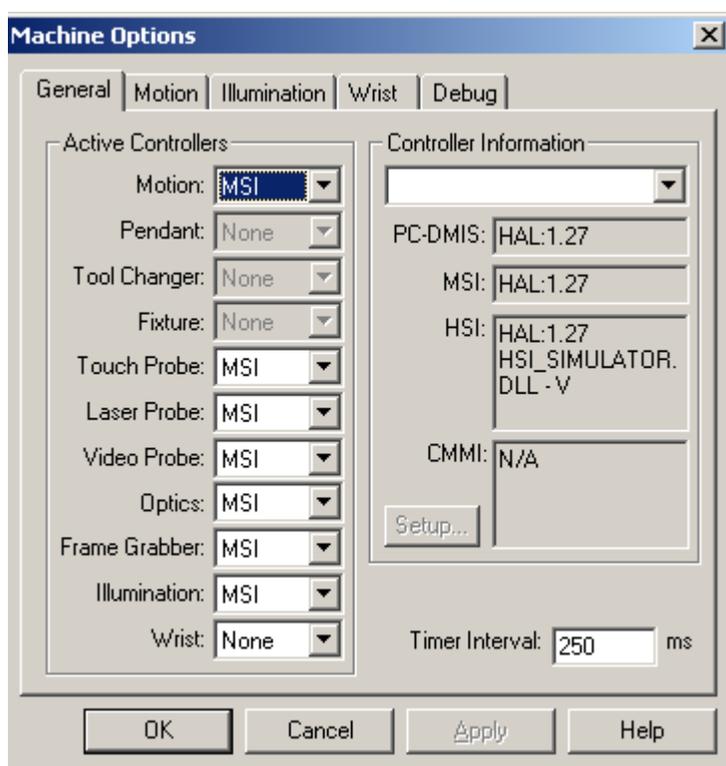
- Specify the active **Hardware Components** you will use with your optical measuring system. This potentially allows you to still use some components of your optical machine, if certain hardware components are broken. See "[Machine Options: General tab](#)".
- Change your **Machine's Speed and Travel Limits**. See "[Machine Options: Motion tab](#)".
- Specify the **Available Lamps** on your machine. See "[Machine Options: Illumination tab](#)". Available in both online and offline modes.

- Specify the settings for your **Wrist Device**. See "[Machine Options: Wrist Tab](#)".
- Define the **Speed Parameters** for your manual control box. See "[Machine Options: Pendant tab](#)".
- Specify the **Communications Port** and settings used to connect your computer to your optical measuring device. See "[Machine Options: Motion Controller Communication tab](#)" and "[Machine Options: Illumination Communication tab](#)".
- Store any communications between PC-DMIS Vision and your optical machine for **Debug** purposes. See "[Machine Options: Debug tab](#)".

CMM-V Note: If you are running PC-DMIS Vision with the CMM-V probe on a CMM, then not all the above pages will be available. To access the standard CMM controller setup, select the **Setup...** button on the **CMMI** section of the **General** tab.

Note: Many of the functions that used to be accessed from the **Machine Options** dialog box have been moved the **Probe Utilities** dialog box as part of the centralized calibration processes. Calibration is now probe specific.

Machine Options: General tab



Machine Options dialog box – General tab

The **General** tab allows you to enable or disable controllers for use with PC-DMIS. You must restart PC-DMIS if you change any of the options on this tab. These three main areas exist on this tab:

- [Active Controllers Settings](#)
- [Controller Settings](#)
- [Timer Interval](#)

Active Controllers Settings

The **Active Controllers** section defines which machine interface PC-DMIS should use to control each hardware component during PC-DMIS online operation. You can select three options: **MSI**, **CMMI** or **None**.

- **MSI:** (Multi Sensor Interface). Select this option for when you want to use the MSI to handle the controller section. For dedicated Vision machines (such as ROI, TESA and MYCRONA), ALL active controllers that are present on the machine will go through the MSI. On a CMM, just the Vision specific controllers (Illumination, Optics, Framegrabber) would normally be set to MSI. The other (Motion, Pendant, Toolchanger, Wrist, Touch Probe, Laser Probe) will use the standard CMM interface (CMMI)
- **CMMI:** Select this option for a Vision probe on a CMM (e.g. the CMM-V camera), where the original controller (e.g. LEITZ) is used to control the Motion, Touch Probe, Wrist, Laser Probe and ToolChanger elements of machine operation.
- **None:** Select this option if the hardware component does not exist or is broken. If the component is broken, selecting this option lets you continue to use functional parts of your optical machine.

Note: MSI and CMMI selections are NOT mutually exclusive. You are permitted to mix MSI with a CMMI controller during the selection.

Controller Information

The **Controller Information** area displays the controller discovered by PC-DMIS during online execution. This section shows four display boxes with this information:

- **Controller** drop-down list: Select your machine model for interfaces that support multiple machine models. For example, the Metronics interface would have “TESA VISIO 300 Manual”, “TESA VISIO 300 DCC” and “Custom” types. This option MUST be set in order to configure machine configuration settings correctly for the target machine. For interfaces that only support one type of machine, the option will have been automatically preselected for you.
- **PC-DMIS** connectivity: Displays the supported version of the Hardware Abstraction Layer (HAL) interface for this version of PC-DMIS supports. The HAL version should be the same for PC-DMIS, MSI and HSI. A warning will be given if differences are encountered.
- **MSI** (Multi-Sensor Interface) connectivity: Displays the supported version of the HAL interface for this MSI.
- **HSI** (Hardware Specific Interface): Displays the HSI used during execution. This component controls the specific hardware device.
- **CMMI** (Coordinate Measuring Machine Interface): Displays the name of the CMMI interface to be used. Click **Setup...** to open the Machine Interface Setup options for the CMMI controller (e.g. B&S LEITZ).

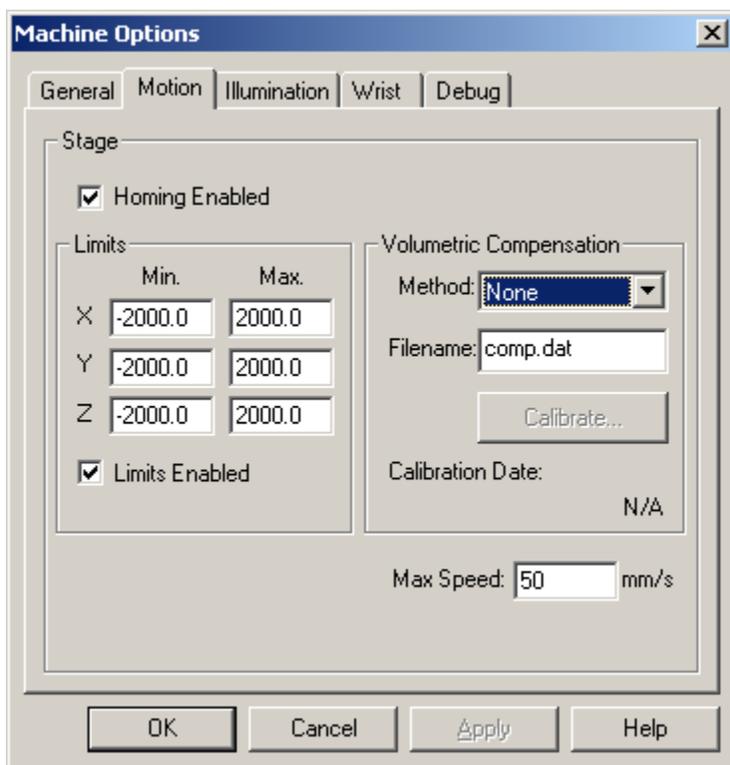
You should provide this information to your PC-DMIS technical support group when you report problems.

Timer Interval

The **Timer Interval** box indicates the maximum time that PC-DMIS Vision will wait before asking the hardware for current motion, illumination and optics settings.

Caution: Unless directed by a trained technician, do not alter this value.

Machine Options: Motion tab



Machine Options dialog box—Motion tab

The **Motion** tab allows you to define the movement parameters of your machine. Your service technician has already set your motion options during the installation of this system.

CMM-V Note: This tab is not available for CMM-V.

Homing Enabled Checkbox

You need to perform the homing operation if you want to use the stage with a fixture. Homing is also needed for systems using any segmented linear or non linear error correction. A specific stage position must be identified in order to correlate the stage position with the error correction data. This operation establishes the machine's zero location. With this check box selected, PC-DMIS will home the machine when it starts. Some hardware may retain its homed state until you switch it off. If the hardware does not need homing, or if it isn't configured for homing, selecting this check box will not have an effect.

Travel Limits and Volumetric Compensation areas

These areas specify the travel limits and volume compensation of your machine. The service technician has already determined the best travel limits and volume compensation values for your system. Only a trained service technician should run the stage calibration utility. The dialog displays the date/time when the last stage calibration was performed.

Limits Enabled checkbox: This allows you to turn off the checking of the limits. The only time you would normally turn this check off is on certain systems when you are performing a stage calibration and you need to work right to the limit of the stage travel. We do not recommend disabling this check at any other time as it can protect the hardware from being damaged by moving outside its limits.

Calibrate: This button begins the Stage calibration procedure. See the "Calibrating the Vision Stage" topic for more information.

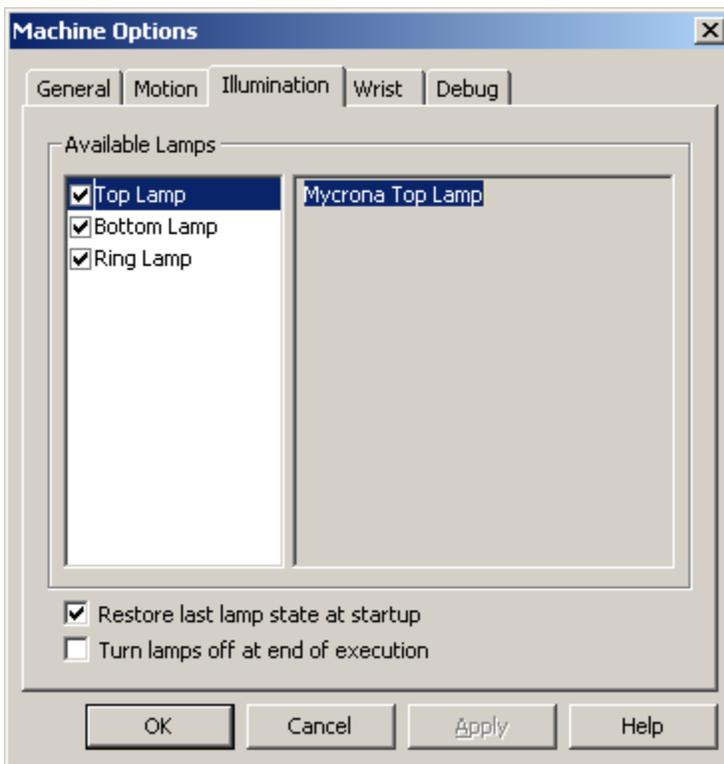
Caution: Unless directed by a trained technician, **do not** alter these values.

Max Speed box

The **Maximum Speed** edit box indicates the speed of DCC moves. If you find that you need to modify the move speed percentages, it is better to make any changes from the **Motion** tab of the **Parameter Settings** dialog box.

Caution: Unless directed by a trained technician, **do not** alter this value.

Machine Options: Illumination tab



Machine Options dialog box – Illumination tab

The **Illumination** tab allows you to select the lamps that are installed on your machine from those available from the machine vendor.

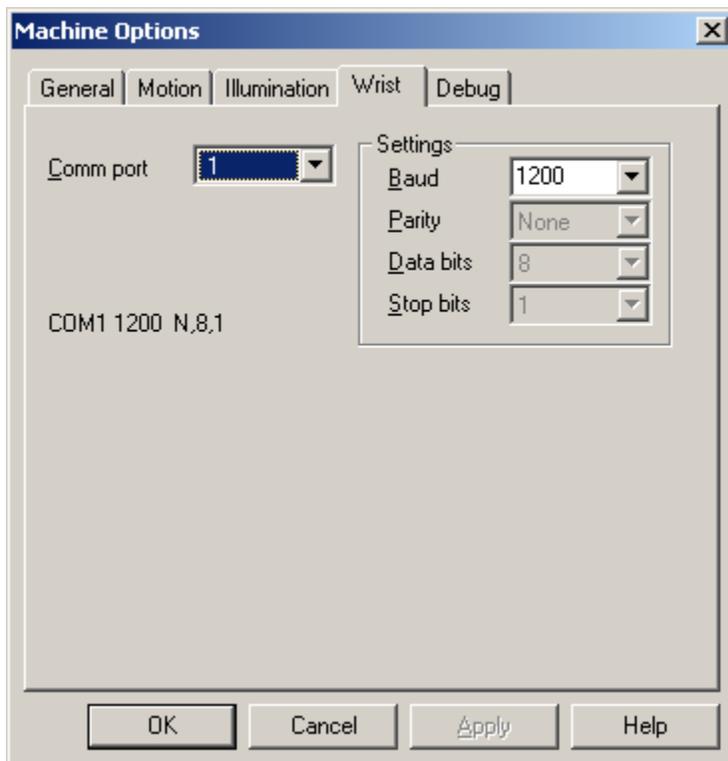
Select the check box next to the lamps that are physically installed on your machine from the Available Lamps list.

Selecting **Restore last lamp state at startup** will turn the lamps on to the last state when PC-DMIS is started.

Selecting **Turn lamps off at end of execution** will turn the lamps off when the part program is completed. This feature is not used for single feature execution (CTRL+E, or Measure Now, or Test), only for execution such as Full, Execute Block, or Execute from Cursor. By default this option is OFF.

Note: Illumination Calibration is done from the **Probe Utilities** dialog box. See the "[Calibrate Illumination](#)" topic

Machine Options: Wrist tab

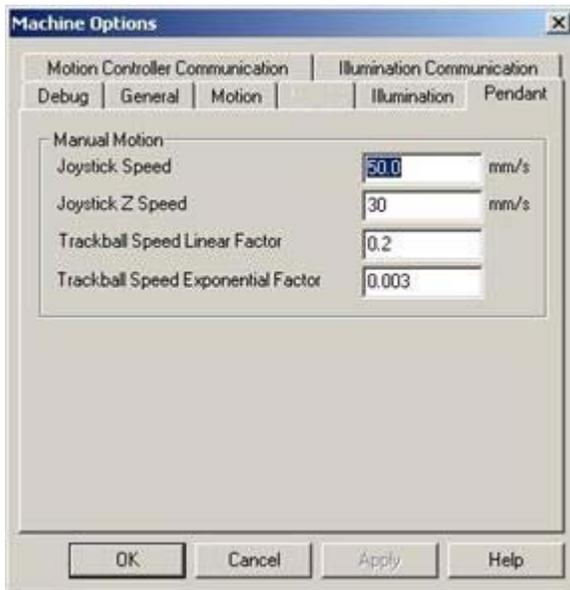


Machine Options dialog box—Wrist tab

The **Wrist** tab allows you to specify the communications port and settings used to connect your computer to your optical measuring device's wrist controller. This is for dedicated vision machines that have PH9 type wrist fitted and the **Wrist** portlock option selected (e.g. Mycrona).

CMM-V Note: On a CMM-V, this tab will not be available as the wrist control is done through the existing CMMI interface.

Machine Options: Pendant tab



Machine Options dialog box – Pendant tab

The **Pendant** tab, available on selected machines, allows you to define the speed parameters for your manual control box. Your manual control box is the hardware component PC-DMIS Vision uses to manually drive your Vision probe toward and away from features you want to measure. This manual control is either a joystick or a joystick and a trackball.

Most optical systems provide just a joystick while *some* systems provide *both* a joystick and a trackball. You can change the speed that the optical probe will use by altering the values in the boxes provided. The speed is listed in mm per second.

Joystick

If your system supports a joystick, you should use the joystick for fast adjustment of the optical probe. Use the **Joystick Speed** and **Joystick Z Speed** boxes to specify the speed used to drive the Vision probe into range of the video measurement. Speed is measured in terms of millimeters per second. The maximum or minimum values that you should use depend on your specific system. Consult your optical measuring system's documentation for any speed restrictions.

Trackball

If your system supports a trackball for manual control, you should use the trackball for fine adjustment of the Vision probe. Use the trackball once the Vision probe is in position and you want to take the video measurement on the part.

- To improve the slow trackball speed response, increase the **Trackball Speed Linear Factor**.
- To get a higher speed response, increase the **Trackball Speed Exponential Factor**.

If you are using a ROI system, the default settings are 0.2 for the **Trackball Speed Linear Factor** and 0.003 for the **Trackball Speed Exponential Factor**.

Machine Options: Motion Controller Communication tab



Machine Options dialog box—Motion Controller Communication tab

The **Motion Controller Communication** tab allows you to specify the communications port and settings used to connect your computer to your optical measuring device's motion controller.

Note: For TESA Visio1 machines there is a single "Machine Controller" tab for Motion and Illumination.

For Metronics (e.g. TESA VISIO 300) and Mycrona interface systems, there are no Controller tabs.

Machine Options: Illumination Communication tab

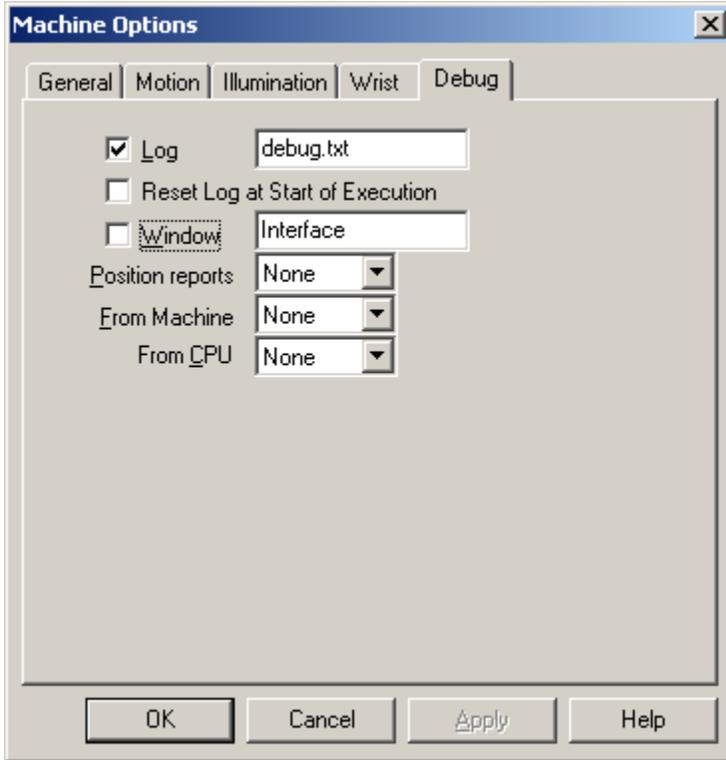


Machine Options dialog box—Illumination Communication tab

The **Illumination Communication** option allows you to specify the communications port and settings used to connect your computer to the Illumination instruments used by your optical measuring device.

Note: For TESA Visio1 machines there is a single “Machine Controller” tab for Motion and Illumination.
For Metronics (e.g. TESA VISIO 300) and Mycrona interface systems, there are no Controller tabs.

Machine Options: Debug tab



Machine Options dialog box—Debug tab

PC-DMIS Vision has the ability to generate a file that records any communication between the software and the hardware during the execution of your part program. This ‘debug’ file is useful in determining the cause of any problems that you might be having with your optical measuring system.

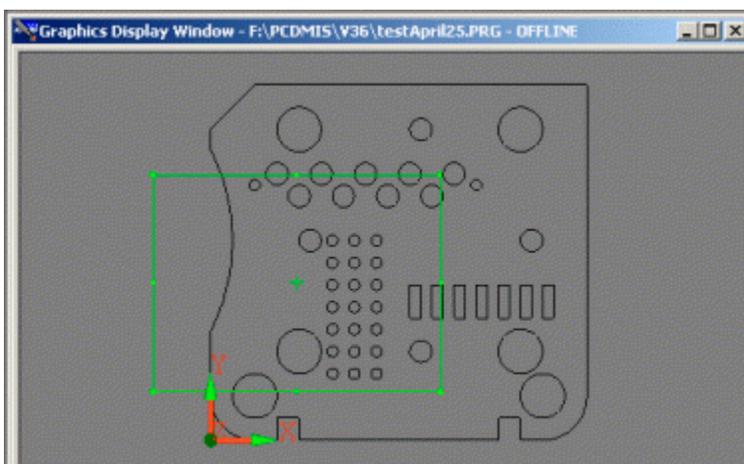
See the "Generating a Debug File" topic in the main PC-DMIS reference manual for more information on generating a debug file.

CMM-V Note: When running on CMM-V, the debug tab is accessed from the **CMMI Setup...** dialog box. Vision and standard CMM debug information will both be written to the same specific debug.txt file.

Using the Graphics Display Window in PC-DMIS Vision

PC-DMIS Vision lets you switch between two view modes in the Graphics Display window. They are the [Cad View](#) and [Live View](#).

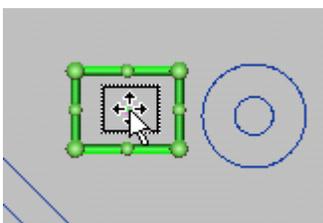
CAD View



Sample Cad View showing the Vision probe's field of view

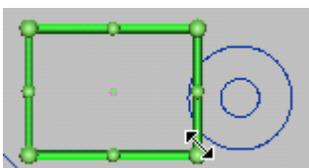
The **Cad View** is the standard view of the part and works the same way as in the standard PC-DMIS software. For in depth information on the **Cad View**, see "The Graphics Display Window" topic in the "Navigating the Interface" chapter of the main PC-DMIS reference manual.

The green rectangular region shown in the CAD view is the "field of view" (FOV). The FOV represents the view through the video camera. The center of the field of view has a cross hair. On a machine supporting DCC motion, you can click and drag this crosshair to move the FOV to a new location on the part:



Moving the FOV

On a machine supporting DCC optics changing, you can also resize (magnify or shrink) the FOV by dragging the corners of the green box. This will change the current magnification:



Sizing the FOV

Importing the Vision Demo Part

CAD models of various formats can be imported and used to create part programs. The Vision demo part named HexagonDemoPart.igs is used for examples throughout this document where CAD data is used. To import this demo part:

1. Select the **File | Import | IGES** menu option, or click the **Import IGES** button  from the Vision toolbar button.

Wilcox Associates, Inc.

2. Browse to and select the HexagonDemoPart.igs file from the **Open** dialog box and click **Import**. This file is normally located in the PC-DMIS install directory.
3. When the **IGES File** dialog box opens, click **Process** to process the demo file and then **OK** to finish the import process. The CAD demo part is displayed in the **Cad View**.

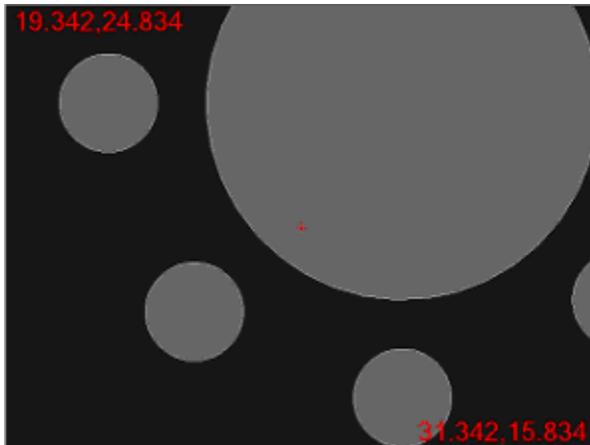
Live View



Sample Live View of the Graphics Display Window

*If you're in online mode, the **Live View** tab shows the actual "real time" view from the video camera.*

*If you're in offline mode, the **Live View** tab displays a "simulated" view of what a video camera would see, based on the imported CAD drawing. It simulates the geometry and also the illumination. This process is called **CAD Camera**.*

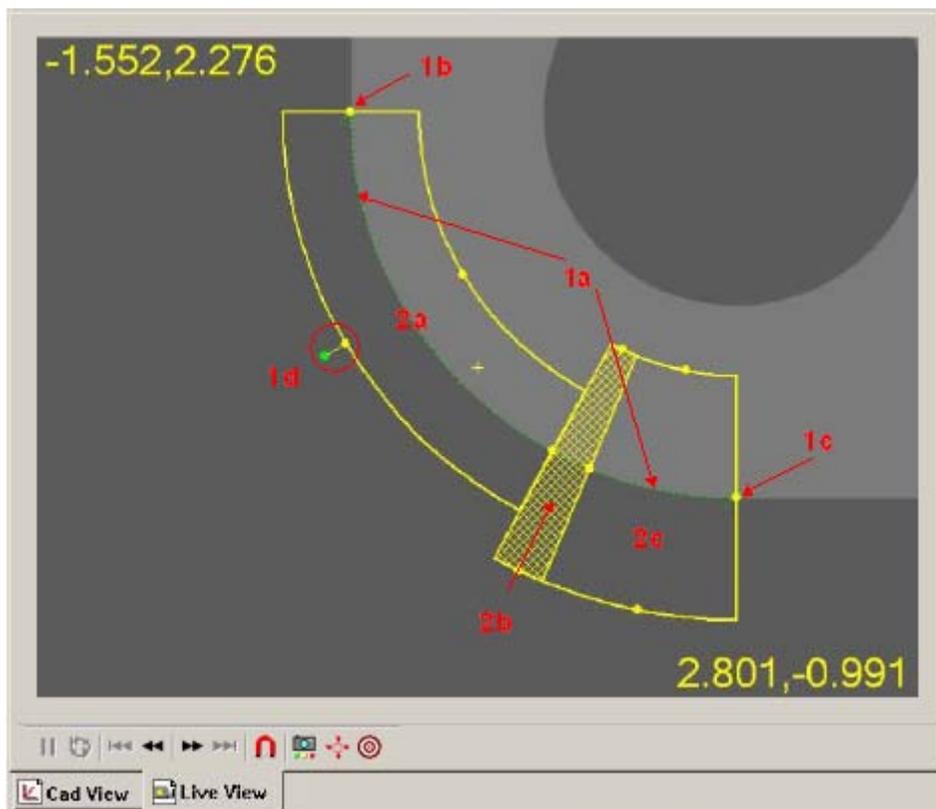


Simulated Live View (CAD Camera)

Tip: You can right click on the image and drag the mouse cursor. This essentially drags the image underneath the camera, allowing you to position the FOV to the new location on the part. This functionality only works on a DCC machine, or when offline.

Live View Screen Elements

This topic discusses the various screen elements available to you within the **Live View** tab.

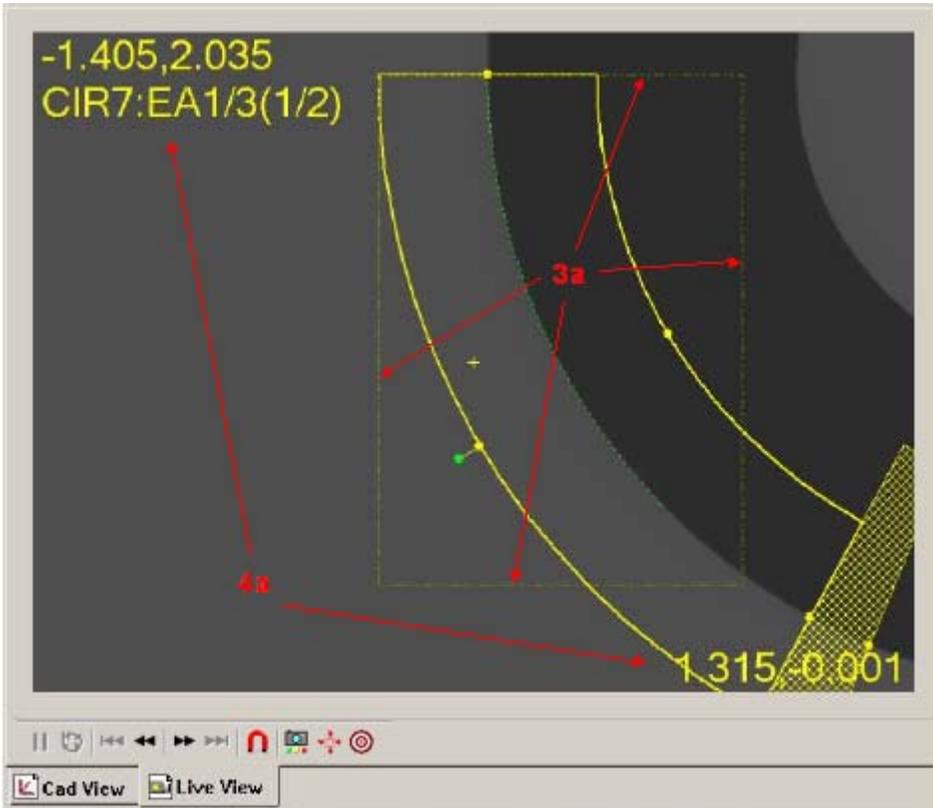


PC-DMIS Vision - Live View showing Tracker and Targets

The elements in the Live View can be altered by clicking and dragging the handles (green or yellow dots) to the desired location. Handles can control the size, orientation, and start and end angles for the targets.

Tracker: The visual user interface to features. In the Circle feature illustrated above, the tracker shows the size of the circle (**1a** - green dotted circle between the lines of the bright yellow donut), and allows the Start angle (**1b**), end angle (**1c**), and orientation (**1d** - altered by dragging the green dot *handle* on the end of a line) to be changed.

Target: Individual addressable user interfaces to point detection. For each region, you can control each Target parameter by clicking in the target, or by dragging the handles. Target parameters are changed in the [Hit Targets](#) tab of the **Probe Toolbox**. In the Circle feature above, the circle has three targets (**2a**, **2b**, & **2c**). Each target has slightly different point detection parameters. **2a** - configured with a smaller scan width. **2b** - configured to detect NO points.



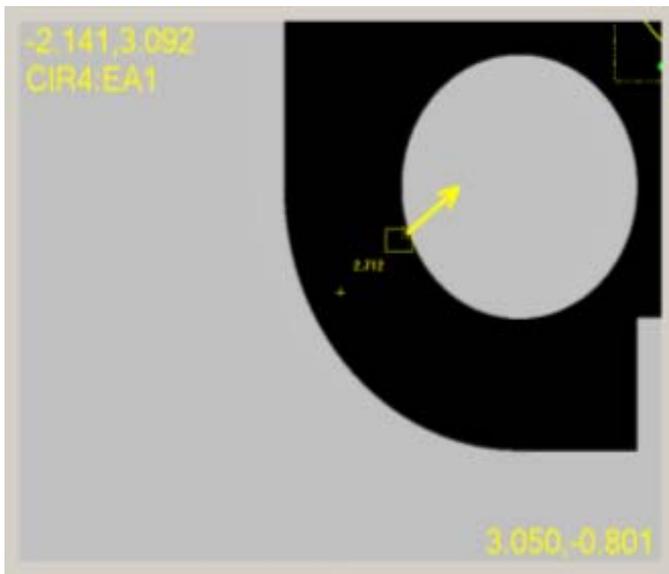
PC-DMIS Vision - Live View showing ROI and FOV coordinates

ROI (regions of interest): During run time, PC-DMIS Vision may need to divide a target into pieces so that each piece may fit into the FOV. ROIs are different from Targets in that the target may be bigger than the FOV. There is no user interaction with ROIs except for some visual indicators (**3a** - the AutoShutter halo for the upper left piece outlines the ROI; the target piece that can safely fit into the FOV at this magnification).

FOV Coordinates: The overlay numbers at the top and bottom of the screen, list the X and Y positions for the top left and bottom right corners of the FOV (**4a**). When right-clicking and dragging in the Live View other numbers appear in brackets which show the distance the camera will move. Additional information is given, depending on currently selected **Probe Toolbox** tab, but in the example above you see feature and target name.

AutoShutter & Auto Compass: According to the Live View Settings, any manual features that you measure with Automatic Targets will make use of a technologies called "AutoShutter" and "AutoCompass". See "[Setting up the Live View](#)" for more information on AutoShutter and AutoCompass settings found in the **Live View Setup** dialog box.

Auto Compass: This will guide the operator to move the stage to get the next feature into the Field Of View, by showing an arrow and a distance to move.



PC-DMIS Vision - Live View showing Auto Compass

You need to move the stage so the entire dashed rectangle box is comfortably within the Field Of View.



PC-DMIS Vision - Live View showing colored light countdown

Auto Shutter: Once the target is within the Field Of View, a coloured light countdown is shown on the Live View where it checks for stage stability, before automatically performing the edge detection on all targets that are within the current Live View.

Note: If a stage movement is detected during AutoShutter, it will discard the points and automatically restart the countdown to measure again.

Live View Controls

This topic discusses the controls located at the bottom of the **Live View** tab.

Live View Freeze:  This button, when pressed, will “pause” the update of the live view display. This is useful if you want to keep something on the screen to analyze or take a screen capture, but you want measurement to continue in the background. To restart the Live View update, release this button.

Auto Live View Freeze:  This button, when pressed, will cause the Live View Freeze button to be automatically pressed on and off at program execution time, so that measured points are frozen on the screen until the next points are available for display.. This is also useful for machines where “image tear” occurs during stage movements.

Move to Previous Target:  This button moves the FOV to the previous target in a list of targets.

Skip Backwards on Target:  This button moves the FOV part way backwards along a target towards the previous target. This helps you see how an entire feature might be measured, even though the feature does not fit inside the FOV.

Skip Forwards on Target:  This button moves the FOV part way forwards along a target towards the next target. This helps you see how an entire feature might be measured, even though the feature does not fit inside the FOV.

Move to Next Target:  This button moves the FOV to the next target in a list of targets.

Snap to Edge Toggle:  This button, when selected, will cause selected points for feature creation to snap to the closest point along the nearest edge. Otherwise, selected points will remain where they are clicked. See "[Setting up the Live View](#)" for more information on this feature.

Snap to Edge is also used at execution time for Manual Targets. When you drag and drop a manual target, when this option is on, PC-DMIS will do edge detection to snap the cross hair to the edge.

AutoShutter Toggle:  This button, when selected, enables AutoShutter capability to measure features. See "[Setting up the Live View](#)" for more information on this feature.

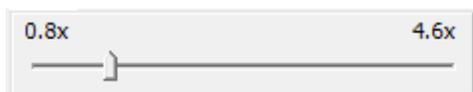
Compass Toggle:  This button, when selected, will cause the AutoCompass to display and arrow and distance to move for the next target. See "[Setting up the Live View](#)" for more information on this feature.

Show Target Toggle:  This button, when selected, will toggle the display of targets in the Graphics Display or Live View windows. This is the same functionality as the show target button on the Auto Feature dialog box. This is particularly useful when you are using the Quick Start window and the Auto Feature dialog box is not open.

Show Gray Scale Toggle:  This button, when selected, will toggle a gray scale depiction of the **Live View** tab.

Magnification:  This button, when selected, *displays a slider* underneath it. You can drag the slider to set the magnification of the live view without having to use **Magnification** tab on the **Probe Toolbox**.

The magnification dynamically updates as you drag the slider. See "[Probe Toolbox: Magnification tab](#)" for more information on magnification.



SensiFocus: .. This button, when selected, executes an automatic "sensible focus".

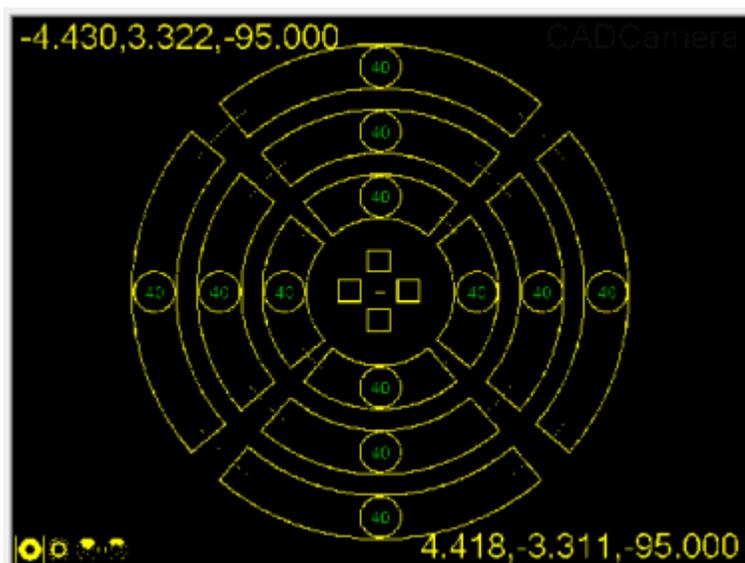
- On a DCC machine, it automatically moves the stage and then returns it to the focus position. The parameters used for this focus *do not* come from **Focus** tab of the **Probe Toolbox**. Instead, they are based on available data such as pixel size, depth of focus, frame rate, and so on. The focus target size is fixed and located in the center of the **Live View** tab.
- On a manual machine, this button is disabled.

SensiLight:  This button, when selected, performs an on-the-spot automatic "sensible lighting" adjustment in an attempt to achieve optimal results. The **Illumination** tab will quickly be selected as this automatic adjustment is made. For additional information on how SensiLight this is used as a parameter for edge features, see the SensiLight description under "[Automatic Hit Target - Edge Parameter Set](#)".

[Top/Bottom/Aux] Light:  Any of these buttons, when selected, *displays a slider* underneath the button. You can drag the slider to define the illumination intensity of that lamp without having to use the **Illumination** tab on the **Probe Toolbox**. The Illumination dynamically updates as you drag the slider. See "[Probe Toolbox: Illumination tab](#)" for more information on illumination.

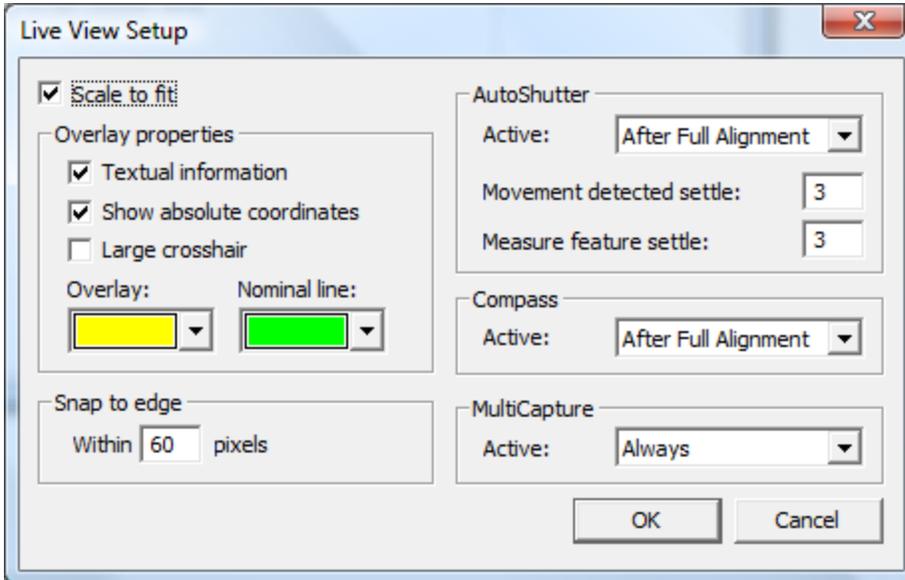


Ring Lamp Overlay:  This button functions a little differently from the **Top Light**, **Bottom Light**, and **Aux Light** buttons above. This button toggles the display of the *Ring Lamp Overlay* on the **Live View** tab. To display the slider, you need to click the black down arrow. See "[Probe Toolbox: Illumination tab](#)" for more information on illumination.



Laser Toggle:  This button, when selected, toggles the laser on and off. This is available for systems with laser probe or laser pointer fitted (e.g. TESA VISIO 300 and 500).

Setting up the Live View



Live View Setup dialog box

The **Live View Setup** dialog box appears if you select the **Edit | Graphics Display Window | Live View Setup** menu or if you right click within the **Live View** tab and select **Setup** from the resulting shortcut menu.

[This option is only available if Vision is programmed on your Port Lock.](#)

The **Live Image Setup** dialog box allows you to configure how the image appears in the **Live View** tab of the Graphics Display window. It contains these controls:

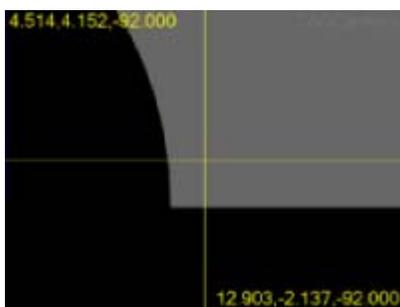
The **Scale to Fit** check box is **Scale to Fit** - This check box determines whether or not the display of the part should be scaled to within the limits of the Graphics Window *only available on some optical machines.*

Overlay Properties

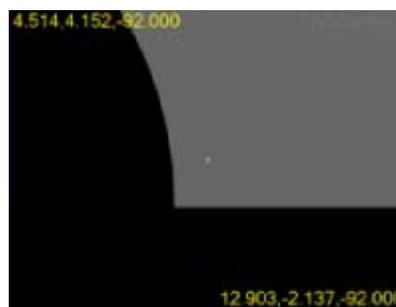
Textual Information: This check box show or hides the various live image overlay information that appears inside the **Live View** tab.

Show Absolute Coordinates: When this option is selected, the overlaid coordinates are displayed as **Absolute** values. For **Absolute** values, the top-left and bottom-right coordinates show the actual position of those corner points in the current machine coordinates. When this option is not selected, **Relative** values are displayed. For **Relative** values, the top-left corner is shown as 0,0 and the bottom-right corner shows the length and width of the FOV in current units.

Large Crosshair: When this option is selected, the crosshair is extended to all sides of the Live View. Otherwise, the crosshair is displayed as a small plus sign in the middle of the Live View.



Large Crosshair



Small Crosshair

Overlay Color: This list allows you to select the color used for most of the overlaid graphics and text on the **Live View** tab. This affects probe hits, targets, gages, as well as textual information for FOV coordinates, magnification, and focus. The default color is red.

Nominal Line Color: This list allows you to select the color used for the nominal line in the targets.

Programming Properties

Snap To Edge: The **Within Pixels** value works in conjunction with the **Snap to Edge Toggle**  found at the bottom of the **Live View** (See "[Live View Controls](#)"). When the **Snap to Edge Toggle** is selected, PC-DMIS Vision will detect the nearest edge and snap target anchor points to that edge when programming features in the **Live View** tab. The value in the **Within Pixels** box indicates the distance the software searches for this edge. If you have a blurred edge that you cannot bring into focus, you may find it necessary to not use **Snap to Edge** to reliably specify anchor points when programming a feature. This also applies at execution time for Manual Targets.

AutoShutter

AutoShutter detects when a target (which may consist of multiple ROIs) is ready to measure points. The three criteria for readiness are: the ROI is entirely within the FOV, the stage has stopped movement, and the user-defined delays have elapsed. When these criteria are satisfied, PC-DMIS automatically takes the points, and proceeds to the next ROI.

The options in this area are used when **AutoShutter Toggle**  is selected at the bottom of the **Live View** (See "[Live View Controls](#)").

Note: AutoShutter does not fire for DCC mode features with enabled Manual Preposition.

Active: Determines when the, AutoShutter capability is used to measure features: **Always**, **After Partial Alignment** and **After Full Alignment**

Movement detected settle: This field specifies a settle time (in seconds) before point detection firing after the current ROI that was not entirely in the FOV has entirely entered the FOV. The user may use this field to slightly delay the automatic firing to review/improve ROI placement within the FOV.

Measure Feature settle – This field specifies a settle time (in seconds) before point detection for the FIRST ROI of a feature, even if this ROI is already entirely in the FOV. The user may use this field to slightly delay the automatic firing to review/improve ROI placement within the FOV. This value is only applied to the first ROI of a feature.

Note: the **Movement Detected settle** is the dominate value, if it conflicts with the **Measure Feature settle** value.

Compass

This will guide the operator to move the stage to get the next feature into the Field Of View, by showing an arrow and a distance to move.

Active: Determines when the, **Compass** capability is used to measure features: **Always**, **After Partial Alignment** and **After Full Alignment**

The **Active** option is applied when **Compass Toggle**  is selected at the bottom of the **Live View** (See "[Live View Controls](#)").

MultiCapture

In order to speed up execution, the MultiCapture functionality causes the software to look at features ahead in the part program and create groups which can be executed within a single camera picture (Live View). These are bundled together and executed simultaneously. The **Active** list contains these options.

Always: MultiCapture mode is always used.

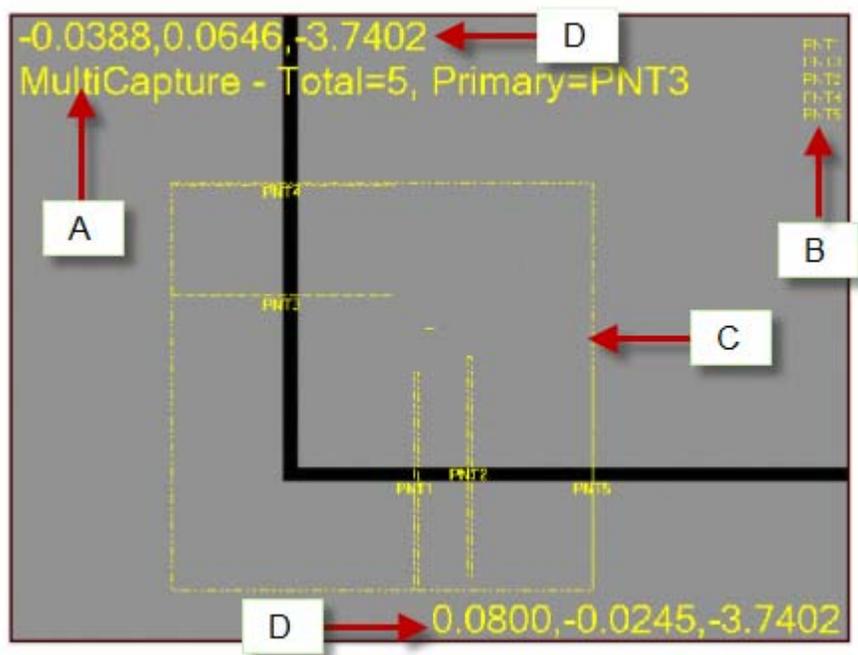
Never: MultiCapture mode is never used.

This defaults to **Always**. Most of the time you will probably want this enabled since it speeds up measurement. But there may be times when you want more visual data on each feature as it is measured. In those cases, you can set this to **Never**.

Note: The **MultiCapture** area of the dialog box is only active in DCC mode, or in Manual mode when the AutoShutter conditions have been met.

So, for example, suppose you have five edge point features that all fit within a single Live View and you have MultiCapture enabled. Instead of the machine measuring the five edge point features separately, during execution PC-DMIS will display a MultiCapture overlay for the feature set as a whole, providing information about what features are in the group and how many. They will all then execute simultaneously, as if one feature were being executed.

The sample MultiCapture overlay here shows five edge points combined into a single grouping. The overlay provides the following information:



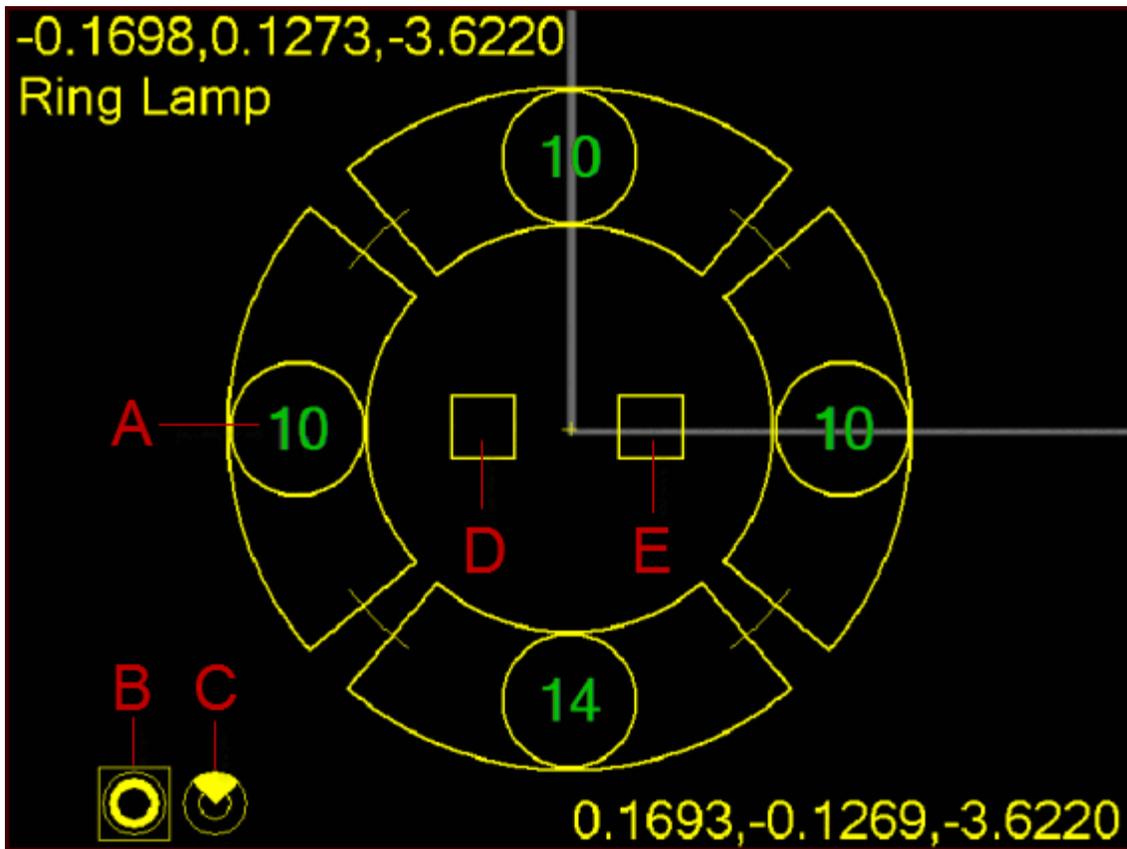
- **A** - The MultiCapture message lets you know you are in MultiCapture mode. It displays the total number of features to be measured in the current grouping and the primary feature in that grouping.
- **B** - This displays all the features within the MultiCapture region that will be measured.
- **C** - This dotted rectangular box is the MultiCapture region. It bounds all the features for the current grouping.
- **D** - These numbers provide the XYZ coordinates for the top-left and bottom-right corners of the MultiCapture region.

Using the Live View Ring Lamp Overlay

The **Live View** tab also supports the ability to display an overlay image of the ring lamp's bulbs. To enable this image overlay, either click on the **Ring Lamp** icon from the **Live View** tab or click on the **Ring Lamp Overlay** icon from the **Live View**.

This overlay corresponds to the ring light image displayed in the [Illumination tab](#) of the Probe Toolbox. Clicking on different areas of this image overlay allows you perform some functions that are also available on the **Illumination** tab.

The graphical ring lamp overlay looks something like what appears in the example image below. Your image overlay may look different depending on the type of ring lamp you have configured:



Example Graphical Overlay of the Ring Lamp in the Live View tab

A - These yellow circles with green numbers represent the different bulbs and the light intensity for each bulb. You can click on the lamp's outline to turn bulbs on or off. Whether a section of bulbs or an entire ring of bulbs are affected depends on whether or not **Change Ring** (item B) or **Change Section** (item C) are selected. Of course, if you only have a single ring of bulbs, like what is shown in the example image above, then using **Change Section** would affect only the single bulb in that section.

B - Clicking this icon places the ring lamp into change ring mode. This lets you change settings for the entire ring of bulbs. This corresponds to clicking the **Change Ring** icon in the **Illumination** tab of the Probe Toolbox. See "[Ring Light Control Modes](#)".

C - Clicking this icon places the ring lamp into section mode. This lets you change settings to all the bulbs in a specific section. If you click on a number within a circle, you will notice that all the numbers in that section turn green and all the other numbers in other sections turn red. This indicates that any intensity value change will affect only the active section. This corresponds to clicking the **Change Section** icon in the **Illumination** tab of the Probe Toolbox. See "[Ring Light Control Modes](#)".

D - Clicking this square icon shifts the lamp settings one section in a counter clock-wise direction. See "[Positioning Ring Light Segments](#)".

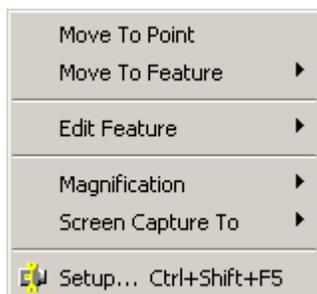
E - Clicking this square icon shifts the lamp settings one section in a clock-wise direction. See "[Positioning Ring Light Segments](#)".

Using Shortcut Menus

Two menu shortcuts are available to access commonly used commands and options:

Live View Menu

To access the **Live View** menu, right click on the **Live View** tab but not on a target.



Move To Point: When you select the option, it will move to centre the Live View image to the location where the right-click was done.

Move To Feature submenu: Selecting one of the nearest ten features from this submenu will move the center of the Live View image to the center of the selected feature.

Edit Feature submenu: Selecting one of the nearest ten features from this submenu will open the **Auto Feature** dialog box allowing you to edit the properties for the selected feature. See "[The Auto Feature Dialog Box in PC-DMIS Vision](#)".

Note: The features listed under the **Move To Feature** and **Edit Feature** submenus are listed in increasing order of distance.

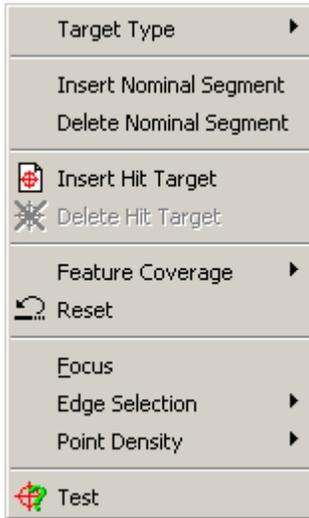
Magnification submenu: This submenu gives another way to affect the magnification of the camera's view of the part. This submenu contains menu options that function just like the shortcut keys discussed in "[Changing the Magnification of the Part Image](#)".

Screen Capture To submenu: This submenu lets you save a screen capture of the **Live View** tab to a file, the Clipboard, or to a PC-DMIS report. The currently selected view (**Cad View** or **Live View**) will determine which display is captured.

Setup: This menu option accesses the **Live Image Setup** dialog box. See "[Setting up the Live View](#)".

Live View Target Menu

To access the **Live View Target** menu, right click on a target in the **Live View**.



Target Type submenu: Right-click on a target and change the target type from one of the following: **Automatic Target**, **Manual Target**, **Gage Target**, and **Optical Comparator**. See "[Probe Toolbox: Hit Targets tab](#)" for detailed information on each target type.

Insert Nominal Segment: To add a segment, right-click at the needed location and select the **Insert Nominal Segment** menu option. This will add a handle to the target that you can drag to match the geometry of the target. For example, there may be a V notch on a straight edge that you need to add to the target.

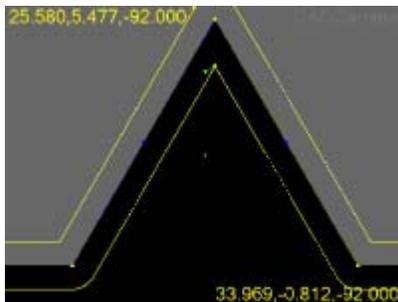
Delete Nominal Segment: To delete a segment, right-click on the handle select the **Delete Nominal Segment** menu option. This will remove the selected handle. This is useful to "simplify" the nominal form of a target by removing detail.

Note: Inserting and Deleting Nominal Segments is only used for Profile 2D Features. These options allow you to add or remove segments to a Profile 2D shape in order to more accurately match the feature.

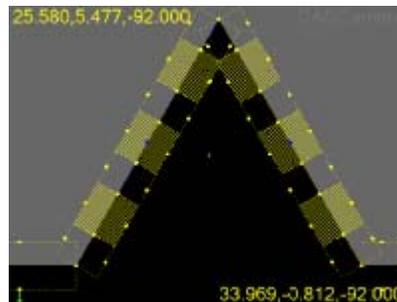
Insert Hit Target: To insert a new Hit Target, right-click at the needed location and select the **Insert Hit Target** menu option. This is unlike the **Insert Hit Target** button from the **Probe Toolbox** that randomly inserts a new **Hit Target**.

Delete Hit Target: To delete a Hit Target, right-click the needed target and select the **Delete Hit Target** menu option.

Feature Coverage: This option allows you to quickly change the coverage for a feature. New targets will be created or removed based on the selected percentage of coverage. Notice in the example below that the same feature covered at 100 percent is altered to have many targets that provide a coverage of 50 percent.



Profile 2D - 100% Coverage



Profile 2D - 50% Coverage

Reset: To reset the target areas of a feature, right-click on a target of the needed feature and select the **Reset** menu option. This will delete the entire previously added target, leaving the single default target.

Focus: This on/off toggle allows for focus prior to target measurement. Each target section has the ability to do a focus prior to doing the edge detection. This is the same as the option found in the "[Probe Toolbox: Focus tab](#)".

Edge Selection submenu: Right-click on a target and change the target edge selection method from one of the following: **Automatic Target**, **Manual Target**, **Gage Target**, and **Optical Comparator**. See "[Probe Toolbox: Hit Targets tab](#)" for detailed information.

Point Density submenu: To change the target **Point Density** right-click on a target and select the needed menu option from the **Point Density** submenu. See the "[Edge Parameter Set](#)" for more information on the available **Point Density** options.

Test: To test a feature, right-click on a feature and select the **Test** menu option. See the "[Vision Controls - Command Buttons](#)" topic for more information on testing features.

Using the Probe Toolbox in PC-DMIS Vision

The **Probe Toolbox** is not specific to PC-DMIS Vision, but is part of the standard PC-DMIS software. This toolbox presents tabs and information relative to the type of probe currently being used. When a vision probe is active, the **Probe Toolbox** contains various Vision probe parameters used to acquire the data points needed by part programs.

Important: Your portlock must be programmed with the **Vision** option and a valid **Vision Probe Type** selected, and you must be working with a supported Vision probe in order to access the various PC-DMIS Vision related tabs.

The **Probe Toolbox** works in conjunction with the **Auto Feature** dialog box to define the parameters by which auto features will be measured. Functionality, such as probe movement, magnification, illumination, focus, and gage measurement can be performed independently from auto feature creation.

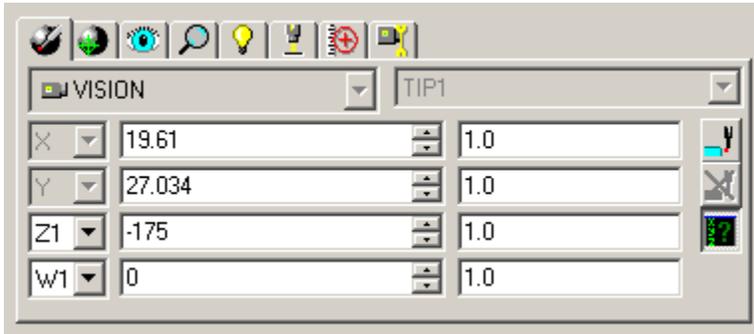
The **View | Other Windows | Probe Toolbox** menu option displays the **Probe Toolbox**.

The **Probe Toolbox** contains the optical parameters within these tabs:



1. [Position Probe](#)
2. [Hit Targets](#)
3. [Feature Locator](#) (available only during program execution)
4. [Magnification](#)
5. [Illumination](#)
6. [Focus](#)
7. [Gage](#)
8. [Vision Diagnostics](#) (available only during program execution)

Probe Toolbox: Position Probe tab



Probe Toolbox—Position Probe tab

The **Position Probe** tab allows you to position the probe/camera so it is over the feature to be measured, as a form of “Virtual Joystick”.

To Position Your Vision Probe:

1. Adjust the **Increment Value** in the **Increment** edit box  to specify the amount that the **Current Position** edit box will be increased or decreased.
2. Click the **Up** and **Down** arrows to change the value in the **Current Position** edit box . This will cause your **Vision Probe** to move in real time by the specified value. Alternately, you may type the value and hit enter to cause your **Vision Probe** to move.

For machines with multiple axis (e.g. two rotary tables), it also allows the currently active rotary table to be selected.

If you don't see any information in the **Probes** and **Probe Tips** lists of the **Probe Toolbox**, you need to first define a probe. See the "Defining Probes" chapter in the main PC-DMIS reference manual on how to do this.

Note: Since you can use this tab with all probe types (contact, laser, or optical), this manual only covers PC-DMIS Vision related items. For information about the toolbox as it relates to probes in general, see "Using the Probe Toolbox" in the main PC-DMIS reference manual.

Position Probe Tab Buttons:

	Clicking the Take a Hit button will measure an edge point at the center of the Field of View. The edge point must be within a 60 pixel range of the center of the Field of View to be measured.
	Clicking the Remove Hit button removes the anchor point hit you just took using the left mouse click. This button remains disabled until you have entered an anchor point hit.
	Clicking the Probe Readout button displays the Probe Readout window. You can easily resize or relocate this window. See the " Using the Probe Readout window with Optical Probes " topic.
	The Toggle Laser On/Off button is available for systems with laser probe or laser pointer fitted (e.g. TESA VISIO 300 and 500). This button toggles the laser on and off.

Using the Probe Readout window with Vision probes

Probe Readout	
X	3.768
Y	6.584
Z	0.000
VX	3.768
VY	6.584
VZ	0.000
DX	-3.768
DY	-6.584
DZ	0.000
Mag	86.6x
W	0.000
Hits	0

Probe Readout window

Most information on the Probe Readout window is the same for all probe types and is already discussed in the "Using the Probe Readout Window" topic of the "Using Other Windows, Editors, and Tools" chapter in the main PC-DMIS reference manual. However, if you use a Vision probe, these additional readouts appear in the window:

Mag: This value shows the current camera magnification setting. Any changes you make in the **Magnification** tab are reflected on this line of the **Probe Readout** window. See the "[Probe Toolbox: Magnification tab](#)".

VX / VY / VZ: If you are using a Vision probe, the X, Y and Z values indicate the co-ordinates of the cross hair at the center of the field of view (FOV). The VX, VY and VZ values indicate the feature Target or Gage location with respect to the current alignment.

DX / DY / DZ: The DX, DY and DZ values indicate the difference between the camera and feature position. You must have the **Distance to Target** option selected in the **Probe Readout Setup** dialog box for these values to be displayed. For more information, see the "Setting Up the Readout Window" in the "Setting your Preferences" chapter of the main PC-DMIS reference manual.

W: Displays the current rotary table axis for a single rotary table.

V: When using a stacked rotary table, the Probe Readout will also show a 'V' value for a second rotary axis.

A Note on Optical Tips

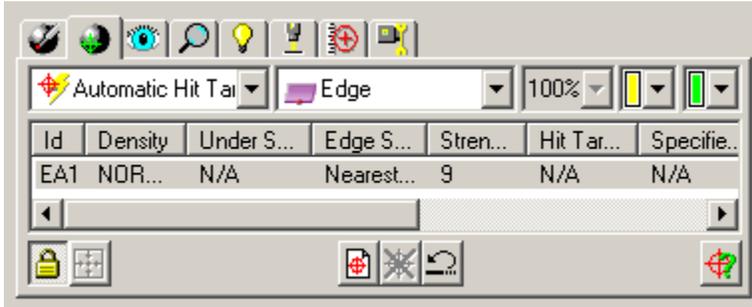
Some other interchangeable terms for "probe tip" are AB angles, AB positions, Tip, Tip Angles, etc.

The concept of a Vision probe parallels a contact probe to a certain point. Obviously a Vision probe doesn't come in physical contact with the part, but both contact probes and optical probes use the term "probe tip" to specify various positions of an articulating probe head. The *actual* tip on a Vision probe contains the optical device (the camera).

If you select a probe from the **Probes** list or a probe tip from the **Probe Tips** list, PC-DMIS Vision inserts a `LOADPROBE/` command or a `TIP/` command respectively into the Edit window.

When PC-DMIS Vision executes these commands, it performs its associated probe definition.

Probe Toolbox: Hit Targets tab



Probe Toolbox—Hit Targets tab

This tab only appears when you define and use a supported Vision probe.

The **Hit Targets** tab shows the edge detection and focus parameters that will be used to measure a feature.

When using a Vision probe you will want to make adjustments and test your targets. This option also allows you to split the default target to into sub-targets, each with its own set of parameters. For example, you can measure a circle using the default single target or split the circle into individual arcs each with their own set of target parameters. These target parameters include edge detection method, illumination, point density, etc.

Targets are displayed in both the [Live View](#) and the [Cad View](#). While it's possible to size the targets in either view, the targets are two dimensional so it's easier to do this on the **Live View** which also uses a two dimensional display of the part.

A feature's targets and their associated parameters used are also displayed as a row in the tab's target list. You can define more than one target. If you select one or more targets from this list you can see them in bold formatting in the **Live View** tab of the Graphics Display window.

Double click on the items in the list to change the parameters for a target. You can change multiple targets at the same time by selecting multiple target rows in the **Probe Toolbox** and then right clicking.

Available Parameter Sets

You can change the parameter set to change which type of target parameters you are currently viewing.

Depending on the feature type that you are targeting, the parameter set option displays one or more of the available options: **Edge**, **Filter**, and **Focus**.

Edge: Defines the target edge parameters used for acquiring the edge points on the feature.

Filter: Defines any filters to be used on the acquired edge points, and their associated parameters. Filters can be used to remove any outliers from the set of edge points, and can also clean the image prior to measurement.

Focus: Defines whether the target should perform a focus prior to acquiring the edge points, and if so, what the focus parameters are.

Icon	Feature Type	Available Parameter Sets
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	Surface Point	Focus
	Edge Point	Edge, Focus
	Line	Edge, Focus, Filter
	Circle	Edge, Focus, Filter
	Round Slot	Edge, Focus, Filter
	Square Slot	Edge, Focus, Filter
	Profile 2D	Edge, Focus, Filter

See the examples below for an explanation of the specific parameters and their usage.

Measuring Features Using a Vision probe

You can specify the measurement method to use by selecting it from the **Target Type** list in the **Hit Targets** tab. Depending on your feature type, there are up to three methods of taking a feature measurement using a Vision probe:

The following examples use a circle feature.

Method 1 – Gage Hit Target: The Gage Hit Target manual method requires you to graphically size (or adjust) the feature (in this case a circle) and position it to match the feature on the **Live View** tab of the Graphics Display window. You can also view the image within the tolerance bands. For a circle, this will give an X, Y position and the diameter. Parameters for this mode are discussed in the "[Gage Hit Target Feature Parameters](#)" topic.

Method 2 – Manual Hit Target: The Manual Hit Target method requires you to position a specified number of points around the feature (in this case a circle). PC-DMIS Vision then uses these points to calculate the feature. Any number of targets can be used to aid in measuring the feature. Parameters for this mode are discussed in the "[Manual Hit Target Feature Parameters](#)" topic.

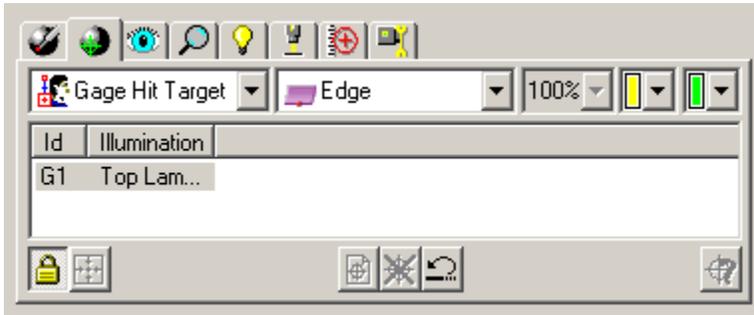
Method 3 – Automatic Hit Target: The Automatic Hit Target method uses image processing to automatically detect a feature (in this case a circle). It then calculates the circle based on the defined targets. Parameters for this mode are discussed in the "[Automatic Target Feature Parameters](#)" topic.

Method 4 – Optical Comparator Hit Target: The Optical Comparator Hit Target mode uses an upper and lower tolerance band for target measurement. During feature execution, you visually inspect that the feature lies within this tolerance band. From the **Execution Mode Options** dialog box, you can then click **Continue** (PASS) or **Skip** (FAIL) to accept or reject the feature. Parameters for this mode are discussed in the "[Optical Comparator Hit Target - Edge Parameter Set](#)" topic.

Gage Hit Target Feature Parameters

The following parameters appear in the column headings of the target list in the **Hit Targets** tab when measuring features using the **Gage** measuring method (see "[Measuring Features Using a Vision probe](#)" for available measuring methods):

Edge Parameter Set



To change a value, right click on the current value for the desired target. If a value says N/A, then that parameter is “not applicable” to the current set.

ID: This displays a unique identifier for the item in the target list. This same ID is used on the Tooltip for the target in the **Live View** tab of the Graphics Display window.

Illumination: This shows the illumination values to be used for this target. To change the illumination for a specific target, select the target in the **Hit Targets** tab, or on the **Live View** tab of the Graphics Display window, and change the illumination on the **Illumination** tab. For information on how to do this, see "[Probe Toolbox: Illumination tab](#)".Edge Parameter Set

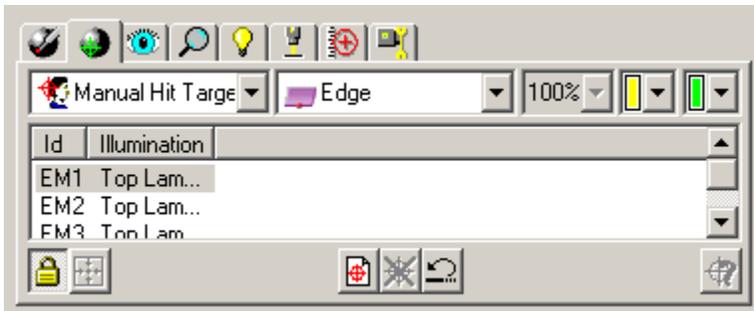
Focus Parameter Set

See the "[Hit Target Focus Parameter Set](#)" target for information.

Manual Hit Target Feature Parameters

The following parameters appear in the column headings of the target list in the **Hit Targets** tab when measuring features using the **Manual Target** measuring method (see "[Measuring Features Using a Vision probe](#)" for available measuring methods):

Edge Parameter Set



To change a value, double click on the current value for the desired target. If a value says N/A, then that parameter is “not applicable” to the current set. To change a parameter for multiple targets at once, select the targets, and then right click on one of them and change the value. It will be updated for all.

ID: This displays a unique identifier for the item in the target list. This same ID is used on the ToolTip for the target in the **Live View** tab of the Graphics Display window.

Illumination: This shows the illumination values to be used for this target. To change the illumination for a specific target, select the target in the **Hit Targets** tab, or on the **Live View** tab of the Graphics Display window, and change the illumination on the **Illumination** tab. For information on how to do this, see "[Probe Toolbox: Illumination tab](#)".

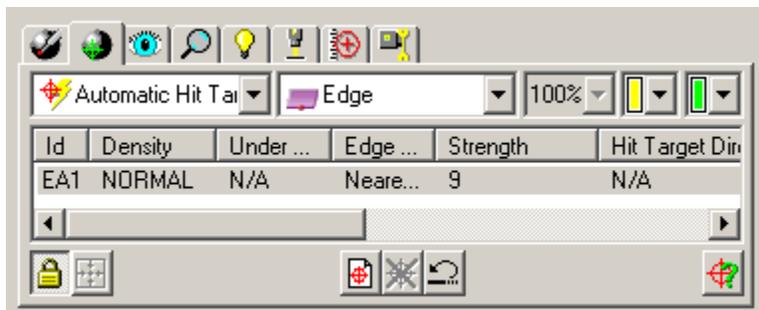
Focus Parameter Set

See the "[Hit Target Focus Parameter Set](#)" target for information.

Automatic Hit Target Feature Parameters

The following parameters appear in the column headings of the target list in the **Hit Targets** tab when measuring features using the **Automatic Target** measuring method (see "[Measuring Features Using a Vision probe](#)" for available measuring methods):

Automatic Hit Target - Edge Parameter Set

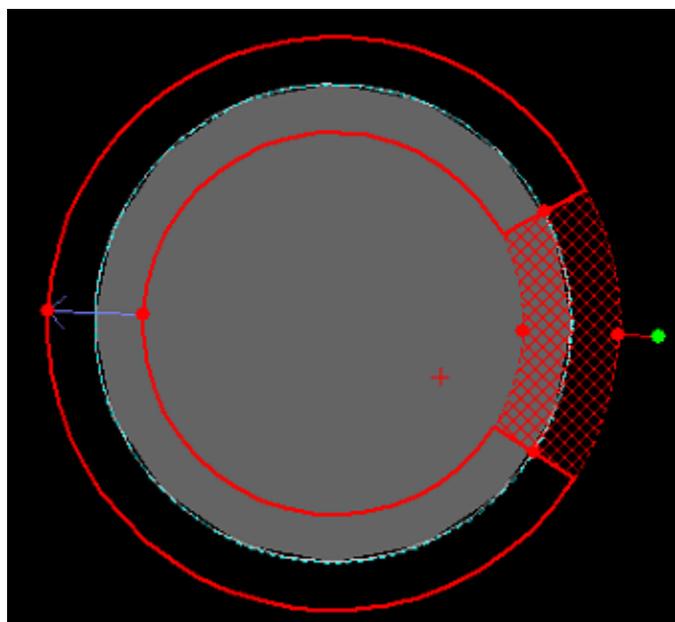


To change a value, right click on the current value for the desired target. If a value says N/A, then that parameter is “not applicable” to the current set.

ID: This displays a unique identifier for the item in the target list. This same ID is used on the ToolTip for the target in the **Live View** tab of the Graphics Display window.

Density: This shows the hit density type for the current target. Available density types include:

- **None:** Does not return points. Use this type when excluding a region on the target. Excluded regions are indicated with a cross-hatch pattern on top of the feature.



A target with an excluded region shown by the cross-hatch pattern

- **Low:** Returns a minimal number of points (one point for every 10 pixels). Use this density type if your feature form doesn't change much in this area, or isn't a critical area of your part.
- **Normal:** Returns the default number of points (one point for every 4 pixels) for that feature type.
- **High:** Returns the maximum number of points (one point per pixel). Use this density type if your feature form changes drastically in this area or is considered a critical area of your part.

Under Scan: This defines (in current units) the under scan distance applied to non blending areas within a target (for example, a corner made from two edges). PC-DMIS Vision doesn't return any points from under scan areas on a target, and the display indicates the ignored area. PC-DMIS Vision will attempt to default the **Under Scan** value to an appropriate setting.

Edge Selection: C-DMIS Vision attempts to find and use the most appropriate means of detecting an edge. It supports these methods:

- **Dominant Edge:** Often, when using the bottom lamp to illuminate the part, you can get best results by returning the dominant (or strongest) edge.
- **Nearest Nominal:** This method detects the qualified edge closest to the nominal edge. This gives you an easy way to select a non-dominant edge for measurement.
- **Matching Edge:** This method detects the edge whose size and location best matches that of the required feature. This is the default edge detection method. See the "[Troubleshooting PC-DMIS Vision](#)" topic for steps that can be taken to speed up this Edge Selection type.
- **Specified Edge:** This method goes in the currently defined scan direction and picks a specified edge from the detected edges whose strength value exceeds that of the edge strength threshold. The Graphics Display window shows the scan direction using a blue arrow in the target. You can reverse this direction to select edges in a preferred order.

Strength: This shows the edge strength threshold to use during the feature measurement. When looking for an edge, the software ignores edges with an assigned 'strength' below this threshold. You can change the predefined value to a new value with a range of 0-255. The larger the number, the stronger the edge. If PC-DMIS Vision does not return sufficient points on an edge, try reducing this value. If Vision returns a number of false edges detected, try increasing this value.

Edge Polarity: This value determines if the edge that is being viewed and discovered goes from black to white, white to black, or either. This value can be specified for the following edge types: **Dominant Edge**, **Nearest Nominal**, **Matching Edge** and **Specified Edge**.

Setting Edge Polarity allows edges of a specific polarity to be excluded from the algorithms, providing speed improvement. For example, setting polarity to `[]>[]` will throw away any edges that are not black to white, as it would for dominant edge.

Hit Target Direction: This value determines the direction that the algorithm will use when determining polarity. For example, if you run across a target in one direction, and edge would be white to black (`[]>[]`), but in the other direction, the same edge would be black to white (`[]>[]`). This value is always available for **Specified Edge** type. If the polarity is set to something other than any to any `[?]>[?]`, then it also becomes available for: **Dominant Edge**, **Nearest Nominal** and **Matching Edge**.

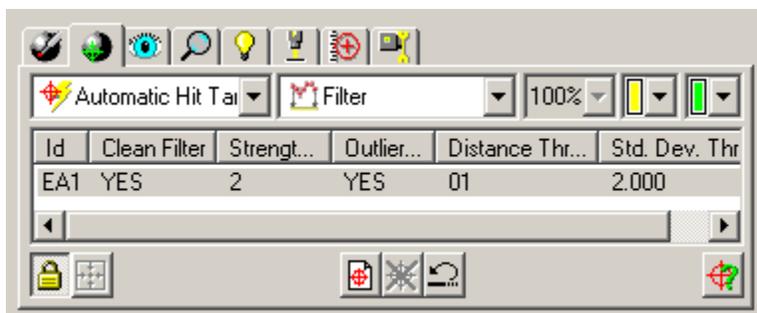
Specified Edge #: This value shows what edge to use for the **Specified Edge** detection method recently discussed. You can specify a value of 1-10.

SensiLight: This determines whether or not the machine should perform an auto-light adjustment prior to measurement, in an attempt to achieve optimal results. If set to NO, PC-DMIS will set lighting according to the learned percentage and the brightness will not be adjusted automatically. SensiLight is short for Sensible Lighting.

At execution time, if SensiLight is ON, a quick check will be made to ensure the illumination is not too dark or too light. If it is, then it will auto adjust the illumination to make it sensible – and give the operator the option of saving this new illumination setting so that the next time the feature is measured – it will use the new improved settings.

Illumination: This shows the illumination values to be used for this target. To change the illumination for a specific target, select the target in the **Hit Targets** tab, or on the **Live View** tab of the Graphics Display window, and change the illumination on the **Illumination** tab. For information on how to do this, see "[Probe Toolbox: Illumination tab](#)".

Automatic Hit Target - Filter Parameter Set



To change a value, right click on the current value for the desired target. If a value says N/A, then that parameter is "not applicable" to the current set.

ID: This displays a unique identifier for the item in the target list. This same ID is used on the ToolTip for the target in the **Live View** tab of the Graphics Display window.

Clean Filter: This determines whether or not to removes dust and small noise particles from the image prior to edge detection.

Strength (Clean Filter): Specifies the size (in pixels) of an object, below which is considered to be dirt or noise.

Outlier Filter: This determines whether or not outlier filtering is required for this target

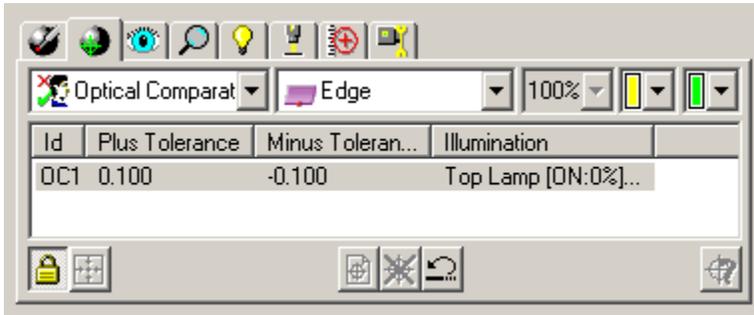
Distance Threshold (Outlier Filter): This specifies the distance in pixels that a point can be away from nominal before discarding it.

Std Dev. Threshold (Outlier Filter): The standard deviation of a point needs to be away from the other points to make it considered to be an outlier.

Optical Comparator Hit Target Parameters

The following parameters appear in the column headings of the target list in the **Hit Targets** tab when measuring features using the **Optical Comparator** measuring method (see "[Measuring Features Using a Vision probe](#)" for available measuring methods):

Edge Parameter Set

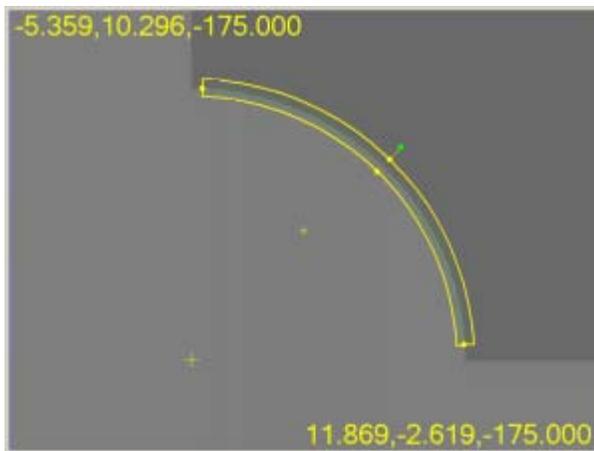


To change a value, right click on the current value for the desired target. If a value says N/A, then that parameter is “not applicable” to the current set.

ID: This displays a unique identifier for the item in the target list. This same ID is used on the ToolTip for the target in the **Live View** tab of the Graphics Display window.

Plus Tolerance: Provides the plus tolerance against which a target is visually compared during execution.

Plus Tolerance: Provides the minus tolerance against which a target is visually compared during execution.



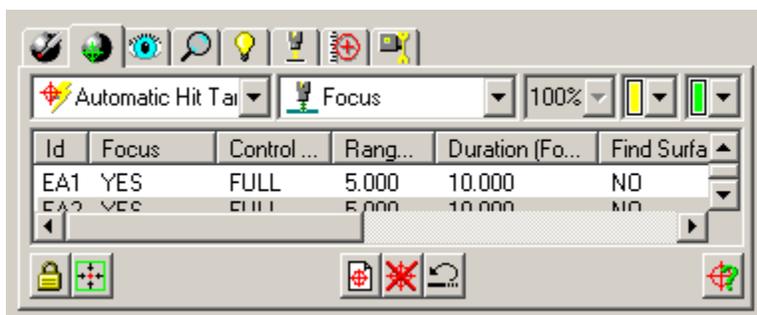
Example of Optical comparator with Plus and Minus tolerance bands

Illumination: This shows the illumination values to be used for this target. To change the illumination for a specific target, select the target in the **Hit Targets** tab, or on the **Live View** tab of the Graphics Display window, and change the illumination on the **Illumination** tab. For information on how to do this, see "[Probe Toolbox: Illumination tab](#)".Edge Parameter Set

Focus Parameter Set

See the "[Hit Target Focus Parameter Set](#)" target for information.

Hit Target Focus Parameter Set



To change a value, right click on the current value for the desired target. If a value says N/A, then that parameter is “not applicable” to the current set. Adjustments to the focus parameter set can be made for Automatic, Manual, Gage and Optical Comparator Hit targets.

ID: This displays a unique identifier for the item in the target list. This same ID is used on the ToolTip for the target in the **Live View** tab of the Graphics Display window.

Focus: This determines whether or not the target requires a pre-edge detection focus.

Note: When using the CAD++ configuration, an AUTO option in addition to the standard YES/NO will only do a focus if the image appears to require one.

Control (Focus): Choose either AUTO or FULL. AUTO mode will use the calibrated focus information to automatically set the range and duration parameters. FULL mode will allow the user to set the range and duration manually.

Range (Focus): This displays the range from the camera to the part. It specifies the distance (in the current units) over which to perform the focus. Using this value the machine searches in the Z direction for the best focal position.

Duration (Focus): This displays the number of seconds to spend searching for the best focal position.

Important: If your Range and Duration combination results are too fast when you do a focus, you will see a warning message overlaid on the **Live View**.

Find Surface (Focus): This displays a YES or NO. Setting this option to YES will cause PC-DMIS to perform a second, slightly slower, pass-to attempt to improve the accuracy of the focal position. The second pass is optimized based on the image data of the first pass and the Numeric Aperture of the current lens. This is useful when measuring a surface that varies in height, requiring a large range to over which to focus.

Surface Variance (Focus): With the **Find Surface** option set to YES, this value is used to determine the distance that will be initially scanned at a fast speed to find where the part is, and then the normal focus will be done around this area. Once the focal position is found, PC-DMIS will do a quick focus scan in that region. This is useful for parts where variability means the focus position can vary a lot.

Assist (Focus): This is used with systems with a laser or Projected Grid device. These devices can be switched to "ON" to assist with the focus as on certain surfaces by improving the contrast. Set this options to "GRID" to enable this functionality.

Illumination-Adjust: This determines whether or not the machine should perform an auto-light adjust prior to focus, in an attempt to achieve optimal focus result. If set to **NO**, PC-DMIS will set lighting according to the learned percentage and the brightness will not be adjusted automatically.

Measure At Centre: If selected, will do the measurement at the center of the Field Of View for improved accuracy.

Using the Shortcut Menu

From the **Live View**, if you right click on the target, a shortcut menu appears. This menu allows you to insert and delete segments or targets, reset hit targets, change the point density, test the edge detection of the currently selected target(s) and change hit target types.

Similarly clicking on the **Live View** tab, but not on a target will provide a menu to adjust magnification, capture the screen or open the **Live Image Setup** dialog box.

See the "[Using Shortcut Menus](#)" topic in the "[Using the Graphics Display Window in PC-DMIS Vision](#)" for more information.

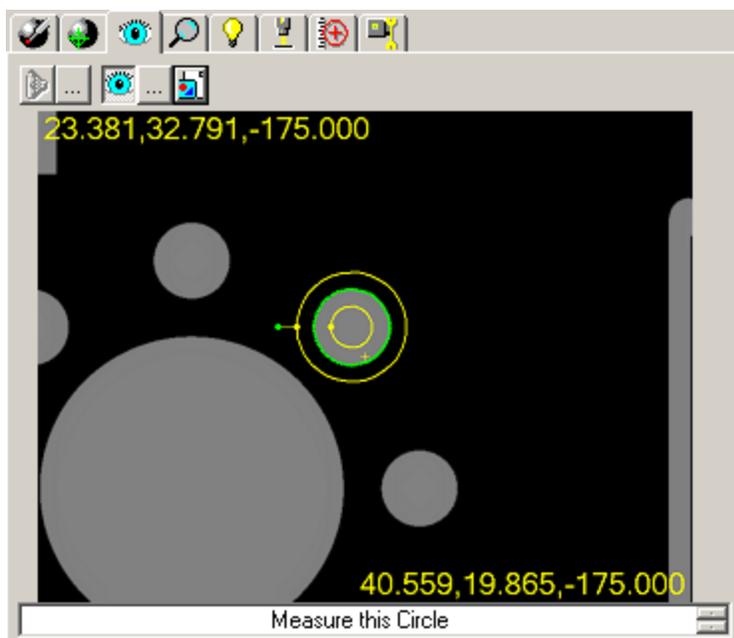
Hit Targets Controls

The controls shown in the **Hit Targets** tab in the **Probe Toolbox** let you edit, test, and modify the targets used to measure the feature. The following table describes what these controls do:

Define Target Button	Description
	The Coverage drop-down box allows you to quickly create target sections in order to only measure a sub set of a feature. Limiting coverage can decrease feature execution time. For example, a large feature measured at high magnification may require lots of camera positions to get all the edge points. Selecting "10%" coverage would only measure edge points at certain locations around the feature – amounting to 10% of it's form.
	The Hit Target Color drop-down box specifies that color that will be applied to the feature hit targets. This allows you to differentiate between features, or to ensure visibility on different types of surface.
	The Nominal Color drop-down box specifies that color that will be applied to the feature nominal line. This allows you to differentiate between features, or to ensure visibility on different types of surface.
	The Lock Hit Targets to Part button secures the size, position or rotation of the target.
	The Center Hit Target button centers the target or FOV. What actually moves depends on the status of the Lock Hit Targets to Part button. If first select the Lock Hit Targets to Part button, and then select the Center Hit Targets button, PC-DMIS Vision moves the current FOV to the target. This is only available on DCC Motion machines. If you deselect the Lock Hit Targets to Part button, and

	select the Center Hit Targets button, the target moves to the current FOV.
	The Insert New Hit Targets button inserts a new target area. You can then set up different parameters for this specific area of the feature.
	The Delete Hit Targets button will let you delete a previously inserted target from the feature.
	The Reset Hit Target(s) button deletes all of the previously inserted target areas from the feature, leaving the single default target.
	The Test Hit Targets button tests the automatic Target Edge detection for the currently selected target(s). PC-DMIS Vision displays any detected points in the Live View tab of the Graphics Display window.

Probe Toolbox: Feature Locator tab



Probe Toolbox—Feature Locator tab

The **Feature Locator** tab allows you give assistance to the operator by instructions for the current feature. Assistance is given by providing one or more of the following prompts during feature execution:

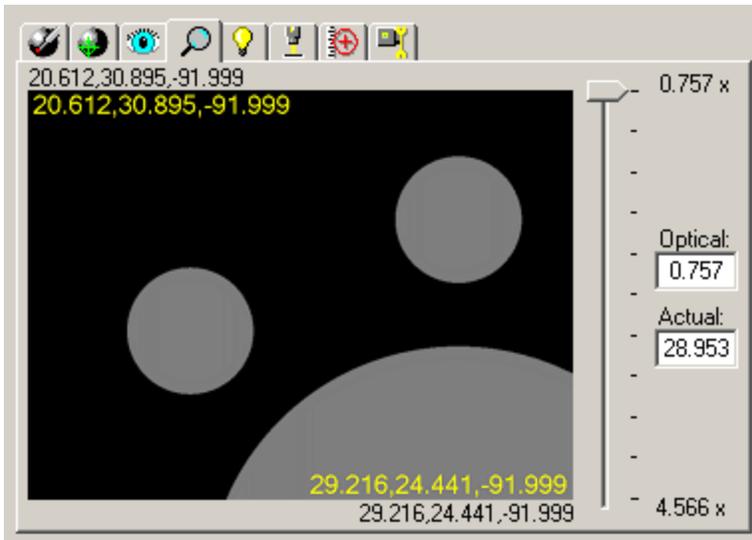
- A Screen capture bitmap, showing the feature's location.
- An Audio prompt, providing audible instructions via a prerecorded .wav file.
- A Text prompt, providing written instructions.

To provide Feature Locator information:

1. Click the  button next to the  (speaker) button to browse to the .wav file to associate with this auto feature. The speaker button must be selected for the audio file to play.
2. Click the **Feature Locator Bitmap File** toggle button  to toggle the display of the associated bitmap.

3. Click the  button next to the  (Feature Locator Capture BMP) button to browse to the .bmp file to associate with this auto feature. The bitmap button must be selected for the bitmap to be displayed on the **Feature Locator** tab.
4. Rather than browsing for a bitmap image, you can click the  button to capture an image from the current Cad View or Live View (whichever is active). This file will be indexed and saved in the PC-DMIS install directory. For example, a part program named Vision.prg would yield bitmaps named Vision0.bmp, Vision1.bmp, Vision2.bmp, etc.
5. Type a message to be displayed as a caption in the text box. For example, "Measure Circle 1" will be displayed on this tab with subsequent feature execution.

Probe Toolbox: Magnification tab



Probe Toolbox - Magnification tab

The **Magnification** tab lets you change the current FOV camera magnification. It also provides a way for you to simultaneously view both the **Cad View** and **Live View** of the Graphics Display window. For information on using these tabs in the Graphics Display window, see "[Using the Graphics Display Window in PC-DMIS Vision](#)".

Two values for magnification are displayed – Optical and Actual.

Optical is the magnification size on the CCD array of the camera. This will not change when the Live View display is resized.

Actual is the magnification size on the Live View window. This will increase and decrease as the Live View window is made bigger and smaller.

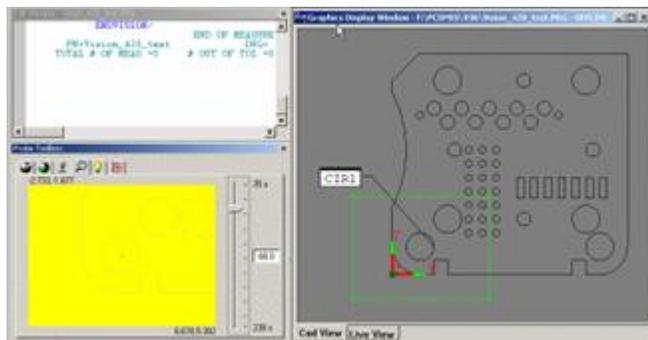
When the **Magnification** tab of the **Probe Toolbox** is open, the **Live View** displays:

FOV=: This overlay value displays the size of the FOV in the part program units of measurement. This only appears on the screen when you have the **Magnification** tab selected from the **Probe Toolbox**.

[0]=: This overlay number reflects your current level of magnification (pixel size). As you zoom in closer to the part this number decreases in size. The closer the number approaches zero, the closer your machine approaches its maximum magnification. This only appears on the screen when you have the **Magnification** tab selected from the **Probe Toolbox**.

Simultaneously Viewing the Cad View and the Live View

- If you select **Cad View**, the **Magnification** tab of the **Probe Toolbox** contains a mini version of the **Live View**.
- If you select **Live View**, the **Magnification** tab of **Probe Toolbox** contains a mini version of the **Cad View**.



Example of the Live View displayed in the Probe Toolbox (left) and the Cad View displayed in the Graphics Display window (right)

Changing the Magnification of the Part Image

On a machine with a DCC Zoom, these are the several ways you can alter the magnification of the part image:

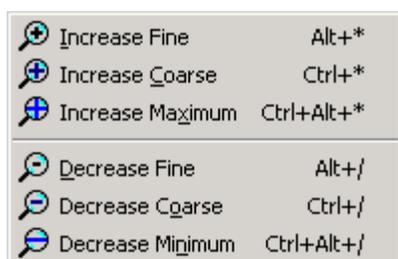
Use the Magnification tab: You can do this by either moving the slider bar up or down, or by typing a value in the box next to the slider. By default, the software uses the lowest magnification to get the largest FOV.

Drag the Green Handles of the FOV: Use the FOV handles in the **CAD View** to resize the rectangle. Grab any corner of the green box and drag the outline to its desired location. On a DCC stage, the green boxes on the edges (not the corners) allow you to move the location of the FOV, not change its size.

Zoom in Live View: In **Live View** hold down the right and left mouse buttons simultaneously. Drag the cursor across the view, creating an outline of a box. When you release the mouse buttons, the field of view magnifies in the requested location.

Use the Magnification menu: Select menu items from the **Operation | Magnification** sub-menu or....

...**Use the Shortcut Menu in Live View:** You can also right click within the **Live View** tab to access the **Magnification** sub-menu. (Be sure that your cursor isn't over the target while right clicking.)

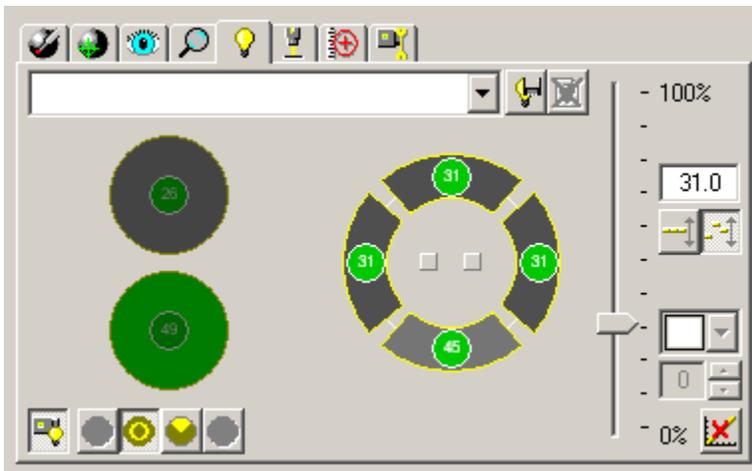


Use Shortcut Keys: Use these shortcut keys to alter the magnification in either **Cad View** or **Live View**:

Magnify Action	Shortcut Keys
Increase Fine	ALT + *
Increase Coarse	CTRL + *
Increase Maximum	CTRL + ALT + *
Decrease Fine	ALT + /
Decrease Coarse	CTRL + /
Decrease Minimum	CTRL + ALT + /

The numbers displayed next to the top left and bottom right corners of the image in the **Field of View** box of the **Probe Toolbox**, indicate the X and Y coordinate values for the FOV. It also displays the current magnification size in pixels.

Probe Toolbox: Illumination tab



Probe Toolbox—Illumination tab

The **Illumination** tab allows you to select which lamps are turned on or off. It also indicates the lamps current light intensity by changing illumination values. The type and number of lamps displayed depends on the machine.

A **Top Light** is an on axis lamp that is directed through the optical path. It can provide better edge and feature visibility on some parts than other light sources that illuminate from above because the light source isn't as diffused. Since it shines parallel to the optics, it's also easier to see into holes.

A **Bottom Light** is a lamp that shines from under the stage. It creates a silhouette of the part to be viewed.

A **Ring Light** is a multi-bulb lamp that illuminates from above. This lamp is normally composed of an array of LED lights arranged in concentric rings or circles. You can usually program the ring light to illuminate a segment or 'pie wedge' of bulbs from one direction. You can control the direction and angle of illumination by illuminating just one of the rings of LEDs, a segment of one of the rings, or individual bulbs.

This tab also allows you to create and store these illumination values in sets termed *Quick Sets*. Once you create a Quick Set you can quickly and easily recall it to set the lamps on a machine to a specific state (for example, bottom light only, top light only and so forth). Quick Sets can be recalled at any time by selecting the set name from the **Quick Set** list.

You can easily save your own Quick Sets by pressing the **Save** button, or delete them by clicking the **Delete** button.

Important: In order for lamps to show up on the **Illumination** tab, make sure you have the lamps selected and properly setup within the **Machine Interface Setup** dialog box on the **Illumination** Tab. See "[Machine Options: Illumination tab](#)".

You can perform the following procedures using this **Illumination** tab:

- [Selecting a Pre-Defined Illumination Quick Set](#)
- [Saving an Illumination Quick Set](#)
- [Deleting an Illumination Quick Set](#)
- [Changing Illumination Values](#)
- [Illumination Calibration Override](#)

A Note on Lamps and Contact Probes

By default, if you switch from a vision probe to a contact probe, the lamps will remain turned on. You can control this default behavior by using the `IlluminationOffForContactProbe` registry entry in the **VisionParameters** section of the PC-DMIS Settings Editor. Setting this entry to TRUE will turn off the lamps whenever the program is using a contact probe.

Selecting a Pre-Defined Illumination Quick Set:

To choose a pre-defined illumination Quick Set, select it from the Quick Set list.

- If you are running in online mode, your system's lamps will change to reflect the selected Quick Set.
- If the illumination changes since selecting a Quick Set, the Quick Set list will show an "*" next to the Quick Set name

Saving an Illumination Quick Set

To create a new illumination quick set:

1. Click the **Save Illumination Quick Set** button . The software displays a **Save Illumination Quick Set** input box:



Save Illumination Quick Set input box

2. Type a name for the illumination Quick Set. The entire name must fit in the box.
3. Click the **OK** button and a new set is created and is automatically selected in the Illumination page.

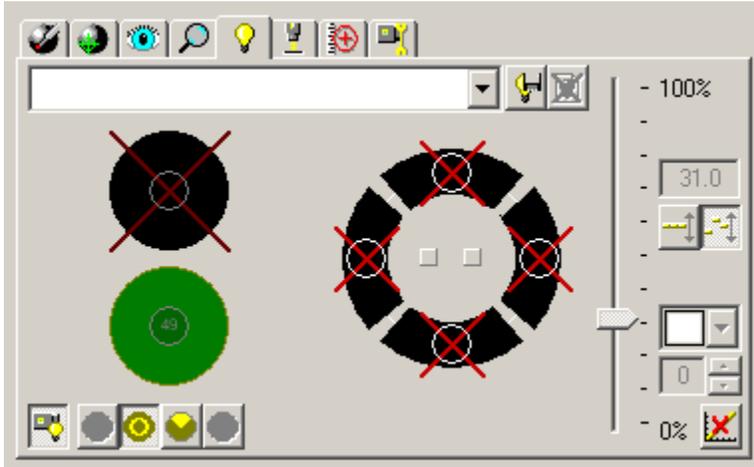
Deleting an Illumination Quick Set

To delete an illumination set:

1. Click the **Delete Illumination Quick Set** button . The software displays a message asking if it's OK to delete the illumination set.
2. Click **Yes**. The software deletes the illumination Quick Set permanently from your system.

Changing Illumination Values

At any one time, only one of the lamps can have its settings changed. This is referred to as the "active" lamp, and is the lamp that is not drawn in a "Dimmed" state.



Illumination tab showing active lamp (bottom light)

In the above example, the bottom light (lower left) is active, and the top light and ring light are "OFF".

Changing the Active Lamp's Values:

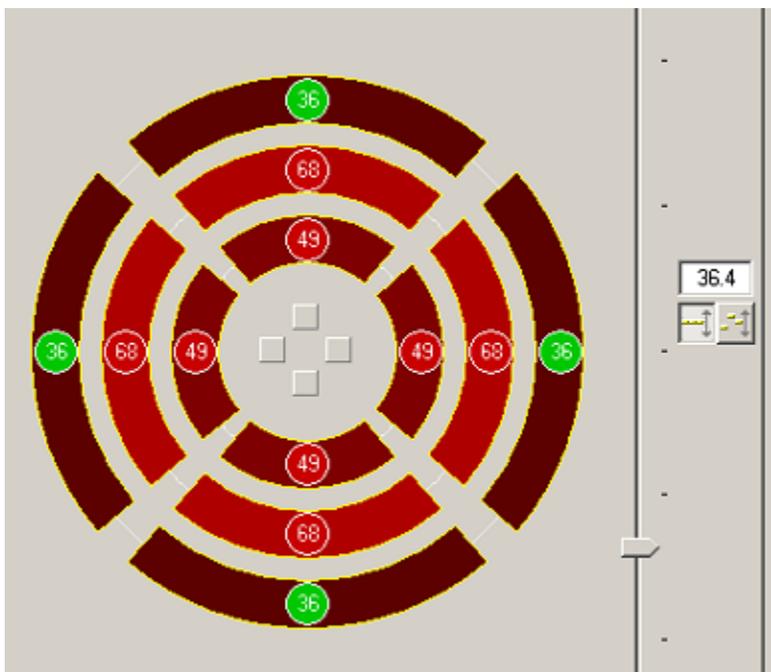
1. Click on the toolbox near the needed lamp, or click on the intensity circle within the lamp. If you click on the bulb itself (not including the intensity circle) it will select the lamp but also toggle the bulb state on/off.
2. Move the slider bar or type a percentage value in the % box. Only the active lamp will be affected.
3. Adjust the Lamp Angle  to physically alter the angle of lamps that support this capability.
4. Change the Lamp Color  by selecting the LED color of lamps that support multiple color LEDs.

Caution: For new users there may be a tendency to "over light". Excessive lighting can cause refraction errors when locating the true edge. It is usually safer to error on the side of "less light".

Ring Light Illumination Values

The process for editing the Ring Light Illumination values is more involved than a Top or Bottom light. Additional controls are provided for Ring lights.

Changing the Ring Light Intensity – You can change the intensity of any lamp by selecting the needed Rings, Sectors, Bulbs or entire ring lamp depending on the "[Ring Light Control Modes](#)". Moving the **slider bar** or typing a percentage value in the **% box** will change the intensity of the active segments.



Absolute and Relative Controls – For Ring lamps, it is also possible to choose whether an increase or decrease of the bulb intensity should keep their relative differences (RELATIVE), or should set them all to the same value (ABSOLUTE).

- With the **Absolute** button  selected, all of the active LEDs get the same intensity specified.
- With the **Relative** button  selected, all of the active LEDs keep their relative differences, but all increase or decrease by a specified amount. For example, if the outer ring has intensity 30%, the middle ring 40%, and the inner ring 50% then sliding the slider up by 10% moves them to 40%, 50% and 60% respectively.

Switching a LED On or Off – You can easily switch a lamp on or off by clicking on the specific LEDs graphic in the tab (though not inside the Intensity circle). A red cross through a bulb indicates that the light is off. A highlighted and shaded bulb indicates that the light is on. The number of LEDs affected on a ring lamp depends on the current "[Control Mode](#)".

Turning on the Live View Overlay  – If you are using ring lights, you can place a [graphical overlay](#) of the lamp to appear in the **Live View** tab of the Graphics Display window. This overlay allows you to set illumination values and switch bulbs on or off directly by clicking on controls in the overlay on the Graphics Display window. You can also control the display of this overlay by using the [Ring Lamp icon](#) in the **Live View** tab.

Click the **Apply** button to actually change the illumination values.

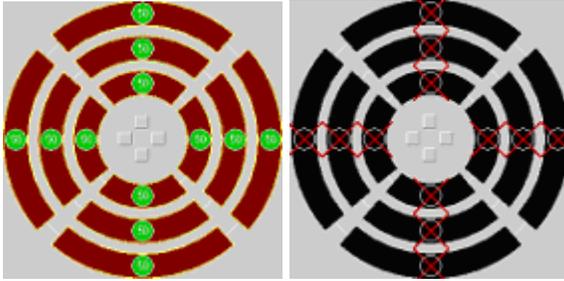
Ring Light Control Modes

Ring lights can be controlled in up to four ways, to make setting the needed lamp's state as quickly as possible.

Change Lamp 

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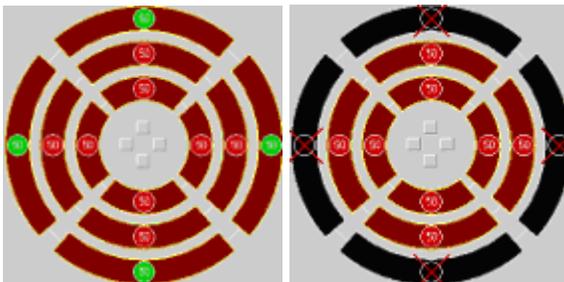
Clicking the **Change Lamp** button will allow you to treat a Ring Lamp as a single bulb. This allows you to quickly set all the separate LEDs to *On* or *Off*. You can also change the intensity of *ALL* the LEDs to a specific value. In the example below, one of the LEDs was clicked and they all turned off.



Change Ring 

Clicking the **Change Ring** button will allow you to treat a ring lamp as a series of rings. This allows you to quickly set all the LEDs in one or more rings to *On* or *Off*. You can also change the intensity for one or more rings to a specific value. To select more than one ring, click the first ring then hold the CTRL button while selecting additional rings. Selecting a different ring *without* holding CTRL will deselect the previously selected ring.

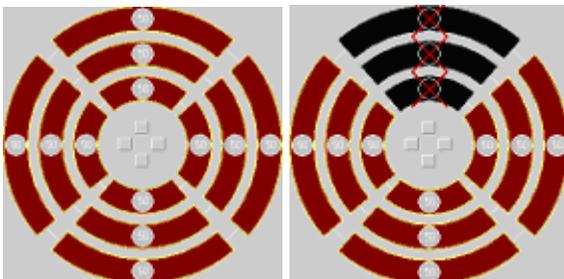
In the example below, the outer ring is selected (shown as green intensity circle) and the other two rings are not.



Note: Clicking on an LED (anywhere except in the intensity circle) will turn that LED, and the others in that ring, to *Off* (as shown in the right hand picture above after the top LED was clicked).

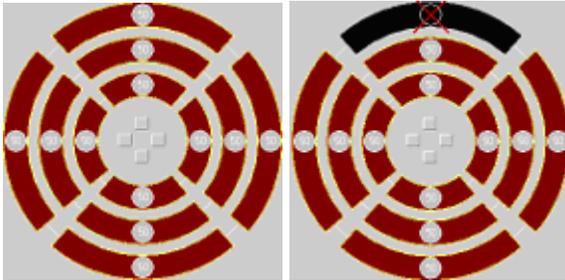
Change Sector 

Clicking the **Change Sector** button will allow you to treat a ring lamp as a series of sectors. This allows you to quickly set all the LEDs in one or more sectors to *On* or *Off*. You can also change the intensity for one or more sectors to a specific value. In the example below, the intensity can not be set per sector on this lamp, so the intensity circles are grayed out. However, you can set the bulb state for all LEDs in a sector (as shown in the right hand picture after the top LED was clicked)



Change Bulb 

Clicking the Change Bulb button will allow you to treat a ring lamp as a series of separate LEDs. This allows you to set one or more of the LEDs to *On* or *Off*. You may also change the intensity of one or more of the LEDs to a specific value. Again, in the example below, this lamp can't cope with changing intensity other than per bulb, so the intensity rings are greyed out. However, you can switch a specific LED bulb on/off by clicking on it.

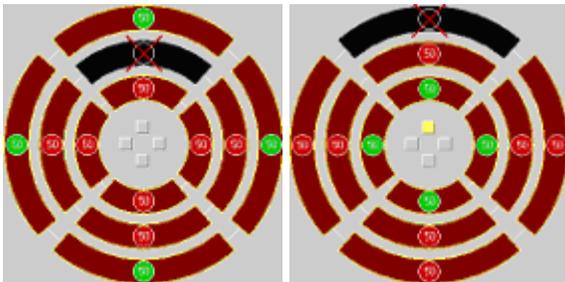


Note: The availability of these options is dependant on what the hardware supports.

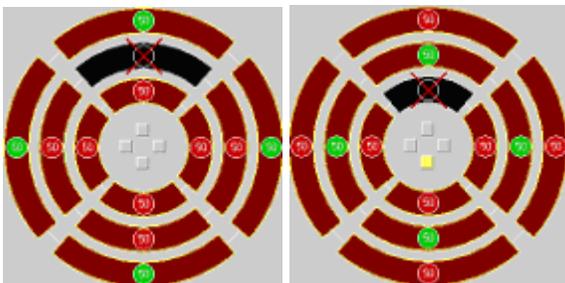
Positioning Ring Light Segments

In addition to the four control modes, there are four other buttons associated for ring lights that allow you to quickly “re-orientate” the lamp in relation to the part.

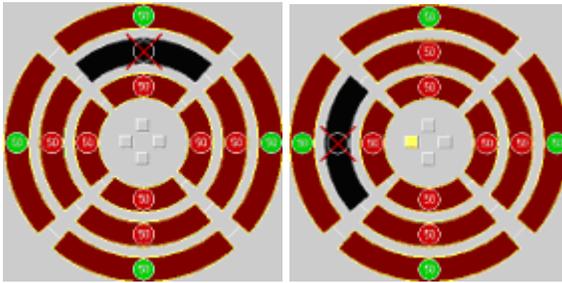
Clicking the **Up** button allows bulb positions to be shifted outwards, as seen below.



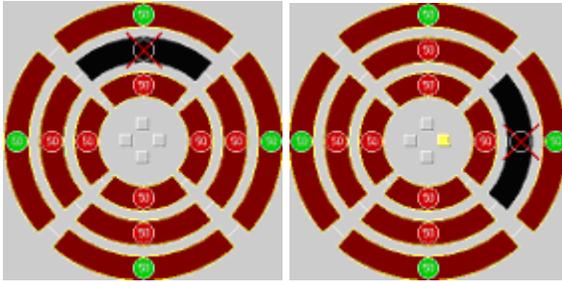
Clicking the **Down** button allows bulb positions to be shifted outwards, as seen below



Clicking the **Left** button allows bulb positions to be shifted counterclockwise, as seen below



Clicking the **Right** button allows bulb positions to be shifted clockwise, as seen below

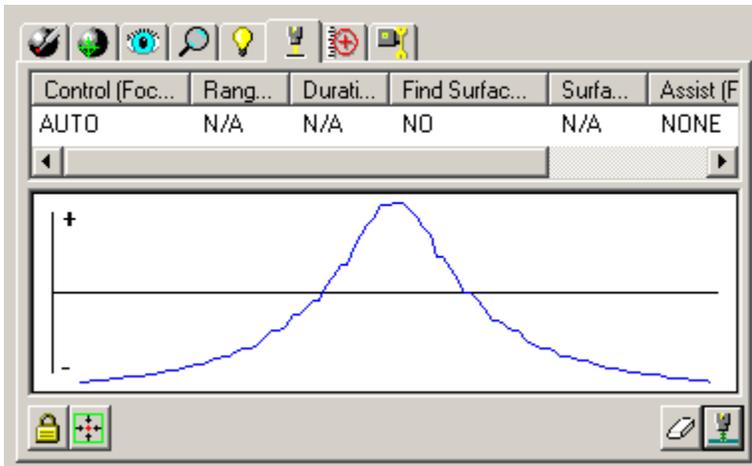


Illumination Calibration Override

The **Illumination Calibration Override** button  is used to temporarily switch off the Illumination Calibration. This can be used for features where it is difficult to get enough intensity and you want to force the machine intensity to the maximum.

When the **Illumination** tab is active, the **Live View** will show the intensity value (between 0 and 255) for the pixel currently being pointed at by the mouse cursor.

Probe Toolbox: Focus tab



Probe Toolbox—Focus tab

The **Focus** tab allows you perform an immediate focus on the part within the rectangular region defined in the Graphics Display window. The software doesn't generate any part program commands using this option.

To perform the focus, use the **Live View** tab in the window to move or resize the rectangular target over the desired portion of the part, and select one of the **Focus** buttons. The machine focuses on the specified area of the target, displays the optimum focus position as an overlay on the **Live View** tab, and displays the focus curve in a graph.

If dual pass is selected, the initial pass is first shown in the graph, then this graph is replaced by the second pass graph.

Important: To get the best focus accuracy and repeatability, focus should be performed at the highest magnification available.

Note: Specific feature focus parameters are set within the **Hit Targets** tab, by selecting the Focus Parameter set. See "Probe Toolbox: Hit Targets tab".

Warnings will appear on the **Live View** to indicate the focus success and give feedback. If a warning prefix is given, the focus value was calculated but the accuracy could be improved by taking the warning text into account. It warns if the speed is too fast, if the focus rectangle is too small, or mag not high.

If an error prefix is given, the focus calculation failed, and so it just restored to the previous focal position.

Focus Parameters

For a machine supporting DCC Motion, the following parameters appear in the column headings of the **Focus** tab when focusing a part:

Control (Focus): AUTO control will perform a focus operation based upon the previously determined values collected during the focus calibration of the "[Optics Calibration](#)" procedure. PC-DMIS will automatically set the range and speed to be optimal for your vision machine. FULL control allows you to manually set the range and duration values.

Range (Focus): This indicates a focal range (in the current units) within which to perform the auto focus. The search for the best focal position within that range takes place (usually in the Z-axis). The available range values vary based on each system's specific parameters. You can edit this parameter by double clicking and entering a different value.

Duration (Focus): This displays the number of seconds to spend searching for the best focal position for auto and manual focus. You can edit this parameter by double clicking and entering a different value.

Note: As a general rule of thumb you should aim to make your duration at least twice as large as the range.

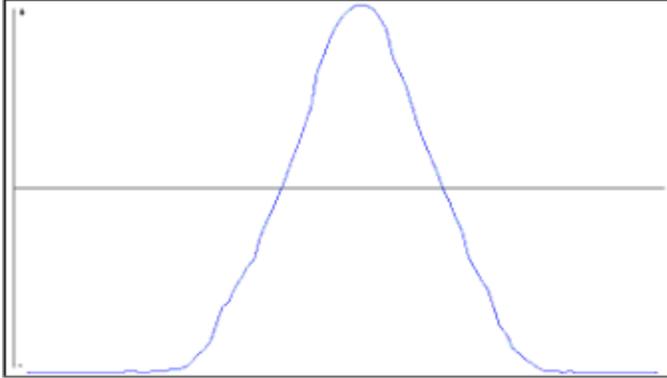
Find Surface (Focus): This displays a YES or NO. Setting this option to YES will cause PC-DMIS to perform a second, slightly slower, pass-to attempt to improve the accuracy of the focal position. The second pass is optimized based on the image data of the first pass and the Numeric Aperture of the current lens. This is useful when measuring a surface that varies in height, requiring a large range to over which to focus.

Surface Variance (Focus): With the **Find Surface** option set to YES, this value is used to determine the distance that will be initially scanned at a fast speed to find where the part is, and then the normal focus will be done around this area. Once the focal position is found, PC-DMIS will do a quick focus scan in that region. This is useful for parts where variability means the focus position can vary a lot.

Assist (Focus): This is used with systems with a laser or Projected Grid device. These devices can be switched to "ON" to assist with the focus as on certain surfaces by improving the contrast. Set this options to "GRID" to enable this functionality.

SensiLight (Focus): This determines whether or not the machine should perform an auto-light adjust prior to focus, in an attempt to achieve optimal focus result. If set to **NO**, PC-DMIS will set lighting according to the learned percentage and the brightness will not be adjusted automatically. SensiLight is short for Sensible Lighting.

Focus Graph



Auto focus will graph the results of the focus by showing the focus score (Y) against time (X). A sharper focus will have a higher focus score.

Auto focus should result in a rounded curve (an inverted "U"). Use the Manual Focus option when you have no DCC to automatically drive the Z axis. If the graph shows a sharp increase in focus score, try reducing the speed of movement. Also, you need to ensure that your range of travel is sufficient so you see the base of the curve on both sides.

If the graph is not smooth, ensure the illumination is sufficient so that surface texture is evident.

Auto Focus on a Manual Machine:

1. Roughly find the in-focus position, and then move out of focus.
2. Click the **Auto Focus** button to start the graph and record the focus score.
3. Move through the focus position by moving a single axis (usually Z).
4. Continue moving the Z axis until you have moved through the focus position, and the graph is a well-proportioned, gradual, inverted U shape.
5. When the specified duration has been reached, the detected focus position will be displayed in the live image view.
6. A message is displayed to accept the focus, or retry.
7. Click the Reset Focus Graph button to clear the graph data and start this process over if there is a problem.

Note: With focus on a manual machine, you need to move the Z stage at a slow and steady speed. You will be warned if you move too fast, or the distance moved was too long or too short.

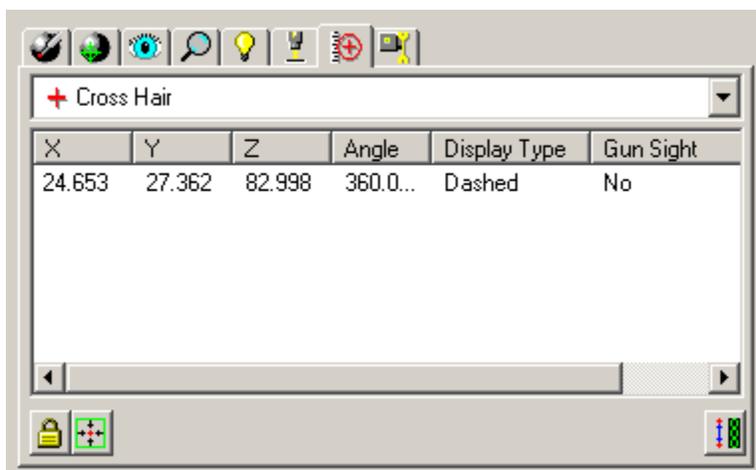
On some machines, you may find you get a better focus result by specifying a longer duration and moving forward and backward through the focus position 3 or 4 times to get a series of U shapes on the graph.

Focus Buttons

PC-DMIS Vision provides a number of tools to help you focus your optical hardware:

Focus Icon	Description
	The Lock Focus to Part button secures the size, position, or rotation of the target to the part.
	<p>The Center Target button centers the target or FOV. What actually moves depends on the status of the Lock Target to Part button.</p> <p>If you click Center Target with the Lock Target to Part button already <i>selected</i>, PC-DMIS Vision moves the current FOV to the target. This is only available on DCC Motion machines.</p> <p>If you click Center Target with the Lock Target to Part button <i>deselected</i>, the target moves to the current FOV.</p>
	The Reset Focus Graph button will clear all data in the Focus Graph.
	The Auto Focus button actually executes the focus using the set parameters, moving the DCC stage and then returning to the focus position. On a manual machine, the operator manually moves the machine for the specified duration. When the duration is met, the user has the option of accepting the focus result or retrying.

Probe Toolbox: Gage tab



Probe Toolbox—Gage tab

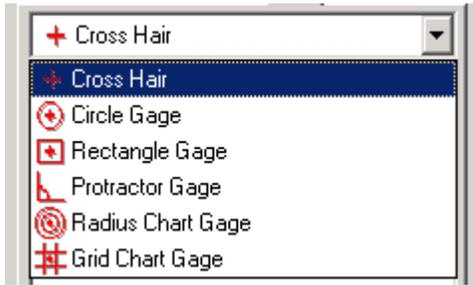
The **Gage** tab provides you with a variety of tools called "gages" that allow you to make quick optical comparisons over features that you are measuring without having to create a part program. Gages can be used where edges are indiscriminate, or difficult to ascertain automatically.

For step by step examples of working with each gage type see "[Using Vision Gages](#)".

The gage provides nominal information that you can type into dialog boxes to create the desired nominal feature. You can also capture the information to clipboard or BMP file to paste into a report.

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Sometimes called "hand gages", these tools are geometric shapes that appear on your screen. You can manipulate these shapes by rotating, sizing, and positioning them on your part with your mouse to find out nominal information about a particular feature, such as position, diameter, angle and so forth.



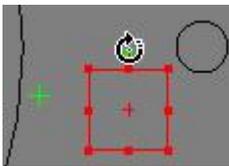
Available Gages

There is no automatic image processing associated with these gages, they are simply tools that you visually adjust to fit a feature on the image.

Rotating, Sizing, or Moving Gages

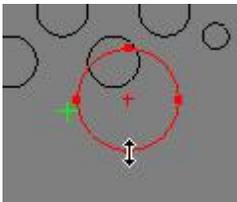
You can easily rotate, size, or move the gage on the graphical representation of the part. Once you correctly position the gage over a feature, sizing it to fit the shape of the feature, the software dynamically updates information on the gage in the **Probe Toolbox** as well as the overlay in your **Live View** tab. You can then use this information as the nominal values of the feature.

Rotate a Gage: Position the mouse over the green dot (some gages don't have a green dot and can't be rotated). The mouse cursor changes to a rounded arrow. Simply click and drag to perform a 2D rotation of the part in either the left or right direction.



Sample rectangular gage being rotated

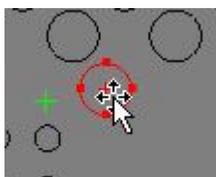
Laterally Sizing Gages: Position the mouse over a red dot until the mouse cursor changes to a two-way arrow. Click and drag the gage to laterally size the gage either larger or smaller.



Sample circular gage being sized

Note: The **Radius Chart** gage and the **Grid Chart** gage don't have a red dot. To size these gages, simply select a part of the gage and drag it.

Moving Gages: Position the mouse over the red crosshair at the middle of the gage until the mouse cursor changes to a four-way arrow. Click and drag the mouse to move the gage to a new location. You can also simply click anywhere on the part and PC-DMIS Vision will move the gage to where you clicked.



Sample circular gage being moved

Supported Gage Types and Gage Parameters

PC-DMIS Vision supports a variety of gage types. Select a gage type from the **Gage Type** list. PC-DMIS Vision places parameters for the gage inside the **Probe Toolbox**. Double click these fields to edit them if you need a gage with specific dimensions.

Note: Selecting and editing gages is strictly visual; the software doesn't insert any commands into the part program.

The following table describes each gage type and then lists the parameters used by that gage:

Icon	Description	Available Parameters
	Cross Hair Gage. Use this to find a point.	Angle: The angle by which you rotate the gage. Display Type: Is the cross hair drawn in solid, dashed, or dotted lines. Gun Sight: Draws a circle around the cross hair to help locating. Tolerance: Allows tolerance lines to be drawn on the cross hair at a specified distance.
	Circle Gage. Use this to find a circle's diameter and center.	Diameter: Diameter of the circle gage
	Rectangle Gage. Use this to find a rectangle's height, width, and center.	Angle: The angle by which you rotate the gage. Width: Determines the width of the Rectangle Gage. Height: Determines the height of the Rectangle Gage.
	Protractor Gage. Use this for finding angles.	Included Angle: Determines the angle between the two lines making up this gage.
	Radius Chart Gage. Use this to find the relative change in diameter between concentric circles and the center.	Spacer: Defines the relative change in diameter between circles.
	Grid Chart Gage. Use this to find the relative distance between horizontal and vertical lines.	Grid: Defines the relative change in distance from one grid position to another.

Note: All gage types use the XYZ values to determine the gage's center relative to the Field of View center.

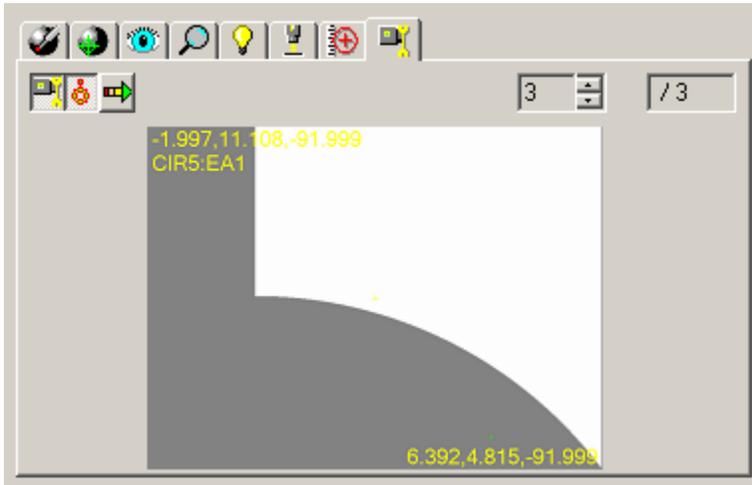
Gage buttons

The following **Gage** buttons are available while using gages to do optical comparisons.

Gage Button	Description
	The Lock Gage to Part Button secures the size, position or rotation of the gage onto graphical representation of the part. Until you click this button again, you can't move or edit the gage.

	<p>The Center Gage button centers the target or FOV. What actually moves depends on the status of the Lock Gage to Part button.</p> <p>If you click Center Gage with the Lock Gage to Part button already <i>selected</i>, PC-DMIS Vision moves the current FOV to the target. This is only available on DCC Motion machines.</p> <p>If you click Center Gage with the Lock Gage to Part button <i>deselected</i>, the target moves to the current FOV.</p>
	<p>The Zero Readouts DXYZ button resets the Probe Readout window's DXYZ value to the position of the current gage. This allows you to measure distances using gages: position the gage on one feature, click this button to zero the readouts, move the gage to another feature and then examine the DXYZ values on the Probe Readout window. This is the distance between the two features. See the "Using the Probe Readout window with Vision probes".</p>

Probe Toolbox: Vision Diagnostics Tab



Probe Toolbox - Diagnostics Tab

The **Vision Diagnostics** tab provides a method for diagnosing problems where edge detection has failed. Diagnostics simply collects bitmap images and current feature parameters that can be exported from PC-DMIS to be sent to support personnel.

To use the Diagnostics tab:

1. Click the **Diagnostics Toggle**  button so the button is depressed to allow for the collection of bitmap images during edge detection execution for the associated feature.
2. Execute the feature by clicking **Test** or during normal execution of the part program. Bitmap images are collected of the Live View for each feature target.
3. If the feature has multiple targets, click the up and down  arrows to review the images that have been captured.
4. Select the **Show Overlays**  button to include the overlay information with each of the bitmap images. If you have selected this option, images will be created with and without overlay information.

5. Click the **Export Feature Diagnostics**  button to create bitmap images and a descriptive text file in the root PC-DMIS install directory. The bitmap images will be named using the following naming convention: *<part program name>_<feature ID>_<image number>_of_<total number of feature images>_<O or no O>.bmp*. For example: **Vision1_CIR5_1_of_3_O.BMP**. Files with an "O" at the end the file name include overlay information. The text file is exported as: *<part program name>_<feature ID>.txt*. For example: **Vision1_CIR5_F.TXT**.

Using Vision Gages

The gage functionality of PC-DMIS Vision provides a simple method to compare actual part geometry to a gage. For example, overlay a gage (whose diameter is set to exactly 1.0mm) to an actual part hole to compare its size.

Considerable functionality is available with gages. This chapter is provided to give an example of the usage of each type of gage. For detailed information in the available buttons and options, see "[Probe Toolbox: Gage tab](#)".

The six available gages are:

-  [Cross Hair Gage](#)
-  [Circle Gage](#)
-  [Rectangle Gage](#)
-  [Protractor Gage](#)
-  [Radius Chart Gage](#)
-  [Grid Chart Gage](#)

 The selected gage can be centered within the FOV at any time by pressing **Center Gage**  from the **Gage** tab of the **Probe Toolbox**.

For each gage example the HexagonDemoPart.igs demo part is used. See "[Importing the Vision Demo Part](#)".

Using the Probe Readout with Gages

Understanding the basic functionality of the **Probe Readout** is essential for use with gages since measurement results are displayed in the **Probe Readout**.

You can open the Probe Readout by doing one of the following:

- Type the hotkey **<CTRL> + W**
- From the **Position Probe** tab of the **Probe Toolbox** dialog box, select **Probe Readouts**. 
- Select the **View | Other Windows | Probe Readouts** menu item.

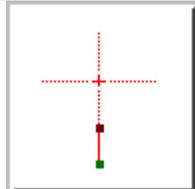
Understanding the Probe Readout Window

 <p>The screenshot shows a window titled "Probe Readout" with the following data:</p> <table border="1"> <tr><td>X</td><td>5.579</td></tr> <tr><td>Y</td><td>5.867</td></tr> <tr><td>Z</td><td>-92.000</td></tr> <tr><td>VX</td><td>6.174</td></tr> <tr><td>VY</td><td>6.603</td></tr> <tr><td>VZ</td><td>-92.000</td></tr> <tr><td>DX</td><td>0.000</td></tr> <tr><td>DY</td><td>0.000</td></tr> <tr><td>DZ</td><td>0.000</td></tr> <tr><td>Mag</td><td>0.6x</td></tr> <tr><td>Hits</td><td>0</td></tr> </table>	X	5.579	Y	5.867	Z	-92.000	VX	6.174	VY	6.603	VZ	-92.000	DX	0.000	DY	0.000	DZ	0.000	Mag	0.6x	Hits	0	<p>XYZ is the location of the FOV center in relation to the current alignment origin.</p> <p>VX, VY and VZ are the location of the gage to the current alignment origin. If the gage is centered within the FOV, then the XYZ and VX, VY, VZ values will be the same. Use the left mouse button to independently drag the gage to the needed position.</p> <p>DX, DY and DZ are used with gages to display relative distances. These values are independent from the currently alignment origin and can be independently zeroed using the Zero Readouts DXYZ button. </p>
X	5.579																						
Y	5.867																						
Z	-92.000																						
VX	6.174																						
VY	6.603																						
VZ	-92.000																						
DX	0.000																						
DY	0.000																						
DZ	0.000																						
Mag	0.6x																						
Hits	0																						

For the gage examples given in this chapter modify the **Probe Readout** as follows:

1. Right-click in the **Probe Readout** window and click **Setup** from the popup menu.
2. Check the following options:
 - Probe Position
 - Show current probe position on screen
 - Distance to Target
3. Press **OK** to save and exit.

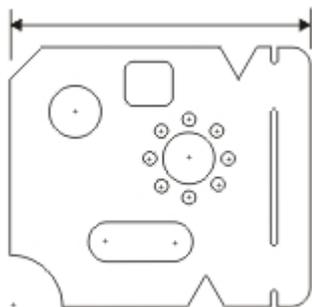
Cross Hair Gage

	<p>The Cross Hair gage can be used to determine X and Y location as well as the Angle of the cross hair as read form the Gage tab of the Probe Toolbox or the corner of the Live View.</p>
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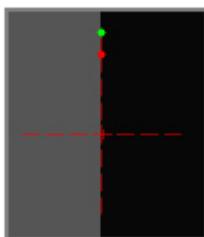
See the "[Rotating, Sizing, or Moving Gages](#)" topic for information on controlling the Cross Hair gage.

Cross Hair Gage Example

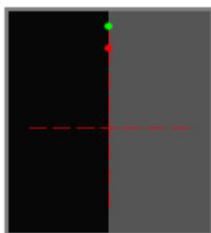
To measure the width of a part:



1. Ensure that the part is physically square on the inspection machine. See "[Creating an Alignment](#)".
2. Open the **Probe Readout** window (CTRL + W).
3. From the **Probe Toolbox** adjust the magnification and lighting as needed. See "[Probe Toolbox: Magnification tab](#)" and "[Probe Toolbox: Illumination tab](#)".
4. Select the **Cross Hair** option from the drop-down list from the **Gage** tab of the **Probe Toolbox**.
5. Move the machine over the *left* edge of the part. When the machine is close you can optionally drag the cross hair to the exact edge using the mouse.

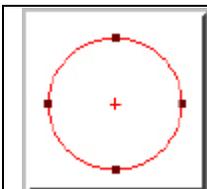


6. Click the **Zero Readouts DXYZ** button  on the **Gage** tab. This zeroes the DX, DT, and DZ values.
7. Move the machine over the *right* edge of the part. Again, drag the cross hair to the exact edge using the mouse.



8. Read the X value from the **Probe Readout** DX value.

Circle Gage

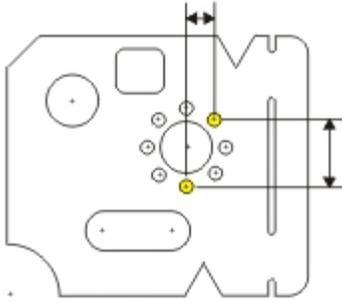


The Circle gage can be used to determine the **Circle Center** (X & Y) as well as **Diameter** as read from the **Gage** tab of the **Probe Toolbox** or the corner of the **Live View**.

See the "[Rotating, Sizing, or Moving Gages](#)" topic for information on controlling the Circle gage.

Circle Gage Examples

To measure the location of a 2mm hole from another 2mm hole:

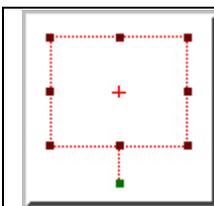


1. Ensure that the part is physically square on the inspection machine. See "[Creating an Alignment](#)".
2. Open the **Probe Readout** window (CTRL + W).
3. From the **Probe Toolbox** adjust the magnification and lighting as needed. See "[Probe Toolbox: Magnification tab](#)" and "[Probe Toolbox: Illumination tab](#)".
4. Select the **Circle Gage** option from the drop-down list from the **Gage** tab of the **Probe Toolbox**.
5. From the **Gage** tab, double-click the **Diameter** field and type the nominal diameter of **2.000**.
6. Move the machine so the *first* hole is within the FOV. When the machine is close you can optionally drag the Circle gage to the exact center using the mouse.
7. Click the **Zero Readouts DXYZ** button  on the **Gage** tab. This zeroes the DX, DT, and DZ values.
8. Move the machine so the *second* hole is within the FOV. Again, drag the Circle gage to the exact center using the mouse.
9. Read the X and Y values from the **Probe Readout** DX and DY values.

To measure the diameter of a hole:

1. Adjust the magnification so the circle is as large as possible within the FOV. See "[Changing the Magnification of the Part Image](#)". Notice the gage size change with the magnification.
2. Move and adjust the size of the Circle gage to exactly overlay the actual circle in the Live View.
3. Read the **Diameter** value as displayed in the corner of the Live View. This value is also found in the **Gage** tab of the **Probe Toolbox**.

Rectangle Gage

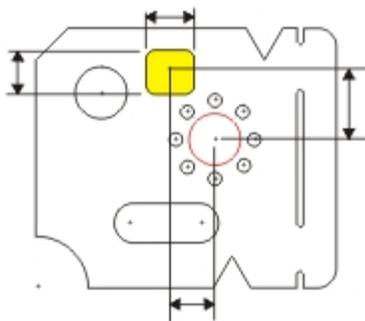


The Rectangle gage can be used to determine the **Rectangle Center** (X & Y) as well as the **Height**, **Width**, and **Angle** of the rectangle as read from the **Gage** tab of the **Probe Toolbox** or the corner of the **Live View**.

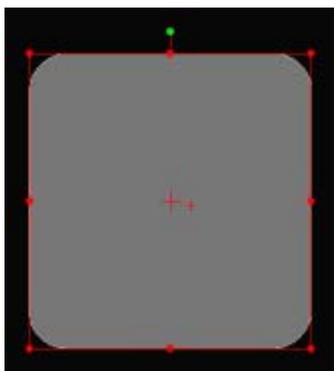
See the "[Rotating, Sizing, or Moving Gages](#)" topic for information on controlling the Cross hair gage.

Rectangle Gage Example

To measure the size and location of a rectangle from the center of a circular hole pattern:

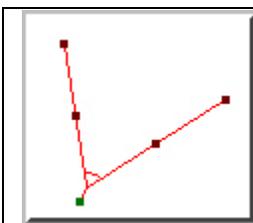


1. Ensure that the part is physically square on the inspection machine. See "[Creating an Alignment](#)".
2. Open the **Probe Readout** window (CTRL + W).
3. From the **Probe Toolbox** adjust the magnification and lighting as needed. See "[Probe Toolbox: Magnification tab](#)" and "[Probe Toolbox: Illumination tab](#)".
4. Select the **Circle Gage** option from the drop-down list from the **Gage** tab of the **Probe Toolbox**.
5. From the **Gage** tab, double-click the **Diameter** field and type the nominal diameter of **8.000**.
6. Move the machine so the *8mm center hole* is within the FOV. When the machine is close you can optionally drag the Circle gage to the exact center using the mouse.
7. Click the **Zero Readouts DXYZ** button  on the **Gage** tab. This zeroes the DX, DT, and DZ values.
8. Change the gage type to **Rectangle Gage**.
9. Move the machine (with the Rectangle gage visible) over the *rectangular* opening. Again, drag the rectangle to the exact center and size the rectangle as needed.



10. Read the X & Y values from the **Probe Readout** (DX & DY) values.
11. Read the **Height** and **Width** values as displayed in the corner of the Live View. This value is also found in the **Gage** tab of the **Probe Toolbox**.

Protractor Gage

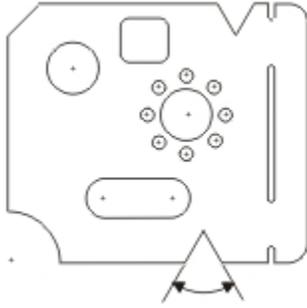


The Protractor gage can be used to determine the (X & Y) location of the **Gage Apex** as well as the **Included Angle** as read from the **Gage** tab of the **Probe Toolbox** or the corner of the **Live View**.

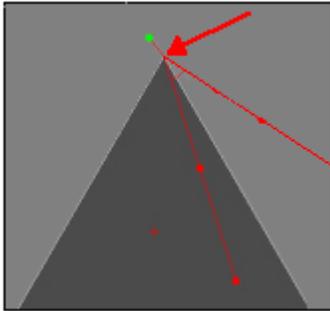
See the "[Rotating, Sizing, or Moving Gages](#)" topic for information on controlling the Cross hair gage.

Protractor Gage Example

To measure the included angle:

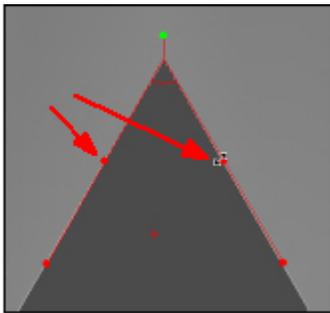


1. Open the **Probe Readout** window (CTRL + W).
2. From the **Probe Toolbox** adjust the magnification and lighting as needed. See "[Probe Toolbox: Magnification tab](#)" and "[Probe Toolbox: Illumination tab](#)".
3. Select the **Protractor Gage** option from the drop-down list from the **Gage** tab of the **Probe Toolbox**.
4. Move the machine so the *angle* is within the FOV. When the machine is close you can optionally drag the protractor gage so the apex lies on top of the feature's apex.



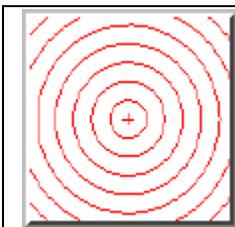
The 2 apexes should coincide

5. Using the center dots on the two legs, rotate them coincident with the sides of the feature.



6. Read the **Included Angle** value as displayed in the corner of the Live View. This value is also found in the **Gage** tab of the **Probe Toolbox**.

Radius Chart Gage

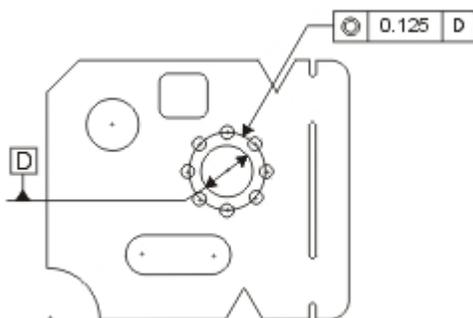


The Radius Chart gage can be used to determine the **Center Location** (X & Y) as well as the **Spacing** between concentric circles as read from the **Gage** tab of the **Probe Toolbox** or the corner of the **Live View**.

See the "[Rotating, Sizing, or Moving Gages](#)" topic for information on controlling the Circle gage.

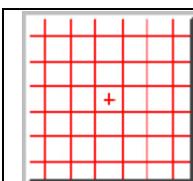
Radius Chart Example

To check to see if circular hole pattern is concentric to a center hole:



1. Open the **Probe Readout** window (CTRL + W).
2. From the **Probe Toolbox** adjust the magnification and lighting as needed. See "[Probe Toolbox: Magnification tab](#)" and "[Probe Toolbox: Illumination tab](#)".
3. Select the **Circle Gage** option from the drop-down list from the **Gage** tab of the **Probe Toolbox**.
4. From the **Gage** tab, double-click the **Diameter** field and type the nominal diameter of **8.000**.
5. Move the machine so the *center* hole is within the FOV. When the machine is close you can optionally drag the Circle gage to the exact center using the mouse.
6. Click the **Zero Readouts DXYZ** button  on the **Gage** tab. This zeroes the DX, DT, and DZ values.
7. Change the gage type to **Radius Chart Gage**.
8. From the **Gage** tab, double-click the **Spacer** field and type the nominal value of **1.000**.
9. Drag the Radius gage such that it is concentric to the pattern.
10. Read the X and Y values from the **Probe Readout** DX and DY values.

Grid Chart Gage



The Grid Chart gage can be used to determine the **Center Location** (X & Y) of the grid pattern as well as the **Spacing** between grid lines as read from the **Gage** tab of the **Probe Toolbox** or the corner of the **Live View**.

See the "[Rotating, Sizing, or Moving Gages](#)" topic for information on controlling the Circle gage.

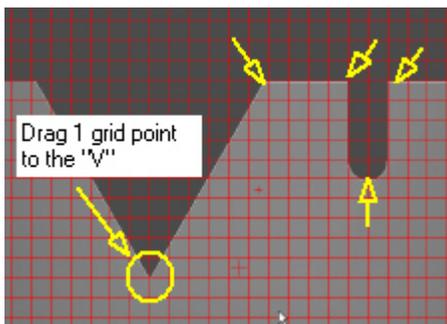
Grid Chart Example

To check features in relation to grid lines:

1. From the **Probe Toolbox** adjust the magnification and lighting as needed. See "[Probe Toolbox: Magnification tab](#)" and "[Probe Toolbox: Illumination tab](#)".
2. Move the machine so the *features requiring comparison* are within the FOV.



3. Change the gage type to **Grid Chart Gage**.
4. From the **Gage** tab, double-click the **Grid** field and type the nominal value of **0.500**.
5. Drag any one grid intersect to the bottom of the "V".



6. All other geometry can be visually compared to the grid lines.

Creating Alignments

Alignments are required whether you are using a the "[CAD Selection Method](#)" (Cad View) or the "[Target Selection Method](#)" (Live View) for measuring your part. The alignment defines the Part Coordinate System. You must perform an alignment if you wish to do any one of the following:

- Change the location or orientation of the part on the stage.
- Move the part program from one machine to another.
- Program the part program offline and then run it online.
- Use vision measurement hardware that does not have homing capability.
- Use the AutoShutter facility on manual machines.

Note: You should create an alignment each time you create a part program to run in DCC Mode.

There are numerous methods for creating Vision alignments; the examples provided in this chapter are intended to give a basic outline for creating alignments. For more information on alignments, see the "Creating and Using Alignments" chapter in the core PC-DMIS manual.

There are two types of scenarios in which Vision alignments can be created:

- [Live View Alignments](#)
- [CAD View Alignments](#)

Live View Alignments

This section describes the process of creating alignments using the **Live View** in PC-DMIS Vision. This is commonly used when you are measuring online but *have not* imported CAD. Creating both **Manual** (rough) and **DCC** (refined) alignments as outlined below will help ensure the accuracy of your alignment. This two-step alignment process is not required but is recommended.



If you are working on manual machine you can take advantage of this two-alignment approach by using the AutoShutter feature to assist you. See "[Setting up the Live View](#)" for information on the AutoShutter feature.

Complete the following steps to create an alignment using the Live View:

- [Step 1: Manually Measure Datum Features](#)
- [Step 2: Create a Manual Alignment](#)
- [Step 3: Remeasure the Datum Features](#)
- [Step 4: Create a DCC Alignment](#)

In this example the **3 2 1 Alignment Wizard** will be used to show how this tool can be used, where the "[Cad View Alignments](#)" example will use the classic **Alignment Utilities** dialog box.

Step 1: Manually Measure Datum Features

The manual alignment in this example will consist of a *Arc* and a *Line*. These datum features will be more accurately remeasured in "[Step 3: Remeasure the Datum Features](#)". Before you begin, mount the part so it is reasonably square to the axes of the measuring machine.

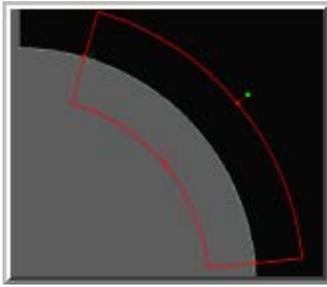
To measure the datum features:

1. Select the **Magnification** tab  and adjust the magnification so it is decreased to the minimum setting (zoomed out).

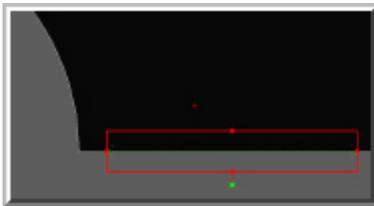


With a manual (approximate) alignment, leaving the magnification at the minimum is acceptable and usually desirable since it is easier to run the program. The DCC alignment (refined) alignment will later improve the quality of these datum features.

2. Select the **Illumination** tab  and set the Top Light to 0% (Off) and the Bottom Light to 35%.
3. Click the **Circle** button  from the **Auto Feature** toolbar. This opens the **Auto Feature** (circle) dialog box.
2. Select the  **Live View** tab.
3. Move the machine so the **Arc** (Datum B) is within the FOV.
4. Click three points spaced along the edge of the arc. A radial target will be overlaid on the arc as shown below:



7. Click **Create** to add this circle to the part program.
8. Select Line  from the drop-down list box of the **Auto Feature** dialog box.
9. Move the machine so the **Edge** (Datum C) ,adjacent to the previously measured arc, is within the FOV.
10. Click two points - One on the left end and one on the right end. A line target will be overlaid on the edge as shown below:



11. Click **Create** to add this line to the part program.
12. Click **Close** to exit the **Auto Feature** dialog box.

Step 2: Create a Manual Alignment

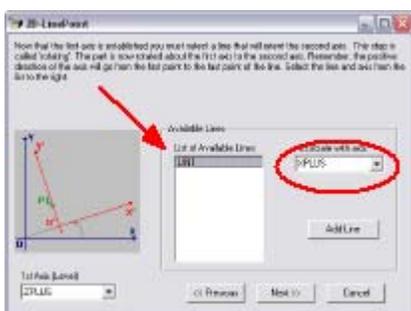
The manual alignment is used to quickly define the part location based on the measured *Arc* and *Line* Datum features.

To create a manual alignment:

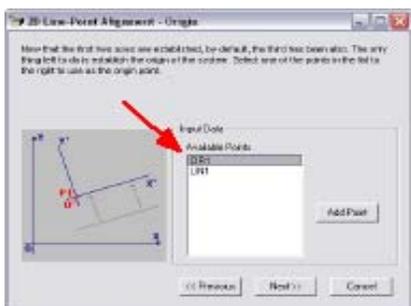
1. Select the **3 2 1 Alignment** button  from the **Vision** toolbar. The **Alignment Type** dialog box appears.



2. Select the **Line-Point 2D** alignment and click **Next >>**. The **2D-LinePoint** dialog box appears.



3. Select **LIN1** from the **List of Available Lines** and associate it with **XPLUS** axis from the **Associate with axis** drop-down list.
4. Click **Next >>**. The **2D-LinePoint Alignment - Origin** dialog box appears.



5. Select **CIR1** from the list of **Available Points** and click **Next >>**. The **Line-Point** dialog box appears.
6. Click **Finish** to insert the alignment command into the part program. The manual alignment is complete.

 Click the **+/-** (expand/collapse) next to the new alignment in the **Edit Window**. Notice the alignment steps that were created under the alignment command by the **3 2 1 Alignment Wizard**.

Step 3: Remeasure the Datum Features

Since the approximate location of the part is known, the Datum Features can be remeasured under computer control with different Vision parameters to more accurately define them.

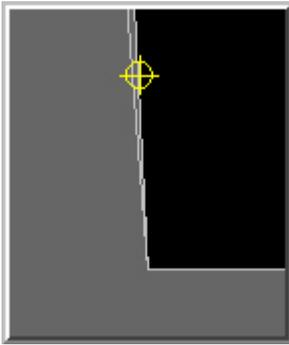


If you are using a DCC machine, select **DCC Mode** from the **Probe Mode** toolbar. Otherwise, you can use AutoShutter to measure using a manual machine.

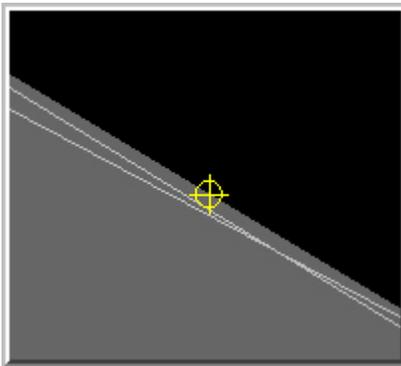
To remeasure the arc datum feature:

1. Click the **Circle** button  from the **Auto Feature** toolbar. This opens the **Auto Feature** (circle) dialog box.
2. Select the **Live View** tab .
3. Select the **Magnification** tab  and adjust the magnification so it is decreased to the minimum setting (zoomed out).
4. Move the machine so the lower edge of the **Arc** (Datum B) is within the FOV.
5. Adjust the magnification to 75% of the maximum zoomed in value.

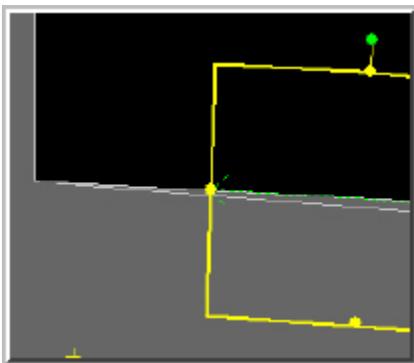
6. Select the **Illumination** tab  and set the Top Light to 0%(Off) and the Bottom Light to 35%.
7. Focus Z if necessary.
8. Pick the first anchor point on the arc's edge using the mouse.



9. Move the machine so the middle of the **Arc** (Datum B) is within the FOV.



10. Move the machine to the upper edge of the **Arc** (Datum B) is within the FOV. The target is displayed.



11. Change the Start and End angle to **5** and **85**.
12. Edit the location parameters to exact values: **X=0, Y=0, D=16**
13. Select the **Hit Targets** tab .
14. Double-click **Normal** under **Density** and select **High** from the drop-down list to change the density. Collecting a high density of points on this arc will improve its accuracy.
15. Set the **Strength** value to **6** by double-clicking and typing the value in the edit box.
16. Edit the Focus parameter set to automatically re-focus prior to measuring the circle feature. First, select the **Focus** from the drop-down list as show below.



17. Change the Focus parameter set as follows: **Focus = Yes, Range = 5, Duration = 4**
18. From the **Auto Feature** dialog box, rename the default Circle Auto Feature to **DATUM B**.
19. Click **Test** to test feature measurement.
20. Click **Create** and then **Close**.

To remeasure the *line* datum feature:

1. Click the **Line** button  from the **Auto Feature** toolbar. This opens the **Auto Feature** (line) dialog box.
2. Move the machine so the *left* end of the **Front Edge** (Datum C) is within the FOV.
3. If necessary, adjust the Z axis to regain focus.
4. Pick the first anchor point on the left front edge using the mouse.



5. Move the machine so the *right* end (just before the "V") of the **Front Edge** (Datum C) is within the FOV. Pick the second anchor point using the mouse. The target is displayed.



6. From the **Auto Feature** dialog box, rename the default Line Auto Feature name to **DATUM C**.
7. Click **Test** to test feature measurement.
8. Click **Create** and then **Close**.

Step 4: Create a DCC Alignment

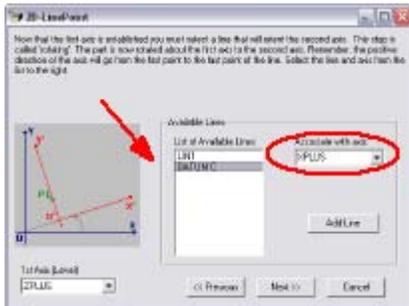
DCC alignment is inherently more accurate due to the fact that features (measured in step 3) used were measured under computer control at higher magnification, with higher density of points and refocusing. The *front edge* (Datum C) and the *center point* of the arc (Datum B) are used in this example.

To create a DCC alignment:

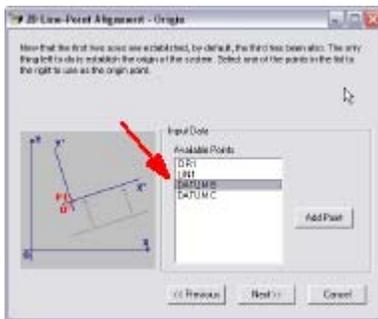
1. Select the **3 2 1 Alignment** button  from the **Vision** toolbar. The **Alignment Type** dialog box appears.



2. Select the **Line-Point 2D** alignment and click **Next >>**. The **2D-LinePoint** dialog box appears.



3. Select **DATUM C** from the **List of Available Lines** and associate it with **XPLUS** axis from the **Associate with axis** drop-down list.
4. Click **Next >>**. The **2D-LinePoint Alignment - Origin** dialog box appears.



5. Select **DATUM B** from the list of **Available Points** and click **Next >>**. The **Line-Point** dialog box appears.
6. Click **Finish** to insert the alignment command into the part program. The DCC (or refined manual) alignment is complete.

 Click the **+/-** (expand/collapse) next to the new alignment in the **Edit Window**. Notice the alignment steps that were created under the alignment command by the **3 2 1 Alignment Wizard**.

Cad View Alignments

This section describes the process of creating alignments using the **Cad View** in PC-DMIS Vision. This is commonly used when you are measuring online and *have* imported CAD. Creating both **Manual** (rough) and **DCC** (refined) alignments as outlined below will help ensure the accuracy of your alignment. This two-step alignment process is not required but is recommended.

 If you are working on manual machine you can take advantage of this two-alignment approach by using the AutoShutter feature to assist you. See "[Setting up the Live View](#)" for information on the AutoShutter feature.

For this alignment example the HexagonDemoPart.igs demo part must be imported prior to beginning. See "[Importing the Vision Demo Part](#)".

Complete the following steps to create an alignment using the Live View:

- [Step 1: Manually Measure an Edge Point](#)
- [Step 2: Create an Manual Alignment](#)
- [Step 3: Measure Features for Datum A](#)
- [Step 4: Construct Datum A](#)
- [Step 5: Measure Datums B and C](#)
- [Step 6: Create a DCC Alignment](#)
- [Step 7: Update Display in CAD View](#)

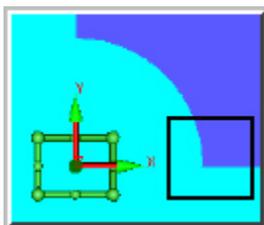
In this example the "Classic" **Alignment Utilities** dialog box will be used to show how this dialog box can be used, where the "[Live View Alignments](#)" example will use the **3 2 1 Alignment Wizard**.

Step 1: Manually Measure an Edge Point

The manual alignment in this example will consist of a single *Edge Point* to approximately locate the part. In later steps, additional datums will be measured (under DCC if applicable) to create a final alignment. Before you begin, mount the part so it is reasonably square to the axes of the measuring machine.

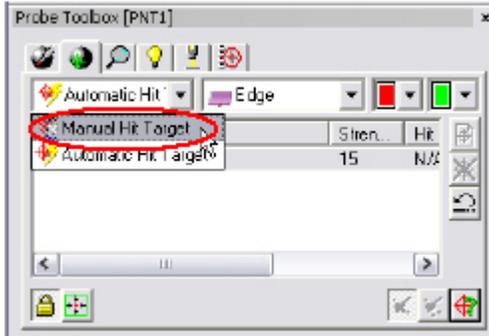
To measure the datum feature:

1. Select the **Magnification** tab  and adjust the magnification so it is decreased to the minimum setting (zoomed out).
2. Select the **Illumination** tab  and set the Top Light to 0% (Off) and the Bottom Light to 35%.
3. Select the **Cad View** tab .
4. Select the **Curve Mode** button  from the **Graphics Modes** toolbar.
5. Move the machine so the front-left **Corner** is within the FOV as shown below:

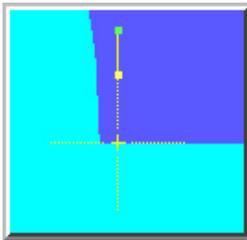


6. Click the **Edge Point** button  from the **Auto Feature** toolbar. This opens the **Auto Feature** (edge point) dialog box.
7. Click a point on the front edge, *VERY CLOSE* to the left corner.

8. Select the **Hit Targets** tab .
9. Change Automatic Target to **Manual Hit Target**.



 Since this is actually a "Manual Target" edge point, the actual point used is where ever the cross hair is physically placed by the operator.



10. Click **Create** to add this edge point to the part program.
11. Click **Close** to exit the **Auto Feature** dialog box.

Step 2: Create an Manual Alignment

For this alignment, only one point was taken ([previous step](#)), so no rotational datum was measured. In this example, it is assumed that the part is reasonably square to the machine axis. The single point will be used to establish the XYZ origin.

To create a manual alignment:

1. Select the **Insert | Alignment | New** menu option. The **Alignment Utilities** dialog box appears
2. Select **PNT1** from the feature list.
3. Select the check boxes next to **X**, **Y**, and **Z**.
4. Click the **Origin** button.
5. Click **OK** to save and exit. The X, Y and Z zero points have all been moved to the edge point.

Executing the part program that you just created will move the origin to this point on the actual part. To do this:

1. Select the  **Live View** tab.
2. Select **Mark All**  from the **Vision** toolbar.
3. When prompted "Ok to mark manual alignment features?", click **Yes**.
4. Select **Execute** .

- When prompted, measure point **PNT1** by aligning the target (cross hair) to the corner and clicking **Continue**. Alternatively, you can drag and drop the cross hair, and it will snap to the edge.
- When the program is finished executing, select the  **Cad View** tab.
- Select **Scale-To-Fit**  from the **Graphics Modes** toolbar.

Step 3: Measure Features for Datum A

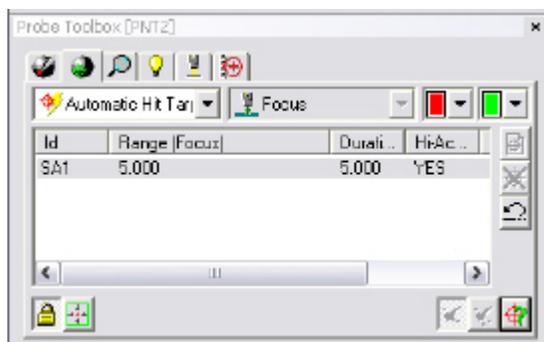
The *top plane* (Datum A) will be used for the primary alignment datum. A reference plane is commonly not required in 2D vision measurements. However, in this example, the datum plane will be measured to accommodate dimensioning flatness. This is useful in situations where you might have feature control frames that reference a datum plane.

Since the approximate location of the part is known, PC-DMIS can operate in DCC mode.

If you are using a DCC machine, select **DCC Mode**  from the **Probe Mode** toolbar. Otherwise, you can use AutoShutter to measure using a manual machine.

To measure a plane features for **Datum A**:

- Select the **Magnification** tab  and adjust the magnification so it is increased to the maximum setting (zoomed in).
- Select the **Live View**  tab.
- Position the camera over the part.
- From the **Illumination** tab  adjust the **Top Light** to a value that makes the surface visible but not too bright. Move Z to focus as necessary.
- Select the **Cad View**  tab.
- Select **Scale-To-Fit**  from the **Graphics Modes** toolbar.
- Select the **Surface Mode** button  from the **Graphics Modes** toolbar.
- Click the **Surface Point** button  from the **Auto Feature** toolbar. This opens the **Auto Feature** (surface point) dialog box.
- Click a point on the top surface.
- Select the **Hit Targets** tab  and change the following parameters: Target Type = **Automatic Hit Target**, Range = **5.0**, Duration = **5**, and Hi-Accuracy = **YES**. For each Automatic Hit Target, double-click the value below the value and type the specified value.



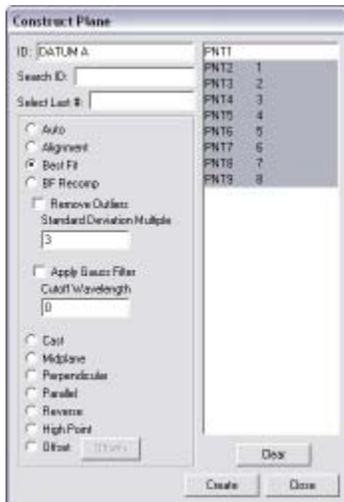
11. Click **Create** to add this edge point to the part program.
12. Click *another* point on the top surface, then click **Create**.
13. Repeat the step above (click a point and then **Create**) until a total of 8 points have been created (PNT2 - PNT9).
14. Click **Close** to exit the **Auto Feature** dialog box.

Step 4: Construct Datum A

Once the 8 surface points have been measured in "[Step 3: Measure Datum A Features](#)" you can construct **DATUM A** from those points.

To construct **DATUM A**:

1. Execute the program up to this point to measure the 8 surface points. To do this:
 - a. Select **Clear Mark** . This is done so that the manual alignment point (PNT1) will not be included when you select **Mark All**.
 - b. Select **Mark All**  from the **Vision** toolbar.
 - c. When the "Ok to mark manual alignment features?" message appears, click **NO**.
 - d. Select **Execute** . The 8 surface points will be measured.
2. From within the **Edit Window**, ensure that the LAST line in the part program is high-lighted.
3. Select the **Insert | Feature | Constructed | Plane** menu item or the **Constructed Plane** button  from the **Constructed Features** toolbar. The **Construct Plane** dialog box appears.



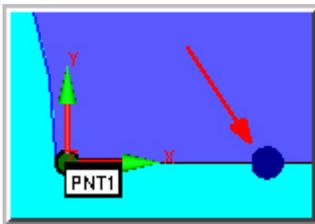
4. Select the **Best Fit** option.
5. From the feature list, high-light the *8 surface points*, measured in "[Step 3: Measure Datum A Features](#)". In this example, the points are 2-9.
6. Type **DATUM A** in the **ID** box.
7. Click **Create**, and then click **Close** to add the plane feature to the part program.

Step 5: Measure Datums B and C

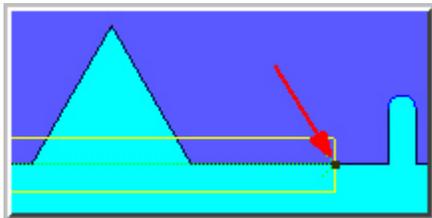
In this step, the *front line* and *left line* will be measured for **Datums B** and **C**. Based on the intersection of the two lines, a *point* will also be constructed to establish the XY origin.

To measure **Datums B:**

1. Select the **Magnification** tab  and adjust the magnification to about 25% of maximum (the actual magnification value will vary depending on your lens.).
2. Select the **Illumination** tab  and set the Top Light to 0% (Off) and the Bottom Light to 35%.
3. Select the **Cad View** tab .
4. Select **Scale-To-Fit**  from the **Graphics Modes** toolbar if necessary.
5. Select the **Curve Mode** button  from the **Graphics Modes** toolbar.
6. Click the **Line** button  from the **Auto Feature** toolbar. This opens the **Auto Feature** (line) dialog box.
7. Click a *point* for the left anchor point of the line on the front edge towards left end.

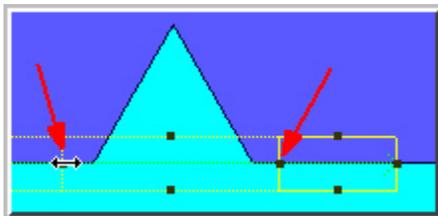


8. Click a *point* for the right anchor point of the line just to the left of the slot (to the right of the "V" as show below). The target is displayed.



 Since the line stretches across a void (the "V"), this region must be excluded so no points are taken in that segment.

9. Right-click inside the rectangular target. From the popup menu, select **Insert Hit Target**. This divides the single rectangular target into two targets.
10. Repeat the above step to insert a third target.
11. Drag the 2 target dividers such that one is on each side of the "V".

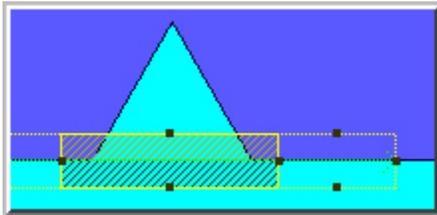


9. Select the **Live View** tab .
10. Position the camera over the part.

- From the **Illumination** tab  adjust the **Top Light** to a value that makes the surface visible but not too bright. Move Z to focus as necessary.
- Select the **Hit Targets** tab . Notice three targets are shown: EA1, EA2, and EA3. The second target (EA2) that crosses the void should not be used. Double-click on Normal, in the EA2 density field and select **None**.

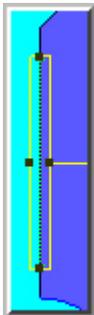
Id	Density	Under...
EA1	Normal	N/A
EA2	None	N/A
EA3	Normal	N/A

- Notice that the EA2 target segment display changes to indicate no data will be taken.



- From the **Auto Feature** dialog box, rename the default Line Auto Feature name to **DATUM B**.
- Click **Create** and then **Close**.

To measure **Datum C**:



- Reselect the **Line** button  from the **Auto Feature** toolbar. This opens the **Auto Feature** (line) dialog box.

 By closing and reopening the Auto Feature dialog box, the number of targets get reset back to 1.

- Select **Scale-To-Fit**  from the **Graphics Modes** toolbar if necessary.
- Click a *two points* for the on the left edge (one in the front and one in the rear).
- Change the default name to **DATUM C**.
- Click **Create** to add this *line* to the part program.
- Click **Close** to exit the **Auto Feature** dialog box.

To construct a point from the lines intersection:

- Select the **Insert | Feature | Constructed | Point** menu item or **Constructed Point**  from the **Constructed Features** toolbar. The **Construct Point** dialog box appears.
- Select the **Intersection** option.
- From the feature list, select **DATUM B** and **DATUM C**.
- Change the ID to **FRNT LEFT CORNER** then click **Create**, then **Close**.

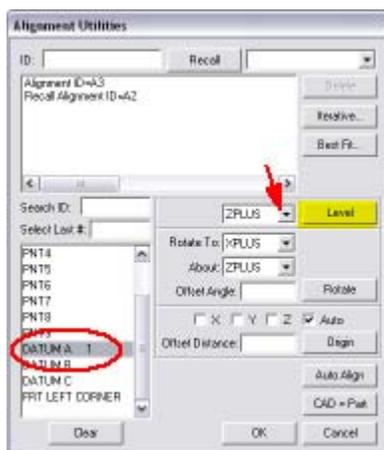
The datum features are now created.

Step 6: Create a DCC Alignment

Since the features that will comprise the DCC alignments were measured under computer control and the exact corner will be used, this alignment will inherently be more accurate.

To create a DCC alignment:

1. Select the **Insert | Alignment | New** menu option. The **Alignment Utilities** dialog box appears



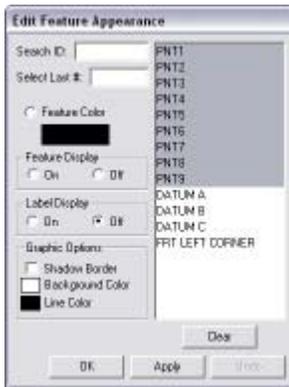
2. Select **DATUM A** from the feature list to level the plane to the ZPLUS plane.
 3. Select **ZPLUS** from the **Level** drop-down box.
 4. Click the **Level** button. This levels the plane to the ZPLUS axis.
-
5. Select **DATUM B** from the feature list to rotates to the XPLUS axis about the ZPLUS axis.
 6. Select **XPLUS** from the **Rotate To** drop-down box.
 7. Select **ZPLUS** from the **About** drop-down box.
 8. Click the **Rotate** button.
-
9. Select **FRNT LEFT CORNER** from the feature list to establish the XYZ origin.
 10. Select the check boxes next to **X** and **Y**.
 11. Click the **Origin** button.
 12. Select **DATUM A**
 13. Select the check box next to **Z**.
 14. Click the **Origin** button again.
 15. Type **ABC** in the **ID** box for the alignment name.
 16. Click **OK** to exit.
 17. Select **Scale-To-Fit**  from the **Graphics Modes** toolbar if necessary.

Step 7: Update Display in Cad View

At this point the CAD view displays all measured features. It might be desirable to disable the display of the Point IDs in the CAD View.

To disable points IDs:

1. Select the **Edit | Graphic Display Window | Feature Appearance** menu item. The **Edit Feature Appearance** dialog box appears.



2. Select the point features (PNT-PNT9) to high-light them.
3. Set the Label Display option to **Off**.
4. Click **Apply**, then **OK**.

The Cad View should be similar to the one shown below. Notice the coordinate system origin is in the lower, left corner. X+ is to the right and Y+ is to the rear.



 Executing the part program up to this point, establishes the needed alignment for measuring additional features for evaluation.

Live View Alignment with CAD

This method is commonly used when you have a fixture but the *fiducials* are not found in the CAD drawing. In this case, although you have the CAD drawing for the part, you will not be able to establish a proper alignment from the CAD file. You will need to establish the alignment in the **Live View** tab. Once you do this, you can then use the **Cad View** to measure additional features.

To establish an alignment that matches the CAD coordinate system, you will need to do the following:

1. Create the alignment features from the **Live View** tab using the method described in the "[Live View Alignments](#)" topic. Establish an alignment as follows:
 - You should generally use three *surface point* features to construct a *plane* to level to, a *line* feature to rotate to and then a *point* feature for the origin.
 - For simple 2D parts, however, you should generally use two *circle* features for leveling, rotating and setting the origin.

2. Translate, rotate, and level this alignment to match the CAD coordinates.
3. Tell PC-DMIS these two coordinate systems should be snapped together.
4. Create the alignment features (same features as above) from the **Cad View** tab using the method described in the "[CAD View Alignments](#)" topic.
5. Transform the alignment so that it matches the CAD coordinate system. To do this, click the **CAD=Part** button on the **Alignment Utilities** dialog box to tell PC-DMIS that the alignment you just created should match up with the CAD coordinate system.

Measuring Auto Features with a Vision Probe

PC-DMIS Vision currently supports the creation of features using the Auto Feature creation functionality. This chapter only discusses Auto Features as they are used with PC-DMIS Vision operation.



For detailed information on auto features, consult the "[Creating Auto Features](#)" chapter in the main PC-DMIS reference manual.

The PC-DMIS Quick Start window supports the creation of Vision auto features using the measured feature buttons. Rather than creating measured features, Vision auto features will be created when working with Vision machines. Not all the available Vision auto features can be created from the Quick Start window, since the available measured feature buttons do not represent all the Vision auto features. The Quick Start window also allows you to "Auto Guess" features by taking hits. See "[Auto Feature Guess Mode](#)".



For detailed information on using the Quick Start window, consult the "[Using the Quick Start Interface](#)" chapter in the main PC-DMIS reference manual.

Vision Measuring Methods

PC-DMIS Vision offers three ways to measure parts in DCC Mode:

- **CAD Selection Method:** If you have a CAD drawing, you can program the entire part program offline based on the CAD drawing. You can then execute this program on a live machine. See "[CAD Selection Method](#)" for more info on this procedure.
- **Target Selection Method:** This method does not require a CAD drawing and is done entirely online using a live machine. See "[Target Selection Method](#)" for more information on this procedure.
- **Auto Feature Guess Mode:** Using the **Quick Start** window, you can begin taking hits and PC-DMIS will automatically guess the feature type. See "[Auto Feature Guess Mode](#)" for more information on this procedure.

CAD Selection Method

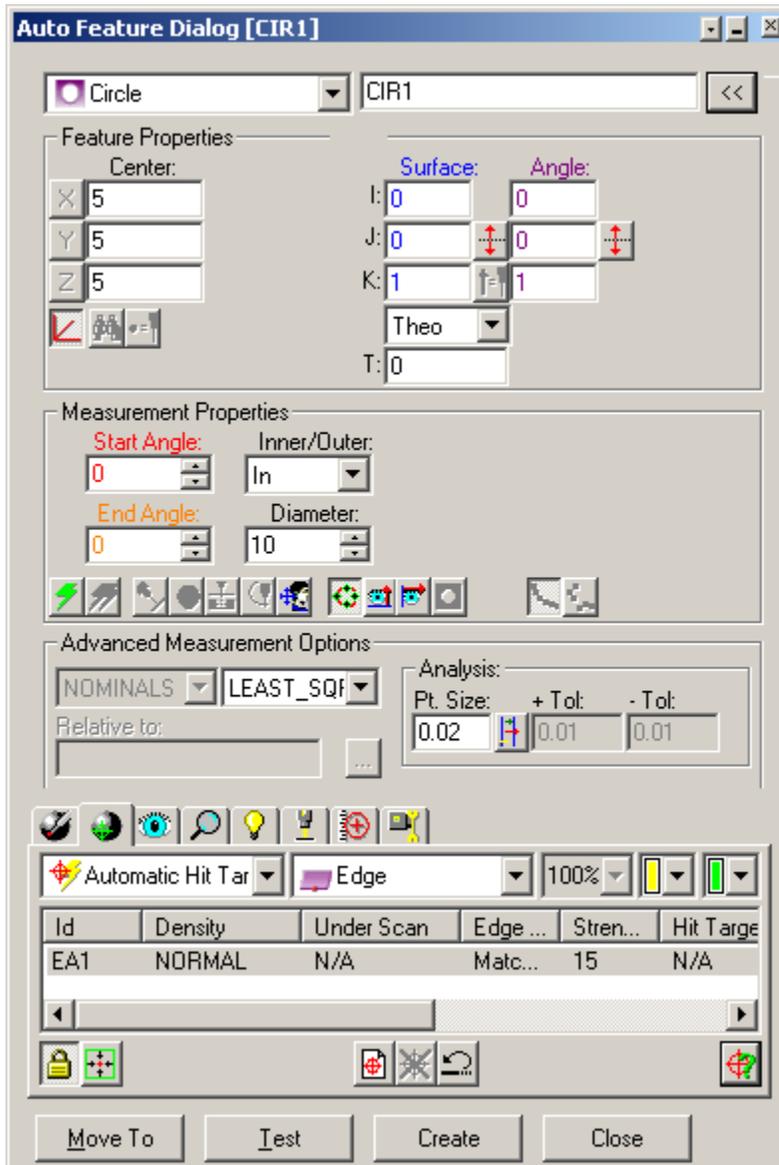
In this method, to add a feature to your part program, you will click on the desired CAD element (such as a circle, an edge, a surface and so on) inside the **Cad View** tab of the Graphics Display window. If you want to insert an open Profile 2D, you would also need to select the series of CAD elements that form the profile 2D you wish to measure.

The following steps show how to add a **circle** feature to your part program using the CAD selection method:

1. Access the **Auto Feature** toolbar.

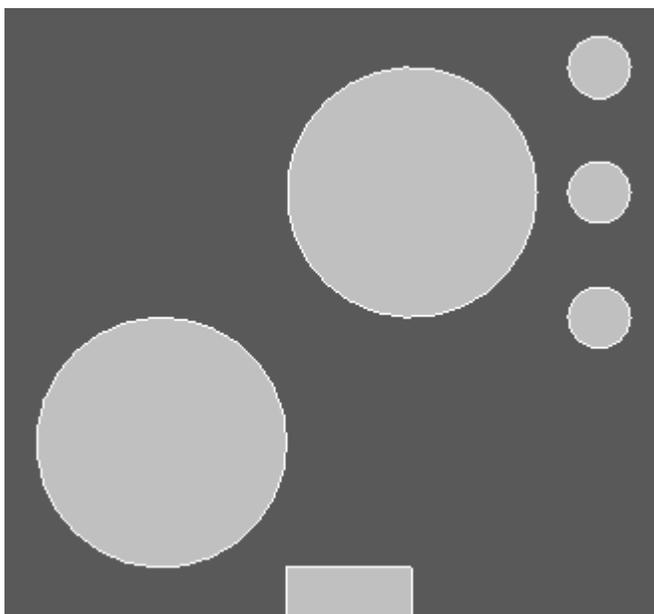


- Click the **Circle** button. The **Auto Feature** dialog box for a circle appears.



Vision Circle Auto Feature dialog box

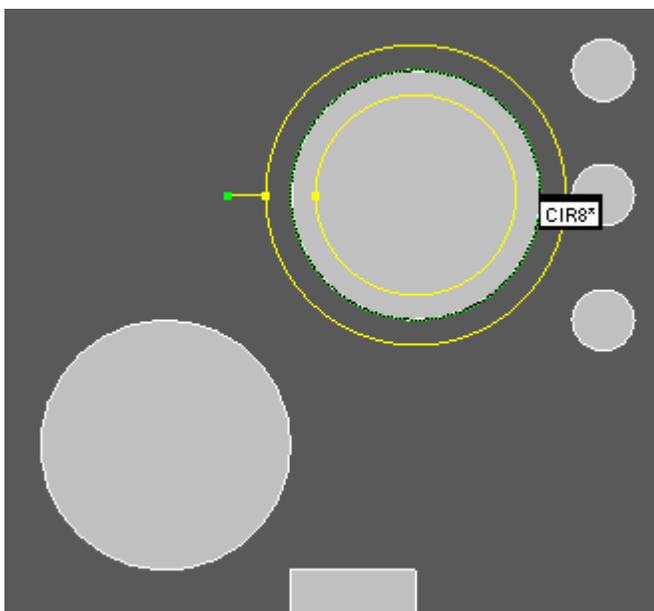
- Keep the **Auto Feature** dialog box open and select the **Cad View** tab of the **Graphics Display** window and click once on the edge of the desired circle. Other features may require additional or fewer clicks. See ["Required Clicks for Supported Features"](#).



Selecting a circle from the Cad View

Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

4. PC-DMIS Vision automatically places the nominal data for the feature into the **Auto Feature** dialog box.
5. For all features the hit targets will automatically be displayed for the feature. The resulting CAD window view should look something like the following:



Circle feature with Target

Notice that the software selects the desired circle feature and draws a target showing the scanning region band.

6. Click **Create** on the **Auto Feature** dialog box to add the feature to the part program.

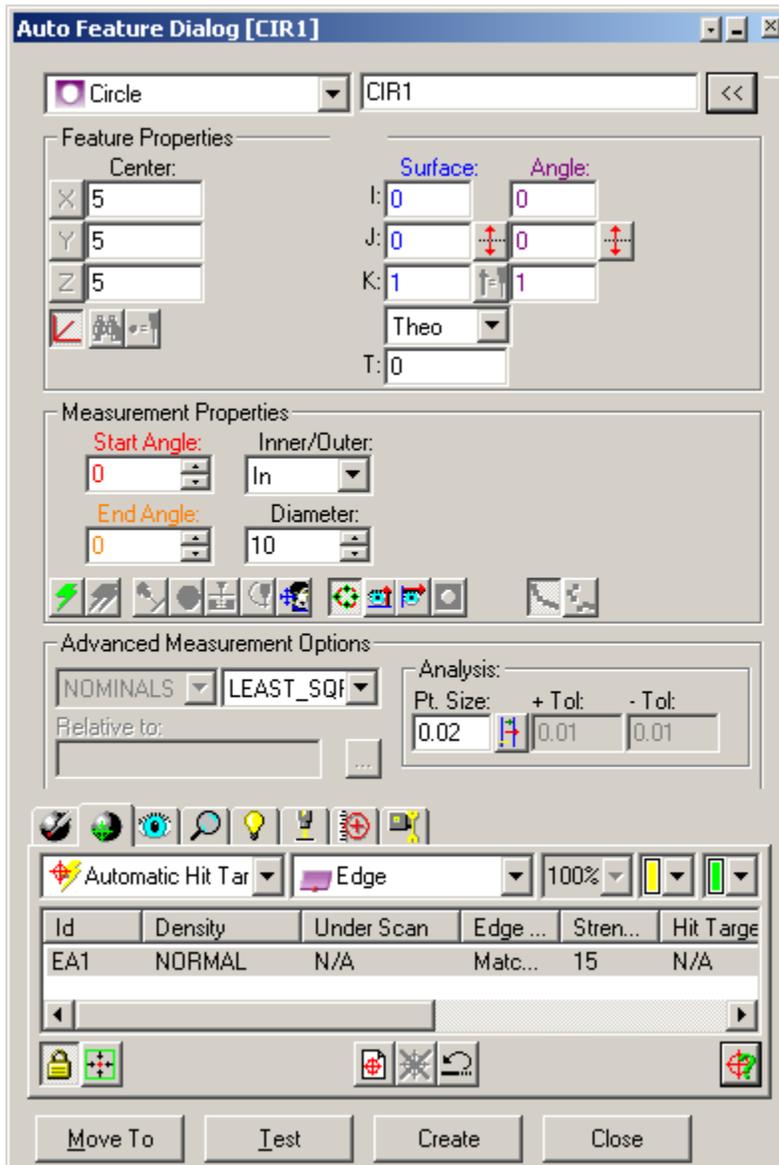
Target Selection Method

For this method, to add a feature to your part program, you should use the **Live View** tab in the Graphics Display window to place target points. The following steps show how to add a circle feature to your part program using this method:

1. Access the **Auto Features** toolbar.



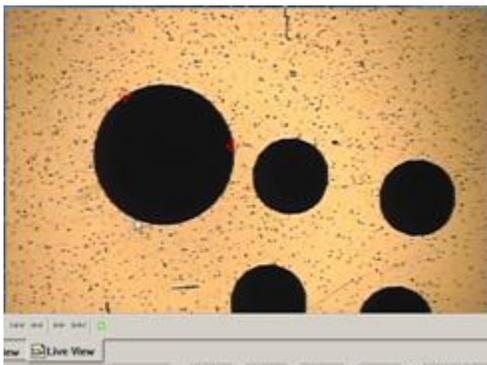
2. Click the **Circle** button. The **Auto Feature** dialog box appears for the circle feature.



Vision Circle Auto Feature dialog box

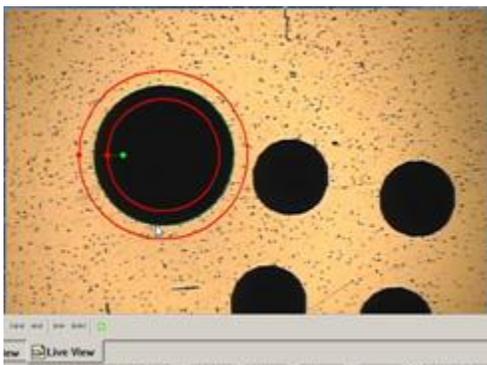
3. Keep the **Auto Feature** dialog box open and select the **Live View** tab of the **Graphics Display** window.

- Click three points along the edge of the desired circle. With each click, a red target anchor point will appear on your image. You can also double-click on the edge for auto detection. Other features may require more or fewer clicks. See [“Required Clicks for Supported Features”](#).



Selecting a circle from the Live View tab

- The Target for the feature will appear in the **Live View** tab once you have placed the required number of anchor points for that feature (or double clicked to detect the edge). See [“Required Clicks for Supported Features”](#).



Target shown for circle feature

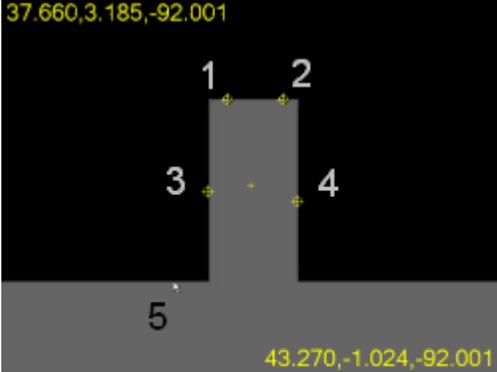
- PC-DMIS Vision automatically places the nominal data for the feature into the **Auto Feature** dialog box.
- Adjust the lighting and magnification to the desired level using the pendant knob control or the **Probe Toolbox**.
- Adjust the nominal information in the dialog to match the theoretical values of the feature.
- Click **Create** on the **Auto Feature** dialog box to add the feature to the part program.

Required Clicks for Supported Features

The following table shows the number of clicks required for each feature type and its associated method of selection:

Required Clicks per Feature

Feature Type	CAD Select Method (Cad View)	Target Point Method (Live View)
Surface Point 	Click once on a surface (Surface Mode) or three times on a wireframe (Curve Mode)	Click once to automatically add a point at the clicked spot on the surface.
Edge Point	Click once near an	Click once to automatically add a point on the

	edge	nearest edge.
	Click once on one end of a line and again at the other end.	Click to locate the start and end points of the line, or double click to automatically add two points at the extent of the current edge.
	Click once near the edge of the circle.	Click to add three points around the circle, or double click to automatically add three points equally spaced around the circumference of the visible circle.
	Click once near the edge of the ellipse.	Click to add five points around the ellipse, or double click to automatically add five points equally spaced around the visible ellipse.
	Click once near the edge of the square slot.	Click two points on one of the two longer side edges, then click one point on one of the two end edges, then once on the other longer side edge, then finally once on the other end edge.
	Click once near the edge of the round slot.	Click three points on the first arc, and then three more points on the opposite ended arc.
	Click once near the edge, opposite the notch opening.	Click five points as follows: Two points (1 & 2) on the edge opposite the opening; two points (3 & 4) on each of the parallel sides of the notch; one point (5) on the edge just outside the notch. 
	Click once near the edge of the polygon.	Click two points on the first side, and then one click on all the other sides. You must set the number of sides parameter in the Auto Feature dialog box before clicking.
	Curve Mode: Click on a series of one or more connected edges or arcs using wireframe curve data (Curve Mode). Surface Mode: Click on a cad entity near the edge and it will build the feature from that and all interconnecting cad elements.	Click sufficient points to define the shape of the profile, with each pair of points being joined by an arc or line. You can insert more points later by right clicking on the Target and selecting Insert Nominal Segment . Or, double click in the Live View image to edge trace. See the " Using 2D Profile Edge Tracer " topic.

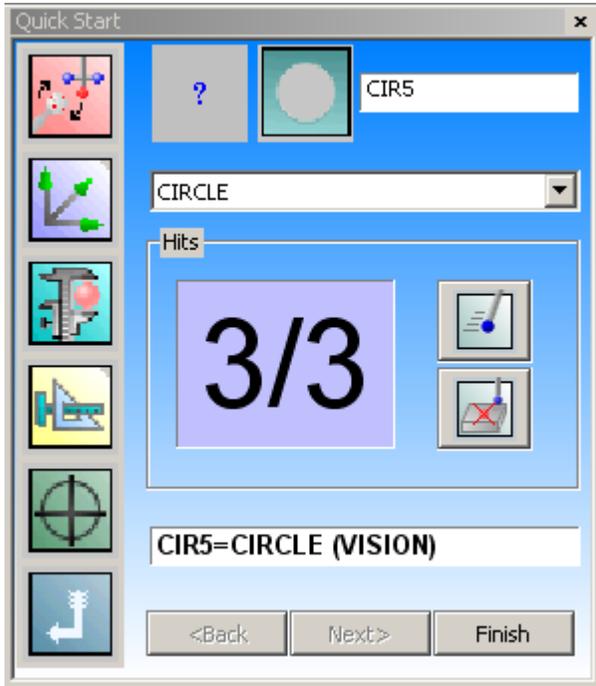
Auto Feature Guess Mode

PC-DMIS Vision will automatically determine what type of feature to add to your part program. Based upon the hits taken, auto features are guessed when the **Quick Start** window is open. The example below shows

the process of guessing a Vision Auto Circle feature, but would be similar for any of the supported features (Edge Point, Line, Circle, Round Slot, Square Slot or Notch Slot).

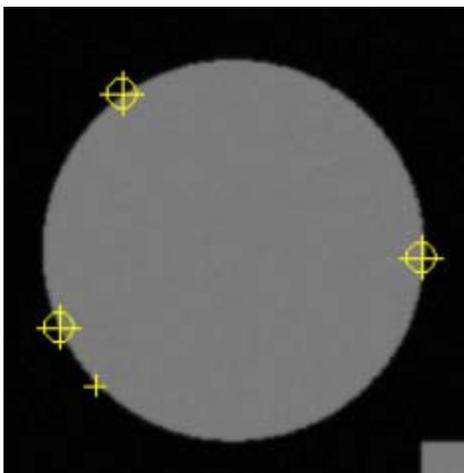
To measure Vision Auto Circle using Guess Mode:

1. Select the **View | Other Windows | Quick Start** menu option. The **Quick Start** window appears.



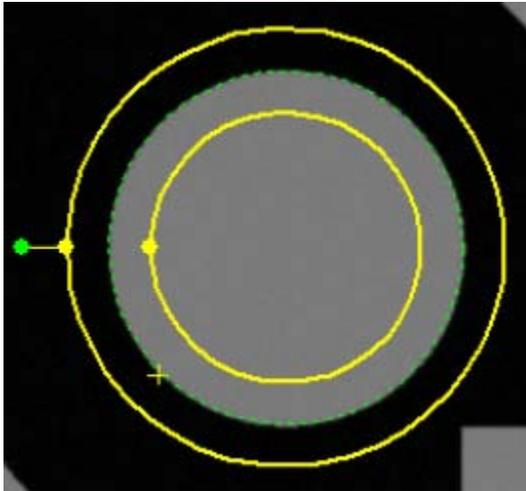
Quick Start window

2. Take your first hit on the edge of the circle feature by using your machine's jogbox, or by left-clicking on the feature's edge in the **Live View**. The **Quick Start** window will update showing one hit (1/1) in the buffer and the guessed POINT feature.
3. Take your second hit on the edge of the circle in the same way as the first hit in a different location. The **Quick Start** window will update showing two hits (2/2) in the buffer and the guessed LINE feature.
4. Take your third hit on the edge of the circle in the same way as the first two hits at yet another location. The **Quick Start** window will update showing three hits (3/3) in the buffer and the guessed CIRCLE feature.



Guessed Measured Circle Hits

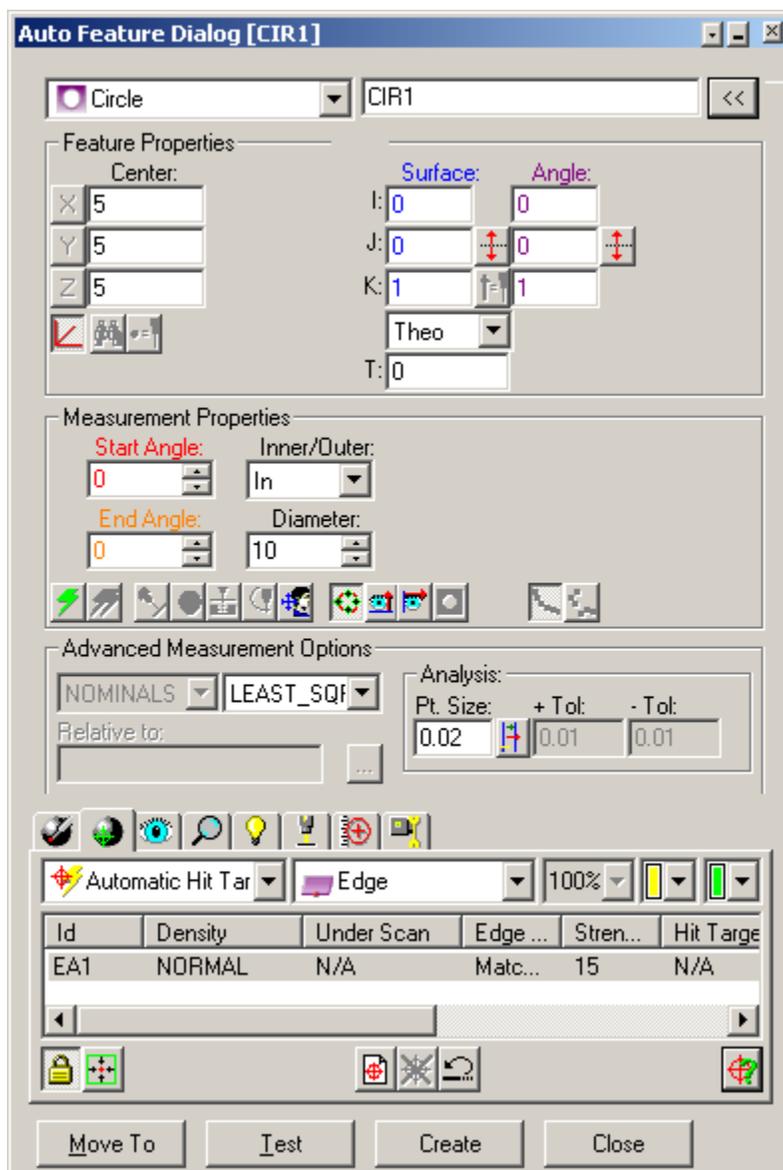
5. Click the **Erase Hit** button  if you are not satisfied with the location of any of your hits and the hit will be removed from the buffer.
6. Once the desired feature has been guessed, click **Finish**. The feature is added to you part program.
7. To display the feature target, click the **Show Target Toggle**  button on the **Live View** tab of the **Graphics Display** window (See "[Live View](#)"). Right-click on the target to perform common target parameter changes from the pop-up menu (point density, edge selection type, insert target, etc). See "[Using Shortcut Menus](#)"



Circle Target in the Live View

8. Clicking **F9** on the new Auto Feature in the **Edit Window** will allow you to edit the parameters for the feature.

The Auto Feature Dialog Box in PC-DMIS Vision



Auto Feature dialog box

The **Auto Feature** dialog box helps you determine what to measure. Regardless of your selection, the **Auto Feature** dialog box appears with the appropriate feature type selected from the list in the **Measurement Properties** area.

Features can be programmed using a Vision probe in a manner similar to using a contact probe. The three available methods are:

- Selecting CAD data in the **Cad View** tab.
- Placing target anchor points with mouse clicks in the **Live View** tab.
- Entering values into the **Theoretical** edit boxes found in the **Auto Feature** dialog box.

Those discussed controls of the Auto Feature dialog box that used for PC-DMIS Vision. See the "Common Auto Feature Dialog Box Options" topic in the core PC-DMIS manual for information that is not covered in this section.

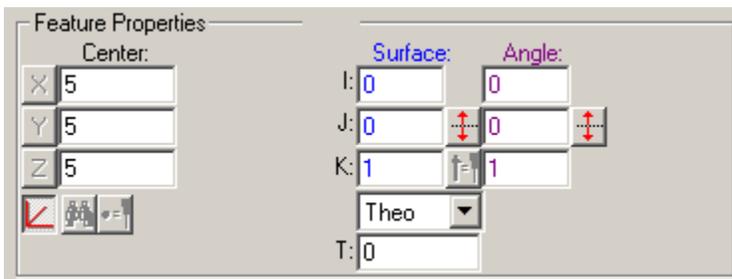
Probe Toolbox settings are included at the bottom of the Auto Feature dialog box. The settings are specific to current Auto Feature being edited. See "[Using the Probe Toolbox in PC-DMIS Vision](#)"

A Note on the Terminology of Hits

We refer to the process of using a contact probe to measure a feature as "taking a hit". In PC-DMIS Vision's case, the hit refers to the actual position of the point in the measurement process. It is inaccurate to use this same terminology for Vision measurements. In PC-DMIS Vision, you actually click on the image in the **Live View** tab to relay 'hits' to the machine.

The term "Target Anchor Point" better defines the process as it occurs inside PC-DMIS Vision. The points derived from these clicks are used as a reference to calculate the nominal form of the feature.

Feature Properties Area



Point: Specifies the XYZ values for Surface or Edge Point features.

Start: Specifies the XYZ values for the start point of a Line feature.

End: Specifies the XYZ values for the end point of a Line feature. This is only available when **Yes** is selected for the **Bounded** property of the "[Measurement Properties Area](#)".

Center: Specifies the XYZ values for the center of a Circle, Round Slot, Square Slot or Profile 2D feature.

Surface: Specifies the IJK values for the surface vector of any Vision auto feature.

Edge: Specifies the IJK values for the edge vector for an Edge or Line feature. The Edge vector points away from the edge.

Angle: Specifies the IJK values for the angle vector for a Square or Round Slot feature. The Angle vector defines the feature's centerline. The feature centerline and normal vector must be perpendicular to each other. This also specifies the reference vector for start and end angles for Circles (Arcs).

Thickness Type (Theo/Actl/None): This option determines if a thickness is applied to **Surface** or **Edge** values of a feature. "Theo" specifies that thickness is applied as a theoretical value. "Actl" specifies that thickness is applied as an actual value. When "None" is selected, NO thickness is applied.

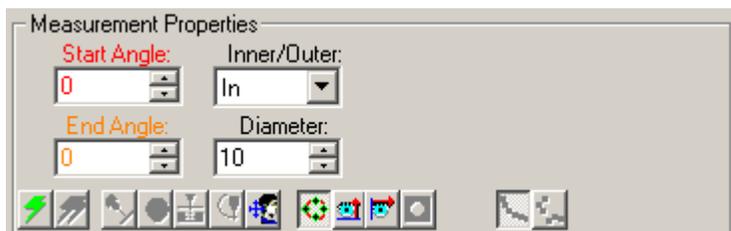
T (thickness distance): Provides the thickness distance that will be applied to **Surface** or **Edge** values of a feature depending on the thickness type. This value is not available if a **Thickness Type** of "None" is selected.

Feature Properties - Control Buttons

Vision Buttons	Description
----------------	-------------

 <p>Polar / Cartesian Toggle button</p>	<p>Clicking this button will switch between Polar and Cartesian coordinate system.</p>
 <p>Find Nearest CAD Element button</p>	<p>When you select an axis (X,Y, or Z) from one of the Point or Start boxes and click this button, PC-DMIS finds the closest CAD element in the Graphics Display window to that axis.</p> <p>Note: This option is only available for Surface Point, Edge Point, and Line features.</p>
 <p>Read Point from Machine button</p>	<p>Clicking this button will read the probe tip's position (stage position) and inserts it into the X, Y, and Z boxes.</p> <p>Note: if you're on the Gage toolbox page when this button is pressed, the Gage centre point is used rather than the stage position.</p>
 <p>Find Vector button</p>	<p>This button will pierce all surfaces along the XYZ point and IJK vector looking for the closest point. The surface normal vector will be displayed as the IJK NOM VEC but the XYZ values will not change.</p> <p>Note: This option is only available for Surface Point.</p>
 <p>Flip Vector button</p>	<p>Clicking this button reverses the direction of I, J, K vector.</p>
 <p>Read Vector From Machine button</p>	<p>Clicking this button will read and apply vector values based upon your Vision machine's vector.</p>
 <p>Swap Vectors button</p>	<p>Clicking this button causes the current edge vector and surface vector to switch vectors with each other.</p>

Measurement Properties Area



Snap: When **Yes** is selected, measured values "snap to" the theoretical vector for Surface Points. All the deviation will be along the vector of the point. This is useful for focusing on a deviation along one particular vector.

Length: Specifies the Length of a Line feature.

Bounded: When **Yes** is selected, the **End** property is available in the "[Feature Properties Area](#)" to define the end point of a Line feature.

Start Angle: Specifies the Start angle of a Circle feature.

End Angle: Specifies the End angle of a Circle feature.

Inner/Outer: Circle, Square Slot, Round Slot, Notch Slot, Ellipse or Polygon features allow you to determine whether the feature is an Inner or Outer feature.

Diameter: Specifies the diameter of a Circle or Polygon feature. The diameter for a polygon defines an inscribed circle within the polygon.

Major Diam: Specifies the diameter of the long axis of an Ellipse feature.

Minor Diam: Specifies the diameter of the short axis of an Ellipse feature.

Width: Provides the width for Round Slot, Square Slots or Notch Slots.

Length: Provides the length for Round Slot, Square Slots or Notch Slots.

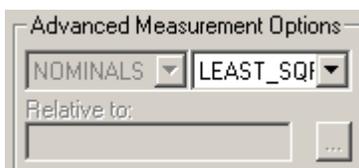
Num Sides: Specifies the number of sides for a Polygon feature (3-12).

Closed: When this value is set to "Yes" the 2D Profile Edge Tracer determines that the first nominal segment is joined to the last nominal segment. Basically, it determines if the feature is Open or Closed.

Measurement Properties - Control Buttons

Vision Buttons	Description
 Measure Now button	When this button is selected the feature will be measured when you click Create .
 Manual Pre-Position toggle button	When running in DCC mode and this button is selected, PC-DMIS has operator confirm the target position before measurement takes place.
 Show Hit Targets button	Shows/Hides the Target data on the Live and Cad Views, that were acquired and used to measure the feature.
 View Normal Toggle button	Clicking this button orients that CAD so that you look down on the feature.
 View Perpendicular Toggle button	Clicking this button orients the CAD so that you look at the side of the feature.
 Show Measured Points button	Shows/Hides the image processing data points on the Live and Cad Views, that were acquired and used to measure the feature.
 Show Filtered Points button	Shows/Hides the image processing data points on the Live and Cad Views, that were acquired and discarded by the current filter settings.

Advanced Measurement Options Area



Nominal Mode

FIND NOMS: PC-DMIS Vision will pierce the CAD model to find the closest location on a CAD edge (or surface) to the measured point, and set the nominals to that location on the CAD element.

MASTER: If a feature is created when the Mode list is set to **MASTER**, then the next time the part is measured, PC-DMIS Vision will set the nominal data equal to the measured data. The Mode list will then be reset to **NOMINALS**.

NOMINALS: This option requires you to have nominal data before the measurement process begins. PC-DMIS will compare the measured feature with the theoretical data in the dialog box, using the measured feature for any necessary calculations.

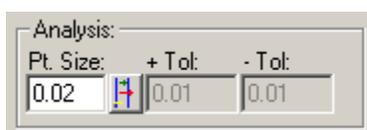
Best Fit Math Type

A Vision Auto Feature Circle also allows you to define the Best Fit Math Type. This is discussed in the "Best Fit Type" topic of the core PC-DMIS documentation.

Relative to

This allows you to keep the relative position and orientation between a given feature (or features) and the auto feature. Click the  button to open the **Relative Feature** dialog box to select the feature or features to which the auto feature is relative. Multiple features can be defined for each axis (XYZ) relative to your auto feature.

Analysis Area



The **Analysis** area allows you to determine how each measured hit/point is displayed.

Pt. Size: Determines how big the measured points will be drawn in the Cad View. This value specifies the diameter, as is specified in current units (mm or inch).

Graphic Analysis button : When switched on, PC-DMIS will do a tolerance check on each point (how far from theoretical position it is), and draw them in the appropriate based on the current defined dimension color range.

+ Tol: This provides the positive tolerance from the nominal, and is specified in current part program units. Points that are greater than this value from the nominal will be colored based on the standard PC-DMIS plus tolerance color. See the "Editing Dimension Colors" topic in the PC-DMIS Core document.

- **Tol:** This provides the negative tolerance from the nominal, and is specified in current part program units. Points that are less than this value from the nominal will be colored based on the standard PC-DMIS negative tolerance color. See the "Editing Dimension Colors" topic in the PC-DMIS Core document.

Command Buttons

Command Buttons	Description
 Move To button	Clicking the Move To button moves the field of view in the Graphics Display window and centers it on the current feature's XYZ location. If a feature is composed of more than one point (such as a line), then clicking this button switches between the points making up the feature.
 Test button	Clicking the Test button allows you to test a feature's creation and preview its dimensional data before it's actually created. Clicking this button performs a measurement using the current parameters. You can change parameters and click Test repeatedly until you have an acceptable measurement. Then when you click Create the software converts the temporary feature into a normal feature in the part program.
 Create button	Clicking the Create button inserts the defined Auto Feature into the Edit Window at the current position.
 Close button	Clicking the Close button exits the Auto Feature dialog box.
 Basic and Advanced buttons	Clicking the Basic button will display the only the basic Auto Feature options while clicking the Advanced button expands the Auto Feature dialog box to show the advanced options.

Vision Field Definitions

The Edit window command line for a sample vision circle reads:

```

feature_name=FEAT/VISION/TOG1,TOG2,TOG3,TOG4
THEO/ <x_cord,y_cord,z_cord>,<i_vec,j_vec,k_vec>,diam
ACTL/ <x_cord,y_cord,z_cord>,<i_vec,j_vec,k_vec>,diam
TARG/ <x_cord,y_cord,z_cord>,<i_vec,j_vec,k_vec>
SHOW FEATURE PARAMETERS=TOG5

        SURFACE=TOG6,n,EDGE/TOG6,n
        MEASURE MODE=TOG7
    
```

```

RMEAS=CIR1,CIR1,CIR1
GRAPHICAL_ANALYSIS=TOG8,n1,n2,n3
DIAGNOSTICS=TOG9
FEATURE_LOCATOR=TOG10,n1,TOG11,n2,n3

SHOW_VISION_PARAMETERS=TOG12

TYPE=TOG13
COVERAGE=TOG14
MAGNIFICATION=0.843
HIT_TARGET_COLOR=TOG15,NOMINAL_COLOR=TOG15
HIT_TARGET/EA1,0.202,TOG16
FILTER=TOG17,n1,TOG18,n2,n3
EDGE=TOG19,n1,n2,n3,n4
FOCUS/TOG20,n1,n2,TOG21,TOG22

```

THEO, **ACTL**, and **TARG** values will vary depending on the feature type.

- **THEO**: Defines the theoretical values for measuring the Vision Auto Feature.
- **ACTL**: Defines the actual measured values of the measured Vision Auto Feature.
- **TARG**: Defines the target position for the measurement. Use these values when the THEO positions don't match the part. You should leave the THEO values to match the CAD positions, and results will be dimensioned to these values, but change the TARG values so that the feature will actually be measured in a slightly different place.

Toggle Values

TOG1 = FEATURE TYPE

SURFACE POINT / EDGE POINT / LINE / CIRCLE / ELLIPSE / SQUARE SLOT / ROUND SLOT / NOTCH SLOT / POLYGON / PROFILE 2D are the currently available PC-DMIS Vision feature types.

TOG2 = **CARTESIAN** or **POLAR** for POINT, CIRCLE, EDGEPOINT and LINE; **OPEN** or **CLOSED** for PROFILE 2D;

TOG3 = **IN** or **OUT** for CIRCLE; **POLR** or **RECT** for PROFILE 2D and SLOT (not used for POINT, LINE

TOG4 = ALGORITHM

LEAST_SQR, MIN_SEP, MAX_INSC, MIN_CIRSC (Only used for CIRCLE)

TOG5 = SHOW FEATURE PARAMETERS

YES / NO - This toggle field determines whether or not feature parameters are displayed below. These values included TOG6 - TOG11.

TOG6 = THICKNESS

This is a toggle field to determine if Actual Thickness (ACTL_THICKNESS), Theoretical Thickness (THEO_THICKNESS) or thickness is off (THICKNESS_OFF). Edge thickness can be specified for lines and edge points. **n** = thickness value in current units.

TOG7 = MEASURE MODE

NOMINALS / VECTOR / FIND NOMS / MASTER

TOG8 = GRAPHICAL ANALYSIS

YES / NO - This toggle field determines if graphical analysis is applied. When this value is set to YES, then the next three values or Point Size, Plus and Minus Tolerances are applied for graphical analysis. **n1** = point size, **n2** = plus tolerance, **n3** = minus tolerance

TOG9 = DIAGNOSTICS

YES / NO - This toggle field determines whether diagnostic information will be collected for diagnosing

problems where edge detection has failed. Diagnostics simply collects bitmap images and current feature parameters that can be exported from PC-DMIS to be sent to support personnel.

TOG10 = FEATURE LOCATOR (Bitmap)

The feature locator option is used for specifying a bitmap image file that you want to appear in the **Feature Locator** tab of the **Probe Toolbox** when this feature is executed. This option can help you locate the feature. If this option isn't needed, switch it to NO. **n1** = path and name of the bitmap.

TOG11 = FEATURE LOCATOR (Audio File)

The feature locator option is used for specifying a wav file that will play when this feature is executed. If this option isn't needed, switch it to NO. **n2** = path and name of the wav file. **n3** = Caption string for Feature Locator tab.

TOG12 = SHOW VISION PARAMETERS

YES / NO - This toggle field determines whether or not vision parameters for the feature are displayed below. These values included TOG13 - 22.

TOG13 = TYPE

AUTOMATIC HIT TARGET / MANUAL HIT TARGET / GAGE HIT TARGET / OPTICAL COMPARATOR HIT TARGET - This toggle field determines the type of Hit Target.

- GAGE HIT TARGET is only available for LINE, CIRCLE, and ELLIPSE.
- OPTICAL COMPARATOR HIT TARGET is only available for LINE, CIRCLE, ELLIPSE, SQUARE SLOT, ROUND SLOT, and NOTCH SLOT.
- Only the AUTOMATIC HIT TARGET is available for Polygon features.
- Only the OPTICAL COMPARATOR HIT TARGET is available for Polygon features.

TOG14 = COVERAGE

This option allows you to change the coverage for a feature. New targets will be created or removed based on the selected percentage of coverage.

TOG15 = COLOR

Select from 16 basic colors used to denote the HIT TARGET COLOR and the NOMINAL COLOR.

TOG16 = DENSITY

This option toggles between LOW | HIGH | NORMAL | NONE. It indicates the density of points that will be returned for this target. See "[Probe Toolbox: Define Targets tab](#)" for more information.

TOG17 = CLEAN FILTER

YES / NO - This toggle field will apply the clean filter which removes dust and small noise particles from the image prior to edge detection. This value is not used for a SURFACE POINT. **n1** = Strength - Specifies the size (in pixels) of an object, below which is considered to be dirt or noise.

TOG18 = OUTLIER FILTER

YES / NO - This toggle field determines whether the outlier filter is applied for this target. This value is not used for a SURFACE POINT. **n2** = Distance Threshold - This specifies the distance in pixels that a point can be away from nominal before discarding it. **n3** = The standard deviation of a point needs to be away from the other points to make it considered to be an outlier.

TOG19 = EDGE TYPE

This toggle field switches between the available types of edge detections. They are: DOMINANT EDGE, SPECIFIED EDGE, NEAREST NOMINAL, or MATCHING EDGE. See "[Probe Toolbox: Hit Targets tab](#)" for more information. This value is not used for a SURFACE POINT. **n1** = Edge strength threshold to be used during the teach process. All edges that are assigned a 'strength' that is below this threshold will be ignored when looking for an edge. Values should fall between the range of 0 and 255. **n2** = Hit target

direction (--> or <--). **n3** = Specified Edge - This parameter defines the Nth edge to be used for the specified edge detection method. Currently allows a number between 1-10 to be entered. **n4** = This value determines if the edge that is being viewed and found goes from black to white "[] -> []", white to black "[] -> []", or either "[?] -> [?].

TOG20 = FOCUS

YES / NO - This determines whether or not the target requires a pre-edge detection focus. **n1** = This value displays the range from the camera to the part. It specifies the distance (in the current units) over which to perform the focus. **n2** = This value provides the number of seconds to spend searching for the best focal position.

TOG21 = Find Surface

YES / NO - This toggle field determines whether or not the machine should perform a second, slightly slower, pass-to attempt to improve the accuracy of the focal position.

TOG22 = SensiLight

This YES/NO This toggle field determines whether or not the machine should perform an auto-light adjust prior to focus, in an attempt to achieve optimal focus result. If set to **NO**, PC-DMIS will set lighting according to the learned percentage and the brightness will not be adjusted automatically.

Creating Auto Features

The following procedures describe how to measure part features using PC-DMIS Vision. The following features are available in PC-DMIS Vision:

- [Vision Surface Point](#)
- [Vision Edge Point](#)
- [Vision Line](#)
- [Vision Circle](#)
- [Vision Ellipse](#)
- [Vision Round Slot](#)
- [Vision Square Slot](#)
- [Vision Notch Slot](#)
- [Vision Polygon](#)
- [Vision Profile 2D](#)

Important: Before measuring you must first properly set up the various machine options, calibrate your Vision probe, understand how to use the **Probe Toolbox**, **Cad View** and **Live View** tab. You should also create alignments as needed. See these topics if you need information:

["Setting Machine Options"](#)

["Calibrating the Vision Probe"](#)

["Calibrating the Vision Stage"](#)

["Using the Graphics Display Window in PC-DMIS Vision"](#)

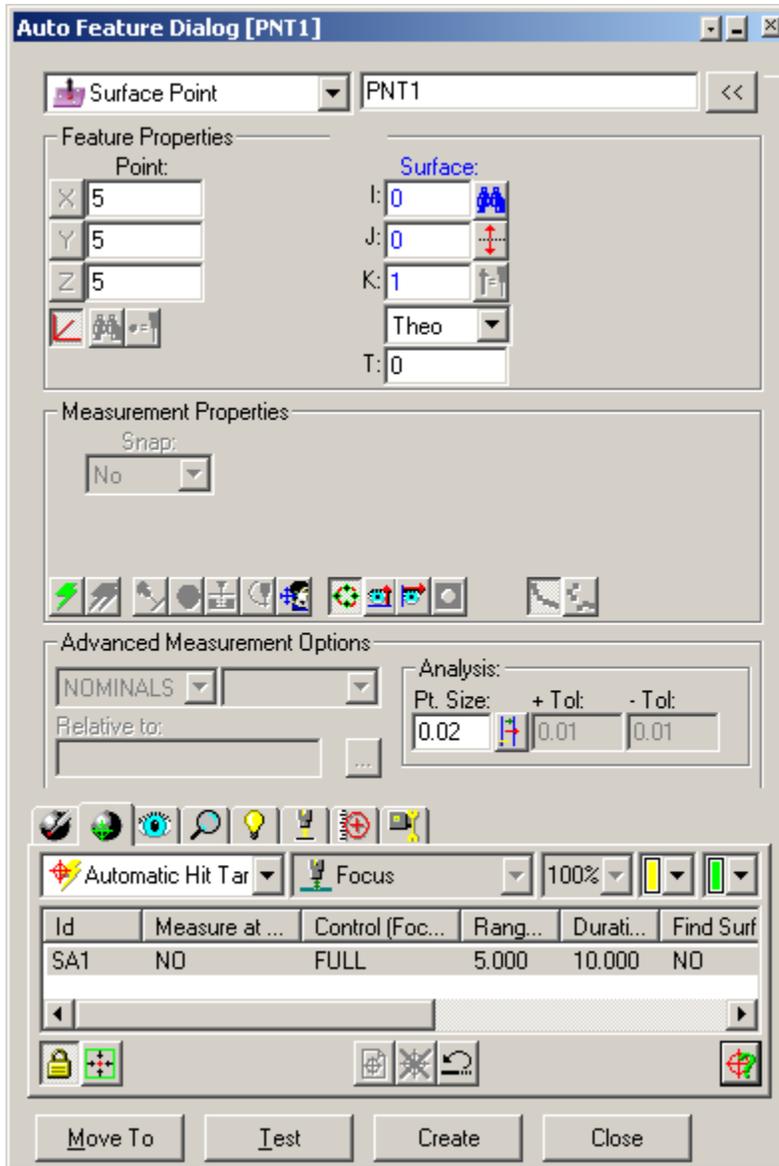
["Using the Probe Toolbox in PC-DMIS Vision"](#)

["Creating an Alignment"](#)

Vision Surface Point

To create a Vision Surface Point:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure surface points in DCC mode.
2. Select **Auto Surface Point**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Point | Surface Point** menu option. This opens the **Auto Feature** (surface point) dialog box.



Vision Surface Point Auto Feature dialog box

3. With the **Auto Feature** dialog box open, select a surface point in one of two ways:
 - [CAD Selection Method](#) - From the **Cad View**, click once on the CAD surface (surface mode) or three time on the wireframe (curve mode) to establish the point's location.
 - [Target Selection Method](#) - From the **Live View**, click once on the surface to establish the point's location. Adjust the lighting and magnification from the [Probe Toolbox](#) as needed.

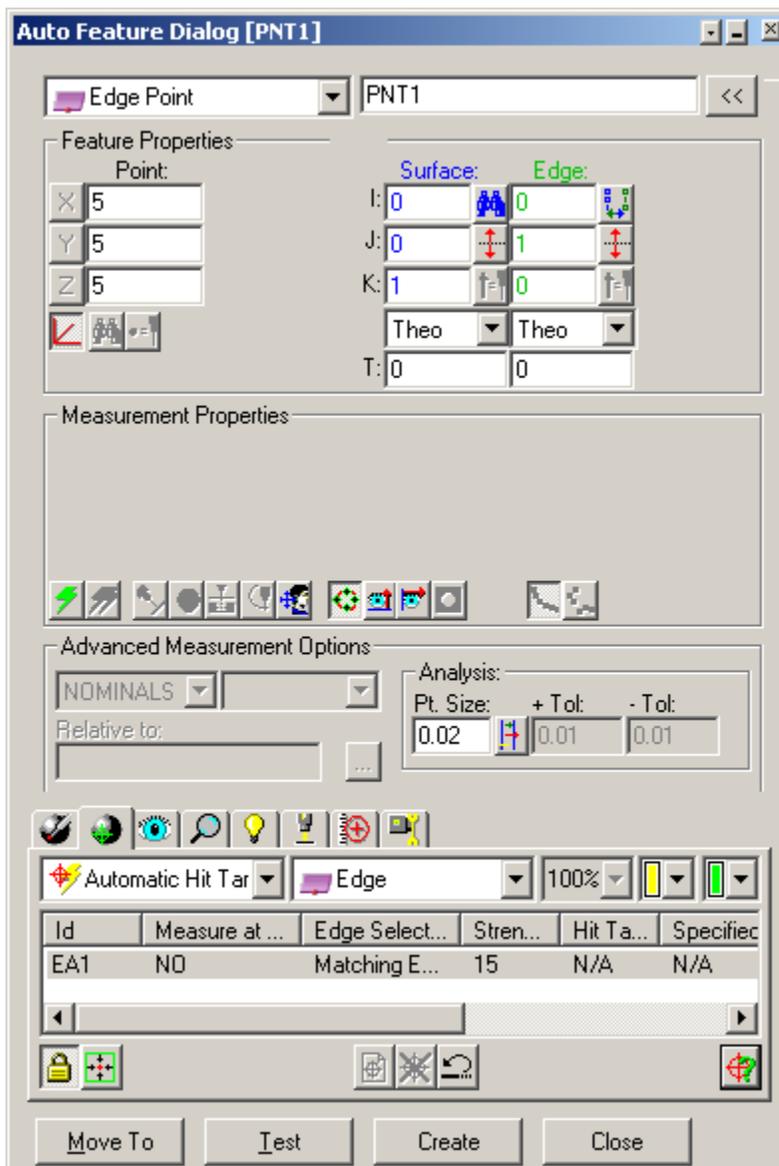
Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

4. PC-DMIS Vision automatically places the nominal data for the point into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the surface point.
5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the point. Also, adjust the values of the [Probe Toolbox](#) as needed.
6. Click **Test** to test point measurement.
7. Click **Create** on the **Auto Feature** dialog box to add the surface point to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Vision Edge Point

To create a Vision Edge Point:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure edge points in DCC mode.
2. Select **Auto Edge Point**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Point | Edge Point** menu option. This opens the **Auto Feature** (edge point) dialog box.



3. With the **Auto Feature** dialog box open, Select a edge point in one of two ways:
 - [CAD Selection Method](#) - From the **Cad View**, click once near the edge on the CAD surface to establish the point's location.
 - [Target Selection Method](#) - From the Live View, click once near the edge of the surface to establish the point's location. Adjust the lighting and magnification from the [Probe Toolbox](#) as needed.

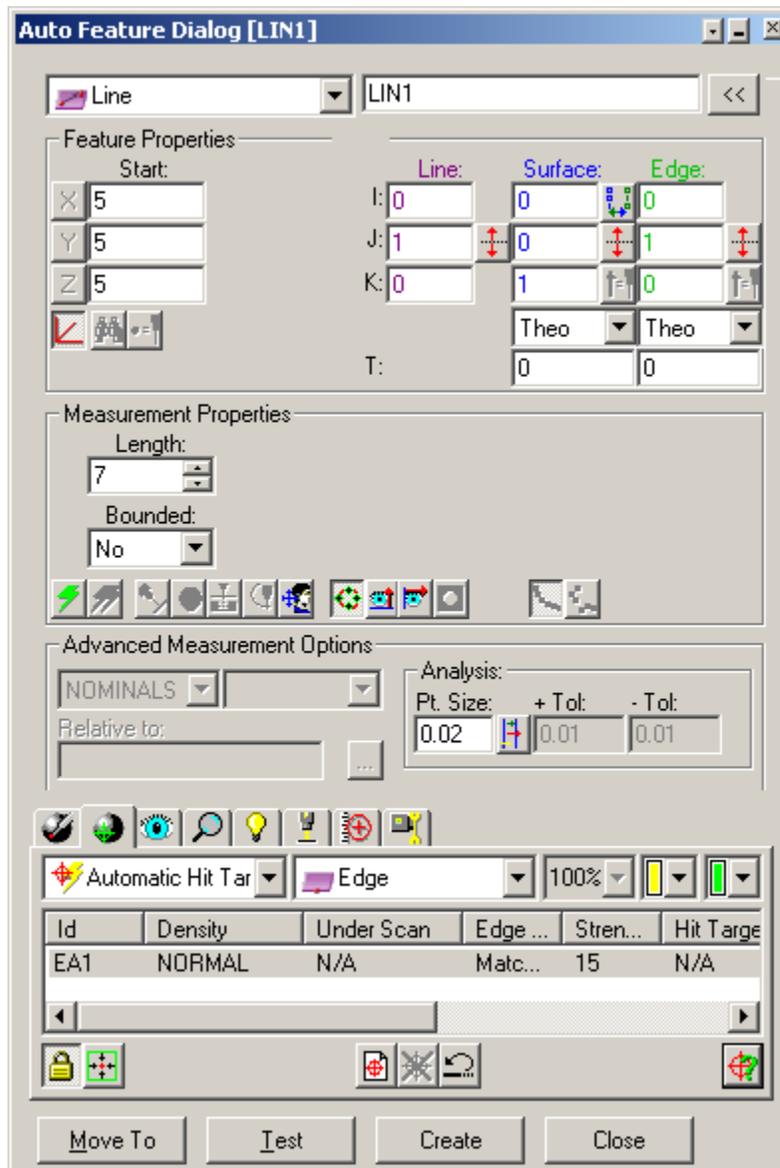
Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

4. PC-DMIS Vision automatically places the nominal data for the point into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the edge point.
5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the point. Also, adjust the values of the [Probe Toolbox](#) as needed.
6. Click **Test** to test point measurement.
7. Click **Create** on the **Auto Feature** dialog box to add the edge point to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Vision Line

To create a Vision Line:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure lines in DCC mode.
2. Select **Auto Line**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Line** menu option. This opens the **Auto Feature** (line) dialog box.



Vision Line Auto Feature dialog box

3. With the **Auto Feature** dialog box open, Select a line in one of two ways:
 - [CAD Selection Method](#) - From the **Cad View**, click once on one end of the line and again at the other end on the CAD surface to establish the line's location.
 - [Target Selection Method](#) - From the **Live View**, click to locate the start and end points of the line, or double-click to automatically add two points at the extents of the selected edge. This establishes the line's location. Adjust the lighting and magnification as needed.

Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

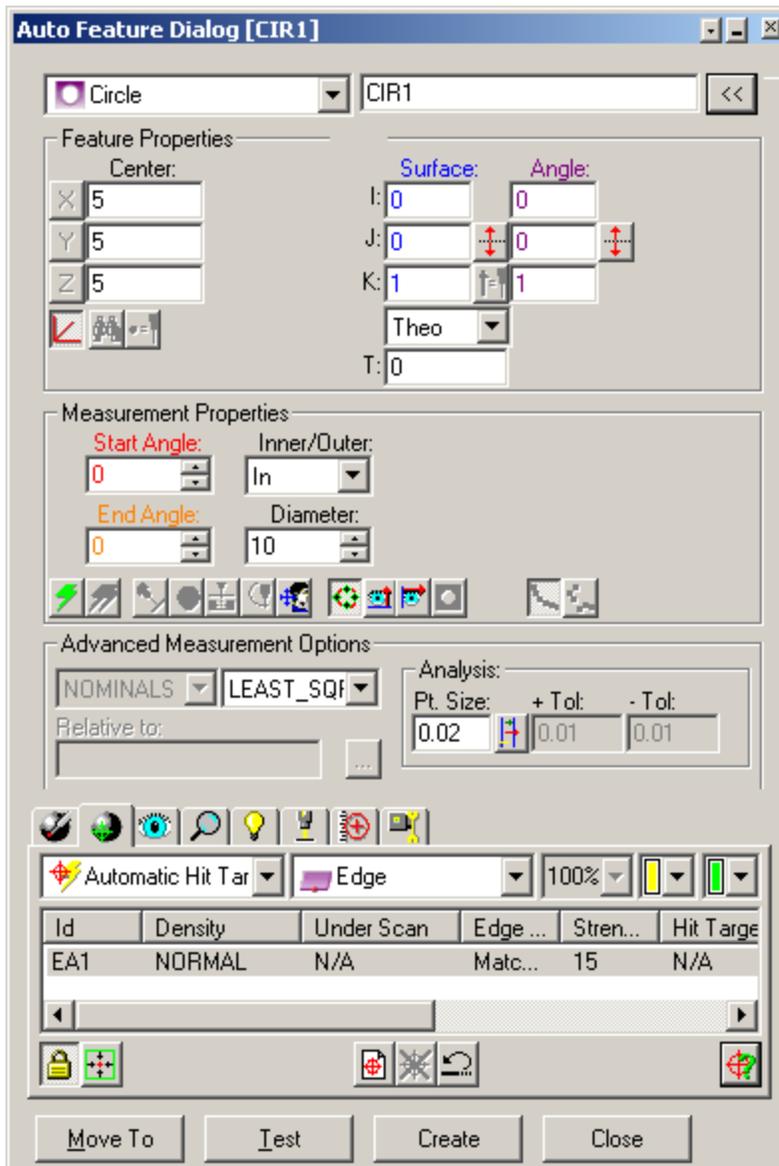
4. PC-DMIS Vision automatically places the nominal data for the line into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the line.
5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the line. Also, adjust the values of the [Probe Toolbox](#) as needed.
6. Click **Test** to test line measurement.

7. Click **Create** on the **Auto Feature** dialog box to add the line to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Vision Circle

To create a Vision Circle:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure circles in DCC mode.
2. Select **Auto Circle**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Circle** menu option. This opens the **Auto Feature** (circle) dialog box.



Vision Circle Auto Feature dialog box

3. With the **Auto Feature** dialog box open, Select a circle in one of two ways:

- [CAD Selection Method](#) - From the **Cad View**, click once near the edge of the circle on the CAD surface to establish the circle's location.
- [Target Selection Method](#) - From the **Live View**, click to add three points around the circle, or double click to automatically add three points equally spaced around the circumference of the visible circle. This establishes the circle's location. Adjust the lighting and magnification as needed.

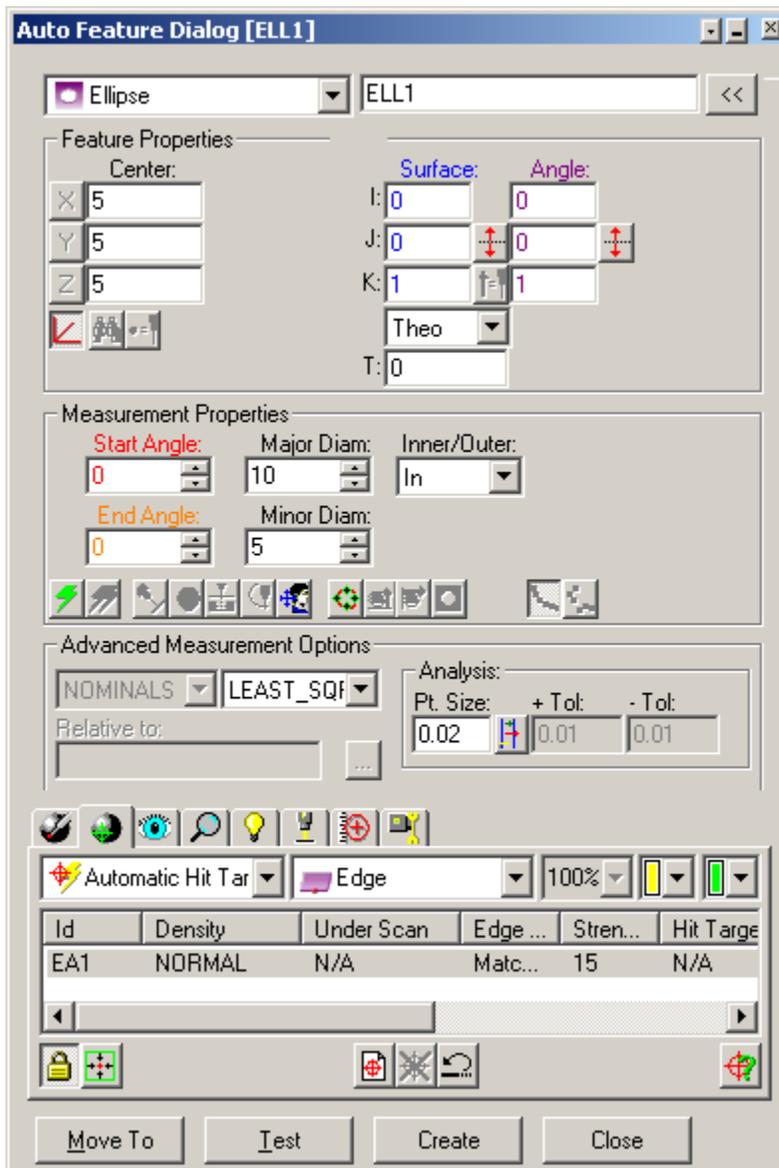
Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

4. PC-DMIS Vision automatically places the nominal data for the circle into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the circle.
5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the circle. Also, adjust the values of the [Probe Toolbox](#) as needed.
6. Click **Test** to test circle measurement.
7. Click **Create** on the **Auto Feature** dialog box to add the circle to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Vision Ellipse

To create a Vision Ellipse:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure ellipses in DCC mode.
2. Select **Auto Ellipse**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Ellipse** menu option. This opens the **Auto Feature** (ellipse) dialog box.



Vision Ellipse Auto Feature dialog box

3. With the **Auto Feature** dialog box open, Select an ellipse in one of two ways:
 - [CAD Selection Method](#) - From the **Cad View**, click once near the edge of the ellipse on the CAD surface to establish the ellipse's location.
 - [Target Selection Method](#) - From the **Live View**, click to add five points around the ellipse, or double click to automatically add five points equally spaced around the visible ellipse. This establishes the ellipse's location. Adjust the lighting and magnification as needed.

Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

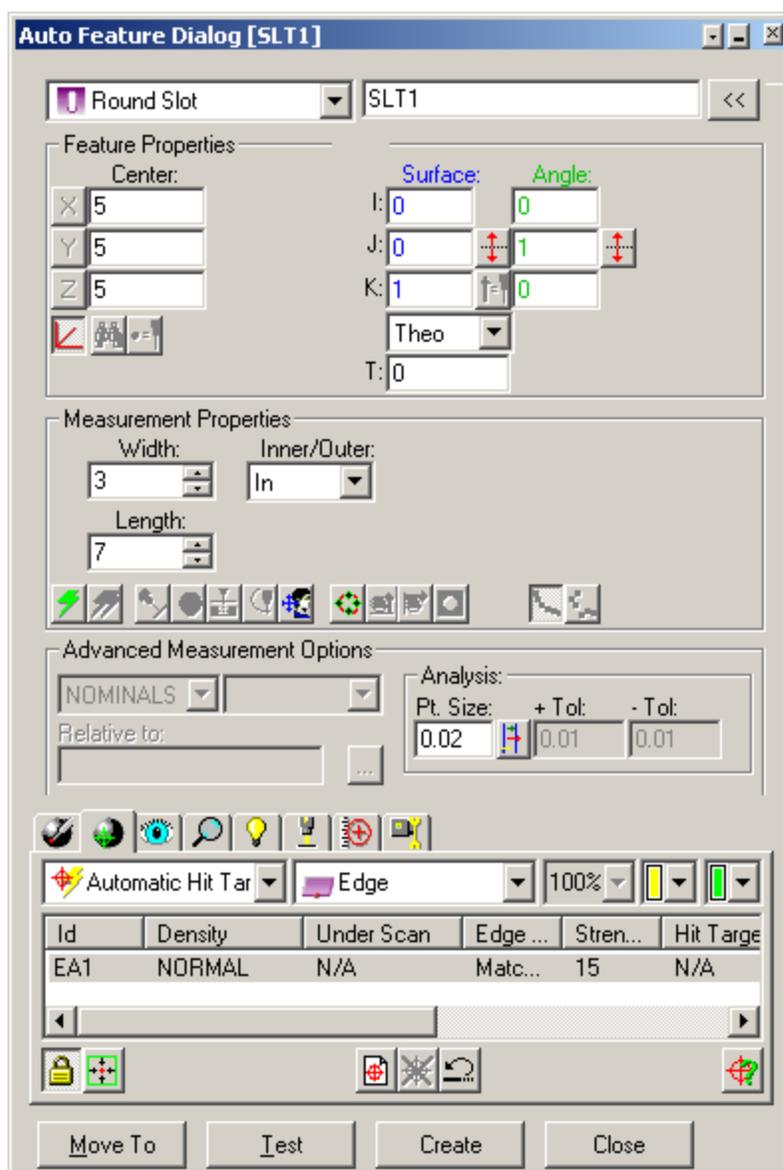
4. PC-DMIS Vision automatically places the nominal data for the ellipse into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the ellipse.
5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the ellipse. Also, adjust the values of the [Probe Toolbox](#) as needed.
6. Click **Test** to test ellipse measurement.

7. Click **Create** on the **Auto Feature** dialog box to add the ellipse to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Vision Round Slot

To create a Vision Round Slot:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure square slots in DCC mode.
2. Select **Auto Round Slot**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Ellipse** menu option. This opens the **Auto Feature** (round slot) dialog box.



Vision Round Slot Auto Feature dialog box

3. With the **Auto Feature** dialog box open, Select a round slot in one of two ways:

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- [CAD Selection Method](#) - From the **Cad View**, click once near the edge of the round slot on the CAD surface to establish the round slot's location.
- [Target Selection Method](#) - From the **Live View**, click three points on the first arc, and then three more points on the opposite ended arc. This establishes the round slot's location. Adjust the lighting and magnification as needed.

Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

4. PC-DMIS Vision automatically places the nominal data for the round slot into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the round slot.
5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the round slot. Also, adjust the values of the [Probe Toolbox](#) as needed.
6. Click **Test** to test round slot measurement.
7. Click **Create** on the **Auto Feature** dialog box to add the round slot to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Vision Square Slot

To create a Vision Square Slot:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure square slots in DCC mode.
2. Select **Auto Square Slot**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Square Slot** menu option. This opens the **Auto Feature** (square slot) dialog box.

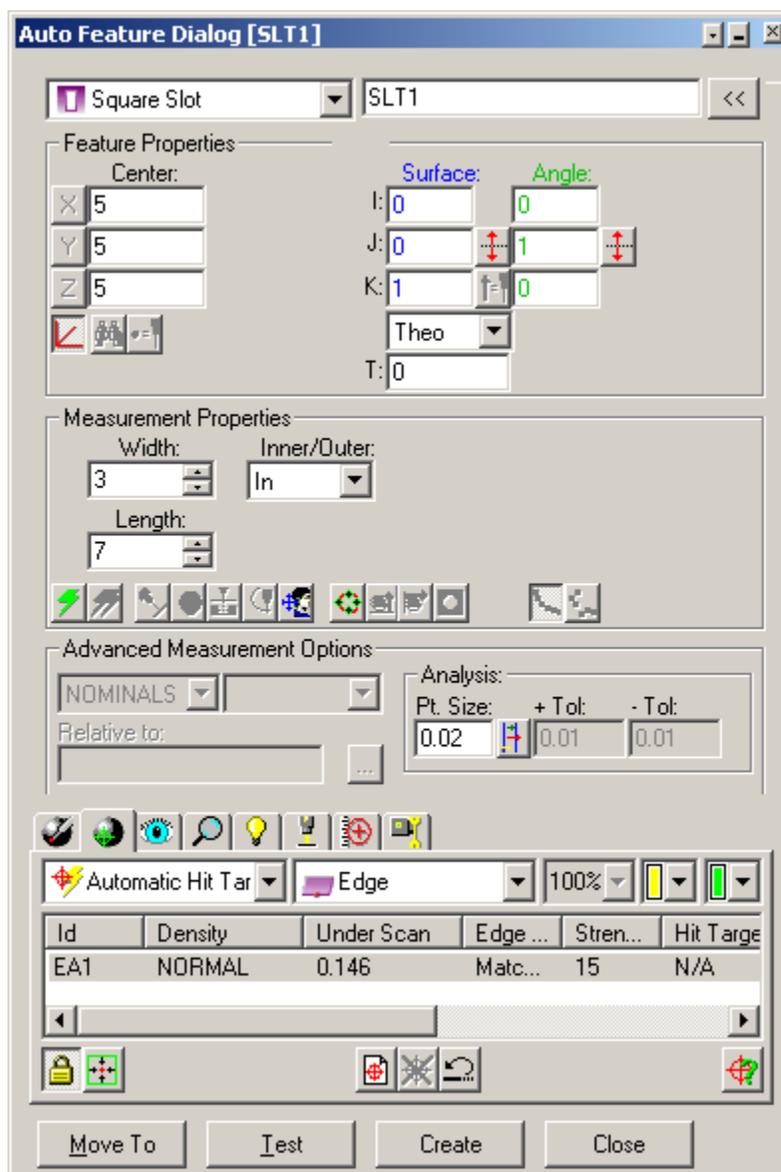


Figure 1: Vision Square Slot Auto Feature dialog box

3. With the **Auto Feature** dialog box open, Select a square slot in one of two ways:
 - [CAD Selection Method](#) - From the **Cad View**, click once near the edge of the square slot on the CAD surface to establish the square slot's location.
 - [Target Selection Method](#) - From the **Live View**, click two points on one of the two longer side edges, then click one point on one of the two end edges, then once on the other longer side edge, then finally once on the other end edge. This establishes the square slot's location. Adjust the lighting and magnification as needed.

Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

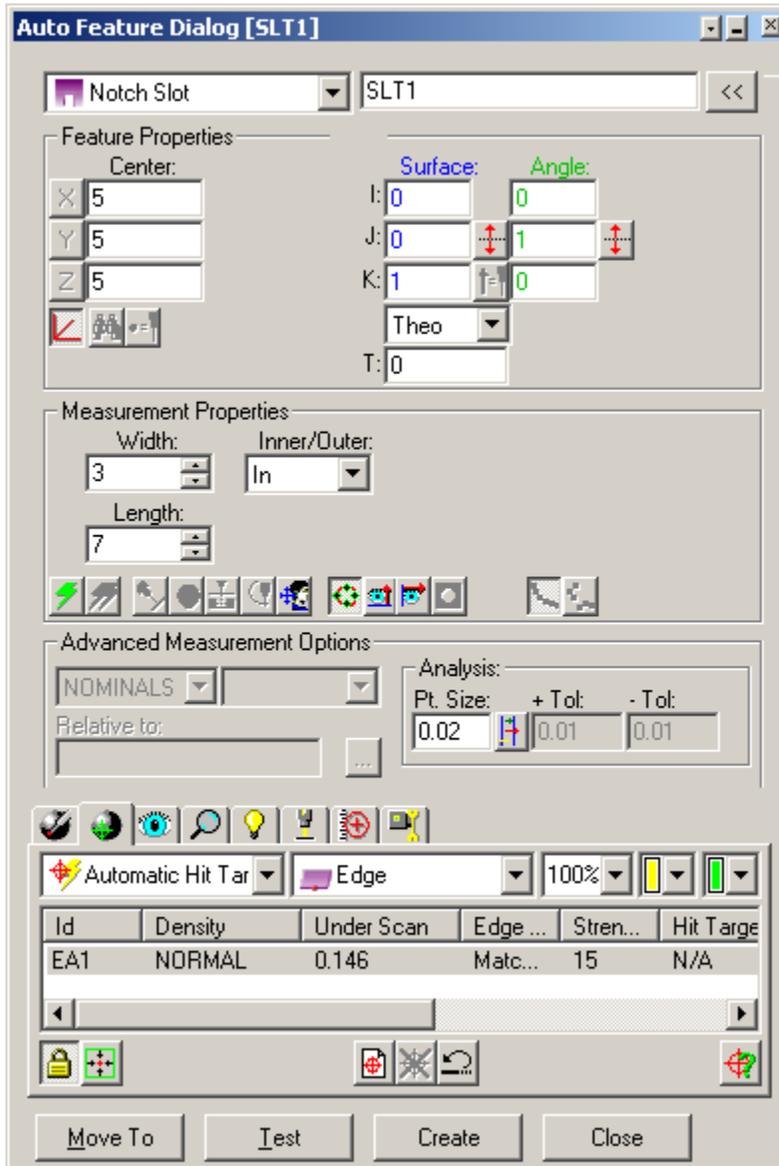
4. PC-DMIS Vision automatically places the nominal data for the square slot into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the square slot.
5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the square slot. Also, adjust the values of the [Probe Toolbox](#) as needed.

6. Click **Test** to test square slot measurement.
7. Click **Create** on the **Auto Feature** dialog box to add the square slot to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Vision Notch Slot

To create a Vision Notch Slot:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure notch slots in DCC mode.
2. Select **Auto Notch Slot**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Notch Slot** menu option. This opens the **Auto Feature** (notch slot) dialog box.



Vision Notch Slot Auto Feature dialog box

3. With the **Auto Feature** dialog box open, Select a notch slot in one of two ways:

- [CAD Selection Method](#) - From the **Cad View**, click once near the edge of the notch slot on the CAD surface to establish the notch slot's location.
- [Target Selection Method](#) - From the **Live View**, click five points as follows: Two points (1 & 2) on the edge opposite the opening; two points (3 & 4) on each of the parallel sides of the notch; one point (5) on the edge just outside the notch. This establishes the notch slot's location. Adjust the lighting and magnification as needed.

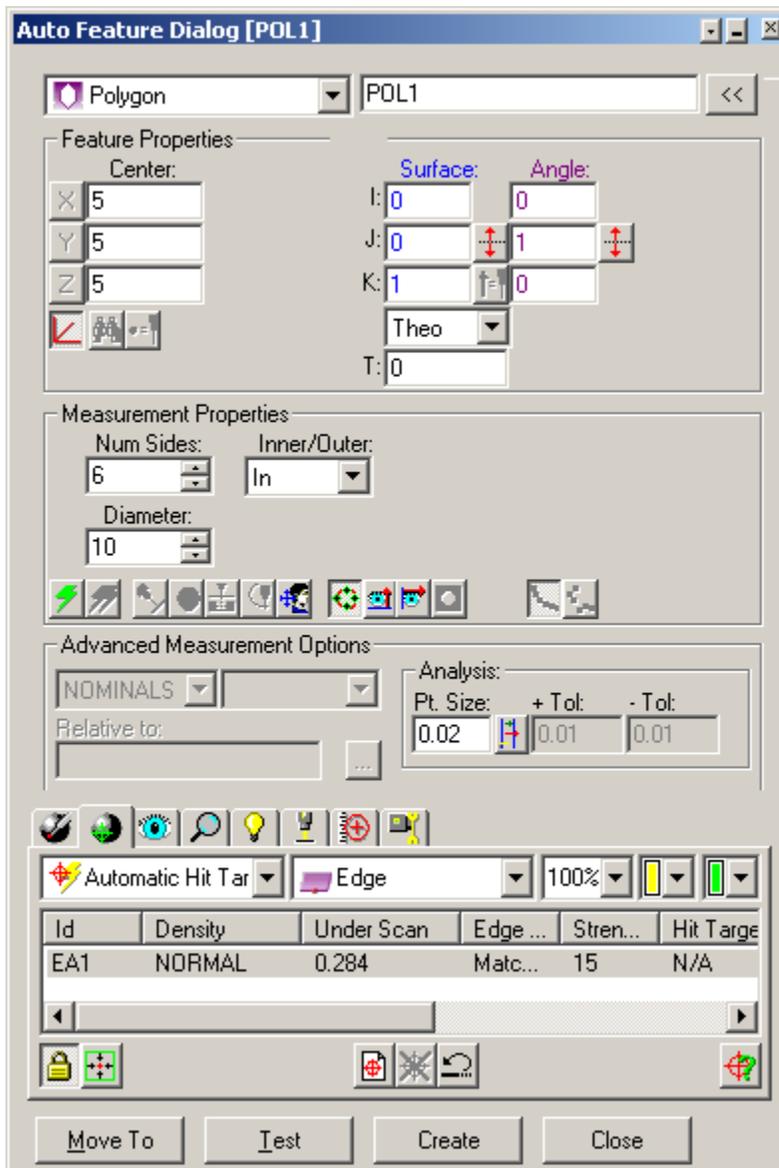
Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

4. PC-DMIS Vision automatically places the nominal data for the notch slot into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the notch slot.
5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the notch slot. Also, adjust the values of the [Probe Toolbox](#) as needed.
6. Click **Test** to test notch slot measurement.
7. Click **Create** on the **Auto Feature** dialog box to add the notch slot to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Vision Polygon

To create a Polygon:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure polygons in DCC mode.
2. Select **Auto Polygon**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Polygon** menu option. This opens the **Auto Feature** (polygon) dialog box.



Vision Polygon Auto Feature dialog box

3. With the **Auto Feature** dialog box open, Select a polygon in one of two ways:
 - [CAD Selection Method](#) - From the **Cad View**, click once near the edge of the polygon on the CAD surface to establish the polygon's location.
 - [Target Selection Method](#) - From the **Live View**, click two points on the first edge, and then one click on all the other sides to define the feature. Ensure that you have set the **Number Of Sides** parameter first. This establishes the polygon's location. Adjust the lighting and magnification as needed.

Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

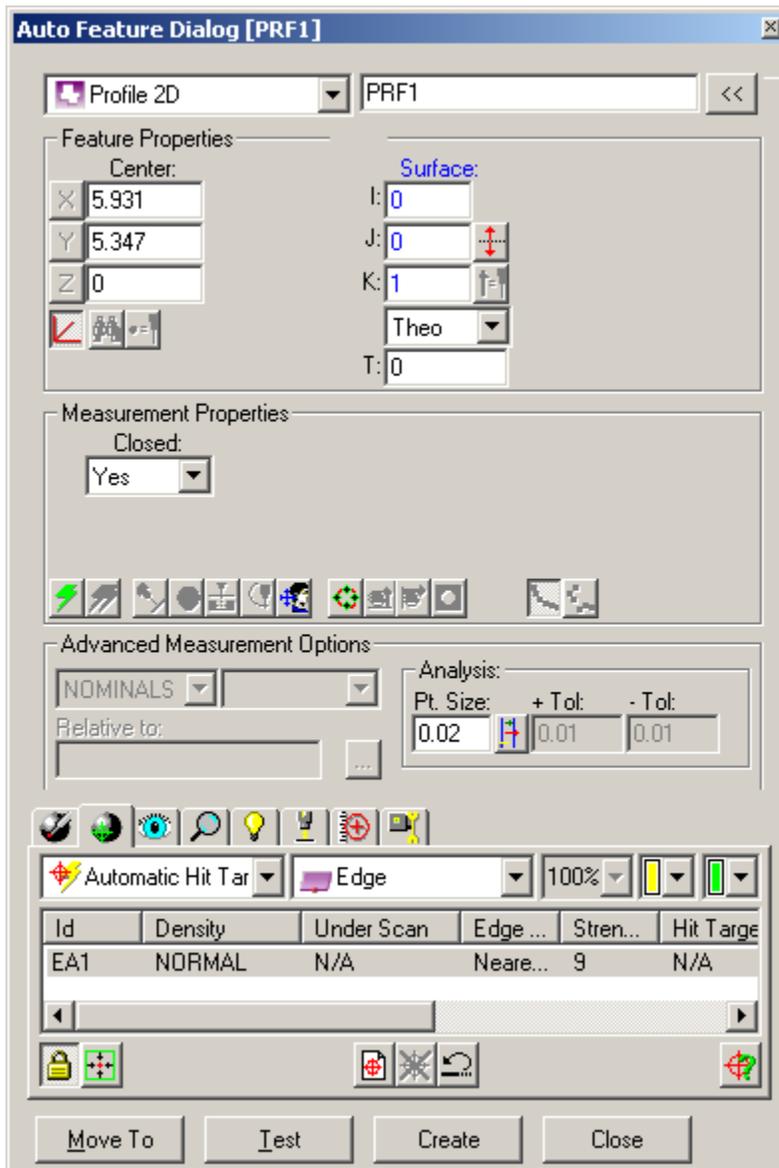
4. PC-DMIS Vision automatically places the nominal data for the polygon into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the polygon.
5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the polygon. Also, adjust the values of the [Probe Toolbox](#) as needed.

6. Click **Test** to test polygon measurement.
7. Click **Create** on the **Auto Feature** dialog box to add the polygon to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Vision Profile 2D

To create a Profile 2D:

1. For machines supporting DCC motion, select **DCC Mode**  if you want to create and measure profile 2Ds in DCC mode.
2. Select **Auto Profile 2D**  from the **Auto Feature** toolbar. You can also select the **Insert | Feature | Auto | Profile 2D** menu option. This opens the **Auto Feature** (profile 2D) dialog box.



Vision Profile 2D Auto Feature dialog box

3. With the **Auto Feature** dialog box open, Select a profile 2D in one of two ways:

- [CAD Selection Method](#) - From the **Cad View**, click once (in surface mode) near the edge of the profile 2D on the CAD surface to establish the profile 2D's location. In curve mode, you must select each of the cad entities that make up the feature's form.
- [Target Selection Method](#) - From the **Live View**, click sufficient points to define the shape of the profile, with each pair of points being joined by an arc or line. You can insert more points later by right clicking on the Target and selecting **Insert Nominal Segment**. Or, you may also double-click in the **Live View** image to edge trace. See the "[Using 2D Profile Edge Tracer](#)" topic. This establishes the profile 2D's location. Adjust the lighting and magnification as needed.

Important: Click as close as possible to the CAD element to ensure the PC-DMIS will not choose an incorrect element.

4. PC-DMIS Vision automatically places the nominal data for the profile 2D into the **Auto Feature** dialog box. The hit targets will automatically be displayed for the profile 2D.



For all features (except for Profile 2D) the hit targets will automatically be displayed for the feature. For a Profile 2D feature, you need to click on the **Show Hit Targets** button on the auto features dialog when you've defined the profile's nominal position. See "[Required Clicks for Supported Features](#)".

5. Adjust the nominal information in the **Auto Feature** dialog box to match the theoretical values of the profile 2D. Also, adjust the values of the [Probe Toolbox](#) as needed.
6. Click **Test** to test profile 2D measurement.
7. Click **Create** on the **Auto Feature** dialog box to add the profile 2D to the part program.
8. Save the part program for future execution. See "[A Note on Executing a Vision Part Program](#)".

Using 2D Profile Edge Tracer

You can program a 2D Profile feature simply by double-clicking near the edge of the feature in the **Live View**. PC-DMIS Vision, will automatically trace around the edge of the feature, moving the machine stage on a DCC machine if necessary.

Rules for Clicks to Start Edge Tracer

- If you just double-click, PC-DMIS Vision will travel around the edge in an counter-clockwise direction, trying to return to the start position.
- If you first single click a point before double clicking, that first clicked point will be your start point and the double click point will be your targeted end point.
- If you click two points before double clicking, the first click is the start point, and the second click dictates the direction in which the trace will proceed. The double-click position will be the end point.

Once the edge trace is completed, you can then adjust the nominal segments as necessary.

A Note on Executing a Vision Part Program

When you are executing your part program there are steps that can be taken that will cause a feature to be in tolerance (PASS) or out of tolerance (FAIL). This is done by clicking **Continue** in the **Execution Mode Option** dialog box to PASS the feature or by clicking **Skip** to FAIL the feature.

- If you PASS a feature, the MEAS values for the CENTROID are set to the THEO values.
- If you FAIL a feature, the MEAS values for the CENTROID are set to the THEO values + 100mm in the probe vector direction (usually Z). The feature will show in the **Graphics Display** window as floating above the part. However, if looking straight down in the **Graphics Display** window, the feature will appear to be drawn correctly.

So, if you have a dimension on the position of the feature, it will be in tolerance or out of tolerance, depending on whether you clicked **Continue** or **Skip**.

Modifying a Programmed Feature Using the Auto Feature Dialog Box

To modify a feature command in your part program, use these steps:

1. Place your cursor on the feature you want to edit in the Edit window and press F9 to access its **Auto Feature** dialog box.
2. If you have a DCC machine and have already established and ran your "first alignment" with a real part, you can click on the **Move To** button in the **Auto Feature** dialog box to move the FOV to the center of the feature. This button only works on DCC enabled machines.



Warning: If you have not established the "first alignment" for your part program, do *not* click the **Move To** button. Doing so may cause the stage to run off or damage the part you are measuring. Remember, PC-DMIS first needs to know the location of the part on the stage, its orientation and level to calculate the target feature location. See "[Creating an Alignment](#)".

3. Switch to the **Live View** tab in the Graphics Display window.
4. Ensure that the lamps are properly illuminating the edges of the feature. If you need to make changes, switch to the **Illumination** tab on the **Probe Toolbox** and make the necessary adjustments.
5. Click the **Test** button in the **Auto Feature** dialog box. PC-DMIS Vision inserts a temporary test feature into the Edit window and executes the feature.
6. Examine the detected points in the **Live View**. These points indicate the raw hits PC-DMIS will use to fit the geometry. If there are outliers you wish to reject, use the **Hit Targets** tab on the **Probe Toolbox**, and make changes to the **Filter Parameter Set**. If the detected points are not at the location you expect, continue to the next step.
7. Access the Preview window (**View | Other Windows | Preview**) to ensure that the feature was properly measured in this test.
8. If the test data appears incorrect, the following suggestions may help to fix the problem:
 - If most of the feature appears correct, but one region is returning incorrect points, insert a new target in that region, and set different parameters (illumination, edge detection, filters, and so on) until that region of the feature also measures correctly.
 - Click on the **Hit Targets** tab of the **Probe Toolbox** and insert a new target in the target region. See "[Probe Toolbox: Hit Targets tab](#)".
 - Click on the **Hit Targets** tab of the **Probe Toolbox** and adjust the target parameters. See "[Probe Toolbox: Hit Targets tab](#)".
 - Click on the **Illumination** tab of the **Probe Toolbox** and adjust any illumination settings. See "[Machine Options: Illumination tab](#)". The changed illumination settings are applied to any targets currently selected in the **Hit Targets** tab. You may also use the attached pendant to set the luminosity if the machine supports it.
9. Once you have made the suggested changes, test the results of the target by clicking the **Test** button again. When you are satisfied with the target results, continue with the next step.
10. Make adjustments to the options on the dialog box as needed.
11. Click the **OK** button on the **Auto Feature** dialog box to update the feature with the new settings.



The **Auto Feature** dialog box shown above is the expanded version of this dialog box. Click the << button to see the reduced version of the dialog box.



Modifying a feature command in an offline part program is very similar to modifying an online part program. The only difference is that in offline mode, you don't have an external pendant. Dragging with the right mouse button in the **Cad View** tab simulates the stage motion.

Using AutoTune Execution



AutoTune button.

To enter *AutoTune Execution*, select the **AutoTune** from the **Edit Window** toolbar or from the **File** menu.

The **AutoTune** button, places your computer into **AutoTune** execution.

AutoTune execution allows you to conveniently teach illumination, magnification and image processing parameters of your part program commands for the target optical machine.

You should use this mode when you move your part program from one computer to another, or when you are ready to execute an offline prepared part program in an online environment. If you are running an offline part program in online mode for the first time, PC-DMIS Vision automatically enters **AutoTune** execution. It needs to do this because during offline preparation, PC-DMIS uses simulated lighting which may not match the actual lighting behaviour on the target machine.

In summary, you may want to execute your part program using **AutoTune** execution when you have the following conditions:

- You move a part program from one machine to another.
- You need to run a part program in online mode that was prepared in offline mode.
- You change hardware components that affect the lighting, such as lamps.
- Lighting conditions of the room where you have your optical machine changes.
- You want to change the magnification setting for a number of features in one operation, rather than individually feature by feature.

You will find that there are slight differences between different hardware systems and, over time, even within the same hardware system. **AutoTune** execution addresses these issues.

How AutoTune Execution Works

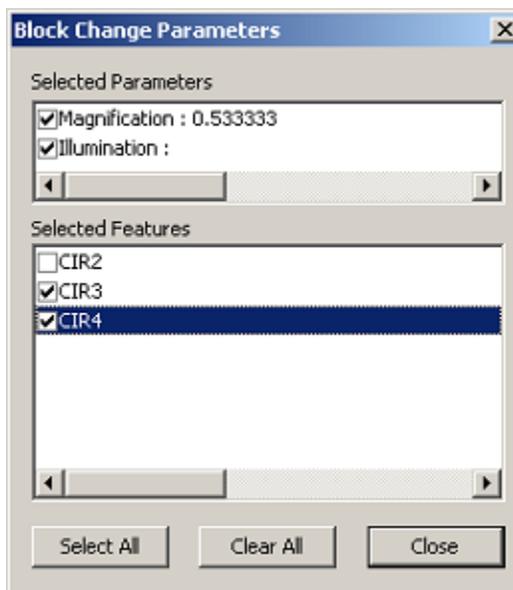


AutoTune button.

To enter *AutoTune execution*, select the **AutoTune** from the **Edit Window** toolbar or from the **File** menu.

When you execute your part program in **AutoTune** execution, PC-DMIS Vision steps you through the program, feature by feature.

It performs a test measurement on each feature and then displays a dialog box indicating what had been changed.



You then have the option to apply one or more of those changes to one or more subsequent features in the part program.

Once you are satisfied with the feature and click OK, PC-DMIS Vision then tests the next feature. It continues doing this until the entire part program has been executed in **AutoTune** execution.

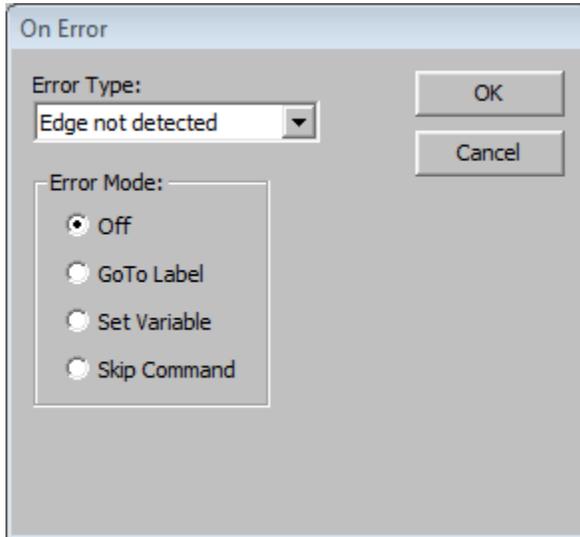
Once you finish executing the part program in **AutoTune** execution, you can return to regular Execute mode.

Using On Error Commands

On Error commands allow you to specify the action that will be taken for *focus* or *edge* detection errors. The 'Vision' option must be enabled on your portlock for these options to be available for the 'On Error' command.

To use On Error commands:

1. Open or Create a Part Program.
2. Insert Manual/DCC mode command, and set it to DCC.
3. Insert an **On Error** command by selecting the **Insert | Flow Control Command | On Error** menu item.



On Error dialog box

4. Select either the 'Edge Not Detected' or 'Focus Not Detected' **Error Type**.
5. Select the Error Mode:
 - **Off**: PC-DMIS does nothing.
 - **GoTo Label**: Jumps to a defined label.
 - **Set Variable**: Sets a variable's value to one.
 - **Skip Command**: Skips over the current command and moves to the next marked command in the part program.

When errors are detected during part program execution, the specified action will be performed.

Using the Image Capture Command

The **Insert | Feature | Image Capture** menu item inserts an `IMAGECAPTURE` command into the Edit window. During execution PC-DMIS will move the vision probe to the specified position, and using the passed magnification and illumination values, it will capture an image of the camera's **Live View** tab and save it as a bitmap file to the specified location.

The command in the Edit window has the following syntax:

```
IMAGECAPTURE/<TheoX, TheoY, TheoZ>,n1  
ILLUMINATION/Top Lamp [ON:60%] : Bottom Lamp [ON:69%] : Ring Lamp [ON:59%{1110}]  
FILENAME=s1
```

TheoX, TheoY, TheoZ are the X,Y,Z coordinates to which the machine will move to take the image capture.

n1 is a number value indicating the desired optical magnification.

The ILLUMINATION line of the command block contains read-only illumination information of the lamps at the time the command was inserted. Currently, you cannot modify any of that information directly in the Edit window. The Illumination settings must be predefined in the Probe Toolbox or by manual controls (if available) before inserting the command.

Specifically, the ILLUMINATION line shows whether a lamp is on or off and what the light intensity is for each lamp. Since the ring lamp is made up of four separate lights, the four numbers in parentheses indicate the ON/OFF state for each of those lights. If they have differing levels of intensity the command will only show the highest value.

s1 is a string value providing the file pathway and name for the captured bitmap image.

A finished command might look something like this:

```
IMAGECAPTURE/<10.825,0.714,-95.008>,1.863
ILLUMINATION/Top Lamp [ON:60%] : Bottom Lamp [ON:69%] : Ring Lamp [ON:59%{1110}]
FILENAME=D:\Images\ImageCapture_4.bmp
```

Currently, this command does not have a dialog box associated with it, so you need to make parameter changes in the Edit window or by creating a new command.

Appendix A: Troubleshooting PC-DMIS Vision

Use this troubleshooting guide to find solutions to your PC-DMIS Vision problems.

Problem: No image in Live View

- Ensure the Frame Grabber drivers have been installed.

Problem: DCC machine does not move

- Check the **Max Speed** setting in the Motion tab of the **Machine Interface Setup** dialog box.

Problem: Point Detection takes a long time

When using **Matching Edge** selection type for an Automatic Hit Target, image detection can sometimes take a long time. Try the following to speed up the detection:

- Reduce scan tolerance (width of the target band). With a narrower band, PC-DMIS Vision has fewer "edges" it has to evaluate in order to find the correct one.
- Change the illumination. You may have a lot of surface texture which can give the **Matching Edge** algorithm more to do. Make the feature a back light measured one (as you'd normally do on holes). Switch *off* the top light, and switch *on* the back light.
- Use the Clean Filter from the Filter Parameter Set to remove small dirt and weak edges from the image.
- If the previous steps don't help, use one of the other edge detection methods. **Matching Edge** is the most reliable for finding the correct edge, but it is the most processor intensive. On this particular edge, try **Specified Edge**, with the direction going from inner to outer.

Problem: Point Detection finds false edge points on parts with strong surface texture

- Use the **Clean Filter** from the Filter Parameter Set to remove small dirt and weak edges from the image.
- Where possible, use bottom light sources with no top light.

Problem: Point Detection finds false edge points on parts with gentle gradient/shadow

- Switch off the **Clean Filter** from the Filter Parameter Set.

Problem: Poor Focus accuracy

- Focus operations (manual and automatic) should always be done at highest possible magnification.

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- Use AUTO control mode where possible. If using FULL control, a slower speed allows for more data collection, improving the accuracy.
- Set the illumination to provide as much contrast as possible on the surface/edge.

Problem: Poor Manual Focus repeatability

- When moving the stage, aim for a slow and steady speed.
- You can move forwards and backwards over the focus point (to get multiple peaks on your graph) if the focus time allows it. See the "[Focus Graph](#)" topic.

Appendix B: Adding a Ring Tool

PC-DMIS Vision supports the use of a Ring Tool for Probe Offset calibration. The ring tool is used for Vision and Multi-sensor machines. See the "[Calibrate Probe Offset](#)" topic for information.

The screenshot shows the 'Edit Tool' dialog box with the following fields and values:

Field	Value
Tool ID:	.475 Tool
Tool Type:	RING
Offset X:	5.139
Offset Y:	2.863
Offset Z:	-91.002
Shank Vector I:	0
Shank Vector J:	0
Shank Vector K:	1
Search Override I:	
Search Override J:	
Search Override K:	
Diameter / Length:	0.475
Z Point Offset X:	5.139
Z Point Offset Y:	2.863
Z Point Offset Z:	0
Datum Depth Start:	0
Datum Depth End:	0
Focus Offset:	

Add Tool dialog box - Ring Tool

Specify the following Ring Tool values:

- **Tool ID:** Provide a descriptive name for the Ring tool.

- **Tool Type:** Ring is selected.
- **Shank Vector IJK:** Specifies the vector of the center axis of the ring tool.
- **Search Override IJK:** These boxes allow you to specify a vector used by PC-DMIS to determine the most efficient order to measure all the tips when you select the **User Defined Calibration Order** check box in the **Probe Utilities** dialog box.
- **Diameter :** Provides the diameter of the ring gage hole or bore
- **Z Point Offset X:** Specifies the X offset of the Z value measurement point from the top center of the bore.
- **Z Point Offset Y:** Specifies the Y offset of the Z value measurement point from the top center of the bore.
- **Z Point Offset Z:** Specifies the Z offset of the Z value measurement point from the top center of the bore.
- **Datum Depth Start:** Specifies the minimum depth into the bore where the bore cylinder is the datum
- **Datum Depth End:** Specifies the maximum depth into the bore where the bore cylinder is the datum
- **Focus Offset:** Provides distance in Z from the top surface to the bore circle focus height.

Appendix C: Using the NC-100 Video Probe

This appendix deals specifically with using a NC-100 Video Probe with PC-DMIS Vision. The NC-100 video probe is considered a "non-contact probe". This means the probe never touches the part while taking measurements. The following topics in the PC-DMIS Core documentation that deal with general NC-100 options:

- Setup Options: NC-100 Setup tab
- Parameter Settings: NC-100 Parameters tab

The following topics are discussed in this appendix:

- [Calibrating NC 100 Video Probes](#)
- [Measuring Auto Features with the NC-100 Video Probe](#)

Calibrating NC 100 Video Probes

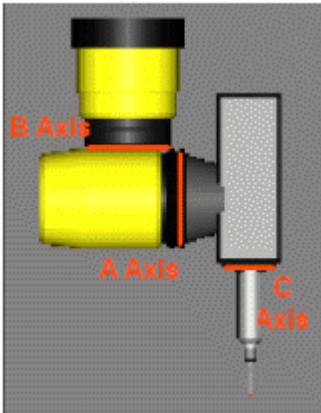
You will need to calibrate this probe on a special polyhedral calibration tool that has 17 faces, requiring 17 orientations of the probe head. You will also need to utilize a calibrated touch trigger probe to calibrate the orientation of the polyhedral tool.

Important! The entire NC-100 Video Probe calibration process takes about one hour to perform. Be sure to allow enough time to complete the process. Segmenting this procedure may result in having to start the process from the beginning.

You will need two types of calibration tools: A sphere calibration tool and a polyhedral calibration tool.

Calibrate the Touch Trigger Probe

First, you will need to calibrate your touch trigger probe. It needs to be calibrated in a least two positions (although depending on your system, you may have three).



Three-Axis Probe

You should use the following positions for machine configurations and gage orientations:

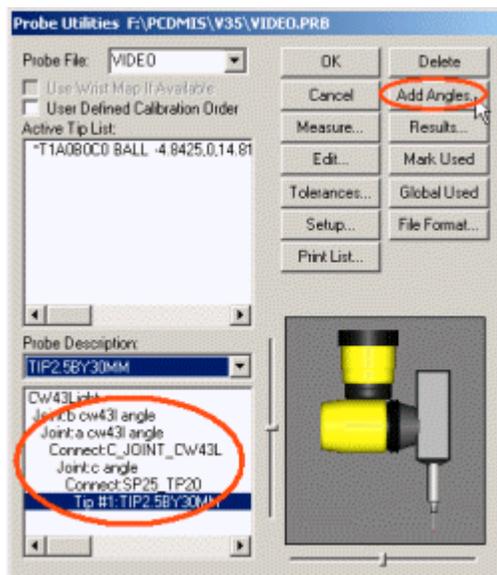
- A0B0C0
- A90B180C0

The process of creating a new touch trigger probe file and calibrating the touch trigger probe type is already covered in the "Defining Probes" topic of the "Defining Hardware" chapter in the PC-DMIS Core documentation. Refer to that topic if you need additional information.

Follow the steps below to complete this phase of the calibration.

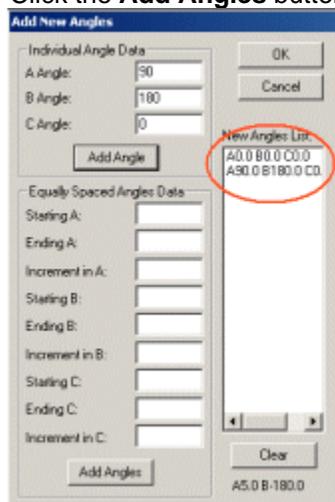
Step 1: Define the Touch Trigger Probe and Two Tip Positions

The first thing you will need to do is define the correct probe, extensions, tip and tip positions for your touch trigger probe.



1. From the **Probe Utilities** dialog box (**Insert | Hardware Definition | Probe**), define the probe, extension, and tips in the **Probe Description** box.

- Click the **Add Angles** button. The **Add New Angles** dialog box appears.



- Add the A0B0C0 and A90B180C0 angles into the **New Angles List**.
- Click **OK** to accept the tip angles specified in the **Add New Angles** dialog box. The angles now appear in the **Active Tip List** of the **Probe Utilities** dialog box.

Step 2: Calibrate the Probe Tip Positions on a Sphere Calibration Tool

Now you will calibrate the two tip positions on a sphere calibration tool.

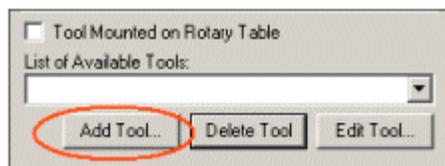
- Select the two tips that you will use to establish the initial orientation of the Polyhedral Gage from the **Active Tip List**.
- Click the **Measure** button on the **Probe Utilities** dialog box. The **Measure Probe** dialog box appears.
- Select a calibration sphere from the **List of Available Tools** list.
- Click **Measure** to calibrate the T1A0B0C0, T1A90B180C0 tips on a calibration sphere.
- Follow the on-screen instructions.

Note: Even though you will use the polyhedral calibration tool in subsequent steps you should keep the sphere tool where it is on the CMM plate for further use in this procedure.

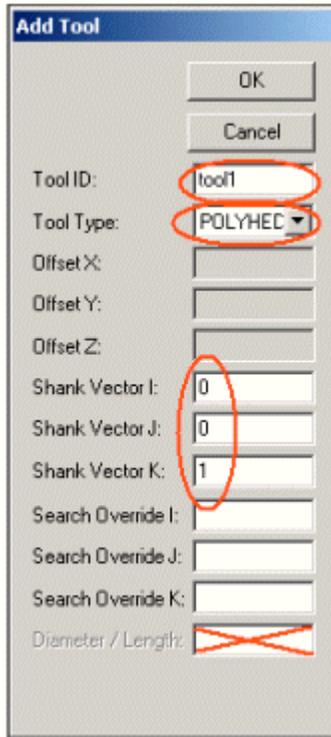
Step 3: Create the Polyhedral Calibration Tool

Prior to calibrating on the polyhedral calibration tool, you will need to define the polyhedral tool.

- Select the two tips that you have just calibrated from the **Active Tip List** of the **Probe Utilities** dialog box.
- Click the **Measure** button again. The **Measure Probe** dialog box appears.
- Click the **Add Tool** button. The **Add Tool** dialog box appears.



- From the **Tool Type** list, select **POLYHEDRAL**.
- Type a name for the tool in the **Tool ID** box.
- Define the I, J, K Shank Vector. You won't need to define the Diameter / Length since this is already hard coded based on your calibration tool type selection.

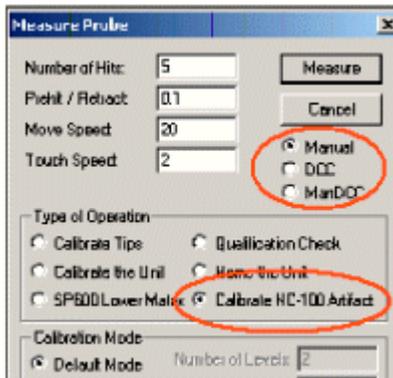


7. Click **OK**. PC-DMIS displays the **Measure Probe** dialog box again.

Step 4: Fill out the Measure Probe Dialog Box

In the **Measure Probe** dialog box, you will now see values displayed in the various boxes. These are the parameter settings that PC-DMIS will use during the measurement process.

You can accept these default values or change them to meet your specific needs.



1. Select **Calibrate NC-100 Artifact** option button from the **Type of Operation** area.
2. Select the **Manual**, **DCC**, or **ManDCC** option.

Note: Even if DCC or ManDCC mode is selected, PC-DMIS will require you to manually take hits on the calibration tool.

Step 5: Establishing the Orientation of the Polyhedral Calibration Tool

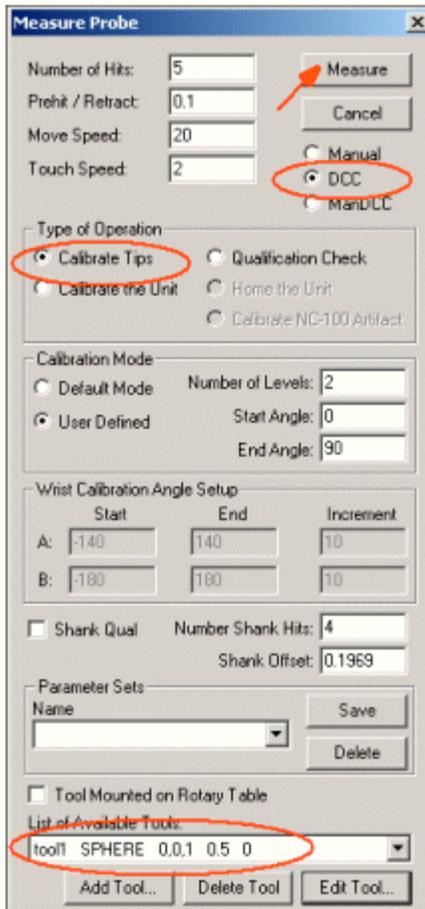
PC-DMIS will ask you to measure two planes on the polyhedral calibration tool. These planes will then be used to establish the orientation of the tool.

1. Click the **Measure** button in the **Measure Probe** dialog box. A message box appears and asks if you would like to establish the initial orientation.
2. Click **YES**. You should only click **NO** if you had previously established the orientation. Another message box appears asking if you want to move the PH9 /10 head.
3. Click **YES**. The **Execute Mode** dialog box appears. PC-DMIS asks you to take three hits to measure a plane.
4. Take the three hits on the face of the calibration tool that is most normal to the probe position of T1A0,B0,C0.
5. Press **Done** on your jog box. PC-DMIS then asks if you're ready to rotate the PH9/10 to the second position.
6. Click **OK**. PC-DMIS rotates the tip angle to the second tip angle of T1A90B180C0. Again, PC-DMIS asks you to take three hits to measure a plane.
7. Take three hits on the face of the calibration tool that is most normal to the current probe position.
8. Press **Done** on your jog box. After you press **Done**, PC-DMIS displays another message box, stating that not all of the tips required for calibration are available in the probe file.
9. Click **YES** to add these tip positions. PC-DMIS will then add up to 17 new positions will to the **Active Tip List** in the **Probe Utilities** dialog box.

Important: Do not move the polyhedral tool after establishing this initial orientation! Even though the sphere calibration tool is used in the next step, you will use the polyhedral tool again, and if you move the tool, you will need to begin the calibration process from the beginning.

Step 6: Calibrating All Needed Probe Tip Positions on the Sphere Tool

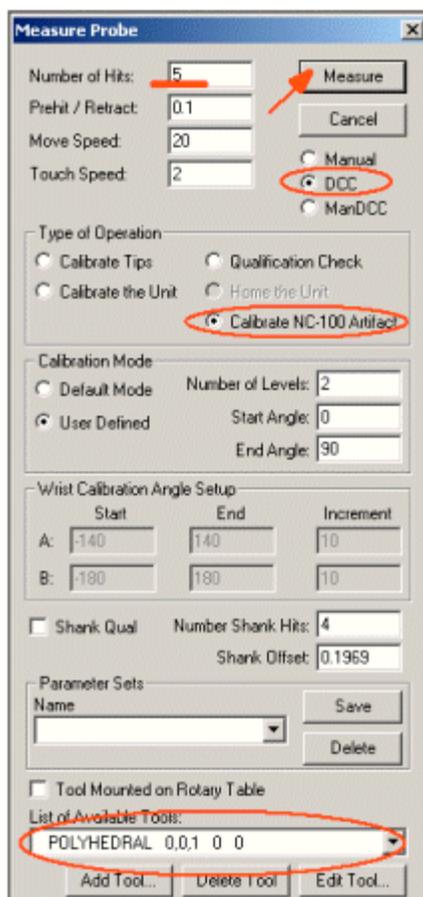
In this step you will be using the sphere calibration tool to measure the new positions added at the end of the previous step. It's best if you haven't moved the tool since you used it last.



1. Select the newly added tip positions from the **Active Tip List** of the **Probe Utilities** dialog box.
2. Click the **Measure** button. The **Measure Probe** dialog box appears.
3. Select the **DCC** or **ManDCC** option button.
4. Select the **Calibrate Tips** option button in the **Type of Operation** area.
5. Select the sphere calibration tool from the **List of Available Tools** list.
6. Click the **Measure** button. If the DCC option was selected, PC-DMIS will automatically begin to measure the sphere using the various probe tip positions.
7. After calibration, PC-DMIS returns to the **Probe Utilities** dialog box.

Step 7: Calibrating the NC-100 Artifact

In this step PC-DMIS will calibrate the polyhedral tool by measuring each hole on each face of the polyhedral tool.



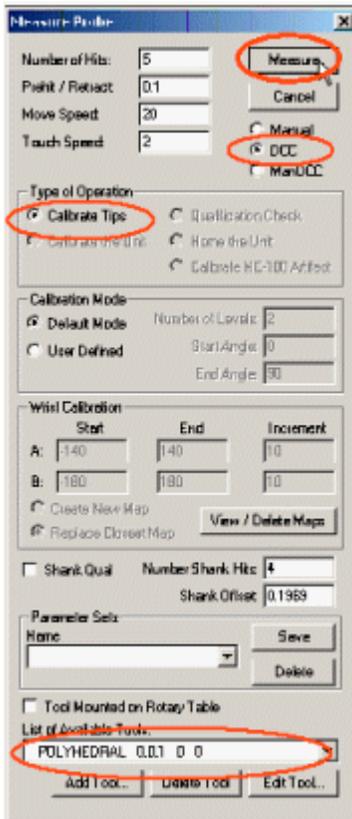
1. Click the **Measure** button from the **Probe Utilities** dialog box. The **Measure Probe** dialog box appears.
2. Ensure that the **Number of Hits** box has the value of 4 or higher. This number indicates the number of hits taken to measure each hole on the faces of the tool.
3. Select the **DCC** option button.
4. Select the **Calibrate NC-100 Artifact** option button from the **Type of Operation** area
5. Select the polyhedral tool from the **List of Available Tools** list.
6. Click the **Measure** button. PC-DMIS displays two message boxes at this point. The first asks if you would like to establish the initial orientation.
7. Click **NO**. You already performed this step earlier. The second message box asks if the qualification tool has been moved.
8. Since you haven't calibrated the polyhedral tool yet, click **YES**. PC-DMIS now asks you if the **CMM** is ready to rotate the probe head.
9. Click **OK**. The **Execution Mode Options** dialog box appears and PC-DMIS will begin the measurement process. You will measure the very first face of the tool manually. PC-DMIS will prompt you to first take three sample hits.
10. Take the three sample hits on the face most normal to the shank vector (the very top of the tool). PC-DMIS will then prompt you to take hits inside the hole (based on the number of hits you specified earlier).
11. Take the hits inside the hole. After you measure the first face manually, PC-DMIS will take over and measure the remaining faces in DCC mode.

When PC-DMIS finishes measuring all 17 faces of the polyhedral tool, it will display the **Probe Utilities** dialog box again.

You have now completed the first half—and most complex part—of the video probe calibration process. The rest of the process is less tedious and should only take a few more minutes.

Calibrate NC100 Video Probe

Now you will need to calibrate the angles used by your NC-100 Vision probe. An NC-100 video probe is the first optical probe available on the market that can be calibrated in multiple orientations.



To calibrate an NC-100 probe:

1. From the **Probe Utilities** dialog box specify the probe, extension and optical probe for your NC-100 system.
2. Click the **Add Angles** button. The **Add New Angles** dialog box appears.
3. Add any angles required by your part program. These angles should be normal to the part feature you will measure.
4. Click **OK** to return to the **Probe Utilities** dialog box.
5. Click **Measure**. The **Measure Probe** dialog box appears.
6. Select the **DCC** option button.
7. Select the **Calibrate Tips** option button from the **Type of Operation** area.
8. Select the polyhedral tool from the **List of Available Tools** list.
9. Click the **Measure** button. PC-DMIS will calibrate the probe positions you selected.

You've successfully calibrated your probe.

Measuring Auto Features with the NC-100 Video Probe

The **Insert | Feature | Auto** menu allows you to access to the Auto Feature (DCC) functions if an automatic CMM (Coordinate Measuring Machine) is being used. The **Auto Features** dialog box allows you to create any type of Auto Feature.

The main topics discussed in this chapter include:

- [Auto Feature Functions Specific to NC 100 Video Probe](#)
- [Vector Point with NC-100](#)
- [Edge Point with NC-100](#)
- [Characteristic Points with NC-100](#)
- [Circle, Pin, or Baricenter with NC-100](#)
- [Round Slot with NC-100](#)
- [Square Slot/Gap & Flush with NC-100](#)

On certain topics this manual will refer you to the "Creating Auto Features" section for more complete information.

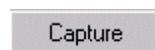
Note: See the "Creating Auto Features" chapter for information on measuring Auto Features in general, but be aware that some options documented in that chapter may not be available when using the NC-100 Video probe.

Auto Feature Functions Specific to NC 100 Video Probe

The "Common Auto Feature Dialog Box Options" topic in the "Creating Auto Features" chapter provides a complete description of the many dialog box options available on the **Auto Features** dialog box.

This topic discusses some of these same dialog box functions and how they're used with NC-100 video probes as well as some dialog box functions that only appear when using NC-100 video probes.

Capture Button



The **Capture** button collects actual measured data as the nominals for a feature. To use the capture button:

1. Place the NC-100 video probe over the feature to be measured.
2. Set up parameters for the video probe by clicking the **Video Setup** button.
3. When finished, click the **Capture** button.

PC-DMIS, along with the NC-100 computer system will measure the feature and place the measured data in the THEO boxes. This allows you to measure features without CAD data.

Video Setup Button

For information on the **Video Setup** button, see "Setup Options: NC-100 Setup tab" in the "Setting Your Preferences" chapter.

Feature Type list

The **Feat Type** list provides you with the following feature types:

For Edge Points



NORMAL = This is the Normal edge type measurement that occurs at the surface height of the edge.

DELTAZ = This option allows the measurement of an edge at a specified depth in respect to the plane on which the surface lies.

HIGH POINT = This option allows the measure of an edge at the maximum value in a specified direction.

BIGHOLE = This option allows the measure of an edge used to measure a part of a hole bigger than the sensor field of view.

For Characteristic Points



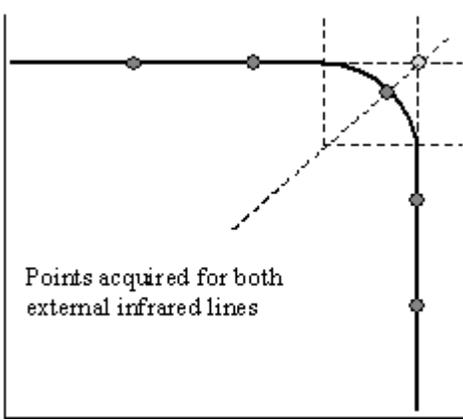
From the Feat Type list you can select the available types of characteristic points. These include:

CHAR 1 = This type of feature allows the measurement of two points (one on each surface) at a given indent from the intersection of two planes.

CHAR 2 = This type of feature measures the point at the intersection of two planes.

Indent boxes

See also "Indent boxes" in the "Creating Auto Features" chapter.

<p>Characteristic Point</p>	<p>PC-DMIS allows you to use two indent values, Indent 1 and Indent 2, for setting the offset distances of the Characteristic Point. PC-DMIS uses these offset distances to calculate a point location on each of the two surfaces of the angle in a Characteristic Point.</p> <p>The indent boxes become available only after you select CHAR 1 from the Feat Type list.</p>  <p>Points acquired for both external infrared lines</p> <p><i>Measure characteristic point using two theoretical distances</i></p> <ul style="list-style-type: none">• The Indent 1 box allows you to set the offset distance from the point location to the sample hits
------------------------------------	--

	<p>on the <i>first</i> surface of the angle.</p> <ul style="list-style-type: none"> The Indent 2 box allows you to set the offset distance from the point location for the sample hits on the <i>second</i> surface of the angle.
--	---

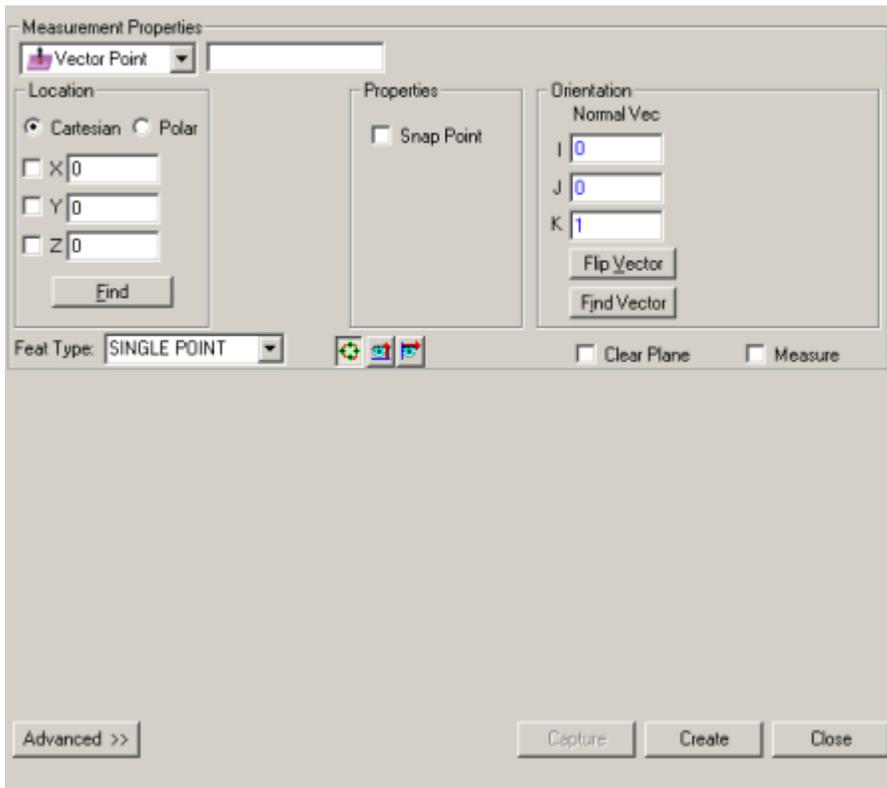
Height box

See also "Height box" in the "Creating Auto Features" chapter.

Bend Radius When `TYPE = HOLE`, the **Height** box defines the nominal length of the feature. If you enter a **Height** value but do not define a depth, PC-DMIS equally divides the **Height** value by three and uses it for the depth.

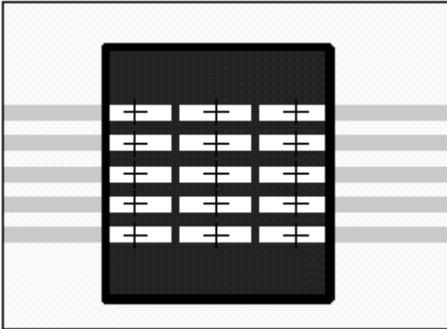
When `TYPE = STUD`, this option will allow for an extra hit on the top of the stud in the center. If this value is anything but 0, PC-DMIS will take an extra hit in the center of the stud. It then will compute the height of the stud.

Vector Point with NC-100



NC-100 Vector Point Auto Feature

The Vector Point measurement option allows you to define a nominal point location as well as the nominal approach direction that the CMM will use to measure the point.



Single point measurement

To access the **Vector Point** option,

1. Access the **Auto Features** dialog box (**Insert | Feature | Auto | Point | Vector**).
2. Select the **Vector Point** auto feature type.

The Edit window command line for a sample Vector Point would read:

```
F_ID=AUTO/VECTOR POINT, THEO_THICKNESS = n, TOG , SNAP = Y/N  
THEO/ TX,TY,TZ,TI,TJ,TK  
ACTL/ X,Y,Z,I,J,K  
TARG/ targX,targY,targZ,targI,targJ,targK  
AUTO MOVE = Y/N, DISTANCE = n
```

Vector Point Field Definitions with NC-100

This is already covered in the "Vector Point Field Definitions" topic in the "Creating Auto Features" chapter. The following definition is specific to NC-100 video probes:

ACTL_THICKNESS = This value indicates the keyed in offset thickness of the measured data. Positive or negative values can be used.

Measuring a Vector Point with NC-100

PC-DMIS allows several methods for measuring a vector point using the auto feature option. They are listed in the following paragraphs:

Using Keyed in Data

This method allows you to key in the desired X, Y, Z, I, J, K values for the vector point.

Using Surface Data on the Screen

To generate a vector point using surface data:

1. Position the cursor in the Graphics Display window to indicate the desired location of the point (on the surface)
2. Click on the surface. PC-DMIS will highlight the selected surface.
3. Verify that the correct surface has been selected.

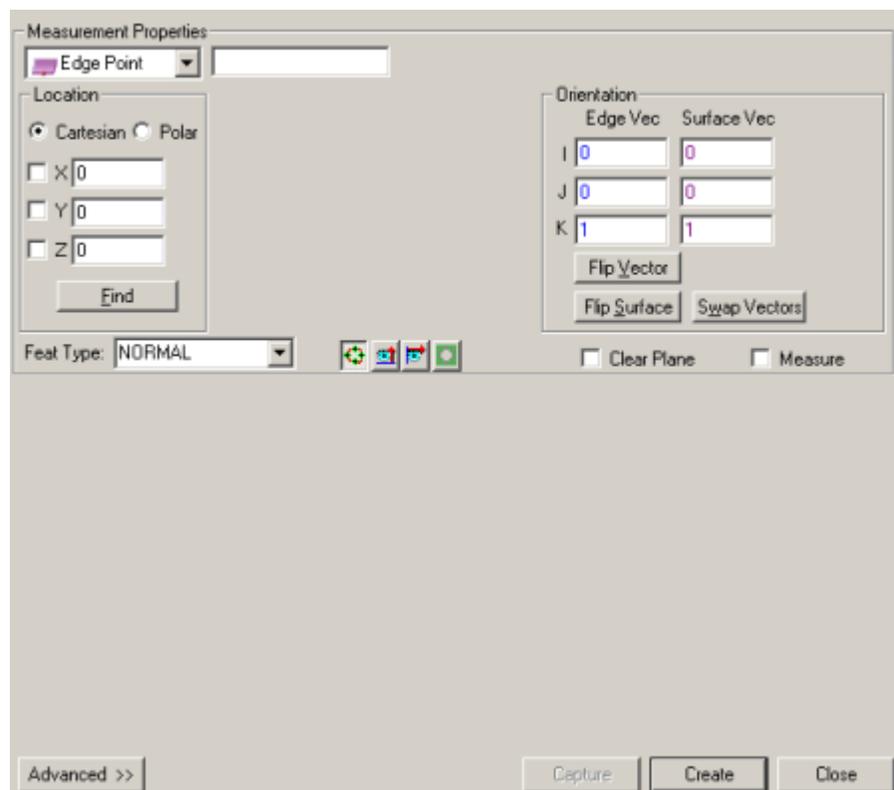
For complete information on this procedure, see "Using Surface Data on the Screen for a Vector Point" in the "Creating Auto Features" chapter.

Using Wire frame Data on the Screen

This is covered in "Using Wire frame Data on the Screen for a Vector Point" in the "Creating Auto Features" chapter.

Note: The mouse cannot be used in the Graphics Display window if CAD data is unavailable.

Edge Point with NC-100



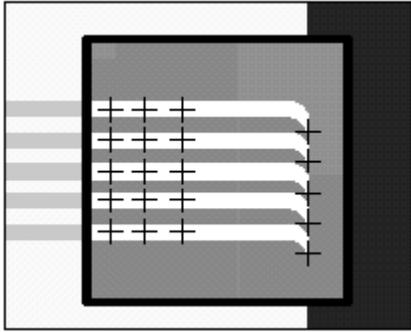
NC-100 Edge Point Auto Feature

The Edge Point measurement option allows you to define a point measurement that is to be taken on the part's edge.

There are four types of edge measurements. These include:

- EDGE NORMAL
- EDGE DELTAZ
- EDGE HIGH
- EDGE BIGHOLE

They require different input-output parameter settings and different theoretical definitions in the PC-DMIS command.



Point acquired by vision system

To access the **Edge Point** option:

1. Access the **Auto Features** dialog box (**Insert | Feature | Auto | Point | Edge**).
2. Select the **Edge Point** auto feature type.

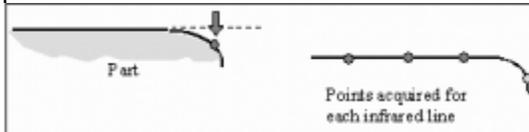
The Edit window command line for a sample Edge Point would read:

```
F_ID=AUTO/EDGE NORMAL, SHOWHITS = Y/N, SHOWALLPARAMS = Y/N,
THEO/ TX,TY,TZ, TI ,TJ ,TK
ACTL/ X,Y,Z, I,J,K
TARG/ targX,targY,targZ,targI,targJ,targK
THEO_THICKNESS = n ,TOG3 ,EDGE THEO_THICKNESS = .n
AUTOMOVE=TOG , DISTANCE = n,
SURFACE NORMAL = I,J,K, DEPTH = n
```

Edge Point Type Definition with NC-100

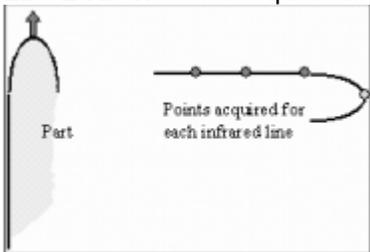
EDGE NORMAL = This is the Normal edge type measurement that occurs at the surface height of the edge.

EDGE DELTAZ = This request allows the measurement of an edge at a specified depth in respect to the plane on which the surface lies.



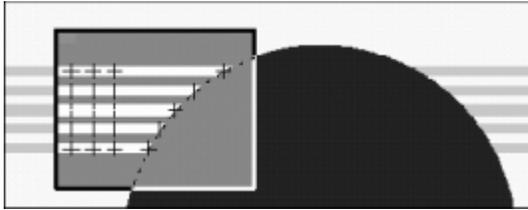
Edge at a predefined depth from the part surface

EDGE HIGH = This request allows the measure of an edge at the maximum value in a specified direction.



Edge at maximum value along a known direction

EDGE BIGHOLE = This request allows the measure of an edge used to measure a part of a hole bigger than the sensor field of view.



Big hole contour measurement

Edge Point Field Definition with NC-100

This is already covered in the "Edge Point Field Definitions" topic in the "Creating Auto Features" chapter. The following is specific to NC-100 video probes:

ACTL_THICKNESS = This value indicates the keyed in offset thickness of the measured data. Positive or negative values can be used.

SHOWHITS = This is a toggle field. It toggles from YES to NO and determines if hits will be displayed with this feature. This is not currently available with Edge Points.

SHOWALLPARAMS = This is a toggle field. It toggles from YES to NO as to displaying all the parameters on an Edge Point

EDGE ACTL_THICKNESS = This value indicates the keyed in offset thickness of the measured edge. Positive or negative values can be used.

DEPTH = This value is an editable distances. (Only Available on "EDGE DELTAZ")

Measuring an Edge Point with NC-100

PC-DMIS allows these methods for measuring an edge point with the NC-100 video probe. They are listed in the following paragraphs:

Using Keyed in Data

This is covered in "Using Keyed in Data for an Edge Point" in the "Creating Auto Features" chapter.

Using Surface Data on the Screen

This is covered in "Using Surface Data on the Screen for an Edge Point" in the "Creating Auto Features" chapter.

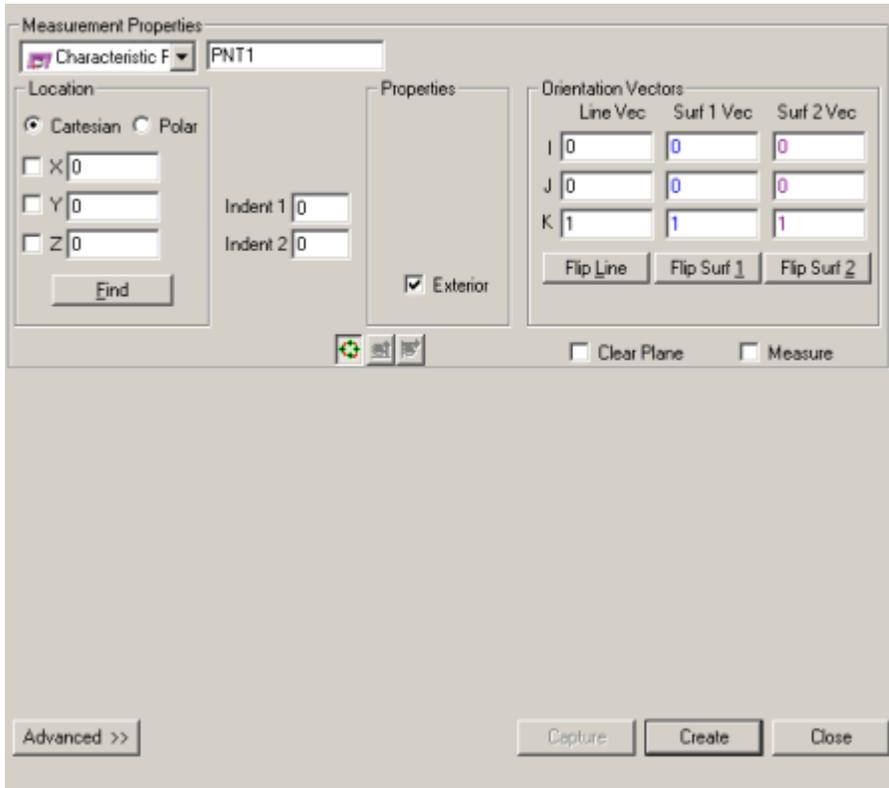
Using Wire frame Data on the Screen

This is covered in "Using Wire frame Data on the Screen for an Edge Point" in the "Creating Auto Features" chapter.

Note: The mouse cannot be used in the Graphics Display window if CAD data is unavailable.

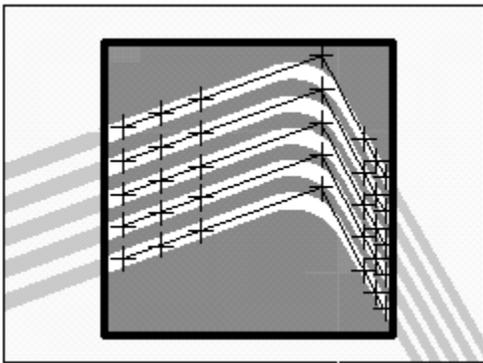
Note: PC-DMIS assumes that the normal surface and the measurement surface are perpendicular.

Characteristic Points with NC-100



NC-100 Characteristic Point Auto Feature

The **Characteristic Point** tab is *only available when using a NC-100 video probe*. A characteristic point is essentially an angle point. There are two types of characteristic points described in "[Characteristic Point Type Definition](#)"; they require different input-output parameter settings and different theoretical definitions in the DMIS command. The DMIS measurement command is the same for both characteristic points. This diagram shows a generic measurement of a Characteristic Point.



Characteristic point measuring

To access the **Characteristic Point** option:

1. Access the **Auto Features** dialog box (**Insert | Feature | Auto | Point | Characteristic**).
2. Select the **Characteristic Pts** auto feature type.

The Edit window command line for a sample Characteristic Point would read:

```

F_ID=AUTO/CHARACTERISTIC 1, SHOWHITS=Y/N,SHOWALLPARAMS=Y/N
THEO/ TX,TY,TZ,TI,TJ,TK, TX2, TY2, TZ2
ACTL/ X,Y,Z,I,J,K, X2, Y2, Z2
TARG/targX,targY,targZ,targI,targJ,targK
THEO_THICKNESS = n, TOG
AUTO MOVE = Y/N, DISTANCE = n VECTOR1 = I,J,K, VECTOR2 = I,J,K
INDENT1= n, INDENT2 = n

```

Characteristic Point Type Definition

CHARACTERISTIC 1 = This type of feature allows the measurement of two points (one on each surface) at a given indent from the intersection of two planes. This gives two points of data.

CHARACTERISTIC 2 = This type of feature measures the point at the intersection of two planes. This gives one point of data.

Characteristic Point Field Definitions

SHOWHITS = This is a toggle field. It toggles from YES to NO and determines if hits will be displayed with this feature. This is currently unavailable.

SHOWALLPARAMS = This is a toggle field. It toggles from YES to NO as to displaying all the parameters on the feature.

THEO_THICKNESS = This value indicates the keyed in thickness of the part. Positive or negative values can be used.

ACTL_THICKNESS = This value indicates the keyed in offset thickness of the measured data. Positive or negative values can be used.

TOG 1 = This is a toggle field. The X,Y,Z,I,J,K will be displayed in RECT (rectangular) or POLR (polar) coordinates.

THEO / = This value represents the target hit .

ACTL / = This value represents the measured hit.

TARG = These values allow you to control the measurement location and vector approach direction for execution while having the ability to have a completely different THEO value.

AUTO MOVE = This is a toggle field. A YES indicates that this option is ON.

DISTANCE = This value indicates the distance the probe will move using the AUTO MOVE option.

VECTOR1 = The three numbers (IJK values) are an editable vector and will be forced to be perpendicular to the vector on the first surface.

VECTOR2 = The three numbers (IJK values) are an editable vector and will be forced to be perpendicular to the vector on the second surface.

INDENT1 = This editable number is the offset distance for the point location on the first surface of the angle. It is not used for Characteristic Point 2.

INDENT2 = This editable number is the offset distance for the point location on the second surface of the angle. It is not used for Characteristic Point 2.

Note: See the "Common Auto Feature Dialog Box Options" topic in the "Creating Auto Features" section for general guidelines on measuring all Auto Feature types.

Measuring a Characteristic Point with NC-100

PC-DMIS allows several methods for measuring a Characteristic Point using the Auto Feature option. They are listed in the following paragraphs as:

Using Keyed in Data

This method allows you to key in the desired X, Y, Z, I, J, K values for the Characteristic Point.

Using Surface Data on the Screen

To generate a Characteristic Point using surface data:

1. Click the **Surface Mode** button .
2. Using the animated probe, touch once near (but not on) the angled edge. PC-DMIS will highlight the selected surface.
3. Verify that the correct surface has been selected.

The dialog box will display the value of the selected Characteristic Point and vector once the point has been indicated. The direction of the surface normal vector is determined by the side of the part that is accessible to the probe. If both sides of the part are equally accessible, the normal from the CAD data is used. The **Flip Vector** button lets you change the direction of the approach.

If additional mouse clicks are detected before you click the **Create** button, PC-DMIS will overwrite the previously displayed information with the new data.

Note: If an additional touch is necessary, click on the opposite surface of the angled edge.

Using Wire frame Data on the Screen

Wire frame CAD data also can be used to generate a Characteristic Point.

To generate the point:

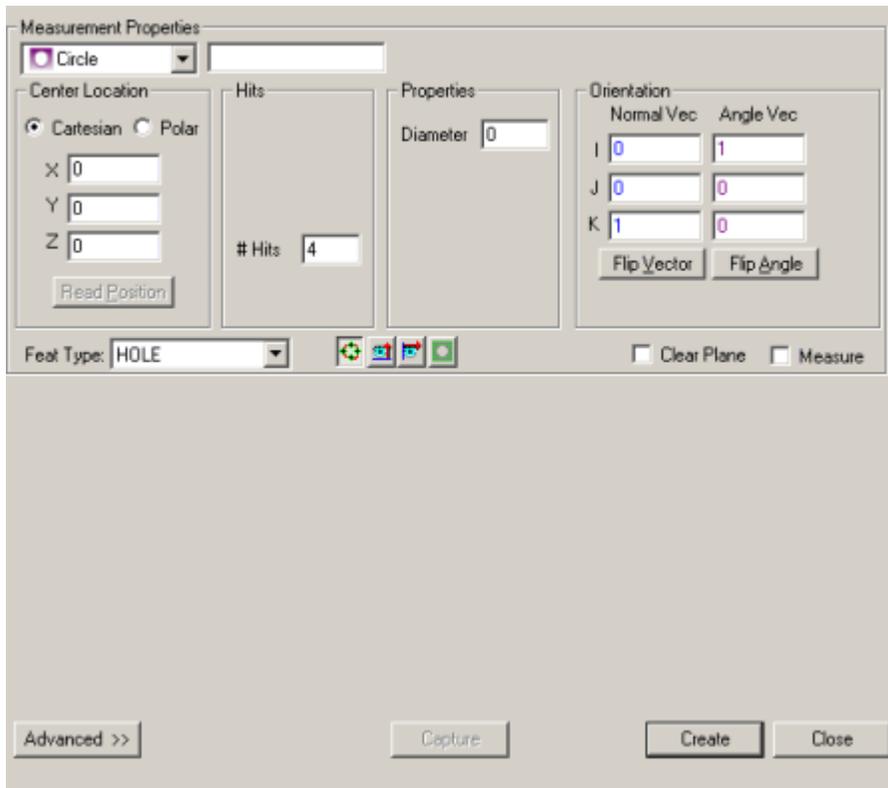
1. Using the animated probe, touch once near (but not on) the angled edge. PC-DMIS will highlight the selected surface.
2. Verify that the correct surface has been selected.

The **Characteristic Pts** auto feature type of the **Auto Features** dialog box will display the value of the selected Characteristic Point and vector once the point has been indicated. The direction of the surface normal vector is determined by the side of the part that is accessible to the probe. If both sides of the part are equally accessible, the normal vector from the CAD data is used. The **Flip Vector** button lets you change the direction of the approach.

- Any additional mouse clicks, prior to clicking the **Create** button, will overwrite the previously displayed information with the new data.
- If an additional touch is necessary, click on the opposite surface of the angled edge.

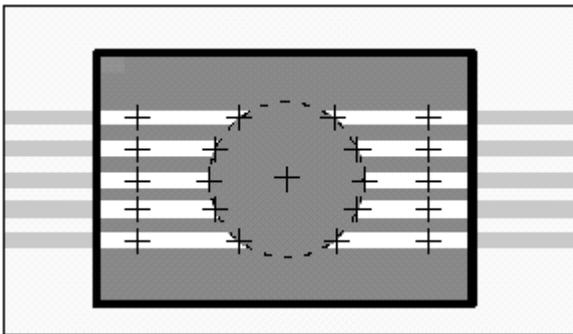
Note: The mouse cannot be used in the Graphics Display window if CAD data is unavailable.

Circle, Pin, or Baricenter with NC-100



NC-100 Circle Auto Feature

The Circle Auto Feature option allows you to define a circle measurement. The three possible measurement types are discussed in "[Circle Type Definition with NC-100](#)". If the number of the required points is greater than 10, or if the sensor is not able to identify the intersection points, the sensor selects points on the hole contour and projects them on the plane. These points can be identified using the infrared lines.



Hole measurement with infrared lines crossing hole contour

To access the **Circle** option:

1. Access the **Auto Features** dialog box (**Insert | Feature | Auto | Circle**).
2. Select the **Circle** auto feature type.

The Edit window command line for a sample circle reads:

```
F_ID=AUTO/CIRCLE, SHOWHITS=Y/N, SHOWALLPARAMS=Y/N
THEO/ TX, TY, TZ, TI, TJ, TK, TDIAM,
```

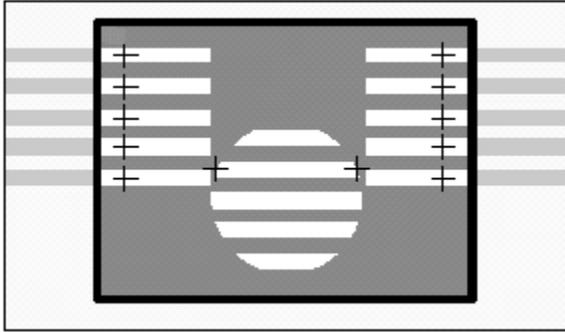
Wilcox Associates, Inc.

```
ACTL/ X,Y,Z,I,J,K,DIAM,  
TARG/ targX,targY,targZ,targI,targJ,targK  
THEO_THICKNESS = n, TOG1, TOG2, TOG3  
AUTO MOVE = Y/N, DISTANCE = n  
NUM HITS = n
```

Circle Type Definition with NC-100

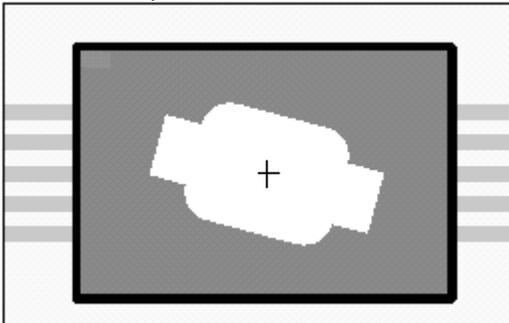
HOLE = This type of feature allows the measurement of an inside or outside circular hole.

PIN = This type of feature allows the measurement of a pin.



Pin measurement

BARICENTER = This type of feature is the measurement of a hole of undetermined shape. Only the location is reported.



Different shape holes measurement

Circle Field Definitions with NC-100

Many of the definitions are already covered in the "Circle Field Definitions" topic in the "Creating Auto Features" chapter. The following definitions are added or changed when using a NC-100 video probe:

SHOWHITS = This is a toggle field. It toggles from YES to NO and determines if hits will be displayed with this feature.

SHOWALLPARAMS = This is a toggle field. It toggles from YES to NO as to displaying all the parameters on the feature.

THEO_THICKNESS = This editable value indicates the keyed in thickness of the part. Positive or negative values can be used.

ACTL_THICKNESS = This value indicates the keyed in offset thickness of the measured data. Positive or negative values can be used.

THEO / = This value represents the theoretic feature location. DNOM is the diameter 's nominal value.

ACTL /= This value represents the measured hit . DNOM is the diameter's measured value.

TOG2 = This toggle field switches between IN and OUT. PC-DMIS will determine the type of circle that is measured based on the location of the probe when taking the hit. (Inside a circle = IN, outside a stud = OUT.) Only available with Hole feature type.

TOG3 = This toggle field switches between LEAST_SQR, MAX_INSC, MIN_CIRCSC, MIN_SEP, and FIXED RAD. Only available with Hole feature type.

NUM HITS = This editable value must be an integer that is greater than two. Only available with Hole feature type.

[See the "Common Auto Feature Dialog Box Options" topic in the "Creating Auto Features" chapter for general guidelines on measuring all Auto Feature types.](#)

Measuring a Circle with NC-100

PC-DMIS allows several methods for measuring an auto circle. These methods are listed in the following paragraphs as:

Using Keyed in Data

This is described in "Using Keyed in Data for an Auto Circle" in the "Creating Auto Features" chapter.

Using Surface Data on the Screen

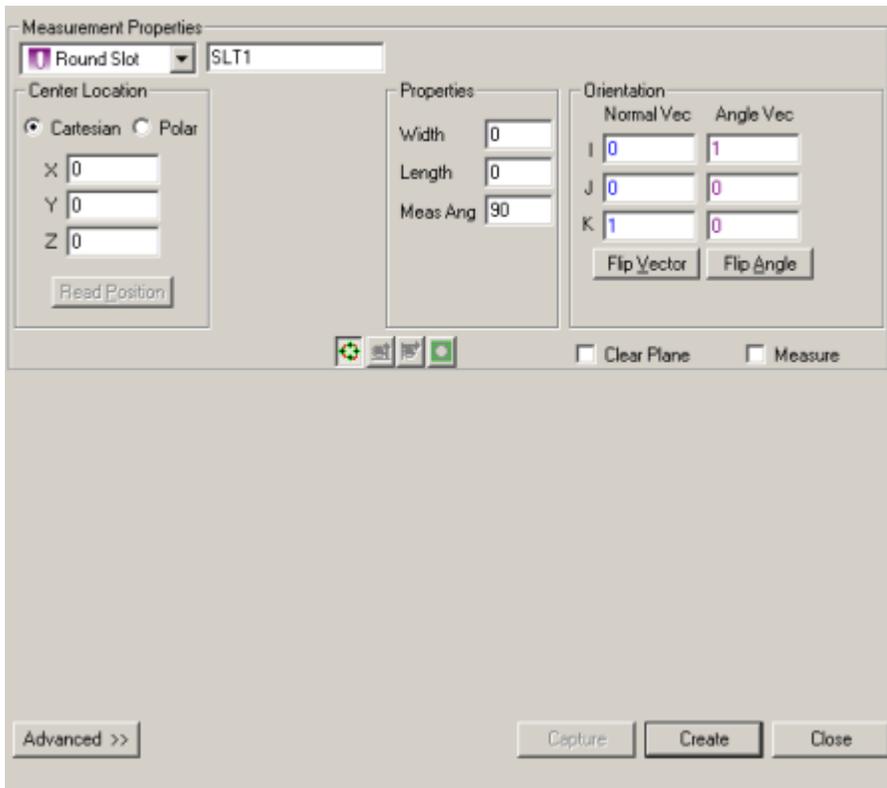
This is described in "Using Surface Data on the Screen for an Auto Circle" in the "Creating Auto Features" chapter.

Using Wire frame Data on the Screen

This is described in "Using Wire frame Data on the Screen for an Auto Circle" in the "Creating Auto Features" chapter.

Note: [The mouse cannot be used in the Graphics Display window if CAD data is unavailable.](#)

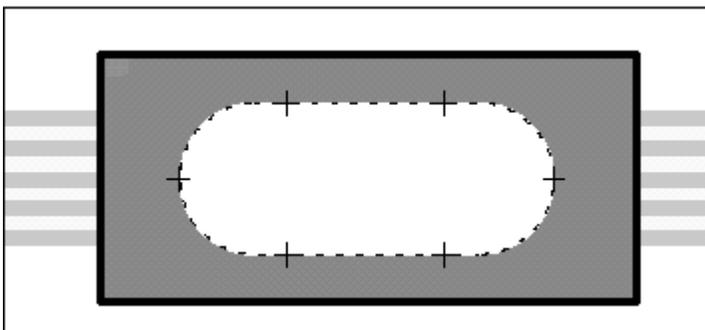
Round Slot with NC-100



NC-100 Round Slot Auto Feature

The Round Slot option allows you to define a round slot measurement. This measurement type is particularly useful when you do not want to measure a series of lines and circles, or construct intersections and midpoints from them.

The Round Slot can be measured using the points inside the ROI along the slot contour.



Round Slot measurement

To access the **Round Slot** option:

1. Access the **Auto Features** dialog box (**Insert | Feature | Auto | Round Slot**).
2. Select the **Round Slot** auto feature type.

The Edit window command line for a sample Round Slot would read:

```

F_ID=AUTO/ROUND SLOT, SHOWHITS=Y/N SHOWALLPARAMS=Y/N
THEO/ TX, TY, TZ, TI, TJ, TK, TLENGTH, TWIDTH
ACTL/ X, Y, Z, I, J, K, LENGTH, WIDTH
TARG/ targX, targY, targZ, targI, targJ, targK
THEO_THICKNESS = n, TOG1
AUTO MOVE = Y/N, DISTANCE = n

```

Round Slot Field Definitions with NC-100

Many of the definitions are already covered in the "Round Slot Field Definitions" topic in the "Creating Auto Features" chapter. The following definitions are added or changed when using a NC-100 video probe :

SHOWHITS = This is a toggle field. It toggles from YES to NO and determines if hits will be displayed with this feature. This is not currently available.

SHOWALLPARAMS = This is a toggle field. It toggles from YES to NO as to displaying all the parameters on the feature.

ACTL_THICKNESS = This value indicates the keyed in offset thickness of the measured data. Positive or negative values can be used.

See the "Common Auto Feature Dialog Box Options" topic in the "Creating Auto Features" chapter for general guidelines on measuring all Auto Feature types.

Measuring a Round Slot with NC-100

PC-DMIS allows several methods for measuring a round slot using the Auto Feature option. These methods are listed in the following paragraphs as:

Using Keyed in Data

This is described in "Using Keyed in Data for a Round Slot" in the "Creating Auto Features" chapter.

Using Surface Data on the Screen

This is described in "Using Surface Data on the Screen for a Round Slot" in the "Creating Auto Features" chapter.

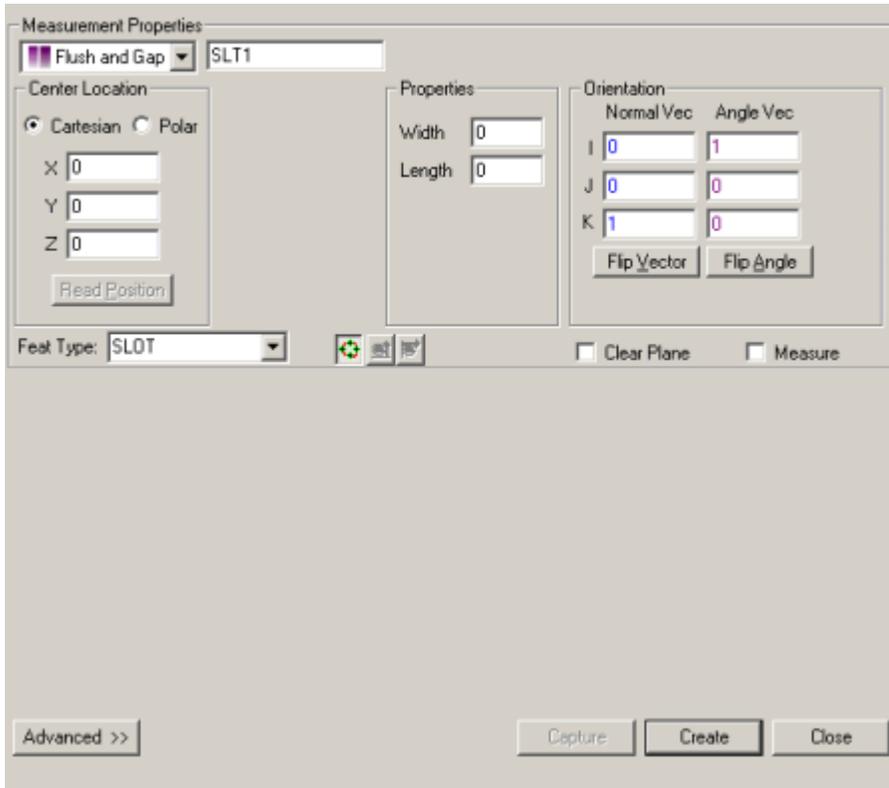
Note: If the CAD data defining the ends of the slot is specifically a CIRCLE or ARC type (i.e., an IGES entity 100), PC-DMIS will automatically take two additional hits on the arc. If both ends are of this type, then one touch on each arc is sufficient to measure this feature type.

Using Wire frame Data on the Screen

This is described in "Using Wire frame Data on the Screen for a Round Slot" in the "Creating Auto Features" chapter.

Note: The mouse cannot be used in the Graphics Display window if CAD data is unavailable.

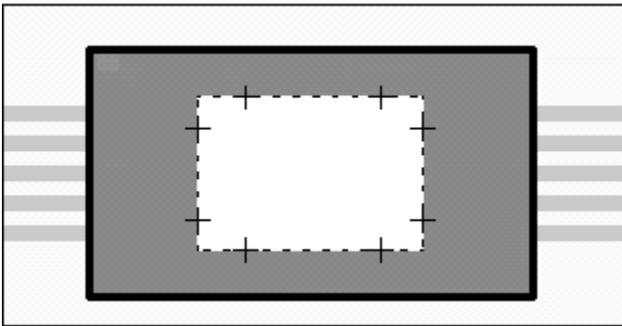
Square Slot/Gap & Flush with NC-100



NC-100 Square Slot/Flush & Gap Auto Feature

The Square Slot option allows you to define a square slot measurement or a Gap & Flush measurement. See "[Square Slot and Gap & Flush Type Definition with NC-100](#)" for the available measurement types.

The Square Slot can be measured using the points inside the ROI and along the slot contour.



Square slot measurement

To access the **Square Slot** option:

1. Access the **Auto Features** dialog box (**Insert | Feature | Auto | Square Slot**).
2. Select the **Square Slot** auto feature type.

The Edit window command line for a sample Square Slot would read:

```
F_ID=AUTO/SQUARE SLOT, SHOWHITS=Y/N, SHOWALLPARAMS=Y/N  
THEO/ TX, TY, TZ, TI, TJ, TK, TWIDTH, TLENGTH,
```

```

ACTL/ X,Y,Z,I,J,K, WIDTH, LENGTH,
TARG/ targX,targY,targZ,targI,targJ,targK
THEO_THICKNESS = n, TOG1
AUTO MOVE = Y/N, DISTANCE = n

```

The Edit window command line for a sample Gap & Flush would read:

```

F_ID=AUTO/GAP DELTAZ, SHOWHITS=Y/N, SHOWALLPARAMS=Y/N
THEO/ TX,TY,TZ,TI,TJ,TK,TGAP,TFLUSH
ACTL/ X,Y,Z,I,J,K,GAP,FLUSH
TARG/ targX,targY,targZ,targI,targJ,targK
THEO_THICKNESS = n, TOG1, TOG2
AUTO MOVE = Y/N, DISTANCE = n, DEPTH = n, DEPTH2 = n

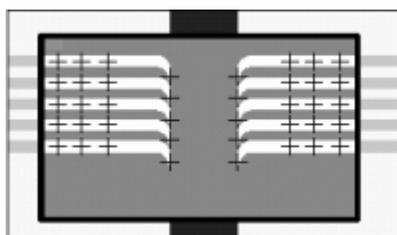
```

Square Slot/Gap and Flush Type Definition

SQUARE SLOT = This type of feature allows the measurement of a square slot

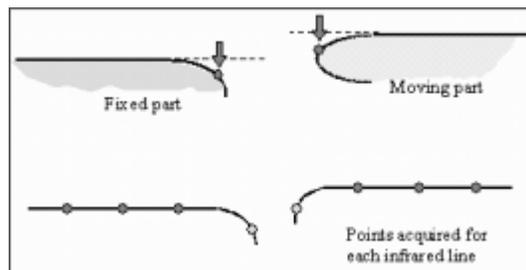
GAP NORMAL = This type of feature allows the measurement of the gap and flush of a gap at the surface level of the fixed side.

The following description shows a generic case of point acquisition:



Gap Normal Point acquired by vision system

GAP DELTAZ = This request allows the measurement of a gap at a specified depth in respect to the fixed side of the part.



Gap & Flush measurement at a specified depth

Square Slot/Gap and Flush Field Definition

Many of the definitions are already covered in the "Square Slot Field Definitions" topic in the "Creating Auto Features" chapter. The following definitions are added or changed when using a NC-100 video probe :

SHOWHITS = This is a toggle field. It toggles from YES to NO and determines if hits will be displayed with this feature.

SHOWALLPARAMS = This is a toggle field. It toggles from YES to NO as to displaying all the parameters on the feature.

ACTL_THICKNESS = This value indicates the keyed in offset thickness of the measured data. Positive or negative values can be used.

Wilcox Associates, Inc.

TOG2 = This field determines the fixed side of a Gap & Flush measurement. Only available on Gap & Flush.

THEO / = This value represents the theoretic feature location.

DEPTH = This value is editable and represents the depth of measurement on the fixed side of a Gap & Flush.

DEPTH2 = This values is editable and represents the depth of measurement on the moving side of a Gap & Flush.

[See the "Common Auto Feature Dialog Box Options" topic in the "Creating Auto Features" chapter for general guidelines on measuring all Auto Feature types.](#)

Measuring a Square Slot with NC-100

PC-DMIS allows several methods for measuring a square slot using the Auto Feature option. These methods are listed in the following paragraphs as:

Using Keyed in Data

This is described in "Using Keyed in Data for a Square Slot" in the "Creating Auto Features" chapter.

Using Surface Data on the Screen

This is described in "Using Surface Data on the Screen for a Square Slot" in the "Creating Auto Features" chapter.

Using Wire frame Data on the Screen

This is described in "Using Wire Frame Data on the Screen for a Square Slot" in the "Creating Auto Features" chapter.

Note: The mouse cannot be used in the Graphics Display window if CAD data is unavailable.

Specific Functions for Flush and Gap Features

There are a few values that are specific to the Flush and Gap Auto Feature dialog box. They are:

- **Depth** - Defines the distance below the surface of the fixed side that PC-DMIS will measure the gap & flush. This becomes available if you select GAP DELTAZ from the **Feat Type** list.
- **Depth2** - Defines the distance below the surface of the moving side that PC-DMIS will measure the gap & flush. This becomes available if you select GAP DELTAZ from the **Feat Type** list.
- **Gap** - Displays the gap of the Gap & Flush.

Gap

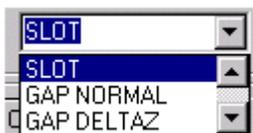
- **Flush** -Displays the Flush of the Gap & Flush.

Flush

- **Type** - The **RIGHT** option and the **LEFT** option define the fixed side of the Gap & Flush measurement. In Gap & Flush measurements you need to define one side as the fixed (or nominal) side. The fixed side becomes the datum against which the other side is measured.

Type
 RIGHT LEFT

Feature Type for a Square Slot and Gap Flush Measurements



The **Feat Type** list provides you with the available types of Square Slot and Gap & Flush measurements. These include:

SLOT = This type of feature allows the measurement of a square slot.

GAP NORMAL = This type of feature allows the measurement of the gap and flush of a gap at the surface level of the fixed side.

GAP DELTAZ = This feature type allows the measurement of a gap at a specified depth in respect to the fixed side of the part.

GAP GAUGE = This measurement type is currently unavailable.

Glossary

C

CCD: Charge Coupled Device - This is one of the two main types of image sensors used in digital cameras.

CMMI: Standard CMM Interface such as a LEITZ.DLL

F

Fiducials: A point of reference. For example, In the case of a CAD file of a circuit board, these fiducials reference the location of soldering. These references may not exist in the CAD file.

Field of View: The FOV represents the view through the video camera. In the Live View, the FOV is everything you see. In the CAD View, PC-DMIS Vision represents the FOV by a green rectangle that appears on top of the graphical image.

FOV: Field of View

H

HSI: Hardware Specific Interface

I

Image Tear: This is where "breaks" in the image occur due to the refresh rate not keeping up with the speed of movement.

Intensity Circle: The circle that is located in the middle of the Top light, Bottom light or segment of a ring light that shows the current intensity value for that light.

M

MSI: Multi Sensor Interface

N

NA: Numerical Aperture (NA) is a measure the light-gathering ability of a Vision device. NA is a measure of the number of highly diffracted image-forming light rays captured by the objective. Higher values of numerical aperture allow increasingly oblique rays to enter the objective front lens, producing a more highly resolved image.

P

Par-centricity: When the Focal XY Center of the optics is aligned with the Video Frame center through the zoom range.

Par-focality: When the focal clarity is consistent through the zoom range.

R

ROI: Region of Interest - Targets are divided into multiple regions based upon the Field of View. Point detection will be determined for each ROI

T

Target: Individual regions that are used for point detection for the specified feature.

Tracker: The visual user interface to features that control the size of the circle, start angle, end angle, and orientation.

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