



CAPPS DMIS User Guide

2018



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CAPPS DMIS Version Enhancements

Software Recognition

- All Applied Automation Technologies, Inc. software products are digitally signed and recognized in Windows, additionally AAT is recognized as a trusted software provider.

File Dialogs

- Capps now provides default names when saving internal files. For MDL/SHD file types Capps uses imported CAD model name. For all others, program name is used as the default name.
- Open/Save dialogs remembers last opened file type automatically.

Probe Model Builder

- New probe models and enhancements on probe model builder.
- CappsDMIS and CappsNC now supports Keyence laser sensors.

Calibration

- Analog sensor calibration now works with any sensor orientation and stem direction.
- Star probe calibration paths are optimized to avoid extra moves and stem collision.
- Enhancements in probe calibrations and AutoCal creator.

DMIS and Programming Enhancements

- DMIS programs now supports BOUND statement.
- SAVE/PROJECT command now has the ability to increment or overwrite the existing project file, along with querying the operator for the project path.
- A new set of shortcuts are available to control DMIS program execution.
- Nominal feature definitions can be added to DMIS program from CAD TreeView.
- Enhancements in handling strings in DMIS (concatenation, supporting STR() and CHR() functions, and more flexible string formatting).
- Labels used for sensors, alignments and features are now case INSENSITIVE in DMIS are now case insensitive.
- Pointcloud measurements are now supported in DMIS.
- Additional reminders are added when DMIS recording is disabled.
- Enhancements in DMIS Mirror option, mirroring was always done at Origin depending on mirror axis but now user can specify the mirror location. User can now mirror 5 axis moves of PH20, REVO and NC heads.

Graphical User Interface

- Customize Screen Layout dialog enhanced to have support multiple screens when using Capps.
- Reset Graphics Options and Display Options dialogs now update graphics immediately.
- Active probe tip is indicated with green color in Graphics Window.
- Capps supports fast switching between feature measurement dialogs.

Manual Measurements

- A dynamic point arrow is used to show the next point in Graphics Window for easy targeting.
- Rubber band is enhanced to zoom in and out of features in Graphics Window for a better visual when measuring a set of features.

Feature Measurement

- Feature calculations are enhanced to reduce the cycle time.
- For features that has large number of points, a progress bar is shown during the computation.
- Unless a curve is measured using Unknown Scanning option, Capps now creates a nominal curve along with the actual curve.
- Capps has a new tool to extract actual features corresponding to nominal ones from surfaces and/or curves. (Only available for Advanced Seats)

Feature Construction

- A new option called Offset is added to Plane and Line construct dialogue, with this option user can construct Offset plane/line using different features. User can enter the distance at which feature needs to be constructed, Capps will try to full fill the requested distances, if it fails then capps will perform Bestfit to construct the feature.

Feature Filtering

- Capps can control the percentage of points that can be removed when filtering out outliers using nominal or actual data.
- Sigma filter option.
- User can now measure the set of points from a point cloud data in two ways one is by specifying the minimum and maximum distance to be measured using Optimize option and other is by using Increment where user can enter a increment value. These two points are mutually exclusive selecting one will disable the other.
- Wildcard can be used in filtering features in Pick-Features dialog

Pointcloud Measurements

- Capps now has the advanced filtering option for pointclouds.
- Automatic geometric feature extraction from pointclouds.
- Faster loading of large pointcloud data.
- Automatic feature path generation with sphere.(Additional features to come).
- Enhanced path generation form CAD.
- Point cloud triangulation is optimized to use less memory for the computed triangles

Nominal Features

- When editing nominal features, the dialog remains open when the user switches between different nominal features.
- Enter Nominals dialog remains open for further changes.
- Cone can be defined by using an axis direction.
- All dialog fields in the dialog accepts mathematical formulas.
- Enter Nominals dialog remains open for further changes.
- In CAD Tree View window, you can select a set of nominals and add their definition to DMIS.

GD&T

- True Position dialogue is more stabilized

Form/Profile Dialogs

- Using Datums in Form-profile dialog.

Alignments

- RPS alignment is enhanced to use up to 20 elements.
- 3D Bestfit Alignment supports better application on global and feature constraints.
- Faster 3D Bestfit iterations when Compared to CAD is used.
- Many reporting options for post Bestfit information.
- Setup alignment has improved to work different types of datums and a new preview button added to the dialog. (i.e. Three Non-perpendicular planes)

Polar Charts

- Points are ordered before drawing the polar charts so the data looks more organized.
- Automatically generates templates for minimum and maximum profiles.

CAD Library

- Catia6 CAD models are now supported both in CappsDMIS and CappsNC.

Interfaces

- Capps now supports Kreon Laser and Kreon portable arms.
- Capps now supports Romer RPS portable arms.
- Capps now supports Friul interface.

Error Compensation File

- Error Compensation file format extension has been updated from text format (.dat) to binary format (.bin).

Reporting

- Graphical Report dialog applies changes and updates graphics immediately.
- Label configurations for reporting options can be accessed from Report drop down menu.
- Enhanced Graphical Reports for curves.

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Getting Started - An Overview

CAPPS DMIS provides an Integrated Programming Environment, to develop inspection part programs for dimensional measurement and analysis. A program code (**DMIS**) is generated, using the various tools in this environment. CAPPS DMIS takes a **LEARN (teach)** approach to program generation. Any program created in **LEARN** mode may be **RUN (executed)**. So at any given time a user may be either learning a program or executing a program that has been learned before. The user will have to be in **LEARN** mode to access most of the measurement menu's and functions in CAPPS DMIS.

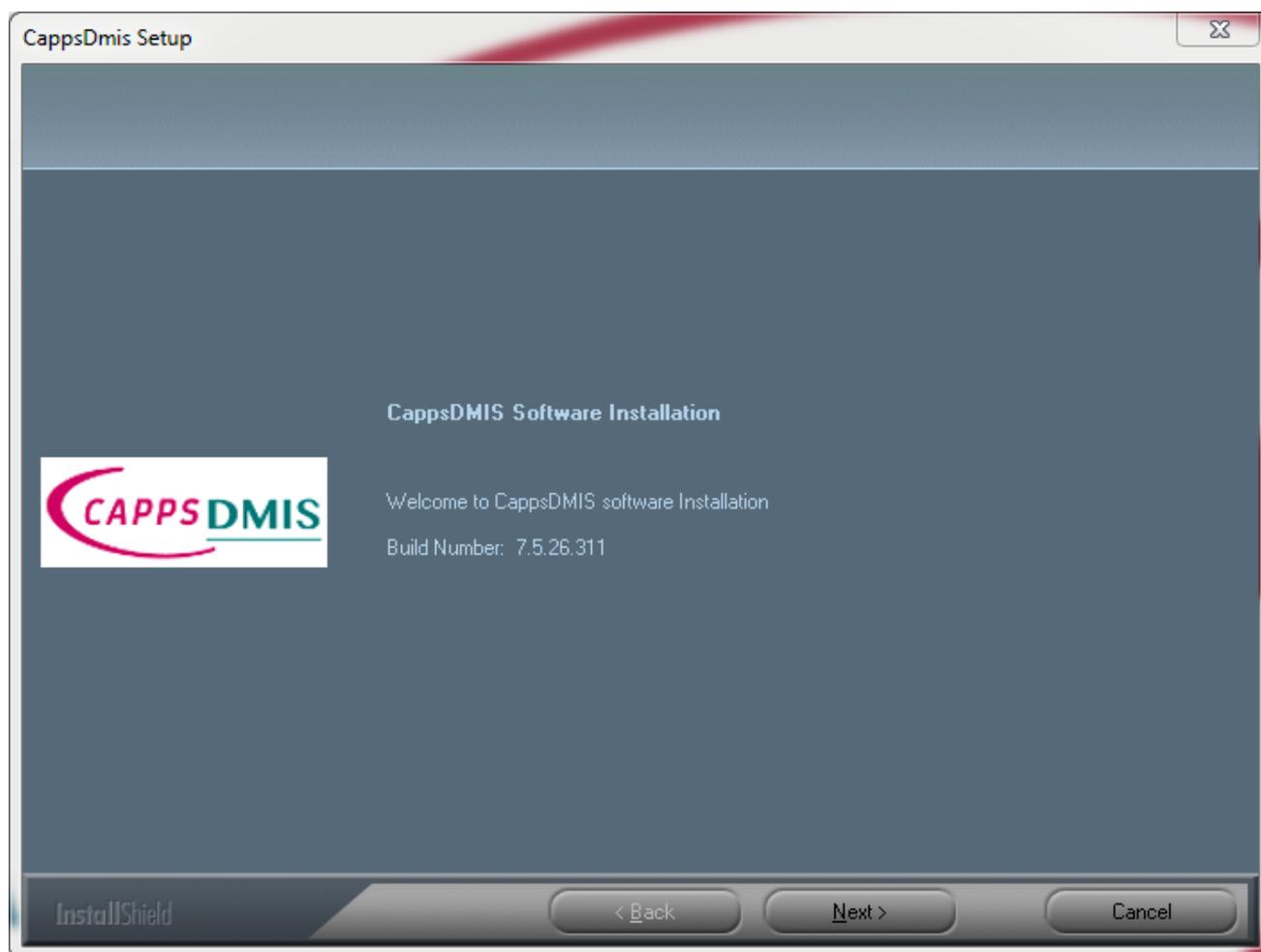
System Requirements

- **Processor:** Intel i7 processor at 4.0 GHz or faster, CAPPS can support multi-core processors as well. Processor speed should be based on CAD model requirements. It is recommended to use a faster processor with large CAD models
- **Memory:** Minimum RAM requirement is 8GB. However, it is recommended to use more RAM with larger CAD models and data sets. Recommended RAM type is DDR4
- **Graphics Card:** NVidia cards are required for CAPPS. NVidia GEFORCE with at least 2GB of on board memory are recommended, however cards with more on board memory should be used for applications with larger CAD models. DO NOT USE any Intel built on mother board graphics processors (i.e Intel HD Series)
- **Hard Drive:** Standard hard drive type should have a spindle speed of 10,000RPM, if a solid state drive is used then it should contain at least 1TB of storage space: CAPPS-DMIS requires about 200MB installation space. Above that, hard drive requirements are based on user requirements for data storage.
- **Operating System:** CAPPS is a 32 bit application but it can run on a 64 bit platform. CAPPS can run in the following operating systems
 - Windows 7
 - Windows 8
 - Windows 10
- **Other Components:**
 - Network Card
 - Speakers
 - Mouse
 - Keyboard
 - Monitor (CAPPS-DMIS supports dual monitor display)

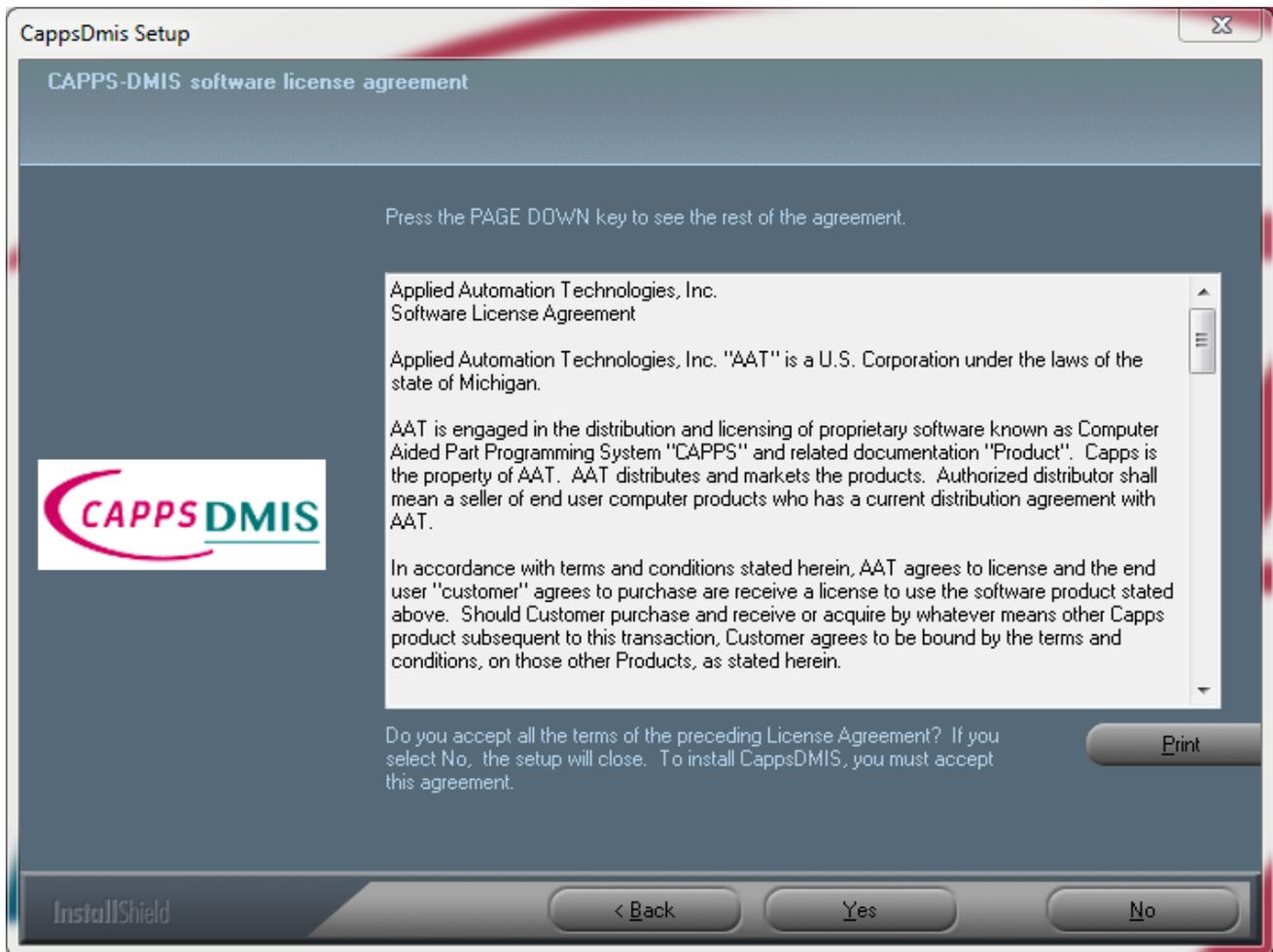
Important Note: If machine requires the COM ports (Serial Ports) it is recommended that the PC includes these ports or a peripheral card with COM ports is installed in the PC. USB to Serial connectors are NOT recommended

Installing the Software

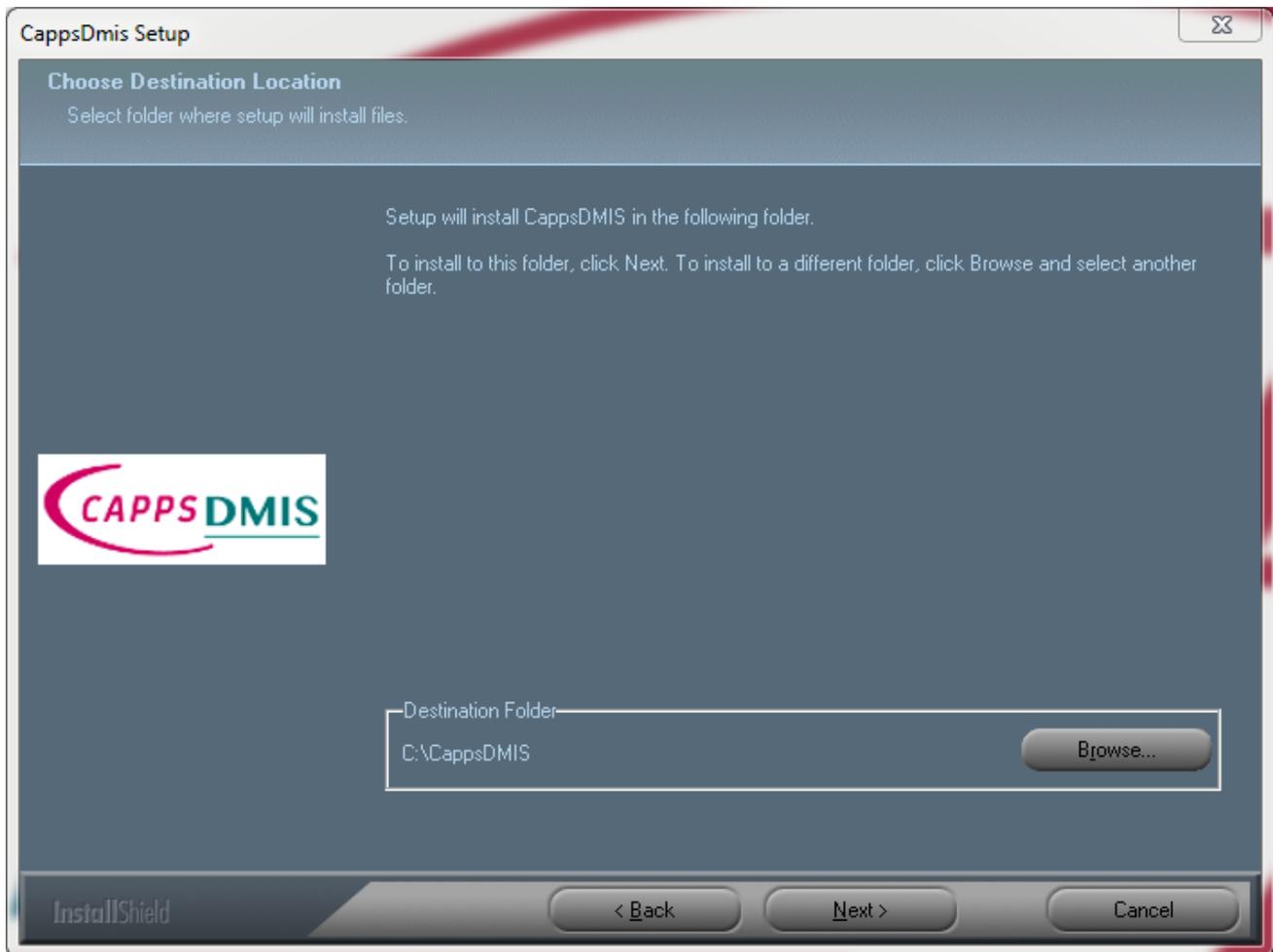
- Insert the CAPPS DMIS CD in to you CD Drive of your PC. This should automatically start Setup software. If the auto start option is disabled on the computer, then the CD can be browsed and the **SETUP** program can be started manually.
- **MAKE SURE THE SOFTWARE SECURITY LOCK (DONGLE) IS NOT ATTACHED TO THE COMPUTER YET.**
- After the setup program starts, it will displayed several screens. Choose the NEXT option in the first one shown below.



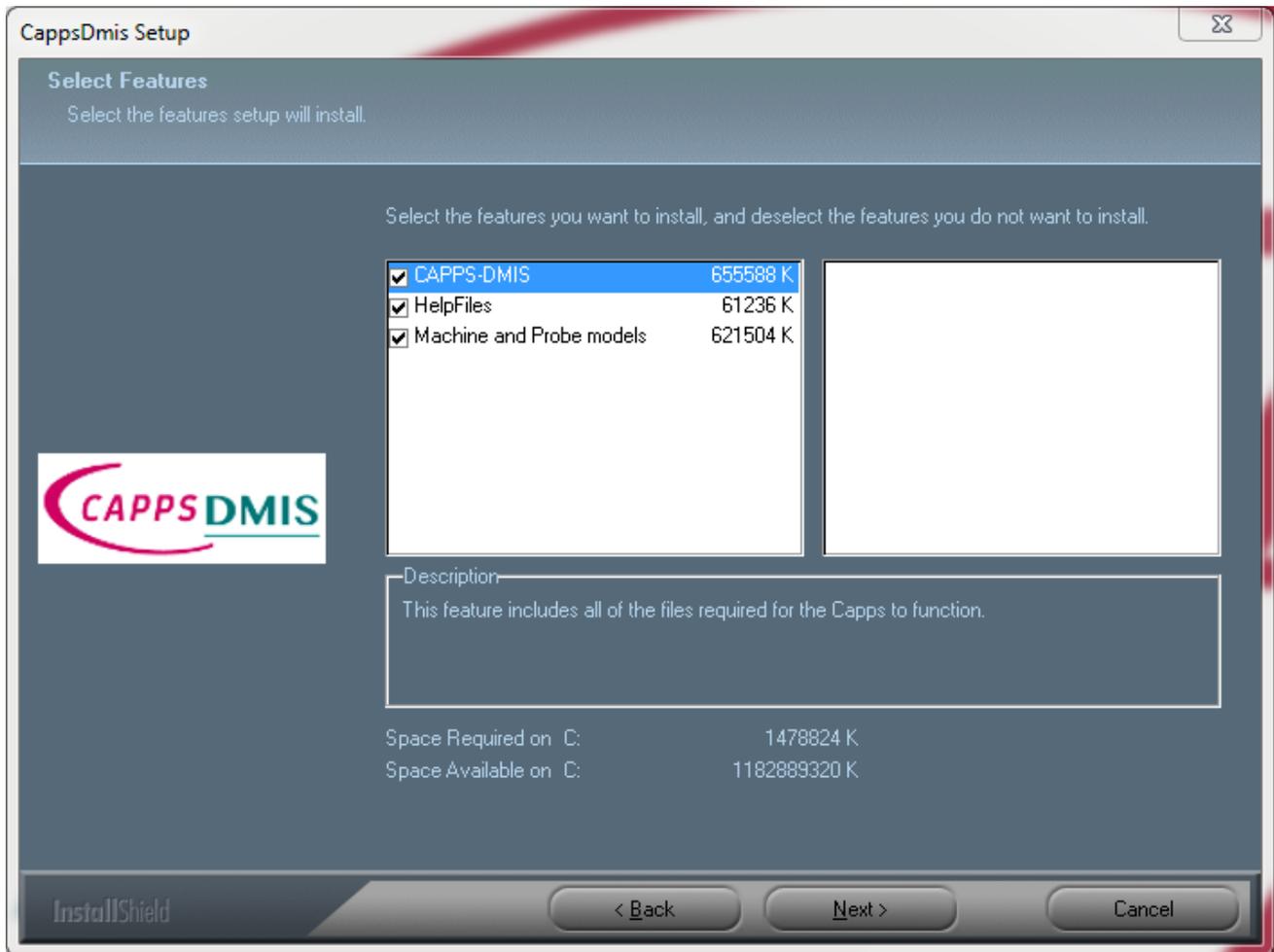
- User confirmation is needed to accept the terms of License Agreement, please read Terms of License Agreement and click on **YES** to continue installation.



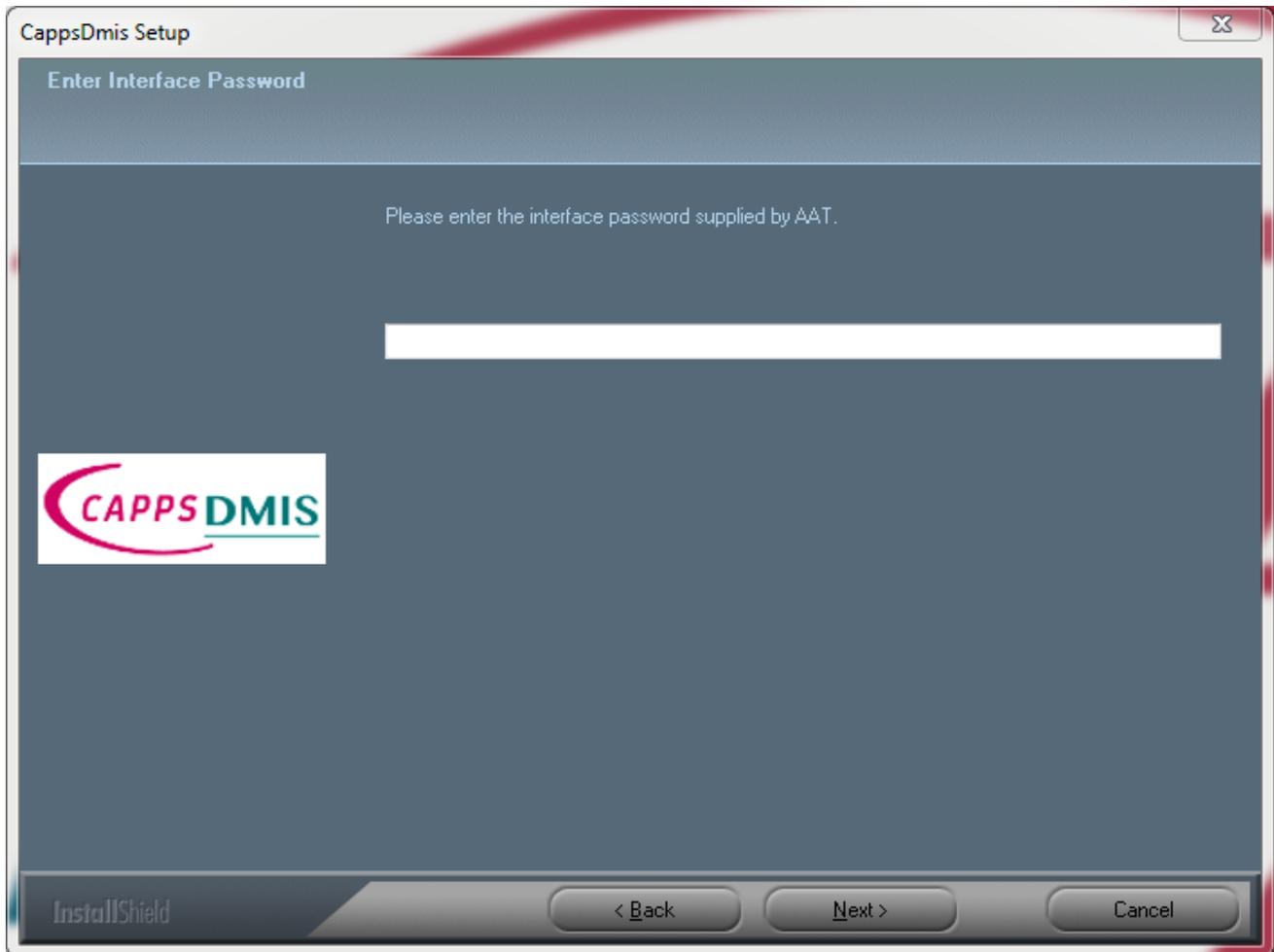
- **Installation Location:** The next screen will display the location where the software will be installed. CAPPS DMIS can be installed on any folder present on the hard drive of the computer. The default location suggested is **C:\CappsDmis**. This can be changed by choosing the **BROWSE** option.



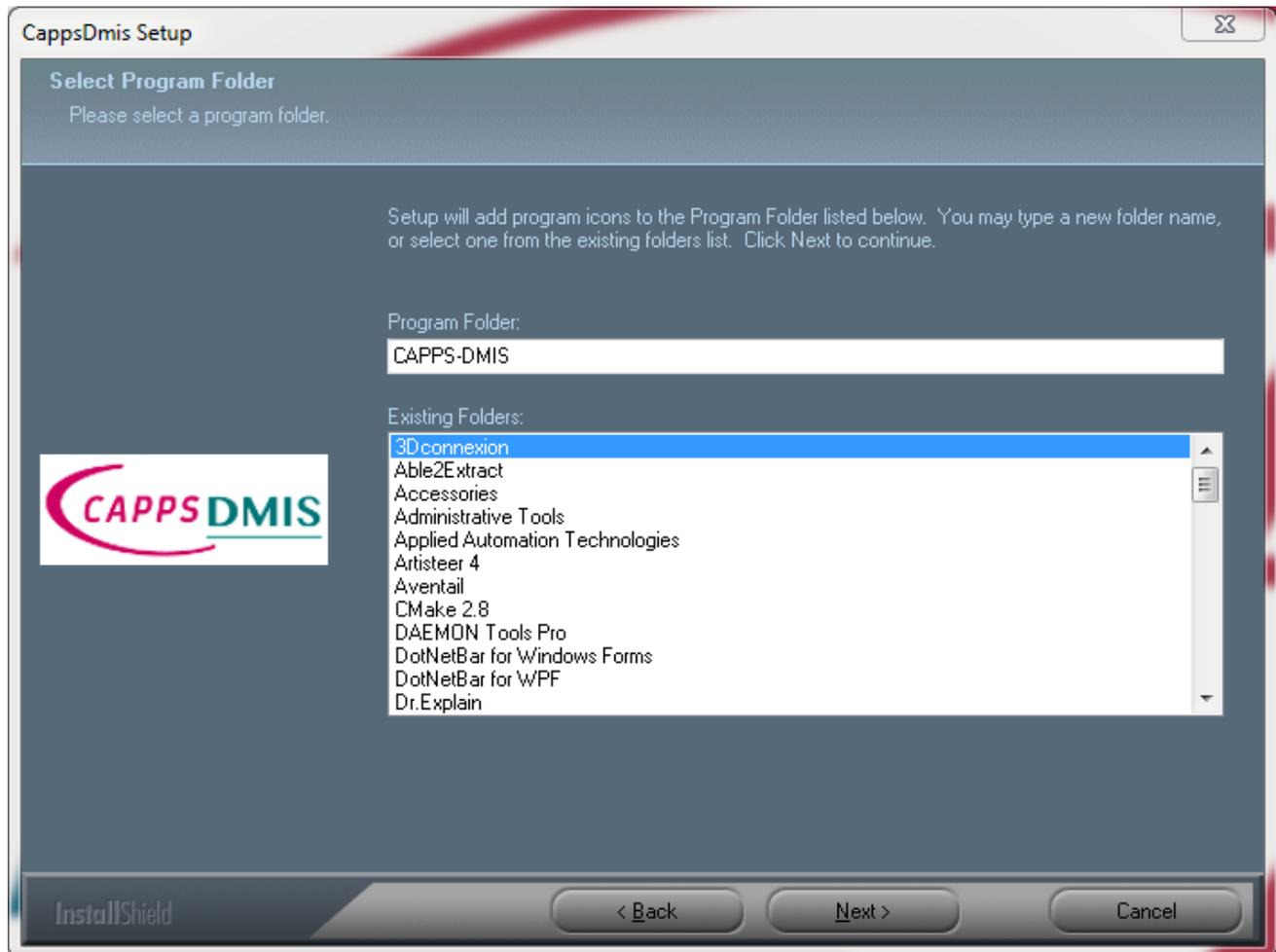
- **Installation Components:** There could be several different options listed in this screen. Choose the components desired and choose the **NEXT** button. **CAPPS_DMIS_XP** needs to be checked **ONLY** for PC's using with **Windows XP Operating System**.



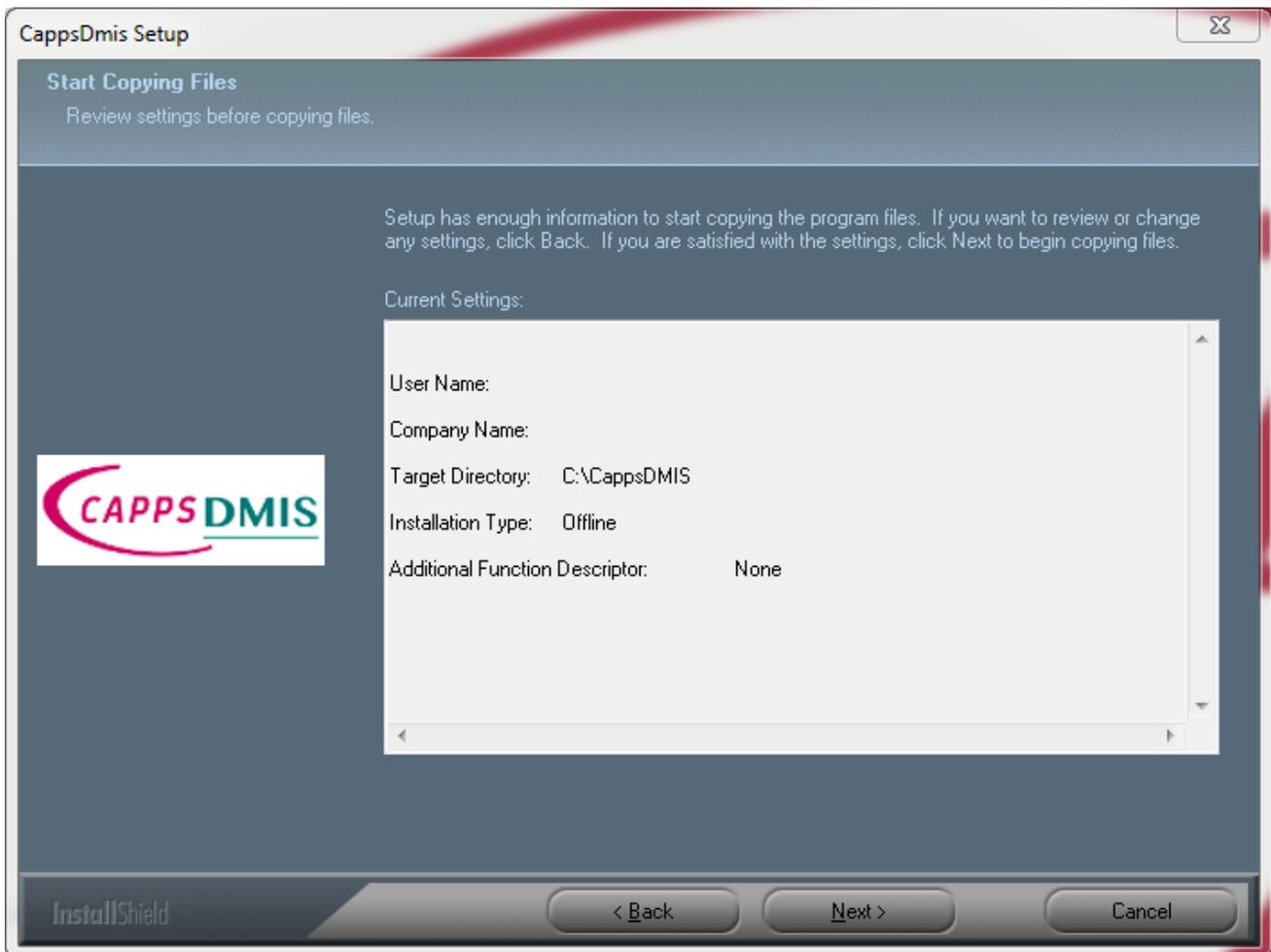
- **Enter Machine Specific Password:** CappsDMIS CD has drivers and interface files for all possible machine interfaces. However, these are encrypted and cannot be copied manually. In order to copy the correct drivers and configuration files, a 5 letter password must be entered in this dialog. This 5 letter password can be found on the software license certificate.



- Setup will add the CappsDMIS folder to install software components. Click **NEXT** to proceed.



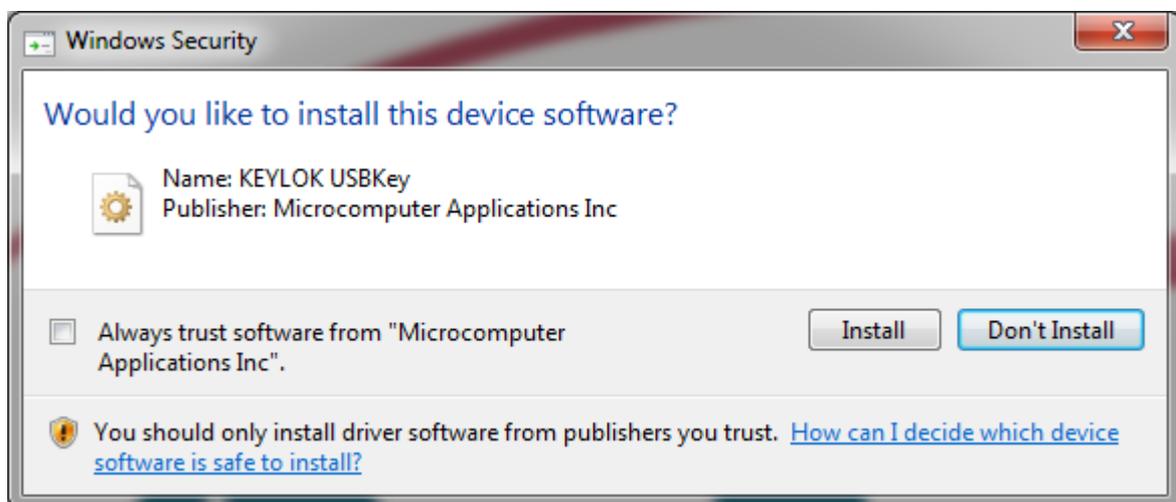
- In the last step, setup will summarize the software information. Click **NEXT** to proceed.



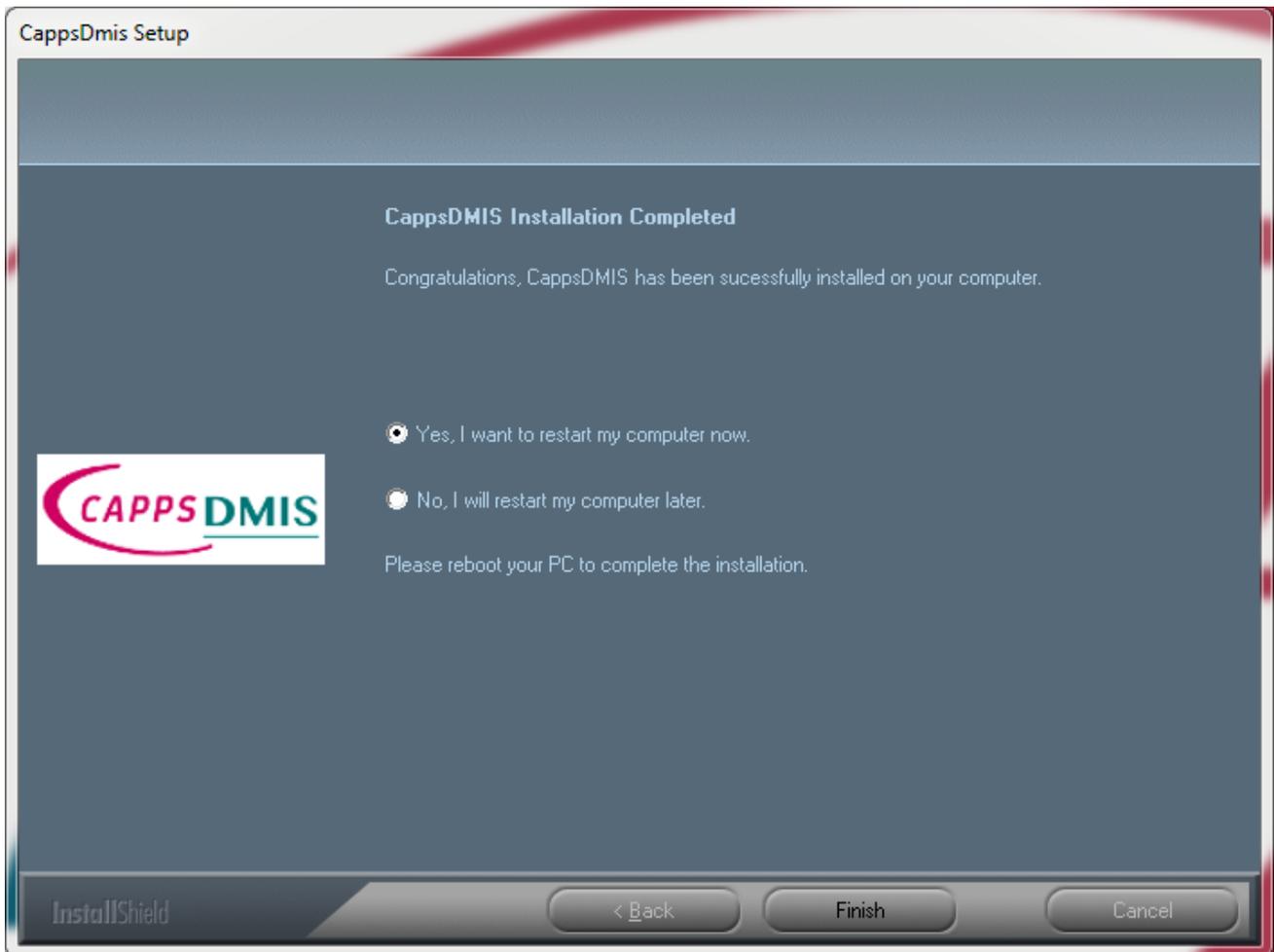
Important Note: Make sure that USB Dongle (green colored) sent from AAT is not connected to the PC. Once after USB Dongle is disconnected click on **OK** to install the Dongle Drivers.



- Once after user clicks on OK, Windows Security installation wizard will popup click on Install



- After installing the dongle drivers CappsDMIS installation is finished and wizard will prompt the window to restart the computer (it is highly recommended to reboot the PC)



Important Note: After rebooting connect the USB Dongle (green colored) sent from AAT to the PC.

- **Completing installation:** Once the installation is completed the software will be ready to start. However, some further configuration might also be necessary to adjust several important parameters according to your machine. If this is necessary, please follow the instructions from the **Configuration Wizard** document.
- **Software Security Codes:** CAPPS DMIS CD is supplied with a software security lock (**DONGLE**) that can be connected to the PC on the USB port or the Parallel port depending on which is supplied.
- **Software License:** The CAPPS DMIS software is supplied with a license certificate. There are several important information on this certificate.
- **Date of Release:** Date when the software license is printed.
- **Software Name:** Type of software purchased, CAPPS DMIS, CAPPS NC, etc.
- **Software Level:** Software level purchased, Advanced, Basic Plus, PS.

- **Options Purchased:** This box lists all the options enabled in the codes in the next section.
- **Dongle Serial Number:** This is the serial number of the hardware lock provide. This number must match the one that is on the dongle itself. If the sticker is removed, this number can also be seen in the “About Menu” of the software.
- **Installation Code:** This is the initial installation code. Normally there will be a 40 days grace period until the software must be registered.
- **Extension Code:** If necessary, an extension code can be supplied to allow more time in the software before final registration.
- **Final Registration Code:** This code is only supplied after full payment of the software.


Software License Certificate
www.aat3d.com

Distributor Name	AAT
Company Name	Company ABC
Date of Release	2/31/2017
Software Name	CAPPSDMIS Version 7.4
Software Level	Basic+
Machine Interface	I++ Server
Options	Full Error Compensation, Tool&Tip Changer, DCC Operations

Dongle Serial Number	15CM03001 - 499113746
Interface Password	21919
Installation Code	EFDAE-EFMYR-BBQDL-LQAEQ-BQRIU-ADKBC-OK6WR
Extension Code	EVCAF-E76QR-BBVJL-DUIHQ-AR3IU-CHCGC-OL6WR
Extension Date	9/23/2015
Final Registration Code	EDVQA-EN6YR-BBQLL-JQAEQ-BRDIU-IHKDC-OK6WR

Installation Instructions:

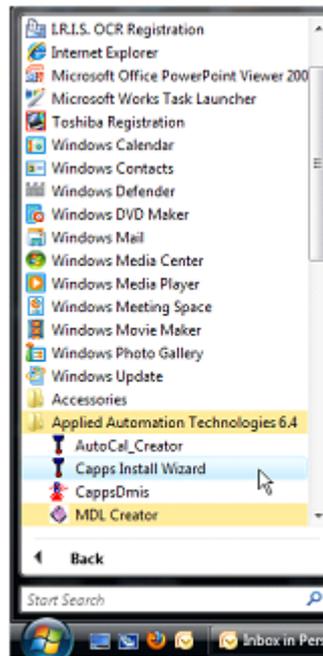
1. Make sure the dongle serial number on your software dongle matches one on this license.
2. When installing from CD, enter the 5 digit password installation password.
3. When installation is complete, start the software. It will ask to enter installation code. Enter this code.
4. If an extension code or Final Registration code is given on this license certificate, enter this.
If final code is given, you do not need to enter extension code.
5. If there is no extension code or final code given, copy the "software generated code" on the software and send it to your distributor to obtain the final code.
You will have 40 days before the software expires.


 1688 Star Batt Dr.
 Rochester Hills, Michigan 48309
 United States

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Configuring The Software

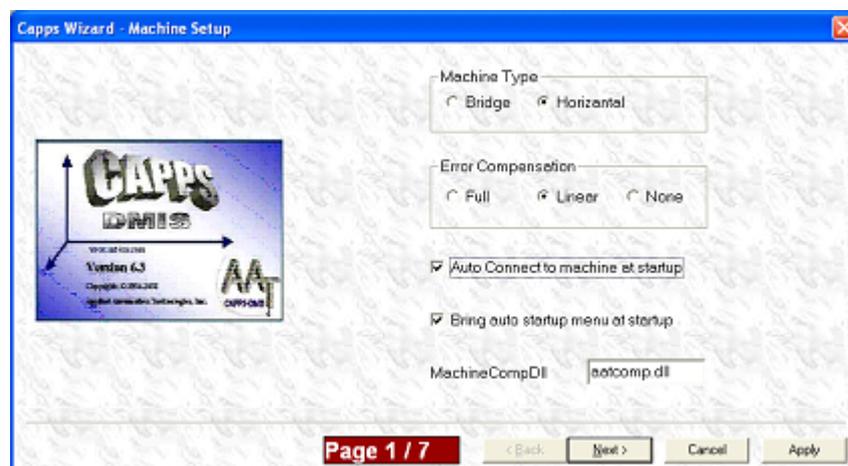
The Installation wizard can be started from the Windows Start/Program menu. This is a 7 step process.



Using the CAPPS DMIS Install Wizard

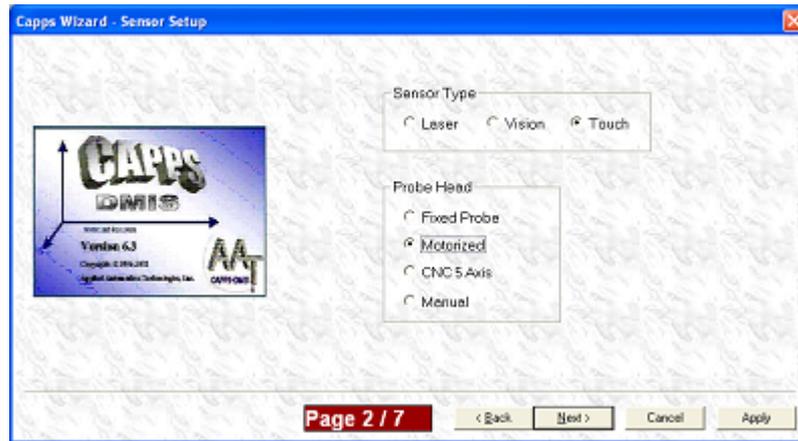
Step 1 of 7 - Machine Setup

- Configure **Machine Type**
- Configure machine **Error Compensation**:
- Configure if CAPPS should connect to machine after startup
- Configure if **Main Options Window** should be displayed after startup.
- Choose if a different machine compensation **DLL** is used for machine compensation



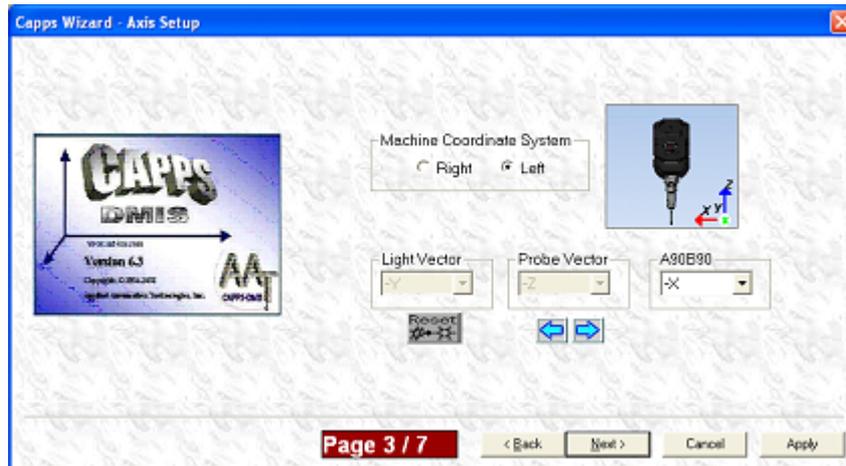
Step 2 of 7 – Sensor Setup

- Choose **Probe Type**
- Select probe head type



Step 3 of 7 – Probe Head Axis Setup

- Choose **Coordinate Type**
- Set probe vectors



Step 4 of 7 – Master Ball Setup

- Enter **Master Ball Stem Vector**
- Enter **Ball Diameter**
- Enter **Shaft Diameter**

Capps Wizard - Master Ball Setup

Stem Vector

I	0.000
J	-1.000
K	1.000

Master Ball

Ball Diem	29.999
Shaft Diem	6

Page 4 / 7 < Back Next > Cancel Apply

Step 5 of 7 – Tool Tip Setup

- If tool tip is available, choose which type
- Enter configuration parameters

Capps Wizard - Tool/Tip Setup

Changer Parameters

Tool Changer Tip Changer

Axis Vector	1.0000	-0.0063	0.0000
Dock Vector	-0.0063	-1.0000	0.0000
Load Vector	0.0000	0.0000	1.0000
Docking Speed	75.0000		
Docking Approach	50.0000		

Page 5 / 7 < Back Next > Cancel Apply

Step 6 of 7 – Controller Setup

- Choose **Controller Type**
- Enter Machine communication update interval



Step 7 of 7 – Sensor Setup (Renishaw Controller Interface ONLY)

- For Renishaw, browse and choose the machine configuration path.



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System Configurations

CAPPS DMIS provides the user with several different configurations to choose from. Some of the configurations found in the system configuration menu should only be changed by qualified AAT personnel.

System/Configuration – Machine

The screenshot shows the 'System Configuration' dialog box with the 'Machine' tab selected. The dialog is divided into several sections:

- Machine Volume:** A sub-section with a table for axis limits.

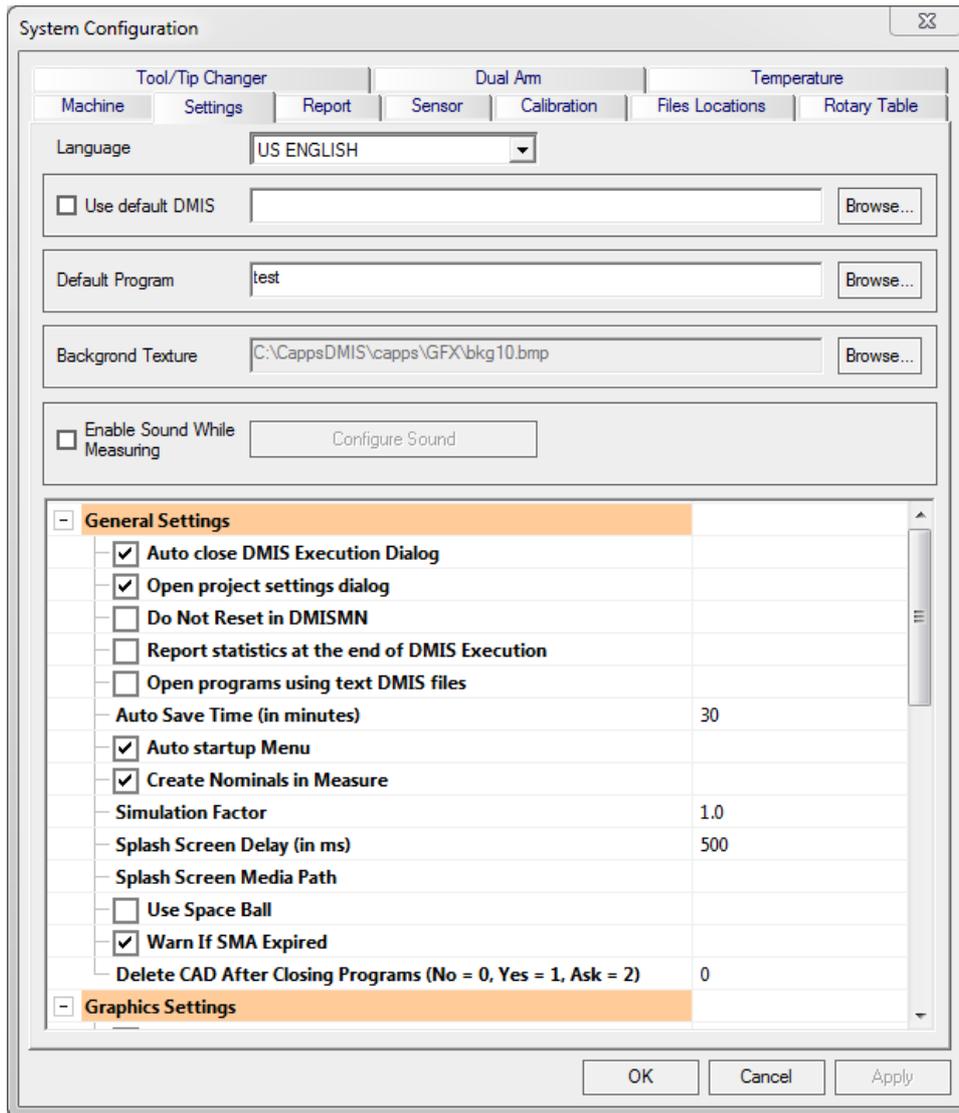
	X - Axis	Y - Axis	Z - Axis
Minimum	500	500	500
Maximum	0	0	0
- Active Interface:** A text field containing 'cpoff.ini'.
- Active Machine Model:** An empty text field.
- Options:**
 - Active
 - Fly Mode
 - Buffered Moves
- Buttons:** 'Set PSWD' and 'Enter PSWD'.
- Machine Type:** Radio buttons for 'Horizontal' and 'Bridge' (selected).
- Error Compensation:** Radio buttons for 'None' (selected), 'Linear', and 'Full'.
- Bottom Buttons:** 'OK', 'Cancel', and 'Apply'.

Machine Volume:	These settings will create virtual machine boundaries, not hard limits. Primarily used in automatic programming of the CMM. Values are expressed in MM units.
Active Interface:	Refers to active interface configurations file.
Active Machine Model:	If machine model files are present on the host computer, then a model of the CMM can be shown in graphics.
Machine Type:	Denotes style of CMM being used.
Fly Mode:	Used to create circular moves in between point touches and/or GOTO points.

Fly Mode is Available Only on the Following DCC Interfaces:	<ul style="list-style-type: none"> • AAT – Reality controller • API • Coord 3 (cpcc3 interface) – does not support buffered moves • I++ • Mora • Renishaw – (cpucc interface) • DEA • Brown and Sharpe (all including Leitz interface) • OTC • Pantec • POLI • G&L – Serial Interface • DEVA – does not support buffered moves • Mitutoyo • Wenzel • Zeiss (cpcmmos interface)
Buffered Moves:	Used in conjunction with the Fly Mode option. Will buffer touch points and move points in a measurement block to increase the efficiency of the machine movement.
Set PSWD/Enter PSWD:	This option is used in conjunction with editing the feature actual results. It is administrator controlled and the user must know the password before proceeding.
Error Compensation:	Used to tell the system whether or not an error compensation or comp map is being used with the software. This option should only be changed by qualified calibration personnel.

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System/Configuration - Settings



Language:	Used for selecting the language in which the menus in CAPPS DMIS are displayed. Language display is controlled by the corresponding (.ini) files in the Capps6(or CappsDmis)/Capps/Language folder.
Use Default DMIS:	Use this option to select a DMIS program (.dms) file to included with every program you create. It is used for creating a generic DMIS main section for every program.
Default Program:	Used to specify the default program to be opened in Open / Create Program dialog.
Background Texture:	Used for selecting a background texture for the outlying areas of the CAPPS DMIS operating screen.
Enable Sound While Measuring:	Allows the user to pick sounds for in/out of tolerance conditions while measuring.
General Settings:	This section specifies the general settings that user can change in Capps. Note: A detailed document on the general settings can be found in the help section

[System Configurations](#)

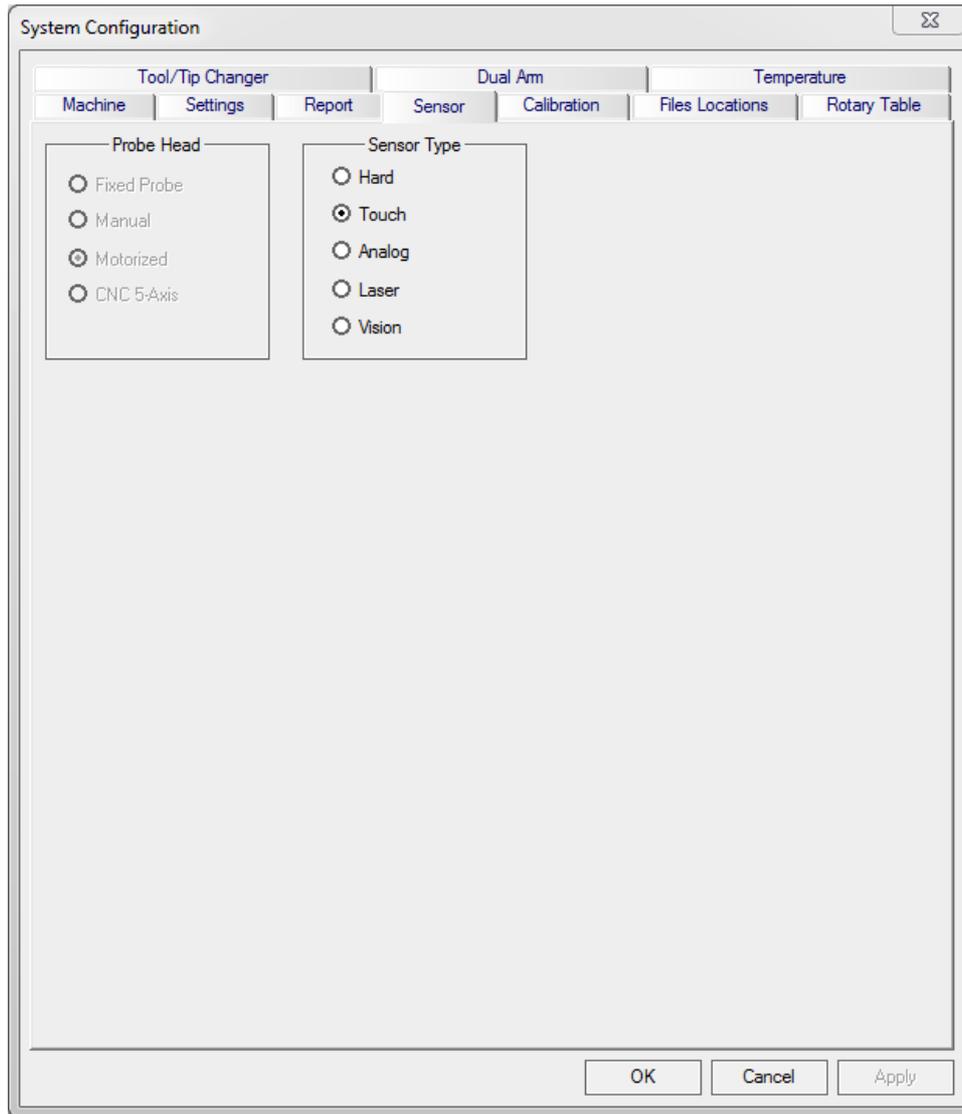
System/Configuration – Report

Report Profile as True Position:	This option controls the output of edge point and angle point measurements. When this option is checked, the surface and edge profiles are reported as a combined true position instead of separately.
Report Deviation for Coordinates as Profile:	Mainly used for checking left hand automotive part configurations. Unchecked, the system will report the deviation as plus/minus in regard to the nominal location, which may not reflect the real condition of the part. However, if this option is checked, then the deviation will always be reported in relation to the natural state of the part.
Auto Save Report at End DMIS:	Having this option checked will save a text version (.rpt) of the results at the end of each part run. The name of the file will be auto incremented.
Report Control Chart:	This will display a graphical in/out of tolerance control chart in the results.
Display Alignment Name:	Checking this option will display the alignment name for each feature in the results in which the feature was measured.
Display Element Name On Each Line:	Checking this option will display the element name (i.e. CIR1) on each line of the feature output including each axis line. If unchecked, then the feature name will only be displayed on the first line of the output.

Overwrite Features:	If this option is checked features with duplicate label names will be overwritten in the feature list.
Reset Tolerances at DMISMN:	At the beginning of each DMIS program there is a DMISMN command. If this option is checked, then the tolerance database will be cleared each time a new program is started.
Increment Binary Report Name:	Increments binary report (.rst) when running a program. Used in conjunction with DMIS command SAVE/REPORT [PATH NAME]
Display Element Header:	If this option is checked then the feature element name will be displayed in the results. Otherwise, only X,Y,Z will be displayed.
Offline Simulated Errors:	Used while offline programming to simulate error conditions on measured features.
Set Labeling:	Allows the user to change the default labeling for features. There are also options for prefix, postfix, Mirror prefix, Nominal counter, and Actual counter.
X,Y,Z Configuration:	Allows the user to configure output of report. For example, companies like Honda Motor Corporation use T,B,H instead of X,Y,Z for output.

[System Configurations](#)

System/Configuration - Sensor



Probe Head:	Used to configure machine probe head type being used. This is normally set up by the installation technician.
Sensor Type:	Used to configure sensor type being used. This is normally set up by the installation technician.

[System Configurations](#)

System/Configuration - Calibration

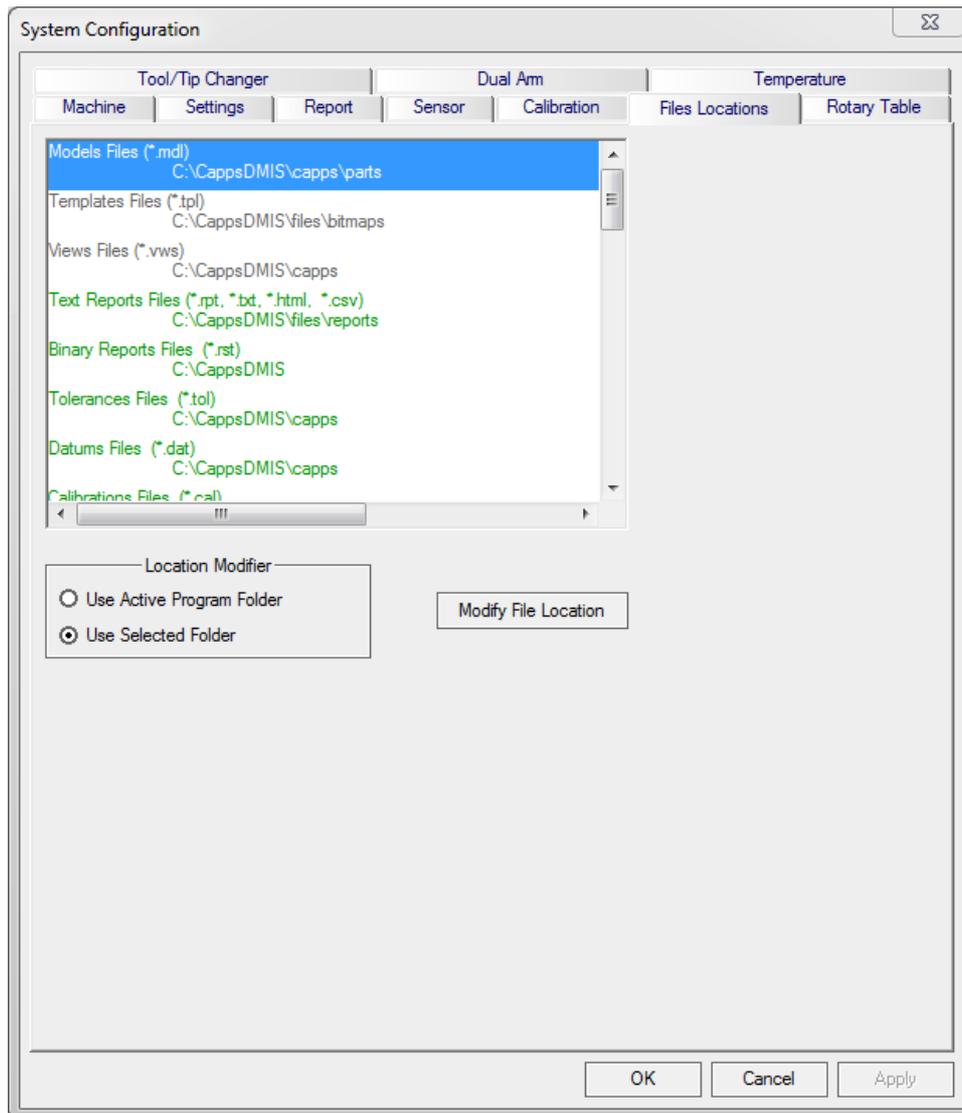
The screenshot shows the 'System Configuration' dialog box with the 'Calibration' tab selected. The 'Machine Coordinate System' is set to 'Right'. The 'Light Vector' is (X: 1, Y: 0, Z: 0). The 'Probe Vector' is (X: 0, Y: 0, Z: -1). The 'A:90 B:90 Vector' is (X: -0, Y: 1, Z: 0). There are two unchecked checkboxes: 'Write Calibration as SNSLCT in DMIS' and 'Probe Auto Labeling with index PA2B4'. An 'Advanced Calibration Settings' button is present. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

Machine Coordinate System:	Used to configure machine coordinate system. Most machines will follow the right hand rule.
Light Vector:	This is the travel direction of the LED light on the Probe Head unit expressed in terms of a vector. For example a light vector which travels in the X+ direction would be expressed as 1,0,0 in the light vector configuration.
Probe Vector:	This is the travel direction of the probe from the center of the Probe Head to the probe stylus with the probe in an A0B0 position expressed in terms of a vector. For example, if when the probe is in an A0B0 position, the direction of travel is (Z-), then the direction would be expressed as 0,0,-1.
A:90 B:90 Vector:	This is the travel direction of the probe from the center of the Probe Head to the stylus with the probe in an A90B90 position expressed in terms of a vector. For example, if when the probe is in a A90B90 position, the direction of travel is (Y-), then the direction would be expressed as 0,-1,0.
Write Calibration as SNSLCT in DMIS:	Checking this option will write all calibrations as sensor selection statements in the Program Window . Conversely, they will be written as calibration statements.

Probe Auto Labeling with index PA2B4:	Checking this option will configure the system to write all probe labels with increment values for the A and B angles of the probe rather than writing them with the actual angles. For example: PA6B6 instead of A45B45 (one increment for every 7.5 degrees of rotation).
Advanced Calibration Settings:	Opens Advanced Calibration Settings dialog.

[System Configurations](#)

System/Configuration – File Locations



Modify File Location:	Allows the user to configure the default location of stored CAPPS DMIS information data including such things as report files, view files, datum files etc.
Use Active Program Folder:	Will store the corresponding file in the active program directory instead of the path shown. The active program directory may be selected when learning a program also.
Use Selected Folder:	If this option is checked, the user may modify the specified file location.

[System Configurations](#)

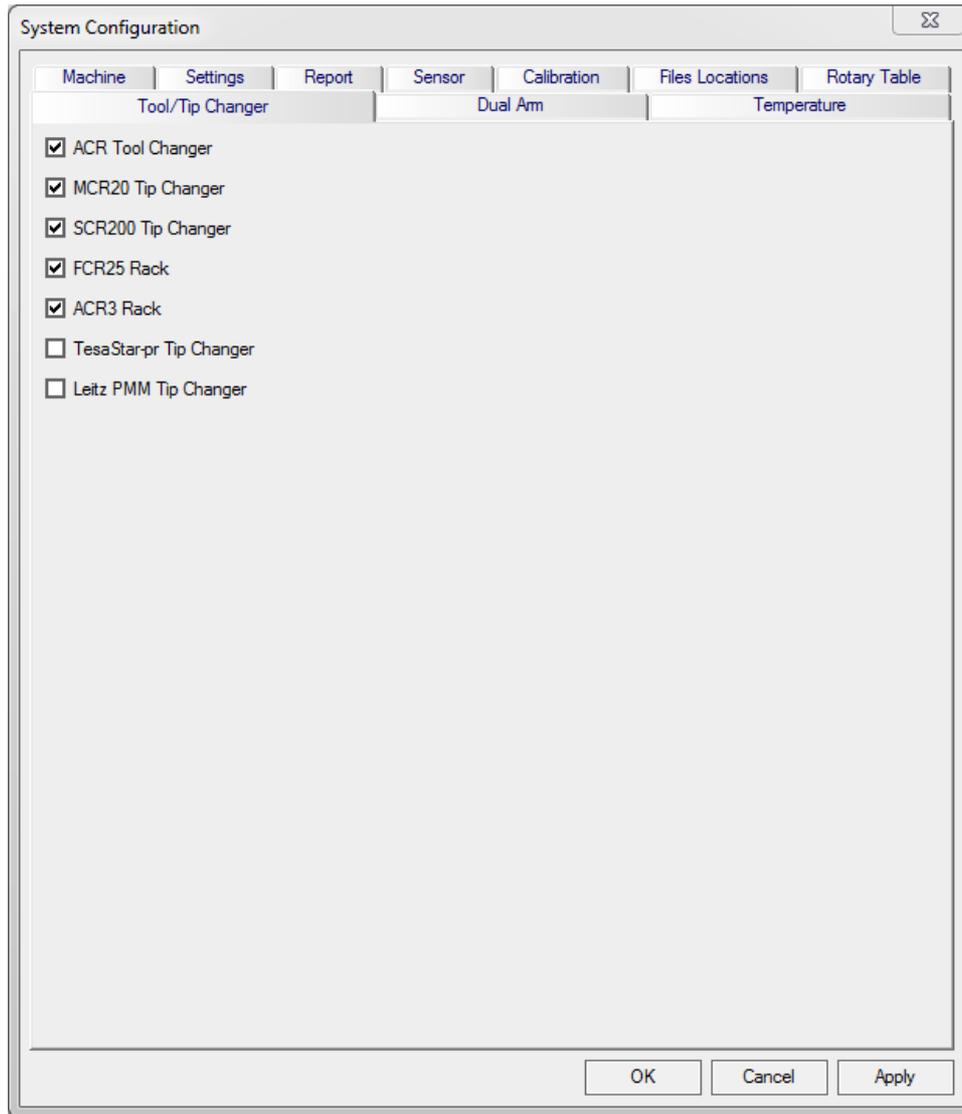
System/Configuration - Rotary Table

Rotary Table:	This is an on/off configuration to turn Rotary Table functionality.
X,Y,Z,I,J,K,LL,UL:	Used for configuration of the Rotary Table .
Table Model:	This option is used to browser a graphical rotary table model if exists.
Diameter:	Used for the diameter of the Rotary Table . Value is expressed in MM .
Height:	Used for the height of the rotary table. Value is expressed in MM .
Scale Res:	Refers to how many counts per millimeter are contained in the Rotary Table scales. This can be different for every table depending on the type of scales being used. This parameter should only be changed by qualified machine personnel.

For more information on how the Rotary Table option is used, please refer to the section on [Using Rotary Table Option](#) in the **CAPPS DMIS User Manual**.

[System Configurations](#)

System/Configuration - Tool Tip



These options used only to configure system for Tool/Tip changers. Please refer to the section on [Working with Tool&Tip Changers](#) in the **CAPPS DMIS User Manual**.

[System Configurations](#)

System/Configuration - Dual Arm

System Configuration

Machine Settings Report Sensor Calibration Files Locations Rotary Table

Tool/Tip Changer Dual Arm Temperature

Dual Arm

TCP/IP name

Port Number

Master

Valisys Host: Set this at the command line using -valisys

OK Cancel Apply

Dual Arm:	Turns on/off the Dual Arm option.
TCP/IP Name:	Transmission Control Protocol / Internet Protocol Name . This is the name of the computer that resides on the CMM acting as the other Arm.
Port Number:	It is likely that this port number will always remain at the default number of 1294 .
Master:	One computer will act as the Master and the other will act as the slave.

For further information on how to use the dual arm capabilities, please see the section on [Using The Dual Arm Option](#) in the **CAPPS DMIS User Manual**.

[System Configurations](#)

System/Configuration - Temperature

The screenshot shows the 'System Configuration' dialog box with the 'Temperature' tab selected. The 'Temperature Compensation' section is active, with the 'Apply Temperature Compensation' checkbox checked. A table lists eight sensors (Sensor1 to Sensor8) with their respective Part, X, Y, or Z Axis, Nominal Temperature (20.000°C), and a coefficient value (1.0000000). Below the table, there are input fields for 'Nominal Temperature' and 'Ambient Temperature', both set to 20.000. A dropdown menu is set to 'Celcius', and there are 'Connect' and 'Refresh' buttons. The 'Refresh Rate' is set to 0.0000000. The 'Material Type' is 'Aluminium', and the 'Material Thermal Expn Coefficient' is 0.0000240. The X, Y, and Z Axis Thermal Expn Coefficients are all 0.0000000. The 'Manual Temperature Entry' section has input fields for X Axis, Y Axis, Z Axis, and Part, all set to 20.000. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

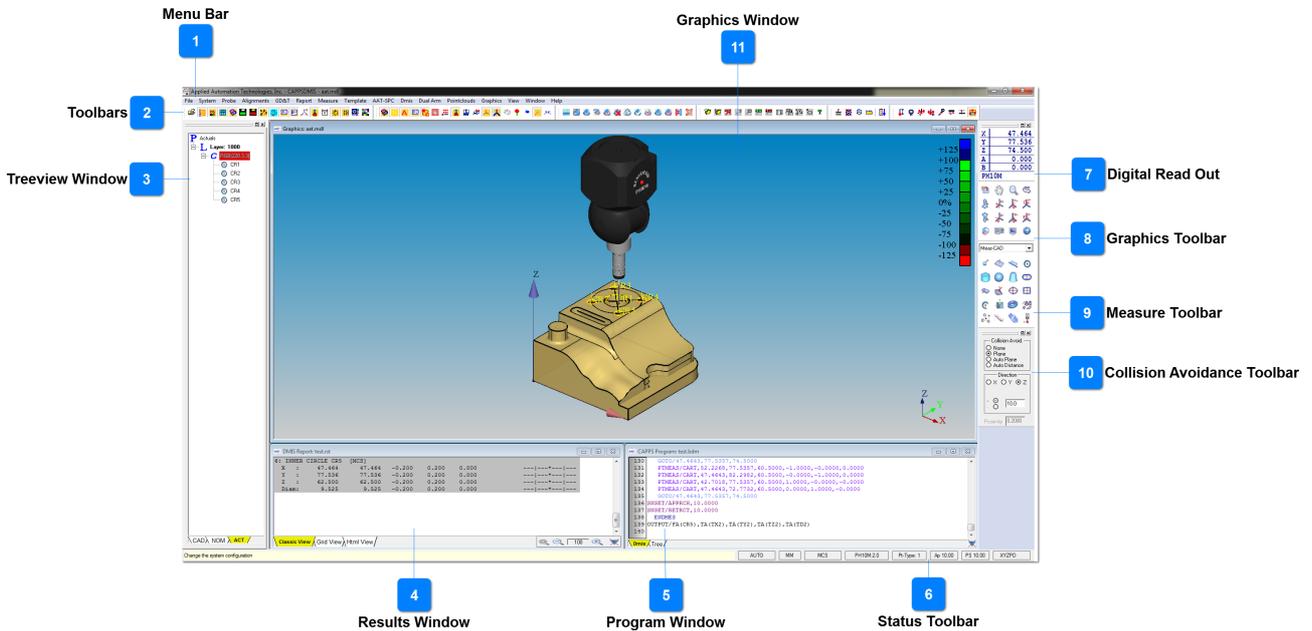
Apply Temperature Compensation:	Check this box to enable temperature compensation.
Nominal Temperature:	This is the temperature of the room when the machine was calibrated.
Ambient Temperature:	Used if no sensors are connected.
Units:	Used for selection of Fahrenheit or Celcius selection.
Material Type:	Type selection of material being inspected.
Expansion Coefficients:	Enter these values based on material being used.
Manual Temperature Entry:	Use these if no sensors are present.

For more information on how to use Temperature Compensation, please refer to the section on [Temperature Compensation](#) in the **CAPPS DMIS User Manual**.

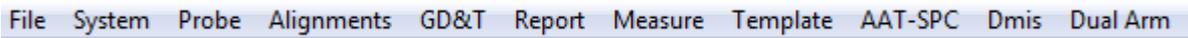
[System Configurations](#)

Navigating The User Interface

CAPPS DMIS provides an integrated part programming environment to develop inspection programs for dimensional measurement and analysis. It is built on a platform that allows software to be run like any other Microsoft Windows application. CAPPS DMIS enables the user to switch between various types of applications to perform multiple tasks simultaneously. The following figure illustrates the CAPPS DMIS operating system layout.



1 Menu Bar



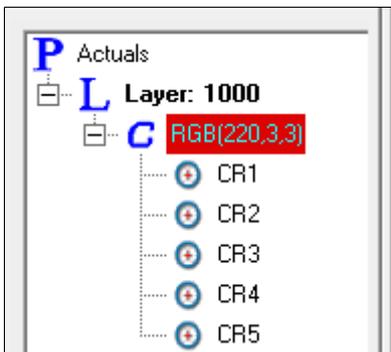
Menus are list of operation commands which are grouped. Each window has its own [System Menu](#) and [Right Button Menu](#).

2 Toolbars



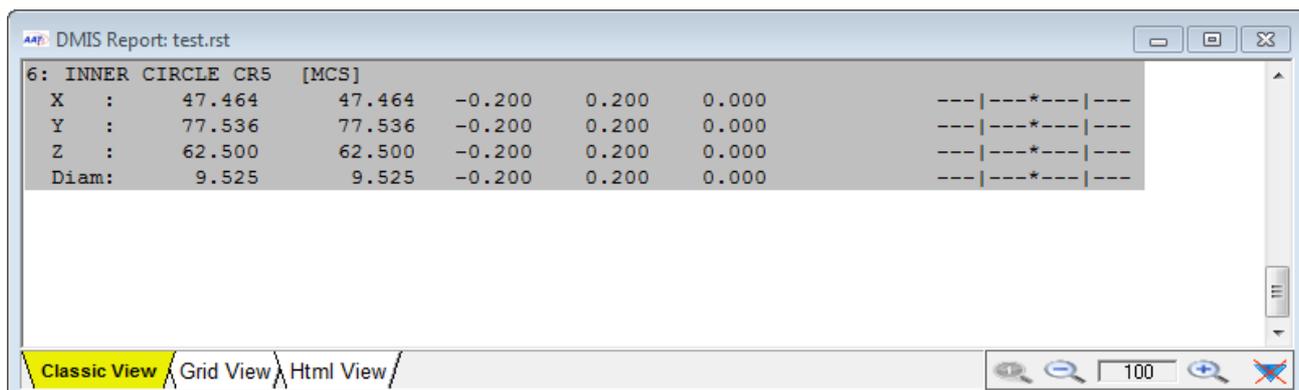
Dockable toolbars are available and grouped for certain tasks. These toolbars can be turned on or off and placed on screen at convenient locations.

3 Treeview Window



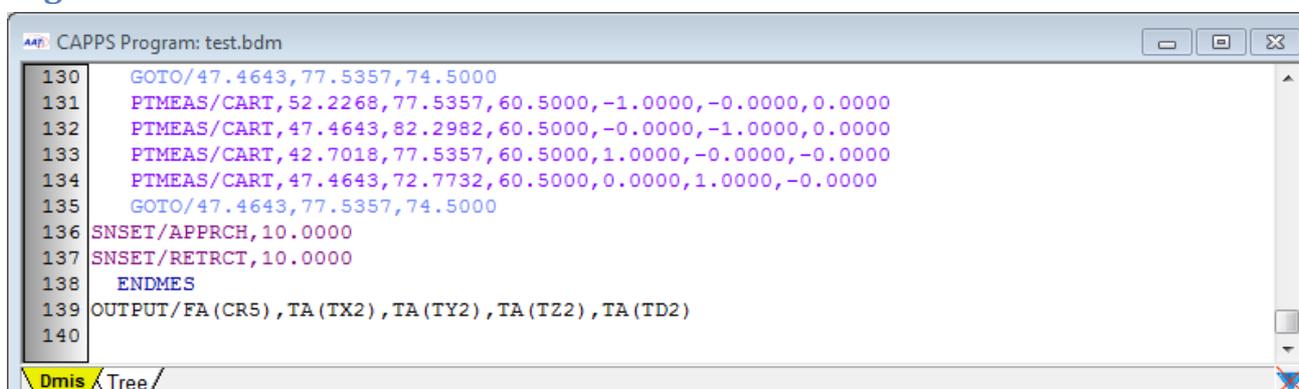
[Treeview Window](#) displays all the layer and color information of the CAD model, measured features or the nominal elements. The user can select and change settings of the CAD graphics models in this window.

4 Results Window



Results Window displays measurement results in **Classic**, **Grid**, or **HTML** view.

5 Program Window



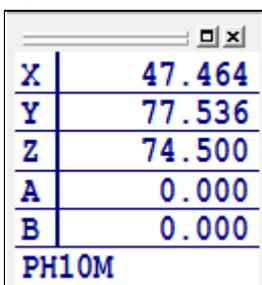
Measurement programs in **DMIS** format or **TREE** view list are displayed in **Program Window**. The desired listing is displayed by choosing the **DMIS** or **TREE** tabs at the bottom of this window.

6 Status Toolbar



[Status Toolbar](#) is used to display active options during a program, such as workplane, units, alignment, probe model. It also gives access to some machine and probe settings described in [Status Toolbar](#) section.

7 Digital Read Out



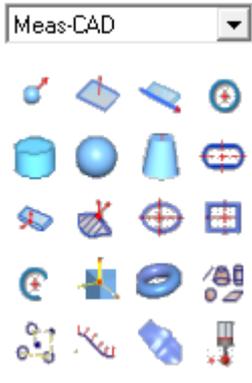
[Digital Read Out \(DRO\)](#) shows current location of the machine is displayed in this window.

8 Graphics Toolbar



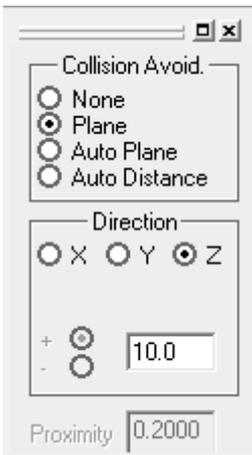
[Graphics Toolbar](#) contains all functions related to manipulating the graphics.

9 Measure Toolbar



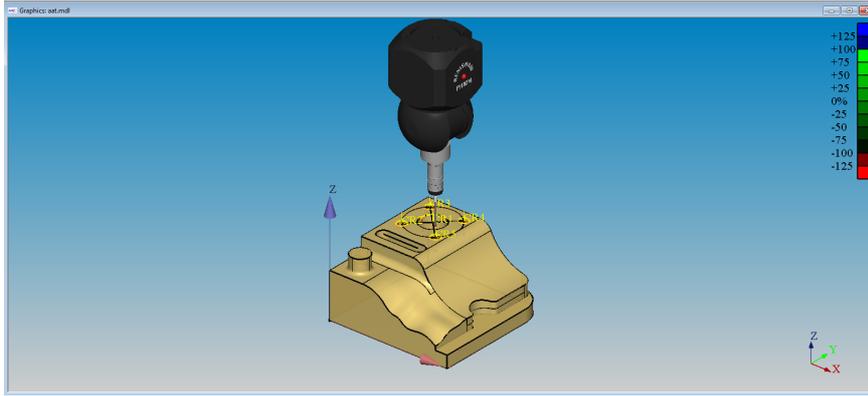
[Measure Toolbar](#) contains all functions related to feature measurement, feature construction, and nominal feature creation.

10 Collision Avoidance Toolbar



[Collision Avoidance Toolbar](#) is a very fast way of detecting potential collision of the tip of the probe with the part. This depends totally on the accuracy of the part model and checks only surface models present in the CAD. It will not detect any holding fixture or other items that are on the machine but not on the CAD model.

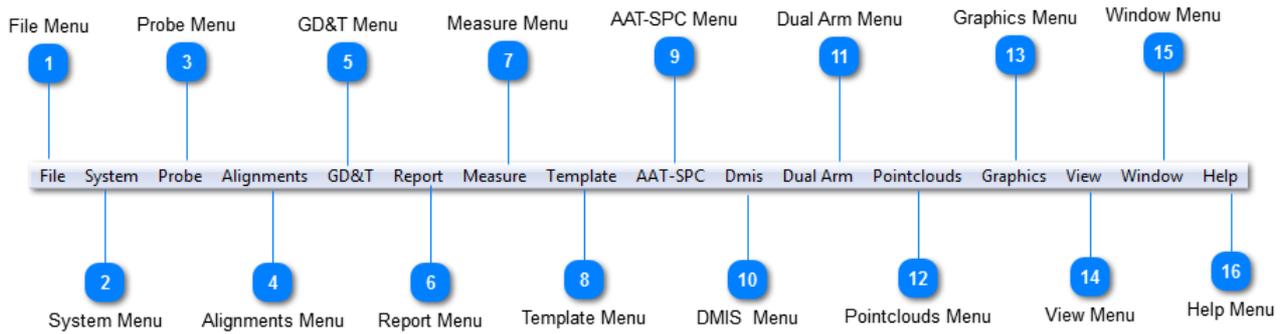
11 Graphics Window



The CAPPS DMIS **Graphics Window** displays 3D graphical entities related to the inspection process and work piece. **Graphics Window** shows actual measurements, nominal features, CAD data, active coordinate systems, vectors, touch points, probe path and other display properties. Live display of the probe and machine is also displayed.

[Table of Contents](#)

Menu Bar



The CAPPS DMIS main menu bar includes all functions available in the CAPPS DMIS software. Most items in this menu are also accessible from toolbars as well. This menu will contain different options depending on whether or not the teach environment is open.

Menu Bar before teach program is started:

File System Probe Graphics View Window Help

Menu Bar during teach program

File System Probe Alignments GD&T Report Measure Template AAT-SPC Dmis Dual Arm Pointclouds Graphics View Window Help

1 File Menu
File

[File Menu](#)

2 System Menu
System

[System Menu](#)

3 Probe Menu
Probe

[Probe Menu](#)

4 Alignments Menu
Alignments

[Alignments Menu](#)

5 GD&T Menu
GD&T

[GD&T Menu](#)

6 Report Menu
Report

[Report Menu](#)

7 Measure Menu
Measure

[Measure Menu](#)

8 Template Menu
Template

[Template Menu](#)

9 AAT-SPC Menu
AAT-SPC

[AAT-SPC Menu](#)

10 DMIS Menu
Dmis

[DMIS Menu](#)

11 Dual Arm Menu
Dual Arm

[Dual Arm Menu](#)

12 Pointclouds Menu
Pointclouds

[Pointclouds Menu](#)

13 Graphics Menu
Graphics

[Graphics Menu](#)

14 View Menu

View

[View Menu](#)

15 Window Menu

Window

[Window Menu](#)

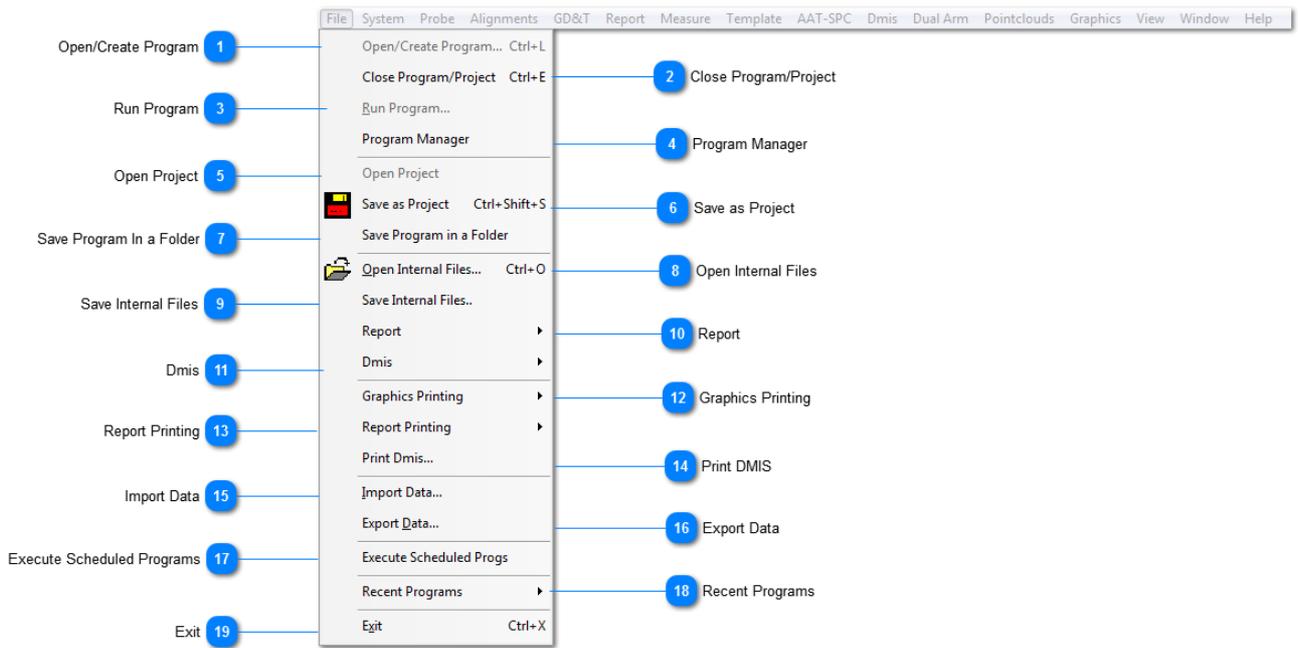
16 Help Menu

Help

[Help Menu](#)

[Navigating The User Interface](#)

File Menu



1 Open/Create Program

Open/Create Program... Ctrl+L

Used to create a new inspection program. This option is not available when in a current program.

2 Close Program/Project

Close Program/Project Ctrl+E

Used to close an inspection program.

3 Run Program

Run Program...

Used to run an existing part program..

4 Program Manager

Program Manager

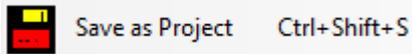
Is used to open a program that has been saved as a project.

5 Open Project

Open Project

Used to open a program that has been saved as a project.

6 Save as Project



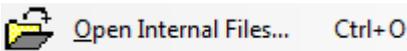
Used to save a program as a project. This will save all files including copies of the sensors and datums, which are usually not saved to a specific program but are shared.

7 Save Program In a Folder

Save Program in a Folder

Used to save a program in a project folder. This is good for organizing part families.

8 Open Internal Files



Used to open CAPPS specific files. These files include:

- Nominal Files (.nom)
- Actual Files (.act)
- Sensor Databases (.sns)
- Datum Databases (.dat)
- Tolerance Databases (.tol)
- View Databases (.vws)
- Picture Files (.bmp, .jpg, .gif, .tif, .png)
- Model Files (CAPPS CAD) format (.mdl)
- Shading Files (.shd)

9 Save Internal Files

Save Internal Files..

Used to save CAPPS specific files. These files include:

- Nominal Files (.nom)
- Actual Files (.act)
- Sensor Databases (.sns)
- Sensor Calibration Files (.cal)
- Datum Databases (.dat)
- Tolerance Databases (.tol)
- View Databases (.vws)
- Model CAPPS CAD format (.mdl)
- Shading Files (.shd)

10 Report

Report

Used for functions pertaining to the Report. (**Save, Save As, Open, Close**)

11 Dmis

Dmis ▶

Used for functions pertaining to the DMIS code. (**Save, Save As, Open, Close**)

12 Graphics Printing

Graphics Printing ▶

Used for functions pertaining to printing of the graphics. (**Printer Settings, Print Preview, Print**)

13 Report Printing

Report Printing ▶

Used for functions pertaining to the printing of the report. (**Print Settings, Header and Footer, Print Preview, Print**)

14 Print DMIS

Print Dmis...

Used to print out the DMIS code.

15 Import Data

Import Data...

Used to import CAD and nominal data into CAPPS. Formats include:

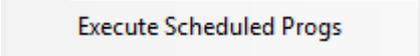
- Iges (.igs, .ige, .iges)
- CATIA V4 (.mod, .model, .exp, .dlv, .cat)
- CATIA V5 (.CATPart, .CATProduct)
- Parasolid Files (.x_t, .x_b, .xmt_txt, .xmt_bin, .p_t, .p_b, .xmp_txt, .xmp_bin)
- Pro/E Files (.prt, .asm, .prt., .asm.)
- UniGraphics Files (.prt)
- STEP Files (.stp, .step)
- VDA Files (.vda)
- Cadds Files (._pd)
- VRML Files (.wrl)
- AAT Nom Files (.aat)
- APT Files (.apt)
- DES Files (.des)
- Chrysler Check Data (.chr)
- 5Unique/System5 Fixture Files (.fxt)
- Point Cloud From File (.asc)
- Curves From File (.txt)

16 Export Data

Export Data...

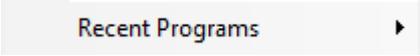
Used to export data, CAD, nominals, or actuals, in either **IGES** or **STEP** format as geometrical or **NURB** data.

17 Execute Scheduled Programs

A screenshot of a menu item labeled "Execute Scheduled Progs". The text is centered within a light gray rectangular box.

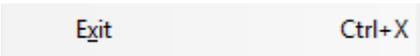
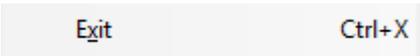
Used to execute a set of scheduled programs.

18 Recent Programs

A screenshot of a menu item labeled "Recent Programs" with a right-pointing arrow. The text is centered within a light gray rectangular box.

Lists of the last four programs opened in CAPPs.

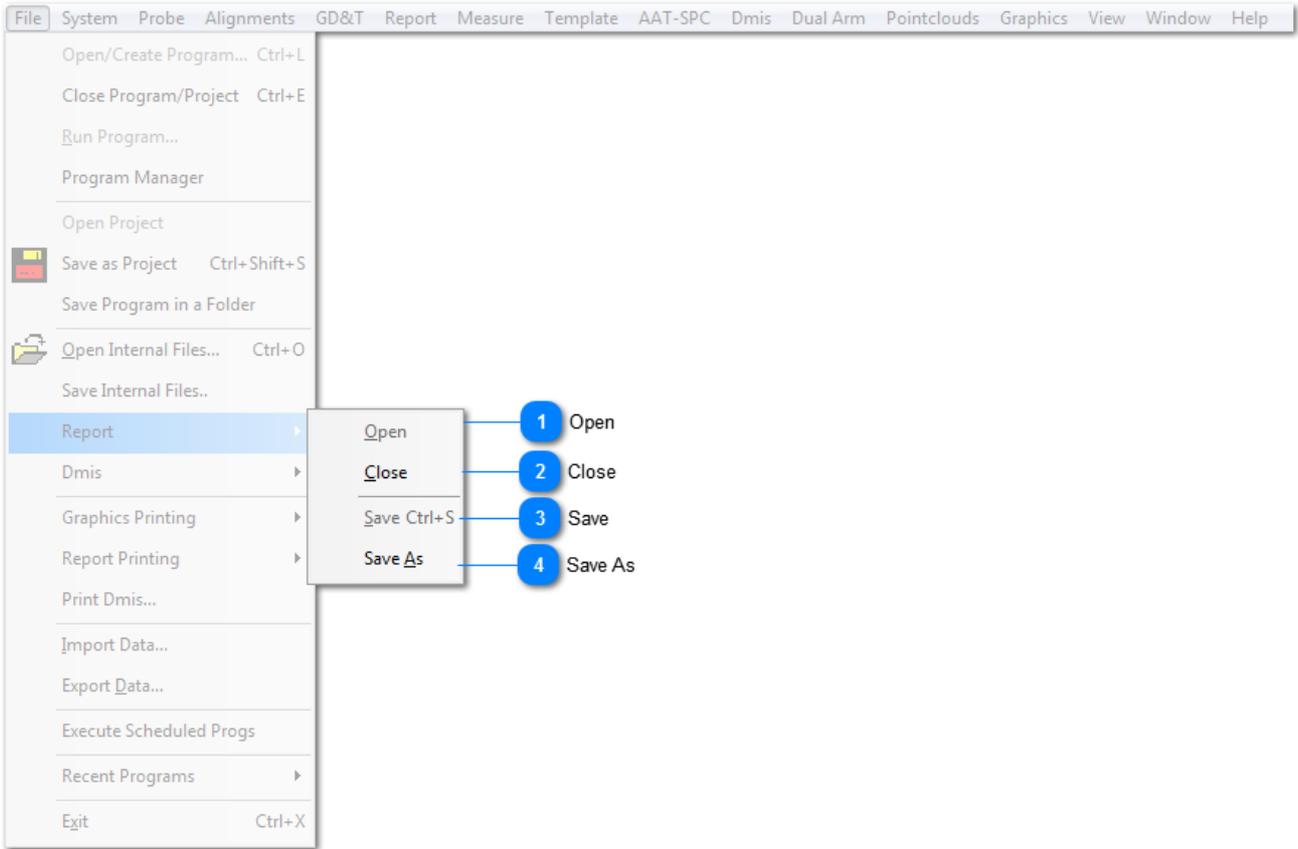
19 Exit

A screenshot of a menu item labeled "Exit". The text is centered within a light gray rectangular box.A screenshot of a keyboard shortcut labeled "Ctrl+X". The text is centered within a light gray rectangular box.

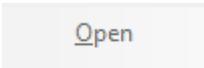
Closes the software.

[Menu Bar](#)

Report

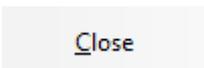


1 Open



Opens an existing report file.

2 Close



Closes a report file. In a program turns off [Results \(Report\) Window](#).

3 Save



Saves a report in **(.rpt)** format.

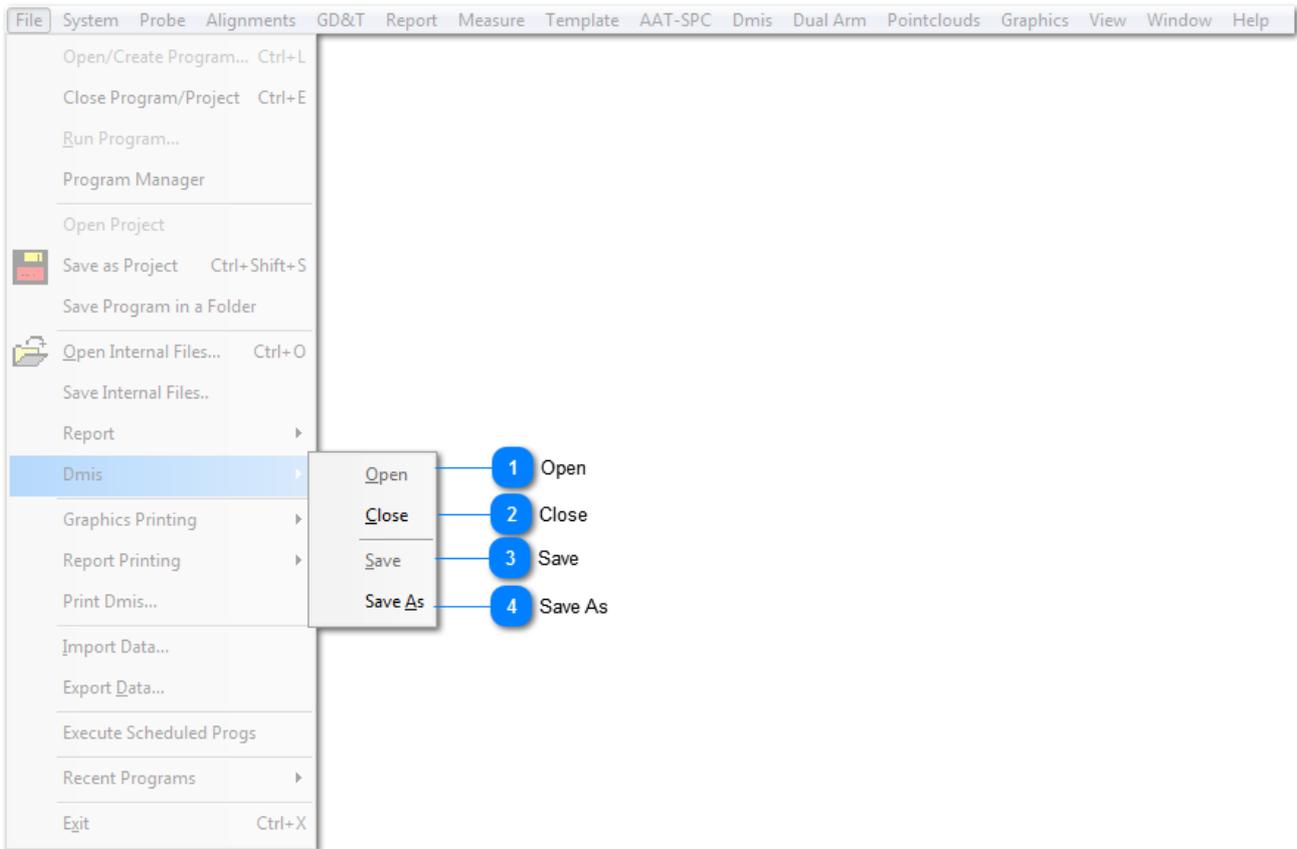
4 Save As



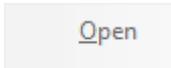
Saves a report in a customized format.

[File Menu](#)

DMIS

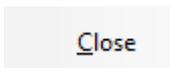


1 Open



Opens a program (.dmi) file.

2 Close



Closes a program (.dmi) file. In a program turns off [Program Window](#).

3 Save



Save current program file in (.dmi) format.

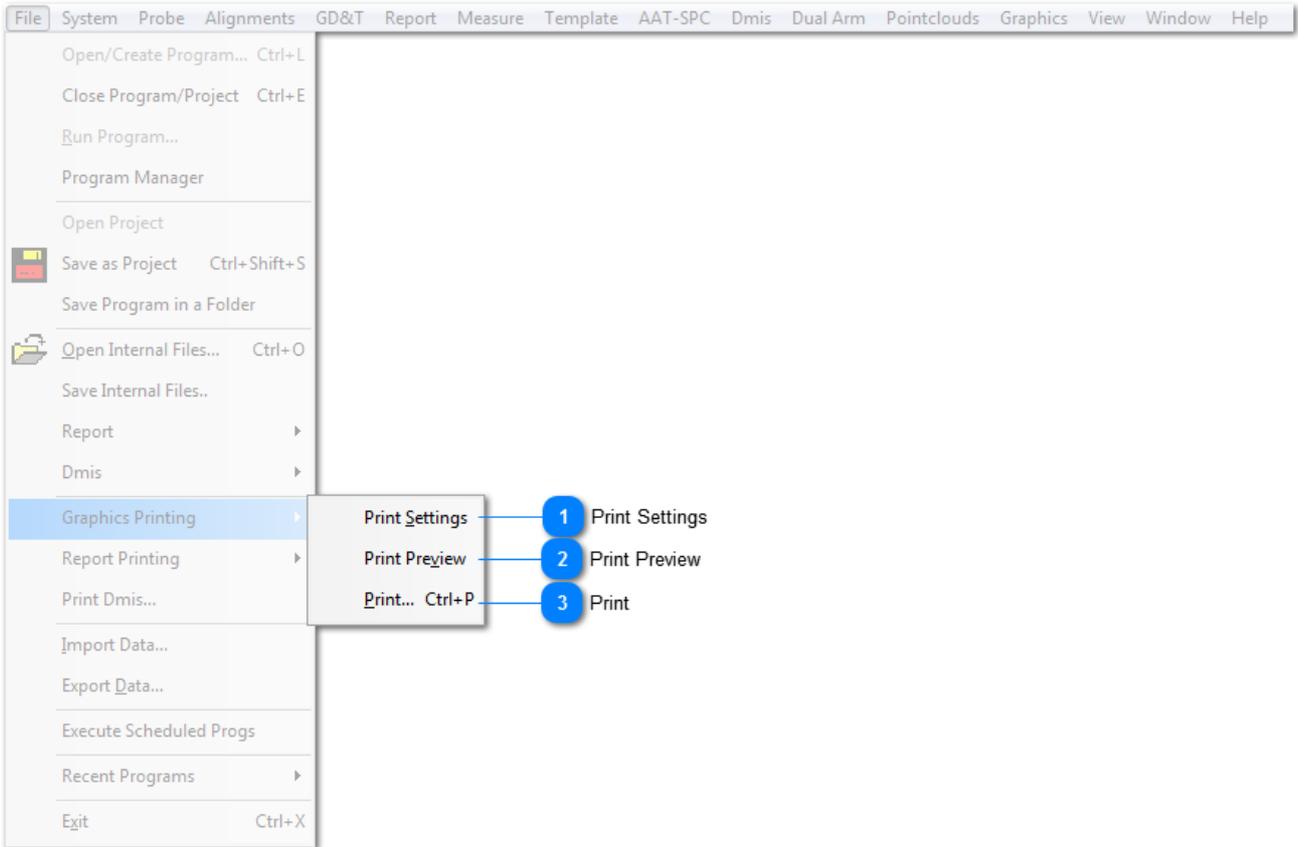
4 Save As



Saves current program in either (.dmi) format or CAPPS program (.bdm) format.

[File Menu](#)

Graphics Printing



1 Print Settings

Print Settings

Turns on [Print Settings](#) dialog.

2 Print Preview

Print Preview

Display a quick preview.

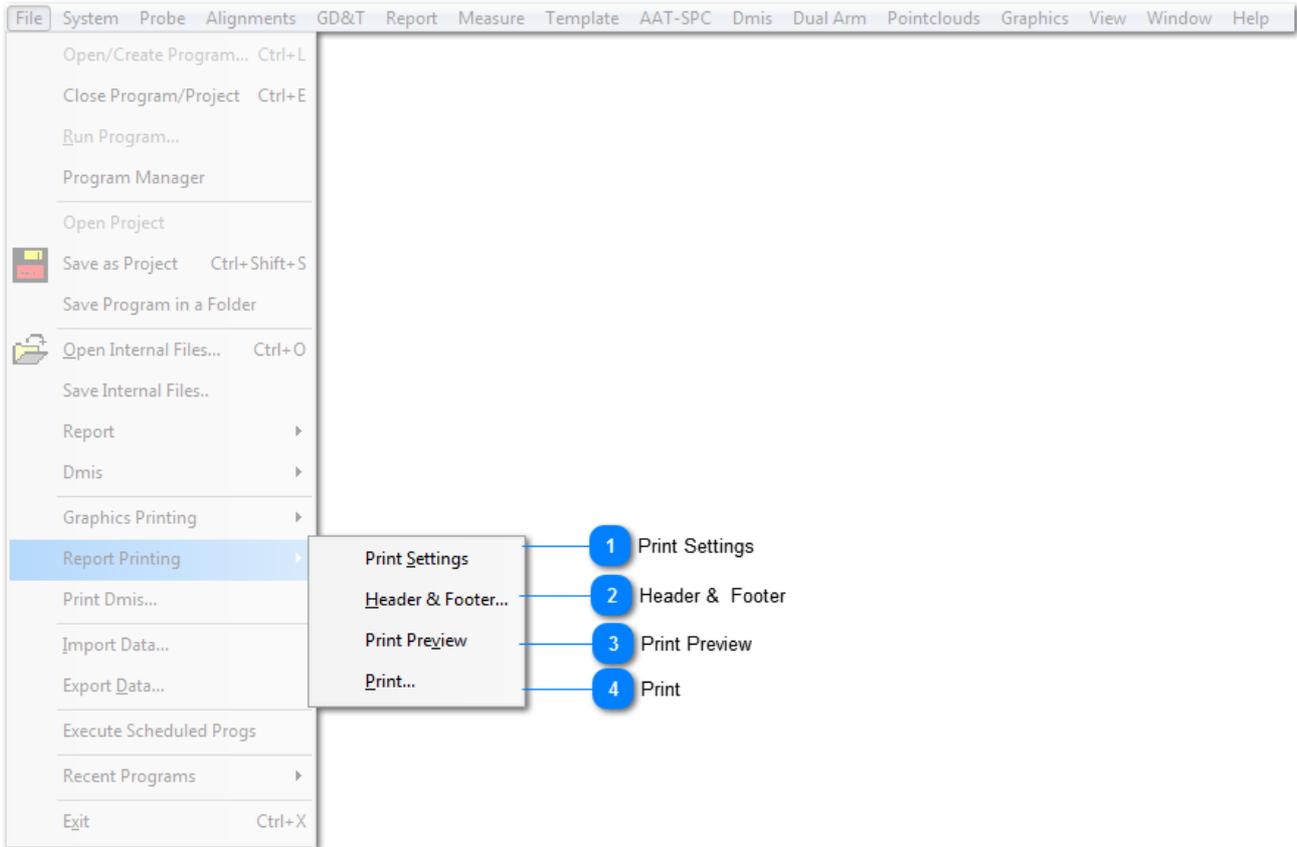
3 Print

Print... Ctrl+P

Prints current view on [Graphics Window](#).

[File Menu](#)

Report Printing



1 Print Settings



Opens **Print Settings** dialog.

2 Header & Footer

Header & Footer...

Enables the user to enter **Header and Footer** information.

Header & Footer Settings

Header Settings

Enable Header

AATBlock Inspection

Header Macros: None | Insert Header Macro | Header Placement: Center | Draw line under header

Footer Settings

Enable Footer

Applied Automation Technologies, Inc

Footer Macros: None | Insert Footer Macro | Footer Placement: Center | Draw line above footer

Draw frame around the page | Add to DMIS

Accept | Cancel

3 Print Preview

Print Preview

Display a quick preview.

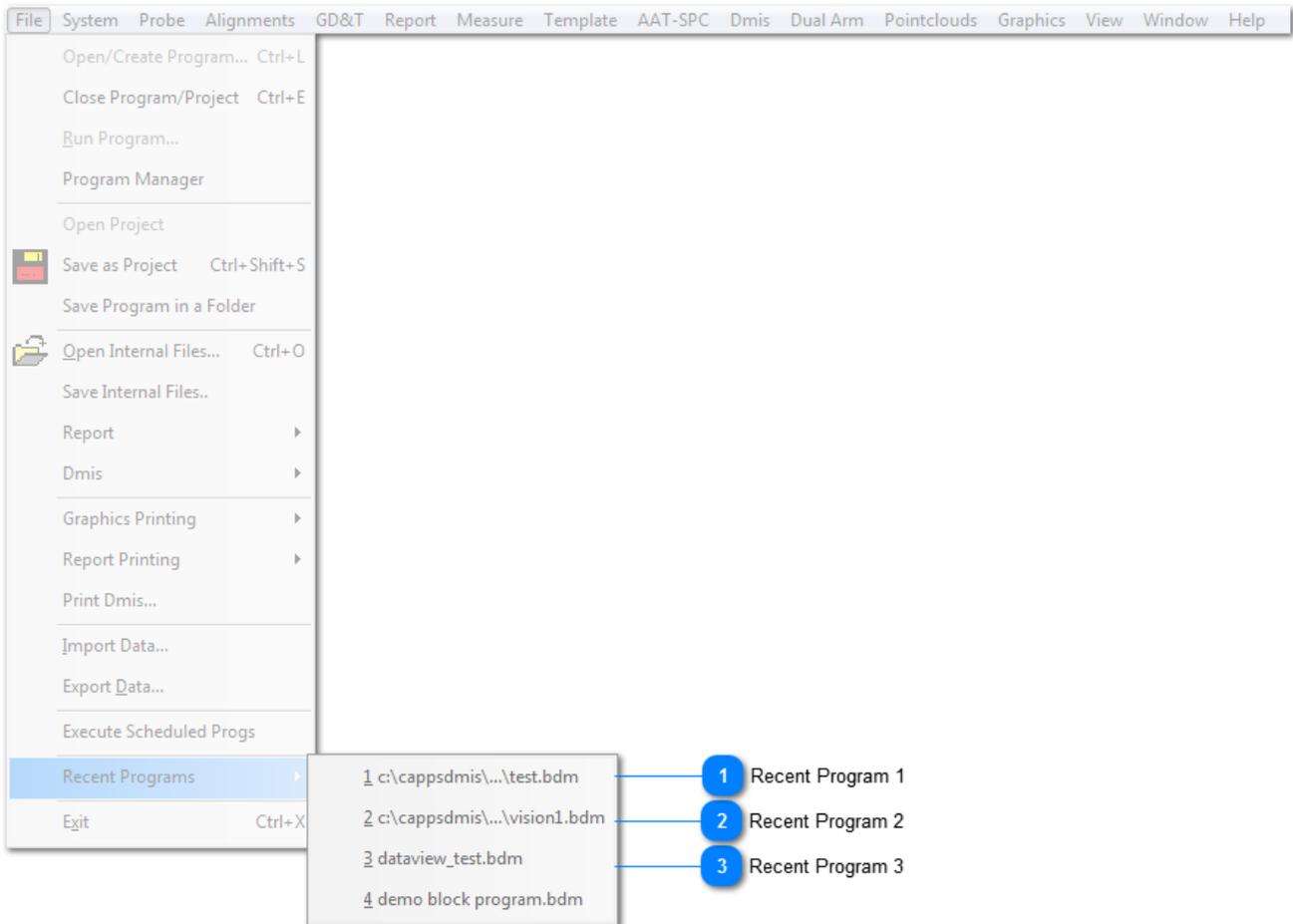
4 Print

Print...

Prints current report.

[File Menu](#)

Recent Programs



1 Recent Program 1

1 c:\cappsdmis\...\test.bdm

Opens most recent program on the list.

2 Recent Program 2

2 c:\cappsdmis\...\vision1.bdm

Opens second most recent program on the list.

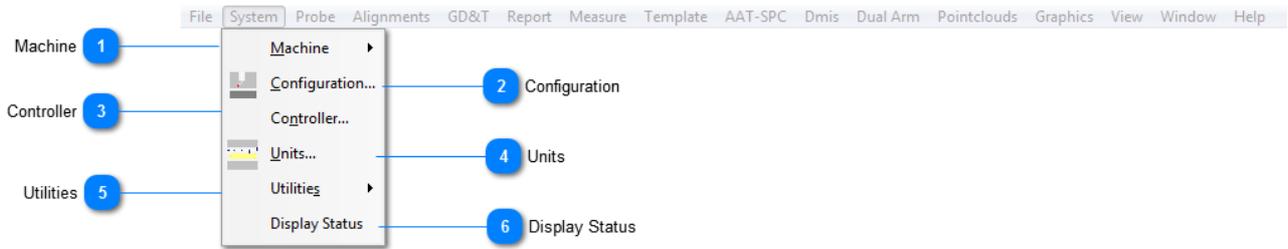
3 Recent Program 3

3 dataview_test.bdm

Opens third most recent program on the list.

File Menu

System Menu



1 Machine



[Machine Menu](#) contains items pertaining to the startup and control of the machine.

2 Configuration

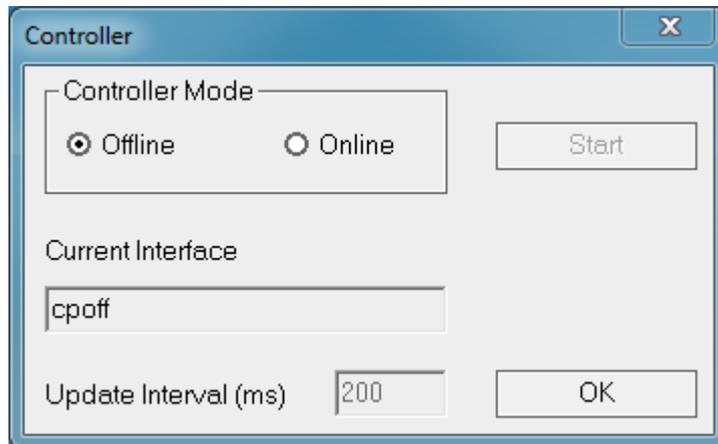


[Configuration Menu](#) contains all machine setup and software parameters.

3 Controller

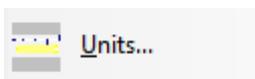


Controller Menu contains machine controller selection, **Online/Offline**, and **Update Interval**.



Controller Mode:	Turns the controller on/off.
Current Interface:	Displays current controller interface that is being used.
Update Interval:	Used to set Update Interval parameter, this is 200 milliseconds by default.

4 Units



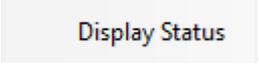
[Units](#) contains all unit configurations.

5 Utilities

A screenshot of a software menu bar showing the 'Utilities' option. The text 'Utilities' is displayed in a light gray font on a white background, with a small black right-pointing arrow to its right.

[Utilities](#) contains some useful CAPPs and Windows applications.

6 Display Status

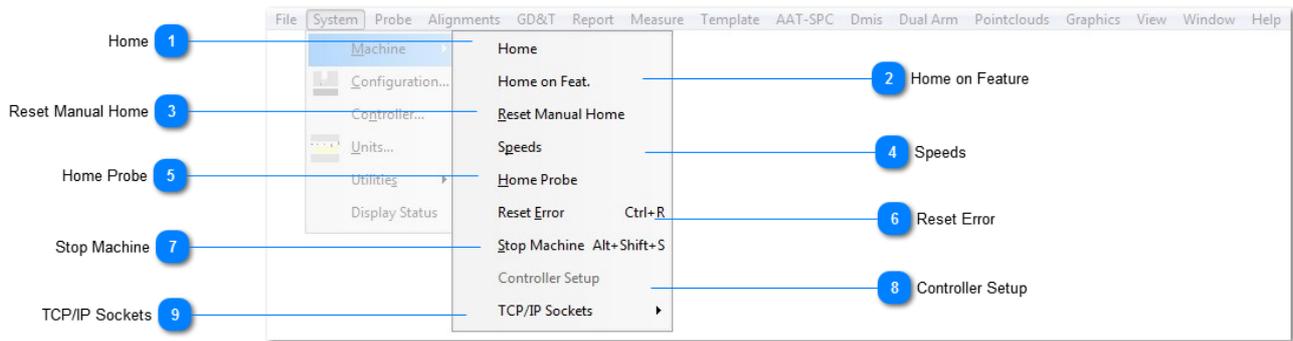
A screenshot of a software menu bar showing the 'Display Status' option. The text 'Display Status' is displayed in a light gray font on a white background.

Display Status is used to display program information, including:

- **Current machine speeds (Position and Measure)**
- **Coordinates of last measured feature**
- **Current alignment offset information**
- **Current probe offset information**
- **Value of current defined variables**

[Menu Bar](#)

Machine



1 Home

Home

Send the machine to the **Home** position.

2 Home on Feature

Home on Feat.

Set the machine home position on a feature.

3 Reset Manual Home

Reset Manual Home

Used to reset home to machine home if **Home On Feature** is used.

4 Speeds

Speeds

Sets the **Position and Measure Speeds**.

Parameter	Value	Min	Max
Position Speed	10	0.01	5000.0
Measure Speed	7	0.01	100.00
Rot. Tbl. Speed	20	0.001	5.000
PH Position Speed	50	1.0	100.0
PH Measure Speed	50	1.0	100.0

Position Speed:	Used to set the Position Speed of the machine.
Measure Speed:	Used to set the Measure Speed of the machine.
Rotary Table Speed:	Used to set the Rotary Table Rotation Speed .
PH Position Speed:	Used to set Head Position Speed for 5 Axis probes, such as PH20, Revo etc.

5 Home Probe

Home Probe

Used to set a motorized head back to the **A0B0 Position**.

6 Reset Error

Reset Error Ctrl+R

Used to reset machine error to regain communication with controller.

7 Stop Machine

Stop Machine Alt+Shift+S

Stops machine communication.

8 Controller Setup

Controller Setup

<TODO>: Insert description

9

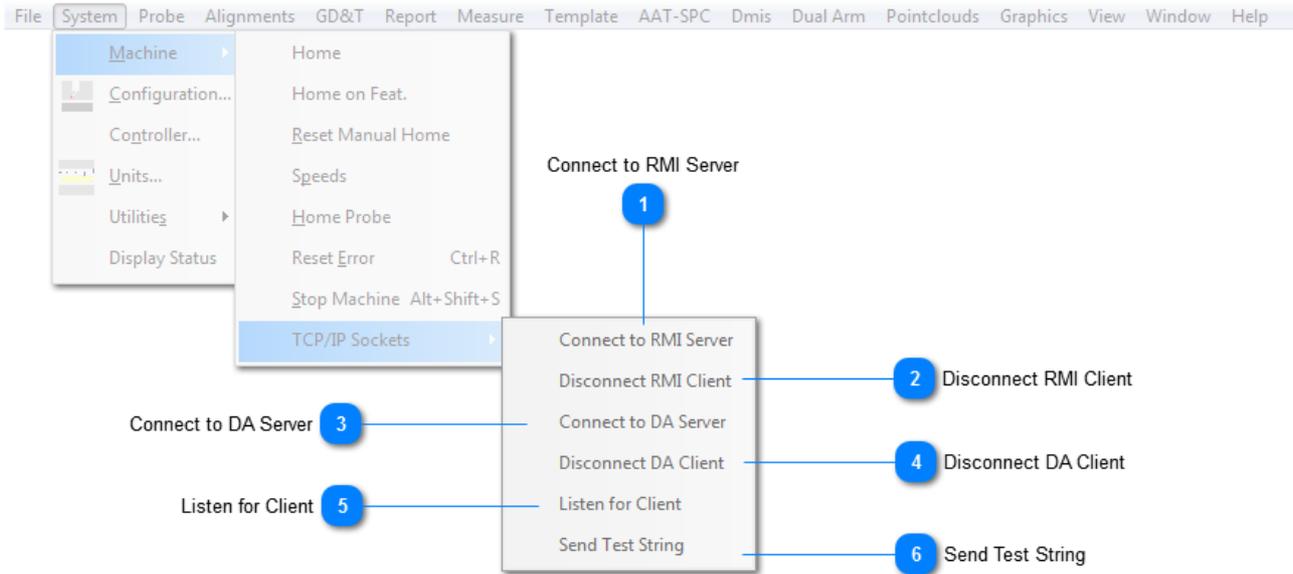
TCP/IP Sockets

TCP/IP Sockets ▶

Contains configurations related to **AAT RMI** and dual arm communication.

[System Menu](#)

TCP/IP Sockets



1 Connect to RMI Server

Connect to RMI Server

Connects to **AAT RMI Server**.

2 Disconnect RMI Client

Disconnect RMI Client

Disconnects from **AAT RMI Server**.

3 Connect to DA Server

Connect to DA Server

Connects to **Dual Arm Server**.

4 Disconnect DA Client

Disconnect DA Client

Disconnects from **Dual Arm Server**.

5 Listen for Client

Listen for Client

Listens for **Dual Arm Client**.

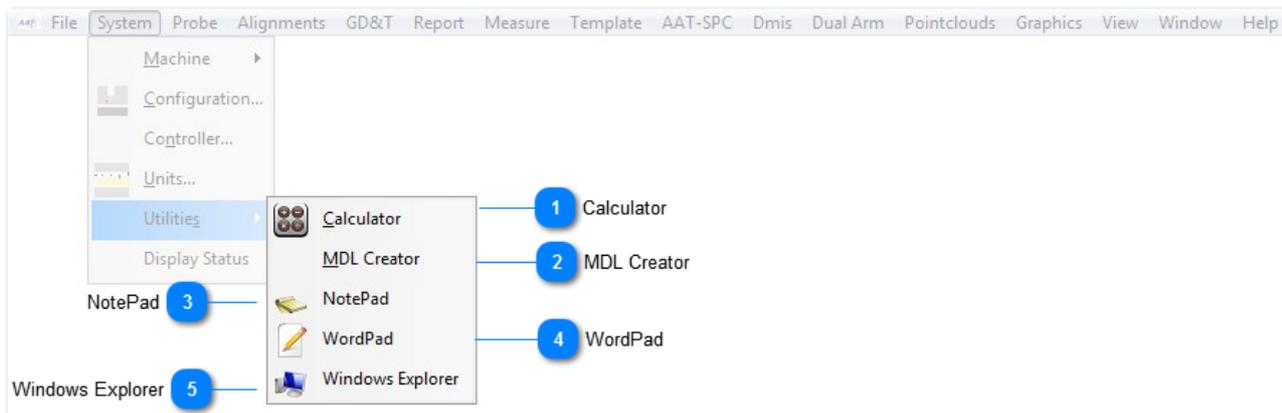
6 Send Test String

Send Test String

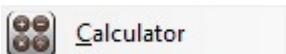
Sends **Test String** to the controller.

[Machine](#)

Utilities

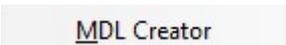


1 Calculator



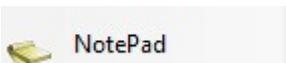
Opens the Microsoft Windows calculator.

2 MDL Creator



Convert IGES and STEP files into CAPPs MDL format.

3 NotePad



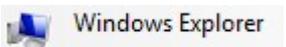
Windows Notepad text editor.

4 WordPad



Windows Wordpad text editor.

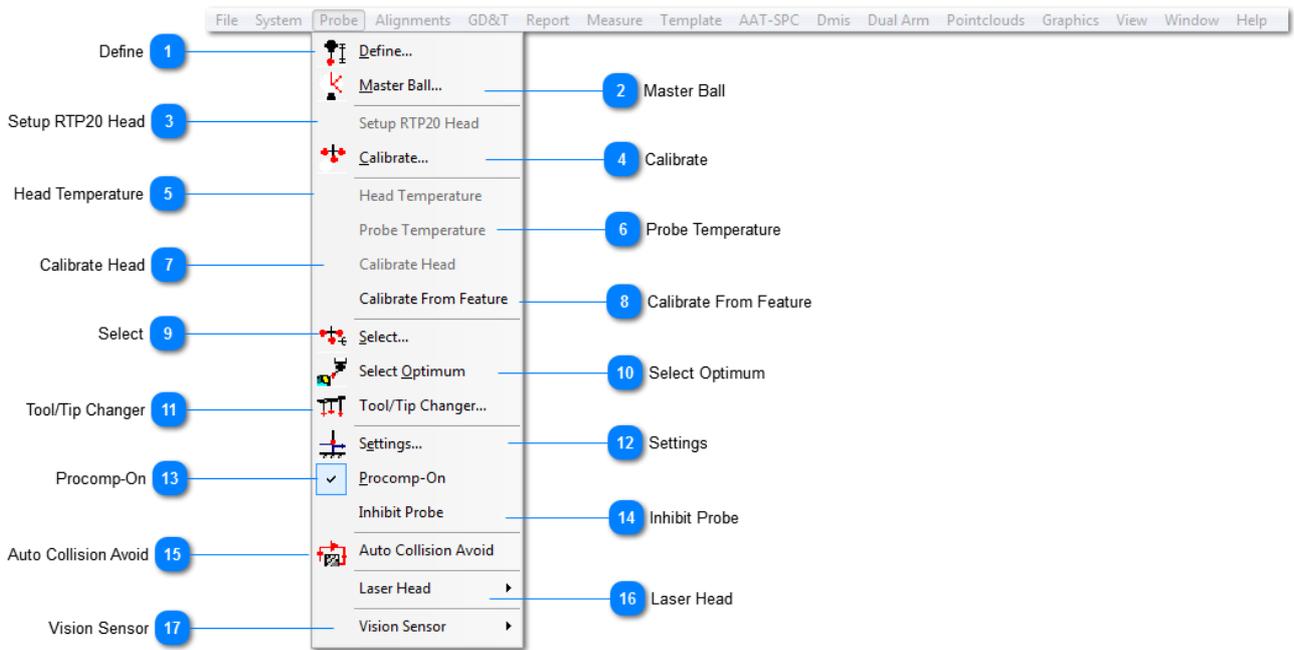
5 Windows Explorer



Opens Windows explorer

[System Menu](#)

Probe Menu

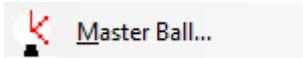


1 Define



[Define](#) is used to define probe length, create probe model, and choose star probe configuration.

2 Master Ball



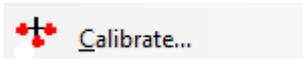
[Master Ball](#) is used to define the location of the master ball.

3 Setup RTP20 Head

Setup RTP20 Head

Used to setup the routines for the **RTP20** head. This option is only visible if the **RTP20** head is installed.

4 Calibrate



[Calibrate](#) is used to calibrate probes individually or run a calibration file list.

5 Head Temperature

Head Temperature

Used to measure the probe head temperature. Requires special equipment.

6 Probe Temperature

Probe Temperature

Used to measure the probe temperature. Requires special equipment.

7 Calibrate Head

Calibrate Head

This feature is used to align the head position of any 5 axis probes with respect to CMM quill.

8 Calibrate From Feature

Is used to calibrate a probe which cannot be calibrated with regular calibration routine. This uses selected feature which is measured with a known calibrated probe or a nominal feature.

9 Select

Calibrate From Featur

[Select](#) is used to select a probe from the list of calibrated probes.

10 Select Optimum

Select...

[Select Optimum](#) is used to select a probe from the list of calibrated probes based on the vector of a selected feature.

11 Tool/Tip Changer

Select Optimum

[Tool/Tip Changer](#) is used to **Load, Drop, and Select Tools/Tips** from changing racks, only available if the **Tool/Tip** option is installed.

12 Settings

Tool/Tip Changer...

[Settings](#) contains probe settings for **DCC** measurement.

13 Procomp-On

Settings...

[Procomp-On](#), turns on probe compensation.

14 Inhibit Probe

Procomp-On

Used with certain controllers to inhibit (turn off) the probe signal. Useful with **TP20** style probe tips.

15 Auto Collision Avoid

Inhibit Probe

Used to open the [Auto Collision Avoidance](#) dialog. This uses entities on the **Graphics Window** to detect collisions to help with **DCC** program programming

16 Laser Head



Auto Collision Avoid

Used to configure **Laser Interfaces**.

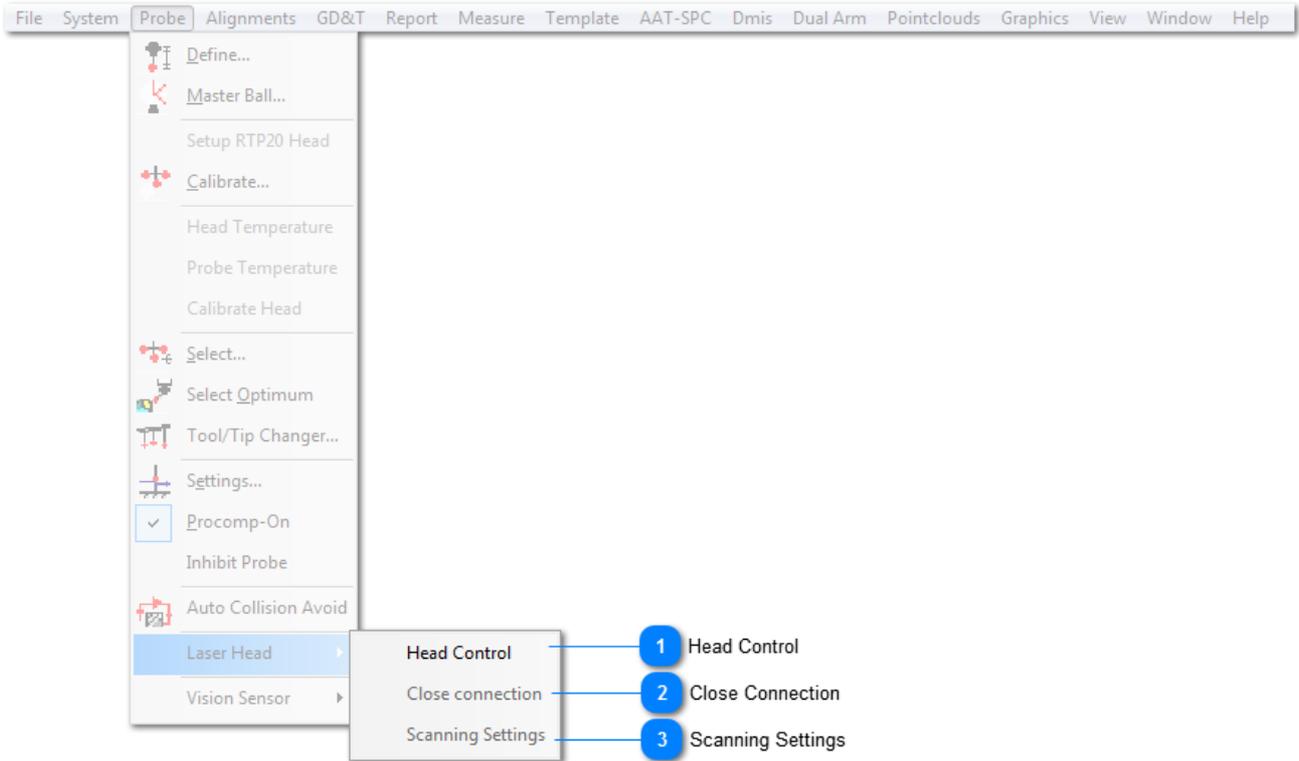
17 Vision Sensor

Laser Head

Used to configure **Vision Interfaces**.

[Menu Bar](#)

Laser Head



1 Head Control

Head Control

Allows user to control the head angles of the laser probe.

2 Close Connection

Close connection

Closes the connection to laser probe.

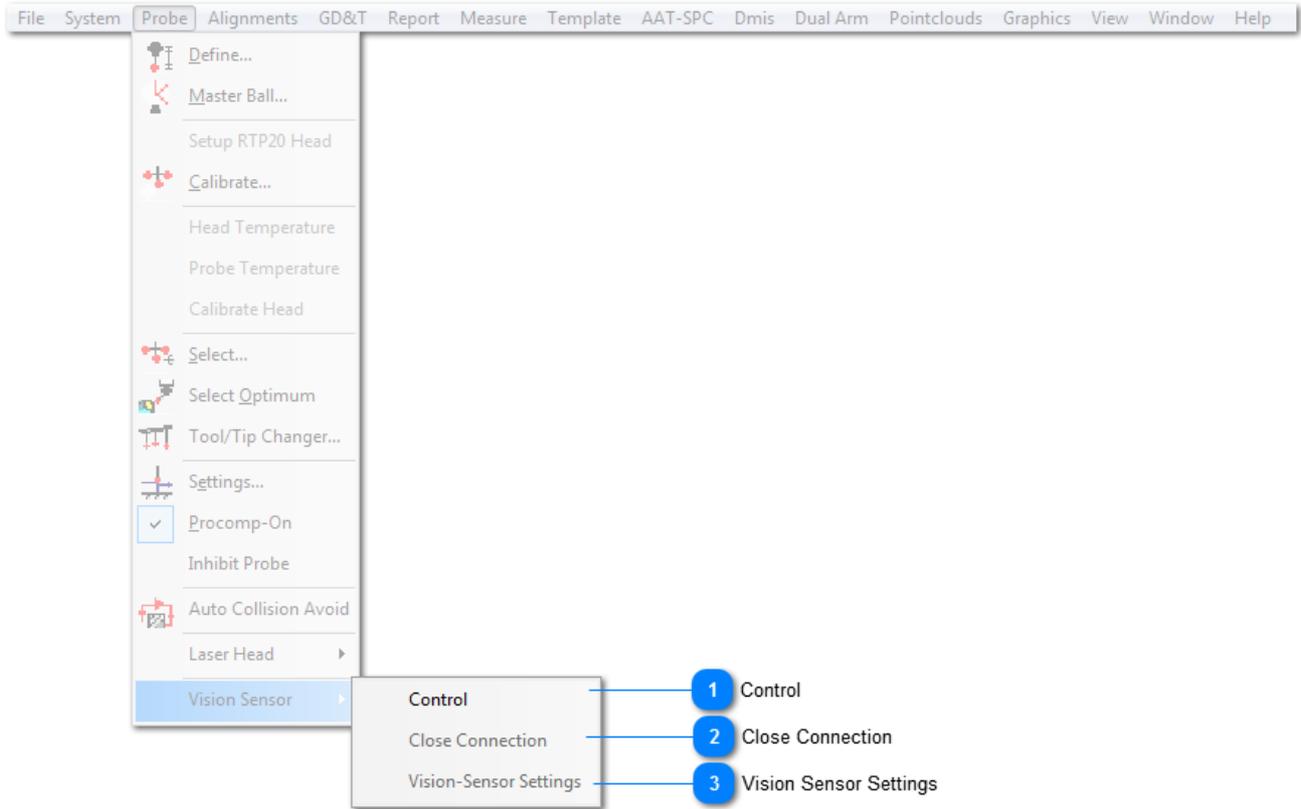
3 Scanning Settings

Scanning Settings

Opens [Scanning Settings](#) dialog.

[Probe Menu](#)

Vision Sensor



1 Control

Control

Opens **Vision Sensor Connection** dialog.

2 Close Connection

Close Connection

Disconnects **Vision Sensor Connection**.

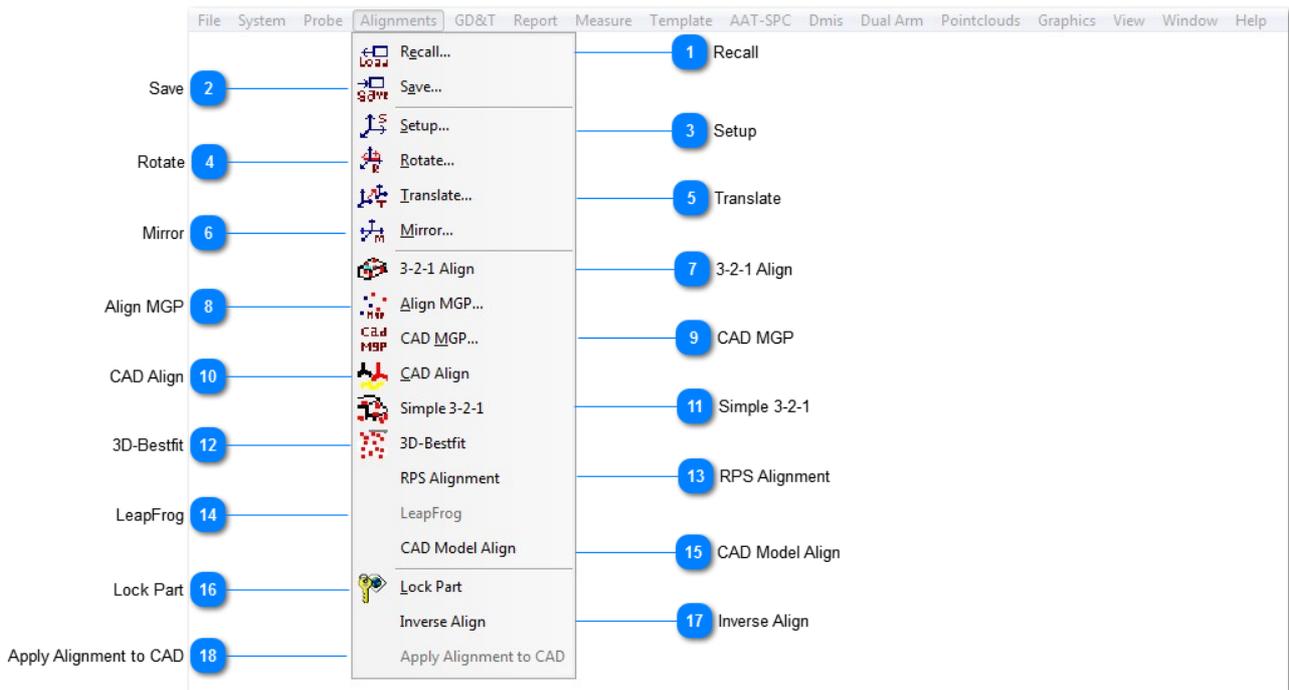
3 Vision Sensor Settings

Vision-Sensor Settings

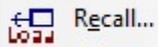
Opens **Vision Sensor Settings** dialog.

[Probe Menu](#)

Alignments Menu

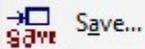


1 Recall



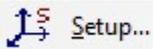
Used to recall an alignment from the alignment database ([Recall Datum List](#)).

2 Save



Used to save an alignment into the alignment database.

3 Setup



[Setup](#) is used to setup alignment orientation, direction, and origin.

4 Rotate



[Rotate](#) is used to rotate the alignment about an axis to an angle.

5 Translate



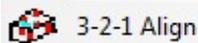
[Translate](#) is used to translate the origin of an alignment to a feature, by an offset, or both.

6 Mirror



[Mirror](#) is used to mirror an axis of an alignment.

7 3-2-1 Align



3-2-1 Align

[3-2-1 Align](#) is an alignment macro that uses 6 actual and 6 nominal features to create a best fit alignment.

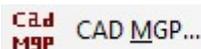
8 Align MGP



Align MGP...

[Align MGP](#) is an alignment macro for fixtures that uses three tooling balls and the offsets to create a best fit alignment.

9 CAD MGP



CAD MGP...

[CAD MGP](#) is an alignment macro that uses 3 actual and 3 nominal features to create a best fit alignment.

10 CAD Align



CAD Align

[CAD Align](#) is an alignment macro that uses identical nominal and actual alignments to create a best fit alignment.

11 Simple 3-2-1



Simple 3-2-1

[Simple 3-2-1](#) is an alignment macro that uses 6 actual features and their offsets to create a best fit alignment.

12 3D-Bestfit



3D-Bestfit

[3D-Bestfit](#) is an alignment macro that uses a minimum of 6 points on a free form surface to create a best fit alignment.

13 RPS Alignment

RPS Alignment

[RPS Alignment](#) is similar to the 3-2-1 Alignment series of alignments, but multiple features may be used.

14 LeapFrog

LeapFrog

[LeapFrog](#) is used in cases where the part must be moved in midinspection because the part is too large for all the features to be inspected during one set up.

15 CAD Model Align

CAD Model Align

CAD Model Align is used by creating an alignment on the actual part, and then creating the same alignment on the CAD wire frame part. The two alignments are then matched; this allows the CAD file to then be used to check the part.

16 Lock Part



Lock Part

[Lockpart](#) is used to lock CAD part and nominal features to the current alignment system.

17 Inverse Align

Inverse Align

Inverses the current alignment.

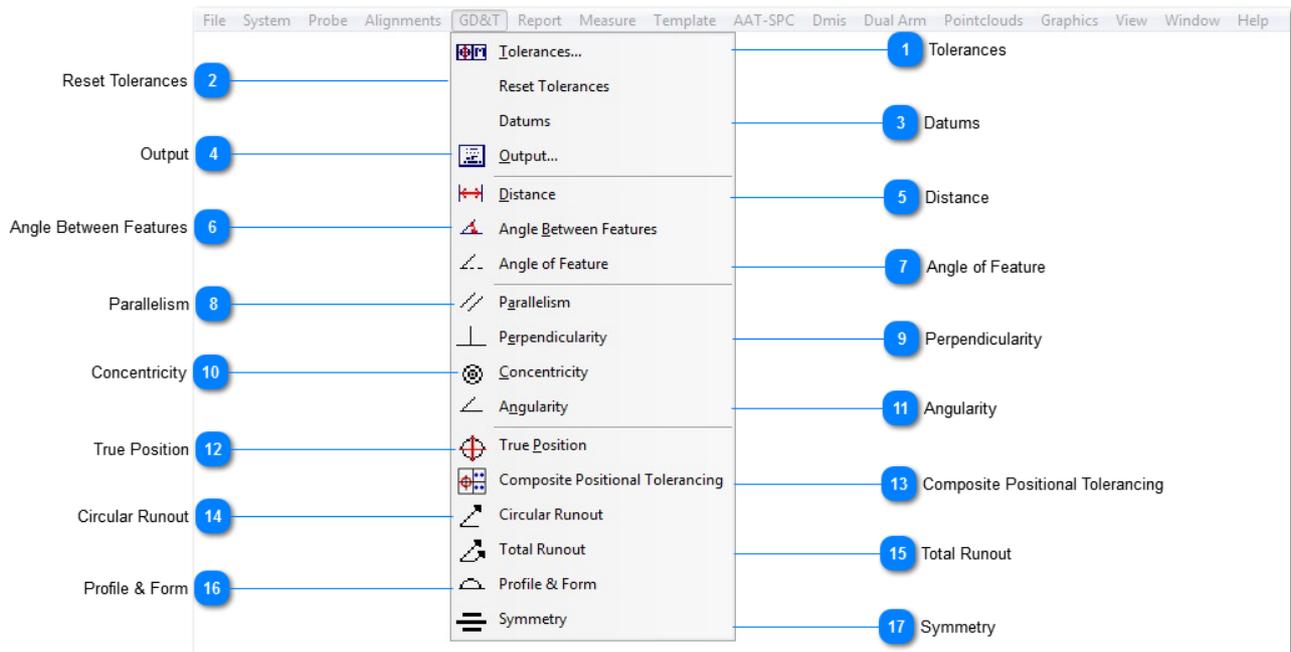
18 Apply Alignment to CAD

Apply Alignment to CAD

[Apply Alignment to CAD](#), applies the current alignment to CAD model.

[Menu Bar](#)

GD&T Menu



1 Tolerances

 Tolerances...

[Tolerances](#) are used to open the Tolerance dialog. This is where all tolerances are entered for the tolerance database.

2 Reset Tolerances

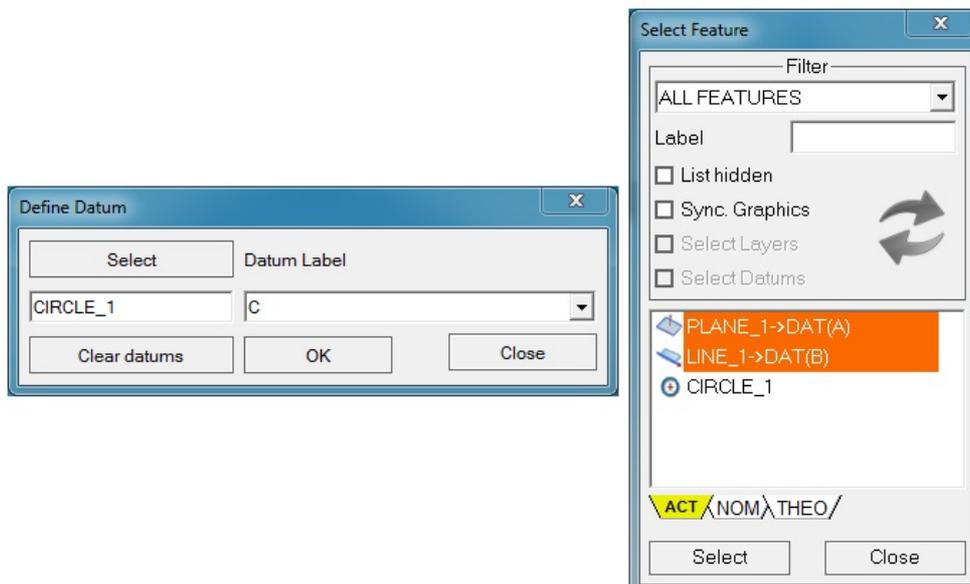
Reset Tolerances

Used to clear the tolerance database.

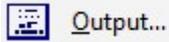
3 Datums

Datums

Datums is used to assign the Datum names to the measured features



4 Output



Output...

Used to output a previously measured feature.

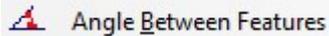
5 Distance



Distance

[Distance](#) is used to output the distance between two features.

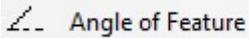
6 Angle Between Features



Angle Between Features

[Angle Between Features](#) is used to output the angle between two features.

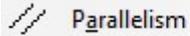
7 Angle of Feature



Angle of Feature

[Angle of Feature](#) is used to output the angle of a feature vector.

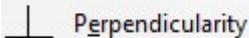
8 Parallelism



Parallelism

[Parallel](#) is used to output parallelism between two features.

9 Perpendicularity



Perpendicularity

[Perpendicular](#) is used to output perpendicularity between two features.

10 Concentricity



Concentricity

[Concentricity](#) is used to output concentricity between two features.

11 Angularity



Angularity

[Angularity](#) is used to output angularity between two features.

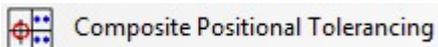
12 True Position



True Position

[True Position](#) is used to output true position of a feature.

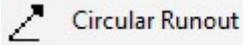
13 Composite Positional Tolerancing



Composite Positional Tolerancing

Used for [Composite True Position](#) callout.

14 Circular Runout



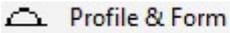
[Circular Runout](#) is used to output circular runout of a feature.

15 Total Runout



[Total Runout](#) is used to output total runout of a feature.

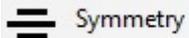
16 Profile & Form



[Profile & Form](#) is used to output the profile and form on planes, circles, cylinders, cones, lines, slots, ellipses, torus, and spheres.

[Menu Bar](#)

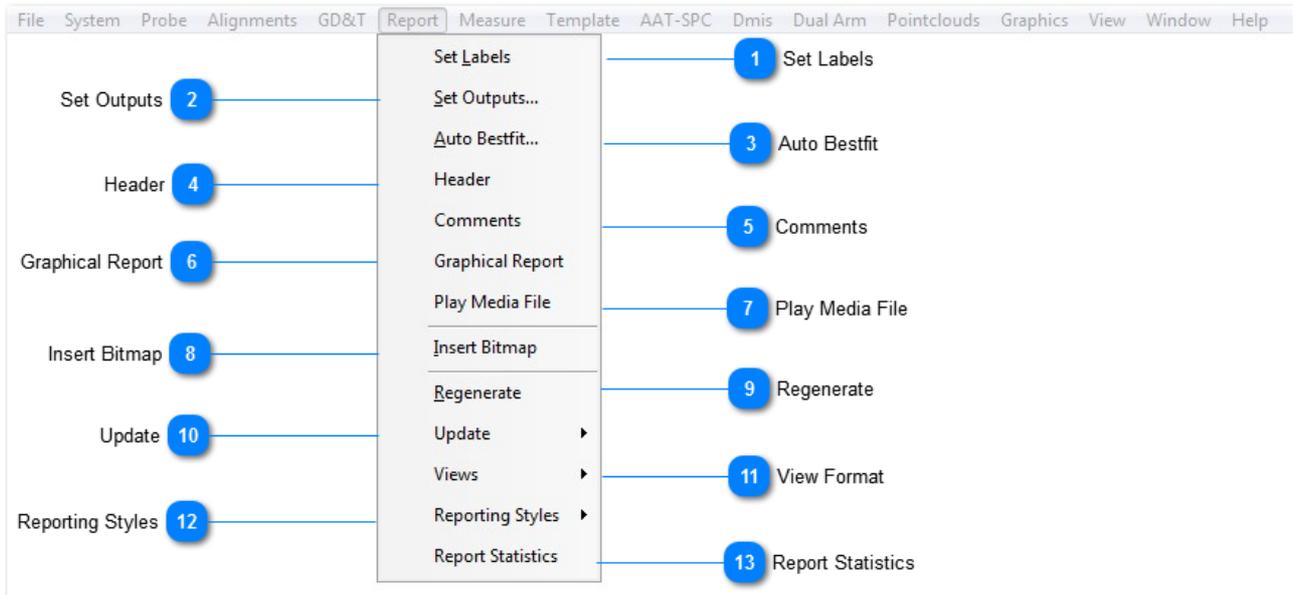
17 Symmetry



[Symmetry](#) is used to output the GD&T callout symmetry.

[Menu Bar](#)

Report Menu



1 Set Labels

Set Labels

[Set Labels](#) is used to assign the name to a feature which will be used in report

2 Set Outputs

Set Outputs...

[Set Outputs](#) is used to set the measurement outputs displayed in the report.

3 Auto Bestfit

Auto Bestfit...

Used to auto best fit the all of the data in the report using liner, rotational, or both.

4 Header

Header

Used to add a header to the report.

5 Comments

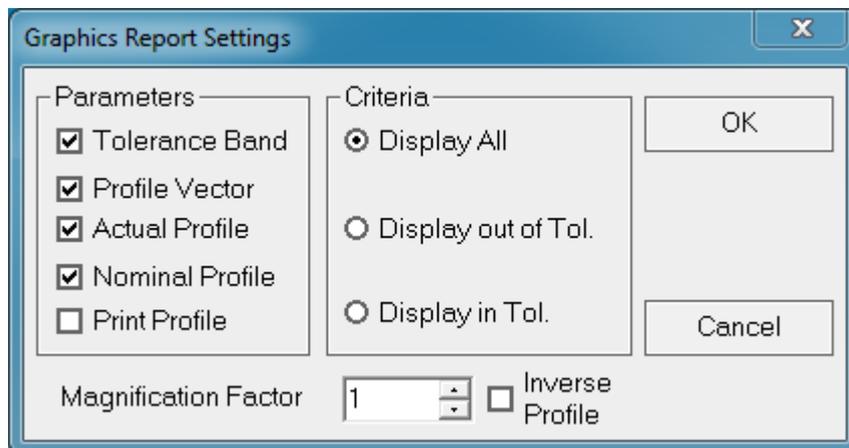
Comments

Used to add four different types of comments to the DMIS program (**R**eport, **M**anual, **U**ser, **C**omment).

6 Graphical Report

Graphical Report

Graphical Report is used to setup parameters for the graphical report option.



7 Play Media File

Play Media File

Used to insert sound or movie file into a program.

8 Insert Bitmap

Insert Bitmap

Used to insert a picture into the report.

9 Regenerate

Regenerate

Used to update the report after certain changes.

10 Update

Update

Contains global update functions for the report.

11 View Format

Views

[View Format](#) is used to change the report to different output formats.

12 Reporting Styles

Reporting Styles

[Reporting Styles](#) is used for various reporting styles in CAPPS.

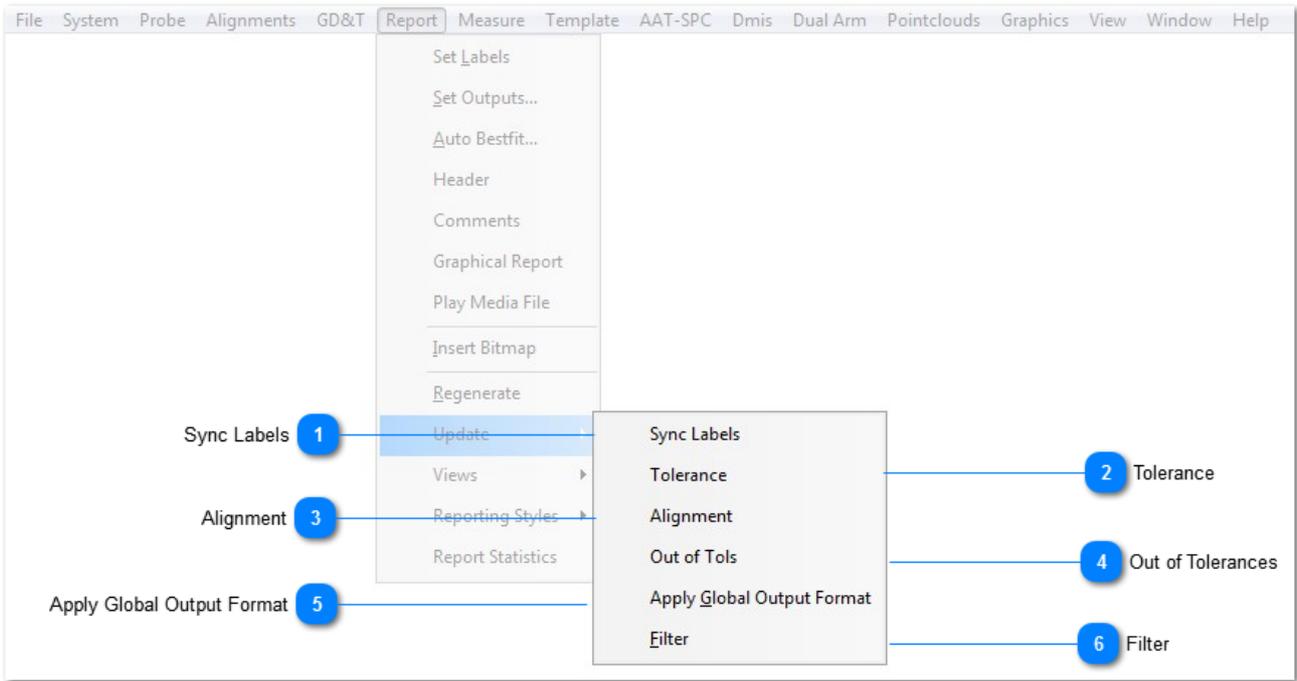
13 Report Statistics

Report Statistics

Calculates SPC parameters on current report.

[Menu Bar](#)

Update



1 Sync Labels

Sync Labels

Used to sync the feature labels to the report index numbers.

2 Tolerance

Tolerance

Used to change the tolerances for the entire report.

3 Alignment

Alignment

Used to update the report to a different coordinate system.

4 Out of Tolerances

Out of Tols

Used to display only the features that are out of tolerance.

5 Apply Global Output Format

Apply Global Output Format

Used to change the output format for the entire report.

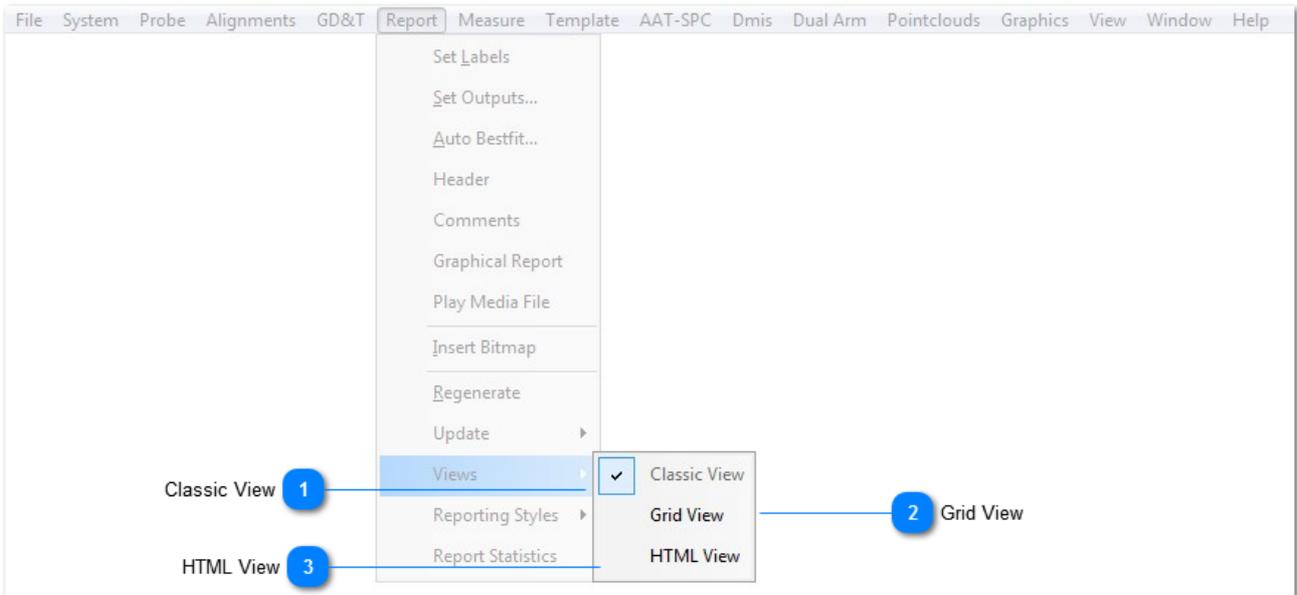
6 Filter

Filter

Allows the user to filter what feature types are shown in report.

Report Menu

View Format



1 Classic View



CAPPS standard output format.

2 Grid View



Report output in grid format.

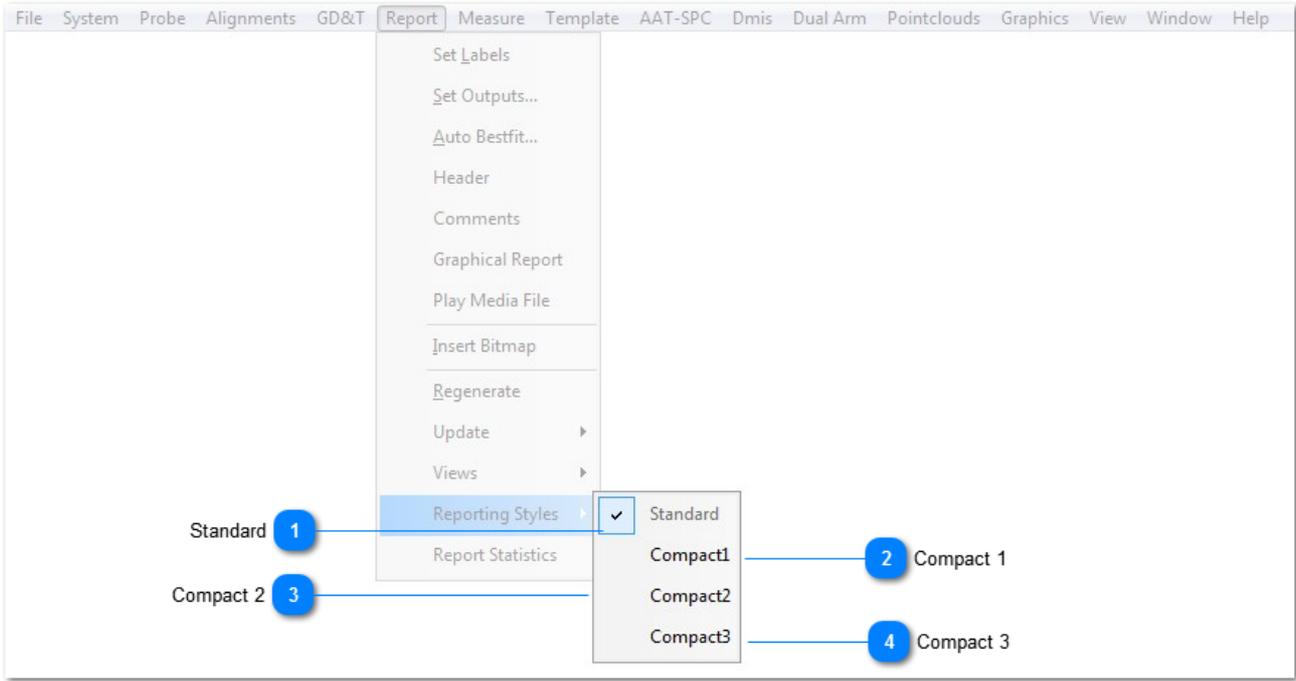
3 HTML View



Report output in HTML format to be via Internet Explorer.

[Update](#)

Reporting Styles



1 Standard



CAPPS standard report style.

```

DATE           : 5/10/2018
TIME           : 11:33:58 AM
COMPANY        : Your Company
OPERATOR       : Your Operator
PART NAME      : Block
PART NUMBER    : 123456
COMMENT        :
    
```

ELEM#	NOMINAL	ACTUAL	LOW_TOL	UPP_TOL	DEV	OUT_OF_TOL	CONTROL

1:	INNER CIRCLE CR1	[MCS]					
X :	29.504	29.504	-0.200	0.200	0.000		--- ---*--- ---
Y :	95.496	95.496	-0.200	0.200	0.000		--- ---*--- ---
Z :	62.493	62.493	-0.200	0.200	0.000		--- ---*--- ---
Diam:	25.396	25.396	-0.200	0.200	0.000		--- ---*--- ---

2 Compact 1

Compact1

Displays the report in following format.

DATE : 5/10/2018
 TIME : 11:33:58 AM
 COMPANY : Your Company
 OPERATOR : Your Operator
 PART NAME : Block
 PART NUMBER : 123456
 COMMENT :

LABEL	XM	XN	DX	YM	YN	DY	ZM	ZN	DZ	DEV	DIR
CR1	29.504	29.504	0.000	95.496	95.496	0.000	62.493	62.493	0.000	0.000	Z+
CR2	12.718	12.718	0.000	77.256	77.256	0.000	62.495	62.495	0.000	0.000	Z+
CR2	11.543	11.543	0.000	77.536	77.536	0.000	62.500	62.500	0.000	0.000	Z+
CR3	11.543	11.543	0.000	113.457	113.457	0.000	62.500	62.500	0.000	0.000	Z+

3 Compact 2

Compact2

Displays the report in below format.

DATE : 5/10/2018
 TIME : 11:33:58 AM
 COMPANY : Your Company
 OPERATOR : Your Operator
 PART NAME : Block
 PART NUMBER : 123456
 COMMENT :

#	Xn	Yn	Zn	Min	Max	Xm	Ym	Zm	DX	DY	DZ	Vector	Nom	Act	Error
1	29.504	95.496	62.493	-0.200	0.200	29.504	95.496	62.493	0.000	0.000	0.000	0.000	25.396	25.396	0.000
2	12.718	77.256	62.495	-0.200	0.200	12.718	77.256	62.495	0.000	0.000	0.000	0.000	11.920	11.920	0.000
3	11.543	77.536	62.500	-0.200	0.200	11.543	77.536	62.500	0.000	0.000	0.000	0.000	9.525	9.525	0.000

4 Compact 3

Compact3

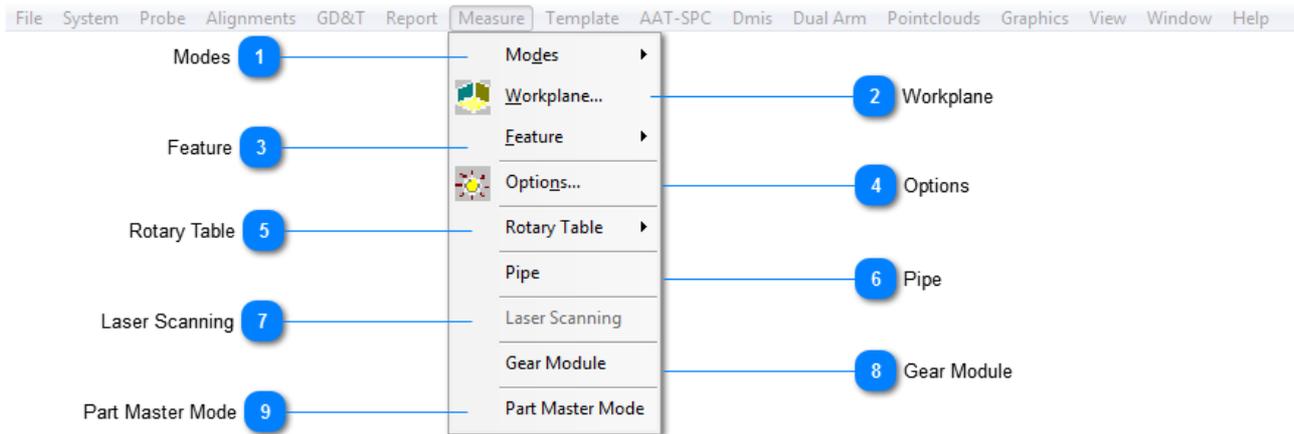
Displays the report in following format

DATE : 5/10/2018
 TIME : 11:33:58 AM
 COMPANY : Your Company
 OPERATOR : Your Operator
 PART NAME : Block
 PART NUMBER : 123456
 COMMENT :

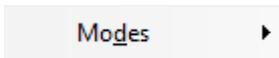
Name	X1	Begin Y1	Z1	X2	End Y2	Z2	DX	Delta DY	DZ	Mag	Sign
CR1	29.504	95.496	62.493	29.504	95.496	62.493	0.000	0.000	0.000	0.000	0
CR2	12.718	77.256	62.495	12.718	77.256	62.495	0.000	0.000	0.000	0.000	0
CR2	11.543	77.536	62.500	11.543	77.536	62.500	0.000	0.000	0.000	0.000	0
CR3	11.543	113.457	62.500	11.543	113.457	62.500	0.000	0.000	0.000	0.000	0

[Report Menu](#)

Measure Menu

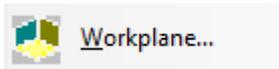


1 Modes



[Modes](#) are used to set different functions while writing a DMIS program.

2 Workplane



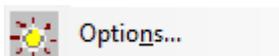
[Workplane](#) is used to select a workplane for measurement of 2 dimensional features such as circles and lines. Selection can be XY, YZ, ZX, actual or nominal. May also be accessed from any manual feature measurement dialog box.

3 Feature



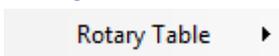
[Feature](#) contains all of the features contained in the Measure Toolbar.

4 Options



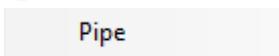
Contains settings pertaining to measurement options which include **Point Types**, **Relative Measurement**, and **Shrink Factor**. For more information, see the section [Utilizing the Measurement Options](#).

5 Rotary Table



[Rotary Table](#) contains all of the features for configuring and using the Rotary Table option. This option is not visible if the **Rotary Table** option is not installed.

6 Pipe



[Pipe](#) refers to the section on Pipe and Tube measurements for further details on how to use this option.

7 Laser Scanning

Laser Scanning

Opens **Laser Scanning** dialog.

8 Gear Module

Gear Module

Opens **Gear Module** dialog.

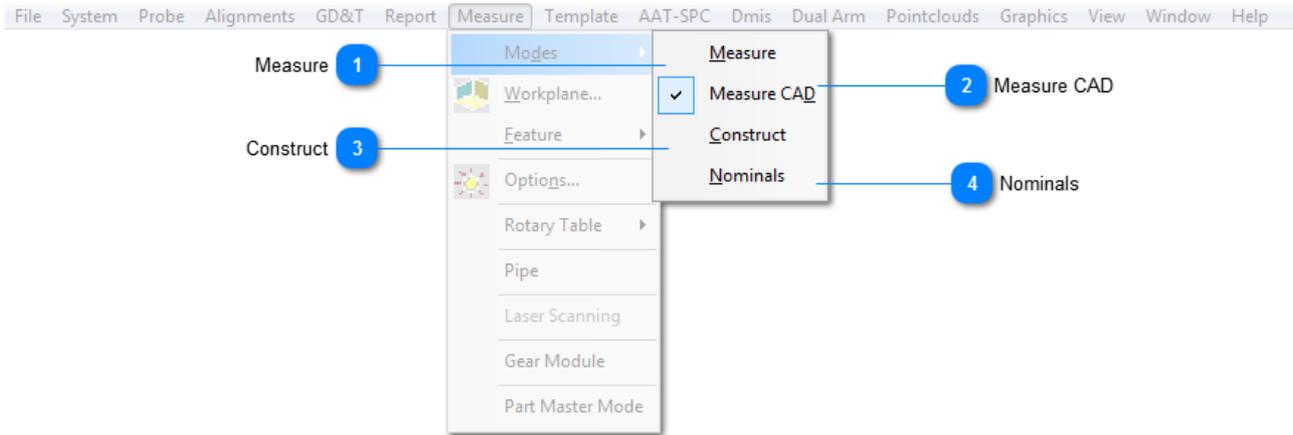
9 Part Master Mode

Part Master Mode

Turns on **Part Master Mode**.

[Menu Bar](#)

Modes



1 Measure

Measure

[Measure](#) is used for manual measurement of features.

2 Measure CAD

Measure CAD

[Measure CAD](#) is used for **Direct Computer Control** of features.

3 Construct

Construct

[Construct](#) is used to construct geometry from existing measured or nominal features.

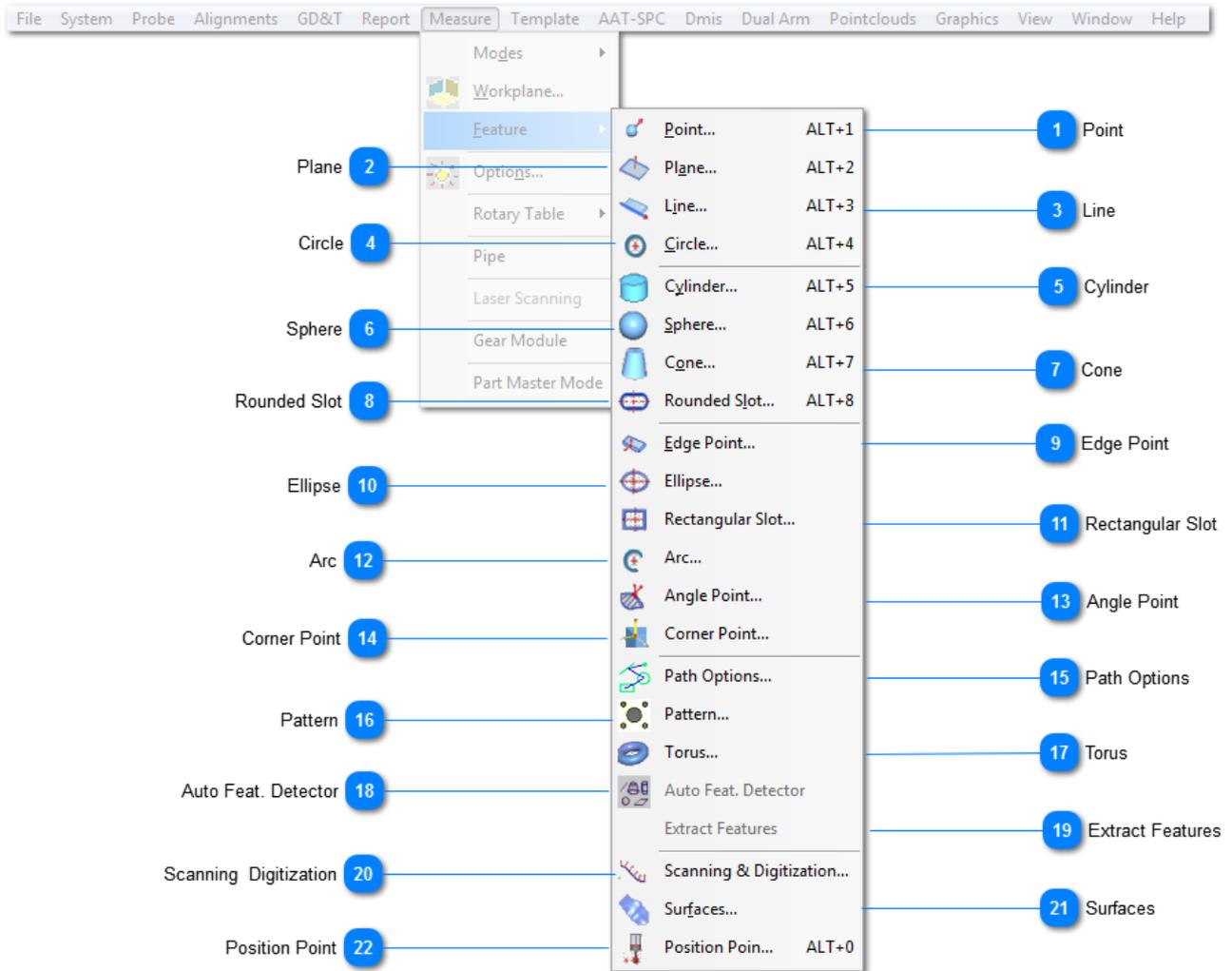
4 Nominals

Nominals

[Nominals](#) are used to create nominals for measurement.

[Measure Menu](#)

Feature



1 Point

 Point... ALT+1

Measures point.

2 Plane

 Plane... ALT+2

Measures plane.

3 Line

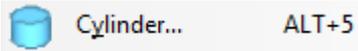
 Line... ALT+3

Measures line.

4 Circle

 Circle... ALT+4

Measures circle.

5 Cylinder

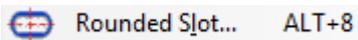
Measures cylinder.

6 Sphere

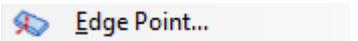
Measures sphere.

7 Cone

Measures cone.

8 Rounded Slot

Measures rounded slot.

9 Edge Point

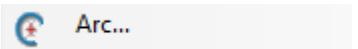
Measures a point on the edge of a part.

10 Ellipse

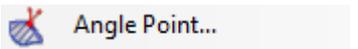
Measures ellipse.

11 Rectangular Slot

Measures rectangular slot.

12 Arc

Measures arc.

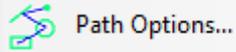
13 Angle Point

Measures point on an angular break of a part.

14 Corner Point

Measures and calculate a point on the corner of a part.

15 Path Options



Used to group nominal features together and perform certain functions.

16 Pattern



Used to generate a patter of features.

17 Torus



Measures torus.

18 Auto Feat. Detector



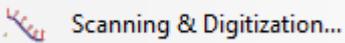
Software automatically determines feature type based on measured points.

19 Extract Features



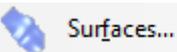
Extract Features will extract the different features for the point cloud data

20 Scanning Digitization



Used for reverse engineering and surface analysis.

21 Surfaces



Contains options for working with surface models.

22 Position Point

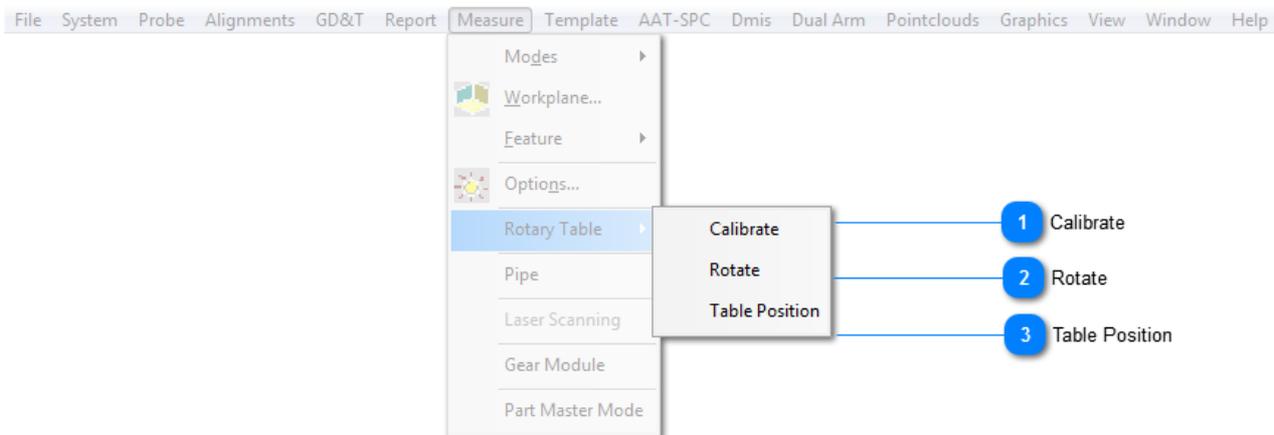


Used to enter [Position Points \(GOTO Points\)](#) to move around work piece.

[Measure Menu](#)

Rotary Table

Please refer to [Using Rotary Table Option](#) section in the CAPPS DMIS User Manual for more information.



1 Calibrate

Calibrate

Used to calibrate the Rotary Table.

2 Rotate

Rotate

Used to enter rotation commands for the Rotary Table.

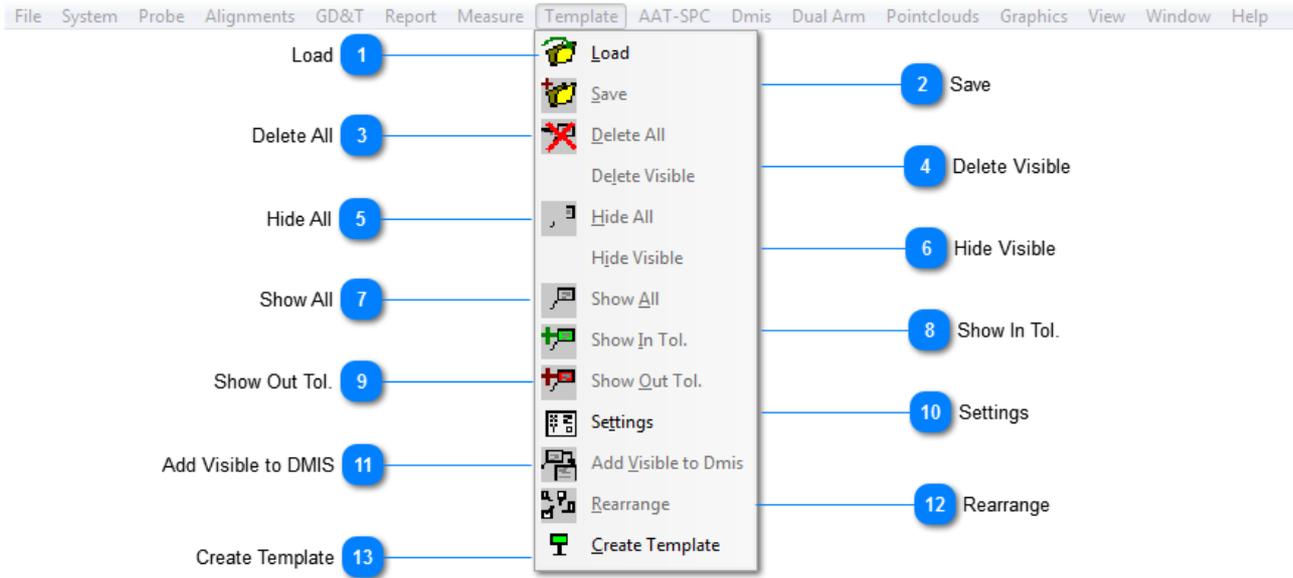
3 Table Position

Table Position

Read the current table position.

[Measure Menu](#)

Template Menu



1 Load



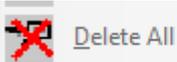
Used to load a template database (.tpl) file.

2 Save



Used to save templates from the **Graphics Window** to a template database (.tpl) file.

3 Delete All



Used to delete all of the templates from the **Graphics Window**.

4 Delete Visible

Delete Visible

Used to delete only the visibly templates from the **Graphics Window**.

5 Hide All



Used to hide all of the templates on the **Graphics Window**.

6 Hide Visible



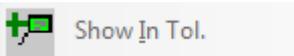
Used to hide all of the visible templates on the **Graphics Window**.

7 Show All



Used to show all of the hidden templates. This option is usually not available unless templates have been hidden.

8 Show In Tol.



Used to show only the tolerances that are in tolerance.

9 Show Out Tol.



Used to show only the tolerances that are out of tolerance.

10 Settings



[Template Settings](#) is used to configure templates setting such as template type, template outputs, and text colors.

11 Add Visible to DMIS



Used to add the current position and outputs of the templates on the **Graphics Window** to the DMIS code for use in executing a program.

12 Rearrange



Used to arrange the templates around the perimeter of the **Graphics Window**. If this is not used, templates can be moved around the screen by left clicking on them.

13 Create Template

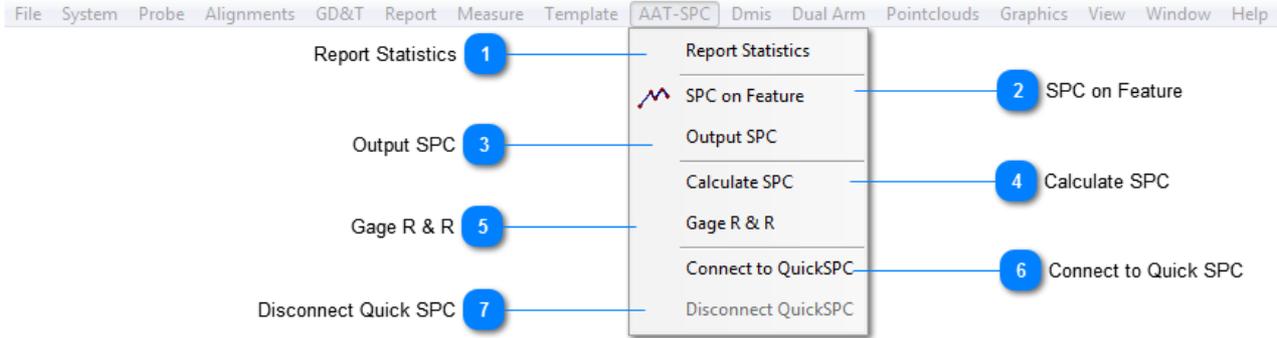


Used to select features to create a template.

[Menu Bar](#)

AAT-SPC Menu

The AAT-SPC module is not a standard option for CAPPs. This menu is only visible if the SPC module has been purchased.



1 Report Statistics

Report Statistics

Used to calculate statistical data from all of the profiles in the report.

2 SPC on Feature

SPC on Feature

Used to configure which information and features will be used for SPC analysis.

3 Output SPC

Output SPC

Used to configure which SPC calculations will be added to the report.

4 Calculate SPC

Calculate SPC

Used to preview SPC calculations from a specified SPC database.

5 Gage R & R

Gage R & R

Used to create a Gage R&R report from a specified SPC database.

6 Connect to Quick SPC

Connect to QuickSPC

Used to connect to Quick SPC.

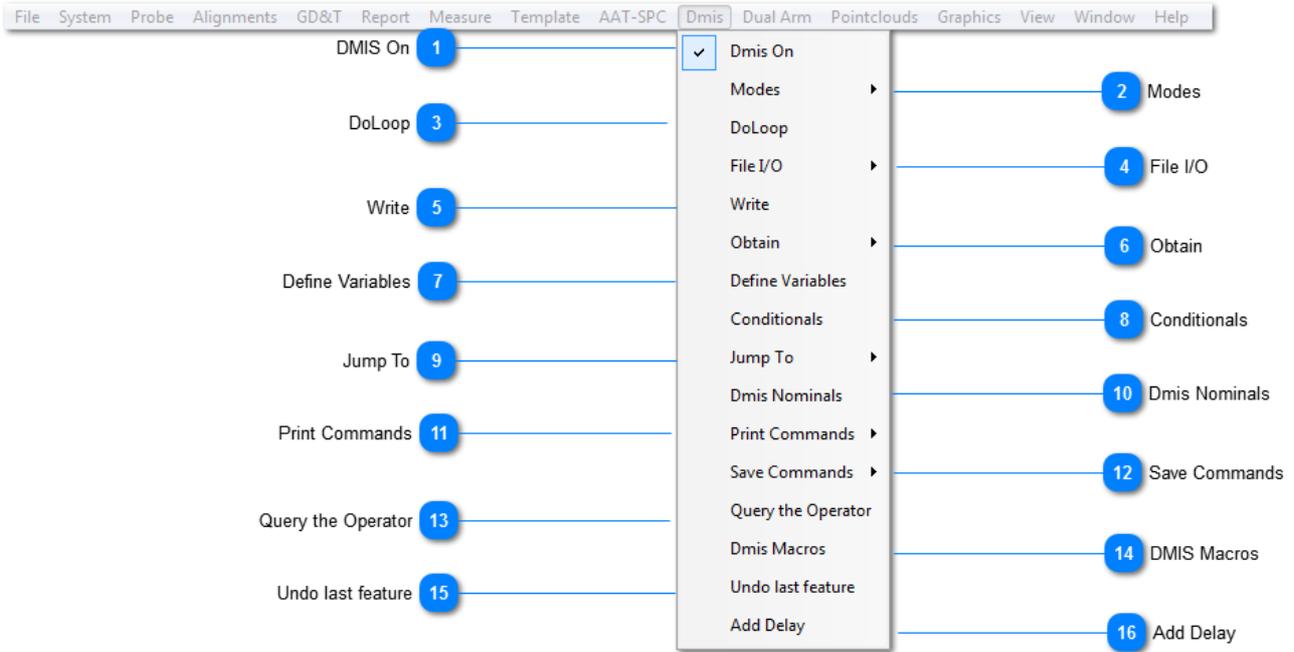
7 Disconnect Quick SPC

Disconnect QuickSPC

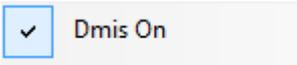
Used to disconnect from Quick SPC.

[Menu Bar](#)

DMIS Menu

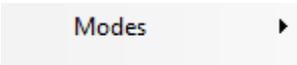


1 DMIS On



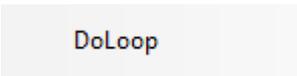
This option will write DMIS code to the program if it is checked.

2 Modes



[Modes](#) are used to set the modes for the DMIS program execution.

3 DoLoop



Used to write a basic programming code for **Do Loop Function**. Please refer to [DMIS Commands Manual](#) for more information.

4 File I/O



Used to write a basic programming code for **File I/O Function**. Please refer to [DMIS Commands Manual](#) for more information.

5 Write



Used to write a basic programming code for **Write Function**. Please refer to [DMIS Commands Manual](#) for more information.

6 Obtain

Obtain ▶

Used to write a basic programming code for **Obtain Function**. Please refer to [DMIS Commands Manual](#) for more information.

7 Define Variables

Define Variables

Used to write a basic programming code for defining variables in the program. Please refer to [DMIS Commands Manual](#) for more information.

8 Conditionals

Conditionals

Used to create conditional branches (**if statements**) in a program. Please refer to [DMIS Commands Manual](#) for more information.

9 Jump To

Jump To ▶

Used to write a basic programming code for **Jump To Function**. Please refer to [DMIS Commands Manual](#) for more information.

10 Dmis Nominals

Dmis Nominals

Used to turn report nominals on and off. This is checked by default.

11 Print Commands

Print Commands ▶

[Print Commands](#) contain print commands that can be added to a program. Please refer to [DMIS Commands Manual](#) for more information.

12 Save Commands

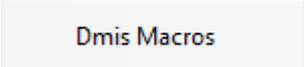
Save Commands ▶

[Save Commands](#) contain report save commands.

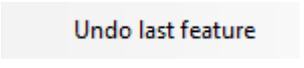
13 Query the Operator

Query the Operator

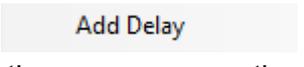
Used to write a basic programming code that asks the operator a question and puts the answer into a variable. Please refer to [DMIS Commands Manual](#) for more information.

14 DMIS MacrosA screenshot of a software menu item labeled "Dmis Macros". The text is centered within a light gray rectangular button.

This feature is used to call a subroutine to the main program.

15 Undo last featureA screenshot of a software menu item labeled "Undo last feature". The text is centered within a light gray rectangular button.

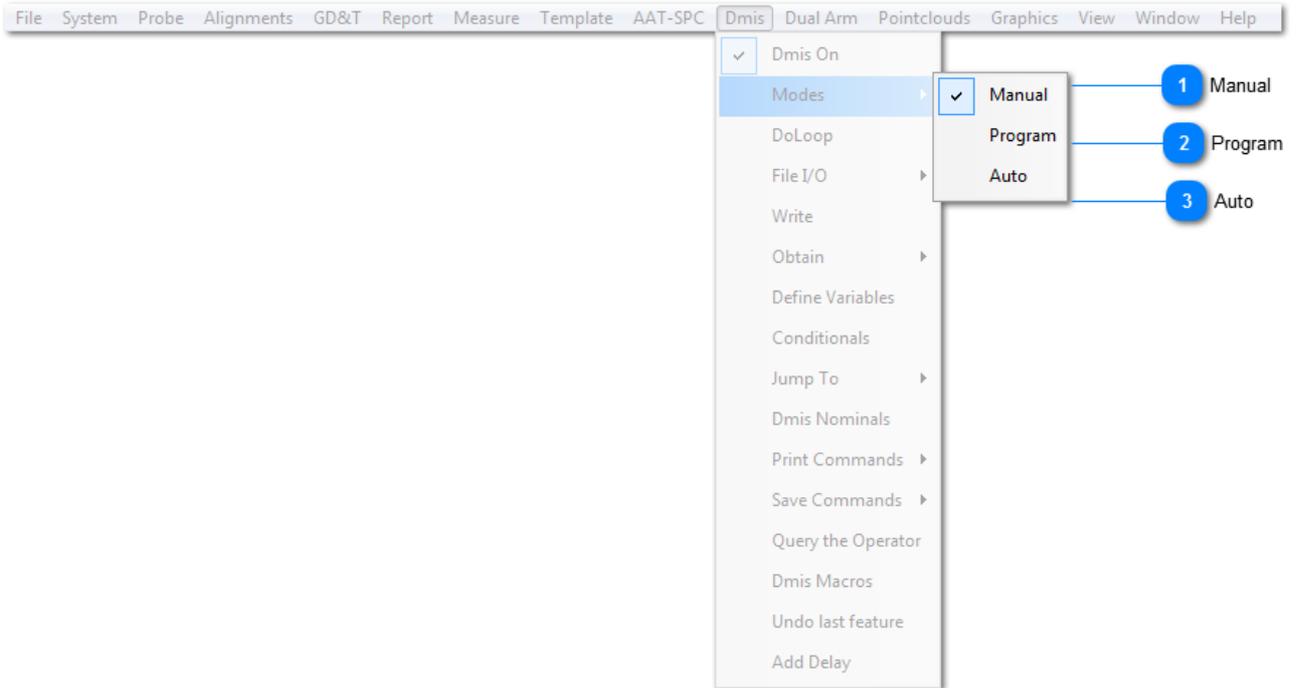
Removes the last feature measured from the DMIS code.

16 Add DelayA screenshot of a software menu item labeled "Add Delay". The text is centered within a light gray rectangular button.

Pauses the program execution or add a delay time

[Menu Bar](#)

Modes



1 Manual



Joystick Mode.

2 Program



DCC mode for most applications.

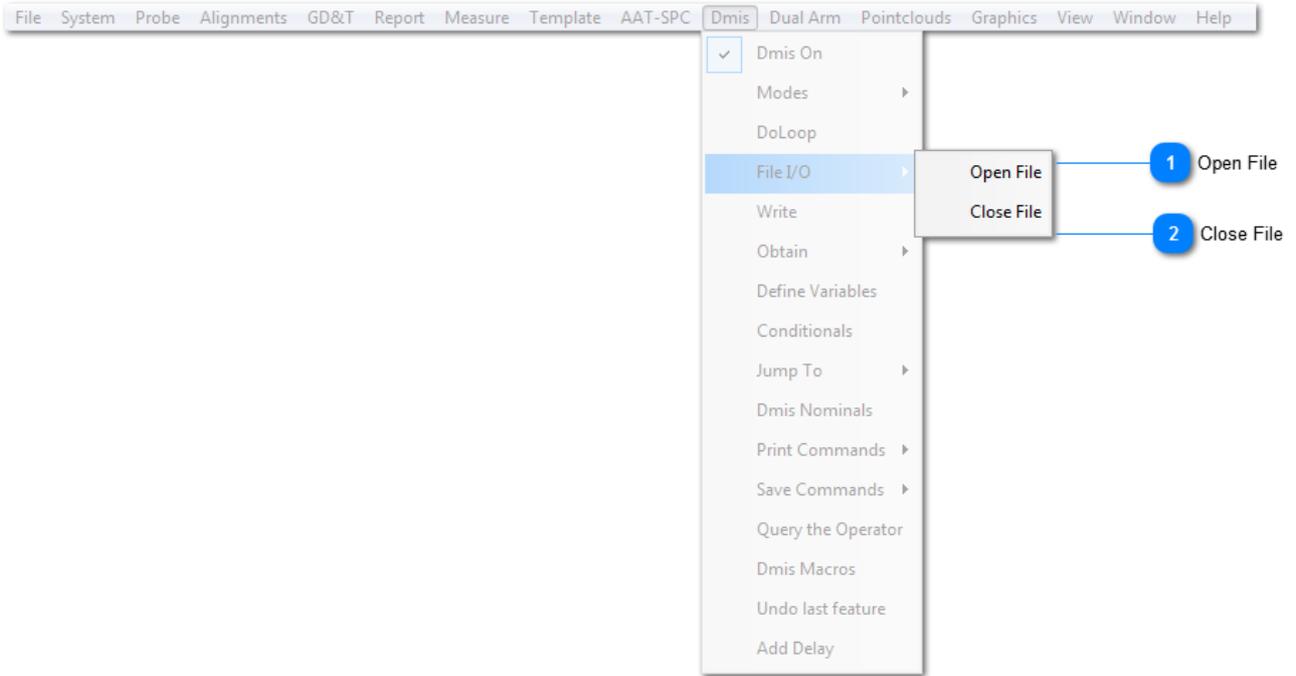
3 Auto



DCC mode primarily used for relative measure.

[DMIS Menu](#)

File I/O



1 Open File

Open File

Opens an input file.

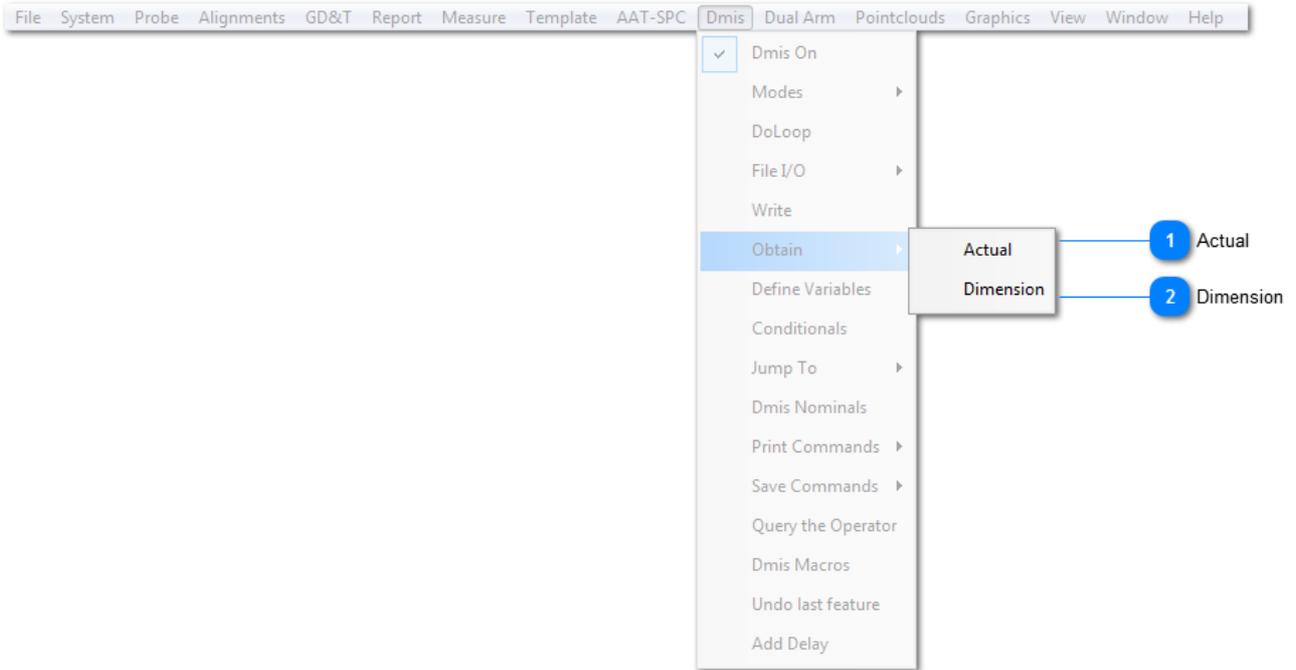
2 Close File

Close File

Closes and input file.

[DMIS Menu](#)

Obtain



1 Actual

Actual

Writes code for obtaining data from an actual.

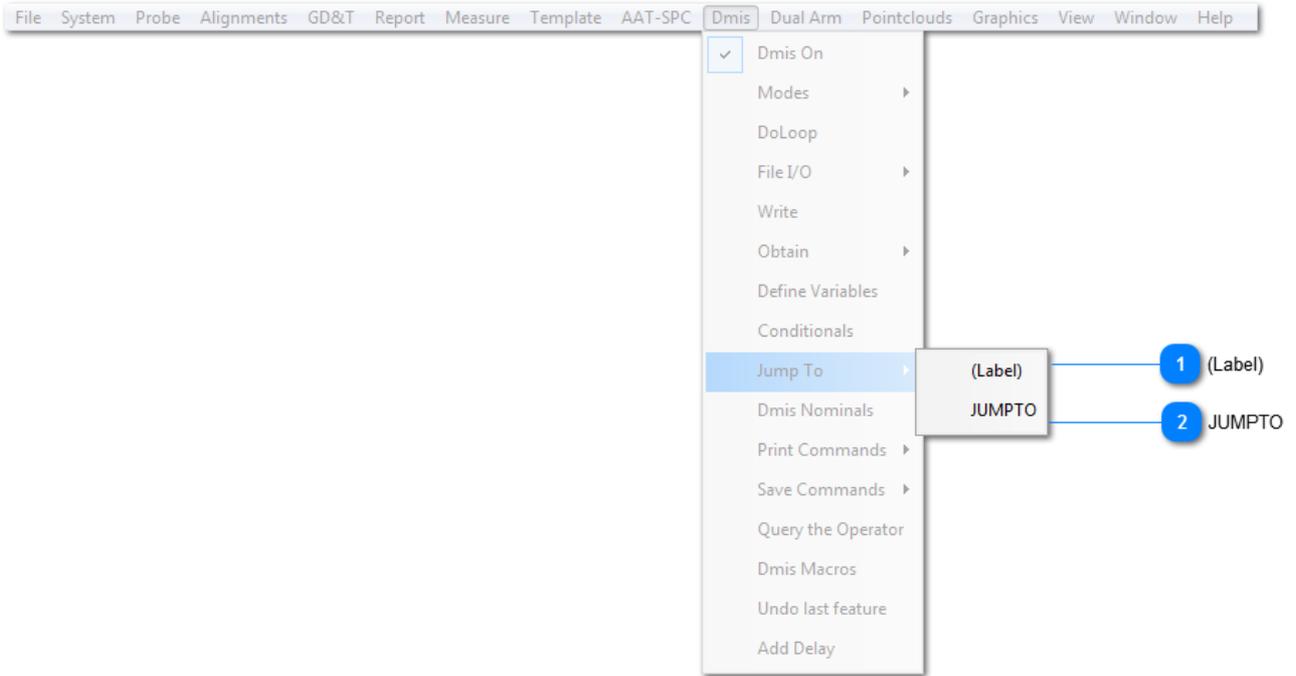
2 Dimension

Dimension

Writes code for obtaining data from a nominal.

[DMIS Menu](#)

Jump To



1 (Label)

(Label)

Used to create a label to jump to.

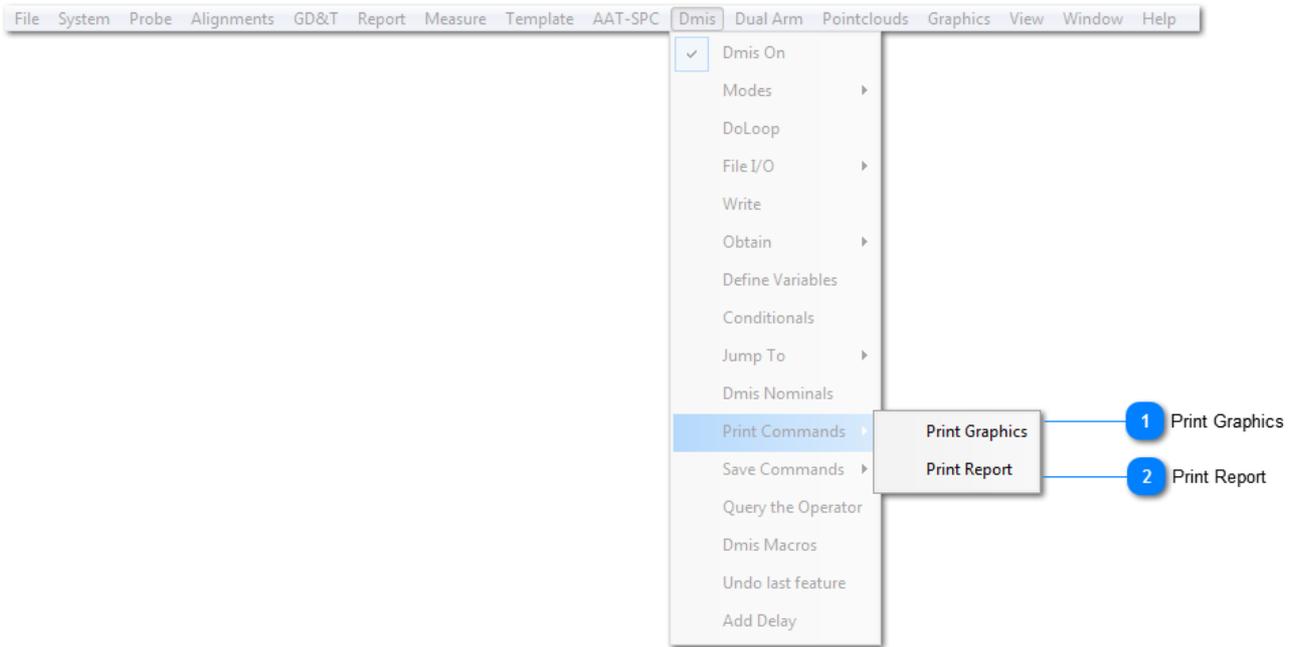
2 JUMPTO

JUMPTO

Used to create a jump command line.

[DMIS Menu](#)

Print Commands



1 Print Graphics

Print Graphics

Add a line to the program that will print the **Graphics Window**.

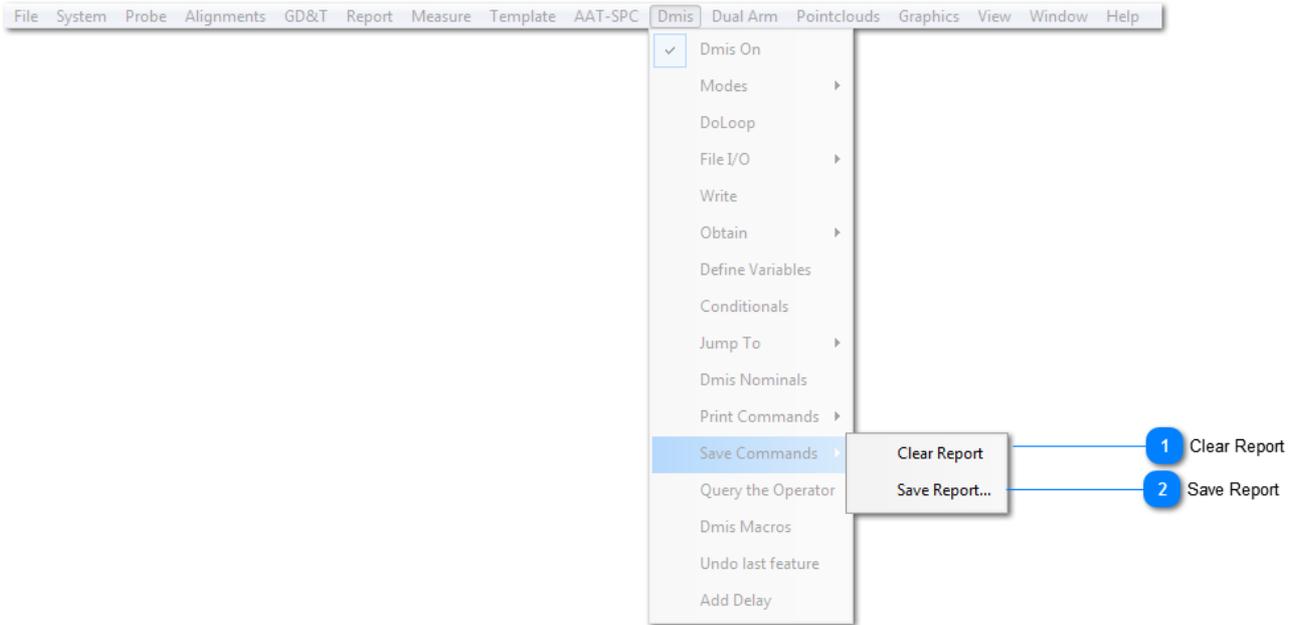
2 Print Report

Print Report

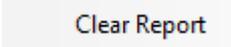
Add a line to the program that will print the report.

[DMIS Menu](#)

Save Commands



1 Clear Report

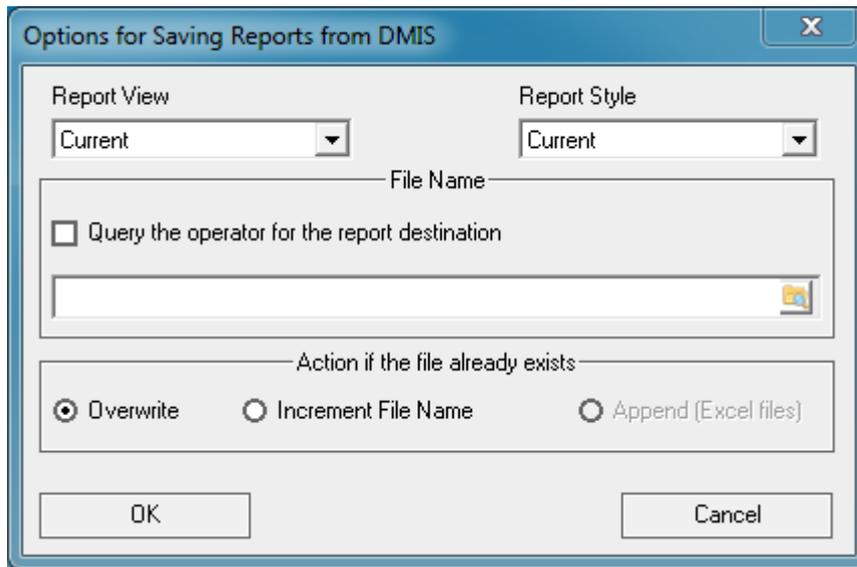


Used to write Report delete command in DMIS

2 Save Report

Save Report...

Used to Save Report in different formats



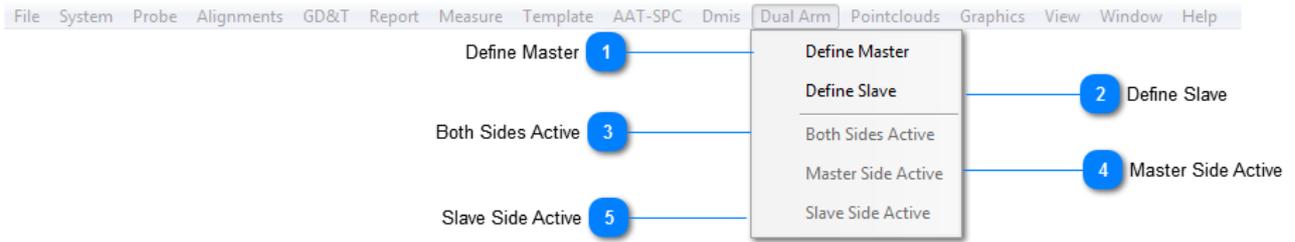
Formats include

- Text Format
- Binary Reports
- Excel Format
- Tab Delimited Format
- Space Delimited Format
- WEB Format
- DMO Format
- Excel (xls & xlsx) Format
- Excel - PDF Format
- Excel-HTML Files

[DMIS Menu](#)

Dual Arm Menu

Please refer to [Using The Dual Arm Option](#) section in the CAPPS DMIS User Manual for more information.



1 Define Master

Define Master

Used in offline programming only.

2 Define Slave

Define Slave

Used in offline programming only.

3 Both Sides Active

Both Sides Active

Used in offline programming only.

4 Master Side Active

Master Side Active

Used in offline programming only.

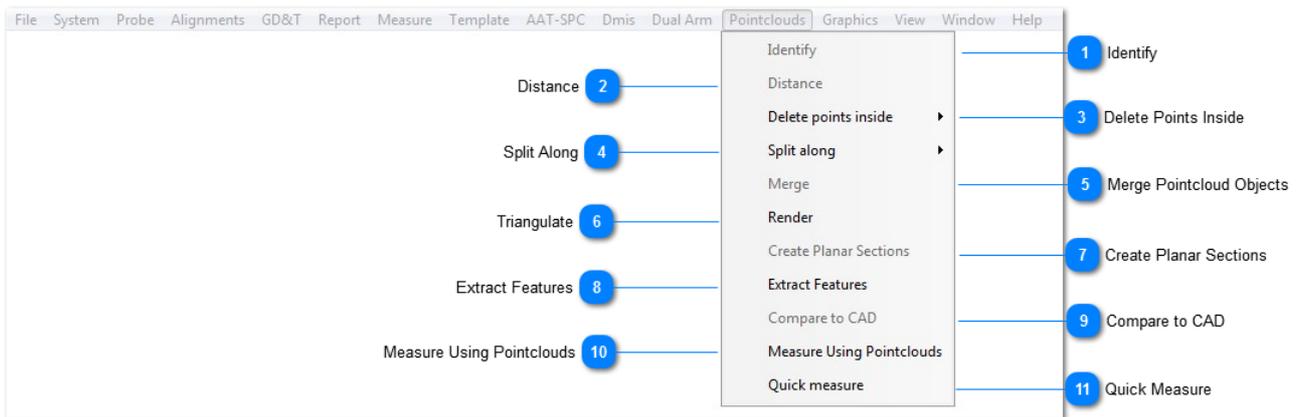
5 Slave Side Active

Slave Side Active

Used in offline programming only.

[Menu Bar](#)

Pointclouds Menu



1 Identify

Identify

Identify is used to view information about point cloud data points.

2 Distance

Distance

Distance is used to display the distance between two points.

3 Delete Points Inside

Delete points inside

[Delete Points Inside](#) options are used to delete sections of the point cloud data.

4 Split Along

Split along

[Split Along](#) options are used to split point clouds into multiple sections.

5 Merge Pointcloud Objects

Merge

Merge Pointcloud Objects is used to merge multiple point cloud entities into one big point cloud entity.

6 Triangulate

Render

Triangulate is used to surface the point cloud data.

7 Create Planar Sections

Create Planar Sections

Create Planar Sections is used to create a curve using the point cloud data.

8 Extract Features

Extract Features

Will extract features from the pointcloud data

9 Compare to CAD

Compare to CAD

Use this option to drop **triangulated** pointcloud data onto a CAD model to generate a color map.

10 Measure Using Pointclouds

Measure Using Pointclouds

Measure Using Pointclouds allows the user to measure geometric features directly from the pointcloud data.

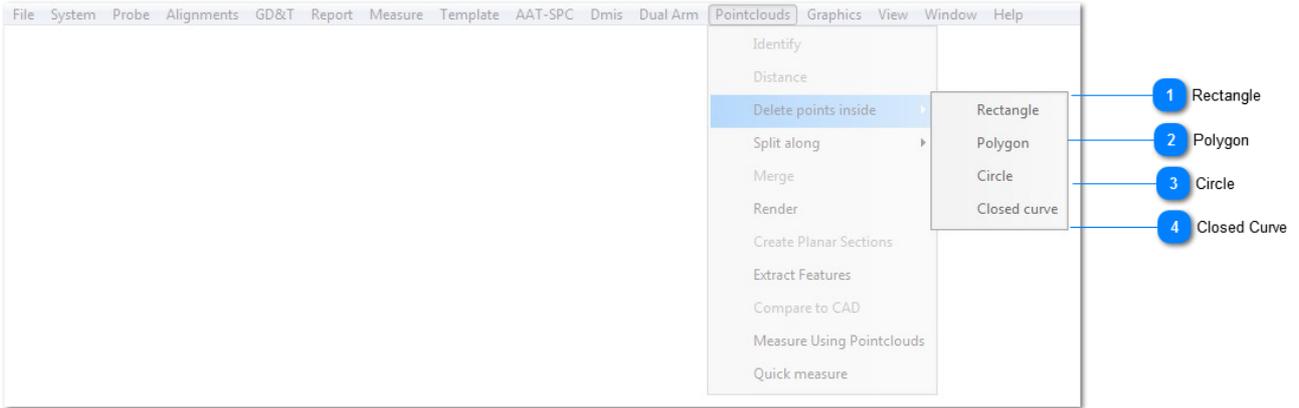
11 Quick Measure

Quick measure

Quick measure is similar to the feature **Measure** using point clouds, the only difference is **Quick Measure** will not generate DMIS code for the action done.

[Menu Bar](#)

Delete Points Inside



1 Rectangle

Rectangle

Use the cursor to select an area of the point cloud in the shape of a rectangle.

2 Polygon

Polygon

Use the cursor to select an area of the point cloud in the shape of a polygon.

3 Circle

Circle

Use the cursor to select an area of the point cloud in the shape of a circle.

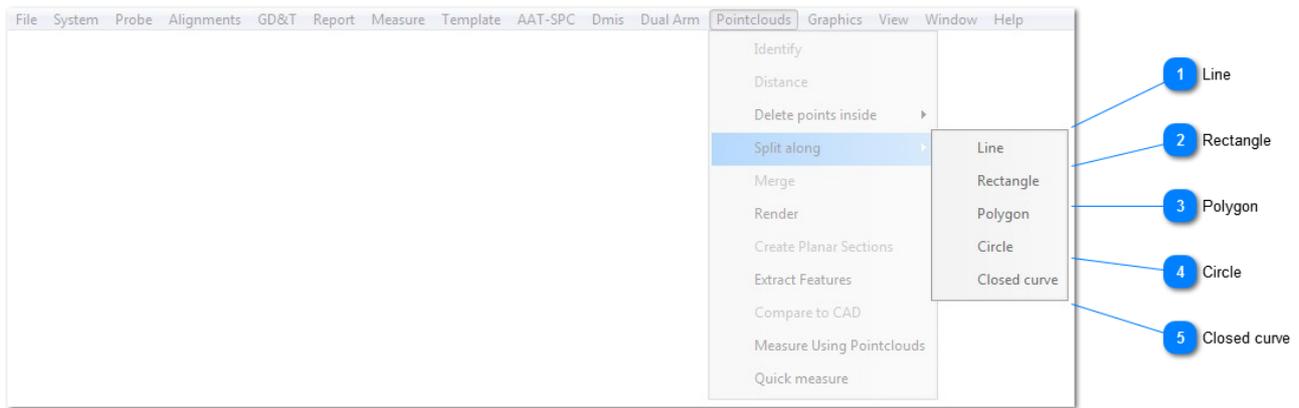
4 Closed Curve

Closed curve

Use the cursor to draw a free form shape around an area to select.

[Pointclouds Menu](#)

Split Along



1 Line

Line

Use the cursor to draw a line through a point cloud.

2 Rectangle

Rectangle

Use the cursor to select an area of the point cloud in the shape of a rectangle.

3 Polygon

Polygon

Use the cursor to select an area of the point cloud in the shape of a polygon.

4 Circle

Circle

Use the cursor to select an area of the point cloud in the shape of a circle.

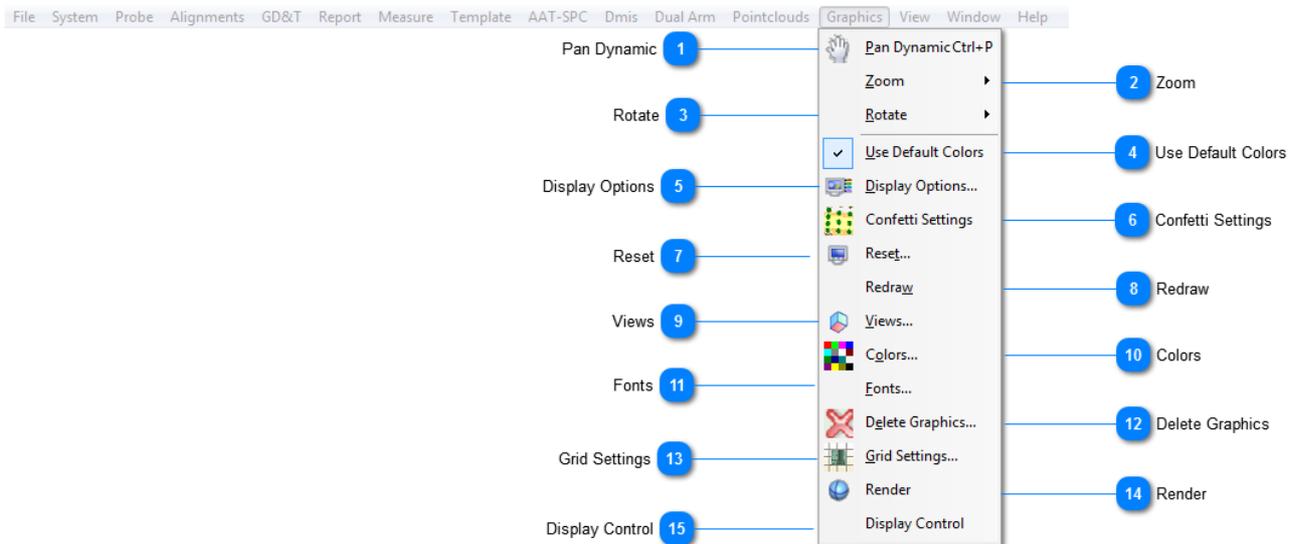
5 Closed curve

Closed curve

Use the cursor to draw a free form shape around an area to select.

[Pointclouds Menu](#)

Graphics Menu

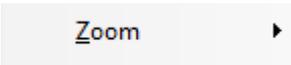


1 Pan Dynamic



Used to pan the graphics.

2 Zoom



[Zoom](#) functions. Zooming also can be done with using your scroll button.

3 Rotate



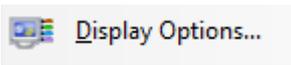
[Rotate](#) functions. Rotating also can be done by pushing and holding your scroll button.

4 Use Default Colors



Used to control CAD, nominal, and actual colors.

5 Display Options



Used to set what is displayed in the **Graphics Window**.

6 Confetti Settings



[Confetti Settings](#) are used to set color coded markers based on feature tolerance.

7 Reset



Used to set the [Graphics Reset Options](#) such as zoom factor, rotation factor, and actual/nominal shading options.

8 Redraw

Redraw the **Graphics Window**.

9 Views



Used to select from default graphics views and set custom graphics views.

10 Colors



Used to set all the various colors in CAPPS.

11 Fonts

Used to set the fonts in the CAPPS.

12 Delete Graphics



Used to delete information from the **Graphics Window**, such as, actuals, nominals, and CAD.

13 Grid Settings



[Grid Settings](#) are used to lay a coordinate system grid on the **Graphics Window**.

14 Render

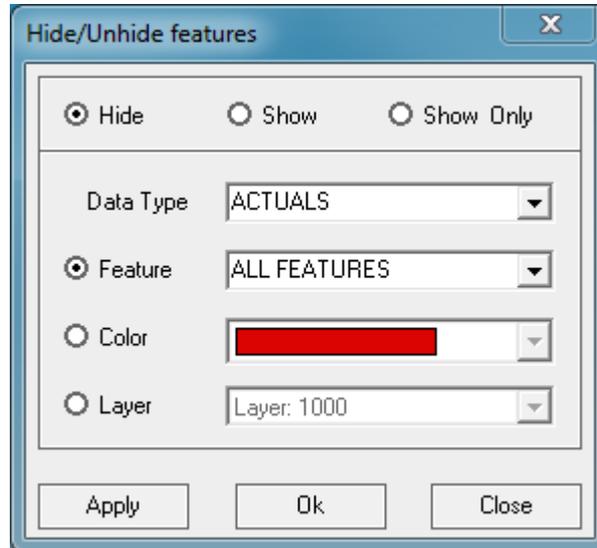


Used to render or shade a CAD model of any type that has surface data.

15 Display Control

Display Control

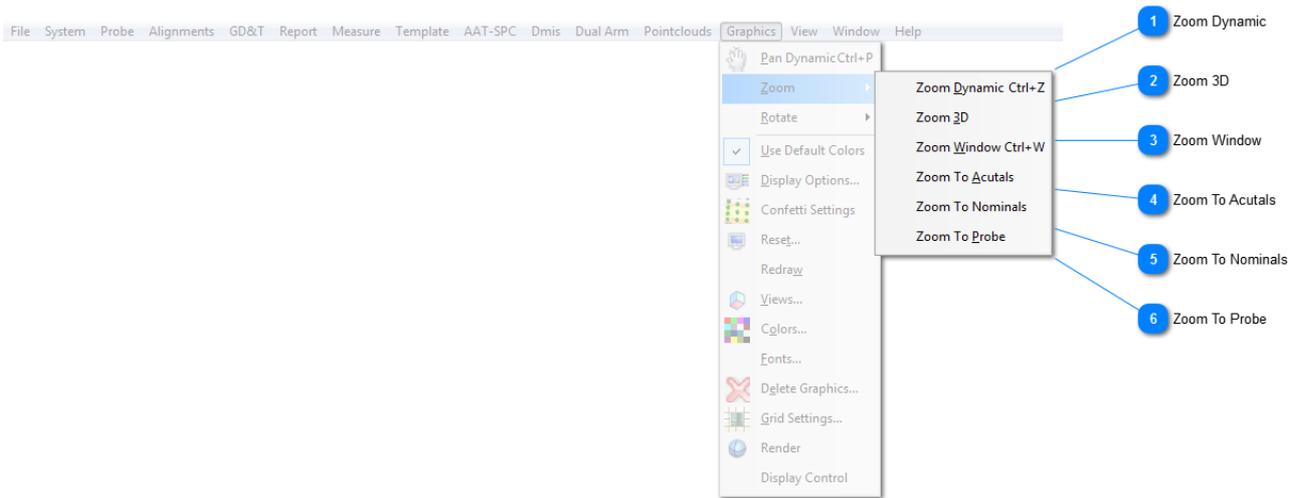
Used to control display options for different types of features and data types (**Actuals/Nominals**). It gives the user to hide and show specified type of features on **Graphics Window**. It turns on the following dialog box:



The user can specify what type of features and data type to be displayed or hide on **Graphics Window** using the menus in the dialog box. Same type of display control can be done using the [Treeview Window](#).

[Menu Bar](#)

Zoom



1 Zoom Dynamic

Zoom Dynamic Ctrl+Z

Dynamically zoom the graphics with the left mouse button.

2 Zoom 3D

Zoom 3D

Click on the CAD file to zoom to it.

3 Zoom Window

Zoom Window Ctrl+W

Draw a window around a section to zoom.

4 Zoom To Actuals

Zoom To Actuals

Select an actual to zoom to.

5 Zoom To Nominals

Zoom To Nominals

Select a nominal to zoom to.

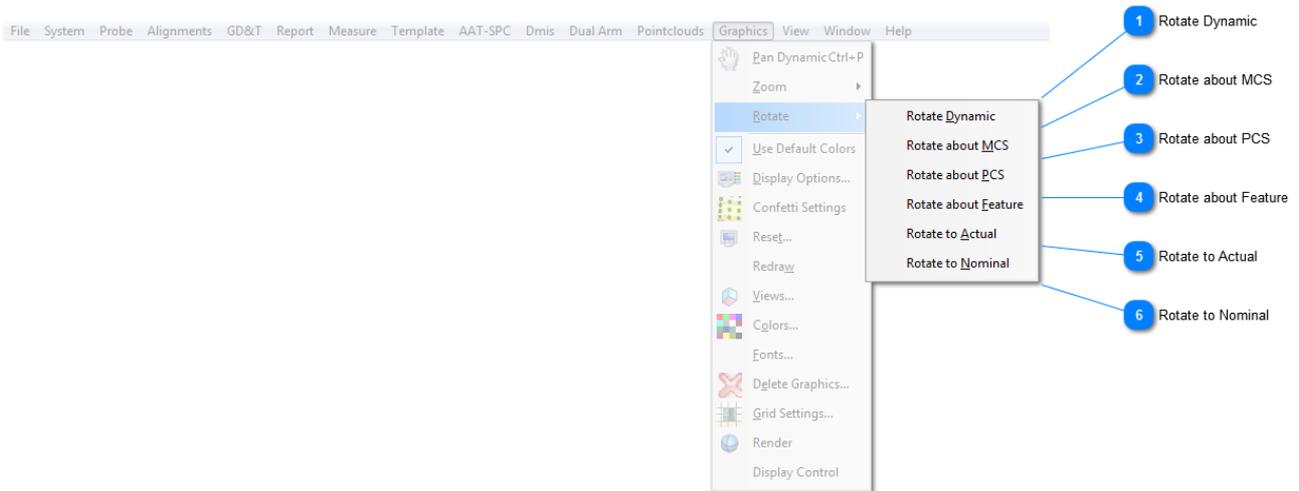
6 Zoom To Probe

Zoom To Probe

Zoom to the probe stylus.

[Graphics Menu](#)

Rotate



1 Rotate Dynamic

Rotate Dynamic

Dynamically rotate the graphics with the left mouse button.

2 Rotate about MCS

Rotate about MCS

Rotate graphics about the MCS.

3 Rotate about PCS

Rotate about PCS

Rotate graphics about the current PCS.

4 Rotate about Feature

Rotate about Feature

Click on the CAD file to rotate about it.

5 Rotate to Actual

Rotate to Actual

Select an actual to rotate about.

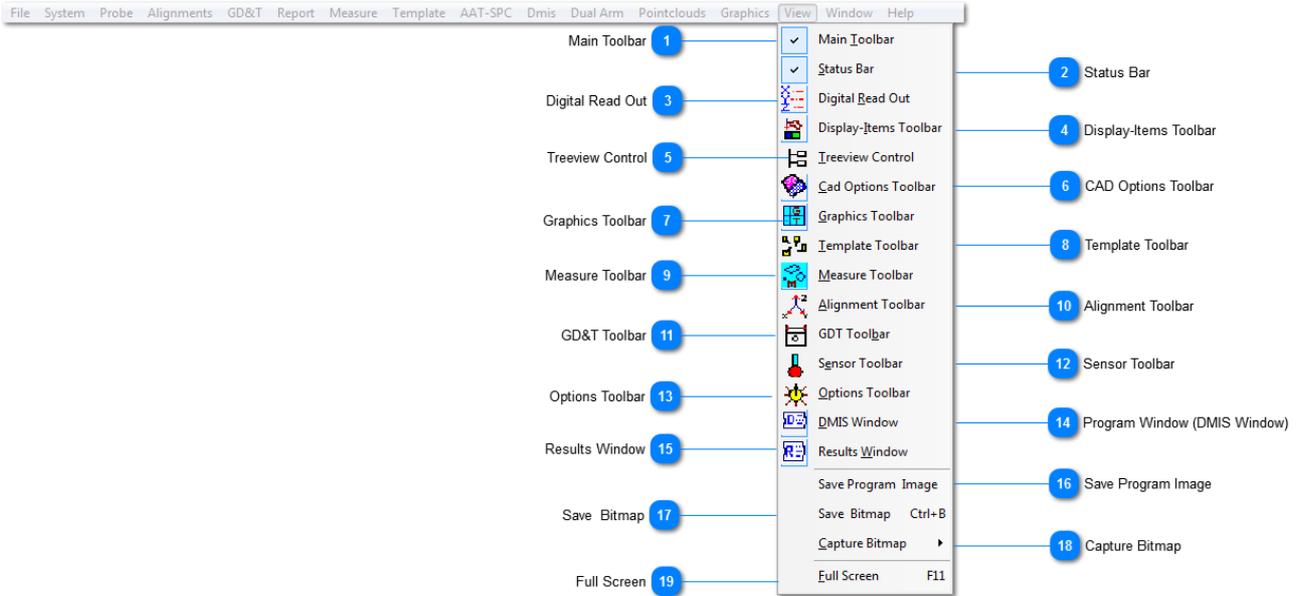
6 Rotate to Nominal

Rotate to Nominal

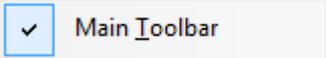
Select a nominal to rotate about

[Graphics Menu](#)

View Menu



1 Main Toolbar



Click to show the [Main Toolbar](#).

2 Status Bar



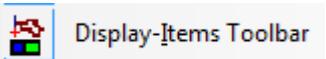
Click to show the [Status Bar](#).

3 Digital Read Out



Click to show the [Digital Read Out](#).

4 Display-Items Toolbar



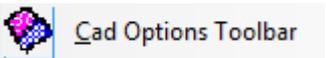
Click to show [Display Items Toolbar](#).

5 Treeview Control

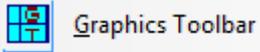


Click to show [Treeview Control](#).

6 CAD Options Toolbar



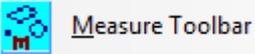
Click to show [CAD Options Toolbar](#).

7 Graphics Toolbar

Graphics Toolbar

Click to show [Graphics Toolbar](#).**8 Template Toolbar**

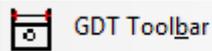
Template Toolbar

Click to show [Template Toolbar](#).**9 Measure Toolbar**

Measure Toolbar

Click to show [Measure Toolbar](#).**10 Alignment Toolbar**

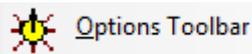
Alignment Toolbar

Click to show [Alignment Toolbar](#).**11 GD&T Toolbar**

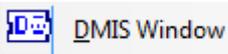
GDT Toolbar

Click to show [GD&T Toolbar](#).**12 Sensor Toolbar**

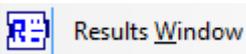
Sensor Toolbar

Click to show [Sensor Toolbar](#).**13 Options Toolbar**

Options Toolbar

Click to show [Options Toolbar](#).**14 Program Window (DMIS Window)**

DMIS Window

Click to show [Program Window](#).**15 Results Window**

Results Window

Click to show [Results Window](#).**16 Save Program Image**

Save Program Image

Used to save a bitmap image to be attached to program calls in [Quick Menu - Open Program](#) dialog.

17 Save Bitmap

Save Bitmap Ctrl+B

Click to save a bitmap file.

18 Capture Bitmap

Capture Bitmap ▶

[Capture Bitmap](#) is used to save a bitmap file.

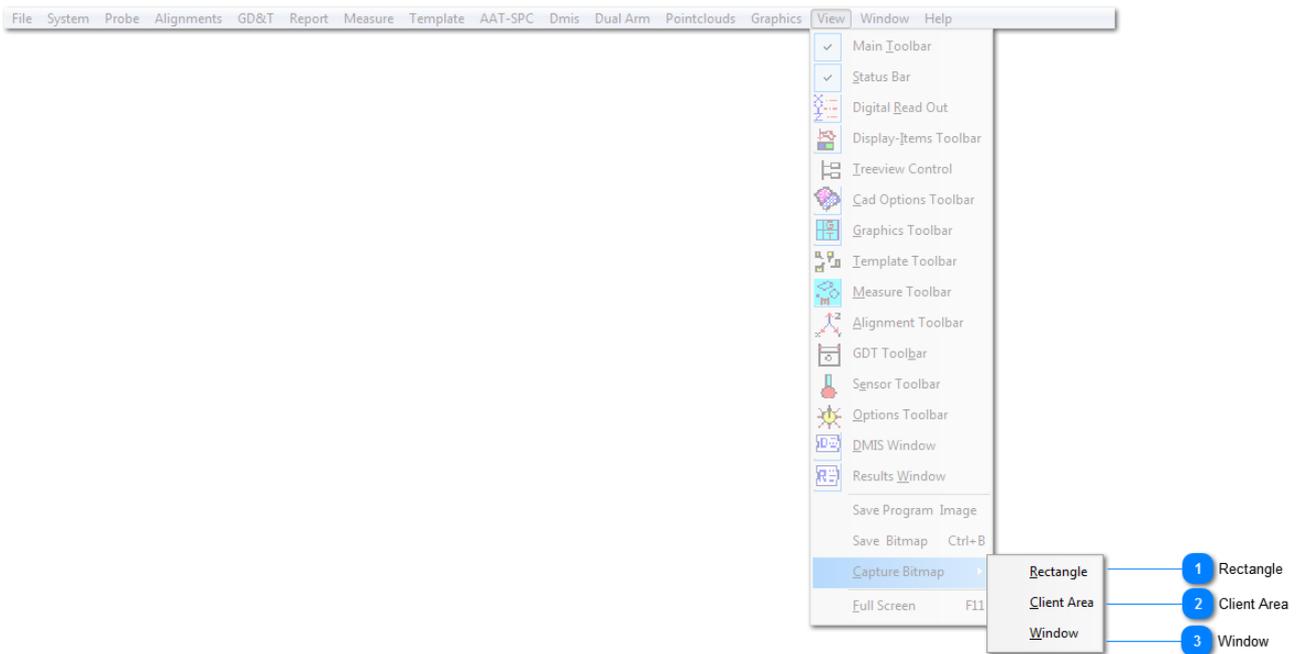
19 Full Screen

Full Screen F11

Click to here to toggle **Full Screen**.

[Menu Bar](#)

Capture Bitmap



1 Rectangle

Rectangle

Used to draw a box around a portion of the screen to capture a picture in **.bmp, .gif, .jpg, .png, or .tif** formats.

2 Client Area

Client Area

Used to capture the frame of a window when the title bar is selected.

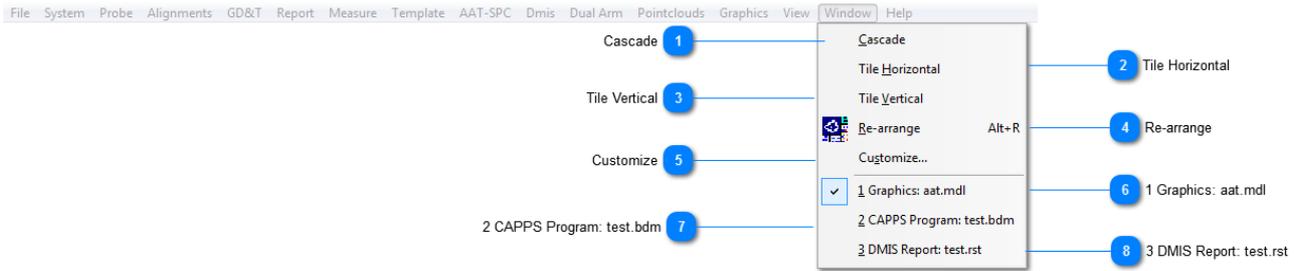
3 Window

Window

Used to capture the entire window when the title bar is selected.

[View Menu](#)

Window Menu



1 Cascade

Cascade

Click to arrange the Graphics, DMIS, and Report windows in a cascade arrangement.

2 Tile Horizontal

Tile Horizontal

Click to arrange the Graphics, DMIS, and Report windows in horizontally tiled arrangement.

3 Tile Vertical

Tile Vertical

Click to arrange the Graphics, DMIS, and Report windows in vertically tiled arrangement.

4 Re-arrange

Re-arrange Alt+R

Used to reset the screen layout to a default layout.

5 Customize

Customize...

Used to select a default screen layout or create a user defined screen layout.

6 1 Graphics: aat.mdl

1 Graphics: aat.mdl

Designates that the **Graphics Window** has the focus.

7 2 CAPPs Program: test.bdm

2 CAPPs Program: test.bdm

Designates that the DMIS program window has the focus.

8 3 DMIS Report: test.rst

3 DMIS Report: test.rst

Designates that the report window has the focus.

Menu Bar

Help Menu



1 Help Desk

Help Desk

Click to open CAPPs help.

2 Register

Register

Used to enter a new registration key that contains different options or software level.

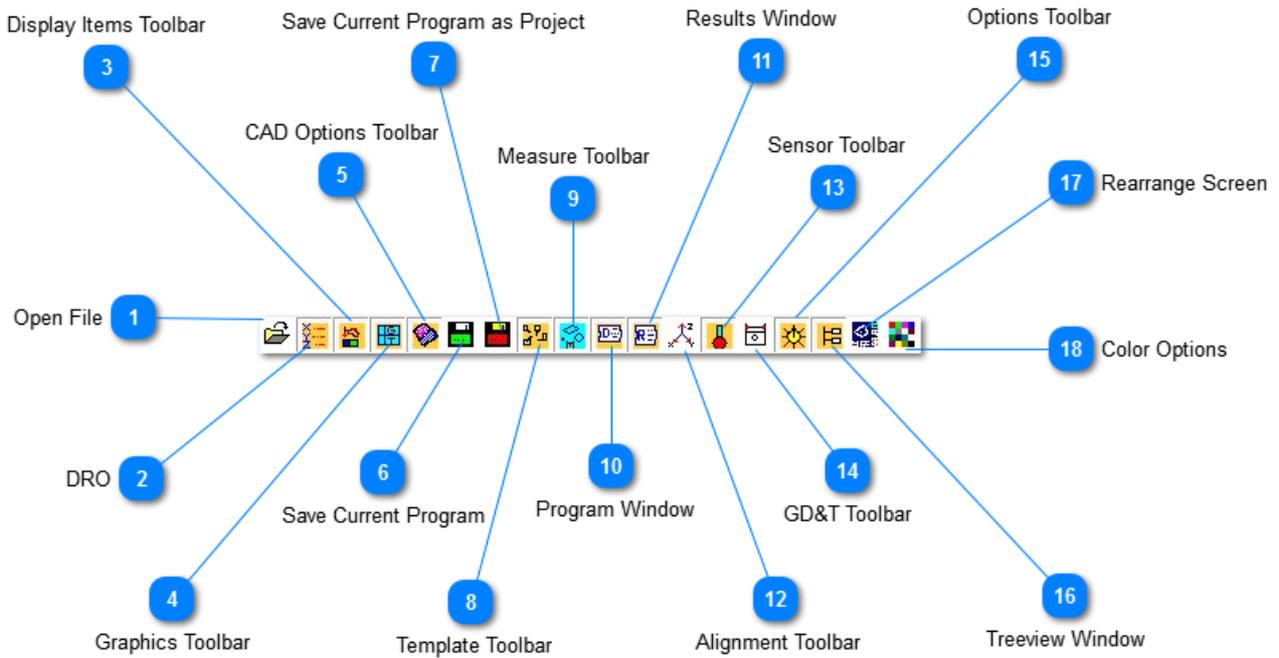
3 About CAPPs

About CAPPs

Contains information about the CAPPs software, such as, **build number, dongle ID, and current installed options.**

[Menu Bar](#)

Main Toolbar



1 Open File



Opens a file.

2 DRO



Turns on/off [Digital Read Out](#).

3 Display Items Toolbar



Turns on/off [Display Items Toolbar](#).

4 Graphics Toolbar



Turns on/off [Graphics Toolbar](#).

5 CAD Options Toolbar



Turns on/off [CAD Options Toolbar](#).

6 Save Current Program



Saves current program with the latest updates.

7 Save Current Program as Project



Saves current program as a project into a specified directory.

8 Template Toolbar



Turns on/off [Template Toolbar](#).

9 Measure Toolbar



Turns on/off [Measure Toolbar](#).

10 Program Window



Turns on/off [Program Window](#).

11 Results Window



Turns on/off [Results Window](#).

12 Alignment Toolbar



Turns on [Alignments Toolbar](#).

13 Sensor Toolbar



Turns on/off [Sensor Toolbar](#).

14 GD&T Toolbar



Turns on/off [GD&T Toolbar](#).

15 Options Toolbar



Turns on/off [Options Toolbar](#).

16 Treeview Window



Turns on/off [Treeview Window](#).

17 Rearrange Screen



Turns on/off **Rearrange Screen**.

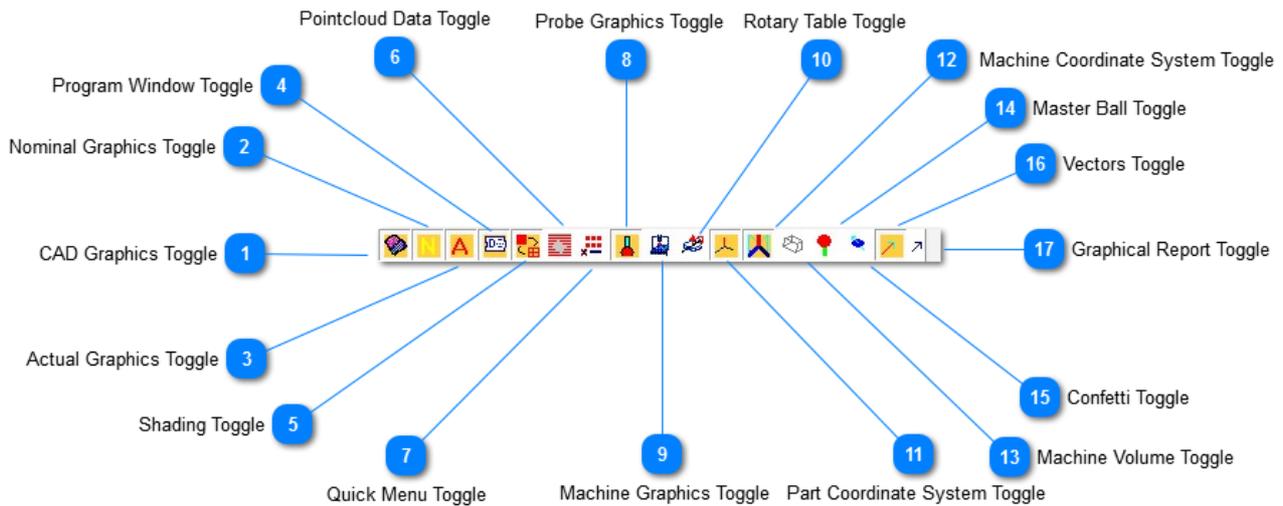
18 Color Options



Turns on/off **Color Options**.

[Navigating The User Interface](#)

Display Items Toolbar



1 CAD Graphics Toggle



Turns on/off the **CAD** model on [Graphics Window](#).

2 Nominal Graphics Toggle



Turns on/off **Nominal Features** on [Graphics Window](#).

3 Actual Graphics Toggle



Turns on/off **Actual Features** on [Graphics Window](#).

4 Program Window Toggle



Turns on/off [Program Window](#).

5 Shading Toggle



Turns on/off shading for **Actual and Nominal Features**.

6 Pointcloud Data Toggle



Turns on/off **Pointcloud Data**.

7 Quick Menu Toggle



Turns on/off [Quick Menu](#).

8 Probe Graphics Toggle



Turns on/off probe model on [Graphics Window](#).

9 Machine Graphics Toggle



Turns on/off machine model on [Graphics Window](#).

10 Rotary Table Toggle



Turns on/off **Rotary Table** model on [Graphics Window](#).

11 Part Coordinate System Toggle



Turns on/off **Part Coordinate System (PCS)** on [Graphics Window](#).

12 Machine Coordinate System Toggle



Turns on/off **Machine Coordinate System (PCS)** on [Graphics Window](#).

13 Machine Volume Toggle



Turns on/off **Machine Volume** on [Graphics Window](#).

14 Master Ball Toggle



Turns on/off **Master Ball** on [Graphics Window](#).

15 Confetti Toggle



Turns on/off **Confetti** on [Graphics Window](#).

16 Vectors Toggle



Turns on/off **Vectors** on [Graphics Window](#).

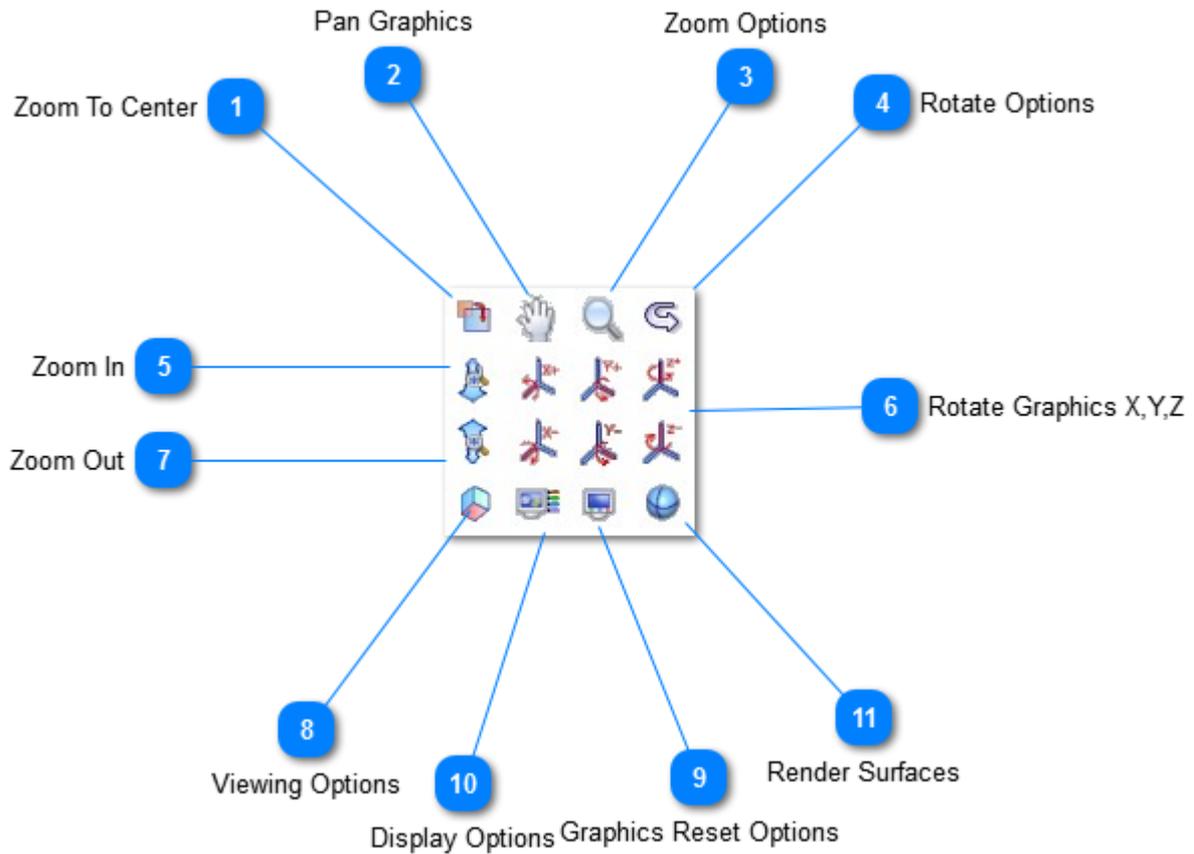
17 Graphical Report Toggle



Turns on/off **Graphical Report** on [Graphics Window](#).

[Main Toolbar](#)

Graphics Toolbar



1 Zoom To Center



Used in conjunction with the mouse wheel. The user simply holds the mouse pointer over an area of the CAD file and scrolls the mouse wheel. That point will now become the center of zoom. To disable this option, simply depress this button in the graphics toolbar.

2 Pan Graphics

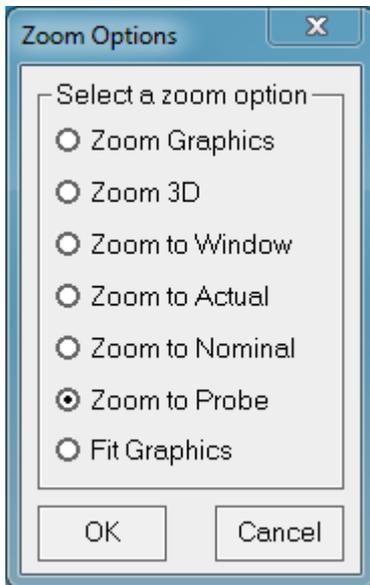


Option is represented by a hand icon in the toolbar shown above. This operates as an **on/off** function. By clicking this button, the user is then able to position the mouse pointer anywhere in the **Graphics Window** and move the CAD model by holding down the left mouse button. To cancel this option, simply click on the hand icon again.

3 Zoom Options



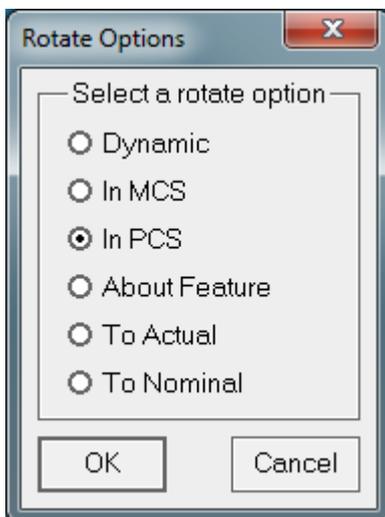
Zoom Options, gives the user the following options to zoom:



4 Rotate Options



Rotate Options includes following options:

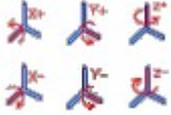


5 Zoom In



This option may be used incrementally (**by single clicking the button until the desired distance is achieved**), or dynamically (**holding down the button until the desired distance is achieved**).

6 Rotate Graphics X,Y,Z



These options may be used incrementally or dynamically to rotate the current graphics shown in the **Graphics Window**. It is recommended that a feature or CAD point of reference is made to be the center of rotation before using these options.

7 Zoom Out

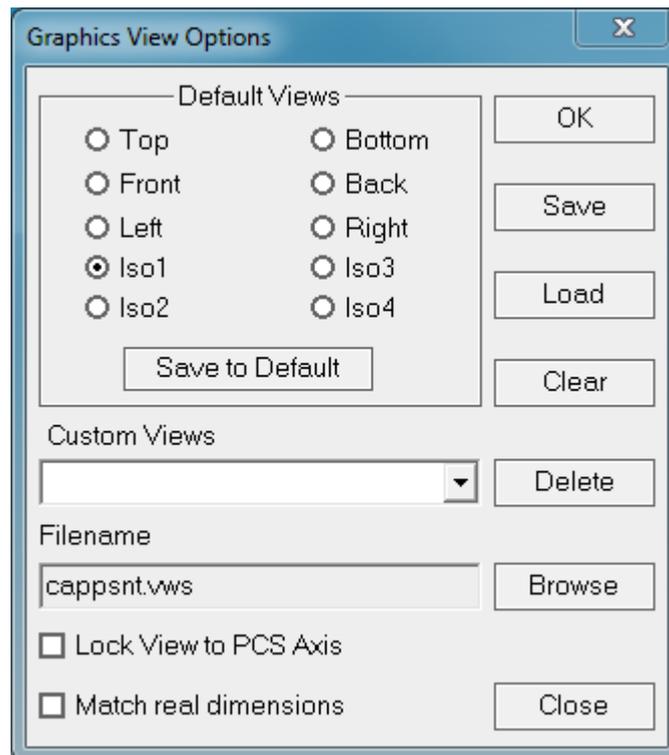


This option may be used incrementally (**by single clicking the button until the desired distance is achieved**), or dynamically (**holding down the button until the desired distance is achieved**).

8 Viewing Options



Viewing Options menu includes:

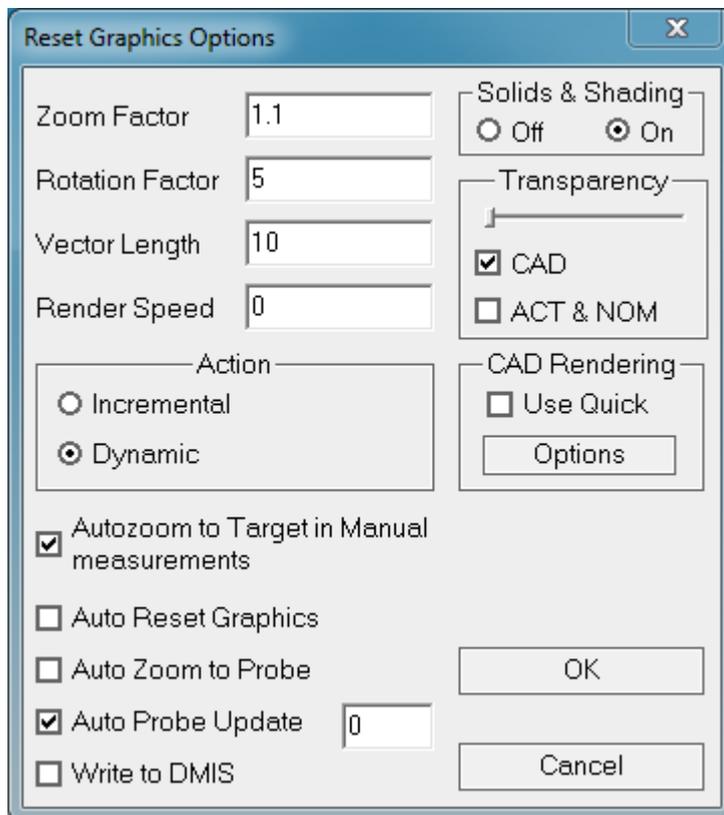


Viewing Options provide default views as **Iso, Front, Left, etc.** Also using **Custom Views**, users can create their own custom views and save this view as a (**.vws**) file to load it in the program, which allows them to recall the custom view during the execution of the program. Also a user can lock the view to **Part Coordinate System Axis (PCS)**, so even though the part moves away from its current location the view will always follow the part during the execution.

9 Graphics Reset Options



[Graphics Reset Options](#) allow the configuration of graphical manipulation properties as shown and detailed below:



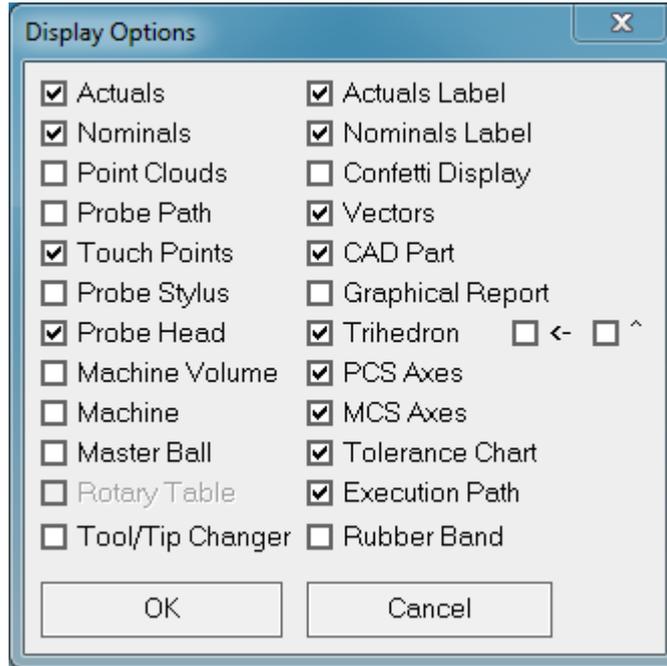
Zoom Factor:	A larger or smaller number will allow faster zooming in/out.
Rotation Factor:	A larger or smaller number will allow faster or slower rotating.
Vector Length:	Works to display longer or shorter graphical vectors on nominal and actual features. This values is unit specific.
Action:	May be configured incrementally or dynamically. This setting will affect rotation and zooming when done using the rotation/zoom options as found in the graphics toolbar menu.
Autozoom to Target in Manual Measurements	Used to set the auto zooming on/off to the target feature during manual measurements.
Auto Reset Graphics:	Used in conjunction with panning and zooming options. If this flag is checked, the panning, zooming option is reset once the left mouse button is released in the Graphics Window .
Auto Zoom to Probe:	If this flag is off (unchecked), then the probe will be dynamic during feature measurements. If this flag is on (checked), then the probe will be static during part measurements.
Auto Probe Update:	Parameter controls how often the probe is updated in graphics. Expressed in milliseconds.
Write to DMIS:	Writes code to DMIS.

Solids and Shading:	Controls the solids display on/off for the CAD actuals, nominals and probe.
Transparency Slider Bar:	Controls the amount of transparency that is displayed for either the CAD model or actuals/nominals or both.
CAD Rendering (Use Quick):	Tessellates CAD much quicker for larger files. Less graphical accuracy will be achieved.

10 Display Options



This will allow the turning on/off of several graphical properties as shown in the menu below.



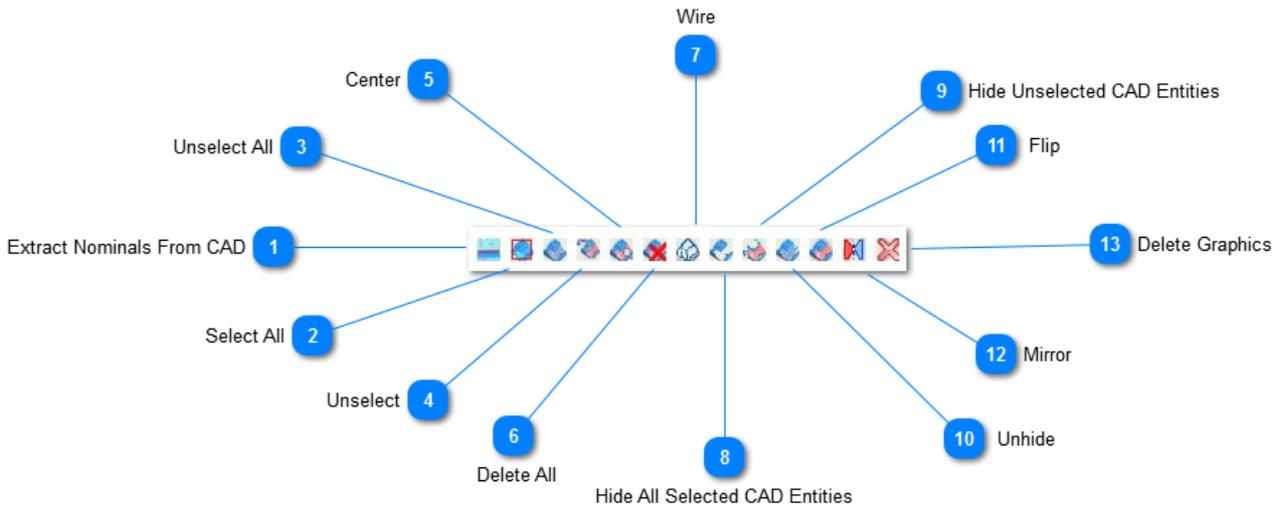
11 Render Surfaces



This will allow the CAD model to be shown as a solid if surface data is readily available in the math of the model.

[Main Toolbar](#)

CAD Options Toolbar



1 Extract Nominals From CAD



Used to extract batch data from CAD file.

2 Select All



Selects all surfaces on CAD file.

3 Unselect All



Unselects all surfaces on CAD file.

4 Unselect



Unselects last selected surface.

5 Center



Centers the CAD model on last selected surface.

6 Delete All



Deletes all selected CAD entities.

7 Wire



Creates wire frame data from surface data.

8 Hide All Selected CAD Entities

Hides all selected CAD items.

9 Hide Unselected CAD Entities

Hides unselected CAD entities.

10 Unhide

Unhides all Hidden entities.

11 Flip

Flips the surface normal of any selected surfaces.

12 Mirror

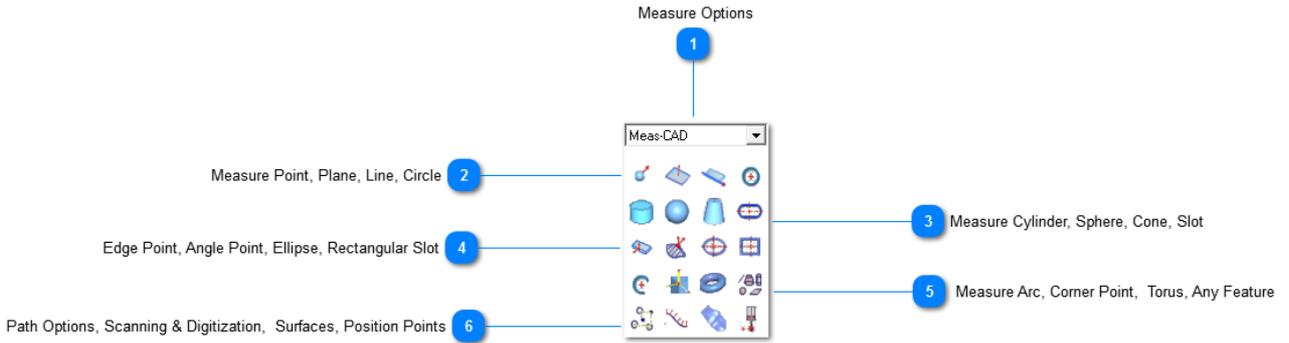
Mirrors a CAD model in any axis and about any origin.

13 Delete Graphics

Deletes CAD, Nominals, Actuals or All.

[Main Toolbar](#)

Measure Toolbar



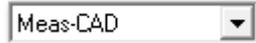
1 Measure Options

Measure



Used to measure features manually.

Meas-CAD



Used to measure features in **DCC (automatic) mode**.

Construct



Used to construct features, using existing features.

Nominals



Used to create nominal features out of CAD boundaries.

2 Measure Point, Plane, Line, Circle



Measure Point



Used to measure a point.

Measure Plane



Used to measure a plane.

Measure Line



Used to measure a line.

Measure Circle



Used to measure a circle.

3 Measure Cylinder, Sphere, Cone, Slot



Measure Cylinder



Used to measure a cylinder.

Measure Sphere



Used to measure a sphere.

Measure Cone



Used to measure a cone.

Measure Slot



Used to measure a slot.

4 Edge Point, Angle Point, Ellipse, Rectangular Slot



Measure Edge Point



Used to measure an edge point.

Measure Angle Point



Used to measure an angle point.

Measure Ellipse



Used to measure an ellipse.

Measure Rectangular Slot



Used to measure a rectangular slot.

5 Measure Arc, Corner Point, Torus, Any Feature



Measure Arc



Used to measure an arc.

Measure Corner Point



Used to measure a corner point.

Measure Torus



Used to measure a torus.

Measure Any Features



Used to measure any feature.

6 Path Options, Scanning & Digitization, Surfaces, Position Points



Path Options



Used to generate path options between selected features.

Scanning & Digitization



Used to open [Scanning & Digitization](#) dialog box for more options.

Surfaces



Used to open Surfaces options.

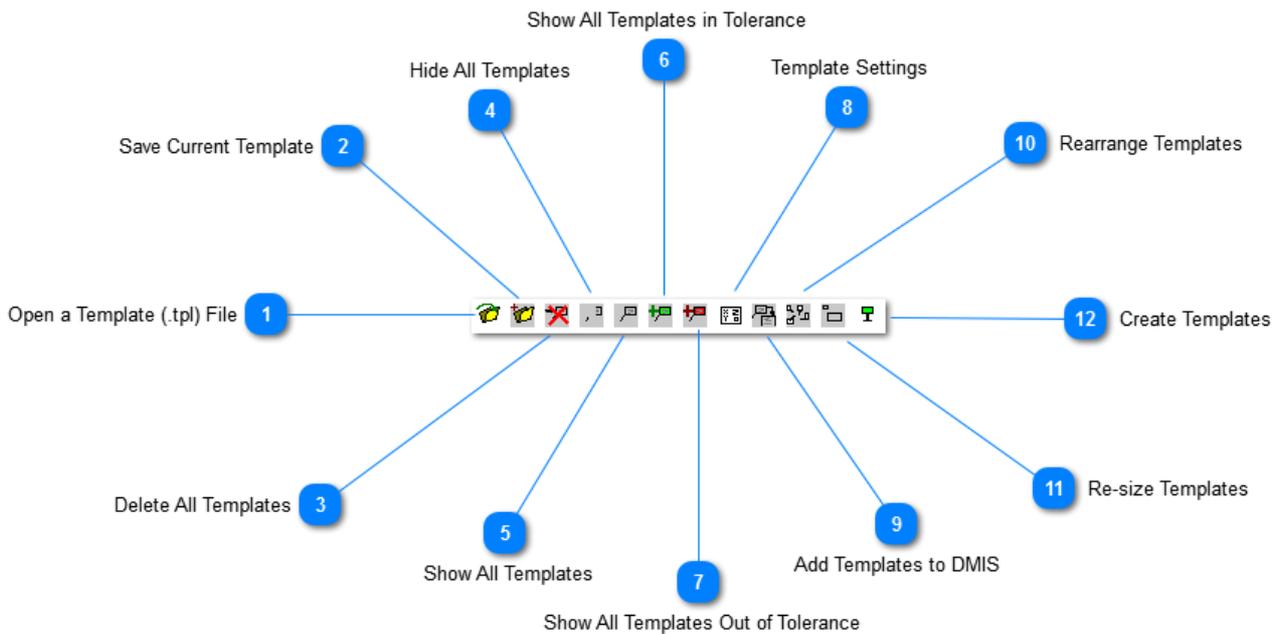
Position Points



Used to generate [Position Points \(GOTO points\)](#).

[Main Toolbar](#)

Template Toolbar



1 Open a Template (.tpl) File



Opens an existing template file.

2 Save Current Template



Saves current template/s as a (.tpl) file format.

3 Delete All Templates



Deletes all templates on [Graphics Window](#).

4 Hide All Templates



Hide all templates on [Graphics Window](#).

5 Show All Templates



Shows all templates on [Graphics Window](#).

6 Show All Templates in Tolerance



Shows all templates that are in tolerance.

7 Show All Templates Out of Tolerance



Show all templates that are out of tolerance.

8 Template Settings



Opens [Template Settings](#) window.

9 Add Templates to DMIS



Creates command lines in DMIS for existing templates. During the execution of the commands, CAPPS automatically generates templates.

10 Rearrange Templates



Rearranges templates on [Graphics Window](#).

11 Re-size Templates



Resizes templates on [Graphics Window](#).

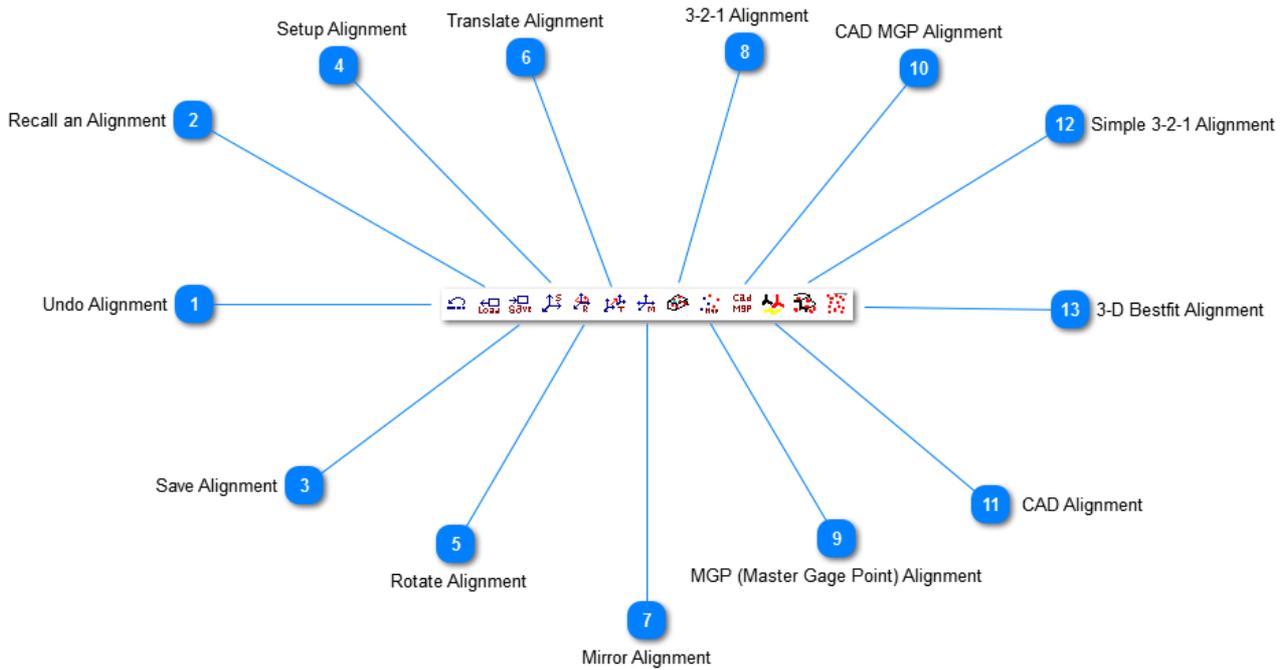
12 Create Templates



Creates templates for selected features.

[Main Toolbar](#)

Alignment Toolbar



1 Undo Alignment



Undo the current alignment.

2 Recall an Alignment



Recalls an existing alignment from [Recall Datum List](#).

3 Save Alignment



Saves current alignment.

4 Setup Alignment



Opens [Setup Alignment](#) dialog.

5 Rotate Alignment



Rotates current alignment.

6 Translate Alignment



Translates current alignment.

7 Mirror Alignment

Mirrors current alignment.

8 3-2-1 Alignment

Opens [3-2-1 Alignment](#) dialog.

9 MGP (Master Gage Point) Alignment

Opens [MGP Alignment](#) dialog.

10 CAD MGP Alignment

Opens [CAD MGP Alignment](#) dialog.

11 CAD Alignment

Opens [CAD Alignment](#) dialog.

12 Simple 3-2-1 Alignment

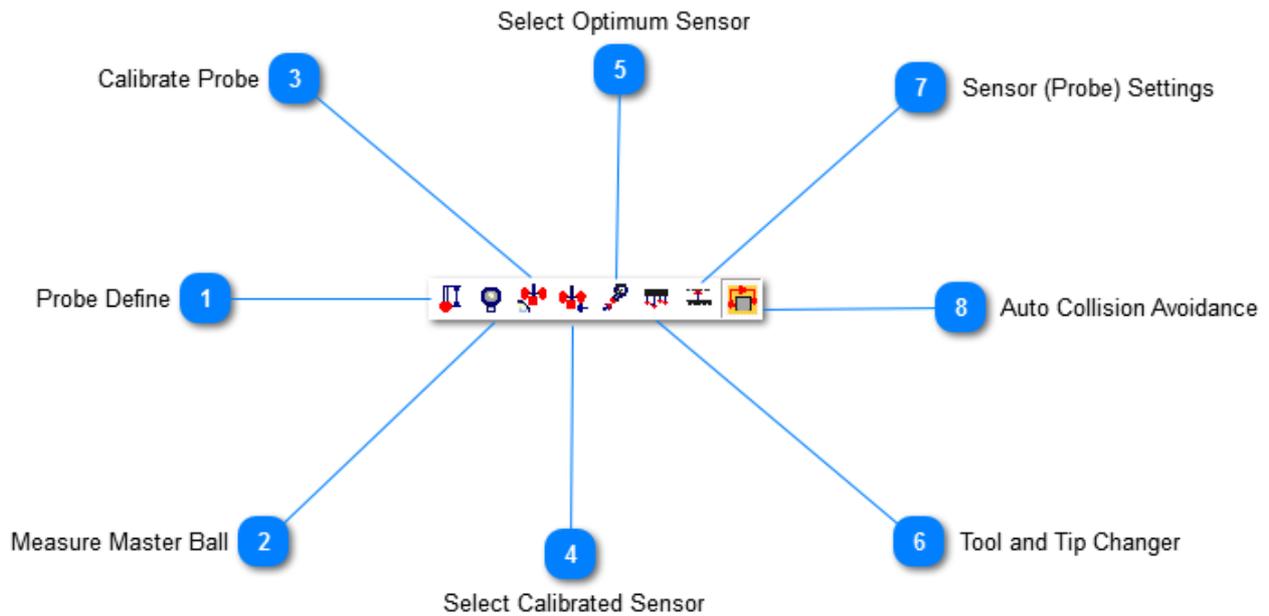
Opens [Simple 3-2-1 Alignment](#) dialog.

13 3-D Bestfit Alignment

Opens [3-D Bestfit Alignment](#) dialog.

[Main Toolbar](#)

Sensors Toolbar



1 Probe Define



Opens [Probe Define](#) dialog.

2 Measure Master Ball



Opens [Measure Master Ball](#) dialog.

3 Calibrate Probe



Opens [Calibrate Probe](#) dialog.

4 Select Calibrated Sensor



Opens [Sensor Select](#) list.

5 Select Optimum Sensor



Opens [Optimum Sensor](#) dialog.

6 Tool and Tip Changer



Opens [Tool and Tip Changer](#) dialog.

7 Sensor (Probe) Settings



Opens [Sensor Settings](#) dialog.

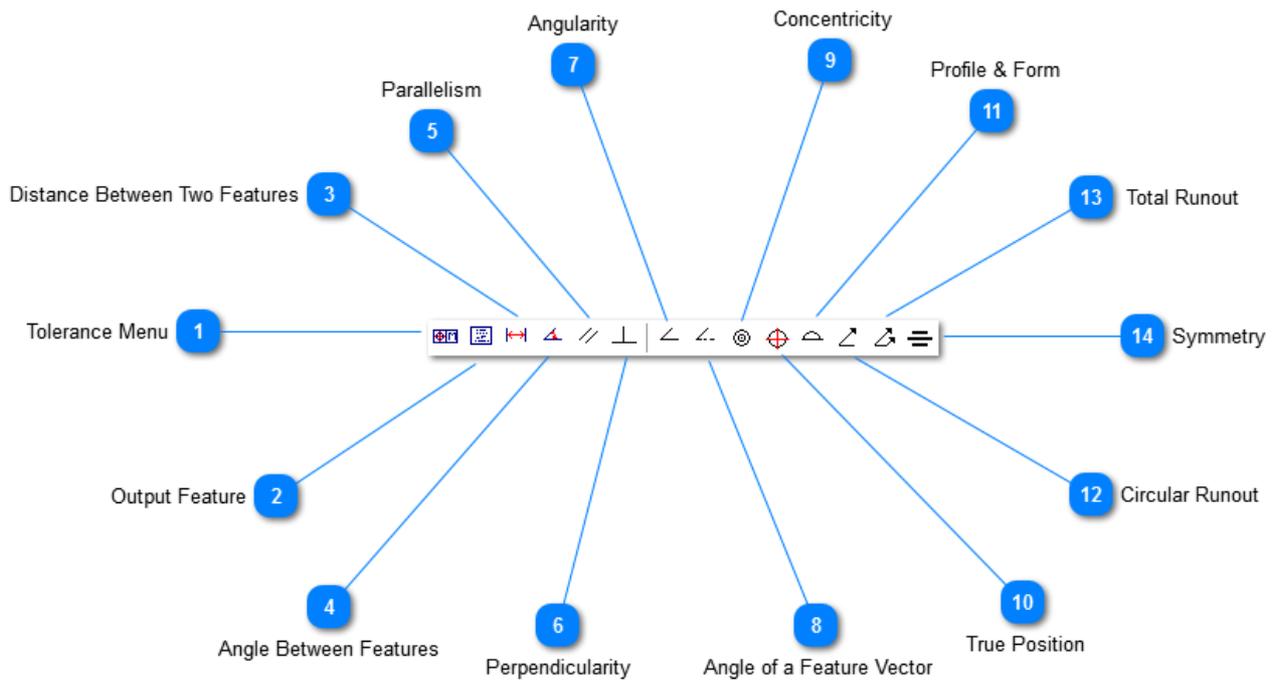
8 Auto Collision Avoidance



Turns on [Auto Collision Avoidance](#) toolbar. It is used to create alternative pathways for the sensor to go around obstacles between position points. This toolbar is dockable and can be docked where other toolbars are located on the screen. It can also remaining floating anywhere on the screen.

[Menu Toolbar](#)

GD&T Toolbar



1 Tolerance Menu



Opens [Tolerance Menu](#) dialog.

2 Output Feature



Opens **Output Feature** dialog.

3 Distance Between Two Features



Opens [Distance Between Two Features](#) dialog.

4 Angle Between Features



Opens [Angle Between Two Features](#) dialog.

5 Parallelism



Opens [Parallelism](#) dialog.

6 Perpendicularity



Opens [Perpendicularity](#) dialog.

7 Angularity

Opens [Angularity](#) dialog.

8 Angle of a Feature Vector

Opens [Angle of a Feature Vector](#) dialog.

9 Concentricity

Opens [Concentricity](#) dialog.

10 True Position

Opens [True Position](#) dialog.

11 Profile & Form

Opens [Profile & Form](#) dialog.

12 Circular Runout

Opens [Circular Runout](#) dialog.

13 Total Runout

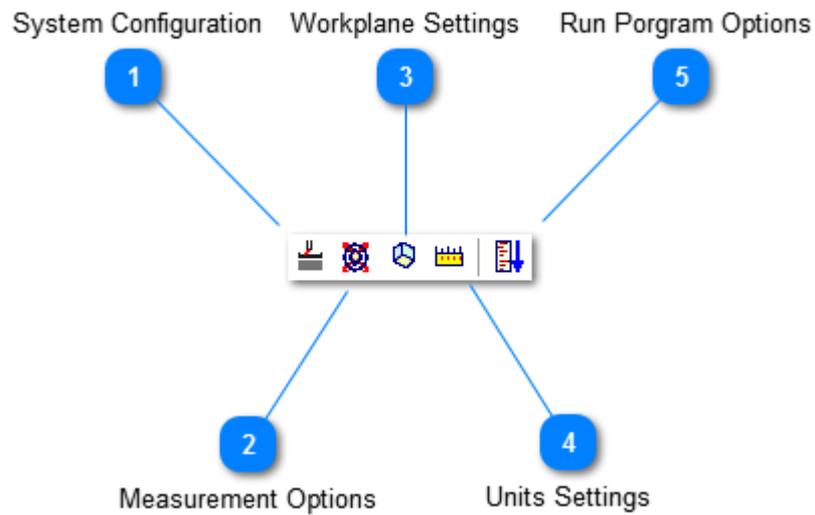
Opens [Total Runout](#) dialog.

14 Symmetry

Opens [Symmetry](#) dialog.

[Main Toolbar](#)

Options Toolbar



1 System Configuration



Opens [System Configuration](#) dialog.

2 Measurement Options



Opens [Measurement Options](#) dialog.

3 Workplane Settings

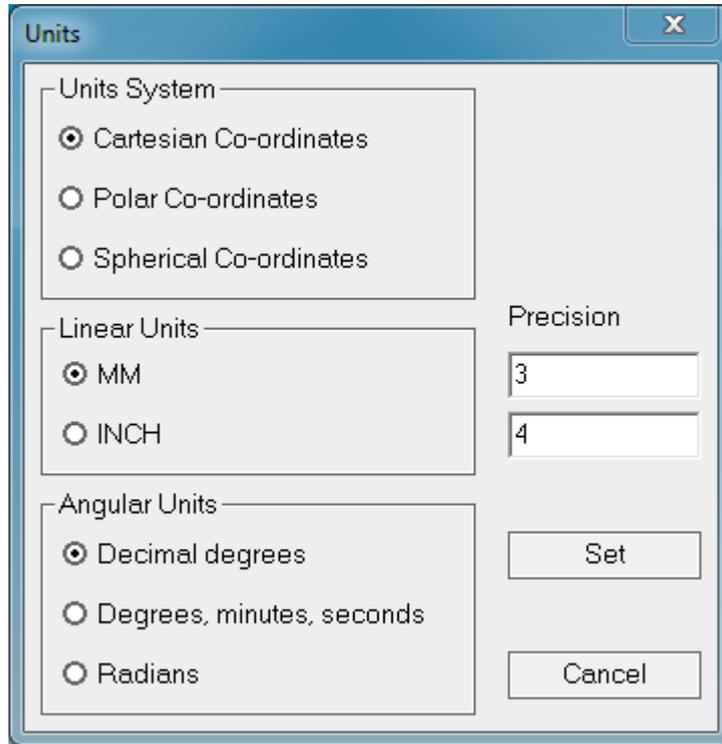


Opens [Workplane Settings](#) dialog.

4 Units Settings



Opens **Units Settings** dialog.



Unit System:	Sets units systems to use Cartesian Coordinates, Polar Coordinates or Spherical Coordinates .
Linear System:	Sets linear units to either millimeters or inches. (Decimal Places also change with selection)
Angular Units:	Sets angular units to Decimal, Degrees Minutes Seconds, or Radians .
Precision:	Used in reporting. Denotes how many places past the decimal the feature is reported. i.e. 45.5566 or 45.556 or 45.55 or 45.5
OK:	Accepts changes.
Cancel:	Cancel changes and closes the dialog.

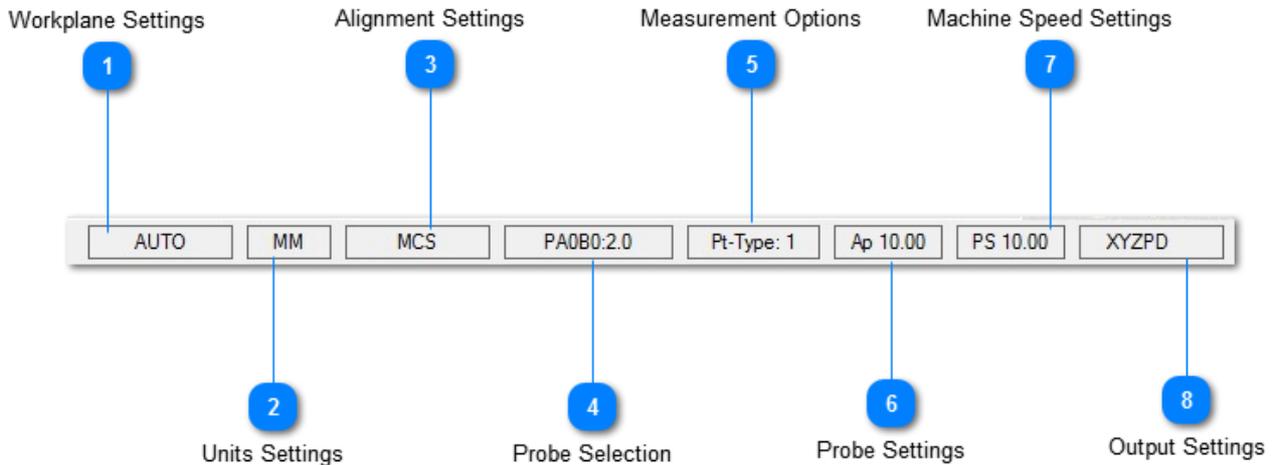
5 Run Program Options



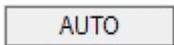
Opens [Run Program Options](#) dialog.

[Main Toolbar](#)

Status Toolbar



1 Workplane Settings



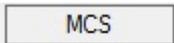
Opens [Workplane Settings](#) dialog.

2 Units Settings



Opens [Unit Settings](#) dialog.

3 Alignment Settings



Opens [Recall Alignment](#) dialog.

4 Probe Selection



Opens [Sensor Select](#) dialog.

5 Measurement Options

Opens [Measurement Options](#).

6 Probe Settings

Opens [Probe Settings](#) dialog.

7 Machine Speed Settings

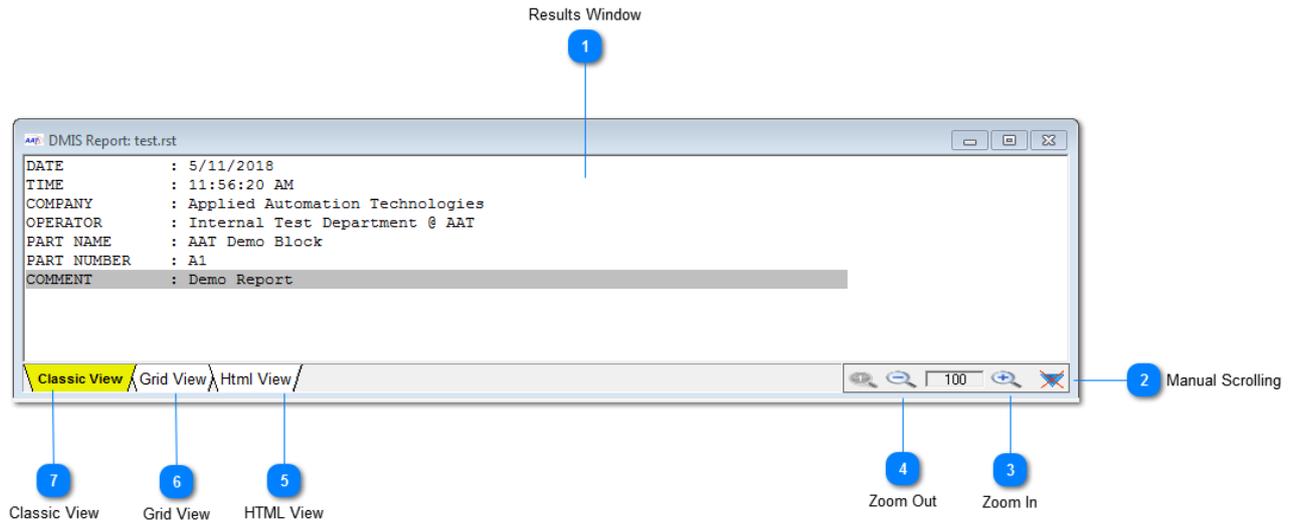
Opens [Machine Speed Settings](#) dialog.

8 Output Settings

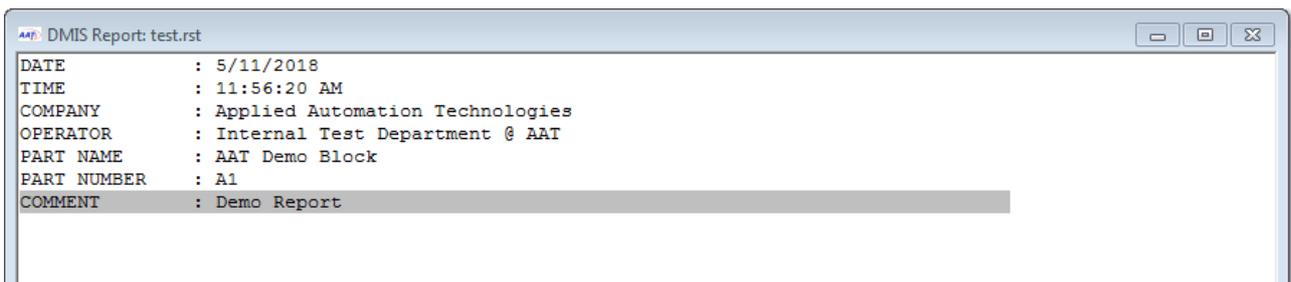
Opens [Output Settings](#) dialog.

[Main Toolbar](#)

Results Window



1 Results Window



Results Window displays the data collected for part programs as long as the **actuals, nominals, tolerance values, deviations, GD&T outputs and header & footer information** for the report.

2 Manual Scrolling



Used to turn on/off the **Manual Scrolling** function during the execution of a program. If the icon is set to off  then CAPPs will automatically scroll down during the execution, if it is on  it will let the user to scroll down manually or just observe a block of code.

3 Zoom In



Used to zoom in. Also Holding the **Ctrl** key and **scroll up** zooms out in [Results Window](#).

4 Zoom Out



Used to zoom out. Also Holding the **Ctrl** key and **scroll down** zooms out in [Results Window](#).

5 HTML View
Html View

Displays report in HTML View.

DMIS Report: test.rst

CAPPSDMIS REPORT

OUTPUT	NOMINAL	ACTUAL	-TOL	+TOL	DEV	OUT	CHART
DATE	5/11/2018						
TIME	12:06:13 PM						
COMPANY	Applied Automation Technologies						
OPERATOR	Internal Test Department @ AAT						
PART NAME	AAT Demo Block						
PART NUMBER	A1						
COMMENT	Demo Report						
1: INNER CIRCLE CR1 MCS							
X	29.504	29.504	-0.200	0.200	0.000		--- ----- ---
Y	95.496	95.496	-0.200	0.200	0.000		--- ----- ---
Z	62.500	62.500	-0.200	0.200	0.000		--- ----- ---
Diam	25.400	25.400	-0.200	0.200	0.000		--- ----- ---
Circularity		0.000		0.200			--- ----- ---
IJK	I: 0.000	J: 0.000	K: 1.000	A: 90.000	B: 90.000	C: 0.000	
2: INNER CIRCLE CR2 MCS							
X	11.543	11.543	-0.200	0.200	0.000		--- ----- ---
Y	77.536	77.536	-0.200	0.200	0.000		--- ----- ---
Z	62.500	62.500	-0.200	0.200	0.000		--- ----- ---
Diam	10.000	9.525	-0.200	0.200	-0.475	-0.275	*** ---0--- ---
Circularity		0.000		0.200			--- ----- ---
IJK	I: 0.000	J: 0.000	K: 1.000	A: 90.000	B: 90.000	C: 0.000	
3: INNER CIRCLE CR3 MCS							
X	11.543	11.543	-0.200	0.200	0.000		--- ----- ---
Y	113.457	113.457	-0.200	0.200	0.000		--- ----- ---
Z	62.500	62.500	-0.200	0.200	0.000		--- ----- ---
Diam	9.525	9.525	-0.200	0.200	0.000		--- ----- ---
Circularity		0.000		0.200			--- ----- ---
IJK	I: 0.000	J: 0.000	K: 1.000	A: 90.000	B: 90.000	C: 0.000	
4: INNER CIRCLE CR4 MCS							
X	49.000	47.464	-0.200	0.200	-1.536	-1.336	*** ---0--- ---
Y	113.500	113.457	-0.200	0.200	-0.043		--- ---0--- ---
Z	62.100	62.500	-0.200	0.200	0.400	0.200	--- ---0--- ---
Diam	9.525	9.525	-0.200	0.200	0.000		--- ----- ---
Circularity		0.000		0.200			--- ----- ---
IJK	I: 0.000	J: 0.000	K: 1.000	A: 90.000	B: 90.000	C: 0.000	
5: INNER CIRCLE CR5 MCS							
X	47.464	47.464	-0.200	0.200	0.000		--- ----- ---
Y	77.542	77.542	-0.200	0.200	0.000		--- ----- ---
Z	62.489	62.489	-0.200	0.200	0.000		--- ----- ---
Diam	9.525	9.525	-0.200	0.200	0.000		--- ----- ---
Circularity		0.000		0.200			--- ----- ---
IJK	I: 0.000	J: 0.000	K: 1.000	A: 90.000	B: 90.000	C: 0.000	
6: INNER SLOT SL6 MCS							
Output for Round Slot with length and width							
X	29.919	29.919	-0.200	0.200	0.000		--- ----- ---

Classic View | Grid View | **Html View**

6 Grid View


Displays report in **Grid View**.

DMIS Report: test.rst

Date: 5/11/2018 Operator: Internal Test Part Number: A1
 Time: 12:06:13 PM Department: AAT
 CMM Name: Part Name: AAT Demo Comment: Demo Report Block

ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
1 INNER CIRCLE CR1 [MCS]							
X	29.504	29.504	-0.200	0.200	0.000		
Y	95.496	95.496	-0.200	0.200	0.000		
Z	62.500	62.500	-0.200	0.200	0.000		
Diam	25.400	25.400	-0.200	0.200	0.000		
Circularity		0.000		0.200			
IJK	0.000	0.000	1.000	Angles	90.000	90.000	0.000
2 INNER CIRCLE CR2 [MCS]							
X	11.543	11.543	-0.200	0.200	0.000		
Y	77.536	77.536	-0.200	0.200	0.000		
Z	62.500	62.500	-0.200	0.200	0.000		
Diam	10.000	9.525	-0.200	0.200	-0.475	-0.275	
Circularity		0.000		0.200			
IJK	0.000	0.000	1.000	Angles	90.000	90.000	0.000
3 INNER CIRCLE CR3 [MCS]							
X	11.543	11.543	-0.200	0.200	0.000		
Y	113.457	113.457	-0.200	0.200	0.000		
Z	62.500	62.500	-0.200	0.200	0.000		
Diam	9.525	9.525	-0.200	0.200	0.000		
Circularity		0.000		0.200			
IJK	0.000	0.000	1.000	Angles	90.000	90.000	0.000
4 INNER CIRCLE CR4 [MCS]							
X	49.000	47.464	-0.200	0.200	-1.536	-1.336	
Y	113.500	113.457	-0.200	0.200	-0.043		
Z	62.100	62.500	-0.200	0.200	0.400	0.200	
Diam	9.525	9.525	-0.200	0.200	0.000		
Circularity		0.000		0.200			
IJK	0.000	0.000	1.000	Angles	90.000	90.000	0.000
5 INNER CIRCLE CR5 [MCS]							
X	47.464	47.464	-0.200	0.200	0.000		
Y	77.542	77.542	-0.200	0.200	0.000		
Z	62.489	62.489	-0.200	0.200	0.000		
Diam	9.525	9.525	-0.200	0.200	0.000		
Circularity		0.000		0.200			
IJK	0.000	0.000	1.000	Angles	90.000	90.000	0.000
6 INNER SLOT SL6 [MCS] Output for Round Slot with length and width							

Classic View | **Grid View** | Html View | 100

7 Classic View



Displays report in **Classic View**.

```

DMIS Report: test.rst
TIME : 12:06:13 PM
COMPANY : Applied Automation Technologies
OPERATOR : Internal Test Department @ AAT
PART NAME : AAT Demo Block
PART NUMBER : A1
COMMENT : Demo Report
-----
ELEM#  NOMINAL  ACTUAL  LOW_TOL  UPP_TOL  DEV  OUT_OF_TOL  CONTROL
-----
1: INNER CIRCLE CR1 [MCS]
X : 29.504 29.504 -0.200 0.200 0.000 ---|---*---|---
Y : 95.496 95.496 -0.200 0.200 0.000 ---|---*---|---
Z : 62.500 62.500 -0.200 0.200 0.000 ---|---*---|---
Diam: 25.400 25.400 -0.200 0.200 0.000 ---|---*---|---
Circularity : 0.000 0.200 ---|---*---|---
IJK : 0.000 0.000 1.000 Angles: 90.000 90.000 0.000

2: INNER CIRCLE CR2 [MCS]
X : 11.543 11.543 -0.200 0.200 0.000 ---|---*---|---
Y : 77.536 77.536 -0.200 0.200 0.000 ---|---*---|---
Z : 62.500 62.500 -0.200 0.200 0.000 ---|---*---|---
Diam: 10.000 9.525 -0.200 0.200 -0.475 -0.275 *---|---0---|---
Circularity : 0.000 0.200 ---|---*---|---
IJK : 0.000 0.000 1.000 Angles: 90.000 90.000 0.000

3: INNER CIRCLE CR3 [MCS]
X : 11.543 11.543 -0.200 0.200 0.000 ---|---*---|---
Y : 113.457 113.457 -0.200 0.200 0.000 ---|---*---|---
Z : 62.500 62.500 -0.200 0.200 0.000 ---|---*---|---
Diam: 9.525 9.525 -0.200 0.200 0.000 ---|---*---|---
Circularity : 0.000 0.200 ---|---*---|---
IJK : 0.000 0.000 1.000 Angles: 90.000 90.000 0.000

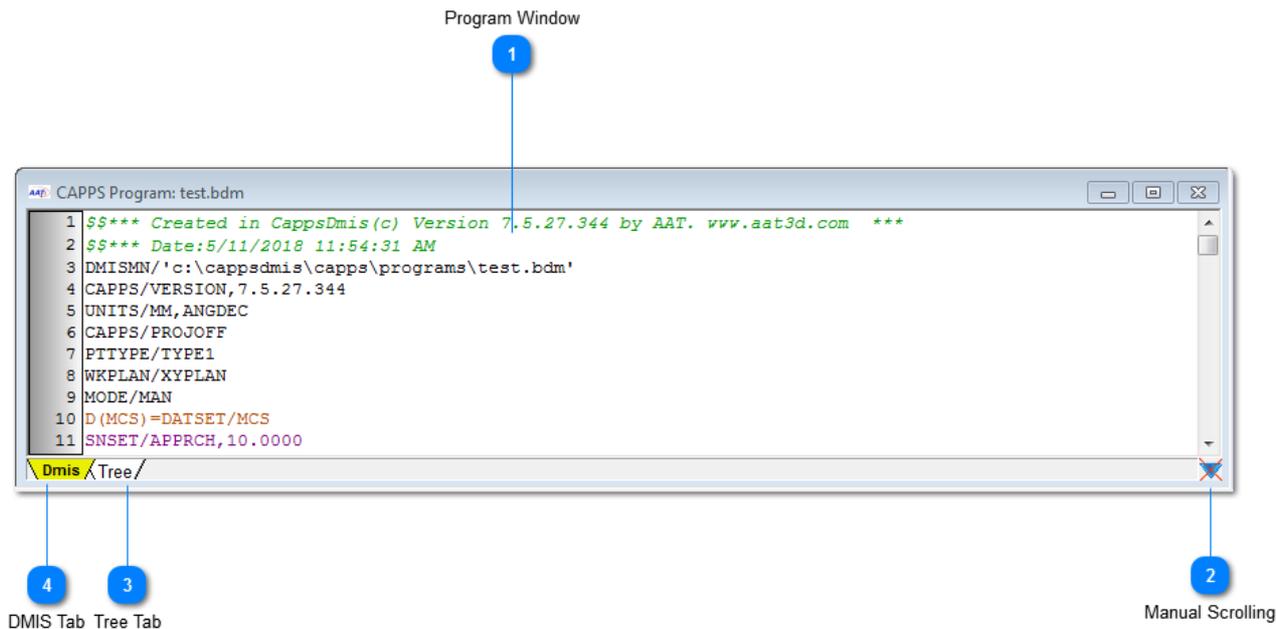
4: INNER CIRCLE CR4 [MCS]
X : 49.000 47.464 -0.200 0.200 -1.536 -1.336 *---|---0---|---
Y : 113.500 113.457 -0.200 0.200 -0.043 ---|---*0---|---
Z : 62.100 62.500 -0.200 0.200 0.400 0.200 ---|---0---|---*
Diam: 9.525 9.525 -0.200 0.200 0.000 ---|---*---|---
Circularity : 0.000 0.200 ---|---*---|---
IJK : 0.000 0.000 1.000 Angles: 90.000 90.000 0.000

5: INNER CIRCLE CR5 [MCS]
X : 47.464 47.464 -0.200 0.200 0.000 ---|---*---|---
Y : 77.542 77.542 -0.200 0.200 0.000 ---|---*---|---
Z : 62.489 62.489 -0.200 0.200 0.000 ---|---*---|---
Diam: 9.525 9.525 -0.200 0.200 0.000 ---|---*---|---
Circularity : 0.000 0.200 ---|---*---|---
IJK : 0.000 0.000 1.000 Angles: 90.000 90.000 0.000

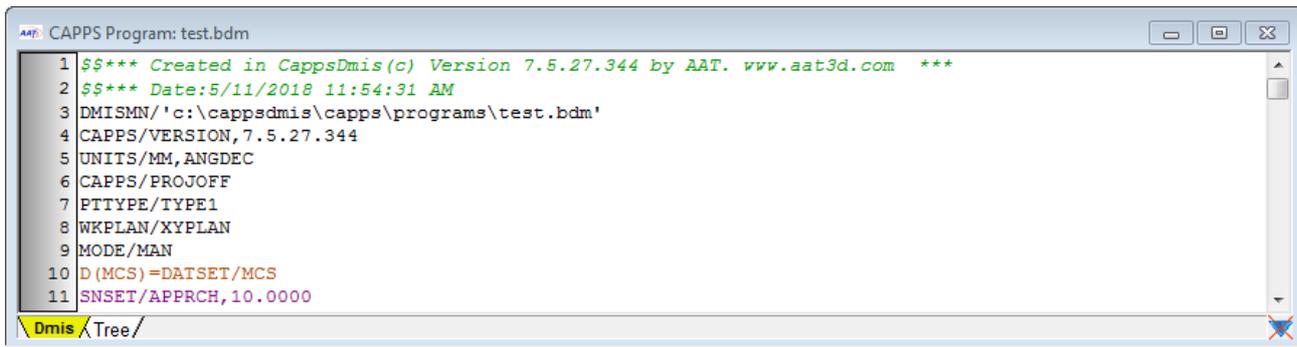
6: INNER SLOT SL6 [MCS] [Output for Round Slot with length and width]
X : 29.919 29.919 -0.200 0.200 0.000 ---|---*---|---
Y : 54.636 54.636 -0.200 0.200 0.000 ---|---*---|---
Z : 62.500 62.500 -0.200 0.200 0.000 ---|---*---|---
Length: 50.129 50.129 -0.200 0.200 0.000 ---|---*---|---
    
```

[Navigating The User Interface](#)

Program Window



1 Program Window



Program Window is used to create part programs. For most of the actions that is done using toolbars, menus etc. are written as a DMIS command in Program Window. To learn more about DMIS commands please refer to [DMIS Commands Manual](#) in [Help Section](#).

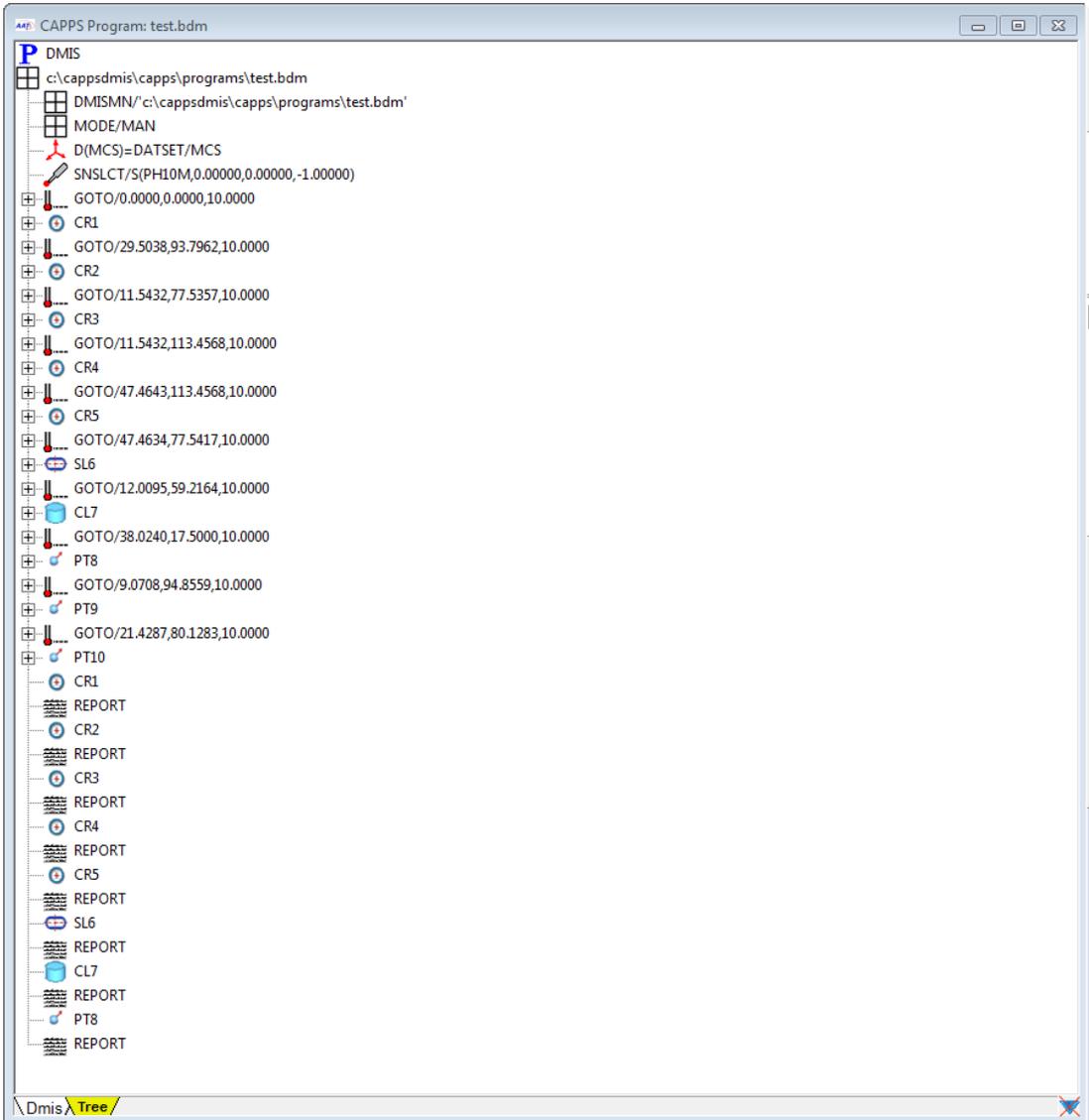
2 Manual Scrolling



Used to turn on/off the **Manual Scrolling** function during the execution of a program. If the icon is set to off  then CAPPS will automatically scroll down during the execution, if it is on  it will let the user to scroll down manually or just observe a part of the report.

3 Tree Tab

Tree Tab displays measured features in the part program.



4 DMIS Tab

DMIS

DMIS tab displays DMIS commands for the particular part program.

```

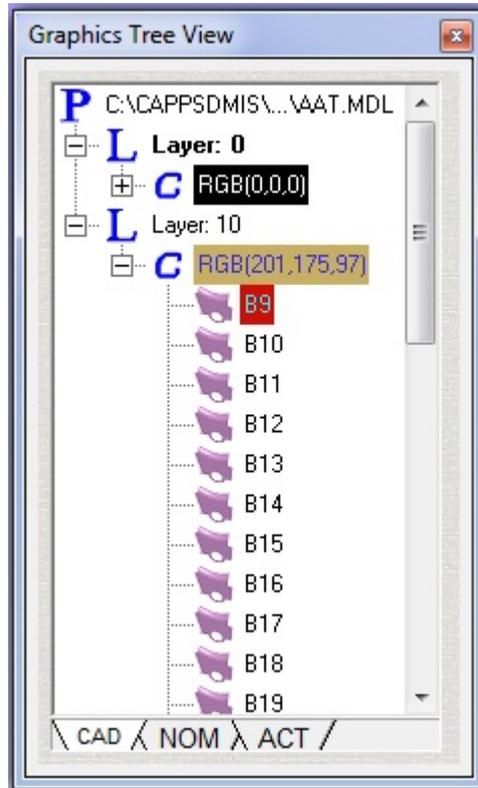
CAPPS Program: test.bdm
51 T (TD2)=TOL/DIAM, -0.2000, 0.2000
52 T (TRAD2)=TOL/RAD, -0.2000, 0.2000
53 T (TL2)=TOL/LENGTH, -0.2000, 0.2000
54 T (TW2)=TOL/WIDTH, -0.2000, 0.2000, SHORT
55 T (TAN)=TOL/ANGL, 0.000, 0.000
56 T (FLAT2)=TOL/FLAT, 0.2000
57 T (LSTRGHT2)=TOL/STRGHT, 0.2000
58 T (LCYLCY2)=TOL/CYLCY, 0.2000
59 T (LCIRLTY2)=TOL/CIRLTY, 0.2000
60 T (LSPHCTY2)=TOL/SPHCTY, 0.2000
61 $$DATE: 5/11/2018
62 $$TIME: 11:56:20 AM
63 CO(1)=COMPNY/'Applied Automation Technologies'
64 OP(1)=OPERID/'Internal Test Department @ AAT'
65 PN(1)=PARTID/'AAT Demo Block'
66 PS(1)=PARTSN/'A1'
67 CM(1)=COMMNT/'Demo Report'
68 R(1)=REPORT/DATE, TIME, CO(1), OP(1), PN(1), PS(1), CM(1)
69 OUTPUT/R(1)
70 $$SELECT PROBE PH10M AT A=0.0, B=0.0
71 SNSLCT/SA (PH10M), 0.00000, 0.00000, -1.00000
72 GOTO/0.0000, 0.0000, 10.0000
73 GOTO/31.2037, 95.4962, 10.0000
74 F (CR1)=FEAT/CIRCLE, INNER, CART, 29.5038, 95.4962, 62.5000, -0.0000, -0.0000, 1.0000, 25.4000
75 MEAS/CIRCLE, F (CR1), 4
76 PTMEAS/CART, 42.2037, 95.4962, 60.5000, -1.0000, 0.0000, -0.0000
77 PTMEAS/CART, 29.5038, 108.1962, 60.5000, -0.0000, -1.0000, -0.0000
78 PTMEAS/CART, 16.8038, 95.4962, 60.5000, 1.0000, -0.0000, 0.0000
79 PTMEAS/CART, 29.5038, 82.7962, 60.5000, 0.0000, 1.0000, 0.0000
80 ENDMES
81 GOTO/29.5038, 93.7962, 10.0000
82 GOTO/11.5432, 77.5357, 10.0000
83 OUTPUT/FA (CR1), TA (TX2), TA (TY2), TA (TZ2), TA (TD2), TA (LCIRLTY2)
84 F (CR2)=FEAT/CIRCLE, INNER, CART, 11.5432, 77.5357, 62.5000, 0.0000, 0.0000, 1.0000, 9.5250
85 MEAS/CIRCLE, F (CR2), 4
86 SNSSET/APPRCH, 3.7625
87 SNSSET/RETRCT, 3.7625
88 PTMEAS/CART, 16.3057, 77.5357, 60.5000, -1.0000, -0.0000, 0.0000
89 PTMEAS/CART, 11.5432, 82.2982, 60.5000, -0.0000, -1.0000, 0.0000
90 PTMEAS/CART, 6.7807, 77.5357, 60.5000, 1.0000, -0.0000, -0.0000
91 PTMEAS/CART, 11.5432, 72.7732, 60.5000, 0.0000, 1.0000, -0.0000
92 SNSSET/APPRCH, 10.0000
93 SNSSET/RETRCT, 10.0000
94 ENDMES
95 GOTO/11.5432, 77.5357, 10.0000
96 GOTO/11.5432, 113.4568, 10.0000
97 F (CR3)=FEAT/CIRCLE, INNER, CART, 11.5432, 113.4568, 62.5000, -0.0000, -0.0000, 1.0000, 9.5250
98 MEAS/CIRCLE, F (CR3), 4
99 SNSSET/APPRCH, 3.7625
100 SNSSET/RETRCT, 3.7625
101 PTMEAS/CART, 16.3057, 113.4568, 60.5000, -1.0000, 0.0000, -0.0000
102 PTMEAS/CART, 11.5432, 118.2193, 60.5000, -0.0000, -1.0000, -0.0000
103 PTMEAS/CART, 6.7807, 113.4568, 60.5000, 1.0000, -0.0000, 0.0000
104 PTMEAS/CART, 11.5432, 108.6943, 60.5000, 0.0000, 1.0000, 0.0000

```

[Navigating The User Interface](#)

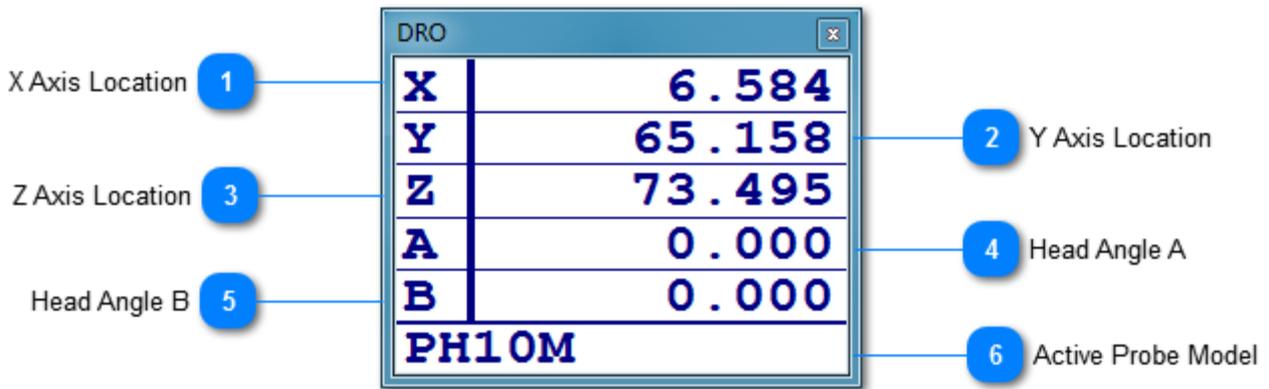
Treewiew Window

The CAD Tree view allows certain entities or levels of CAD to be viewed and/or displayed. The CAD tree works on three levels, by CAD, Nominal, or Actual. For more information about **Treewiew Window** please refer to [Basic CAD Operations](#) section.



[Navigating The User Interface](#)

Digital Read Out (DRO)



1 X Axis Location

X | **6.584**

Displays the **X Axis Location** of the probe tip.

2 Y Axis Location

Y | **65.158**

Displays the **Y Axis Location** of the probe tip.

3 Z Axis Location

Z | **73.495**

Displays the **Z Axis Location** of the probe tip.

4 Head Angle A

A | **0.000**

Displays the **A Head Angle** of the probe head.

5 Head Angle B

B | **0.000**

Displays the **B Head Angle** of the probe head.

6 Active Probe Model

PH10M

Displays the active **Probe Model**.

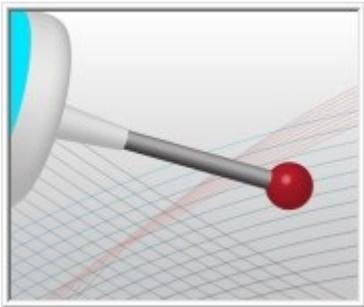
[Navigating The User Interface](#)

Quick Menu

The **Quick Menu** is a shortcut menu used to access various functions in the software without the need to follow menu paths. Traditionally with CAPPS, when the software was started, it necessary to open a program from the [File Menu](#). Now, opening a program has the option of using the icon based **Quick Menu**. The **Quick Menu** also has many other functions for accessing data, defining and calibrating a probe, and so on. The **Quick Menu** may also be accessed during teach mode, although some functions will not be accessible to the user.



1 Probes



Allows the user to define a probe length. For more information on defining probes, please see the section on [Probe Calibrations](#).

2 Execute Programs



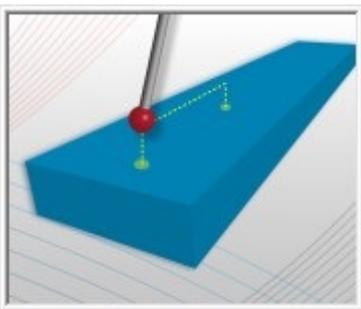
Allows the user to run a program in different modes. For more information on running programs, please see the section on [Running Programs](#).

3 Open Program



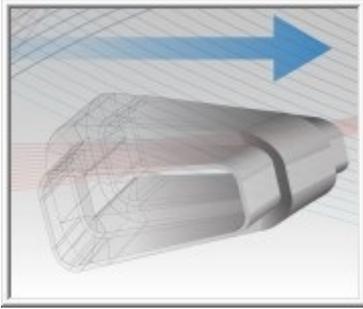
Allows the user to open a new program or append an already established program. For more information on opening/creating programs, please see the section below on [Getting Started With a Part Program](#).

4 Quick Measure



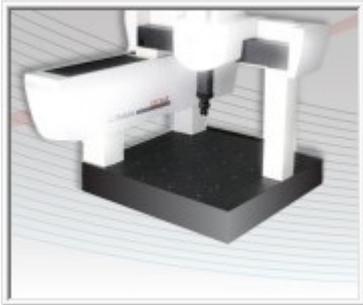
This option will create a default program called **'test'** which may be used over and over again. A good use for this option may be that a user wants to define a separate program in which to perform a certain function all the time and does not care whether or not the program is overwritten.

5 Import CAD



Used to import different CAD formats into CAPPS DMIS.

6 Machine



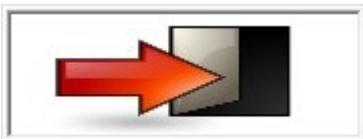
Contains options for Startup (those machines having to load startup files), choose an interface, home the CMM, connect to a machine, and stop communication with a machine.

7 Close Quick Menu



Closes **Quick Menu**.

8 Exit

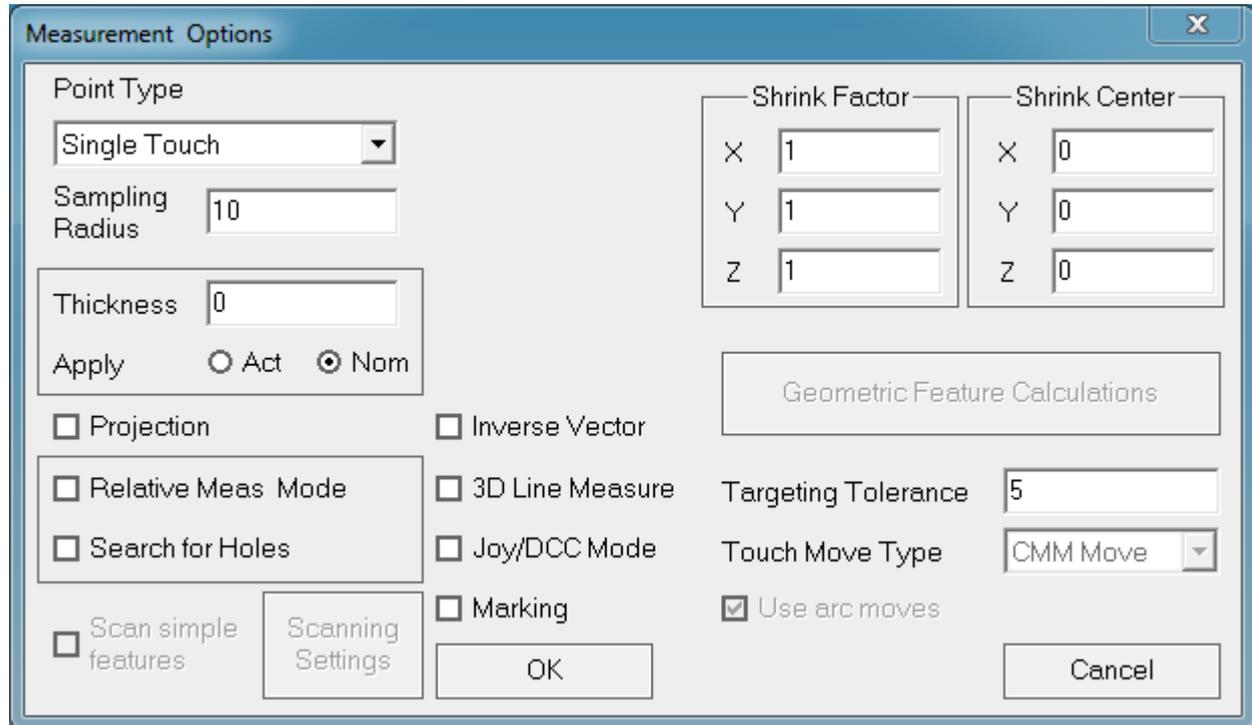


Turns off CAPPS.

[Navigating The User Interface](#)

Utilizing The Measurement Options

Measurement Options have long been used in the CAPPS DMIS software. These options are more or less used for many of the global configurations of CAPPS DMIS. Following is a brief description of each of the options.



Point Types:	The presentation for Point Types have been drastically shortened from previous versions of CAPPS. However, they have not been forgotten. If it is needful to see the point types presented in the way in which they were in previous versions, it may be handled at the capps.ini level using the Display Old Options parameter. Otherwise, the single and multiple touch option will only be the only options available.
Sampling Radius:	Used in conjunction with the multiple touch point type setting or auto plane measurements when not teaching from the CAD. Value is unit specific.
Thickness:	Used to create a virtual part thickness. One way this option is useful is checking net pads on a part fixture while only the opposite side of the CAD for the part is available. Thickness may be applied to either the Actual or the Nominal.
Inverse Vector:	This is an on/off flag. With this feature on, all point features created from CAD will have vectors automatically inverted. This is useful in the case of a supplied CAD file with reversed surface normals.
Relative Measure:	This is an on/off flag. With this feature on, all hole features will be measured using the vector build method. This means that the depth of the hole will always be consistent with the location of the current surface. This flag is a global setting.
Search for Holes:	This is an on/off flag. With this feature on, the CMM will first search for the hole to verify its presence in the part. Once the hole is found, the CMM will proceed to measure the hole. This option may be used in conjunction with relative measure. This flag is a global setting.
Projection On/Off:	This is a global setting which will project all point features onto the current workplane.

3-D Line Measure:	Will allow the measurement and calculation of 3D lines without having to select a workplane.
Joy/DCC Mode:	This allows a DCC machine to be configured much like a manual CMM when using Measure-CAD Mode . This would also work well to measure holes that are extremely out of location where the search function will not work.
Marking:	Used for the layout of trim lines. This is an on/off option. The CMM will not measure points, but simply position itself close to the desired point allowing the user to manually mark the touch point.
Targeting Tolerance	Used for Manual CMMs to create a targeting tolerance zone for a point measurement. If the point measured is within that zone in respect to its nominal definition, then the measurement is taken if not the user should take the point until the point measured falls into the targeting tolerance zone around the nominal point. The value reflects the current UNITS selected in CappsDmis. e.g. 5MM or 5INCH depends on the units, as shown in the dialog above.
User Arc Moves	Enables arc moves between point measurements instead of linear moves.

[Navigating The User Interface](#)

Graphical Manipulation

Graphical Manipulation Using Mouse Commands

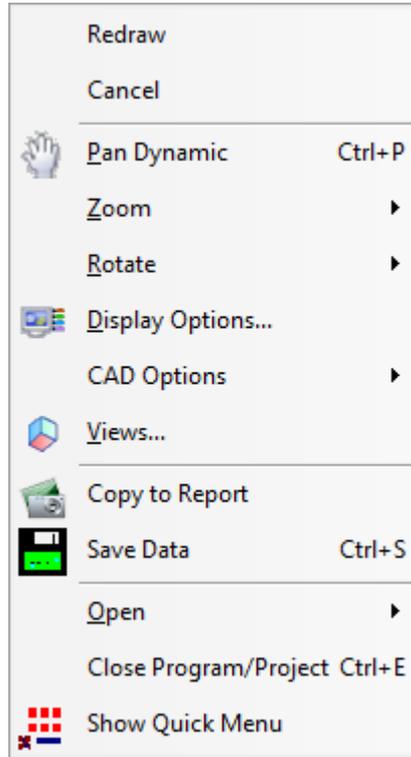


<CTRL> + <LEFT MOUSE CLICK>	Pan Dynamic
<CTRL> + <RIGHT MOUSE CLICK>	Zoom Dynamic
<SHIFT> + <RIGHT MOUSE CLICK>	Rotate about the screen
<SHIFT> + <LEFT MOUSE CLICK>	3D Rotation

Graphical Manipulation Using Keyboard Shortcuts

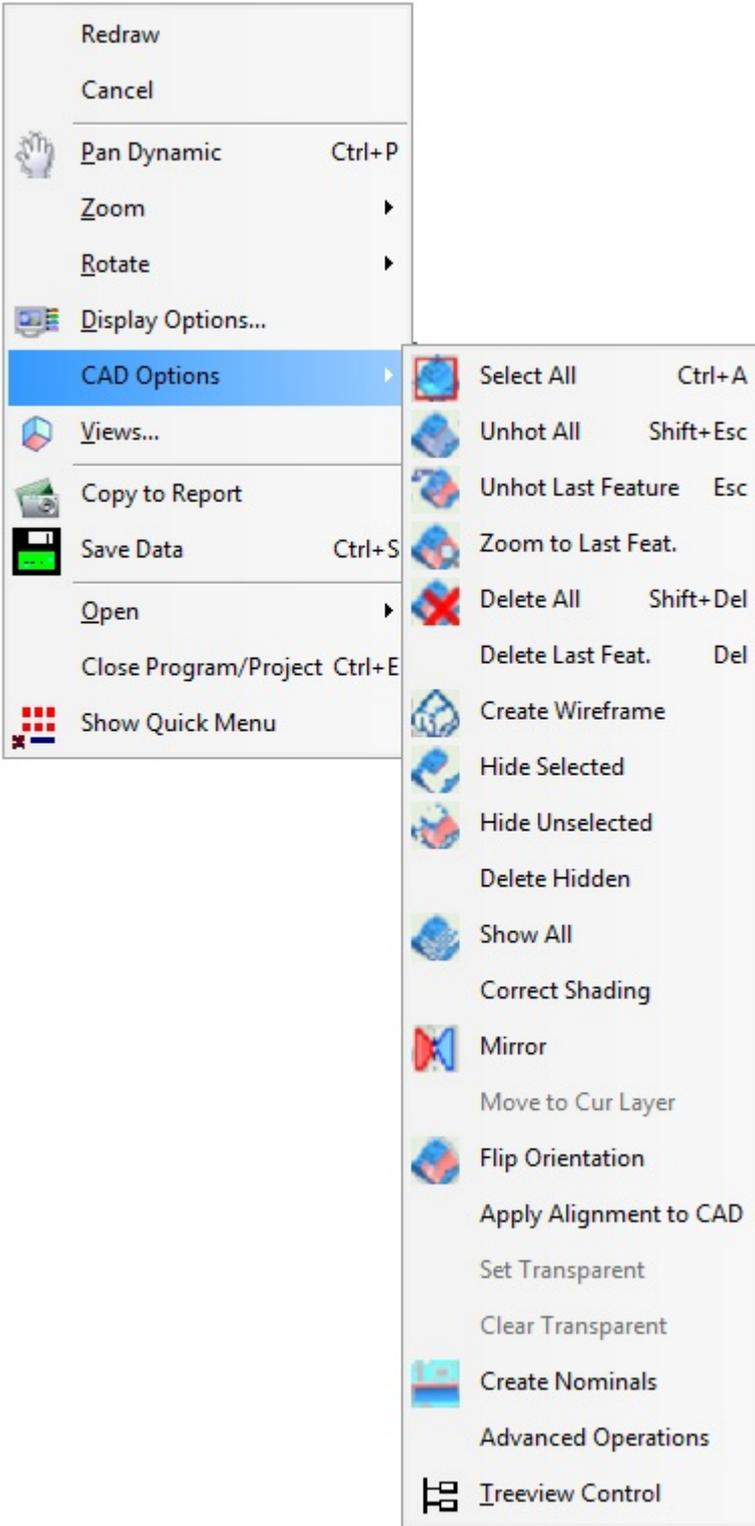


<CTRL> + <Z>	Zoom Dynamic
<SHIFT> + <S>	Shade the CAD model
<SHIFT> + <U>	Display the UV lines in the CAD model
<SHIFT> + <O>	Display the outline of the CAD model
<ALT> + <Z>	Fit Graphics
<ALT> + <A>	Show all CAD Data
<ALT> + <S>	Show all surface CAD Data
<ALT> + <W>	Show all wire frame CAD Data
<CTRL> + <A>	Select all CAD entities
<SHIFT> + <ESC>	Unselect all CAD entities



Each active window in CAPPs DMIS has a right click menu option available. Here we will discuss the right click options in the [Graphics Window](#).

Redraw:	Refreshes the Graphics Window .
Cancel:	Clears a mouse mode (Pan, Rotate, or Zoom).
Pan Dynamic:	Used to Pan the Graphics Window .
Zoom:	Contains the Zoom options also accessible from the Graphics Toolbar .
Rotate:	Contains the Rotate options also accessible from the Graphics Toolbar .
Display Options:	Contains the Display options also accessible from the Graphics Toolbar .



CAD Options: Contains all functions available in the CAD Options Toolbar, as well as, some other options

Select All:	Click to select all CAD Entities.
Unhot All:	Click to Unselect all selected CAD entities.
Unhot Last Feature:	Click to Unselect the last CAD entity selected.
Zoom To Last Feature:	Click to zoom to the last feature selected.
Delete All:	Click to delete all of the selected entities.

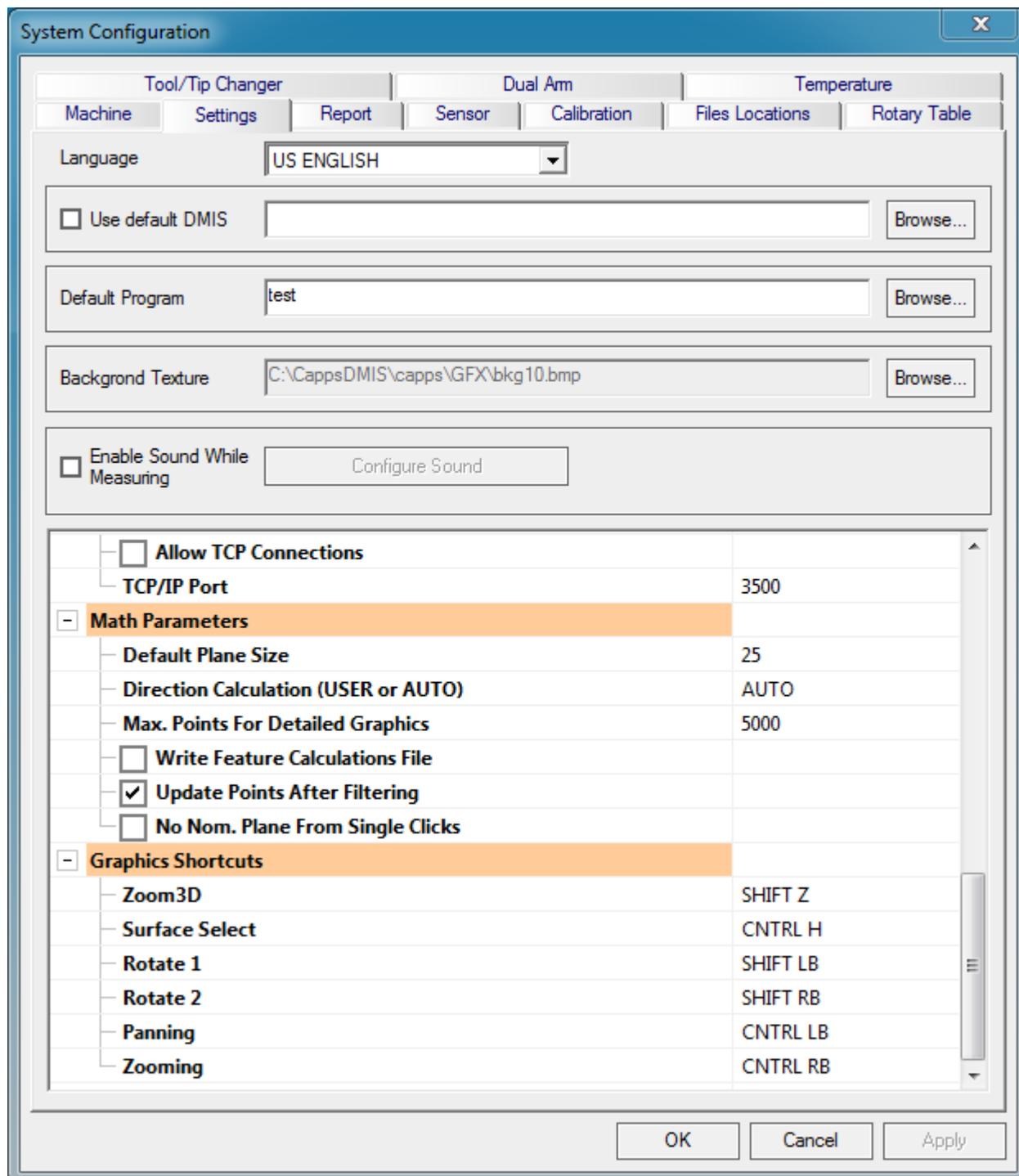
Delete Last Feat:	Click to delete the last selected entity.
Create Wireframe:	Click to create wire frame from selected surface CAD entities.
Hide Selected:	Click to Hide the selected CAD entities.
Hide Un Selected	Click to Hide the unselected CAD entities.
Delete Hidden:	Click to delete all hidden files.
Show All:	Click to show all hidden CAD entities.
Correct Shading:	Click to correct any incorrectly shaded CAD entities.
Mirror:	Click to mirror CAD entities.
Move to Cur Layer:	Click to move selected CAD entities to selected layer.
Flip Orientation:	Click to flip the orientation of selected CAD entities.
Apply Alignment:	Click to move the coordinate system of a CAD part.
Set Transparency:	Click to set transparency of selected surfaces.
Clear Transparency:	Click to reset surfaces.
Create Nominals:	Click to create nominals on wire frame CAD file.
Advanced Operations:	Click to open Advanced CAD Operations .
Treeview Control:	Click to open CAD / ACT / NOM Treeview .

Views:	Contains the View options also accessible from the Graphics Toolbar .
Copy to Report:	Click to insert a screen capture of the Graphics Window into the report.
Save Data:	Click to save all binary data.
Open:	Click to open internal file types.
Close Program/Project:	Click to close program.

[Navigating The User Interface](#)

Customizing Graphics Shortcut Keys

CAPPS DMIS allows the user to have some control over keyboard shortcuts for certain graphical functions. These configurations are found in the [System Configurations - Settings Menu](#).



The keywords must be as follows:

CNTRL:	Used to assign the Control key
SHIFT:	Used to assign the Shift key
LB:	Used to assign the Left button of the mouse

RB:	Used to assign the Right button of the mouse
------------	---

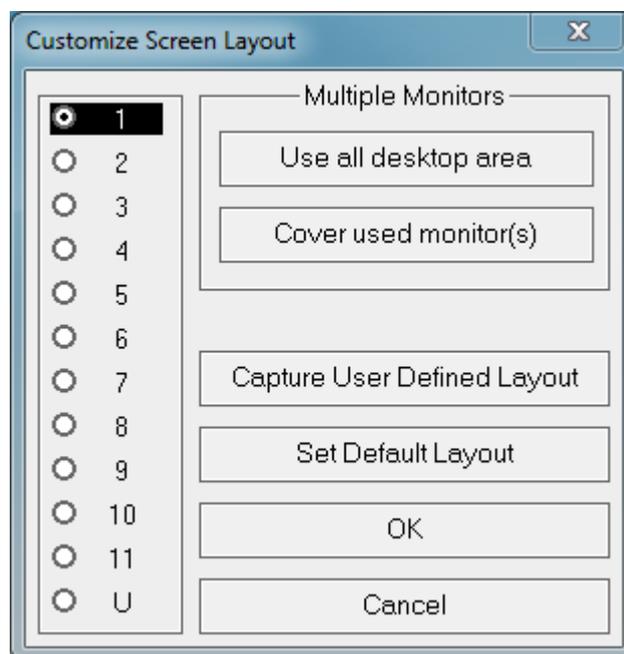
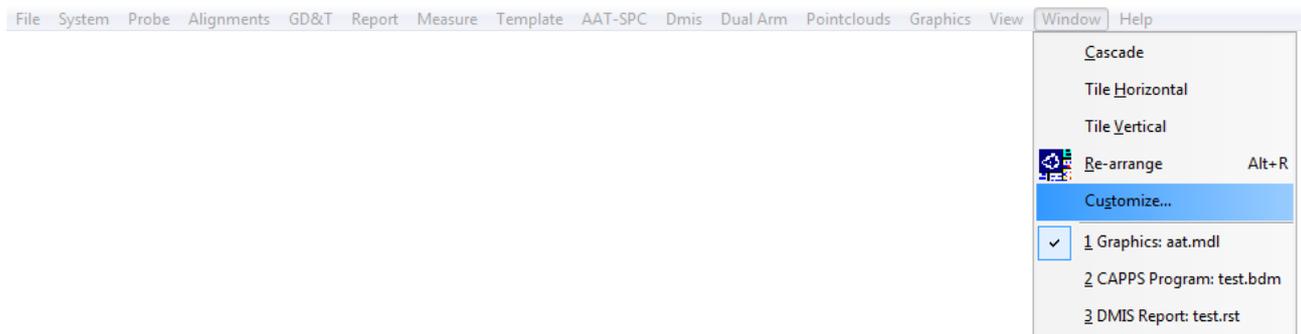
Important Notes:

- **Alpha Numeric** characters must be **capitalized** and must be 0-9 or A-Z.
- A space must be used in the assignment convention. For instance, **SHIFT S**, not **SHIFTS**.
- These parameters may also be accessed through the **capps.ini** file.

[Graphical Manipulation](#)

Customizing The User Interface

CAPPS DMIS gives the options of customizing the user interface. There are 11 default window options and one user specific option available.



Each one of the radial button options may be used to set the CAPPS DMIS screen default layout.

Multiple Monitors: Following options will be highlighted when the user has more than one monitor

Use all desktop area: Capps will use all the connected monitors

Cover used monitor(s): This option will fill the monitor(s) that Capps is present

Capture User Defined Layout: Arrange the CAPPS DMIS operating windows in any fashion desired and then click on the **Capture User Defined Layout** button. The user defined layout may also then be used as the default layout.

Set Default Layout: Simply select 1 of the 11 default options or User Defined Layout and then click on the **Set Default Layout** button. After clicking the **OK** button this will be the standard default layout every time when entering the software.

[Navigating The User Interface](#)

Getting Started With a Part Program

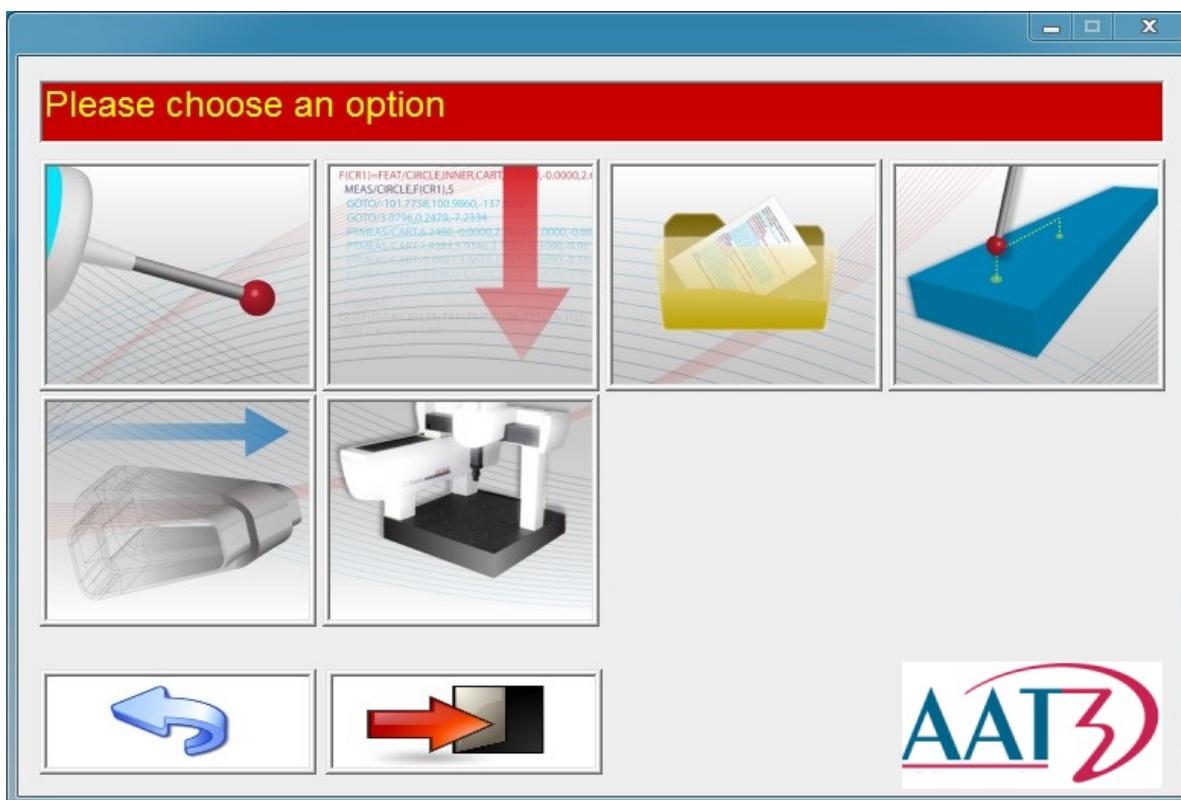
Part inspection can be very subjective. Understanding the requirements necessary and what tools are needed is a learning process. Here are some questions to help plan the part inspection and eliminate unneeded obstacles. Visualizing the entire inspection process will help you to see what is needed to have to obtain a successful part inspection.

- What kind of output does the customer want to see? This can mean types of reports, pictures, hit maps that need to come as a result of my inspection.
- What is going to dictate the inspection? For example, do I have a part print, CAD model, hand sketch etc?
- If there is a part print, are the datums being defined properly? Is this part drawn as it is being used in the manufacturing or assembly process? The same question applies if CAD data is being supplied instead of a part print.
- In determining what features need to be inspected, it is possible to decide what probe styli and length of probe need to be calibrated. It may also be required that more than one stylus be used during an inspection.

Opening/Creating a Part Program

To begin working with CAPPS DMIS, locate the CAPPS DMIS Icon on the Windows desktop or click the CAPPS DMIS option in the **Start** menu. (Windows Vista shown for start menu option, other versions of Windows will vary slightly)

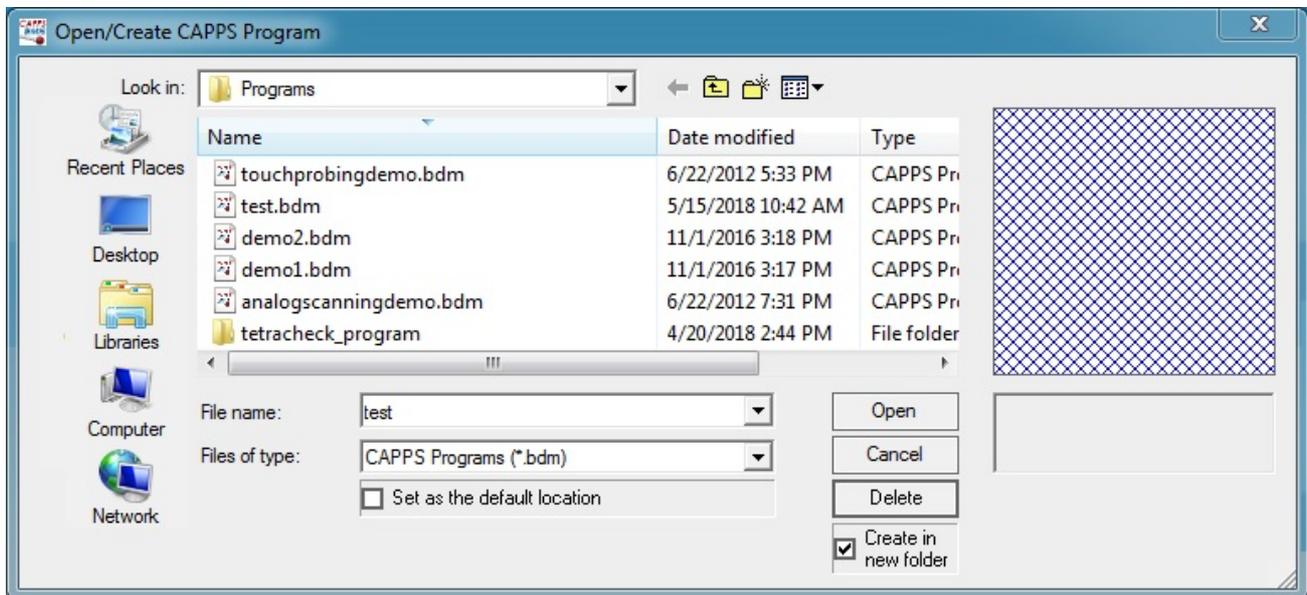
After the initial startup, you will see the CAPPS DMIS **Quick Measure** menu as discussed earlier. Click on the **Open Programs** option as shown below.



After clicking on the **Open Programs** option you will see another similar window appear with an icon based system that will show all of the available programs on the system.



At this point, the user can pick the icon for the specified program to open. To create a new program, click on the **Open Programs** icon and you will see a standard windows dialog box from which to choose a program name. If you are creating a new program, then you will type the name of the program as with any other standard windows program.



Set as the Default Location: This will allow the default location to be wherever the current directory is set when clicking on **Open**.

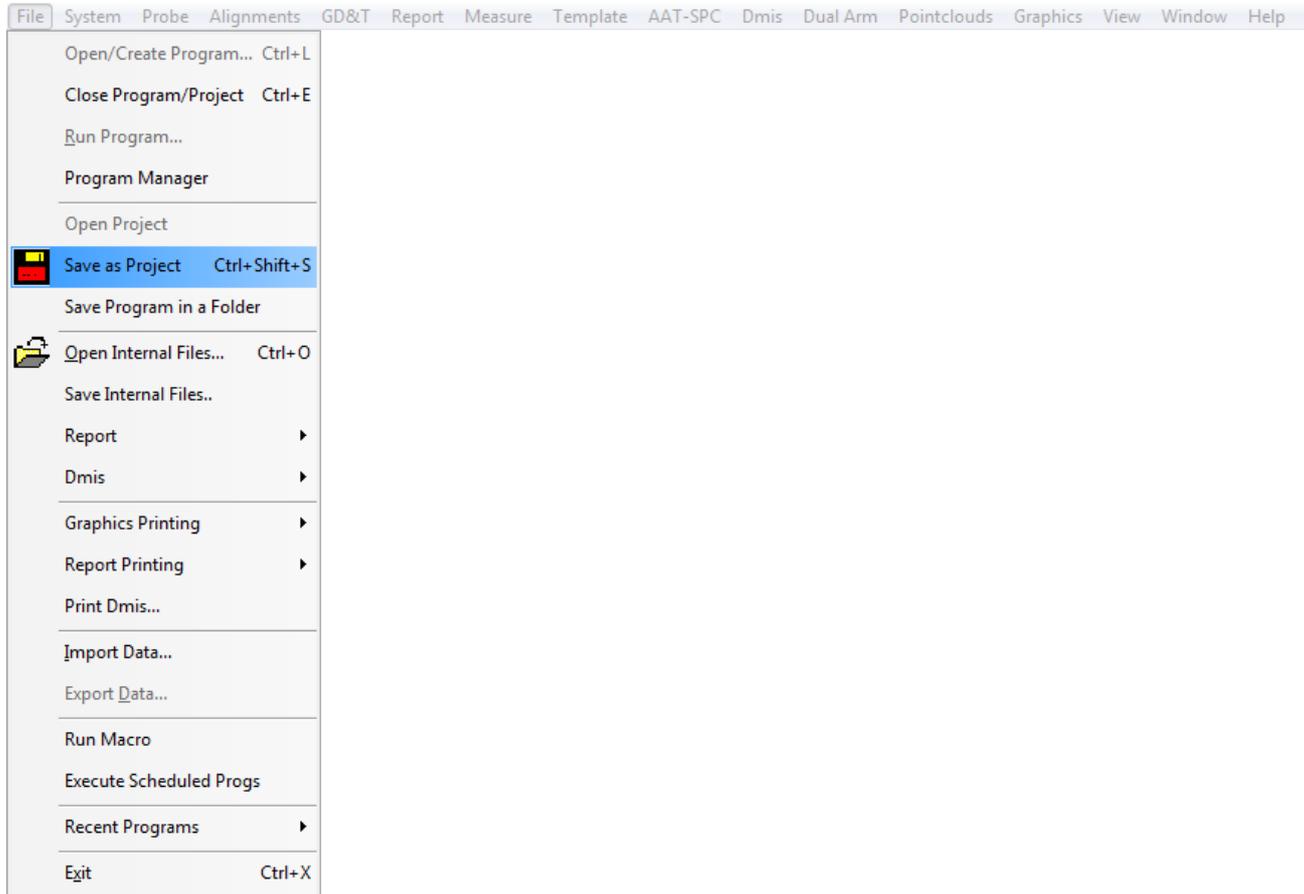
Create in New Folder: If this option is checked when the **Open** button is clicked, then all of the associated program files will be stored in one place. However, the shared files will be stored in their respective locations.

[Navigating The User Interface](#)

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Working With Project Files

Project Files are useful when transferring programs from one CMM to another. They are also useful if it is needful to keep all associated files for the program in one place. This is slightly different than simply creating a program in a new folder because all necessary files are grouped together. Once a part program is learned, and all the necessary features are checked, it is possible to save your program as a project.



Important Note: When wanting to work with an already saved project file, it is important to use the [Open Project](#) option. Do not simply select [Open/Create Program](#).

[Getting Started With a Part Program](#)

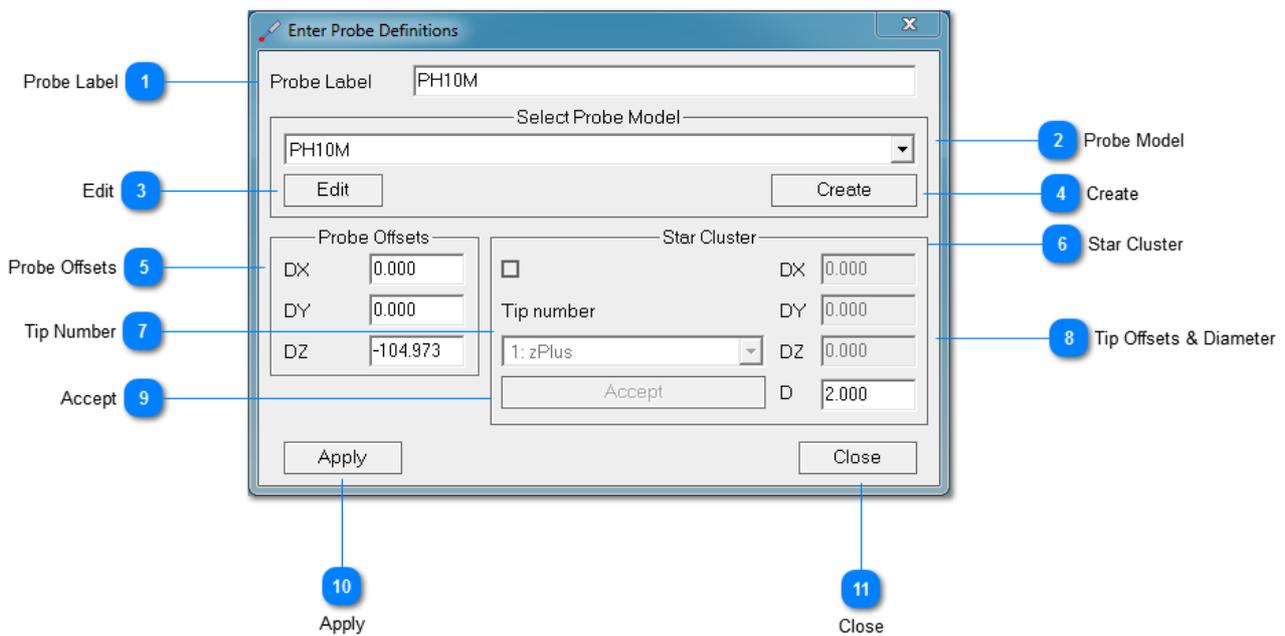
Probe Calibrations

Probe Define

Defining the probe length is the first step in the process of calibration. Once the CMM knows the length of the probe build up, it will be able to perform other functions such as calibration, and measurement of features. Different probe length and styli configurations may be necessary because of the complexity of the part or simply because parts will vary in shape and size, so users may find it necessary to change probe buildups on a regular basis. There are 3 ways to tell the CMM the length of the probe buildup.

Manually Entering Probe Length

If the probe length is known, it may be entered in the dialog box shown below after clicking on [Probe Menu - Define - Probe Offsets](#).



1 Probe Label

Probe Label PH10M

Indicates the probe label that is used to define the probe model.

2 Probe Model

Select Probe Model
PH10M

Indicates the probe model. Probe models are created by using the [Probe Builder](#) dialog and saved as a text document. Created probe models can be selected from the drop down menu and used with different label names.

3 Edit

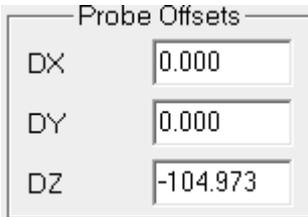
Edit

Used to edit the text document of the probe model.

Important Note: Editing the text document and saving the changes will overwrite the probe model.

4 Create

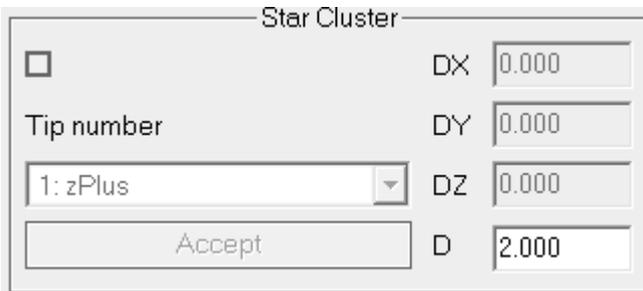

Used to create a probe model using the [Probe Builder](#).

5 Probe Offsets


Probe Offsets

DX	0.000
DY	0.000
DZ	-104.973

Used to enter probe offsets for probe models. If the user is using the [Probe Builder](#), the offsets will automatically added, but if the user is manually defining a probe the offsets must enter by hand.

6 Star Cluster


Star Cluster

Tip number

1: zPlus

Accept

DX	0.000
DY	0.000
DZ	0.000
D	2.000

Used to define different tips on a [Star Probe](#).

7 Tip Number


Tip number

1: zPlus

Used to select different tips of a [Star Probe](#).

8 Tip Offsets & Diameter


DX	0.000
DY	0.000
DZ	0.000
D	2.000

Used to enter offset values and diameters for different tips on a [Star Probe](#).

9 Accept


Applies the changes to the selected tip.

10 Apply

Applies changes to the probe model.

11 Close

Closes the [Probe Define](#) dialog.

[Table of Contents](#)

Using The Probe Builder

The CAPPS DMIS probe builder is a utility that allows the definition of a probe to be done by choosing from a list of graphical components. The probe model file that is created will have a **(.txt)** extension and will be stored by default in the

Capps6(or CappsDmis)/Files/Calfile folder. This file will contain the elements that essentially draw the probe on the **Graphics Window**. However, the sensor file that is created when you calibrate a probe will have a **(.sns)** extension. The **(.sns)** file is binary and only readable by CAPPS. The **(.sns)** file will contain angle information, and it will also reference the model file. Notice the sensor list below:

Label	A	B	Diam	Form	X	Y	Z	Date	Model
PH10M	0.00	0.00	2.000	0.000	-0.000	-0.000	-104.973		PH10M
REVO	0.00	0.00	3.000	0.000	0.000	-0.000	-260.000	May 15,11:13:47	revo
PH10M_SF	0.00	0.00	2.000	0.000	0.000	-0.000	-137.223	May 15,11:13:16	PH10M
T1A0B0	0.00	0.00	3.000	0.000	0.000	-0.000	-260.000	May 15,11:13:27	revo
TEMP	0.00	0.00	2.000	0.000	-5.700	-0.000	-92.025	May 15,11:14:01	RTP20

1 Probe Label

TEMP

Probe Label must be unique if changing probe models with the same sensor file.

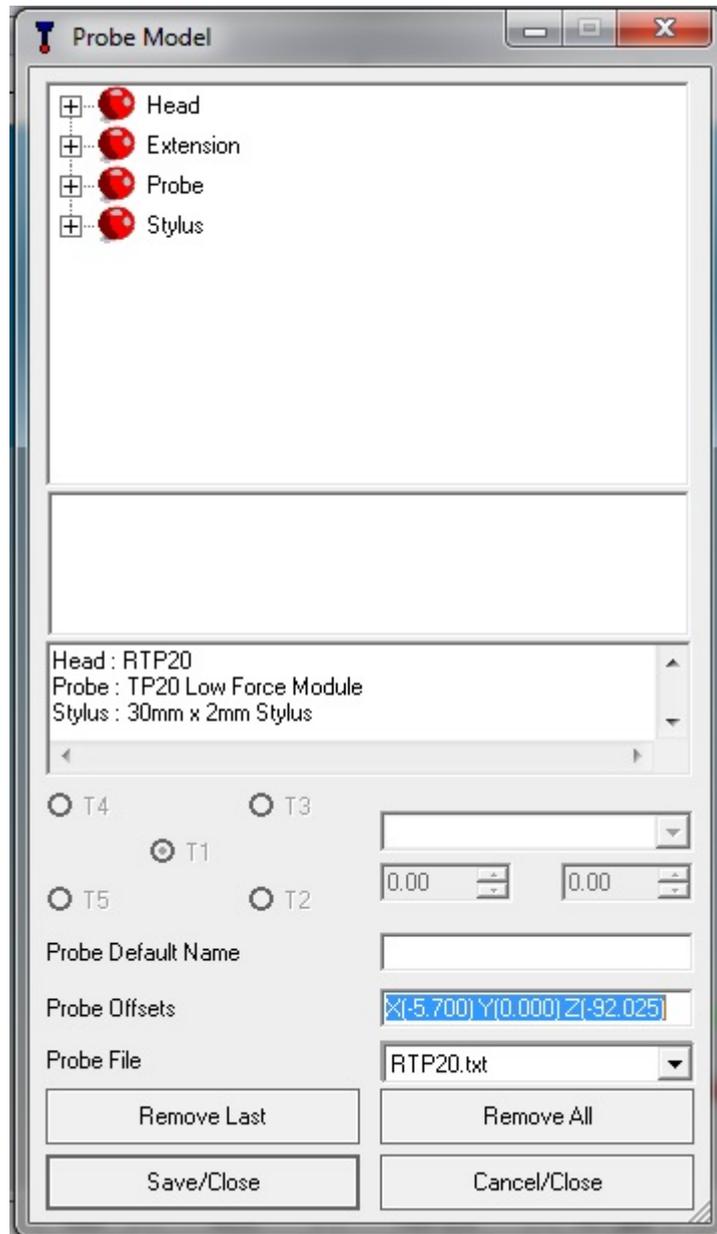
2 Probe Model

RTP20

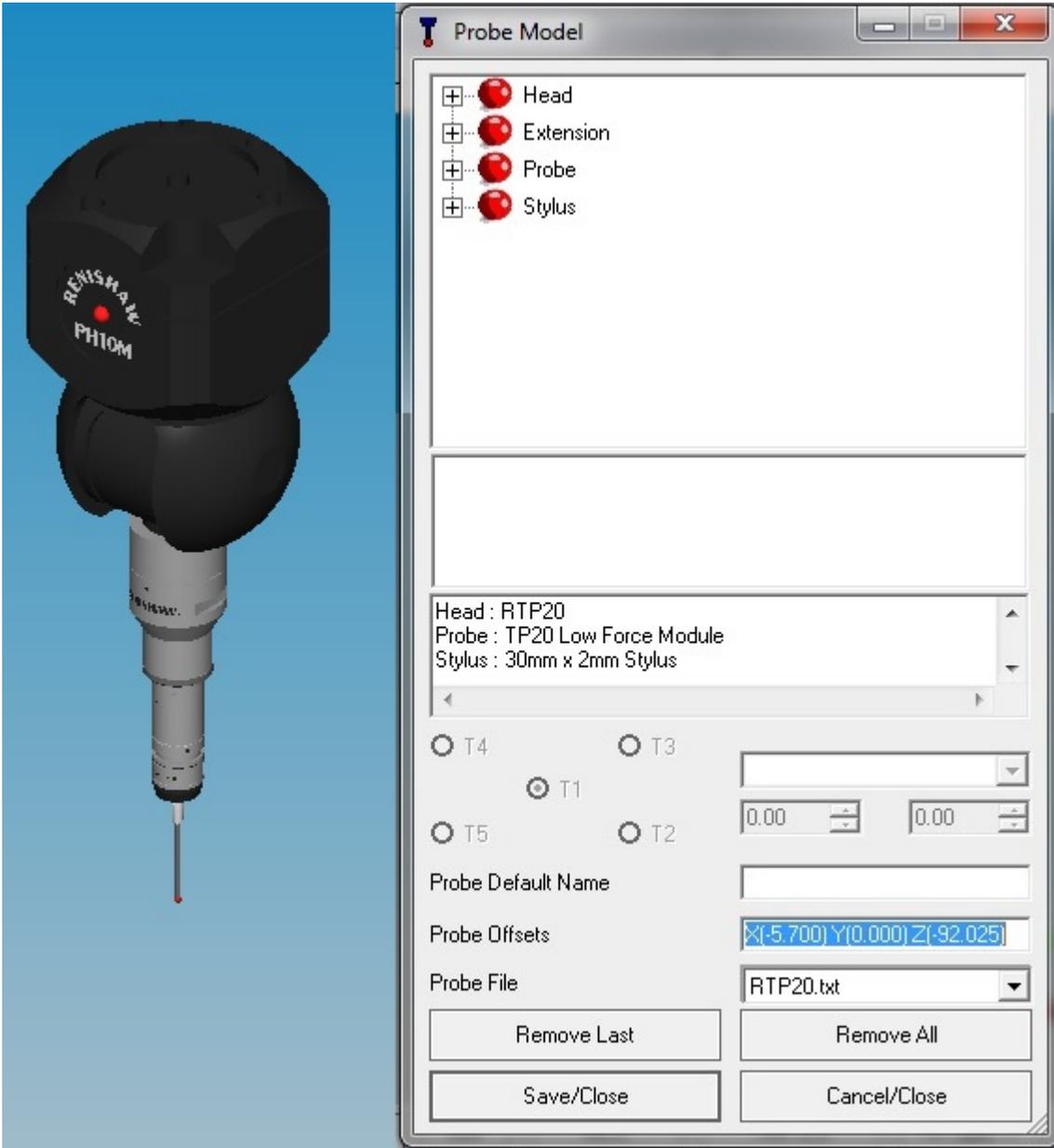
Probe Model definition. File name is given when defining a probe using the probe builder.

Notice in the list above that the labels are similar in nature until the last one shown in the list. Here is an example where during a teach program, it is determined that a new length/probe stylus is needed to complete the inspection. The user will simply build a new probe configuration using the probe builder, being careful to give the first and every successive probe a unique name, so as not to overwrite the sensors that were defined from the previous configuration.

The alternative to this method would be to keep all common probe lengths in its own unique sensor file. Then, when that probe configuration is needed to check certain features on a part, the user may simply open that sensor file by clicking on [File Menu - Open Internal Files](#) and locating the appropriately named sensor file. To begin using the probe builder, click on [Probe Menu - Define - Create](#). The following dialog will appear.



Click on the plus sign next to the word Head in the model list in the dialog shown above. This will give the user a list of all available probe heads. To select a probe head style, simply double click a probe head style. Notice that the components will begin to populate the lower part of the dialog as probe head components are selected. Notice also from the picture below, that as you double click the components from the list, they also get added to the [Graphics Window](#).

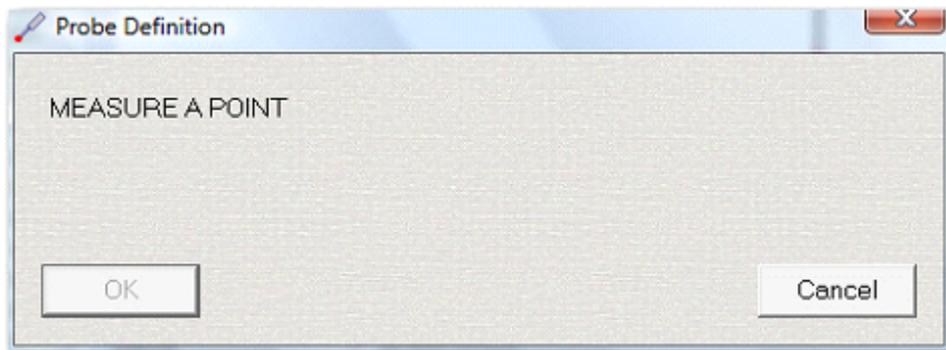


Remove Last	Removes the last added probe component from the graphics.
Remove All	Removes all of the probe components from the graphics.
Cancel/Close	Closes the probe builder dialog box and returns to the main probe/define dialog.
OK	Once the probe configuration is complete, click the OK button. A save dialog will appear. It is recommended that you give the probe model file a meaningful name so it is easily recognizable for future reference.

[Probe Calibrations](#)

Mechanically Defining A Probe

- The option to mechanically define the probe in CAPPs DMIS still exists. The procedure has not changed. To mechanically define a probe in CAPPs DMIS, click on [Probe Menu - Define](#) - **OK**.
- After clicking **OK**, the following dialog will appear.



- Measure a point in the following manner.

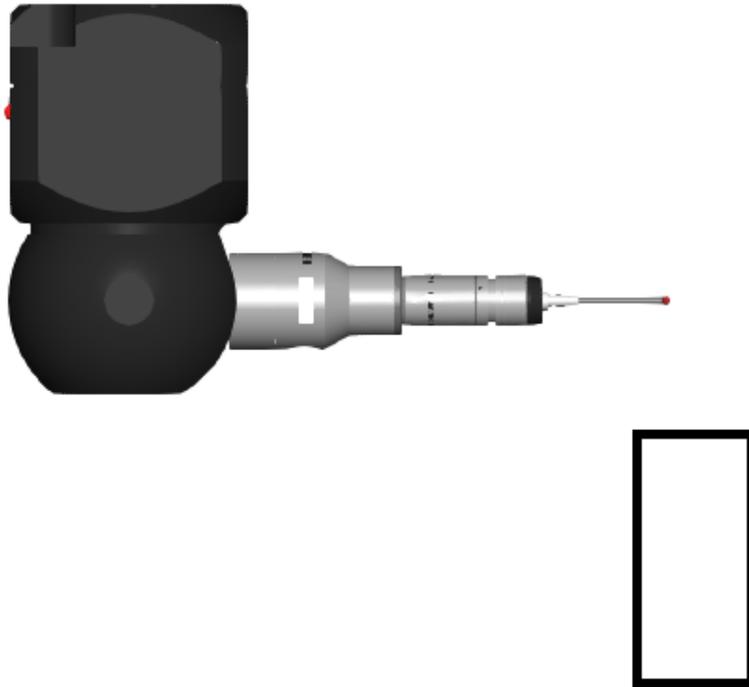


Flat Surface as the top of a
metric block or a 1-2-3 block



After measuring a single point on top of a flat surface, the system will display another menu warning of a probe rotation to **A90** and **B180**. Be sure there are no obstructions in the path of the probe for this rotation.

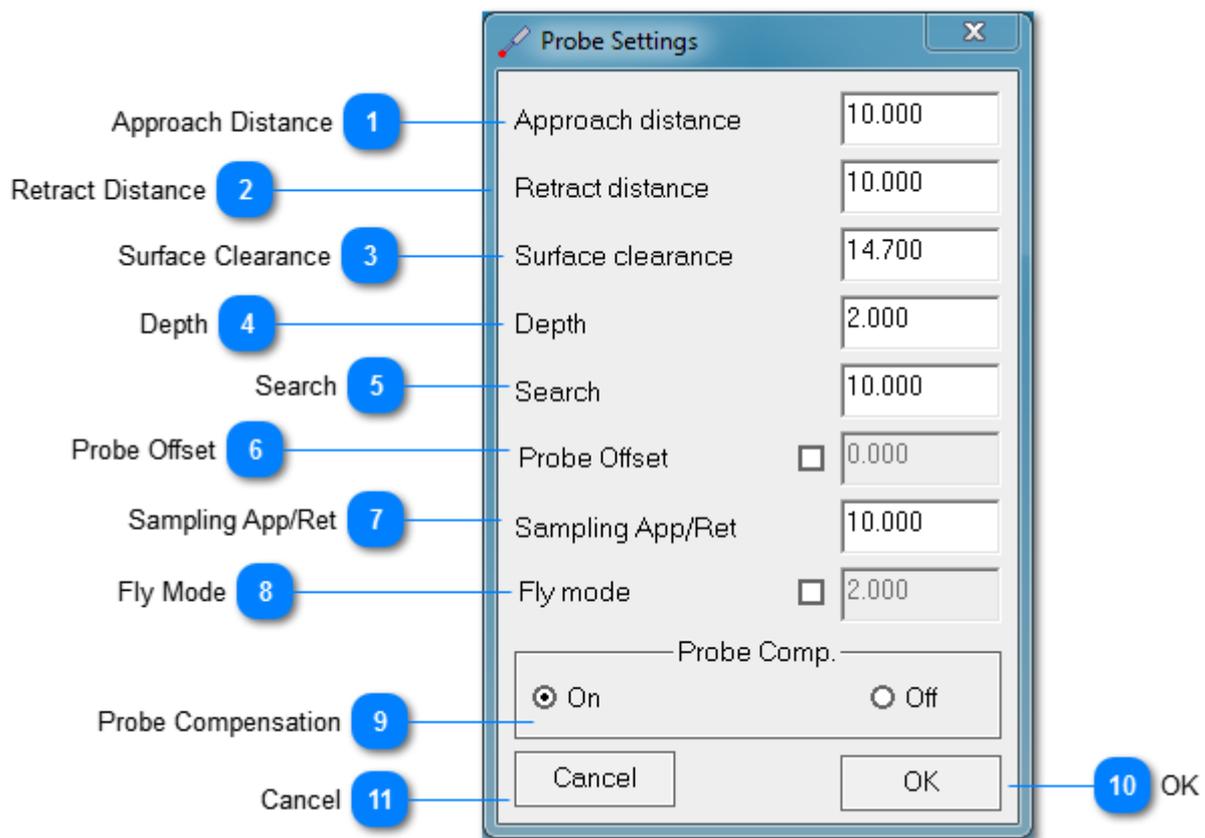
- Once the probe has rotated, the user will measure the same surface with the **A90B180** probe angle.



- After measuring the second point with the A90 B180 angle, move the probe clear of any obstructions and click **OK** once again. The probe will index back to **A0B0** and display the measured probe length.

[Probe Calibrations](#)

Probe Settings



1 Approach Distance

Approach distance 10.000

Approach distance before a touch.

2 Retract Distance

Retract distance 10.000

Retract distance after a touch.

3 Surface Clearance

Surface clearance 14.700

The distance achieved before moving to the Approach distance. Used for calibration, holes, slots, and cylinders.

4 Depth

Depth 2.000

The distance that a feature is measured relative to the nominal. In the case of a hole, it is how deep the hole is measured relative to nominal.

5 Search

Search

This value describes how far the CMM will search past the specified nominal before a no feature found message is displayed.

6 Probe Offset

Probe Offset

Used in the case of measuring sheet metal probes. The value indicates how far along the stylus from center that the machine should calibrate the probe.

7 Sampling App/Ret

Sampling App/Ret

Approach and Retract distance that is used for Relative Measurement applications.

8 Fly Mode

Fly mode

Is used to move the probe radially on the corners when doing consecutive [Position Points \(GOTO points\)](#) by giving radius values.

9 Probe Compensation

Probe Comp.
 On Off

When taking touch points, the user can decide if the taken point should be compensated for the probe radius or not. Should always be set to on when using traditional measurement.

10 OK

Applies the changes.

11 Cancel

Cancels the changes and closes the dialog.

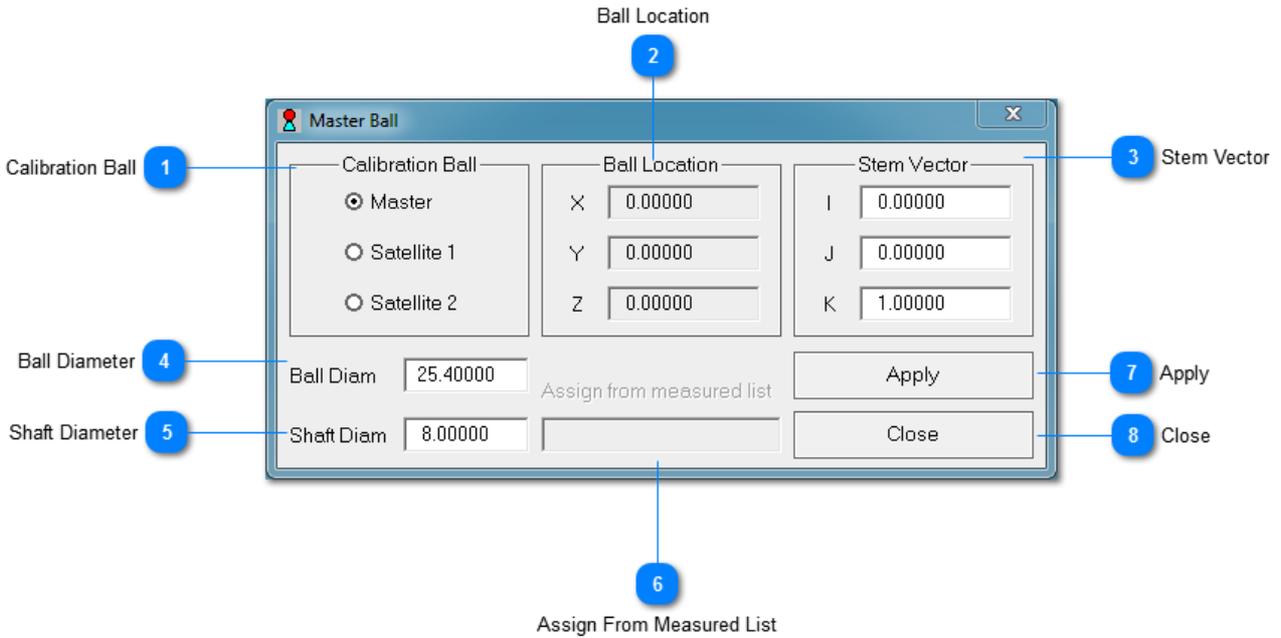
[Probe Calibrations](#)

Measuring The Master Ball

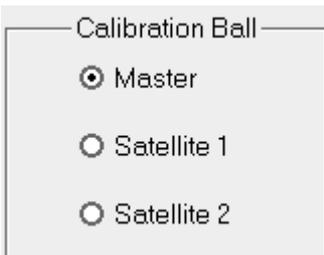
Measuring the **Master Ball** is the second step in the process of calibration. Once the CMM knows the length of the probe build up, it will now be necessary to dictate the location of the **Master Calibration Sphere**, otherwise known as the **Master Ball**. To let CAPPS DMIS know the location of the Master Ball, it will be necessary to Measure the ball using a minimum of 5 hits. Click on [Probe Menu - Master Ball](#) and the following dialog will appear.

How To Measure Master Ball Manually ?

To measure the master sphere using 5 hits, click the **OK** button. Take the hits in the following fashion. One hit on top, and **4** at the equator of the sphere, spanning **360 degrees**.



1 Calibration Ball



Master:	This is the primary calibration sphere that will be used for the majority of the calibrations on the CMM.
Satellite 1:	This is an auxiliary sphere that may be designated in the case that the Master calibration sphere is not physically accessible during a part program and additional probes must be calibrated. Calibration spheres both Master and Satellite may be generated from other sphere types as well and need not be the calibration sphere supplied by the OEM. However, be aware that the sphere that is being used to calibrate should be certified. This will ensure reliable calibrations of styli.
Satellite 2:	Same as Satellite 1 . CAPPS DMIS allows for the definition of a total of 2 auxiliary or satellite spheres within the software.

2 Ball Location

Ball Location	
X	<input type="text" value="0.00000"/>
Y	<input type="text" value="0.00000"/>
Z	<input type="text" value="0.00000"/>

Is used to enter Master Ball location according to **Machine Coordinate System (MCS)**. It is usually turned off for most applications since **Master Ball** location is set by performing a manual **Master Ball** measurement.

3 Stem Vector

Stem Vector	
I	<input type="text" value="0.00000"/>
J	<input type="text" value="0.00000"/>
K	<input type="text" value="1.00000"/>

Is used to input the **Stem Vector** of the **Master Ball**.

4 Ball Diameter

Ball Diam	<input type="text" value="25.40000"/>
-----------	---------------------------------------

Is used to input from **Master Ball Diameter**. This is the nominal definition of the calibration sphere and is unit sensitive. This is typically a known value.

5 Shaft Diameter

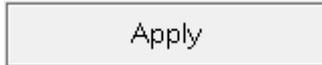
Shaft Diam	<input type="text" value="8.00000"/>
------------	--------------------------------------

Is used to input the **Shaft Diameter** of the **Master Ball**. The shaft diameter should normally be set to at least one third to one half of the **Ball Diameter**.

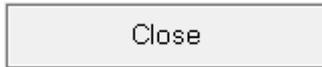
6 Assign From Measured List

Assign from measured list	<input type="text"/>
---------------------------	----------------------

Is used in conjunction with the select button, the user will select a measured sphere feature that is to be treated as the master calibration sphere. This could be a tooling sphere or something similar.

7 Apply

Applies the changes.

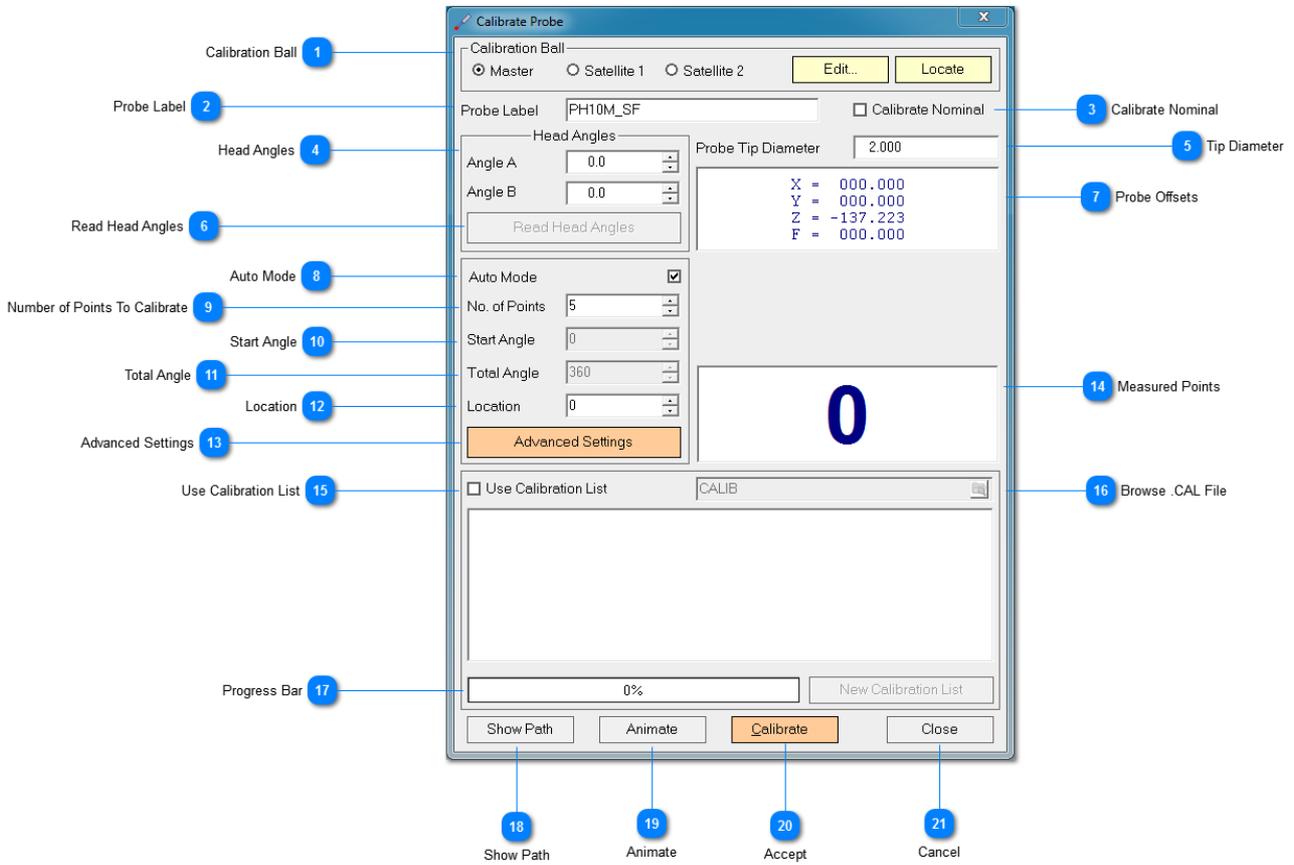
8 Close

Closes the dialog.

[Probe Calibrations](#)

Calibrating a Probe

After defining the probe and measuring the master sphere, it will be necessary to calibrate a probe or series of probes. To perform a probe calibration, set the mode to **Measure** in your [Measure Toolbar](#), and click on [Probe Menu - Calibrate](#). The following dialog will appear. A brief description of each of the functions is described below.



1 Calibration Ball



Calibration Ball is used for telling the CMM which calibration sphere will be used for the calibration. It can be selected as either the **Master Ball** or the **Satellites**.

Edit: Opens [Master Ball](#) dialog.

Locate: This allows the user to locate the Master Ball for the first time. (It replaces the **Measure** button in old **Master Ball** dialog.) If the the [Auto Mode](#) is checked, Capps will prompt the user to place the probe on top of the master ball and locate the master ball automatically, otherwise it will prompt the user to locate the master ball manually.

2 Probe Label

Probe Label

Each probe must have a label. Default labeling is one increment for every 7.5 degrees of rotation. **For example PA2B7** is equal to a probe rotation of 15 degrees of rotation for the A angle and 52.5 degrees of rotation for the B angle. The

default naming convention can also be changed to reflect the true angle of the probe. To change this, click on [System Configuration - Calibration Menu](#).

If the desired labeling is default as described above, then this flag should be checked. If the desired labeling system for probes is by angle, then uncheck the flag and the same probe (**PA2B7**) will now be labeled as **PA15B52.5** after

calibration. Note that checking or unchecking this option will not affect the currently calibrated probes in the list, only future calibrations.

3 Calibrate Nominal

Calibrate Nominal

Allows probe angles to be added to the probe list without actually calibrating them. These probes will be designated with an 'N' in the list as follows. This may be useful in the case where a program is being written and a probe needs to be added for measurement of a feature, but accessibility to a calibration sphere is not possible. Therefore, probes may be calibrated at a later time. It is important to note that measurements made with nominal probes will not give accurate results. These probes must be calibrated at a later time before obtaining reliable measurement results.

4 Head Angles

Head Angles

Angle A

Angle B

PH Angle A: Designates the first rotation of the probe head from **0 to 105** degrees.

PH Angle B: Designates the second rotation of the probe head from **0 to 180** and **0 to -180** degrees.

5 Tip Diameter

Probe Tip Diameter

Tip Diameter is calculated upon completing a probe calibration.

6 Read Head Angles

Used to read the current head angles of a probe.

7 Probe Offsets

```
X = 000.000
Y = 000.000
Z = -137.223
F = 000.000
```

Display current probe offsets. If the probe is a star probe which has more than one tip, the values will differ each time a new is selected.

8 Auto Mode

Auto Mode

Auto Mode will allow the automatic calibration of any probe angle. Notice that when this option is checked, the [Measure Toolbar](#) automatically turns to [MEASCAD Mode](#). It is important to note that probe settings as described in the previous section must be configured correctly in order to avoid any collisions.

9 Number of Points To Calibrate

No. of Points

Minimum of 5 points required with a **maximum of 50 points**.

10 Start Angle

Start Angle

Start Angle can be configured by input or with the arrow keys. A zero start angle will begin on the **X+ axis** of the **Machine Coordinate System (MCS)** with a master ball **stem vector of 0,0,1**.

11 Total Angle

Total Angle

Total Angle can be configured by input or with the arrow keys.

12 Location

Location

Location moves the configured group of touch points for calibration up or down on the master sphere. Use the **Graphics Window** to get a clear picture of how location works with calibration.

13 Advanced Settings

Advanced Settings

Opens [Advanced Settings](#) dialog.

14 Measured Points

0

Measured Points are used as a counter for the points being measured on the calibration sphere.

15 Use Calibration List

Use Calibration List

Use Calibration List is enabled in conjunction with **Auto Mode (or MEASCAD Mode)**, this allows the user to pick a previously saved list of angles in the form of a **(.cal)** file for calibration. This option is a more automated way of calibrating

probes, thereby eliminating the need to calibrate one probe angle at a time. The **(.cal)** file can be created by saving the active sensor list as a **(.cal)** file by going to [File Menu- Save Internal Files](#).

16 Browse .CAL File

CALIB

Browses for **(.cal)** file location on your hard drive.

17 Progress Bar

0%

Displays the progression of the **.cal** file calibration routine.

18 Show Path

Show Path

Show Path is used to show the path of the calibration process.

19 Animate

Animate

Animates the calibration routine for the given head angle.

20 Accept

Calibrate

Starts calibration process.

21 Cancel

Close

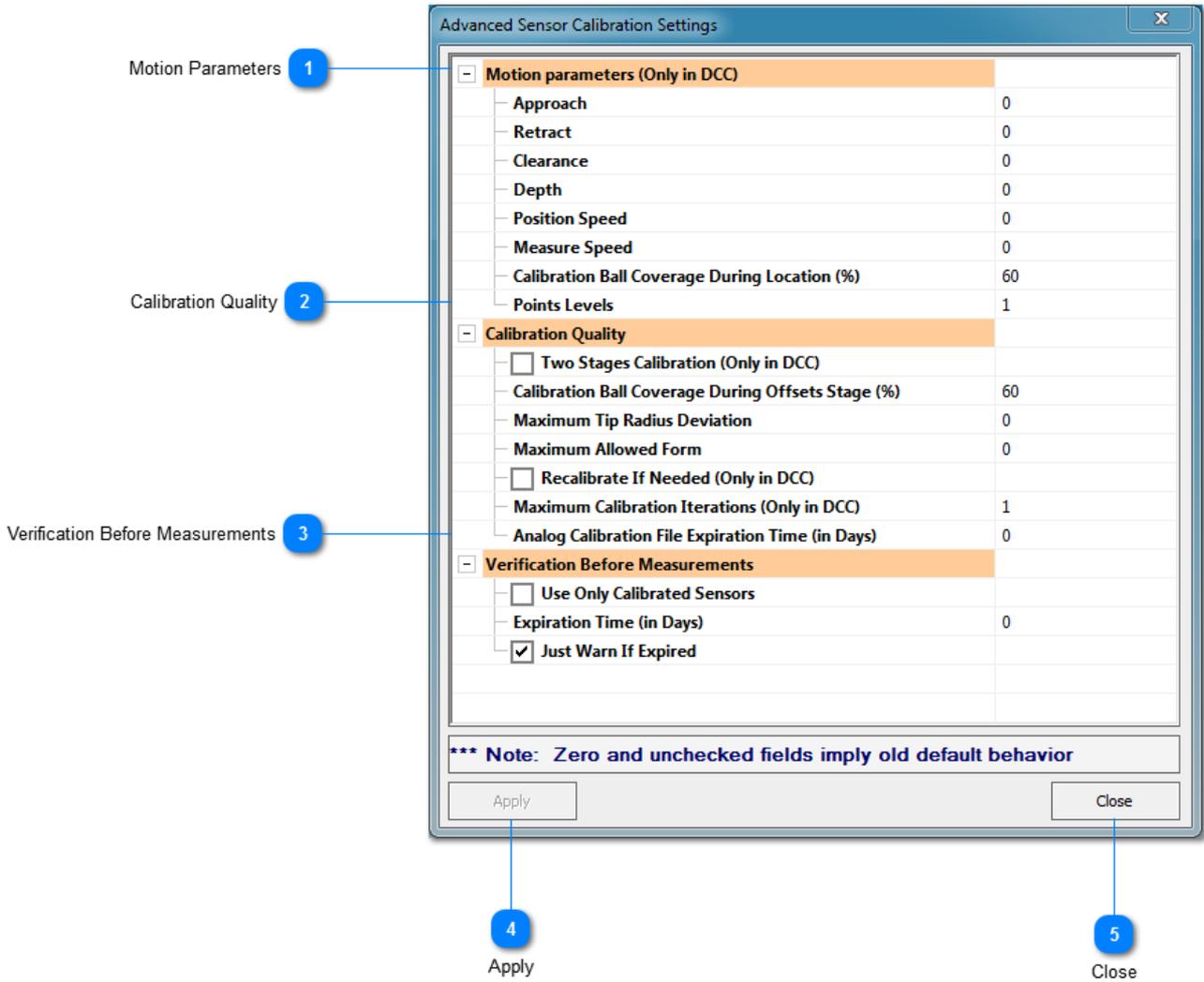
Cancel the changes and close the dialog.

Using the Autocal Creator Utility

Using the [AutoCal Creator Utility](#) will allow the user to make angle lists that may be used with any probe standard probe configuration. This utility will not work with things such as star probes or unique type probes such as disk probes or ceramic probes. To access the **AutoCal Creator**, go to [System Menu- Utilities - AutoCal Creator](#). The following dialog will appear. For more information how to automate calibration, follow the link [Auto Calibration Creator](#).

[Probe Calibrations](#)

Advanced Settings



1 Motion Parameters

Motion parameters (Only in DCC)	
Approach	0
Retract	0
Clearance	0
Depth	0
Position Speed	0
Measure Speed	0
Calibration Ball Coverage During Location (%)	60
Points Levels	1

All the following parameters are only allowed in DCC machines.

Approach: Sets the [Approach Distance](#) for probe motion.

Retract: Sets the [Retract Distance](#) for probe motion.

Clearance: Sets the [Clearance Distance](#) for probe motion.

Position Speed: Sets the [Position Speed](#) for probe motion.

Measure Speed: Sets the [Measure Speed](#) for probe motion.

Calibration Ball Coverage During Location(%): Sets how much of the master ball surface will be covered during location process.

Points Levels: Sets how many levels will be used to cover the master ball surface during calibration.

2 Calibration Quality

<input type="checkbox"/>	Calibration Quality	
<input type="checkbox"/>	Two Stages Calibration (Only in DCC)	
	Calibration Ball Coverage During Offsets Stage (%)	60
	Maximum Tip Radius Deviation	0
	Maximum Allowed Form	0
<input type="checkbox"/>	Recalibrate If Needed (Only in DCC)	
	Maximum Calibration Iterations (Only in DCC)	1
	Analog Calibration File Expiration Time (in Days)	0

Two Stages Calibration (Only in DCC): Turns **Two Stages Calibration** on/off.

Calibration Ball Coverage During Offsets Stage (%): Sets how much of the master ball surface will be covered during **Offsets Stage**.

Maximum Tip Radius Deviation: Sets maximum allowed probe tip radius deviation for a calibration routine.

Maximum Allowed Form: Sets maximum allowed probe form deviation for a calibration routine.

Recalibrate If Needed (Only in DCC): If the calibration fails to within the maximum limits, this option will be used to recalibrate the probe automatically.

Maximum Calibration Iterations (Only in DCC): Sets how many times the recalibration routine will run until either it stays within the maximum limits or terminate.

Analog Calibration File Expiration Time (in Days): Sets a expiration date for analog calibration files, it will warn the user if the specified date is expired after the last calibration routine.

3 Verification Before Measurements

<input type="checkbox"/>	Verification Before Measurements	
<input type="checkbox"/>	Use Only Calibrated Sensors	
	Expiration Time (in Days)	0
<input checked="" type="checkbox"/>	Just Warn If Expired	

Use Only Calibrated Sensors: Checks if the selected probe is a calibrated probe or not before inspection.

Expiration Time (in Days): Sets an expiration date for recalibration.

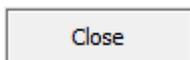
Just Warn If Expired: Turns user warnings for expired probe calibrations on/off.

4 Apply



Applies changes.

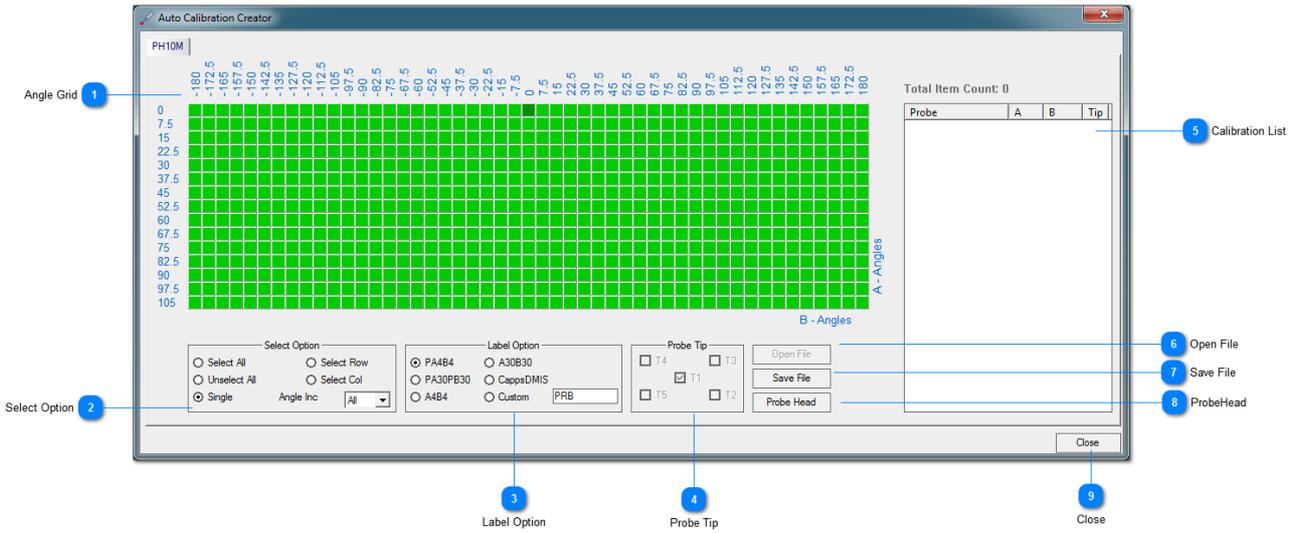
5 Close



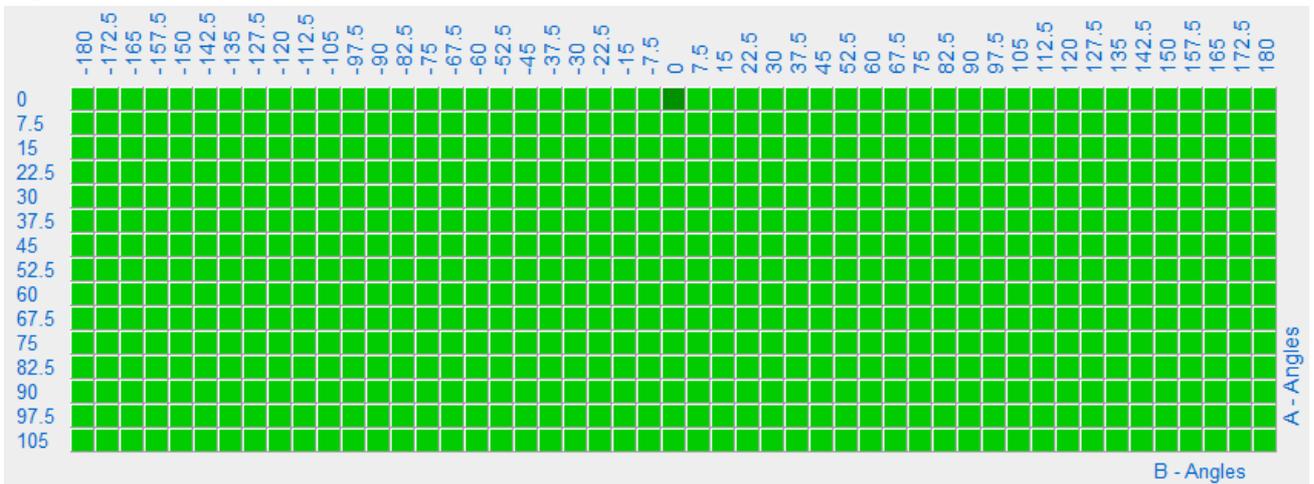
Closes the dialog.

[Calibrating A Probe](#)

Auto Calibration Creator

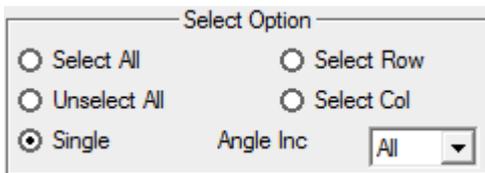


1 Angle Grid



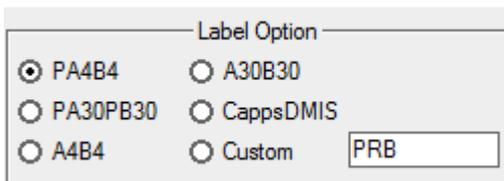
Used to easily select probe angles to be calibrated from the grid.

2 Select Option



User can select from the above **Select Option** to create a new calibration list.

3 Label Option



Used to select which naming convention will be used to name calibrated probe angles. User can create his/her own by typing in the label in **Custom** box for each angle.

4 Probe Tip

Probe Tip

T4 T3

T1

T5 T2

Used to specify the tip direction in a star probe calibration.

5 Calibration List

Probe	A	B	Tip

All probe angles to be calibrated will be combine under the list with corresponding label names. Eventually this list will be converted into a **.CAL (calibration list)** file.

6 Open File

Open File

Opens an existing **.CAL (calibration list)** file.

7 Save File

Save File

Saves the calibration list created in to the specified directory.

8 ProbeHead

Probe Head

Used to specify the probe head for probe model. Every model has their own limits and angle increment specifications.

9 Close

Close

Closes **Auto Calibration Creator**.

[Calibrating a Probe](#)

Star Probes

Starting in **CAPPS DMIS version 7.0.4.190** the following enhancements have been added to the probe model functionality:

- Configurable probe database name.
- Full multi sensor (**Star Probe**) functionality.
- Define nominal probe calibrations for all positions.
- Calibrate all positions.

Configurable Probe Database Name

Currently, the probe database displayed in the probe builder UI is hard coded to be **RenishawProbeStuff3.csv** and the location for all probe model components was hard coded to be **C:\CAPPS\Machine\Renishaw**, this is no longer the case.

There has been a new parameter added to the **[Files]** section of the **capps.ini** file which allows the user to define the storage location for both the probe database file and the probe model components.

ProbeModelDataBase=

However, due to the file structure of CAPPS DMIS, the location of the probe model data must be a sub directory of the **C:\CAPPS\Machine** directory. See below for an example:

Probe model data is stored in the following directory.

C:\CappsDmis\CAPPS\Machine\UserProbeData\UserProbeData.csv

Path in **capps.ini** file would be as follows:

ProbeModelDataBase= UserProbeData\UserProbeData.csv

If the **ProbeModelDataBase** entry in the **capps.ini** file is left blank the default location will be used for all probe model data.

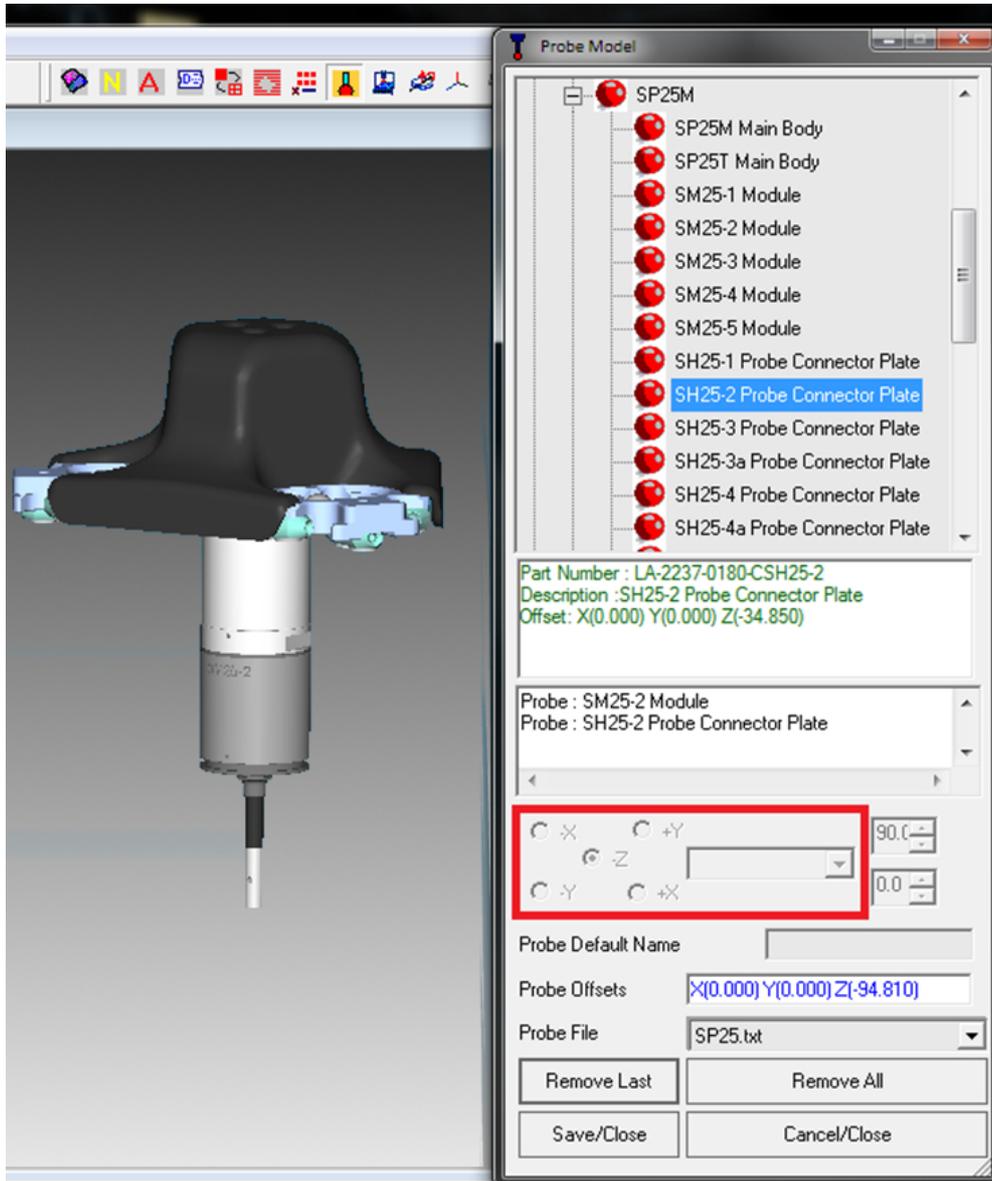
Important Note: If the user changes this path on an existing installation of CAPPS DMIS all probe model definitions must be redefined !!

[Probe Calibrations](#)

Building Star Probe Models

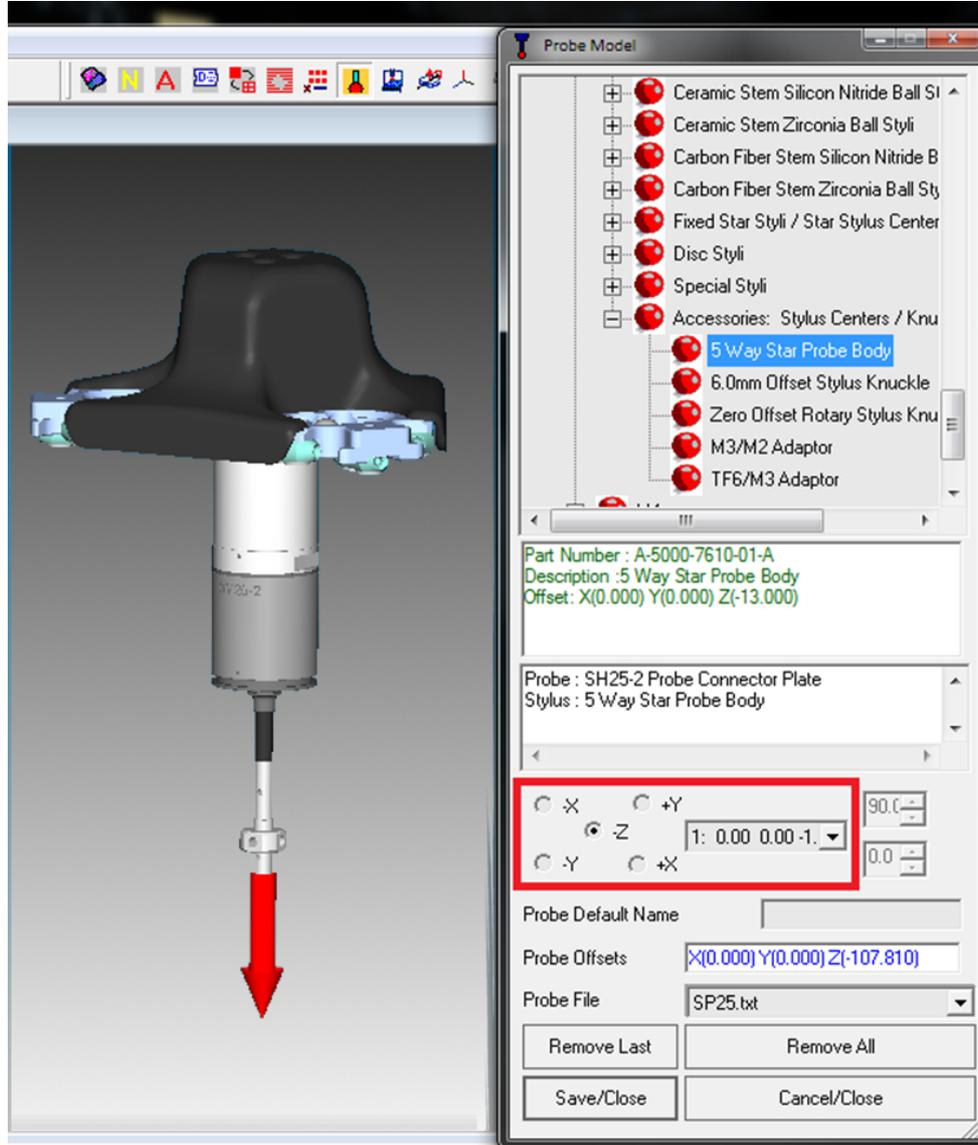
Multi Sensor Functionality

A new section has been added with **CAPPS DMIS version 7.0.4.190** to the **Probe Builder UI** to support multi sensor functionality. When building a probe model the star position section of the menu will remain disabled unless a predefined star or star center component is added to the probe model.

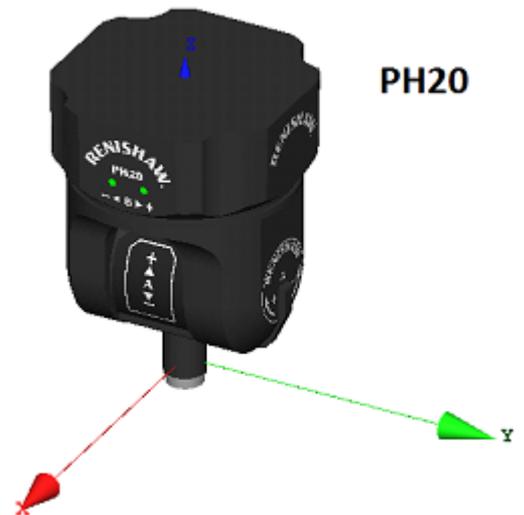
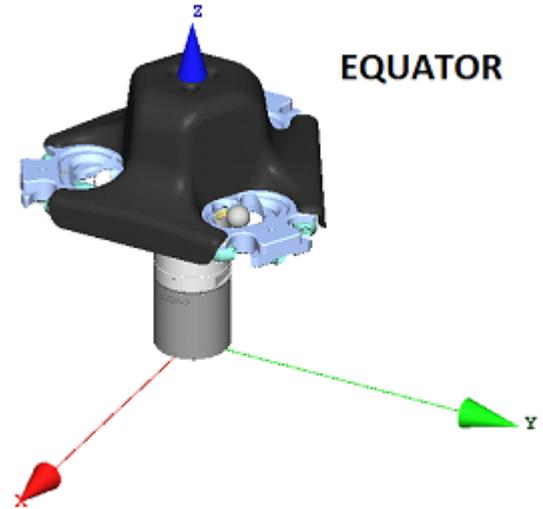
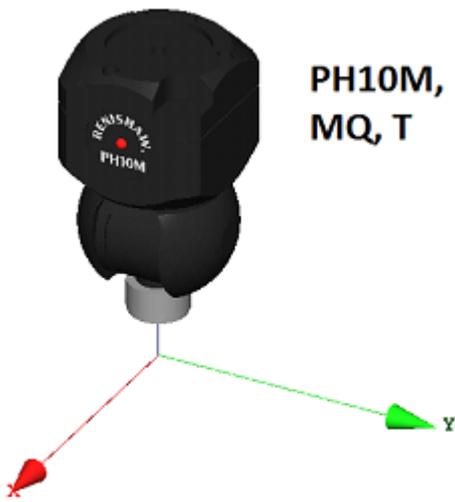


- However, once a **Star Probe Body** component has been added the star position section of the menu will become active and a red arrow will appear to indicate which position of the star body is currently selected.

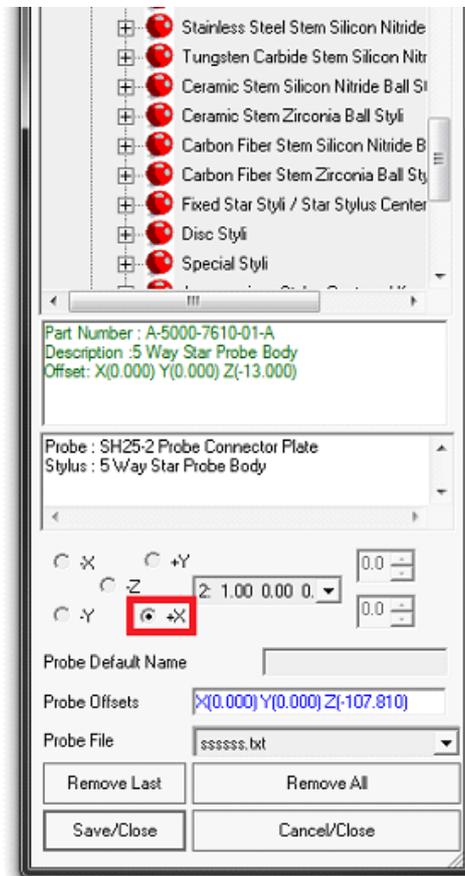
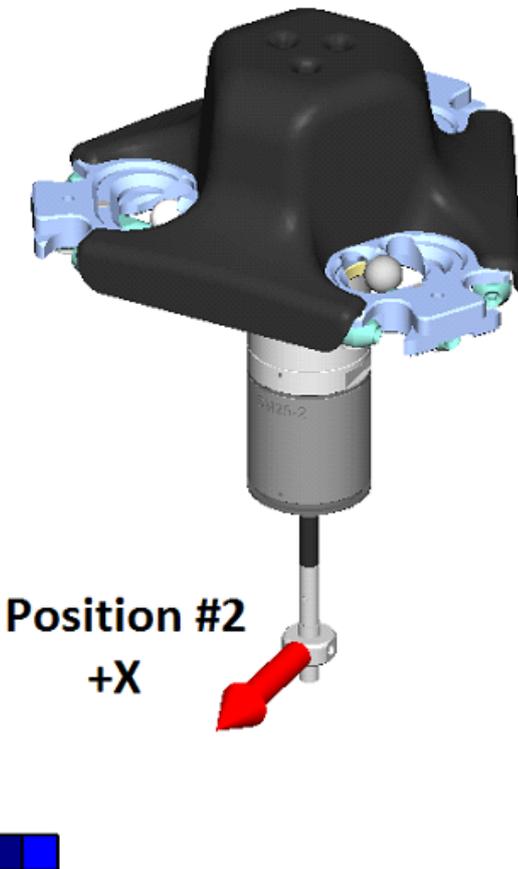
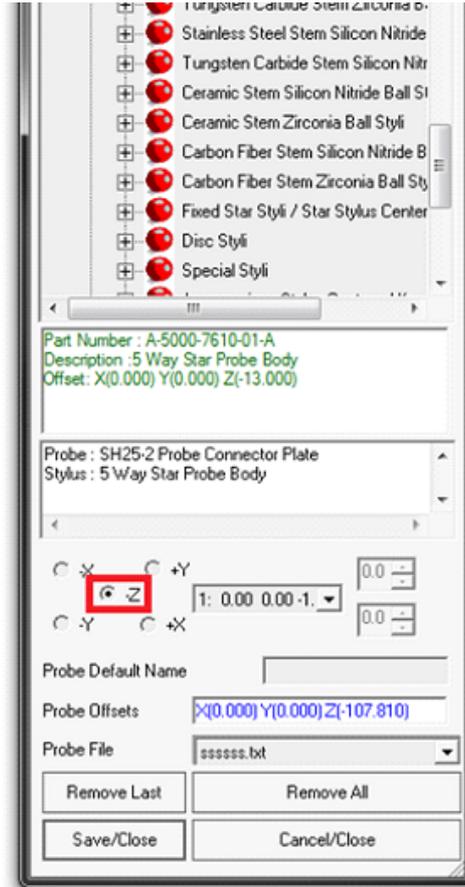
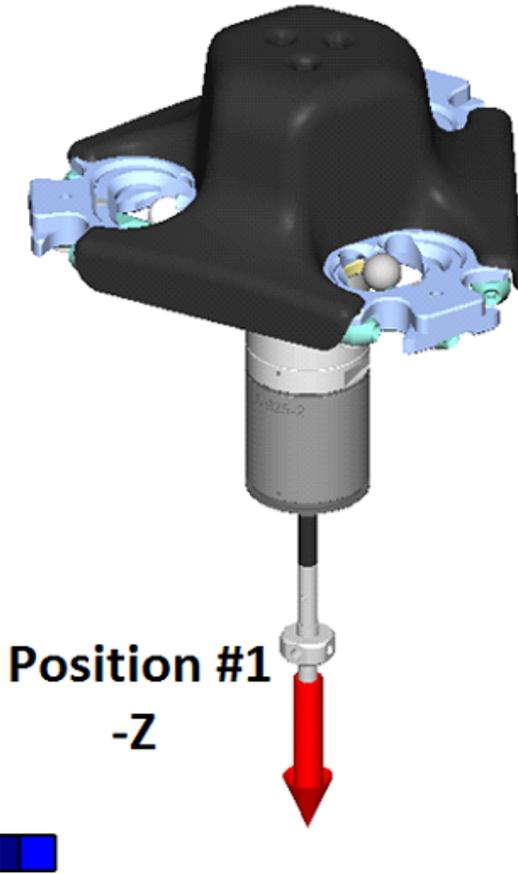
Important Note: The Z position is shown as the selected star position.

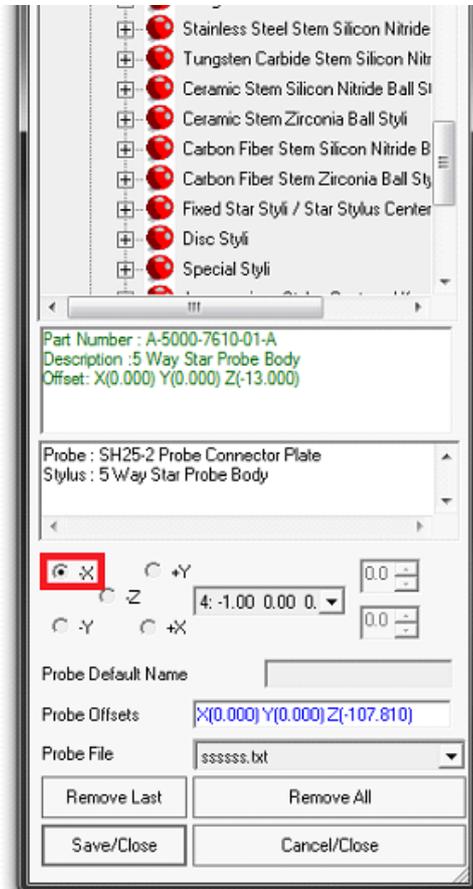
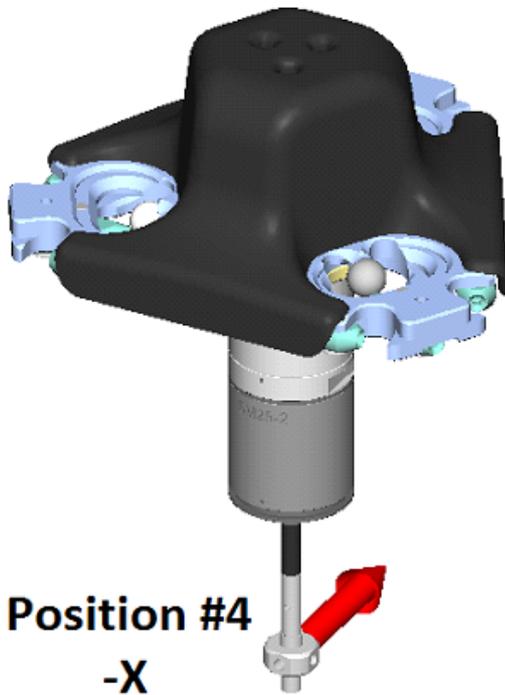
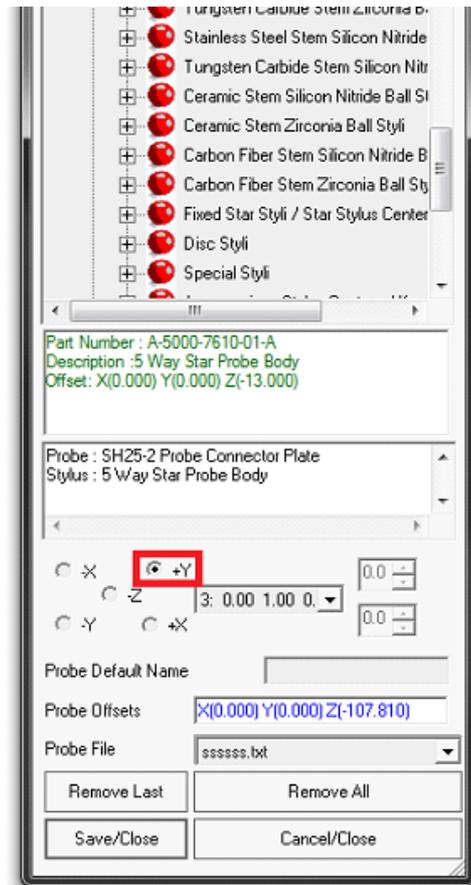
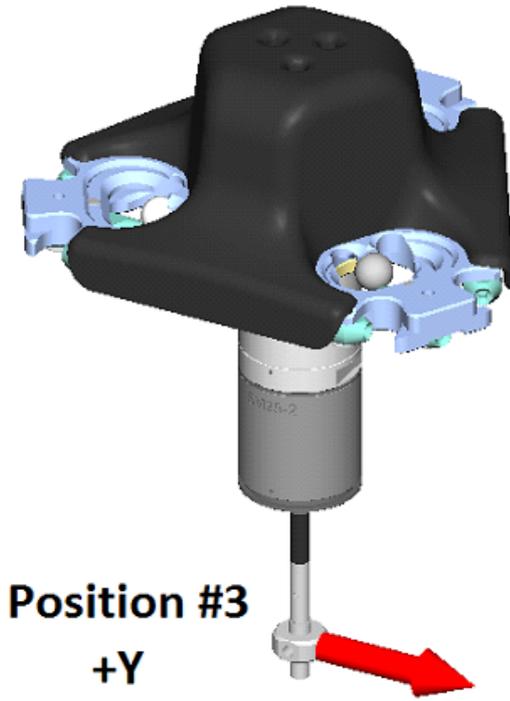


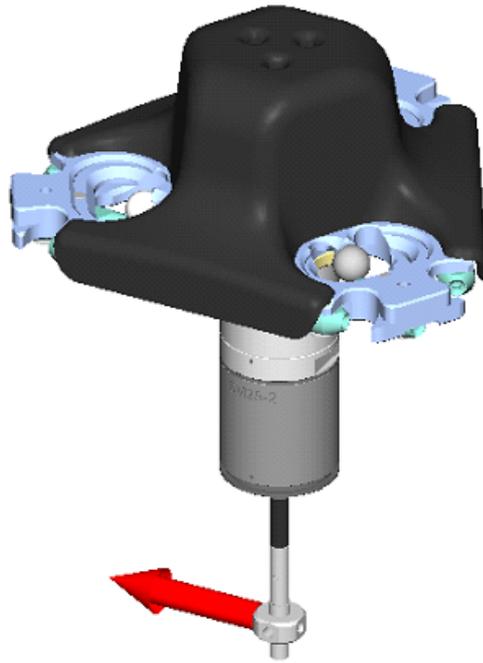
- The positions and axis directions are defined relative to the **Head Coordinate System (HCS)**. The HCS is defined as follows and is completely independent of the orientation of the head relative to the **CMM axes**.



- The positions for the star bodies are defined as follows:







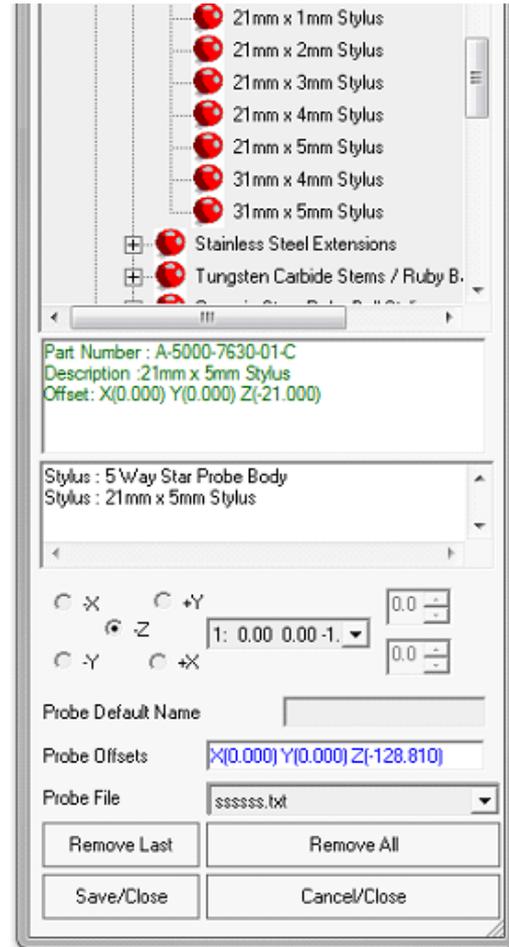
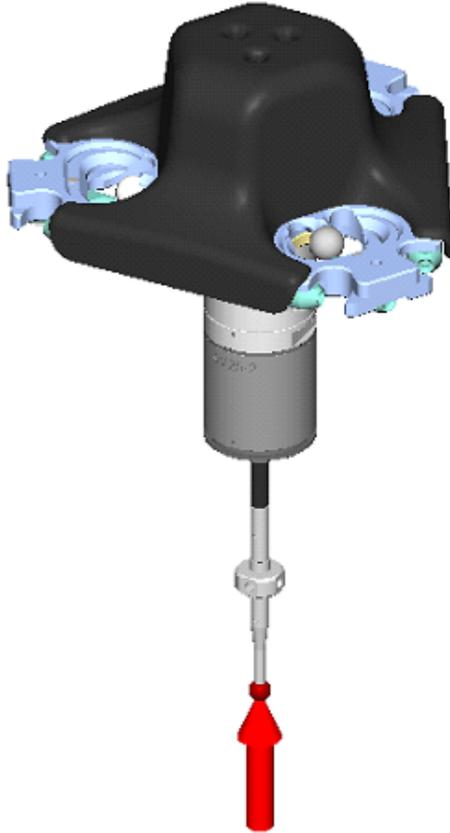
Position #5
-Y



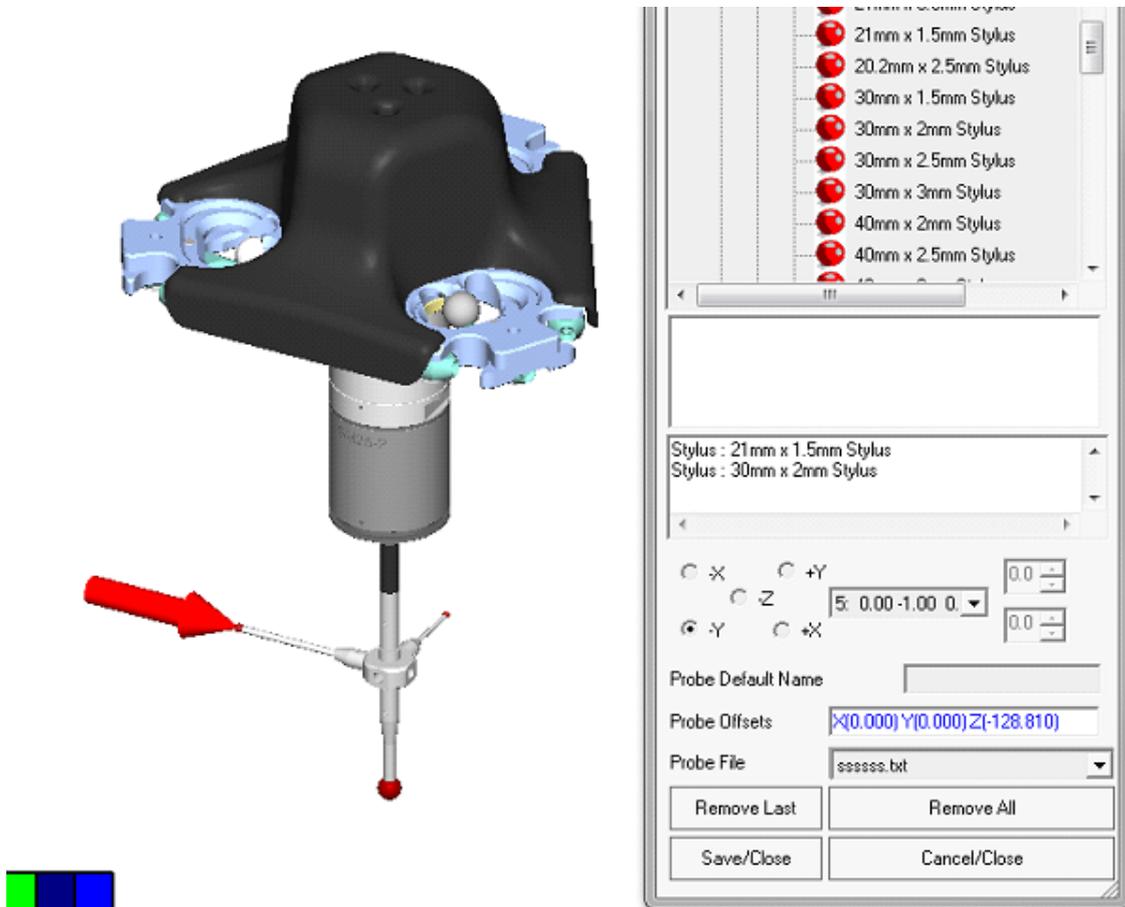
The screenshot shows a software interface for configuring a probe. At the top is a list of probe types with red circular icons: Tungsten Carbide Stem Zirconia B..., Stainless Steel Stem Silicon Nitride, Tungsten Carbide Stem Silicon Nitr..., Ceramic Stem Silicon Nitride Ball St..., Ceramic Stem Zirconia Ball Styli, Carbon Fiber Stem Silicon Nitride B..., Carbon Fiber Stem Zirconia Ball Sty..., Fixed Star Styli / Star Stylus Center, Disc Styli, and Special Styli. Below the list, the following information is displayed:
Part Number : A-5000-7610-01-A
Description : 5 Way Star Probe Body
Offset: X(0.000) Y(0.000) Z(-13.000)
Probe : SH25-2 Probe Connector Plate
Stylus : 5 Way Star Probe Body
A directional control section has radio buttons for -X, +Y, -Z, and +X. The -Y radio button is selected and highlighted with a red box. Below this are fields for Probe Default Name, Probe Offsets (set to X(0.000) Y(0.000) Z(-107.810)), and Probe File (set to ssssss.txt). At the bottom are buttons for Remove Last, Remove All, Save/Close, and Cancel/Close.

- Once the stylus has been added to the position the red arrow changes position to show the selected position with the added stylus.

Important Note: The positions of the star components can be added in any order, the order used in this example does not need to be followed implicitly. Also, it is not required that all positions of the star center are used.

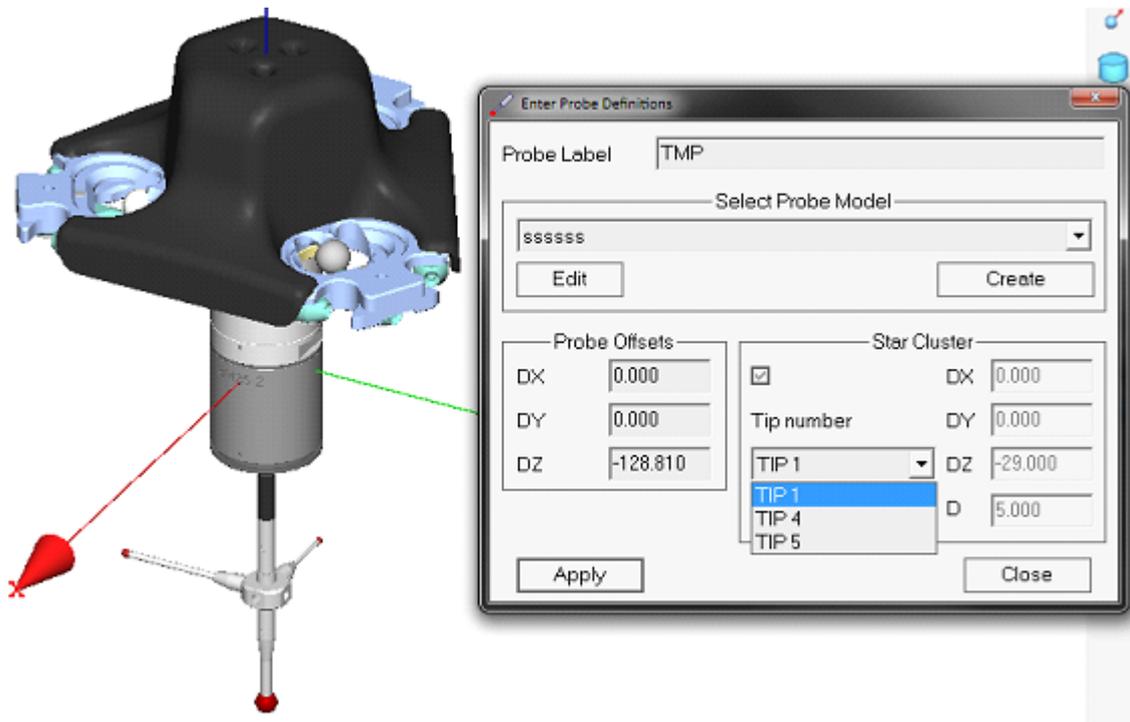


- To add styli to the different positions click on the desired position, then select the necessary stylus from the correct stylus branch of the tree.



- After all of the styli have been added, click on the **Save/Close** button to save the probe model.

- Once CAPPSS switches back to the [Enter Probe Definitions](#) dialog the tip positions and offsets can be reviewed in the **Star Cluster** section. Note that the position numbers in the selection drop down match the positions defined earlier above.



[Star Probes](#)

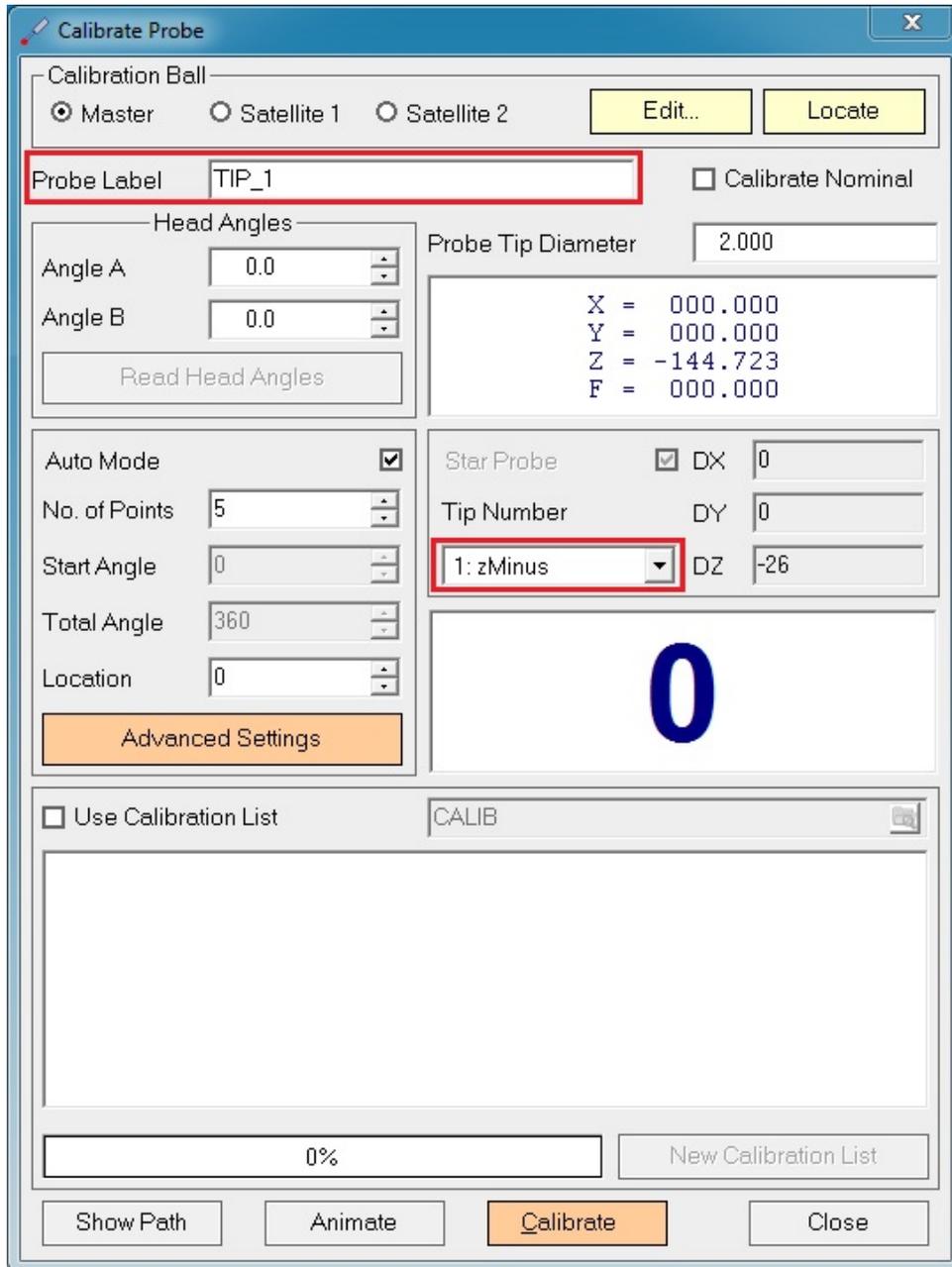
Calibrating A Star Probe

Calibrations for all different positions are done using the [Probe Calibrate](#) dialog. Use the **Star Probe** section to choose which tip is to be calibrated.

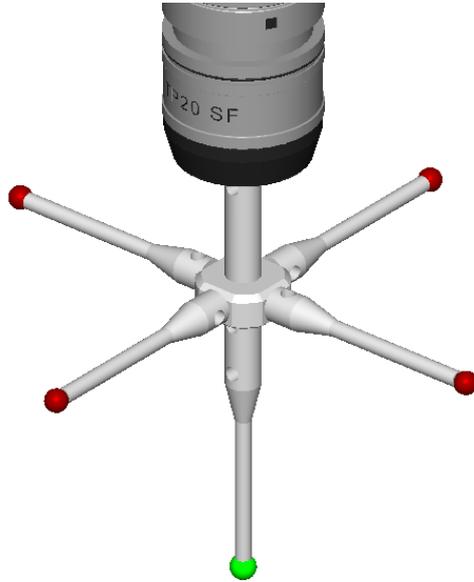
- Choose the tip number to be calibrated
- Verify the probe label, change if desired
- Check the **Auto Mode** box
- Click the **OK** button to begin the calibration

Important Note: As of CappsDmis version 7.3.15.251, active star probe tips has their unique color to distinguish which tip is active in **Graphics Window**. The active tip color is editable and can be edit using **Graphics Menu > Colors >Active Tip**.

Repeat steps to calibrate all the star components. If an index able head (**i.e. a PH10**) is installed on the machine use the **Angle A** and **Angle B** text boxes to set the desired head position before. Click on the **Show Path** button if the path on the screen is not updated.



Also the current tips that are selected to be calibrated are highlighted with a bright green color as shown below:



Some example calibration paths:

TIP 1 calibration path is shown below. Note that in **Probe Label** section, CAPPS automatically adds **T1** at the end of probe label. This comes handy to identify the tip when selecting the probe from the [Sensor Select](#) dialog.

Calibrate Probe

Calibration Ball
 Master Satellite 1 Satellite 2

Probe Label: Calibrate Nominal

Head Angles
 Angle A:
 Angle B:

Probe Tip Diameter:

X = 000.000
 Y = 000.000
 Z = -144.723
 F = 000.000

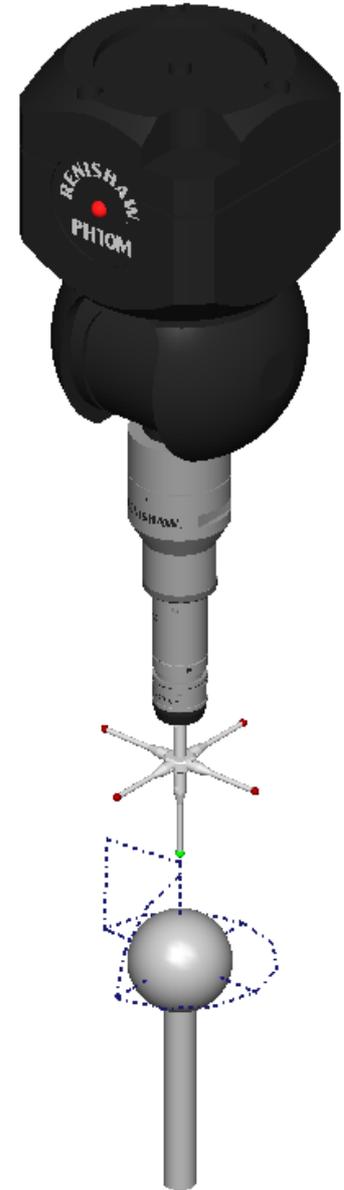
Auto Mode:
 No. of Points:
 Start Angle:
 Total Angle:
 Location:

Star Probe: DX:
 Tip Number: DY:
 1: zMinus: DZ:

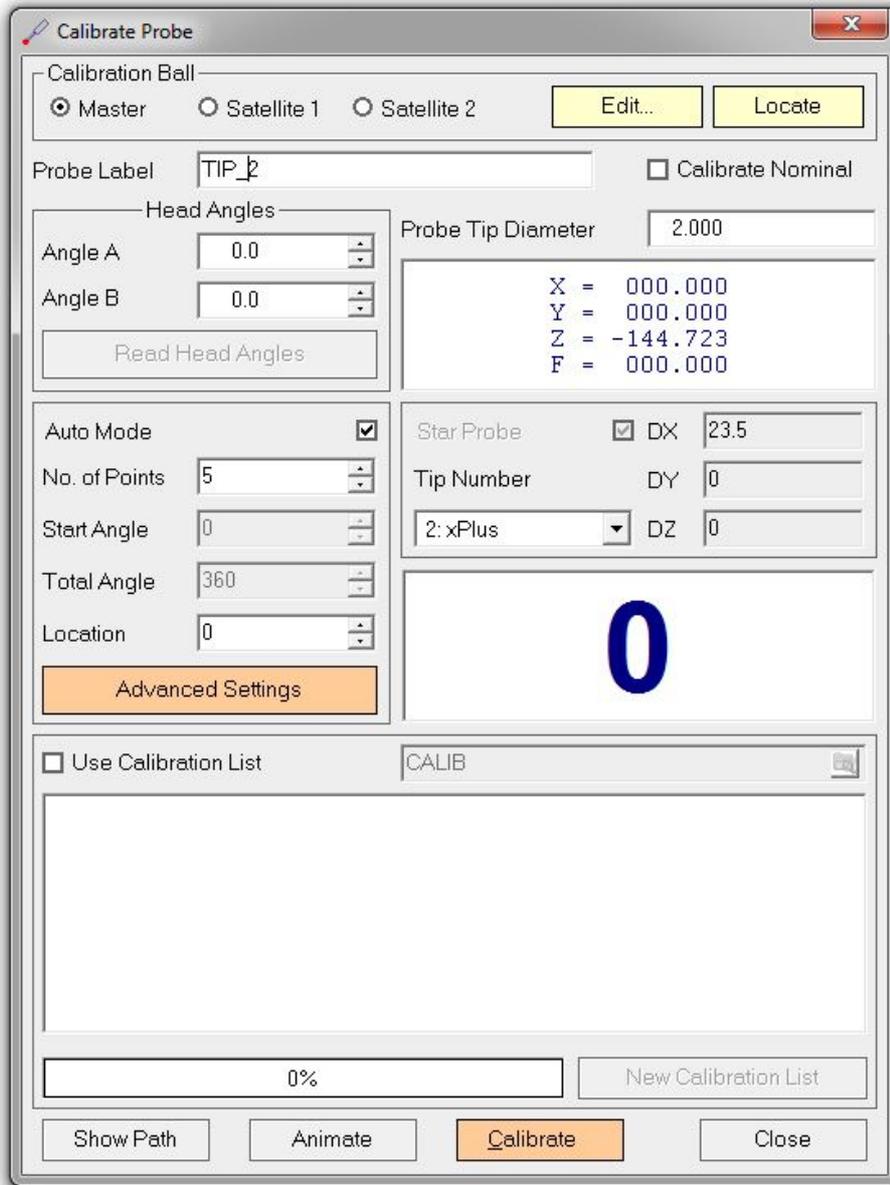
0

Use Calibration List CALIB

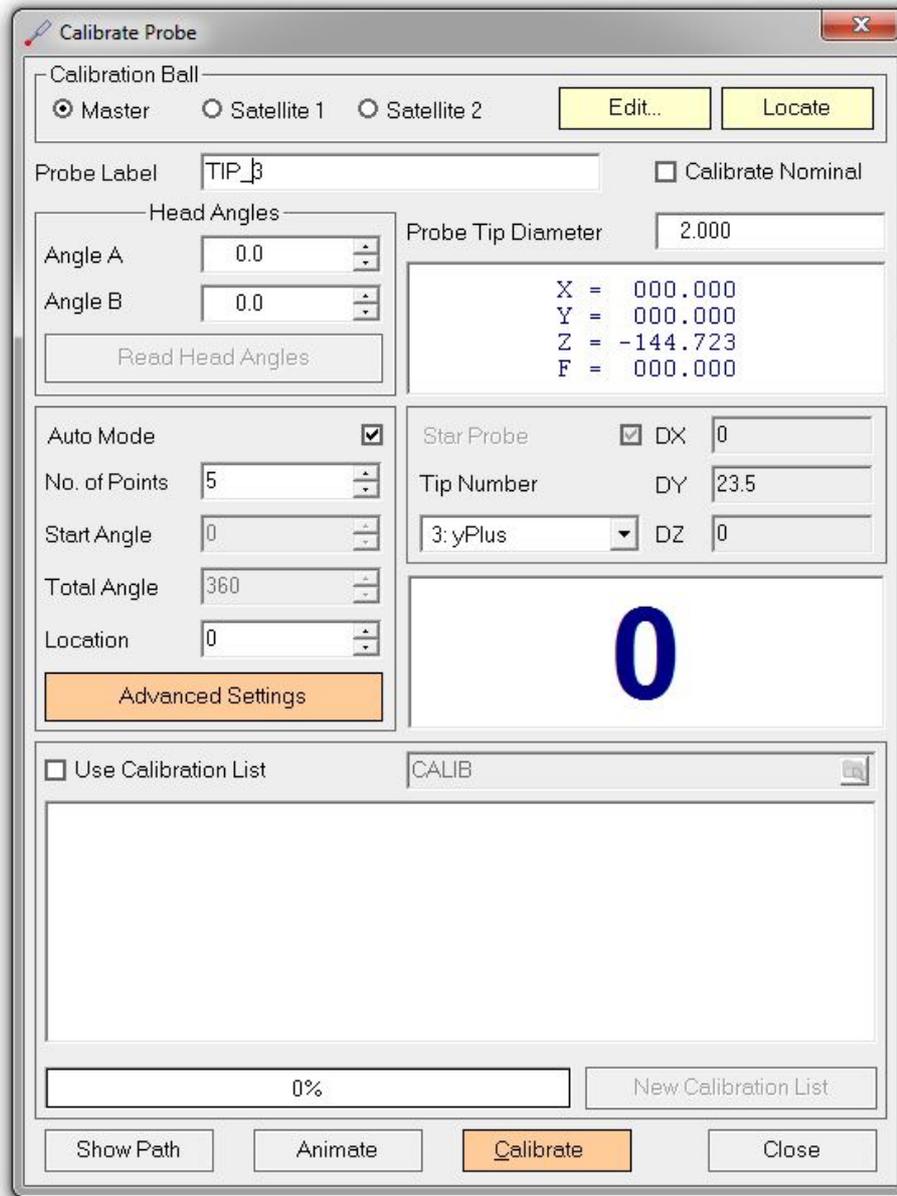
0%



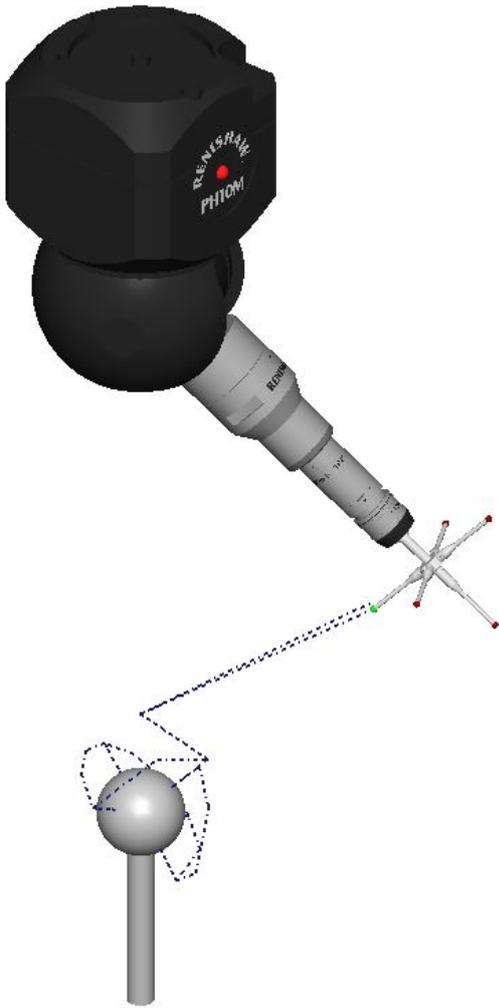
TIP 2 calibration path is shown below:



TIP 3 calibration path is shown below:



TIP 4 calibration path with **head angle** at **A=45 B=30** is shown below. Also note that the **Probe Label** automatically adds the head angles to probe label along with the tip number.



Calibrate Probe
✕

Calibration Ball

Master Satellite 1 Satellite 2 Edit... Locate

Probe Label Calibrate Nominal

Head Angles

Angle A ⬆ ⬇ ⬆

Angle B ⬆ ⬇ ⬆

Read Head Angles

Probe Tip Diameter

X = 000.000

Y = 000.000

Z = -144.723

F = 000.000

Auto Mode

No. of Points ⬆ ⬇ ⬆

Start Angle ⬆ ⬇ ⬆

Total Angle ⬆ ⬇ ⬆

Location ⬆ ⬇ ⬆

Advanced Settings

Star Probe DX

Tip Number DY

 DZ

0

Use Calibration List ⓧ

0%

New Calibration List

Show Path
Animate
Calibrate
Close

[Star Probes](#)

Calibrating a Nominal Star Probe

At this point it is possible to add all or the star position to the probe database as nominal probes using the define dialog.

- Enter an appropriate label for the probe position
- Select the appropriate tip from the **Star Cluster** section of the define dialog
- Click the **Apply** button

The screenshot shows the 'Enter Probe Definitions' dialog box. The 'Probe Label' field is set to 'NOM_PROBE_1'. The 'Select Probe Model' dropdown is set to 'PH10M_SP25_5Pos_Star'. The 'Probe Offsets' section shows DX: 0.000, DY: 0.000, and DZ: -178.750. The 'Star Cluster' section is checked, with 'Tip number' set to 'TIP 1', DX: 0.000, DY: 0.000, DZ: -29.000, and D: 3.000. The 'Apply' button is highlighted in red.

Perform these steps for each tip that should be added to the probe database. Once all the tips have been added to the probe database click on the **Close** button to close this dialog.

The left screenshot shows the 'Enter Probe Definitions' dialog box for 'NOM_PROBE_2'. The 'Star Cluster' section is checked, with 'Tip number' set to 'TIP 2', DX: 35.000, DY: 0.000, DZ: 0.000, and D: 2.000. The 'Apply' button is highlighted in red.

The right screenshot shows the 'Enter Probe Definitions' dialog box for 'NOM_PROBE_3'. The 'Star Cluster' section is checked, with 'Tip number' set to 'TIP 3', DX: 0.000, DY: 126.000, DZ: 0.000, and D: 0.000. The 'Apply' button is highlighted in red.

All sensors will now be added to the probe database as shown below:



The screenshot shows a window titled "Select Sensor: C:\Capps06\capps\cappsnt.sns". It contains a table with the following data:

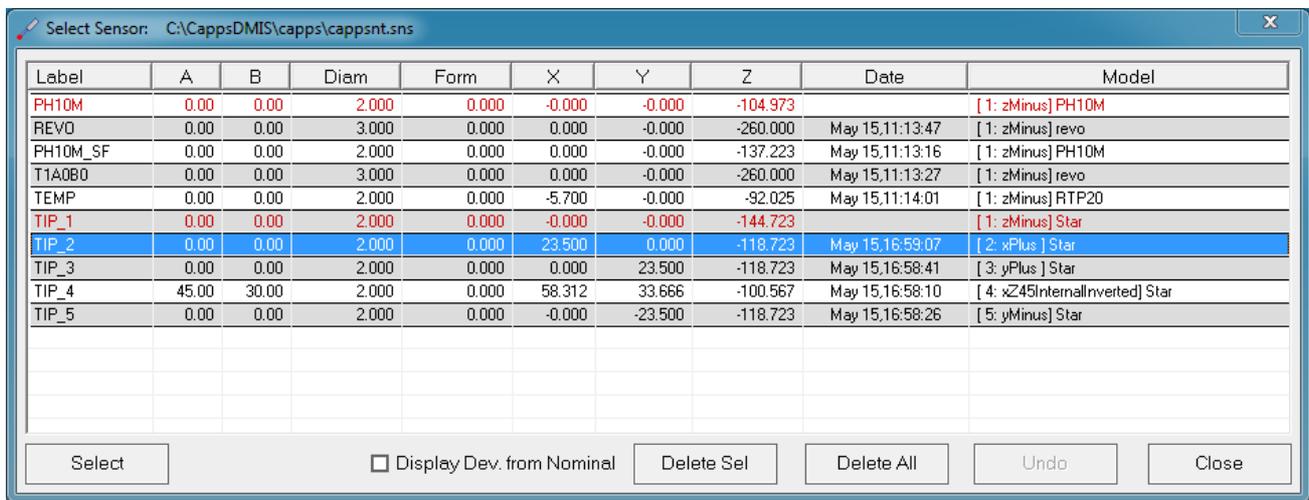
Label	A	B	Diam	Form	X	Y	Z	Date	Model
NOM_PROBE_1	0.0	0.0	4.000	0.000	-0.000	-0.000	-178.750		[TIP 1] PH10M_SP2..
NOM_PROBE_2	0.0	0.0	4.000	0.000	35.000	-0.000	-149.750		[TIP 2] PH10M_SP2..
NOM_PROBE_3	0.0	0.0	4.000	0.000	-0.000	126.000	-149.750		[TIP 3] PH10M_SP2..
NOM_PROBE_4	0.0	0.0	4.000	0.000	-105.000	-0.000	-149.750		[TIP 4] PH10M_SP2..
NOM_PROBE_5	0.0	0.0	4.000	0.000	-0.000	-55.000	-149.750		[TIP 5] PH10M_SP2..

At the bottom of the window, there are five buttons: "OK", "Delete Sel", "Delete All", "Undo", and "Cancel".

[Star Probes](#)

Selecting a Probe

Once a probe has been calibrated either nominally or actually, it may be selected for use in a part program. To do this, click on [Probe Menu- Select](#). The menu below will be shown:



Either double click the probe needed, or single click the probe and click **OK**. Be aware that the motorized probe head will index to the new position. Move probe clear of any obstructions before acknowledging probe moves.

Delete Selected:	Used to delete the selected probe from the list.
Delete All:	Used to delete all probes from the list. Once a probe or all probes are deleted from the list, UNDO button will be enabled. UNDO is used to undo the last actions performed in the list.
Cancel:	Used to close the Select Sensor dialog.

Important Note: Once a probe or all probes deleted from the list and the Select Sensor dialog is closed there is no **UNDO**.

[Probe Calibrations](#)

Using Sensor Files in Part Programs

Often times, it is necessary to use multiple styli during part programs. Some companies have the luxury of having an automatic tip changer, while others do not. In either case handling different styli configurations has its own rubrics that need to be followed to ensure efficient part programming. Although there are many different ways to handle this, it is this author's opinion that each new stylus configuration ought to be saved as its own sensor file within CAPPs.

Case Study – John Q. Customer

In this example, **John Q. Customer** has a part where all of the features can be checked using one stylus configuration except for one feature. He will need to perform a stylus change during the program in order to inspect this one lone feature. In this example, we will assume that John knows about this at the beginning of the inspection process, so he will proceed to define and calibrate the probes for his **Stylus 1 Setup** and then he will define and calibrate the probes needed for his **Stylus 2 Setup**.

Stylus 1 Setup

- Define Stylus 1 setup using the probe model builder as described in the section on defining the probes.
- Measure the [Master \(sphere\) Ball](#).
- Calibrate all the probes needed for the inspection that will use this stylus configuration.
- Save the sensor (**.sns**) file; [File Menu - Save Internal Files](#). From the drop down list, choose (**.sns**) files for save as type. This step is extremely important in this case study.
- Give the sensor file a meaningful name that would somehow relate to the probe configuration (**i.e. PH10_2X40.sns**). Having a unique naming convention for the file will make it easily recognizable for future reference.
- It is also recommended that the sensor file is also saved as a (**.cal**) file; [File Menu - Save Internal Files](#). From the drop down list, choose (**.cal**) files for save as type.

Important Note: Remember that a (**.cal**) file is merely a text file with probe angles that replicate the angles that are in the current sensor list in CAPPs.

- Stylus 1 define and necessary angle calibrations complete.

Stylus 2 Setup

- Delete all the current sensors in the sensors list. [Probe - Select - Delete All](#).
- Define Stylus 2 setup using the probe model builder as described in the section on defining the probes.
- Calibrate all the probes needed for the inspection that will use this stylus configuration.
- Save the sensor **(.sns)** file; [File Menu - Save Internal Files](#). From the drop down list, choose **(.sns)** files for save as type. This step is extremely important in this case study.
- Give the sensor file a meaningful name that would somehow relate to the probe configuration (**i.e. PH10_2X40.sns**). Having a unique naming convention for the file will make it easily recognizable for future reference.
- It is also recommended that the sensor file is also saved as a **(.cal)** file; [File Menu - Save Internal Files](#). From the drop down list, choose **(.cal)** files for save as type.

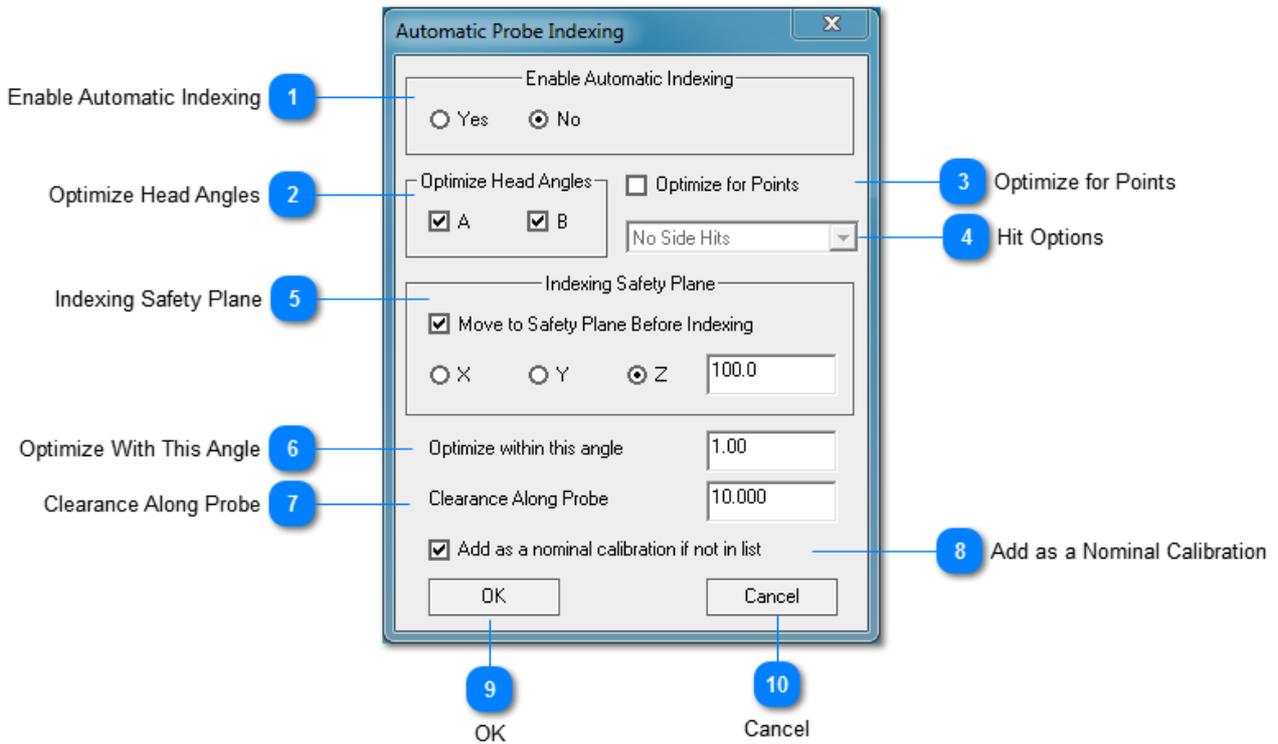
Important Note: Remember that a **(.cal)** file is merely a text file with probe angles that replicate the angles that are in the current sensor list in CAPPs.

Now that you have defined, calibrated, and saved 2 sensor files, it is possible to seamlessly switch between sensor files within a program. To open a previously saved sensor file within a program, simply go to [File Menu - Open Internal Files](#). From the drop down list, choose **(.sns)** files for **Files of Type** and pick the desired sensor file.

[Probe Calibrations](#)

Select Optimum

This option works only with **Indexable Probes**, such as **PH10M**, **PH20**, **Revo**, etc. **Select Optimum** finds the closest matching head angle to the feature vector.

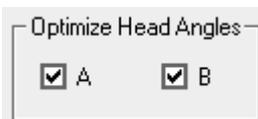


1 Enable Automatic Indexing



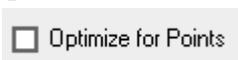
Enables **Autotomatic(Optimum) Indexing** option for suitable probe models.

2 Optimize Head Angles



Used to select which head angles are used for optimum indexing.

3 Optimize for Points



Activates optimization options for points.

4 Hit Options

No Side Hits

- No Side Hits
- Take Side Hits
- Outward Radial Side Hits
- Inward Radial Side Hits

No Side Hits:	CAPPS optimizes the head angle to ONLY take direct hits along the feature vector.
Take Side Hits:	CAPPS allows the probe to take side hits.
Outward Radial Side Hits:	CAPPS allows the probe to take side hits ONLY if the feature is a part of an Outward Radial surface.
Inward Radial Side Hits:	CAPPS allows the probe to take side hits ONLY if the feature is a part of an Inward Radial surface.

5 Indexing Safety Plane

Indexing Safety Plane

Move to Safety Plane Before Indexing

X
 Y
 Z

Enables moving to safety plane before indexing the probe head. The user specifies the safety plane direction and distance using this dialog.

6 Optimize With This Angle

Optimize within this angle

Used to optimize the probe head angle within the angle limit set by the user.

7 Clearance Along Probe

Clearance Along Probe

Used to enter a distance to clear the probe along the probe.

8 Add as a Nominal Calibration

Add as a nominal calibration if not in list

Adds nominal calibration to [Sensor Select Menu](#) for each head angle used for optimization during a feature measurement.

9 OK

OK

Applies changes.

10 Cancel

Cancel

Cancel the changes and close the dialog.

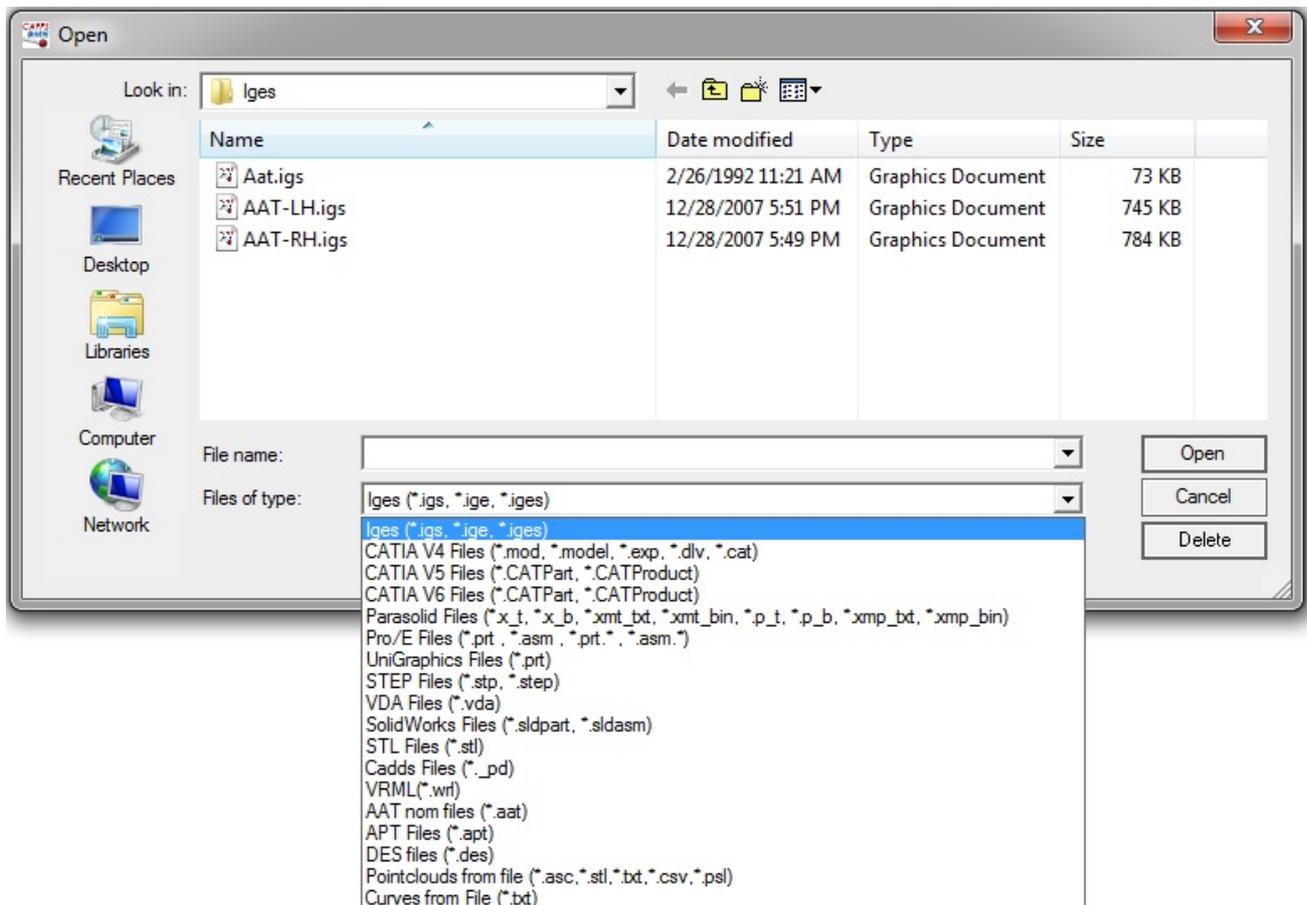
[Probe Calibrations](#)

Basic CAD Operations

CAPPS DMIS has long had an excellent reputation for working with CAD files to aid and assist in part inspection. This section will give some details on the types of files that can be imported/exported and used for the measurement process.

Import Options with CAPPS DMIS

CAD data comes in many forms from solid models, to wire frame models, to point check data. To import a CAD data, go to [File Menu - Import Data](#) and following dialog will be opened. The import options are as presented in the following window:



Standard import options available with CAPPS DMIS

- **IGES**
- **STEP**
- **AAT Nom Files**
- **STL Files**

Export Options with CAPPS DMIS

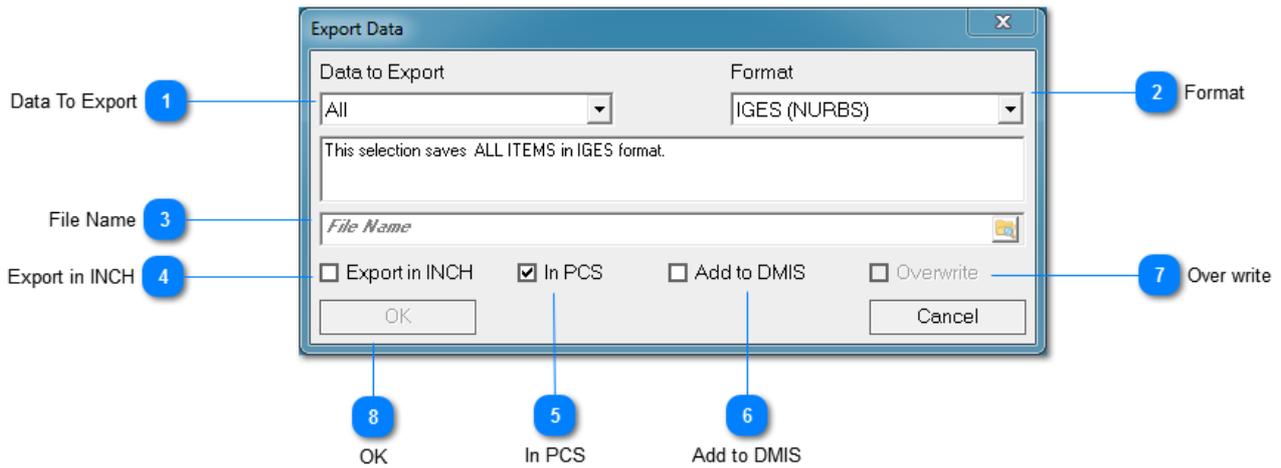
In CAPPS, to export a CAD data go to [File Menu - Export Data](#) and the following dialog will be opened. You must have a model on the **Graphics Window** to use **Export Data** option. The export options allow the exportation of the following:

- **Actuals**
- **All Data**
- **CAD entities**
- **Nominal Data**
- **Selected surfaces**
- **Visible**

The aforementioned items may be exported to the following formats:

Actuals	<ul style="list-style-type: none"> • IGES – Geometrical • IGES – Nurbs • STEP • STL (ASCII) • STL (Binary) • Text (AAT Format) • Text (APT Format) • Text (ASC Format) • VDA
All Data	<ul style="list-style-type: none"> • IGES (Nurbs) • STEP • VDA
CAD Entities	<ul style="list-style-type: none"> • IGES (Nurbs) • STEP

Nominal Data	<ul style="list-style-type: none"> • IGES – Geometrical • IGES – Nurbs • STEP • STL (ASCII) • STL (Binary) • Text (AAT Format) • Text (APT Format) • Text (ASC Format) • VDA
Selected Surfaces	<ul style="list-style-type: none"> • IGES (Nurbs) • STEP • VDA • Visible • IGES (Nurbs) • STEP • VDA



1 Data To Export

Data to Export
All

Used to select data type to export as shown above.

2 Format

Format
IGES (NURBS)

Used to select output format.

3 File Name

File Name

Clicking the browse option will allow the user to choose a destination for the file being saved and provide a name for the file.

4 Export in INCH

Export in INCH

Clicking the **OK** button will export the model into selected format.

5 In PCS

In PCS

Cancel the changes and close the dialog.

[Table of Contents](#)

6 Add to DMIS

Add to DMIS

<TODO>: Insert description text here...

7 Over write Overwrite

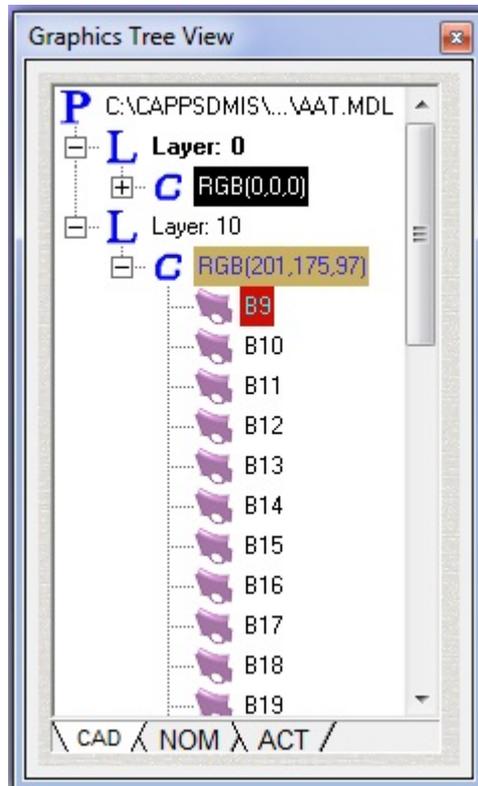
<TODO>: Insert description text here...

8 OK

<TODO>: Insert description text here...

Working With CAD Treeview Window

The CAD Tree view allows certain entities or levels of CAD to be viewed and/or displayed. The CAD tree works on three levels, by CAD, Nominal, or Actual, which will be discussed here.

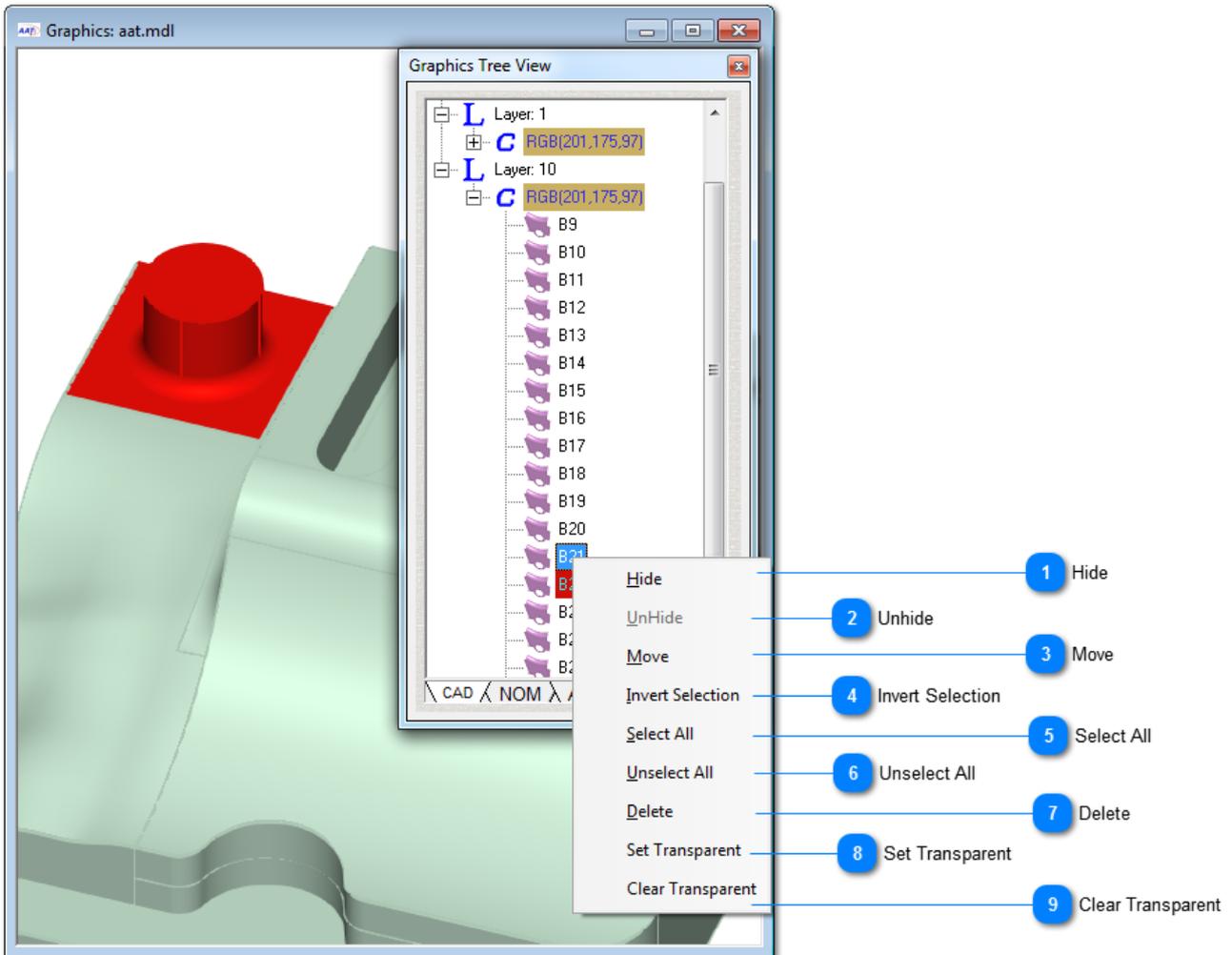


Each tab, **CAD**, **NOM**, and **ACT** will have a list of all the available entities. These entities are interactive. Notice in the picture below, the CAD surface has been highlighted. This surface entity will also be highlighted in the tree view. It is then possible to interact with this surface. By right clicking on the mouse, the options below should appear.

CAD:	Shows the individual levels of CAD in a tree view. The levels are read when the CAD file is imported into CAPPs DMIS. CAD levels are typically part of the architecture of any CAD file and are normally handled by the design department of the OEM.
NOM:	Shows the nominals that have been created in CAPPs in the current program.
ACT:	Shows the actuals that have been created via measurement in CAPPs in the current program.

Important Note: Both the **NOM** and **ACT** tabs have their own right click menu options which are identical to the options above with one exception.

Copy to CAD:	Allows any nominal or actual entity to be converted to a CAD entity and may be saved as a model file for future use. One example of this is where the user may create nominal values for a tooling ball alignment and may want to reference them at a future time.
---------------------	--



1 Hide

Hide

Allows a selected surface or group of selected surfaces to be hidden from view in the **Graphics Window**.

2 Unhide

UnHide

Unhides hidden surfaces.

3 Move

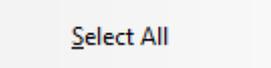
Move

Moves selected CAD entities to the **Active Layer**.

4 Invert Selection

Invert Selection

Highlights every surface except for the selected surface.

5 Select AllA rectangular button with a light gray background and the text "Select All" in a dark gray font.

Selects all the surfaces.

6 Unselect AllA rectangular button with a light gray background and the text "Unselect All" in a dark gray font.

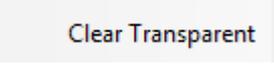
Unselects all the surfaces.

7 DeleteA rectangular button with a light gray background and the text "Delete" in a dark gray font.

Deletes the selected surface.

8 Set TransparentA rectangular button with a light gray background and the text "Set Transparent" in a dark gray font.

Shows the selected surface as transparent.

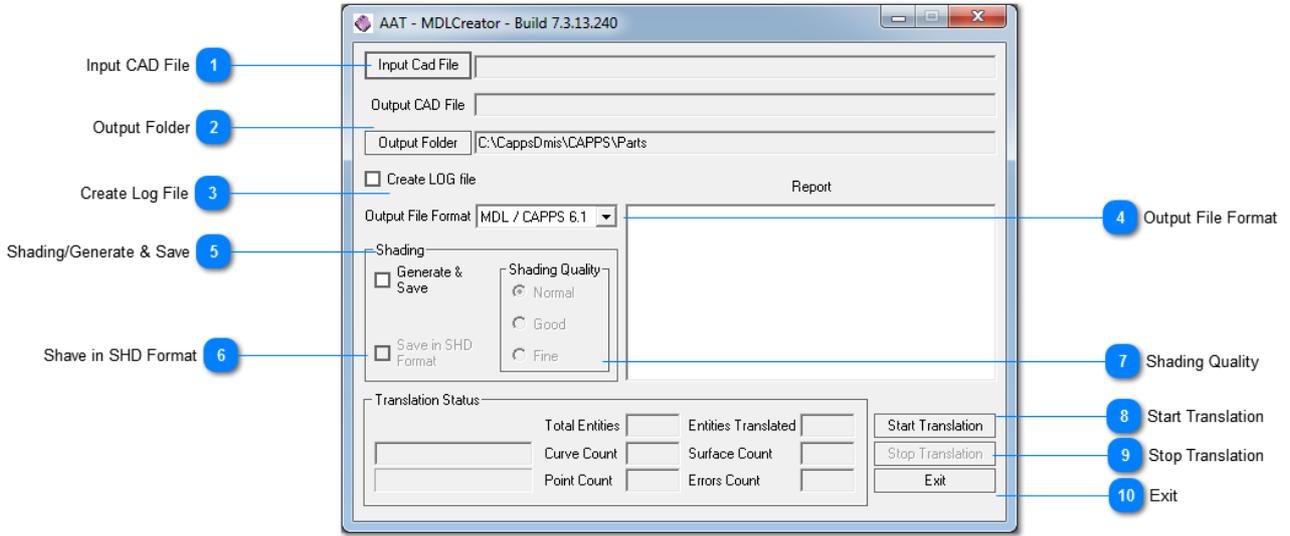
9 Clear TransparentA rectangular button with a light gray background and the text "Clear Transparent" in a dark gray font.

Sets the transparent surface back to normal viewing.

[Basic CAD Operations](#)

Using The MDL Creator

The **MDL Creator** allows any importable CAD data (.igs, .stp, etc...) to be saved in CAPPs DMIS native format. To access the **MDL Creator** click on [System Menu - Utilities - MDL Creator](#). The following application will appear:



1 Input CAD File



Clicking this button allows the user to select the file to be converted into (.mdl) format.

2 Output Folder



Click this button to choose the destination folder for the file after translation.

3 Create Log File



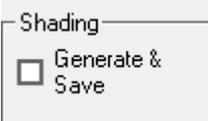
Will create a log file called **CADReading.log** in the **Capps6(or CappsDmis)** folder of the translation process. This can be useful on problem files.

4 Output File Format

Output File Format MDL / CAPP6.1 ▼

Translated file can be saved in current format or previous version format.

5 Shading/Generate & Save



If this option is checked, then the shading information will be saved with the (.mdl) file. If the file is opened at a future time, there will be no need for rendering.

6 Shave in SHD Format



This option would be useful for graphical purposes only. This format is not interactive and contains no math data from which to create nominals or execute measurements.

7 Shading Quality



From **Normal** to **Fine**, this will generate more or less detail during the tessellation of the file. The finer the quality, the larger the file that is generated.

8 Start Translation



Starts the translation.

9 Stop Translation



Stops and aborts the translation.

10 Exit



Exits from **MDL Creator**.

[Basic CAD Operations](#)

Quick Operations Using CAPPs DMIS

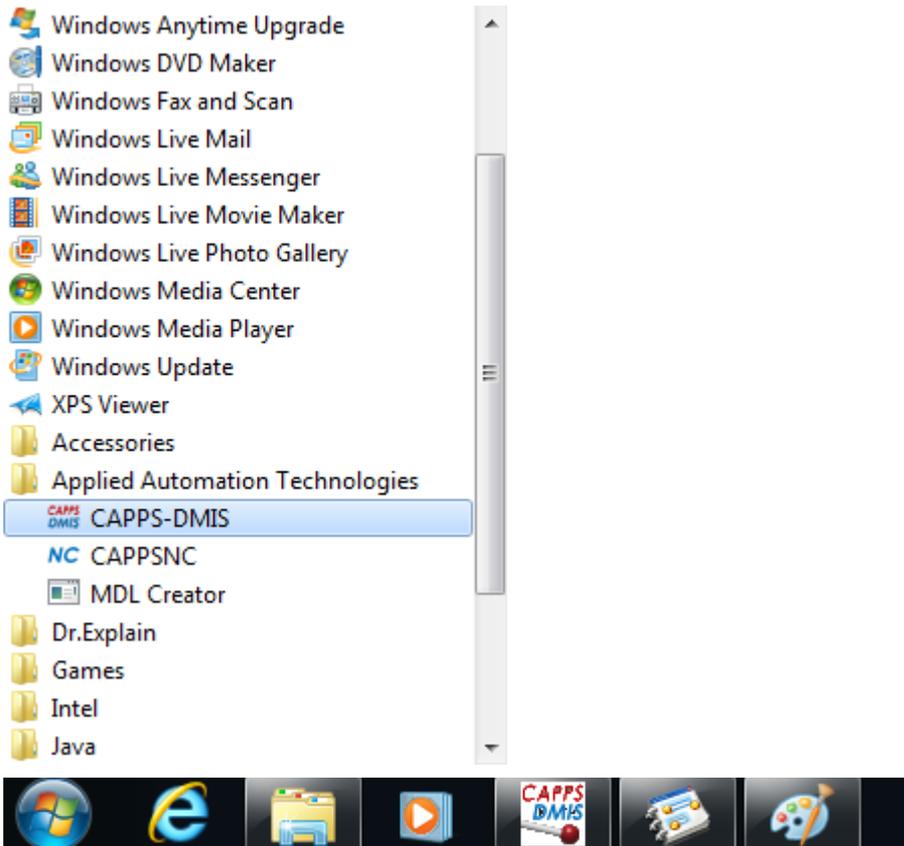
This section reviews a how to perform a quick measurement operation using CAPPs DMIS. In this section, it is assumed that the user has already set up [System Configurations](#) and performed [Probe Calibrations](#) before starting a new part program. Please follow step by step instructions to create a basic part program.

Step 1: Running CAPPs DMIS

CAPPs DMIS can be run by either double clicking the shortcut icon on your desktop or from the Windows **Start Menu > All Programs > Applied Automation Technologies > CAPPs DMIS**.

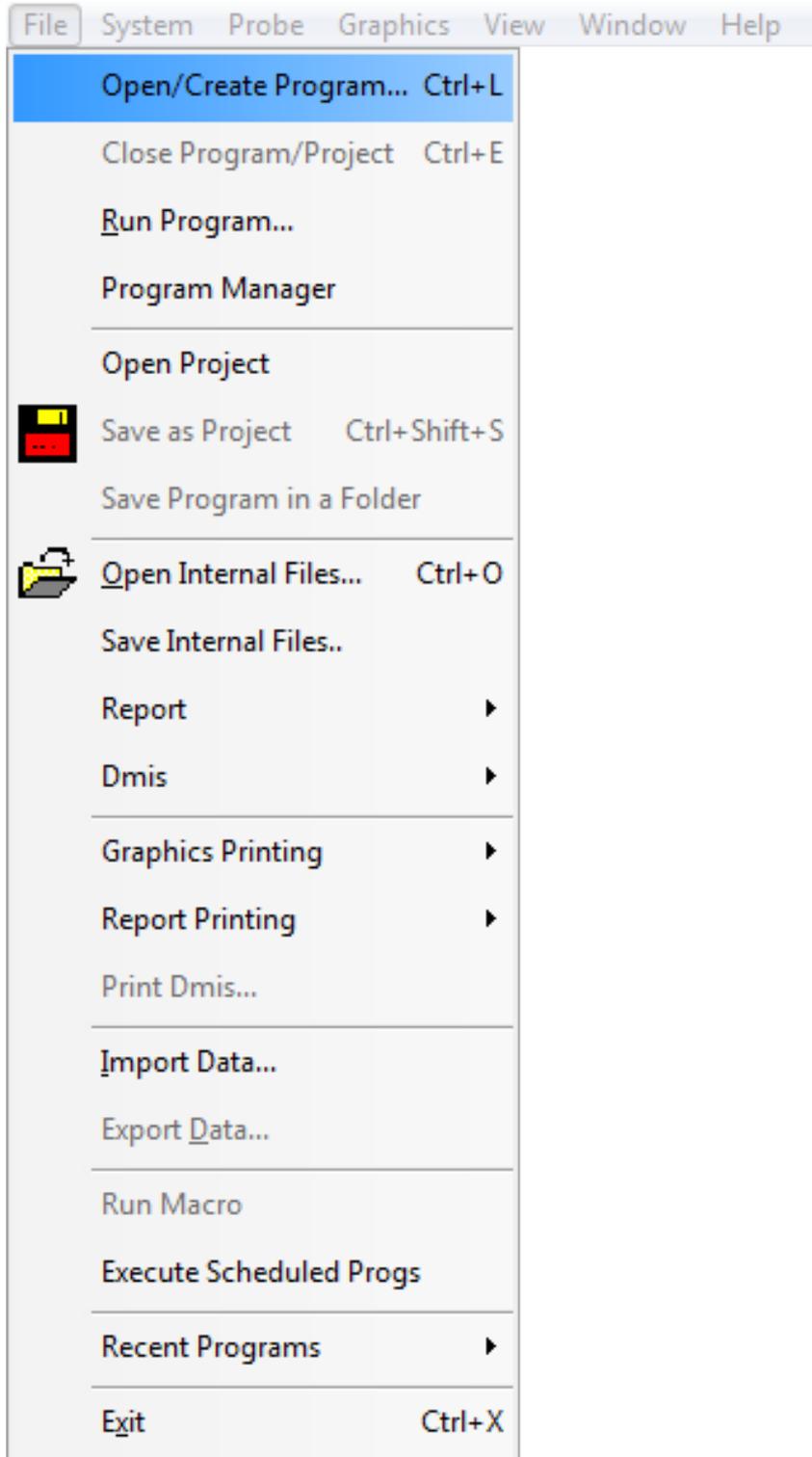


CAPPs DMIS Desktop Shortcut

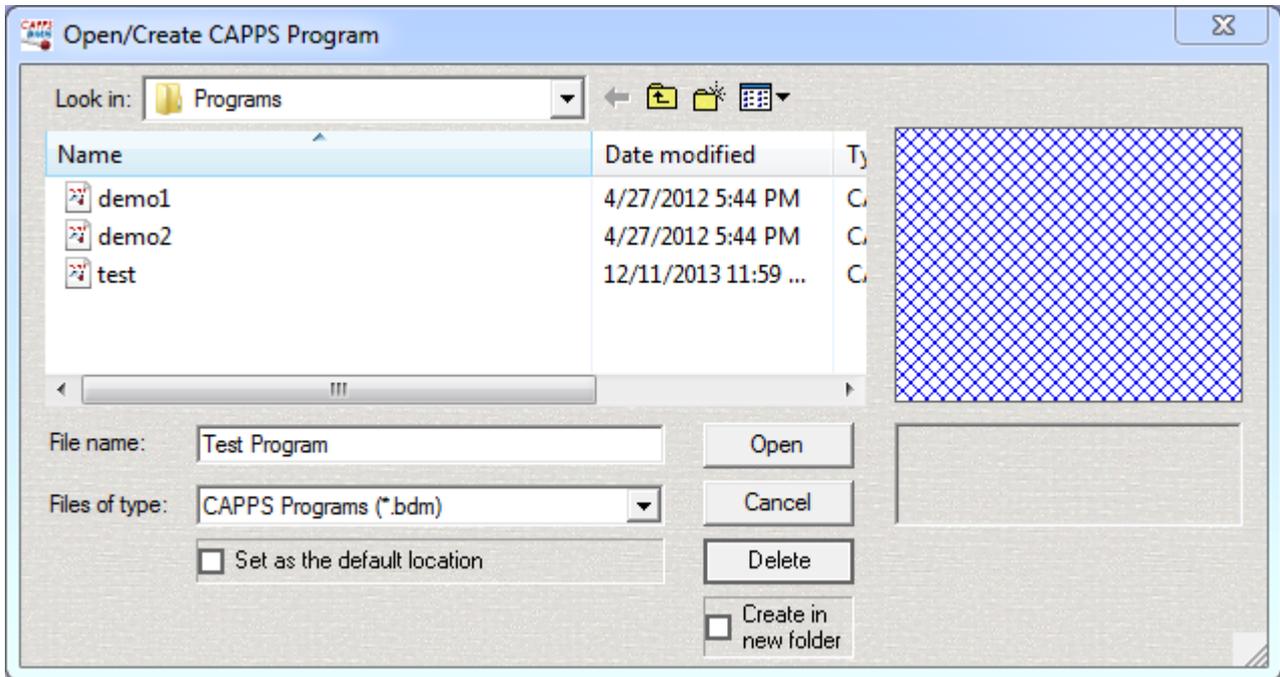


CAPPs DMIS Windows Start Menu

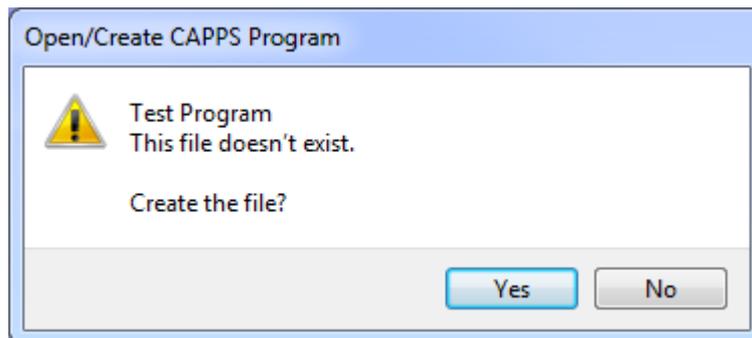
Go to [Menu Bar](#) and click on [File - Open/Create a New Program](#).



Once Open/Create Program is clicked, the following dialog appears. **By default the location is set to C:\Capps6(or CappsDmis)\Capps\Programs for all programs and the File Name is "test"**. For this instance, leave the location as default and type **"Test Program"**. Click **OK** to proceed.

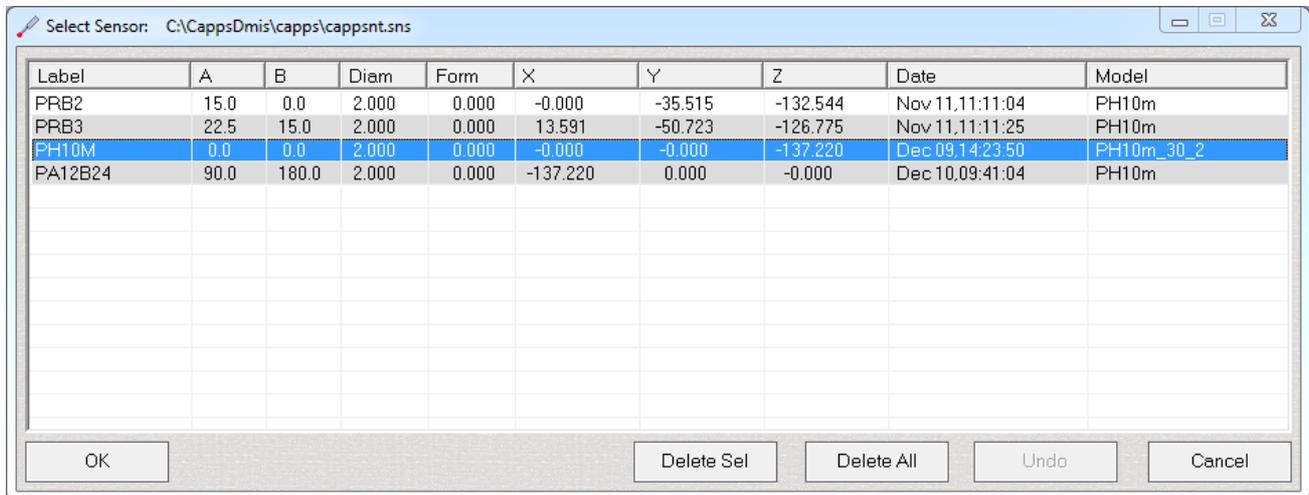


CAPPs will automatically prompt a message box if you want to create a file named **"Test Program"**. Click **Yes** to proceed.

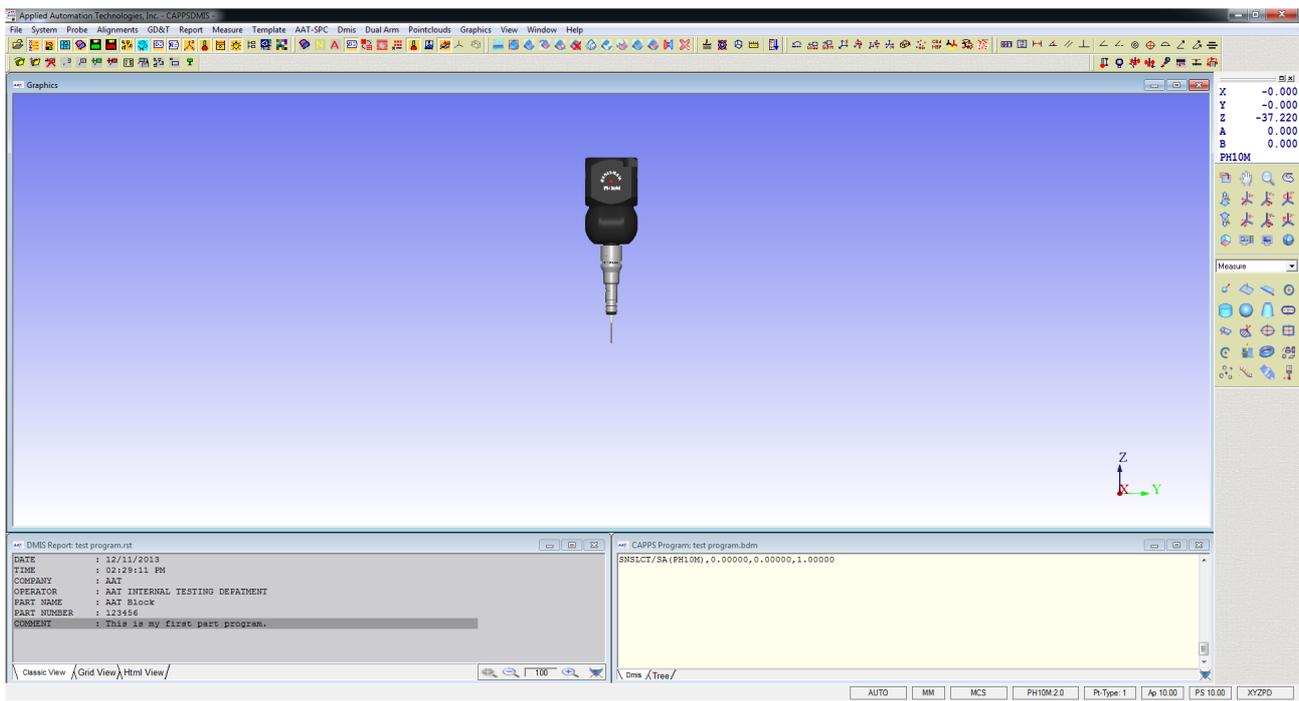


Now select a calibrated sensor(probe) from [Select Sensor](#) window. Make sure you have a calibrated probe in the list before you proceed to next step. **Calibrated probes are displayed in black font as shown above.** To select a probe basically double click on the probe from the list or highlight a probe by left clicking it once and click **OK**.

Important Note: If your probes are shown in a red font in **Select Sensor** window, please refer back to [Probe Calibrations](#) section to perform a calibration.



Once the user clicks **OK**, a new program will be started with given information above.

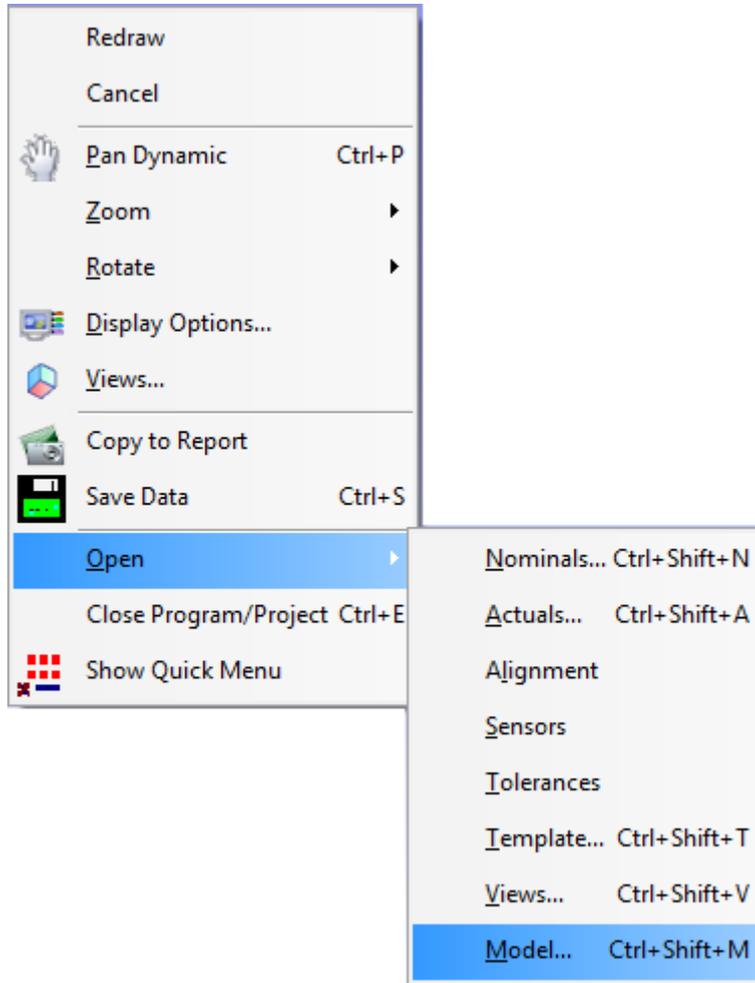


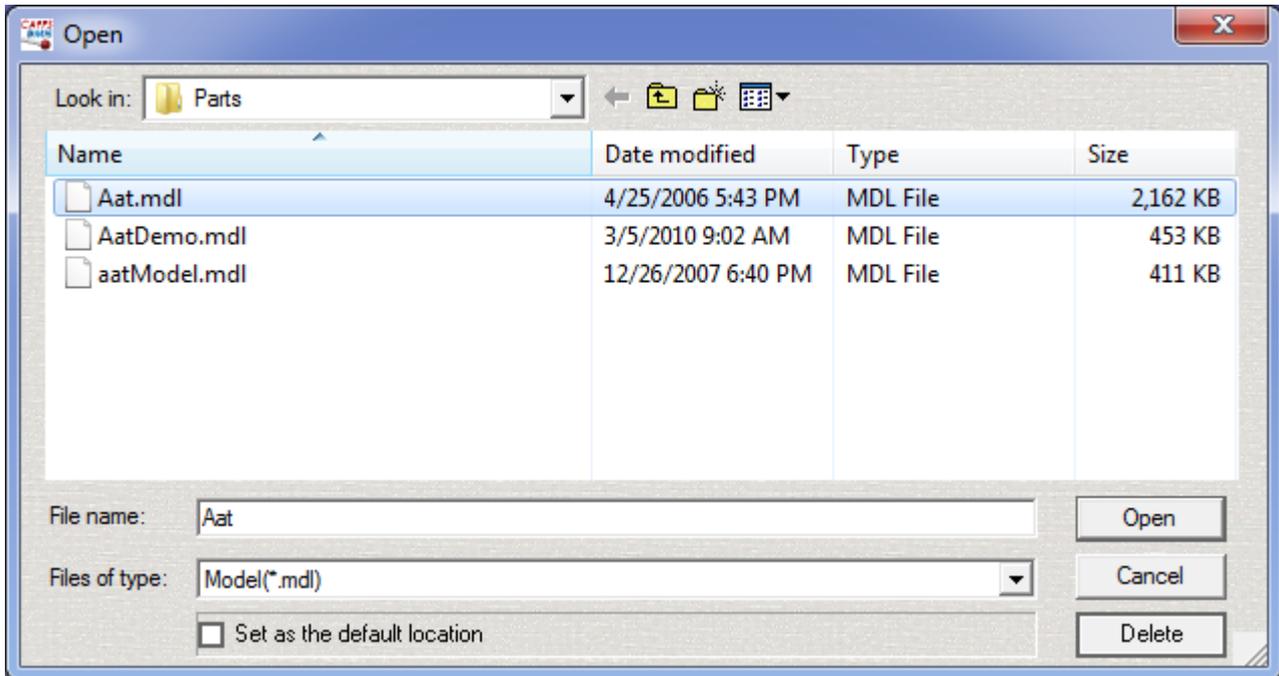
[Proceed to Next Step](#)

How to Import a CAD Model

Step 3: Importing a CAD Model

To open a CAD model, right click on anywhere on your [Graphics Window](#) which will open up the **Right Mouse Button Menu** shown below. Go to **Open - Model** to select **AAT.mdl** from the next window. To open a model double click on the model from the list or highlight a model by left clicking on it and clicking **Open**.

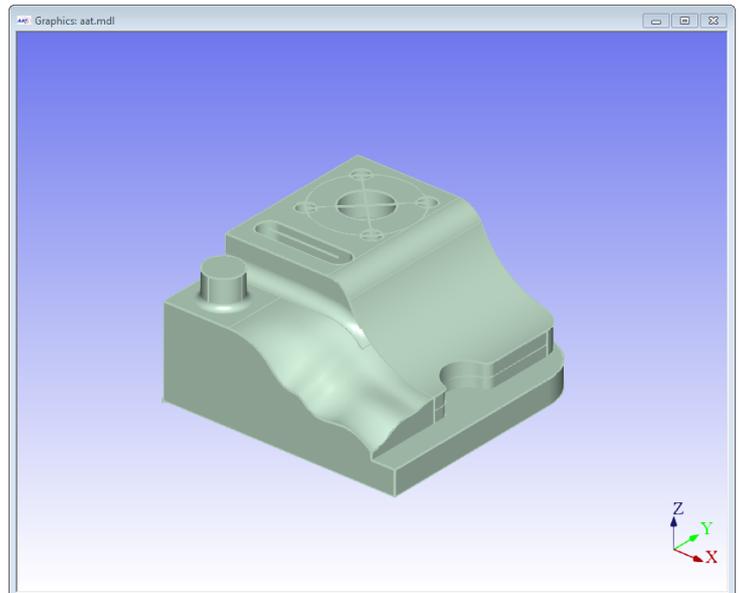
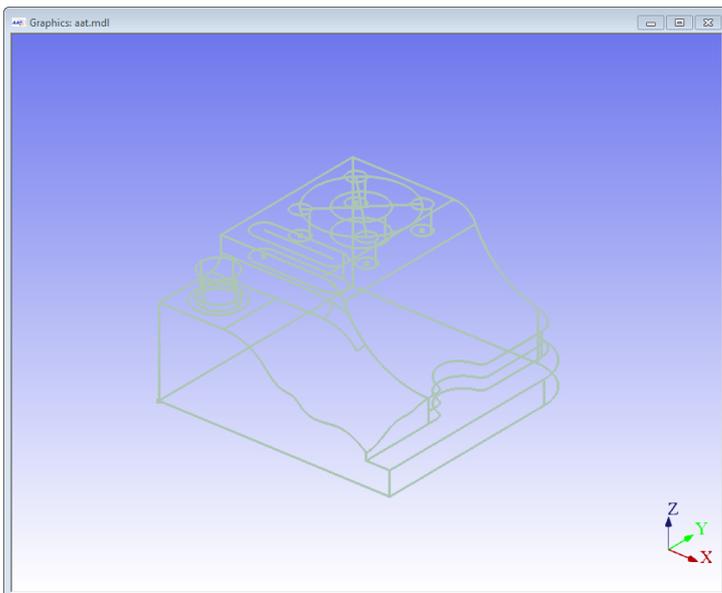




This will bring the your model to your [Graphics Window](#).

Important Note: **AAT.mdl** model will be used as the default CAD model in the rest of this section.

The CAD model might come as a wire frame for the first time a user opens it. To create shaded surfaces please click on [Render Surfaces](#) button on your [Graphics Toolbar](#).



[Proceed To Next Step](#)

Measure Plane

Nominals
 Automatic Manual

Feature Label: DATUMA

No. of Points: 4

Meas. Points

Form: 0.000

Write to Report
Compare to CAD

Compute
Pos. Point
Select Probe
WorkPlane
5Axis
Close

No.	X	Y	Z
-----	---	---	---

Delete Last Delete All Del Selection

Type in **DATUMA** into your **Feature Label** section and drive your probe on your actual part and take 4 points on the top plane. **The Number of Points** to compute a plane is set to 4 by default. Once you have taken the last point, CAPPS will automatically create an actual plane on [Graphics Window](#).

Important Note: Please make sure that you have turned on your [Actual Graphics Toggle](#) on [Display Items Toolbar](#) for them to be displayed on your [Graphics Window](#).

Measure Plane

Nominals
 Automatic Manual

Feature Label: DATUMA

No. of Points: 4

Meas. Points: 

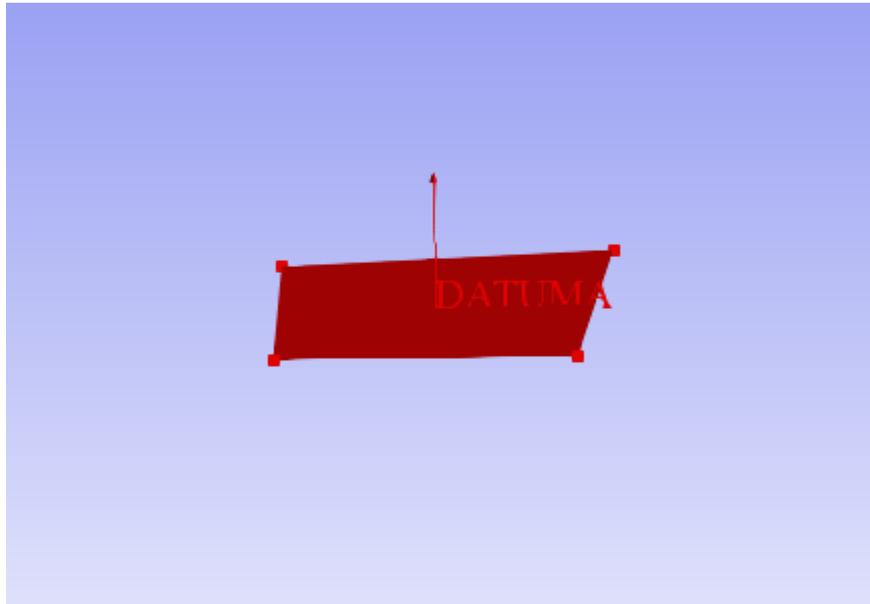
Form: 0.000

Write to Report
 Compare to CAD

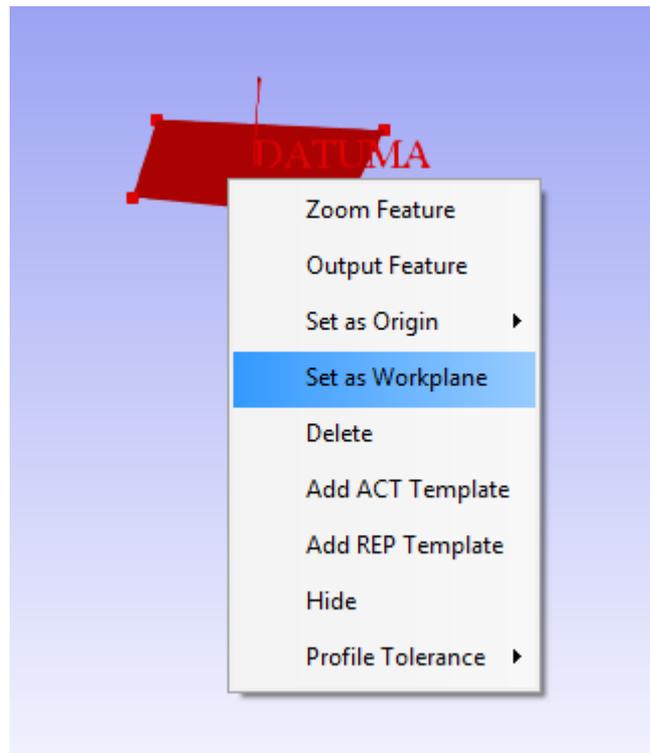
Buttons: Compute, Pos. Point, Select Probe, WorkPlane, 5Axis, Close

No.	X	Y	Z
1 : POINT	46.934	93.114	63.489
2 : POINT	26.996	116.875	63.494
3 : POINT	11.113	97.113	63.496

Buttons: Delete Last, Delete All, Del Selection



Double click on **DATUMA** on [Graphics Window](#). From the menu select **Set as Workplane** option as shown below:



To measure a secondary datum, select [Line](#) icon  on [Measure Toolbar](#). CAPPS will bring a **Measure Line** window to the screen. Enter **DATUMB** in **Feature Label** section and take two points on the back side of the block.

Measure Line [X]

Nominals
 Automatic Manual

Feature Label: 

No. of Points:

Meas. Points: 

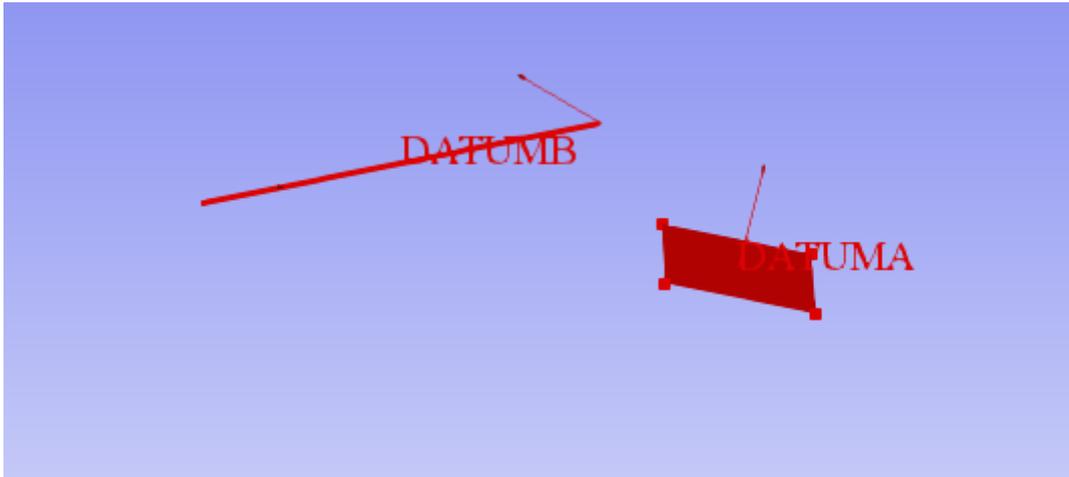
Form:

Compute
 Pos. Point
 Select Probe
 WorkPlane
 5Axis
 Close

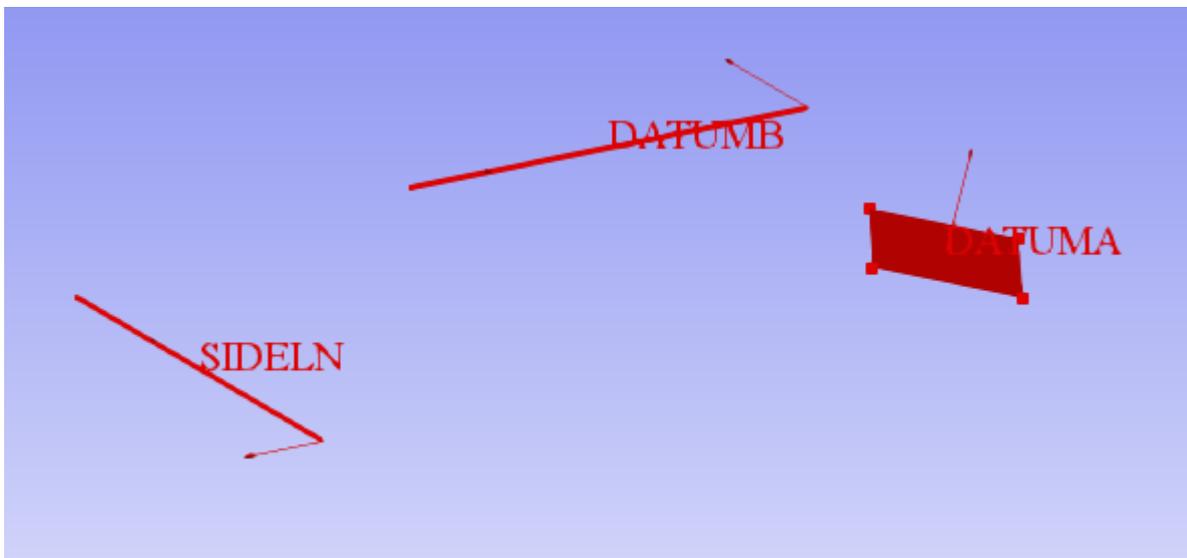
Write to Report
 Compare to CAD

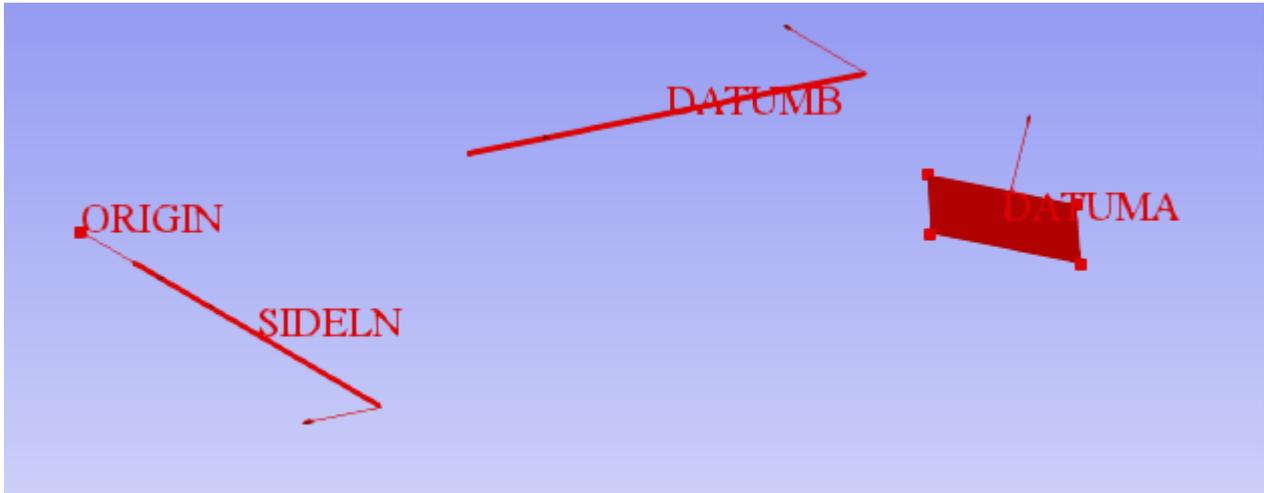
No.	X	Y	Z	
1	: POINT	-1.000	52.485	58.448

Delete Last Delete All Del Selection



Open up **Measure Line** window again from the [Measure Toolbar](#), and enter **SIDELN** to **Feature Label** section. Measure a line on the left side of the part with two points. This line will be used to create the origin point.





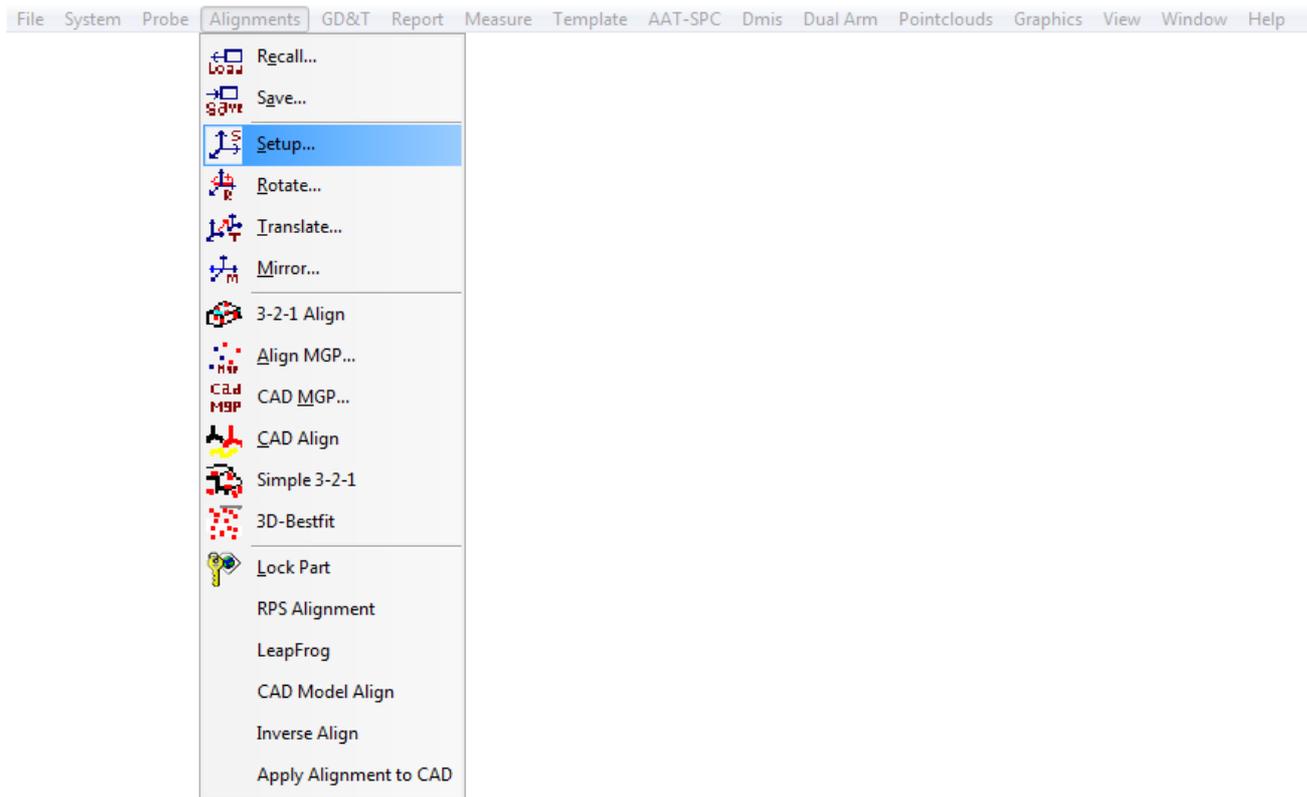
After creating the **Origin** point, all actual features are going to look similar to the image above.

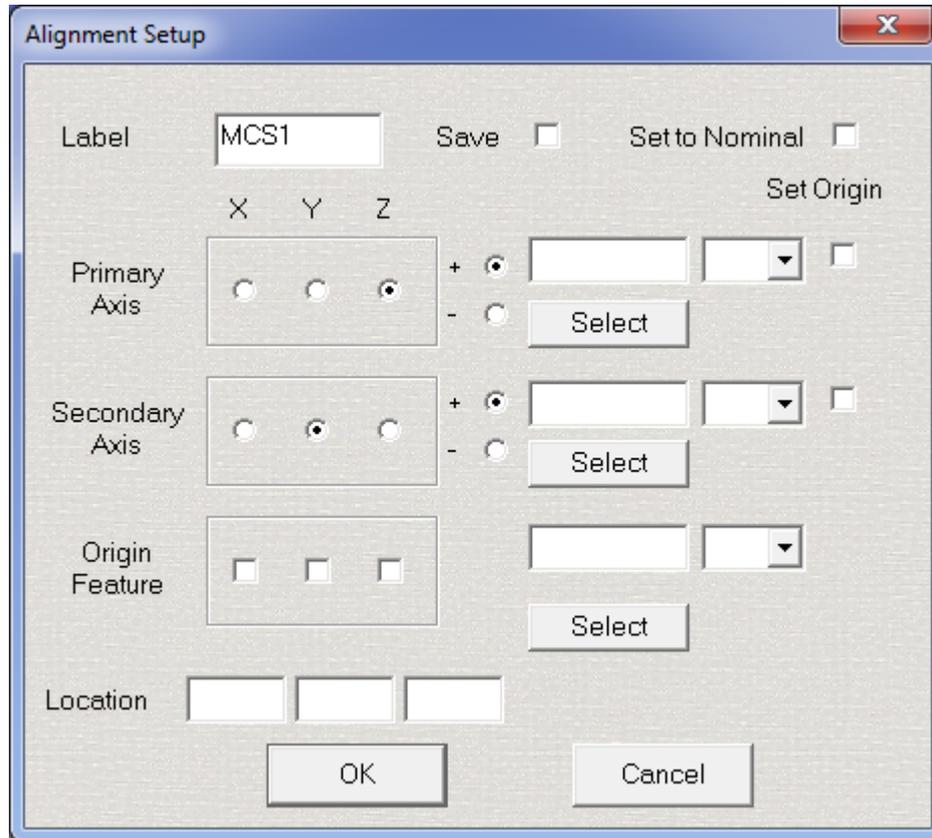
[Proceed To Next Step](#)

Set Up An Alignment

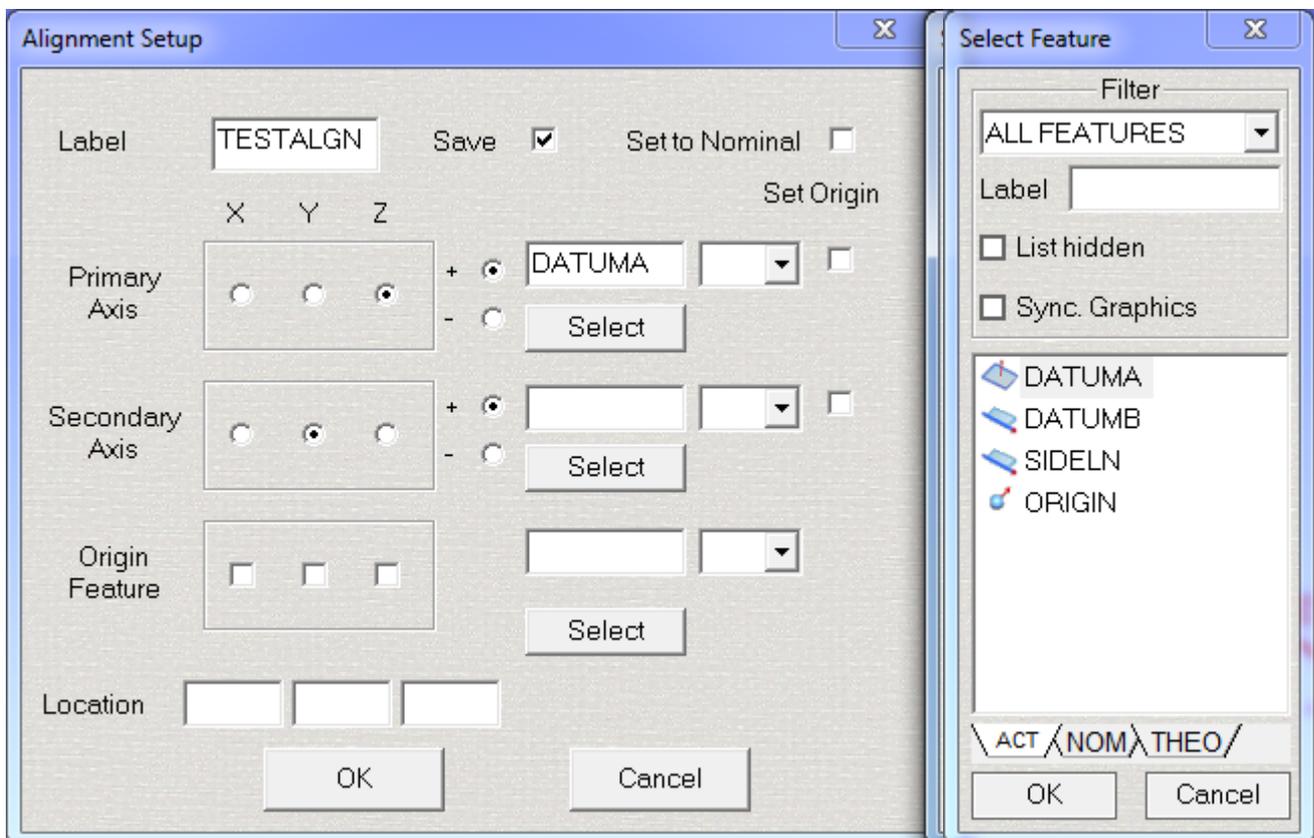
Step 5: Creating A Basic Alignment

To set your basic alignment go to [Alignments Menu - Setup](#) as shown below. This will bring up **Alignment Setup** window.

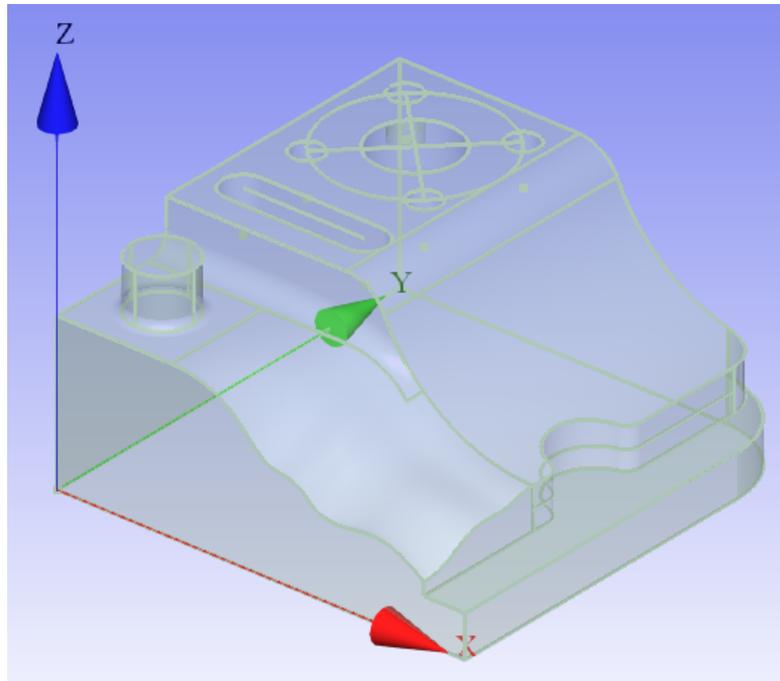




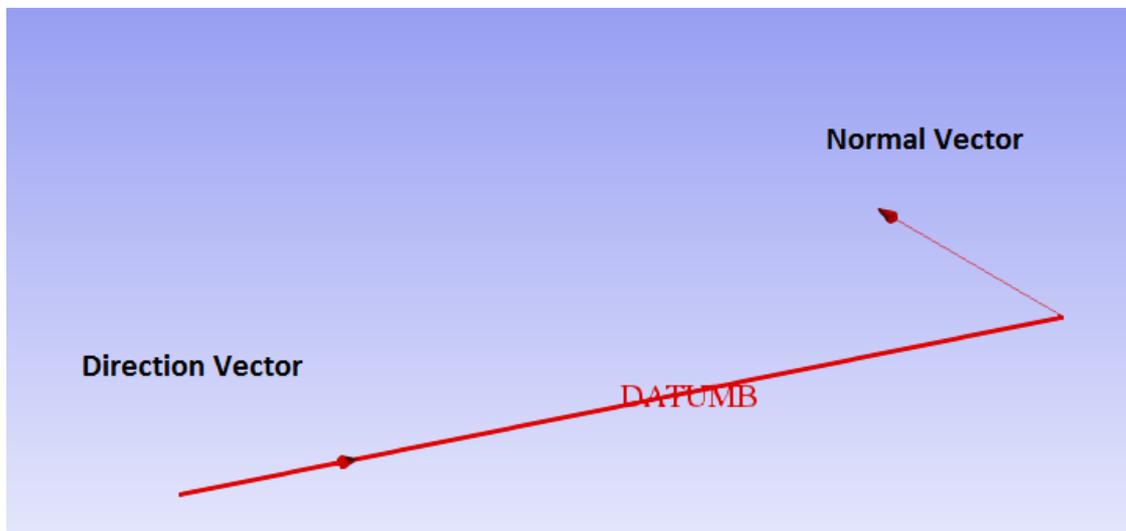
Enter **TESTALGN** to **Label** box and check the **Save** check box. For the **Primary Axis** select **Z** and **+** direction. Click on **Select** and select **DATUMA** as your primary datum as shown below:



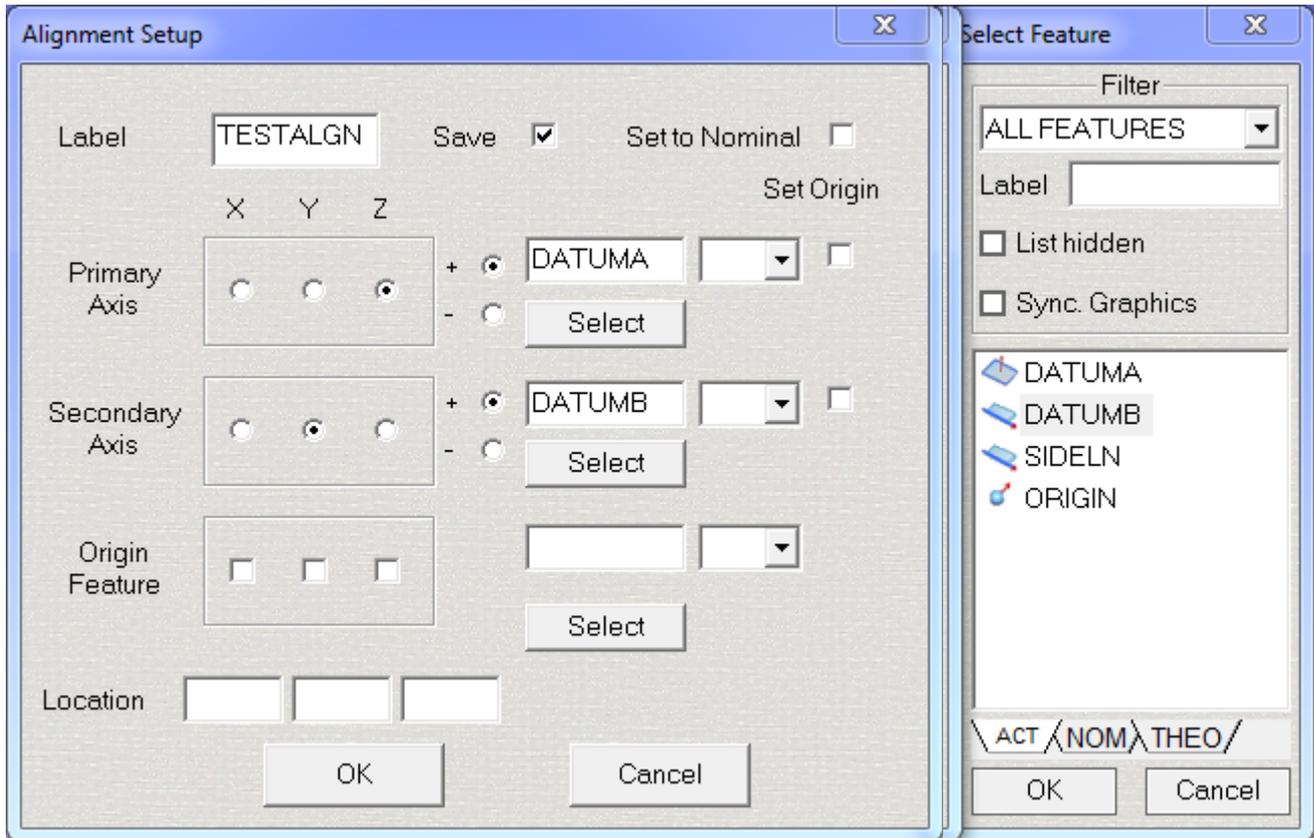
Secondary axis selection depends on the your CAD coordinate system and the direction of your **DATUMB** line. You can check the direction vector of your **DATUMB** line by zooming in to your line on [Graphics Window](#) as shown below.



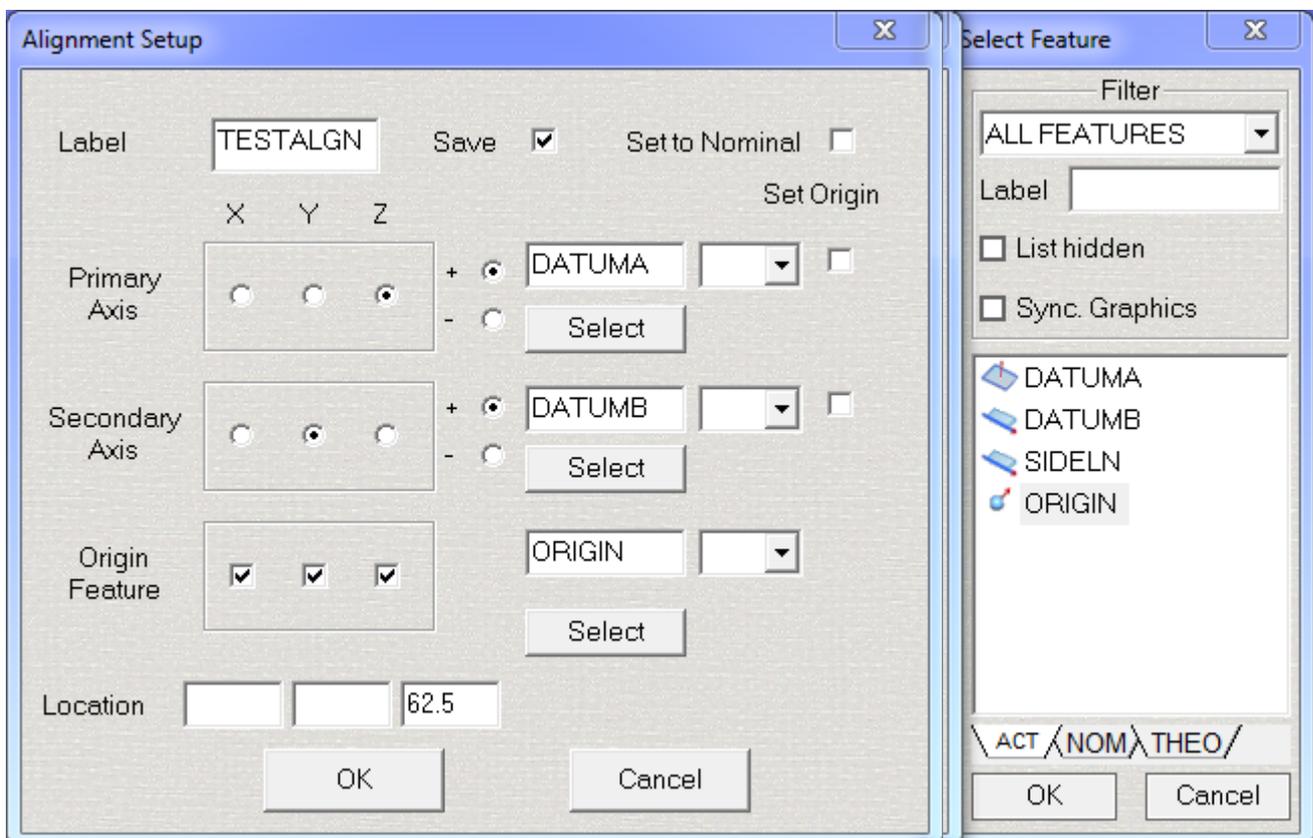
CAD Coordinate System



Note that how **DATUMB's** **Direction Vector** is pointing to **+Y direction** in CAD Coordinate System. That means the **Secondary Axis** should be selected as **Y** and **+** direction in **Alignment Setup** window.

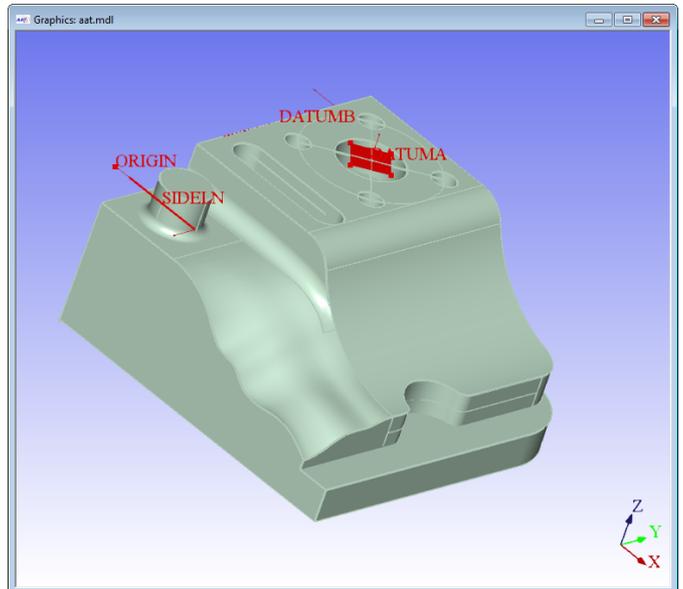
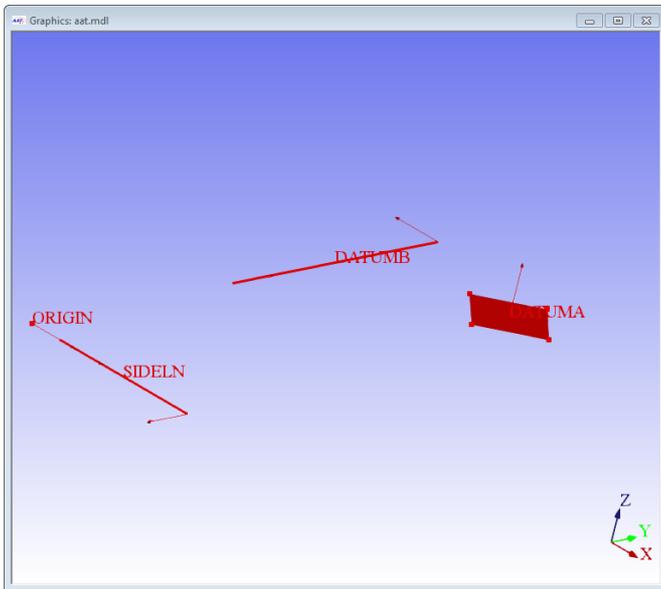
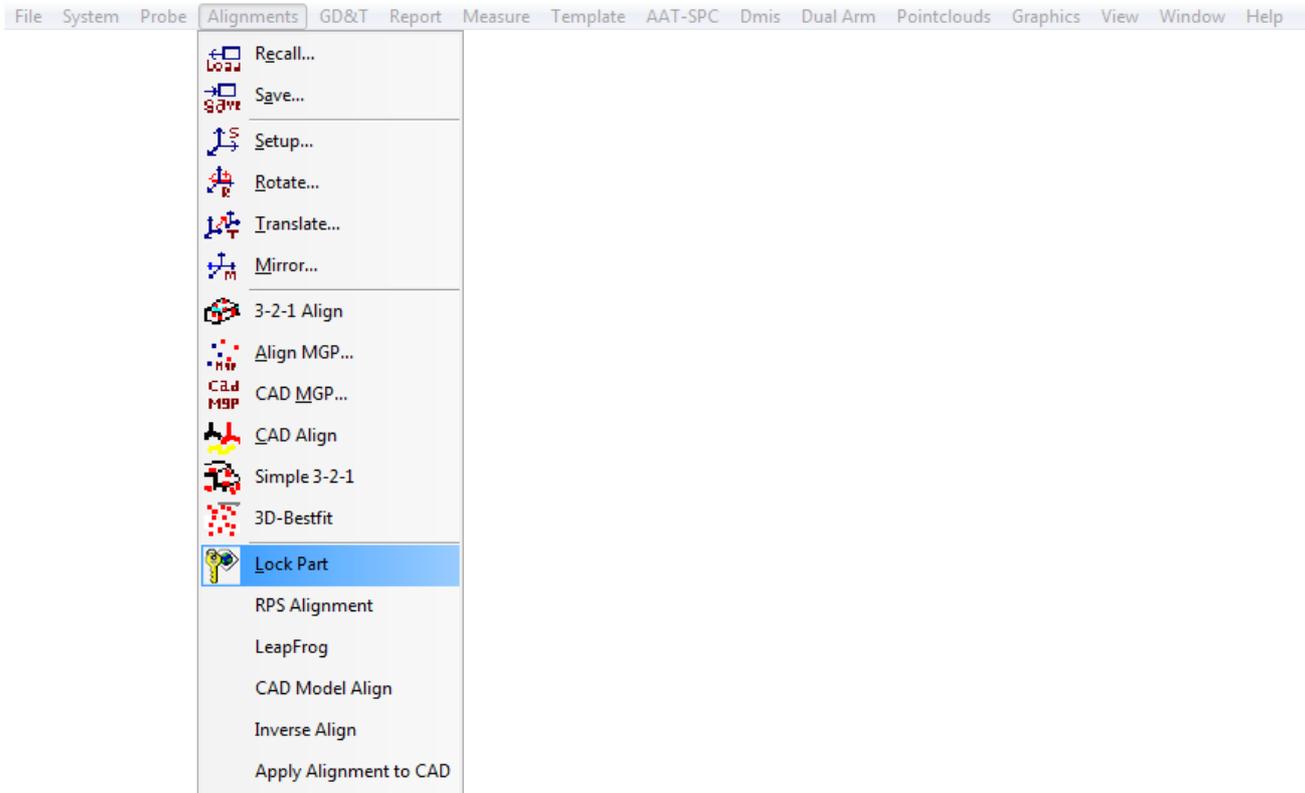


The last feature to select to create a basic alignment is the **Origin** feature. The **ORIGIN** point will be selected as the origin feature. Check **X,Y** and **Z** check boxes and select **ORIGIN** point from the list.



Enter **62.5** (the height of the block in metric to match the CAD model origin) to **Z Location** in **Alignment Setup** window before clicking on **OK**. Once you click on **OK**, the alignment will be set.

In order to bring your CAD model to the current alignment use the [Alignments Menu - Lockpart](#). Once clicking on [Lockpart](#), CAPPS takes your CAD model and locks it to the actual features used to create **TESTALGN** as shown below:



[Proceed to Next Step](#)

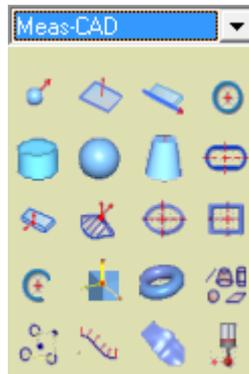
How to Measure Features in Auto Mode ?

Step 6:Using MEASCAD to Measure Features

After the alignment is created, the user can teach part programs using **MEASCAD (Auto Mode)** in CAPPS DMIS. There are two ways to measure features using **MEASCAD option**, automatic **Probe Path** and **Teach From CAD**.

Go to [Measure Toolbar](#) and switch to [MEASCAD Mode](#).

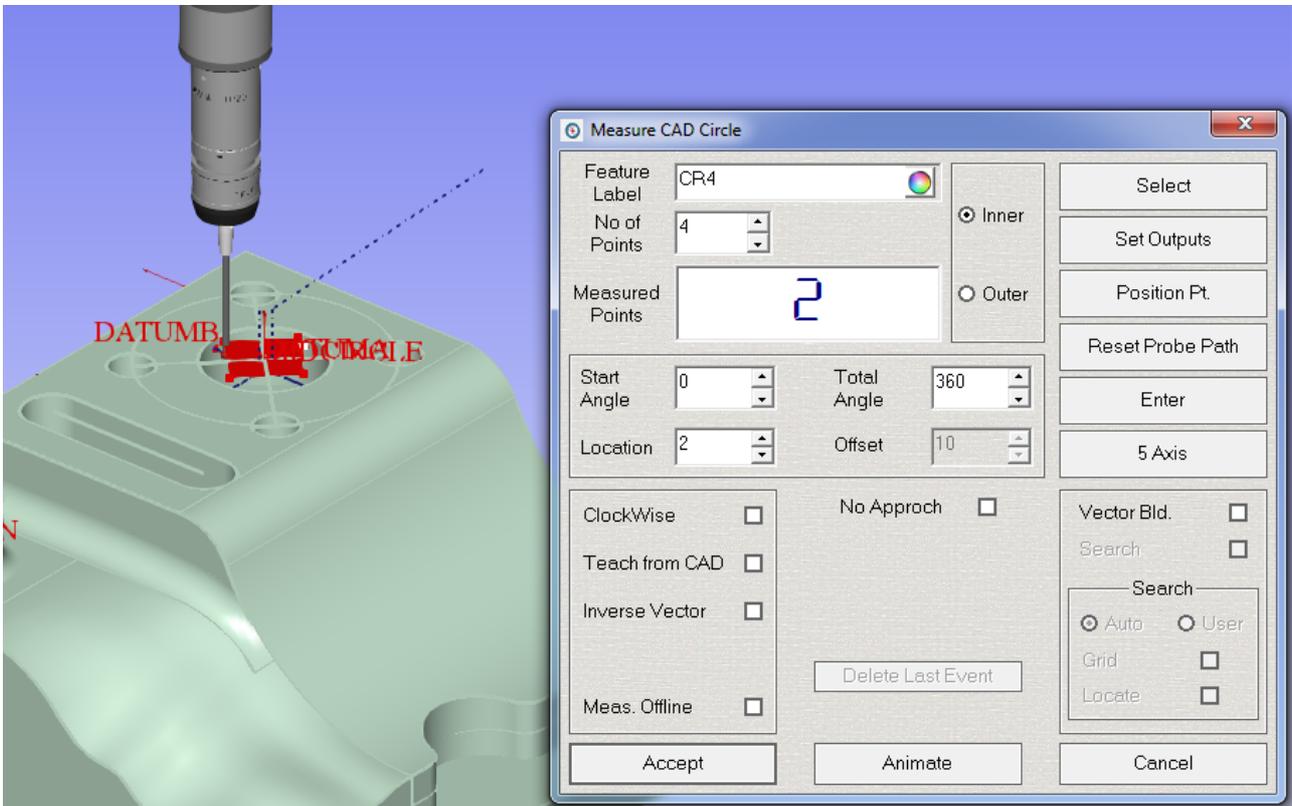
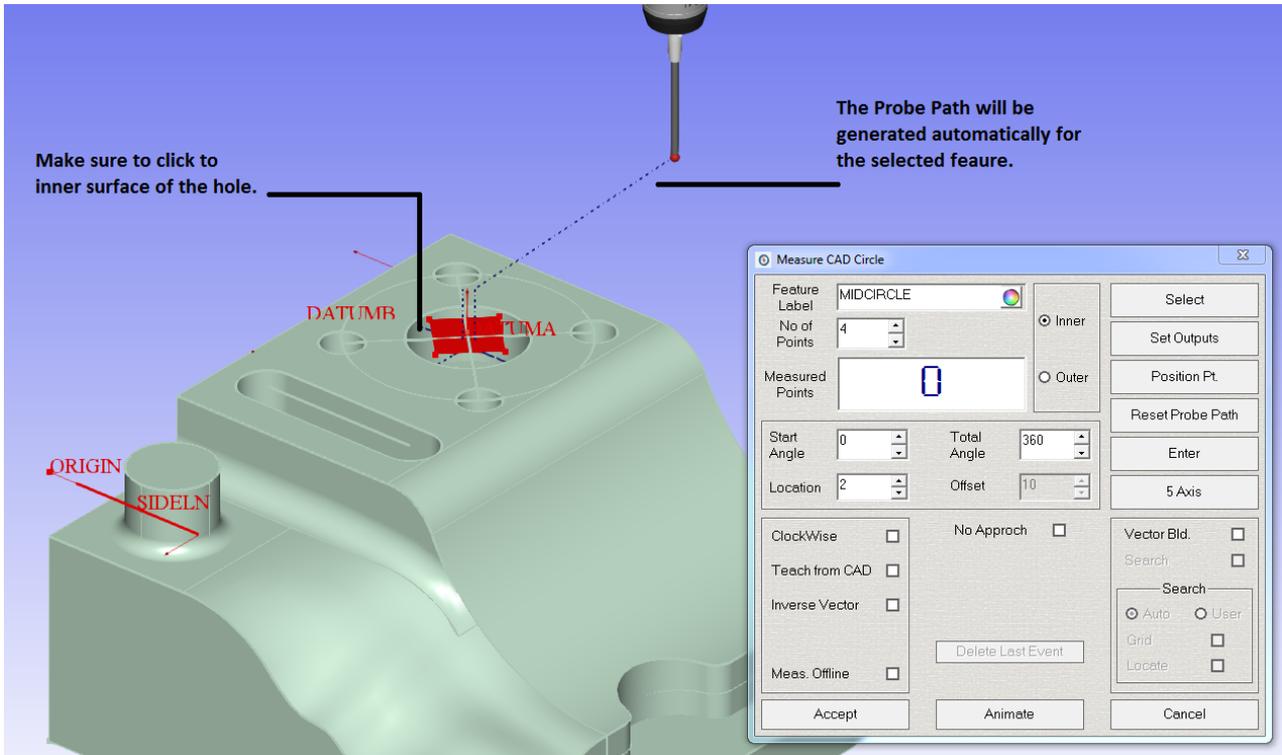
Measuring Features Using Auto Probe Path



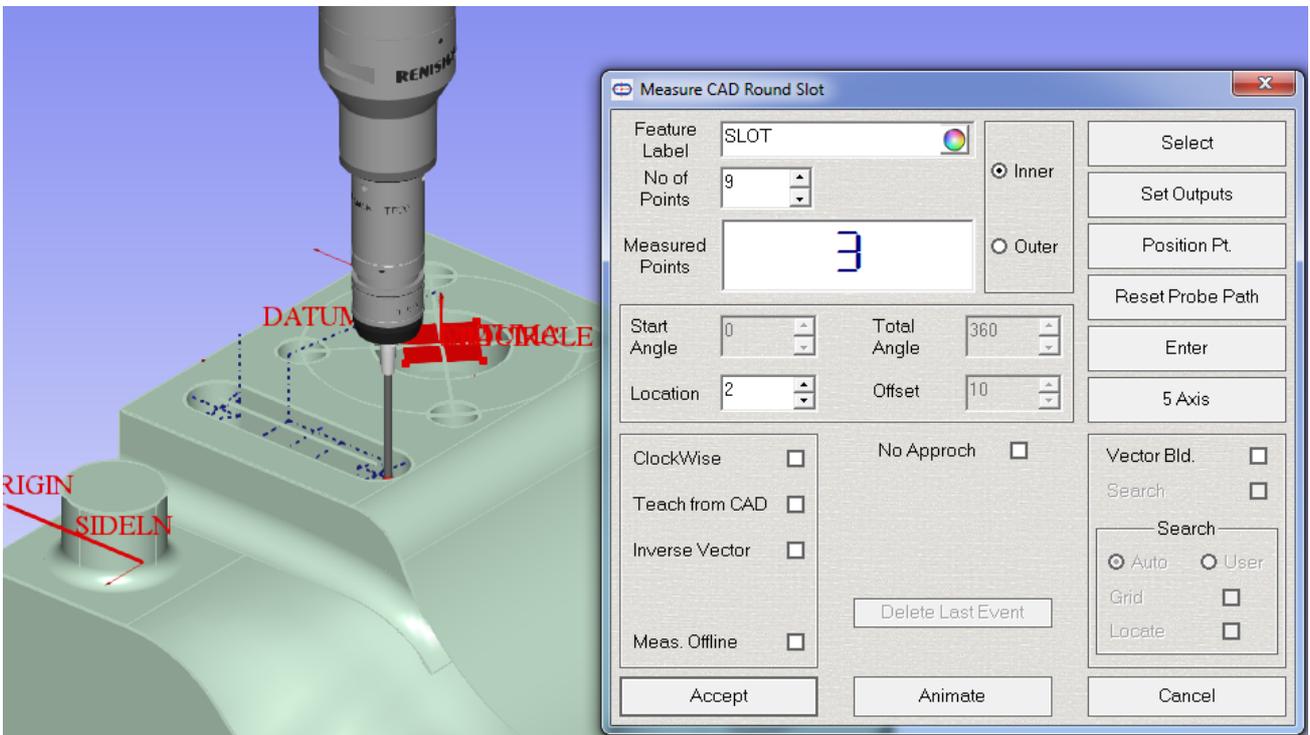
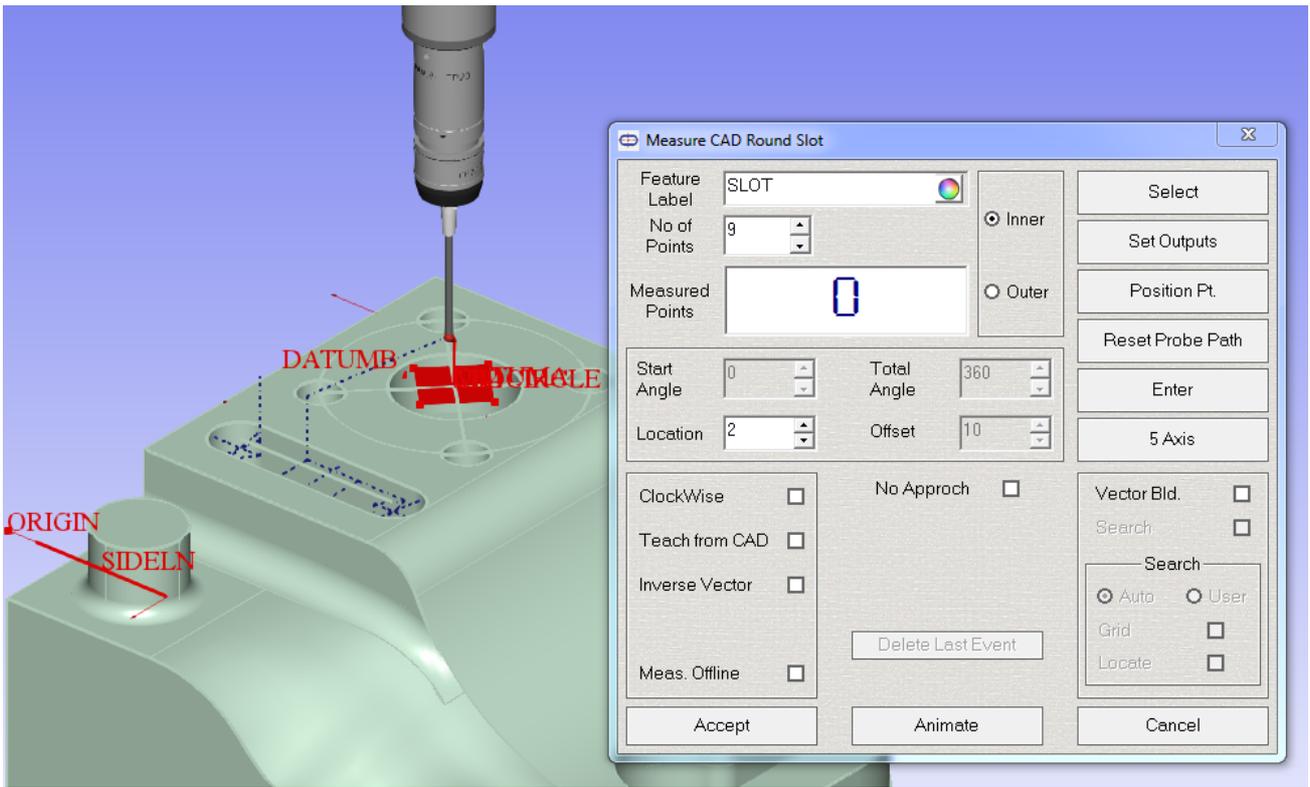
Important Note: Make sure your current alignment is correct before you start measuring any features on using MEASCAD Mode.

Also make sure that when you are in MEASCAD Mode, add proper [Position Points \(GOTO Points\)](#) to create safe position points before and after measuring features.

Select **Circle**  icon from [Measure Toolbar](#) and click the inner surface of the middle hole on top of the **AAT.mdl** part. After the **Probe Path** is created click on **Accept** to measure the hole.

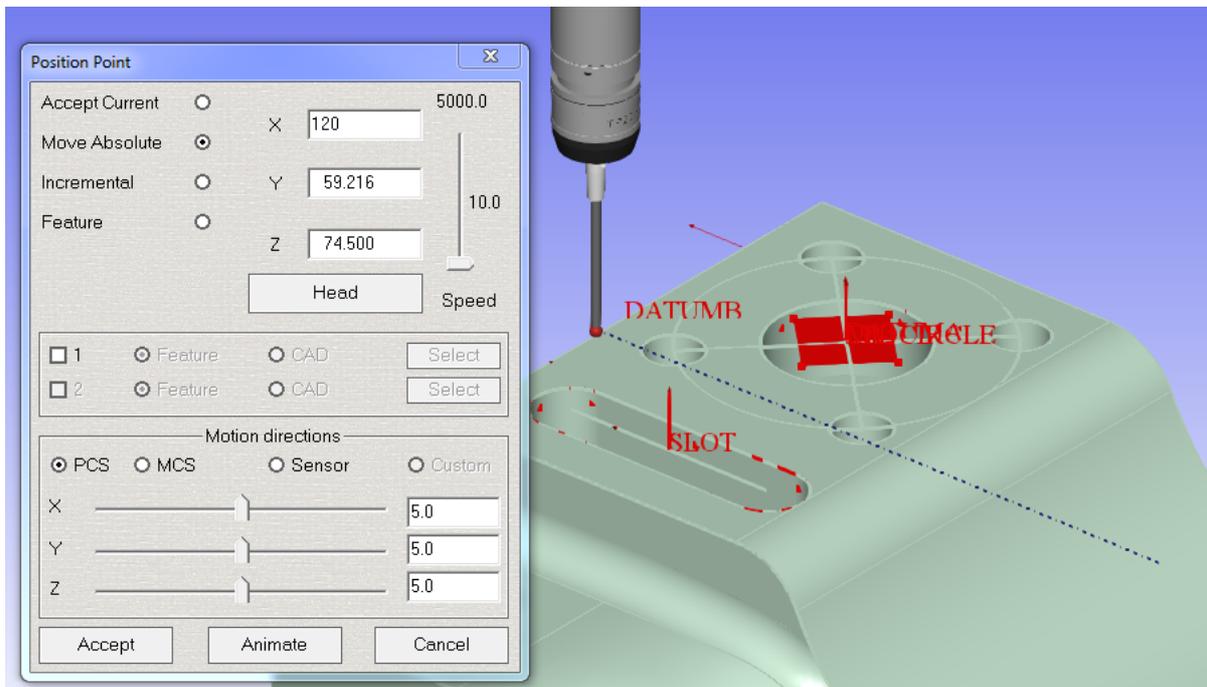
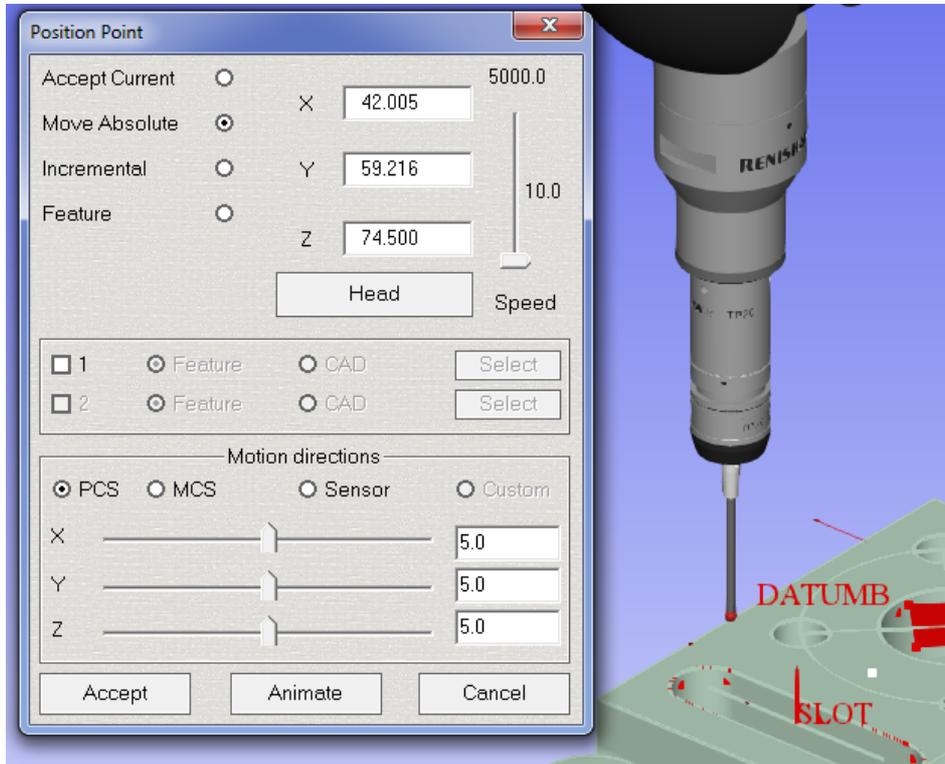


Next select [Rounded Slot](#)  icon from [Measure Toolbar](#) and select the inner surface of the rounded slot. After the **Probe Path** is created click on **Accept** to measure the slot.

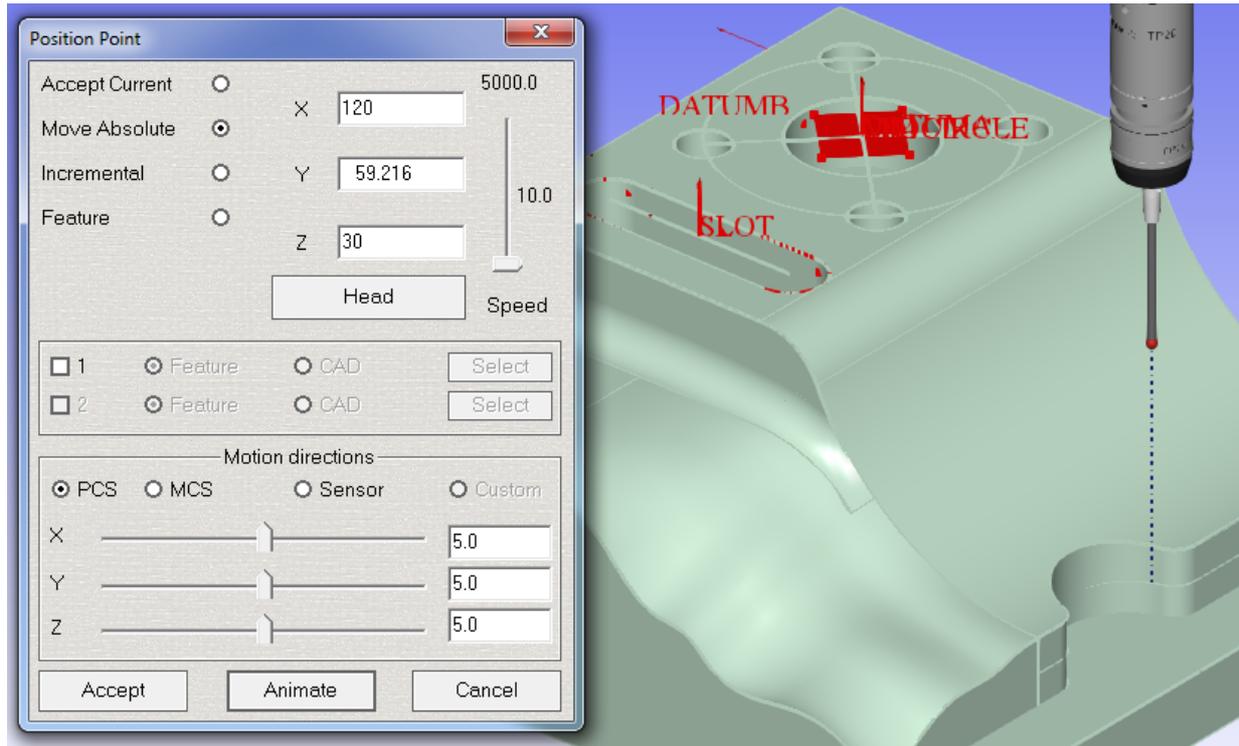


Adding Position Points and Measuring Features with Teach From CAD

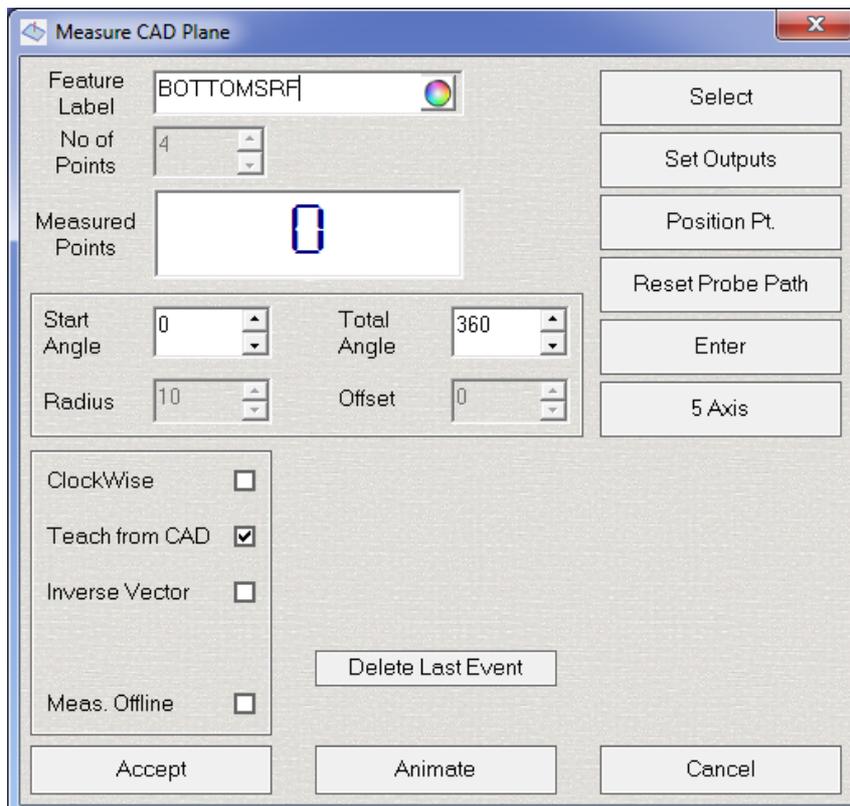
Click on **Position Points**  icon on **Measure Toolbar**. This will open **Position Points** window. Move the slide bars for **X axis** and you will notice a white point from the tip of the probe is moving in **X direction**. You can also control the distance using the coordinate values. Make sure **Move Absolute** is selected and enter **120 in X Axis** input box. Click on **Animate** to see the **Probe Path**. Once the **Probe Path** is shown similar to the one below, click on **Accept** to drive the CMM to the **Position Point**.

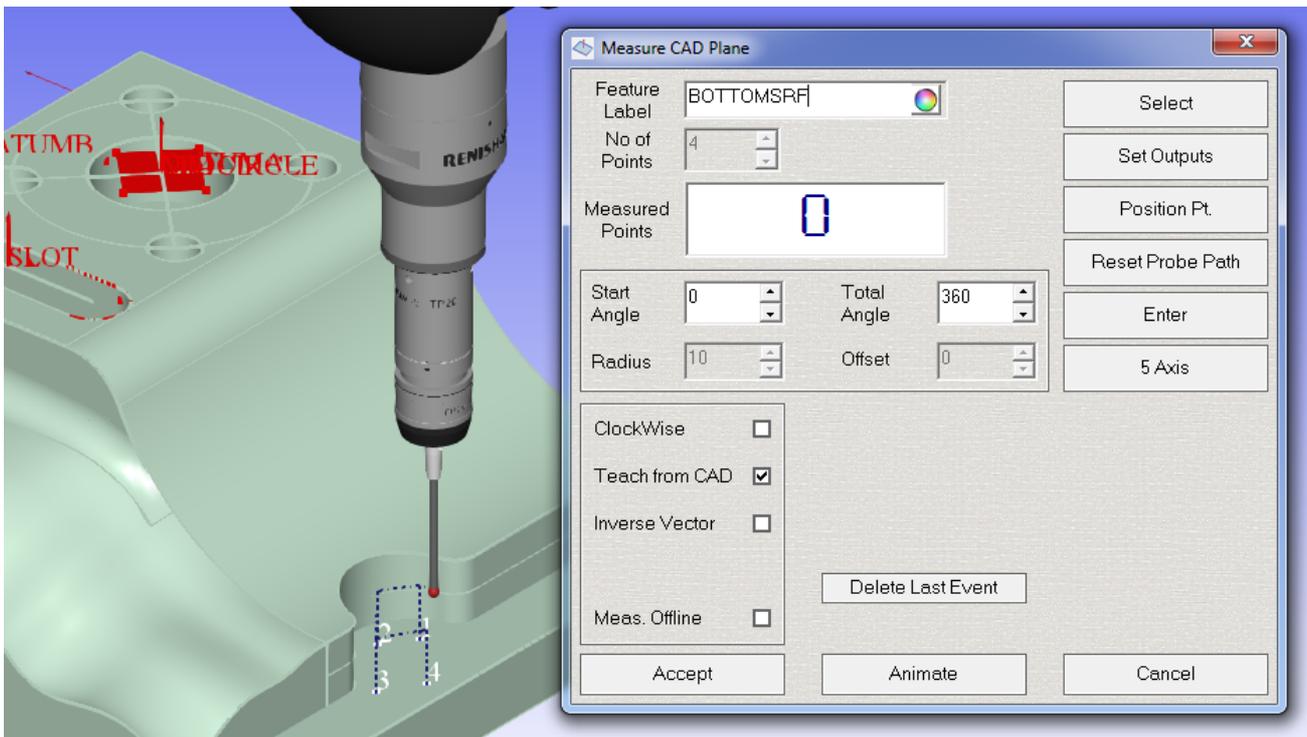


Enter another **Position Point** in **Z direction**, entering **30** in the **Z Axis** input box. Once again click on the **Animate** button, to make sure the position point is in a safe location and click **Accept** to execute it.

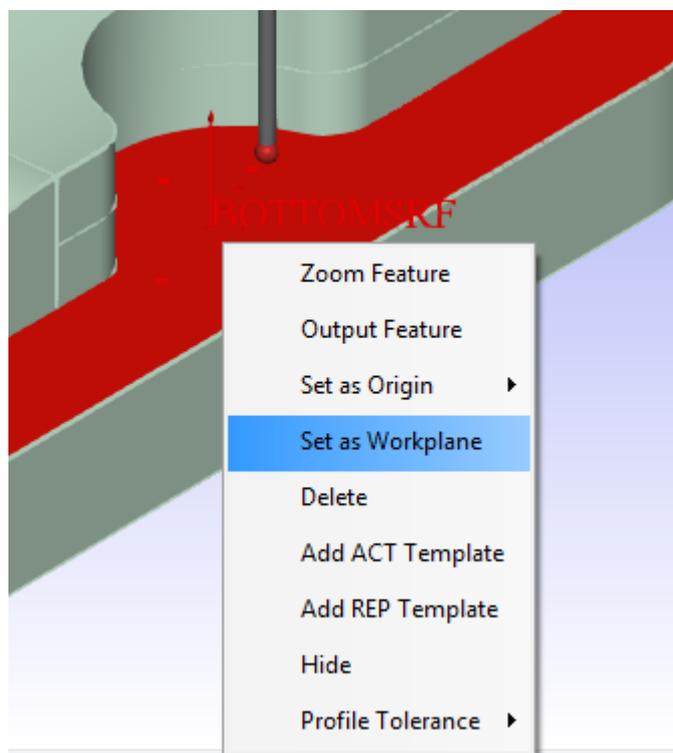


Once the probe moves to the last the **Position Point**, click on [Plane](#)  icon on [Measure Toolbar](#). This time make sure **Teach From CAD** check box is checked before you click on any surface on the CAD. This checkbox allows the user to generate his own path by clicking on the CAD surface. Click on 4 points on the CAD surface to create a plane called **BOTTOMSRF** and hit **Accept** as shown below:



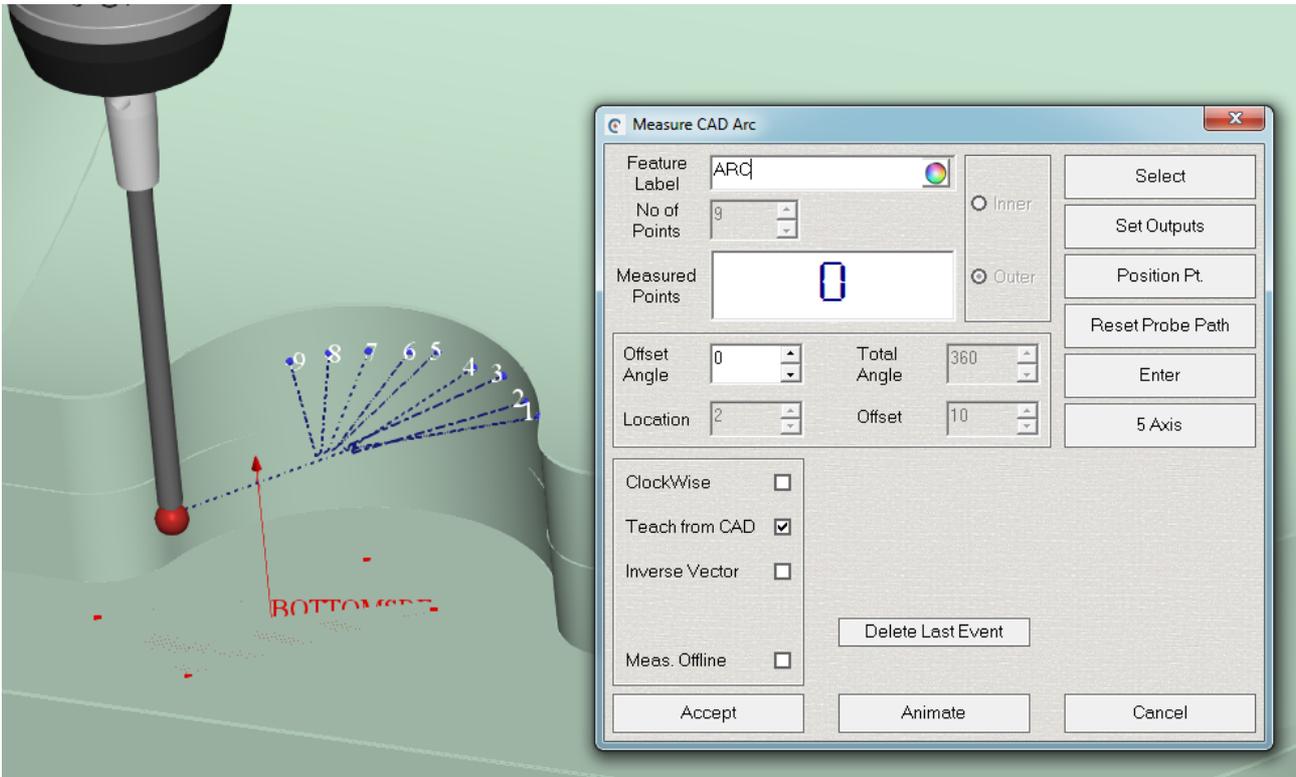


Next is measuring an arc feature using **Teach From CAD** option again. But since an arc is a 2D feature, we want to project the arc to the **BOTTOMSRF**. To do that, double click on the **BOTTOMSRF** on [Graphics Window](#), and select **Set As Workplane** option.

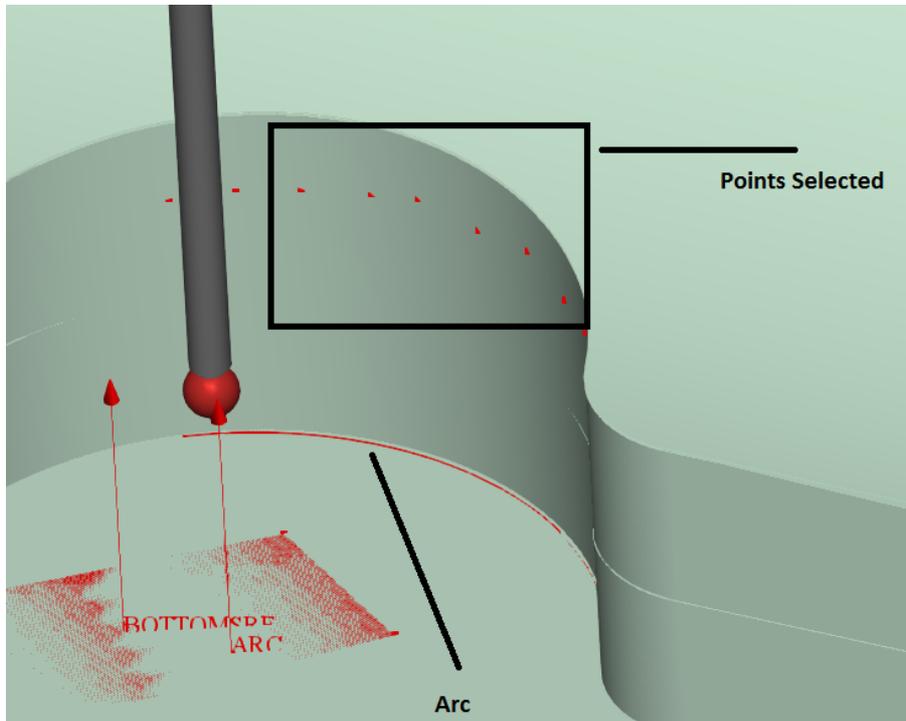


Important Note: If you highlight a CAD surface while trying to double click on the plane, please make sure to click on [Unselect All](#)  icon from the [CAD Options Toolbar](#).

Go to [Measure Toolbar](#) and click on [Arc](#) icon . Once again make sure **Teach From CAD** is checked before clicking on the CAD surfaces. Click on **9 points** on the CAD surface and CAPPS will generate a **Probe Path** similar to shown below. Click on **Accept** once you take enough points to measure an arc.



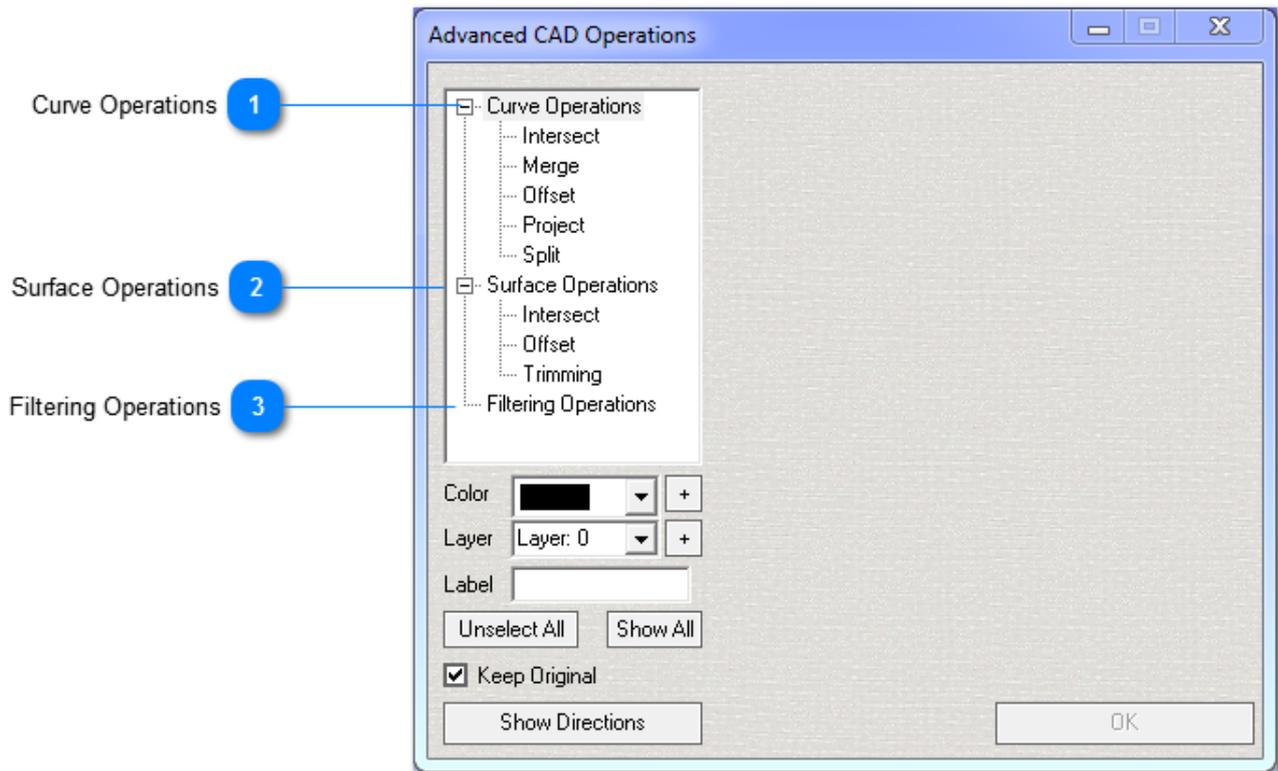
Notice that the arc feature is automatically projected to **BOTTOMSRF**. Even though the distribution of the selected points are not perfect, setting a workplane for 2D features is useful to keep them in 2D form.



[Quick Operations Using CAPPS DMIS](#)

Advanced CAD Operations

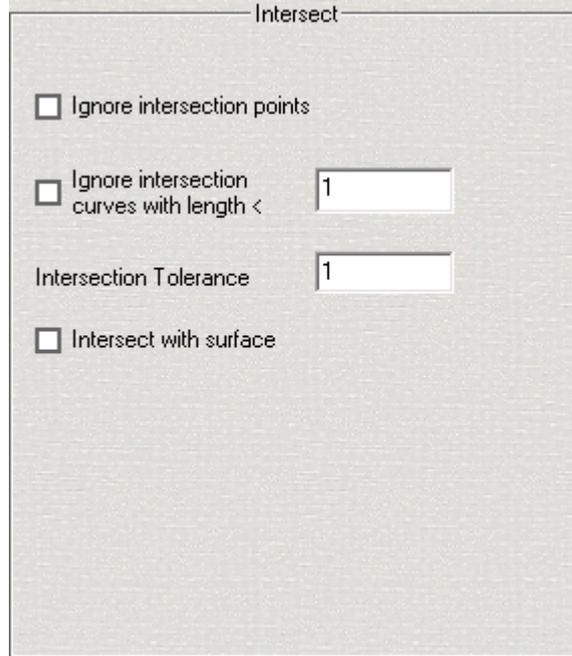
Advanced Cad Operations allow greater filtering and dissection of CAD files. This allows the user to work more greatly at a CAD Level instead of at the CMM level.



1 Curve Operations

☰ Curve Operations

- **Intersect:** Allows the user to intersect two CAD curve entities. A good example of this may be intersecting two lines or a surface and a line in CAD.



Ignore Intersection Points:	Ignores intersection points while intersecting curves.
Ignore Intersection Curves with Length Less Than:	Ignores curves with specified length to be create while intersecting curves.
Intersection Tolerance:	Applies a tolerance value to create curves with intersecting curves.
Intersect with Surface:	Used to intersect a curve and a surface.
Merge:	Not implemented at this time.

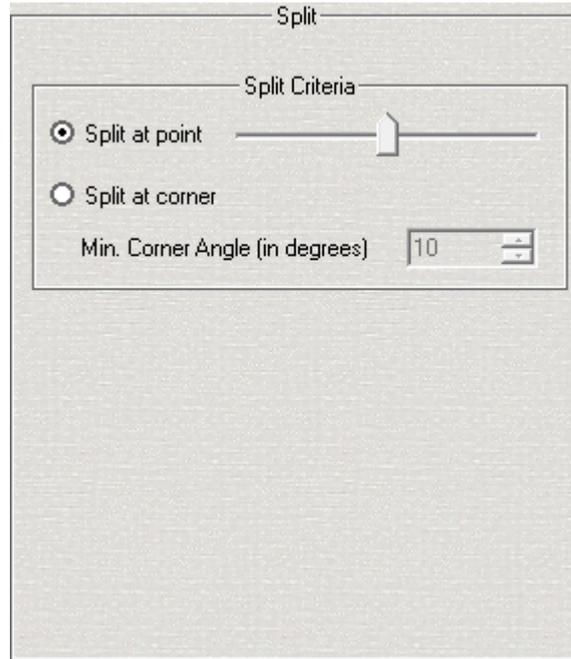
- **Offset:** Used to increase or decrease the size of a 2D feature such as a closed arc entity in CAD.

Offset:	Used to offset the existing curves.
Tolerance:	Applies a tolerance value to create offset curves.
Reverse:	Used to change the direction of the offset.

- **Project:** Allows a 2D feature from CAD to be projected onto another CAD surface.

Projection Tolerance:	Applies a tolerance value to create project curves.
------------------------------	---

- **Split:** Allows a 2D continuous feature to be split up into smaller components.



Split a Point Bar:	Used to split existing curves into points.
Split at Corner:	Used to split curves using corner points.
Minimum Corner Angle (In Degrees):	Sets a minimum angle for creating corner points.

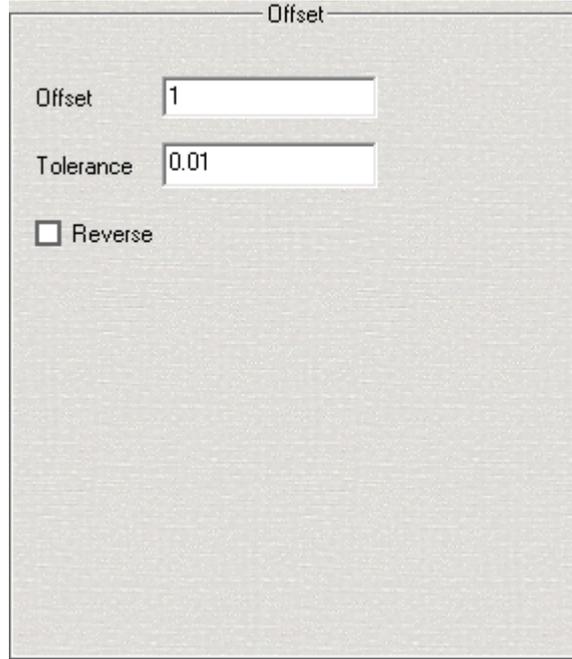
2 Surface Operations

Surface Operations

- **Intersect:** Allows the user to intersect two surface entities.

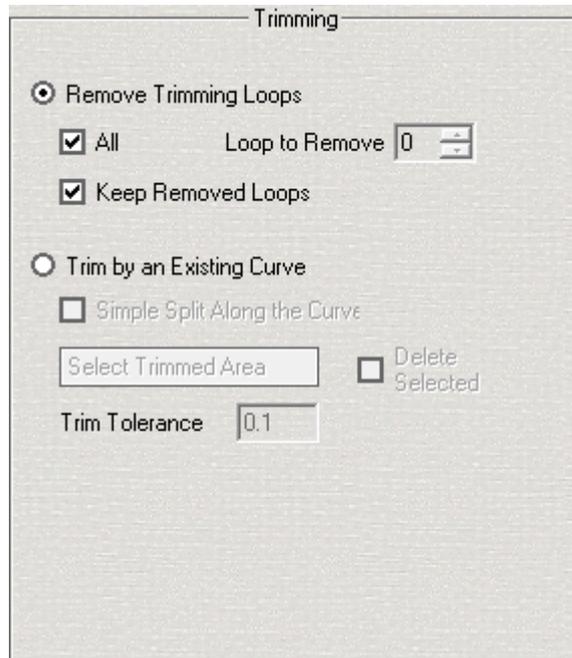
Intersect Selected Entities:	Used to create surface by intersecting selected entities.
Cut The Part with a Line:	Used to cut selected surfaces using a line.
Cut The Part with a Plane:	Used to cut selected surfaces using a plane.
Just Clip Graphics:	Used to clip surfaces to create cross section views.
Reverse:	Used to reverse the direction of the cut.
Ignore Intersection Points:	Ignores intersection points while intersecting surfaces.
Ignore Intersection Curves with Length Less Than:	Ignores intersection curves while intersecting surfaces.
Intersection Tolerance:	Applies a tolerance value to intersect surfaces.

- **Offset:** Allows an offset surface to be created from an existing surface.



Tolerance:	Applies a tolerance value to offset surfaces.
Reverse:	Used to change the direction of the offset.

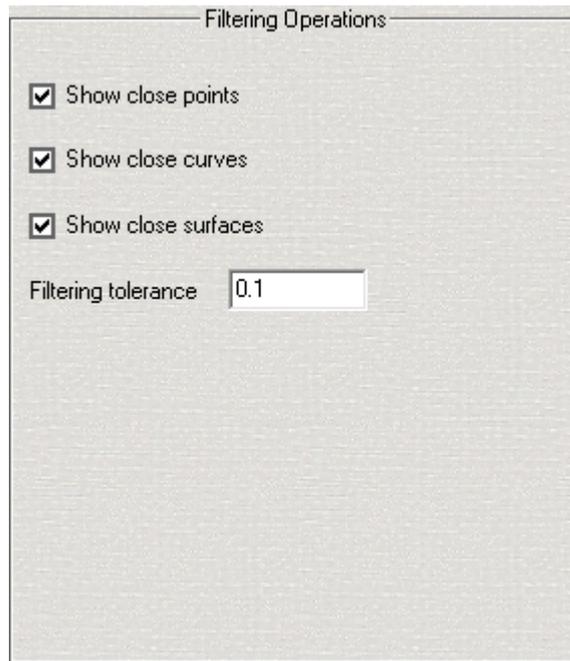
- **Trimming:** This option allows the reversal of a trimmed surface. A good application may be where surface information at hole center data may be needed.



Remove Trimming Loops:	Removes trimming loops.
Trim by an Existing Curve:	Used to trim a surface using an existing curve.

3 Filtering Operations

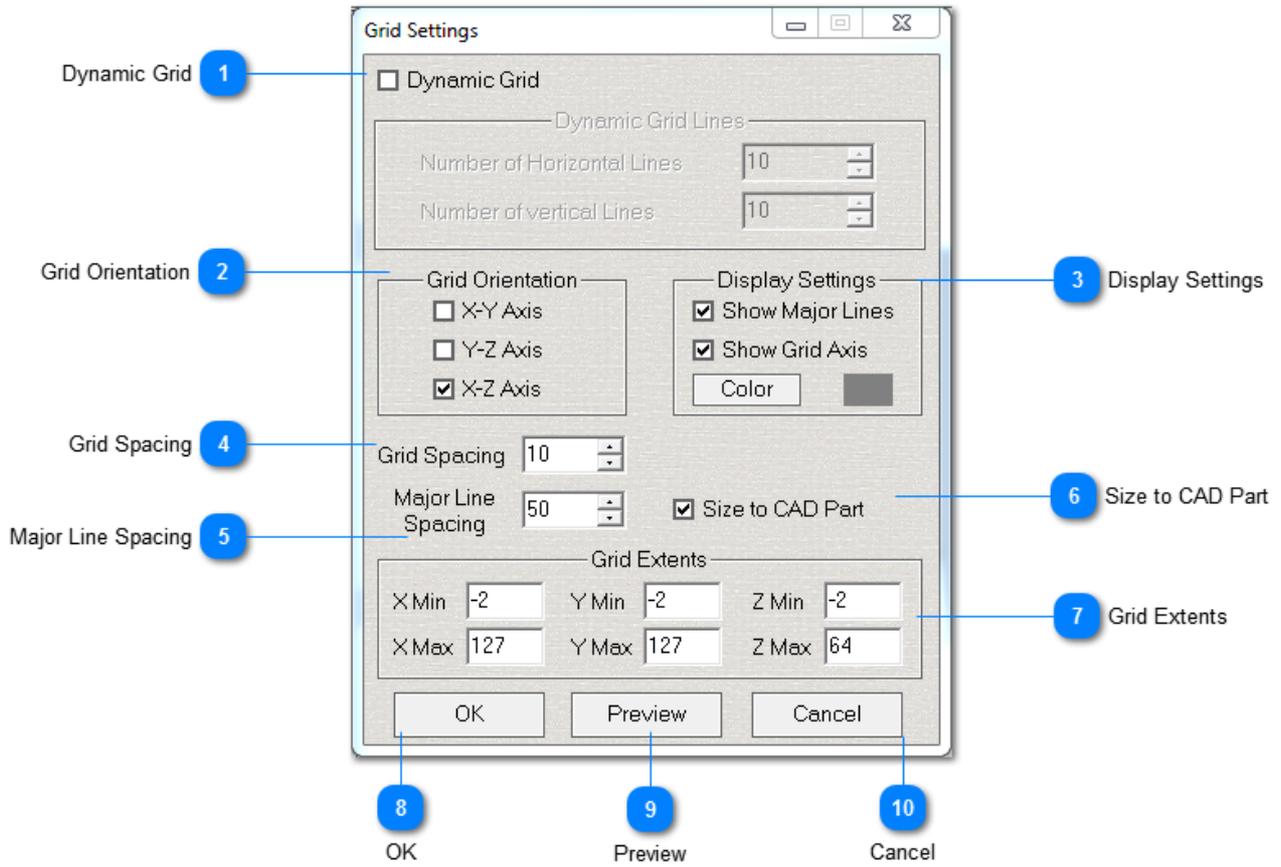
Filtering Operations



Show Closed Points:	This option will display all the closed point entities.
Show Closed Curves:	This option will show all the closed curve entities.
Show Closed Surfaces:	This option will show all the closed surface entities.
Filtering Tolerance:	Applies a tolerance value for filtering.

[Table of Contents](#)

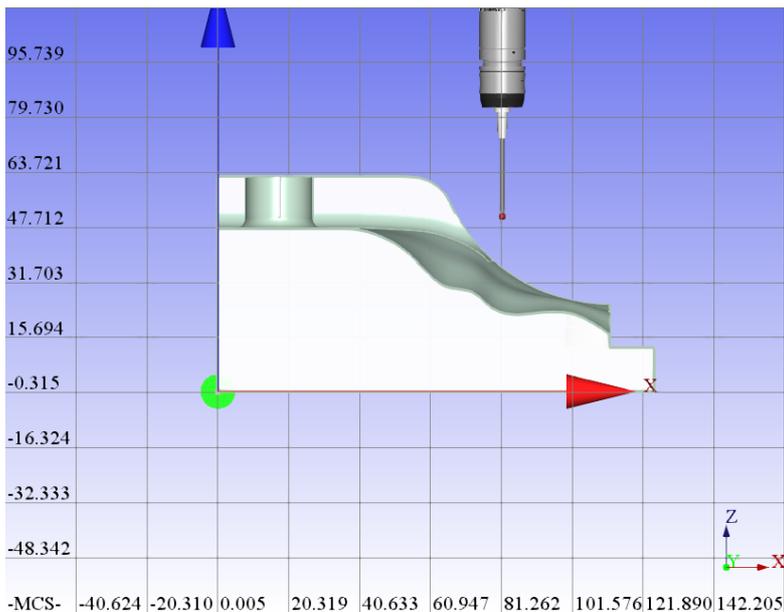
Grid Settings



1 Dynamic Grid

Dynamic Grid

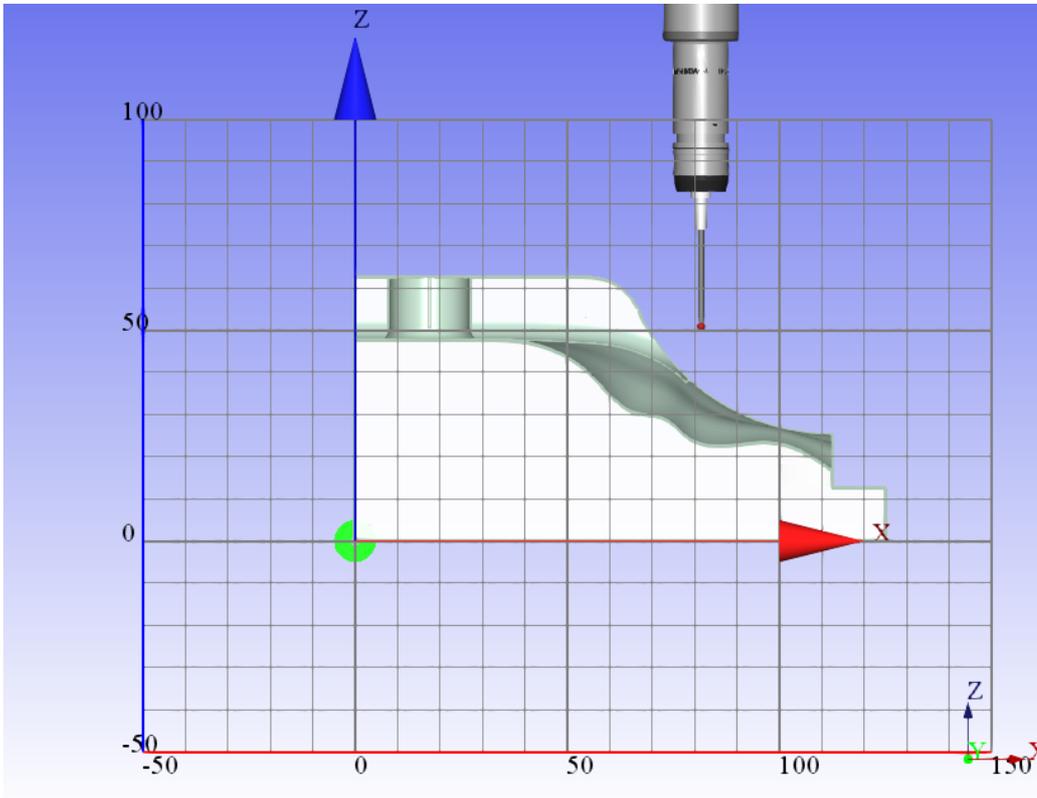
Dynamic Grid divides any 2D view (such as left, right, back, front, etc.) to user defined grid sections. Once **Dynamic Grid** is selected, all other **Grid Settings** will be disabled.



2 Grid Orientation

Grid Orientation	
<input type="checkbox"/>	X-Y Axis
<input type="checkbox"/>	Y-Z Axis
<input checked="" type="checkbox"/>	X-Z Axis

Allows user to define the grid orientation. The grid view will be available on any view.



3 Display Settings

Display Settings	
<input checked="" type="checkbox"/>	Show Major Lines
<input checked="" type="checkbox"/>	Show Grid Axis
Color	<input type="color" value="#808080"/>

Display Settings are used to display **Major Lines** and **Grid Axis**.

4 Grid Spacing

Grid Spacing	<input type="text" value="10"/>
--------------	---------------------------------

Allows user to set **Grid Spacing**.

5 Major Line Spacing

Major Line Spacing	<input type="text" value="50"/>
--------------------	---------------------------------

Allows user to set spacing between **Major Grid Lines**.

6 Size to CAD Part Size to CAD Part

Allows user to set grid lines compared to the size of CAD.

7 Grid Extents

Grid Extents					
X Min	-2	Y Min	-2	Z Min	-2
X Max	127	Y Max	127	Z Max	64

Allows user to define the X,Y and Z limits of the grid.

8 OK

OK

Applies the changes.

9 Preview

Preview

Allows user to preview the changes.

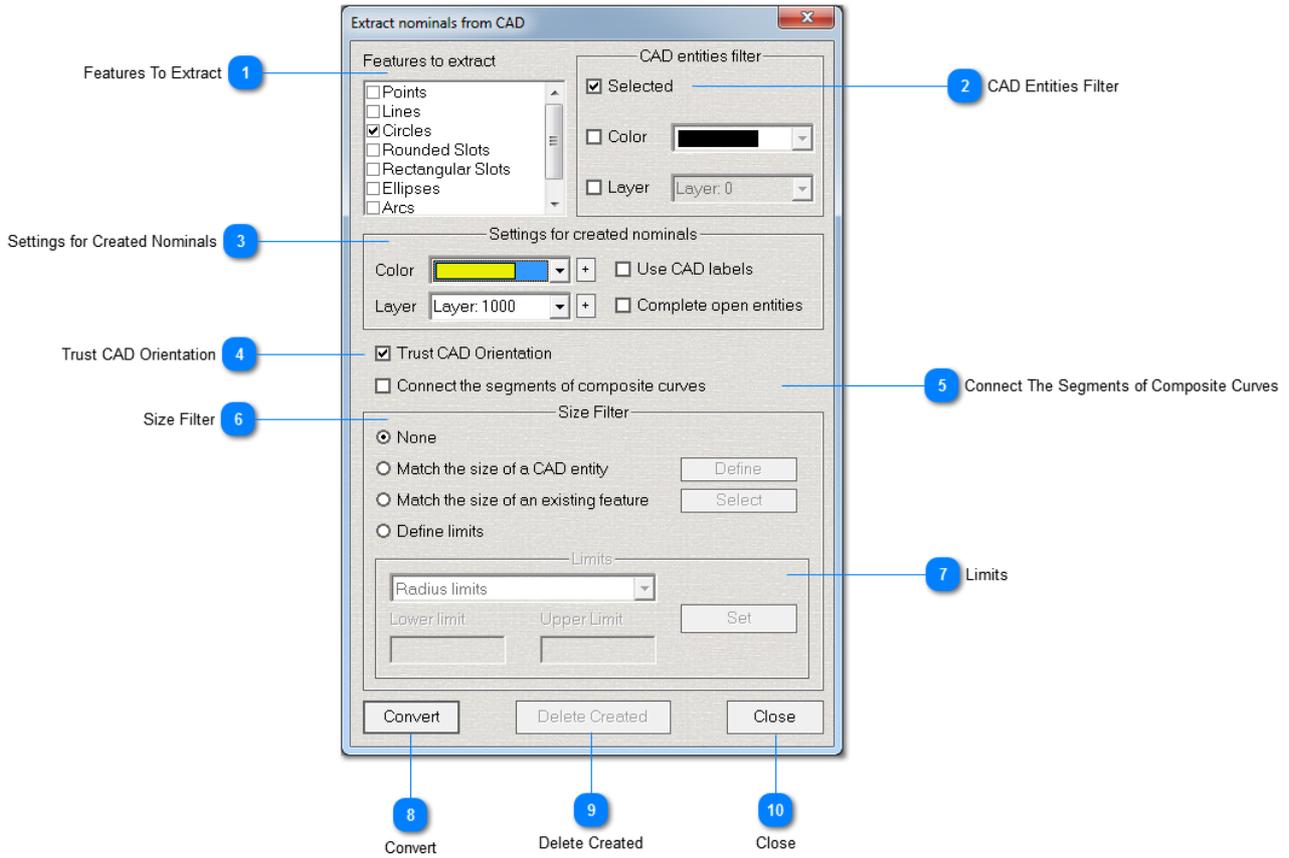
10 Cancel

Cancel

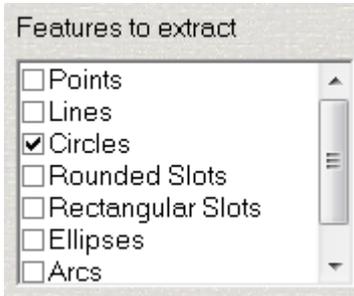
Cancel the changes and close the dialog.

[Advanced CAD Operations](#)

Extract Nominals From CAD

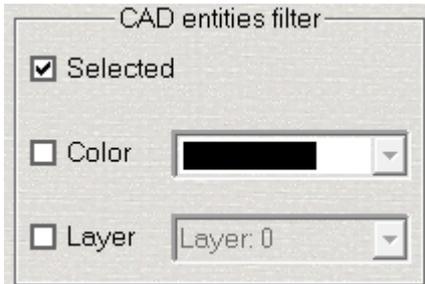


1 Features To Extract



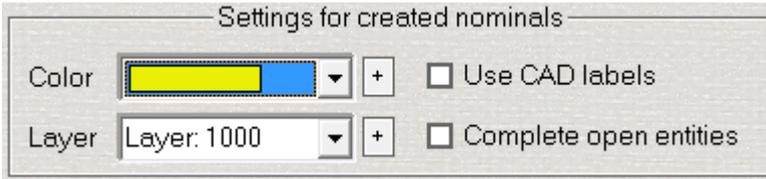
Features To Extract is used to select which CAD entities to be used to extract nominal features. May be points, lines, circles, rounded slots, rectangular slots, or ellipses.

2 CAD Entities Filter



CAD Entities Filter: CAD entities may be extracted according to selected surfaces, by color, or by layer number.

3 Settings for Created Nominals



Settings for Created Nominals: Allows the configuration for color, layer number, whether or not CAPPS will use the defined CAD labels for the nominals, and whether CAPPS will complete any open entities such as converting arcs into complete circles.

4 Trust CAD Orientation

Trust CAD Orientation

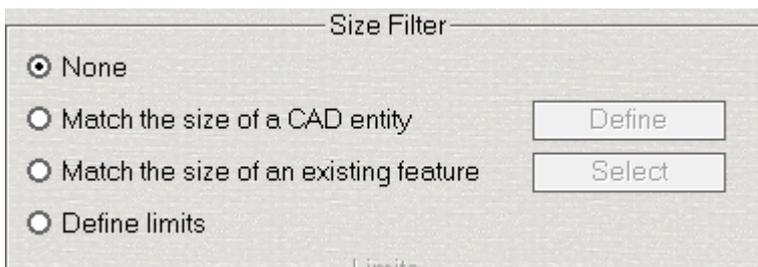
If **Trust CAD Orientation** is checked, Capps doesn't change the surface normals before extracting nominals.

5 Connect The Segments of Composite Curves

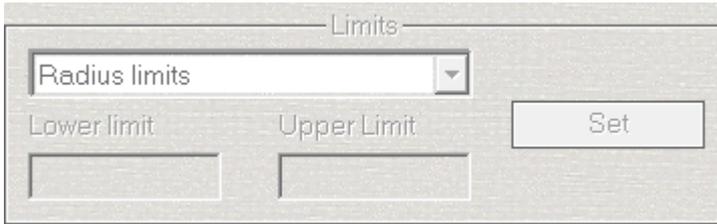
Connect the segments of composite curves

Connects the segments of composite curves on the CAD.

6 Size Filter



Size Filter:	Allows configuration for extraction having to do with size limits.
None:	Size of features will be ignored, all data will be created. This option works in conjunction with the selected function.
Match the Size of a CAD Entity:	Checking this option will allow the user to select a CAD entity to define the desired size for nominal extraction.
Match the Size of an Existing Feature:	Allows the extraction of nominals to match the size of an already measured or created feature. Selection occurs by feature list.
Define Limits:	Allows size range/limits to be set for features of size when extracting nominal data from the CAD model.

7 Limits

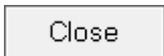
Allows user to define limits for the nominal features to be extracted.

8 Convert

Applies the changes.

9 Delete Created

Deletes the created nominals.

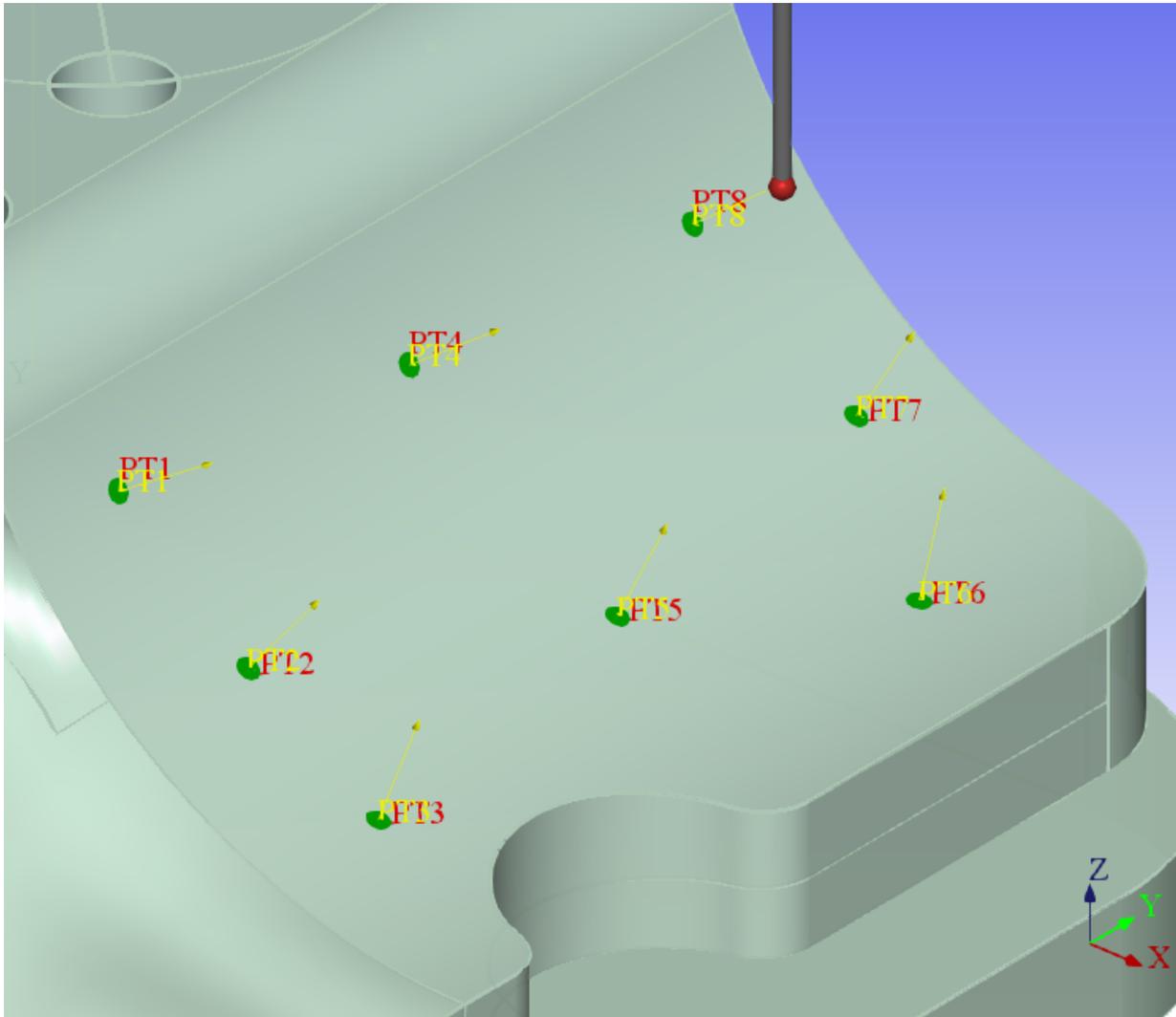
10 Close

Closes the dialog.

[Advanced CAD Operations](#)

Confetti Settings

CAPPS DMIS gives the user the option of showing point touches in confetti mode. Below is a picture showing how this will look.

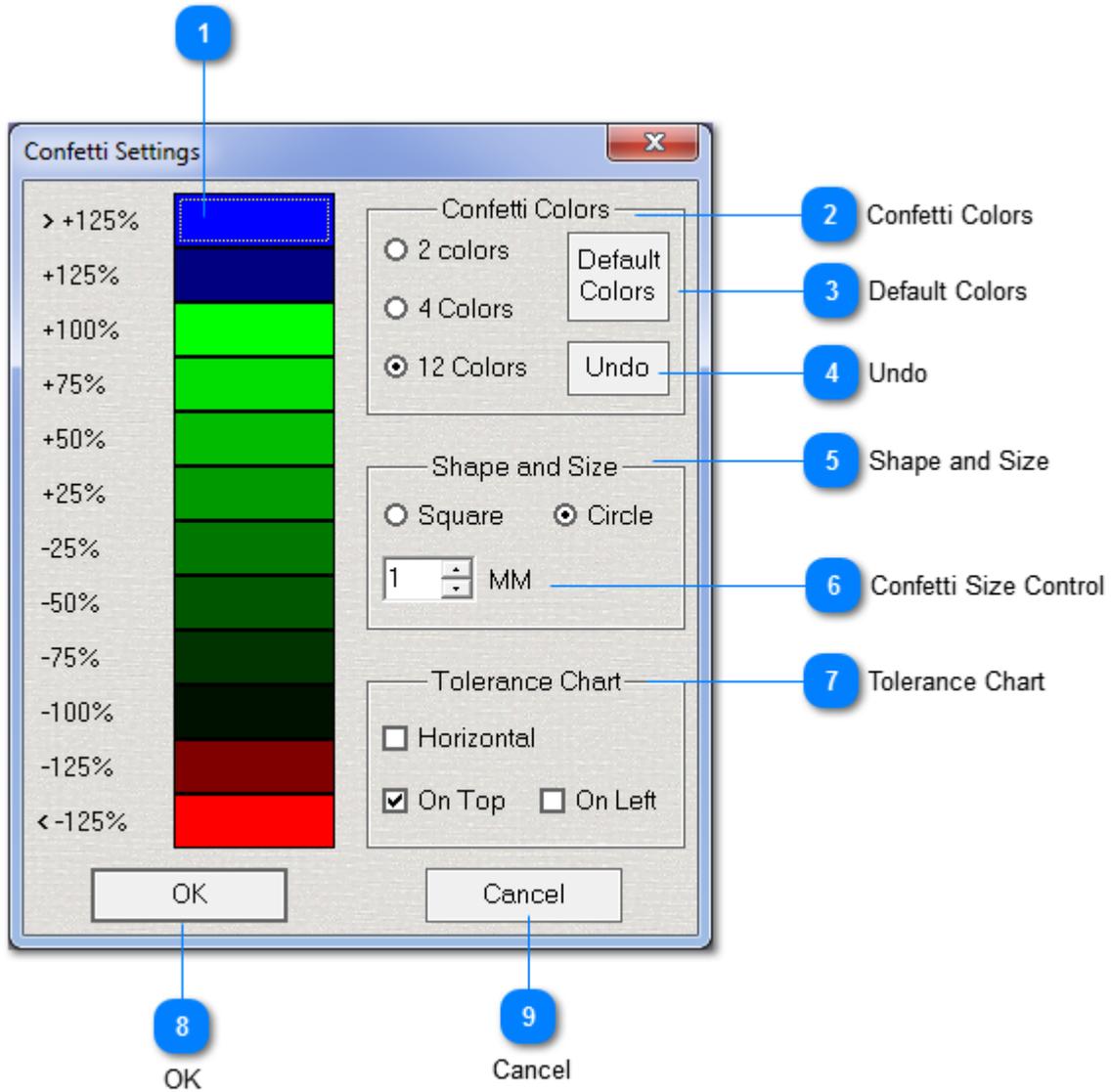


The points are graphically displayed as how they relate to the tolerance band.

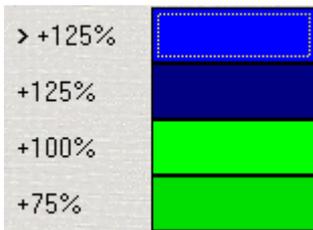
Steps to Use Confetti Settings

Turn on **Confetti Display** and **Tolerance Chart** in the [Display Items Toolbar](#).
Set the appropriate tolerances for points in the [GD&T Tolerances Menu](#).
Go to [Graphics Menu - Confetti Settings](#) and make the appropriate changes.

Chromatic Spectrum of Tolerances

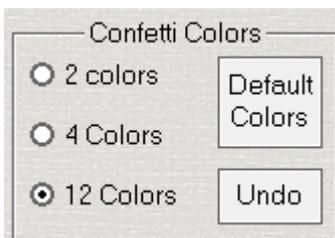


1 Chromatic Spectrum of Tolerances



Used to control color codes for the corresponding tolerance percentage in the list.

2 Confetti Colors



Used to control color code range used in **Chromatic Spectrum of Tolerances**.

3 Default Colors


 A rectangular button with the text "Default Colors" inside.

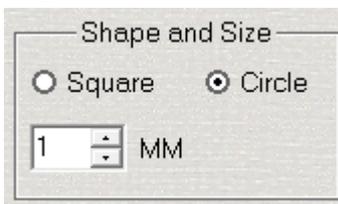
Change the settings back to the default color settings.

4 Undo


 A rectangular button with the text "Undo" inside.

Undo the last change.

5 Shape and Size



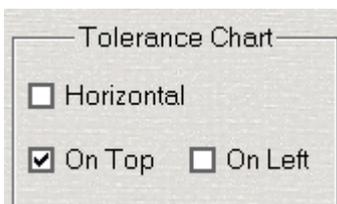
Used to control the shape and size of the confetti points.

6 Confetti Size Control



Used to control the confetti size.

7 Tolerance Chart



Used to control the location of the tolerance chart to be placed in [Graphics Window](#).

8 **OK**



Applies the changes.

9 **Cancel**



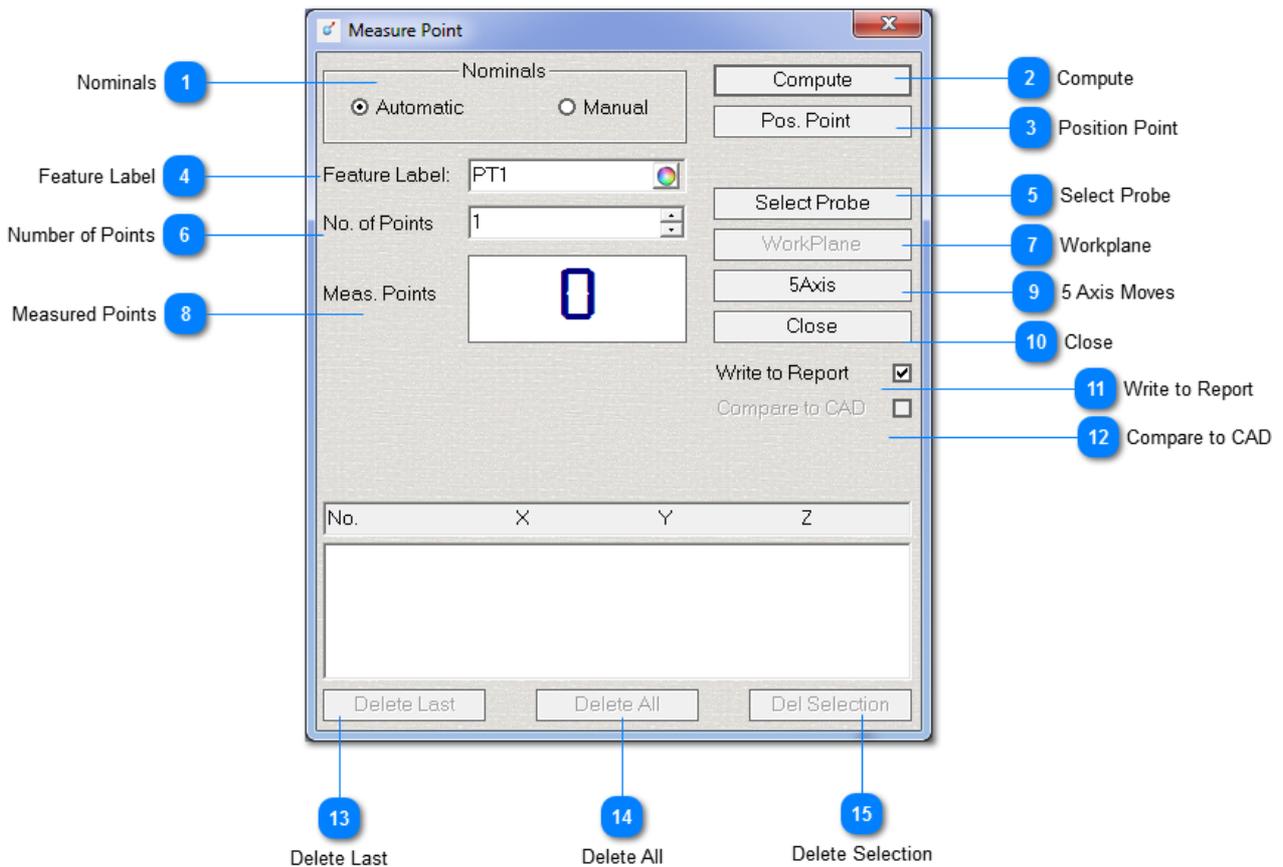
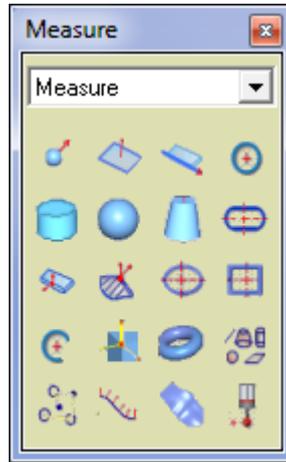
Cancel the changes and close the dialog.

[Advanced CAD Operations](#)

Measuring Features

Measure Mode

This is commonly referred to as **Manual Mode** when measuring feature elements. To measure manual features in CAPPS DMIS, set the [Measure Toolbar](#) to **Measure** and follow the basic instructions included in this chapter. The figure below gives an overall description of the measurement dialog box. Some features will have more options when applicable and are detailed when necessary.



1 Nominals

Nominals

Automatic Manual

Automatic/Manual: After completing measurement, CAPPs DMIS will automatically assign a feature label to the measured feature if configured for Automatic. If configured for Manual, CAPPs DMIS will allow the user to assign a feature label, nominal data, or associated comments about the feature being measured.

2 Compute

Compute

Computes measured feature as long as the minimum number of points has been taken.

3 Position Point

Pos. Point

Clicking on this option will write a move point to act as a safe move in between measurements. This is written as **GOTO/XX,YY,ZZ.**

4 Feature Label

Feature Label: PT1

May assign a feature label without the need to configure for manual labeling.

5 Select Probe

Select Probe

Clicking on this option will allow the user to select a probe from the sensor list without having to close the measurement dialog box and interrupting the measurement process. This may be used where probe angle changes are needed to complete a feature measurement routine.

6 Number of Points

No. of Points 1

Required minimum number of points before a feature is calculated.

7 Workplane

WorkPlane

Allows the selection of a standard or measured workplane when measuring 2D features such as lines or circles. This button is only active for applicable features. Check [Workplanes](#) for more information on workplanes.

8 Measured Points

Meas. Points



Acts as a counter for each point that is taken by the CMM.

9 5 Axis Moves

5Axis

Allows user to control five axis head moves for applicable probe models.

10 Close

Close

Closes the measurement dialog box when complete. If this is closed before the measurement is complete, the points will be lost.

11 Write to Report

Write to Report



Will write the measurement results into the report. If **unchecked**, only graphical and DMIS code will be generated.

12 Compare to CAD

Compare to CAD



If CAD surface data is available; the measurement will be compared to the closest CAD element for the result.

13 Delete Last

Delete Last

Deletes the last point taken by the CMM.

14 Delete AllA rectangular button with a light gray background and a thin black border, containing the text "Delete All" in a standard sans-serif font.

Deletes all the points in the preview window for the current feature before calculation.

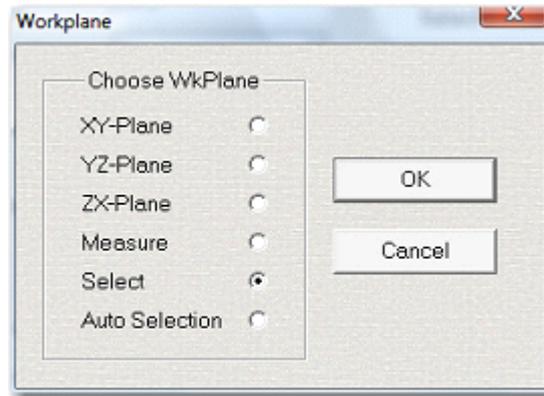
15 Delete SelectionA rectangular button with a light gray background and a thin black border, containing the text "Del Selection" in a standard sans-serif font.

Deletes a selected measurement from the preview window.

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Workplanes

The chart below depicts which features require workplane selection. A workplane must be selected before each noted feature is measured. Selection can be theoretical, actual, or nominal. Workplane selection may be done within each feature measurement dialog box. To access Workplane dialog box select [Workplane Settings](#) button on [Status Toolbar](#).



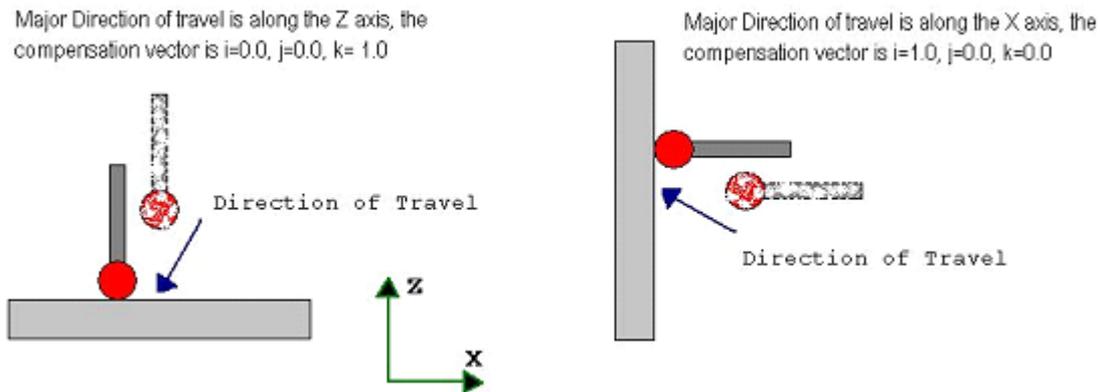
XY Plane:	Uses the current XY plane for projection of measured features.
YZ Plane:	Uses the current YZ plane for projection of measured features.
ZX Plane:	Will use the current ZX plane for projection of measured features.
Measure:	For features such as lines and circles, this option will first allow the user to measure a plane.
Select:	Uses any selected actual or nominal workplane for projection of measured features. May also be used in conjunction with MEASCAD features such as circles.
Auto Selection:	Used to automatically determine the default workplane XY, YZ, or ZX depending on probe orientation.

[Measuring Features](#)

Point

A point is a basic geometrical feature that requires just a single touch of the surface with the probe sensor for its definition. The result generated is compensated for the probe radius. The method of probe compensation depends on the **Point Type** setting in [Measurement Options](#). System defaults to a **Single Touch**, compensation method is as follows.

Position of probe is noted by the system. The system will determine the major direction of travel before a touch and compensate for the probe in that coordinate axis. Example is shown in the figure below:



- Pick on the [Point](#) icon  in the [Measure Toolbar](#) or select [Point](#) from the pull down menu under [Measure Menu](#).
- Touch a point on the surface to be measured.
- Hit **Compute** on the dialog to calculate the point
- Teach [Position Points \(GOTO Points\)](#) if and when required to avoid any collisions of the probe with the part or the fixture if the program needs to be executed in a DCC machine.

Important Note: If Number of points is set to 1, the point is computed after each touch.

DMIS Syntax looks as shown below:

```
F(PT1)=FEAT/POINT,CART, 24.4625, 78.9269, 62.4929, 0.0000, 0.0000, 1.0000
MEAS/POINT,F(PT1),1
PTMEAS/CART,24.4625,78.9269,62.4929,0.0000,0.0000,1.0000
ENDMES
OUTPUT/FA(PT1),TA(TX2),TA(TY2),TA(TZ2),TA(TP2)
```

[Measuring Features](#)

Plane

A plane is an unbounded 3D feature, and requires a minimum of three points for its measurement. Plane is defined as a location, and a direction vector (IJK).

- Pick on the [Plane](#) icon  in the [Measure Toolbar](#) or select [Plane](#) from the pull down menu under [Measure Menu](#).
- Configure the number of points if necessary. Number of points cannot be less than three (3).
- Measure points on the plane surface, first three points to be taken to measure a plane feature should be as far as possible from colinearity.

Important Note: If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture.

DMIS Syntax for plane is as follows:

```
F(PL1)=FEAT/PLANE,CART, 28.4923,94.9516,62.4928,0.0002,-0.0000,1.0000
MEAS/PLANE,F(PL1),4
PTMEAS/CART,28.2798,76.6893,62.4922,0.0002,-0.0000,1.0000
PTMEAS/CART,46.7435,91.6153,62.4895,0.0002,-0.0000,1.0000
PTMEAS/CART,29.9641,113.5029,62.4931,0.0002,-0.0000,1.0000
PTMEAS/CART,8.9819,97.9988,62.4965,0.0002,-0.0000,1.0000
ENDMES
OUTPUT/FA(PL1),TA(TX2),TA(TY2),TA(TZ2)
```

[Measuring Features](#)

Line

A line is an unbounded 3D feature, and requires a minimum of 2 points for its definition. A line may also be measured as a projected line by selecting a **workplane** on which the line needs to be computed. A line is defined as a location and two directions, the location is a point on the line, the first direction is the direction in which the line was measured, and the second direction is the direction used for probe compensation.

- Pick on the [Line](#) icon  in the [Measure Toolbar](#) or select [Line](#) from the pull down menu under [Measure Menu](#).
- Select the appropriate [Workplane](#) from **Measure Toolbar** or pull down menu.
- Configure the number of points if necessary. Number of points cannot be less than two (2).
- Measure points on the surface that are perpendicular to the work plane.

Important Note: If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture.

DMIS Syntax for a line is as follows:

```

WKPLAN/XYPLAN
F(LN1)=FEAT/LINE, UNBND, CART, $
  -0.0000, 119.1048, 55.9288, 0.0000, -1.0000, 0.0000, -1.0000, -0.0000, 0.0000, 68.3737
MEAS/LINE, F(LINE1), 3
  PTMEAS/CART, 0.0000, 119.1048, 56.9115, -1.0000, -0.0000, 0.0000
  PTMEAS/CART, 0.0000, 89.4128, 55.2670, -1.0000, -0.0000, 0.0000
  PTMEAS/CART, 0.0000, 50.7311, 55.6077, -1.0000, -0.0000, 0.0000
ENDMES
OUTPUT/FA(LINE1), TA(TX2), TA(TY2), TA(TZ2)

```

[Measuring Features](#)

Circle

Circle is a 2D feature, and requires a work plane for its definition. A minimum of 3 points is required for a circle to be computed. Center point (X, Y, Z), **workplane** direction vector (I J K), and Diameter define a circle. A circle may be of type **Inner** or **Outer**, this is determined by retract direction of the first point measured for the circle, which will determine if the circle is inner or outer.

- Pick on the [Circle](#) icon  in the [Measure Toolbar](#) or select [Circle](#) from the pull down menu under [Measure Menu](#).
- Select the appropriate [Workplane](#) from **Measure Toolbar** or pull down menu.
- Configure the number of points if necessary. Number of points cannot be less than three.
- Measure points on the circle with even spread to represent the entire circle.

Important Note: If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture while measuring an outer circle, position points may be required after each point is measured.

DMIS Syntax for an outer circle is as follows:

```
F (CR1) =FEAT/CIRCLE, INNER, CART, 29.5038, 95.4962, 61.1040, 0.0000, 0.0000, 1.0000, 25.4000
MEAS/CIRCLE, F (CR1) , 4
PTMEAS/CART, 16.8905, 96.9781, 61.4623, 0.9932, -0.1167, -0.0000
PTMEAS/CART, 28.3659, 82.8473, 61.2289, 0.0896, 0.9960, -0.0000
PTMEAS/CART, 42.0969, 97.1400, 61.3704, -0.9916, -0.1294, -0.0000
PTMEAS/CART, 26.8107, 107.9074, 60.3544, 0.2121, -0.9773, -0.0000
ENDMES
OUTPUT/FA (CR1) , TA (TX2) , TA (TY2) , TA (TZ2) , TA (TD2) 1)
```

[Measuring Features](#)

Cylinder

A cylinder is a 3D feature in space. A minimum of 6 points is required for a cylinder to be computed. A center point (x,y,z) along the axis of the cylinder, a direction vector (IJK) for the axis, and a diameter define a cylinder. A cylinder may be of type **Inner** or **Outer**, this is determined by retract direction of the first point measured for the cylinder.

- Pick on the [Cylinder](#) icon  in the [Measure Toolbar](#) or select [Cylinder](#) from the pull down menu under [Measure Menu](#).
- Minimum number of points to measure a cylinder feature is 6. Enter number of points if default needs to be changed.
- Measure first three points around one of the ends of the cylinder as coplanar as possible. Next three points should be taken the same on the other edge of the cylinder feature. Remaining points could be taken in any order (if more than 6 are to be measured).

Important Note: If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture.

DMIS Syntax for cylinder is as follows:

```
F (CL1) = FEAT / CYLNDR, OUTER, CART, $
    17.4992, 17.5074, 51.3072, -0.0001, 0.0000, 1.0000, 19.0568, 10.3260
MEAS / CYLNDR, F (CL1), 6
PTMEAS / CART, 27.0131, 16.9890, 51.6807, 0.9985, -0.0544, 0.0001
PTMEAS / CART, 20.1582, 8.3575, 51.4348, 0.2791, -0.9603, 0.0001
PTMEAS / CART, 8.0271, 16.4764, 51.3066, -0.9941, -0.1082, -0.0001
PTMEAS / CART, 7.9809, 17.0484, 61.5950, -0.9988, -0.0482, -0.0001
PTMEAS / CART, 20.3849, 8.4272, 61.5806, 0.3029, -0.9530, 0.0001
PTMEAS / CART, 27.0130, 16.9876, 61.6339, 0.9985, -0.0546, 0.0001
ENDMES
OUTPUT / FA (CL1), TA (TX2), TA (TY2), TA (TZ2), TA (TD2)
```

[Measuring Features](#)

Sphere

A sphere is a 3D feature. It requires a minimum of 4 points to be measured for computation. A sphere may also be of type **Inner** or **Outer**, this is determined by retract direction of the first point measured for the sphere. Note that the first 4 points must form a sphere, so it is recommended that the first point be measured on the top of the sphere, and the rest on the equator.

- Pick on the [Sphere](#) icon  in the [Measure Toolbar](#) or select [Sphere](#) from the pull down menu under [Measure Menu](#).
- Configure the number of points if necessary. Number of points cannot be less than four (4).
- Measure first point on the surface of the sphere in the direction of the Stem vector of the probe. Measure next three points approximately around the hemispherical quadrants of the sphere. Remaining points could be taken anywhere on the surface of sphere (if number of points is more than 4).

Important Note: If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture.

DMIS Syntax for a Sphere is as follows:

```
F (SP1) =FEAT/SPHERE, OUTER, CART,    -60.0000, -60.0000, 100.0000, 25.0000, 0.0000, 0.0000, 1.0000
MEAS/SPHERE, F (SP1) , 5
PTMEAS/CART, -59.9636, -60.0000, 112.4999, 0.0029, 0.0000, 1.0000
PTMEAS/CART, -47.9683, -61.9604, 102.7650, 0.9625, -0.1568, 0.2212
PTMEAS/CART, -57.2930, -47.9345, 101.8294, 0.2166, 0.9652, 0.1464
PTMEAS/CART, -71.8541, -56.1787, 101.0615, -0.9483, 0.3057, 0.0849
PTMEAS/CART, -60.6503, -72.4536, 100.8570, -0.0520, -0.9963, 0.0686
ENDMES
OUTPUT/FA (SP1) , TA (TX2) , TA (TY2) , TA (TZ2) , TA (TD2)
```

[Measuring Features](#)

Cone

A Cone is a 3D feature in space. A minimum of 6 points is required for a cone to be computed. An apex point (x,y,z), direction vector for the axis (IJK) and included angle define a cone. A cone feature may also be of type **Inner** or **Outer**, this is determined by retract direction of the first point measured for the cone.

- Pick on the [Cone](#) icon  in the [Measure Toolbar](#) or select [Cone](#) from the pull down menu under [Measure Menu](#).
- Minimum number of points to measure a cone feature is 6 (default). Enter number of points if default needs to be changed. Number of points must be 6 or more.
- Measure first three points around one of the ends of the cone as coplanar as possible. Next three points should be taken the same on the other edge of the cone feature. Remaining points could be taken in any order (if number of points is more than 6).

Important Note: If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture.

DMIS Syntax for a cone is as follows:

```
F (CN1) =FEAT/CONE, INNER, CART, $
  254.3534, 46.6801, -83.5866, -0.0353, -0.1966, -0.9798, 68.7580
MEAS/CONE, F (CN1), 6
PTMEAS/CART, 243.3056, 42.3990, -98.1308, 0.9914, 0.1167, -0.0591
PTMEAS/CART, 263.9826, 46.9925, -97.5168, -0.9568, -0.2765, 0.0899
PTMEAS/CART, 252.2861, 54.3315, -97.5208, 0.1577, -0.9693, 0.1888
PTMEAS/CART, 252.6736, 50.7310, -90.3743, 0.2671, -0.9466, 0.1804
PTMEAS/CART, 248.5496, 44.6665, -90.3758, 0.9928, 0.1051, -0.0568
PTMEAS/CART, 252.4011, 39.9890, -90.3598, 0.3042, 0.9318, -0.1980
ENDMES
```

[Measuring Features](#)

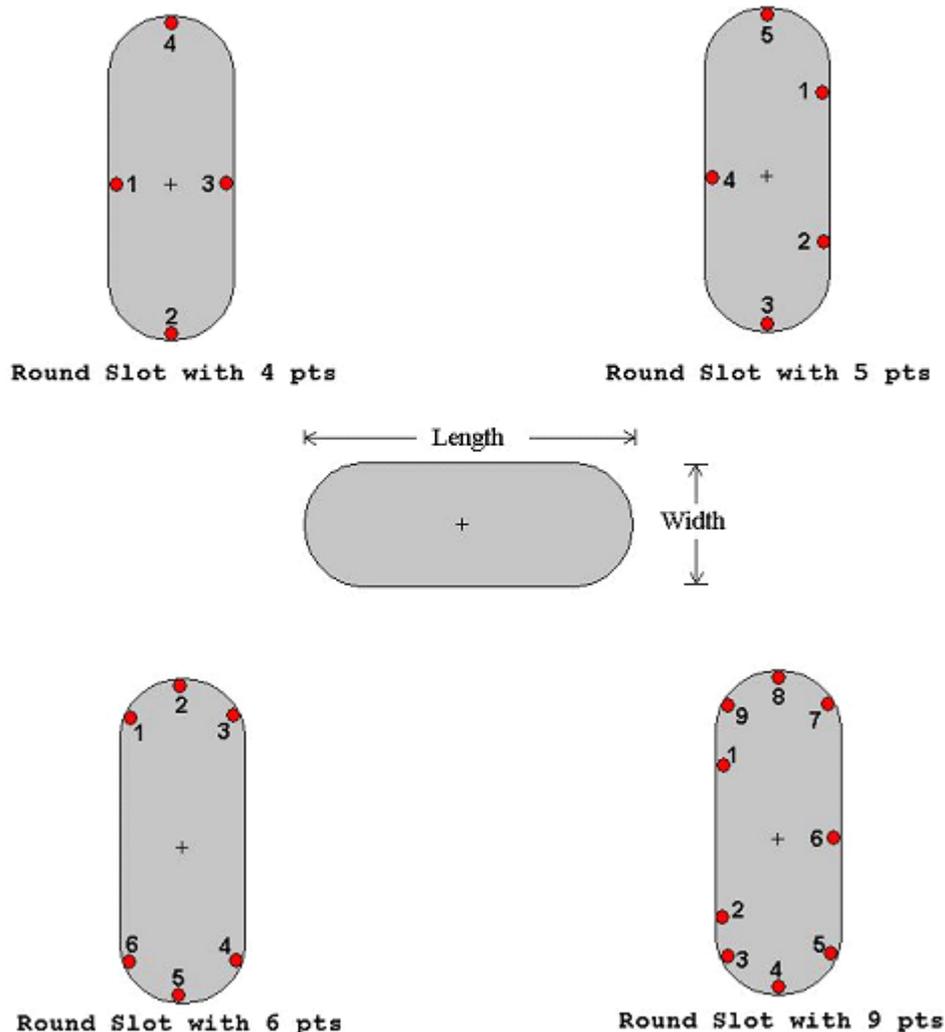
Round Slot

A Round Slot is a 2D feature and requires a **workplane** for its definition. It is a feature defined as close ended parallel lines of equal length with rounded ends. A round slot can be measured most accurately with 9 points in the appropriate order. Round slots can also be measured with 4, 5 or 6 points. Note that these methods of measurement may not be suitable for highly accurate measurements. Round slots could also be **Inner** or **Outer**, this is determined by retract direction of the first point measured for the slot.

- Pick on the [Round Slot](#) icon  in the [Measure Toolbar](#) or select [Round Slot](#) from the pull down menu under [Measure Menu](#).
- Select the appropriate [Workplane](#) from **Measure Toolbar** or pull down menu.

Slot can be measured with 4, 5, 6 or 9 points in an appropriate order as shown below. The points need to be measured in exactly the sequence shown in the figure below.

Important Note: If more than 9 points are used, they may be measured in any order.



Important Note: If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture.

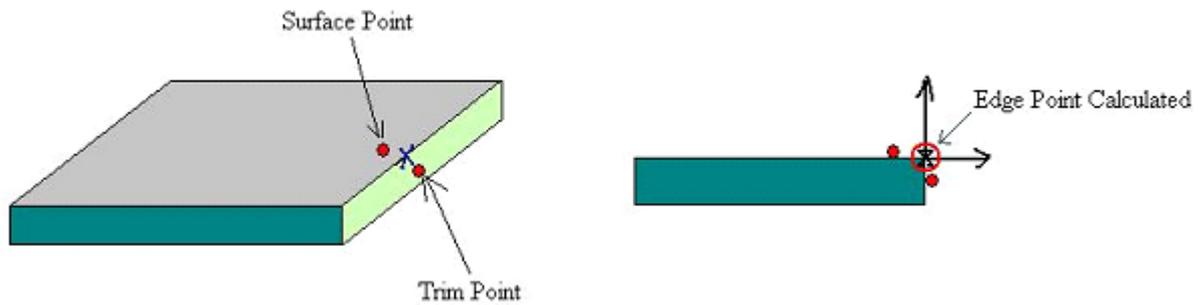
DMIS Syntax for a Round Slot is as follows:

```
F(SL1)=FEAT/CPARLN, INNER, ROUND, CART, 29.9198, 54.6356, 60.8673, $
0.0000, 0.0000, 1.0000, -1.0000, 0.0001, 0.0000, 50.1319, 12.6956
MEAS/CPARLN, F(SL1), 5
PTMEAS/CART, 17.0973, 60.9840, 60.9031, -0.0001, -1.0000, -0.0000
PTMEAS/CART, 39.5295, 60.9829, 59.8596, -0.0001, -1.0000, -0.0000
PTMEAS/CART, 54.9853, 54.4456, 61.7479, -0.9996, 0.0298, -0.0000
PTMEAS/CART, 29.4548, 48.2879, 60.5722, 0.0001, 1.0000, -0.0000
PTMEAS/CART, 4.8545, 54.4069, 61.2539, 0.9993, 0.0362, -0.0000
ENDMES
OUTPUT/FA(SL1), TA(TX2), TA(TY2), TA(TZ2)
```

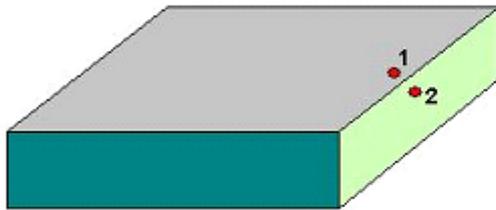
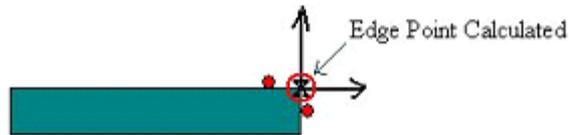
[Measuring Features](#)

Edge Point

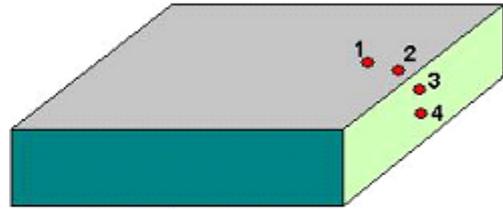
Edge Point is a built in macro feature to calculate a point at the intersection point of two perpendicular surfaces. It is defined by the location of the intersection point and vector normal of the two surfaces in question. This option is very useful for sheet metal parts. The figure below shows an edge point depiction.



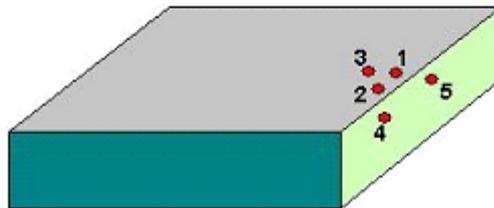
- Pick on the [Edge Point](#) icon  in the [Measure Toolbar](#) or select [Edge Point](#) from the pull down menu under [Measure Menu](#).
- An edge point may be determined using 2, 4 or 5 points. The figure below shows the measurement sequence. 5 points will yield the most accurate result. Note that 2 or 4 points will approximate the result, as the compensation of probe depends entirely on the method in which operator measures the point.



Edge Pt with 2 points,
Measure 1 point on each surface



Edge Pt with 4 points,
Measure 2 point line on each surface



Edge Pt with 5 points,
Measure a 3 pt plane on surface and
2 point line on the trim

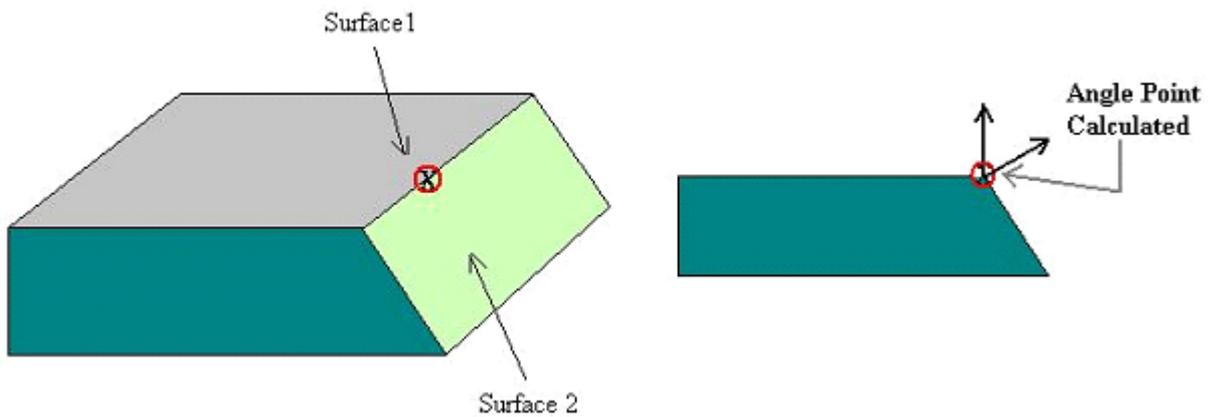
DMIS Syntax for an Edge Point is as follows:

```
F (EP1) =FEAT/EDGEPT, CART, 0.0000, 62.9312, 62.4956, $
-1.0000, -0.0000, 0.0001, 0.0001, -0.0001, 1.0000
MEAS/EDGEPT, F (EP1), 2
PTMEAS/CART, 3.1663, 62.9312, 62.4952, 0.0001, -0.0001, 1.0000
PTMEAS/CART, -0.0000, 62.9172, 56.5907, -1.0000, -0.0000, 0.0001
ENDMES
OUTPUT/FA (EP1), TA (TX2), TA (TY2), TA (TZ2), TA (TP2)
```

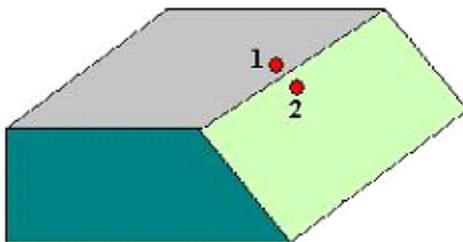
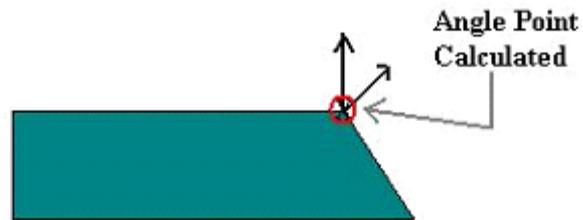
Measuring Features

Angle Point

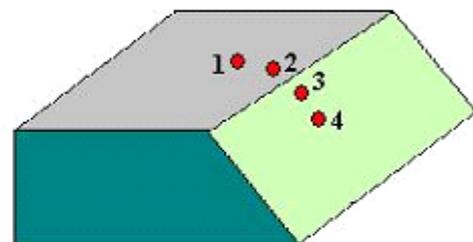
Angle Point is a built in macro feature to calculate a point at the intersection point of two non 90 degree surfaces. It is defined by the location of the intersection point and vector normal of the two surfaces in question. This option is very useful in the plastic mold industry. The figure below shows an edge point depiction.



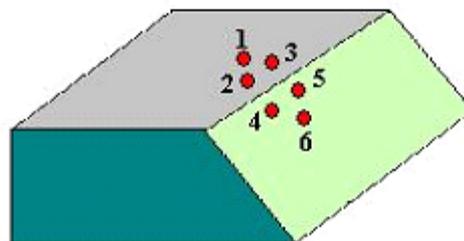
- Pick on the [Angle Point](#) icon  in the [Measure Toolbar](#) or select [Angle Point](#) from the pull down menu under [Measure Menu](#).
- An angle point may be determined using 2, 4 or 6 points. The figure below shows the measurement sequence. 6 points will yield the most accurate result. Note that 2 or 4 points will approximate the result, as the compensation of probe depends entirely on the method in which operator measures the point.



Angle Pt with 2 points
measured on each surface



Angle Pt with 4 Points,
Measure 2 pt line on each surface



Angle Pt with 6 Points,
Measure 3 pt plane on each surface

DMIS Syntax for an Angle Point is as follows:

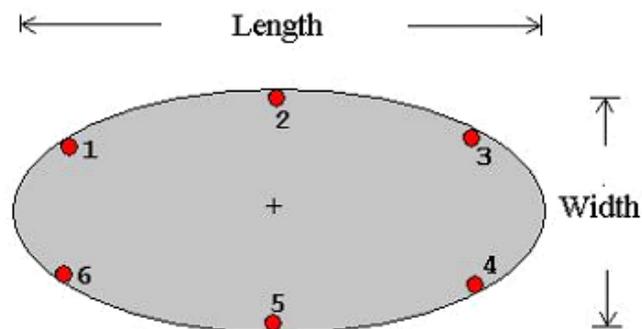
```
F (AP1) =FEAT/ANGLPT, OUTER, CART, 63.7341, 70.8529, 60.0233, $
0.8660, 0.0000, 0.5000, 0.3592, 0.0000, 0.9333
MEAS/ANGLPT, F (AP1), 2
PTMEAS/CART, 59.5551, 70.8529, 61.6316, 0.3592, 0.0000, 0.9333
PTMEAS/CART, 65.9892, 69.4670, 56.1174, 0.8660, 0.0000, 0.5000
ENDMES
OUTPUT/FA (AP1), TA (TX2), TA (TY2), TA (TZ2), TA (TP2)
```

[Measuring Features](#)

Ellipse

Ellipse is a 2D feature, and requires a **workplane** for its definition. A minimum of 6 points is required for an ellipse to be computed. Center point (X, Y, Z), Workplane direction vector (I J K), Major (length) & Minor (width) Diameter and orientation define an ellipse. An ellipse may be of type **Inner** or **Outer**, this is determined by retract direction of the first point measured for the ellipse.

- Pick on the [Ellipse](#) icon  in the [Measure Toolbar](#) or select [Ellipse](#) from the pull down menu under [Measure Menu](#).
- Select the appropriate [Workplane](#) from **Measure Toolbar** or pull down menu.
- Measure 6 or more points to represent the entire ellipse.



If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture

DMIS Syntax for Ellipse is as follows:

```
F(EL1)=FEAT/ELLIPS, OUTER, CART, -18.2122, 52.5555, 0.0000, $
0.0000, 0.0000, 1.0000, MAJOR, 1.0000, 0.0000, 0.0000, 15.0000, 8.0000
MEAS/ELLIPIS, F(EL1), 6
PTMEAS/CART, -55.4075, 2.9111, -291.5347, 0.0000, 0.0000, 1.0000
PTMEAS/CART, -69.1510, 49.6986, -291.5652, 0.0000, 0.0000, 1.0000
PTMEAS/CART, -53.8165, 108.8756, -291.5602, 0.0000, 0.0000, 1.0000
PTMEAS/CART, 14.8055, 107.8696, -291.5482, 0.0000, 0.0000, 1.0000
PTMEAS/CART, 31.6705, 67.3286, -290.7587, 0.0000, 0.0000, 1.0000
PTMEAS/CART, 18.9935, -1.1819, -286.6632, 0.0000, 0.0000, 1.0000
ENDMES
OUTPUT/FA(EL1), TA(CX5), TA(CY5), TA(CZ5), TA(Length), TA(Width)
```

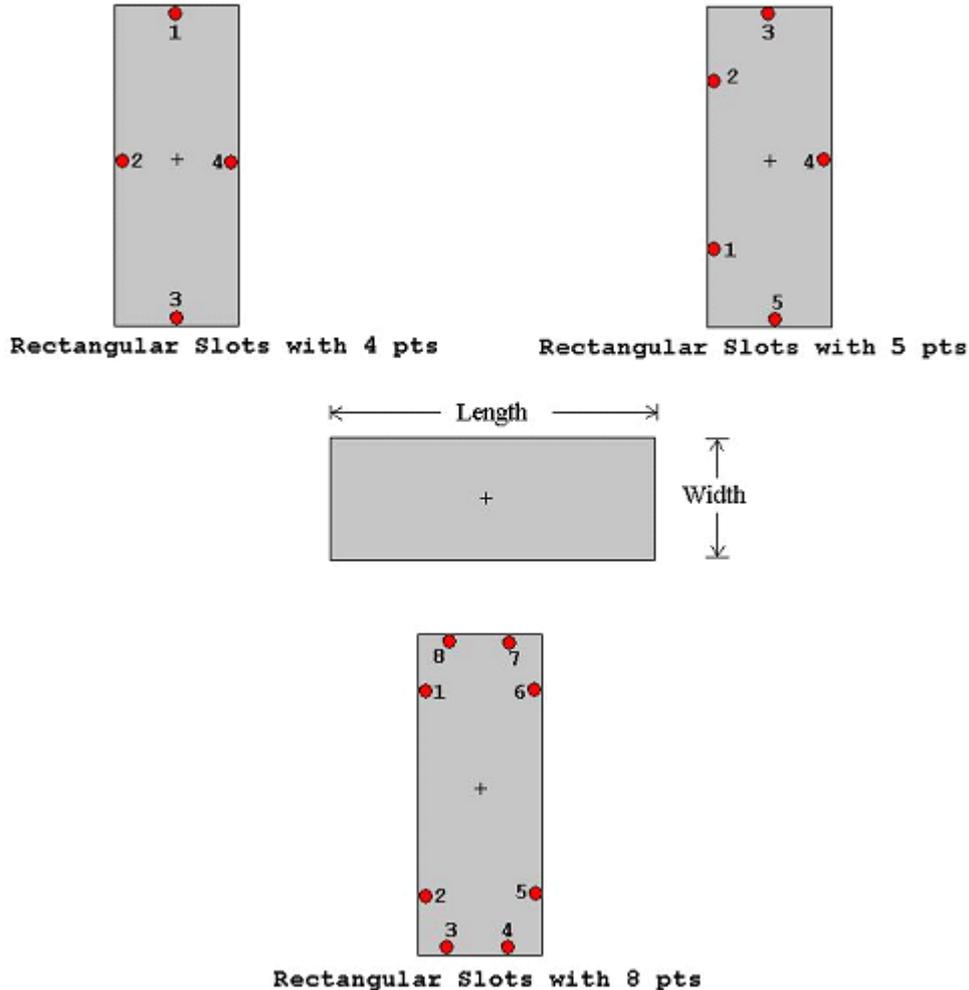
[Measuring Features](#)

Rectangular Slot

A Rectangular Slot is a 2D feature and requires a **workplane** for its definition. It is a feature defined as close ended parallel lines of equal length with flat ends. A rectangular slot can be measured most accurately with 8 points in the appropriate order. Rectangular slots can also be measured with 4 or 5 points. Note that this method of measurement may not be suitable for highly accurate measurements. Rectangular slots could also be **Inner** or **Outer**, this is determined by retract direction of the first point measured for the slot.

- Pick on the [Rectangular Slot](#) icon  in the [Measure Toolbar](#) or select [Rectangular Slot](#) from the pull down menu under [Measure Menu](#).
- Select the appropriate [Workplane](#) from **Measure Toolbar** or pull down menu.
- Slot can be measured with 4, 5 or 8 points in an appropriate order as shown below. The points need to be measured in exactly the sequence shown in the figure below.

Important Note: If more than 8 points are used, they may be measured in any order.



Important Note: If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture.

DMIS Syntax for a Rectangular Slot is as follows:

```
F(SL1)=FEAT/CPARLN, INNER, FLAT, CART, 5.0000, 55.0000, 43.9000, $
  0.0000, 0.0000, 1.0000, -1.0000, 0.0000, 0.0000, 20.0000, 10.0000
MEAS/CPARLN, F(SL1), 8
GOTO/5.0000, 55.0000, 48.9000
GOTO/5.0000, 55.0000, 41.9000
  PTMEAS/CART, 9.0000, 50.0000, 41.9000, 0.0000, 1.0000, 0.0000
  PTMEAS/CART, 1.0000, 50.0000, 41.9000, 0.0000, 1.0000, 0.0000
  PTMEAS/CART, -5.0000, 53.0000, 41.9000, 1.0000, 0.0000, 0.0000
  PTMEAS/CART, -5.0000, 57.0000, 41.9000, 1.0000, 0.0000, 0.0000
  PTMEAS/CART, 1.0000, 60.0000, 41.9000, 0.0000, -1.0000, 0.0000
  PTMEAS/CART, 9.0000, 60.0000, 41.9000, 0.0000, -1.0000, 0.0000
  PTMEAS/CART, 15.0000, 57.0000, 41.9000, -1.0000, 0.0000, 0.0000
  PTMEAS/CART, 15.0000, 53.0000, 41.9000, -1.0000, 0.0000, 0.0000
GOTO/5.0000, 55.0000, 48.9000
ENDMES
OUTPUT/FA(SL1), TA(x1), TA(y1), TA(z1), TA(l1), TA(w1)
```

Measuring Features

Arc

Arc is a 2D feature, and requires a work plane for its definition. A minimum of 3 points is required for an arc to be computed. Center point (X, Y, Z), **workplane** direction vector (I J K), and Diameter, Start and End Angle to define an arc. An arc may be of type **Inner** or **Outer**, this is determined by retract direction of the first point measured for the arc, which will determine if the arc is inner or outer.

- Pick on the [Arc](#) icon  in the [Measure Toolbar](#) or select [Arc](#) from the pull down menu under [Measure Menu](#).
- Select the appropriate [Workplane](#) from **Measure Toolbar** or pull down menu.
- Configure the number of points if necessary. Number of points cannot be less than three.
- Measure points on the circle with even spread to represent the entire arc.

Important Note: If the program needs to be executed in a DCC machine teach position points if and when required to avoid any collisions of the probe with the part or the fixture while measuring an outer arc, position points may be required after each point is measured.

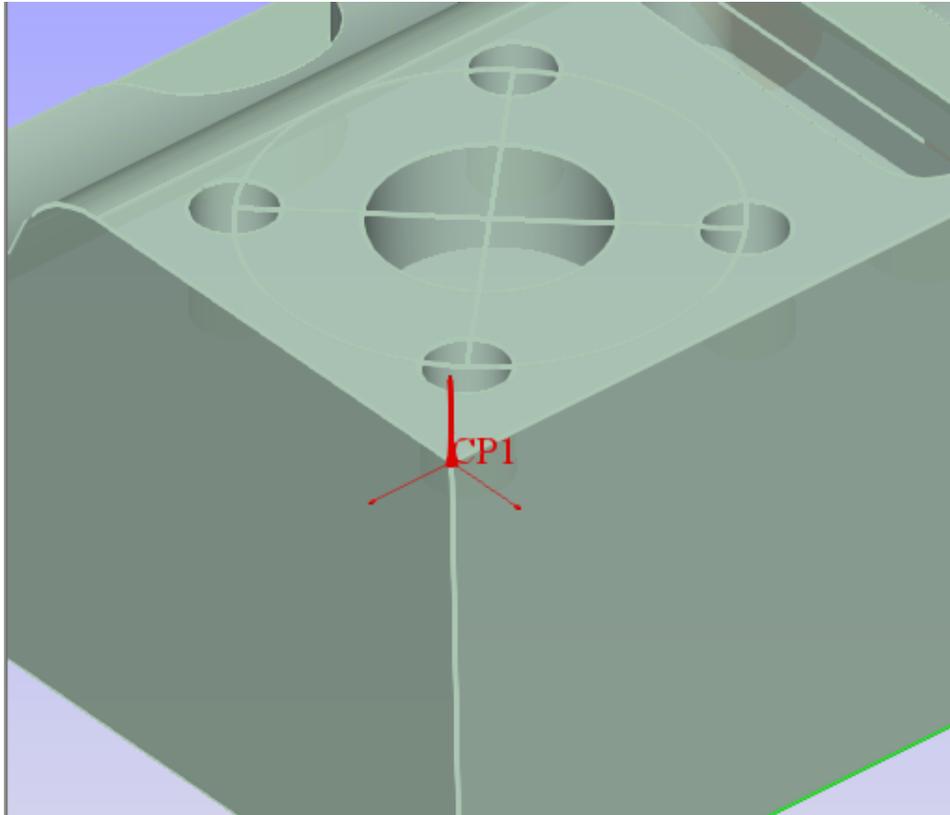
DMIS Syntax for an outer circle is as follows:

```
F (AR1) =FEAT/ARC, OUTER, CART, $
      85.0000,75.0000,0.0000,0.0000,0.0000,1.0000,50.0000,35.0000,180.0000
MEAS/ARC, F (AR1) , 9
GOTO/134.9683,109.9882,12.0000
PTMEAS/CART,125.9576,103.6788,-2.0000,0.8192,0.5736,0.0000
PTMEAS/CART,115.0036,114.9973,-2.0000,0.6001,0.7999,0.0000
PTMEAS/CART,101.0720,122.3465,-2.0000,0.3214,0.9469,0.0000
PTMEAS/CART,85.5454,124.9970,-2.0000,0.0109,0.9999,0.0000
PTMEAS/CART,69.9647,122.6858,-2.0000,-0.3007,0.9537,0.0000
PTMEAS/CART,55.8761,115.6423,-2.0000,-0.5825,0.8128,0.0000
PTMEAS/CART,44.6778,104.5655,-2.0000,-0.8064,0.5913,0.0000
PTMEAS/CART,37.4810,90.5546,-2.0000,-0.9504,0.3111,0.0000
PTMEAS/CART,35.0000,75.0000,-2.0000,-1.0000,-0.0000,0.0000
GOTO/24.0000,75.0000,12.0000
ENDMES
OUTPUT/FA (AR1) , TA (X1) , TA (Y1) , TA (Z1) , TA (RAD_TOL)
```

[Measuring Features](#)

Corner Point

Corner Point is a built in macro feature to calculate a point at the intersection point of three non 90 degree surfaces. It is defined by the location of the intersection point and vector normal of the two surfaces in question. This option is very useful in the plastic mold industry. The figure below shows a corner point depiction.



- Pick on the [Corner Point](#) icon  in the [Measure Toolbar](#) or select [Corner Point](#) from the pull down menu under [Measure Menu](#).
- A corner point may be determined using 3 or 9 points. The figure below shows the measurement sequence. 9 points will yield the most accurate result. Note that 3 points will approximate the result, as the compensation of probe depends entirely on the method in which operator measures the point.
- A 3 point corner point is defined as one touch on each opposing surface.
- A 9 point corner point is defined as 3 touches on each opposing surface.

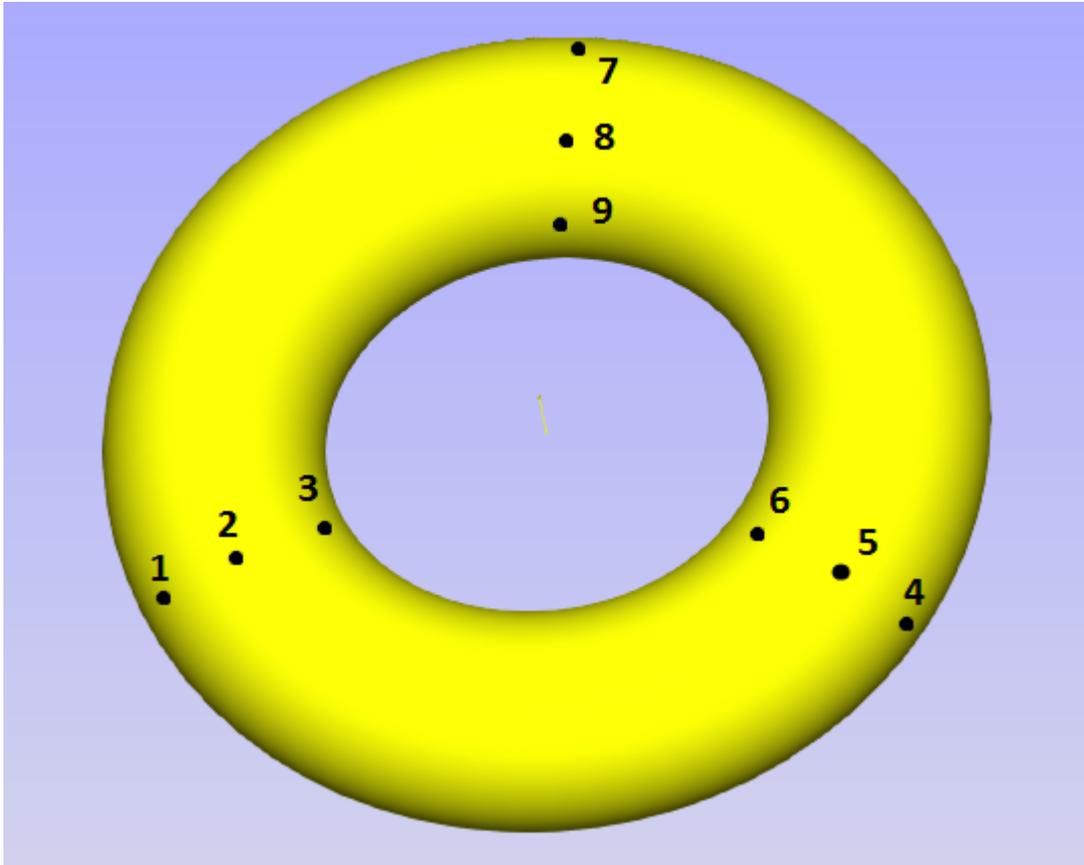
DMIS Syntax for Corner Point is as follows:

```
F (CP5) =FEAT/CRNRPT, OUTER, CART, 0.0000, 125.0000, 62.5000, $  
    0.0002, -0.0001, 1.0000, -0.0000, 1.0000, -0.0000, -1.0000, 0.0000, 0.0000  
MEAS/CRNRPT, F (CP5), 3  
    PTMEAS/CART, 2.1499, 122.6834, 62.4994, 0.0002, -0.0001, 1.0000  
    PTMEAS/CART, 4.9825, 125.0000, 58.1897, -0.0000, 1.0000, -0.0000  
    PTMEAS/CART, 0.0000, 118.8856, 58.8703, -1.0000, 0.0000, 0.0000  
ENDMES  
OUTPUT/FA (CP5), TA (TX1), TA (TY1), TA (TZ1), TA (TP1)
```

[Measuring Features](#)

Torus

Torus is a 3D feature, and does not require a work plane for its definition. A minimum of 9 points is required for a torus to be computed. Radial center point (X, Y, Z), Major & Minor (width) Diameter and orientation define an torus. A torus may be of type **Inner** or **Outer**, this is determined by retract direction of the first point measured for the torus. The figure below shows a torus depiction. A more realistic application for this might be a pipe or tube measurement.



- Pick on the [Torus](#) icon  in the [Measure Toolbar](#) or select [Torus](#) from the pull down menu under [Measure Menu](#).
- Configure the number of points if necessary. Number of points cannot be less than nine (9).
- Measure the points similar to the picture shown above.
- If more than 9 points are used, then the order of points is irrelevant.

DMIS Syntax for Torus is as follows:

```
F (TR4) =FEAT/TORUS, OUTER, CART, $
  17.5000,17.5003,50.6753,0.0000,-0.0000,1.0000,25.4010,6.3506
MEAS/TORUS, F (TR4) , 9
PTMEAS/CART,23.3248,2.7348,50.8106,0.3666,-0.9294,0.0426
PTMEAS/CART,23.3456,3.9944,53.1282,0.2522,-0.5827,0.7726
PTMEAS/CART,21.8970,6.7943,53.6438,-0.1348,0.3283,0.9349
PTMEAS/CART,33.1995,15.1412,50.6752,0.9889,-0.1486,-0.0000
PTMEAS/CART,32.8492,15.0345,52.0844,0.8848,-0.1421,0.4438
PTMEAS/CART,31.5605,15.4000,53.4652,0.4722,-0.0705,0.8787
PTMEAS/CART,26.4031,30.0494,52.3688,0.4895,0.6899,0.5333
PTMEAS/CART,26.1257,28.8007,53.4655,0.2896,0.3794,0.8787
PTMEAS/CART,24.8406,26.1727,53.5547,-0.2724,-0.3218,0.9068
ENDMES
OUTPUT/FA (TR4) , TA (TX1) , TA (TY1) , TA (TZ1) , TA (TD2)
```

[Measuring Features](#)

Space Point

Using the **Space Point** feature in CAPPs DMIS can be a very powerful tool. It basically has a twofold function.

- The ability to record a point at the current location of the center of the probe tip. This may be to start a reference frame at any given location in space.
- With respect to running several parts, there are times where features of size, (circles, slots, etc.) are out of location. CAPPs DMIS gives the ability to record a point at the center of a feature that may be out of location, and measure the current location of the same feature on the next part in relationship to the most recent recorded space point.
- To perform a space point function, open the Point measure dialog box and hit the F3 key on the keyboard

DMIS Syntax for Space Point is as follows:

```
F (PT1) =FEAT/POINT, CART, $
    -6.6962, -92.5926, 37.1699, 0.000, 0.000, 1.000
MEAS/POINT, F (PT1), 0
    PTMEAS/CART, -6.6962, -92.5926, 37.1699, 0.0000, 0.0000, 1.0000
ENDMES
OUTPUT/FA (PT1), TA (x1), TA (y1), TA (z1), TA (lprofpt76)
```

Measuring Features

Measuring Features in Polar Coordinates

Measuring Features in Polar Coordinates

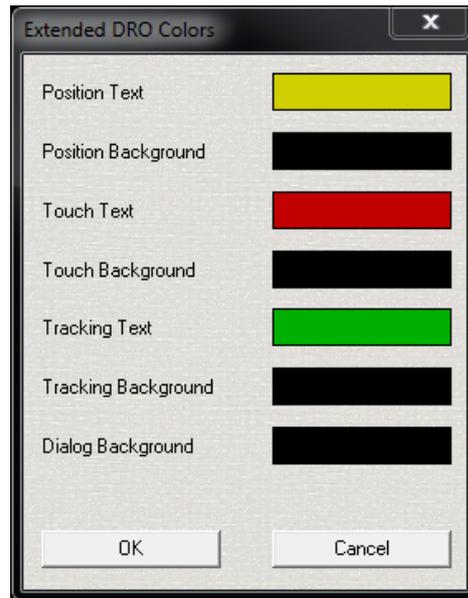
There are two ways to get a polar output from a feature:

- Configure the measurement units for [Polar by clicking on System Units](#). Proceed to measure the feature with outputs turned on using either manual or **DCC Mode**.
- Measure the feature in **Cartesian** using either manual or **DCC Mode**, change the measurement units to **Polar by clicking on System Units**, and then output the feature using **GD&T Output**.

Using the Extended DRO Option

The screenshot displays a CNC control interface with several readout windows and control panels. At the top, a large black window with yellow text shows Cartesian coordinates: X=29.504, Y=93.796, and Z=74.500. Below this, two smaller windows show polar coordinates: a red-bordered window with X=29.504, Y=82.796, Z=60.500, and a green-bordered window with X=16.804, Y=95.496, Z=60.500. On the right side, there are control panels for 'Datum Operations' (Preset, Use Probe Position, From Probe Touch, Mirror, Swap, Reset), 'Units' (MM, 0.000), 'Probe' (Compensate, Radius 1.000), and 'Machine Compensation' (None, Apply, Edit Error-Map File).

Important Note: To change the colors of any of the DRO areas **other than the DRO Operations area**, right click inside the DRO and select **Colors** from the **Extended DRO Colors Menu** to open the dialog below.



Datum Operations - Preset

With this operation, the user can translate and offset the X, Y, and/or Z of datum's origin to

- The current probe position, or
- A probe touch

To change the origin for X, check X. To offset X, enter the desired offset in the field next to X. The same applies to Y, and Z. After configuring these options, click the button **Apply** under the **Datum Operations Menu**. If **Use Probe Position** was checked, the datum will be constructed with no further steps. If **From Probe Touch** was checked, the user will need to take a touch point for X, if checked, then a touch point for Y, if checked, then a touch point for Z, if checked. While taking the touch point for X, Y, or Z, the field corresponding to the axis will be in **RED** as shown below.



Datum Operations - Mirror

With this operation, the user can reverse the direction of X, Y and/or Z. For example, to reverse the X-axis, the user may check X, click the button **Apply** under the **Datum Operations Menu**. After that, the DRO will change X to $-X$ in various **DRO** areas.

Important Note: The offset fields are disabled in this operation.

Datum Operations - Swap

With this operation, the user can swap, or interchange, two axes. For example, to swap X with Y, then user may choose **Swap**, click X and Y, then the button **Apply** under the **Datum Operations Menu**. After that, the DRO will change X to Y, and Y to X.

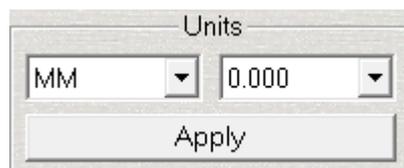
Important Note: When the user selects two axes, the third will be disabled.

Datum Operations - Reset

With this operation, the user can clear any datum operations that may have been executed, and the datum will return to the **Machine Coordinate System (MCS)**.

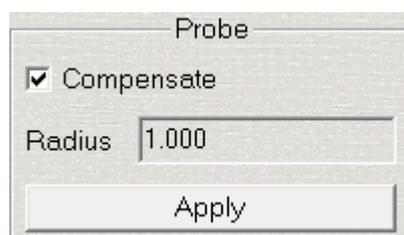
Units and Precision

To change the units and the precision, the user may refer to next figure.



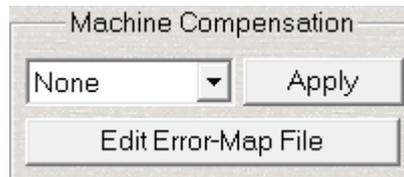
Probe Compensation

When taking touch points, the user can decide if the taken point should be compensated for the probe radius or not.



Machine Error Compensation

To control the usage of the machine error compensation, the user may do as explained in the following figure.



Important Note: **None** means machine error compensation will be **OFF**, **Linear** means the correction of the linear errors, and **Full** means the correction of linear and rotational errors.

Previous Point Measured

This window shows the previous point measured. The coordinates displayed in the last point window will be moved to this window when a new point is received.

X	16.804
Y	95.496
Z	60.500

Target Tracking

When the user tries to measure a specific point, the DRO will show three charts for X, Y, and Z. These charts visualize the difference between the target and the current machine position as shown in the following figure.



The colors map for this chart is as follows:

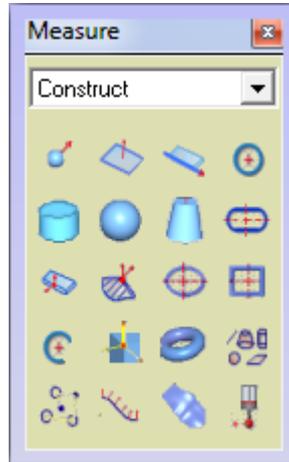
- If the probe is more than 10 mm away from the point, the color will be **RED**.
- If the probe is to the left of the target within 10 mm, then the color will be **YELLOW**.
- If the probe is to the right of the target within 10 mm, then the color will be **GREEN**.

[Measuring Features](#)

Constructing Features

Construct Mode

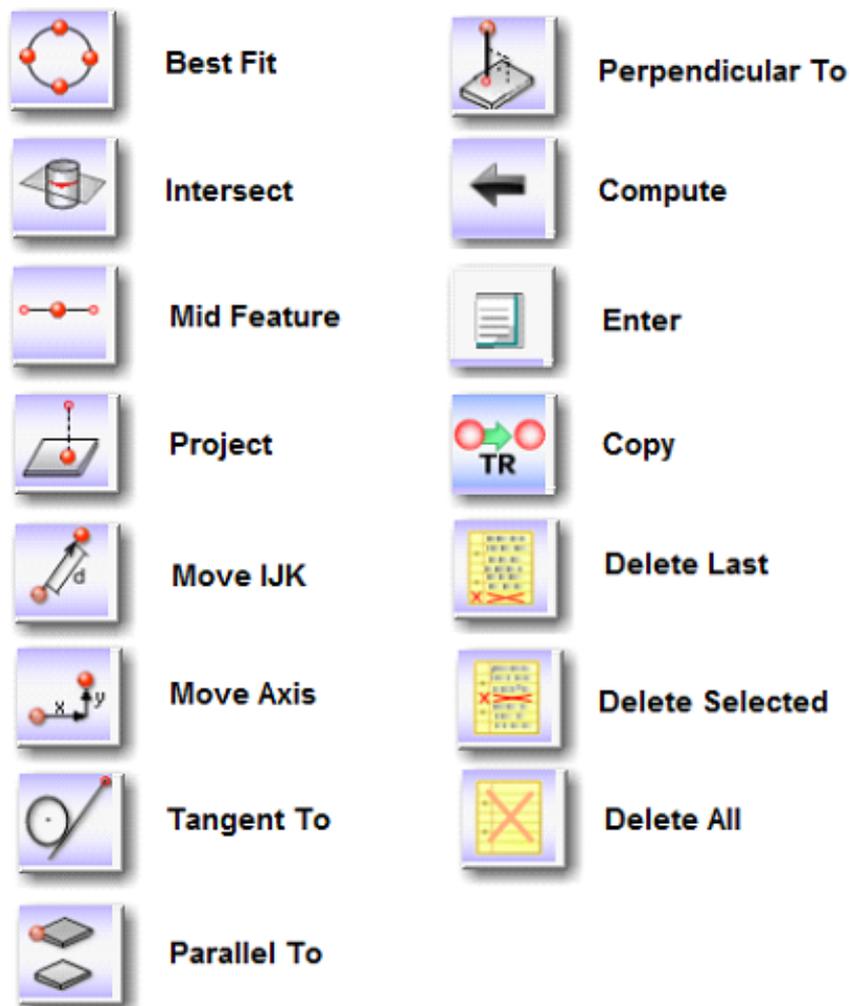
In order to construct features with CAPPS DMIS it will be necessary to change to [Construct Mode](#).



Features to Method Relationships

Features	Best Fit	Intersect	Move IJK	Move Axis	Project	Mid Feat	Perp To	Parallel To	Tan To
Point		X	X	X	X	X			X
Plane	X		X	X		X	X	X	
Line	X	X	X	X	X	X	X	X	X
Circle	X	X	X	X	X	X			X
Sphere	X		X	X	X	X			X
Ellipse	X	X	X	X	X				
Cylinder	X		X	X	X	X			X
Cone	X		X	X	X	X			X
Round Slot	X		X	X	X	X			X
Rec Slot	X		X	X	X	X			X
Arc	X	X	X	X	X	X			X
Torus	X	X	X	X	X	X	X	X	X

Construct Feature Dialog Description



Best Fit:	Used to construct features by best fitting it among unselected features.
Intersect:	Used to construct features by intersecting selected features.
Mid Feature:	Used to construct features as a mid feature between selected features.
Project:	Used to construct features by projecting them to selected plane or theoretical plane.
Move IJK:	Used to construct features by entering a distance in selected feature's vector direction.
Move Axis:	Used to construct features by entering the distance in X,Y and Z directions relative to selected features position.

Tangent To:	Used to construct features by using tangent relationship to the selected feature.
Parallel To:	Used to construct features by using two features one for setting the parallel relationship and one for the level.
Perpendicular To:	Used to construct features by using two features one for setting the perpendicular relationship and one for the location.
Compute:	Used to construct the feature.
Enter:	Used to construct a feature by entering the position and the vector of the feature.
Copy:	Used to construct a feature by copying an existing one.
Delete Last:	Deletes the last feature selected from the list.
Delete Selected:	Deletes the feature selected from the list.
Delete All:	Deletes all the features from the list.

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Point Construction

Intersect

The intersect method constructs a point of intersection between two features:

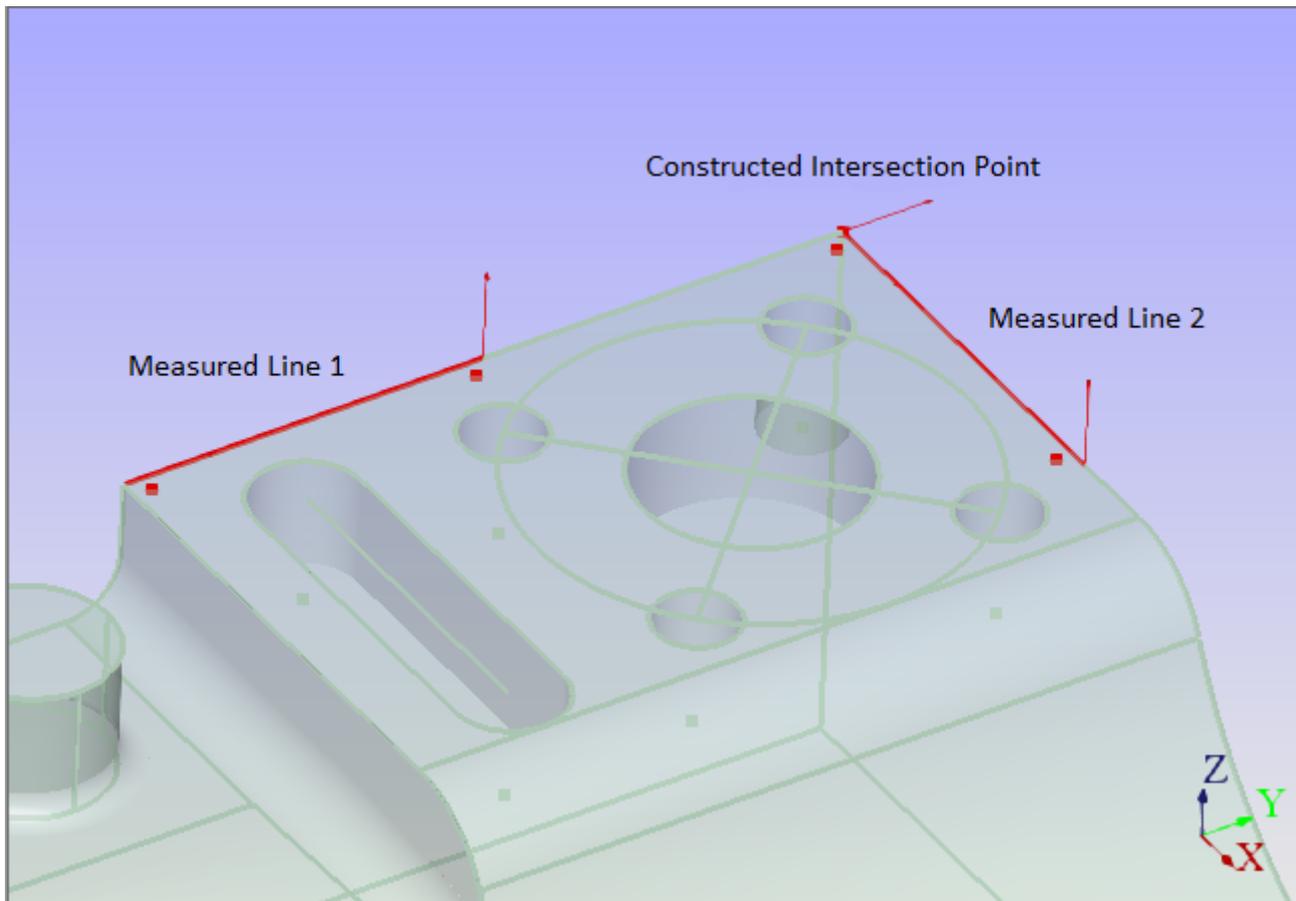
- Intersection between line reducible features
- Intersection between line reducible features and plane feature

Possible options available:

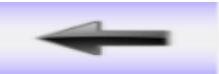
- Intersecting Two Lines
- Intersect a Line with a Measured Plane or a Constructed Plane
- Intersect a Line with a Theoretical Workplane (XY, YZ, ZX) at a Particular Value
- Intersect a Cylinder with a Measured, Constructed, or Theoretical Workplane
- Intersect a Cone with a Measured, Constructed, or Theoretical Workplane
- Intersect a Line and a Circle which Share a Common Workplane (2 point output)

Intersect Two Lines to Construct a Point

The following is an example of how to use the **Intersect** option to construct a point. This example uses two lines to construct a point.

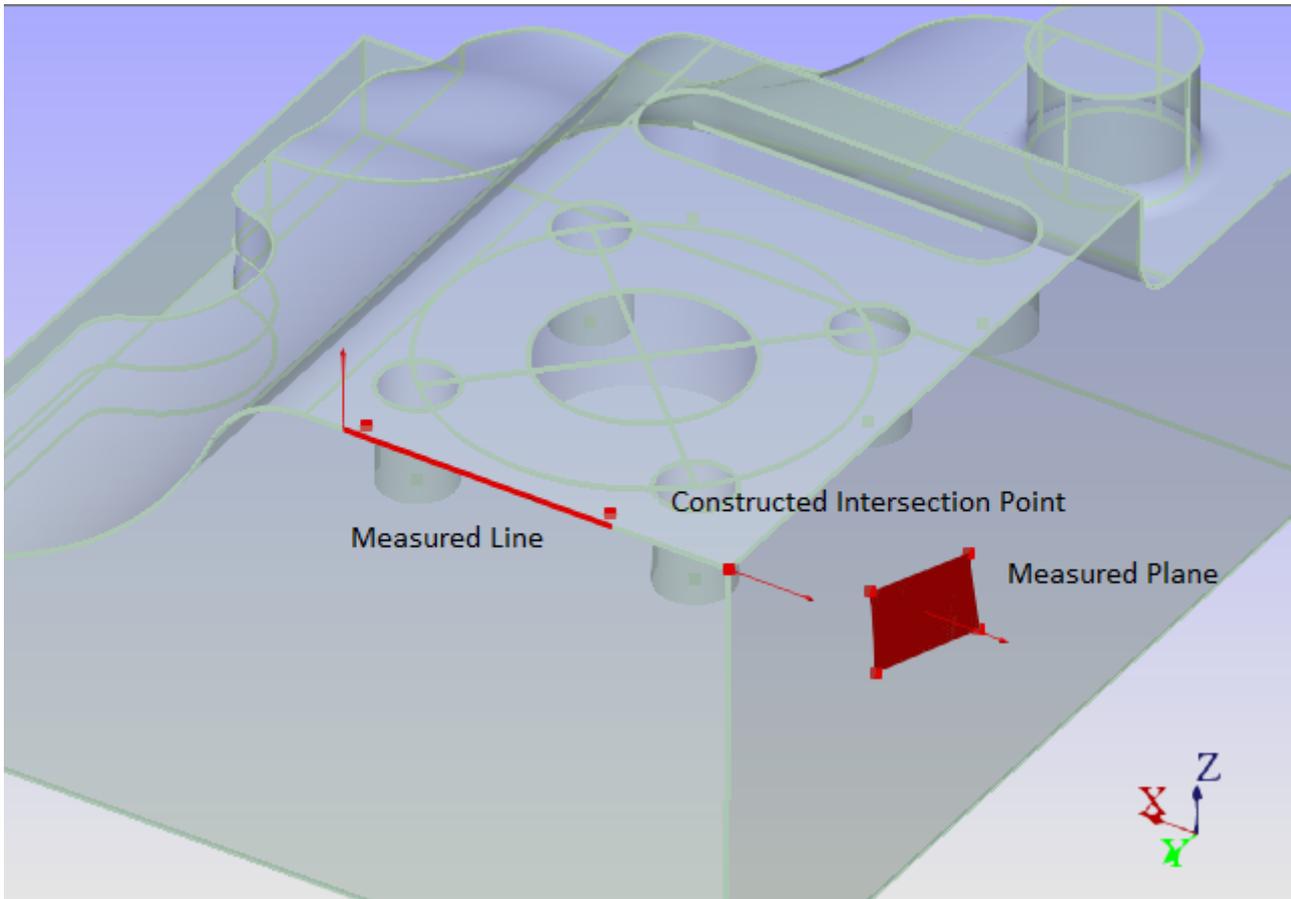


Steps to follow:

- Measure two lines to a common **Workplane**.
-  Switch to the **Construct Mode**, choose the **Point Icon** .
-  Click in the **Intersect** button .
- Choose the two actual line features that were measured.
-  Click on **Compute** .

Intersect a Line with a Measured or Constructed Plane

The following is an example of how to use the **Intersect** option to construct a point. This example uses a line and a plane to construct a point.

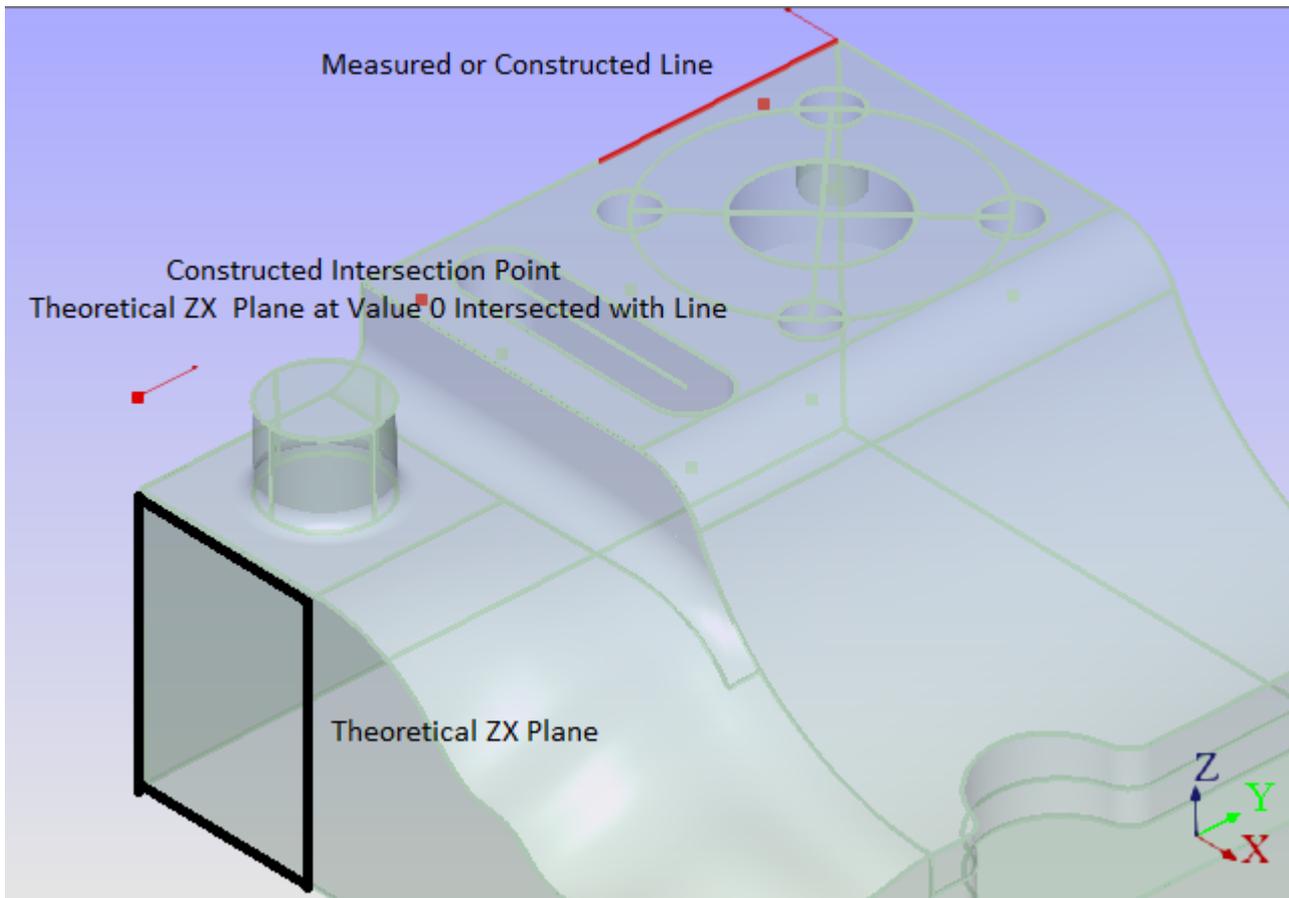


Steps to follow:

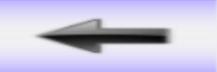
- Measure a line, and measure a plane **perpendicular** to the line.
-  Switch to the **Construct Mode**, choose the **Point Icon**.
-  Click in the **Intersect** button.
- Choose the line feature and then the plane feature from the actuals list.
-  Click on **Compute**.

Intersecting a Line with a Theoretical Plane

The following is an example of how to use the **Intersect** option to construct a point. This example uses a line and a theoretical plane to construct a point.

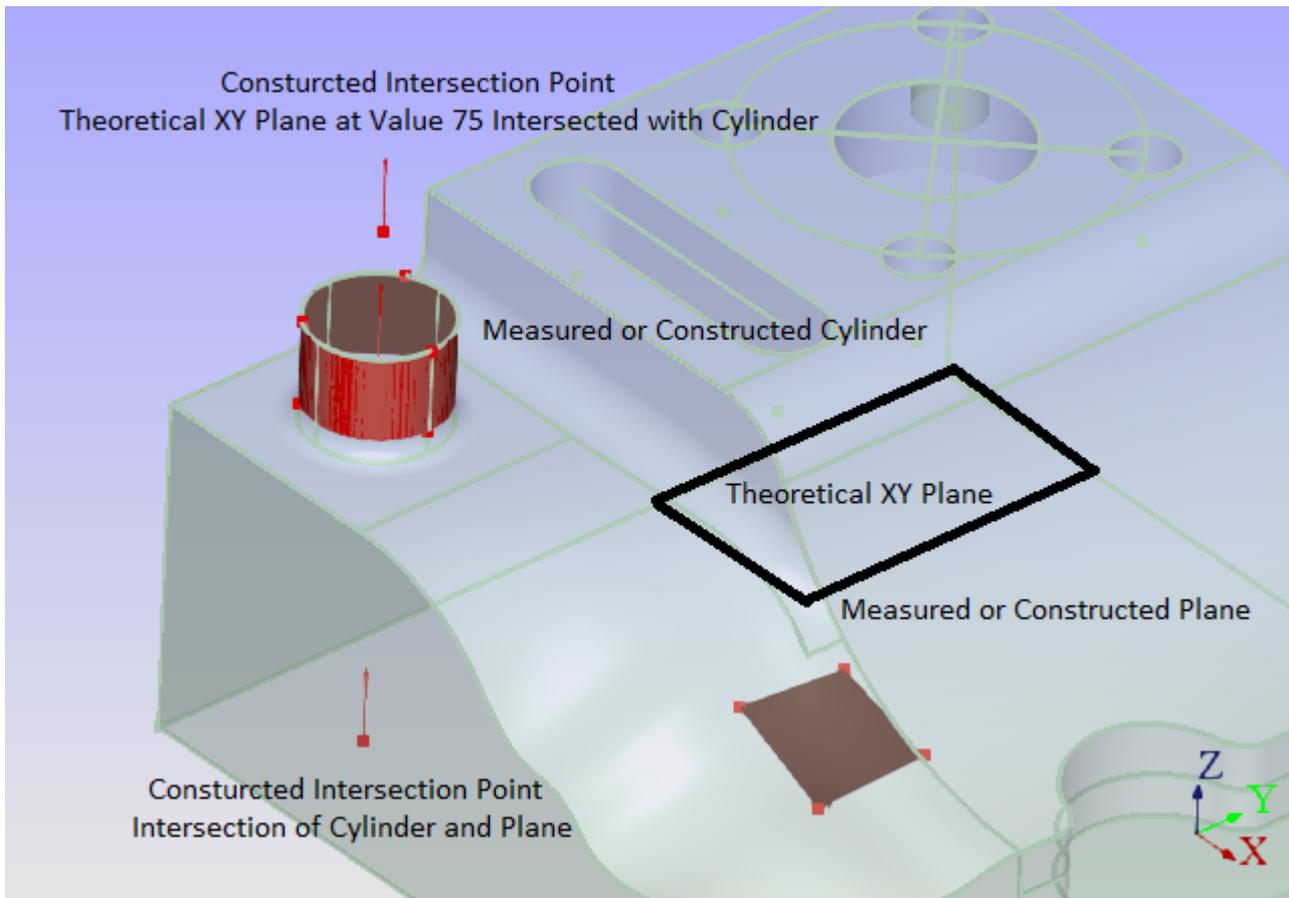


Steps to follow:

- Measure a line, or have a constructed line available.
-  Switch to the **Construct Mode**, choose the **Point Icon**.
-  Click in the **Intersect** button.
- Choose the line feature from the actuals list. Next, click on the **theoretical** option in the feature list. Choose the **Theoretical Workplane** to intersect the line with.
- Type in the value of the suggested intersection, click **OK**.
-  Click on **Compute**.

Intersect a Cylinder with a Measured, Constructed, or Theoretical Workplane

The following is an example of how to use the **Intersect** option to construct a point. This example uses a cylinder and two planes (one measured or constructed plane and one theoretical plane) to construct a point.



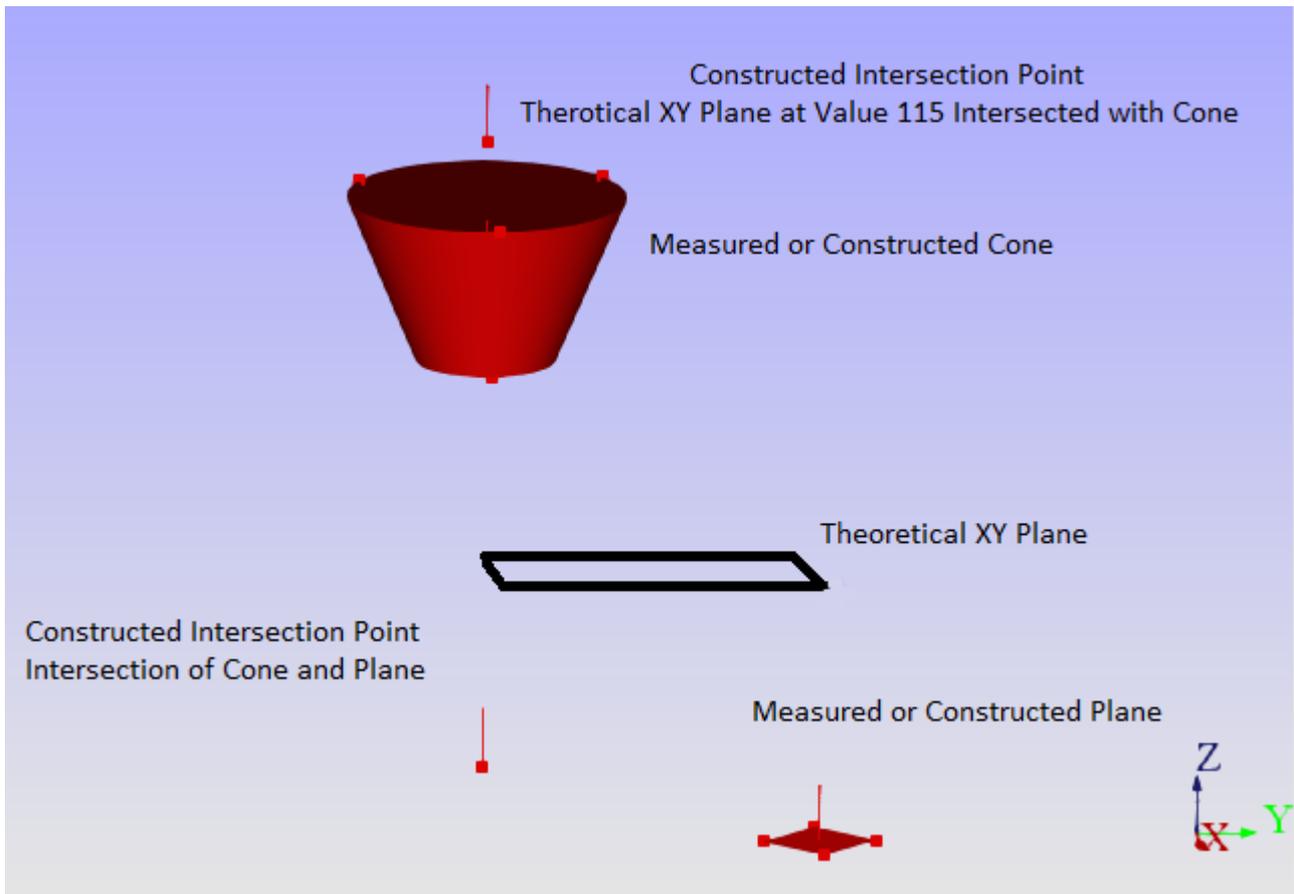
Steps to follow:

- Measure a cylinder, and have a measured or constructed plane available.
-  Switch to the **Construct Mode**, choose the **Point Icon**.
-  Click in the **Intersect** button.
- Choose the line feature, then choose the plane feature, or theoretical plane from the actuals list.
-  Click on **Compute**.

For the steps on how to intersect a **Cylinder** with a **Theoretical Workplane**, see steps in above example (intersecting a line with a theoretical plane).

Intersect a Cone with a Measured, Constructed, or Theoretical Workplane

The following is an example of how to use the **Intersect** option to construct a point. This example uses a cone and a theoretical plane to construct a point.



Steps to follow:

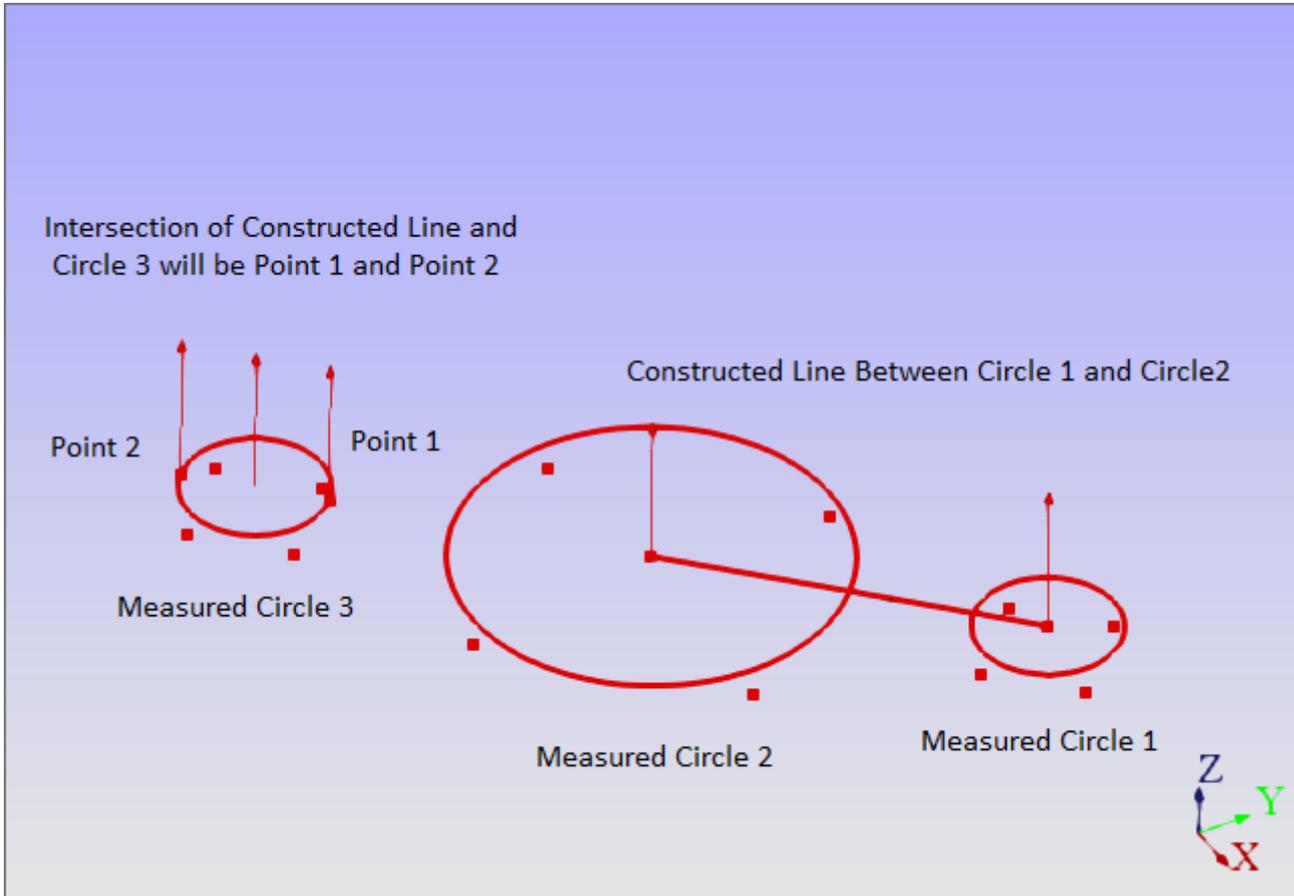
- Measure a cone, and have a measured or constructed plane available.
-  Switch to the **Construct Mode**, choose the **Point Icon**.
-  Click in the **Intersect** button.
- Choose the cone feature, then choose the plane feature, or theoretical plane from the actuals list.
-  Click on **Compute**.

For the steps on how to intersect a **Cone** with a **Theoretical Workplane**, see steps in above example (intersecting a line with a theoretical plane).

Intersect a Line with a Circle, Both of which Share the Same Workplane

The following is an example of how to use the **Intersect** option to construct a point. This example uses two circles and a line to construct a point.

Important Note: There will be two outputs in this instance, where the line enters the circle and where the line exits the circle.

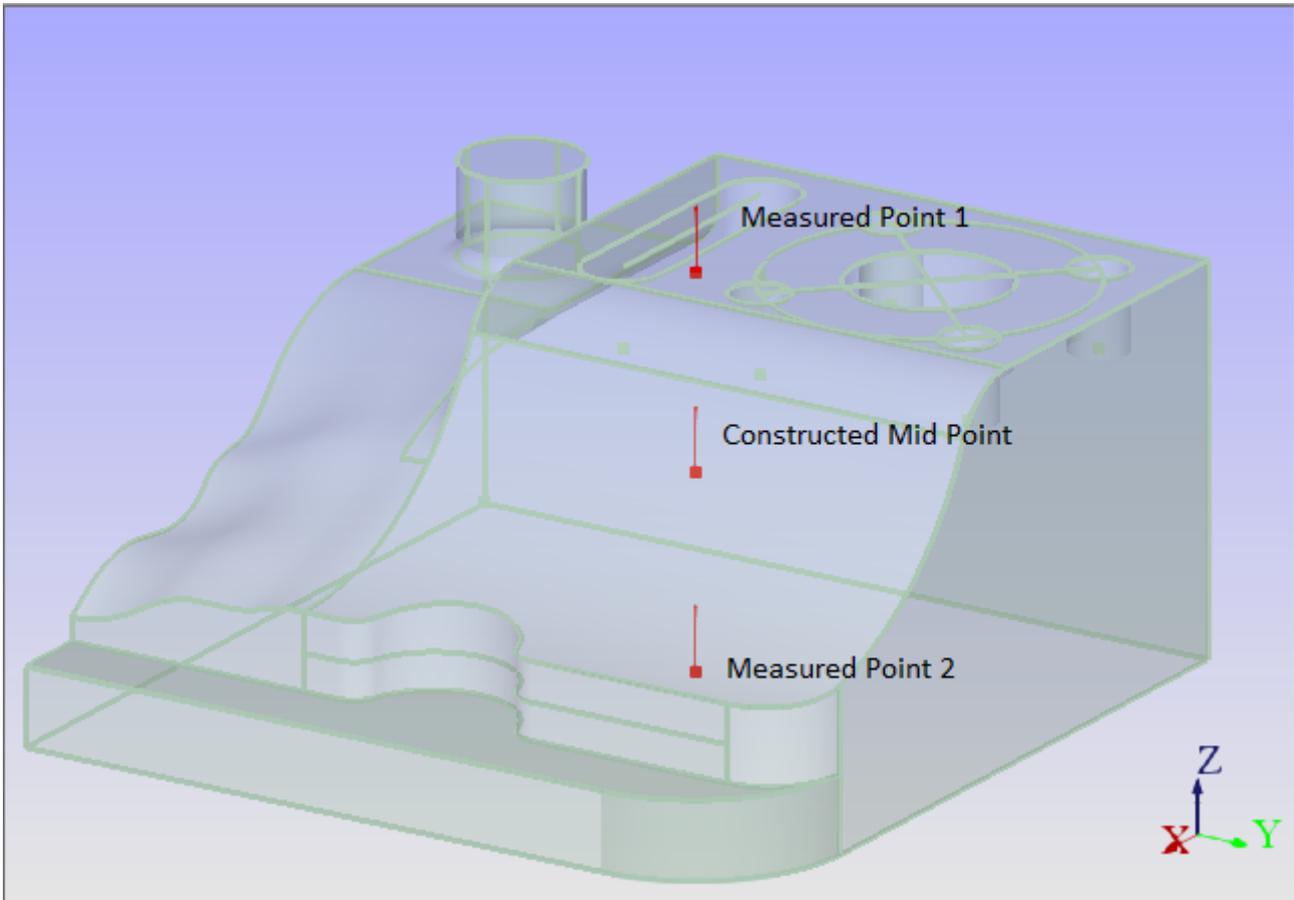


Steps to follow:

- Measure a line and a circle, both of which should share the same **Workplane**.
-  Switch to the **Construct Mode**, choose the **Point Icon**.
-  Click in the **Intersect** button.
- Choose the line feature, then choose the circle feature from the actuals list.
-  Click on **Compute**.

Mid-Point

The following is an example of using the **Mid Feature** option in the **Construct Menu** to create a mid-point between two measured or constructed points.

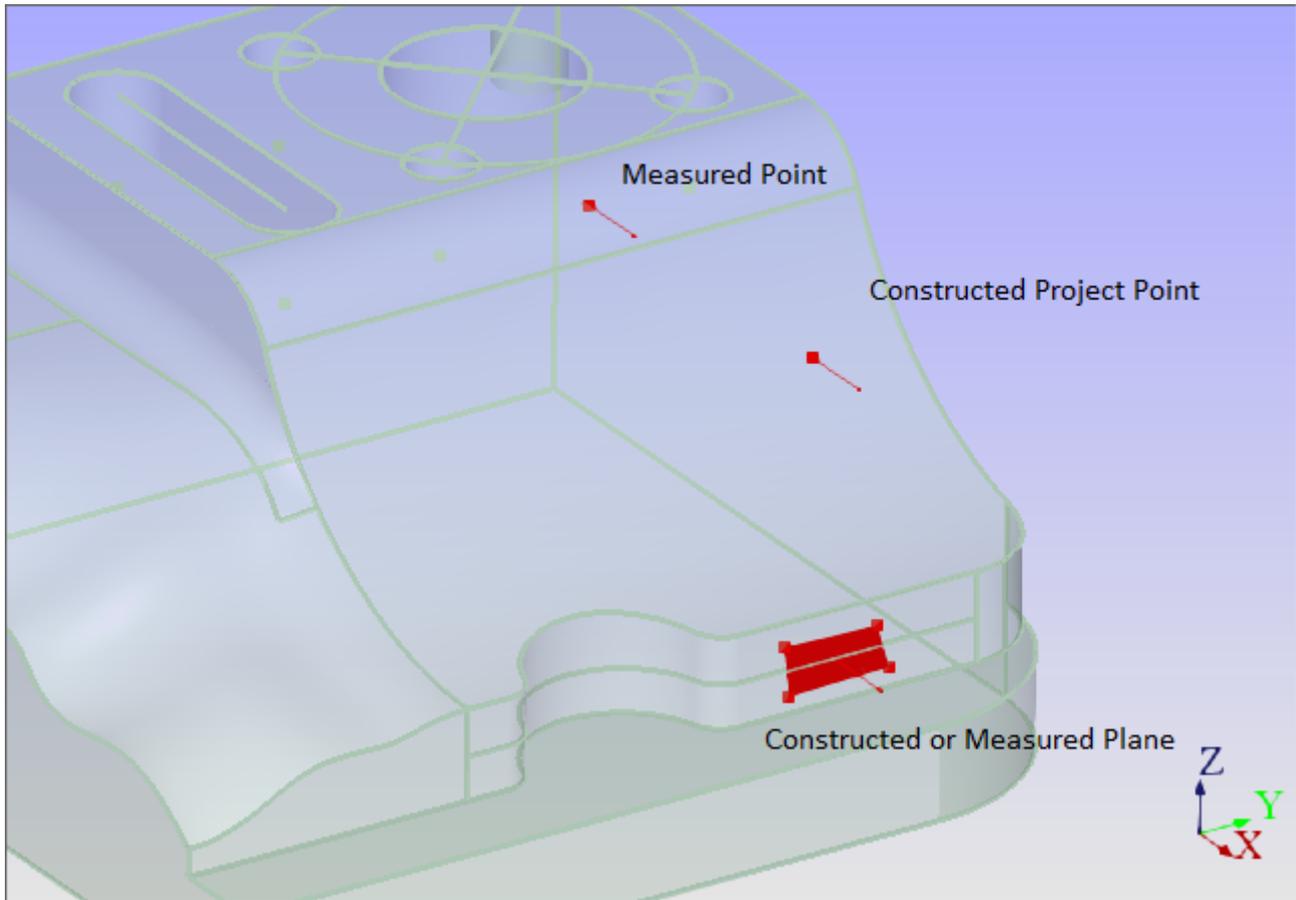


Steps to follow:

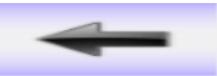
- Using two measured or a constructed points.
-  Switch to the **Construct Mode**, and choose the **Point Icon**.
-  Click on the **Mid Feature** option.
-  Choose the two points that have been measured, and click on **Compute**.

Project

The following is an example of how to use the **Project** feature to construct a new point. Keep in mind that this is not piercing or intersecting another feature, but merely projecting a point onto another feature, such as a plane.

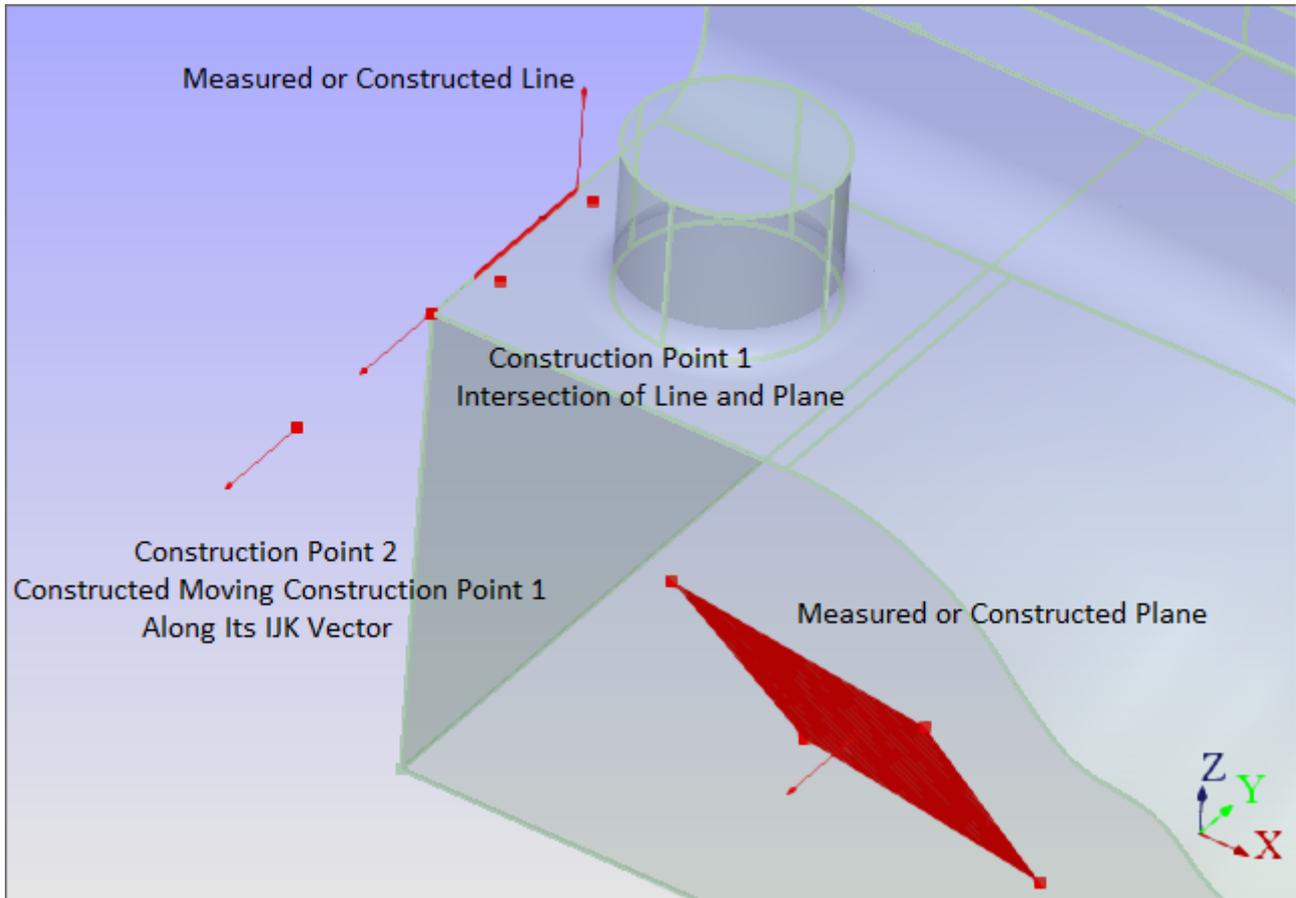


Steps to follow:

- Using a measured or a constructed point.
-  Switch to the **Construct Mode**, and choose the **Point Icon**.
-  Click on the **Project** option.
- Choose the point to be projected, and then choose the feature to project it to.
-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** option in the **Construct Menu** to create a new point from an existing or constructed point.

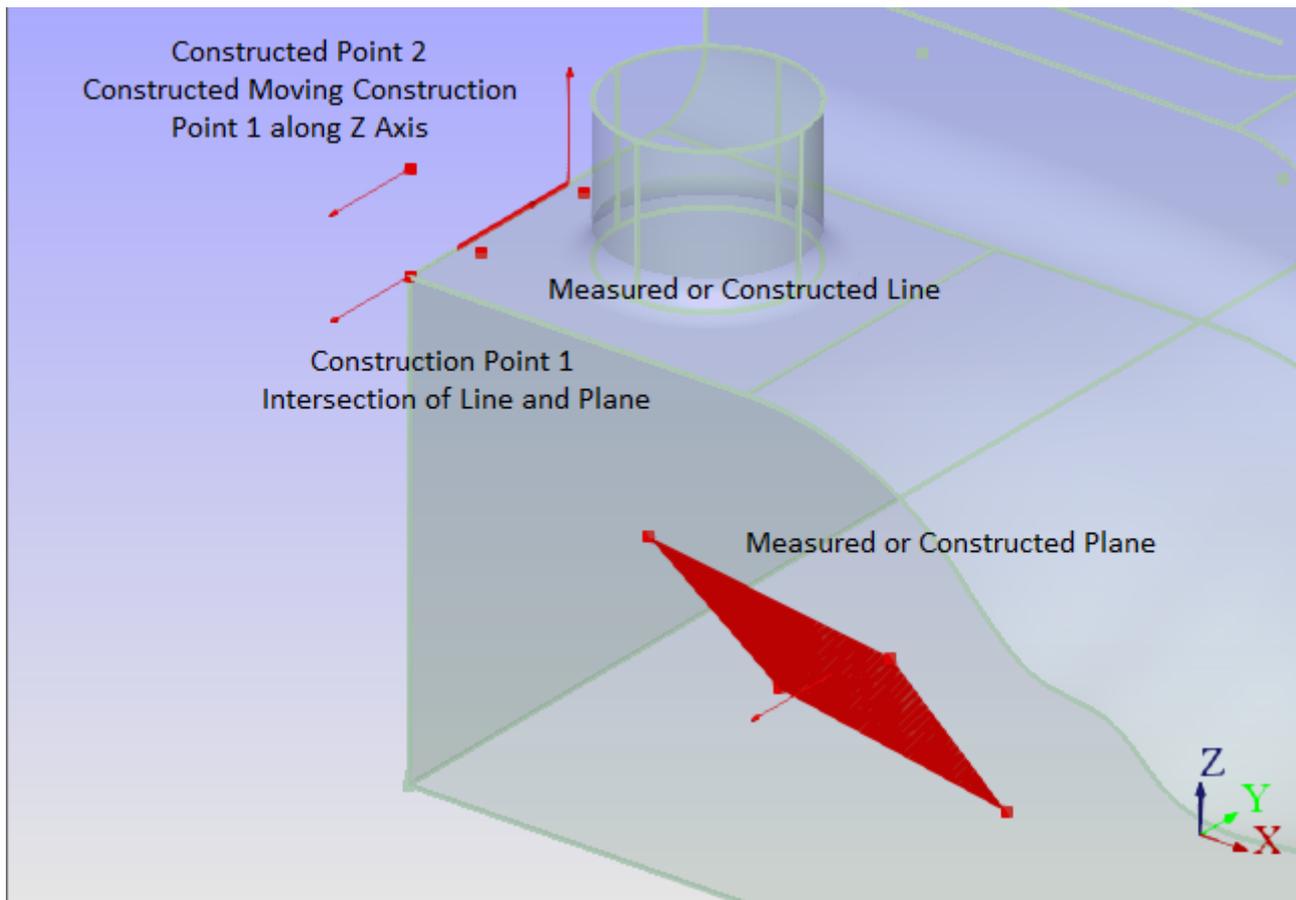


Steps to follow:

- Using a measured or a constructed point.
-  Switch to the **Construct Mode**, and choose the **Point Icon**.
-  Click on the **Move IJK** option.
-  Choose the point to be moved along its IJK, and click on **Compute**.
- Type in the value for the IJK move in the dialog box.

Move Axis

The following is an example of how to use the **Move Axis** option to construct a new point from an existing point

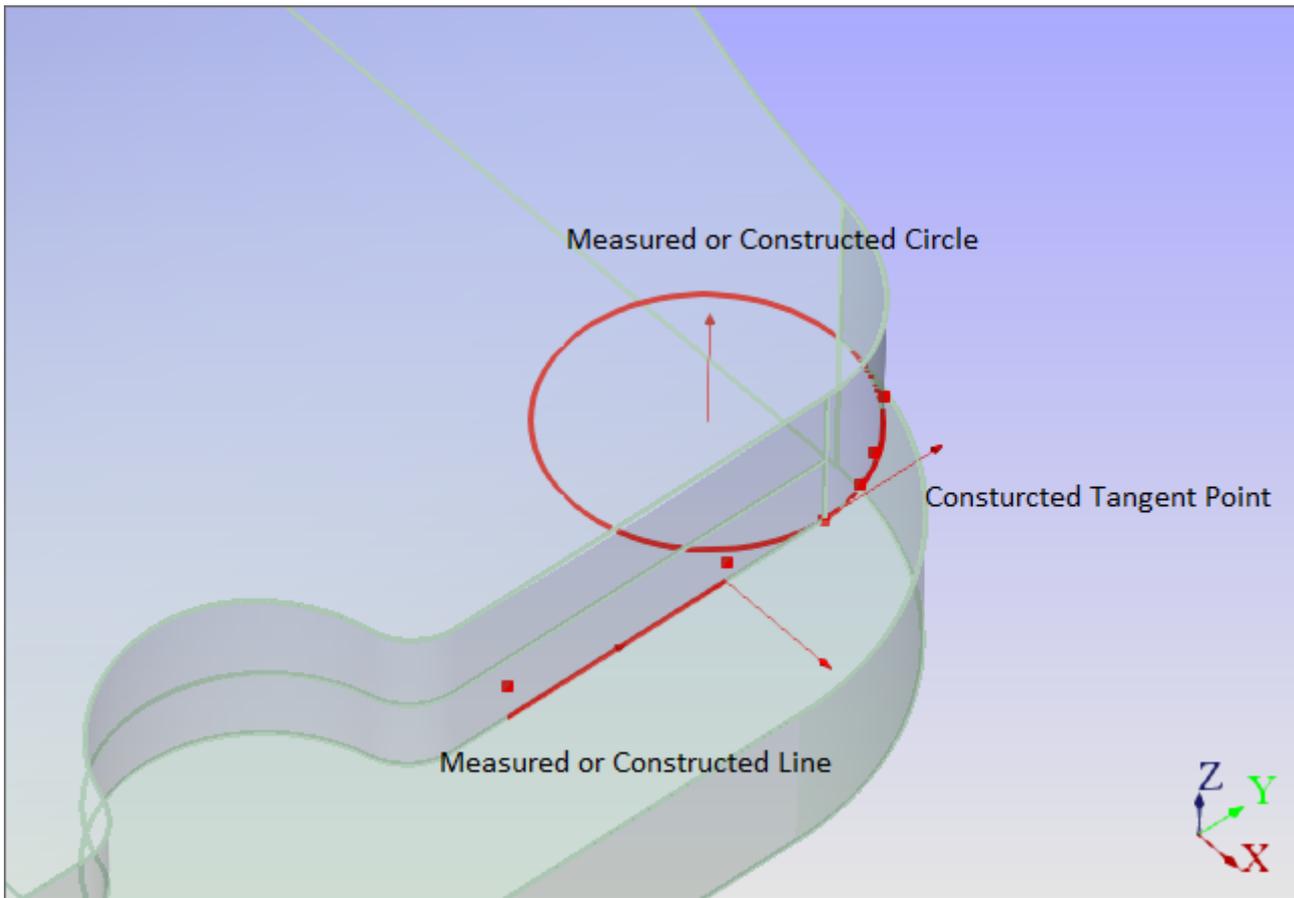


Steps to follow:

- Using a measured or a constructed point.
-  Switch to the **Construct Mode**, and choose the **Point Icon**.
-  Click on the **Move Axis** option.
-  Choose the point to be moved along its axis, and click on **Compute**.
- Type in the value for the axis move in the axis dialog box.

Tangent To

The following is an example of how to use the **Tangent To** option to construct a point, using a circle and a line.



Steps to follow:

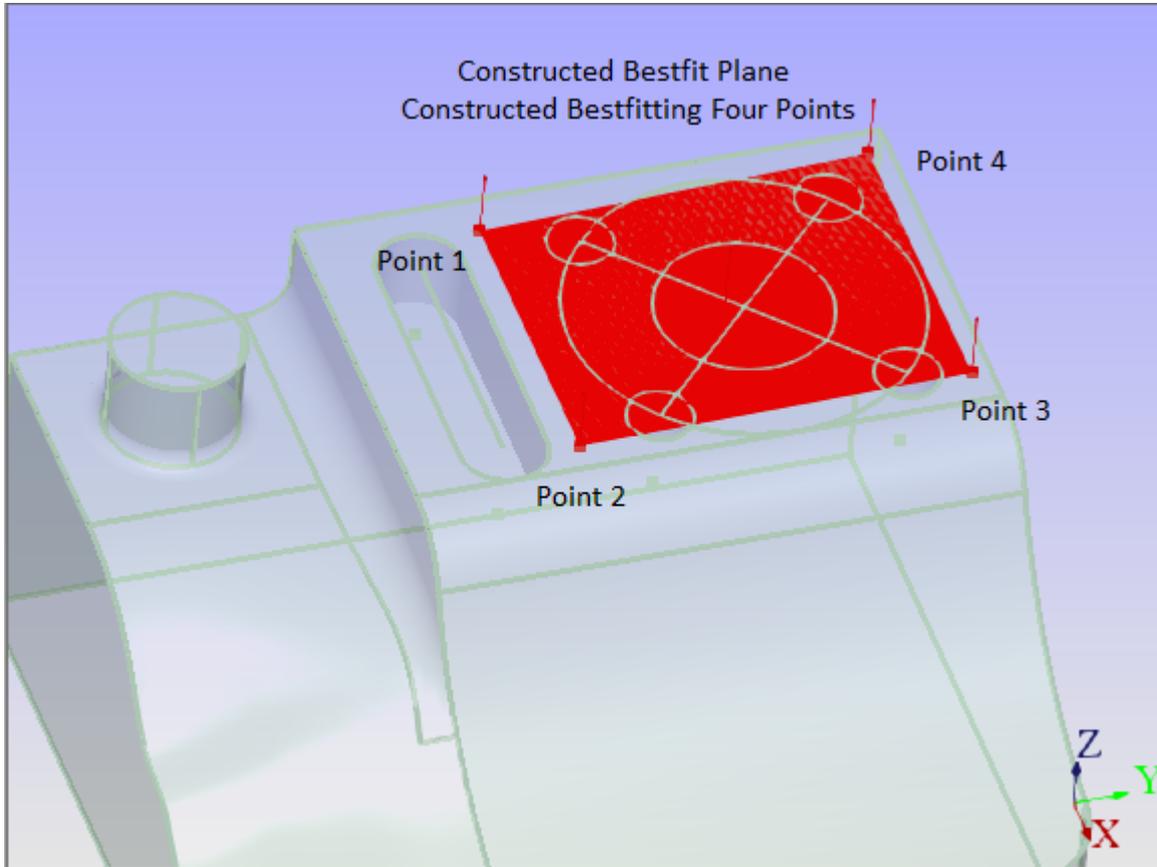
- Measure a line and a circle to a common **Workplane**.
-  Switch to the **Construct Mode**, and choose the **Point Icon**.
-  Click on the **Tangent To** option.
- Choose the circle feature first, and then the line feature.
-  Click on **Compute**.

[Constructing Features](#)

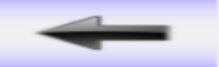
Plane Construction

Best Fit

The following is an example of using the **Bestfit** option to construct a plane from point reducible features. Although the example below uses points, it is also possible to use features such as circles and spheres to construct a **Bestfit** plane.

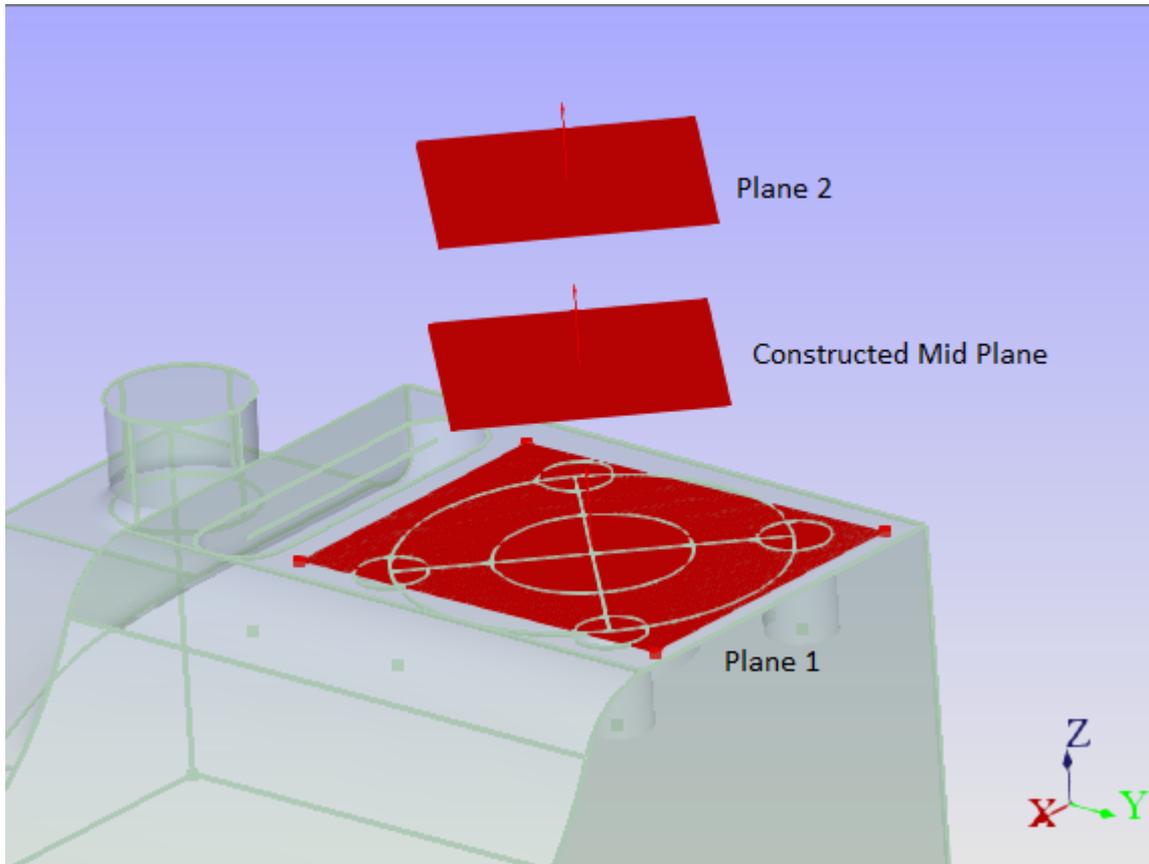


Steps to follow:

- Measure a series of points (up to 99).
-  Switch to the **Construct Mode**, choose the **Plane Icon**.
-  Click on the **Bestfit** option, and choose the desired points from the feature list.
- Make sure that the first three points picked have an offset between the second and the third point.
-  Click on **Compute**.

Mid-Plane

The following is an example of how to use the **Mid Feature** option in the construct menu to create a mid-plane between two measured or constructed planes.

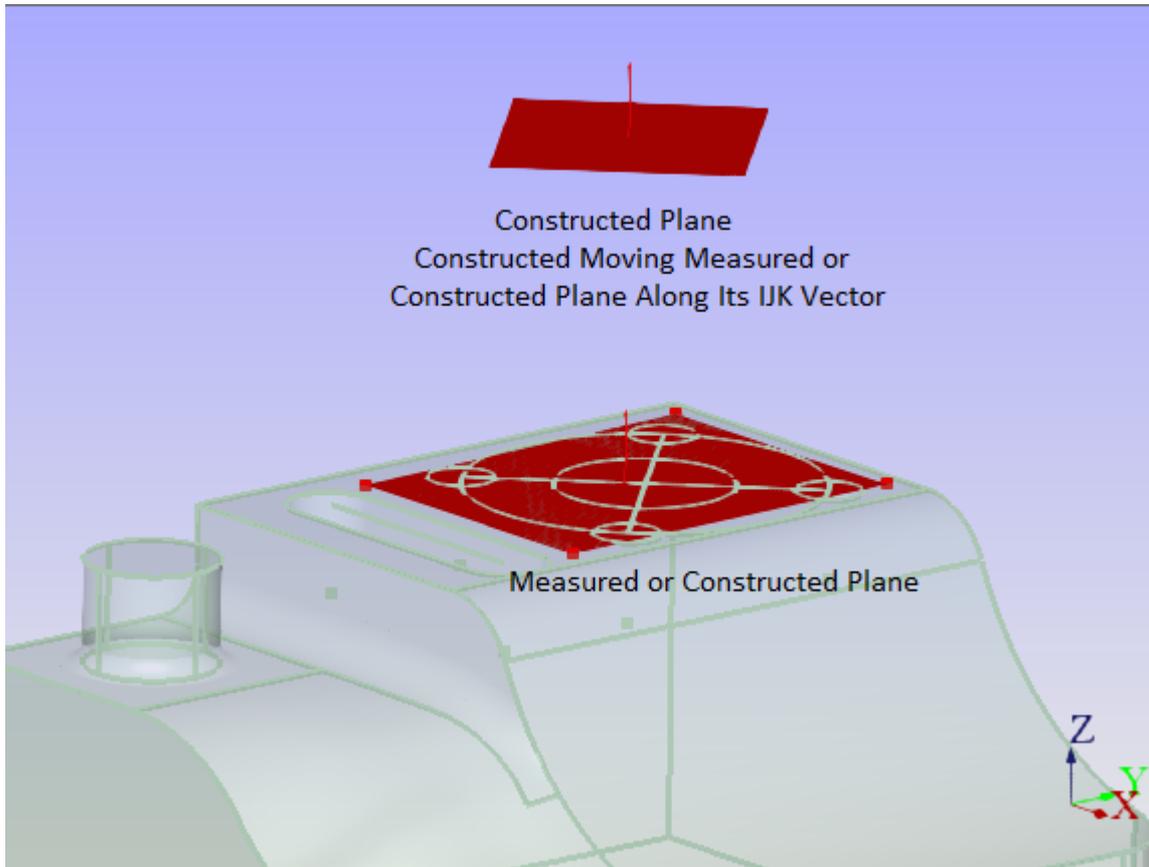


Steps to follow:

- Having two measured or constructed planes available.
-  Switch to the **Construct Mode**, choose the **Plane Icon**.
-  Select the **Mid Feature** option.
- Click on the 2 plane features that exist.
-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** option in the construct menu to create a new plane from an existing or constructed plane.

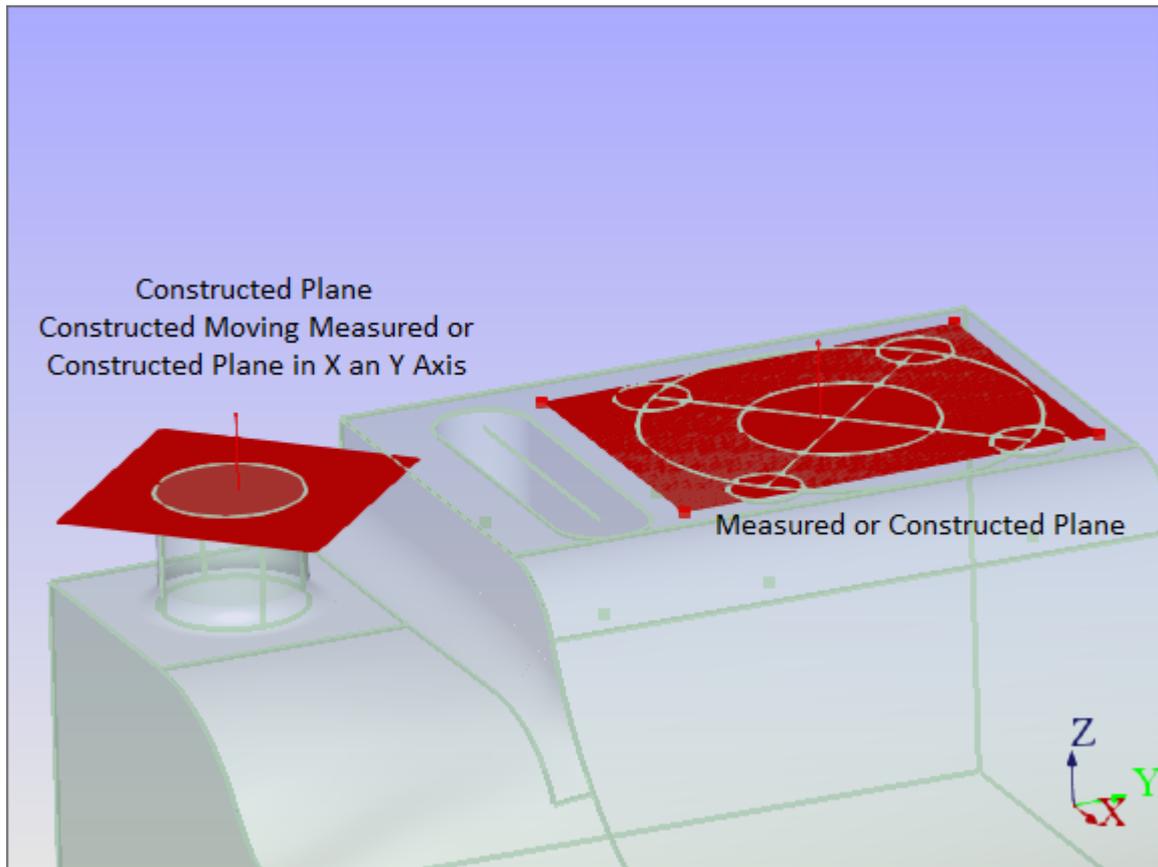


Steps to follow:

- Measure a plane or use an existing plane.
-  Switch to the **Construct Mode**, choose the **Plane Icon**.
-  Select the **Move IJK** option.
- Click on the plane feature to be moved along its IJK.
-  Click on **Compute**. There will be a box that will pop up. Type in the value of the move that is desired. For instance, to move the plane by 20mm, then type in 20. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** option to construct a new line from an existing line.

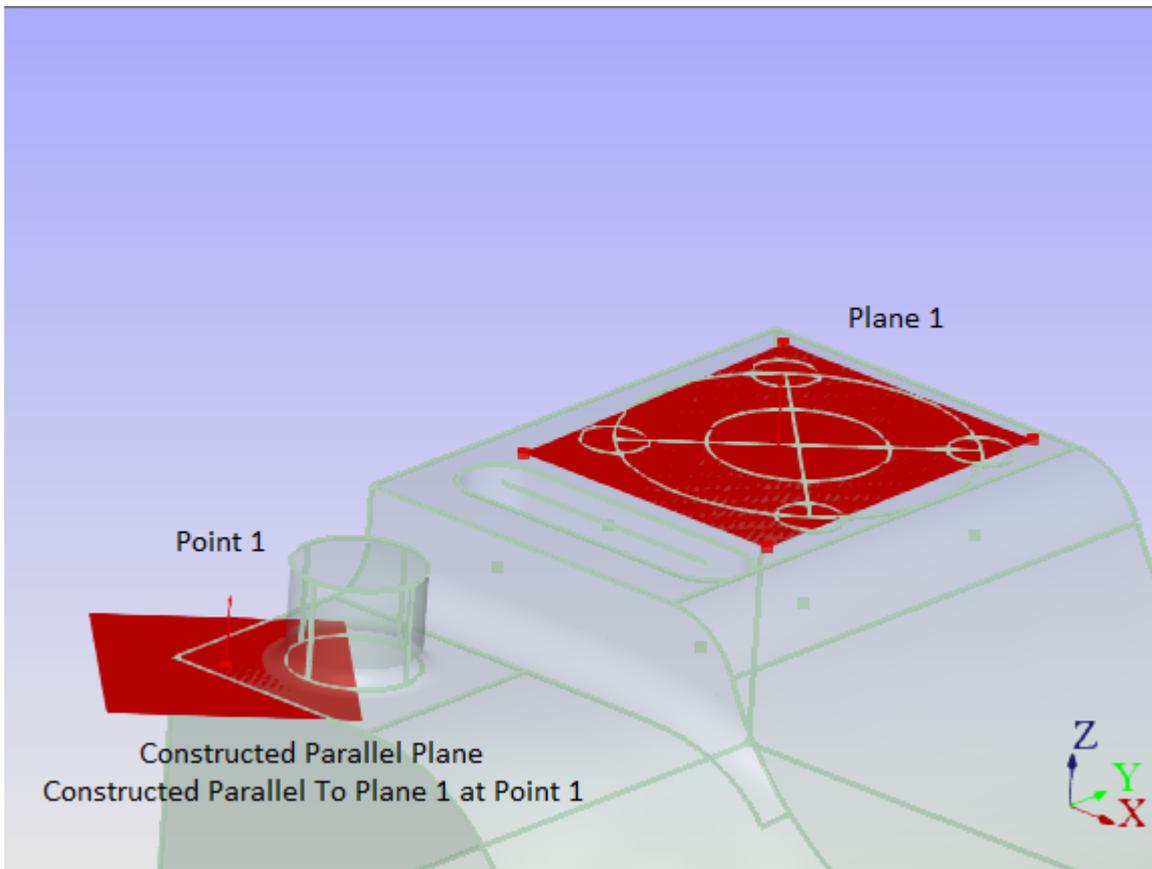


Steps to follow:

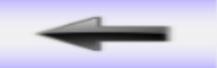
-  Switch to **Construct Mode**, and choose the **Plane Icon**.
-  Click on **Move Axis**.
- Pick the measured or constructed plane from the actuals list.
-  Choose the plane to be moved along its axis, click on **Compute**.
- Enter in the desired value of the move in the proper direction.

Parallel To

The following example shows how to construct a plane **Parallel To** another feature. It must be remembered that the constructed feature must pass through some tangible feature such as a point. So again, when choosing the features from the construct list, use the logic, "Constructing a plane, parallel to another feature, through some feature."

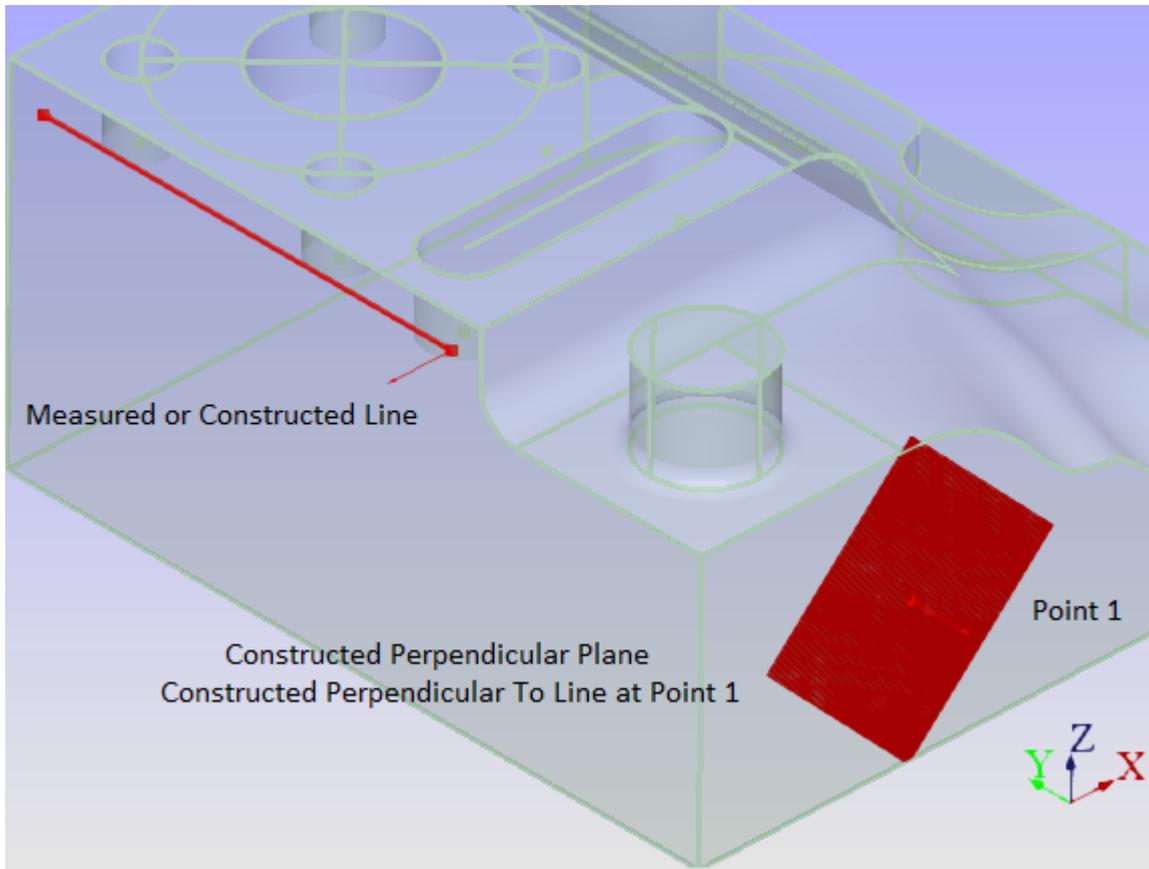


Steps to follow:

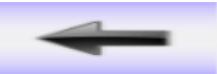
- Measure a plane or use an existing plane.
-  Switch to the **Construct Mode**, choose the **Plane Icon**.
-  Select the **Parallel To** option.
- Select the measured or constructed feature that the new feature is to be **Parallel To**.
- Now, select the feature which the new feature will pass through.
-  Click on **Compute**.

Perpendicular To

The following is an example of using the **Perpendicular To** option in the construct menu to create a line that is Perpendicular to another feature. Like using the perpendicular to function elsewhere, the logic should be, "Construct a line, perpendicular to a feature, passing through another feature."



Steps to follow:

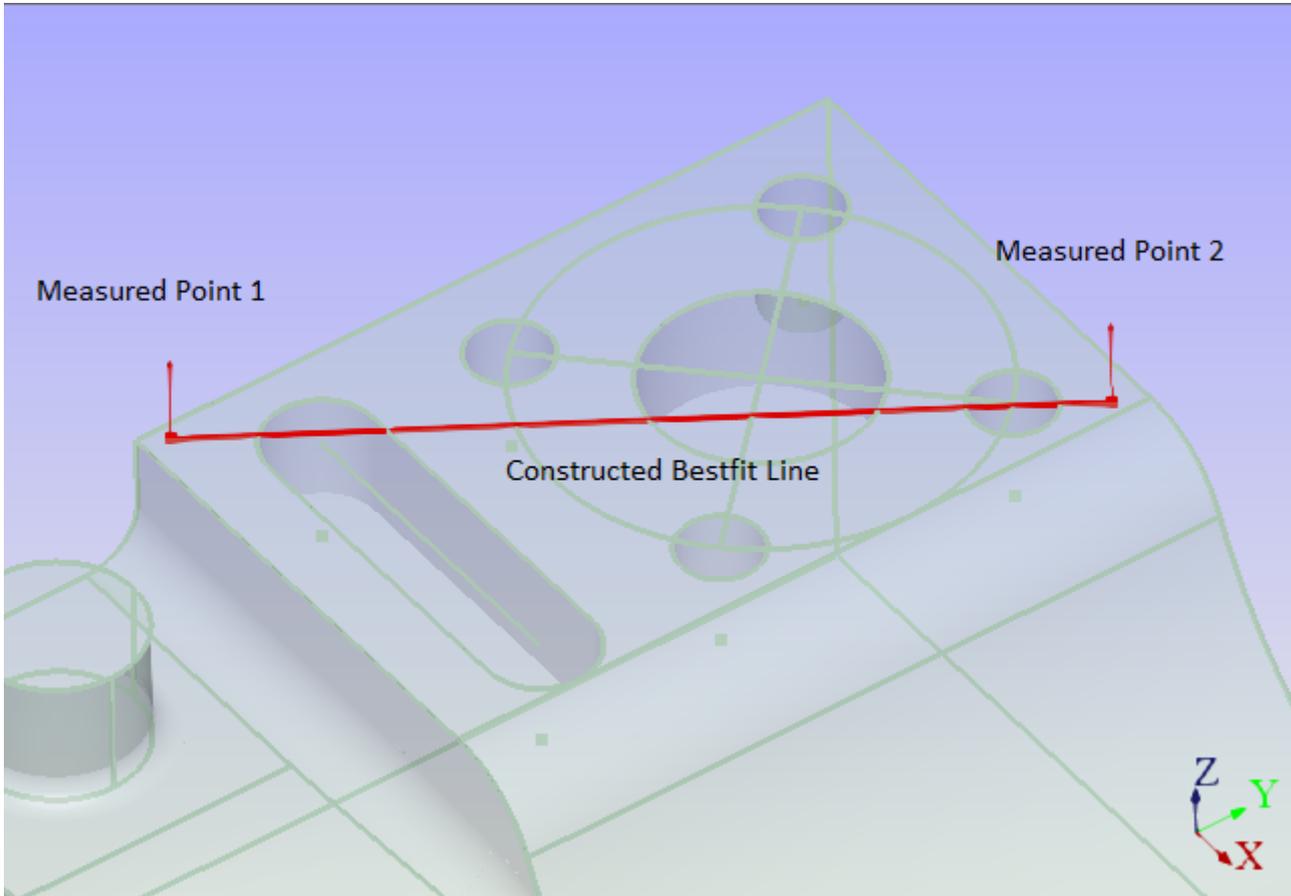
- Having measured or constructed a line, a plane feature or a point, and also having a point feature available.
-  Switch to **Construct Mode**, and choose the **Plane Icon**.
-  Click on **Perpendicular To**. Pick the line or plane feature that the new feature should be **Perpendicular To**. Pick the through feature, usually a point.
-  Click on **Compute**.

[Constructing Features](#)

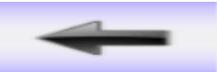
Line Construction

Best Fit

The following is an example of constructing a **Bestfit** line between point features. It is also possible to construct a **Bestfit** line between two circles, or between a point and a circle. When using the **Bestfit** option, it is usually going to include point reducible features. (Points, circles, spheres, slots)

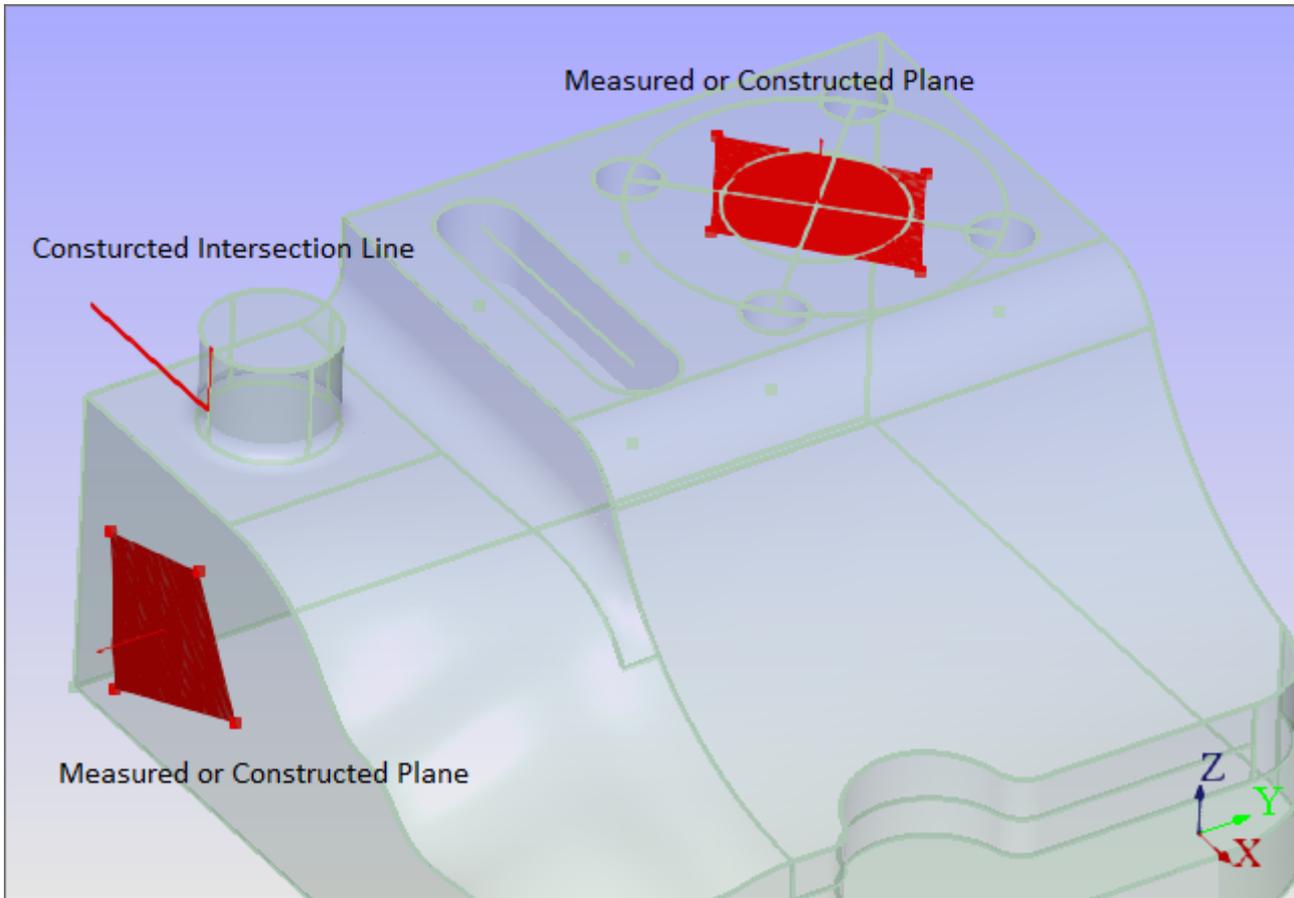


Steps to follow:

- Measure the required number of point reducible features. This will usually be two features, unless the user is opting to construct a plane using **Bestfit**.
-  Switch to the **Construct Mode**, and choose the **Line Icon**.
-  Click on **Bestfit**. Pick the features to be used for the construction of the **Bestfit** line.
-  Click on **Compute**.

Intersect

The following is an example of how to use the **Intersect** option to construct a line. This example uses two planes to construct a line.

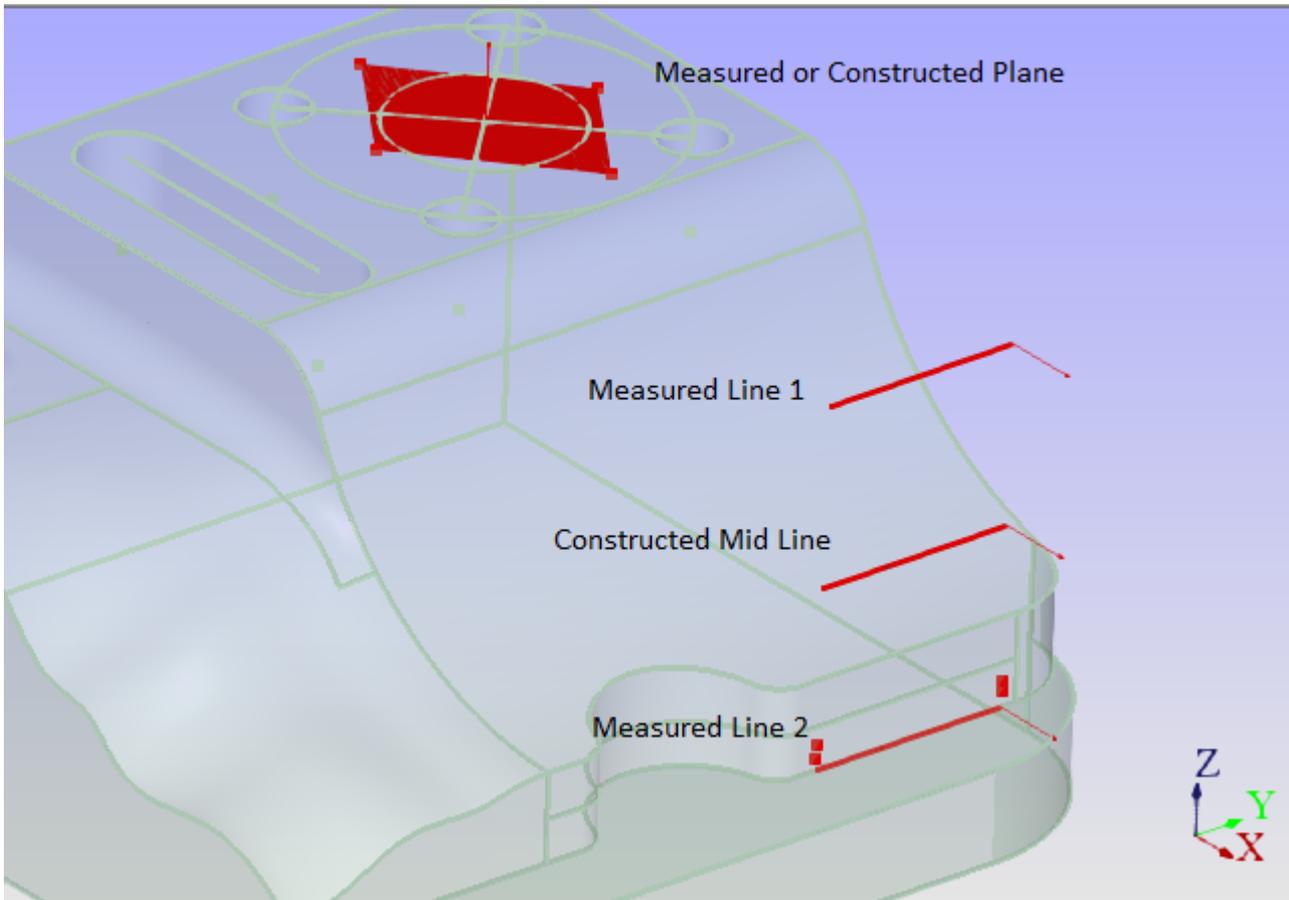


Steps to follow:

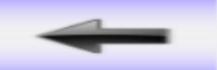
- Measure **Plane 1** and **Plane 2**.
-  Switch to **Construct Mode**, and choose the **Line Icon**.
-  Click on **Intersect**.
- Pick plane 1 and plane 2 from the actuals list.
-  Click on **Compute**.

Mid-Line

The following is an example of using the **Mid Feature** option in the **Construct Menu** to create a mid-line between two measured or constructed lines.

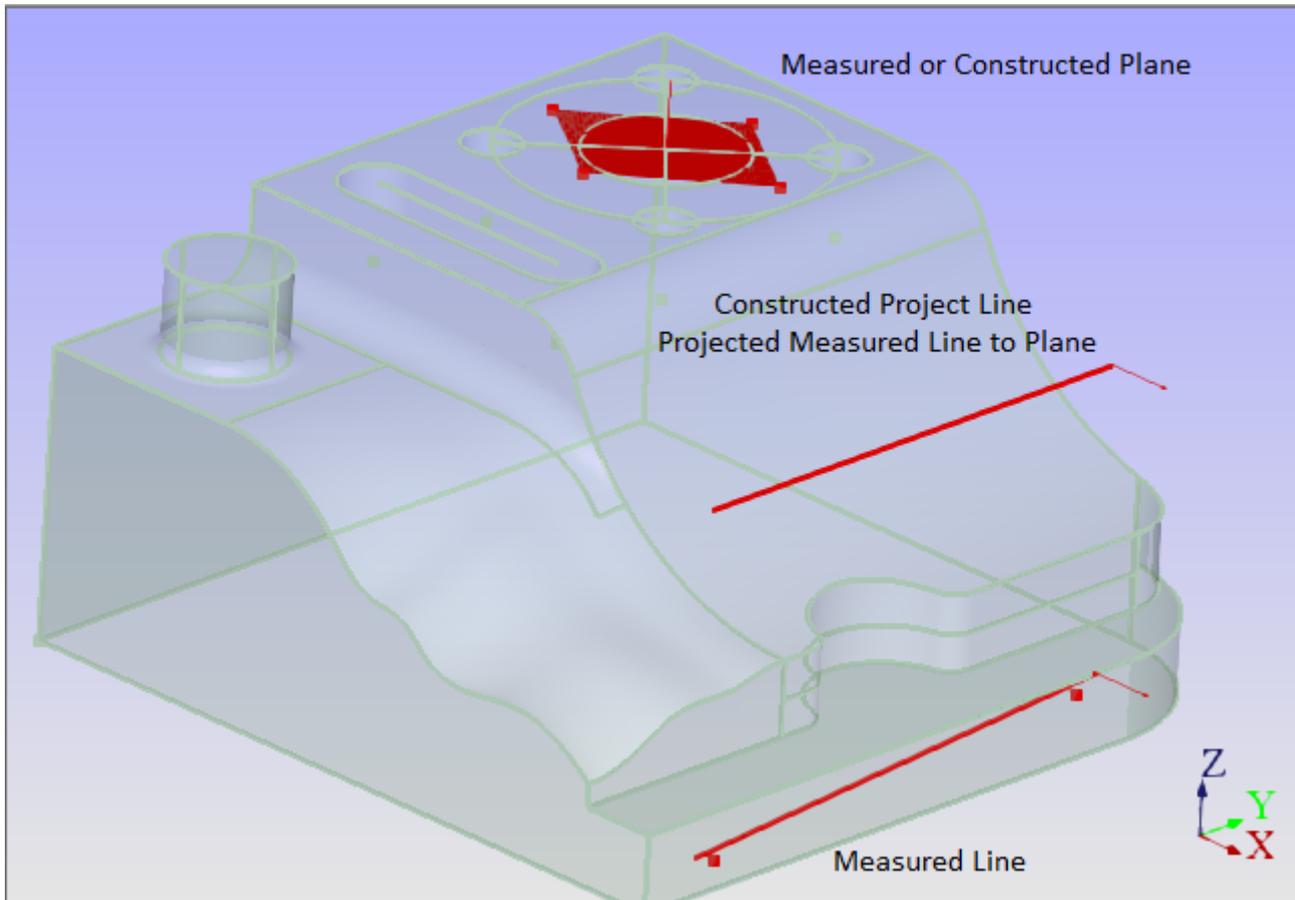


Steps to follow:

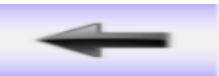
- Measure two lines, or have two constructed lines available.
-  Switch to **Construct Mode**, and choose the **Line Icon**.
-  Click on **Mid feature**.
- Pick the two measured or constructed lines to construct the mid-line.
-  Click on **Compute**.

Project To

The following is an example of how to use the **Project** feature to construct a new line. Keep in mind that this is not piercing or intersecting another feature, but merely projecting a line onto another feature, such as a plane.

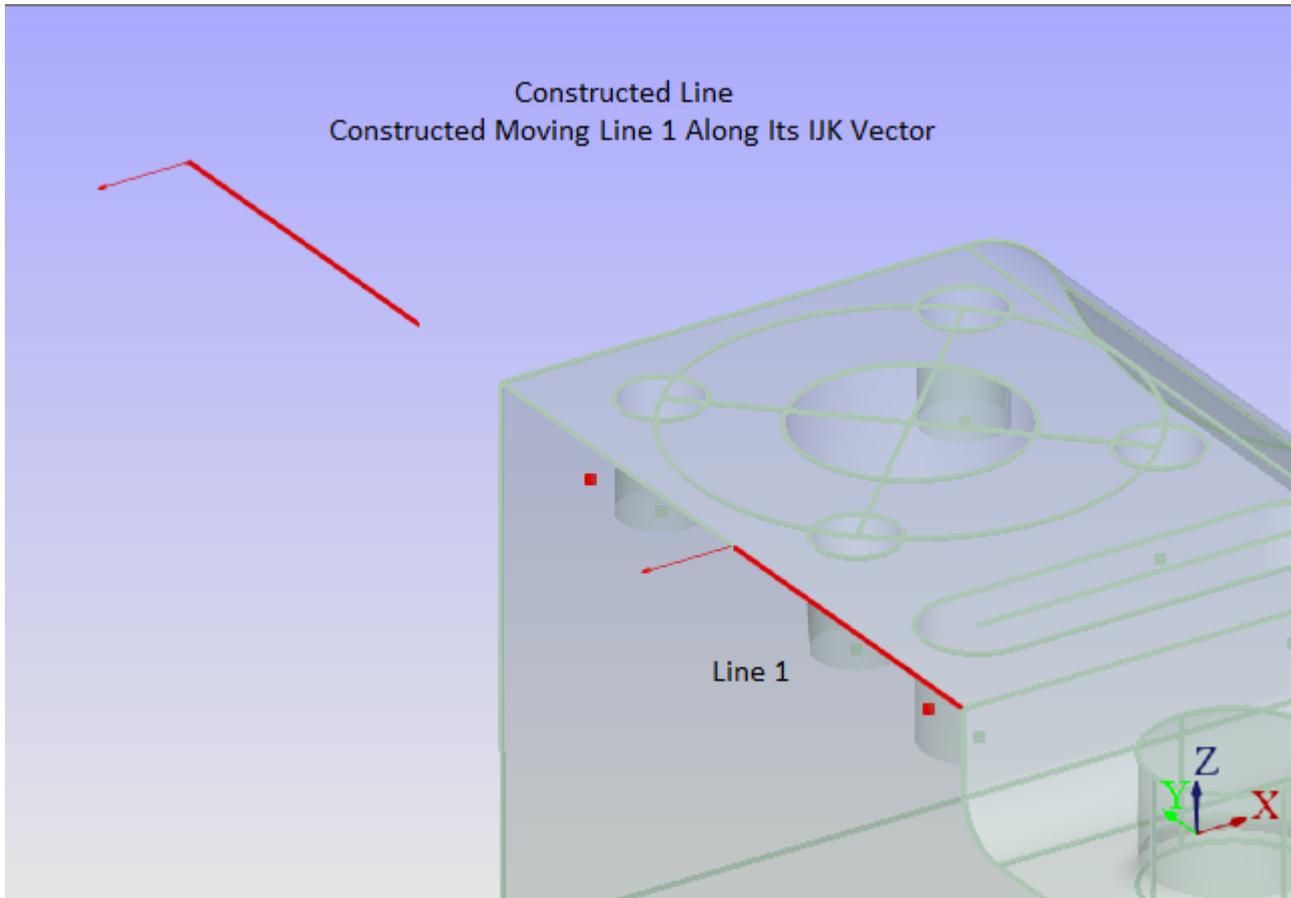


Steps to follow:

- Measure a line.
-  Switch to **Construct Mode**, and choose the **Line Icon**.
-  Click on **Project**.
- Pick the measured or constructed line to be projected, and then pick the feature to project it onto.
-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** option in the **Construct Menu** to create a new line from an existing or constructed line.

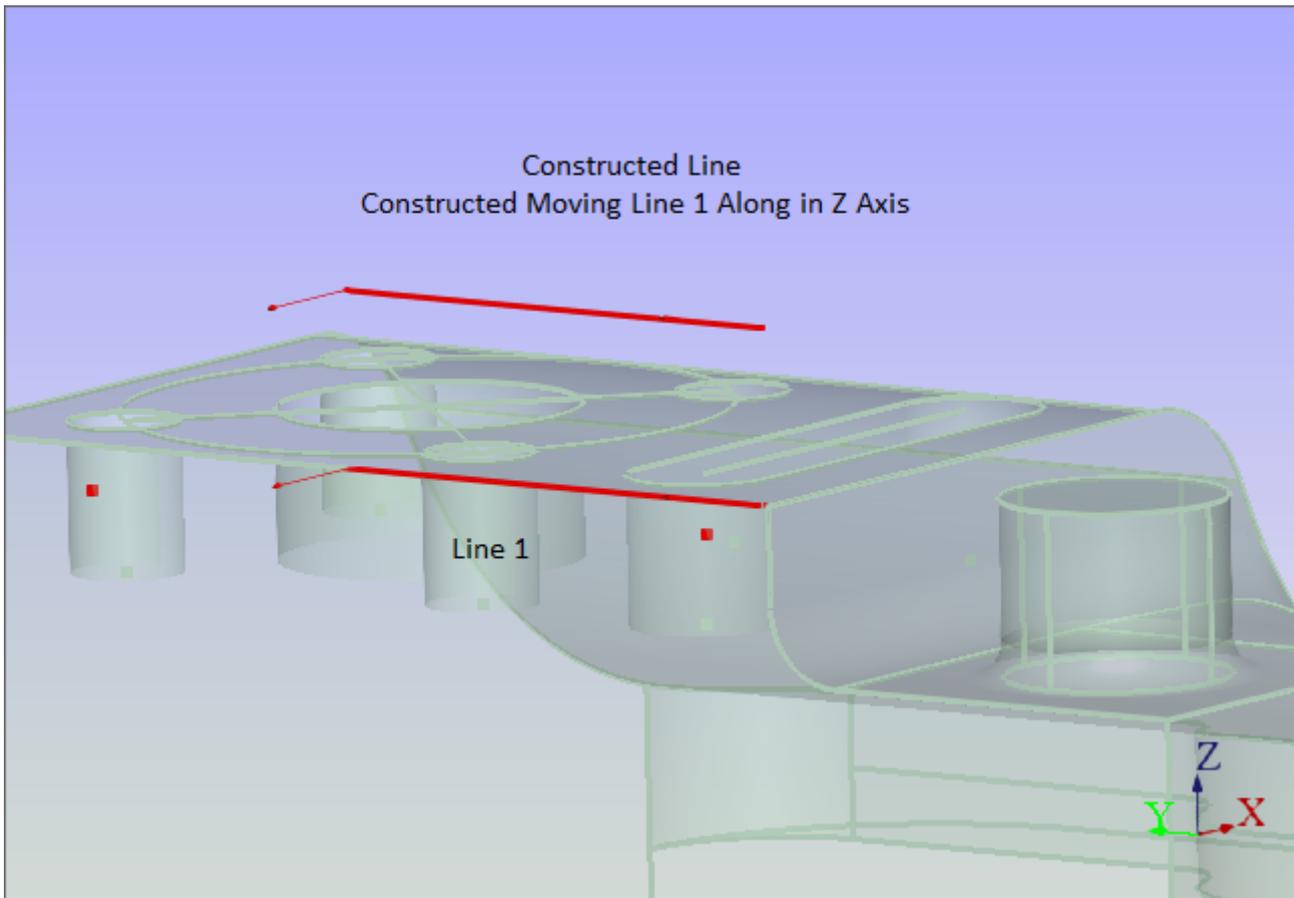


Steps to follow:

- Using a measured or a constructed line.
-  Switch to the **Construct Mode**, and choose the **Line Icon**.
-  Click on the **Move IJK** option.
-  Choose the line to be moved along its IJK, and click on **Compute**.
- Type in the value for the IJK move in the dialog box.

Move Axis

The following is an example of how to use the **Move Axis** option to construct a new line from an existing line.

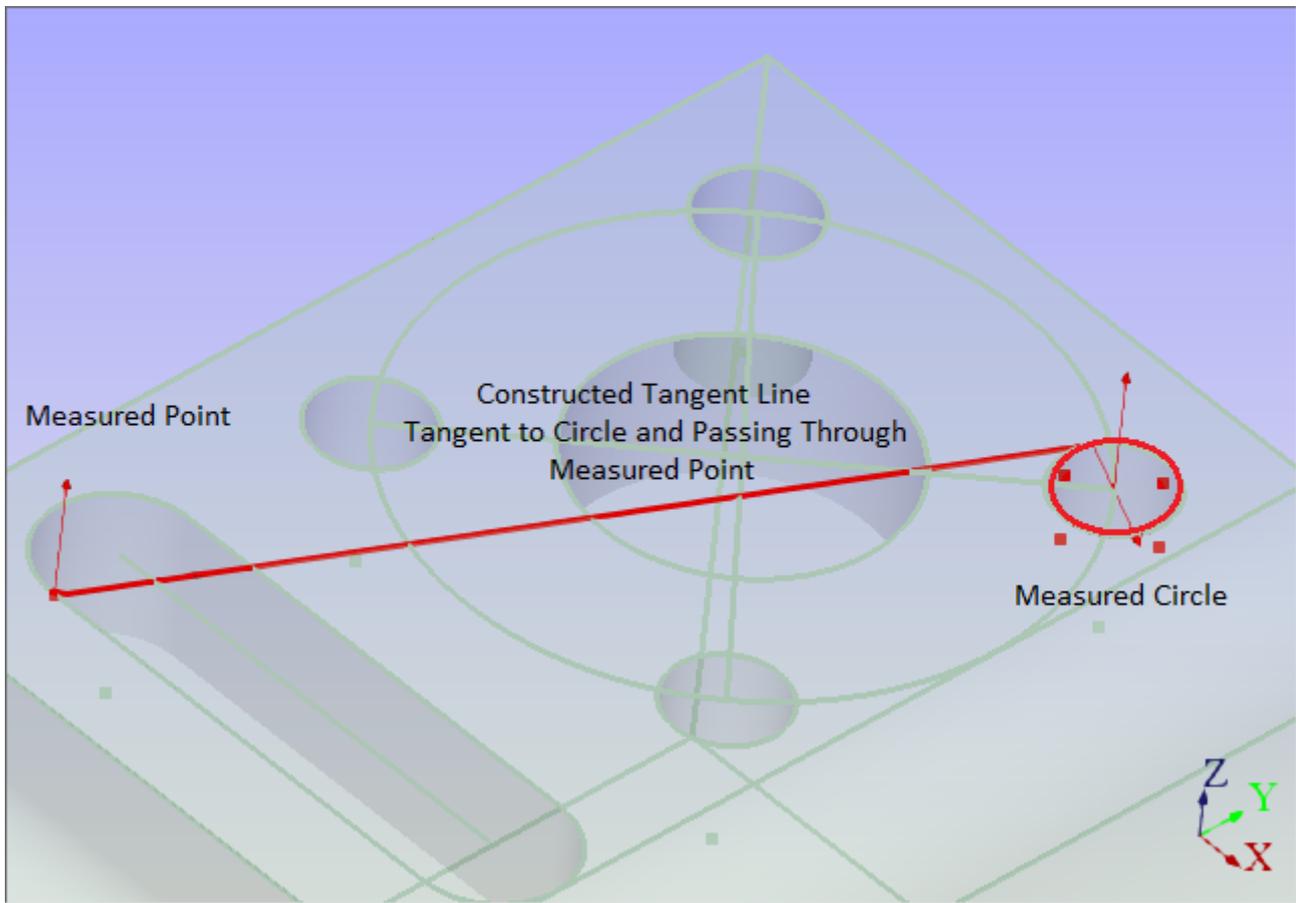


Steps to follow:

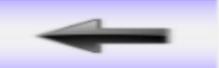
-  Switch to **Construct Mode**, and choose the **Line Icon**.
-  Click on **Move Axis**.
- Pick the measured or constructed line from the actuals list.
-  Choose the line to be moved along its axis, click on **Compute**.
- Enter in the desired value of the move in the proper direction.

Tangent To

The following is an example of how to use **Tangent To** option to construct a tangent line from one feature to another. For example, the diagram below constructs a tangent line between a point and a circle. If the tangent is needed for the other side of the circle, pick the features in the opposite order.

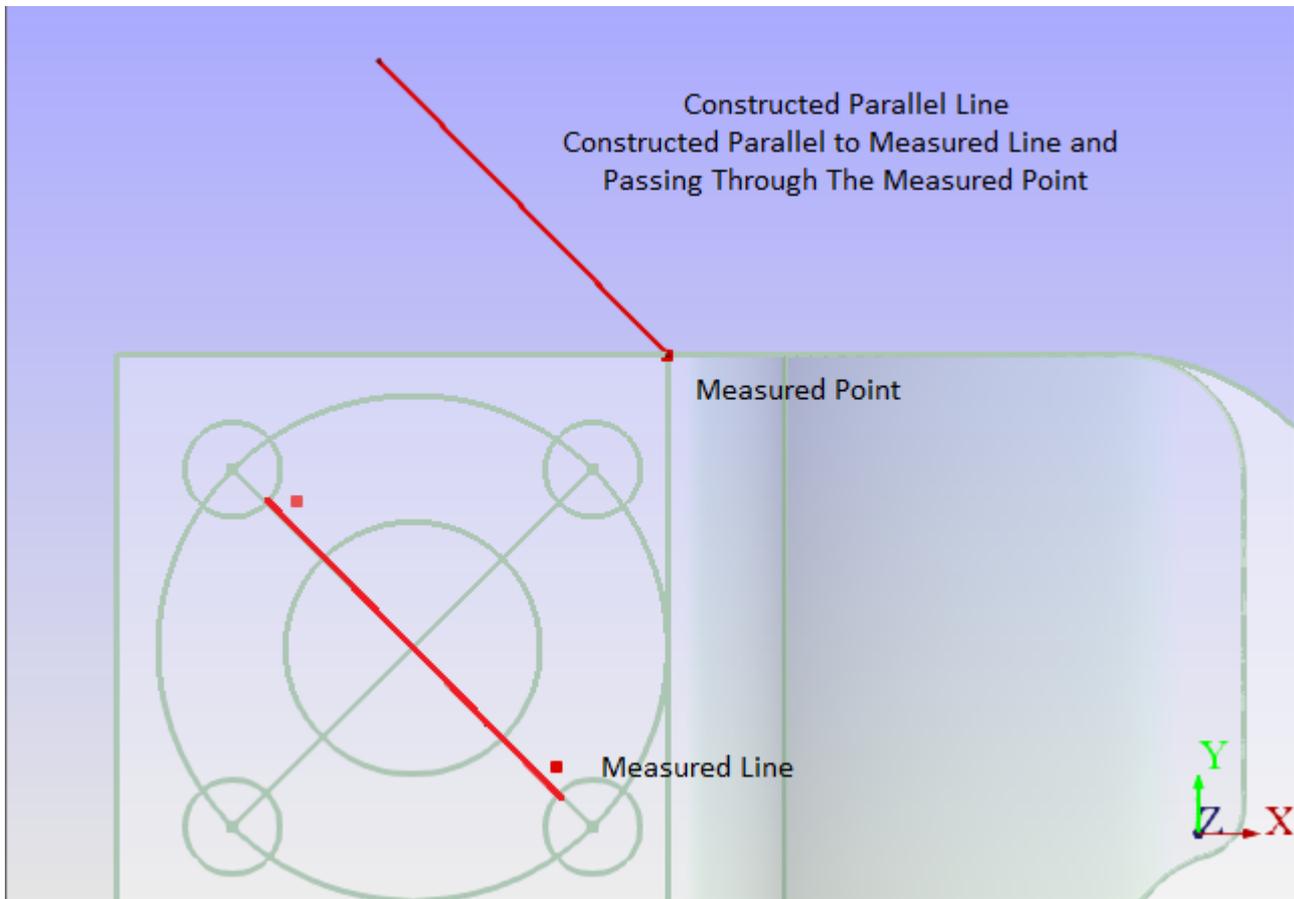


Steps to follow:

- Having measured or constructed a point feature and a circle feature.
-  Switch to **Construct Mode**, and choose the **Line Icon**.
-  Click on **Tangent To**.
- Pick the point, and then pick the circle feature (Vice versa if the tangent is needed on the other end of the circle)
-  Click on **Compute**.

Parallel To

The following is an example of using the **Parallel To** option in the **Construct Menu** to create a line that is parallel to another feature. Like using the parallel to function elsewhere, the logic should be, "Construct a line, parallel to a feature, through another feature."

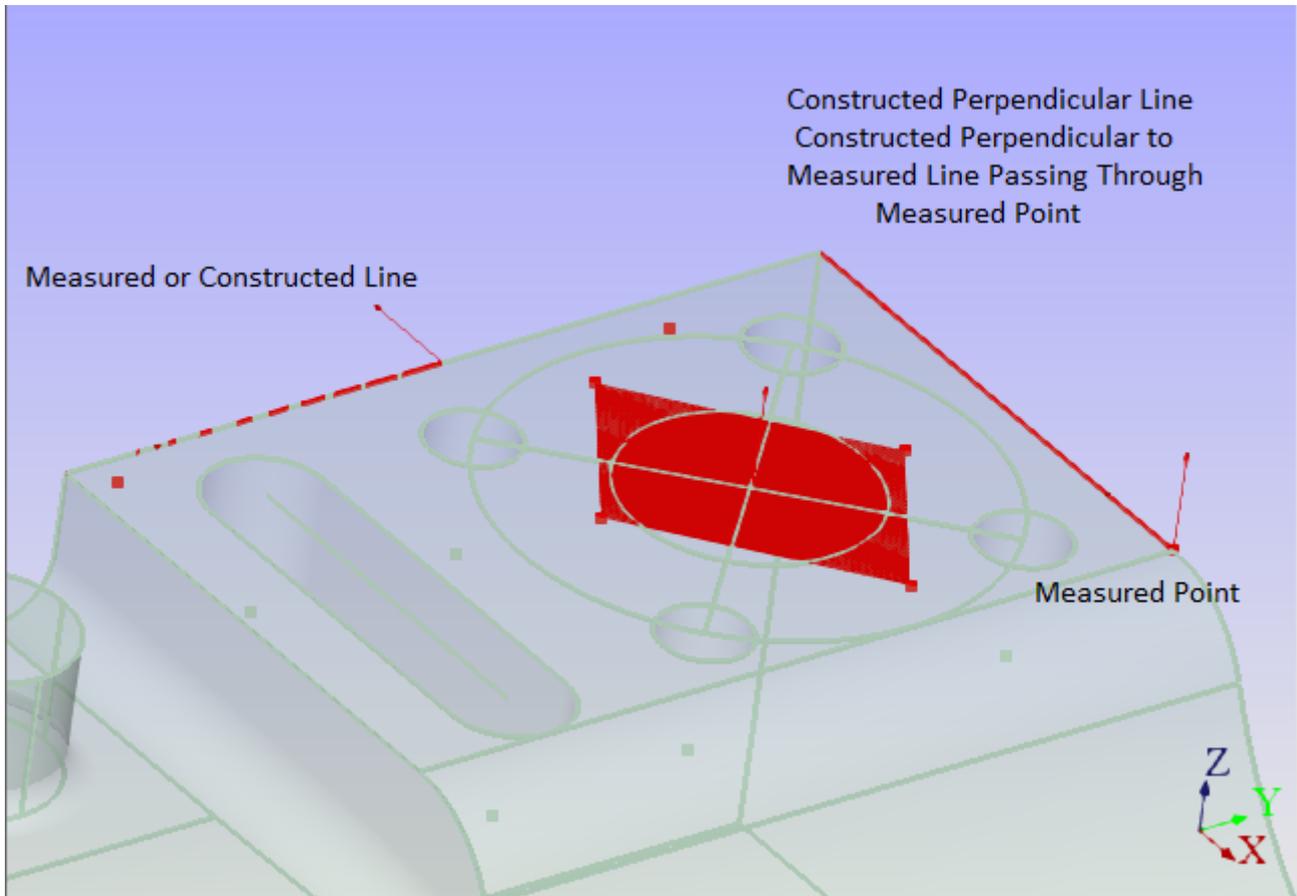


Steps to follow:

- Having measured or constructed a line or a plane feature, and also having a point feature available.
-  Switch to **Construct Mode**, and choose the **Line Icon**.
-  Click on **Parallel To**. Pick the line or plane feature that the new feature should be **Parallel To**. Pick the through feature, usually a point.
-  Click on **Compute**.

Perpendicular To

The following is an example of using the **Perpendicular To** option in the **Construct Menu** to create a line that is perpendicular to another feature. Like using the perpendicular to function elsewhere, the logic should be, "Construct a line, perpendicular to a feature, passing through another feature."



Steps to follow:

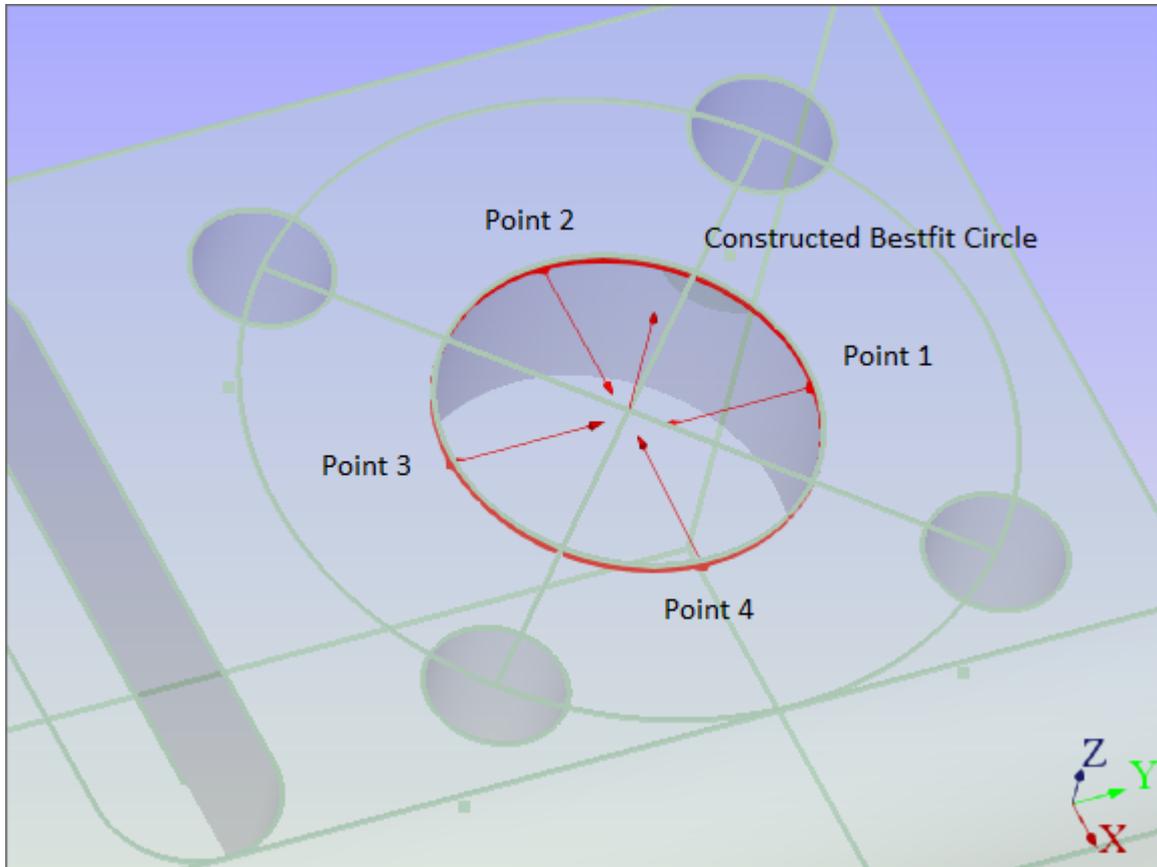
- Having measured or constructed a line or a plane feature, and also having a point feature available.
-  Switch to **Construct Mode**, and choose the **Line Icon**.
-  Click on **Perpendicular To**. Pick the line or plane feature that the new feature should be **Perpendicular To**. Pick the through feature, usually a point
-  Click on **Compute**.

[Constructing Features](#)

Circle Construction

Best Fit

The following is an example of how to use the **Bestfit** method to construct a circle feature. The example below uses points to construct a circle, this is usually a commonly accepted method.

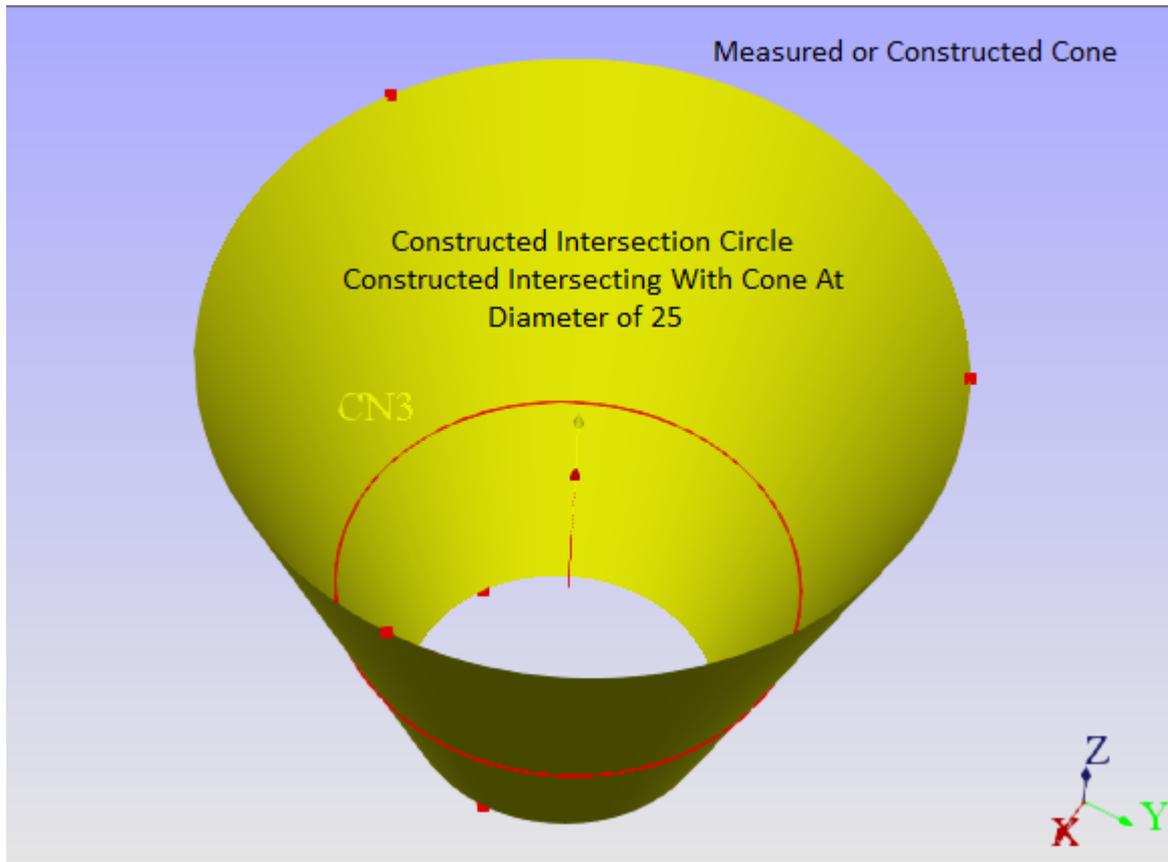


Steps to follow:

- Measure the required number of point reducible features for a bestfit circle. This will usually be three features, and they will usually be points.
-  Switch to the **Construct Mode**, and choose the **Circle Icon**.
-  Click on **Bestfit**.
- Pick the features to be used for the construction of the **Bestfit** circle.
-  Click on **Compute**.

Intersect

The following is an example of how to construct a circle by intersecting a cone at a particular diameter.

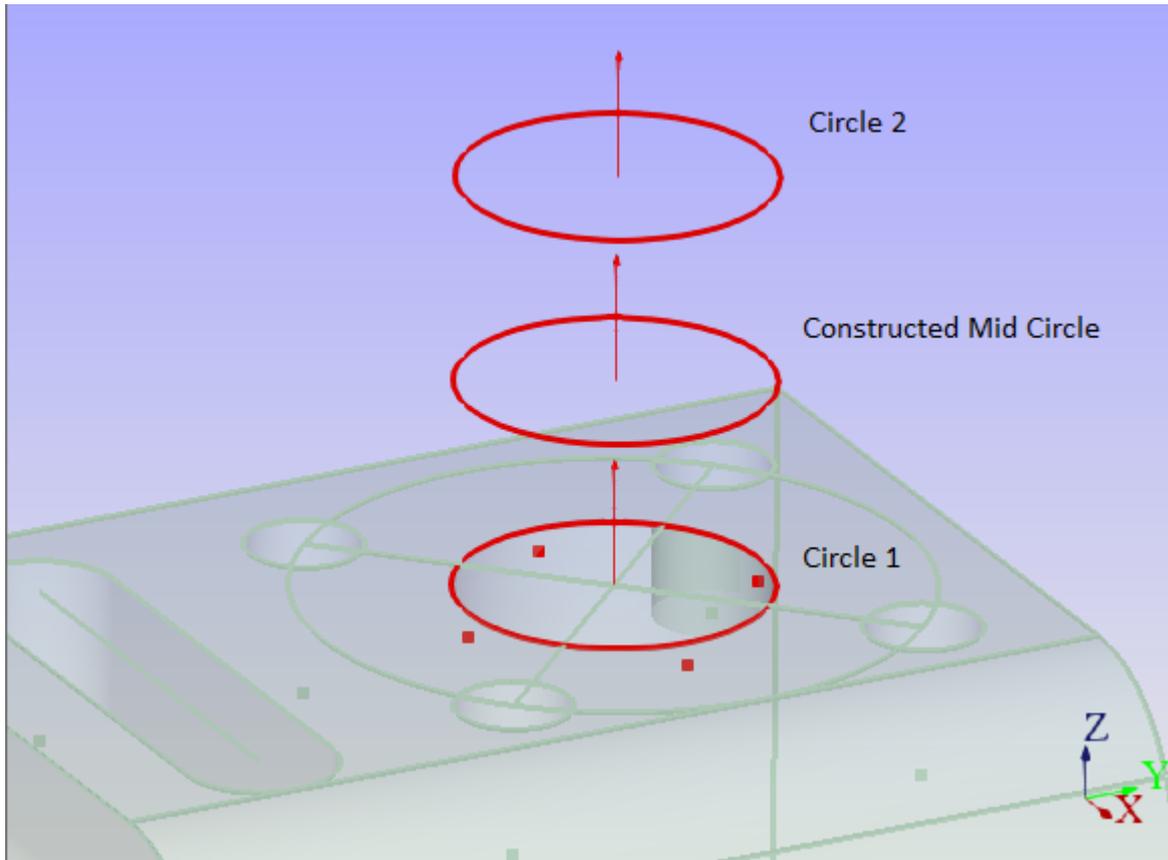


Steps to follow:

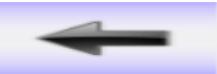
- Using a cone feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Circle Icon**.
-  Click on **Intersect**.
- Pick the cone that was measured or constructed .
-  Click on **Compute**. Type in the diameter in the dialog box at which to intersect the cone. Click **OK**.

Mid-Circle

The following is an example of how to construct a **Mid Feature** or a mid-circle between two existing features, such as two circles. This is the same logic as with other point reducible features.

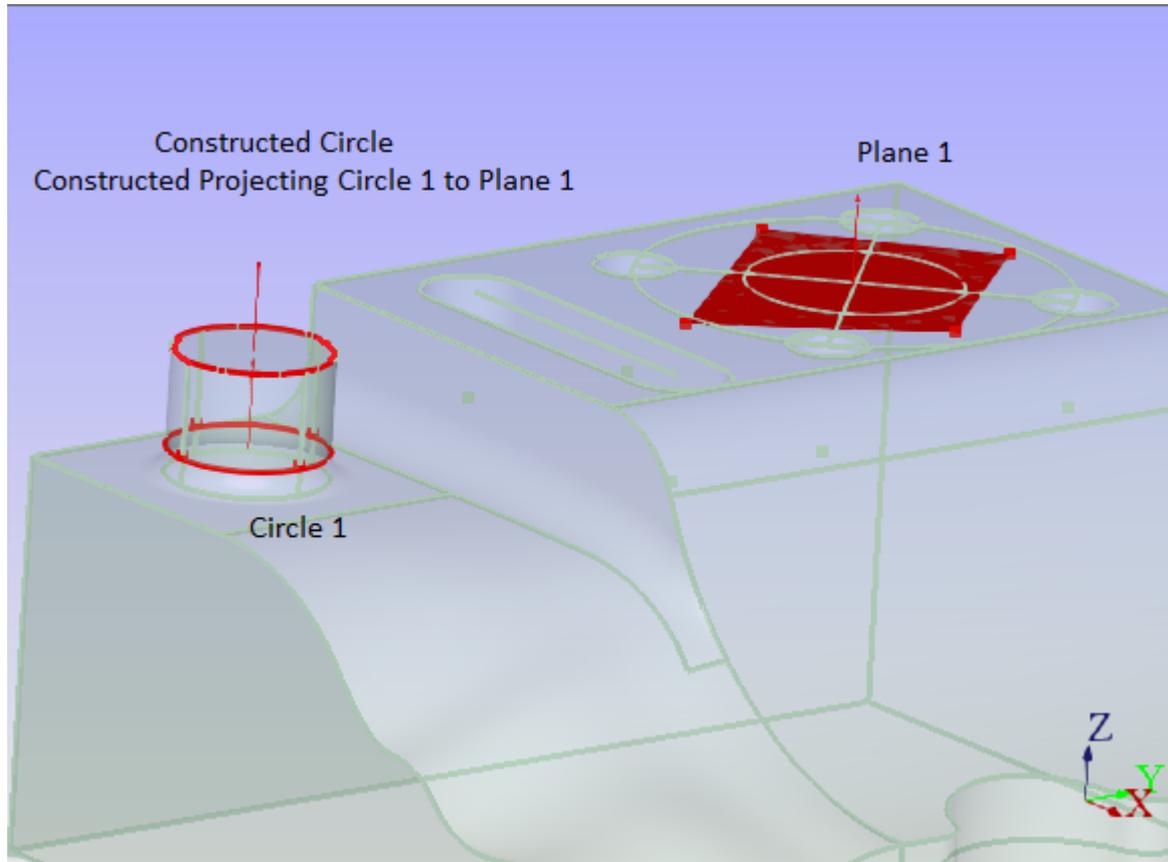


Steps to follow:

- Measure two circles, or have two constructed circles available.
-  Switch to the **Construct Mode**, and choose the **Circle Icon**.
-  Click on **Mid Feature**.
- Pick the two measured or constructed circles to construct the mid-circle, or mid-feature.
-  Click on **Compute**.

Project To

The following is an example of using the project feature to construct a new circle by projecting it onto a feature such as a plane surface.

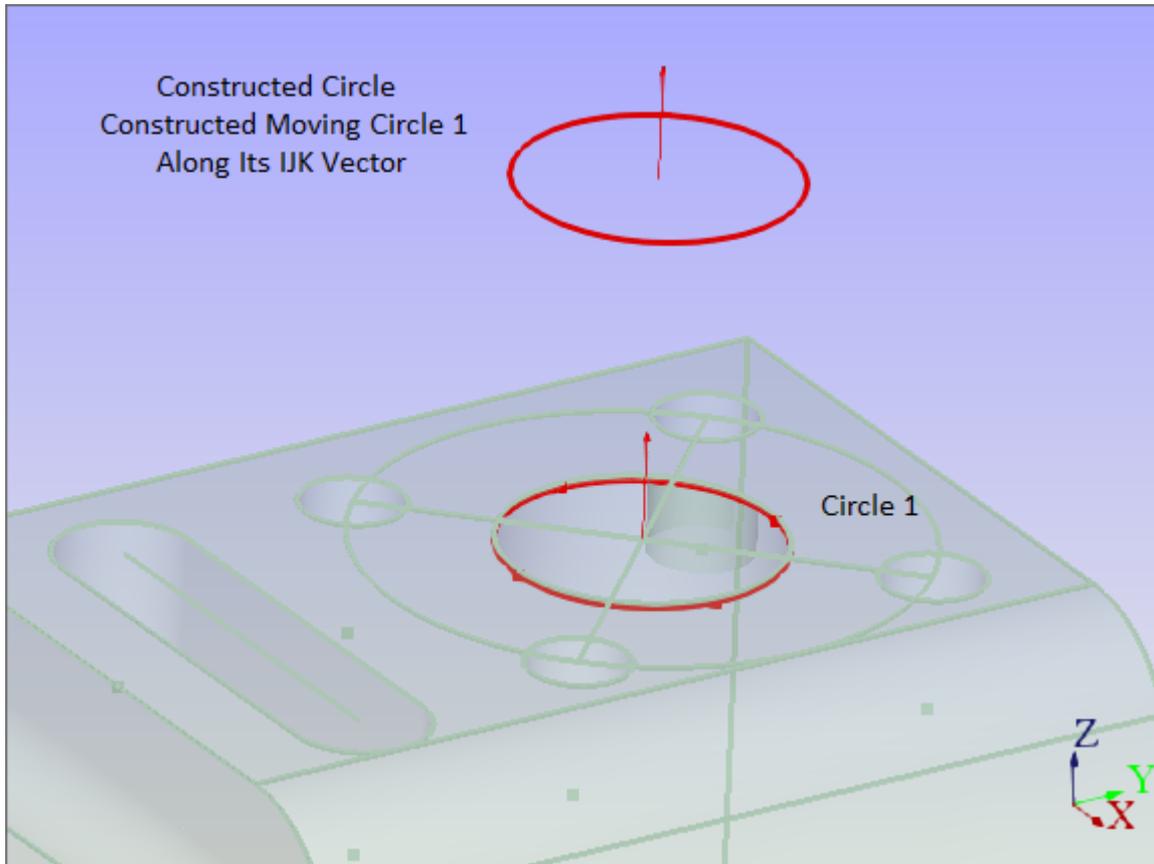


Steps to follow:

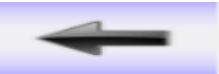
- Using a circle feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Circle Icon**.
-  Click on **Project**.
- Pick the circle to be projected, and also pick the feature to project it onto.
-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** method to construct a circle feature from a measured or existing feature, such as another circle.

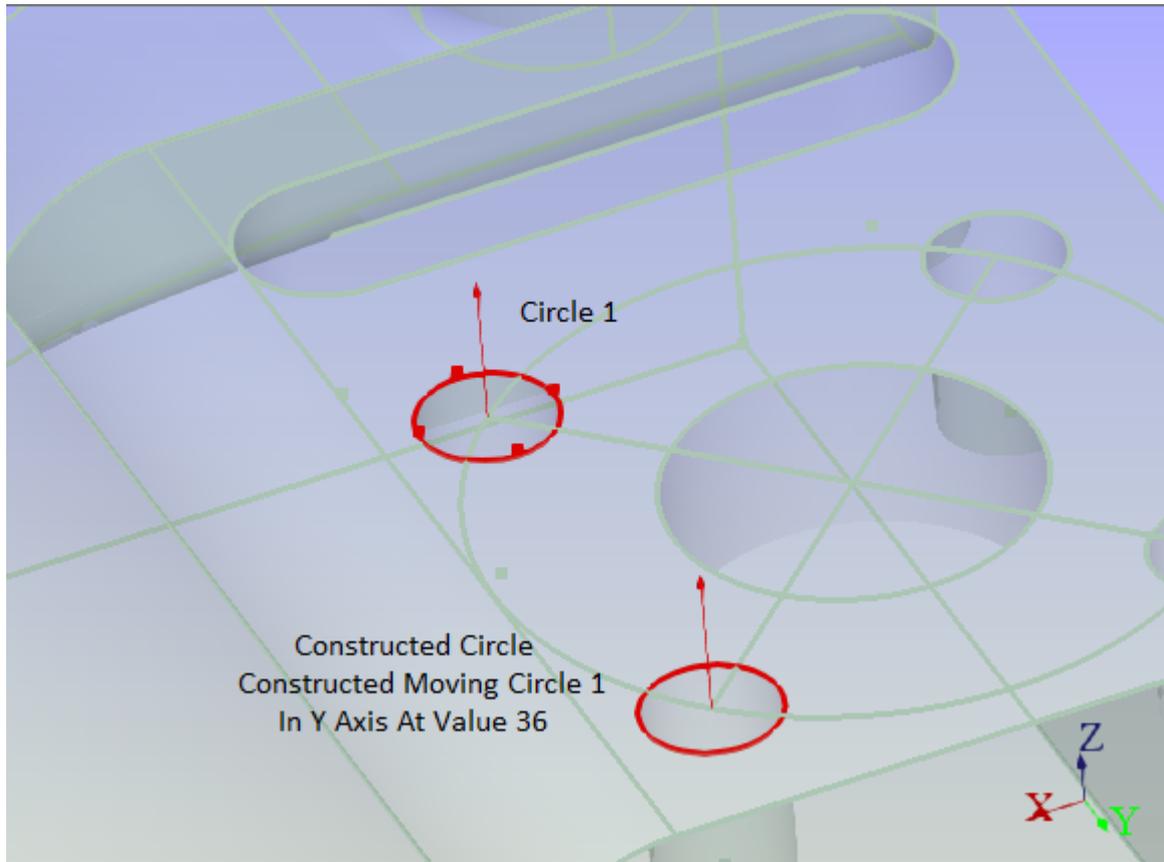


Steps to follow:

- Using a circle feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Circle Icon**.
-  Click on **Move IJK**.
- Pick the circle to be moved along its IJK.
-  Click on **Compute**. Type in the IJK move in the dialog box. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** method to construct a circle feature from a measured or existing feature, such as another circle.



Steps to follow:

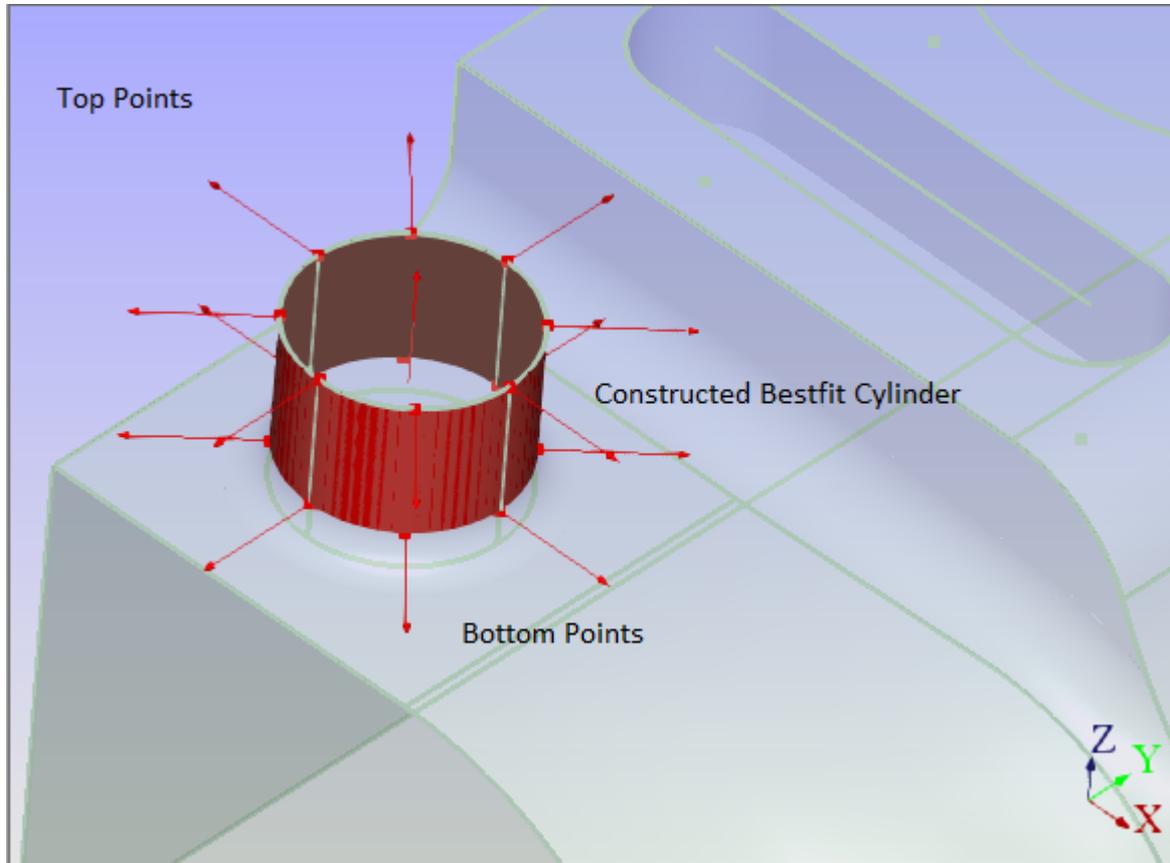
- Using a circle feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Circle Icon**.
-  Click on **Move Axis**.
- Pick the circle to be moved along its axis.
-  Click on **Compute**. Type in the axis move in the correct axis box. Click **OK**.

[Constructing Features](#)

Cylinder Construction

Best Fit

The following is an example of how to use the **Bestfit** method to construct a cylinder. The example below uses points to construct a cylinder

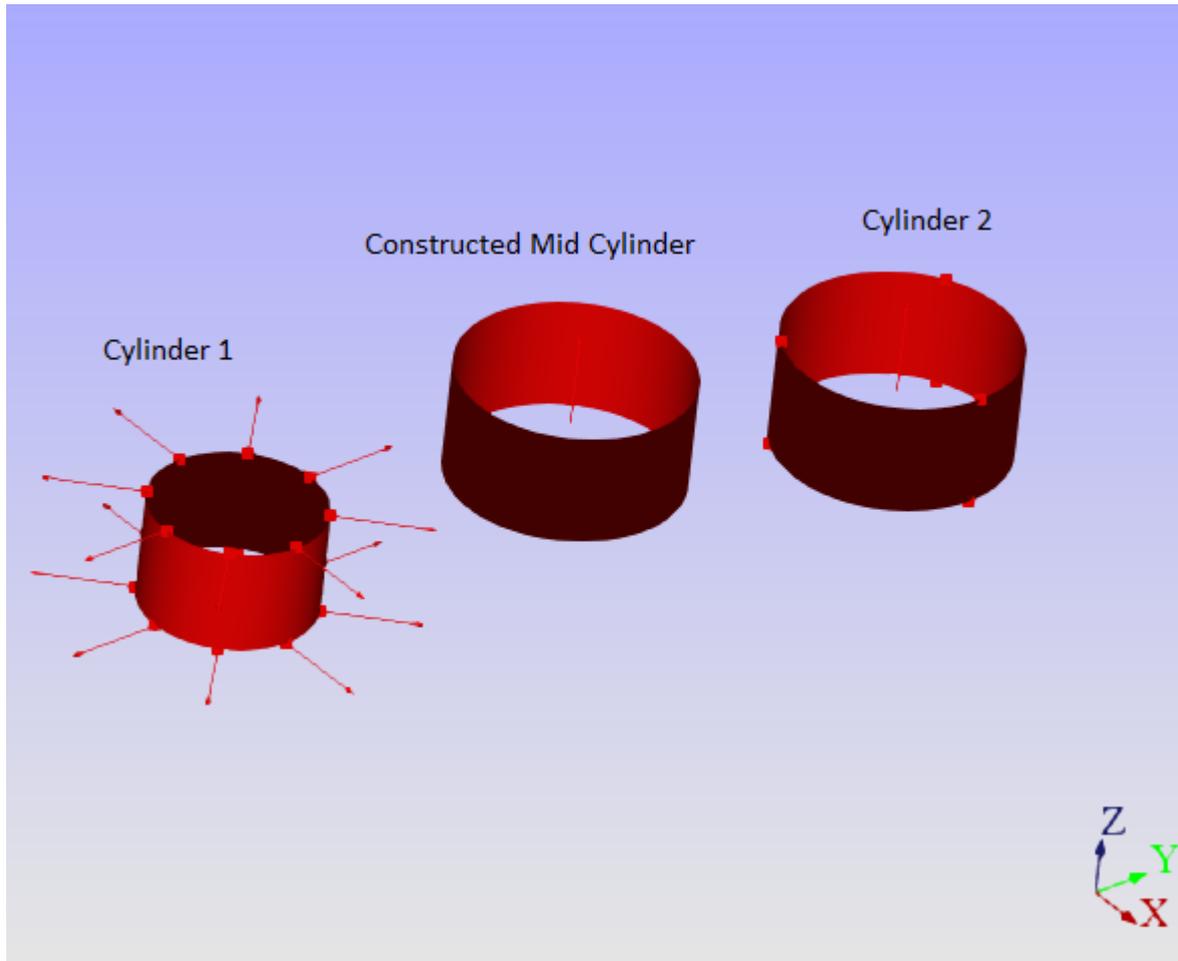


Steps to follow:

- Measure the required number of point reducible features for a **Bestfit** cylinder. This will usually be a minimum of six points, at two levels. (three at one level and three at another level) If using more than six points, first pick the six, (three at one level and three at another) and then pick the rest of the points in any order.
-  Switch to the **Construct Mode**, and choose the **Cylinder Icon**.
-  Click on **Bestfit**. Pick the features to be used for the construction of the bestfit cylinder.
-  Click on **Compute**.

Mid-Cylinder

The following is an example of how to construct a **Mid Feature** or a mid-cylinder between two existing features, such as two cylinders. This is the same logic as with other point reducible features.

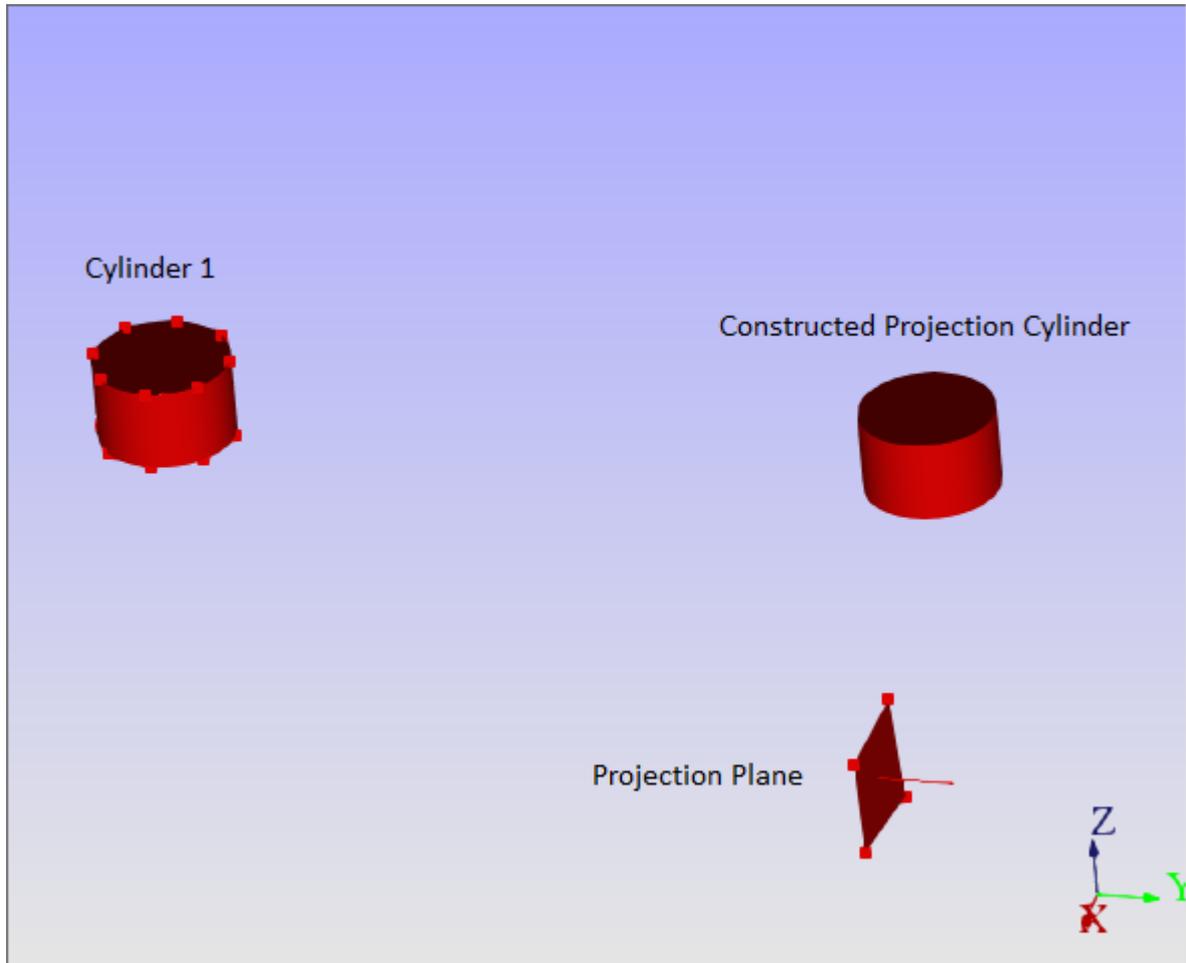


Steps to follow:

- Measure two cylinders, or have two constructed cylinders available.
-  Switch to the **Construct Mode**, and choose the **Cylinder Icon**.
-  Click on **Mid Feature**.
- Pick the two measured or constructed cylinders to construct the mid-cylinder, or mid-feature.
-  Click on **Compute**.

Project To

The following is an example of using the project feature to construct a new cylinder by projecting it onto a feature such as a plane surface.



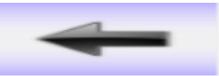
Steps to follow:

- Using a cylinder feature that already exists, whether measured or constructed.

-  Switch to the **Construct Mode**, and choose the **Cylinder Icon**.

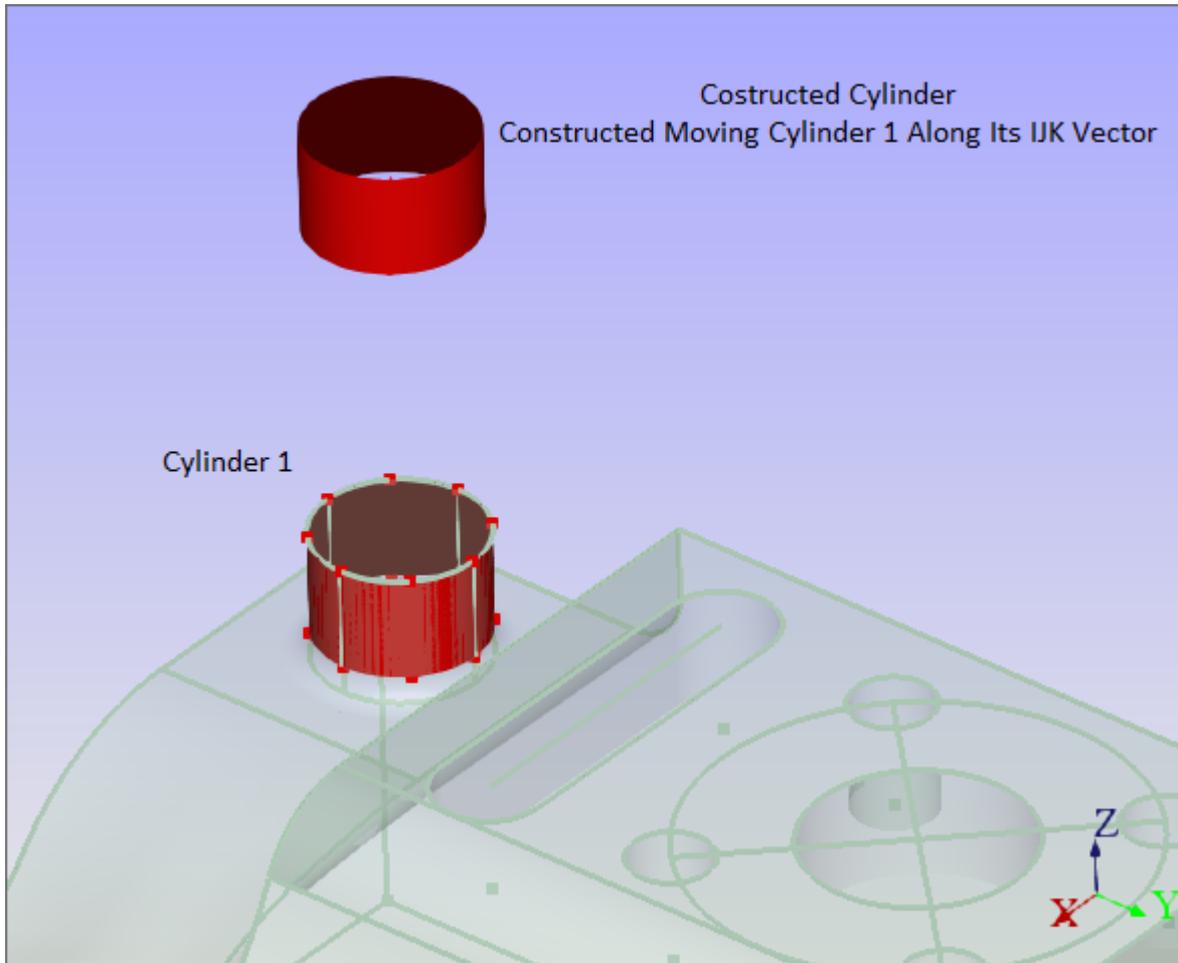
-  Click on **Project**.

- Pick the cylinder to be projected, and also pick the feature to project it onto.

-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** method to construct a cylinder feature from a measured or existing feature, such as another cylinder.

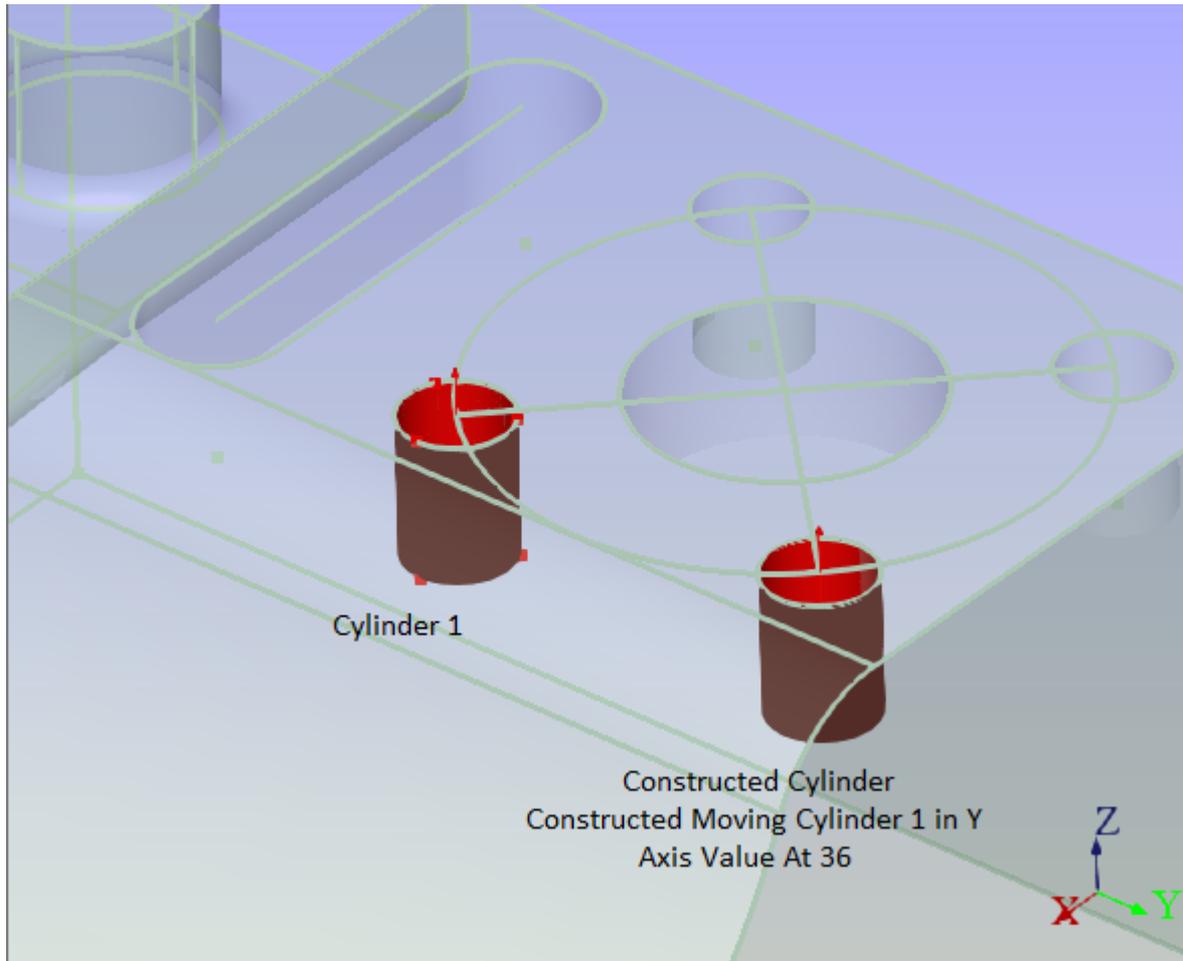


Steps to follow:

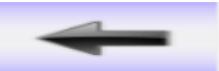
- Using a cylinder feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Cylinder Icon**.
-  Click on **Move IJK**.
- Pick the cylinder to be moved along its IJK.
-  Click on **Compute**. Type in the IJK move in the dialog box. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** method to construct a cylinder feature from a measured or existing feature, such as another cylinder.



Steps to follow:

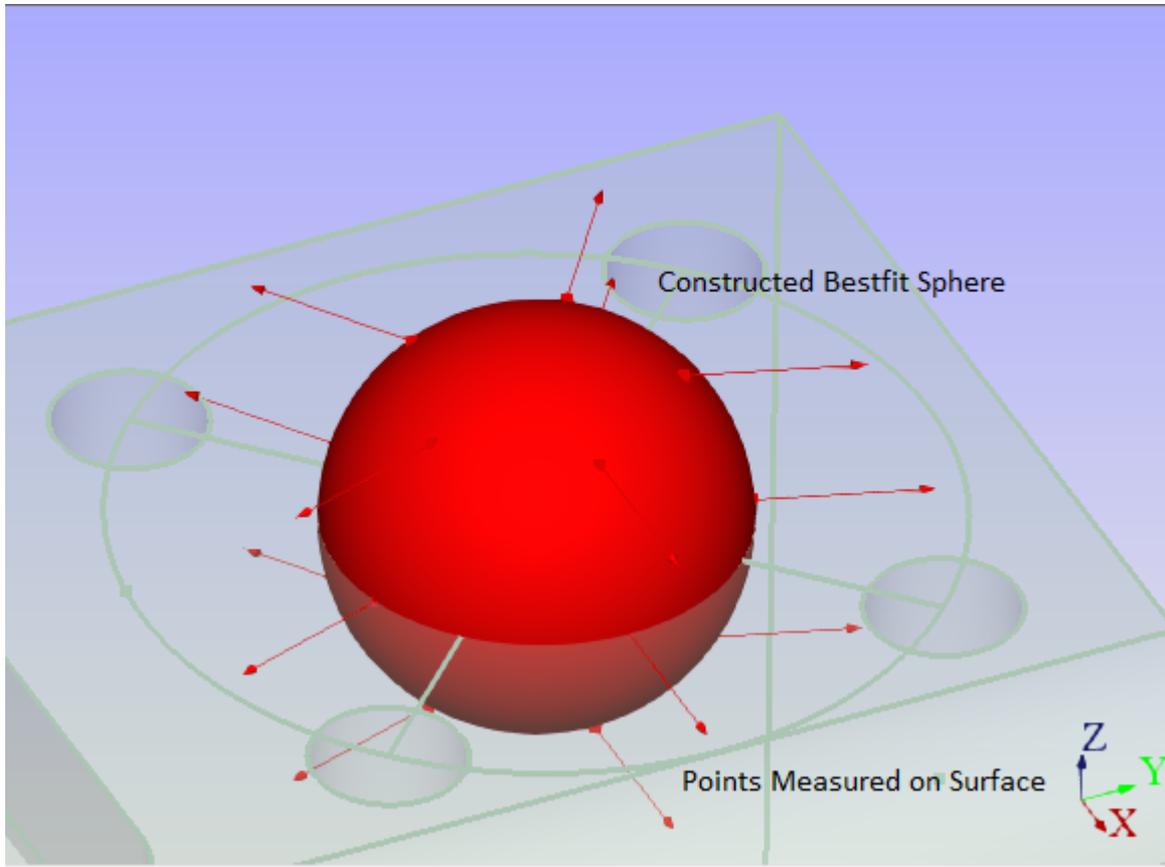
- Using a cylinder feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Cylinder Icon**.
-  Click on **Move Axis**. Pick the cylinder to be moved along its axis.
-  Click on **Compute**. Type in the axis move in the correct axis box. Click **OK**.

[Constructing Features](#)

Sphere Construction

Best Fit

The following is an example of how to use the **Bestfit** method to construct a sphere. The example below uses points to construct a sphere; this is usually a commonly accepted method.

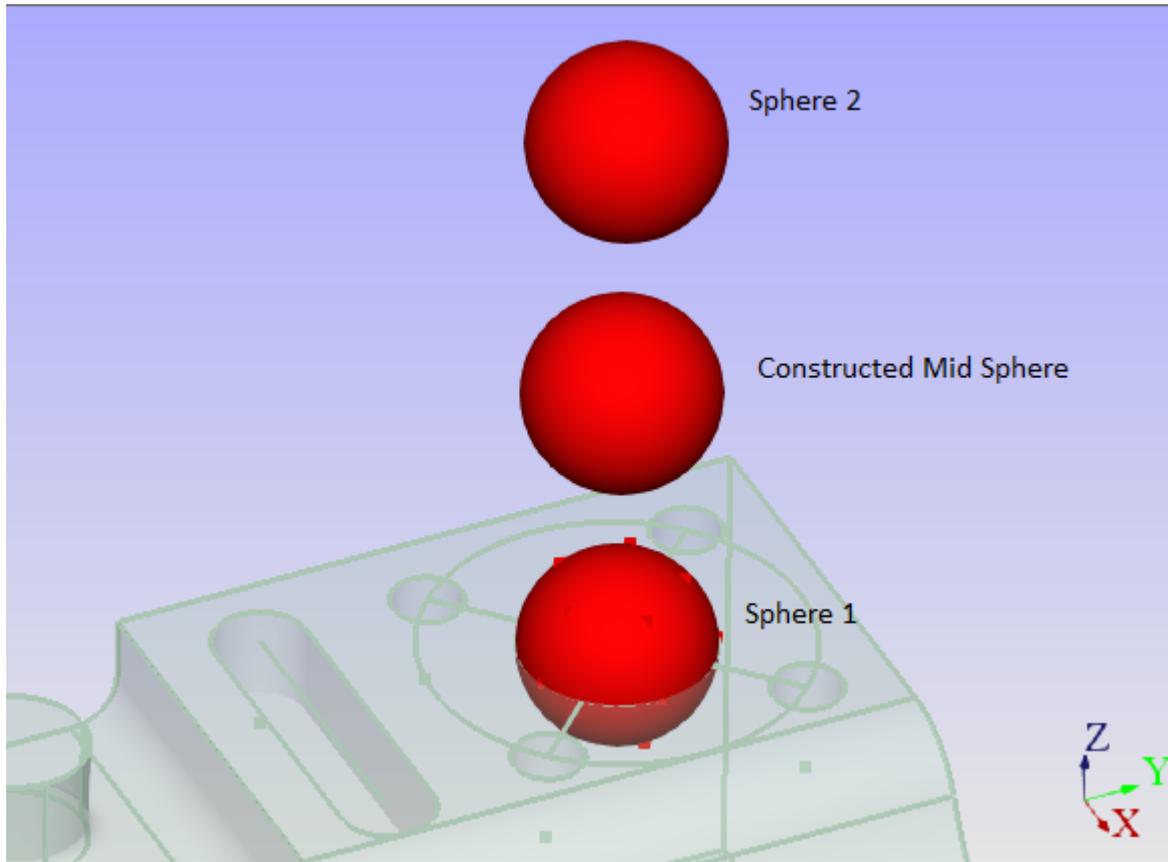


Steps to follow:

- Measure the required number of point reducible features for a bestfit sphere. This will usually be four features, however, it is possible to choose a series of points.
-  Switch to the **Construct Mode**, and choose the **Sphere Icon**.
-  Click on **Bestfit**.
- Pick the features to be used for the construction of the bestfit sphere.
-  Click on **Compute**.

Mid-Sphere

The following is an example of how to construct a mid-feature or a mid-sphere between two existing features, such as two spheres. This is the same logic as with other point reducible features.

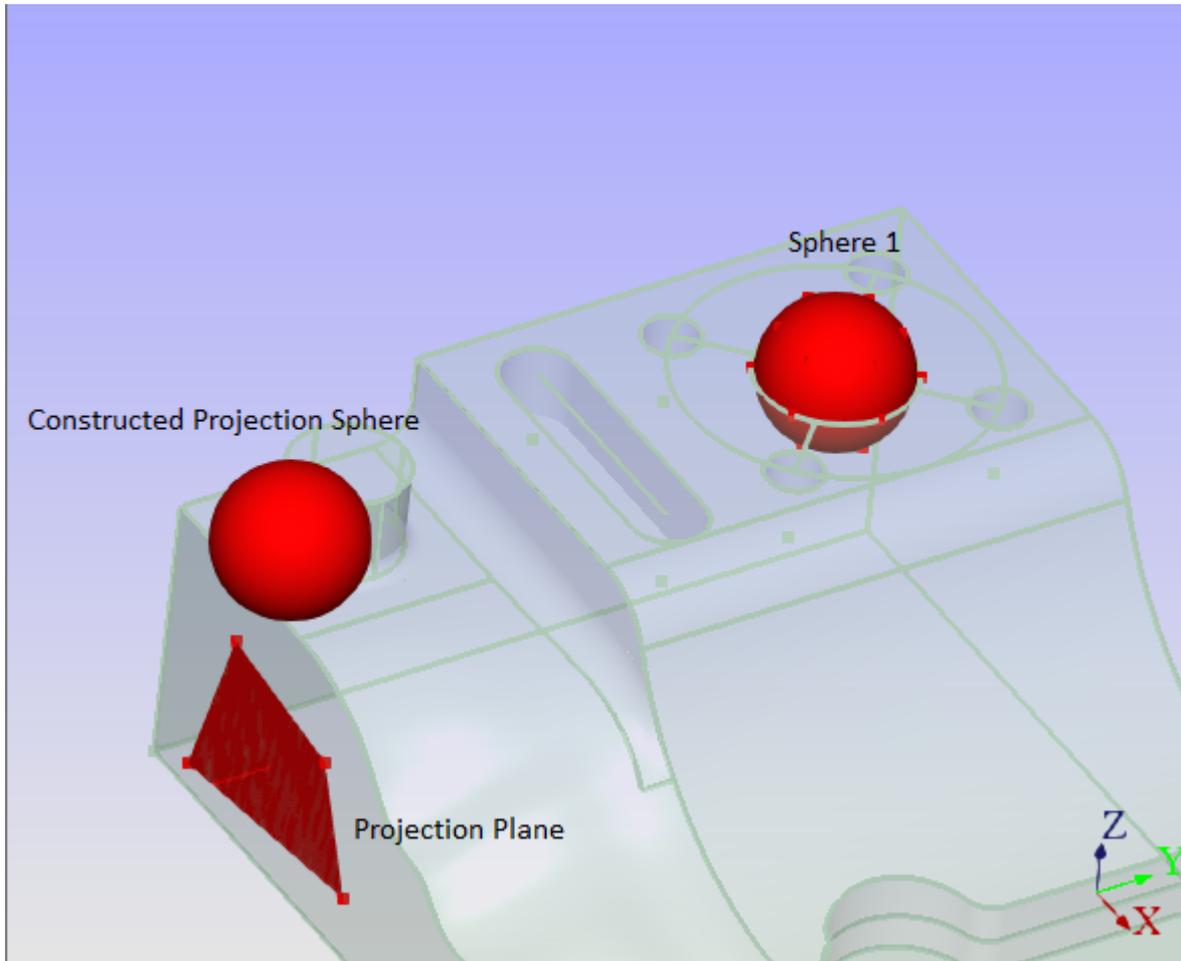


Steps to follow:

- Measure two spheres, or have two constructed spheres available.
-  Switch to **Construct Mode**, and choose the **Sphere Icon**.
-  Click on **Mid-feat**.
- Pick the two measured or constructed spheres to construct the mid-sphere, or mid-feature.
-  Click on **Compute**.

Project To

The following is an example of using the project feature to construct a new cone by projecting it onto a feature such as a plane surface.



Steps to follow:

- Using a cone feature that already exists, whether measured or constructed.

-  Switch to the **Construct Mode**, and choose the **Cone Icon**.

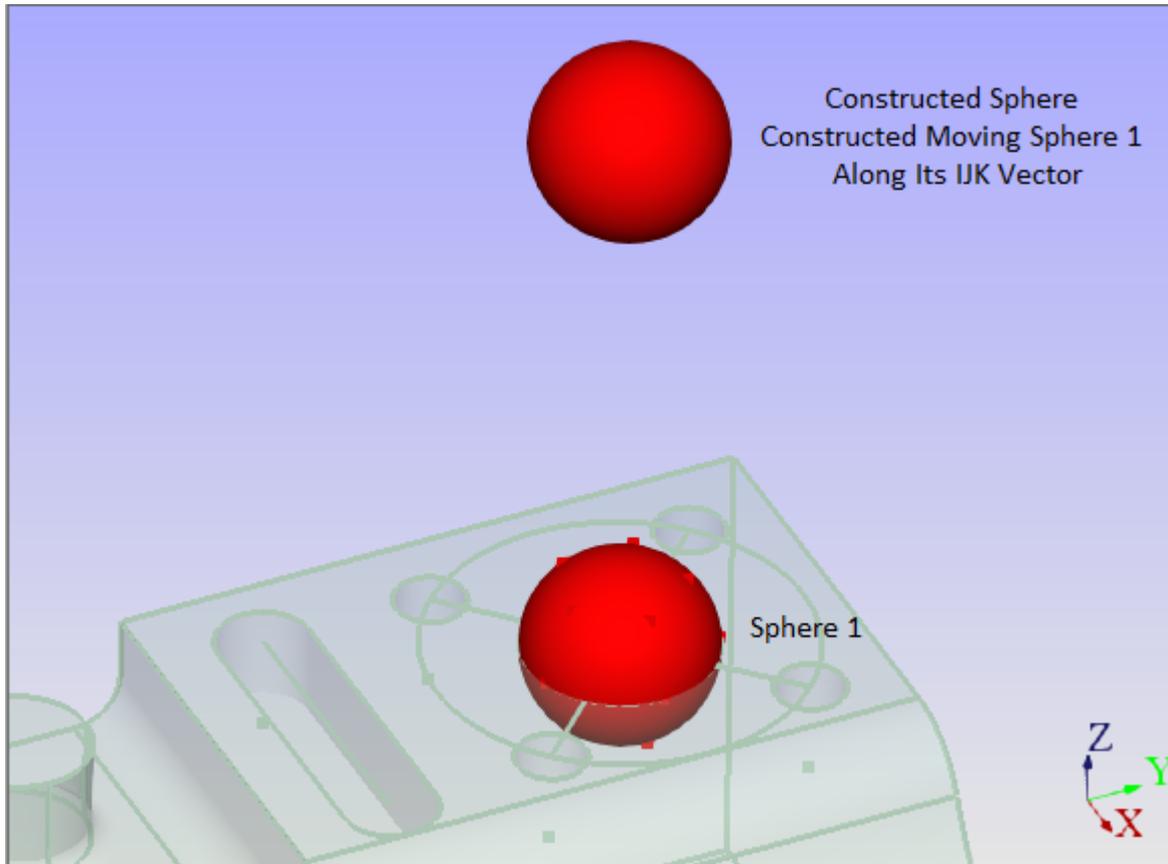
-  Click on **Project**.

- Pick the cone to be projected, and also pick the feature to project it onto.

-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** method to construct a sphere feature from a measured or existing feature, such as another sphere.

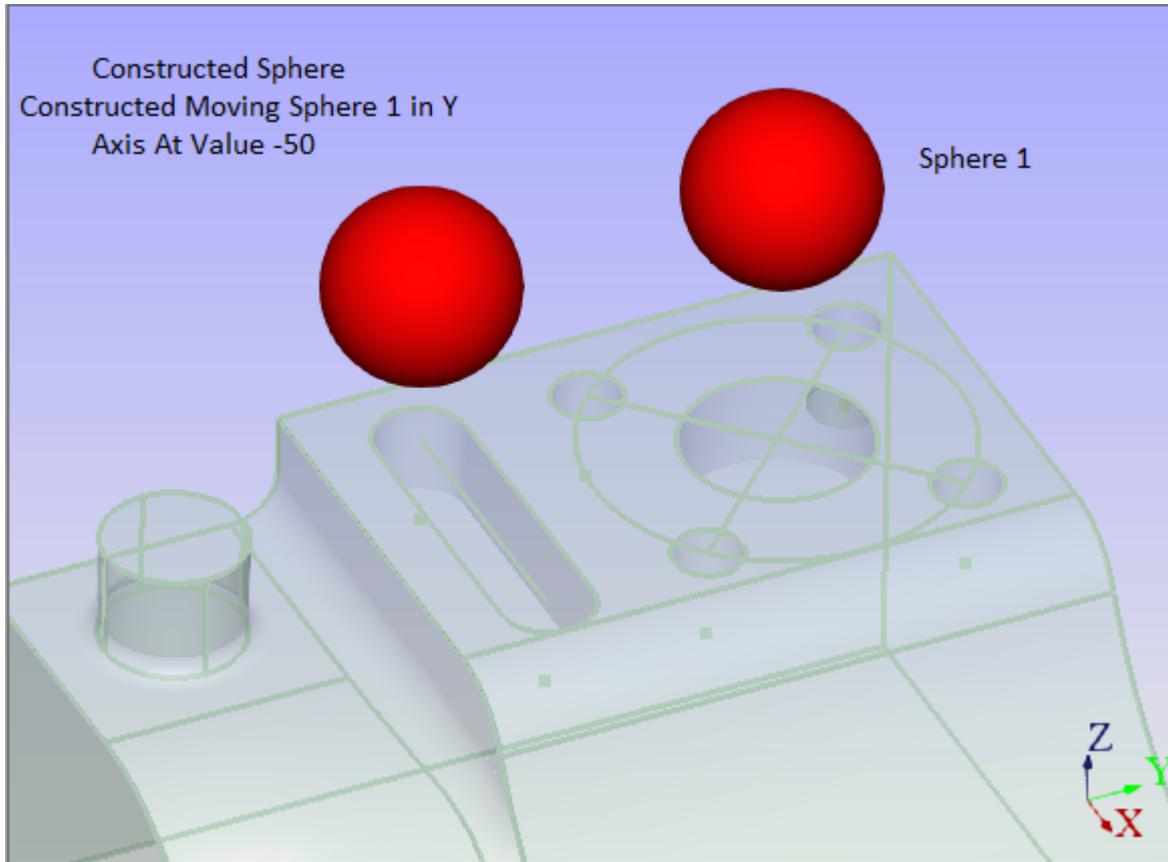


Steps to follow:

- Using a sphere feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Sphere Icon**.
-  Click on **Move IJK**.
- Pick the sphere to be moved along its IJK.
-  Click on **Compute**. Type in the IJK move in the dialog box. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** method to construct a sphere from a measured or existing feature, such as another sphere



Steps to follow:

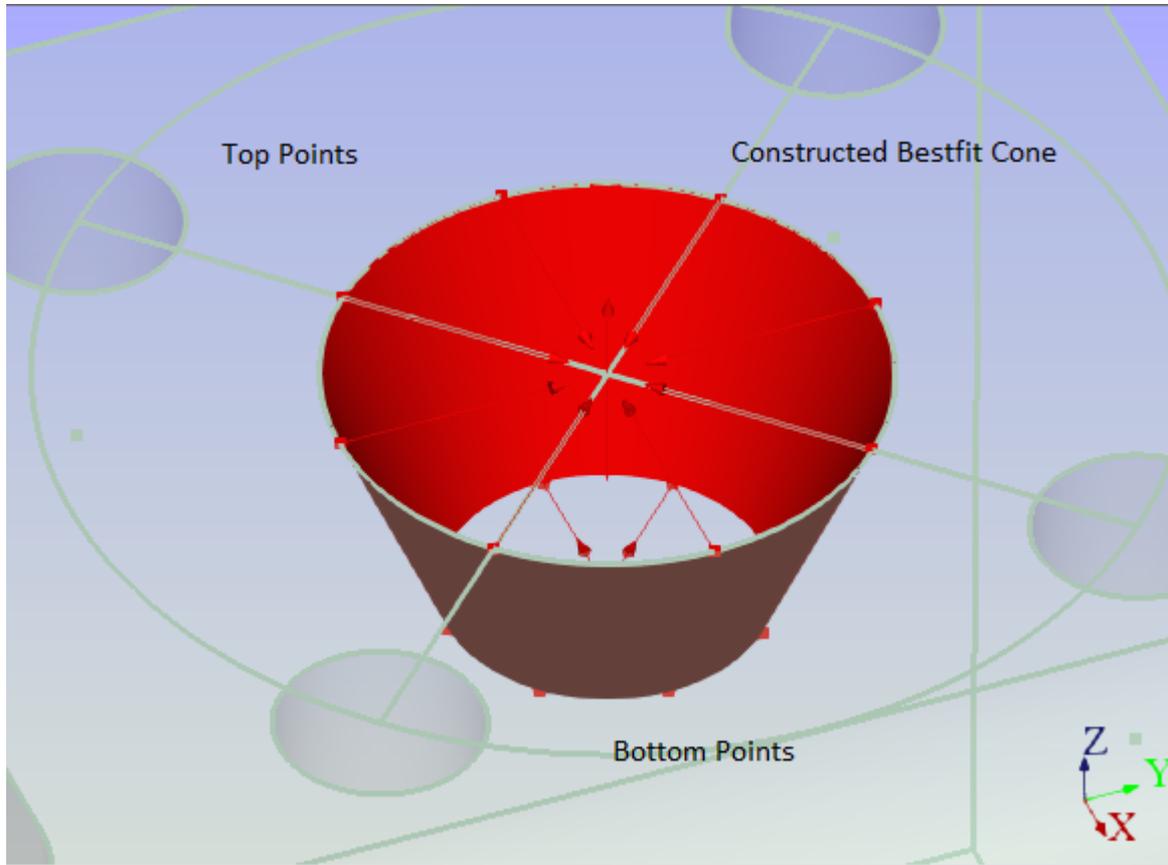
- Using a sphere feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Sphere Icon**.
-  Click on **Move Axis**.
- Pick the sphere to be moved along its axis.
-  Click on **Compute**. Type in the axis move in the correct axis box. Click **OK**.

[Constructing Features](#)

Cone Construction

Best Fit

The following is an example of how to use the **Bestfit** method to construct a cone. The example below uses points to construct a cone.

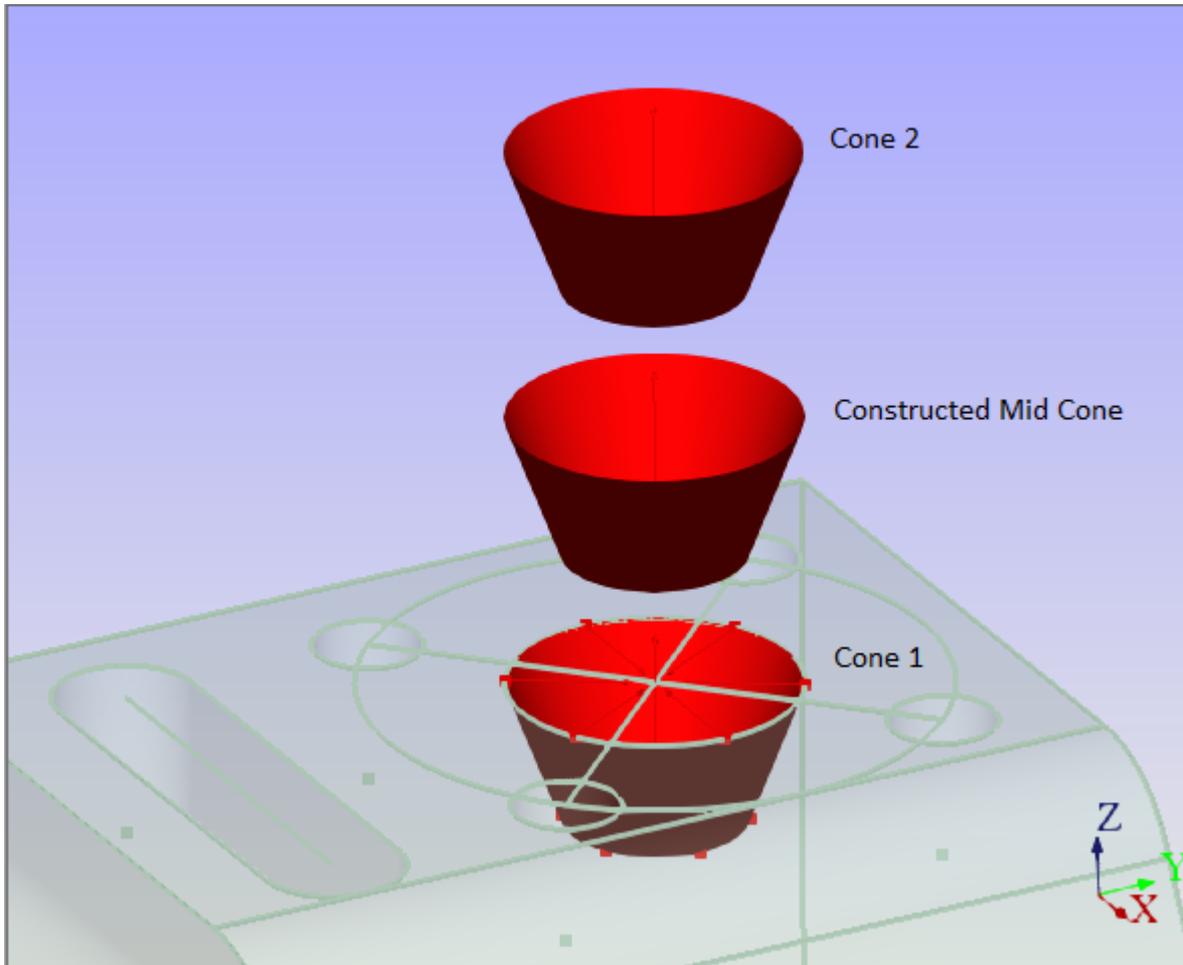


Steps to follow:

- Measure the required number of point reducible features for a bestfit cone. This will usually be a minimum of six points, at two levels. (three at one level and three at another level) If using more than six points, first pick the six,(three at one level and three at another) and then pick the rest of the points in any order.
-  Switch to the **Construct Mode**, and choose the **Cone Icon**.
-  Click on **Bestfit**.
- Pick the features to be used for the construction of the bestfit cone.
-  Click on **Compute**.

Mid-Cone

The following is an example of how to construct a **Mid Feature** or a mid-cone between two existing features, such as two cones. This is the same logic as with other point reducible features.

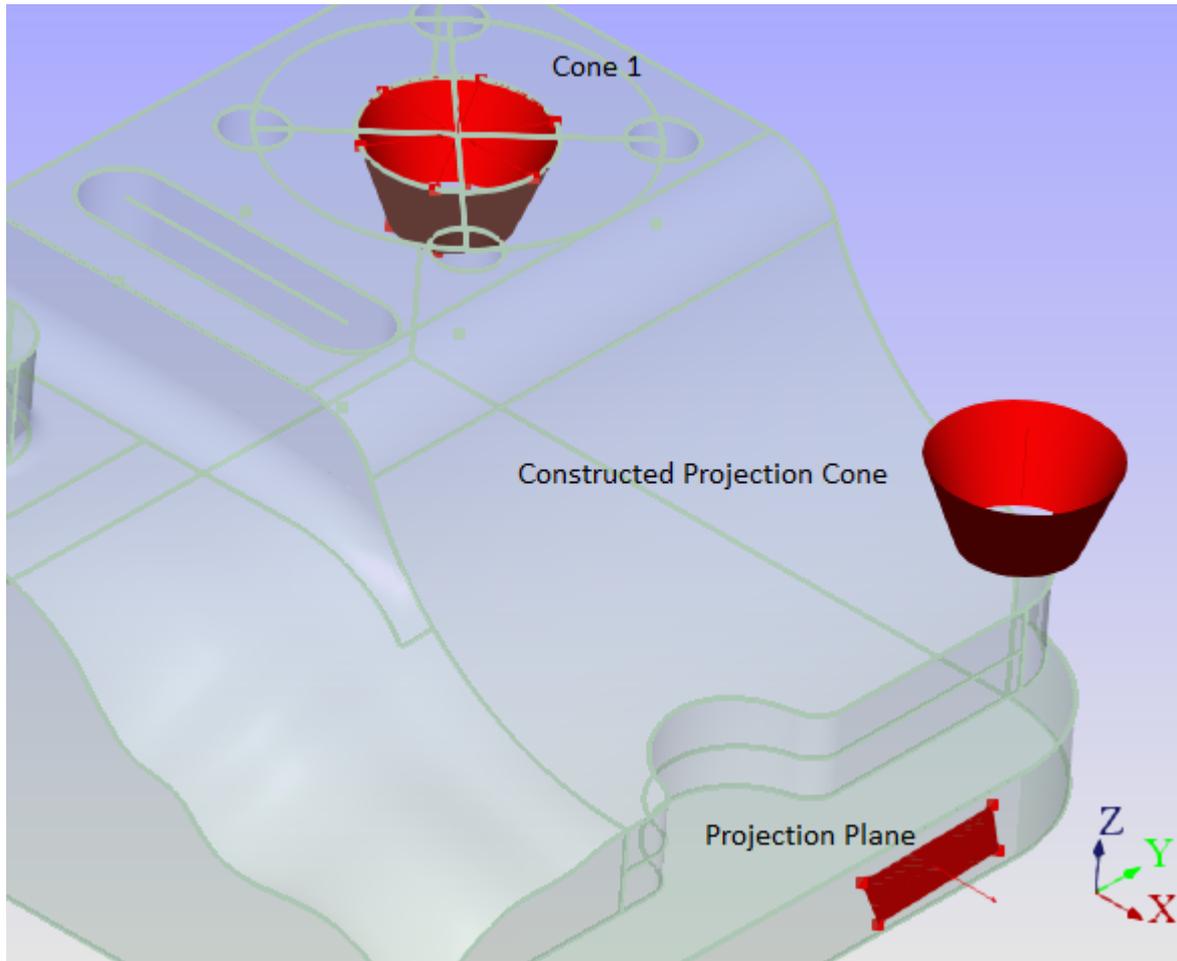


Steps to follow:

- Measure two cones, or have two constructed cones available.
-  Switch to the **Construct Mode**, and choose the **Cone Icon**.
-  Click on **Mid Feature**.
- Pick the two measured or constructed cones to construct the mid-cone, or mid-feature.
-  Click on **Compute**.

Project To

The following is an example of using the project feature to construct a new cone by projecting it onto a feature such as a plane surface.

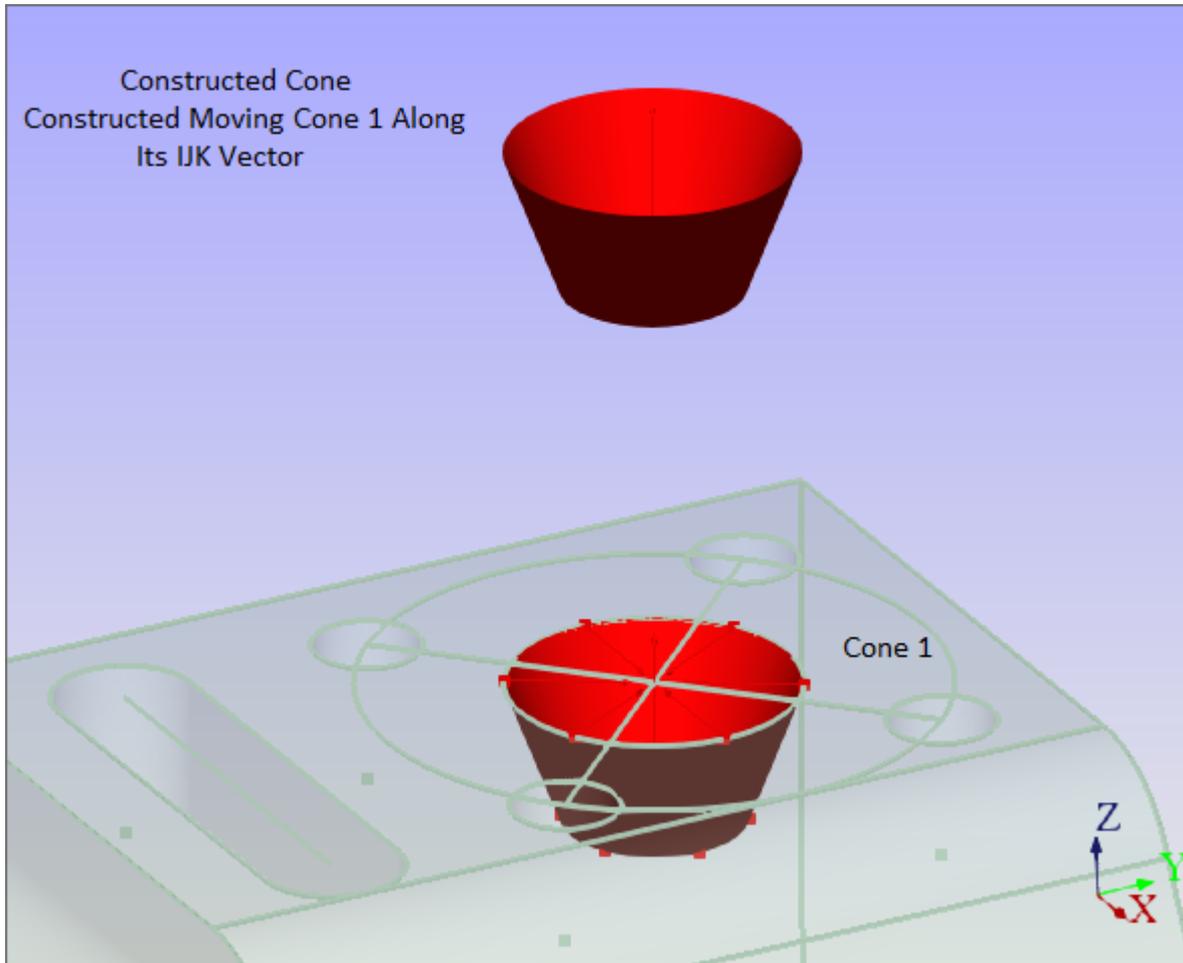


Steps to follow:

- Using a cone feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Cone Icon**.
-  Click on **Project**.
- Pick the cone to be projected, and also pick the feature to project it onto.
-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** method to construct a cone feature from a measured or existing feature, such as another cone.

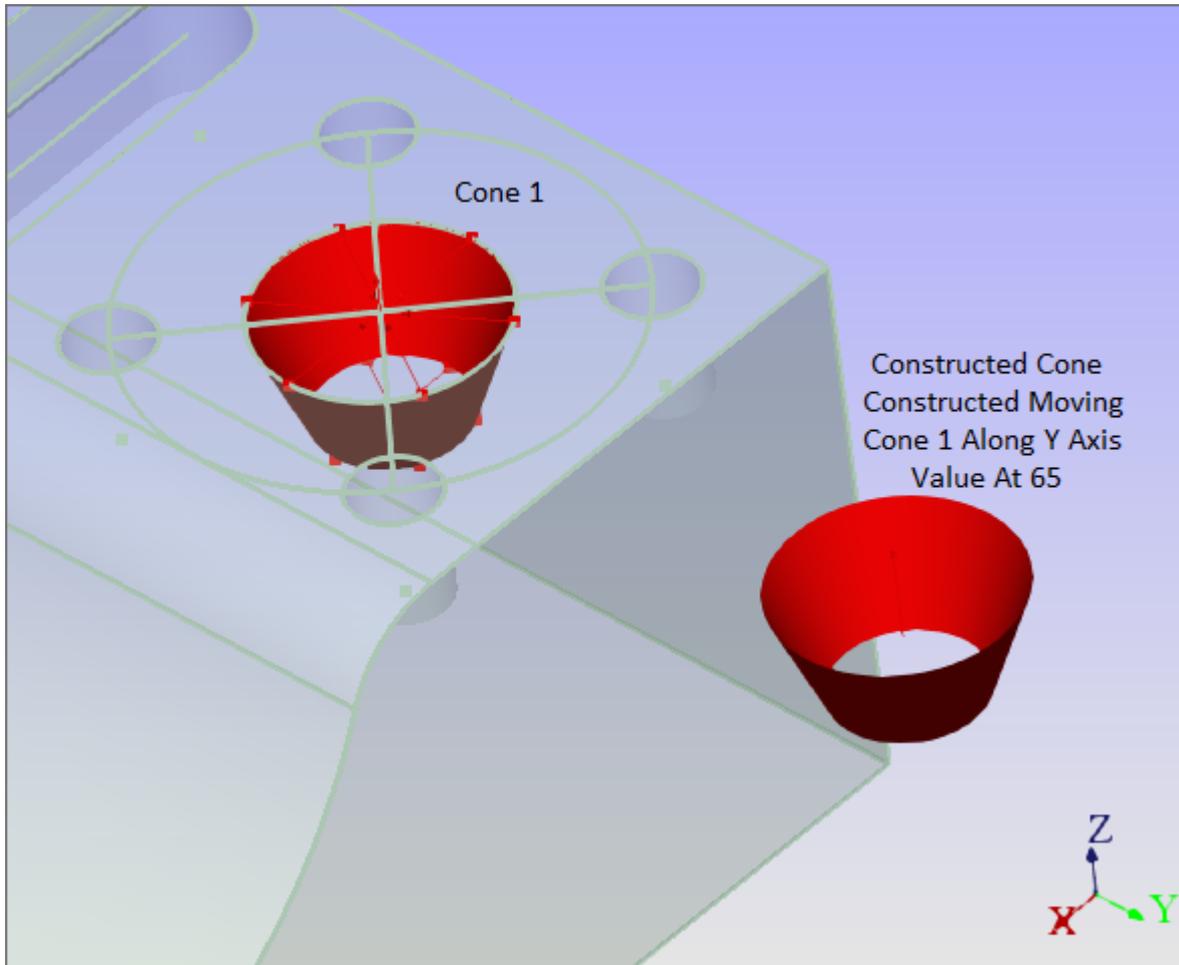


Steps to follow:

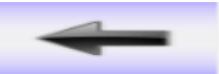
- Using a cone feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Cone Icon**.
-  Click on **Move IJK**.
- Pick the cone to be moved along its IJK.
-  Click on **Compute**. Type in the IJK move in the dialog box. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** method to construct a cone feature from a measured or existing feature, such as another cone.



Steps to follow:

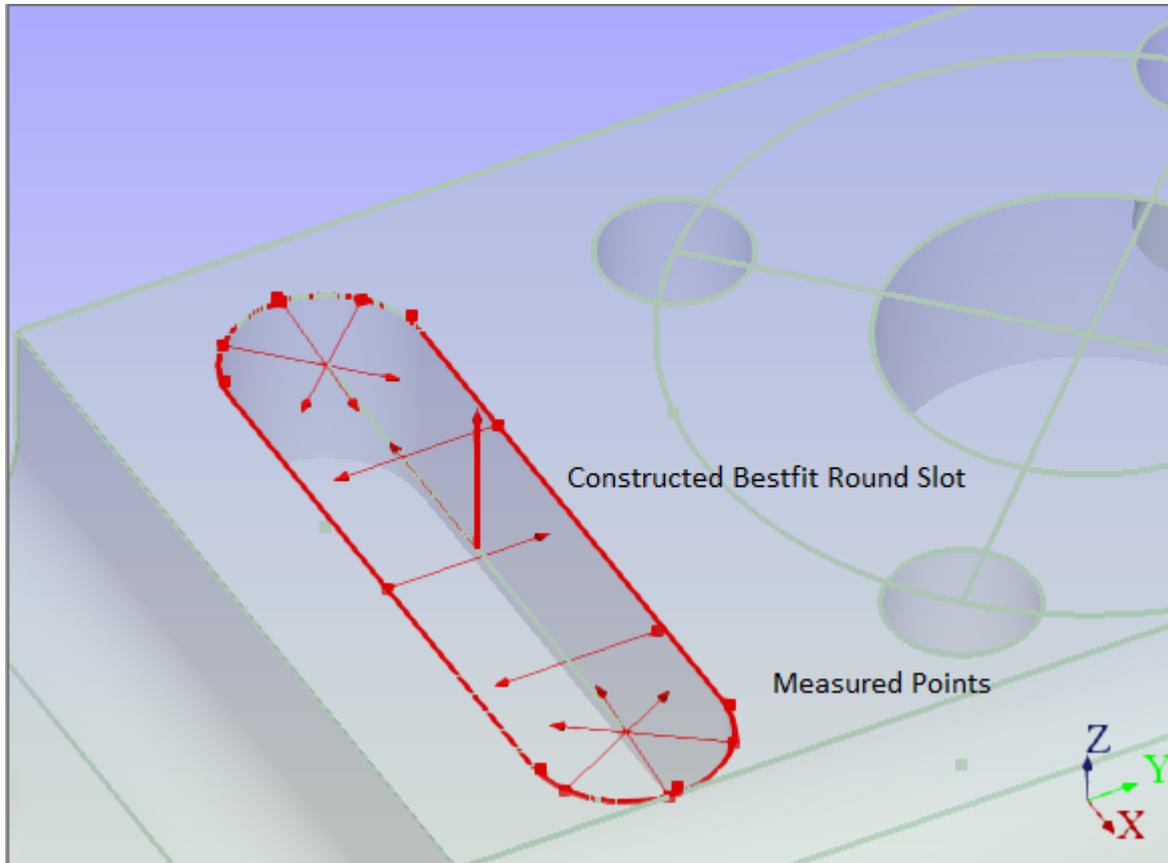
- Using a cone feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Cone Icon**.
-  Click on **Move Axis**. Pick the cone to be moved along its axis.
-  Click on **Compute**. Type in the axis move in the correct axis box. Click **OK**.

[Constructing Features](#)

Round Slot Construction

Best Fit

The following is an example of how to use the **Bestfit** method to construct a slot feature. The example below uses points to construct a slot; this is usually a commonly accepted method.

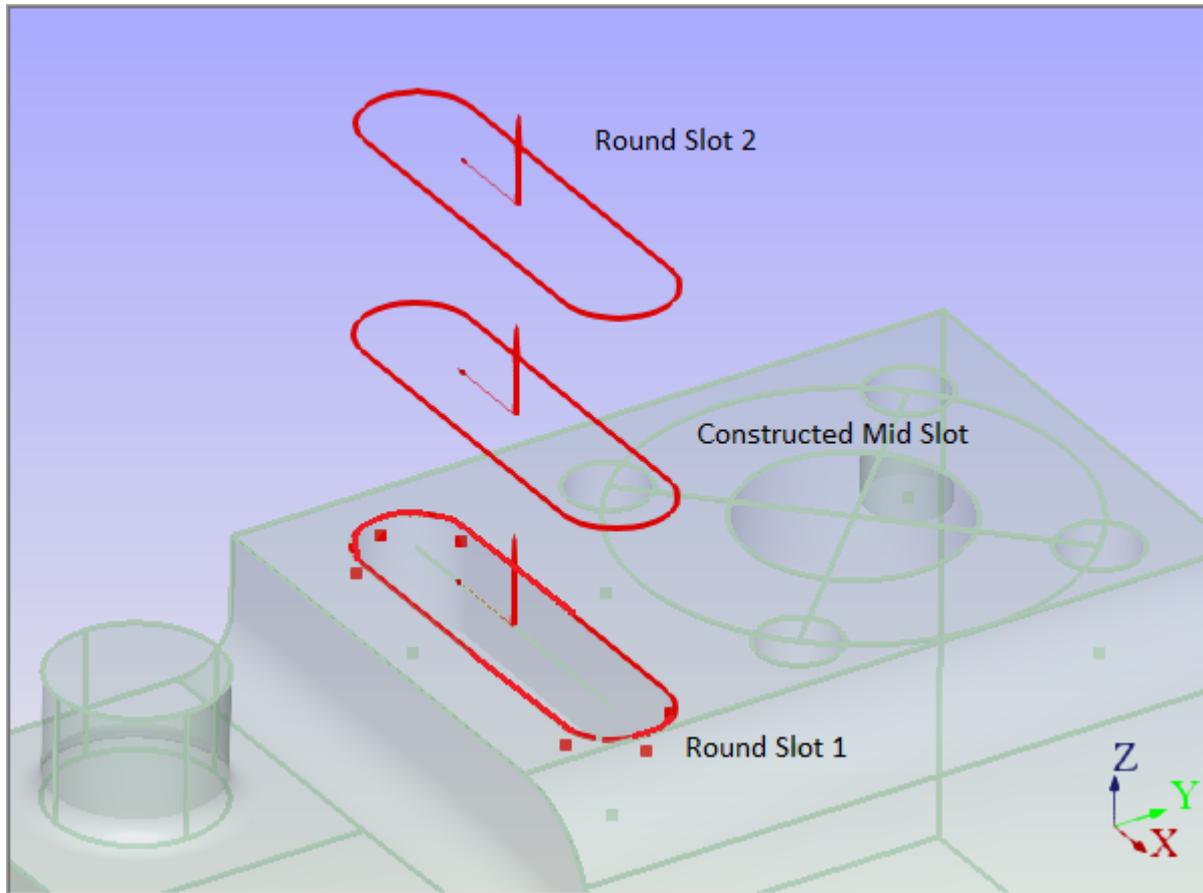


Steps to follow:

- Measure the required number of point reducible features for a bestfit slot. This will usually be nine features, and they will usually be points.
-  Switch to the **Construct Mode**, and choose the **Round Slot Icon**.
-  Click on **Bestfit**.
- Pick the features to be used for the construction of the bestfit slot.
-  Click on **Compute**.

Mid-Slot

The following is an example of how to construct a **Mid Feature** or a mid-slot between two existing features, such as two slots. This is the same logic as with other point reducible features.

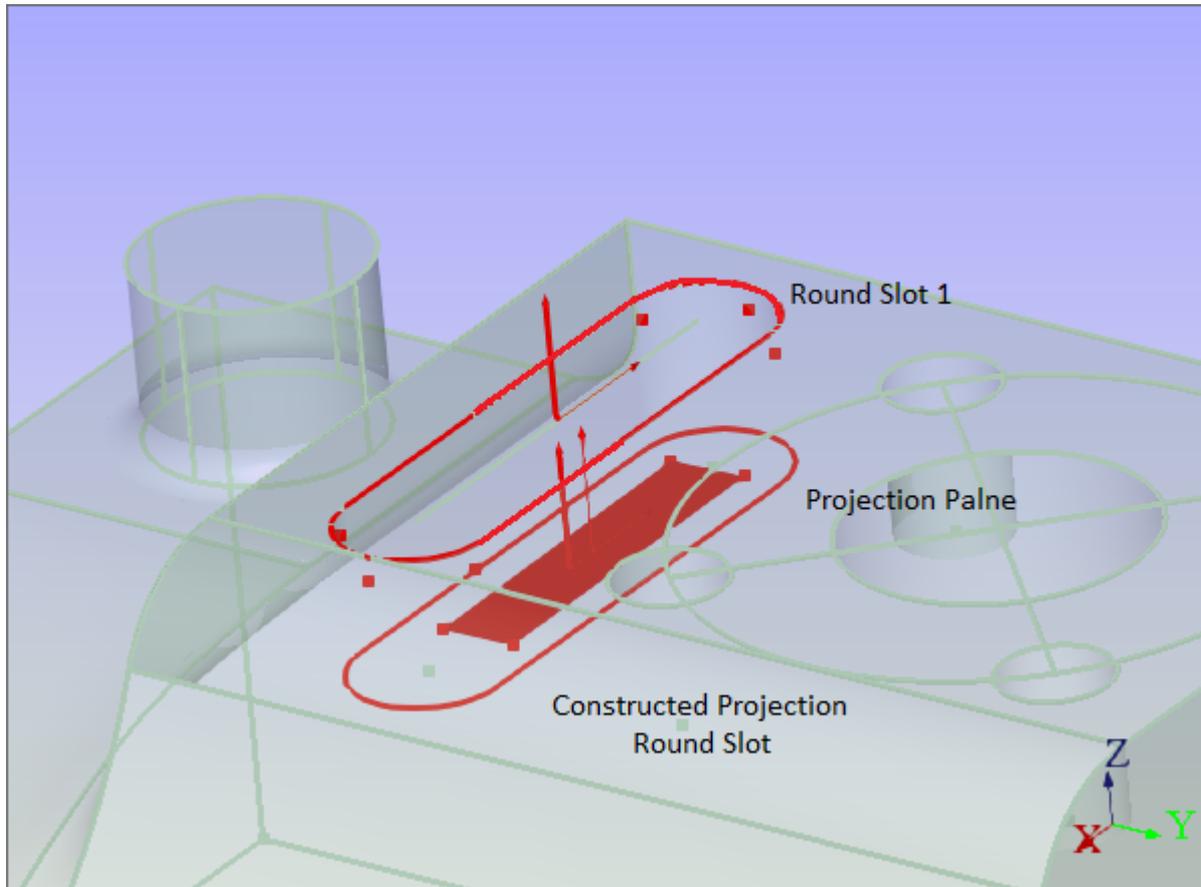


Steps to follow:

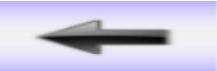
- Measure two slots, or have two constructed slots available.
-  Switch to the **Construct Mode**, and choose the **Round Slot Icon**.
-  Click on **Mid Feature**.
- Pick the two measured or constructed slots to construct the mid-slot, or mid-feature.
-  Click on **Compute**.

Project To

The following is an example of using the project feature to construct a new round slot by projecting it onto a feature such as a plane surface.

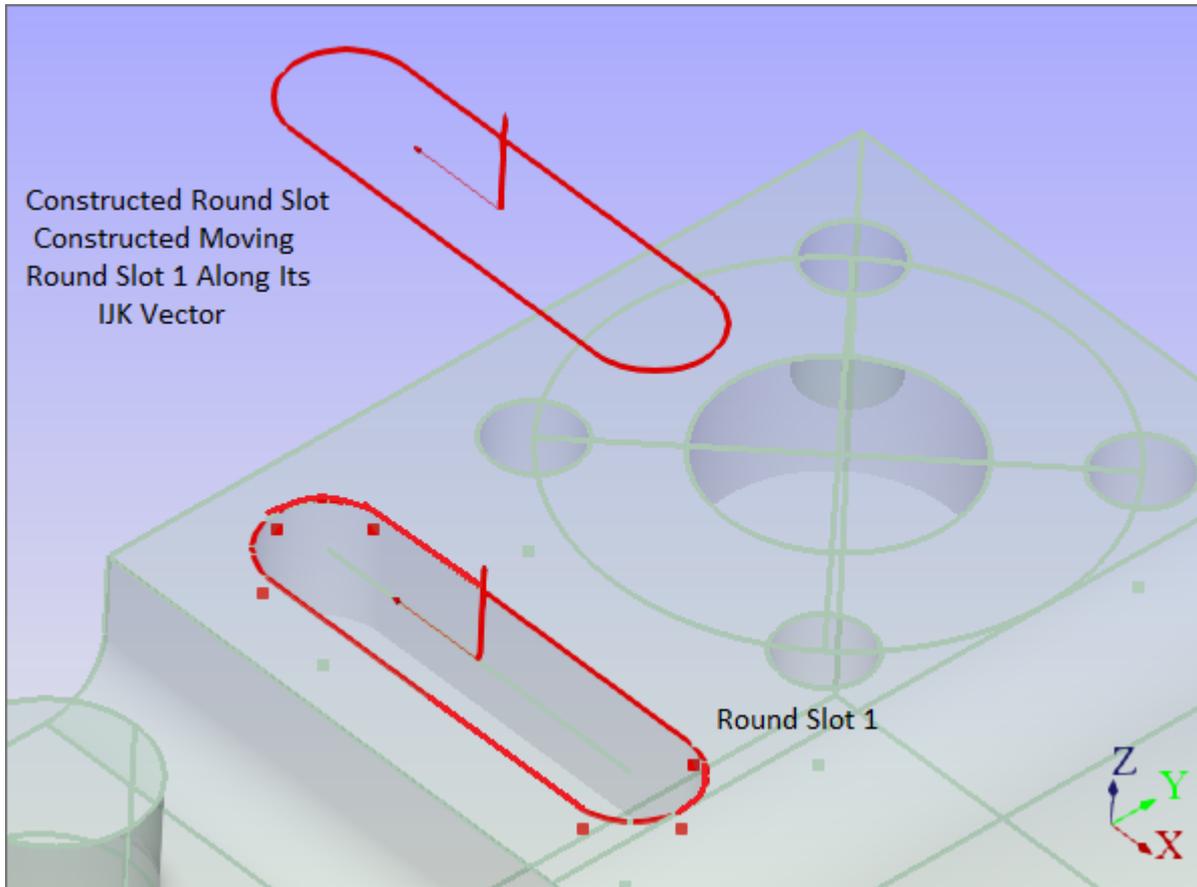


Steps to follow:

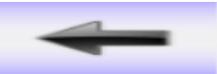
- Using a slot feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Round Slot Icon**.
-  Click on **Project**.
- Pick the round slot to be projected, and also pick the feature to project it onto.
-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** method to construct a slot feature from a measured or existing feature, such as another slot.

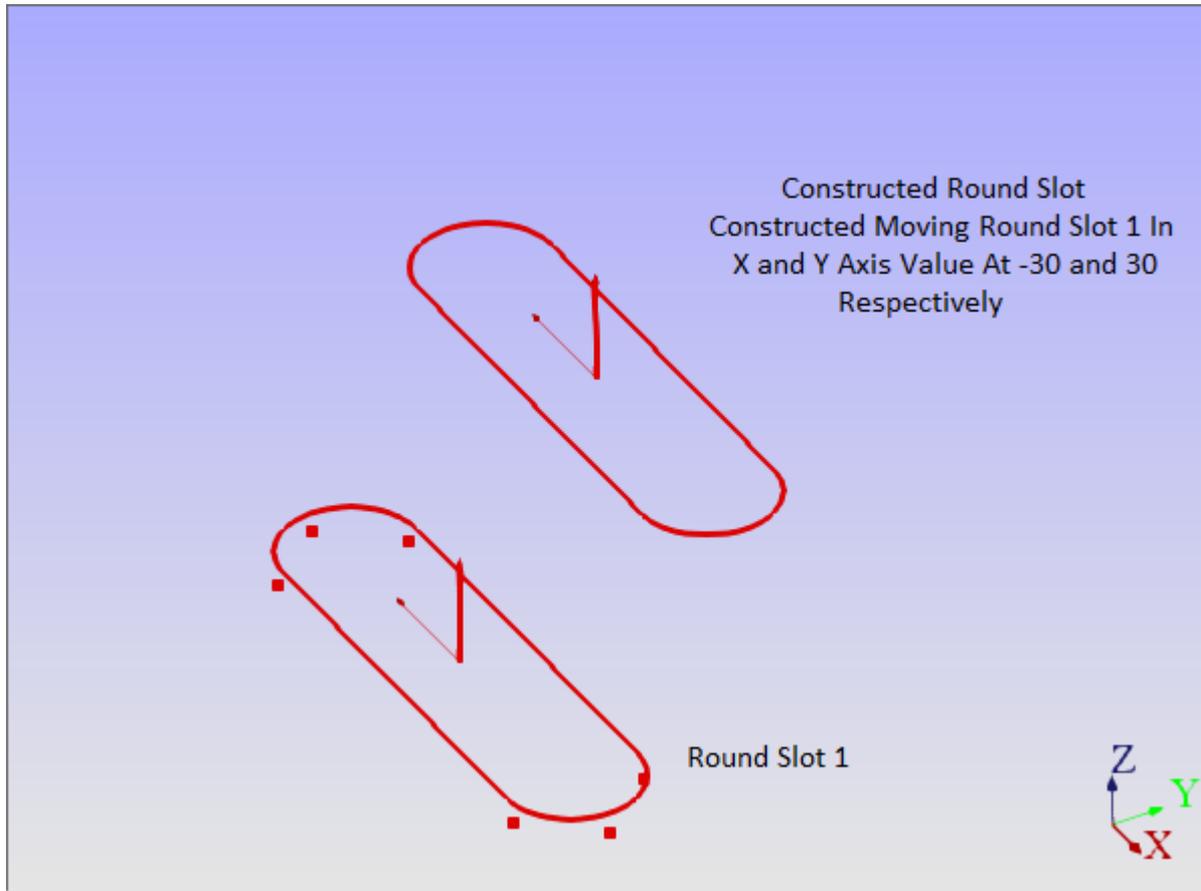


Steps to follow:

- Using a slot feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Round Slot Icon**.
-  Click on **Move IJK**.
- Pick the slot to be moved along its IJK.
-  Click on **Compute**. Type in the IJK move in the dialog box. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** method to construct a slot from a measured or existing feature, such as another slot.



Steps to follow:

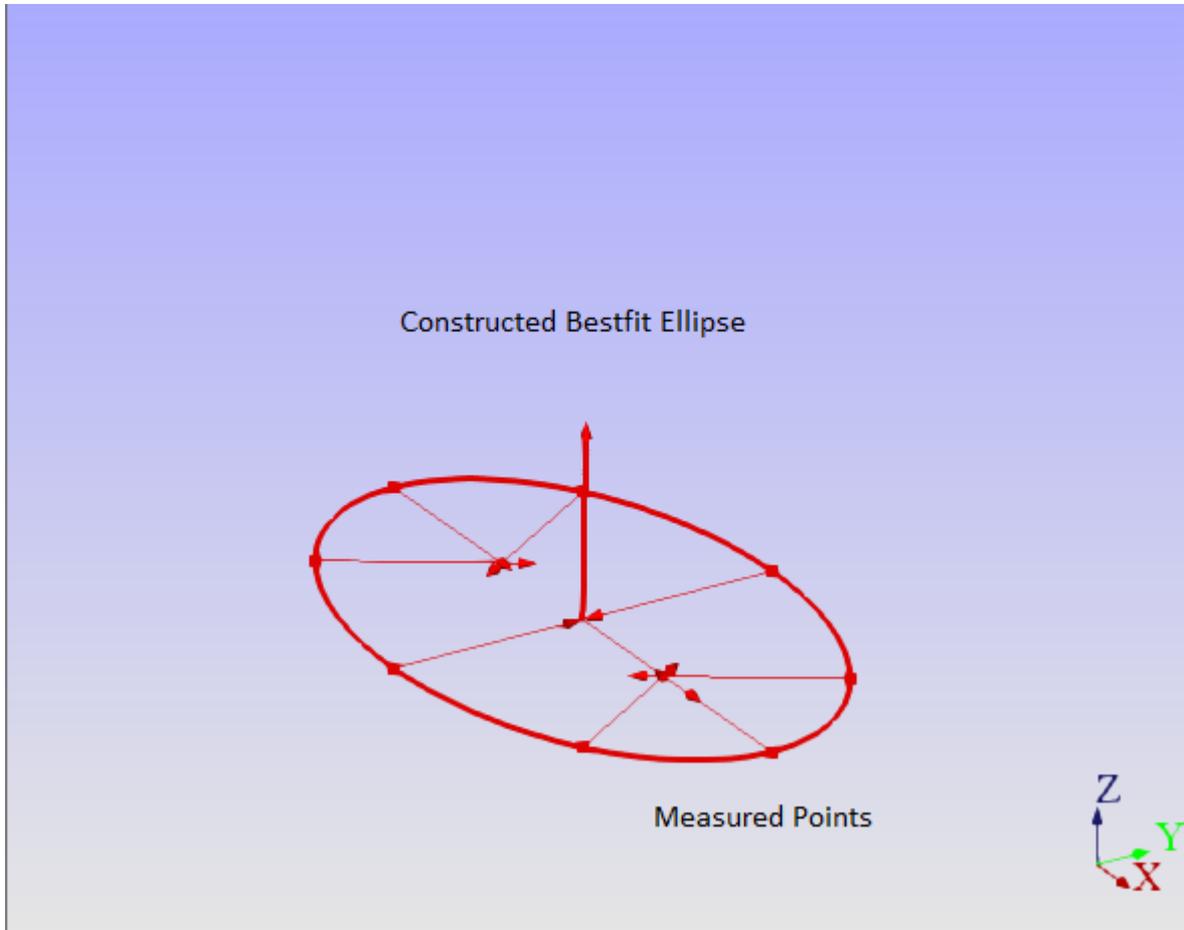
- Using a slot feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Round Slot Icon**.
-  Click on **Move Axis**. Pick the slot to be moved along its axis.
-  Click on **Compute**. Type in the axis move in the correct axis box. Click **OK**.

[Constructing Features](#)

Ellipse Construction

Best Fit

The following is an example of how to use the **Bestfit** method to construct an ellipse feature. The example below uses points to construct an ellipse; this is usually a commonly accepted method.

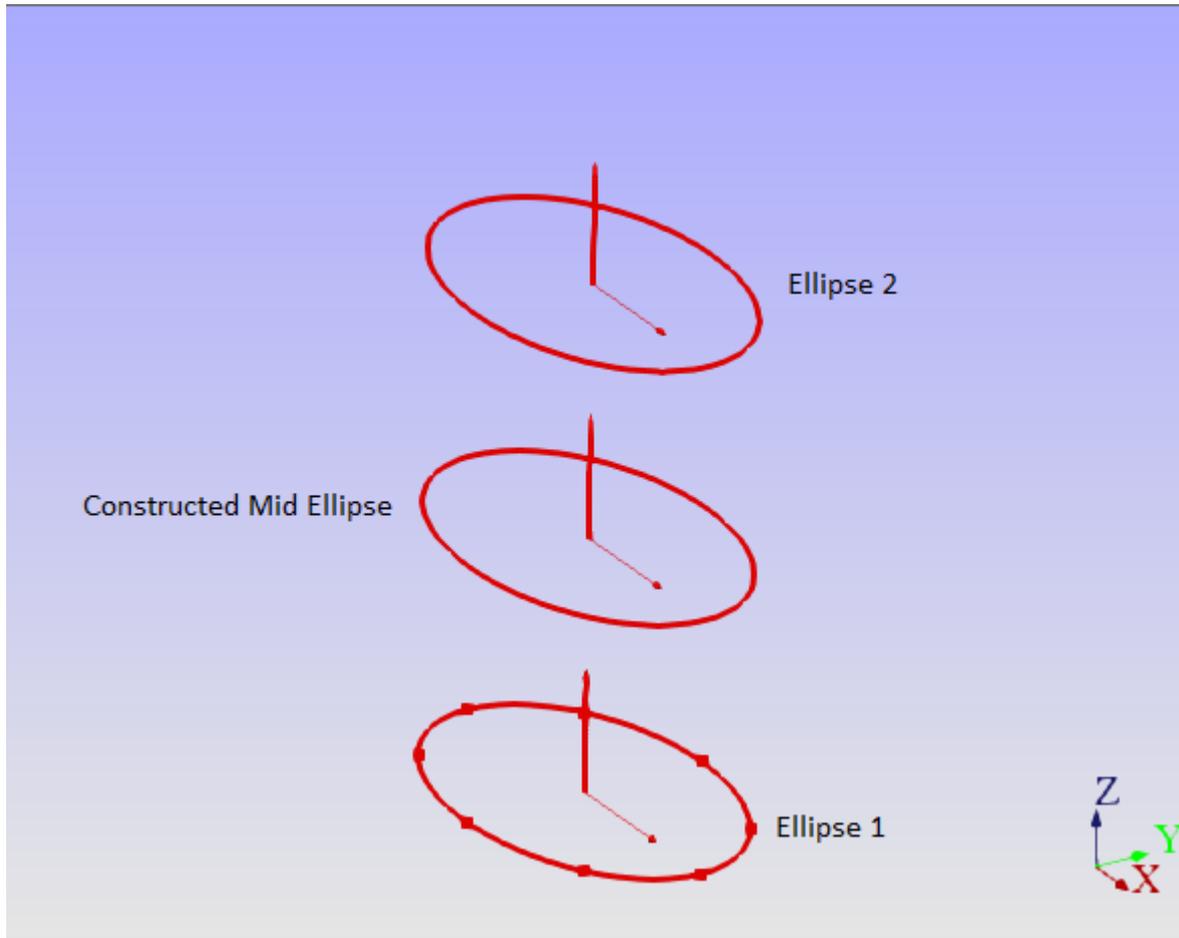


Steps to follow:

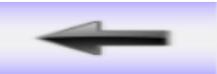
- Measure the required number of point reducible features for a bestfit ellipse. This will usually be nine features, and they will usually be points.
-  Switch to the **Construct Mode**, and choose the **Ellipse Icon**.
-  Click on **Bestfit**. Pick the features to be used for the construction of the bestfit ellipse.
-  Click on **Compute**.

Mid-Ellipse

The following is an example of how to construct a **Mid Feature** or a mid-ellipse between two existing features, such as two ellipses. This is the same logic as with other point reducible features.

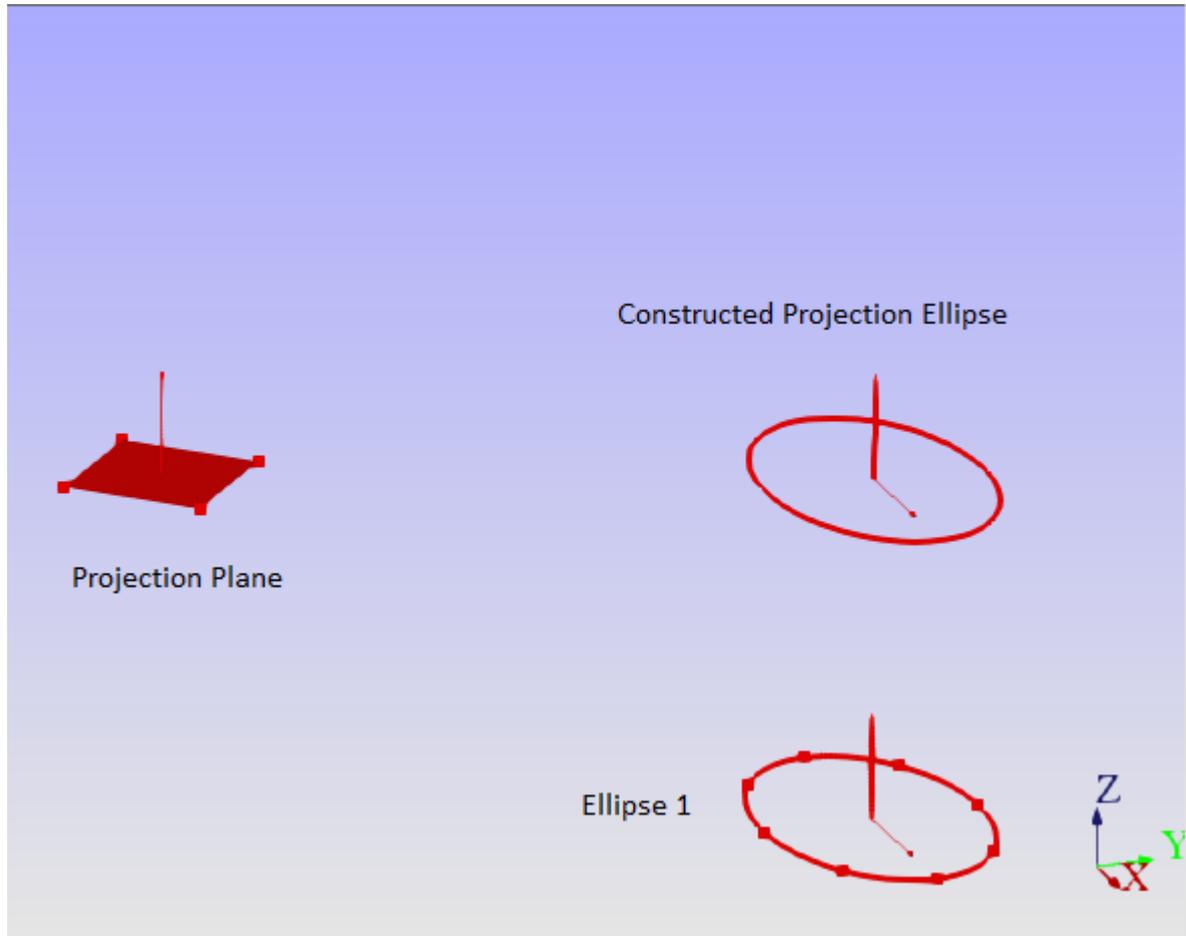


Steps to follow:

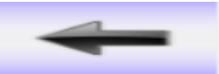
- Measure two ellipses, or have two constructed ellipses available.
-  Switch to the **Construct Mode**, and choose the **Ellipse Icon**.
-  Click on **Mid Feature**.
- Pick the two measured or constructed ellipses to construct the mid-ellipse, or mid-feature.
-  Click on **Compute**.

Project To

The following is an example of using the project feature to construct a new ellipse by projecting it onto a feature such as a plane surface.

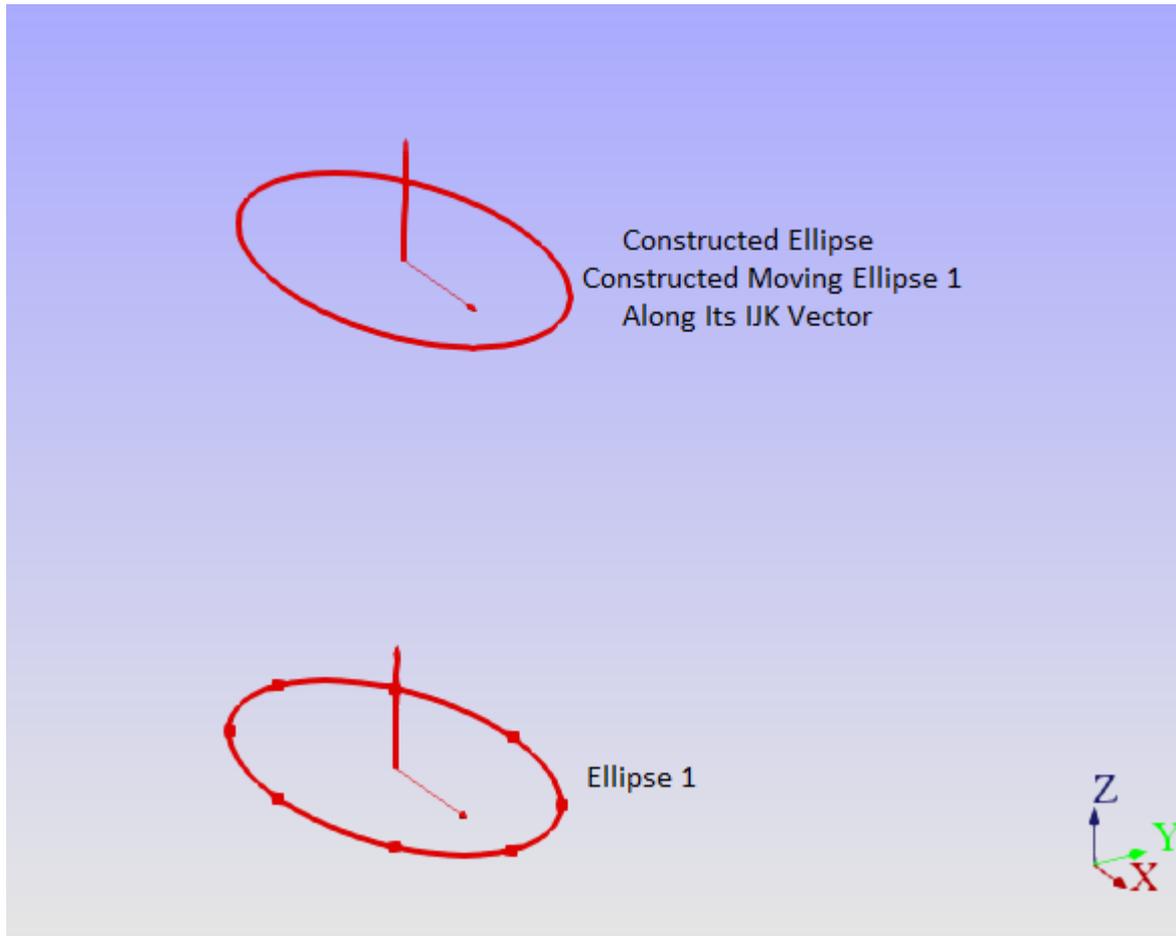


Steps to follow:

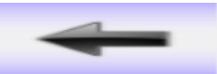
- Using an ellipse feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Ellipse Icon**.
-  Click on **Project**.
- Pick the ellipse to be projected, and also pick the feature to project it onto.
-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** method to construct an ellipse feature from a measured or existing feature, such as another ellipse.

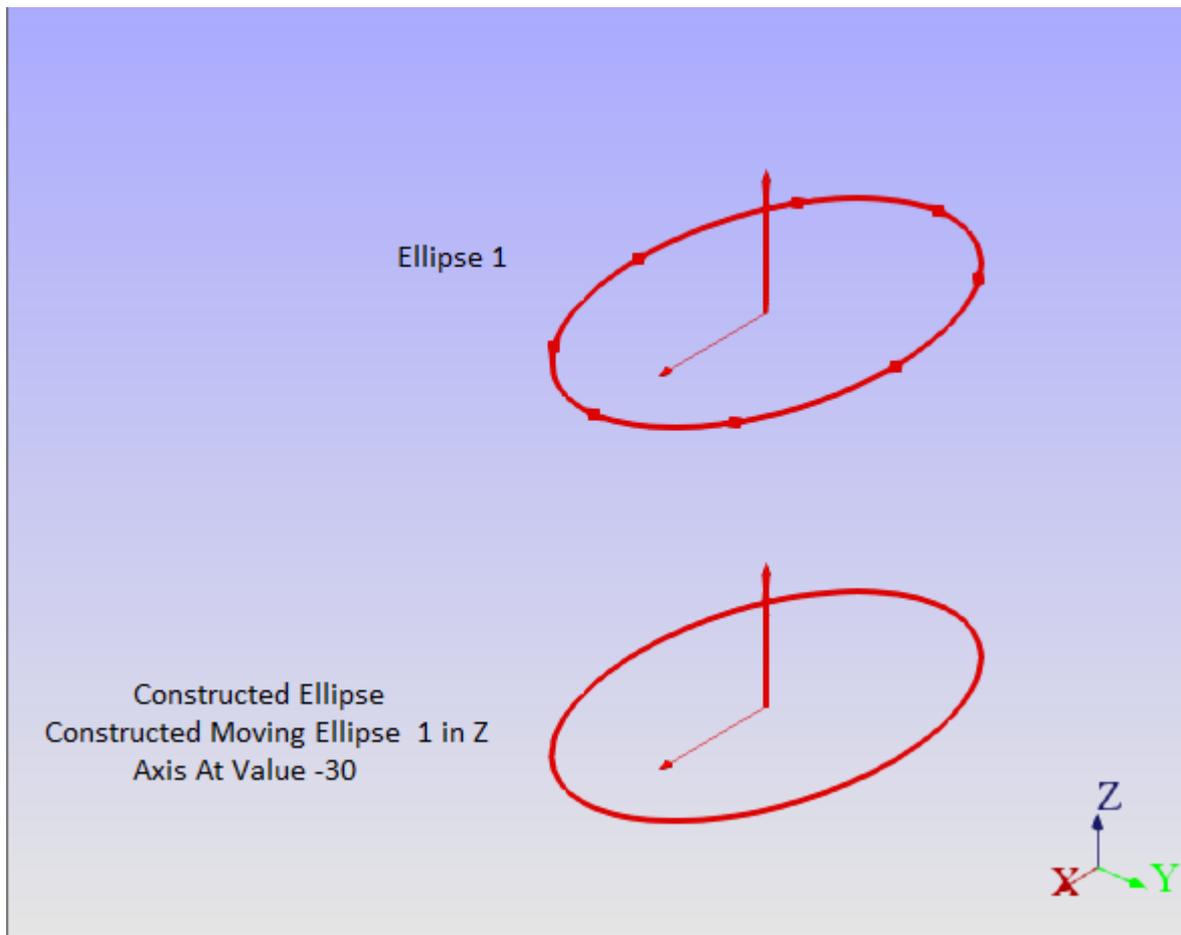


Steps to follow:

- Using an ellipse feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Ellipse Icon**.
-  Click on **Move IJK**.
- Pick the ellipse to be moved along its IJK.
-  Click on **Compute**. Type in the IJK move in the dialog box. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** method to construct an ellipse from a measured or existing feature, such as another ellipse.



Steps to follow:

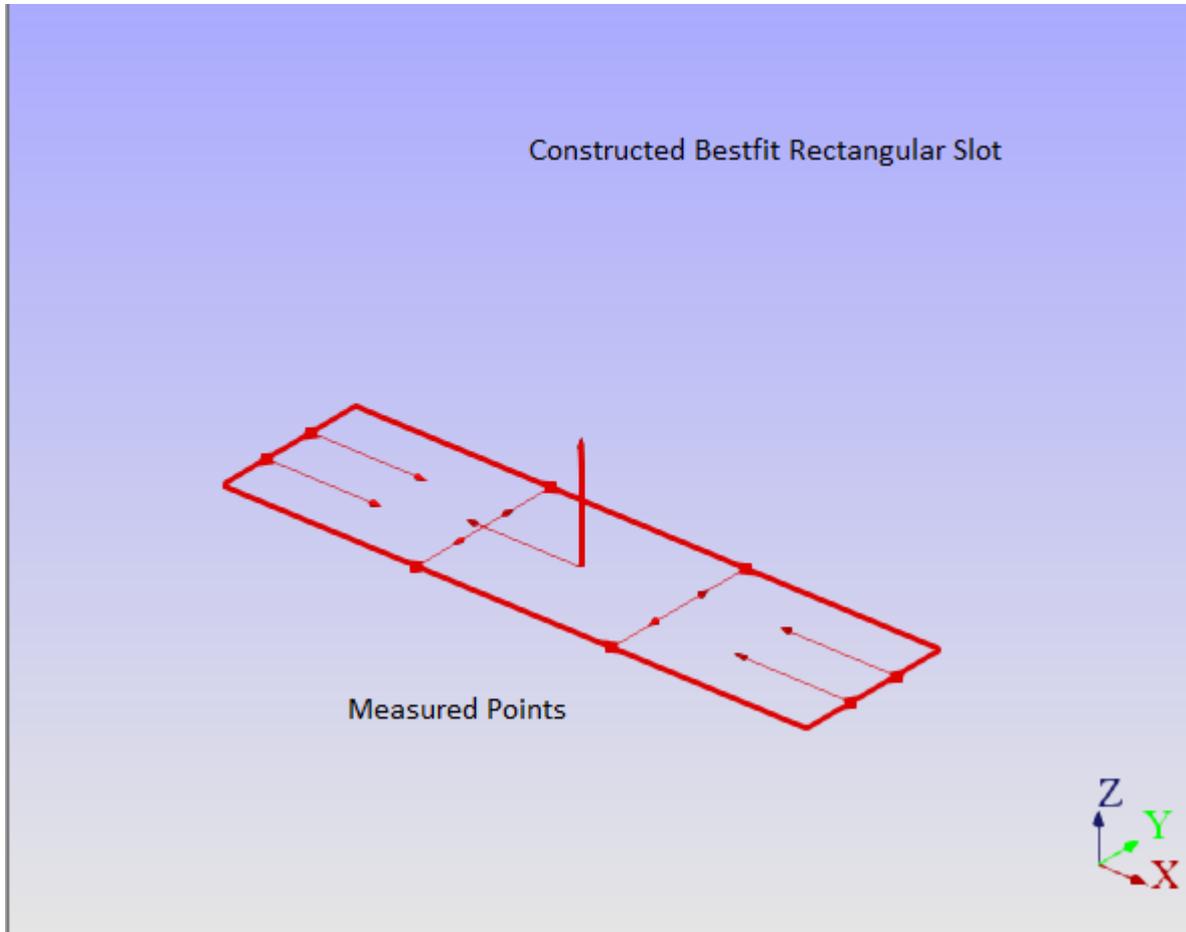
- Using an ellipse feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Ellipse Icon**.
-  Click on **Move Axis**. Pick the ellipse to be moved along its axis.
-  Click on **Compute**. Type in the axis move in the correct axis box. Click **OK**.

[Constructing Features](#)

Rectangular Slot Construction

Best Fit

The following is an example of how to use the **Bestfit** method to construct a slot feature. The example below uses points to construct a slot; this is usually a commonly accepted method.

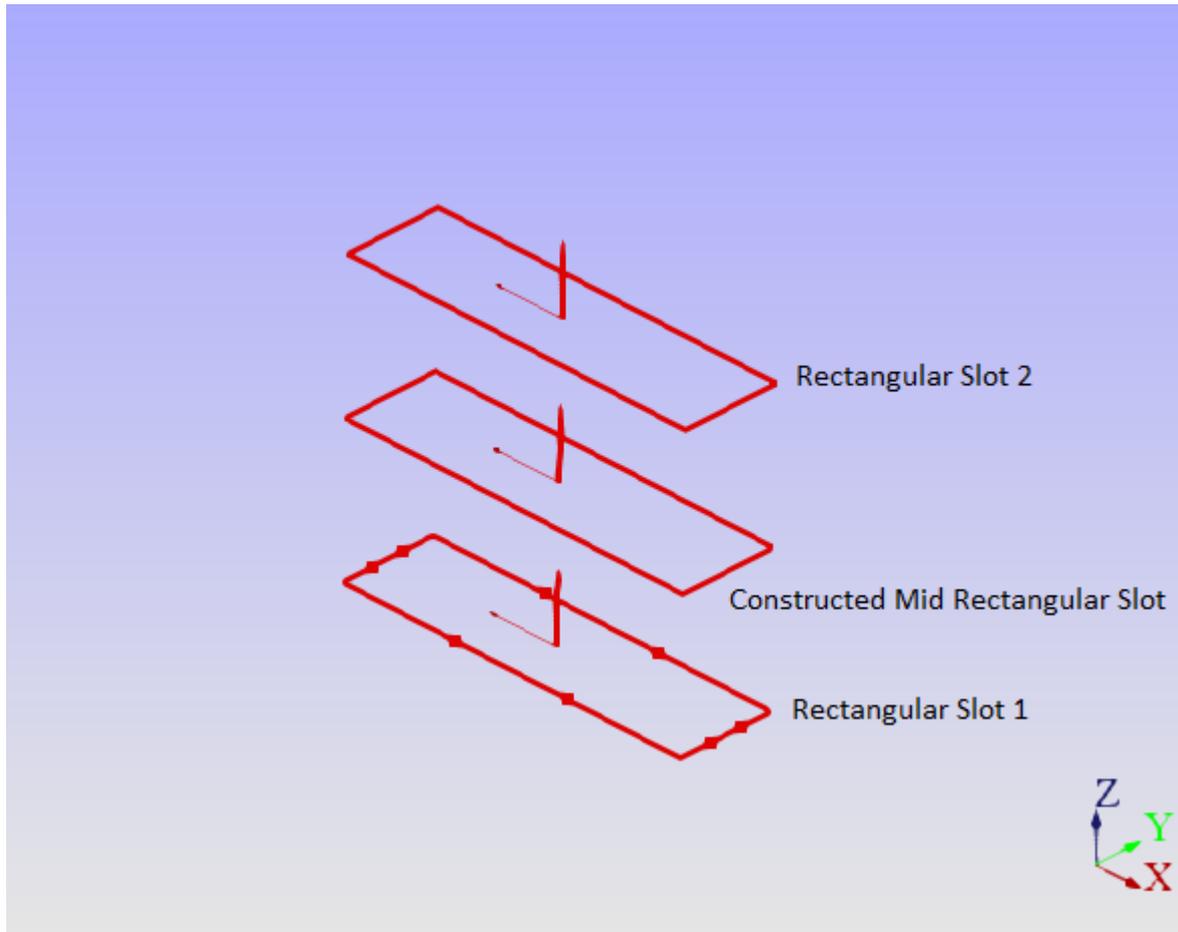


Steps to follow:

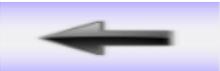
- Measure the required number of point reducible features for a bestfit slot. This will usually be nine features, and they will usually be points.
-  Switch to the **Construct Mode**, and choose the **Rectangular Slot Icon**.
-  Click on **Bestfit**. Pick the features to be used for the construction of the bestfit slot.
-  Click on **Compute**.

Mid-Slot

The following is an example of how to construct a **Mid Feature** or a mid-slot between two existing features, such as two slots. This is the same logic as with other point reducible features.

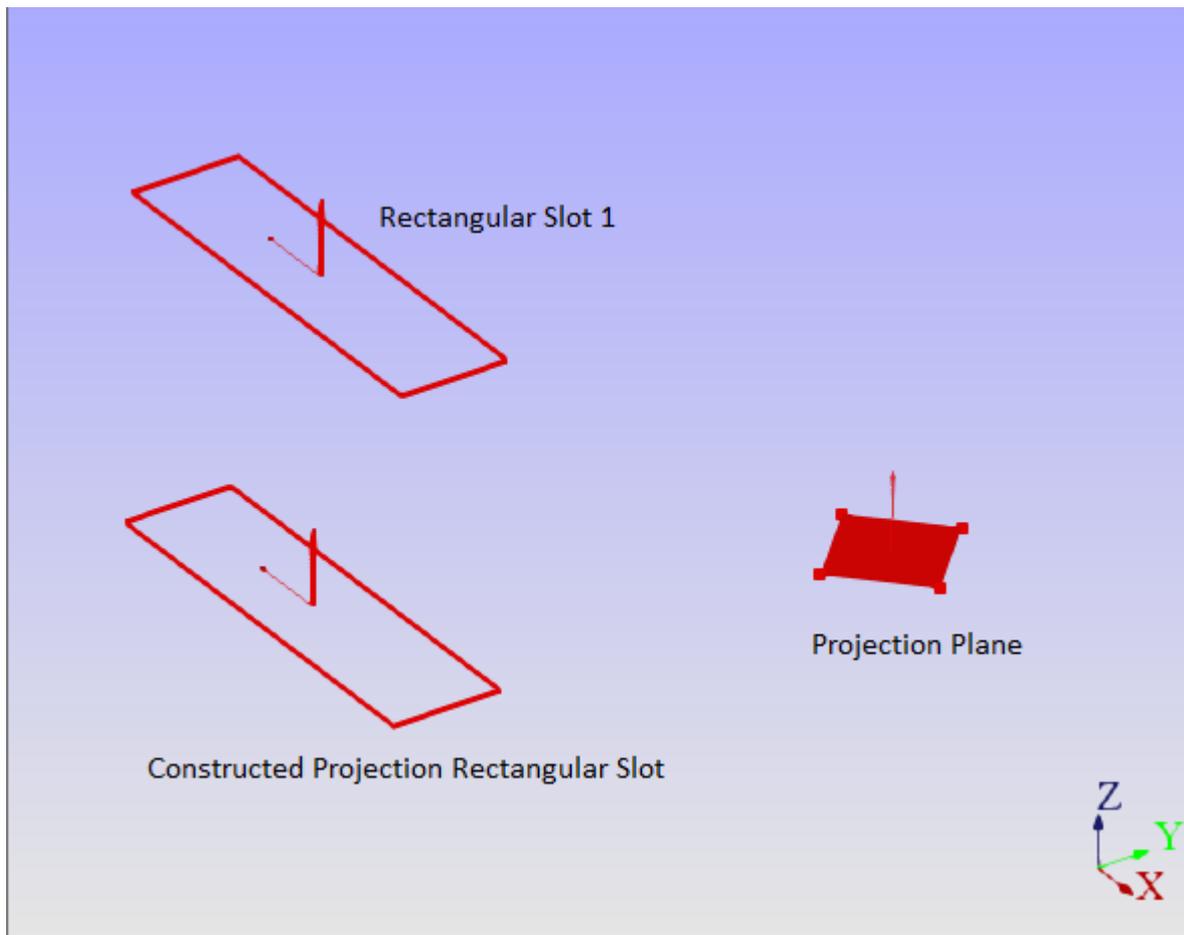


Steps to follow:

- Measure two slots, or have two constructed slots available.
-  Switch to the **Construct Mode**, and choose the **Rectangular Slot Icon**.
-  Click on **Mid Feature**.
- Pick the two measured or constructed slots to construct the mid-slot, or mid-feature.
-  Click on **Compute**.

Project To

The following is an example of using the project feature to construct a new round slot by projecting it onto a feature such as a plane surface.

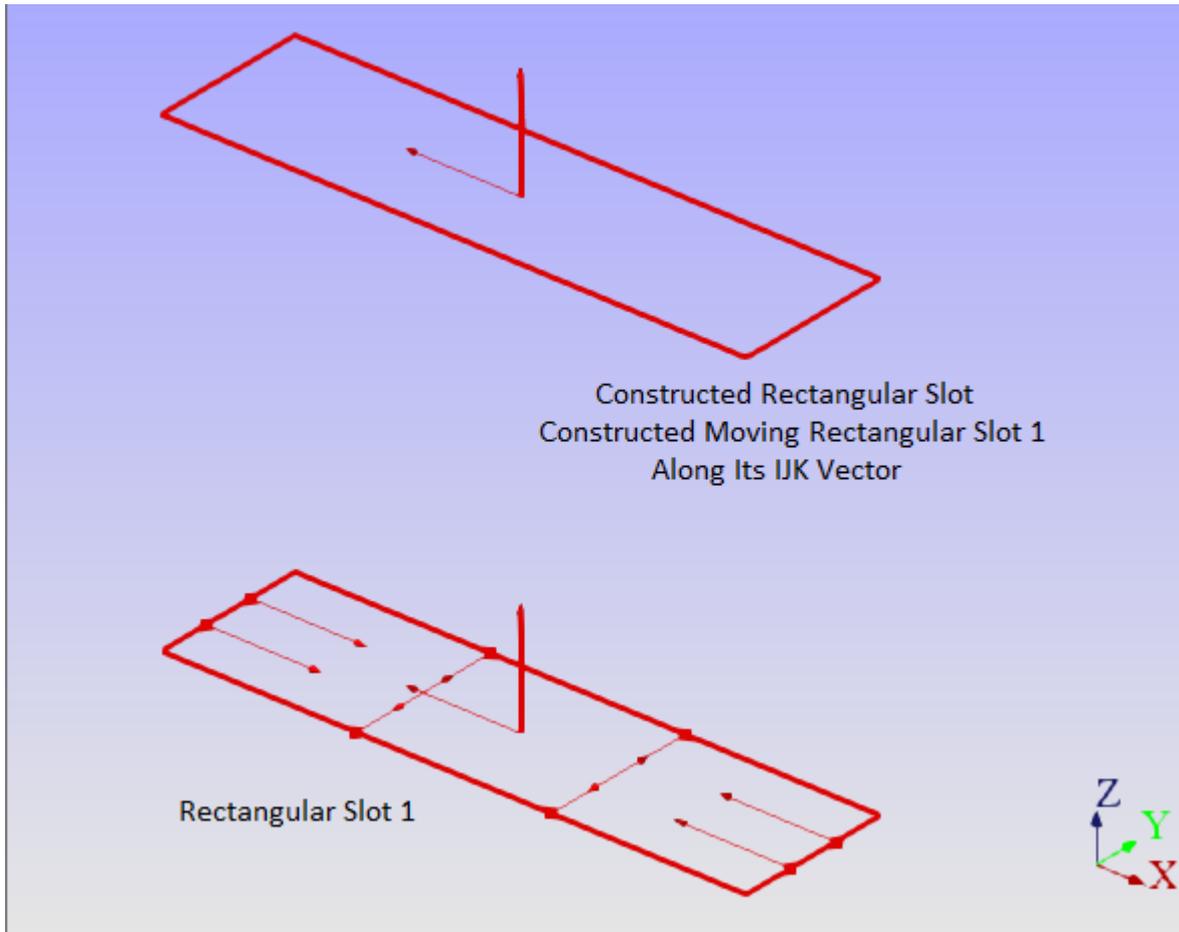


Steps to follow:

- Using a slot feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Rectangular Slot Icon**.
-  Click on **Project**.
- Pick the rectangular slot to be projected, and also pick the feature to project it onto.
-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** method to construct a slot feature from a measured or existing feature, such as another slot.

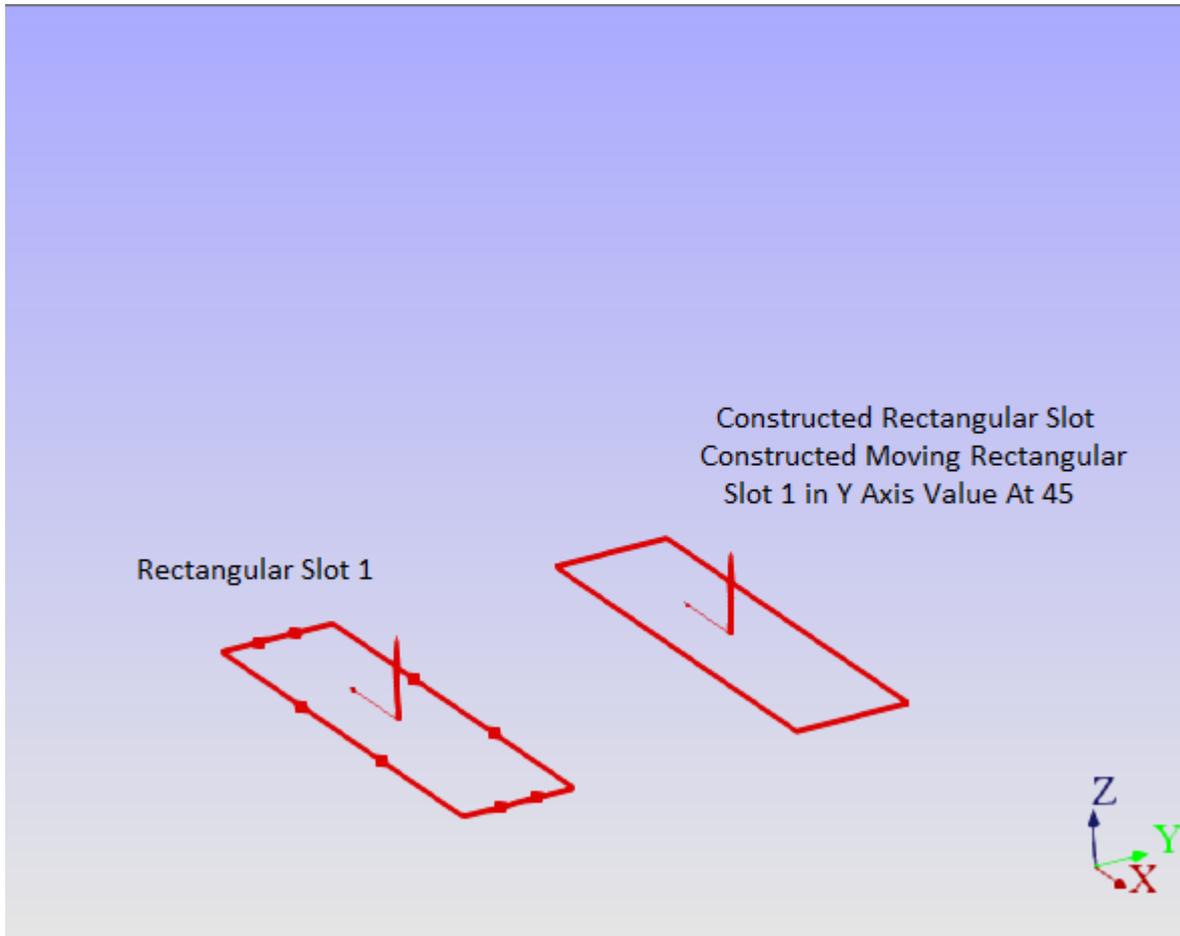


Steps to follow:

- Using a slot feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Rectangular Slot Icon**.
-  Click on **Move IJK**.
- Pick the slot to be moved along its IJK.
-  Click on **Compute**. Type in the IJK move in the dialog box. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** method to construct a slot from a measured or existing feature, such as another slot.



Steps to follow:

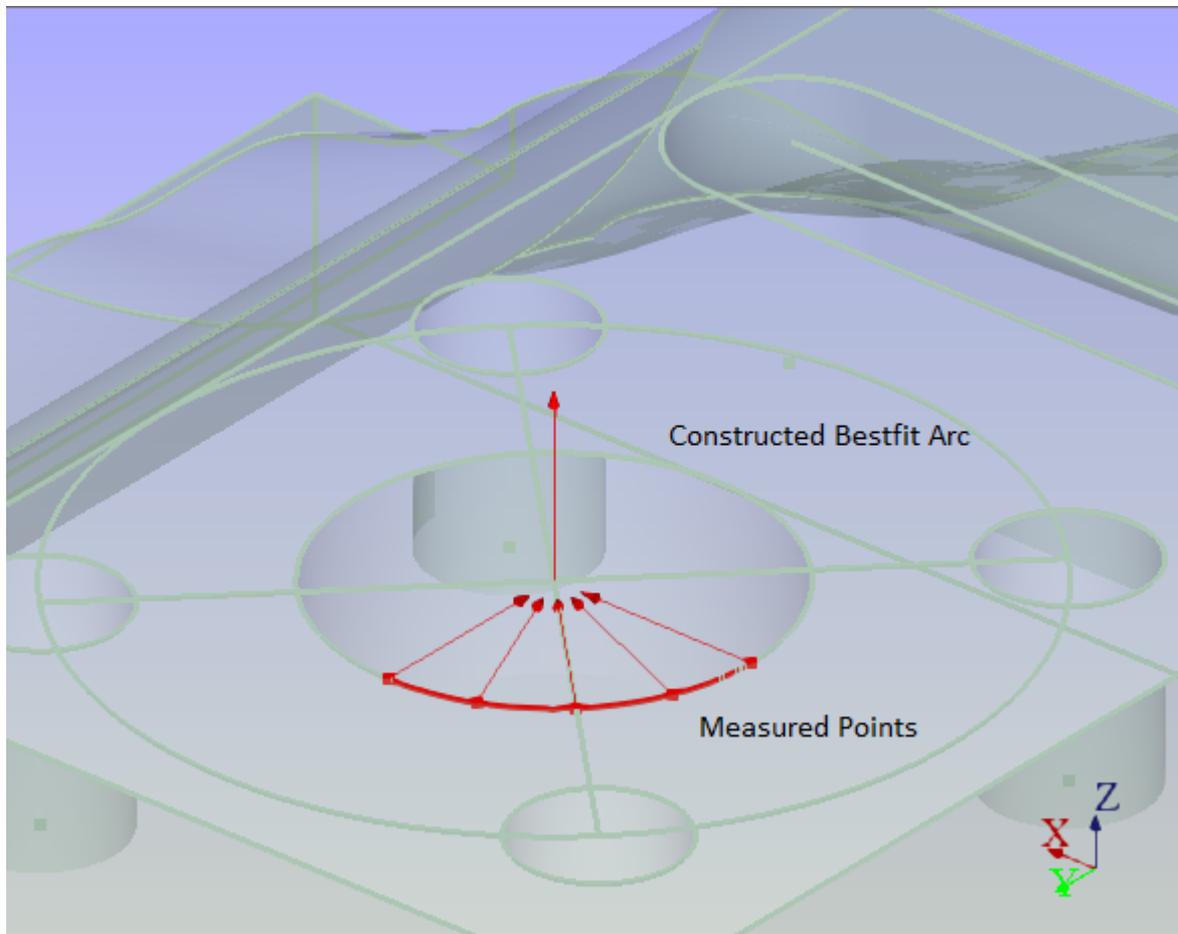
- Using a slot feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Rectangular Slot Icon**.
-  Click on **Move Axis**. Pick the slot to be moved along its axis.
-  Click on **Compute**. Type in the axis move in the correct axis box. Click **OK**.

[Constructing Features](#)

Arc Construction

Best Fit

The following is an example of how to use the **Bestfit** method to construct an arc feature. The example below uses points to construct an arc, this is usually a commonly accepted method.

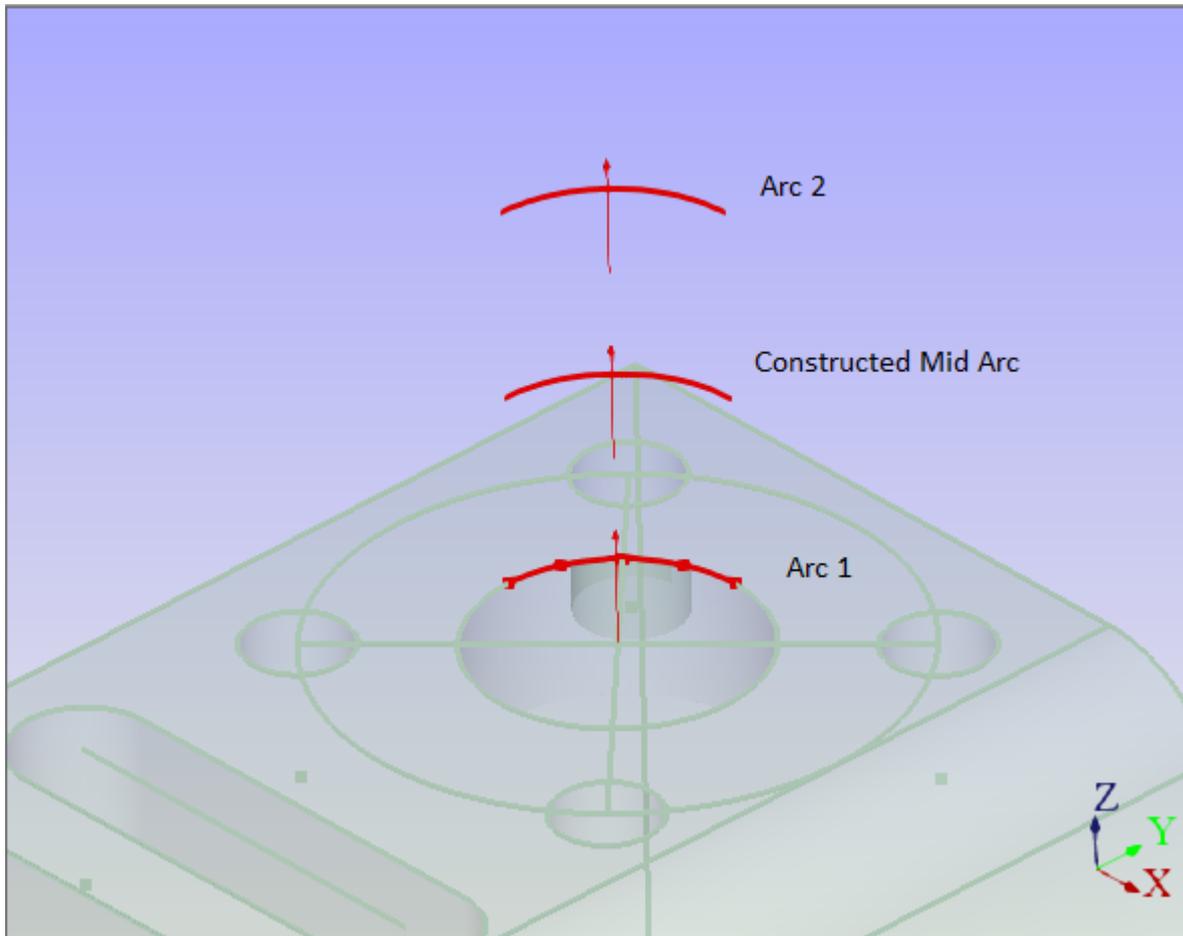


Steps to follow:

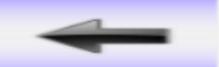
- Measure the required number of point reducible features for a bestfit arc. This will usually be three features, and they will usually be points.
-  Switch to the **Construct Mode**, and choose the **Arc Icon**.
-  Click on **Bestfit**. Pick the features to be used for the construction of the bestfit arc.
-  Click on **Compute**.

Mid-Arc

The following is an example of how to construct a **Mid Feature** or a mid-arc between two existing features, such as two arcs. This is the same logic as with other point reducible features.

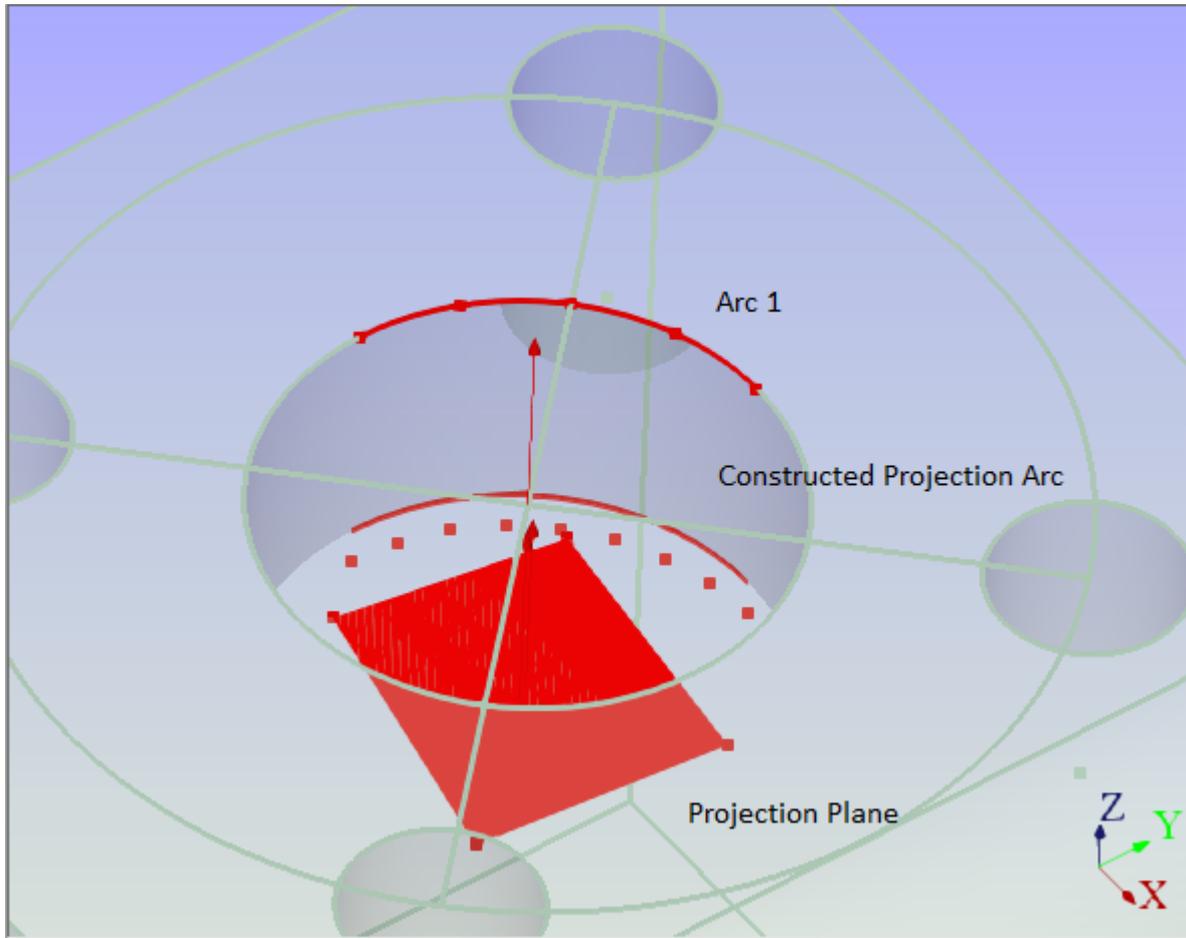


Steps to follow:

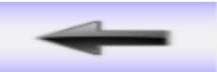
- Measure two arcs, or have two constructed arcs available.
-  Switch to the **Construct Mode**, and choose the **Arc Icon**.
-  Click on **Mid Feature**.
- Pick the two measured or constructed arcs to construct the mid-arc, or mid-feature.
-  Click on **Compute**.

Project To

The following is an example of using the project feature to construct a new arc by projecting it onto a feature such as a plane surface.

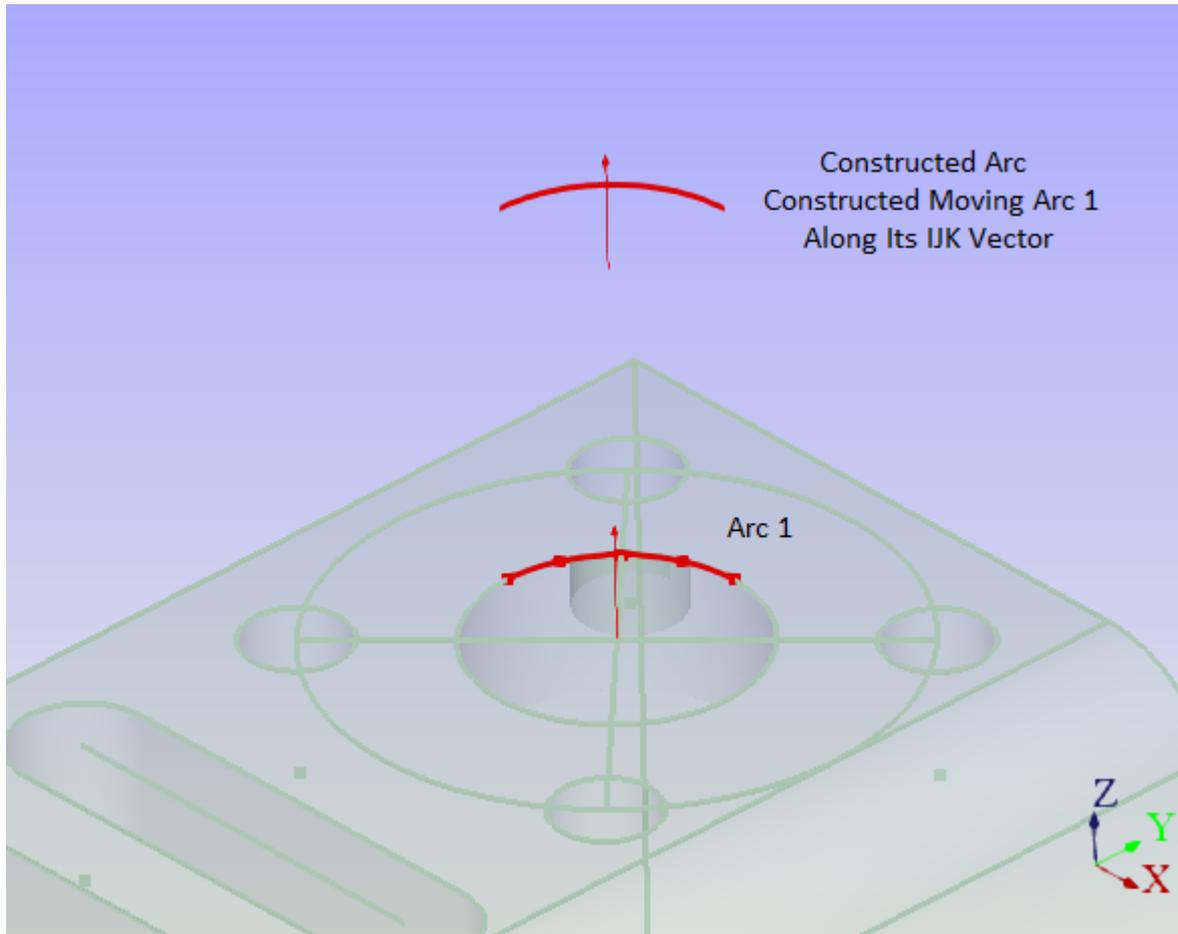


Steps to follow:

- Using an arc feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Arc Icon**.
-  Click on **Project**.
- Pick the arc to be projected, and also pick the feature to project it onto.
-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** method to construct an arc feature from a measured or existing feature, such as another arc.

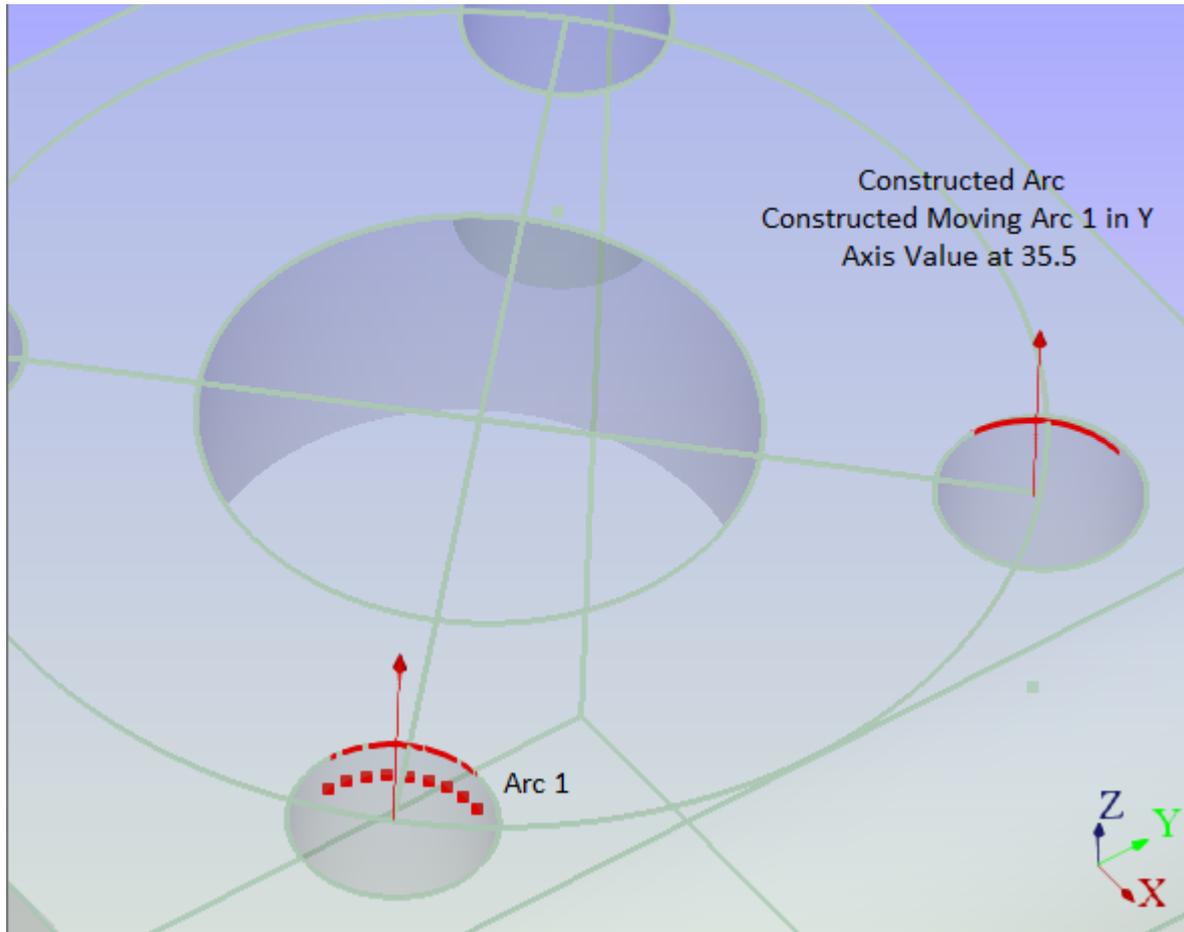


Steps to follow:

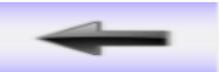
- Using an arc feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Arc Icon**.
-  Click on **Move IJK**.
- Pick the arc to be moved along its IJK.
-  Click on **Compute**. Type in the IJK move in the dialog box. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** method to construct an arc feature from a measured or existing feature, such as another arc.



Steps to follow:

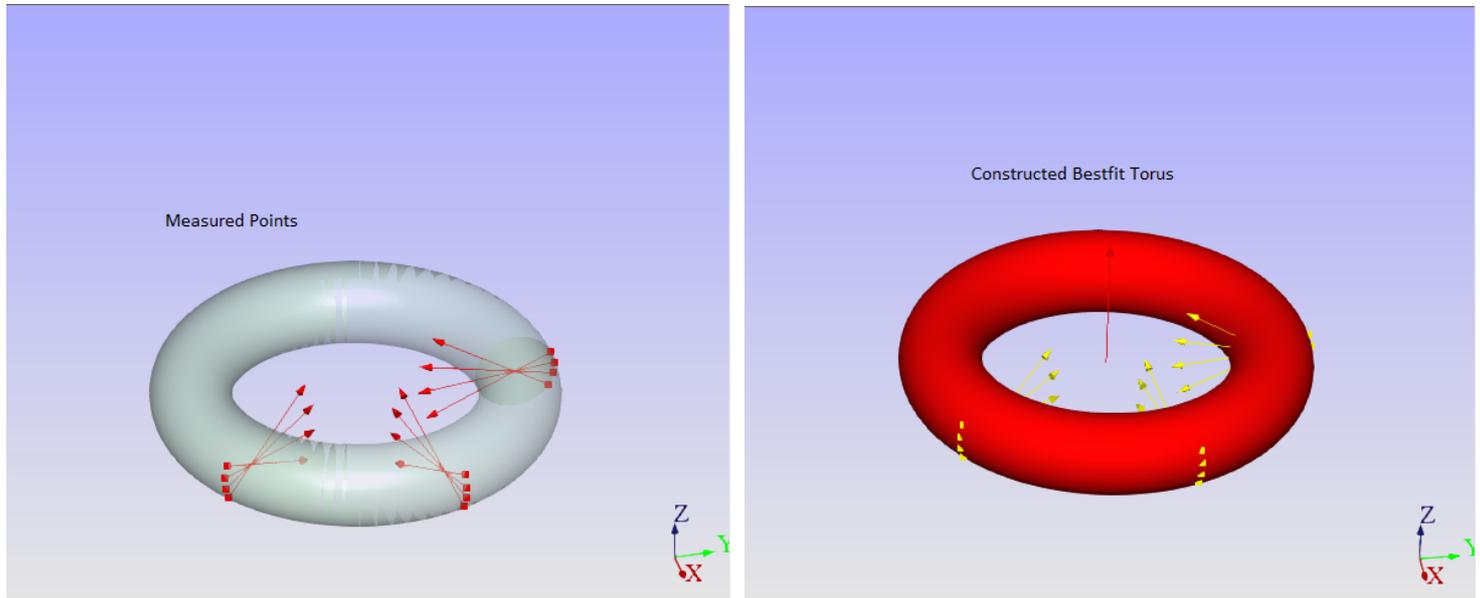
- Using an arc feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Arc Icon**.
-  Click on **Move Axis**. Pick the arc to be moved along its axis.
-  Click on **Compute**. Type in the axis move in the correct axis box. Click **OK**.

[Constructing Features](#)

Torus Construction

Best Fit

The following is an example of how to use the **Bestfit** method to construct a torus feature. The example below uses points to construct a torus; this is usually a commonly accepted method.

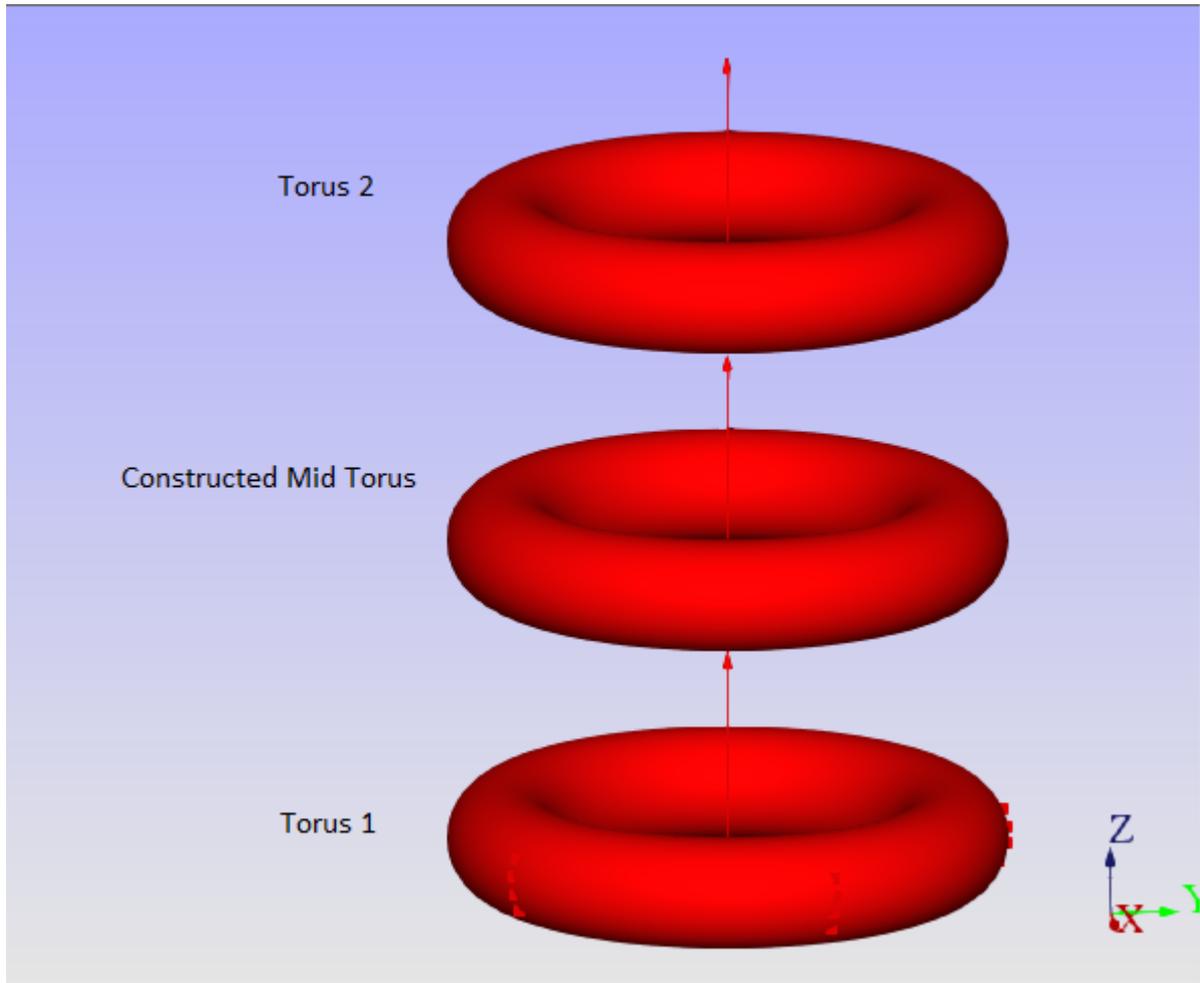


Steps to follow:

- Measure the required number of point reducible features for a bestfit torus. This will usually be a minimum of nine features, and they will usually be points. More than 9 features is allowed.
-  Switch to the **Construct Mode**, and choose the **Torus Icon**.
-  Click on **Bestfit**.
- Pick the features to be used for the construction of the bestfit slot. Minimum of 9 points must be from 3 cross sections, 3 points per cross section. If any additional points are used, order is irrelevant.
-  Click on **Compute**.

Mid-Torus

The following is an example of how to construct a **Mid Feature** or a mid-torus between two existing features, such as two tori. This is the same logic as with other point reducible features.

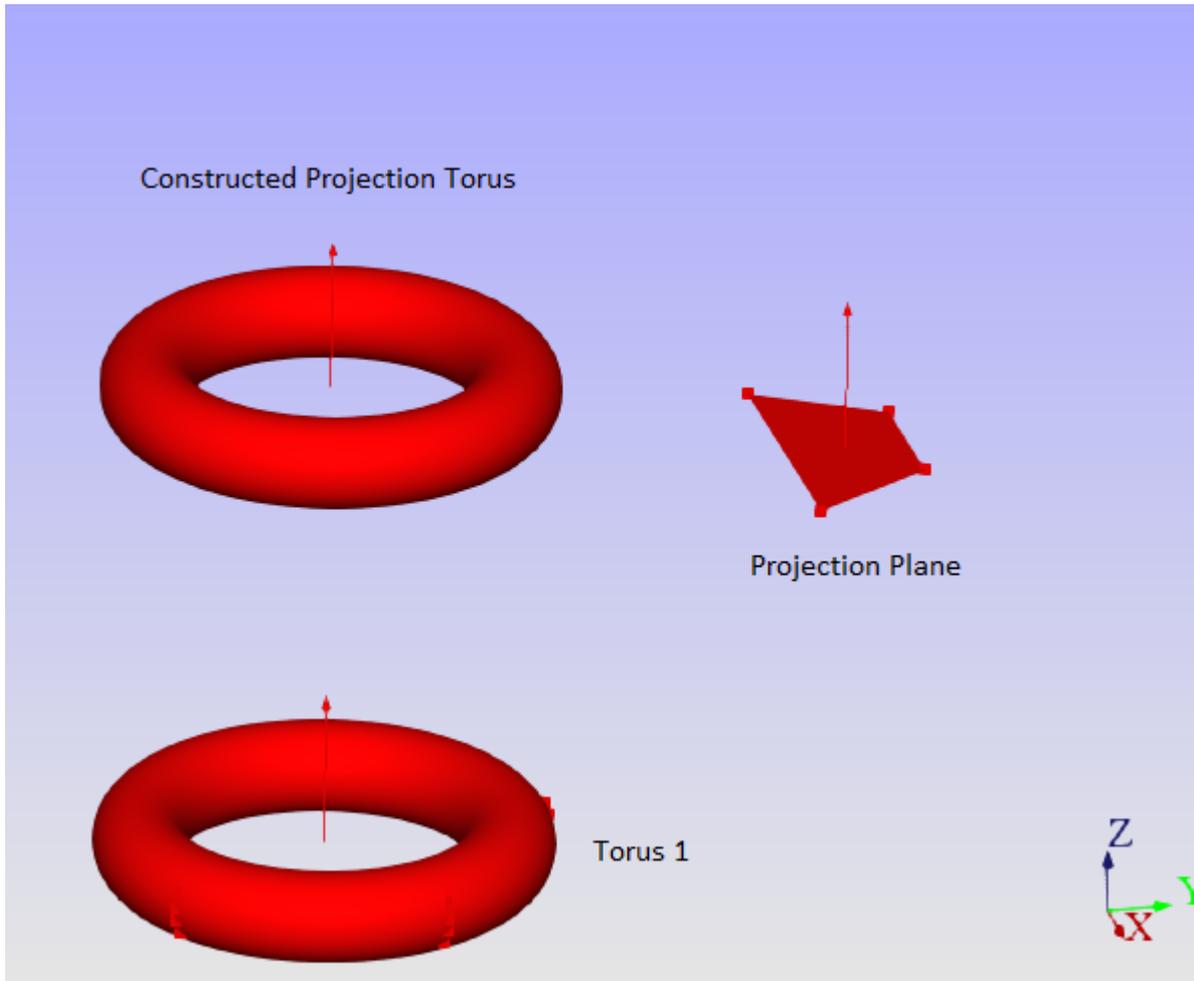


Steps to follow:

- Measure two tori, or have two constructed tori available.
-  Switch to the **Construct Mode**, and choose the **Torus Icon**.
-  Click on **Mid Feature**.
- Pick the two measured or constructed tori to construct the mid-torus, or mid-feature.
-  Click on **Compute**.

Project To

The following is an example of using the project feature to construct a new torus by projecting it onto a feature such as a plane surface.



Steps to follow:

- Using a torus feature that already exists, whether measured or constructed.

-  Switch to the **Construct Mode**, and choose the **Torus Icon**.

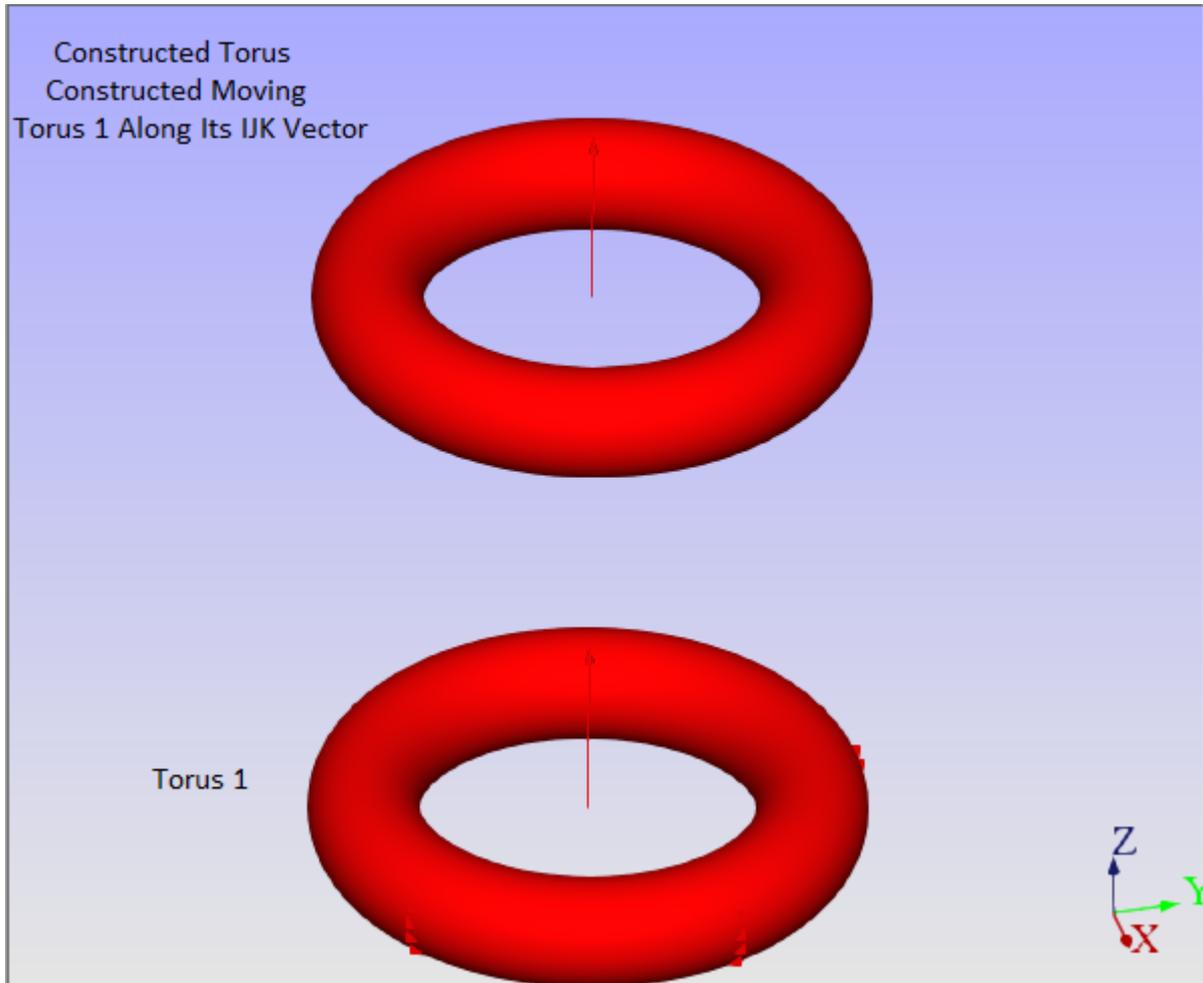
-  Click on **Project**.

- Pick the torus to be projected, and also pick the feature to project it onto.

-  Click on **Compute**.

Move IJK

The following is an example of how to use the **Move IJK** method to construct a torus feature from a measured or existing feature, such as another torus.

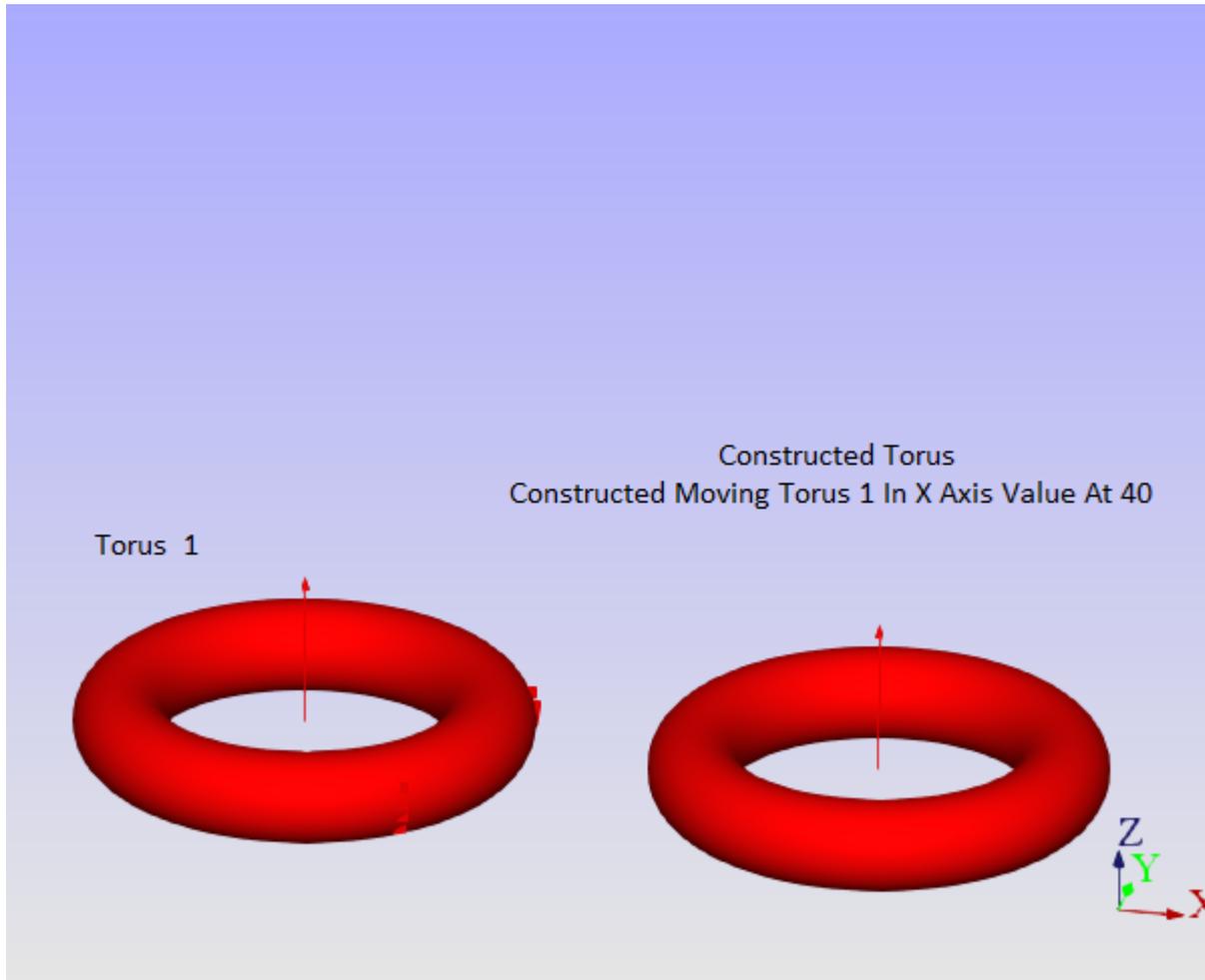


Steps to follow:

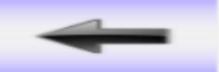
- Using a torus feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Torus Icon**.
-  Click on **Move IJK**.
- Pick the torus to be moved along its IJK.
-  Click on **Compute**. Type in the IJK move in the dialog box. Click **OK**.

Move Axis

The following is an example of how to use the **Move Axis** method to construct a torus feature from a measured or existing feature, such as another torus.



Steps to follow:

- Using a torus feature that already exists, whether measured or constructed.
-  Switch to the **Construct Mode**, and choose the **Torus Icon**.
-  Click on **Move Axis**. Pick the torus to be moved along its axis.
-  Click on **Compute**. Type in the axis move in the correct axis box. Click **OK**.

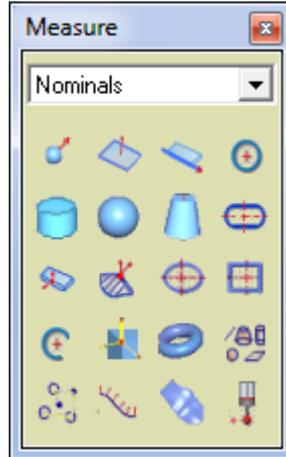
[Constructing Features](#)

Creating Nominal Data

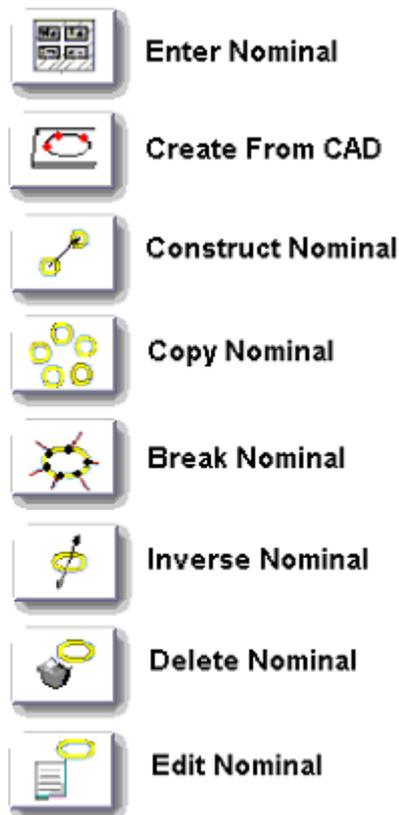
The purpose of Nominal Data is to define feature definitions. CAPPS DMIS allows the user to define most types of common geometrical features in order to create a measurement program. Each nominal that is defined will be stored in an internal database that will be tied to the parent program or it may be used separately. The nominal data may also be exported as text for use by another CMM running CAPPS DMIS or even another CMM that is able to read in standard text data.

Nominals Mode

In order to create Nominal Data of any feature type, make sure that **Nominals Mode** is selected on the measurement toolbar as shown in the following figure.



Create Nominal Feature Dialog Description



Enter Nominal:	Allows user to enter nominal feature specifications manually.
Create From CAD:	Allows user to create nominal features from CAD entities.
Construct Nominal:	Constructs a nominal feature using existing features.
Copy Nominal:	Copies an existing nominal feature to a user defined location and position.
Break Nominal:	Breaks nominal feature into points.
Inverse Nominal:	Inverses the nominal vector direction.
Delete Nominal:	Deletes the nominal feature.
Edit Nominal:	Edits the specifications of the nominal feature.

Nominal Feature Definitions

Nominal feature data may be entered manually in CAPPS DMIS. This means that CAD data may or may not have been supplied for the inspection. This applies to all types of geometrical features. Certain information must be known about the element when using the Enter function in the Nominal feature dialog box.

Entering Nominal Data in CAPPS DMIS

For each geometrical feature, certain information must be known. X,Y,Z and I,J,K data is important in describing the feature. In the case of circular features, diametrical information is important to know also.

- Change to **Nominals Mode**
- Click desired feature definition, in this case POINT
- Type in the appropriate information to define the feature

MAKE NOMINAL - (POINT)

Label: PT1

Coordinates:

X: 65.00

Y: 35.0

Z: 62.5

Vector:

I: 0.000

J: 0.000

K: 1.000

OK Cancel

Point:	Needs X, Y, Z, I, J, K
Plane:	Needs X, Y, Z, I, J, K
Line:	Needs X, Y, Z, (I, J, K approach), (I, J, K direction)
Circle:	Needs X, Y, Z, I, J, K, D (Diameter)
Cylinder:	Needs X, Y, Z, (Top or Bottom) I, J, K, D (Diameter), length
Cone:	Needs X, Y, Z, (Apex) X, Y, Z, (Small Base Center), Diameter, Length
Sphere:	Needs X, Y, Z, I, J, K, D (Diameter)
Slot (Both Round & Rectangular):	Needs X, Y, Z, (I, J, K approach), (I, J, K direction), Length, Width
Edge Point:	Needs X, Y, Z, (I, J, K sampling), (I, J, K second surface)
Angle Point:	Needs X, Y, Z, (I, J, K sampling), (I, J, K second surface)
Corner Point:	Needs X, Y, Z, (I, J, K sampling), (I, J, K second surface), (I, J, K third surface)
Ellipse:	Needs X, Y, Z, (I, J, K approach), (I, J, K major axis direction), Major Diameter, Minor Diameter
Arc:	Needs X, Y, Z, I, J, K, Radius, Start Angle , End Angle
Torus:	Needs X, Y, Z, (I, J, K approach), Rotation Radius, Cross Section Radius.

Entering Nominal Data Using a Text Editor

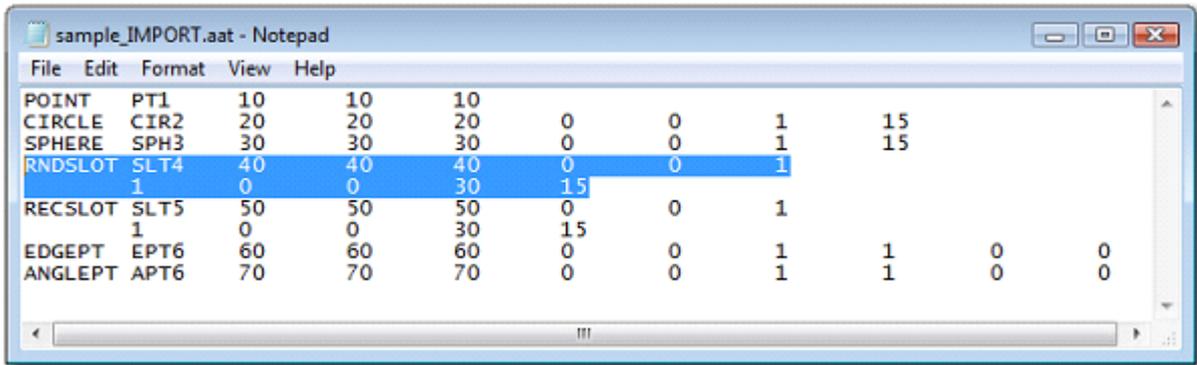
A different way of entering data for creating nominals is through the use of a text editor. This could be notepad, word pad or something similar. It is also possible to use such applications as Microsoft Excel to enter data that may be imported into CAPPs DMIS and be displayed as nominal data. This option works only when used for point reducible features.

The format for the data should be as follows:

Points	Feature Type, Label Name, X, Y, Z, I, J, K
Circles	Feature Type, Label Name, X, Y, Z, I, J, K, D (Diameter)
Round Slots	Feature Type, Label Name, X, Y, Z, I, J, K, I, J, K, L, W
Square Slots	Feature Type, Label Name, X, Y, Z, I, J, K, I, J, K, L, W
Spheres	Feature Type, Label Name, X, Y, Z, I, J, K, D
Edge Point	Feature Type, Label Name, X, Y, Z, I, J, K, I, J, K
Angle Points	Feature Type, Label Name, X, Y, Z, I, J, K, I, J, K

Feature types should be defined exactly as stated below.

Important Note: For **Round Slot** and **Rectangular Slot** features; **Second IJK**, **Length** and **Width** must be on secondary line as shown below:



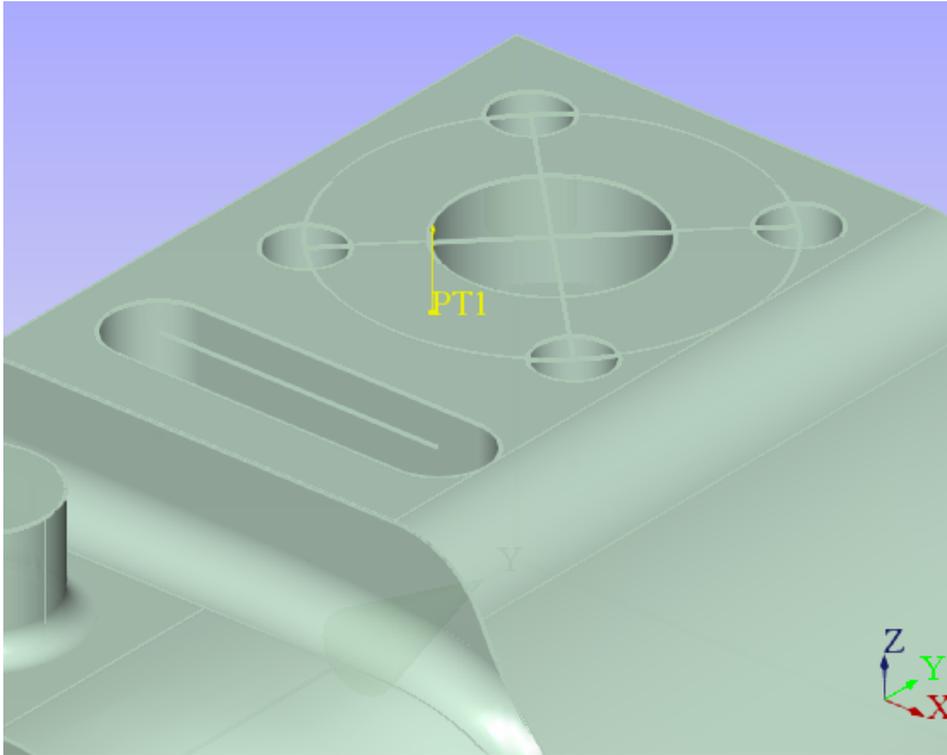
The screenshot shows a Notepad window titled 'sample_IMPORT.aat'. The window contains a table with the following data:

File	Edit	Format	View	Help							
POINT	PT1	10	10	10							
CIRCLE	CIR2	20	20	20	0	0	1		15		
SPHERE	SPH3	30	30	30	0	0	1		15		
RNDSLOT	SLT4	40	40	40	0	0	1				
	1	0	0	30	15						
RECSLOT	SLT5	50	50	50	0	0	1				
	1	0	0	30	15						
EDGEPT	EPT6	60	60	60	0	0	1	1	0	0	
ANGLEPT	APT6	70	70	70	0	0	1	1	0	0	

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Creating Nominal Entities From CAD

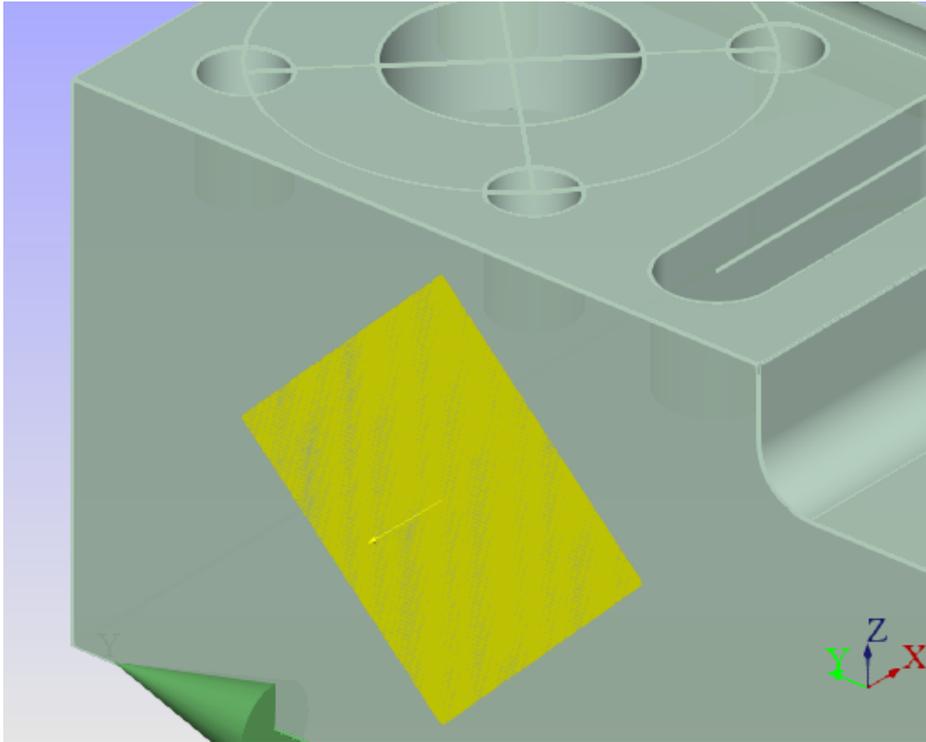
Point



Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Click on the **Point Icon**. 
- Click on the **Create from CAD** button. 
- Click an area of the CAD surface model

Plane



Steps to Follow:

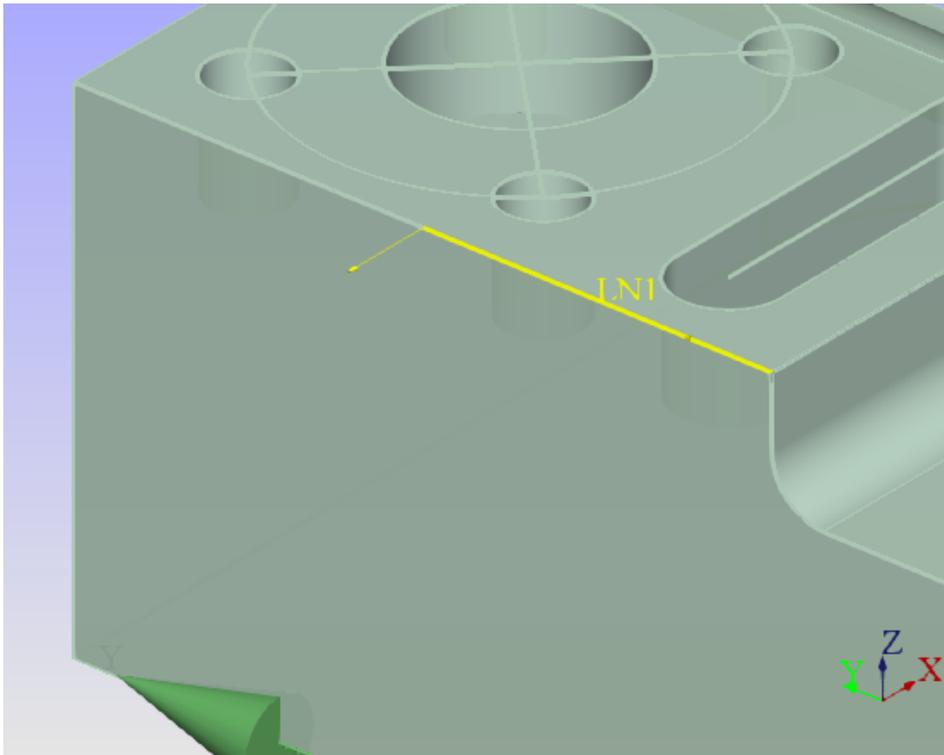
- Switch **Measure Toolbar** to [Nominals Mode](#).

- Click on the **Plane Icon**. 

- Click on the **Create from CAD** button. 

- Click an area of the CAD surface model. If one click is not enough to define the plane, simply click 2 additional points and the nominal plane will appear.

Line



Steps to Follow:

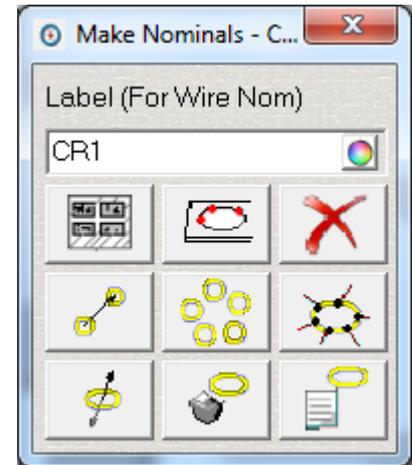
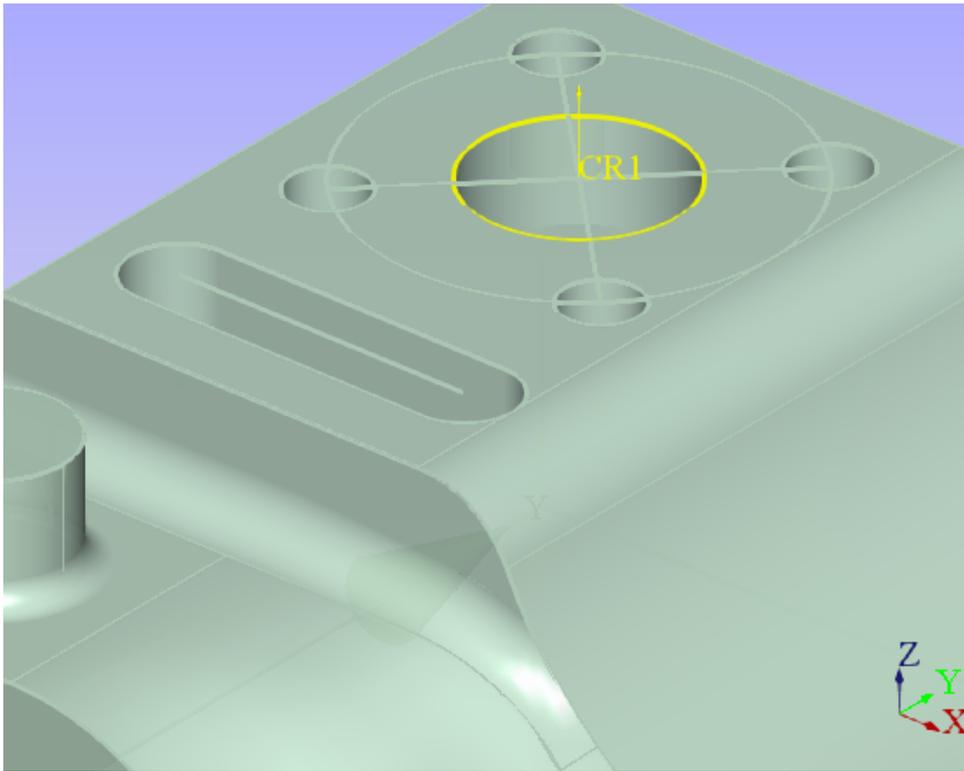
- Switch **Measure Toolbar** to [Nominals Mode](#).

- Click on the **Line Icon**. 

- Click on the **Create from CAD** button. 

- Click an area of the CAD surface model. If one click is not enough to define the Line, simply click 1 additional points and the nominal Line will appear.

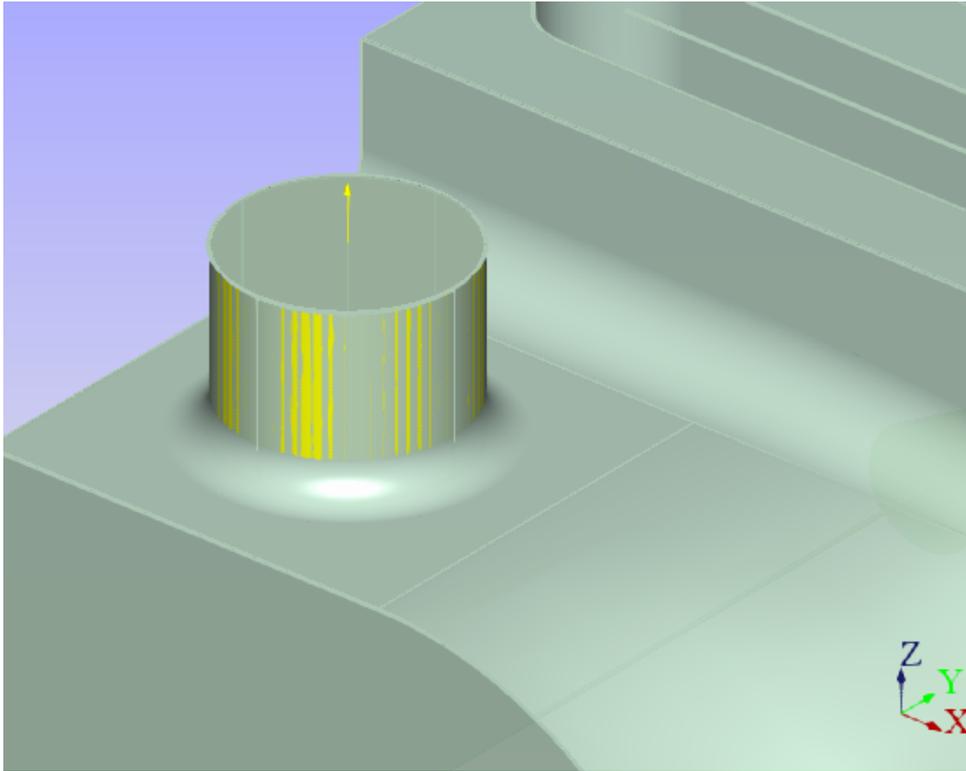
Circle



Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Click on the **Circle Icon**. 
- Click on the **Create from CAD** button. 
- Click an area of the CAD surface model near the circle entity of the CAD. If one click is not enough to define the Line, simply click 2 additional points and the nominal Circle will appear.

Cylinder



Steps to Follow:

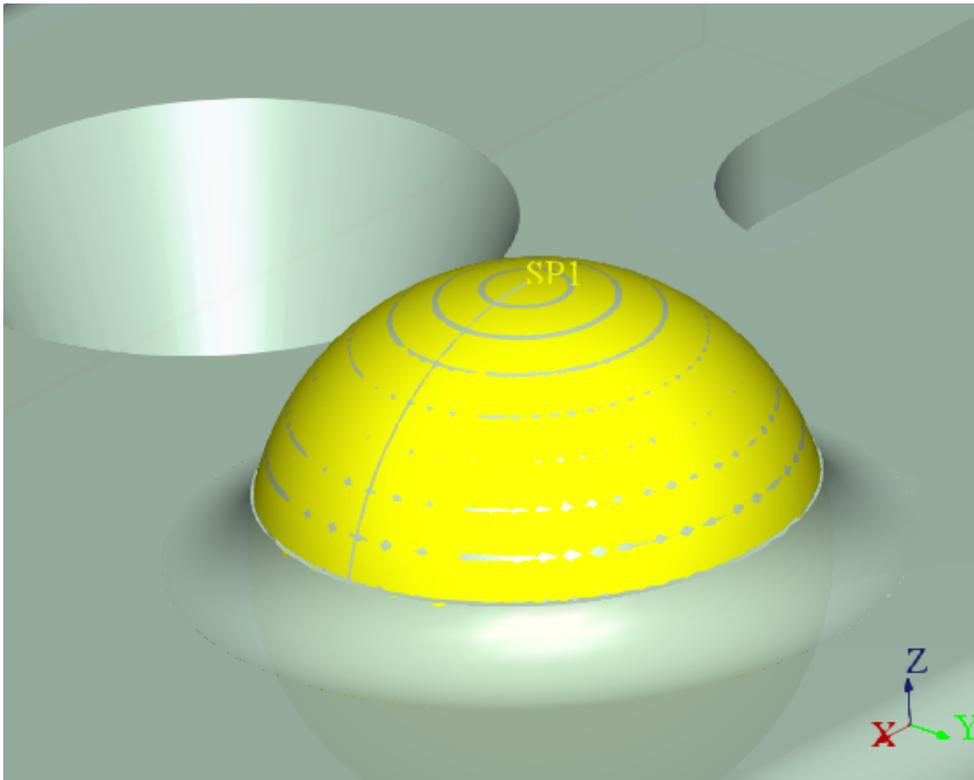
- Switch **Measure Toolbar** to [Nominals Mode](#).

Click on the **Cylinder Icon**. 

-  Click on the **Create from CAD** button.

- Click an area of the CAD surface model near one end of the Cylinder entity of the CAD. If one click is not enough to define the Cylinder, simply click 1 additional point at the opposite end and the nominal Cylinder will appear. In extreme cases, it may be necessary to click 6 points to define the Cylinder, three near one end and 3 near the opposite end.

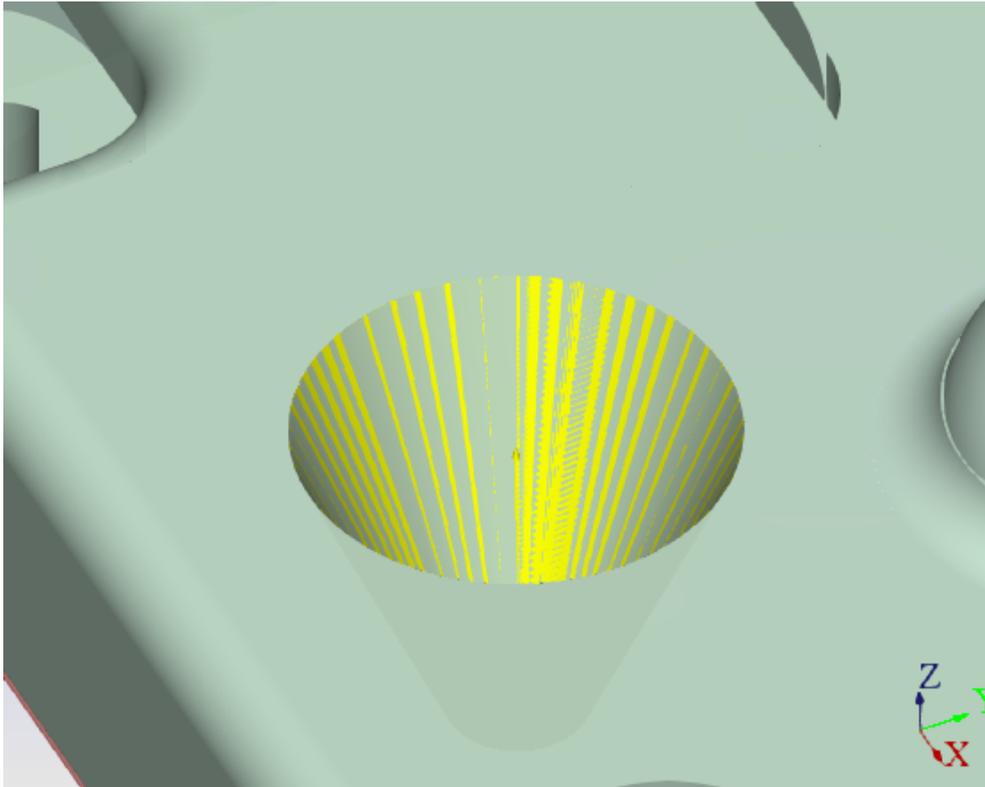
Sphere



Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Click on the **Sphere Icon**. 
- Click on the **Create from CAD** button. 
- Click an area of the CAD surface model on the Sphere entity of the CAD. If one click is not enough to define the Line, simply click 3 additional points evenly spread on the sphere and the nominal Sphere will appear.

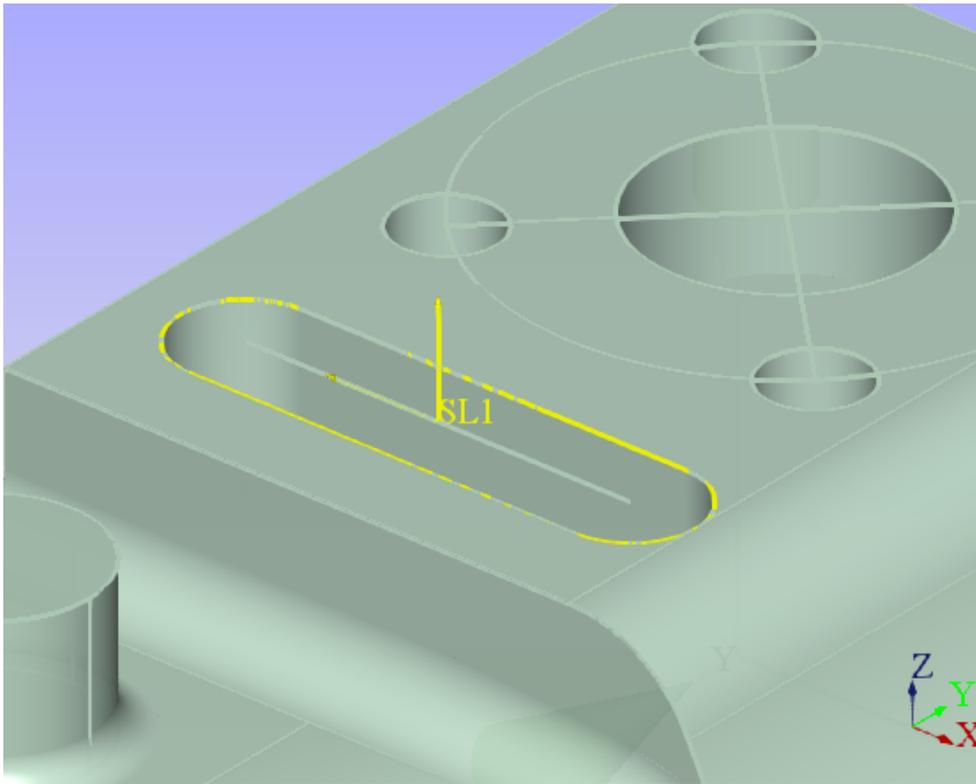
Cone



Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Click on the **Cone Icon**. 
- Click on the **Create from CAD** button. 
- Click an area of the CAD surface model near one end of the Cone entity of the CAD. If one click is not enough to define the Cone, simply click 1 additional point at the opposite end and the nominal Cone will appear. In extreme cases, it may be necessary to click 6 points to define the Cone, three near one end and 3 near the opposite end.

Round Slot



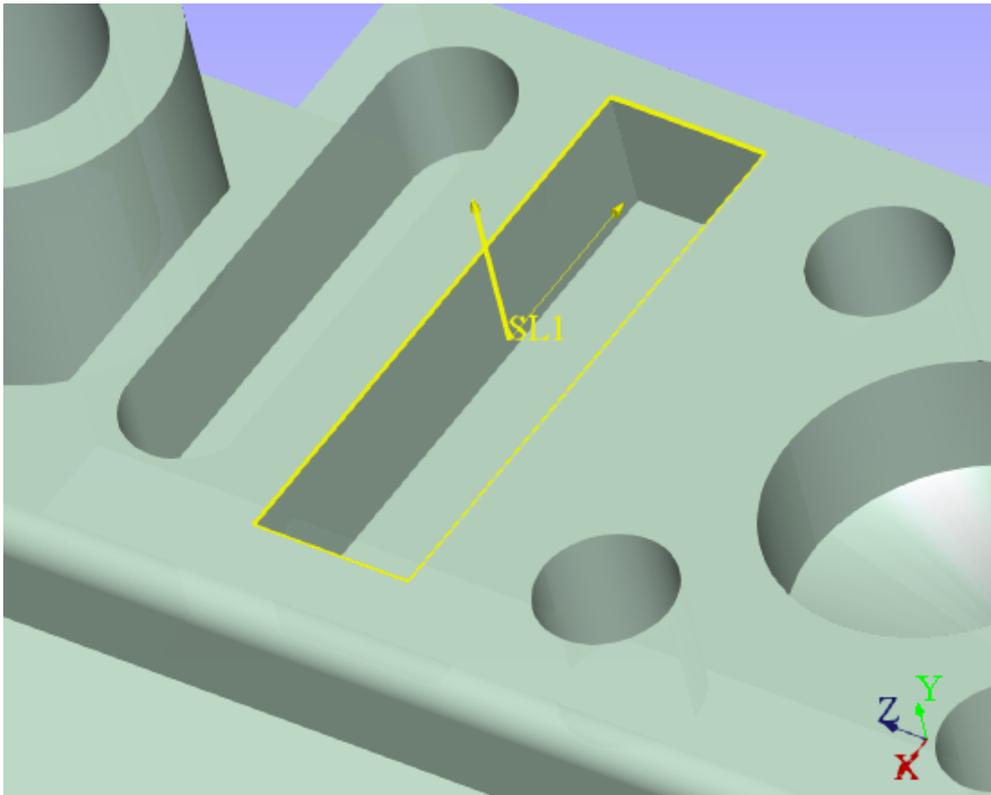
Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).

- Click on the **Rounded Slot Icon**. 
- Click on the **Create from CAD** button. 

- Click an area of the CAD surface model near the slot entity of the CAD. If one click is not enough to define the Slot, a six point routine may be necessary, consisting of 3 on one radius and 3 on the opposite radius.

Rectangular Slot



Steps to Follow:

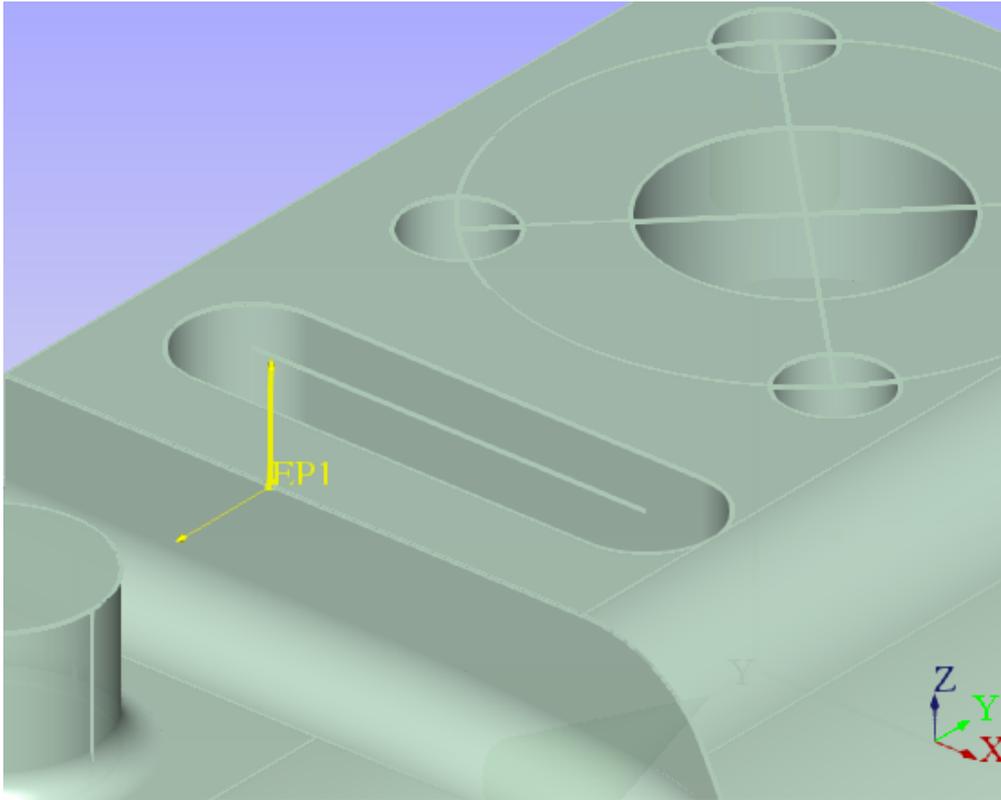
- Switch **Measure Toolbar** to [Nominals Mode](#).

- Click on the **Square Slot Icon**. 

- Click on the **Create from CAD** button. 

- Click an area of the CAD surface model near the Slot entity of the CAD. If one click is not enough to define the Slot, a seven point routine may be necessary, consisting of 2 on a long side, 2 on a short side, 2 on a long side, and 1 on a short side as shown above.

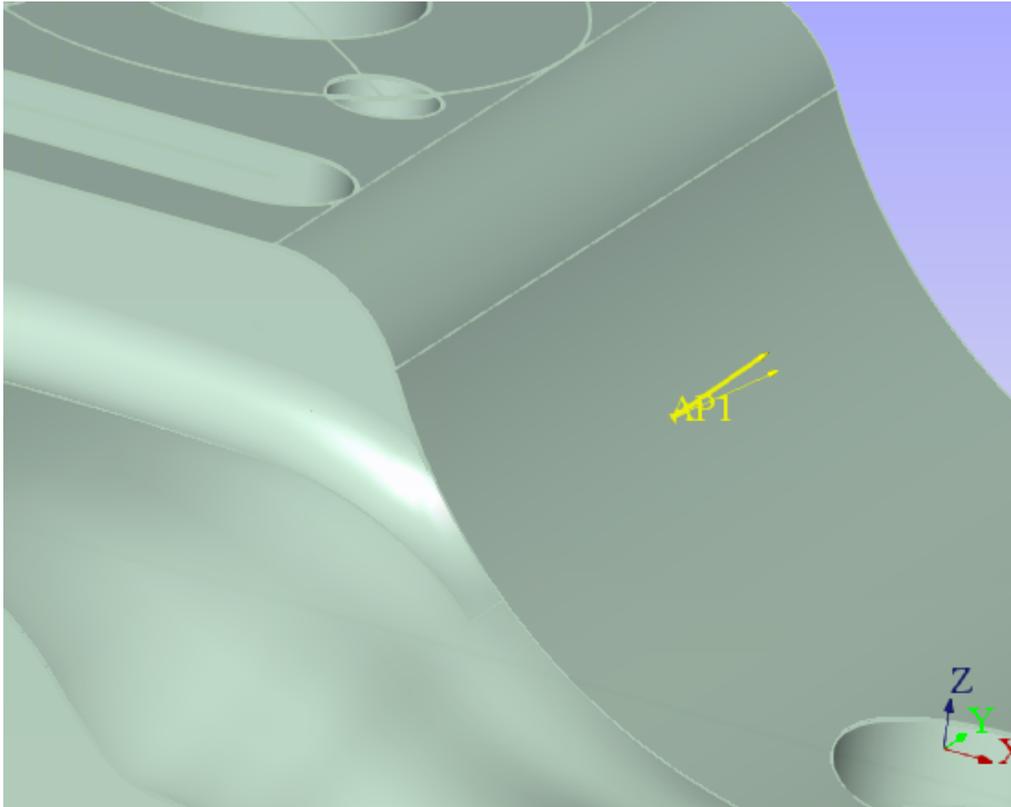
Edge Point



Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Click on the **Edge Point Icon**. 
- Click on the **Create from CAD button**. 
- Click an area of the CAD surface model near the edge of the CAD. If one click is not enough to define the Edge Point, a two point routine may be necessary, consisting of 1 on the approach surface and one on the secondary surface.

Angle Point



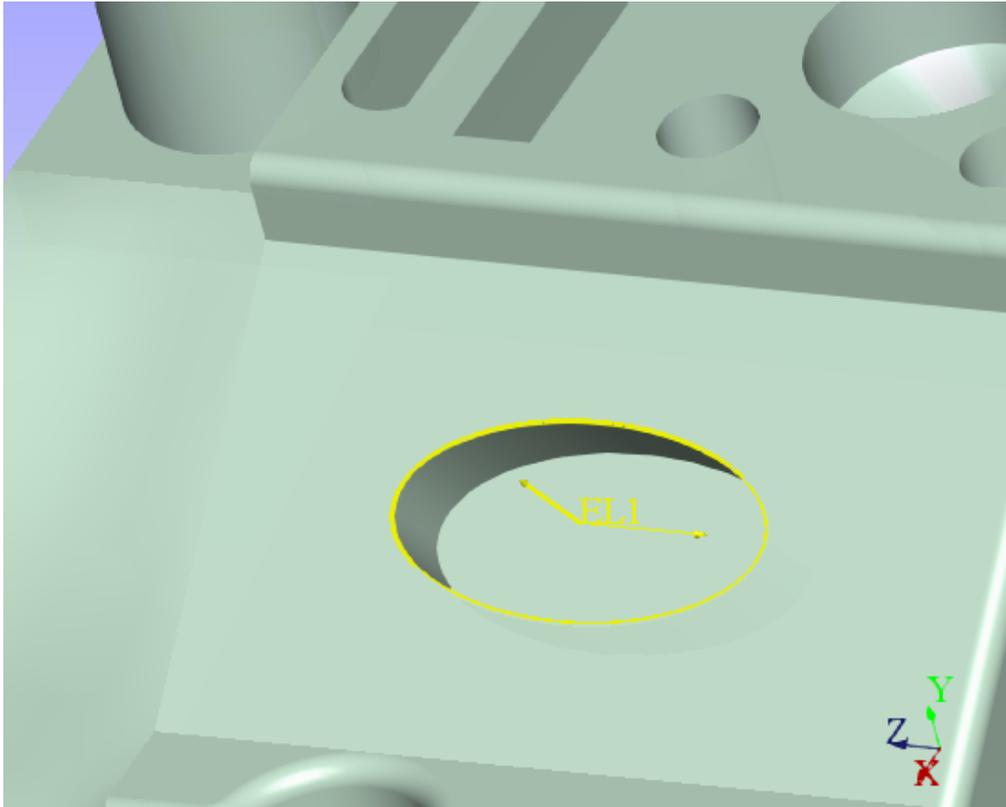
Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).

- Click on the **Angle Point Icon**. 
- Click on the **Create from CAD** button. 

- Click an area of the CAD surface model near the edge of the CAD. If one click is not enough to define the Angle Point, a two point routine may be necessary, consisting of 1 on the approach surface and one on the secondary surface.

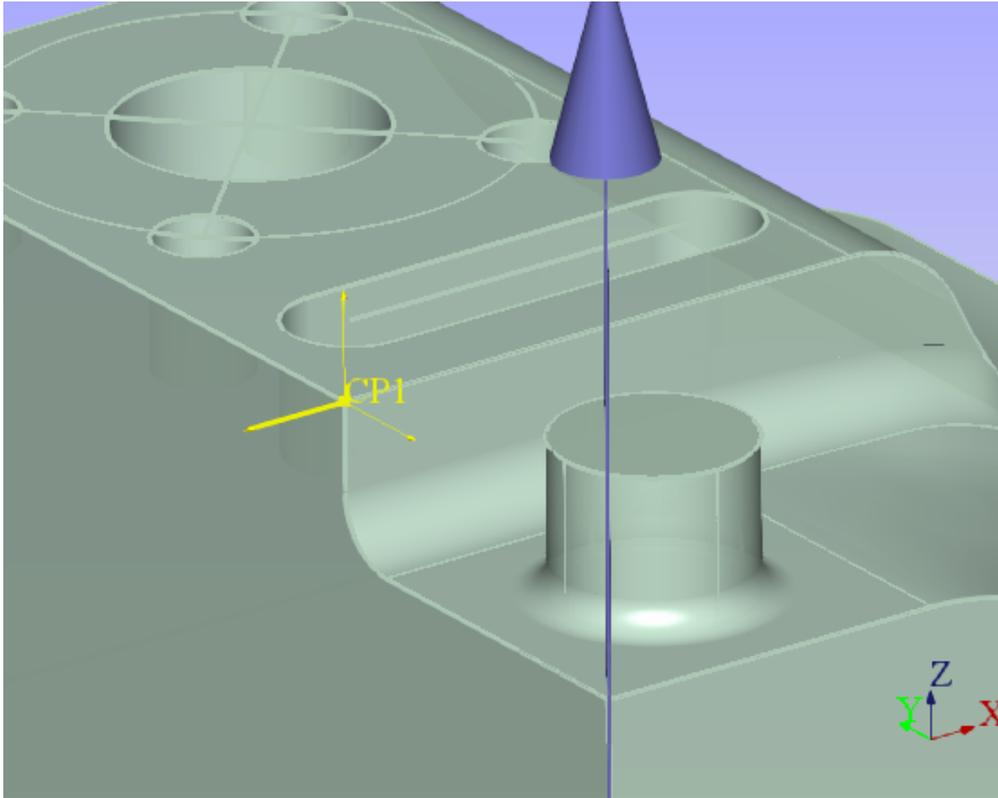
Ellipse



Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Click on the **Ellipse Icon**. 
- Click on the **Create from CAD** button. 
- Click an area of the CAD surface model near the edge of the Ellipse entity on CAD. If one click is not enough to define the Ellipse, a five point routine may be necessary, consisting of 1 on the long side, 1 on the end, 2 on the opposite long side, and 1 on the other short end.

Corner Point



Steps to Follow:

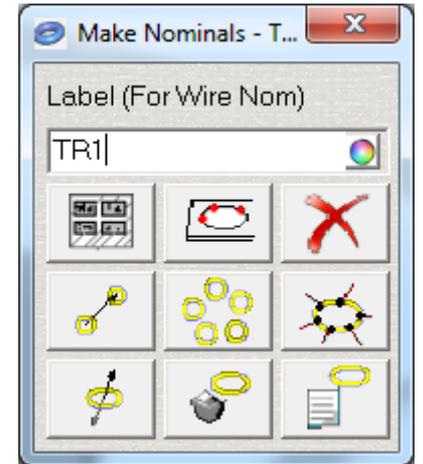
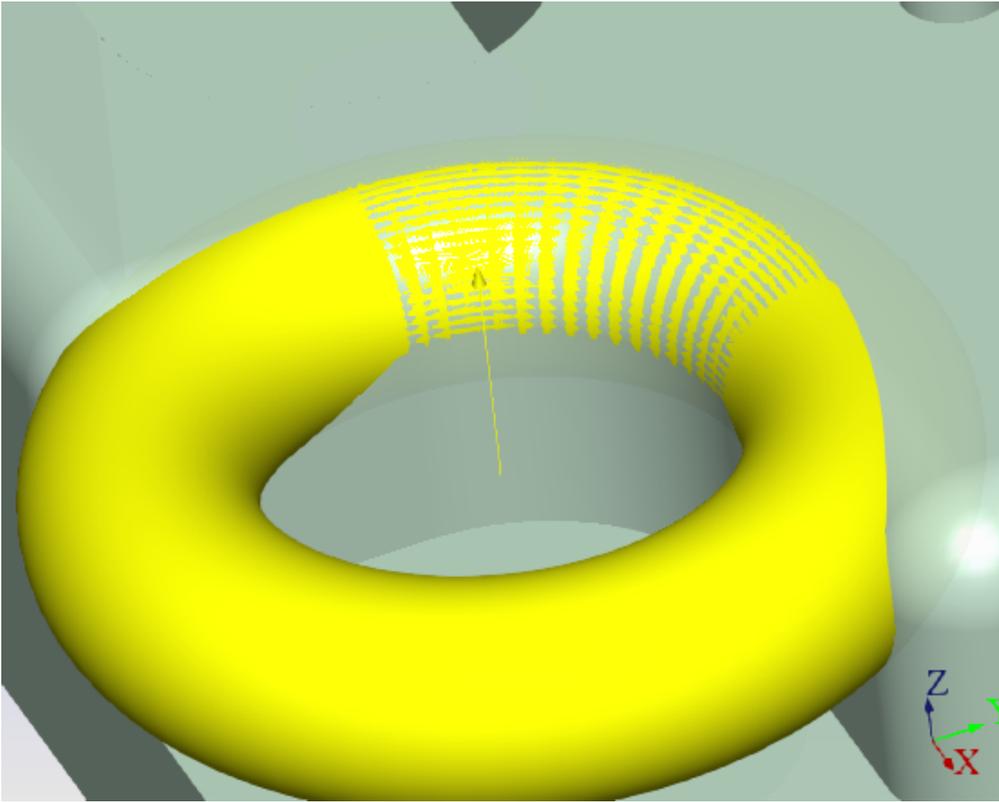
- Switch **Measure Toolbar** to [Nominals Mode](#).

Click on the **Corner Point Icon**. 

- Click on the **Create from CAD** button. 

- Click an area of the CAD surface model on the 3 opposing surfaces as shown in the figure above. The corner point should appear.

Torus



Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).

- Click on the **Torus Icon**. 

- Click on the **Create from CAD** button. 

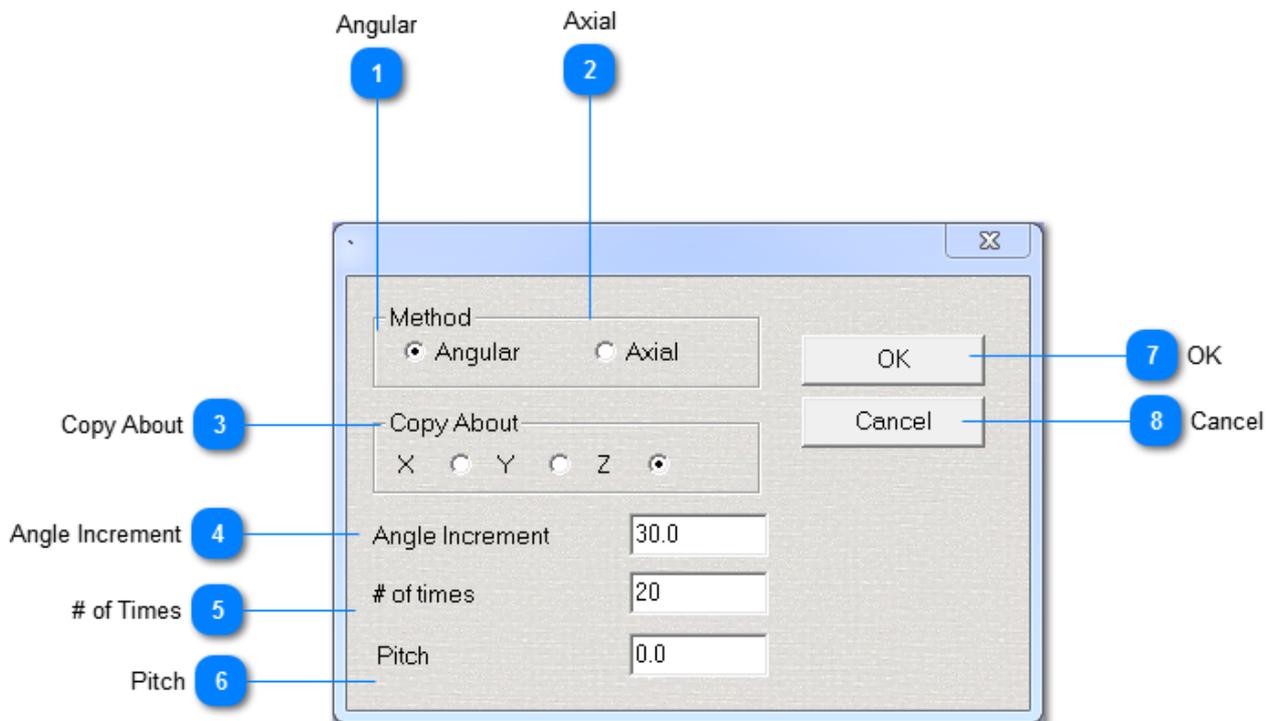
- Click six spots on the CAD model in the fashion shown above, 3 sections of 3 points to define the Torus.

[Creating Nominal Data](#)

Copying Nominals

Nominal construction of features is handled the same as regular construction of features. For more help on constructing features, please see the section in the help file on Constructing Features.

Angular Method



1 Angular

Angular

Creates a bolt pattern around the origin at a specified degree increment in any axis.

2 Axial

Axial

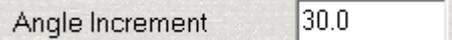
Creates a pattern of features in a linear fashion from the reference feature in X, Y, Z or all three axes.

3 Copy About

Copy About

X Y Z

Used to signify which axis the bolt pattern will rotate about.

4 Angle IncrementA screenshot of a software dialog box showing a text input field labeled "Angle Increment" with the value "30.0" entered.

Used to signify the angle of rotation for copying the nominal feature when using the Angular method of copy nominal.

5 # of TimesA screenshot of a software dialog box showing a text input field labeled "# of times" with the value "20" entered.

Used to signify the number of times that a nominal is to be copied about an axis at the specified angle.

6 PitchA screenshot of a software dialog box showing a text input field labeled "Pitch" with the value "0.0" entered.

This option is best used in the case of measuring points on a thread.

7 OKA screenshot of a rectangular button with the text "OK" centered on it.

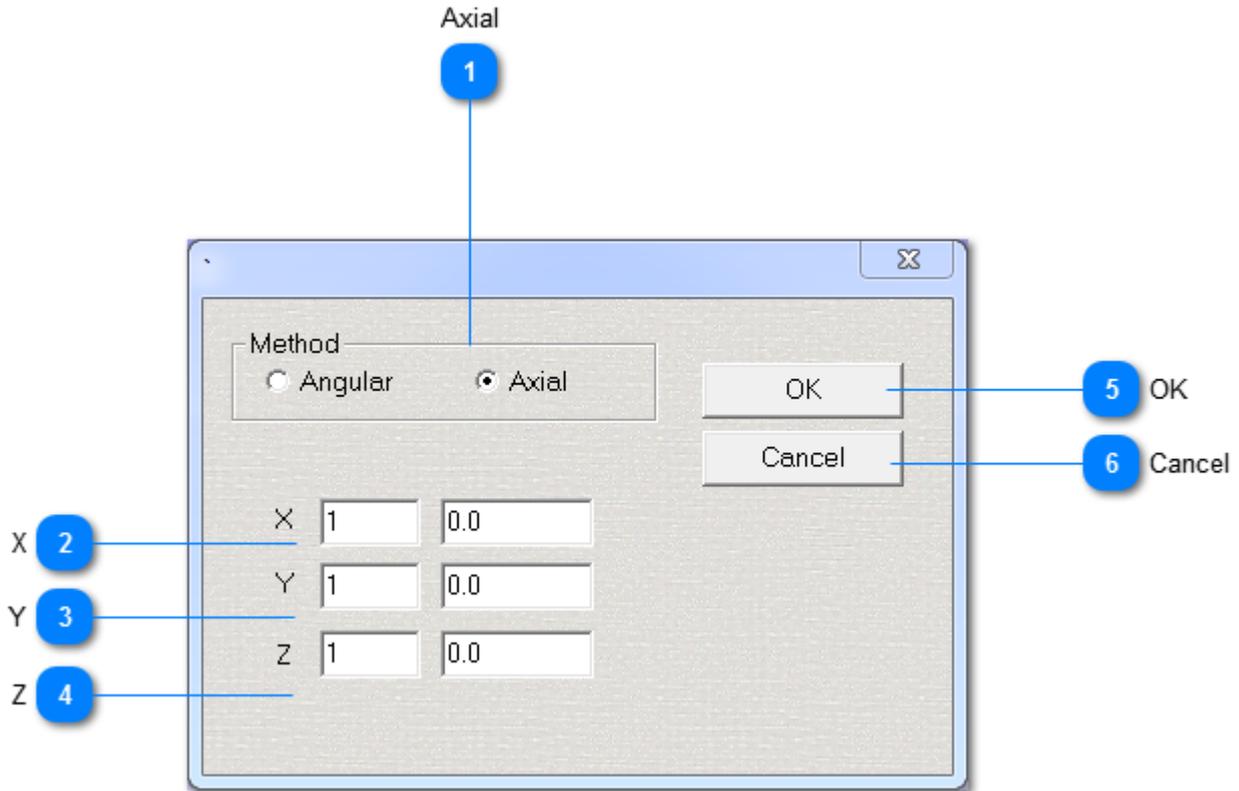
Applies the changes.

8 CancelA screenshot of a rectangular button with the text "Cancel" centered on it.

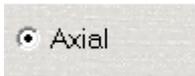
Cancel the changes and close the dialog.

[Creating Nominal Data](#)

Axial Method



1 Axial



Creates a pattern of features in a linear fashion from the reference feature in X, Y, Z or all three axes.

2 X



Number of times to copy the specified feature in the X axis. The adjacent box is for the increment value by which the feature will be copied.

3 Y



Number of times to copy the specified feature in the Y axis. The adjacent box is for the increment value by which the feature will be copied.



Number of times to copy the specified feature in the Z axis. The adjacent box is for the increment value by which the feature will be copied.



Applies the changes.



Cancel the changes and close the dialog.

[Copying Nominals](#)

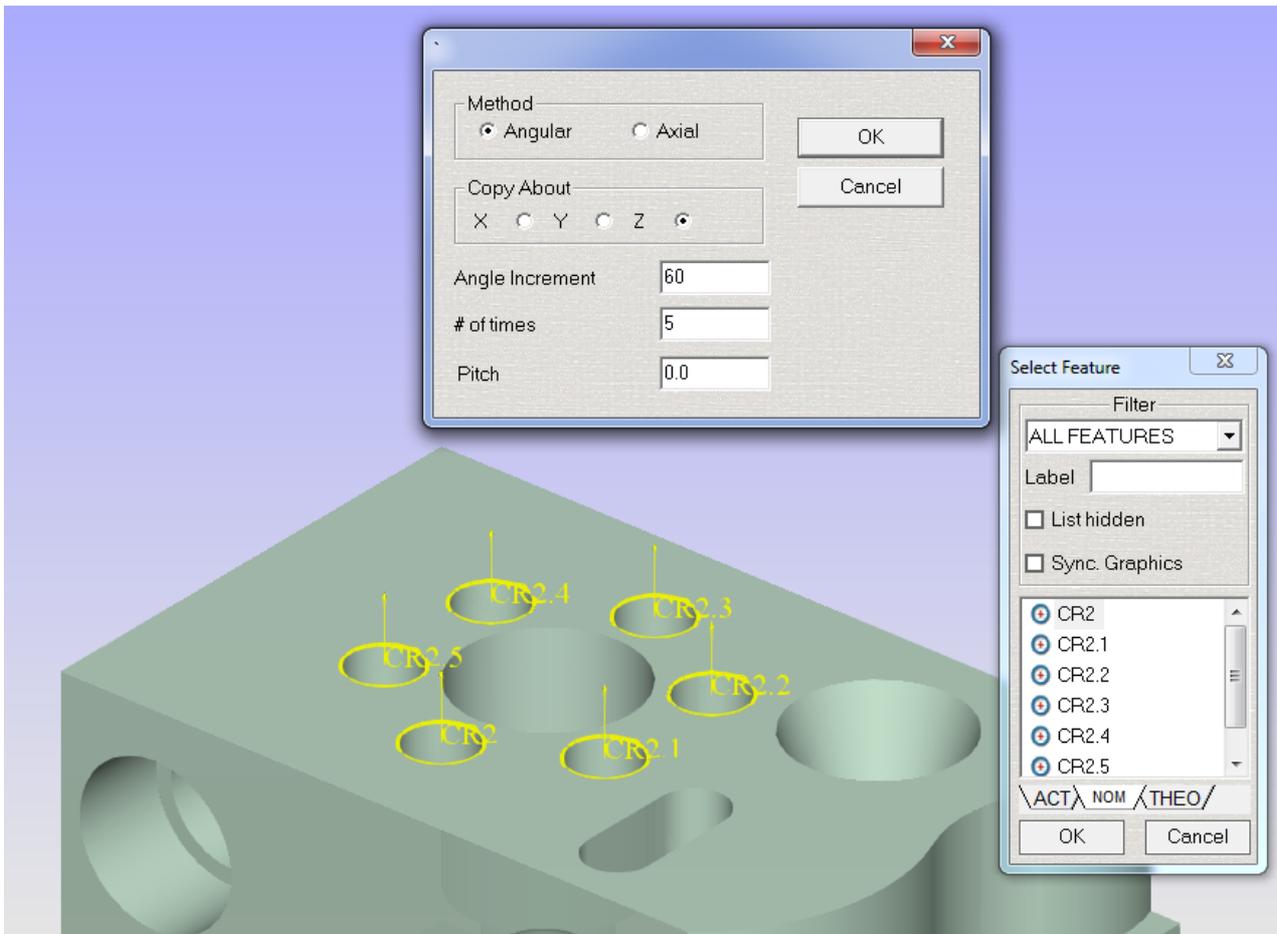
How to Copy Nominals

Angular

A good application for this function would be in the case of a bolt hole circle pattern where the angle between the features is a known value. If the angle is not known, it can be derived from the CAD model by creating other nominal features. Use the steps below to copy a nominal feature (in this case it will be a hole) several times around an axis.

Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Create the first nominal circle feature. For this example, the first feature is created at the 6 o'clock position (**CR2**) on the CAD model. The angle between the holes on the pattern shown is known at 60 degrees.
- Click on the copy nominal button and pick the circle that was just created in the previous step.
- In the dialog shown above, configure the copy method for **Angular**.
- Click on the Z axis for the copy about parameter.
- For number of times, use a value of 5.
- Leave the Pitch at zero.



Axial

A good application for this function would be in the case of a pattern of holes that needs to be inspected where the spacing requirement is known for each axis. The user need only make the first nominal feature and then copy that nominal using the axial method.

Steps to Follow:

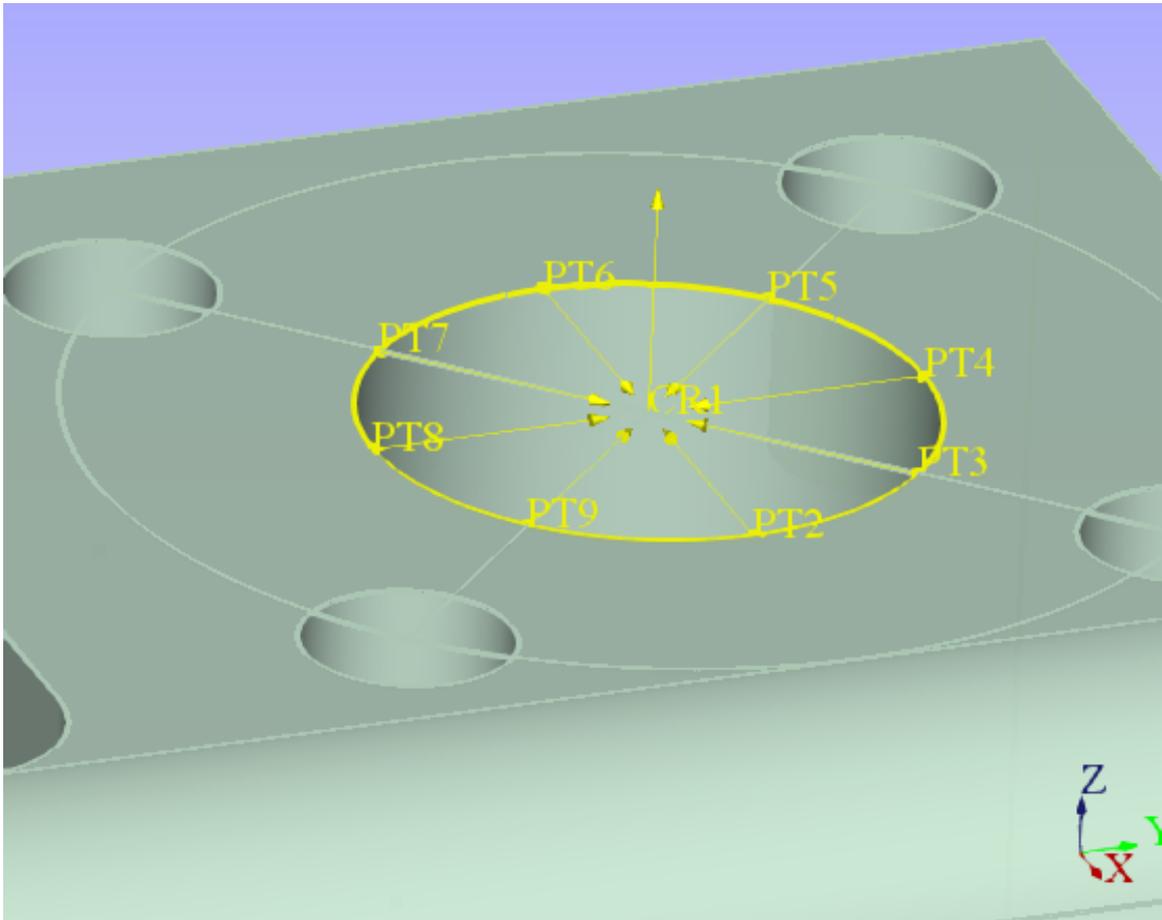
- Switch **Measure Toolbar** to [Nominals Mode](#).
- Create the first nominal circle feature. For this example, the first feature is created at the upper left position on the CAD model.
- Click on the copy nominal button and pick the circle that was just created in the previous step.
- In the dialog shown above, configure the copy method for **Axial**.
- Set # of times for X and Y to be at 5. This value is unit sensitive.
- Set the adjacent value boxes to be at 50 and 25 respectively. This value is also unit sensitive.



[Copying Nominals](#)

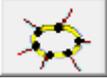
Break Nominals

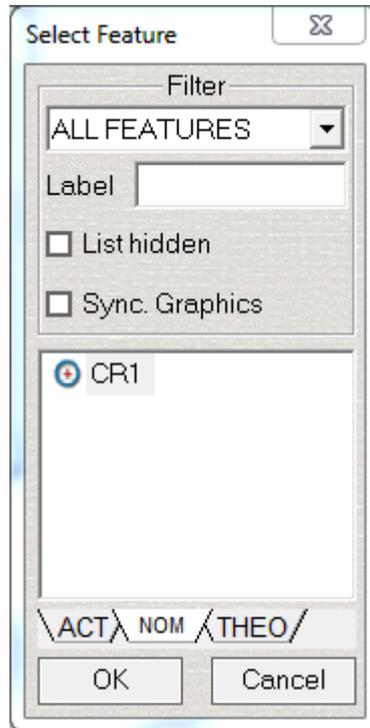
Function will break a nominal circle feature into individual points. Configuration may be inner or outer points.



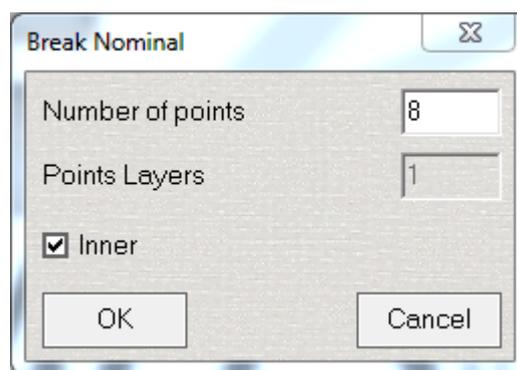
Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Create the nominal circle feature that is to be broken.

- Click on **Break Nominal** , click on the feature from the **Select Feature** dialog.

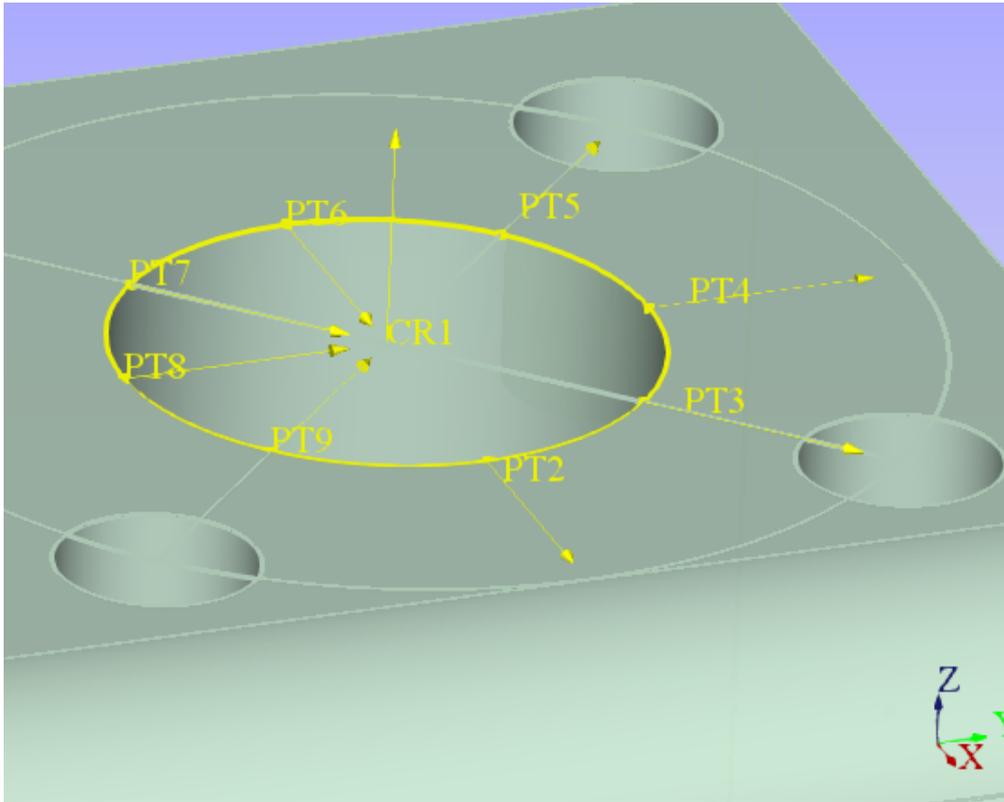


- Configure **number or points**, and whether the points should be **inner** or **outer**.



[Creating Nominal Data](#)

Inverse Nominals



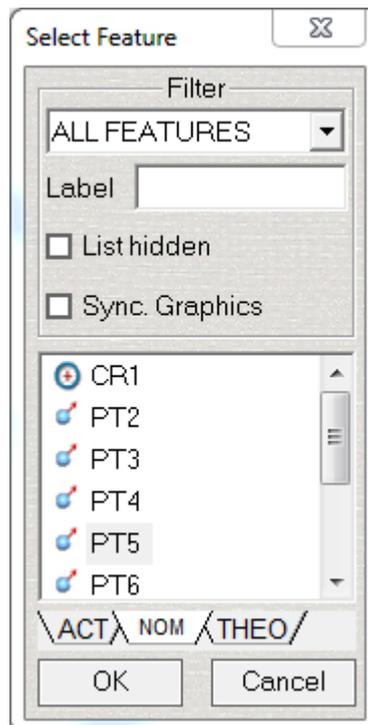
Steps to Follow:

- Switch **Measure Toolbar** bar to [Nominals Mode](#).

•

Click on the **Point Feature Icon** , and then click on the **Inverse Icon** .

- Select the feature for the vector inverse either from the **Select Feature** dialog or from the graphics.



[Creating Nominal Data](#)

Editing and Deleting Nominals

Delete Nominals

Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Click on any feature icon.

•

Click on the **Delete Icon**  and select the feature from either **Select Feature** dialog or from the **Graphics Window**.

Edit Nominals

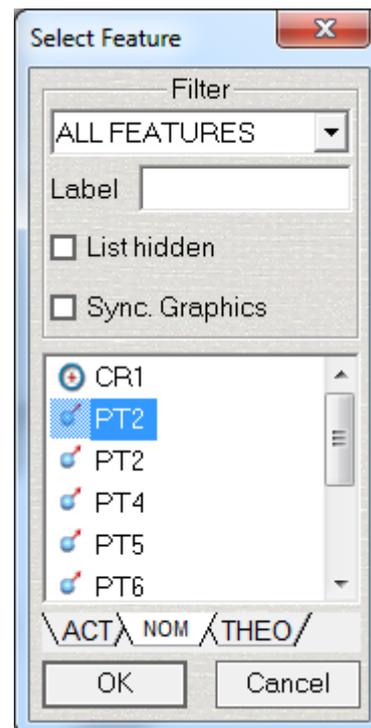
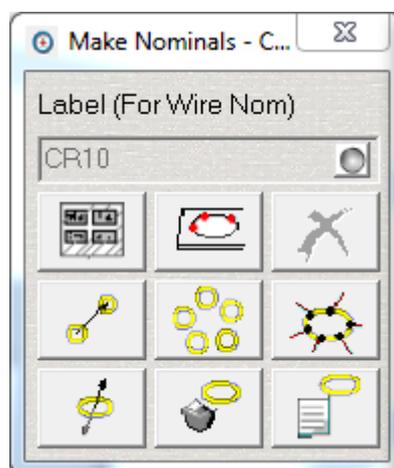
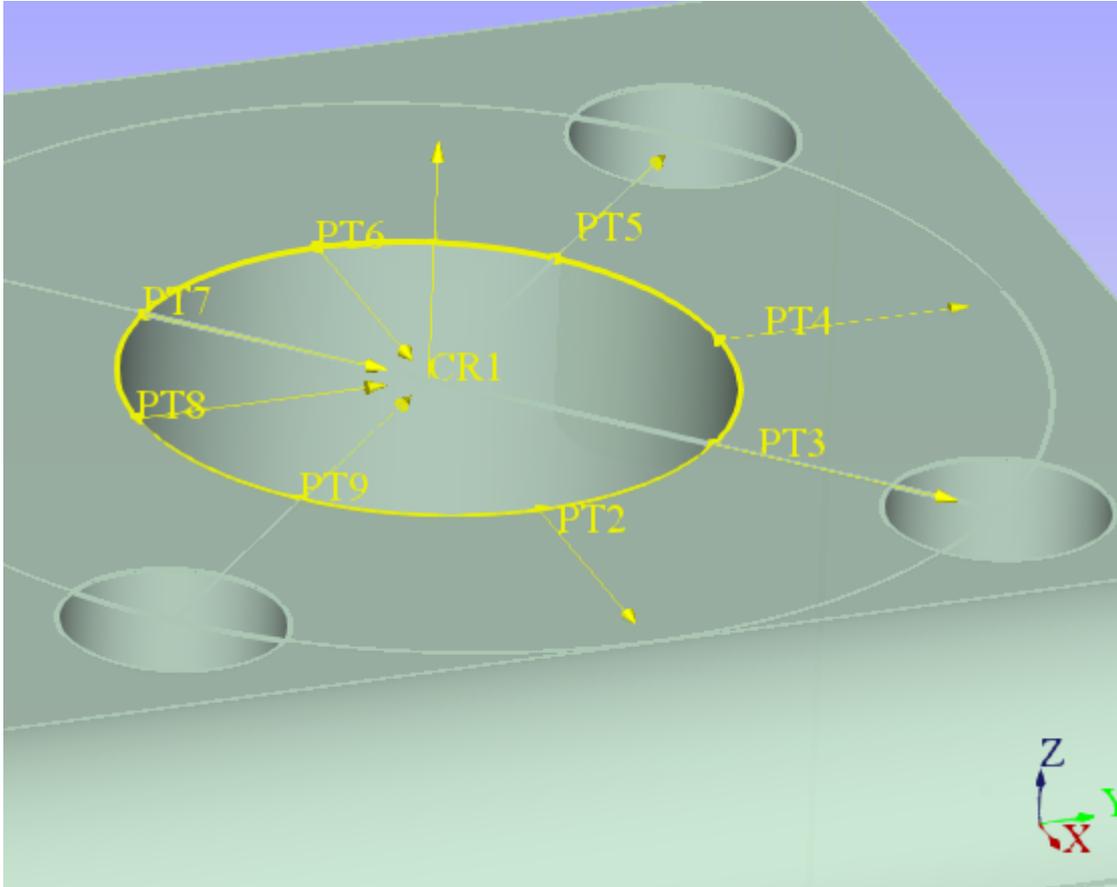
Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- Click on the feature icon for the feature type to be edited.

•

Click on the **Edit Icon**  and select the feature for the editing either from the **Select Feature** dialog or from the **Graphics Window**.

- This option may also be used to convert a feature type from one to another. For instance, it is possible to convert a nominal point to a nominal circle. To do this, simply click on the **Circle Icon** , then select **Edit Icon**  from the nominal circle dialog and select the point either from the **Select Feature** dialog or from the **Graphics Window**.



- Once the user clicks on the any point from the list or from the **Graphics Window, Make Nominal-(Circle)** window will appear. Its recommended to edit **Labelname, Diameter and Normal Direction** values since the circle has different settings than a point.

MAKE NOMINAL - (CIRCLE)

Label: CR2

Inner Outer

Center:

X: 42.204

Y: 95.496

Z: 62.500

Normal Direction:

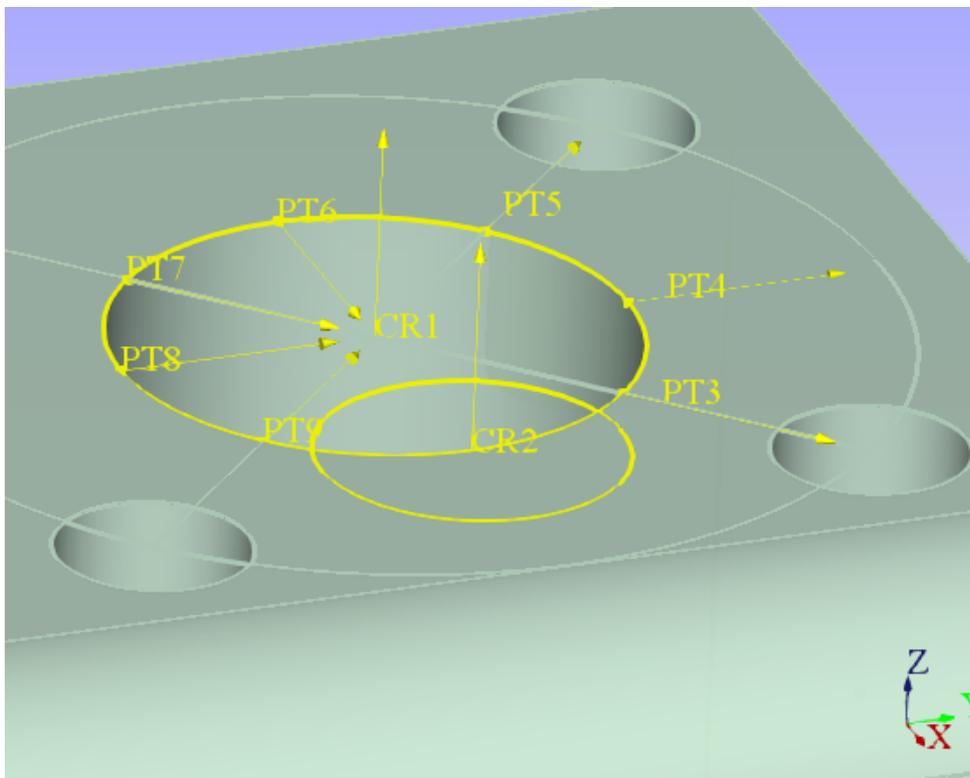
I: 0.000

J: 0.000

K: 1.000

Diameter: 15.000

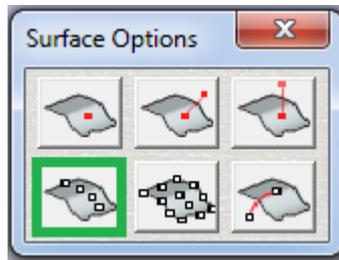
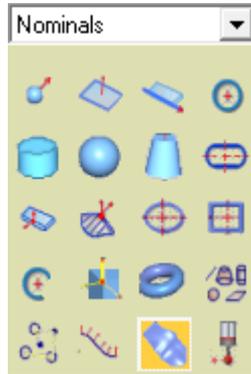
OK Cancel



[Creating Nominal Data](#)

Creating Planar Sectional Curves

The following option allows the user to create nominal sections on multiple surfaces at given body sections. These can be created at one section at a time or at multiple sections. It can be accessed through **Measure Mode > Surfaces > Section Cuts**.



Planar Sectional Curves

Section(s) Plane(s) Settings

- 1** Make: Single Section Multiple Sections
- 2** along: X-Axis Y-Axis Z-Axis
- 3** Filter Out Short Segments: Filter Out Short Segments (Min. Length: 1.000)
- 4** Avoid Edge Points: Avoid Edge Points (1.000, 1.000)
- 5** First Section Plane: First Section Plane is @ 0.000
- 6** Fix Increment Sections: Fix Increment b/n Sections @ 10.000
- 7** Fix Number of Sections: Fix Number of Sections @ 3
- 8** Last Section Plane: Last Section Plane is @ 1.000

Increment Criteria

- 9** Along Curve: Along Curve
- 10** Along Axis: Along Axis
- Y-Axis Z-Axis

Increment Mode

- Fix Increment b/n Points @ 5.000
- Center Points
- 11** Fix Increment Points: Optimize Increment b/n Points keeping Max. Increment @ 5.000
- 12** Optimize Increment
- 13** Min. Increment Points: Min. Increment b/n Points is 1.000
- 14** Fix Number of Points: Fix Number of Points @ 10
- Per Segment

Buttons: **15** Generate, **16** Delete last, **17** Close

18 Zigzag the Points: Zigzag the points

19 Trust CAD Orientation: Trust CAD Orientation

20 Force Last Point: Force Last Point

21 Reverse Normals: Reverse Normals

1 Make

Make Single Section Multiple Sections
 along X-Axis Y-Axis Z-Axis

Configure the curves in Single or Multiple sections through all active surfaces. Then choose the direction of the curves from X Y or Z axis. The direction is along the current part alignment so by changing the alignment, different directions can be cut.

2 Reverse Sampling Direction

Reverse sampling direction

Can be checked to reverse the order of points.

3 Filter Out Short Segments

Filter Out Short Segments

Filters out the short segments of the curve.

4 Avoid Edge Points

Avoid Edge Points

Will not make points on the edge of the surfaces. The first and last points will be slightly inside of the surfaces.

5 First Section Plane

First Section Plane is @ 

Can be entered in the coordinate system. This can also be selected from the model by choosing the From CAD option. If multiple sections option is selected, the location of the last section may also be entered or selected From CAD.

6 Fix Increment Sections

Fix Increment b/n Sections @

Defines a specific distance between each section.

7 Fix Number of Sections

Fix Number of Sections @

Defines a specific number of sections evenly distributed over the selected surfaces.

8 Last Section Plane

Last Section Plane is @ 

Coordinate of the last possible section plane.

9 Along Curve

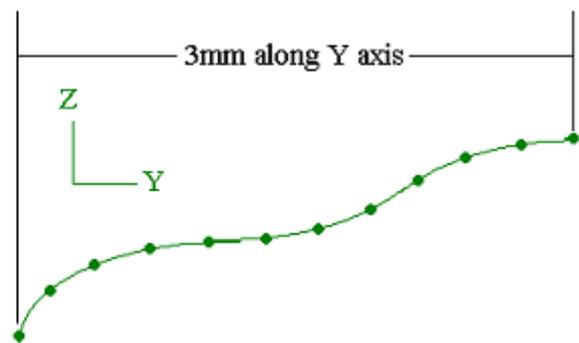
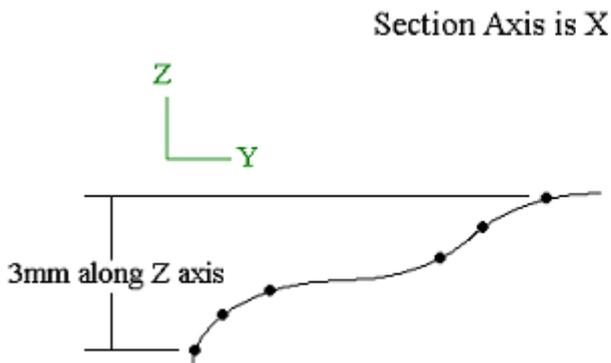
Along Curve

Along curve option creates nominal points on the surface with respect to chordal distance as opposed to straight axis distance. In Figure 1.7 the red line represents the chordal distance between each point.

10 Along Axis

Along Axis

Along axis option is configured based upon section axis preferences. It creates the nominal points perpendicular to the corresponding plane of the selected axis.



11 Fix Increment Points

Fix Increment b/n Points @ 5.000

Can be set to have equal distance between points.

12 Optimize Increment

Optimize Increment b/n Points keeping Max. Increment @ 5.000

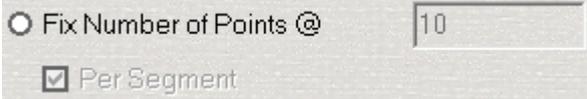
Will automatically adjust the spacing by adding more points when the surface curvature is changing.

13 Min. Increment Points

Min. Increment b/n Points is 1.000

The smallest distance between two points allowed when using the [Optimize Increment](#) option.

14 Fix Number of Points



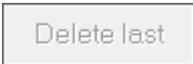
Can also be created on each section.

15 Generate



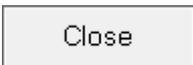
Once the settings are completed, using the generate option will create all the points and display in graphics.

16 Delete Last



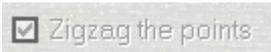
Can be used remove the last set of points created from the generate option.

17 Close



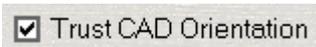
Closes the dialog.

18 Zigzag the Points



Option can be used to change the direction of the sections from one to the other.

19 Trust CAD Orientation



When the **Trust CAD Orientation** check box is checked, CAPPS will trust the surface orientation of the CAD model to calculate the vector normals of the curve. Otherwise, CAPPS will use the view to calculate the correct vector normals.

20 Force Last Point

Force Last Point

Works in coordination with [Fix Number of Points](#), CAPPS will force the last point to be created even though it does not fit into the fix distance criteria. For example, if the distance between points is set to 5mm and the distance between the last and previous to the last point can not exceed 2mm, then CAPPS will create the last point 2mm away from the previous point if the **Force Last Point** is checked.

21 Reverse Normals

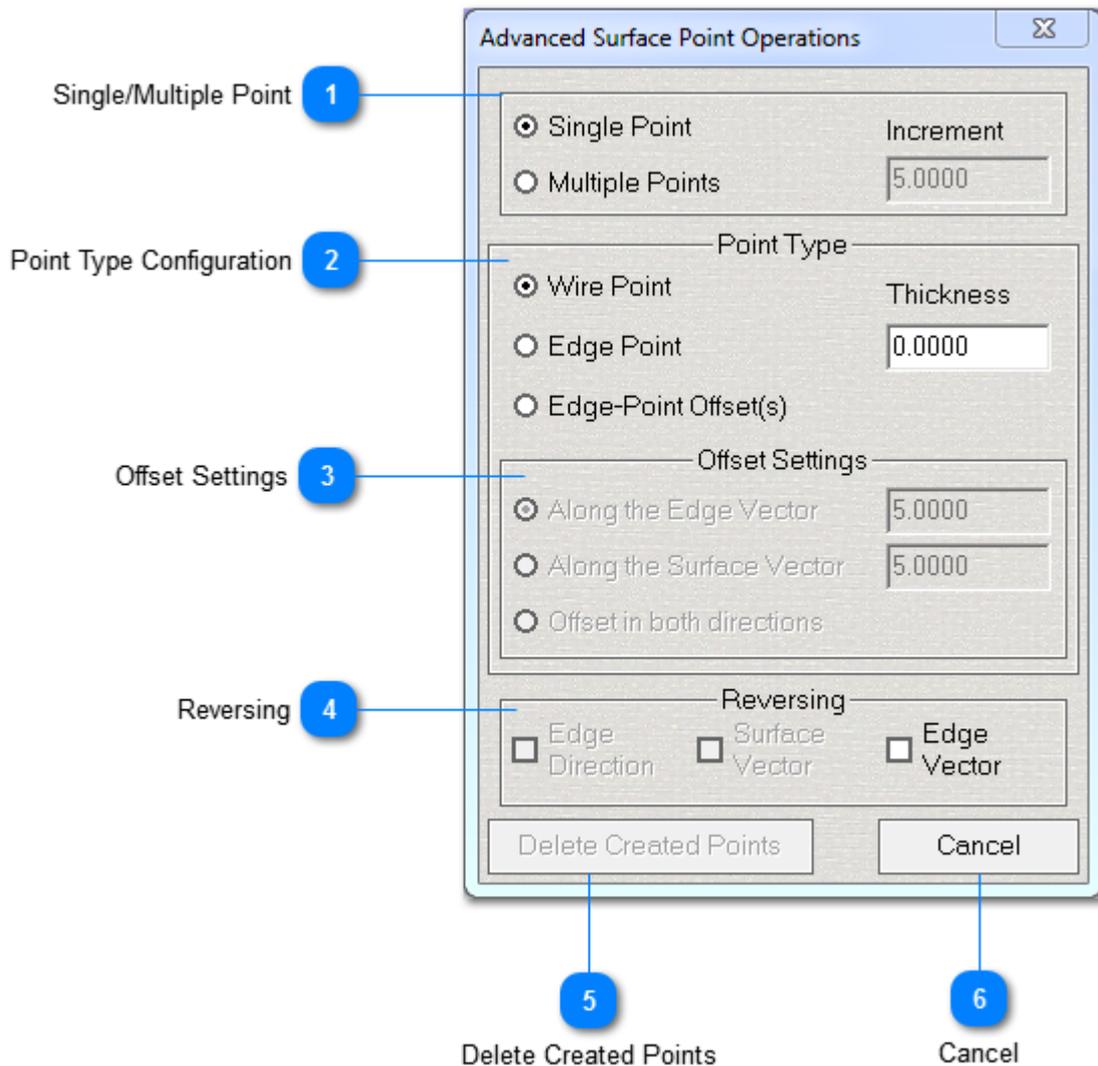
Reverse Normals

Can be used to inverse the directions of the vectors.

[Creating Nominal Data](#)

Advanced Surface Point Operations

This option allows the user to create section cuts on wire frame data either by single point or multiple points. Also allows offset points and edge points to be created for use in flush/feeler applications.



1 Single/Multiple Point

- Single Point
- Multiple Points

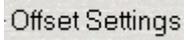
Configures the system to create single point entities or multiple point entities on the wire frame in conjunction with the underlying CAD surface data. If multiple points are configured, then an increment input will be allowed. This is the spacing between the points that will be created.

2 Point Type Configuration

- Multiple Points

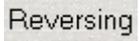
Allows the configuration of the style of points to be created on the wire frame section. If edge point offsets are configured, then the user will be able to select how the offsets are determined for the points being created.

3 Offset Settings

A rectangular button with a light gray background and the text "Offset Settings" in a dark gray font.

Moves the edge point along the selected direction(s).

4 Reversing

A rectangular button with a light gray background and the text "Reversing" in a dark gray font.

Allows vectors for edge point data to be reversed, either one or both.

5 Delete Created Points

A rectangular button with a light gray background and the text "Delete Created Points" in a dark gray font.

Deletes created nominal points.

6 Cancel

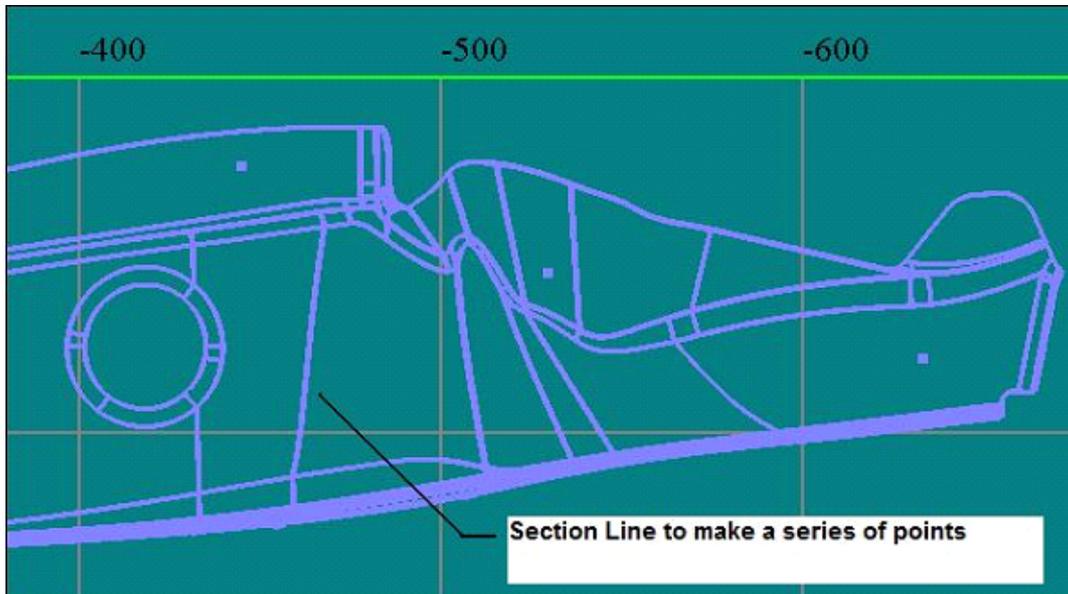
A rectangular button with a light gray background and the text "Cancel" in a dark gray font.

Cancel the changes and close the dialog.

[Creating Nominal Data](#)

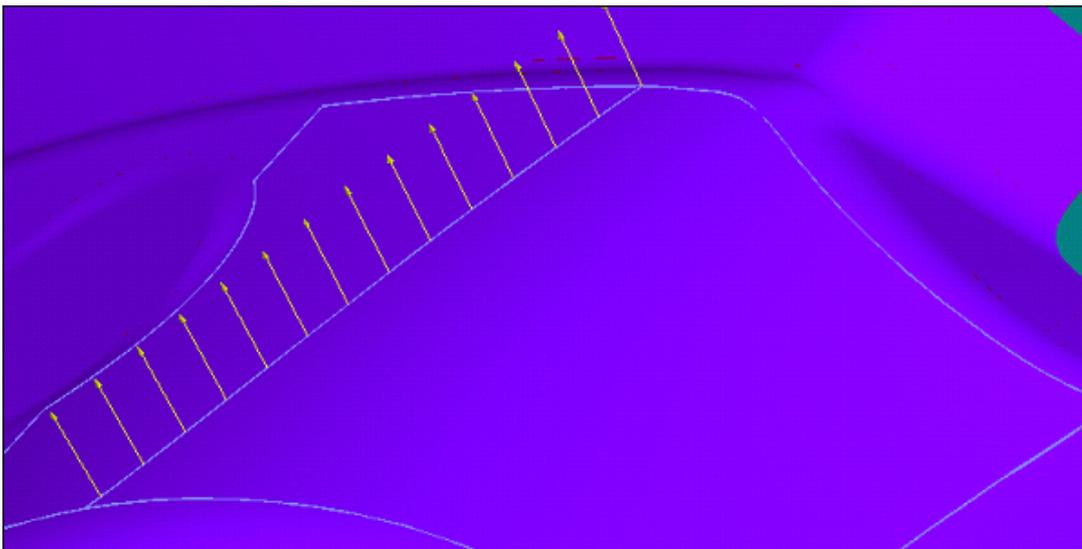
Creating Non-Body Lines

There are times when section lines are drawn in an irregular manner on the part print for specific reasons. One reason may be that the customer wants to see a series of points measured along that line. That line may not be square or parallel to the body or aircraft coordinate system. In this case it is useful to use the advanced surface point options to create nominal points. The figure below shows such an application.



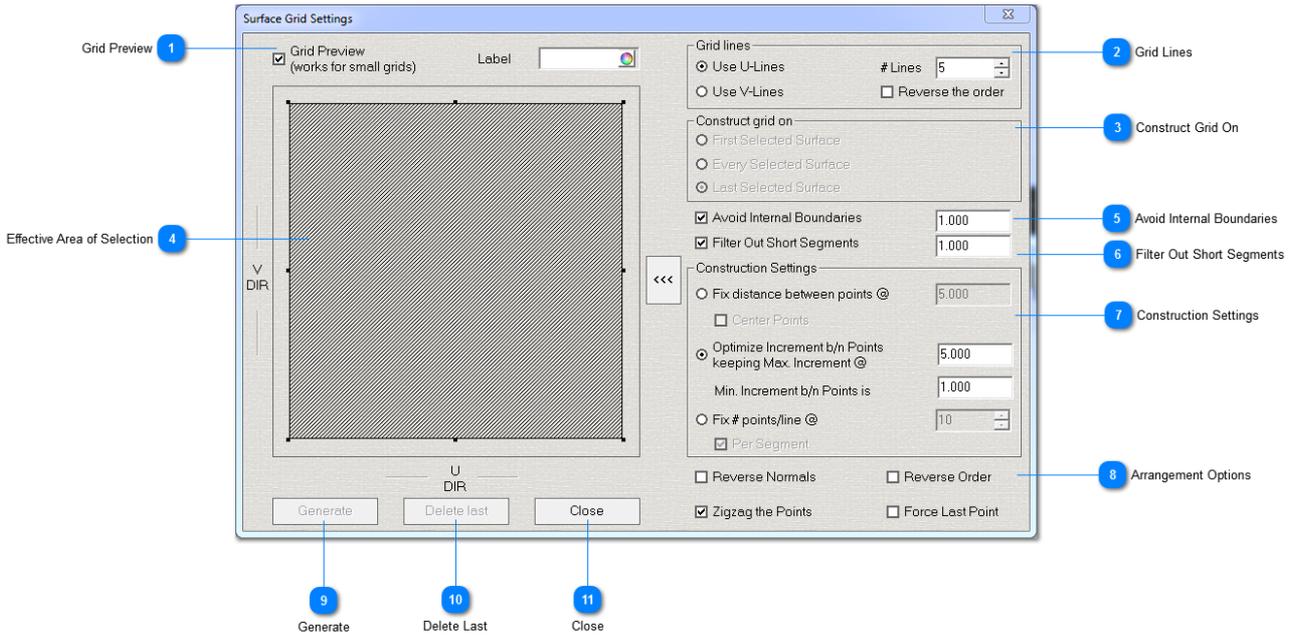
Steps to Follow:

- Switch **Measure Toolbar** to [Nominals Mode](#).
- If there is no wire frame information provided in the supplied CAD file, it will be necessary to create wire frame data from the section line.
- Once there is wire frame created, click on the surface icon under the nominals toolbar.
- From the surface menu choices, click on the advanced surface options. Configure the settings as needed and click on the section line. Notice below, the completed section line. All points are on the wire frame section and normal to the surface that lies beneath.



[Creating Nominal Data](#)

Creating Nominal Grid Points



1 Grid Preview



Works as a virtual place mat for the anticipated grid. If there is a surface selected upon opening this dialog, the user will immediately see a preview of the grid on the CAD model.

2 Grid Lines



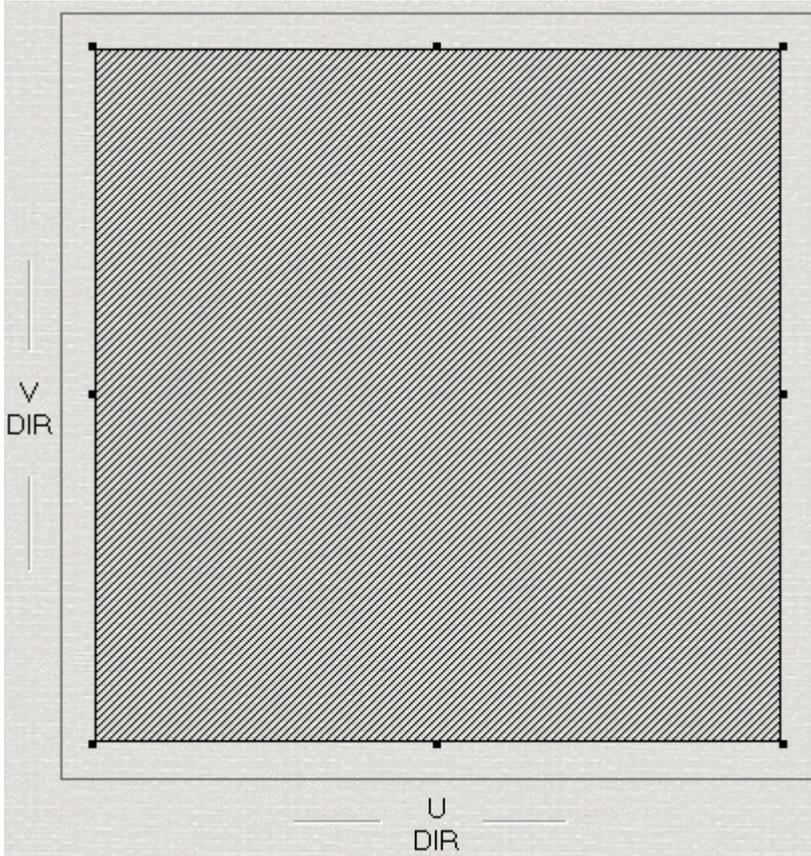
Used to configure whether the nominal grid will follow the U or V lines to create nominal points. Number of lines may also be configured here. Reversing the order of creation may be selected.

3 Construct Grid On



This option will be available once the user selects more than one surface on a CAD model. These options lets the user to determine how the grid points will be distributed on the selected surfaces.

4 Effective Area of Selection



Used to change the effective area of a selected surface by manipulating the corners of this virtual place mat, the actual point grid on the part will also be manipulated.

5 Avoid Internal Boundaries

Avoid Internal Boundaries

Will allow the created grid to be placed inside of a specified value noted by the user.

6 Filter Out Short Segments

 Filter Out Short Segments

Filters out the short segments of the grid.

7 Construction Settings

Construction Settings

Fix distance between points @

Center Points

Optimize Increment b/n Points keeping Max. Increment @

Min. Increment b/n Points is

Fix # points/line @

Per Segment

Fix Distance Between Points: Sets a fix distance between each point in the grid.

Optimize Increment Between Points Keeping Maximum Increment: Distributes points using maximum and minimum increment values. Sets maximum increment distance.

Minimum Increment Between Points is: Sets minimum increment distance.

Fix Number of Points per Line : Create fixed number of points for the grid.

8 Arrangement Options

 Reverse Normals Reverse Order
 Zigzag the Points Force Last Point

Reverse Normals: Reverses the normals of the grid points.

Zigzag Points: Will create a zigzag configuration of points as opposed to straight line order. Arranges each line of grid points in end to start fashion.

Reverse Order: Reverse the order of points in the grid.

Force Last Point: Works in coordination with [Fix Number of Points](#), CAPPS will force the last point to be created even tough it does not fit into the fix distance criteria. For example, if the distance between points is set to 5mm and the distance between the last and previous to the last point can not exceed 2mm, then CAPPS will create the last point 2mm away from the previous point if the **Force Last Point** is checked.

9 Generate

Applies the changes.

10 Delete LastA rectangular button with a light gray background and a thin black border, containing the text "Delete last" in a standard sans-serif font.

Deletes last grid created.

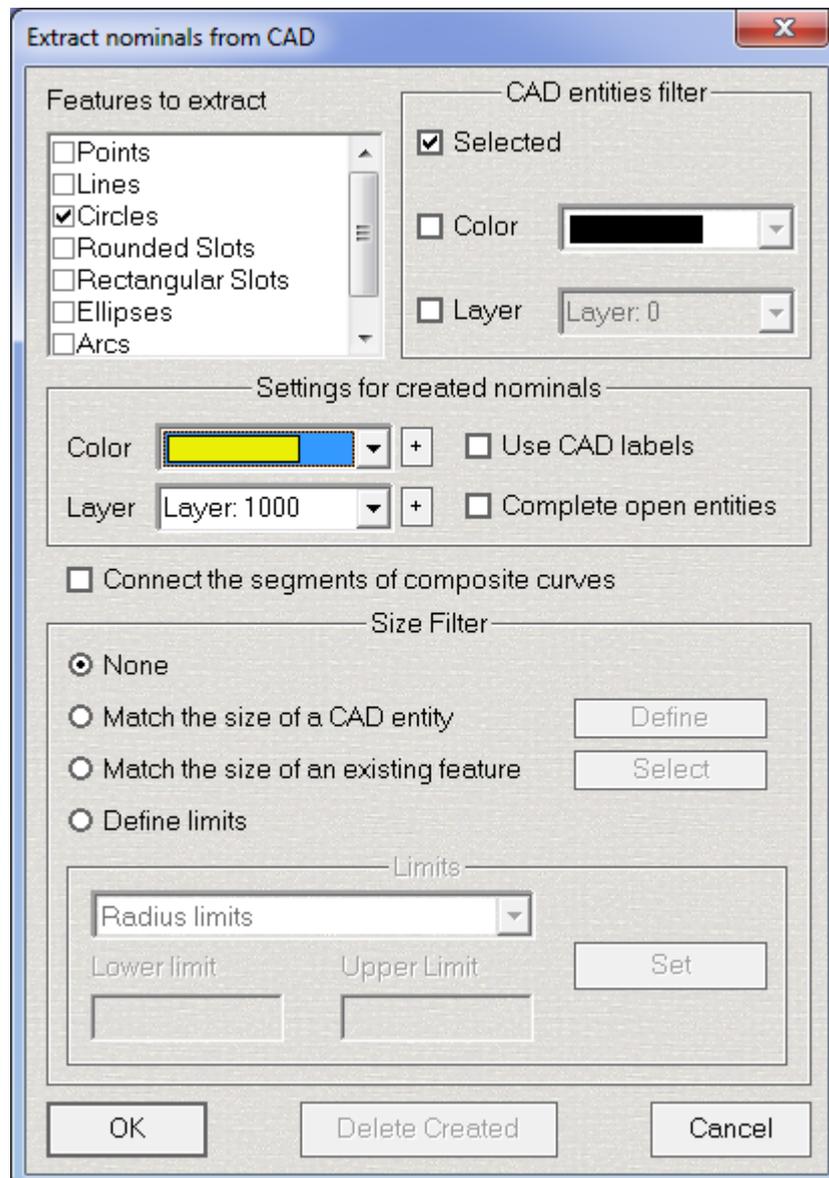
11 CloseA rectangular button with a light gray background and a thin black border, containing the text "Close" in a standard sans-serif font.

Closes the dialog.

[Creating Nominal Data](#)

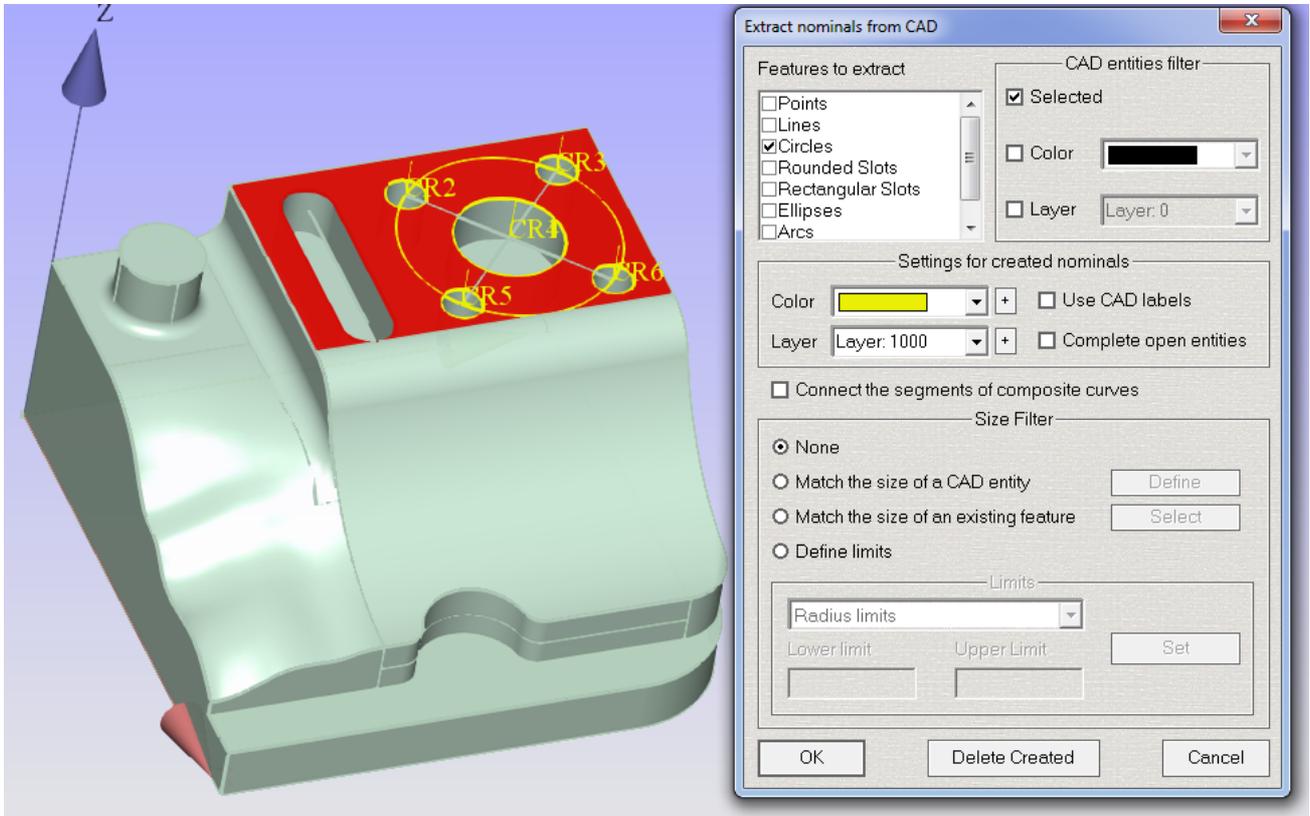
Extracting Group Nominals From CAD

The purpose of this function is to extract nominal data from the CAD model quickly and easily without a lot of mouse clicks. A useful application for this may be if there were to be a CAD model with perhaps a hundred holes to be inspected. It would be a long and tedious job to traditionally create one hundred nominal circles on a part. This menu can be accessed through **Extract Nominals From CAD** option under [CAD Options Toolbar](#).



For more information on **Extract Nominals from CAD** please refer to following link, [Extract Nominals from CAD](#).

The figure below shows an example of this application. The top surface is selected; the system is set to extract only the circles from the CAD model. There are no size limitations set. So when the nominals are created, you will see 6 nominal circles created on the **Graphics Window** after clicking **OK**.



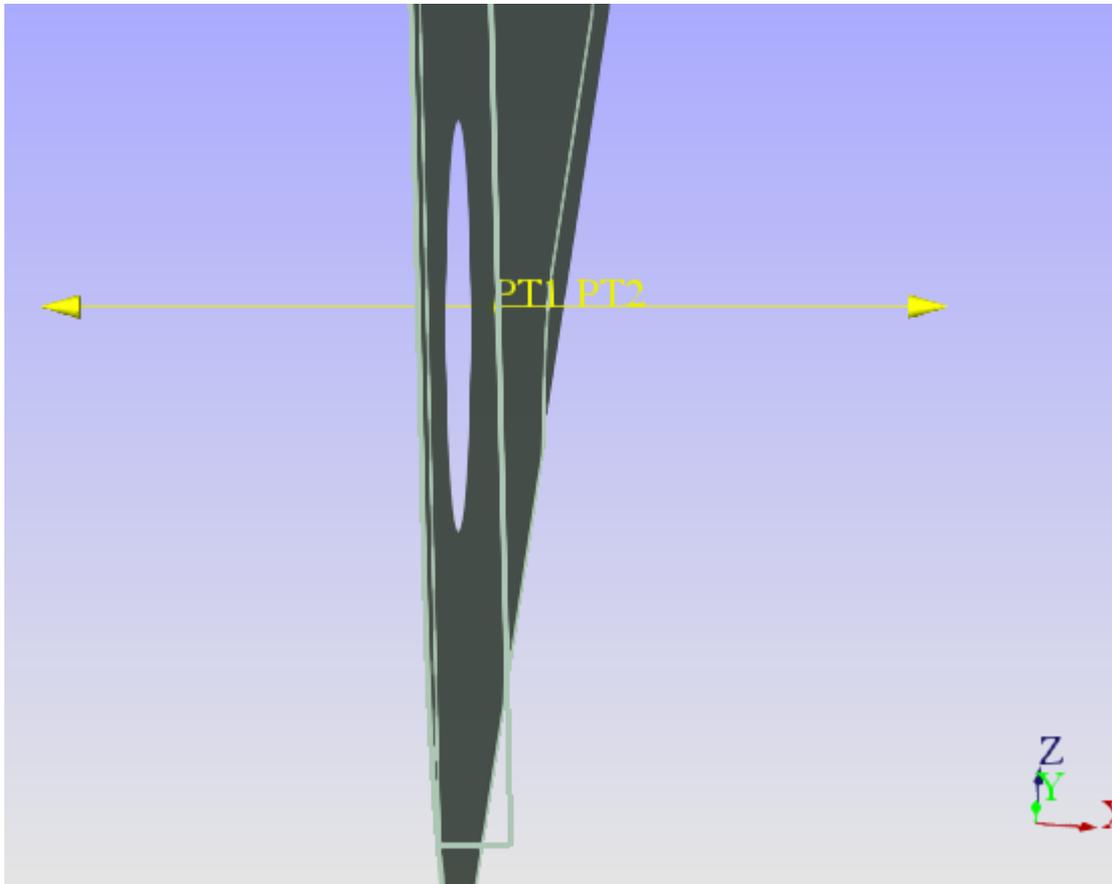
[Creating Nominal Data](#)

Drop Point Application

Drop point is used to drop data (either measured or nominal) onto a selected surface. This function has many applications. The example shown is used when you have two sides of a part where a point is created on one side of the part and must be measured on the opposite side of the part in the exact same location along the vector of the point.

Steps to Follow:

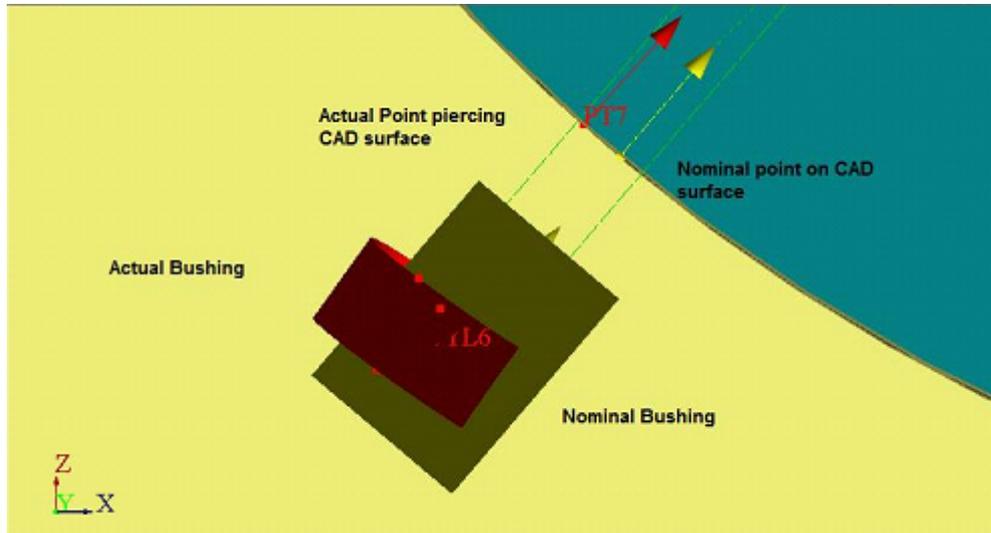
- Change Measure bar to [Nominals Mode](#).
- Create a point on the desired surface.
- Make a copy of that same nominal using the nominal/construct option. There will now be two identical points with different labels in the same location.
- Select the opposite surface for the new nominal to be dropped on.
- Click on the drop option from the nominal surface menu.
- Select the second of the two points.
- Inverse the vector of the dropped point.



[Creating Nominal Data](#)

Actual Pierce Point

Normally, in a cylinder/plane intersection it is possible to use the construct point option to find out where the cylinder feature pierces the plane feature. This is a common practice. The actual pierce point function is used when the surface of intersection is either concave or convex, and that surface is represented by a CAD model.



Steps to Follow:

- Select the surface on which the actual pierce point is to be created.
- Change the measurement mode to Measure mode.
- Select the Surface Icon.
- Click on the Pierce Point option.
- Pick the cylinder feature that will be intersected with the CAD surface
- The pierce point will appear.
- Compare the actual/nominal deviation using the Output function.

[Creating Nominal Data](#)

Automating Feature Measurement

MEASCAD Mode

Please refer to the following link about [MEASCAD Mode](#).

There are three main ways to measure features automatically while teaching a program using CAPPS DMIS.

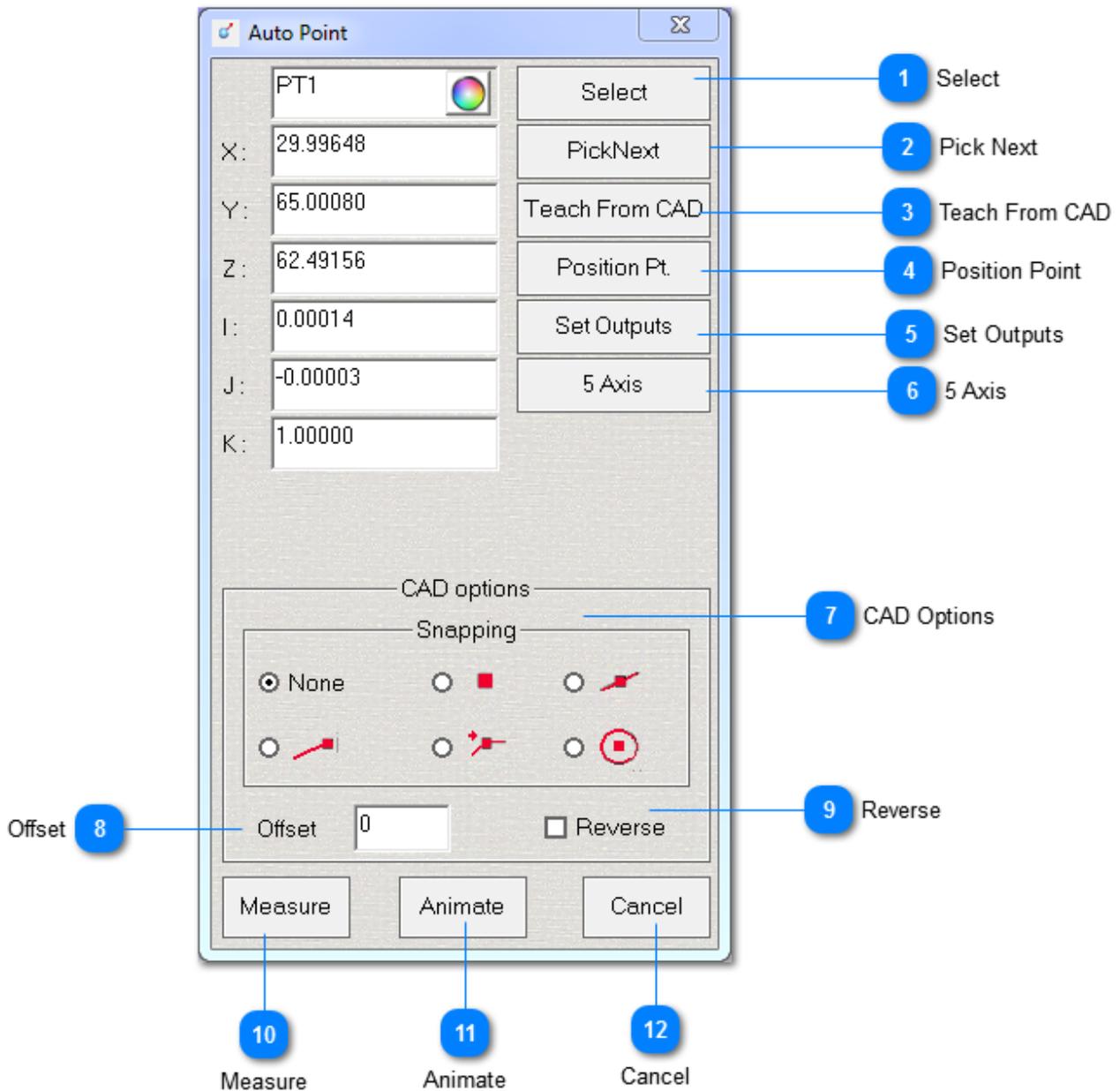
Directly from Nominals: If a series of nominal features have been created, these features may be measured by clicking the **Select** button in any **MEASCAD** feature dialog box.

Directly from CAD wire frame or surfaces: If CAD data is available, created nominals need not be present in order to measure using the math model. Using this option, the system will decide where to place the touch points in the case of any feature of size. This works in an **AUTO** mode fashion.

Teach from CAD: Allows the user to teach the touch points of any feature using the mouse pointer. This works in a **PROG** mode fashion. Created nominals need not be present.

[Table of Contents](#)

MEAS-CAD Point



1 Select



Click this option to select a nominal point either from the nominals list or from the **Graphics Window**.

2 Pick Next



Used for a series of nominal features. Click on the pick next option and then click the first nominal feature to be measured either from the nominals list or from the graphics. After the measurement is complete, the system will automatically draw a path to the next nominal feature in the sequence.

3 Teach From CAD

Teach From CAD

Used if nominal data has not been created. Simply click the CAD model surface and then click the measure button.

4 Position Point

Position Pt.

Used to create move points to avoid collisions. For more information on position points, **please refer to [Position Points](#) section in the CAPPS DMIS User Manual for more information.**

5 Set Outputs

Set Outputs

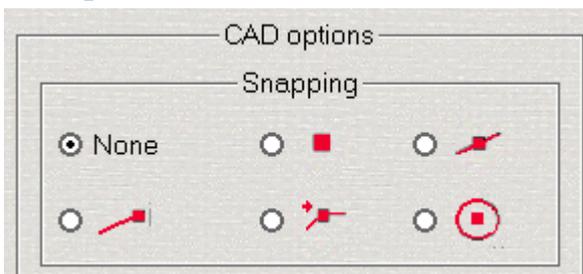
Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

6 5 Axis

5 Axis

Used to display the 5 axis head positioning dialog for PH20 and REVO probe heads.

7 CAD Options



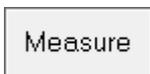
Allows snapping to specific wire frame items such as wire frame point, wire frame midcurve, or end of wire frame curve.

8 OffsetA rectangular input field with the label "Offset" on the left and the number "0" inside the field.

Offsets point to be measured along the point vector.

9 ReverseA rectangular button with a small square checkbox on the left and the text "Reverse" to its right.

Reverse the vector of the point to be measured.

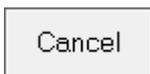
10 MeasureA rectangular button with the text "Measure" centered inside.

Accepts input and automatically measures feature.

CAUTION: Be sure to avoid any collisions when working in an online environment.

11 AnimateA rectangular button with the text "Animate" centered inside.

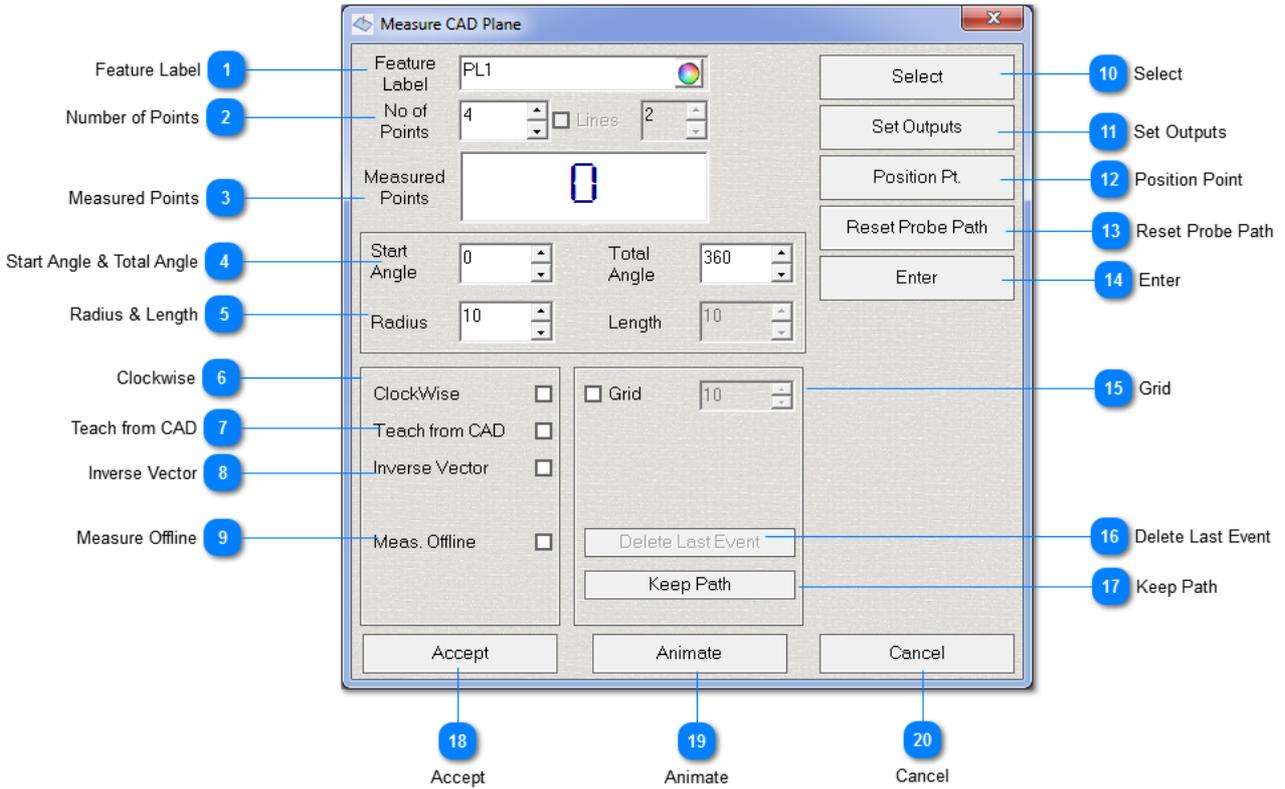
Will show a graphical animation of the measurement.

12 CancelA rectangular button with the text "Cancel" centered inside.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Plane



1 Feature Label



Input a label for the feature to be measured here.

2 Number of Points



May be configured when not using teach from CAD option.

3 Measured Points



Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Start Angle	0	Total Angle	360
-------------	---	-------------	-----

Start Angle of the plane measurement, **Total Angle** of the plane measurement, radial distance of the plane measurement from the pick point on CAD or the center point of the created nominal.

5 Radius & Length

Radius	10	Length	10
--------	----	--------	----

Radius: Specifies the radius of the plane. **Length:** This input not applicable for plane measurement.

6 Clockwise

Clockwise	<input type="checkbox"/>
-----------	--------------------------

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD	<input type="checkbox"/>
----------------	--------------------------

Used as if the system is in **Program Mode**, the user will be able to control the point measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

Inverse Vector	<input type="checkbox"/>
----------------	--------------------------

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline	<input type="checkbox"/>
---------------	--------------------------

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 Select

Select

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

11 Set Outputs

A rectangular button with a light gray background and a thin black border, containing the text "Set Outputs" in a standard sans-serif font.

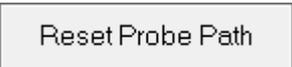
Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

12 Position Point

A rectangular button with a light gray background and a thin black border, containing the text "Position Pt." in a standard sans-serif font.

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

13 Reset Probe Path

A rectangular button with a light gray background and a thin black border, containing the text "Reset Probe Path" in a standard sans-serif font.

Will clear the probe path from the **Graphics Window**.

14 Enter

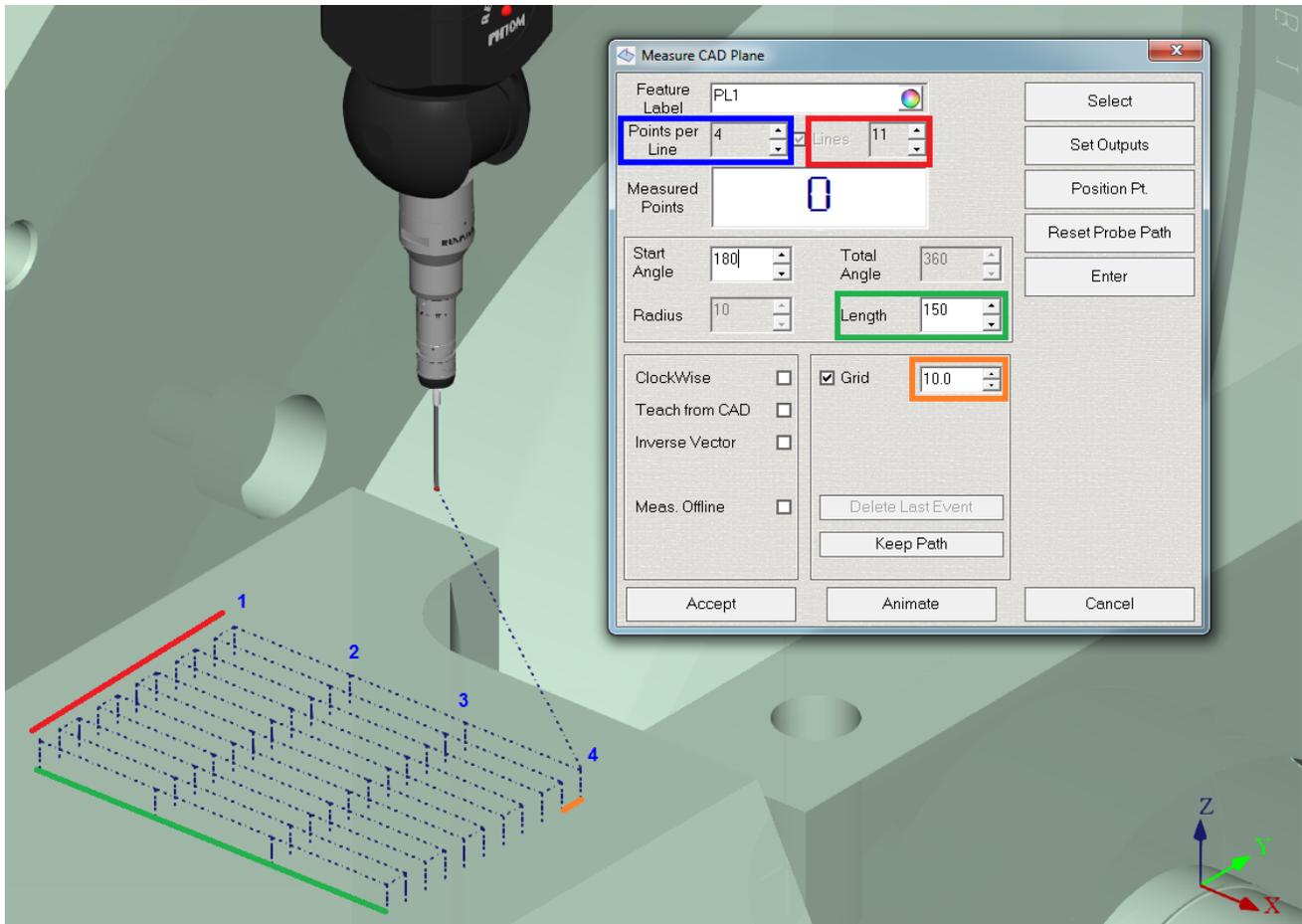
A rectangular button with a light gray background and a thin black border, containing the text "Enter" in a standard sans-serif font.

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

15 Grid



Used to define a grid pattern in for the plane feature to be measured. The following screen capture shows how the grid parameters are controlled using the MeasCAD Plane dialog:



Points per Line: Controls the number of points for the each line in the **Grid**.

Lines: Controls the number of lines in the **Grid**.

Start Angle: Controls the rotation of the **Grid**.

Length: Based on the current **Units** selected, length represents the length of each line. **e.g. .150 MM per line.**

Grid Pitch: Based on the current Units selected, pitch represents the pitch length of the **Grid**, that is the distance between each line. **e.g. 10 MM.**

16 Delete Last Event



Deletes the last event.

17 Keep Path



Used to prevent making changes to the probe path generated manually.

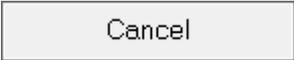
18 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!! Be sure to avoid any collisions when working in an online environment.

19 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard sans-serif font.

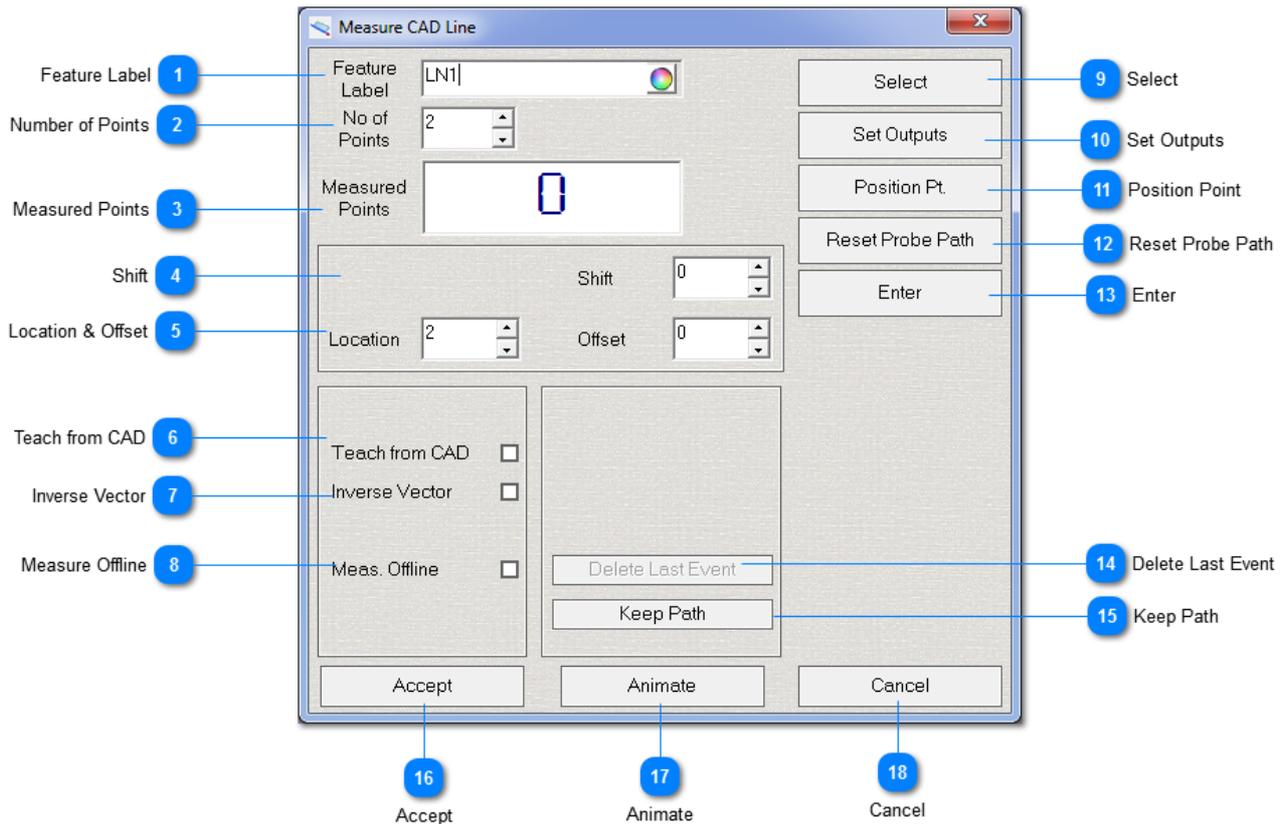
Will show a graphical animation of the measurement.

20 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Line



1 Feature Label



Input a label for the feature to be measured here.

2 Number of Points



May be configured when not using teach from CAD option.

3 Measured Points



Acts as a point counter when features are in the process of being measured.

4 Shift


 A control panel for the 'Shift' parameter. It consists of a text label 'Shift' on the left and a numeric input field on the right. The input field contains the number '0' and has small upward and downward arrow icons on its right side.

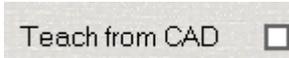
Used to shift the start and end points of the line.

5 Location & Offset


 Two control panels side-by-side. The left panel is for 'Location', with a text label 'Location' and a numeric input field containing '2'. The right panel is for 'Offset', with a text label 'Offset' and a numeric input field containing '0'. Both input fields have small upward and downward arrow icons on their right sides.

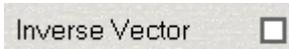
Location: Used when picking features from a list or graphics. Not used when teach from CAD is enabled. This parameter is used to control the depth of the measurement. **Offset:** Used to define the start and the end positions of a line.

6 Teach from CAD


 A control panel for the 'Teach from CAD' option. It features a text label 'Teach from CAD' followed by an unchecked checkbox.

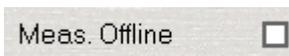
Used as if the system is in **Program Mode**, the user will be able to control the point measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

7 Inverse Vector


 A control panel for the 'Inverse Vector' option. It features a text label 'Inverse Vector' followed by an unchecked checkbox.

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

8 Measure Offline


 A control panel for the 'Measure Offline' option. It features a text label 'Meas. Offline' followed by an unchecked checkbox.

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

9 Select


 A simple rectangular button with the text 'Select' centered on it.

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

10 Set Outputs

 A rectangular button with a light gray background and a thin black border, containing the text "Set Outputs" in a standard sans-serif font.

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

11 Position Point

 A rectangular button with a light gray background and a thin black border, containing the text "Position Pt." in a standard sans-serif font.

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

12 Reset Probe Path

 A rectangular button with a light gray background and a thin black border, containing the text "Reset Probe Path" in a standard sans-serif font.

Will clear the probe path from the **Graphics Window**.

13 Enter

 A rectangular button with a light gray background and a thin black border, containing the text "Enter" in a standard sans-serif font.

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

14 Delete Last Event

 A rectangular button with a light gray background and a thin black border, containing the text "Delete Last Event" in a standard sans-serif font.

Deletes the last event.

15 Keep Path

 A rectangular button with a light gray background and a thin black border, containing the text "Keep Path" in a standard sans-serif font.

Used to prevent making changes to the probe path generated manually.

16 Accept

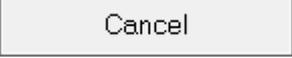
 A rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!! Be sure to avoid any collisions when working in an online environment.

17 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard sans-serif font.

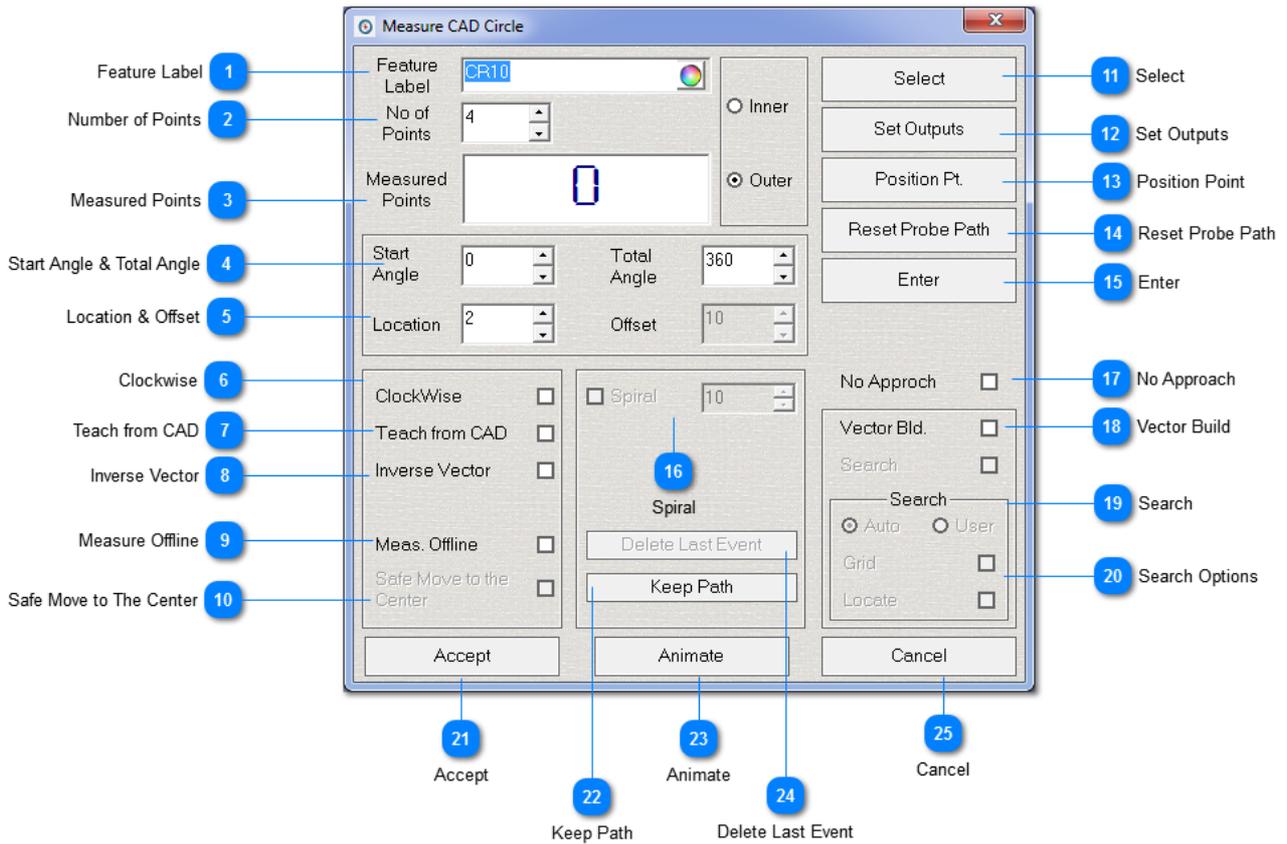
Will show a graphical animation of the measurement.

18 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Circle



1 Feature Label



Input a label for the feature to be measured here.

2 Number of Points



May be configured when not using teach from CAD option.

3 Measured Points



Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Start Angle	0	Total Angle	360
-------------	---	-------------	-----

Start Angle: This option configures the start of the measurement. The start point is always at X+ if in the XY workplane, Y+ if in the YZ workplane, and Z+ if in the ZX workplane. This is according to PCS.

Total Angle: This option configures the end of the feature measurement travel. For instance, a half circle measurement would be configured for 180 degrees from the start angle.

5 Location & Offset

Location	2	Offset	10
----------	---	--------	----

Location: Used when picking features from a list or graphics. Not used when teach from CAD is enabled. This parameter is used to control the depth of the measurement. **Offset:** Used in conjunction with the vector build option in the same dialog.

6 Clockwise

Clockwise	<input type="checkbox"/>
-----------	--------------------------

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD	<input type="checkbox"/>
----------------	--------------------------

Used as if the system is in **Program Mode**, the user will be able to control the pt measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

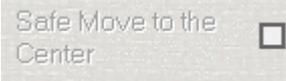
Inverse Vector	<input type="checkbox"/>
----------------	--------------------------

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline	<input type="checkbox"/>
---------------	--------------------------

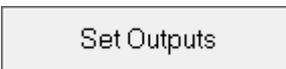
Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 Safe Move to The Center

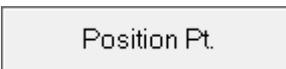
Moves the probe from its current position to the center of the circle before start measuring the feature.

11 Select

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

12 Set Outputs

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

13 Position Point

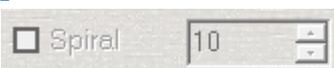
Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

14 Reset Probe Path

Will clear the probe path from the **Graphics Window**.

15 Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

16 Spiral

Used to measure parts with threads. Allows to scan along the thread using the pitch value.

17 No Approach

No Approach

Used to eliminate the **Approach Distance** for feature measurements.

18 Vector Build

Vector Bld.

Used as a standalone on/off or in conjunction with **Search, Grid and Locate** options. If used as a standalone configuration, the CMM will measure 3 points on the surface where the feature lies and then measure the feature at a depth (controlled by the location parameter) relative to the measured surface.

19 Search

Search

Searches for the presence of the feature in the part.

20 Search Options

Search

Auto User

Grid

Locate

Auto & User:	Specifies if the search process is done either by user or in auto mode.
Grid:	If the machine finds material (no feature), it will perform a grid search on the part by the specified parameters. Default parameters are noted. 5mm x 5mm grid with an 11.7mm step over. GRID,5,5,11.7
Locate:	This parameter will tell the CMM to locate the position of the found feature by taking 3 hits inside the feature once the presence of the feature is found. After the feature is located, the vector build routine will begin. Vector build used in conjunction with search, grid, and locate functions.

```
F (CR1) =FEAT/CIRCLE, INNER, CART, $
170.0000,-141.5732,-893.8579,1.0000,0.0000,0.0000,35.0000
RMEAS/CIRCLE, F (CR1) , 5, VECBLD, 2.0000, 3, SEARCH, LOCATE, GRID, 5, 5, 11.7
GOTO/195.0000,-129.5732,-893.8579
PTMEAS/CART, 168.0000,-124.0732,-893.8579,-0.0000,-1.0000,-0.0000
PTMEAS/CART, 168.0000,-129.1988,-881.4835,-0.0000,-0.7071,-0.7071
PTMEAS/CART, 168.0000,-141.5732,-876.3579,-0.0000,-0.0000,-1.0000
PTMEAS/CART, 168.0000,-153.9476,-881.4835,-0.0000,0.7071,-0.7071
PTMEAS/CART, 168.0000,-159.0732,-893.8579,-0.0000,1.0000,-0.0000
GOTO/195.0000,-153.5732,-893.8579
ENDMES
OUTPUT/FA (CR1) , TA (TX1) , TA (TY1) , TA (TZ1) , TA (TD2)
```

21 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!! Be sure to avoid any collisions when working in an online environment.

22 Keep PathA rectangular button with a light gray background and a thin black border, containing the text "Keep Path" in a standard sans-serif font.

Used to prevent making changes to the probe path generated manually.

23 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard sans-serif font.

Will show a graphical animation of the measurement.

24 Delete Last EventA rectangular button with a light gray background and a thin black border, containing the text "Delete Last Event" in a standard sans-serif font.

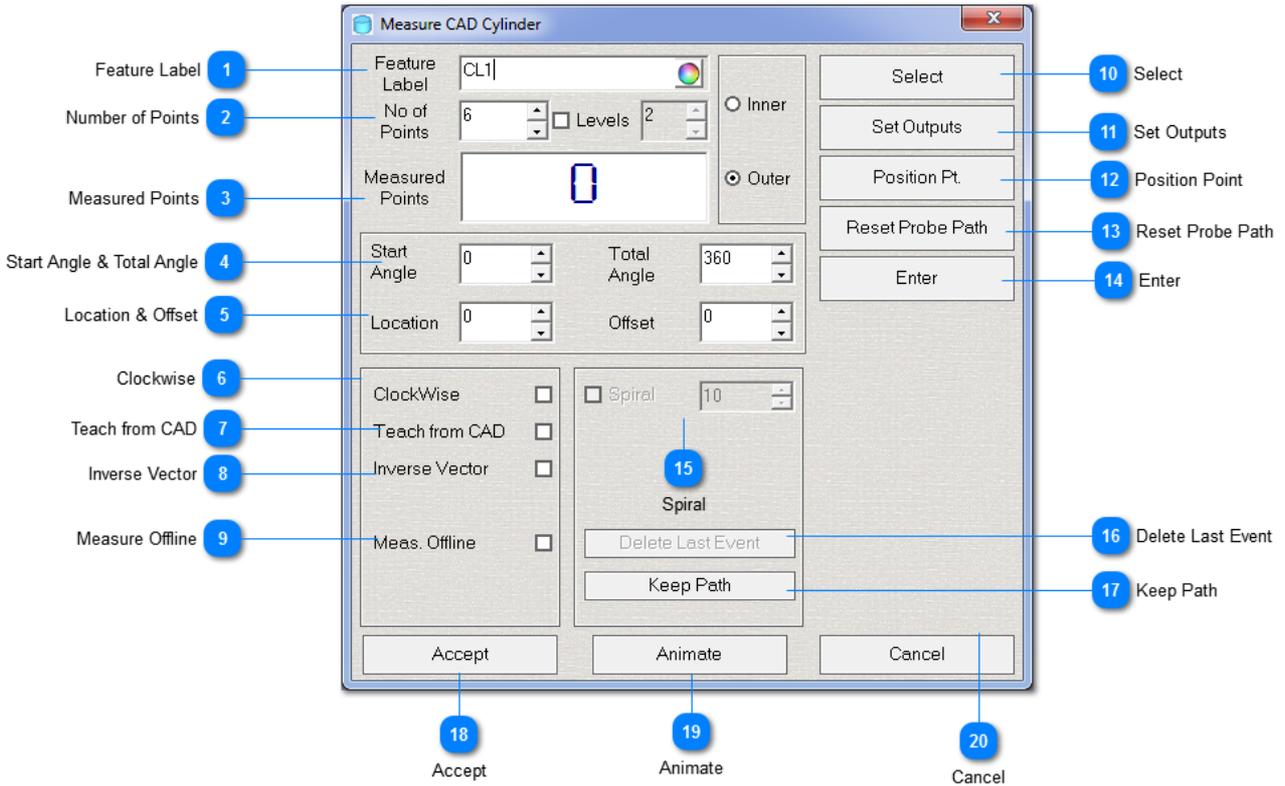
Deletes the last event.

25 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Cylinder



1 Feature Label



Input a label for the feature to be measured here.

2 Number of Points



May be configured when not using teach from CAD option.

3 Measured Points



Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Start Angle	0	Total Angle	360
-------------	---	-------------	-----

Start Angle: This option configures the start of the measurement. The start point is always at X+ if in the XY workplane, Y+ if in the YZ workplane, and Z+ if in the ZX workplane. This is according to PCS.

Total Angle: This option configures the end of the feature measurement travel. For instance, a half circle measurement would be configured for 180 degrees from the start angle.

5 Location & Offset

Location	0	Offset	0
----------	---	--------	---

Location: Used when picking features from a list or graphics. Not used when teach from CAD is enabled. This parameter is used to control the depth of the measurement. **Offset:** This parameter controls how far inside the ends of the cylinder the CMM will measure.

6 Clockwise

Clockwise	<input type="checkbox"/>
-----------	--------------------------

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD	<input type="checkbox"/>
----------------	--------------------------

Used as if the system is in **Program Mode**, the user will be able to control the pt measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

Inverse Vector	<input type="checkbox"/>
----------------	--------------------------

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline	<input type="checkbox"/>
---------------	--------------------------

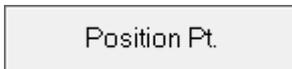
Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 Select

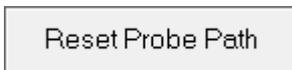
Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

11 Set Outputs

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

12 Position Point

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

13 Reset Probe Path

Will clear the probe path from the **Graphics Window**.

14 Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

15 Spiral

Used to measure parts with threads. Allows to scan along the thread using the pitch value.

16 Delete Last Event

Deletes the last event.

17 Keep PathA rectangular button with a light gray background and a thin black border, containing the text "Keep Path" in a standard sans-serif font.

Used to prevent making changes to the probe path generated manually.

18 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!!: Be sure to avoid any collisions when working in an online environment.

19 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard sans-serif font.

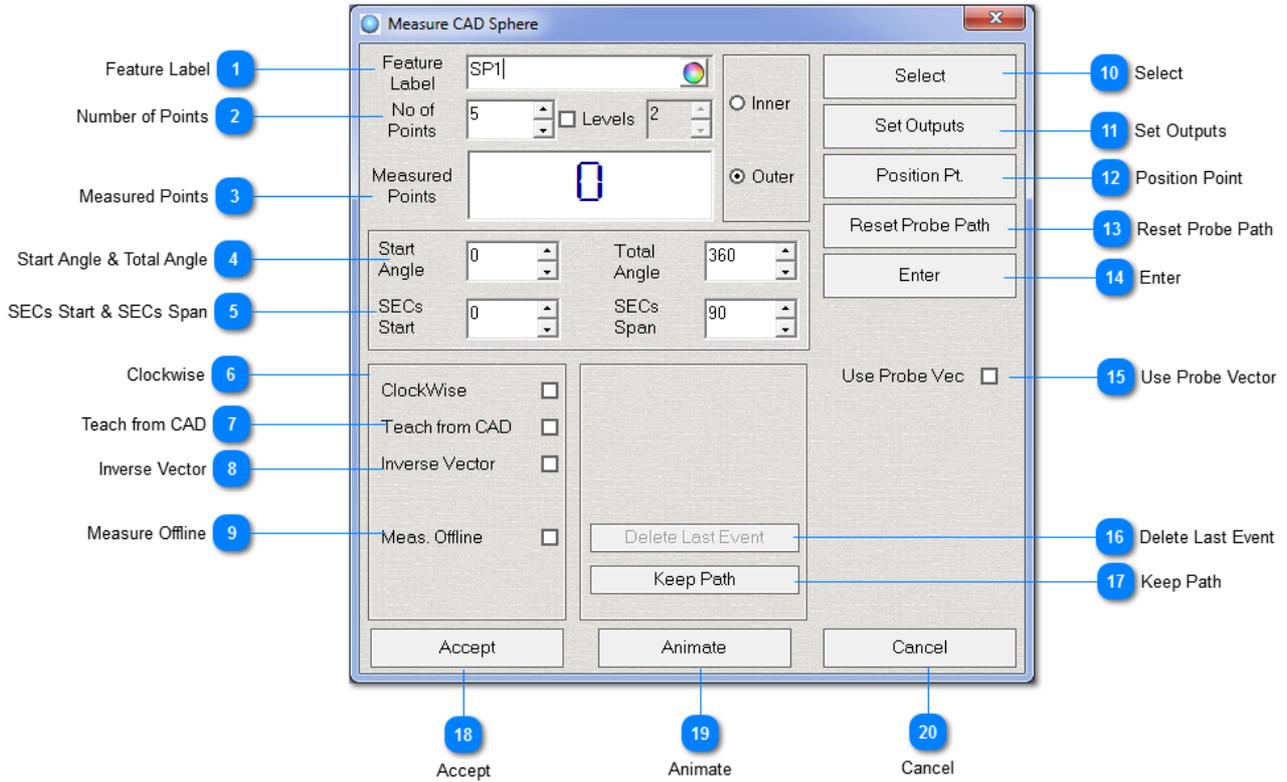
Will show a graphical animation of the measurement.

20 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Sphere



1 Feature Label



Input a label for the feature to be measured here.

2 Number of Points



May be configured when not using teach from CAD option.

3 Measured Points



Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Start Angle	0	Total Angle	360
-------------	---	-------------	-----

Start Angle: This option configures the start of the measurement. The start point is always at X+ if in the XY workplane, Y+ if in the YZ workplane, and Z+ if in the ZX workplane. This is according to PCS.

Total Angle: This option configures the end of the feature measurement travel. For instance, a half circle measurement would be configured for 180 degrees from the start angle.

5 SECs Start & SECs Span

SECs Start	0	SECs Span	90
------------	---	-----------	----

SECs Start: This parameter controls the angle of start with zero being the first touch on top of the sphere.

SECs Span: This parameter controls total span of measurement in degrees from the top of the sphere.

6 Clockwise

Clockwise	<input type="checkbox"/>
-----------	--------------------------

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD	<input type="checkbox"/>
----------------	--------------------------

Used as if the system is in **Program Mode**, the user will be able to control the pt measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

Inverse Vector	<input type="checkbox"/>
----------------	--------------------------

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline	<input type="checkbox"/>
---------------	--------------------------

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 Select

Select

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

11 Set Outputs

Set Outputs

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

12 Position Point

Position Pt.

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

13 Reset Probe Path

Reset Probe Path

Will clear the probe path from the **Graphics Window**.

14 Enter

Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

15 Use Probe Vector

Use Probe Vec

If this on/off flag is checked, the CMM will use the current vector of the probe for the initial approach on the sphere measurement.

16 Delete Last Event

Delete Last Event

Deletes the last event.

17 Keep PathA rectangular button with a light gray background and a thin black border, containing the text "Keep Path" in a standard sans-serif font.

Used to prevent making changes to the probe path generated manually.

18 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!!: Be sure to avoid any collisions when working in an online environment.

19 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard sans-serif font.

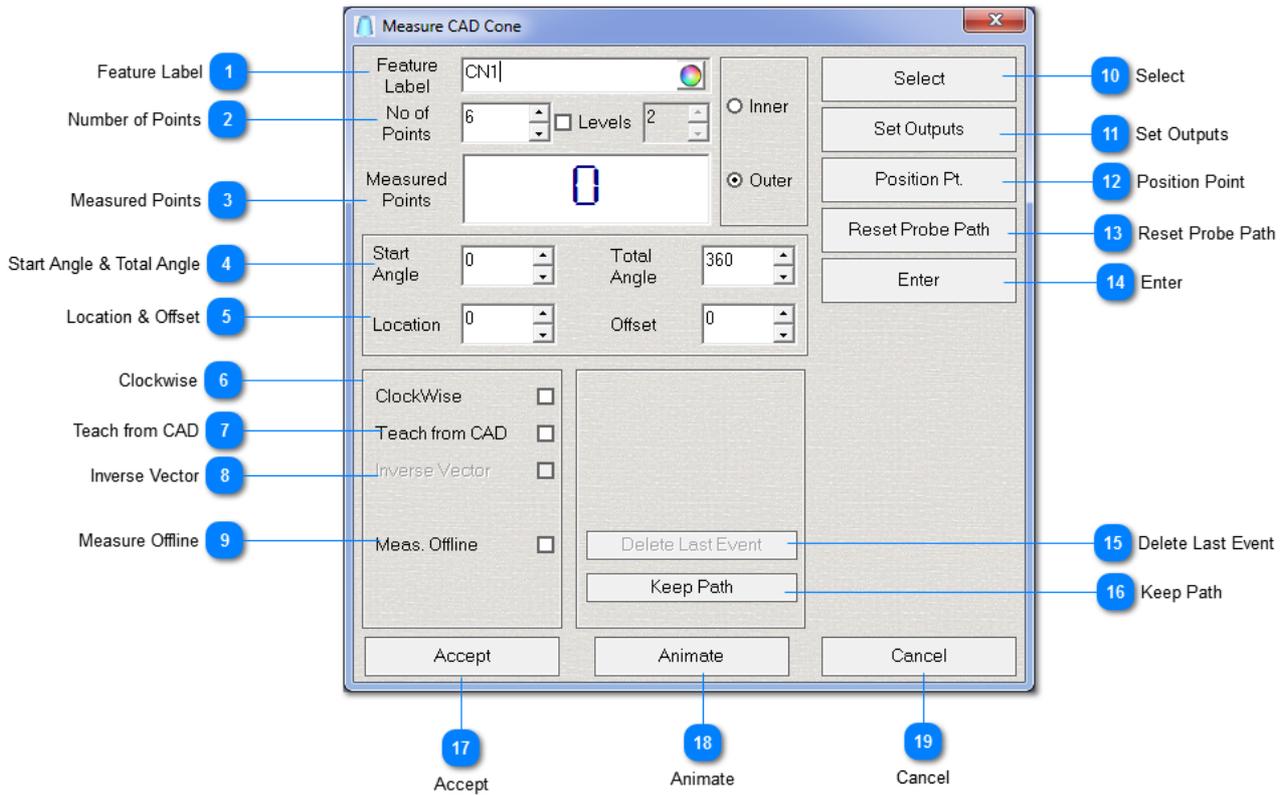
Will show a graphical animation of the measurement.

20 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Cone



1 Feature Label



Input a label for the feature to be measured here.

2 Number of Points



May be configured when not using teach from CAD option.

3 Measured Points



Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Start Angle	0	Total Angle	360
-------------	---	-------------	-----

Start Angle: This option configures the start of the measurement. The start point is always at X+ if in the XY workplane, Y+ if in the YZ workplane, and Z+ if in the ZX workplane. This is according to PCS.

Total Angle: This option configures the end of the feature measurement travel. For instance, a half circle measurement would be configured for 180 degrees from the start angle.

5 Location & Offset

Location	0	Offset	0
----------	---	--------	---

Location: Used when picking features from a list or graphics. Not used when teach from CAD is enabled. This parameter is used to control the depth of the measurement. **Offset:** This parameter controls how far inside the ends of the cylinder the CMM will measure.

6 Clockwise

Clockwise	<input type="checkbox"/>
-----------	--------------------------

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD	<input type="checkbox"/>
----------------	--------------------------

Used as if the system is in **Program Mode**, the user will be able to control the pt measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

Inverse Vector	<input type="checkbox"/>
----------------	--------------------------

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline	<input type="checkbox"/>
---------------	--------------------------

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 SelectA rectangular button with a light gray background and a thin black border, containing the text "Select" in a standard sans-serif font.

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

11 Set OutputsA rectangular button with a light gray background and a thin black border, containing the text "Set Outputs" in a standard sans-serif font.

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

12 Position PointA rectangular button with a light gray background and a thin black border, containing the text "Position Pt." in a standard sans-serif font.

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

13 Reset Probe PathA rectangular button with a light gray background and a thin black border, containing the text "Reset Probe Path" in a standard sans-serif font.

Will clear the probe path from the **Graphics Window**.

14 EnterA rectangular button with a light gray background and a thin black border, containing the text "Enter" in a standard sans-serif font.

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

15 Delete Last EventA rectangular button with a light gray background and a thin black border, containing the text "Delete Last Event" in a standard sans-serif font.

Deletes the last event.

16 Keep PathA rectangular button with a light gray background and a thin black border, containing the text "Keep Path" in a standard sans-serif font.

Used to prevent making changes to the probe path generated manually.

17 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard black font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!!: Be sure to avoid any collisions when working in an online environment.

18 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard black font.

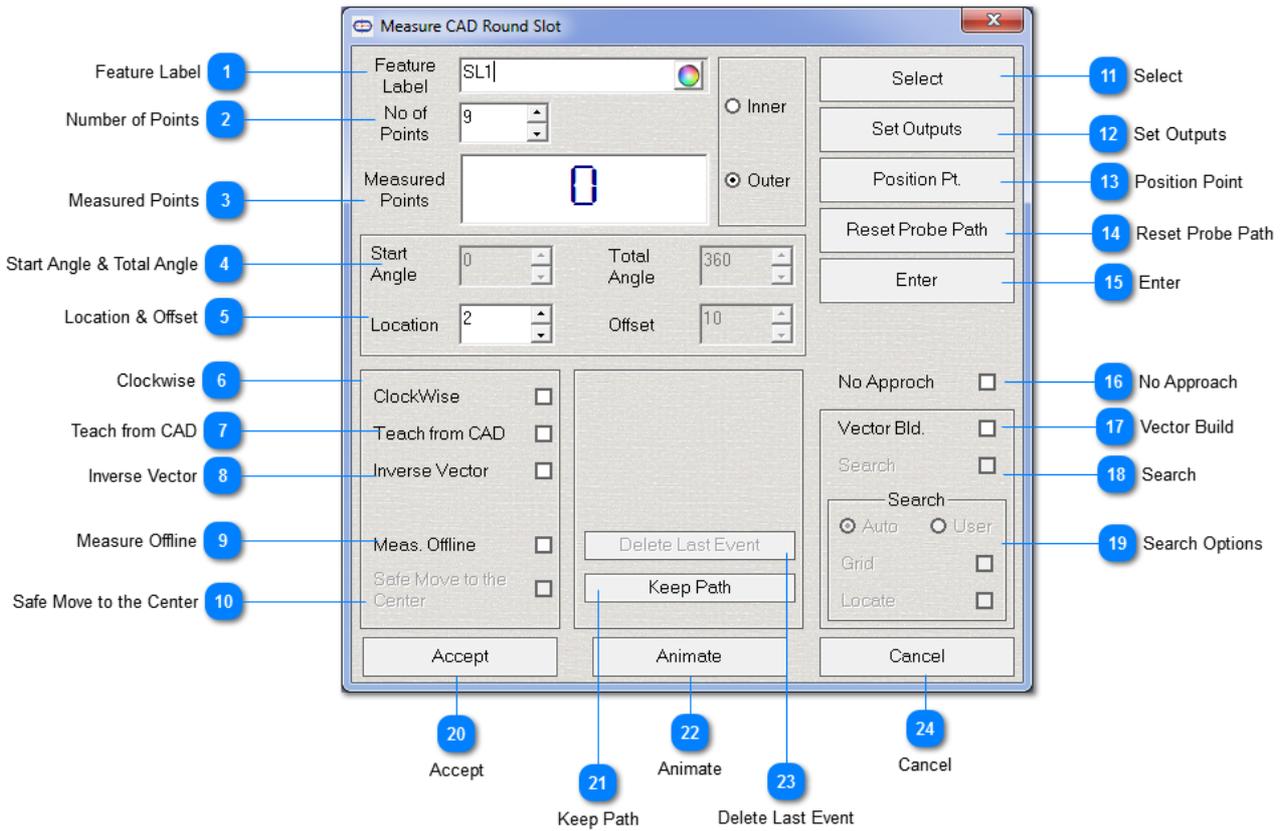
Will show a graphical animation of the measurement.

19 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard black font.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Round Slot



1 Feature Label



Input a label for the feature to be measured here.

2 Number of Points



May be configured when not using teach from CAD option.

3 Measured Points



Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Start Angle	0	Total Angle	360
-------------	---	-------------	-----

Start Angle: This option configures the start of the measurement. The start point is always at X+ if in the XY workplane, Y+ if in the YZ workplane, and Z+ if in the ZX workplane. This is according to PCS.

Total Angle: This option configures the end of the feature measurement travel. For instance, a half circle measurement would be configured for 180 degrees from the start angle.

5 Location & Offset

Location	2	Offset	10
----------	---	--------	----

Location: Used when picking features from a list or graphics. Not used when teach from CAD is enabled. This parameter is used to control the depth of the measurement. **Offset:** Used in conjunction with the vector build option in the same dialog.

6 Clockwise

Clockwise	<input type="checkbox"/>
-----------	--------------------------

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD	<input type="checkbox"/>
----------------	--------------------------

Used as if the system is in **Program Mode**, the user will be able to control the pt measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

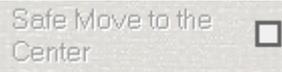
Inverse Vector	<input type="checkbox"/>
----------------	--------------------------

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline	<input type="checkbox"/>
---------------	--------------------------

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 Safe Move to the Center

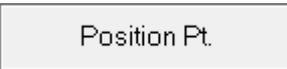
Moves the probe from its current position to the center of the circle before start measuring the feature.

11 Select

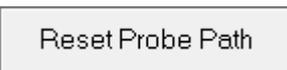
Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

12 Set Outputs

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

13 Position Point

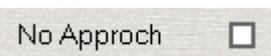
Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

14 Reset Probe Path

Will clear the probe path from the **Graphics Window**.

15 Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

16 No Approach

Used to eliminate the **Approach Distance** for feature measurements.

17 Vector Build

Vector Bld.

Used as a standalone on/off or in conjunction with Search, Grid and Locate options. If used as a standalone configuration, the CMM will measure 3 points on the surface where the feature lies and then measure the feature at a depth (controlled by the location parameter) relative to the measured surface.

18 Search

Search

Searches for the presence of the feature in the part.

19 Search Options

Search

Auto User

Grid

Locate

Auto & User:	Specifies if the search process is done either by user or in auto mode.
Grid:	If the machine finds material (no feature), it will perform a grid search on the part by the specified parameters. Default parameters are noted. 5mm x 5mm grid with an 11.7mm step over. GRID,5,5,11.7
Locate:	This parameter will tell the CMM to locate the position of the found feature by taking 3 hits inside the feature once the presence of the feature is found. After the feature is located, the vector build routine will begin. Vector build used in conjunction with search, grid, and locate functions.

```
F (SL1)=FEAT/CPARLN, INNER, ROUND, CART, 29.9190, 54.6355, 62.5000, $
0.0000, -0.0000, 1.0000, -1.0000, -0.0001, 0.0000, 50.1381, 12.6948
RMEAS/CPARLN, F (SL1), 9, VECBLD, 2.0000, 3, SEARCH, LOCATE, GRID, 5, 5, 4.2
GOTO/23.6785, 52.7878, 87.5000
PTMEAS/CART, 23.6788, 48.2878, 60.5000, -0.0001, 1.0000, 0.0000
PTMEAS/CART, 36.1599, 48.2885, 60.5000, -0.0001, 1.0000, 0.0000
PTMEAS/CART, 49.7431, 48.3856, 60.5000, -0.1737, 0.9848, 0.0000
PTMEAS/CART, 54.9880, 54.6369, 60.5000, -1.0000, -0.0001, 0.0000
PTMEAS/CART, 49.7424, 60.8876, 60.5000, -0.1736, -0.9848, -0.0000
PTMEAS/CART, 29.9186, 60.9829, 60.5000, 0.0001, -1.0000, -0.0000
PTMEAS/CART, 10.0948, 60.8854, 60.5000, 0.1737, -0.9848, -0.0000
PTMEAS/CART, 4.8499, 54.6341, 60.5000, 1.0000, 0.0001, -0.0000
PTMEAS/CART, 10.0955, 48.3834, 60.5000, 0.1736, 0.9848, 0.0000
GOTO/10.8767, 52.8151, 87.5000
ENDMES
OUTPUT/FA (SL1), TA (TX1), TA (TY1), TA (TZ1), TA (TW2)
```

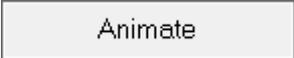
20 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!!: Be sure to avoid any collisions when working in an online environment.

21 Keep PathA rectangular button with a light gray background and a thin black border, containing the text "Keep Path" in a standard sans-serif font.

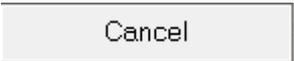
Used to prevent making changes to the probe path generated manually.

22 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard sans-serif font.

Will show a graphical animation of the measurement.

23 Delete Last EventA rectangular button with a light gray background and a thin black border, containing the text "Delete Last Event" in a standard sans-serif font.

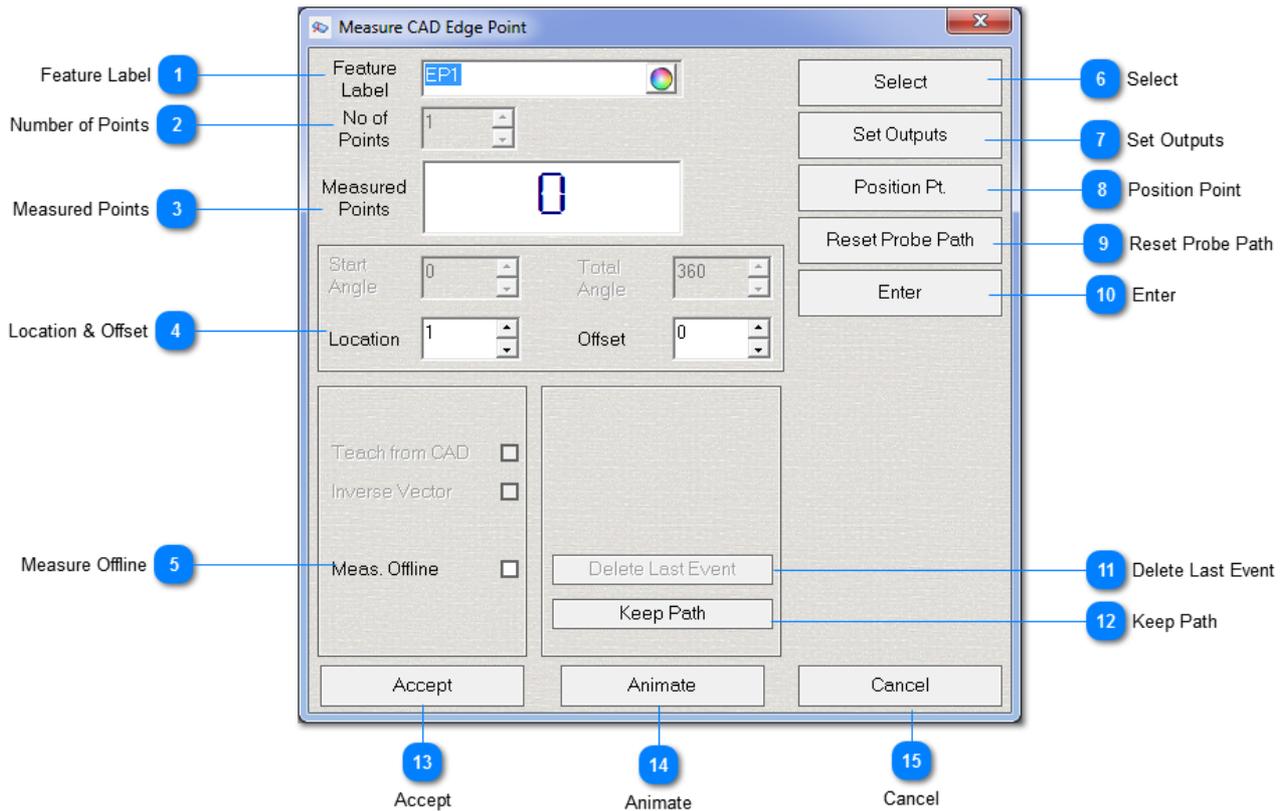
Deletes the last event.

24 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Edge Point



1 Feature Label

Feature
Label

Input a label for the feature to be measured here.

2 Number of Points

No of
Points

May be configured when not using teach from CAD option.

3 Measured Points

Measured
Points

Acts as a point counter when features are in the process of being measured.

4 Location & Offset

Location: Used to control how far in from the edge the first touch or series of touches are made on the part.

Offset: Used to control the depth on the second touch or series of touches in relation to the first set of touches.

5 Measure Offline

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

6 Select

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

7 Set Outputs

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

8 Position Point

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

9 Reset Probe Path

Will clear the probe path from the **Graphics Window**.

10 Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

11 Delete Last Event

Deletes the last event.

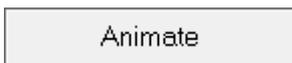
12 Keep Path

Used to prevent making changes to the probe path generated manually.

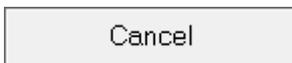
13 Accept

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!! Be sure to avoid any collisions when working in an online environment.

14 Animate

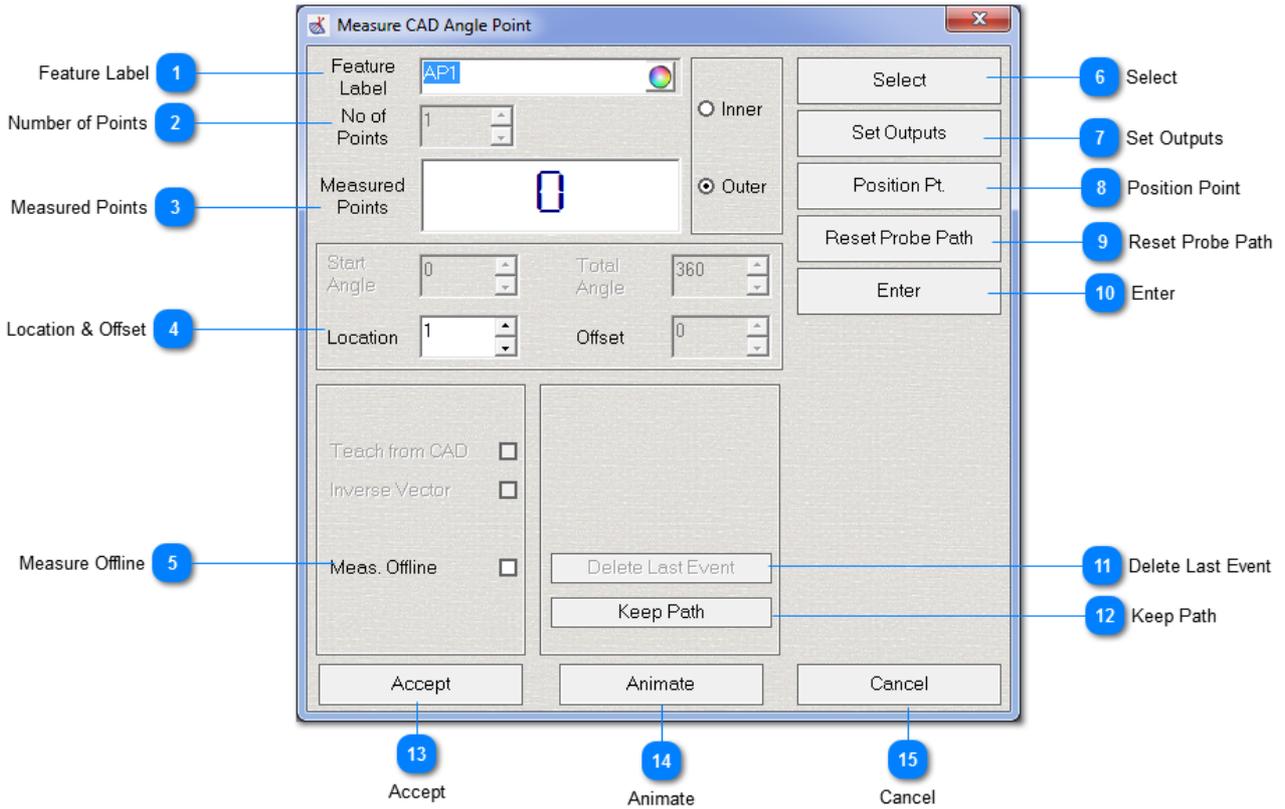
Will show a graphical animation of the measurement.

15 Cancel

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Angle Point



1 Feature Label



Input a label for the feature to be measured here.

2 Number of Points



May be configured when not using teach from CAD option.

3 Measured Points



Acts as a point counter when features are in the process of being measured.

4 Location & Offset

Location: Used to control how far in from the edge the first touch or series of touches are made on the part.

Offset: This input not applicable for angle point measurement.

5 Measure Offline

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

6 Select

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

7 Set Outputs

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

8 Position Point

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

9 Reset Probe Path

Will clear the probe path from the **Graphics Window**.

10 Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

11 Delete Last Event

Deletes the last event.

12 Keep Path

Used to prevent making changes to the probe path generated manually.

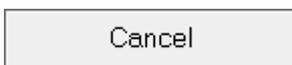
13 Accept

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!! Be sure to avoid any collisions when working in an online environment.

14 Animate

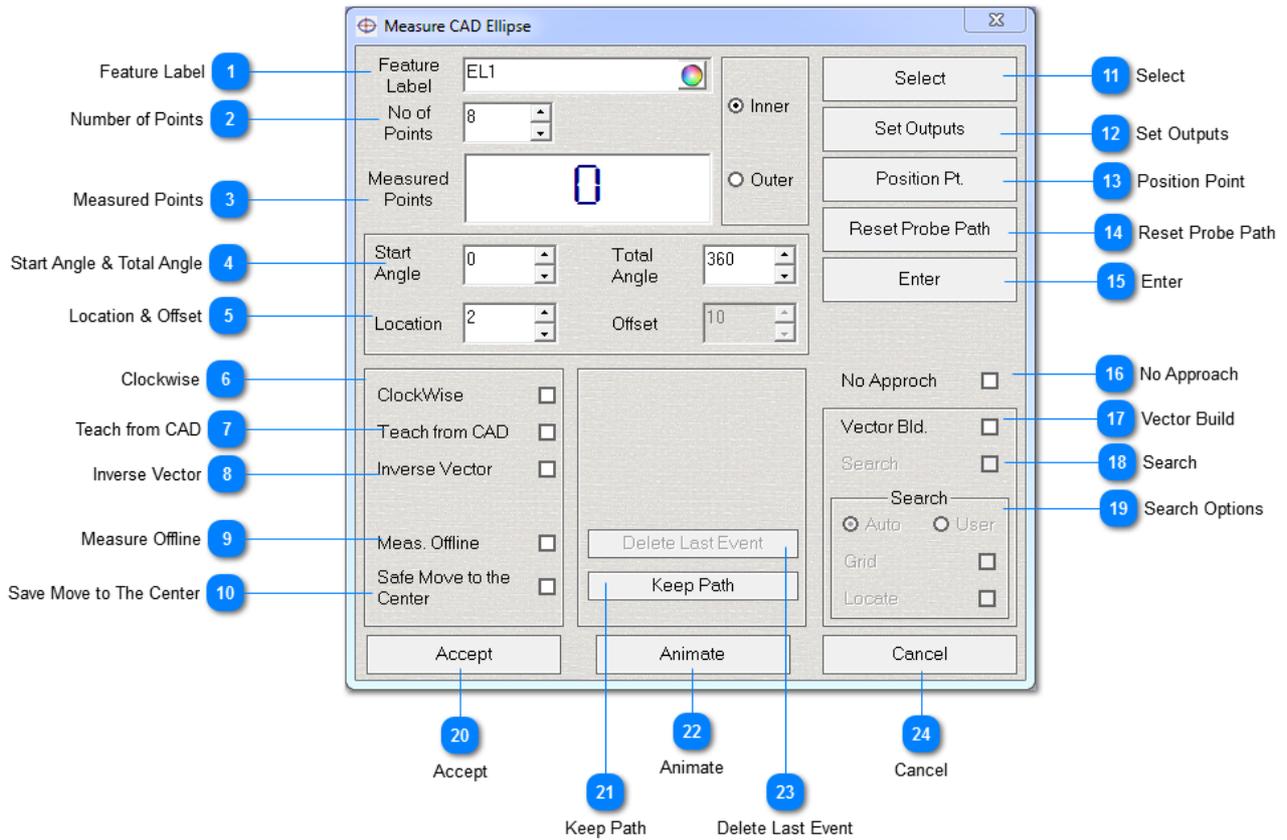
Will show a graphical animation of the measurement.

15 Cancel

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Ellipse



1 Feature Label

Feature
Label

Input a label for the feature to be measured here.

2 Number of Points

No of
Points

May be configured when not using teach from CAD option.

3 Measured Points

Measured
Points

0

Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Start Angle	0	Total Angle	360
-------------	---	-------------	-----

Start Angle: This option configures the start of the measurement. The start point is always at X+ if in the XY workplane, Y+ if in the YZ workplane, and Z+ if in the ZX workplane. This is according to PCS.

Total Angle: This option configures the end of the feature measurement travel. For instance, a half circle measurement would be configured for 180 degrees from the start angle.

5 Location & Offset

Location	2	Offset	10
----------	---	--------	----

Location: Used when picking features from a list or graphics. Not used when teach from CAD is enabled. This parameter is used to control the depth of the measurement. **Offset:** Used in conjunction with the vector build option in the same dialog.

6 Clockwise

Clockwise	<input type="checkbox"/>
-----------	--------------------------

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD	<input type="checkbox"/>
----------------	--------------------------

Used as if the system is in **Program Mode**, the user will be able to control the pt measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

Inverse Vector	<input type="checkbox"/>
----------------	--------------------------

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline	<input type="checkbox"/>
---------------	--------------------------

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 Save Move to The Center

Safe Move to the Center

Moves the probe from its current position to the center of the ellipse before start measuring the feature.

11 Select

Select

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

12 Set Outputs

Set Outputs

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

13 Position Point

Position Pt.

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

14 Reset Probe Path

Reset Probe Path

Will clear the probe path from the **Graphics Window**.

15 Enter

Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

16 No Approach

No Approach

Used to eliminate the **Approach Distance** for feature measurements.

17 Vector Build

Vector Bld.

Used as a standalone on/off or in conjunction with Search, Grid and Locate options. If used as a standalone configuration, the CMM will measure 3 points on the surface where the feature lies and then measure the feature at a depth (controlled by the location parameter) relative to the measured surface.

18 Search

Search

Searches for the presence of the feature in the part.

19 Search Options



Auto & User:	Specifies if the search process is done either by user or in auto mode.
Grid:	If the machine finds material (no feature), it will perform a grid search on the part by the specified parameters. Default parameters are noted. 5mm x 5mm grid with an 11.7mm step over. GRID,5,5,11.7
Locate:	This parameter will tell the CMM to locate the position of the found feature by taking 3 hits inside the feature once the presence of the feature is found. After the feature is located, the vector build routine will begin. Vector build used in conjunction with search, grid, and locate functions.

```
F (CR1) =FEAT/CIRCLE, INNER, CART, $
170.0000, -141.5732, -893.8579, 1.0000, 0.0000, 0.0000, 35.0000
RMEAS/CIRCLE, F (CR1), 5, VECBLD, 2.0000, 3, SEARCH, LOCATE, GRID, 5, 5, 11.7
GOTO/195.0000, -129.5732, -893.8579
PTMEAS/CART, 168.0000, -124.0732, -893.8579, -0.0000, -1.0000, -0.0000
PTMEAS/CART, 168.0000, -129.1988, -881.4835, -0.0000, -0.7071, -0.7071
PTMEAS/CART, 168.0000, -141.5732, -876.3579, -0.0000, -0.0000, -1.0000
PTMEAS/CART, 168.0000, -153.9476, -881.4835, -0.0000, 0.7071, -0.7071
PTMEAS/CART, 168.0000, -159.0732, -893.8579, -0.0000, 1.0000, -0.0000
GOTO/195.0000, -153.5732, -893.8579
ENDMES
OUTPUT/FA (CR1), TA (TX1), TA (TY1), TA (TZ1), TA (TD2)
```

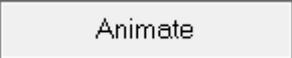
20 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!!: Be sure to avoid any collisions when working in an online environment.

21 Keep PathA rectangular button with a light gray background and a thin black border, containing the text "Keep Path" in a standard sans-serif font.

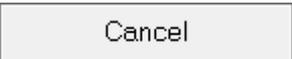
Used to prevent making changes to the probe path generated manually.

22 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard sans-serif font.

Will show a graphical animation of the measurement.

23 Delete Last EventA rectangular button with a light gray background and a thin black border, containing the text "Delete Last Event" in a standard sans-serif font.

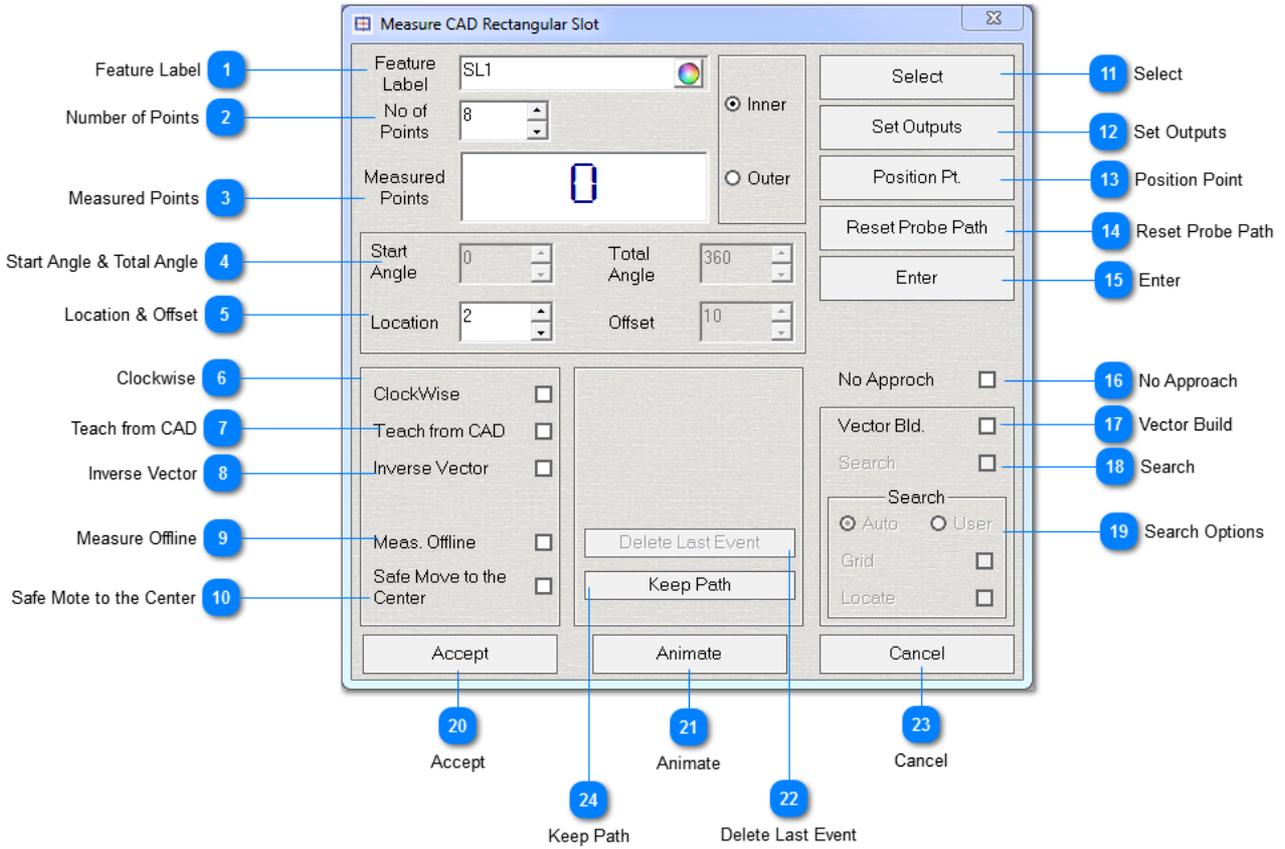
Deletes the last event.

24 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

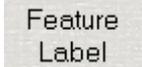
Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Rectangular Slot

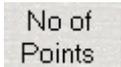


1 Feature Label



Input a label for the feature to be measured here.

2 Number of Points



May be configured when not using teach from CAD option.

3 Measured Points



Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Start Angle	0	Total Angle	360
-------------	---	-------------	-----

Start Angle: This option configures the start of the measurement. The start point is always at X+ if in the XY workplane, Y+ if in the YZ workplane, and Z+ if in the ZX workplane. This is according to PCS.

Total Angle: This option configures the end of the feature measurement travel. For instance, a half circle measurement would be configured for 180 degrees from the start angle.

5 Location & Offset

Location	2	Offset	10
----------	---	--------	----

Location: Used when picking features from a list or graphics. Not used when teach from CAD is enabled. This parameter is used to control the depth of the measurement. **Offset:** Used in conjunction with the vector build option in the same dialog.

6 Clockwise

Clockwise	<input type="checkbox"/>
-----------	--------------------------

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD	<input type="checkbox"/>
----------------	--------------------------

Used as if the system is in **Prog Mode**, the user will be able to control the pt measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

Inverse Vector	<input type="checkbox"/>
----------------	--------------------------

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline	<input type="checkbox"/>
---------------	--------------------------

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 Safe Move to the Center

Safe Move to the Center

Moves the probe from its current position to the center of the slot before start measuring the feature.

11 Select

Select

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

12 Set Outputs

Set Outputs

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

13 Position Point

Position Pt.

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

14 Reset Probe Path

Reset Probe Path

Will clear the probe path from the **Graphics Window**.

15 Enter

Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

16 No Approach

No Approach

Measures the rectangular slot by measuring each point from the centre of the rectangular slot.

17 Vector Build

Vector Bld.

Used as a standalone on/off or in conjunction with Search, Grid and Locate options. If used as a standalone configuration, the CMM will measure 3 points on the surface where the feature lies and then measure the feature at a depth (controlled by the location parameter) relative to the measured surface.

18 Search

Search

Searches for the presence of the feature in the part.

19 Search Options



Auto & User:	Specifies if the search process is done either by user or in auto mode.
Grid:	If the machine finds material (no feature), it will perform a grid search on the part by the specified parameters. Default parameters are noted. 5mm x 5mm grid with an 11.7mm step over. GRID,5,5,11.7
Locate:	This parameter will tell the CMM to locate the position of the found feature by taking 3 hits inside the feature once the presence of the feature is found. After the feature is located, the vector build routine will begin. Vector build used in conjunction with search, grid, and locate functions.

```
F (SL1)=FEAT/CPARLN, INNER, FLAT, CART, 29.9190, 54.6360, 62.5000, $
0.0000, 0.0000, 1.0000, -1.0000, 0.0000, 0.0000, 50.1380, 12.6950
RMEAS/CPARLN, F (SL1), 8, VECBLD, 2.0000, 3, SEARCH, LOCATE, GRID, 5, 5, 4.2
GOTO/22.5627, 52.7885, 87.5000
PTMEAS/CART, 22.5627, 48.2885, 60.5000, -0.0000, 1.0000, -0.0000
PTMEAS/CART, 37.2753, 48.2885, 60.5000, -0.0000, 1.0000, -0.0000
PTMEAS/CART, 54.9880, 53.5202, 60.5000, -1.0000, 0.0000, 0.0000
PTMEAS/CART, 54.9880, 55.7518, 60.5000, -1.0000, 0.0000, 0.0000
PTMEAS/CART, 37.2753, 60.9835, 60.5000, 0.0000, -1.0000, 0.0000
PTMEAS/CART, 22.5627, 60.9835, 60.5000, 0.0000, -1.0000, 0.0000
PTMEAS/CART, 4.8500, 55.7518, 60.5000, 1.0000, -0.0000, -0.0000
PTMEAS/CART, 4.8500, 53.5202, 60.5000, 1.0000, -0.0000, -0.0000
GOTO/9.3500, 53.5202, 87.5000
ENDMES
OUTPUT/FA (SL1), TA (TX1), TA (TY1), TA (TZ1), TA (TW2)
```

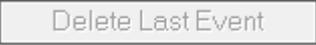
20 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!! Be sure to avoid any collisions when working in an online environment.

21 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard sans-serif font.

Will show a graphical animation of the measurement.

22 Delete Last EventA rectangular button with a light gray background and a thin black border, containing the text "Delete Last Event" in a standard sans-serif font.

Deletes the last event.

23 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

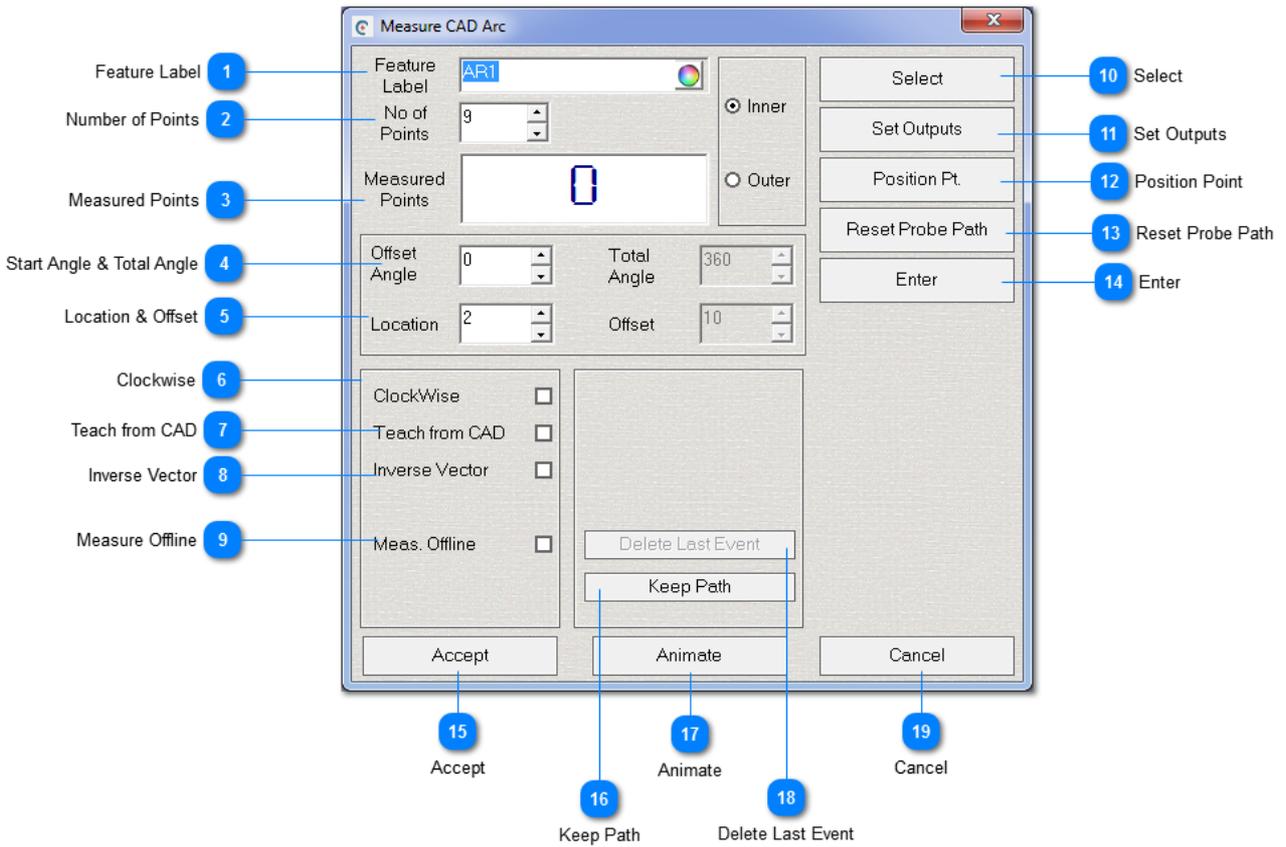
Cancel the changes and close the dialog.

24 Keep PathA rectangular button with a light gray background and a thin black border, containing the text "Keep Path" in a standard sans-serif font.

Used to prevent making changes to the probe path generated manually.

[Automating Feature Measurement](#)

MEAS-CAD Arc



1 Feature Label

Feature Label

Input a label for the feature to be measured here.

2 Number of Points

No of Points

May be configured when not using teach from CAD option.

3 Measured Points

Measured Points

Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Offset Angle	0	Total Angle	360
--------------	---	-------------	-----

Start Angle: This option configures the start of the measurement. The start point is always at X+ if in the XY workplane, Y+ if in the YZ workplane, and Z+ if in the ZX workplane. This is according to PCS.

Total Angle: This option configures the end of the feature measurement travel. For instance, a half circle measurement would be configured for 180 degrees from the start angle.

5 Location & Offset

Location	2	Offset	10
----------	---	--------	----

Location: Used when picking features from a list or graphics. Not used when teach from CAD is enabled. This parameter is used to control the depth of the measurement. **Offset:** Used in conjunction with the vector build option in the same dialog.

6 Clockwise

ClockWise	<input type="checkbox"/>
-----------	--------------------------

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD	<input type="checkbox"/>
----------------	--------------------------

Used as if the system is in **Prog Mode**, the user will be able to control the pt measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

Inverse Vector	<input type="checkbox"/>
----------------	--------------------------

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline	<input type="checkbox"/>
---------------	--------------------------

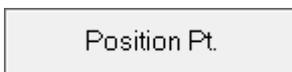
Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 Select

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

11 Set Outputs

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

12 Position Point

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

13 Reset Probe Path

Will clear the probe path from the **Graphics Window**.

14 Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

15 Accept

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!! Be sure to avoid any collisions when working in an online environment.

16 Keep Path

Used to prevent making changes to the probe path generated manually.

17 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Animate" in a standard sans-serif font.

Will show a graphical animation of the measurement.

18 Delete Last EventA rectangular button with a light gray background and a thin black border, containing the text "Delete Last Event" in a standard sans-serif font.

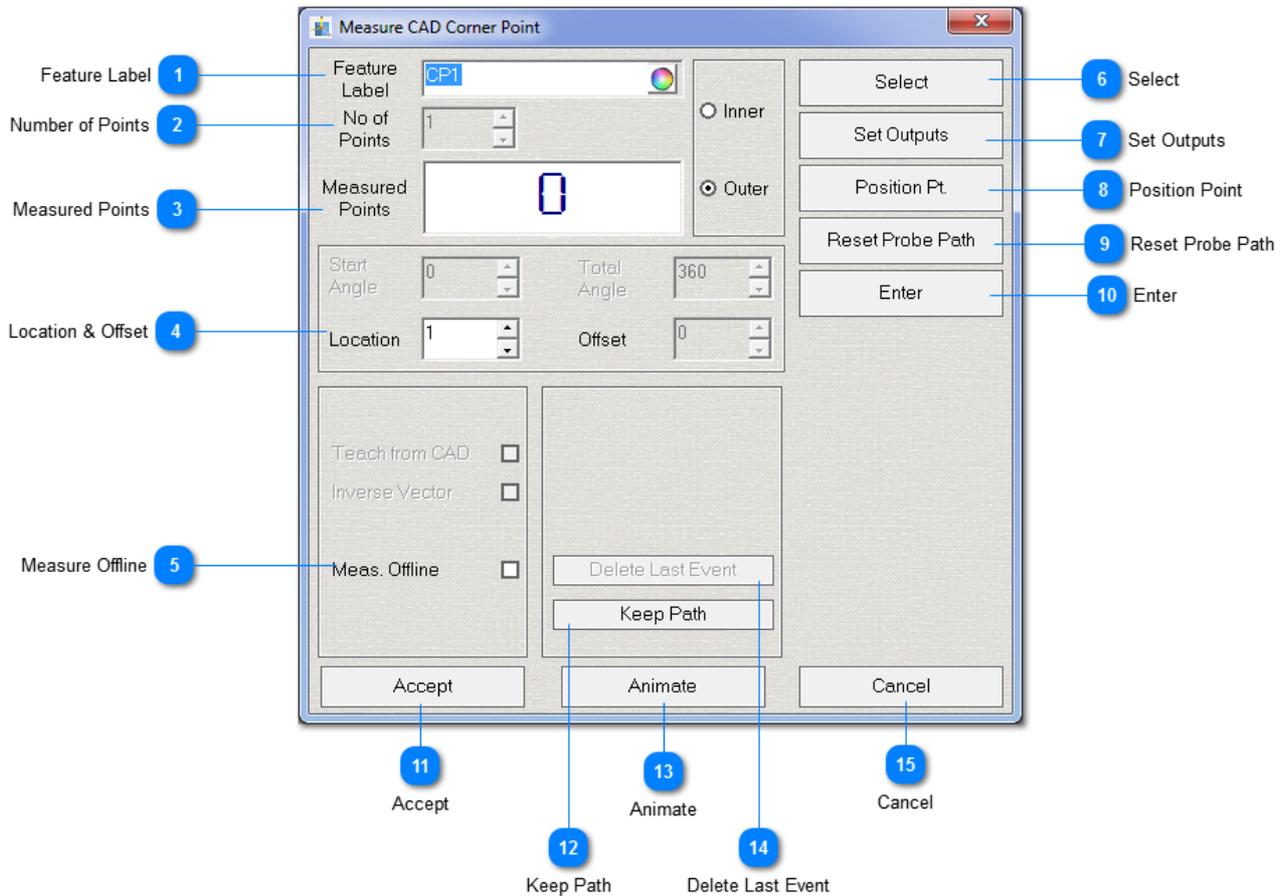
Deletes the last event.

19 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Corner Point



1 Feature Label

Feature
Label

Input a label for the feature to be measured here.

2 Number of Points

No of
Points

May be configured when not using teach from CAD option.

3 Measured Points

Measured
Points

0

Acts as a point counter when features are in the process of being measured.

4 Location & Offset

Location: Used to control how far in from the edge the first touch or series of touches are made on the part.

Offset: This input not applicable for angle point measurement.

5 Measure Offline

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

6 Select

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

7 Set Outputs

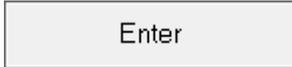
Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

8 Position Point

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

9 Reset Probe Path

Will clear the probe path from the **Graphics Window**.

10 Enter

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

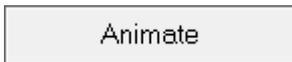
11 Accept

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!! Be sure to avoid any collisions when working in an online environment.

12 Keep Path

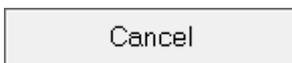
Used to prevent making changes to the probe path generated manually.

13 Animate

Will show a graphical animation of the measurement.

14 Delete Last Event

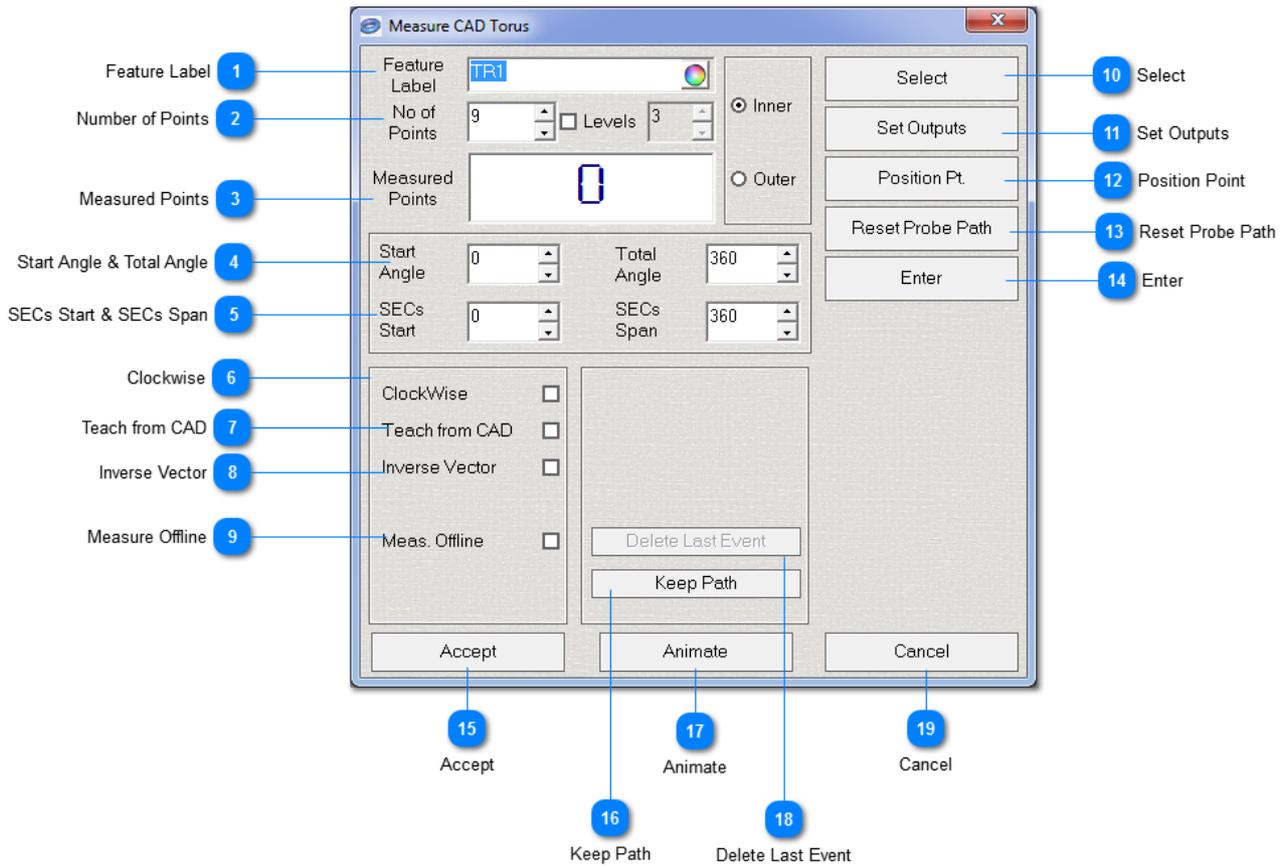
Deletes the last event.

15 Cancel

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

MEAS-CAD Torus



1 Feature Label

Feature Label

Input a label for the feature to be measured here.

2 Number of Points

No of Points

May be configured when not using teach from CAD option.

3 Measured Points

Measured Points

Acts as a point counter when features are in the process of being measured.

4 Start Angle & Total Angle

Start Angle	0	Total Angle	360
-------------	---	-------------	-----

Start Angle: Controls the start of the cross section radius, from 0 to 360 degrees.

Total Angle: Controls the end of the cross section radius, from 0 to 360 degrees.

5 SECs Start & SECs Span

SECs Start	0	SECs Span	360
------------	---	-----------	-----

SECs Start: Controls the start of the measurement for the rotation radius from 0 to 360 degrees.

SECs Span: Controls the end of the measurement for the rotation radius from 0 to 360 degrees.

6 Clockwise

ClockWise

Feature will either be measured clockwise (if checked) or **counter clockwise (if not checked)**.

7 Teach from CAD

Teach from CAD

Used as if the system is in **Prog Mode**, the user will be able to control the pt measurements for the feature by using the mouse as opposed to the software deciding how to measure the feature.

8 Inverse Vector

Inverse Vector

Only used when selecting a nominal or directly from CAD. This on/off flag does not work in conjunction with the **Teach from CAD** option.

9 Measure Offline

Meas. Offline

Will animate the feature measurement and write DMIS code. However, there will be no physical measuring of the feature. This works similar to an offline mode while still being connected to a machine.

10 SelectA rectangular button with a light gray background and a thin black border, containing the text "Select" in a standard sans-serif font.

Click this option to select a nominal feature either from the nominals list or from the **Graphics Window**.

11 Set OutputsA rectangular button with a light gray background and a thin black border, containing the text "Set Outputs" in a standard sans-serif font.

Used to set what will be displayed in the report for the feature measurement. For more information on setting outputs, see the section on [Reporting Options](#).

12 Position PointA rectangular button with a light gray background and a thin black border, containing the text "Position Pt." in a standard sans-serif font.

Used to create move points to avoid collisions. For more information on position points, see the chapter entitled **Position Points** in the help documentation.

13 Reset Probe PathA rectangular button with a light gray background and a thin black border, containing the text "Reset Probe Path" in a standard sans-serif font.

Will clear the probe path from the **Graphics Window**.

14 EnterA rectangular button with a light gray background and a thin black border, containing the text "Enter" in a standard sans-serif font.

Will allow the coordinates for the feature measurement to be entered rather than picked from the feature list or **Graphics Window**.

15 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will accept the settings in the dialog box and proceed with the measurement.

CAUTION!!! Be sure to avoid any collisions when working in an online environment.

16 Keep PathA rectangular button with a light gray background and a thin black border, containing the text "Keep Path" in a standard sans-serif font.

Used to prevent making changes to the probe path generated manually.

17 AnimateA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Will show a graphical animation of the measurement.

18 Delete Last EventA rectangular button with a light gray background and a thin black border, containing the text "Delete Last Event" in a standard sans-serif font.

Deletes the last event.

19 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

[Automating Feature Measurement](#)

Feature Calculations Algorithm

The following table shows the algorithms supported for each geometric feature.

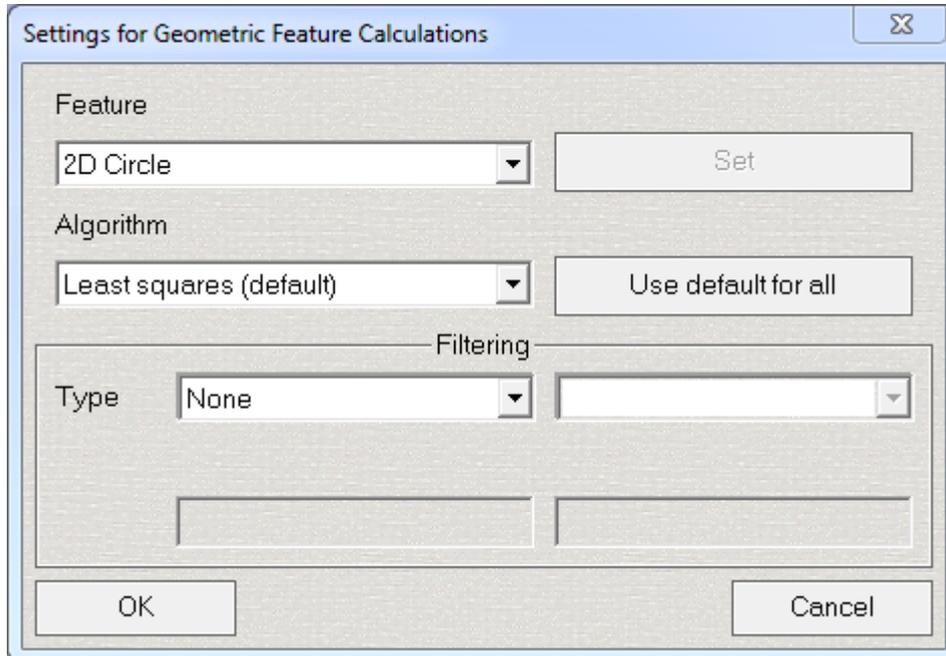
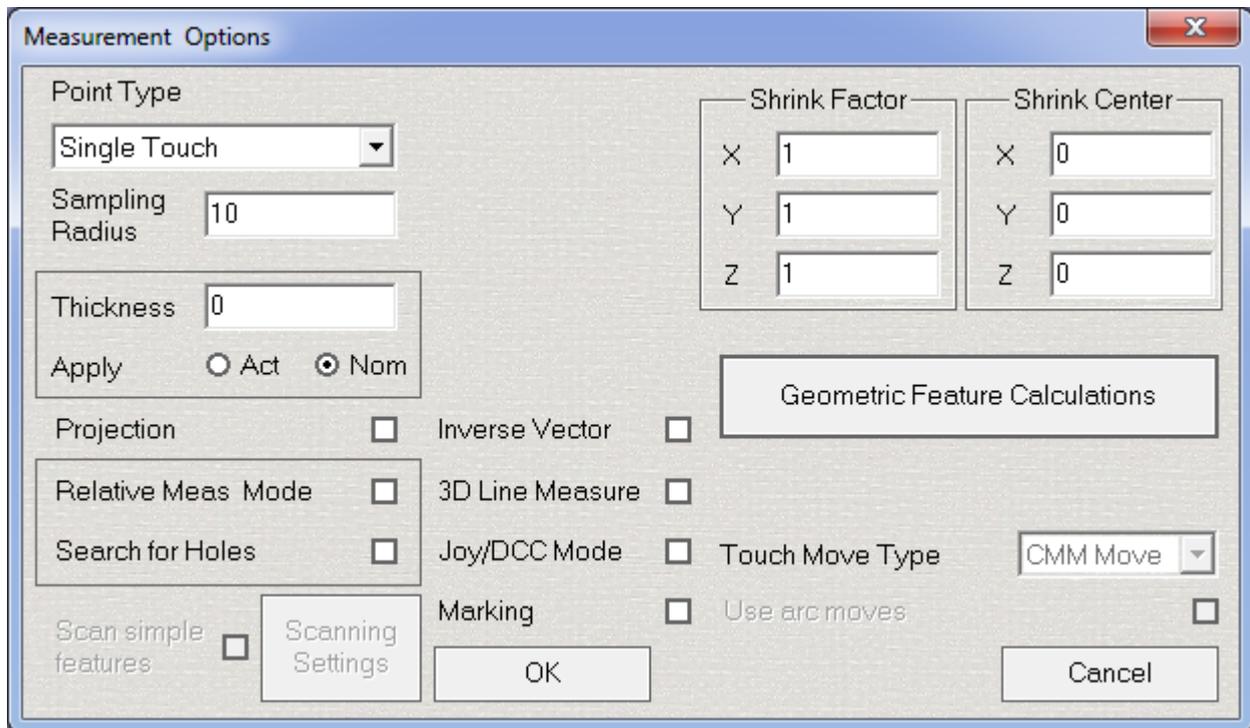
	2D Circle	Sphere	Plane	2D Line	Cone	Cylinder	Torus	Ellipse	Round. Slot	Rect. Slot
Least Squares (Default)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minimum Circumscribed	Yes	----	Yes	----	*****	*****	*****	*****	*****	*****
Maximum Inscribed	Yes	----	Yes	----	*****	*****	*****	*****	*****	*****
Maximum Feature	Yes	----	Yes	----	*****	*****	*****	*****	*****	*****
Minimum Feature	Yes	----	Yes	----	*****	*****	*****	*****	*****	*****
High-Tangent Feature	----	Yes	----	*****	----	----	----	----	----	----
Low-Tangent Feature	----	Yes	----	*****	----	----	----	----	----	----
Highest Feature	----	Yes	----	*****	----	----	----	----	----	----
Lowest Feature	----	Yes	----	*****	----	----	----	----	----	----

Important Note:

- “*****” means it is possible to use the algorithm, but it is not done yet.
- “----” means it is not possible to use the algorithm

Steps to Activate The Required Algorithm

- Open [Measurement Options from Status Toolbar](#). Select **Geometric Feature Calculations** from the window shown below:

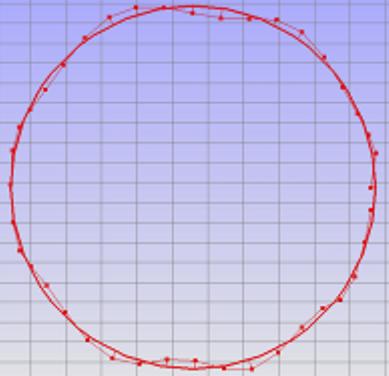
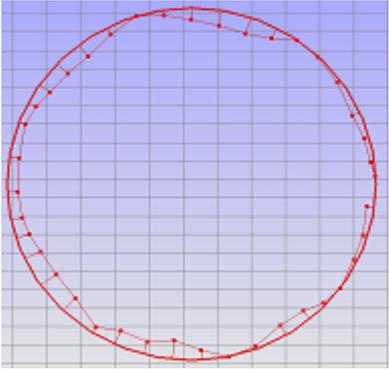
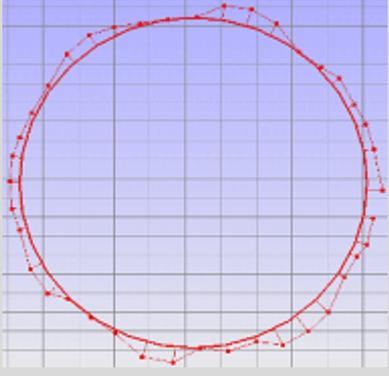


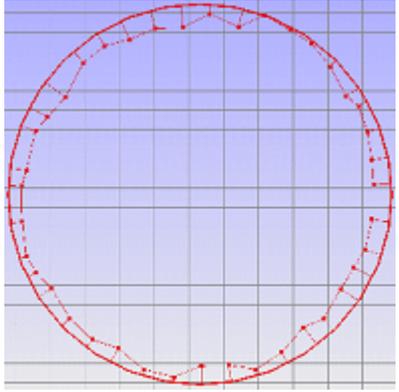
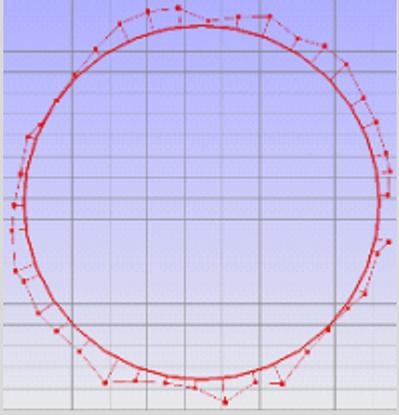
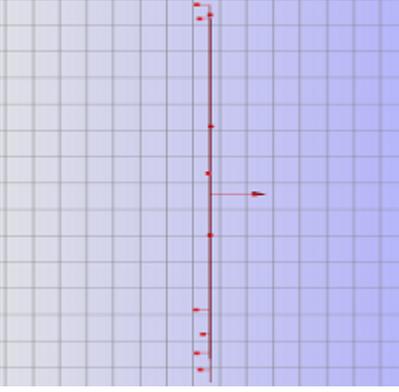
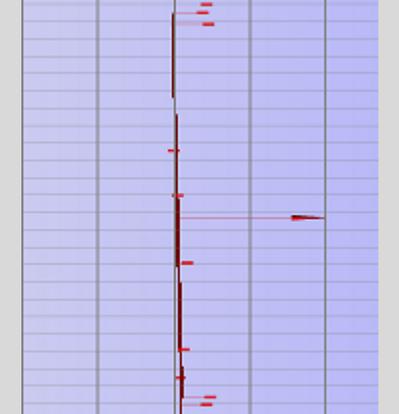
- Algorithm selection is done by selecting the feature, then selecting the algorithm, then clicking on the **Set** button. If the **Set** button is grayed out, this means the feature is currently calculated using the selected algorithm.
- If the user wants to use the default algorithm, **Least Squares**, in all features calculations, he can click **Use default for all**.
- Click the **OK** button. CAPPs will insert the DMIS code that controls the feature calculations.

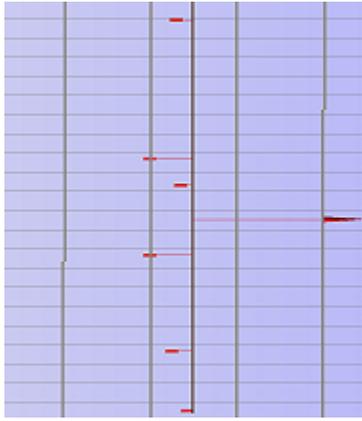
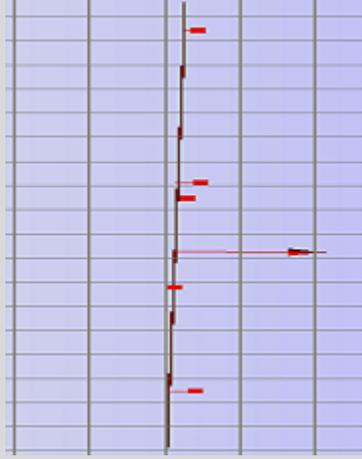
Below are some examples using **Feature Calculations Algorithms**:

DMIS Execution

Internally, CAPPS keeps a list of the features and their calculations algorithms. Also, CAPPS saves this list into the **STS** file, and use it if the user uses learn append. If the user executes DMIS, CAPPS backs up the existing list, and sets each feature to use the default algorithm (**least squares**). This list gets populated using the DMIS commands. At the end of DMIS execution, CAPPS restore the list that was backed up at the beginning.

Algorithm	How does it work?	Explanation
<p>Least Squares (Default)</p>	<p>Feature is computed such that the sum of the distance errors is minimized</p>	
<p>Minimum Circumscribed</p>	<p>Feature is calculated such that it has all the points inside it and such that the distance error is zero at least at the minimum number of points required to measure the feature. For example, the error will be zero at 3 points for circles, and at 4 points for spheres.</p>	
<p>Maximum Inscribed</p>	<p>Feature is calculated such that it has all the points outside it, and such that the distance error is zero at least at the minimum number of points required to measure the feature. For example, the error will be zero at 3 points for circles, and at 4 points for spheres.</p>	

<p>Maximum Feature</p>	<p>Feature is calculated in two steps. In the first step, least squares is used to compute the feature and the distance error for every point. In the second step, we maximize the feature "size" so that it includes all the points. In this case, at least one point will have zero error. Note that this is the point that has the worst distance error outside the feature computed in step1.</p>	
<p>Minimum Feature</p>	<p>Feature is calculated in two steps. In the first step, least squares is used to compute the feature and the distance error for every point. In the second step, we minimize the feature "size" so that it includes all the points. In this case, at least one point will have zero error. Note that this is the point that has the worst distance error inside the feature computed in step1.</p>	
<p>High Tangent Feature</p>	<p>The feature is computed so that it is above all the points such that the distance error is zero at least at minimum number of points required to measure the feature. For example, the error will be zero at 3 points for planes, and at 2 points for lines.</p>	
<p>Low Tangent Feature</p>	<p>The feature is computed so that it is below all the points and that the distance error is zero at least at minimum number of points required for measuring the feature. For example, the error will be zero at 3 points for planes, and at 2 points for lines.</p>	

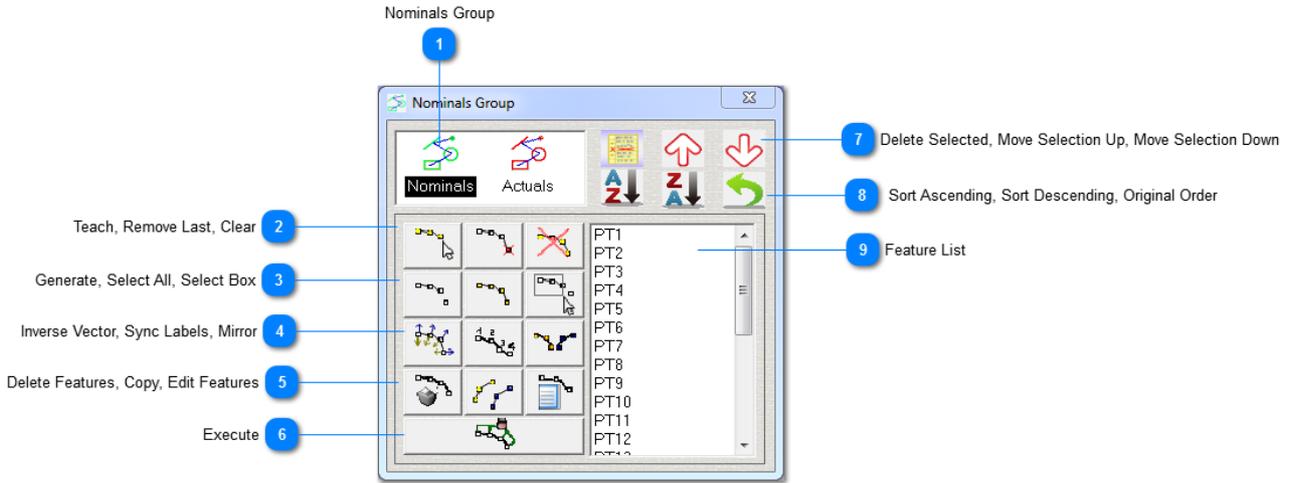
<p>Highest Feature</p>	<p>Feature is calculated in two steps. In the first step, least squares is used to compute the feature and the distance error for every point. In the second step, we move the feature along its normal so that all the points are below it. In this case, at least one point will have zero error. This is the point that has the worst distance error above the feature computed in step1.</p>	
<p>Lowest Feature</p>	<p>Feature is calculated in two steps. In the first step, least squares is used to compute the feature and the distance error for every point. In the second step, we move the feature along its normal so that all the points are above it. In this case, at least one point will have zero error. This is the point that has the worst distance error below the feature computed in step1.</p>	

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[Automating Feature Measurement](#)

Nominal Group Path Options

Nominal Group Path Options work with the assumption that you have more than one nominal feature already created on the **Graphics Window**.



1 Nominals Group



Used to switch to **Nominals Group Path Options**.

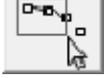
2 Teach, Remove Last, Clear



<p>Teach:</p> 	<p>Click the teach button and then pick a series of nominals in any order either from the nominals list or from the Graphics Window. As the user picks the nominals in any order a graphical path will be drawn on the screen.</p>
<p>Remove Last:</p> 	<p>Removes the last picked feature in the path sequence.</p>
<p>Clear:</p> 	<p>Clears the generated path from the Graphics Window without executing.</p>

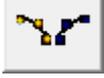
3 Generate, Select All, Select Box



Generate: 	Used to generate a path using a start nominal and an end nominal. The path generated will follow the list in sequential order as the nominals were previously created.
Select All: 	Selects all the nominal features by type for execution. The path is generated in the order that the features were created.
Select Box: 	Select this button and then drag a box around the nominal features on the Graphics Window . A path will be generated according the order in which the features were created.

4 Inverse Vector, Sync Labels, Mirror



Inverse Vector: 	This option works on features that have already been selected by generating a path using the teach, or select box method. The user is presented with a secondary dialog which gives the option of inverting the points or even offsetting the points.
Sync Labels: 	This option works on features that have already been selected by generating a path using the teach, or select box method. Instead of Nominal Labels being PT1, CIR3, PT2, SLT8 they will be synced as PT1, CIR2, PT3, SLT4.
Mirror: 	Works to mirror a selected group of nominals about an axis.

5 Delete Features, Copy, Edit Features



Delete Features: 	Works to delete a selected group of nominals.
Copy: 	Makes a copy of a group of nominal features. Useful for pattern features.
Edit Features: 	Works to edit a selected group of nominals.

6 Execute



Execute:	Executes a path based on selected features.
-----------------	---

7 Delete Selected, Move Selection Up, Move Selection Down



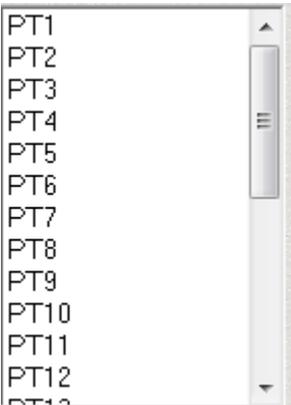
Delete Selected: 	Deletes the selected item from the Feature List .
Move Selection Up: 	Moves selected item up in the Feature List .
Move Selection Down: 	Moves selected item down in the Feature List .

8 Sort Ascending, Sort Descending, Original Order



Sort Ascending: 	Sorts the features in the Feature List in ascending order.
Sort Descending: 	Sorts the features in the Feature List in descending order.
Original Order: 	Sorts the features in the Feature List in original order, as they have selected by the user.

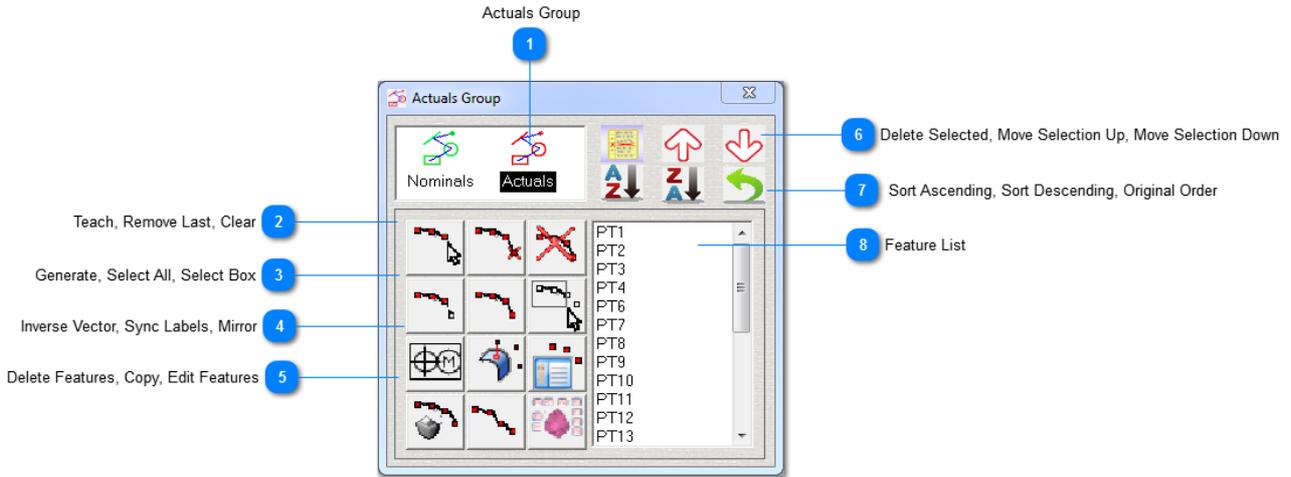
9 Feature List



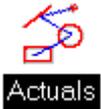
Displays the features to be used with **Nominals Group Path Options**.

Actuals Group Path Options

Actual Group Options work to collectively work with measured features for group output or handling groups of data in different ways. The first series of options deal with creating the path. The second series of options have to do with handling the path. Creating the path works in much the same way as in nominal path generation.



1 Actuals Group



Used to switch to **Actuals Group Path Options**.

2 Teach, Remove Last, Clear



Teach: 	Click the teach button and then pick a series of nominals in any order either from the nominals list or from the Graphics Window . As the user picks the nominals in any order a graphical path will be drawn on the screen.
Remove Last: 	Removes the last picked feature in the path sequence.
Clear: 	Clears the generated path from the Graphics Window without executing.

3 Generate, Select All, Select Box



<p>Generate:</p> 	<p>Used to generate a path using a start actual and an end actual. The path generated will follow the list in sequential order as the actuals were previously measured.</p>
<p>Select All:</p> 	<p>Selects all the actual features and populates the list. Once the features populate the list, a secondary function may be performed.</p>
<p>Select Box:</p> 	<p>Select this button and then drag a box around the actual features on the Graphics Window. A path will be generated according the order in which the features were created. Once a path has been generated in any fashion, notice that features will populate the list.</p>

4 Inverse Vector, Sync Labels, Mirror



<p>True Position:</p> 	<p>This function reports True position in a bulk type fashion rather than one feature at a time.</p>
<p>Drop on Surface:</p> 	<p>This function takes selected curves and drops them on the closest highlighted surface.</p>
<p>Output:</p> 	<p>This function will output the features that have populated the list as a result of generating a path. This works as a group type output as opposed to one feature at a time.</p>

5 Delete Features, Copy, Edit Features



<p>Delete Features:</p> 	<p>This function will delete the features that have populated the list as a result of generating a path.</p>
<p>Make Curve:</p> 	<p>This function will create a curve out of measured points. Usually this comes in the form of section lines that have been measured. Group select the points measured on the section line and then choose the make curve option.</p>
<p>Template:</p> 	<p>This function will create templates on the features that have populated the list as a result of generating a path.</p>

6 Delete Selected, Move Selection Up, Move Selection Down



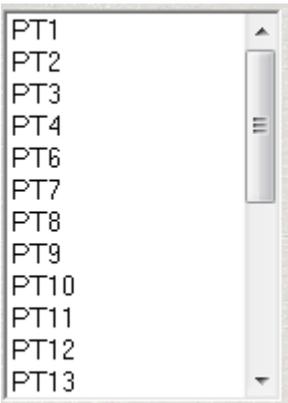
<p>Delete Selected:</p> 	<p>Deletes the selected item from the Feature List.</p>
<p>Move Selection Up:</p> 	<p>Moves selected item up in the Feature List.</p>
<p>Move Selection Down:</p> 	<p>Moves selected item down in the Feature List.</p>

7 Sort Ascending, Sort Descending, Original Order



Sort Ascending: 	Sorts the features in the Feature List in ascending order.
Sort Descending: 	Sorts the features in the Feature List in descending order.
Original Order: 	Sorts the features in the Feature List in original order, as they have selected by the user.

8 Feature List



Displays the features to be used with **Actuals Group Path Options**.

[Automating Feature Measurement](#)

Auto Feature Detector

The auto feature detector is a **feature wizard** that calculates features by considering their measurement points and vectors. It automatically determines the feature based on measurement points. Therefore, it is not necessary to select a feature from the measurement dialog box when using the **Auto Feature Detector**.

The automatic feature detector dialog box contains measurement functions common to all features. However, number of measurement points required to detect a feature is different than regular feature measurement.

For example, while only three points needed to measure a plane, you will need to measure as many as four points to detect a plane feature. The following table illustrates the list of features and minimum number of points needed to calculate them when using **Auto Feature Detector**.

Feature Name	Regular Points Measured	Auto Feature Detector Points
Point	1	1
Plane	3	4
Line	2	2
Circle	3	4
Sphere	4	5
Cylinder	6	10
Cone	6	10
Ellipse	5	6

Steps to follow:

- Change the measurement toolbar to reflect [Measure Mode](#).
- Click on the **Auto Feature Icon** . The **Auto Feature Detector** dialog will appear.
- Measure the required number of points for any given feature as specified in the table above.
- Be sure to assign an appropriate label for the feature
- Click **Compute**.

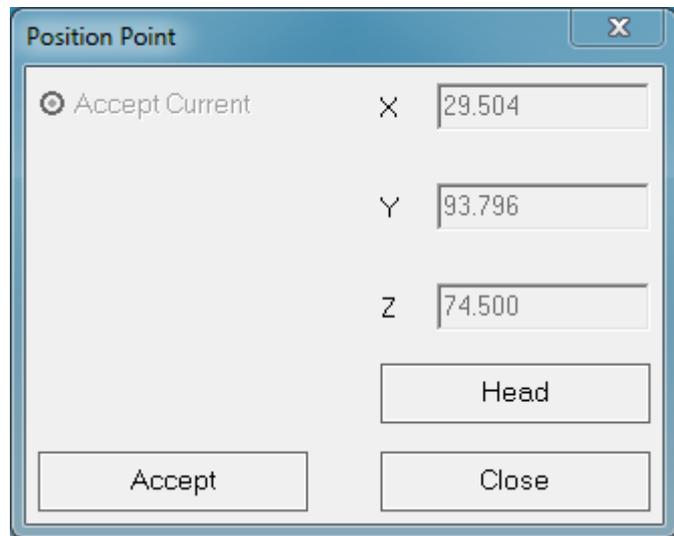
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Position Points

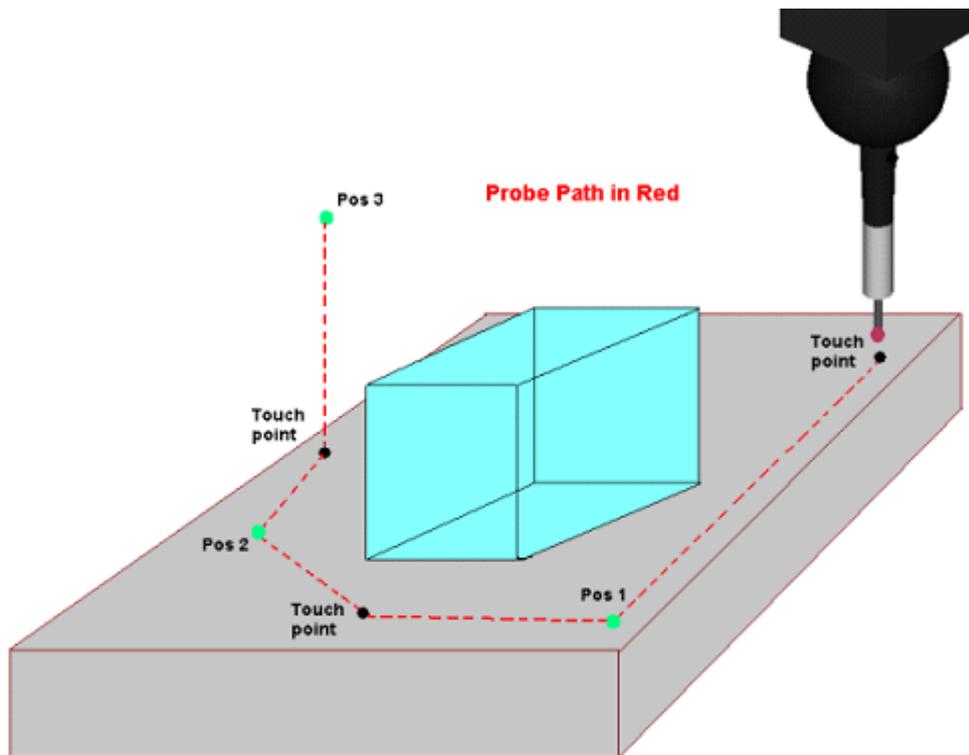
Position points, commonly referred to as **clearance moves**, are inserted in a measurement sequence to avoid any collisions. An example below shows how a plane would be measured with clearance moves to avoid collisions. The measurement sequence for the plane includes 3 touch points, and 3 position points inserted before the feature is computed. The last clearance move is to clear the part after the plane is measured.

Stand Alone Position Points

Position points may be inserted into a program at any time while in the CAPPS DMIS environment. In **Measure Mode**, positions can only be accepted since the coordinate values indicates the current position of the probe tip. By accepting the current position of the tip, allows the user to insert a position point command in the program which can be later executed to move the machine to this position in **DCC Mode**.



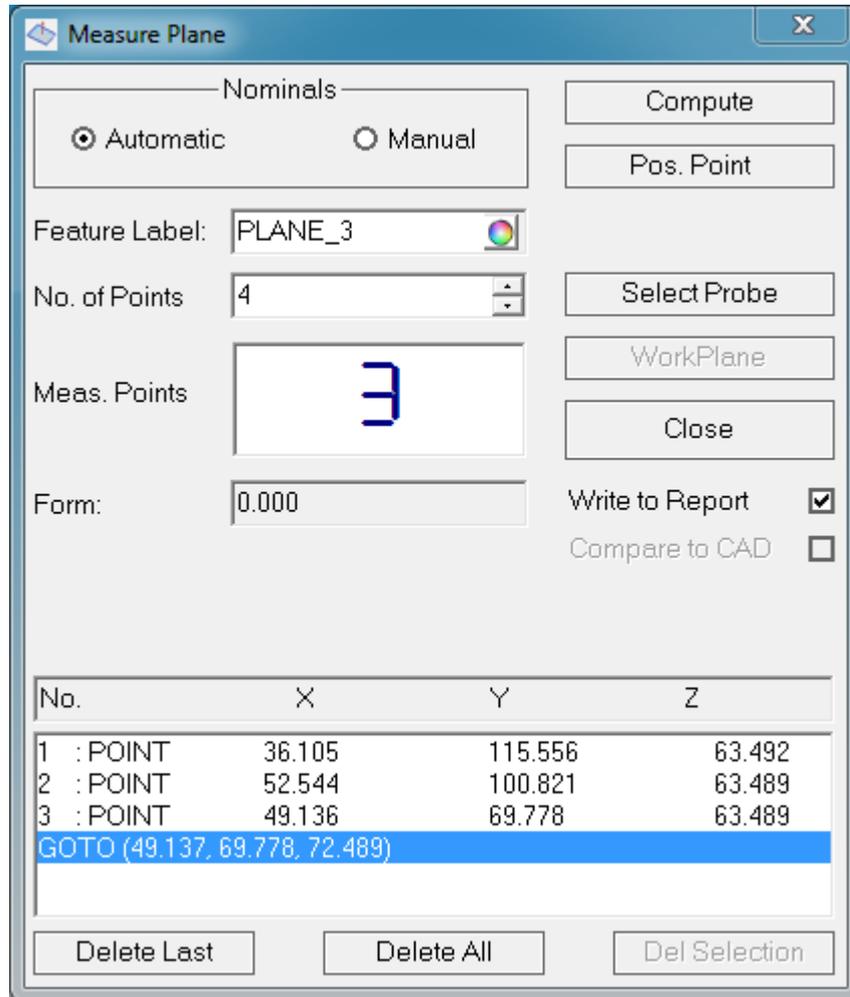
Measure Mode



To teach a measurement sequence with position points, place the probe at the desired clearance move, and click on **Position Point** in the measurement dialog box.

To teach the measurement sequence shown in the above example:

- Measure first touch point,
- Place the probe at the location Pos 1 and click on the **Position Point**
- Measure the second touch point
- Place the probe at the location Pos 2 click on **Position Point**
- Measure the third touch point
- Place the probe at location Pos3, click on **Position Point**
- Click on the **Compute**.



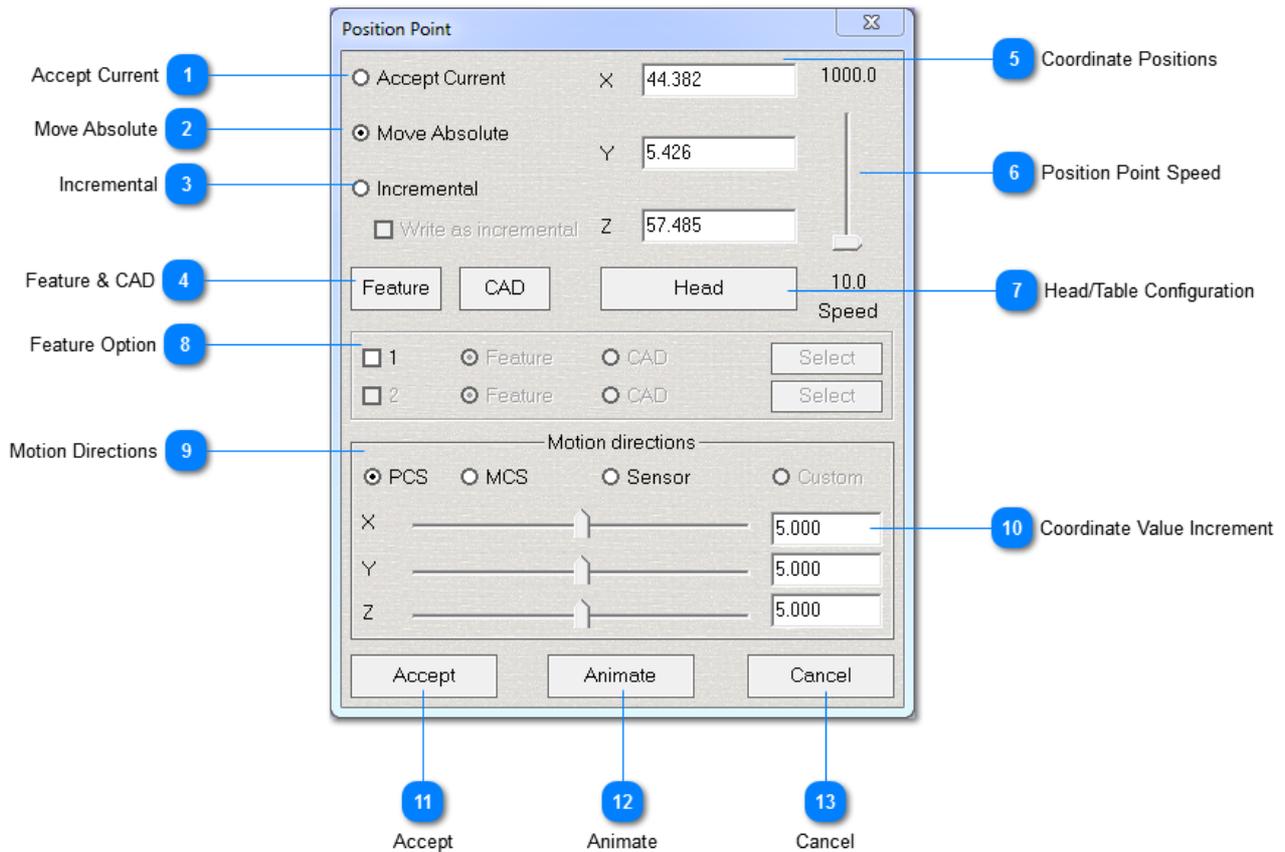
The move points or **GOTO's** will be written into the **DMIS** program as shown below.

```
F(PL1)=FEAT/PLANE,CART, 25.1856,85.0290,62.4930,0.0002,-0.0000,1.0000
MEAS/PLANE,F(PL1),6
PTMEAS/CART,6.7572,65.7900,62.4949,0.0002,-0.0000,1.0000
PTMEAS/CART,5.7414,90.1737,62.4966,0.0002,-0.0000,1.0000
PTMEAS/CART,18.5322,114.9947,62.4955,0.0002,-0.0000,1.0000
PTMEAS/CART,51.4532,102.5276,62.4887,0.0002,-0.0000,1.0000
GOTO/48.5507,85.7433,72.4891
PTMEAS/CART,42.8061,66.3096,62.4898,0.0002,-0.0000,1.0000
PTMEAS/CART,25.8237,70.3784,62.4924,0.0002,-0.0000,1.0000
ENDMES
OUTPUT/FA(PL1),TA(TX2),TA(TY2),TA(TZ2)
```

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Position Points in MEASCAD Mode

Position points may also be inserted into the DMIS program while in **Measure CAD (MEASCAD) Mode** using either [Position Point](#) option in [Measure CAD Mode](#) dialog or  icon on [Measure Toolbar](#).



1 Accept Current

Accept Current

Writes a position point X, Y, Z into the DMIS code which reflects the current position of the probe tip.

2 Move Absolute

Move Absolute

Allows the user to input absolute value moves according to the current alignment system.

3 Incremental

Incremental

Position moves are written according to the current position of the probe viewed as X=0, Y=0, Z=0.

4 Feature & CAD

Uses the Clearance surface parameter to position the machine above a nominal, actual feature or a CAD entity.

5 Coordinate Positions

X	44.382
Y	5.426
Z	57.485

Displays the current absolute or incremental coordinate positions.

6 Position Point Speed

1000.0

10.0

Speed

Used to determined to real time positioning speed.

7 Head/Table Configuration

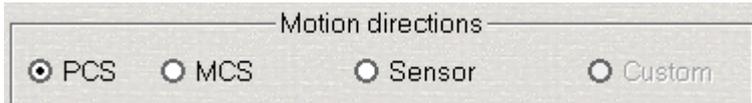
Used to control the probe head axis positioning (or table axis positioning) if available for the selected probe.

8 Feature Option

<input type="checkbox"/> 1	<input checked="" type="radio"/> Feature	<input type="radio"/> CAD	<input type="button" value="Select"/>
<input type="checkbox"/> 2	<input checked="" type="radio"/> Feature	<input type="radio"/> CAD	<input type="button" value="Select"/>

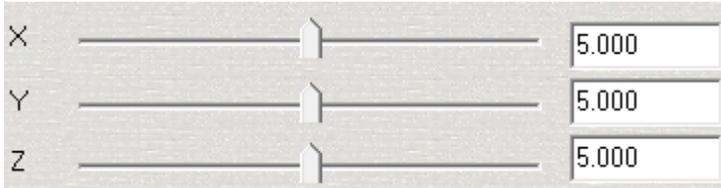
Used to move the probe along the selected features' or CAD surfaces' normal vector.

9 Motion Directions



Position points will be executed according to PCS, MCS, or according to the vector of the sensor.

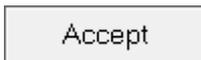
10 Coordinate Value Increment



Slide Control: Slide control gives the user to control the location of the position point.

Increment Values: Increment values used to change the distance of travel for each increment for position points.

11 Accept



Accepts the recent position point and moves the machine to the position point.

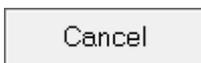
WARNING: It is always the operator's responsibility to make sure the move is in a clean path before executing a Position Point.

12 Animate



Animates the last **Position Point** move.

13 Cancel



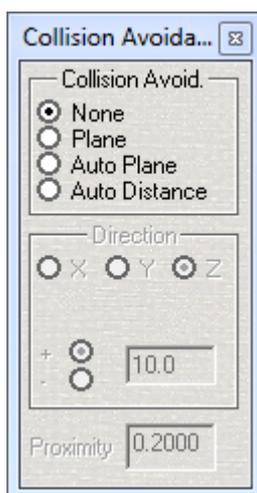
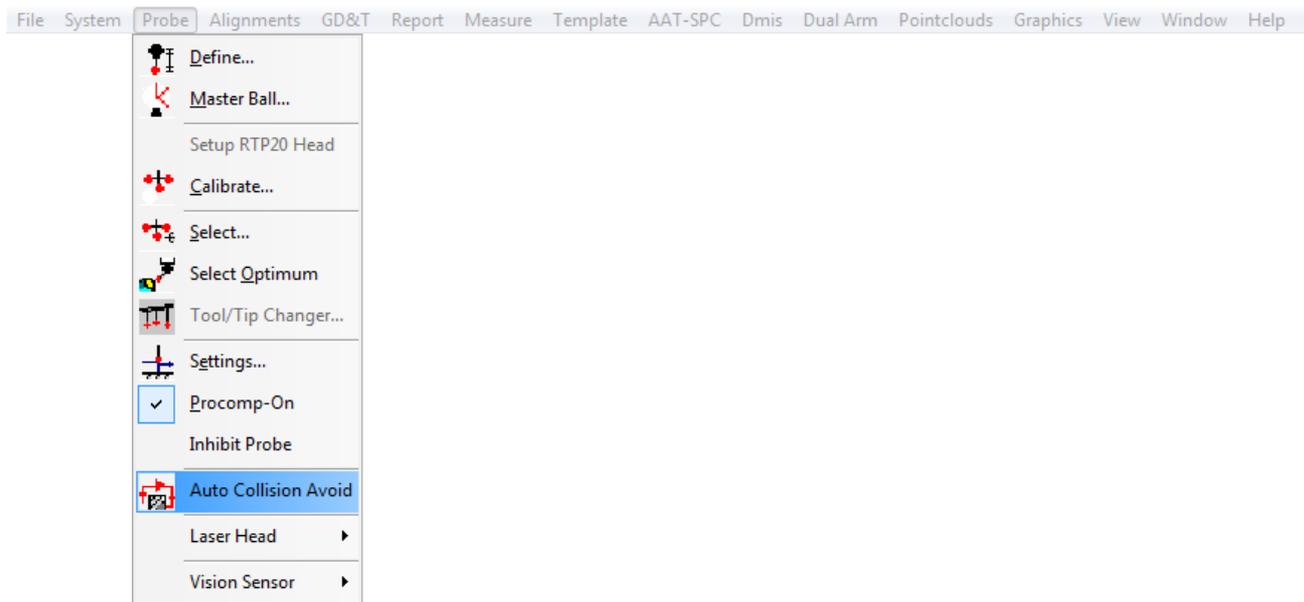
Cancel the changes and close the dialog.

[Position Points](#)

Using The Auto-Collision Avoidance

CAPPS collision avoidance is a very fast way of detecting potential collision of the tip of the probe with the part. This depends totally on the accuracy of the part model and checks only surface models present in the CAD. It will not detect any holding fixture or other items that are on the machine but not on the CAD model.

WARNING: It is always the operator's responsibility to make sure the move is in a clean path before executing a Position Point.



This dialog can be docked on the side of the window or floating. CAPPS will remember its last setting when CAPPS is started again. This dialog can be turned on or off from the [Probe Menu](#) or the [Sensor Toolbar](#).

METHODS OF COLLISION AVOIDANCE

None / Disabled:	When collision avoidance is disabled or its window is turned off, there will not be any collision avoidance detection. In this case, CAPPs will rely on the CLRSRF parameter for most geometrical feature or directly approach to the points using the APPRCH parameter. If Collision avoidance is activated, it will automatically enter GOTO points according to the condition of the probe and the model.
Plane:	In this method, CAPPs will always move the probe to the specified clearance plane no matter if there was a potential collision or not. The location and direction of the plane are set in the dialog area.
Auto Plane:	CAPPs will check if there is a collision with the CAD model and only if it is detected, it will insert GOTO commands at the location of the clearance plane as it is entered in the dialog area. In this method, all the GOTO s entered will be at the same height in the alignment.
Auto Distance:	In this method, if a collision is detected, CAPPs will try to avoid it by trying a set of GOTO commands away from the detected collision zone by as much as the value in the dialog. If a collision is still detected, it will try this 10 times until it can avoid it or it will generate an error stating it cannot avoid collision with these parameters.

Two Important Checks Are Done with Collision Avoidance

- Direction of each path is checked during positioning moves. This check is done along the path using the probe diameter + proximity (safety) zone. Potential crash points are marked in **RED** points on the screen.
- Final resting position is checked to see if it is too close to anything.

[Position Points](#)

Alignments

An alignment relates the part coordinate system (PCS) to the machine coordinate system (MCS). The alignment tells the coordinate measuring machine (CMM) how the part is oriented within the measuring volume of the CMM. Every part to be inspected has 6 degrees of freedom. The purpose of the alignment is to eliminate these degrees of freedom within the part. This is often known as constraining the part.

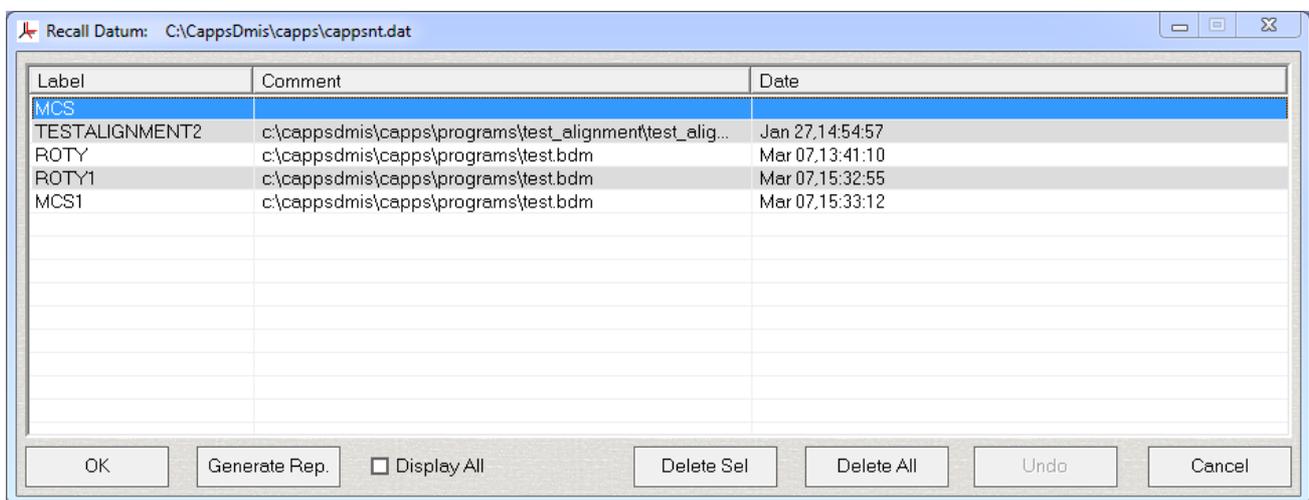
The position of the part, as it sits on the machine, is not generally important within reason. Good judgment is critical when placing a part on the machine for inspection.

Inspection programs are expected to provide results that relate actual features to the origin of the math data. If the alignment is not done properly, the relationship of the math data to the actual part will be useless.

Basic Alignment Functions

Recall

Recalls a saved alignment from **Recall Datum** list (**Alignment Database**) shown below:



The screenshot shows a window titled "Recall Datum: C:\CappsDmis\capps\cappsnt.dat". It contains a table with three columns: Label, Comment, and Date. The table lists several saved alignments, with "MCS" selected. Below the table are several buttons: OK, Generate Rep., Display All, Delete Sel, Delete All, Undo, and Cancel.

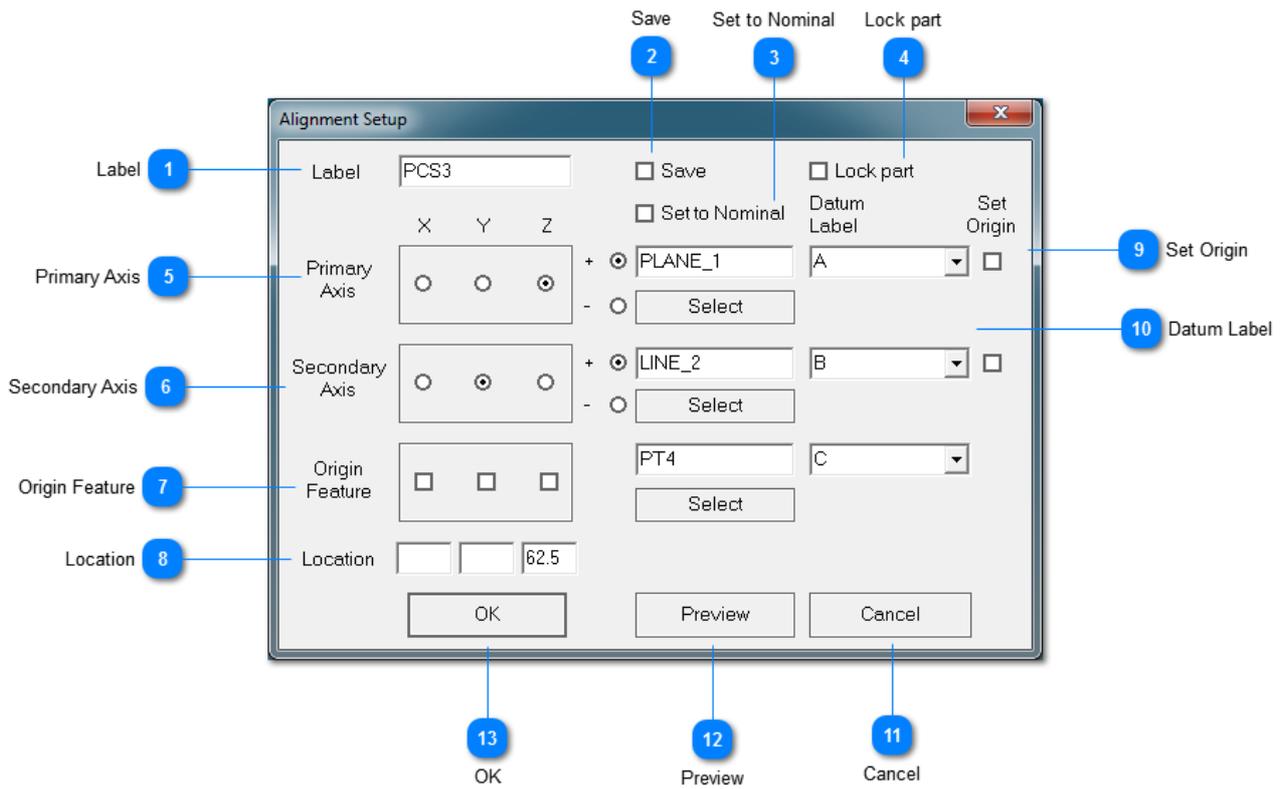
Label	Comment	Date
MCS		
TESTALIGNMENT2	c:\cappsdmis\capps\programs\test_alignment\test_alig...	Jan 27,14:54:57
ROTY	c:\cappsdmis\capps\programs\test.bdm	Mar 07,13:41:10
ROTY1	c:\cappsdmis\capps\programs\test.bdm	Mar 07,15:32:55
MCS1	c:\cappsdmis\capps\programs\test.bdm	Mar 07,15:33:12

Save

Save is used to save an alignment into the alignment database.

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Setup



1 Label

Label

Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

2 Save

Save

Saves the alignment to Recall Datum list.

3 Set to Nominal

Set to Nominal

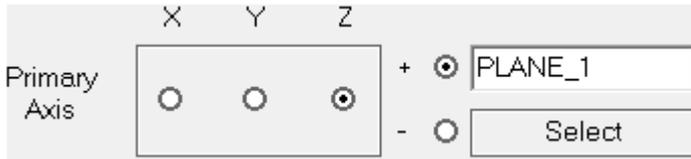
Used to shift the alignment as much as deviation between the nominal and actuals of the datum features.

4 Lock part

Lock part

[Lock Part](#) is used to lock CAD part and nominal features to the current alignment system

5 Primary Axis



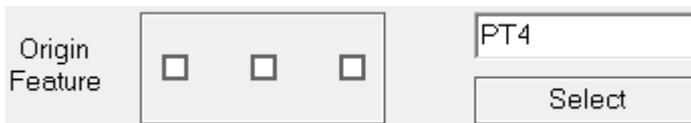
The feature that is selected for primary axis will be used to level the part, thereby eliminating 3 degrees of freedom; normally a plane feature. However, this could also be an axis feature like a line or a cylinder. Travel direction may also be set here using the plus (+) or minus (-) radial buttons. Select the feature for the primary axis by clicking on the select button and choosing it from the list or from the graphics. The set origin option for the primary axis will work only for the direction specified, so normally this option will only be used with plane features.

6 Secondary Axis



This is normally used as the rotation feature, thereby eliminating 2 more degrees of freedom. The feature used for a secondary axis would normally be a plane, or a line type feature. Travel direction may also be set here using the plus (+) or minus (-) radial buttons. Select the feature for the secondary axis by clicking on the select button and choosing it from the list or from the graphics. The set origin option for the secondary axis will work only for the direction perpendicular to the line axis travel.

7 Origin Feature



This option will work to set an origin on a feature in one or all three axes and may be used in conjunction with the origin feature.

8 Location



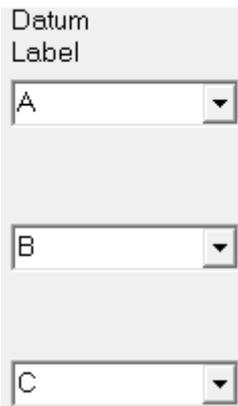
This is used to move the location of the X, Y and Z in coordinate system based on the number that is entered in the box. The three input boxes are listed as X, Y, Z respectively.

9 Set Origin



Sets selected feature as selected axis origin. For example if the user selects a plane that has a normal vector in Z+ direction and sets it as origin, the plane becomes the Z origin for the alignment.

Note: If Set origin is used for a feature that have Z vector in Primary axis, then Z should not be checked in the Origin feature

10 Datum Label

Datum Label

A

B

C

This will assign the Datum label to the selected feature

11 Cancel

Cancel

Cancel will close the Setup alignment dialogue without creating the alignment

12 Preview

Preview

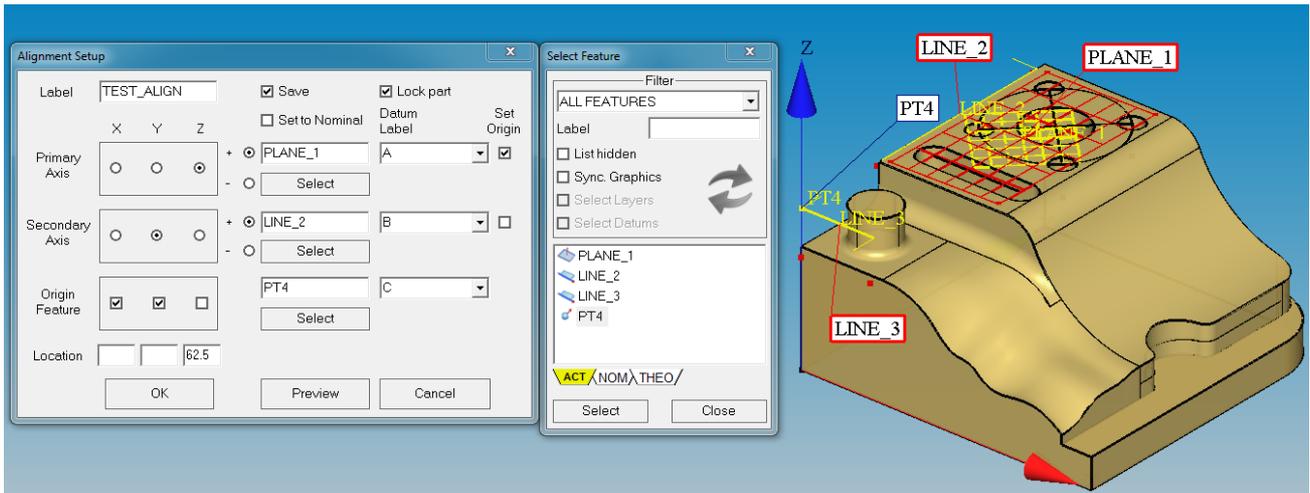
Preview will give an option to look the alignment before it is created

13 OK

OK

OK will close the dialogue by creating the alignment

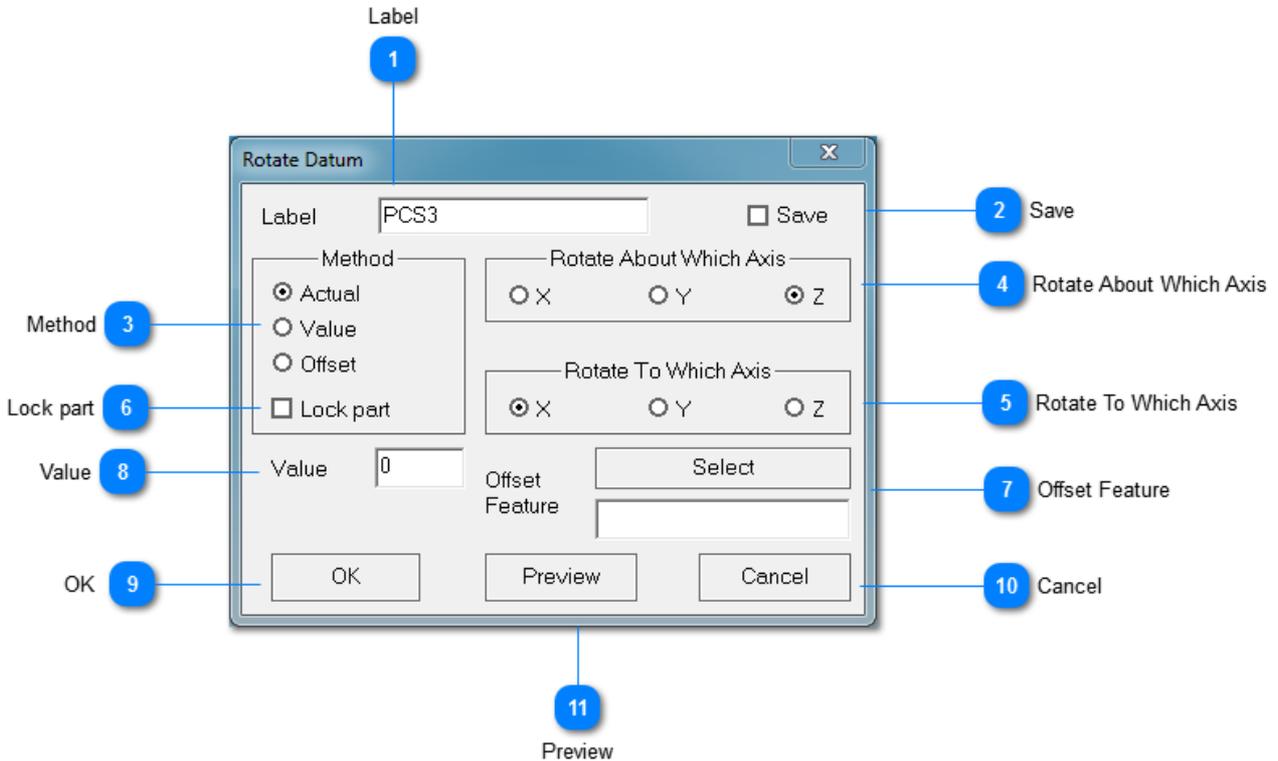
The image below shows a basic Plane, Line, Line intersect alignment on the AAT block using the setup dialog to complete the alignment.



[Alignments](#)

Rotate

Rotate will modify the existing alignment by Rotating chosen actual/nominal feature, value, or offset.



1 Label

Label PCS3

Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

2 Save

Save

Saves the alignment to Recall Datum list.

3 Method

Method

- Actual
- Value
- Offset

Actual: Rotates alignment with respect to the Actual Feature select

Value: Rotates the alignment in the chosen axis by the value that is assigned

Offset: This method is used when a rotation is unknown but feature offsets are known.

4 Rotate About Which Axis

Rotate About Which Axis

X Y Z

Alignment will be rotated about the selected axis.

5 Rotate To Which Axis

Rotate To Which Axis

X Y Z

Alignment will be rotated to the selected axis by the angle of the selected feature.

6 Lock part

Lock part

[Lock Part](#) is used to lock CAD part and nominal features to the current alignment system

7 Offset Feature

Offset Feature

Allows the user to select the Actual/Nominal feature for rotation. Actual/Nominal can be toggled in the feature selection list.

8 Value

Value

Will rotate the axis by the number that is entered in this section

9 OK

OK will close the dialogue by creating the alignment

10 Cancel

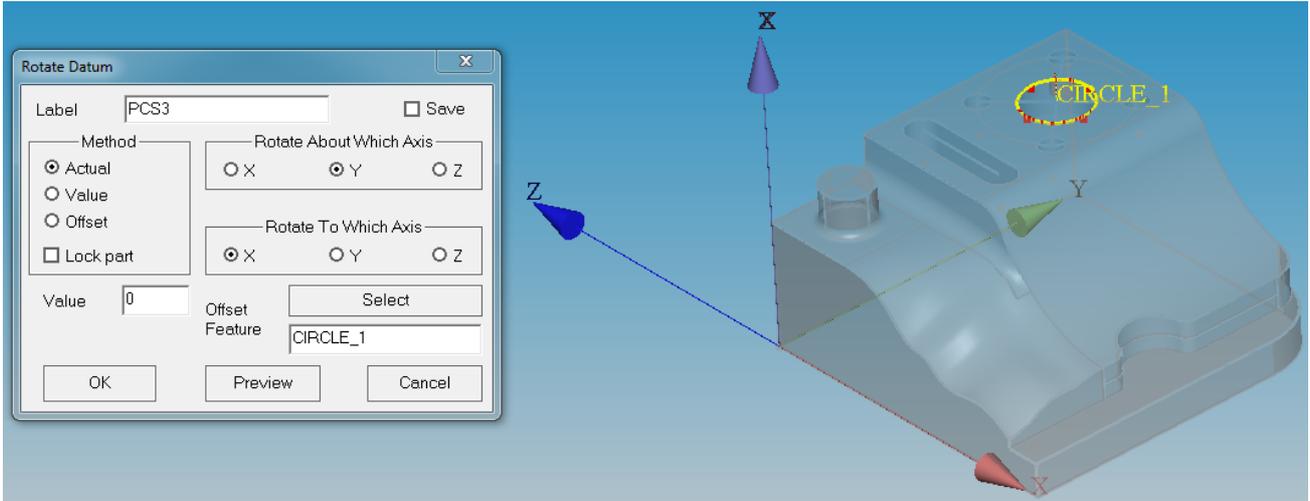
Cancel will close the Setup alignment dialogue without creating the alignment

11 Preview

Preview will give an option to look the alignment before it is created

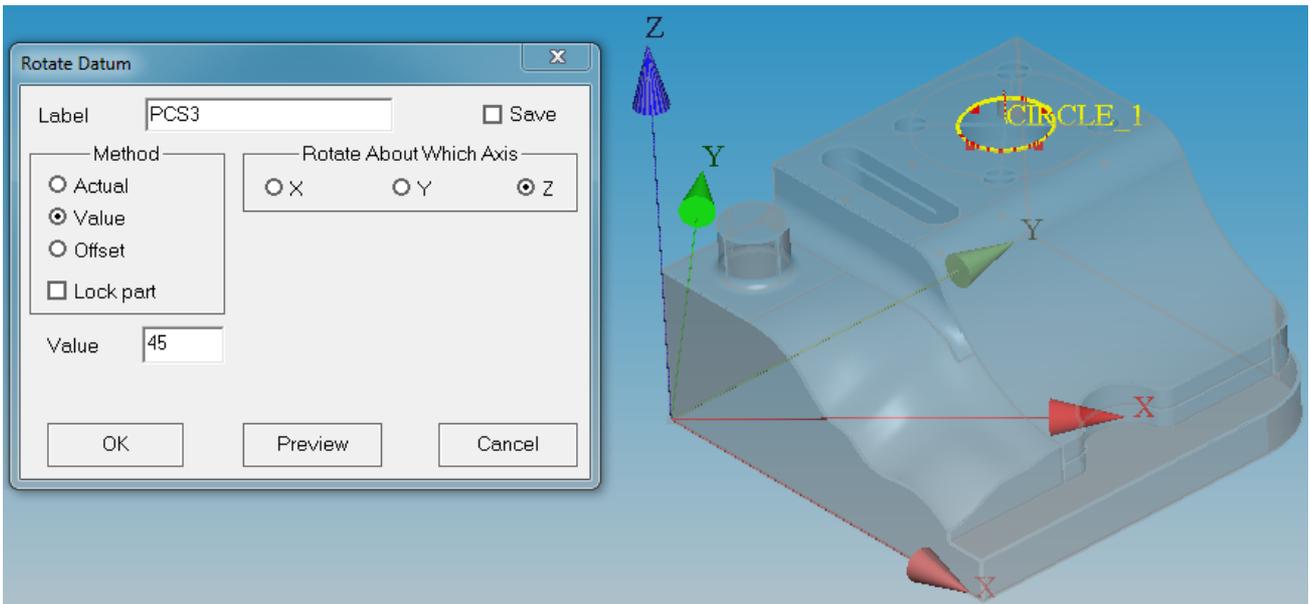
Actual

The image below shows how the alignment will look when using the rotate option in conjunction with an actual feature.



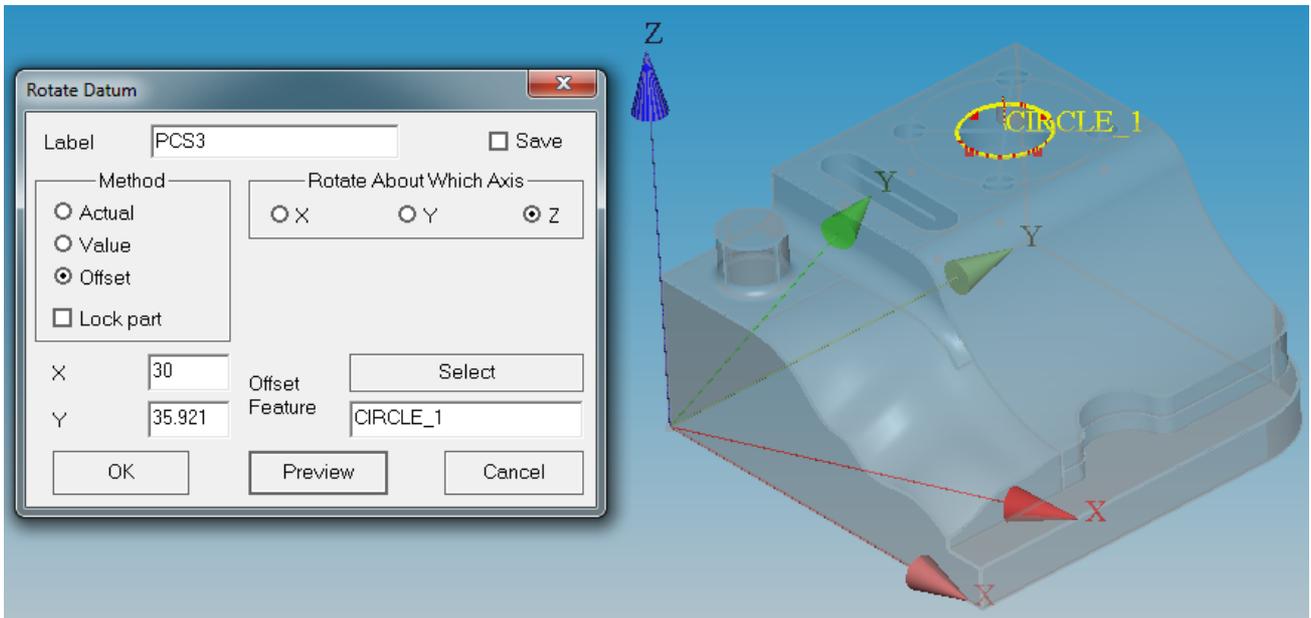
Value

The image below shows how the alignment will look when using the rotate option in conjunction with the value method.



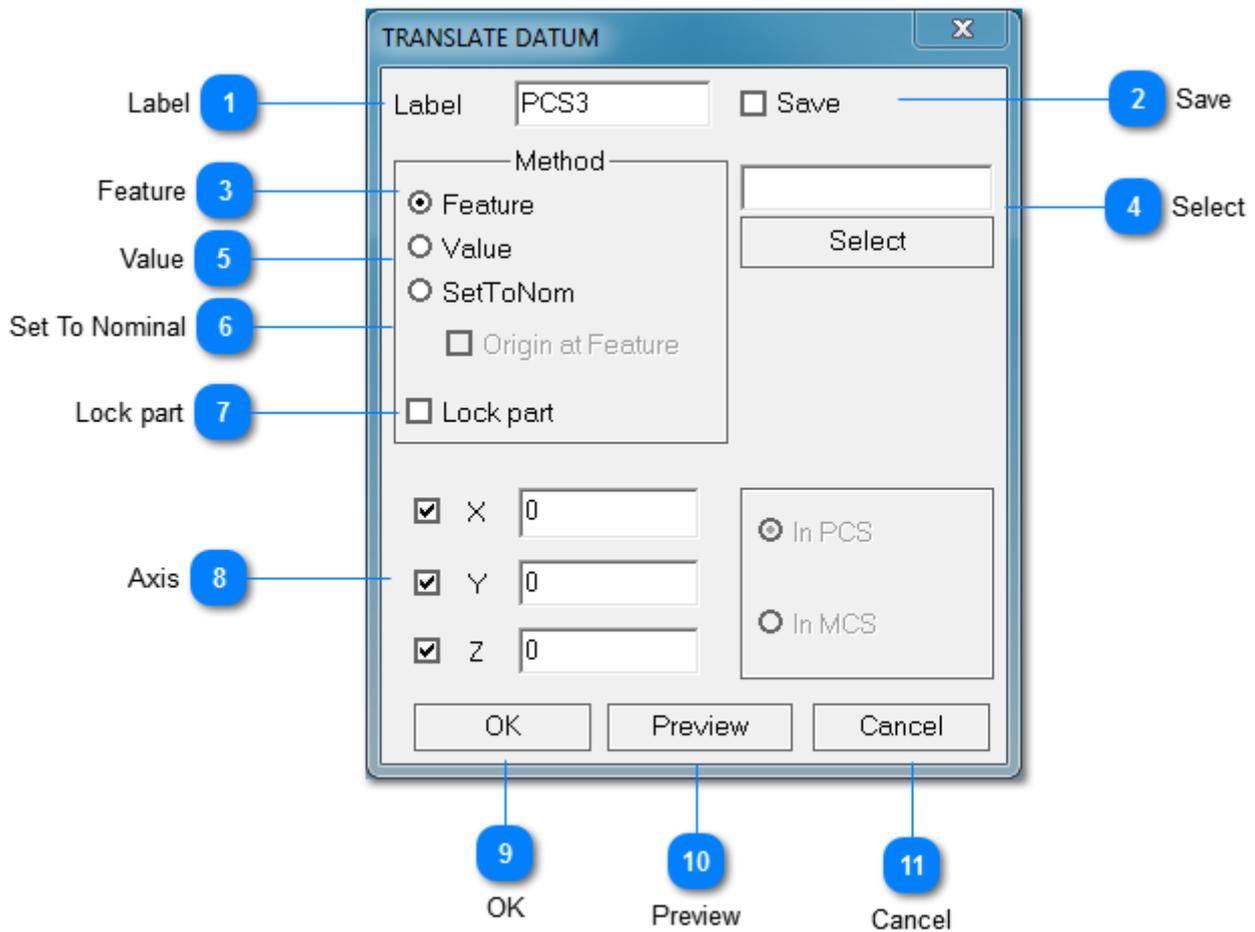
Offset

The picture below shows how the alignment will look when using the rotate option in conjunction with the offset method. The following are before and after scenario.



Alignments

TRANSLATE



1 Label

Label PCS3

Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

2 Save

Save

Used to save the alignment in the [Recall Datum List](#).

3 Feature

Feature

Used to translate the current part coordinate system origin to an actual feature for one or all three axes.

4 Select

Select

Select will allow user to select the actual feature.

5 Value Value

May be used to translate the origin of the datum from the current **PCS** by a specific value in one or all three axes.

6 Set To Nominal SetToNom Origin at Feature

Used to designate an actual feature to be nominally perfect. **CAD** defined nominals must be present in order to use this feature.

7 Lock part Lock part

[Lock Part](#) is used to lock CAD part and nominal features to the current alignment system

8 Axis

<input checked="" type="checkbox"/>	X	<input type="text" value="0"/>	<input checked="" type="radio"/> In PCS <input type="radio"/> In MCS
<input checked="" type="checkbox"/>	Y	<input type="text" value="0"/>	
<input checked="" type="checkbox"/>	Z	<input type="text" value="0"/>	

Will allow user to enter the value in each axis to translate the new coordinate system

9 OK

OK

OK will close the dialogue by creating the alignment

10 Preview

Preview

Preview will give an option to look the alignment before it is created

11 Cancel

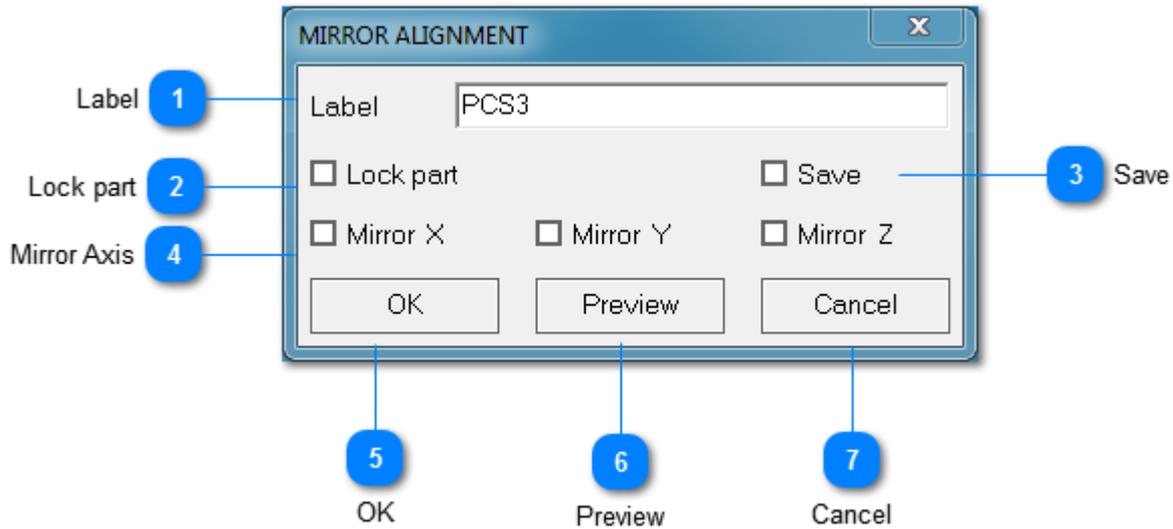
Cancel

Cancel will close the Setup alignment dialogue without creating the alignment

[Alignments](#)

MIRROR

The **Mirror Alignment** option is used to change the direction of one or more axes by 180 degrees. In other words, the axis that is mirrored will count in the opposite direction.



1 Label

Label PCS3

Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

2 Lock part

Lock part

[Lock Part](#) is used to lock CAD part and nominal features to the current alignment system

3 Save

Save

Used to save the alignment in the [Recall Datum List](#).

4 Mirror Axis

Mirror X Mirror Y Mirror Z

When Check coordinate system will be mirrored in that particular axis

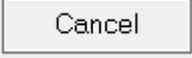
5 OK

OK

OK will close the dialogue by creating the alignment

6 PreviewA rectangular button with a light gray background and a thin black border, containing the text "Preview" in a standard sans-serif font.

Preview will give an option to look the alignment before it is created

7 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel will close the Setup alignment dialogue without creating the alignment

[Alignments](#)

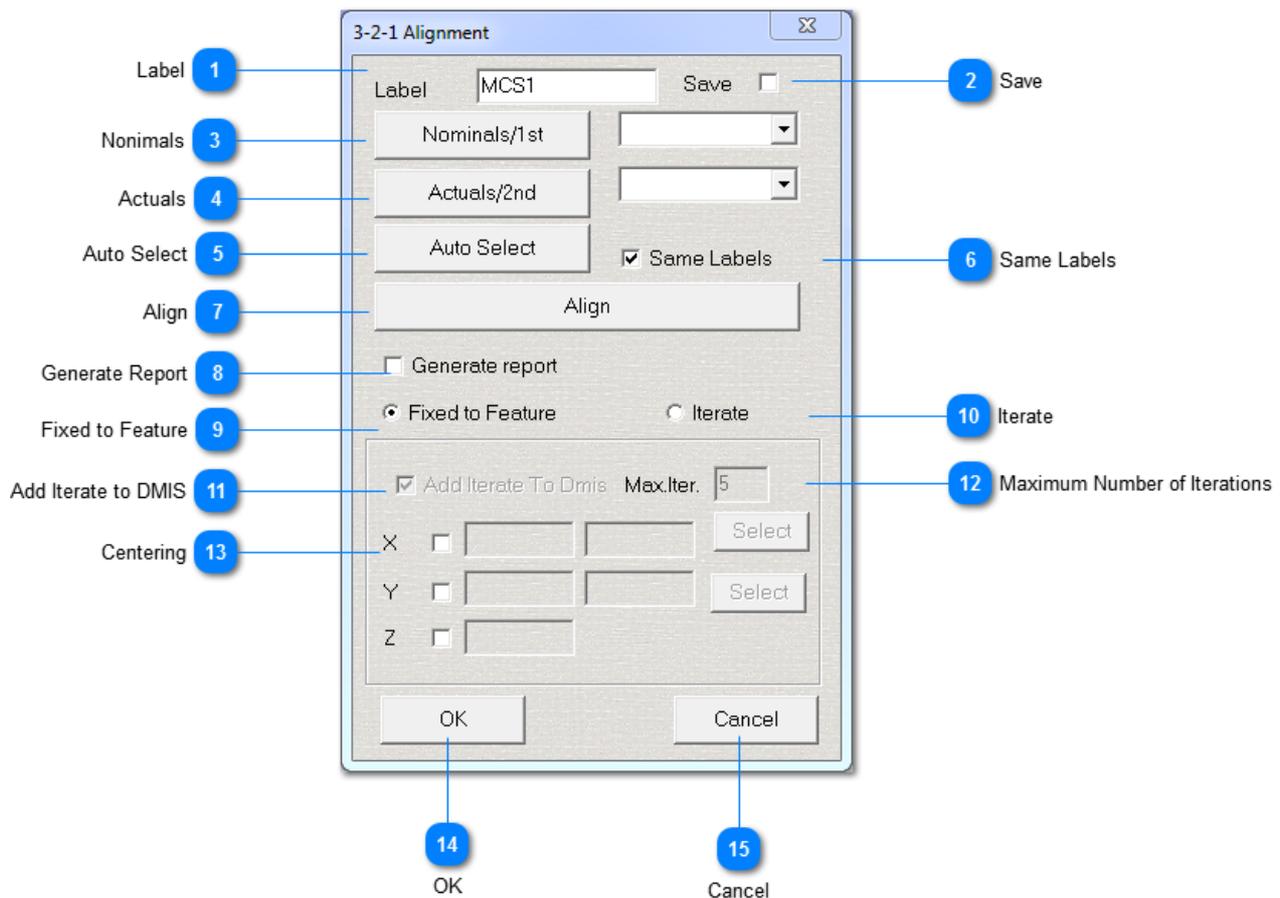
3-2-1 Alignment

The 3-2-1 Alignment can be used when a straightforward alignment using the previous options are not possible or easy. Basic principle is to choose 6 points in 3 groups.

These features should encompass the X, Y and Z axis. Measure the points in the following manner:

- The first three (3) points are taken from the same axis (either X, Y or Z)
- The next two (2) points are taken from one of those two axis that were not used for the first three points
- Finally, the last (1) point is taken from the remaining last axis.

Selecting surfaces that are flat and at 90 degrees to each other are the best option, but are not required. The better the surfaces to take the points on, the less iteration will be required. Iteration is the act of repeating the alignment procedure, possibly several times, to narrow down the amount of error contained in the alignment. This creates a **type of Best Fit alignment**.

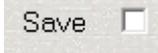


1 Label



Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

2 Save



Used to save the alignment in the [Recall Datum List](#).

3 Nonimals



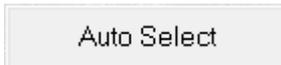
This button allows you to select 6 nominal points. Clicking on this button prompts the Feature Select Dialog box. The shift click method may be used when the feature list appears.

4 Actuals



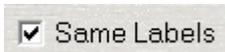
This button allows you to select 6 measured points. The shift click method may be used when the feature list appears.

5 Auto Select



Upon clicking this button, the software will select the last 6 features for both nominals and actuals automatically and insert into the Actuals and Nominals list. The labels of these features do not have to match but they have to be in the same order in terms of their configuration.

6 Same Labels



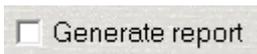
Used to select same labeled actuals and nominals to match them together.

7 Align



Click this button once all of the features have been selected. The **Align** button will best fit the nominal and actual values and return an RMS error value. If the RMS error value is not acceptable, move on to the **Iterate** function of the **3-2-1 Alignment**. It is possible to test the accuracy of the features selected for the alignment by touching points on the part and using the ALIGN function again. The **CANCEL** option will put the system back into the previous alignment, **ACCEPT** will update the alignment. The user can also verify the alignment without having to leave this dialog.

8 Generate Report



Generates a report for the selected features used in **3-2-1 Alignment**.

9 Fixed to Feature

Fixed to Feature

This option allows the user to lock the alignment to a feature after the base **321 Alignment** has been created. The user has the option to lock the alignment to a different feature for the X & Y Axis as well as enter an offset. The user can only enter an offset for the Z axis.

Tips on using the fixed to feature option after the base alignment has been created.

- Use the check boxes to designate which axes to fix to a feature
- Use the select button to select a feature to lock to
- Use the text boxes to the right of the axis letters to enter the offset values if needed

10 Iterate

Iterate

The iteration option can be used to improve the alignment especially when the selected features are not measured where they are indicated on the CAD model. Before the iterate option is used, the part must be aligned roughly in order to calculate points on the surfaces or measure them with the machine. There are two methods of iteration.

Surface Iterate:	This option is used to extract nominal points that are close to where the actual measurements are taken on the part. This method does not require remeasurement of the features therefore faster. However, it uses different nominal data than intended.
Machine Iterate:	This option will allow remeasuring all the points in order to get points that are closer to where the nominal data are. If the points are at a 3D orientation, several iterations might be necessary to get a close alignment. Machine iteration can also be done in 2 ways:
Manual Iteraion:	This option can also be used in DCC machine by moving the machine in joystick mode. In this case, the target points are put in the center of the graphics and a rubber band line is connected from the target point to the tip of the probe. The XYZ display in graphics will also show the distance to be traveled, so it will be easy to make the 2 axis 0 and take the point on the 3 rd .
Automatic Iteration:	If the mode is in MES-CAD, the points will be automatically measured by the machine. Make sure that the collision avoidance option is also enabled in order to clear around the part. In this case, the machine will take the points and a new alignment will be automatically calculated with the alignment error displayed in the window.

11 Add Iterate to DMIS

Add Iterate To Dmis

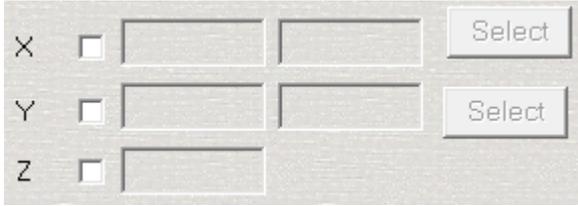
Adds the iteration into [Program Window](#) as a DMIS command.

12 Maximum Number of Iterations

Max.Iter.

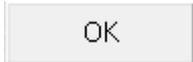
Used to set the maximum number of iterations.

13 Centering



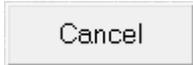
Used to center the deviations and create an equally distributed deviation along the part body. X and Y uses actual features to set a midpoint along X and Y axis. Z is used to set up a location along the Z axis.

14 OK



Applies the changes.

15 Cancel



Cancel the changes and close the dialog.

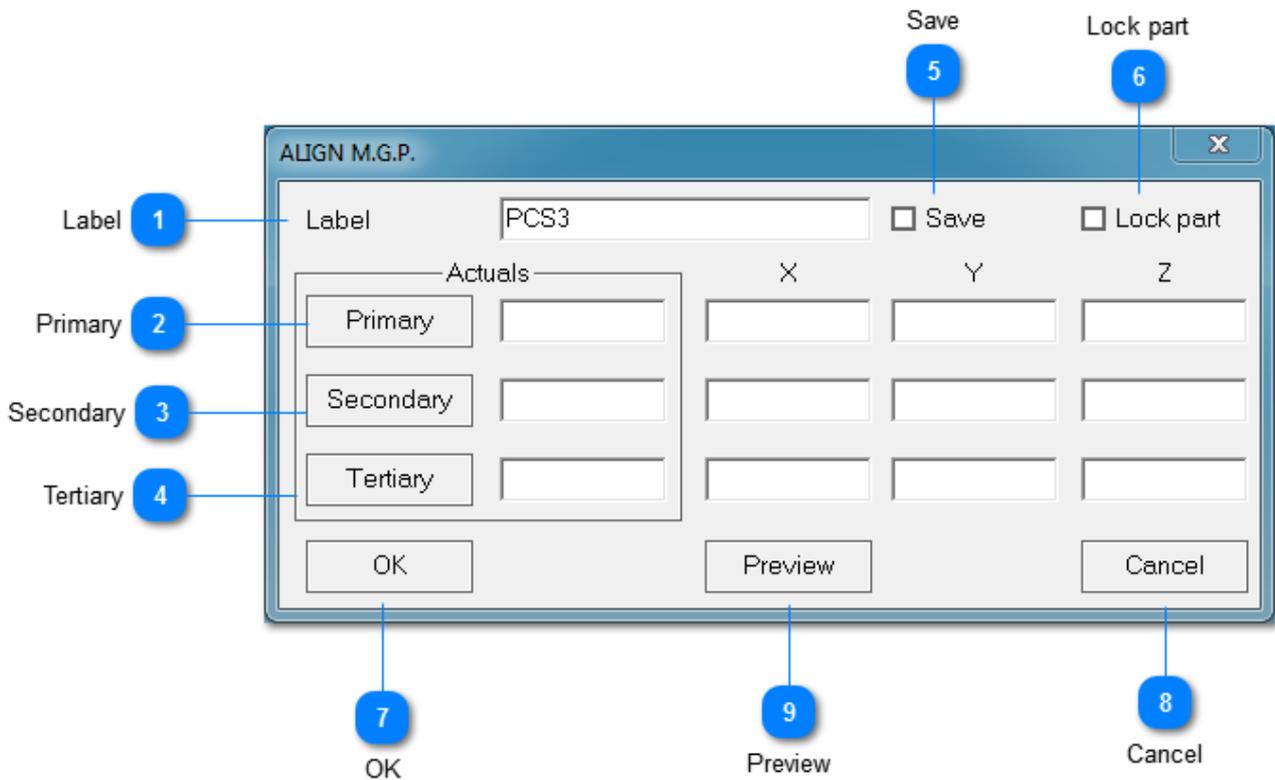
RMS Tolerance:	RMS (root means squared) stands for the total allowable tolerance deviation between measured locations of the actuals and theoretical locations of the nominals for surface points. The user should determine this value before starting alignment iteration. Hint: The tighter the tolerance the better the alignment.
RMS Error:	RMS error is the total calculated deviation between actual surface points and nominal surface points. If RMS error is larger than RMS tolerance, the alignment should be iterated. If RMS error is within the RMS tolerance, the alignment is acceptable.

[Alignments](#)

Align MGP

The **Align MGP** routine uses three point reducible features to create an alignment. These features can be tooling balls that are built into the fixture for a work piece or they may be point reducible features, such as circles or slots projected onto an actual plane.

In either case, the locations of the point reducible features must be determined from actual measurements. A common application for this alignment would be when there is three tooling spheres attached to a fixture that have coordinate values associated with them. This alignment is **non iterative**.



1 Label

Label

Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

2 Primary

Primary

This is the point reducible feature of first importance. Normally this would be the tooling sphere located near the base edge of the fixture base if using tooling spheres for an alignment of this type.

3 Secondary

Secondary

This is the point reducible feature of secondary importance. Normally this would be the tooling sphere adjacent to the primary sphere having the longest distance between.

4 Tertiary

This is the point reducible feature of last importance. Normally this would be the tooling sphere with the shortest distance in relationship to the primary sphere in the case of a fixture alignment.

5 Save
 Save

Save will save the alignment to the recall list with select features

6 Lock part
 Lock part

[Lock Part](#) is used to lock CAD part and nominal features to the current alignment system

7 OK

Applies the changes.

8 Cancel

Cancel the changes and close the dialog.

9 Preview

Preview will give an option to look the alignment before it is created

How to Make a Align MGP Alignment

- Measure three point reducible features on the part or fixture. This may be done in any order; however it is usually easiest to measure the features in order of importance.
- Select the [Align MGP](#) alignment from the [Alignments Menu](#).
- Select the features in order of importance using the select buttons. Once the select button is clicked, the user is presented with a feature selection list whereby the desired feature may be selected.
- Enter the nominal X, Y, Z values for each feature. Once the nominal values are entered, click **OK**. The part is now aligned.

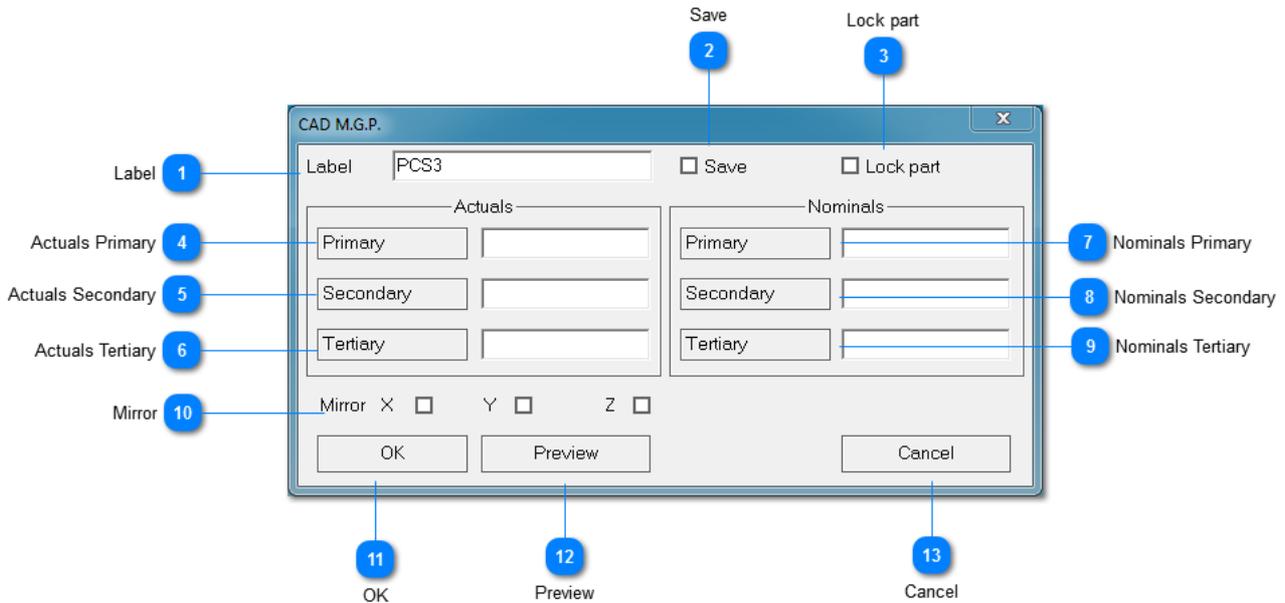
[Alignments](#)

CAD MGP

The CAD MGP macro functions the same as Align MGP macro. This option allows user to select nominal points rather than enter them. The nominal points can be selected from graphics or from the list.

The CAD MGP Macro has two conditions to be matched. First, you must be able to measure three (3) point reducible features; second, you must be able to create these three (3) point reducible features on the wire frame CAD file of the part or be able to enter the nominal values to create nominals.

A common application for this alignment would be when there are three point reducible features on the actual part that can be used in conjunction with three point reducible nominal features from the CAD file to align the part. CAD file is not required, but nominal feature data is needed. This alignment is also **non iterative**.



1 Label

Label PCS3

Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

2 Save

Save

Save will save the alignment to the recall list with select features

3 Lock part

Lock part

[Lock Part](#) is used to lock CAD part and nominal features to the current alignment system

4 Actuals Primary

Primary

This is the point reducible feature of first importance.

5 Actuals Secondary

This is the point reducible feature of secondary importance.

6 Actuals Tertiary

This is the point reducible feature of last importance.

7 Nominals Primary

The nominal feature of the same primary actual feature.

8 Nominals Secondary

The nominal feature of the same secondary actual feature.

9 Nominals Tertiary

The nominal feature of the same tertiary actual feature.

10 Mirror
 Y Z "/>

Mirrors the alignment over the selected axis.

11 OK

Applies the changes.

12 Preview

Preview will give an option to look the alignment before it is created

13 Cancel

Cancel the changes and close the dialog.

How to Make a CAD MGP Alignment

- Measure three point reducible features on the part or fixture. This may be done in any order; however it is usually easiest to measure the features in order of importance.
- Create **Nominal Features** either directly from **CAD** or by entering them via **Nominals Mode**. This step may be interchangeable with the first step above.
- Select the [CAD MGP](#) alignment from the [Alignments Menu](#).
- Select the features in order of importance using the select buttons. Once the select button is clicked, the user is presented with a feature selection list whereby the desired feature may be selected.
- Select the **OK** button. The part is now aligned.

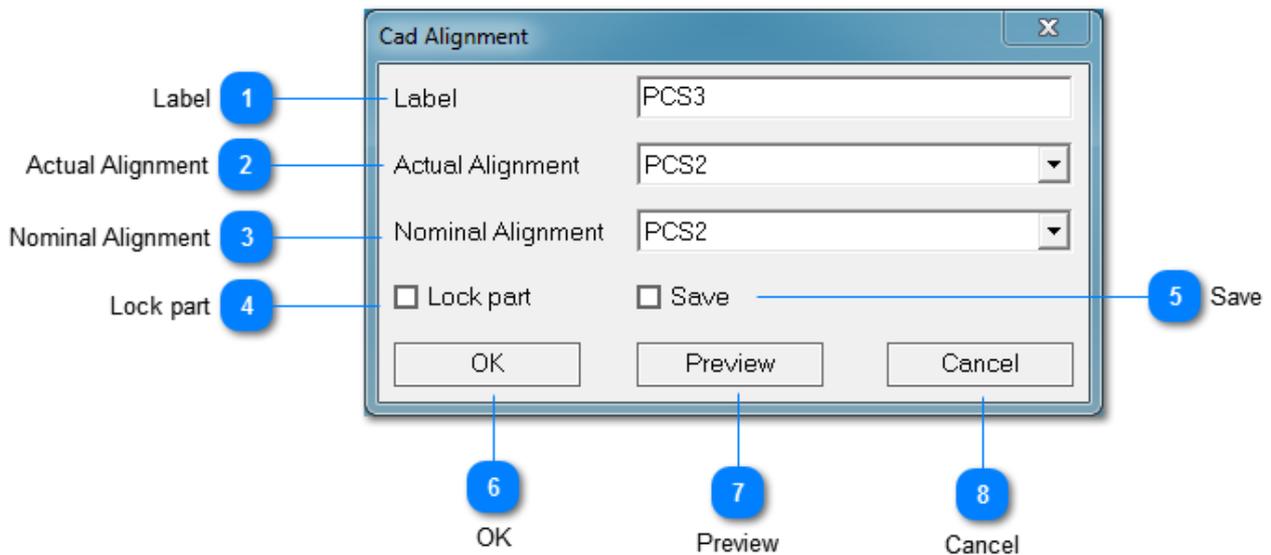
[Alignments](#)

CAD Align

The CAD Align macro was developed to orient the actual part to the CAD position. There are two important differences between **CAD Align** macro and **CAD MGP** macro.

- The CAD wire frame data must include CAD position information to utilize **CAD Align** macro.
- The features that will be used to perform the alignment are datum features. The datum features are identified on the CAD drawing and corresponding datum features are measured on the actual part.

This macro is used by creating an alignment on the actual part, and then creating the same alignment on the CAD wire frame part. The two alignments are then matched; this allows the CAD file to then be used to check the part. The important thing to keep in mind with the CAD Align procedure is that the same alignment must be created on the CAD as is on the actual part. Once this is done and a lock part is complete, CAPPS will place the actual part in CAD position.



1 Label

Label

Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

2 Actual Alignment

Actual Alignment

Used to select actual alignment label from the drop down menu.

3 Nominal Alignment

Nominal Alignment

Used to select nominal alignment label from the drop down menu.

4 Lock part

Lock part

[Lock Part](#) is used to lock CAD part and nominal features to the current alignment system

5 Save Save

Used to save the alignment into the [Recall Datum](#) list. (Alignment Database)

6 OK

OK

Applies the changes.

7 Preview

Preview

Preview will give an option to look the alignment before it is created

8 Cancel

Cancel

Cancel the changes and close the dialog.

How to Make a CAD Align

- Create a nominal alignment on the CAD model. This can be any alignment; however make sure that a true alignment is created using a primary, secondary, and a tertiary feature such as a plane, line, point or a plane and two holes etc. Most importantly, this alignment that is created does NOT have to mimic the part alignment; the key is simply creating some alignment.
- Once the nominal alignment is created, save the alignment. The system will attempt to automatically save the alignment as the default name, TMP. It is suggested that a more appropriate name is chosen for the nominal alignment. For instance, save the nominal alignment name as 'NOMINAL'.
- Measure the actual part on the CMM to obtain the same features to mimic the nominal alignment in the previous step. Create that alignment and save it as 'ACTUAL'. Again, this does not have to be the CAD position alignment, simply because the CAD position alignment often has offsets and rotations that are unknown to the user. The actual alignment merely has to match the nominal alignment created on the CAD part.
- Choose the CAD align option from the Alignments menu. Choose the appropriate alignments from the drop down menus and click OK. The CAD align is complete.
- This alignment option is fully executable but non iterative.

[Alignments](#)

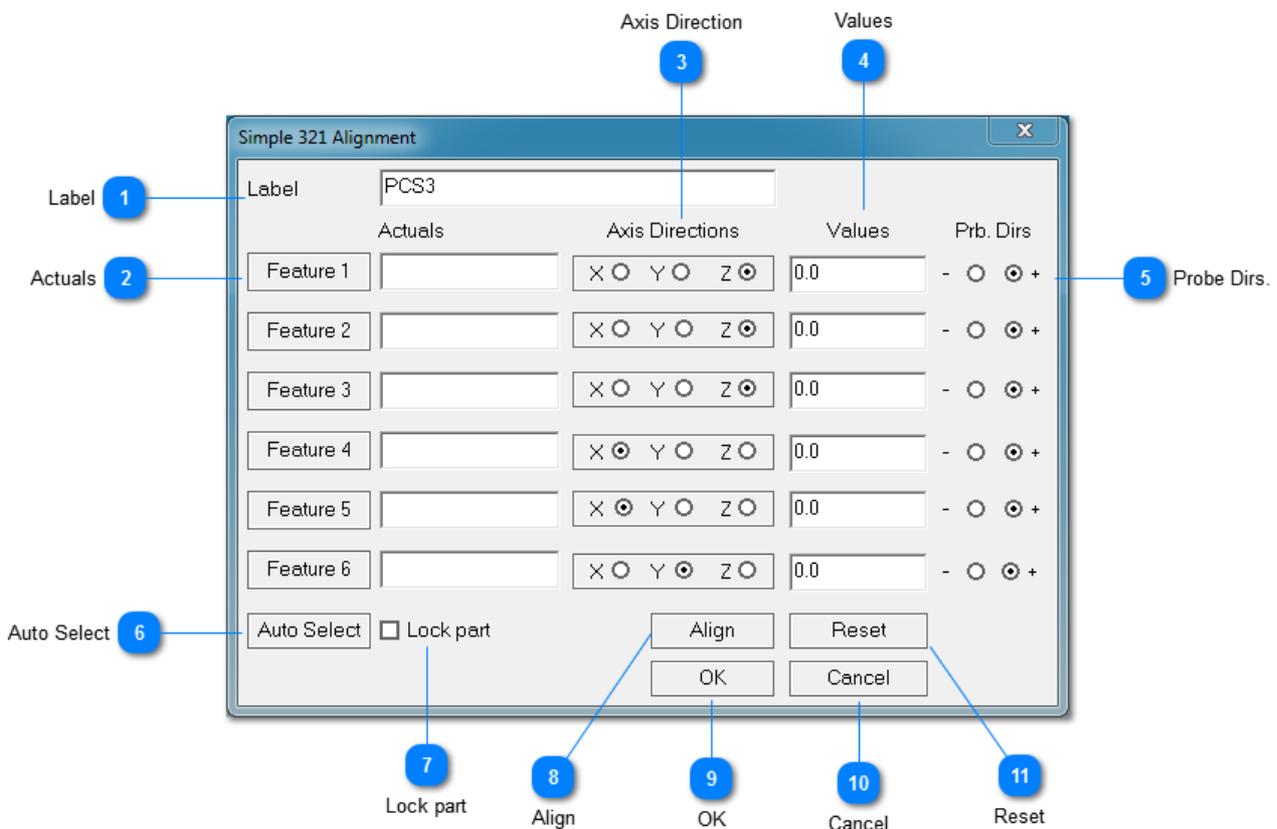
Simple 321 Alignment

The **Simple 3-2-1 Alignment** is a simple method of creating alignments on free formed parts without the CAD, where nominal control directions are known. This alignment is similar to the align MGP option except that up to 6 features may be used.

There are two ways in which to use the **Simple 3-2-1 Alignment**.

- **Using Only points:** Choose six features, usually points, in a 3-2-1 configuration. The first 3 features control the primary direction, 2 features controlling the secondary direction and the last point locating the part in the 3rd direction.
- **Using Other Features:** A combination of points and other features can also be used. For example, 3 points (Primary), a slot (Two way), and a circle (4 way) can also be used.

Important Tip: Features controlling the same coordinate direction do not have to be at the same surface or same elevation level on the work piece.



1 Label

Label PCS3

Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

2 Actuals

Select the features to be used for the alignment from the feature list.

3 Axis Direction

Select axes in a 3 – 2 – 1 configuration.

4 Values

Enter the natural values for each feature. These are as wanting to see values. This input method should not be confused with a traditional translate option whereby the user inputs opposite sine values. Here, the natural values should be used.

5 Probe Dirs.

Used to set the alignment direction for each axis. This is based off the vector direction of the features.

6 Auto Select

Using the **Auto Select** option, this will select the last 6 features measured by the user.

7 Lock part

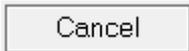
[Lock Part](#) is used to lock CAD part and nominal features to the current alignment system

8 Align

Creates the alignment. After the **OK** button is clicked, a [Lock Part](#) should be done.

9 OK

Used to accept the alignment.

10 Cancel

Cancel the changes and close the dialog.

11 Reset

This option is used to erase the actual features in their respective input boxes.

[Alignments](#)

3D Bestfit

The **3D Bestfit** alignment in CAPPs DMIS is a multi use function which allows the user to **Bestfit** measurement data using either nominal or CAD data. The **3D Bestfit** function can either be used to establish an initial part alignment or as a way to redistribute error using all, or some, of the measured part data. Furthermore, the **3D Bestfit** alignment also contains functions which allow the user to mathematically iterate the applied **Bestfit** to a surface CAD model based on a defined tolerance and set constraints on selected features. There are two main methods to using the **3D Bestfit** option.

- **Initial Part Setup:** Measure features and create nominal to match. Then use the **Compare to Nominals** function to **Bestfit** the actual and nominal data to create an alignment.
- **Bestfit Data Measured from an Initial Alignment:** This allows the defined coordinate system to be the initial start point for the bestfit. The **3D Bestfit** is used to **Bestfit** the existing data and redistribute the error to give better results. By using the **Compare to Nominals** option the original nominal values are maintained.

The screenshot shows the '3D Bestfit Alignment' dialog box. It contains a table of features with columns for Feature, Error, EX, EY, EZ, Prof, and Dist. Below the table is a graph showing Error on the y-axis (ranging from -0.003 to 0.003) and iteration on the x-axis (ranging from 0 to 11). The graph shows a red line connecting data points for iterations 1 through 10. The dialog also has various input fields for parameters like # Elements, RMS Error, MAX Error, # Iterations, Tolerance, and Label. There are checkboxes for 'Minimize Points profile', 'Use CAD Selection', and 'Uncomp points first'. A 'Global Constraints' section has checkboxes for X, Y, Z, A, B, and C, each with a numerical value. At the bottom, there are buttons for 'Accept', 'Close', 'Iterate', 'Reset', 'Remove Selected', and 'Select Features'. There are also radio buttons for 'Compare To Nominals' and 'Compare To CAD', and a checkbox for 'Add to DMIS'. Numbered callouts (1-20) point to these various elements.

1 # of Elements

Elements

Listed automatically after the read features button is selected.

2 RMS Error

RMS Error 0.0015

Calculated as root means squared error. The diagram below shows how RMS error calculation is performed. Calculated as root means squared error. The diagram below shows how RMS error calculation is performed.

In the case of a set of n values $\{x_1, x_2, \dots, x_n\}$, the RMS value is given by:

$$x_{\text{rms}} = \sqrt{\frac{x_1^2 + x_2^2 + \dots + x_n^2}{n}}$$

3 MAX Error

MAX Error 0.0020

Calculated by the software as maximum profile error.

4 # of Iterations

Iterations 1000

This option is used in conjunction with the compare to CAD selection. This allows the user to input the desired number of iterations that the software will go through to achieve the smallest possible RMS error on the measured features within the specified tolerance.

5 Tolerance

Tolerance 0.010

Input by the user and used in conjunction with the compare to CAD option and will be directly associated with the number of iterations input by the user. This tolerance is RMS tolerance, which is not to be confused with individual profile tolerance.

6 Label

Label PCS34

Used to input an alpha numeric name for the alignment. Alignment names should always carry meaning with them for recall purposes. Spaces and wildcard characters should be avoided when naming an alignment. However dashes and underscores may be used.

7 Minimize Points Profile

Minimize Points profile

This is a special option that only works with point features and when the user wants compare the actual features with nominals. Once the the check box is checked, CAPPS only reports the profile errors for selected points.

8 Use CAD Selection

Use CAD Selection

User can use this option to specify the CAD surfaces s/he is interested in to use for **3D Bestfit** alignment. To do so, highlight the surfaces by clicking on them on the CAD model and check this check box before accepting the alignment.

9 Uncomp Points First

Uncomp points first

This option will normally be checked. This will eliminate any cosine error that is being introduced with the touch points. This option would normally be in use if the bestfit method is the primary method of alignment.

10 Use Global Tolerances for Constraints

Global Constraints		
<input type="checkbox"/>	X	0.00000
<input type="checkbox"/>	Y	0.00000
<input type="checkbox"/>	Z	0.00000
<input type="checkbox"/>	A	-0.00000
<input type="checkbox"/>	B	0.00000
<input type="checkbox"/>	C	-0.00000
User Apply		

This input will use the standard defined tolerances for the features that are designated to be used for the constrained features if any.

11 Compare to Nominals

Compare To Nominals

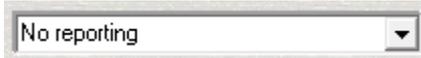
Used if specific nominal data has been supplied for the bestfit. Keep in mind that the bestfit that takes place will only be as accurate as can be based on the touch points.

12 Compare To CAD

Compare To CAD

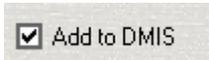
This allows a more thorough bestfit based on the CAD surface definition. Essentially new nominals are made and dropped on the surface based on the current locations of the touch points.

13 Report Options



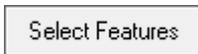
Used to select reporting options for the alignment.

14 Add to DMIS



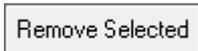
Will add DMIS code to the program upon clicking the **OK** button. This will allow the bestfit portion of the inspection to be executable.

15 Select Features



Used to select features from the list to perform a **3D Bestfit** alignment.

16 Remove Selected



Allows the user to remove a problem feature from the feature list being used in the bestfit calculation. Once an initial iteration is done, the user may find that there is one point that will never achieve to fall within the desired tolerance. That feature may be eliminated from the bestfit calculation.

17 Reset



Will reset the bestfit without performing an alignment on the features.

18 Iterate



Aligns the part.

19 Accept



Once the **OK** button is clicked, the bestfit alignment will be performed based on the configurations described above.

20 **Close**



Cancel the changes and close the dialog.

[Alignments](#)

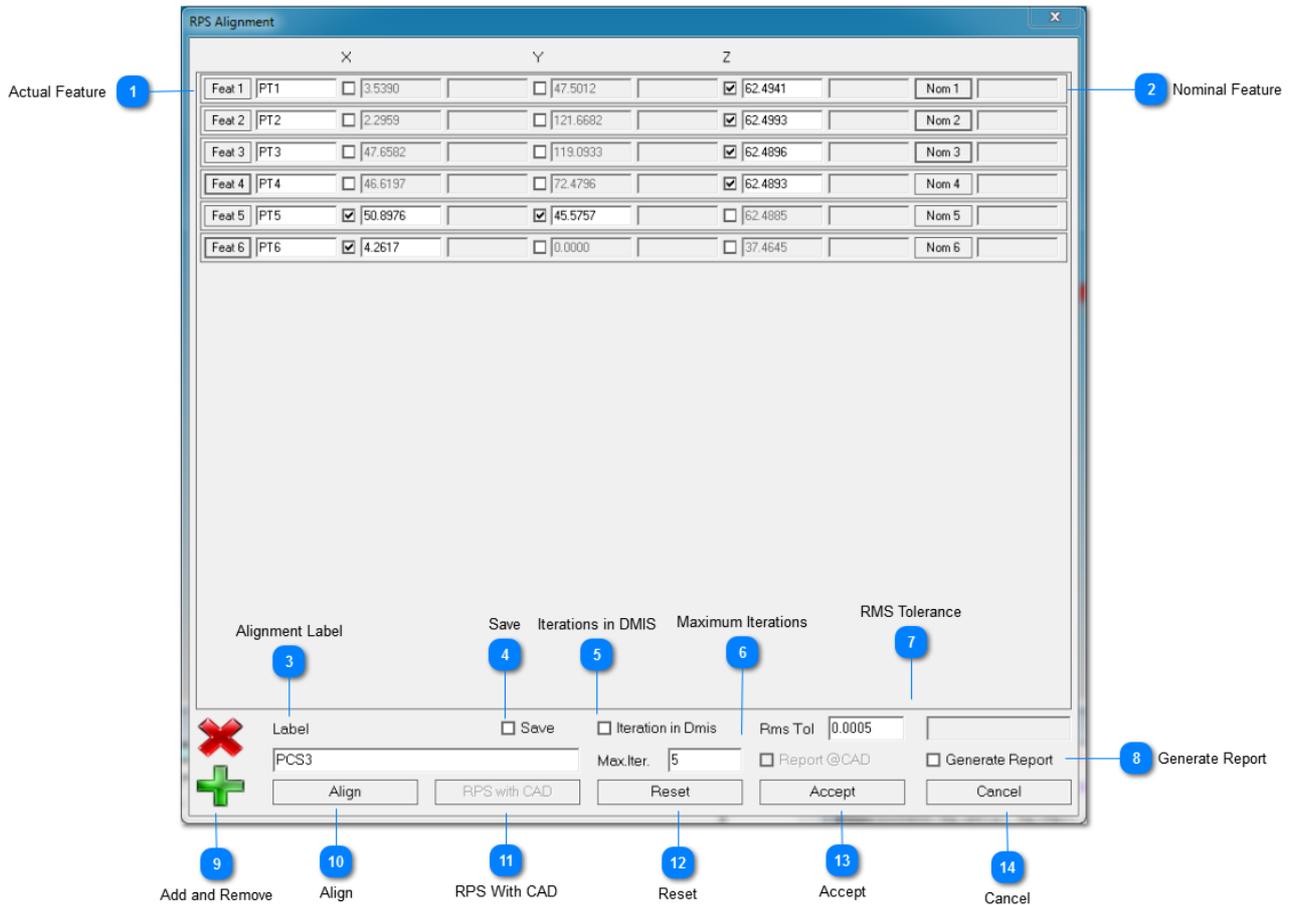
RPS Alignment

The **RPS (Reference Point System) Alignment** is designed to use multiple features and feature types for an alignment which expands upon the traditional 3-2-1 alignment series. More features generally equal more flexibility and better alignment production.

- Limited to 10 feature inputs
- Can use a series of points or point reducible features
- Can also use planes and lines, much like the CAD Align option
- Does not generate DMIS code

Suggestions On Using the RPS Alignment

- If using CAD to define nominal locations, decide what features will control which directions and be sure that these features do not exceed 10 inputs. In other words, for single point touches, they may be over multiple surfaces, but they will likely control only one direction, thereby using 1 input per point touch. However, for a point reducible feature such as a circle, this feature will control up to three possible inputs.
- Create these features on the CAD model. It is suggested that you use the **Set Labeling** option in the [System Configuration - Report](#) to configure the labels for the nominals and actuals to be identical.
- **i.e. PT1 (Nom) = PT1 (Act)**. This procedure is useful when auto selecting features. CAPPs DMIS will look for matching actual labels based on the nominal selection in the RPS dialog box.
- Measure the actual features on the part. Pay careful attention to measure the features in the order in which they were created nominally.
- Open the RPS alignment dialog. Select the **Nom1** button. If the features were labeled identically as was suggested above, group select the nominals that are to be used for the alignment. Notice that the input boxes next to the **Feat** buttons will populate with their corresponding actuals automatically.
- Make any necessary changes to the axis directions for controlling the part.
- Click on the **Align** button to complete the RPS alignment.



1 Actual Feature

Feat 1 | PT1

Used to select actual features.

2 Nominal Feature

Nom 1 |

Used to select nominal features. CAPPS automatically selects nominal features that has the same label names as their actuals. Users can use this button to select a nominal with a different label name.

3 Alignment Label

Label Save
PCS3

Used to set a label name for the RPS alignment.

4 Save

Save

Used to save the alignment into the [Recall Datum](#) list. (Alignment Database)

5 Iterations in DMIS

Iteration in Dmis

Adds the iteration commands to [Program Window](#), so it can be executed.

6 Maximum Iterations

Max.Iter.

Used to set maximum number of iterations to refine the alignment.

7 RMS Tolerance

Rms Tol

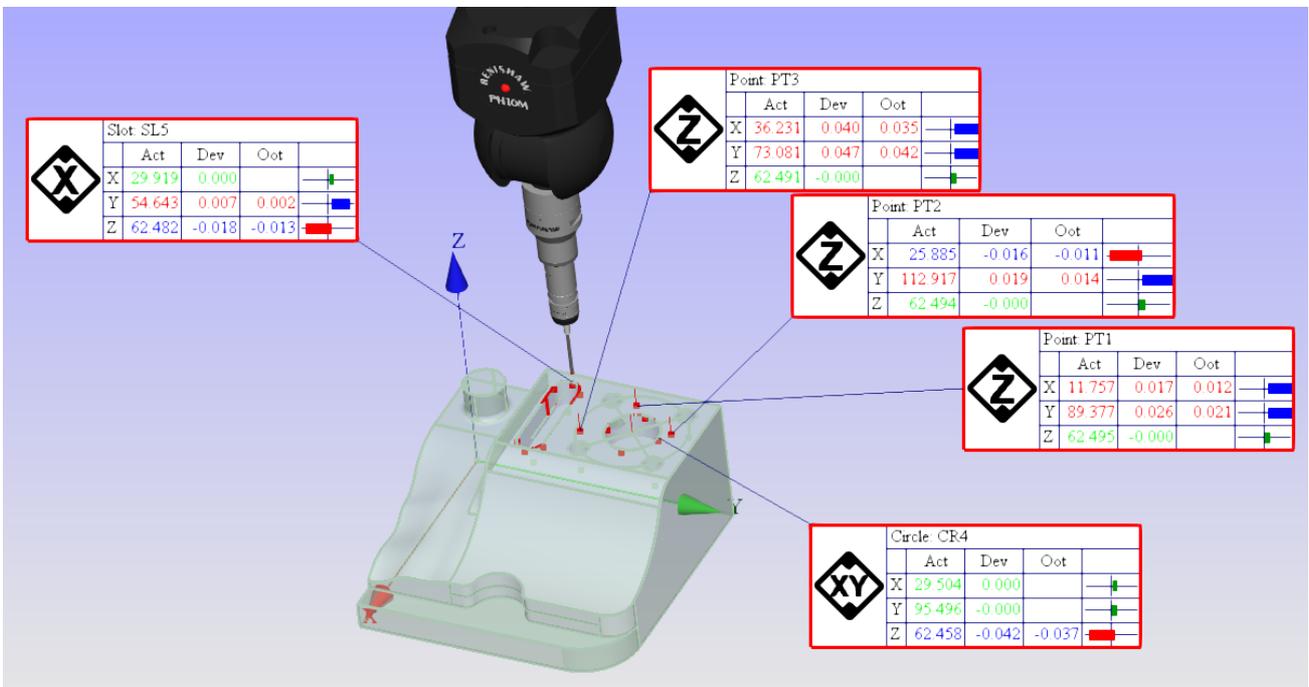
RMS (root means squared) stands for the total allowable tolerance deviation between measured locations of the actuals and theoretical locations of the nominals for surface points. The user should determine this value before starting alignment iteration.

Hint: The tighter the tolerance the better the alignment.

8 Generate Report

Generate Report

Generates report and templates for alignment features as shown below:



9 Add and Remove



Red cross will remove the last feature from the list
Green Plus will add a feature for the current list

10 Align

Aligns the part with given features.

11 RPS With CADA rectangular button with a light gray background and a thin black border, containing the text "RPS with CAD" in a standard sans-serif font.

Performs an iteration process on CAD surface.

12 ResetA rectangular button with a light gray background and a thin black border, containing the text "Reset" in a standard sans-serif font.

Resets the alignment.

13 AcceptA rectangular button with a light gray background and a thin black border, containing the text "Accept" in a standard sans-serif font.

Applies the current alignment and generates DMIS code.

14 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

[Alignments](#)

Extended Alignments

Leapfrog Alignment

Sometimes there are situations where a part must be moved during the course of the measurement. Below are a couple of possibilities.

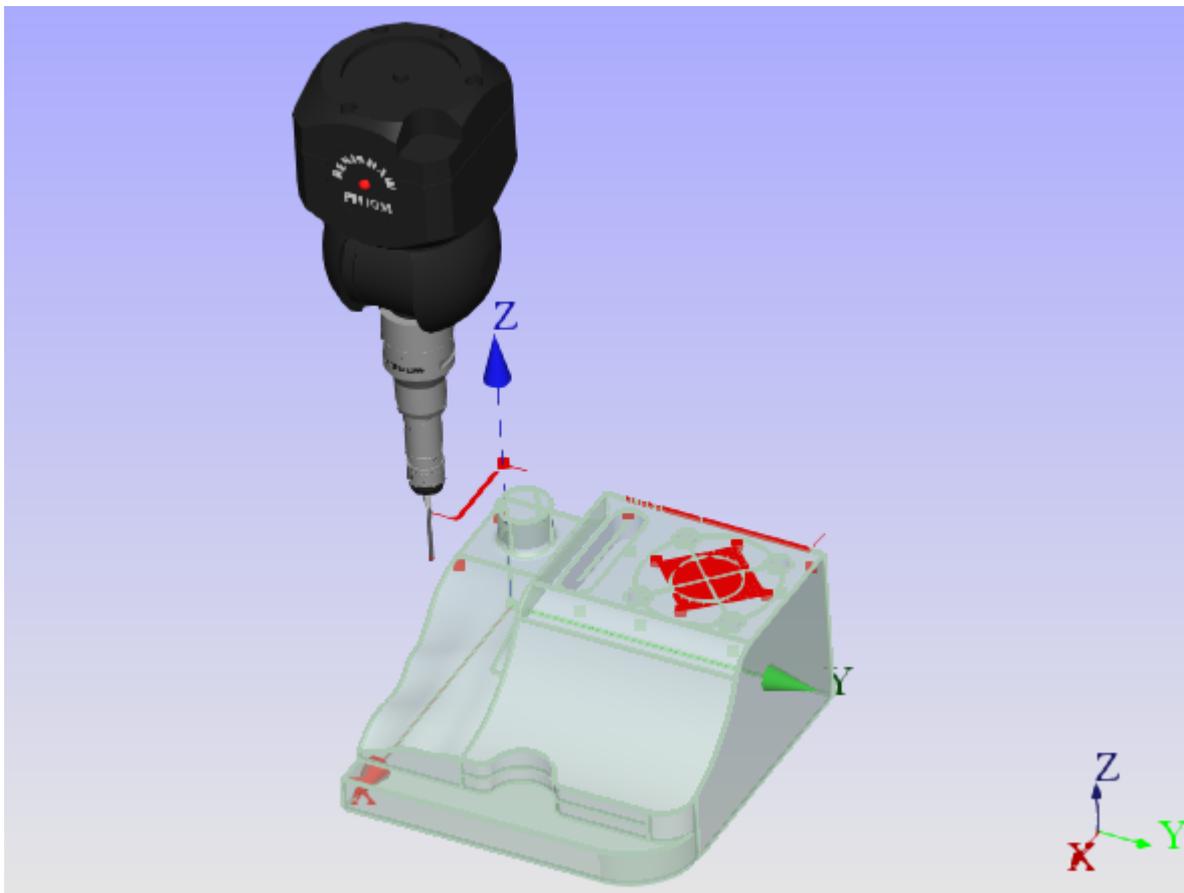
- Part is larger than the measurement volume of the CMM
- Part must be flipped in order to measure the bottom of the part

In these cases a **Leap Frog Alignment** can be used to easily relate the two sets of data once the part has been moved / flipped and realigned. Please note that the **Leap Frog Alignment** only works with alignments that exist in the current alignment list so make sure that both alignments have been saved before attempting to use the **Leap Frog Alignment**.

Important Note: As of version 6.6 the **Leap Frog Alignment** function **DOES NOT** generate **DMIS** code, therefore this is not an executable function. **DMIS** code generation will be added in a future release.

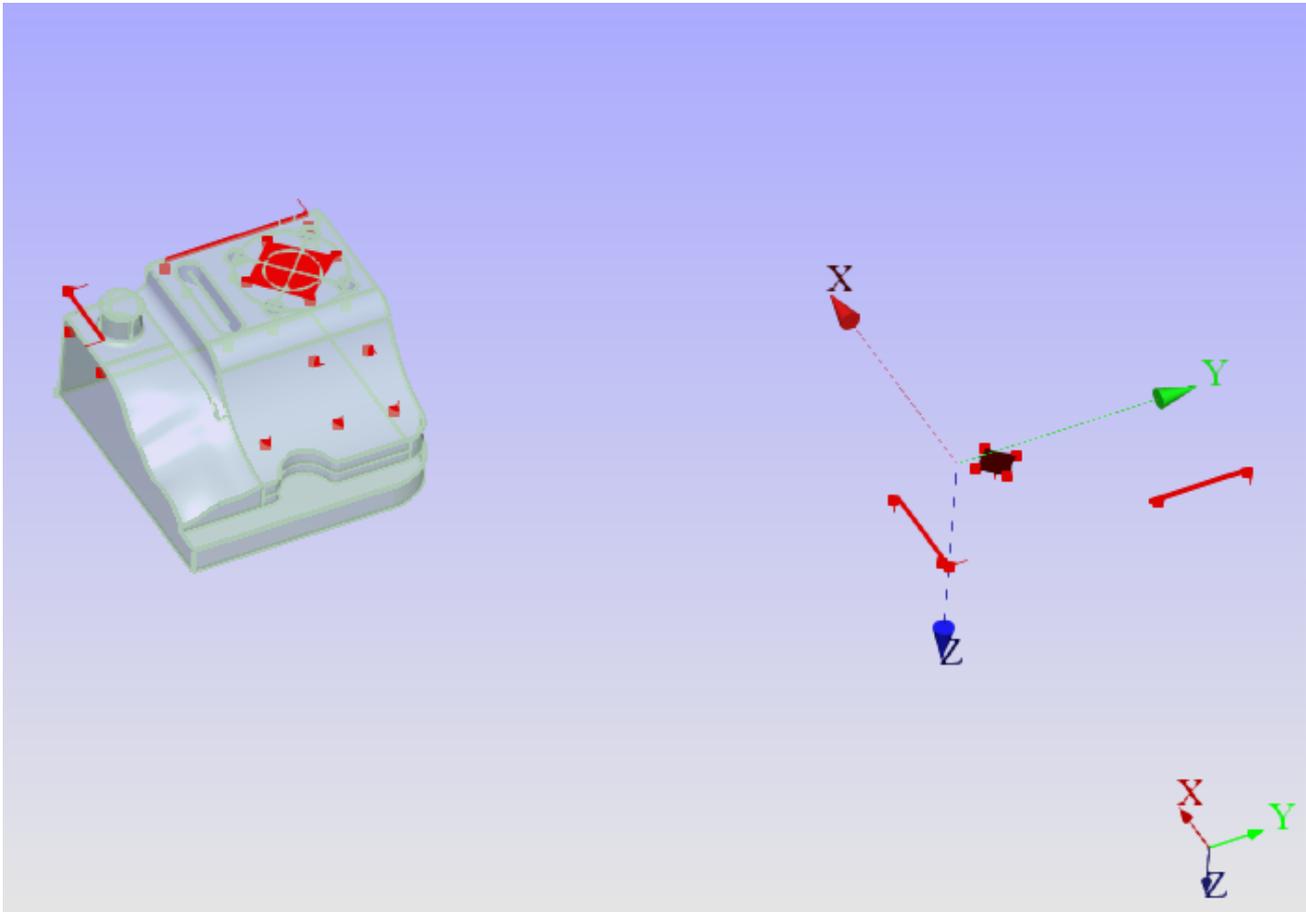
How to Make a Leapfrog Alignment

- Create an alignment in the first setup.
- Save the alignment with a meaningful name such as **SETUP-1** or something similar.
- Measure all the features that are physically possible in this alignment. Shown below are just a few measurements to demonstrate this example.

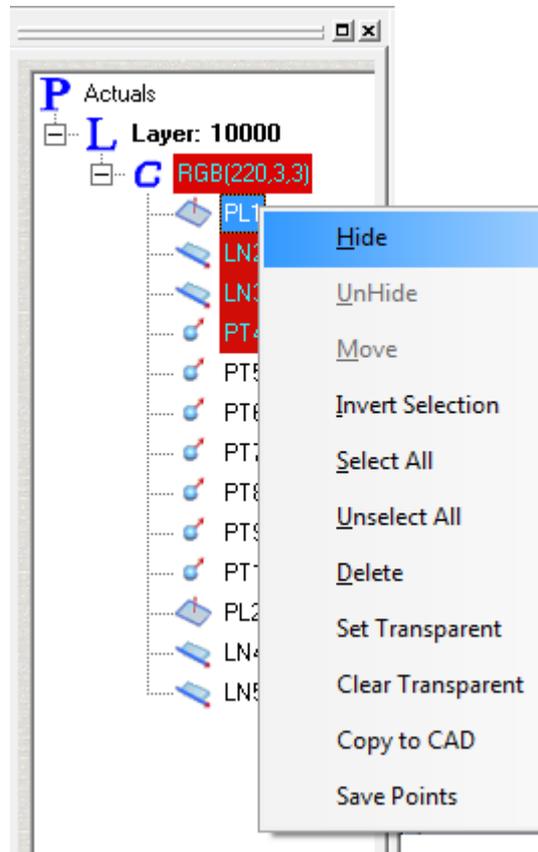


- Move the part, measure the features for **the second alignment**.

- Create **the second alignment** so that it has the same origin and direction as **the first alignment**
- Save the second alignment with a different name than the first alignment. Give this alignment a meaningful name such as **SETUP-2** or something similar.



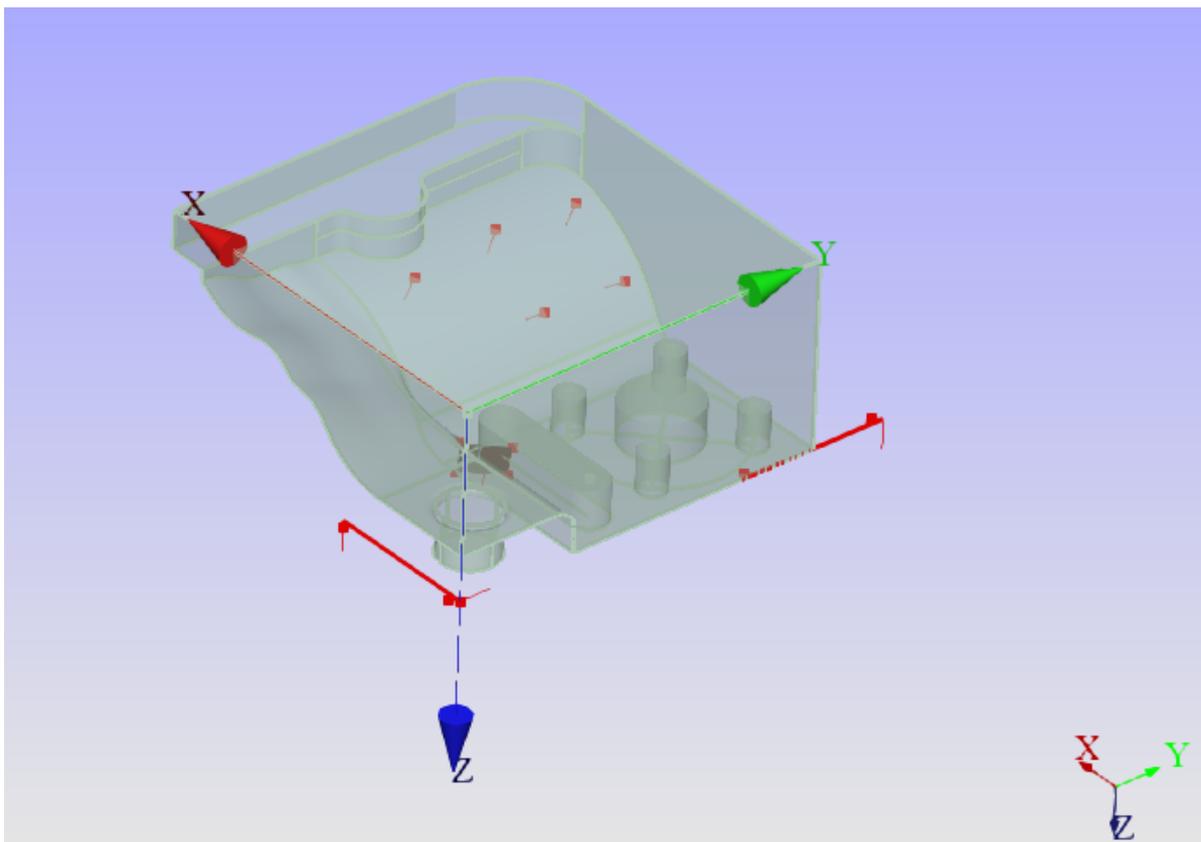
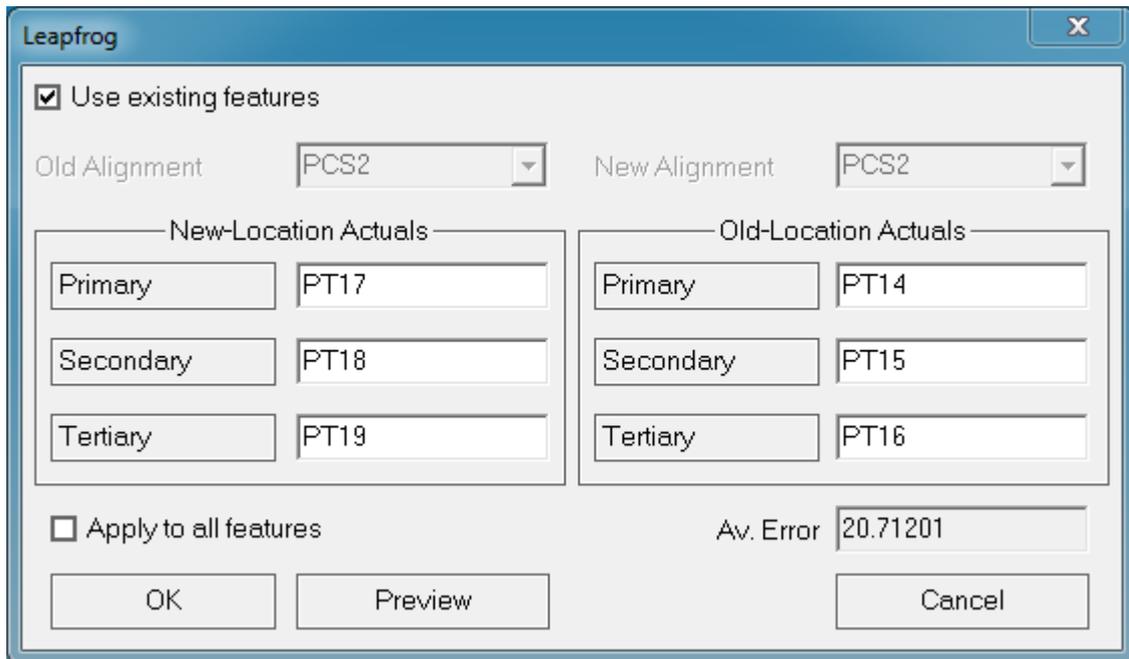
- If there are any measured features that should not be shifted when the Leap Frog alignment is performed simply hide them using the [TreeView Menu](#).



- Features measured in **the first alignment** but used to create **the second alignment**.
- Features measured after **the second alignment** has been created but before the **Leap Frog Alignment** is performed.

Important Note: Hidden features can be unhidden after the **Leap Frog Alignment** has been performed. They will then be shown in the correct orientation.

- To perform the **Leap Frog Alignment**, open the [Alignment Leap Frog menu](#), select the **first alignment** as the **Old Align** and select the **second alignment** as the **NEW Align**. This will equate the **Old Align** to the **New Align** and translate all displayed features to the **New Align**.



After Leapfrog has been completed.

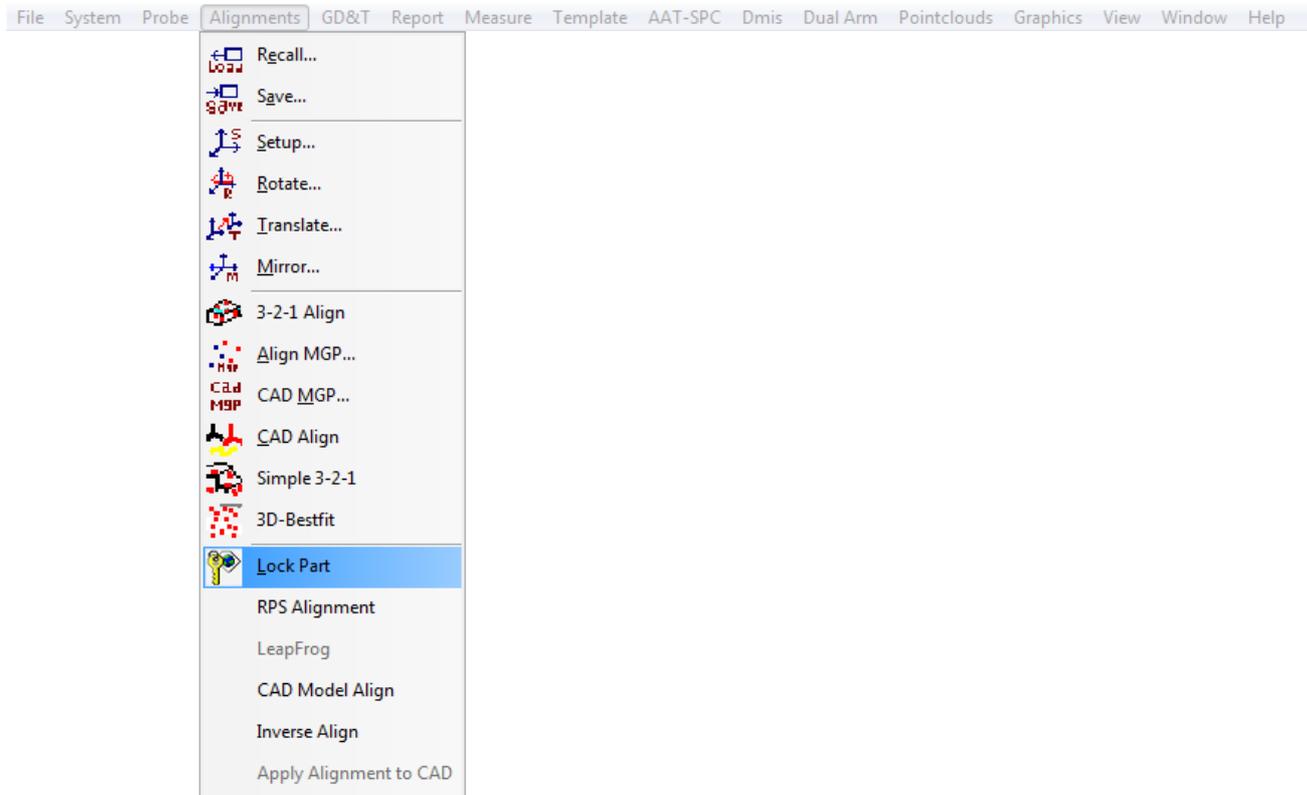
[Alignments](#)

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Other Alignment Functions

Lockpart

The **Lock Part** function in CAPPS DMIS is simply a way to overlay the CAD or nominal data on the current alignment scheme. A lock part function should always be done before creating any nominal data on a CAD model.



The following DMIS code will appear:

```

CAPPS Program: test.bdm
64 SNSLCT/SA (PA0B0) ,0.00000,0.00000,1.00000
65 CAPPS/LOCKPART
66 CAPPS/NOMREP,ON
67
  
```

Important Note:

When NOT to Use The Lock Part Function

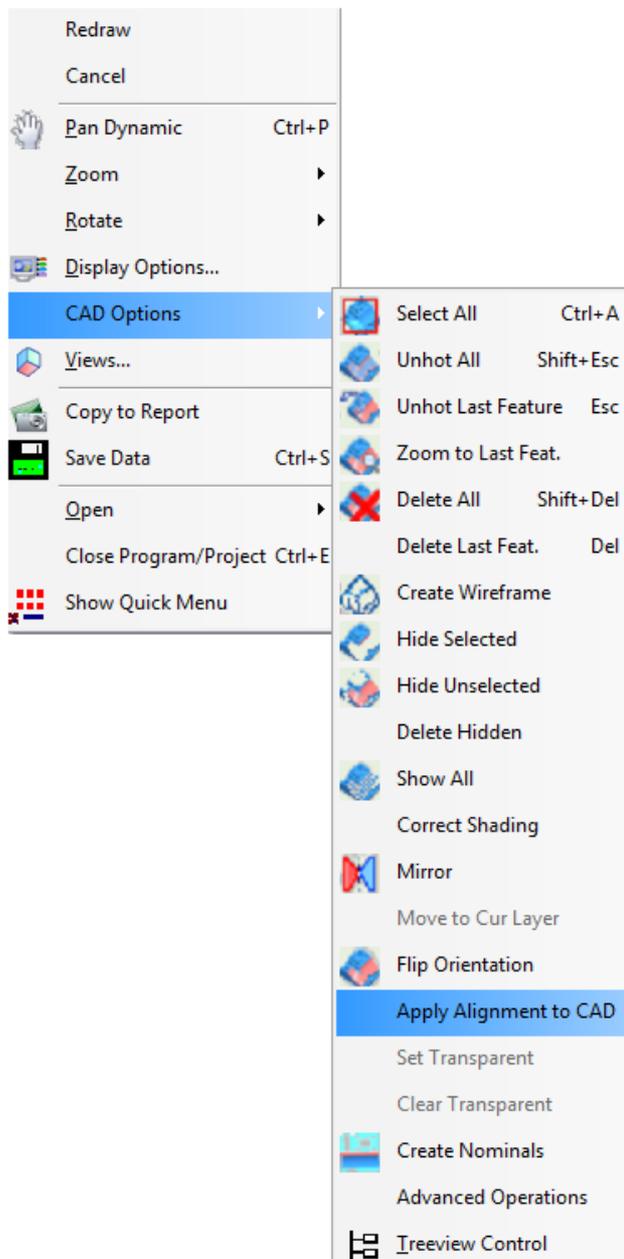
If sub alignments are created in a DMIS program, and new nominal data is being created in each sub alignment.

Apply Alignment To CAD

CAPPS DMIS allows the user to apply an alignment to any location on the CAD part and create a new CAD model (.mdl) based upon the applied alignment origin.

How to Use Apply Alignment To CAD

- Translate the datum to any location on the CAD model either by the translate option under the alignment menu or by transferring the datum to a feature nominal. This new datum location that is being created on the CAD should accurately represent a true datum scenario. The user should proceed with extreme caution before applying any new alignment to a CAD model, since any new data generated will be a reflection of the new datum scheme.
- Right click the mouse in the **Graphics Window** and select the Apply Alignment option.
- Save the CAD as an MDL file. This is very important because these changes will not be permanently applied to any other native CAD format. This is by design to save the integrity of the original model data.



[Alignments](#)

Geometric Dimensioning and Tolerancing

Form Tolerances

Form Tolerances control the form of individual features. No datums are allowed.

Symbol	Type of Tolerance	Shape of Tolerance Zone	2D or 3D	APP Of Feature Modifier
	Flatness	2 Parallel Planes	3D	NO
	Straightness Controls Surface Line Elements	2 Parallel Lines	2D	NO
	Straightness Controls Axis or Median Plane	2 Parallel Planes or Cylindrical Zone	3D	YES
	Circularity Roundness	2 Concentric Circles	2D	NO
	Cylindricity	2 Concentric Cylinders	3D	NO

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Setting Tolerances

Active Tolerances

Currently Active Tolerances are the tolerance values that were established and available during the last CAPPS DMIS inspection program. That is to say, the most recently used tolerance values are saved at the end of the program and reloaded when a new program is started. These values would include the last changes made to any individual tolerances in the tolerance table. When a new tolerance file is loaded during a program, those tolerances become the current active tolerances.

Passive Tolerances

Passive Tolerances are those tolerances that are not dependent on features, values, or any part of the DMIS program for definition. **Passive Tolerance** labels and values are recalled from the **Currently Active Tolerance** table and written into the DMIS program as the tolerances are applied.

Associative Tolerances

Associative tolerances can be separated into two branches: Standard associative tolerances and relative associative tolerances.

Standard Associative Tolerances have a nominal or an actual Datum feature in the tolerance definition. The feature must either be defined or measured or defined and constructed. Before the statement can be written into the DMIS program, the feature must be associated to the tolerance. **Parallelism** and **Perpendicularity** can be given as examples of **Standard Associative Tolerances**.

Relative Associative Tolerances have a nominal value included in the definition. Features with these types of tolerances must be related to each other and evaluated before they can be written into the DMIS program. Either type of **Associative Tolerance** is not written to the DMIS program automatically. When the **GD&T** option is used to output measured or constructed features, these tolerance statements will be recalled from the currently active tolerance file and the correct tolerance statement is then written into the DMIS program.

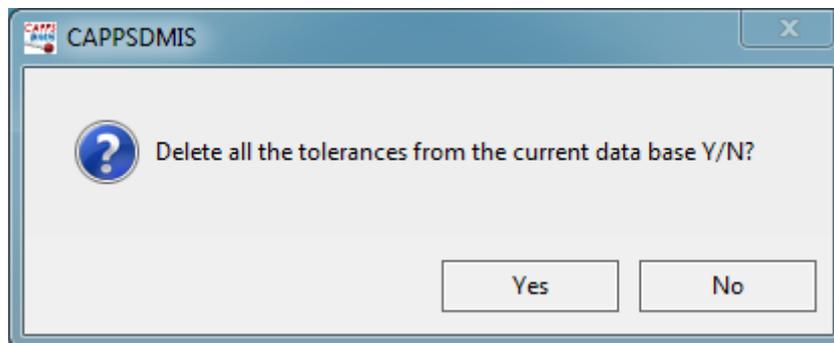
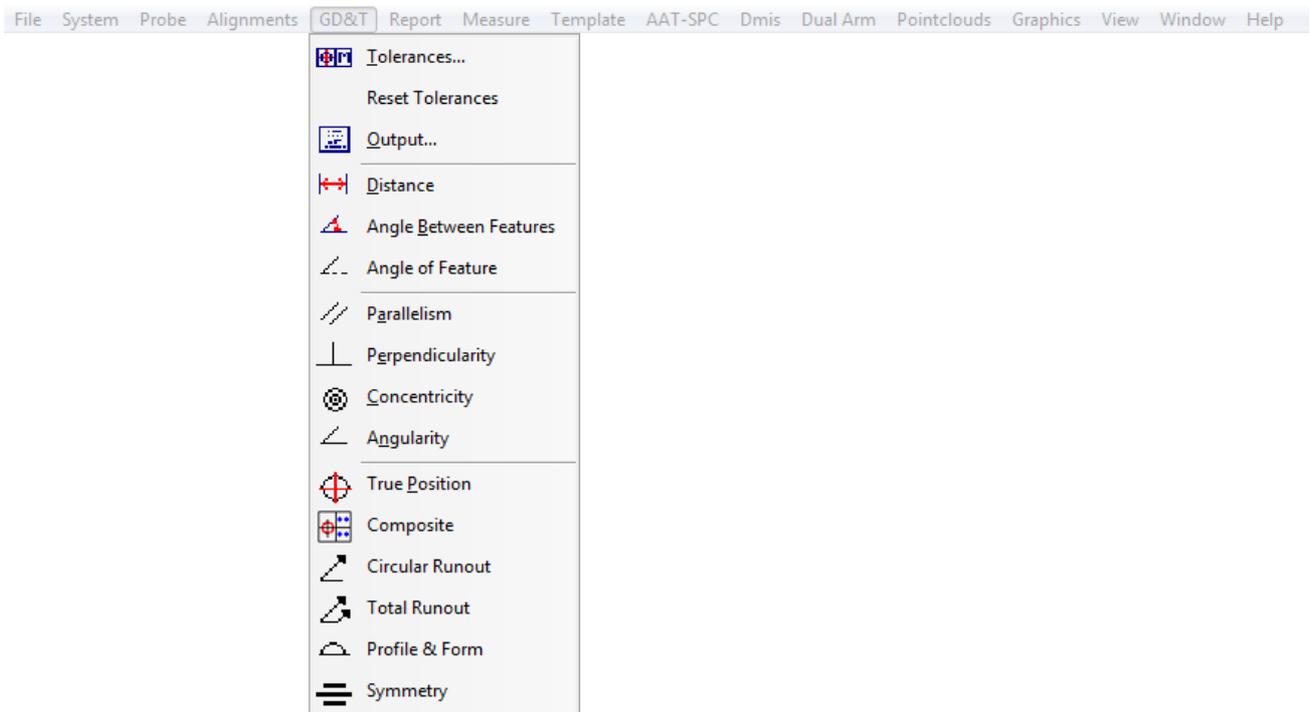
Saving and reloading tolerance information automatically is very convenient for the user. It makes sense, however, that program for different parts or different customers will have different tolerances associated with them. It is for this reason that CAPPS also provides the option of creating and saving complete tolerance files that have specific applications. In order to change the tolerance user can change it in the respective output dialogue or in the tolerance option under GD&T

Tolerance Label	Lower Tolerance	Upper Tolerance
X - Axis TOLX	-0.000	0.000
Y - Axis TOLY	-0.000	0.000
Z - Axis TOLZ	-0.000	0.000
Polar - Radius TOLR	-0.000	0.000
Polar - Angle TOLA	-0.000	0.000

Select the option for which tolerance should be changed, assign a meaning full name and enter the new tolerance value click apply and then click OK to set the new Tolerance

Reset Tolerances

Each time a new tolerance is created for a specific output the new label for that tolerance is added to the list of labels for that specific output. Over a period of time the list may get quite long and contain many labels, which may no longer be valid or useful. The **Reset Tolerances** option will take care of this problem.



Clicking on the **Yes** button will reset all tolerances. What happens at this point is all tolerances and their labels are deleted from the tolerance label lists leaving only the last entered tolerances available for use. If no tolerance has been entered for a specific output, the system default tolerance will be retained.

All tolerance lists, which have been previously saved, are still intact. This operation only clears those labels that have built up over a period of time. Previously saved tolerances may be loaded.

[Geometric Dimensioning and Tolerancing](#)

Flatness

The condition of a surface having all of its elements in one place.

Control Applies to:

- Plane Features

Tolerance Input

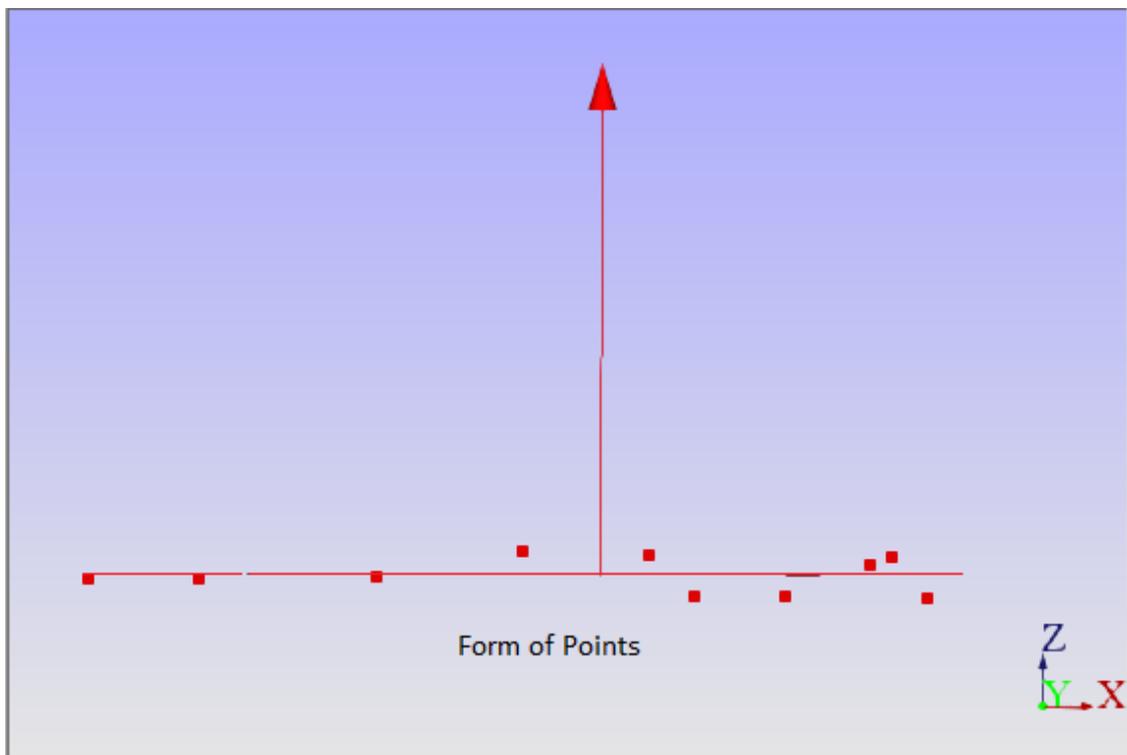
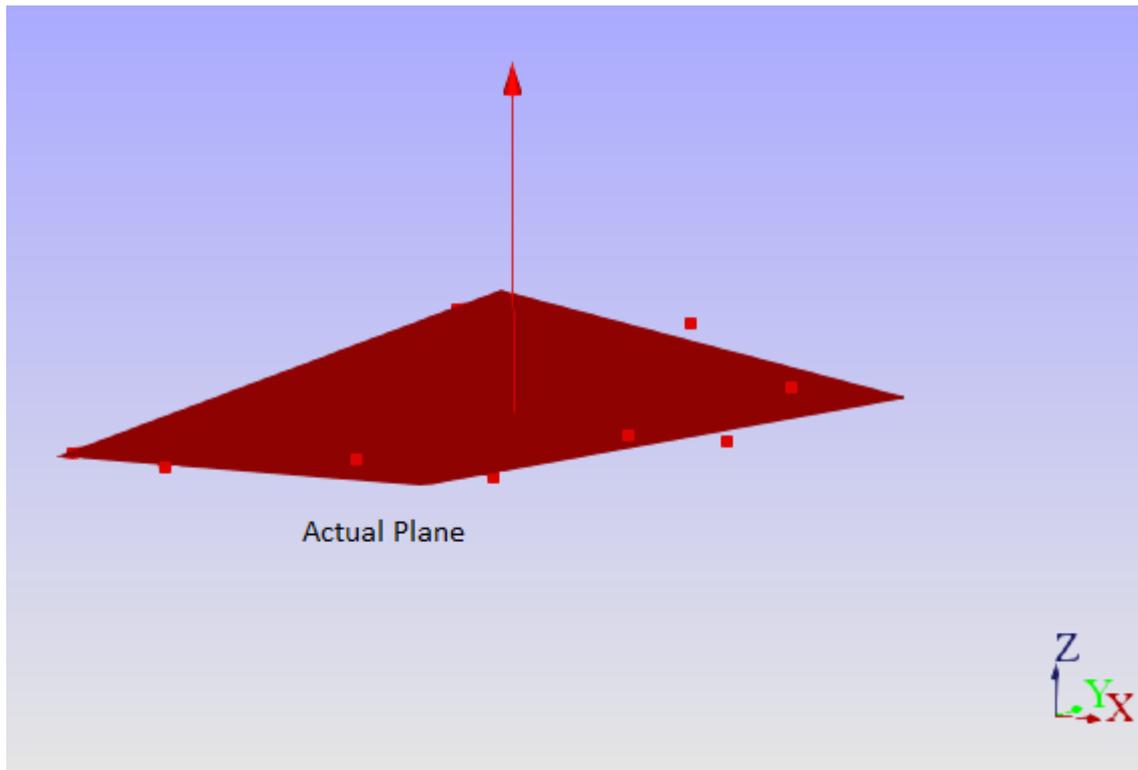
To change **Flatness** tolerance go to [GD&T Menu - Tolerances](#) and select **Form** tab to input **Flatness** tolerance, click **Apply** to apply changes.

The image shows a software dialog box titled "GDT Tolerances" with a close button (X) in the top right corner. The dialog is divided into several sections. At the top, there is a grid of tabs for different tolerance types: Angle Between Two Features, Angle, Angularity, Parallelism, Perpendicularity, Profile, Radius, Total Runout, True Position, Width, Composite, Circular Runout, Concentricity, Coordinate Tolerances, Diameter, Distance, Form, and Length. The "Form" tab is currently selected and highlighted with a blue border. Below the tabs, there are two columns: "Tolerance Label" and "Limit". Under the "Form" tab, there are five sections, each with a dropdown menu for the tolerance label and a text input field for the limit value:

Tolerance Label	Limit
Flatness TOLFLT	0.200
Circularity TOLCIR	0.000
Cylindricity/Conicity/Torusity TOLCYL	-0.000
Straightness TOLSTR	0.000
Sphericity TOLSPH	-0.000

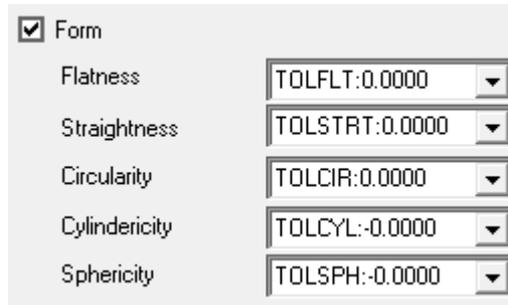
At the bottom of the dialog box, there are three buttons: "OK", "Cancel", and "Apply".

Application

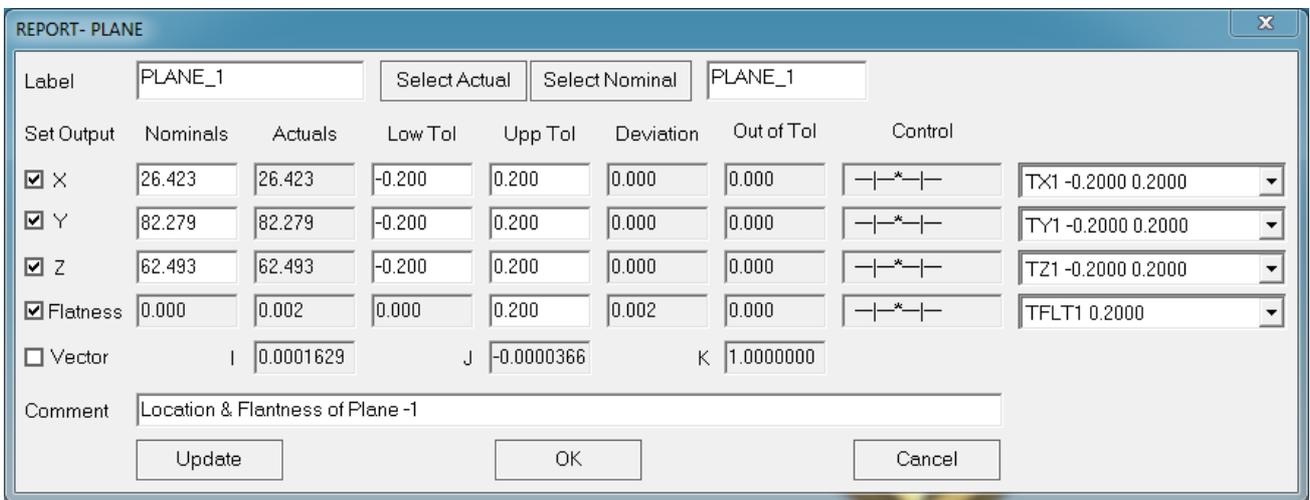
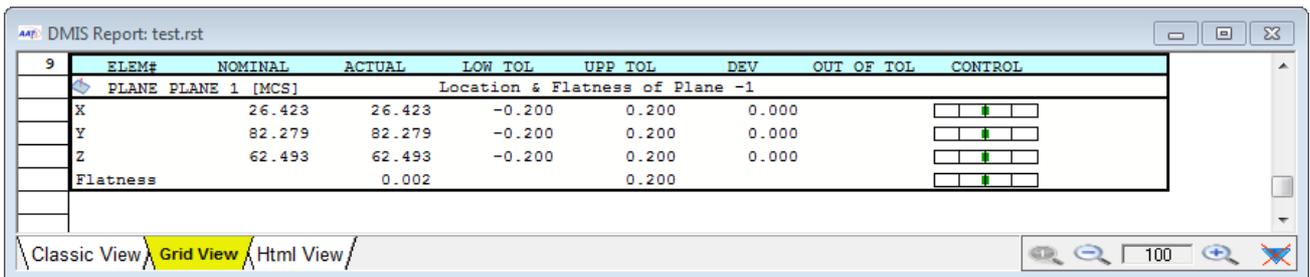


Steps To Follow:

- To automatically output **Flatness**, go to [Status Toolbar](#) and check **Form** from [Current Outputs](#) option.



- To manually output **Flatness**, go to [GD&T Menu - GD&T Output](#) and simply check **Flatness** tolerance from the output window and click **OK** as shown below:

ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
Location & Flatness of Plane -1							
X	26.423	26.423	-0.200	0.200	0.000		OK
Y	82.279	82.279	-0.200	0.200	0.000		OK
Z	62.493	62.493	-0.200	0.200	0.000		OK
Flatness		0.002		0.200			OK

[Geometric Dimensioning and Tolerancing](#)

Straightness

The condition where an axis is a straight line (or, in the case of a center plane, each line is a straight line.)

Control Applies to:

- Lines
- Cylinders

Tolerance Input

To change **Straightness** tolerance go to [GD&T Menu - Tolerances](#) and select **Form** tab to input **Straightness** tolerance, click **Apply** to apply changes.

The screenshot shows the 'GDT Tolerances' dialog box with the 'Form' tab selected. The 'Straightness' section is highlighted with a blue border. The 'Tolerance Label' is 'TOLSTRT' and the 'Limit' is '0.000'.

Tolerance Label	Limit
Flatness TOLFLT	0.200
Circularity TOLCIR	0.000
Cylindricity/Conicity/Torusity TOLCYL	-0.000
Straightness TOLSTRT	0.000
Sphericity TOLSPH	-0.000

Application

Steps To Follow:

- To automatically output **Straightness**, go to [Status Toolbar](#) and check **Form** from [Current Outputs](#) option.

- To manually output **Straightness**, go to [GD&T Menu - GD&T Output](#) and simply check **Straightness** tolerance from the output window and click **OK** as shown below:

Label	Set Output	Nominals	Actuals	Low Tol	Upp Tol	Deviation	Out of Tol	Control
LINE_3	<input checked="" type="checkbox"/>	1.726	1.726	-0.200	0.200	0.000	0.000	TX1 -0.2000 0.2000
	<input checked="" type="checkbox"/>	-0.001	-0.001	-0.200	0.200	0.000	0.000	TY1 -0.2000 0.2000
	<input checked="" type="checkbox"/>	62.494	62.494	-0.200	0.200	0.000	0.000	TZ1 -0.2000 0.2000
	<input checked="" type="checkbox"/>	0.000	0.000	0.000	0.200	0.000	0.000	TSTRG1 0.2000

Vector I: 1.0000000 J: 0.0000011 K: -0.0001629

Comment: Location & Straightness of Line-3

12	ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
	LINE LINE 3 (MCS)							
	X	1.726	1.726	-0.200	0.200	0.000		<input type="checkbox"/>
	Y	-0.001	-0.001	-0.200	0.200	0.000		<input type="checkbox"/>
	Z	62.494	62.494	-0.200	0.200	0.000		<input type="checkbox"/>
	Straightnes	0.000			0.200			<input type="checkbox"/>

Geometric Dimensioning and Tolerancing

Circularity

The condition where all points of a surface of revolution, at any section perpendicular to a common axis, are equidistant from the axis.

Control Applies to:

- Holes (Circular cross sections of a cylindrical or conical feature or 2D circle checks)

Tolerance Input

To change **Circularity** tolerance go to [GD&T Menu - Tolerances](#) and select **Form** tab to input **Circularity** tolerance, click **Apply** to apply changes.

The screenshot shows the 'GDT Tolerances' dialog box with the 'Form' tab selected. The 'Circularity' section is highlighted with a blue border. The 'Tolerance Label' is 'TOLCIR' and the 'Limit' is '0.000'. Other sections include Flatness (TOLFLT, 0.200), Cylindricity/Conicity/Torusity (TOLCYL, -0.000), Straightness (TOLSTRT, 0.000), and Sphericity (TOLSPH, -0.000). Buttons for 'OK', 'Cancel', and 'Apply' are at the bottom.

Tolerance Label	Limit
Flatness (TOLFLT)	0.200
Circularity (TOLCIR)	0.000
Cylindricity/Conicity/Torusity (TOLCYL)	-0.000
Straightness (TOLSTRT)	0.000
Sphericity (TOLSPH)	-0.000

Application

Steps To Follow:

- To automatically output **Circularity**, go to [Status Toolbar](#) and check **Form** from [Current Outputs](#) option.

- To manually output **Circularity**, go to [GD&T Menu - GD&T Output](#) and simply check **Circularity** tolerance from the output window and click **OK** as shown below:

Set Output	Nominals	Actuals	Low Tol	Upp Tol	Deviation	Out of Tol	Control
<input checked="" type="checkbox"/> X	29.504	29.504	-0.200	0.200	0.000	0.000	TX1 -0.2000 0.2000
<input checked="" type="checkbox"/> Y	95.496	95.496	-0.200	0.200	0.000	0.000	TY1 -0.2000 0.2000
<input checked="" type="checkbox"/> Z	62.500	62.493	-0.200	0.200	-0.007	0.000	TZ1 -0.2000 0.2000
<input checked="" type="checkbox"/> Diam	25.400	25.400	-0.200	0.200	0.000	0.000	TD1 -0.2000 0.2000
<input checked="" type="checkbox"/> Circularity	0.000	0.000	0.000	0.000	0.000	0.000	TOLCIR 0.0000

ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL	
13	INNER CIRCLE	CENTER CR [MCS]	Location & Circularity of the Center Circle					
X	29.504	29.504	-0.200	0.200	0.000			
Y	95.496	95.496	-0.200	0.200	0.000			
Z	62.500	62.493	-0.200	0.200	-0.007			
Diam	25.400	25.400	-0.200	0.200	0.000			
Circularity	0.000	0.000	0.000	0.000	0.000			

Geometric Dimensioning and Tolerancing

Sphericity

Technically, there is no standard GD&T symbol for **Sphericity**; however this is also a form tolerance. **Sphericity** tolerance is circularity as it relates to a sphere. A circle is defined as a result of the intersection of a plane passing through the center of the sphere. Sphericity creates a 2D circular zone within which all points of the surface of the sphere must lie at the intersection with the plane passing through its center.

Control Applies to:

- Spheres

Tolerance Input

To change **Sphericity** tolerance go to [GD&T Menu - Tolerances](#) and select **Form** tab to input **Sphericity** tolerance, click **Apply** to apply changes.

The screenshot shows the 'GDT Tolerances' dialog box with the 'Form' tab selected. The 'Form' tab is highlighted with a blue border. The 'Sphericity' tolerance is also highlighted with a blue border. The 'Sphericity' section shows a dropdown menu with 'TOLSPH' selected and a limit of '-0.000'. Other tolerance sections include Flatness (TOLFLT, 0.200), Circularity (TOLCIR, 0.000), and Straightness (TOLSTRT, 0.000). The 'Form' tab also includes options for Diameter, Distance, and Length.

Tolerance Label	Limit
Flatness (TOLFLT)	0.200
Circularity (TOLCIR)	0.000
Cylindricity/Conicity/Torusity (TOLCYL)	-0.000
Straightness (TOLSTRT)	0.000
Sphericity (TOLSPH)	-0.000

Application

Steps To Follow:

- To automatically output **Sphericity**, go to [Status Toolbar](#) and check **Form** from [Current Outputs](#) option.

- To manually output **Sphericity**, go to [GD&T Menu - GD&T Output](#) and simply check **Sphericity** tolerance from the output window and click **OK** as shown below:

Label	Set Output	Nominals	Actuals	Low Tol	Upp Tol	Deviation	Out of Tol	Control	
<input checked="" type="checkbox"/> X		50.000	50.091	-0.200	0.200	0.091	0.000	— —0* —	TX1 -0.2000 0.2000
<input checked="" type="checkbox"/> Y		50.000	50.002	-0.200	0.200	0.002	0.000	— * —	TY1 -0.2000 0.2000
<input checked="" type="checkbox"/> Z		62.500	62.280	-0.200	0.200	-0.220	-0.020	* —0 —	TZ1 -0.2000 0.2000
<input checked="" type="checkbox"/> Diam		25.400	25.625	-0.200	0.200	0.225	0.025	— —0 —*	TD1 -0.2000 0.2000
<input checked="" type="checkbox"/> Sphrcity		0.000	0.390	0.000	0.200	0.390	0.190	— —0 —*	TSPH1 0.2000

15	ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
	OUTER SPHERE SPHERE 1 [MCS]							Location & Sphericity of Sphere
	X	50.000	50.091	-0.200	0.200	0.091		
	Y	50.000	50.002	-0.200	0.200	0.002		
	Z	62.500	62.280	-0.200	0.200	-0.220	-0.020	
	Diam	25.400	25.625	-0.200	0.200	0.225	0.025	
	Sphericity		0.390		0.200		0.190	

[Geometric Dimensioning and Tolerancing](#)

Cylindricity

The condition of a surface of revolution in which all points of the surface are equidistant from a common axis.

Control Applies to:

- Cylinders

Tolerance Input

To change **Cylindricity** tolerance go to [GD&T Menu - Tolerances](#) and select **Form** tab to input **Cylindricity** tolerance, click **Apply** to apply changes.

The image shows a software dialog box titled "GDT Tolerances" with a close button (X) in the top right corner. The dialog is divided into several sections. At the top, there is a grid of tabs for different tolerance types: Angle Between Two Features, Angle, Angularity, Parallelism, Perpendicularity, Profile, Radius, Total Runout, True Position, Width, Composite, Circular Runout, Concentricity, Coordinate Tolerances, Diameter, Distance, Form, and Length. The "Form" tab is currently selected and highlighted with a blue border. Below the tabs, there are five sections, each with a title and a pair of input fields: "Tolerance Label" and "Limit".

Tolerance Type	Tolerance Label	Limit
Flatness	TOLFLT	0.200
Circularity	TOLCIR	0.000
Cylindricity/Conicity/Torusity	TOLCYL	-0.000
Straightness	TOLSTRT	0.000
Sphericity	TOLSPH	-0.000

At the bottom of the dialog, there are three buttons: "OK", "Cancel", and "Apply".

Application

Steps To Follow:

- To automatically output **Cylindricity**, go to [Status Toolbar](#) and check **Form** from [Current Outputs](#) option.

- To manually output **Cylindricity**, go to [GD&T Menu - GD&T Output](#) and simply check **Cylindricity** tolerance from the output window and click **OK** as shown below:

ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
INNER CYLINDER CYLINDER 1 [MCS] Location & Cylindricity of the Cylinder-1							
X	29.504	29.504	-0.200	0.200	0.000		
Y	95.496	95.496	-0.200	0.200	0.000		
Z	49.800	49.800	-0.200	0.200	0.000		
Diam	25.400	25.400	-0.200	0.200	0.000		
Cylindricit		0.000		0.200			

Geometric Dimensioning and Tolerancing

Orientation Tolerances

Orientation Tolerances control the orientation of individual features datums are required.

Symbol	Type of Tolerance	Shape of Tolerance Zone	2D or 3D	APP of Feature Modifier
	Perpendicularity	2 Parallel Lines	2D or 3D	Yes If Features Have Size
	Parallelism	2 Parallel Planes	2D or 3D	Yes If Features Have Size
	Angularity	Cylindrical	2D or 3D	Yes If Features Have Size

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Parallelism

The condition that results when a surface, axis or center plane is exactly parallel to a datum.

Control Applies to:

- Planes
- Lines
- Cylinders

Tolerance Input

To change **Parallelism** tolerance go to [GD&T Menu - Tolerances](#) and select **Parallelism** tab to input tolerance, click **Apply** to apply changes.

The image shows a software dialog box titled "GDT Tolerances". It contains a grid of tabs for different tolerance types. The "Parallelism" tab is currently selected and highlighted with a blue border. Below the tabs, there is a section titled "Tolerances for Parallelism" which contains two input fields: "Label" with a dropdown menu showing "TOLPARL" and "Limit" with a text box containing "0.010". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Apply".

Angle Between Two Features	Angle	Angularity
Diameter	Distance	Form
Total Runout	True Position	Width
Circular Runout	Concentricity	Coordinate Tolerances
Parallelism	Perpendicularity	Profile
		Radius

Tolerances for Parallelism

Label: TOLPARL

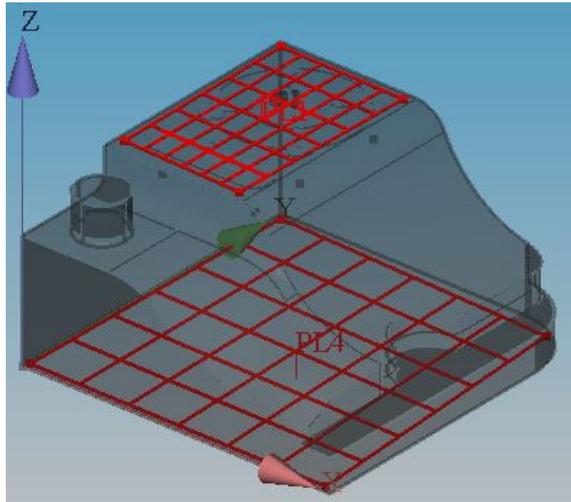
Limit: 0.010

OK Cancel Apply

Application

Steps To Follow:

- To output **Parallelism**, go to [GD&T Menu - Parallel](#).
- Select datum feature as reference and measured or constructed feature to output **Parallelism**.
- Click **OK** to output **Parallelism**.



Parallelism Report

Label: PARL_PL4_PL1 Include Form

Datum Feature: PL4 Select Feature: PL1

Material Condition: RFS

Part:	Size	Actuals	Tol	Bonus	Total	Out of Tol	Control
89.889	0.015	0.200	0.000	0.200	0.000	---	0*---

Comment: Parallelism btw PL4 & PL1

Update OK Cancel

APR: DMIS Report: test.rst

5	ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
	PARALLELISM PARL PL4 PL1[RFS] [W/FORM]	Parallelism btw PL4 & PL1						
	Parl:		0.015		0.200			

Classic View | **Grid View** | Html View

100

[Geometric Dimensioning and Tolerancing](#)

Perpendicularity

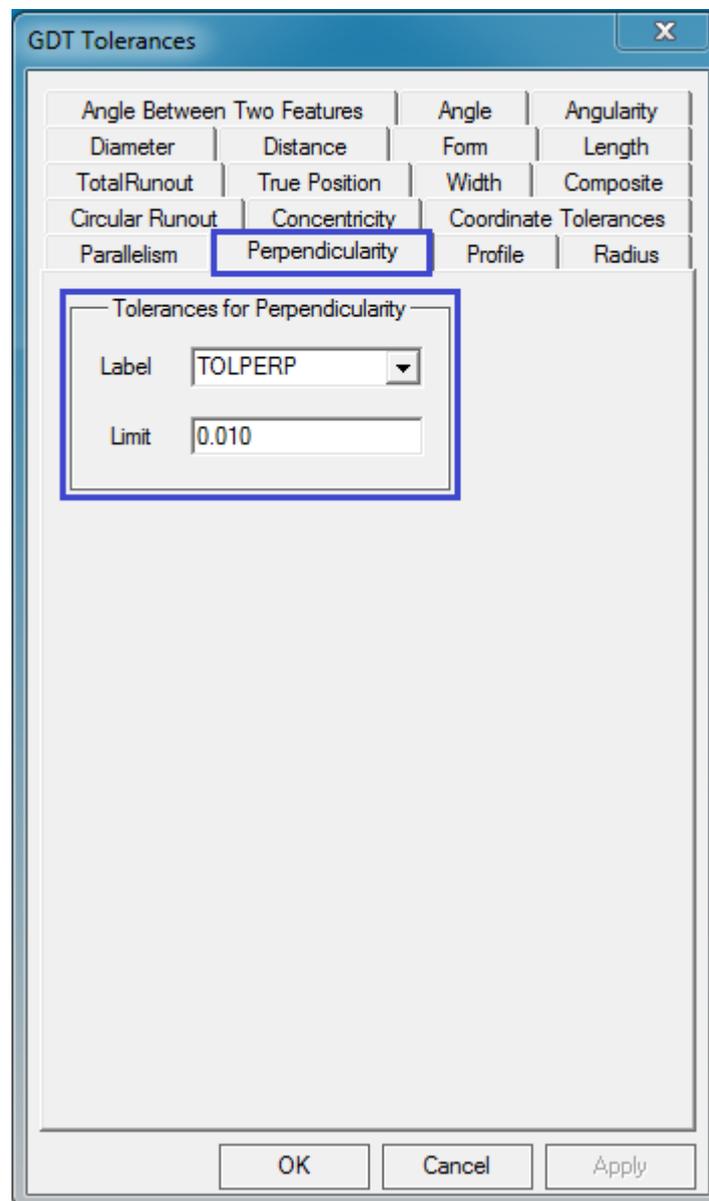
The condition that results when a surface, axis, or center plane is exactly 90 degrees to a datum.

Control Applies to:

- Planes
- Lines
- Cylinders

Tolerance Input

To change **Perpendicularity** tolerance go to [GD&T Menu - Tolerances](#) and select **Perpendicularity** tab to input tolerance, click **Apply** to apply changes.



The image shows a software dialog box titled "GDT Tolerances". It features a grid of tabs for different tolerance types. The "Perpendicularity" tab is currently selected and highlighted with a blue border. Below the tabs, there is a section titled "Tolerances for Perpendicularity" which contains two input fields: "Label" with a dropdown menu set to "TOLPERP" and "Limit" with a text box containing "0.010". At the bottom of the dialog, there are three buttons: "OK", "Cancel", and "Apply".

Angle Between Two Features	Angle	Angularity
Diameter	Distance	Form
Total Runout	True Position	Width
Circular Runout	Concentricity	Coordinate Tolerances
Parallelism	Perpendicularity	Profile
		Radius

Tolerances for Perpendicularity

Label: TOLPERP

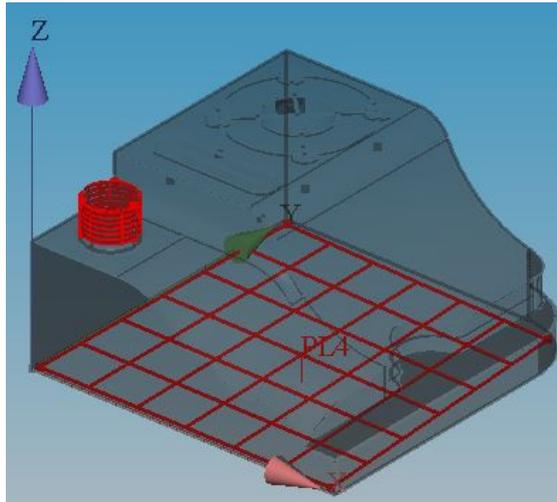
Limit: 0.010

OK Cancel Apply

Application

Steps To Follow:

- To output **Perpendicularity**, go to [GD&T Menu - Perpendicular](#).
- Select datum feature as reference and measured or constructed feature to output **Perpendicularity**.
- Click **OK** to output **Perpendicularity**.



Perpendicularity Report

Label: PERP_PL4_CL5 Include Form

Datum Feature: PL4 Select Feature: CL5

Material Condition: RFS

	Size	Actuals	Tol	Bonus	Total	Out of Tol	Control
Perp:	11.825	0.000	0.200	0.000	0.200	0.000	— * — PERP_PL4_CL5 0.200

Comment: Perpendicularity btw PL4 & CL5

Update OK Cancel

APR: DMIS Report: test.rst

7	ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
	L	PERPENDICULARITY	PERP PL4 CL5 [RFS]	[W/FORM]	Perpendicularity btw PL4 & CL5			
	Perp:		0.000		0.200			<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>

Classic View **Grid View** / Html View /

100

[Geometric Dimensioning and Tolerancing](#)

Angularity

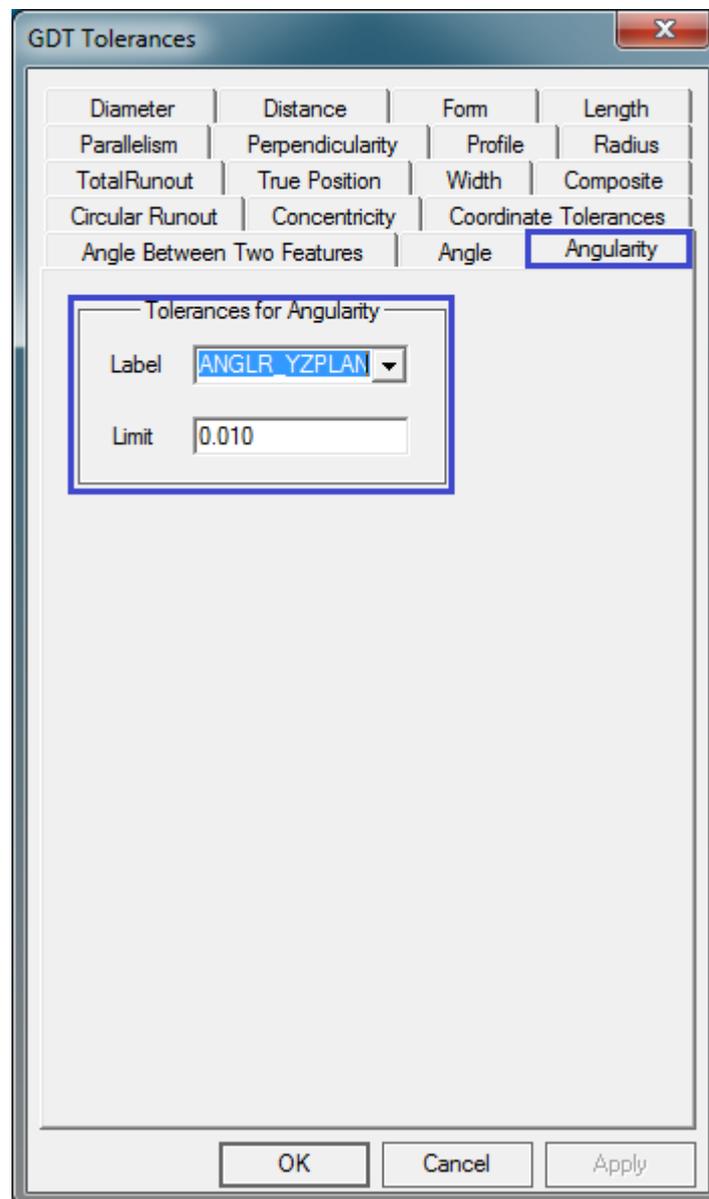
The condition of a surface, center plane or axis being exactly at a specified angle.

Control Applies to:

- Planes
- Lines
- Cylinders

Tolerance Input

To change **Angularity** tolerance go to [GD&T Menu - Tolerances](#) and select **Angularity** tab to input tolerance, click **Apply** to apply changes.



The screenshot shows the 'GDT Tolerances' dialog box with the 'Angularity' tab selected. The dialog box contains a grid of tabs for various GD&T features. The 'Angularity' tab is highlighted with a blue border. Below the tabs, there is a section titled 'Tolerances for Angularity' which contains a 'Label' dropdown menu set to 'ANGLR.YZPLAN' and a 'Limit' text box containing the value '0.010'. At the bottom of the dialog box, there are three buttons: 'OK', 'Cancel', and 'Apply'.

Diameter	Distance	Form	Length
Parallelism	Perpendicularity	Profile	Radius
Total Runout	True Position	Width	Composite
Circular Runout	Concentricity	Coordinate Tolerances	
Angle Between Two Features	Angle	Angularity	

Tolerances for Angularity

Label: ANGLR.YZPLAN

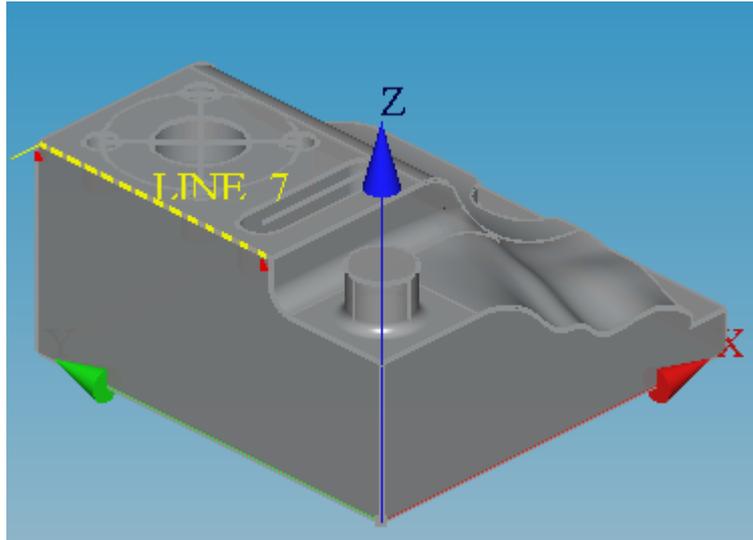
Limit: 0.010

OK Cancel Apply

Application

Steps To Follow:

- To output **Angularity**, go to [GD&T Menu - Angularity](#).
- Select datum feature as reference and measured or constructed feature to output **Angularity**.
- Click **OK** to output **Angularity**.



Angularity Report

Label: ANGLR_YZPLANE_LINE_7 Include Form

Datum Feature: YZPLANE Select Feature: LINE_7

Material Condition: RFS Angle: 0.000

	Size	Actuals	Tol	Bonus	Total	Out of Tol	Control
Anglr:	500	0.001	0.010	0.000	0.010	0.000	— —0*— — ANGLR_YZPLANE_LINE_7 0.010

Comment: Angle btw Theoretical YZ plane & Line 7

Update OK Cancel

DMIS Report: test.rst

11	ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
	ANGULARITY ANGLR YZPLANE LINE 7 (RFS)	[W/FORM Angle btw Theoretical YZ plane & Line 7						
	Anglr:		0.001		0.010			

Classic View **Grid View** Html View

Geometric Dimensioning and Tolerancing

Position Tolerancing

Position Tolerance controls the location of an axis, median plane or surface of a feature. Datums are usually required.

True Position

The zone within which the axis or center plane of a feature is permitted to vary from true (theoretically exact) position.

Control Applies to:

- Holes
- Cylinders

Tolerance Input

To change **True Position** tolerance go to [GD&T Menu - Tolerances](#) and select **True Position** tab to input tolerance, click **Apply** to apply changes.

The image shows a software dialog box titled "GDT Tolerances". At the top, there is a grid of tolerance categories: Diameter, Distance, Form, Length, Parallelism, Perpendicularity, Profile, Radius, Circular Runout, Concentricity, Coordinate Tolerances, Angle Between Two Features, Angle, Angularity, Total Runout, True Position (highlighted with a blue box), Width, and Composite. Below this grid is a section titled "Tolerances for True Position" which contains several input fields and options: a "Label" dropdown menu set to "TOLTP", a "Limit" text box containing "0.010", a "Material Condition" section with three radio buttons (RFS is selected, MMC and LMC are unselected), and a "Zone Space" section with two radio buttons (2-D is selected, 3-D is unselected). At the bottom of the dialog are three buttons: "OK", "Cancel", and "Apply".

True Position Report

Label: CIRCLE_1 Select Actual Select Nominal: CIRCLE_1 ISO (GPS) ANSI Y14.5M

Set Output: Nominals Actuals Low Tol Upp Tol Deviation Out of Tol Control

X 17.960 17.960 0.000

Y 17.961 17.961 0.000

Z 0.010 0.000 -0.010

Diam 9.525 9.525 -0.200 0.200 0.000 0.000 TD1 -0.2000 0.2000

TPos 0.000 0.000 0.010 0.000 TPOS1 0.0100

Total Bonus: 0.000 Tolerance: 0.010

Datum Shift: A: 0.000 B: 0.000 C: 0.000

Comment: True Position of Circle_1

Settings: Zone Space: 2D 3D

Material Condition: RFS MMC LMC

DMIS Report: test.rst

16	ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
	TRUE POS (INNER CIRCLE CIRCLE 1)			[RFS]	[0.010]			[-A-B-C-True Position of Circle 1]
	X	17.960	17.960			0.000		
	Y	17.961	17.961			0.000		
	Z	0.010	0.000			-0.010		
	Diam	9.525	9.525	-0.200	0.200	0.000		
	TPOS		0.000		0.010			

Classic View / **Grid View** / Html View /

[Geometric Dimensioning and Tolerancing](#)

Concentricity Tolerancing

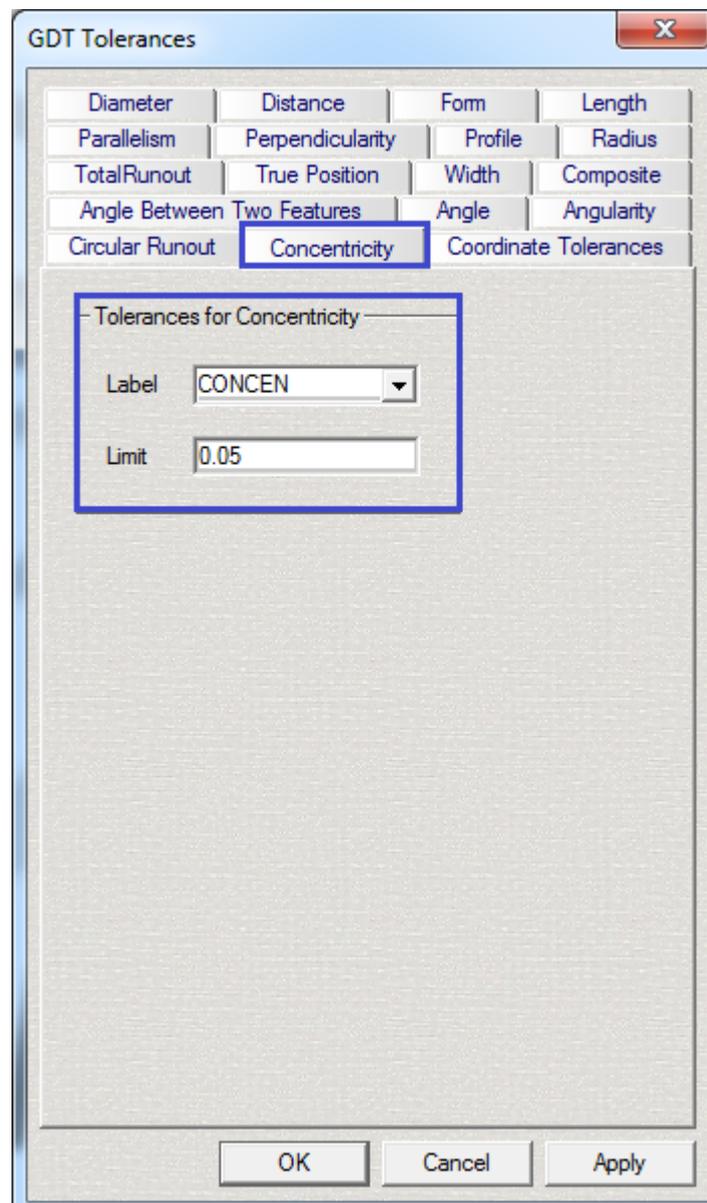
The condition where the median points of all diametrically opposed elements of a cylinder (or a surface of revolution) are congruent with axis of a datum feature.

Control Applies to:

- Holes and Cylinders

Tolerance Input

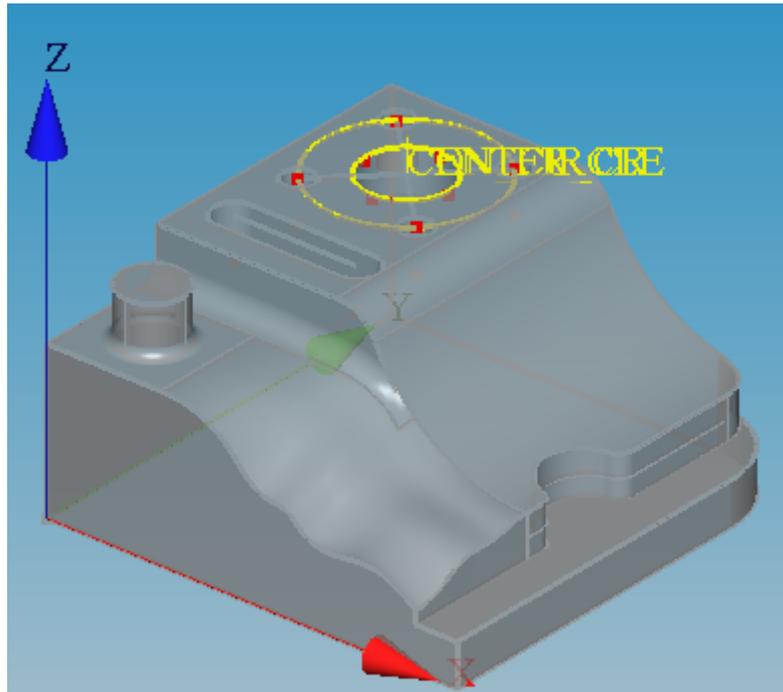
To change **Concentricity** tolerance go to [GD&T Menu - Tolerances](#) and select **Concentricity** tab to input tolerance, click **Apply** to apply changes.



Application

Steps To Follow:

- To output **Concentricity**, go to [GD&T Menu - Concentricity](#).
- Select datum feature as reference and measured or constructed feature to output **Concentricity**.
- Click **OK** to output **Concentricity**.



Concentricity Report

Label: Closest Axis

Datum Feature: Select Feature:

Actuals: Tol: Out of Tol: Control:

Comment:

APR DMIS Report: test.rst

21	ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
	◎	CONCENTRICITY CONC C CON CIRCLE					Concentricity btw Center Circle and Construction Circle	
	Conc		0.000		0.200			<input type="text" value=""/>

Classic View **Grid View** Html View

100

Symmetry Tolerancing

The condition where the median points of all opposed elements of two or more feature surfaces are congruent with the axis or center plane of a datum feature.

Control Applies to:

- Planes

Tolerance Input

The input for symmetry is handled in the symmetry dialog box as the function is performed.

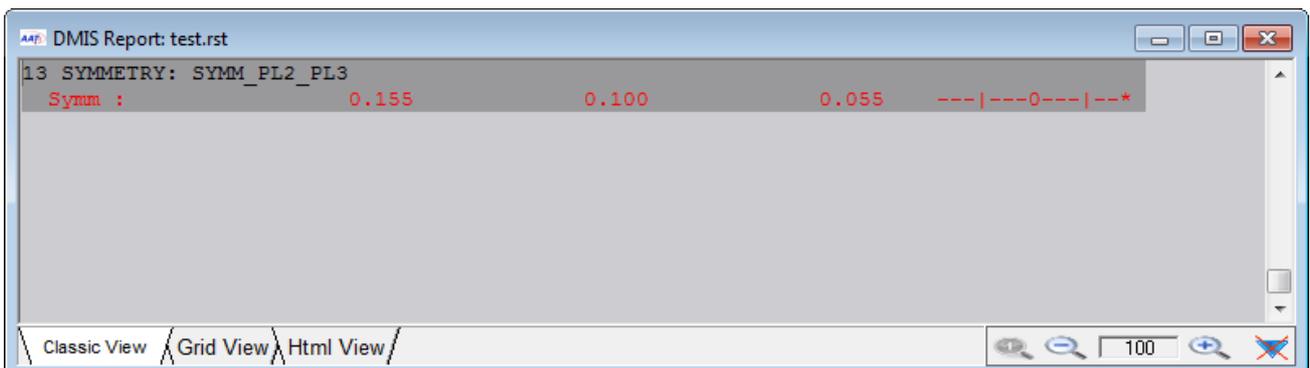
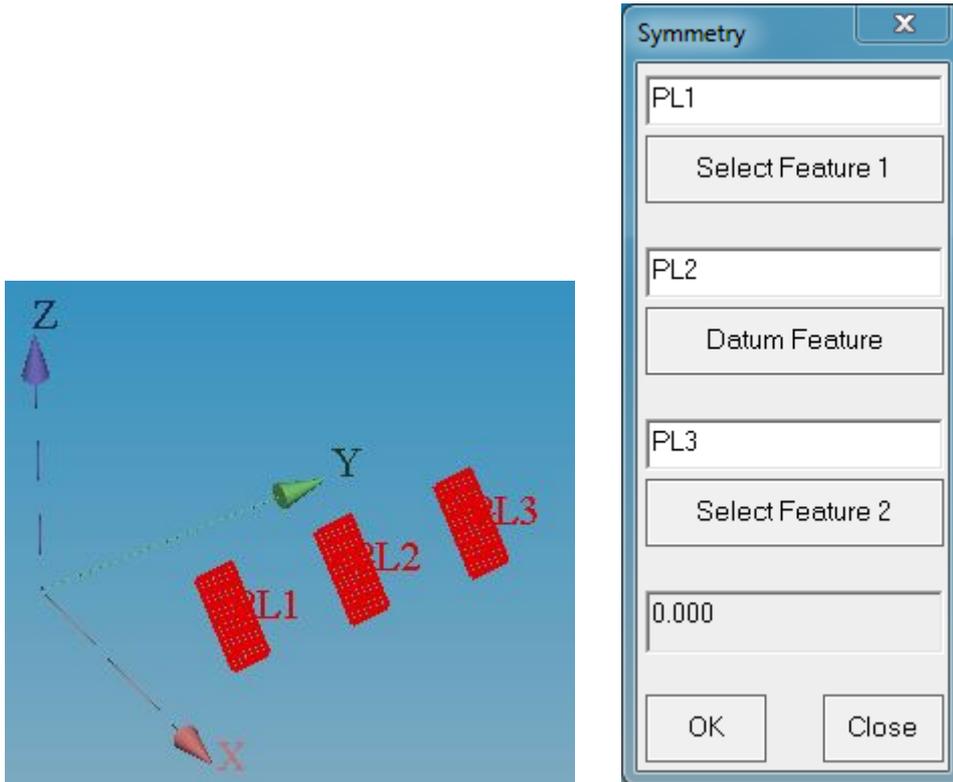
The screenshot shows a dialog box titled "Symmetry Report" with a close button (X) in the top right corner. The dialog contains the following fields and controls:

- Label:** A text input field containing "SYMM".
- Actuals:** A numeric input field containing "0.000".
- Tol:** A numeric input field containing "0.100".
- Upp Tol:** A numeric input field containing "0.000".
- Out of Tol:** A numeric input field containing "0.000".
- Control:** A dropdown menu with a symbol $\text{---}^* \text{---}$ and a downward arrow.
- Comment:** An empty text input field.
- Buttons:** "Update", "OK", and "Cancel" buttons are located at the bottom of the dialog.

Application

Steps To Follow:

- To output **Symmetry**, go to [GD&T Menu - Symmetry](#).
- Select datum feature as reference and two measured or constructed features to output **Symmetry**.
- Click **OK** to output **Symmetry**.



Geometric Dimensioning and Tolerancing

Runout Tolerancing

Runout Tolerances control the form, orientation and position of individual features. Datum axis required.

Symbol	Type of Tolerance	Shape of Tolerance Zone	2D or 3D	APP of Feature Modifier
	Circular Runout	2 Concentric Circles About A Datum Axis <hr style="border-top: 1px dashed black;"/>	2D	NO
		2 Concentric Circular Line Elements About Datum Axis 		
	Total Runout	2 Concentric Cylinders About A Datum Axis <hr style="border-top: 1px dashed black;"/>	3D	NO
		2 Parallel Planes About A Datum Axis 		

Circular Runout

A composite control that affects the form, orientation, and location of circular elements of a part feature relative to a datum axis.

Control Applies to:

- Holes

Tolerance Input

The image shows a software dialog box titled "GDT Tolerances". It contains a grid of tolerance types. The "Circular Runout" option is selected and highlighted with a blue border. Below this grid is a section titled "Tolerances for Circular Runout" which contains two input fields: "Label" with a dropdown menu showing "TOLCRO" and "Limit" with a text box containing "0.010". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Apply".

Angle Between Two Features	Angle	Angularity
Diameter	Distance	Form
Parallelism	Perpendicularity	Profile
Total Runout	True Position	Width
Circular Runout	Concentricity	Coordinate Tolerances

Tolerances for Circular Runout

Label: TOLCRO

Limit: 0.010

OK Cancel Apply

Application

Steps To Follow:

- To output **Circular Runout**, go to [GD&T Menu - Circular Runout](#).
- To assign datum feature click on the Datum Feature button and from the select Feature window assign the Datum feature then in the same way select the feature for which circular runout needs to be measured.
- Click **OK** to output **Circular Runout**.

Circular Runout Report

Label: CROUT_CENTER_CR_CIRCLE_4

Datum Feature: CENTER_CR Select Feature: CIRCLE_4

Runout: Actuals: 6.676 Tol: 0.500 Out of Tol: 6.176 Control: $\text{---}0\text{---}^*$

Comment: Circular Runout of Circle 4 w.r.t Center Circle

Update OK Cancel

DMIS Report: test.rst

ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
7	RUNOUT CROUT CENTER CR CIRCLE 4	6.676		0.500		6.176	$\text{---}0\text{---}^*$

Classic View / **Grid View** / Html View

Total Runout

A composite control affecting the form, orientation and location of all surface elements of a diameter (or surface) relative to a datum axis.

Control Applies to:

- Cylinders
- Planes

Tolerance Input

The image shows a software dialog box titled "GDT Tolerances". It contains a grid of buttons for selecting different tolerance types. The "TotalRunout" button is highlighted with a blue border. Below this grid is a section titled "Tolerances for Total Runout" which contains two input fields: "Label" with a dropdown menu set to "LTRNOUT" and "Limit" with a text box containing "0.005". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Apply".

Angle Between Two Features	Angle	Angularity
Diameter	Distance	Form
Parallelism	Perpendicularity	Profile
Circular Runout	Concentricity	Coordinate Tolerances
TotalRunout	True Position	Width
		Composite

Tolerances for Total Runout

Label: LTRNOUT

Limit: 0.005

OK Cancel Apply

Application

Steps To Follow:

- To output **Total Runout**, go to [GD&T Menu - Total Runout](#).
- Select datum feature as reference and measured or constructed feature to output **Total Runout**.
- Click **OK** to output **Total Runout**.

Total Runout Report

Label: TROUT_C_CON_CIRCLE

Datum Feature: DAT(C) Select Feature: CON_CIRCLE

Runout: Actuals: 0.000 Tol: 0.200 Out of Tol: 0.000 Control: TROUT_C_CON_CIRCLE 0.200

Comment: Total Runout

Update OK Cancel

DMIS Report: test.rst

23	ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
	RUNOUT TROUT C CON CIRCLE							Total Runout
	Runout:		0.000		0.200			

Classic View Grid View Html View

100

[Geometric Dimensioning and Tolerancing](#)

Relational Tolerancing

Distance

Distance is used to output distance between features in X, Y, Z axis along with true distance.

Control Applies to:

- Most accurately used on point reducible features; however this could also be used to judge a plane to point distance also.

Tolerance Input

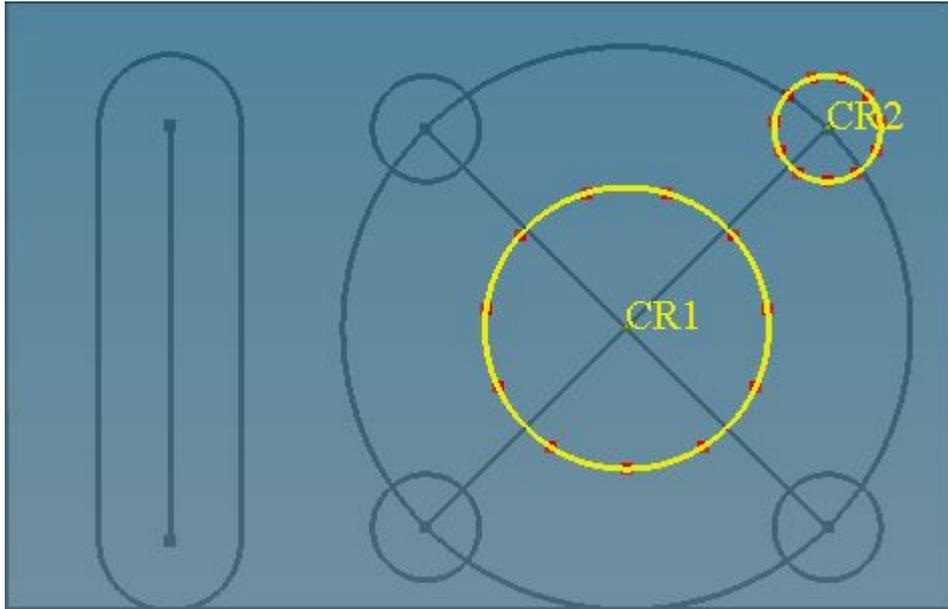
The screenshot shows the 'GDT Tolerances' dialog box with the 'Distance' control selected. The dialog is organized into a grid of tolerance types. The 'Distance' control is highlighted with a blue border. Below the grid, there are four input sections for 'X - Distance', 'Y - Distance', 'Z - Distance', and 'True Distance'. Each section contains a dropdown menu for the tolerance label (set to 'DCR2_PT10') and two text input fields for the lower and upper tolerance values (both set to '-0.005' and '0.005' respectively). At the bottom of the dialog are 'OK', 'Cancel', and 'Apply' buttons.

Tolerance Label	Lower Tolerance	Upper Tolerance
X - Distance	-0.005	0.005
Y - Distance	-0.005	0.005
Z - Distance	-0.005	0.005
True Distance	-0.005	0.005

Application

Steps To Follow:

- To output **Distance**, go to [GD&T Menu - Distance](#).
- Select two features measured or constructed to output **Distance** between.
- Click **OK** to output **Distance**.



REPORT- DISTANCE

Label: DCR1CR2 Feat1: CR1 Feat2: CR2

Set Output	Nominals	Actuals	Low Tol	Upp Tol	Deviation	Out of Tol	Control
<input checked="" type="checkbox"/> X	17.961	18.051	0.249	0.000	0.090	0.090	— —0— —*
<input checked="" type="checkbox"/> Y	17.961	18.219	0.249	0.000	0.258	0.258	— —0— —*
<input checked="" type="checkbox"/> Z	0.000	0.000	0.249	0.000	0.000	-0.249	*— —0— —
<input checked="" type="checkbox"/> 3D	25.400	25.647	0.250	0.000	0.247	0.247	— —0— —*

Comment: _____

Update OK Cancel

Feature	Dimension	Feature 1	Feature 2	Tol 1	Tol 2	Tol 3	Tol 4	Symbol	
3: DIST: PT to PT	DCR1CR2_X	X	17.961	17.981	-0.005	0.005	0.020	0.015	--- ---0--- ---*
4: DIST: PT to PT	DCR1CR2_Y	Y	17.960	17.956	-0.005	0.005	-0.004		--- *--0--- ---
5: DIST: PT to PT	DCR1CR2_Z	Z	0.000	0.010	-0.005	0.005	0.010	0.005	--- ---0--- ---*
6: DIST: PT to PT	DCR1CR2_D	Dist:	25.400	25.412	-0.005	0.005	0.012	0.007	--- ---0--- ---*

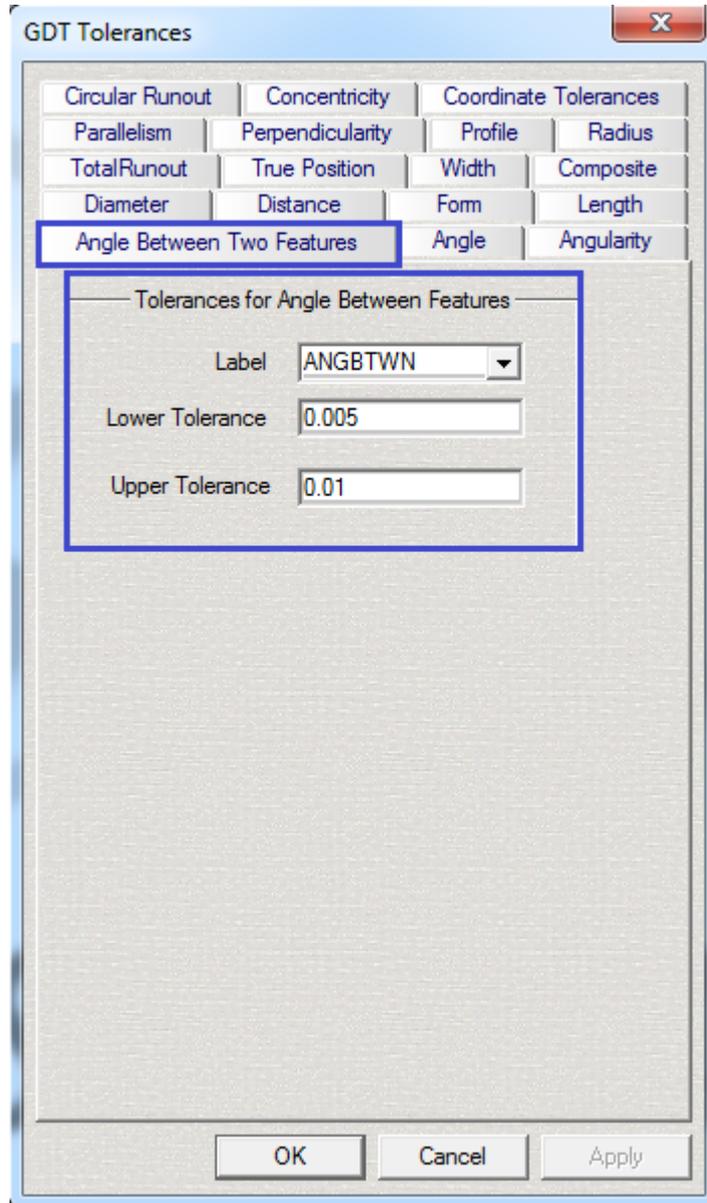
Angle Between Features

Distance is used to output angle between two features.

Control Applies to:

- Most accurately used between two axial features or between a plane and a line type feature. Output will always be 2 dimensional.

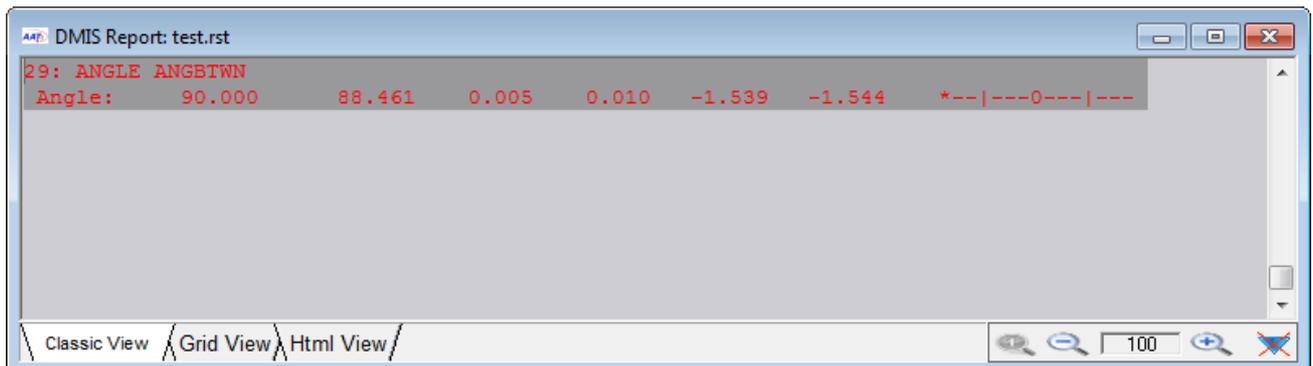
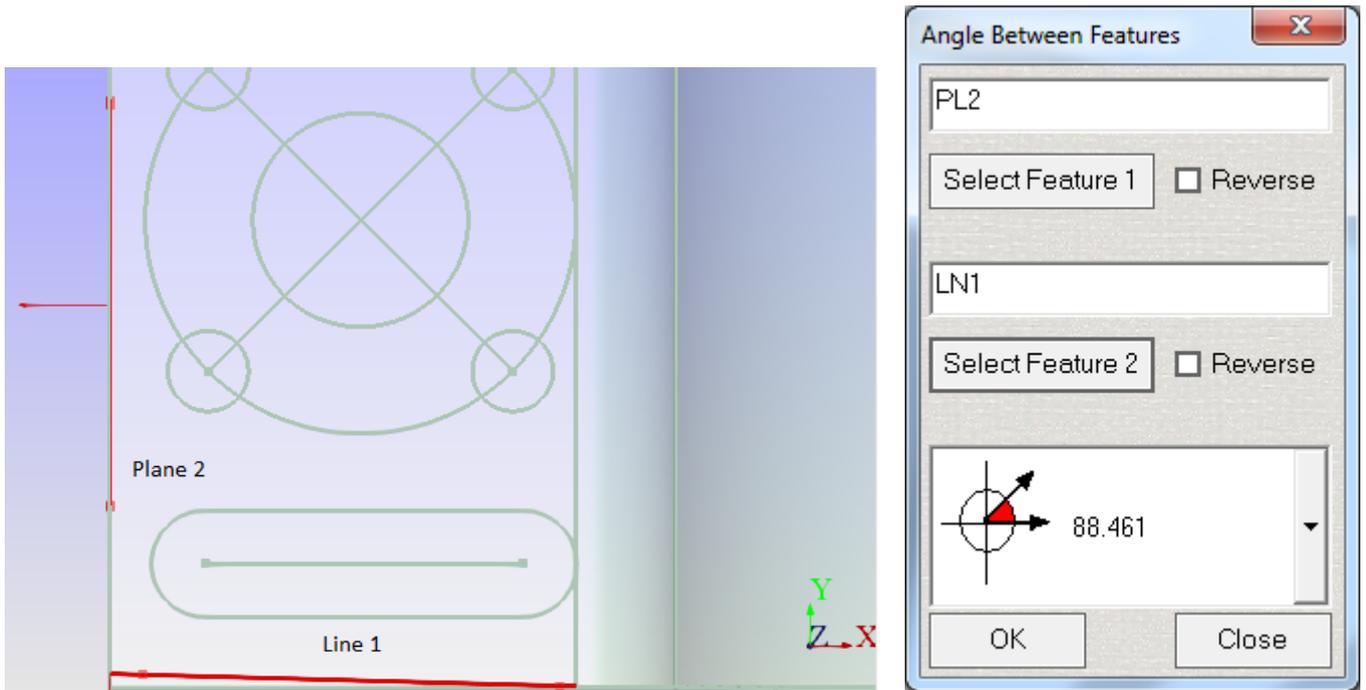
Tolerance Input



Application

Steps To Follow:

- To output **Angle Between Features**, go to [GD&T Menu - Angle Between Features](#).
- Select two features measured or constructed to output **Angle Between Features**.
- Click **OK** to output **Angle Between Features**.



Angle of Feature

This option works similar to the angle between features option, however the software will always compare the feature to a theoretical XY, YZ, or ZX work plane.

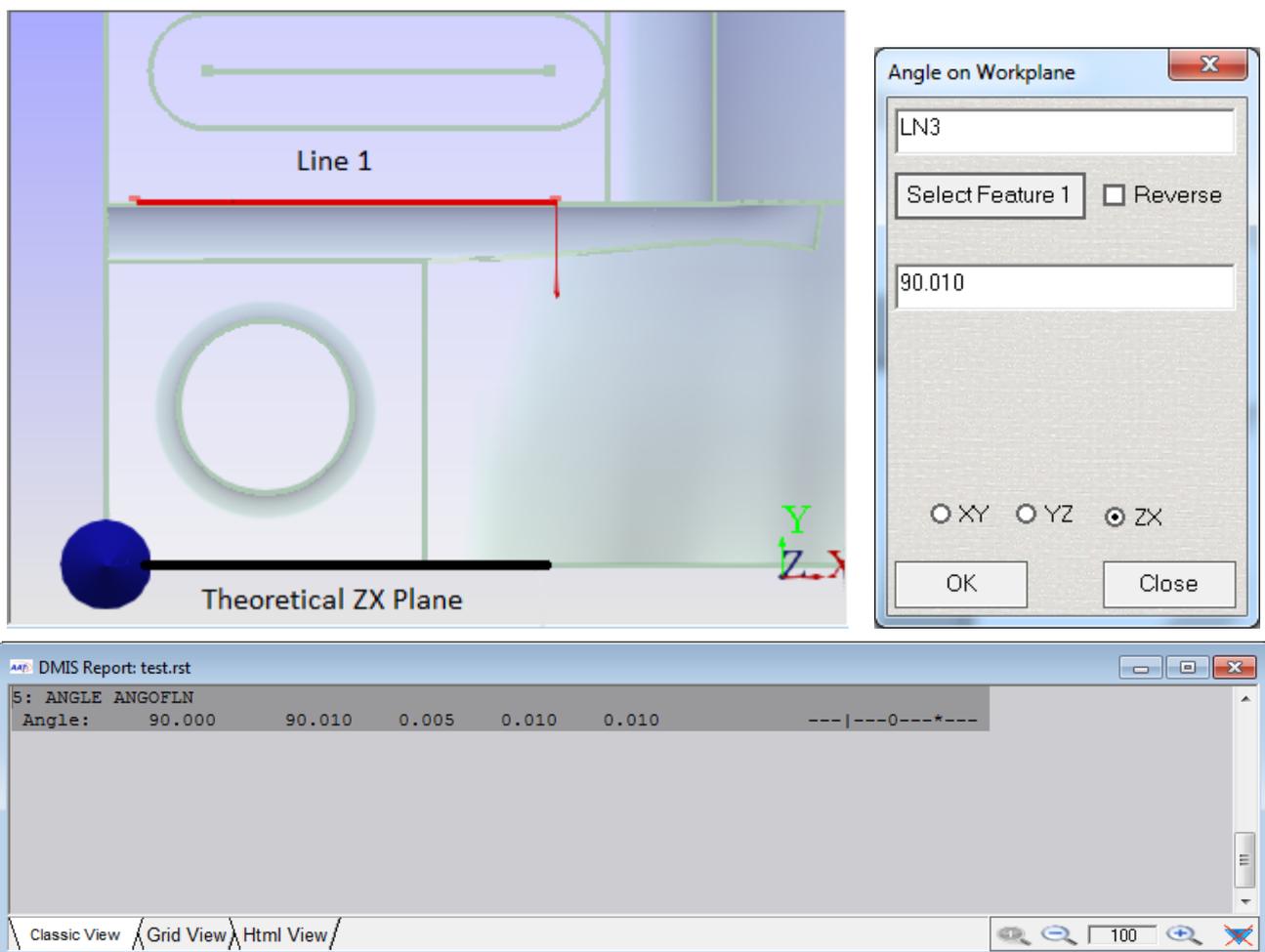
Tolerance Input

This option uses the **Angle Between Features** tolerance found in the tolerance input menu.

Application

Steps To Follow:

- To output **Angle of Feature**, go to [GD&T Menu - Angle of Feature](#).
- Select a feature measured or constructed to output **Angle of Feature**.
- Click **OK** to output **Angle of Feature**.



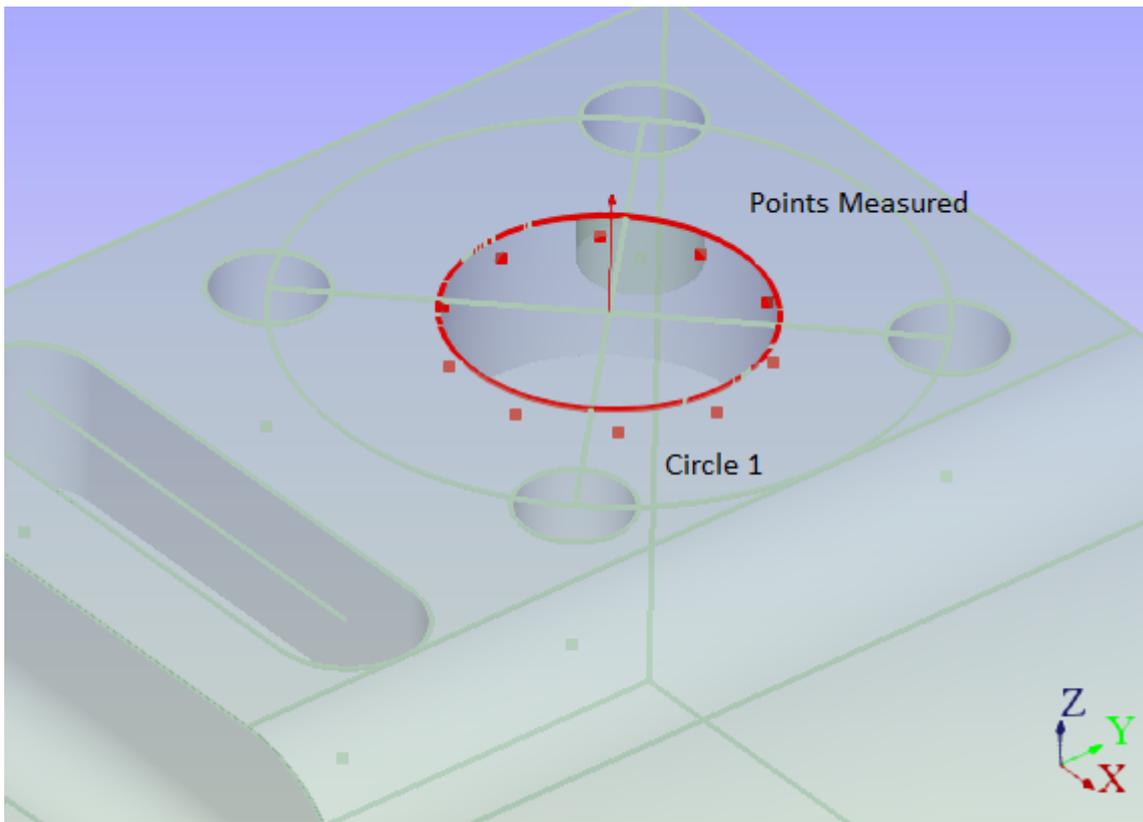
Geometric Dimensioning and Tolerancing

Profile and Form Reporting

Profile Tolerances control the location and/or orientation, and/or size of a feature may or may not have datums.

Symbol	Type of Tolerance	Shape of Tolerance Zone	2D or 3D	APP of Feature Modifier
	Profile of A Line	2 Dimensional Uniform Boundary 	2D	NO
	Profile of A Surface	3 Dimensional Uniform Boundary 	3D	NO

A measured featured profile & form measurement report can be generated using this option. It is important that more than the minimum required number of points are used to measure the feature in order to get a good profile report.



Form Profile

Feature:

Nominal: Comp to Nom

Points To Report: Add templates Lower Prof. Tol: Upper Prof. Tol:

#	X	Y	Z	I	J	K	Prof
1	42.204	95.496	60.500	-1.00000	-0.00000	-0.00000	-0.000
2	40.188	102.362	60.500	-0.84125	-0.54064	-0.00000	+0.000
3	34.780	107.049	60.500	-0.41542	-0.90963	-0.00000	+0.000
4	27.696	108.067	60.500	0.14231	-0.98982	-0.00000	-0.000
5	21.187	105.094	60.500	0.65486	-0.75575	-0.00000	-0.000
6	17.318	99.074	60.500	0.95949	-0.28173	-0.00000	-0.000
7	17.318	91.918	60.500	0.95949	0.28173	-0.00000	+0.000
8	21.187	85.898	60.500	0.65486	0.75575	-0.00000	-0.000
9	27.696	82.925	60.500	0.14231	0.98982	-0.00000	+0.000
10	34.780	83.944	60.500	-0.41541	0.90963	-0.00000	-0.000
11	40.188	88.630	60.500	-0.84125	0.54064	-0.00000	-0.000

Comment:

DMIS Report: test.rst

13	ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
Form Profile CR1 (MCS)								
	CR1_1		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_2		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_3		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_4		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_5		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_6		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_7		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_8		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_9		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_10		0.000	-0.200	0.200			<input type="checkbox"/>
	CR1_11		0.000	-0.200	0.200			<input type="checkbox"/>

Classic View **Grid View** Html View

[Geometric Dimensioning and Tolerancing](#)

Composite True Position

How to Use Composite Tolerancing

- Make sure the current alignment is set to the base coordinate system.
- Select the [GD&T Menu - True Position](#)
- Select the feature used for the **True Position** output.
- Click the **Additional Datums** button, if need.
- Select the features that represent the additional datum features required to calculate the additional bonus to be applied to the selected feature. Then set the bonus condition of each feature selected. All of the bonus will be automatically added to the true position tolerance when the feature is output.
- Click the **OK** button when everything is configured properly.

<input checked="" type="checkbox"/> Use Datums	Add Datum	Condition	Max. Bonus
Primary Datum	A (ACT PLANE_1)	RFS	
Secondary Datum	B (ACT LINE_7)	RFS	
Tertiary Datum	C (ACT CENTER_CR)	RFS	

Apply $\text{⊕} \text{ } \text{Ø} 0.010 \text{ } A \text{ } B \text{ } C$ OK Cancel

Composite Tolerance

Label: PTRN5 Select Actual

Set Output	Nominals	Actuals	Low Tol	Upp Tol	Deviation	Out of Tol	Control
<input checked="" type="checkbox"/> X	29.504	29.504			0.000		
<input checked="" type="checkbox"/> Y	95.496	95.496			0.000		
<input checked="" type="checkbox"/> Z	62.500	62.500			0.000		
<input type="checkbox"/> DIAM	9.525	9.525	-0.200	0.200	0.000	0.000	---*--- TD2 -0.2000 0.2000
		Total Bonus		Total Tolerance			
<input checked="" type="checkbox"/> TPos 1		0.000	0.000	0.025	0.025	0.000	---*---
TPos 2		0.000	0.000	0.025	0.025	0.000	---*---

Comment:

Settings: Zone Space 2D 3D
 Material Condition RFS MMC LMC

Datums Bonus: Additional Datums

Update OK Cancel

DMIS Report: test.rst

ELEM#	NOMINAL	ACTUAL	LOW TOL	UPP TOL	DEV	OUT OF TOL	CONTROL
6	COMPOS TOL [PATTERN PTRN5] [RFS] [MCS]						
X	29.504	29.504			0.000		
Y	95.496	95.496			0.000		
Z	62.500	62.500			0.000		
TPOS 1		0.000		0.025			
TPOS 2		0.000		0.025			
CR1		0.000		0.025			
CR2		0.000		0.025			
CR3		0.000		0.025			
CR4		0.000		0.025			

Classic View **Grid View** / Html View

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[Geometric Dimensioning and Tolerancing](#)

Working With Tool & Tip Changers

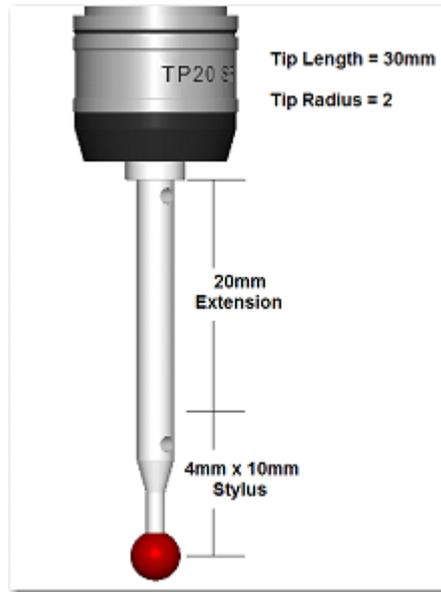
This document is intended to inform the user on the proper calibration and usage techniques for the following **Renishaw Tool/Tip Changers**

- MCR20
- SCR20

MCR Calibration/Datum Setup Procedure

- Using the machine, align the MCR changer to an MCS axis on the CMM.
- Open the following file **CAPPS6(or CappsDmis)\CAPPS\capps.ini** and locate the **[Tip Changer]** section.
- Verify that the following parameters are acceptable for the use of the calibration/datum and use of the tip changer. Tip length is defined in figure below.

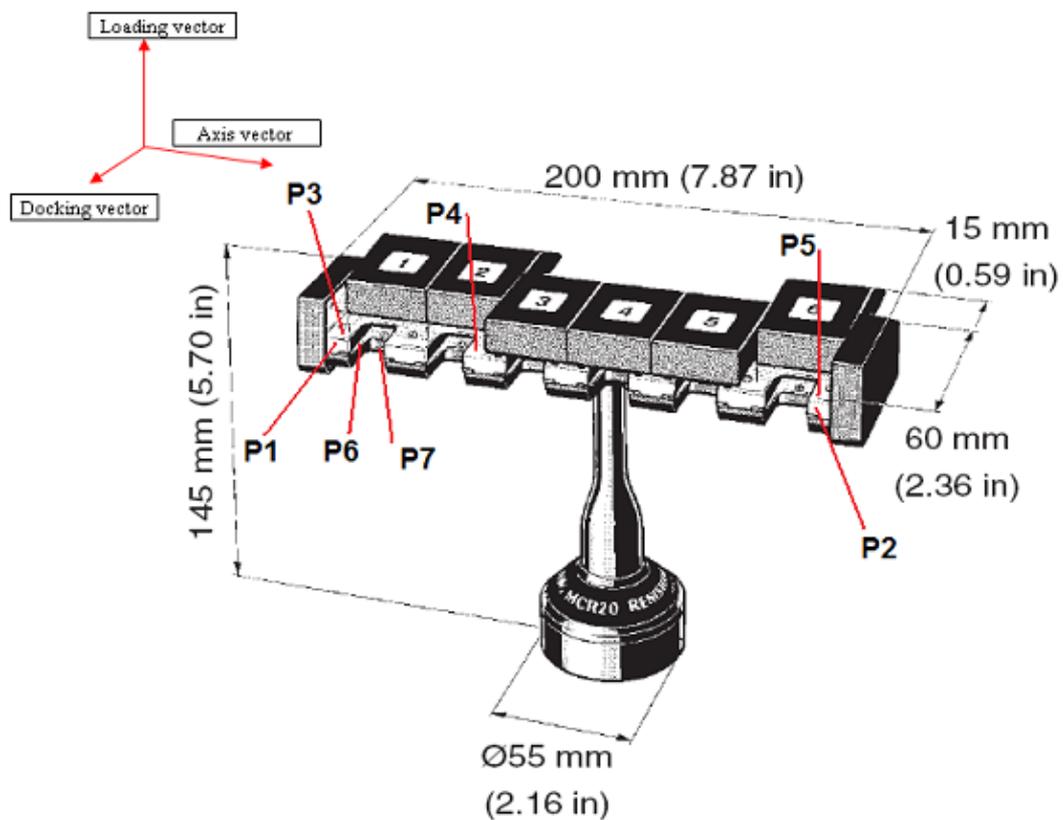
Important Note: It is recommended that the stylus used is at least 20mm in length. This tip must always be used to calibrate the changer and is usually loaded in **Station 1**.



Tip Radius:	Radius of Stylus Ball
Tip Length:	Length of extensions and stylus connected to TP20/200
Dock Speed:	Speed used to move into and out of each station when changing tips
Probe B Angles:	Orientation of the head to be used for tip changing. If the changer is mounted in a position that will require a position other than B0. It should be entered here
Docking Clearance:	Distance away from the front of the tip changer machine will change to Docking Speed .

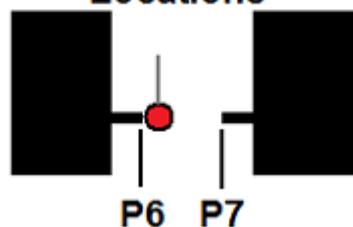
Refer to [Additional Tool&Tip Changer Information](#) for more information about the [Tip Changer] section of the `capps.ini` file.

- Open CAPPs, open a program, and select the stylus which will be used to calibrate/datum the tip changer.
- Go to the [Tool/Tip Menu](#) and click on the **Datum** button. This will execute a CAPPs macro for tip changer calibration/datum.
- Follow the directions from the Macro. See figure below for P1 – P7 point locations.



- P1 – P2 Front of mirrored area.
- P3 – P5 Top of mirrored area.
- P6 – P7 on edge of inner step in 1st station. See figure below:

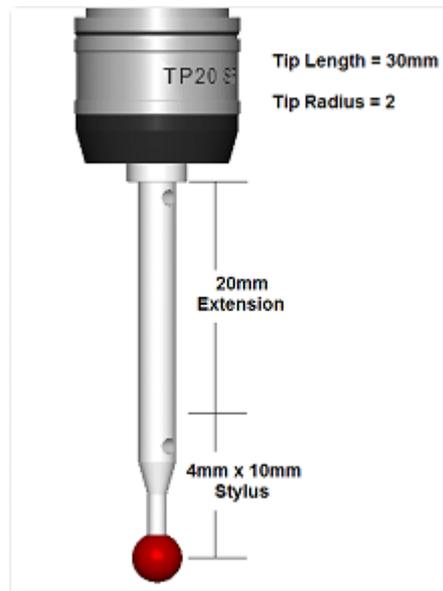
Station #1 P6 & P7 Measurement Locations



SCR Calibration/Datum Setup Procedure

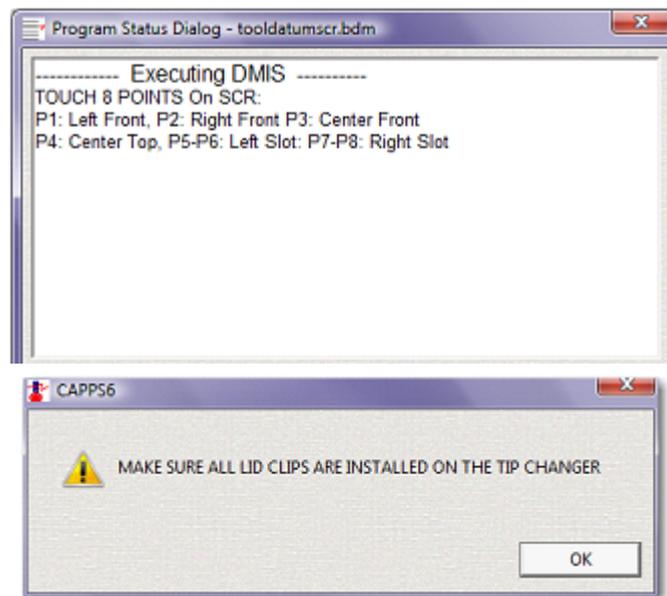
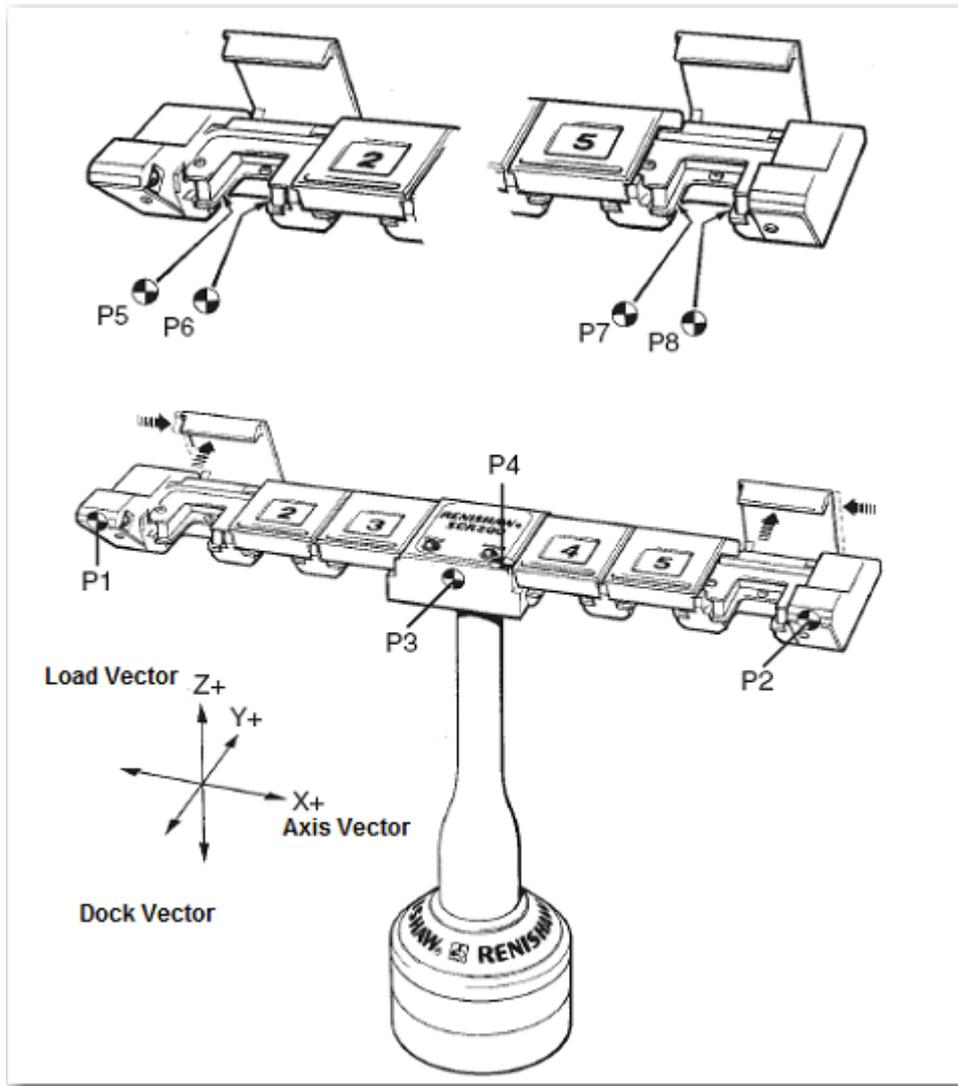
- Using the machine, align the SCR changer to an MCS axis on the CMM
- Open the following file **CAPPS6(or CappsDmis)\CAPPS\capps.ini** and locate the **[Tip Changer]** section
- Verify that the following parameters are acceptable for the use of the calibration/datum and use of the tip changer. Tip length is defined in figure below.

Important Note: It is recommended that the stylus used is at least 20mm in length. This tip must always be used to calibrate the changer and is usually loaded in **Station 1**.



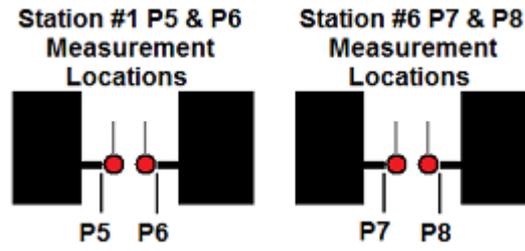
Tip Radius:	Radius of Stylus Ball
Tip Length:	Length of extensions and stylus connected to TP20/200
Dock Speed:	Speed used to move into and out of each station when changing tips
Probe B Angles:	Orientation of the head to be used for tip changing. If the changer is mounted in a position that will require a position other than B0, it should be entered here
Docking Clearance:	Distance away from the front of the tip changer machine will change to Docking Speed .

- Open CAPPS, open a program, and select the stylus which will be used to calibrate/datum the tip changer.
- Go to the [Tool/Tip Menu](#) and click on the **Datum** button. This will execute a CAPPS macro for tip changer calibration/datum
- Follow the directions from the Macro. See figure below for P1 – P8 point locations



- P1 – P3 Front of changer rack
- P4 Top of changer rack by **LEDs**

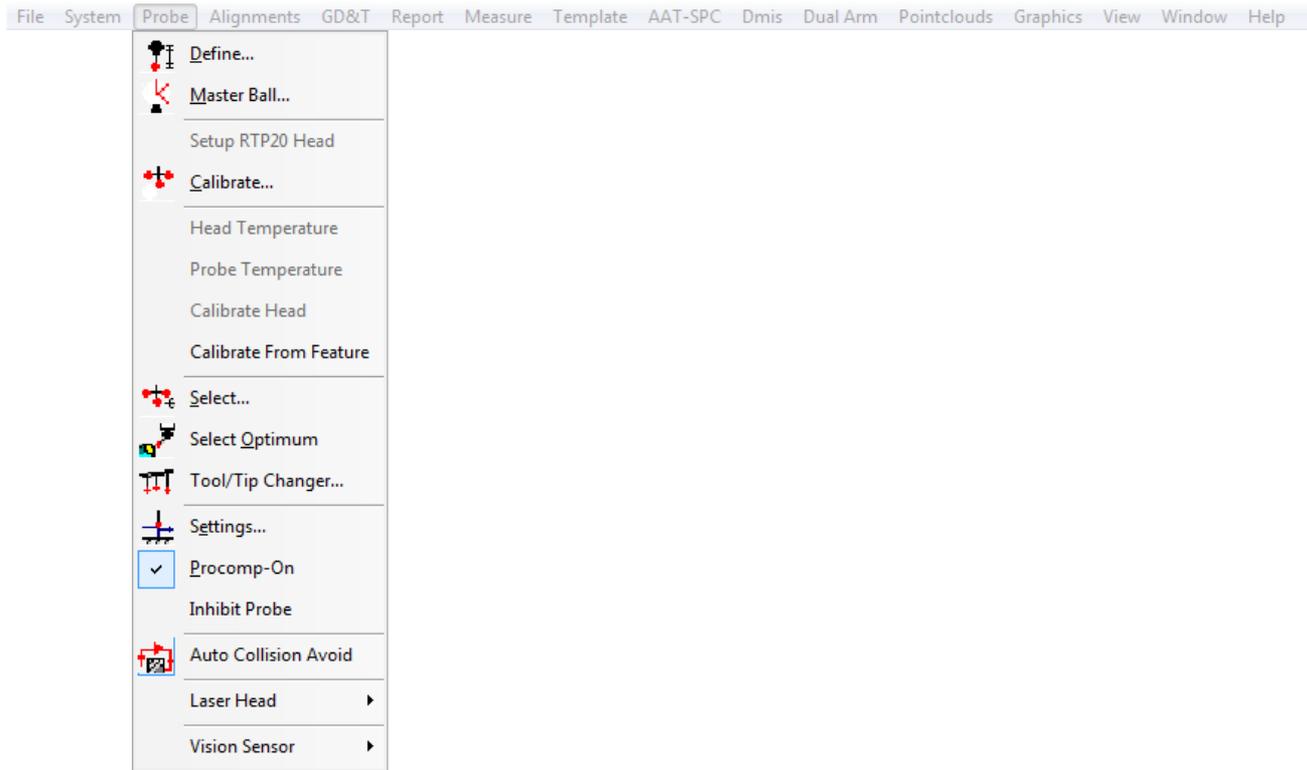
- P5 – P6 on edge of inner step in 1st station. See figure below:
- P7 – P8 on edges of inner step in 2ND station. See figure below:



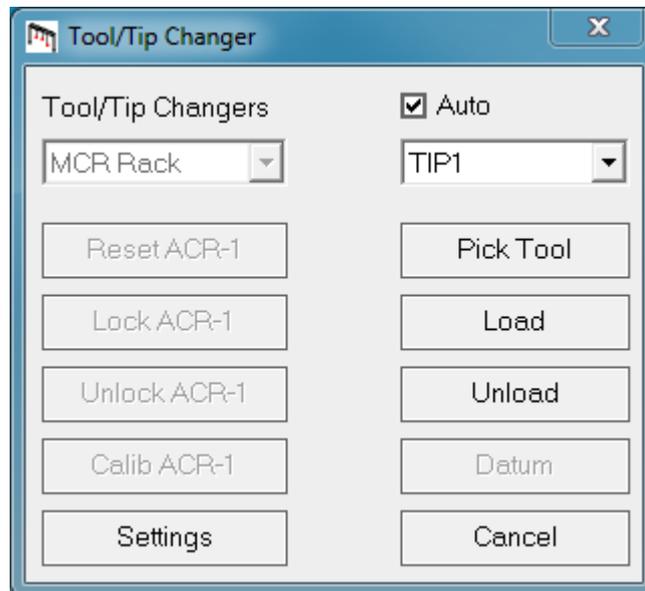
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Tool&Tip Changer Commands

All tool/tip changing commands are generated from the Tool/Tip Changer dialog located in the Probe drop down menu.



Tool/Tip Changer Commands



Top Drop Down:	List of tools, choose tool to be Picked, Loaded, or Unloaded.
Pick Tool:	Unload current tool and load tool selected from the drop down menu.
Load:	Load selected tool from the selected tool location.
Unload:	Unload the current tool to the selected tool location.

[Working With Tool&Tip Changers](#)

Additional Tool&Tip Changer Information

Capps.ini [Tip Changer] Section Information

[Tip Changer]

Axis Vector=0.000000 1.000000 0.000000: (Direction from station 1 to 6) Used to determine orientation of tip changer on machine. This configuration is set automatically during the datum procedure.

Dock Vector=1.000000 0.000000 0.000000: (Direction of probe as it moves out of a docking station) Used to determine direction into and out of the tip changer. This configuration is set automatically during the datum procedure.

Load Vector=0.000000 0.000000 1.000000: (Direction up out of the docking station) Used to determine direction of probe movement when connecting and disconnecting from a probe module. This configuration is set automatically during the datum procedure.

Tool Offset=0.273454 -0.409082 110.575637: Not Used

Datum Location=90.159045 57.391599 -18.795524: X,Y,Z location of station 1 in the tip changer, this location will match the Station 1 location. This configuration is set automatically during the datum procedure.

Station1=90.159045 57.391599 -18.795524: X,Y,Z location of station 1 in the tip changer, this location will match the Datum Location after datum procedure. This configuration is set automatically during the datum procedure.

Station2=90.159045 57.391599 11.204476: X,Y,Z location of station 2 in the tip changer. This configuration is calculated automatically during the datum procedure.

Station3=90.159045 57.391599 41.204476: X,Y,Z location of station 3 in the tip changer. This configuration is calculated automatically during the datum procedure.

Station4=90.159045 57.391599 -78.795524: X,Y,Z location of station 4 in the tip changer. This configuration is calculated automatically during the datum procedure.

Station5=90.159045 57.391599 -48.795524: X,Y,Z location of station 5 in the tip changer. This configuration is calculated automatically during the datum procedure.

Station6=90.159045 57.391599 -18.795524: X,Y,Z location of station 6 in the tip changer. This configuration is calculated automatically during the datum procedure.

Docking Speed=120.000000: Speed used to move into and out of the tip changer during tip changes.

Docking Approach=50.000000: Probe moves to this distance in front of the tip changer on approach and changes to **Docking Speed**. Probe also moves to this distance after a change before continuing with program execution.

Probe B Angle=0.000000: Used if the head must be rotated to an angle zero for the B rotation is required for tip changes. This is typically only required for **FCR rack with SP25 module changes**.

The next section of the Tip Changer configurations uses the following number sequence:

- **0: No Tool Loaded, Port Empty**
- **1: Tool loaded in port**
- **2: Current tool loaded onto probe**

Tool1=2: Status of Tool Port 1.Tool currently loaded on probe.

Tool2=1: Status of Tool Port 2.Tool currently loaded in station.

Tool3=1: Status of Tool Port 3.Tool currently loaded in station.

Tool4=1: Status of Tool Port 4.Tool currently loaded in station.

Tool5=1: Status of Tool Port 5.Tool currently loaded in station.

Tool6=0: Status of Tool Port 6.No tool currently loaded in station.

Tip Radius=1.000000: Radius of tip used to calibrate/datum tip changer.

Tip Length=18.000000: Total length of extension and stylus connected to TP20/200 of tip used to calibrate/datum tip changer.

[Working With Tool&Tip Changers](#)

Using The Dual Arm Option

Dual arm machines are used to inspect large work pieces. Such as formed/molded panels, car bodies, sub assembly components and/or large sheet metal parts. Their modular design allows two CMM machines to be operated under one common world coordinate system (**WCS**) and communicate with each other during the inspection process.

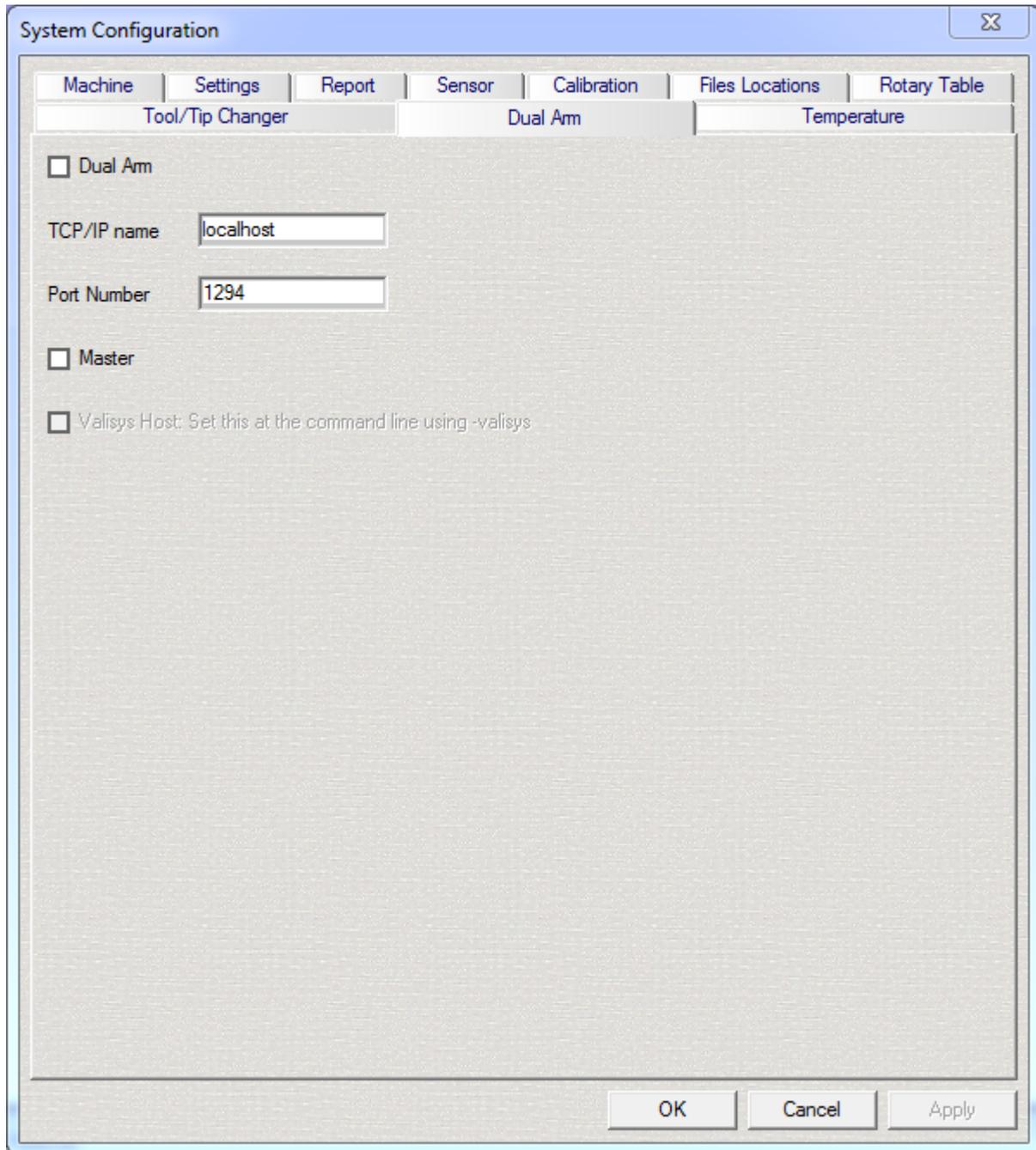


In order to create a single measurement database, where the features measured from each machine are stored and reported, CAPPS configures dual arms as **Master (client) and Slave (server)**. Hence, the data obtained by the server computer is transferred to the master computer for storage and measurement analysis.

Dual Arm Settings

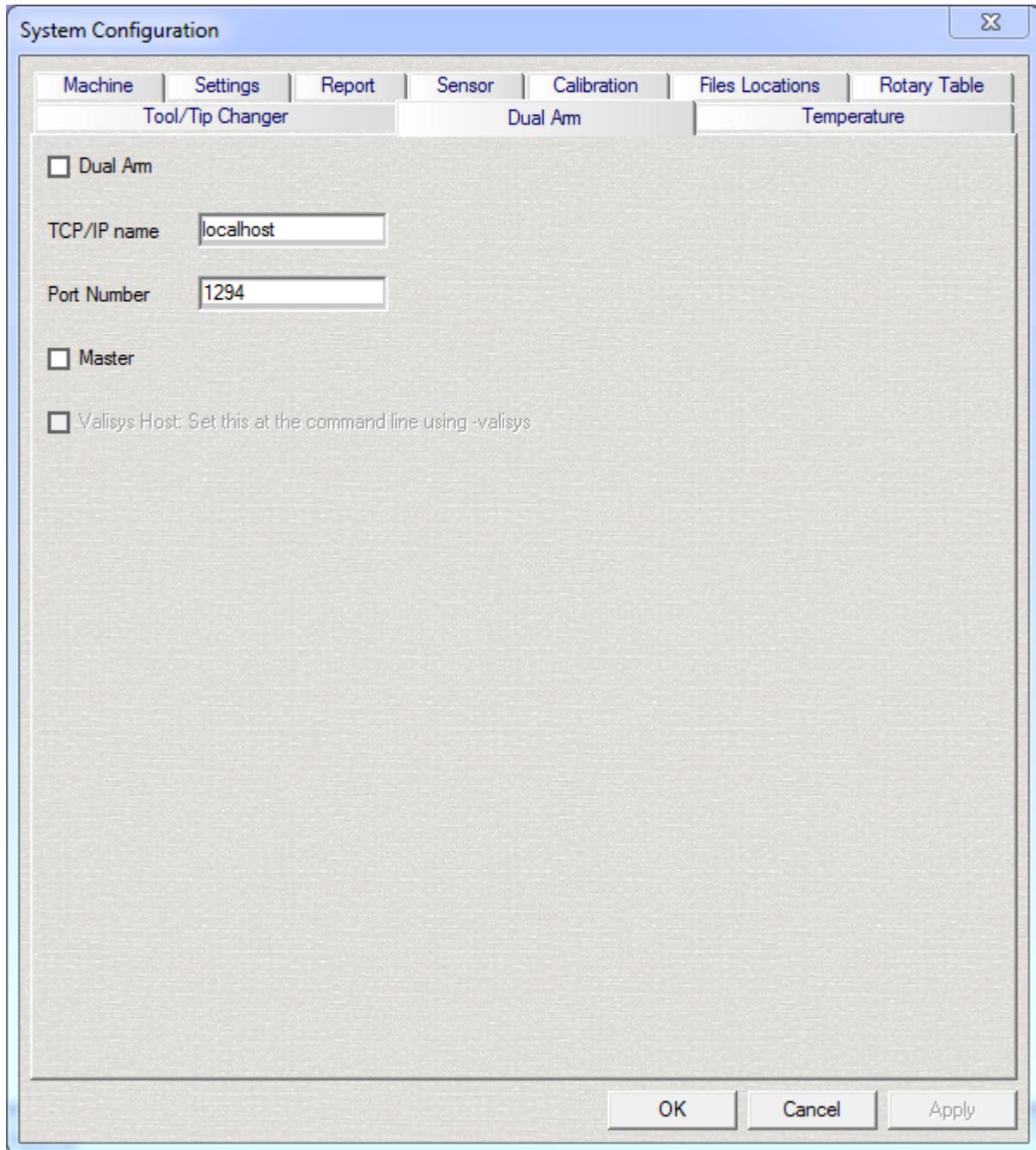
In CAPPS, the dual arm settings are located in the **System Configuration - Dual Arm Menu**. Keep in mind that prior to making dual arm configurations, one should decide which arm (computer) is to be the slave and which one the master, in the system.

Dual Arm Settings on the Slave Computer



- Make sure that the two computers are connected via network and that each computer network name or **IP address** is known
- At the **Slave** computer go to **System Configuration - Dual Arm Menu**.
- Once again, make sure that some kind of a network connects the computers ahead of time. Make sure the **Port Number** option has a number in it. By default, the number is set to **1294**. If a different **Port Number** is required please contact your IT department for the proper one.
- Check the dual arm flag to turn on the **Dual Arm** option but leave the Master box unchecked. This will designate this side as the slave side. As long as the dual arm box is checked the system will stay in **Dual Arm Mode**.
- Click on **Apply** and **OK** to establish the **Slave Side** communication settings and continue to the next section to configure the **Master Computer**.

Dual Arm Settings Through on the Master Computer



- Make sure that the two computers are connected via network and that each computer network name or **IP address** is known
- At the master computer go to **System Configuration - Dual Arm**.
- Enter either the network name or the **IP address of the Slave Computer** (machine to be connected). Once again, make sure that some kind of a network connects the computers ahead of time. By default the **Port Number** is set to **1294**. If a different **Port Number** is required please contact your IT department for the proper one.
- Check the dual arm flag to turn on the **Dual Arm** option and check the Master box to designate this computer as the **Master Side**. As long as the dual arm box is checked the system will stay in **Dual Arm Mode**.
- Click on **Apply** and **OK** to establish communication with the **Slave Computer**.

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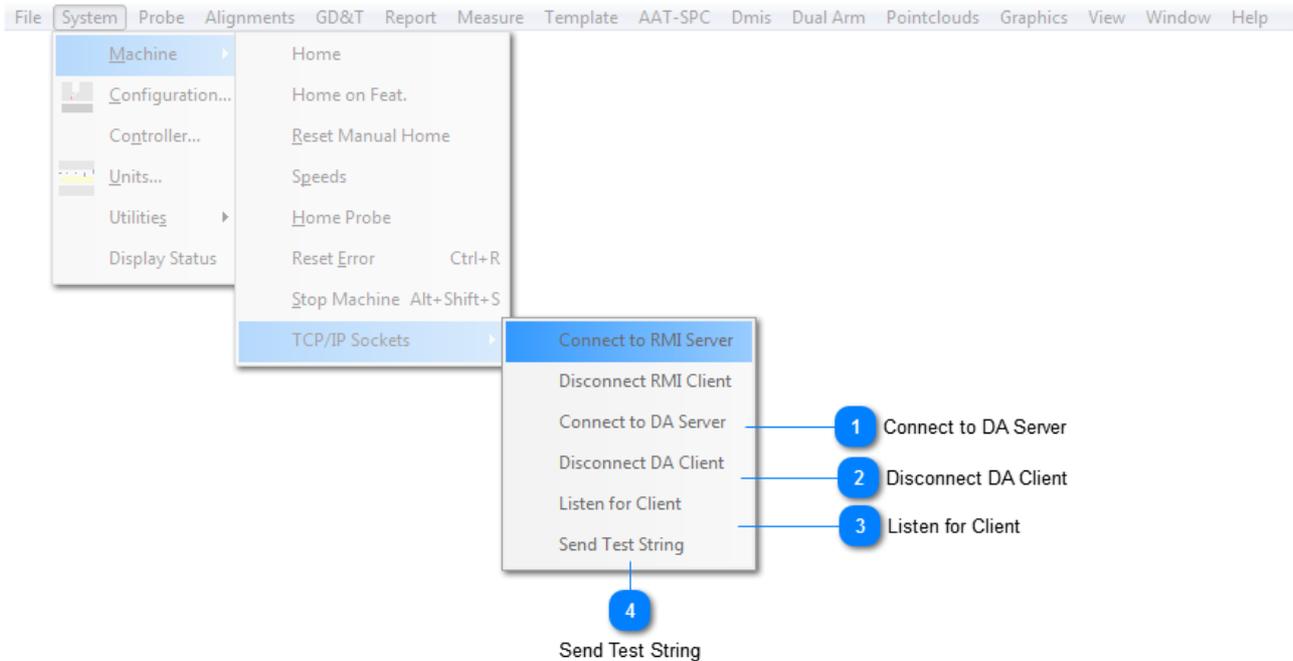
Machine Specific Feature Labeling for Master & Slave Computers

It is also recommended to set the prefix label of the features on each arm through the **System Configuration - Report - Set Labels** dialog. A good recommendation is “**S**” for the **Slave Side** and “**M**” for the **Master Side**.

This will help to prevent unwanted overwriting of features when data is sent from **Slave to Master** computers.

TCP - IP Configurations

Typically, setting up the **Dual Arm** options are all that is needed to set up the communication between **Master and Slave computers**. However, there are options in the **TCP-IP Sockets Menu** for manual connection, as well as, connection testing. While not necessary, it is recommended that anytime the software is opened using the **Dual Arm Configuration** make sure to open the **Slave Side** first.



1 Connect to DA Server

Connect to DA Server

Used on the **Master Side** to connect to the **Slave Side**. This option is only available if no connection is currently present.

2 Disconnect DA Client

Disconnect DA Client

Used on the **Slave Side** to disconnect from the Master. This option is only available is a connection is currently present.

3 Listen for Client

Listen for Client

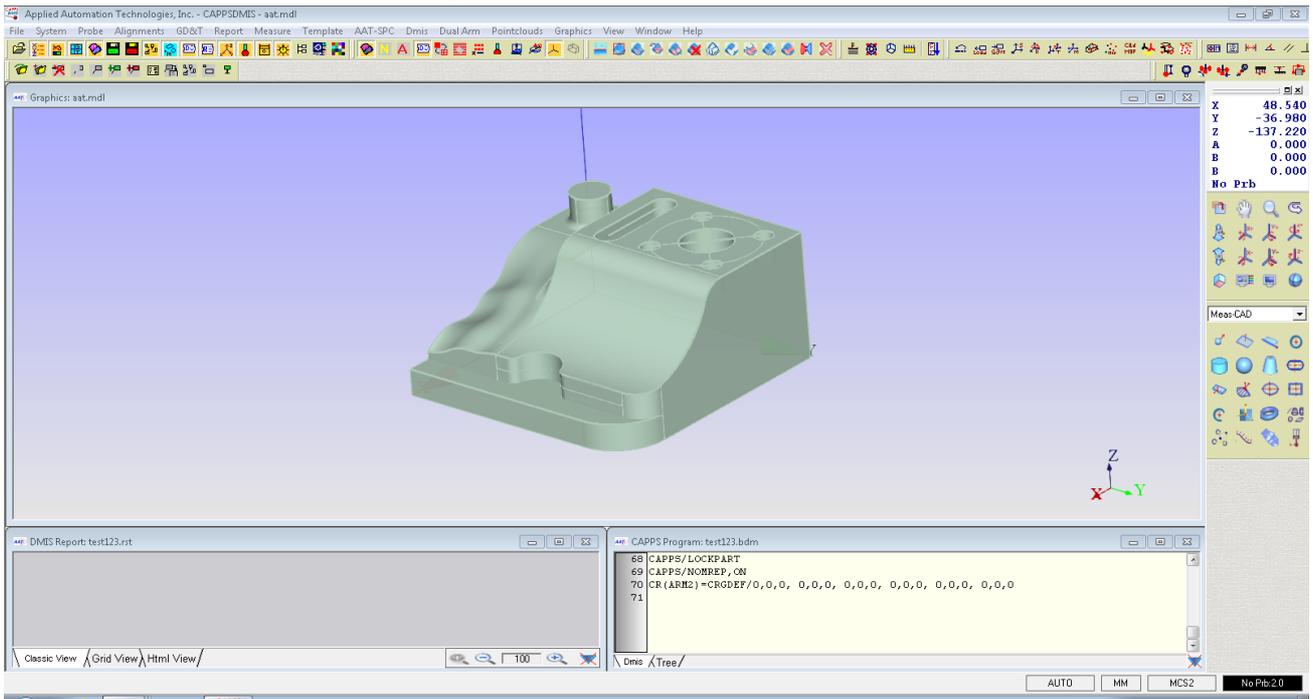
Used on the **Slave Side** to start waiting for a connection request from the **Master Side** if no connection is currently available. This option is only available if no connection is present.

4 Send Test String

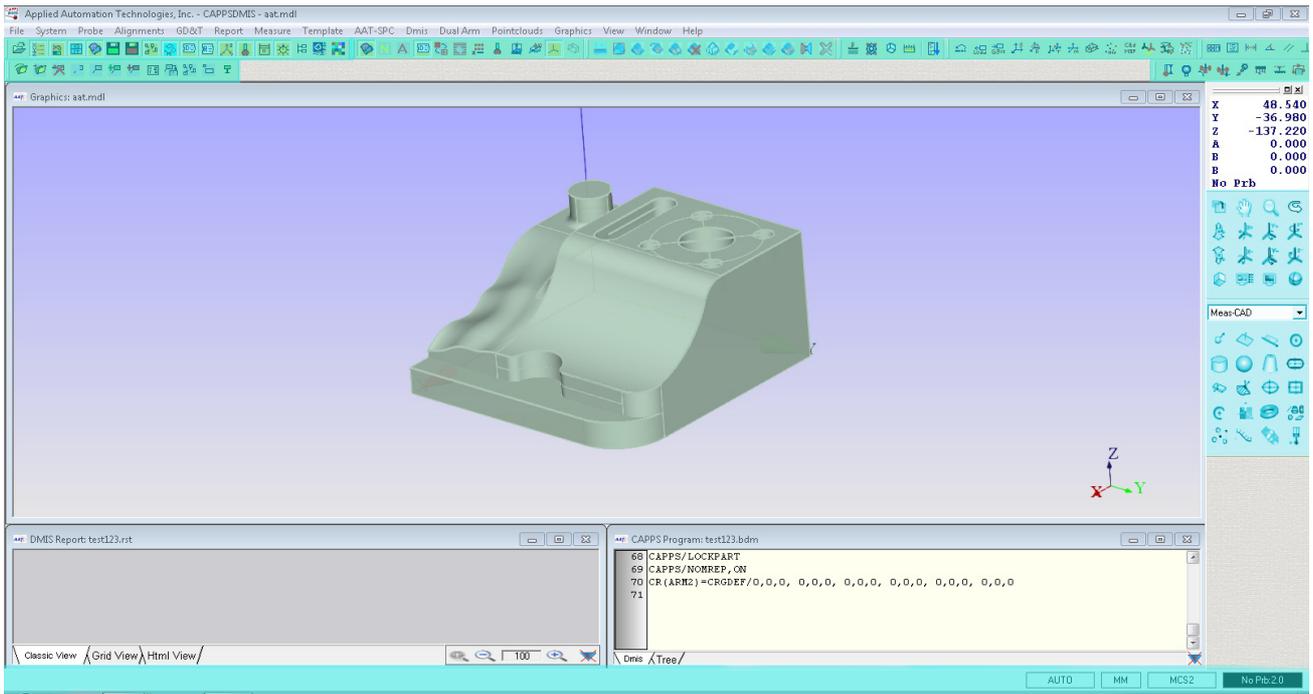
Send Test String

Used to send a test string to either side to verify connection.

After communication has been established the status bar at the bottom of the CAPPS operating environment will change to the tool bar color to show the good connection.



Before Dual Arm Connection



After Dual Arm Connection

[Using the Dual Arm Option](#)

Dual Arm Menu

Dual Arm Options (commands) are available under the Dual Arm pull down menu. Selecting these options will write the **CAPPS Specific Dual Arm commands** into the DMIS programming window automatically. While all of the options appear in the menu not all options are available for both the **Master and Slave** to use. If an option is not available it will be **grayed-out** meaning it cannot be selected.

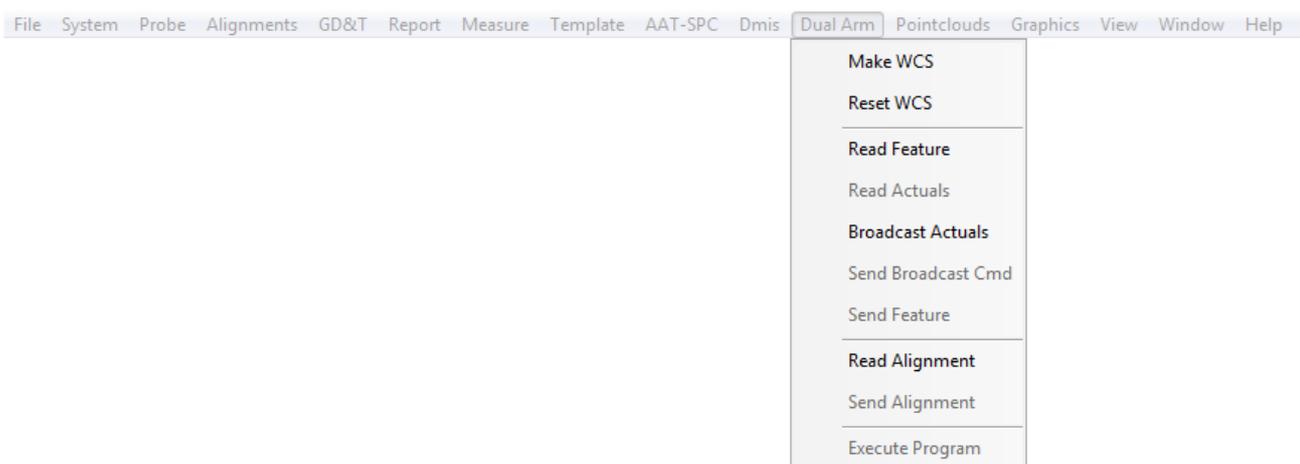
Make WCS: Clicking on this option will establish a common coordinate system between the two arms. This option is only available on the **Slave Side**.

Important Note: If the Dual Arm option is selected the current alignment system on the **Master Side** will become the **WCS** for the master side. To match up the **WCS** of the Slave side to the **Master Side** it will be required that the same three point reducible features are measured using each arm. The actual features from the Master side are then used as **Nominals** along with the features from the Slave side **Actuals** in a [CAD MGP](#) style alignment.

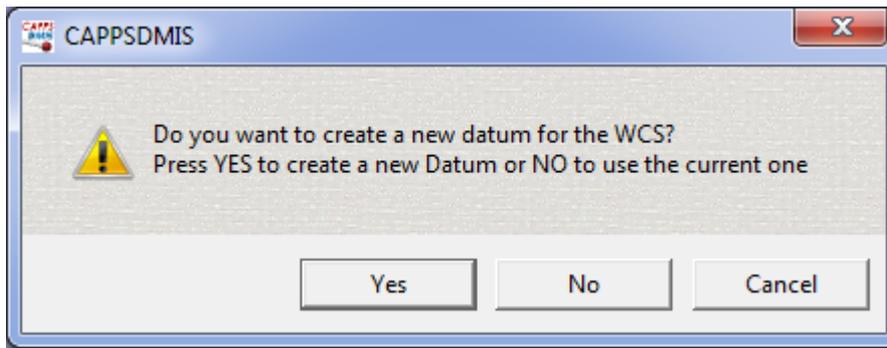
Please follow the steps below for more information. If there are already programs written to create a **WCS** from an older version they will be supported and can be used without modification.

Instructions for Setting Up a WCS Coordinate System

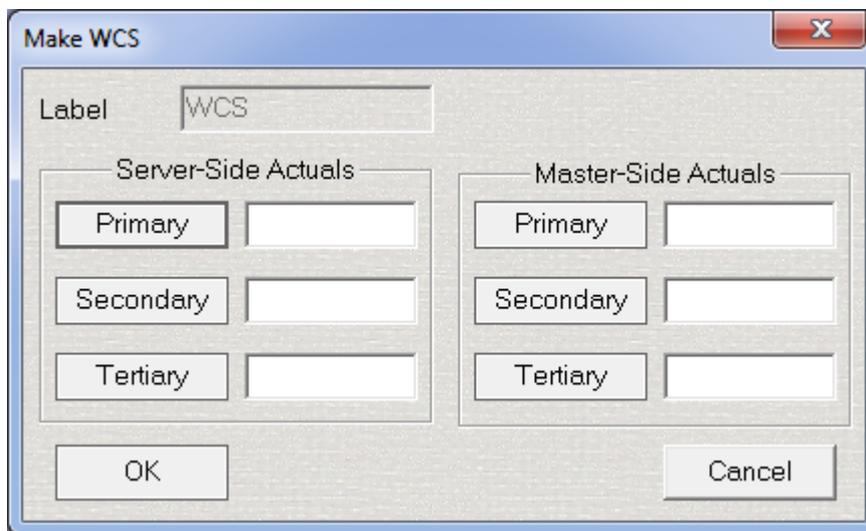
- Locate three point reducible features on the machine that can be measured with both arms
- Measure the features with the **Master Side arm**.
- Send the features to the **Slave Side computer**.
- Measure the same features with the **Slave Side arm**.
- Click on the **Dual Arm Make WCS** menu item.



- If a new **WCS** is to be created choose **Yes** if not choose **No** from the following dialog.

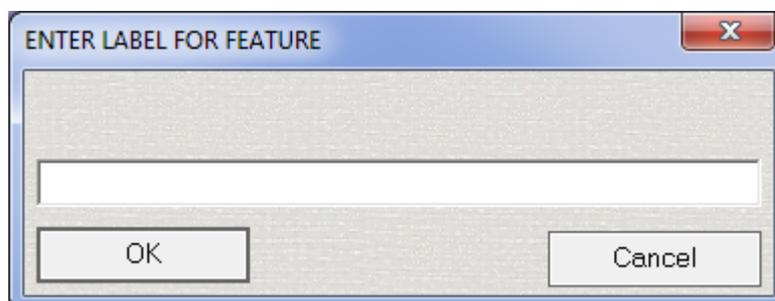


- If **Yes** is selected, the **Make WCS** dialog will appear. Please select the features from the **Master Side** for the **Master-Side Actuals** and select the features from the **Slave** side for the **Server-Side Actuals**. Make sure to select the features in the same order from both arms. Click **OK** when all features have been entered.

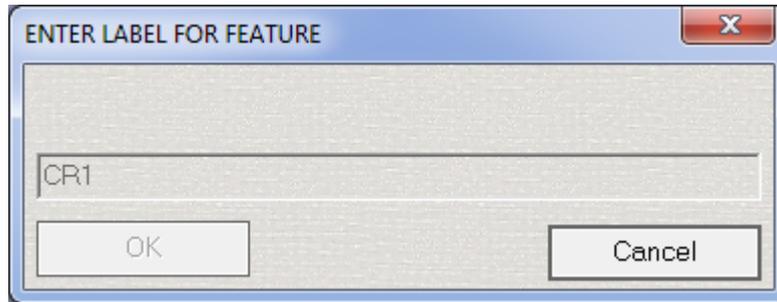


- **You have created the WCS!!!!!!**

Read Feature: Either the **Master Side** or the **Slave Side** uses this command. Clicking on this option allows one arm to read a feature from the other arm.



- Enter the label of the feature and click **OK**. The dialog will stay in this state until the feature is available on the other arm. Click **Cancel** at any time to cancel the read request.



Read Actuals: This command is used by the **Master Side**. Clicking on this option at the **Master Side** allows the master computer to read all the measured elements from the **Slave Side**.

Important Note: Only actual features are read not the actual touch points.

Read Alignment: This command is used by either the **Master Side** or the **Slave Side**. Clicking on this option allows one side to read an alignment from the other side and store it in the alignment list. Note that this alignment is not immediately active and should be selected later when it is to be used.

Send Alignment: This command is used only by the **Master Side**. It is used to send active alignment to the other side.

Important Note: There is no DMIS code generated for this command.

Broadcast Actuals: This command is used by the **Slave Side**. Clicking on this option will send the any measurement immediately to the **Master Side**. The command is given from the **Slave Side**.

Important Note: If this command is executed before any actuals are present the actuals will be sent as soon as they are measured.

Execute Program: This command is used by the **Client Side**. Clicking on this option will allow **Master Side** to start executing a program at the **Server Side**.

Important Note: If the default directory for the programs on **Slave Side** is set in the **System Configuration Files Locations** dialog then only the file name, not the whole path needs to be entered in the **Execute Program** dialog.

Tips For Operation of CAPPS Dual Arm Options

- All probes **MUST** be calibrated outside of **WCS** in the independent **MCS** of the specific side. If you need to calibrate probes after a **WCS** has been established you must first reset the **MCS** of the arm, calibrate probes, and reset the **WCS**.

[Using The Dual Arm Option](#)

Using Rotary Table Option

Configuration

CAPPS can be configured to interface with rotary tables by setting the **Rotary Table Flag** in the [System Configurations - RotaryTable Menu](#). If the rotary table option is also available with the installation key, setting this flag will be necessary to display the W axis for the rotary table angle position and to display an image of the rotary table in graphics.

The screenshot shows the 'System Configuration' dialog box with the 'Rotary Table' tab selected. The 'Table Indexing' section contains a checkbox for 'Table Axis 1' and several input fields for coordinates and vectors: X (0.000000), Y (0.000000), Z (0.000000), I (0.000000), J (1.000000), K (0.000000), LL (-360.0000), and UL (360.0000). Below this is a checkbox for 'TCP in Machine: Post process for G43.4' and a 'Table Model' field with a 'Browse' button. At the bottom, there are three input fields for 'Diameter', 'Height', and 'Scale Res'. The dialog has 'OK', 'Cancel', and 'Apply' buttons at the bottom right.

The X,Y,Z coordinates and the I,J,K vector are the calibrated center and the rotation axis vector of the rotary table. These values are calculated by the calibration procedure below.

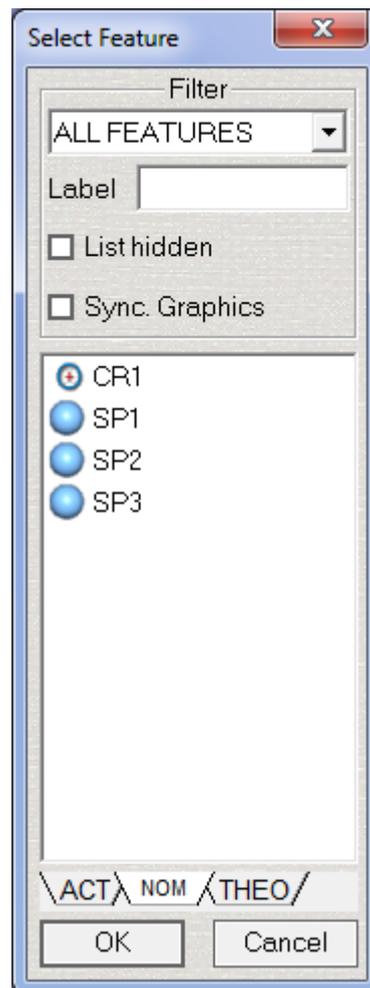
The user configurable **Diameter** and the **Height** parameters are used only for the graphical display of the rotary table. They do not effect any calculations or physical movement of the table. Scale resolution is used if one is not provided by the (.ini) file for the particular machine being used.

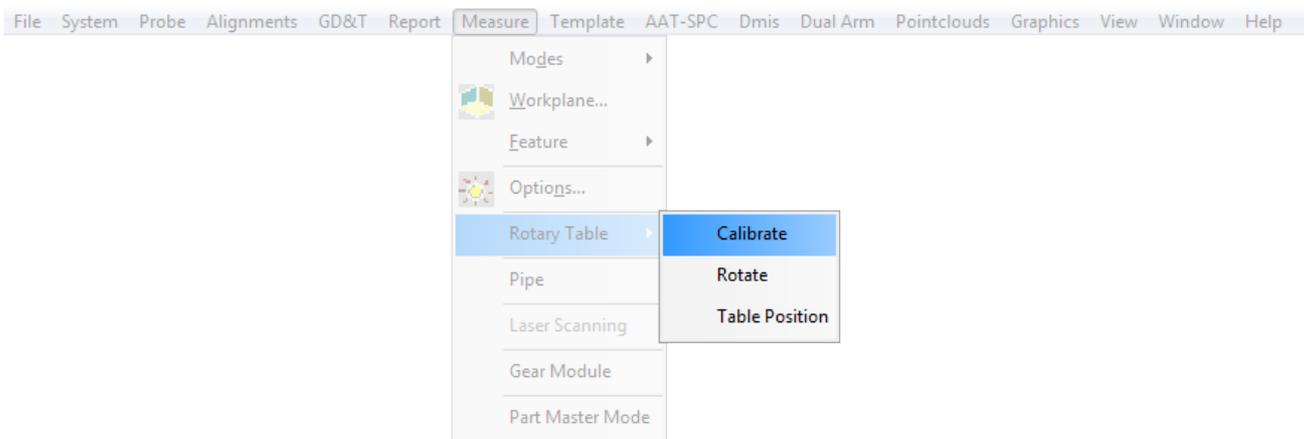
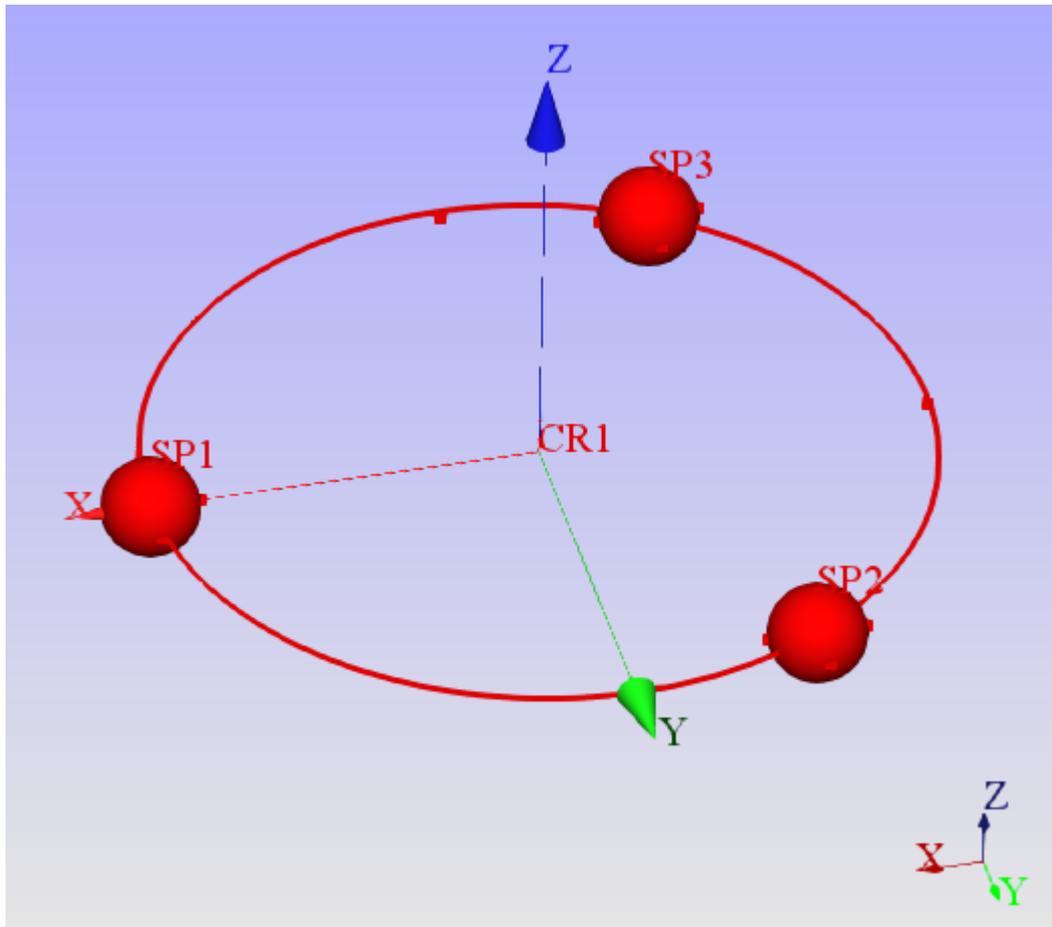
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Calibration

Important Note: Make sure the [Rotary Table](#) option in the [System Configurations](#) dialog is disabled when locating the table center.

- Before using the rotary table, it must be calibrated. To do this, attach a sphere to the rotary table and measure it in at least at 3 locations. Using these measured spheres, construct a circle which will represent the center and the axis of the table. Since CAPPs will use this also as the home of the machine, if preferred, the circle should be projected to a plane measured on the surface of the table.





- To apply the calibration, go to [Measure - Rotary Table - Calibration](#). Then select the circle created in the first step. This will update the rotary table information into the system. Once this is done, exit CAPPS and come back. You will notice that the coordinates will be in relation to the table center.

[Using Rotary Table Option](#)

Rotary Table Menu

The table is operated using the dialog under **Measure Toolbar - Position Points - Table:**

Important Note: CAPPs DMIS must be in **MEASCAD Mode** in order to rotate the table using this dialog.

Position Point [X]

Accept Current 5000.0

Move Absolute X

Incremental Y 10.0

Feature Z

 Speed

1 Feature CAD

2 Feature CAD

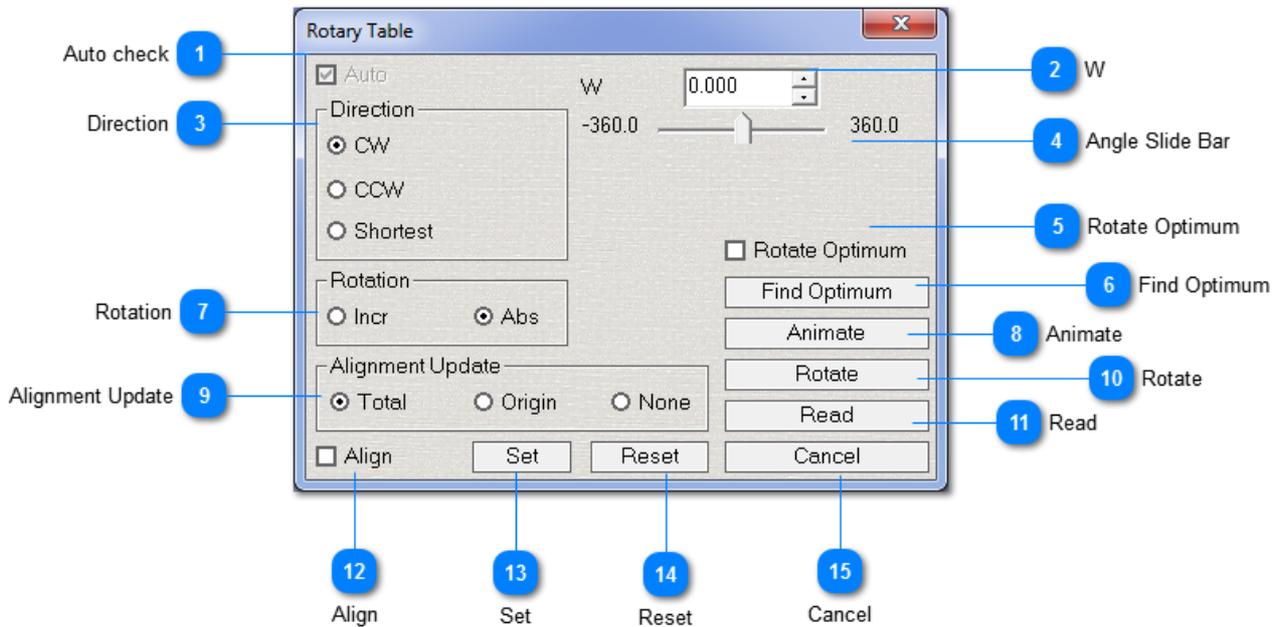
Motion directions

PCS MCS Sensor Custom

X

Y

Z



1 Auto check



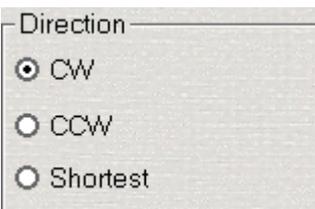
Used to enable [MEASCAD Mode \(Auto Mode\)](#).

2 W



4th axis angle. Enter the desired angle of rotation or use the slider bar to change the value in this box.

3 Direction



Used to choose the direction the table will rotate to position to the desired rotation.

CW:	Clockwise direction.
CCW:	Counter Clockwise direction.
Shortest:	CAPPS decides rotation direction based on current position and desired position.

4 Angle Slide Bar



Used to slide between available angles for the rotary table.

5 Rotate Optimum

Rotate Optimum

Used to rotate the table for the optimum angle to measure a feature.

6 Find Optimum

Find Optimum

Used to select a nominal from the list to find the optimum rotate angle for that feature only.

7 Rotation

Rotation
 Incr Abs

Used to determine rotation action.

Incremental:	Rotate the table from the current position by the desired rotation angle.
Absolute:	Rotate the table to the desired angle relative to the 0° position of the table encoder.

8 Animate

Animate

Used to animate the **Rotary Table** move before executing it.

9 Alignment Update

Alignment Update
 Total Origin None

Used to determine how to apply table rotation to the current **Part Coordinate System (PCS)**

Total:	Update the origin and axis rotation of the current PCS when the table is rotated.
Origin:	Update only the origin not the axis direction of the current PCS when the table is rotated.
None:	Do not update the current PCS when the table is rotated.

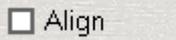
10 Rotate

Rotate

Use this button to initiate the rotation of the table once the desired angle has been entered.

11 ReadA rectangular button with the text "Read" centered inside.

Used to read the current position of the table.

12 AlignA rectangular button with a small square icon to the left of the text "Align".

Used to set a temporary table zero based on the current angular position of the table.

13 SetA rectangular button with the text "Set" centered inside.

Use this button to set the current position of the rotary table to zero.

14 ResetA rectangular button with the text "Reset" centered inside.

Use this button to clear the zero set position created by the Set button and return the display back to the actual table rotation.

15 CancelA rectangular button with the text "Cancel" centered inside.

Cancel the changes and close the dialog.

[Using Rotary Table Option](#)

Additional Notes

- When the rotary table option is enabled in CAPPs DMIS the [DRO](#) will update to the center position of the rotary table (**As Determined by the Calibration**) and display a **W** coordinate in the [DRO](#).
- When the rotation is applied to the origin all information, CAD, Actual features, Nominal features, and **PCS** will rotate in the **Graphics Window**.
- When using a manual table, switch to [Measure Mode](#), enter the angle into the **W** box, and click **Update** to update the current **PCS**.
- Both nominal and actual features may be selected after the rotation is completed.
- On a **Renishaw MCU** the table can be rotated by pressing the **MODE** button until the **Rotary Table** screen is displayed on the handbox. Once the **Rotary Table** screen is displayed rotate the joystick to move the table.

[Using Rotary Table Option](#)

Rotary Table Exercises

Once the table is calibrated, the following tests can be used to verify the calibration and also to gain a better understanding of how CAPPS DMIS applies the rotary table position to measurements.

TEST 1: Manual Table Update

In this test, the user will see how rotating the table manually without updating the position in CAPPS DMIS has no effect on the measurement results.

- Make sure the rotary table has been calibrated and is currently in use
- Attach a sphere to the rotary table
- Measure the sphere
- Rotate the table using the joystick
- Measure the sphere in the new position
- Output the distance between the two spheres

Because the rotation of the table was done manually and not updated in CAPPS DMIS the distance between the two spheres should be zero. If it is not, please recheck the calibration of the rotary table.

TEST 2: Table Rotation With Alignment Update

In this test, the user will see how CAPPS DMIS applies the table rotation to the current **PCS** and feature measurement.

- Make sure the rotary table has been calibrated and is currently in use
- Attach a sphere to the rotary table
- Measure a point on the top of the sphere
- Create a nominal feature from this measured point
- Measure the nominal point in [MEASCAD Mode](#)
- Make sure the **Alignment Update** is set to either **Total** or **Origin**
- Rotate the table using the [Rotary Table Menu - Rotate](#) dialog
- Measure the same nominal point using [MEASCAD Mode](#)

Because the rotation was done from the **Rotary Table** dialog and the rotation was applied to the current **PCS** the nominal point location was updated based on the rotation applied. If the **Alignment Update** is set to **None**, the rotation is not applied to the nominal position and the point will be measured in the original location where it was created.

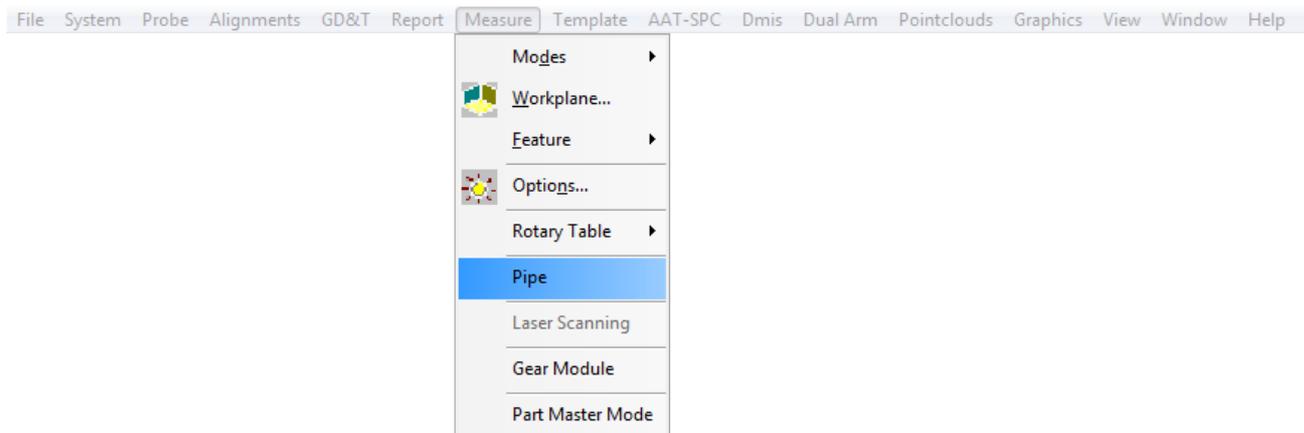
[Using Rotary Table Option](#)

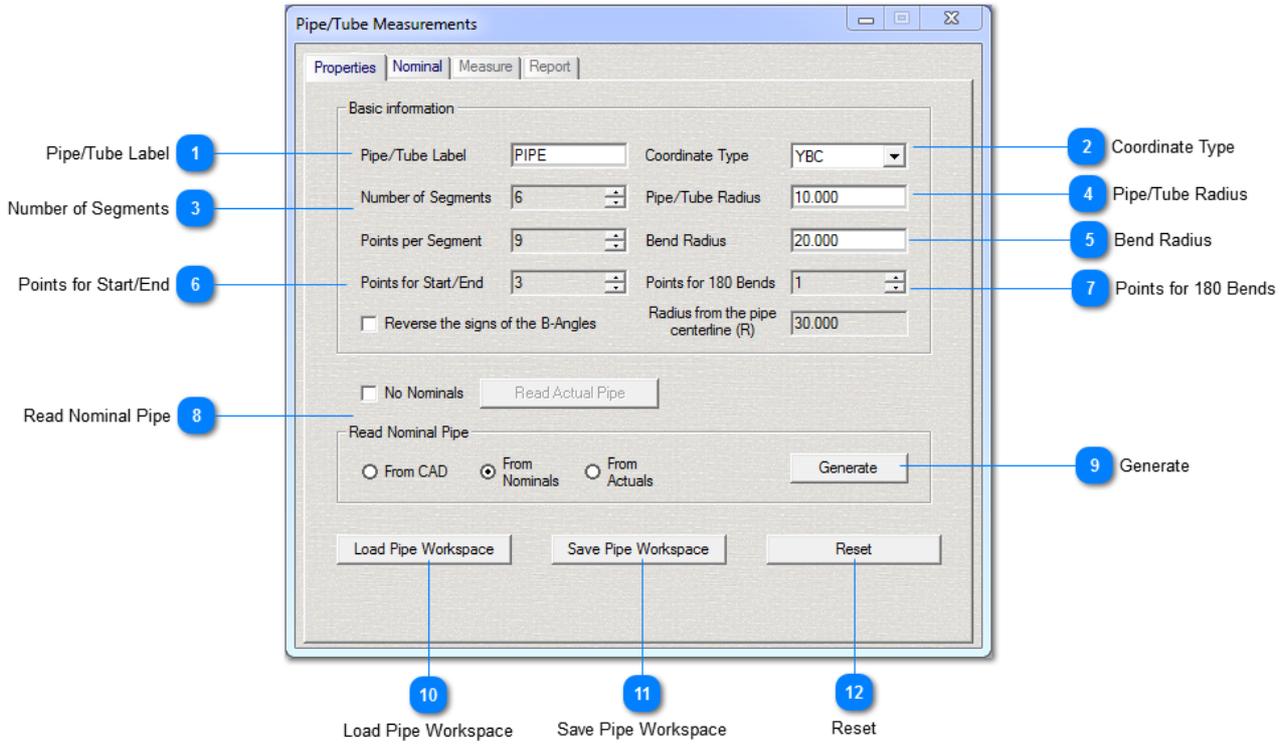
Measuring Pipes and Tubes

AAT introduces a pipe & tube design and measurement module as optional module to CAPPs software. The following is a list of some of the important functionality of this module:

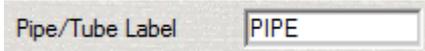
- Design a tubular pipe by entering **XYZ** or **YBC** coordinates.
- Design by extracting pipe data from a CAD module.
- Design by constructing a pipe from a nominal data with **XYZ** or **cylinders**.
- **Reverse Engineer** a pipe by measuring cylinders on the actual part.
- Edit and modify an existing pipe data.
- Convert coordinates of pipe from **YBC** to **XYZ** coordinates.
- Measure a designed pipe.
- Align a measured pipe to design data.
- Generate measurement reports of pipe.

The pipe application is under the [Measure Menu](#). If this option is purchased, it will be listed in the menu and when clicked, it will open the main dialog window for pipe.





1 Pipe/Tube Label



Used to enter a name for the pipe in this field.

2 Coordinate Type



Used to determine how the data should be entered in **YBC** or **XYZ**.

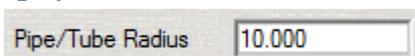
YBC:	This is the coordinates that defines each segment of the pipe in terms of its length (Y) its rotation about its cylinder axis (B) and bending angle (C) .
XYZ:	The coordinate of the each intersection point.

3 Number of Segments



Used to set number of segments if data will be entered manually.

4 Pipe/Tube Radius



Used to enter the radius of the cylinder from which the pipe will be manufactured.

5 Bend Radius



Bend Radius

Used to enter the radius of each bend.

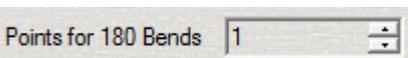
6 Points for Start/End



Points for Start/End

When measuring the pipe, there will be points required to be measured at the beginning and the end of the part. Number of points to measure will be set here.

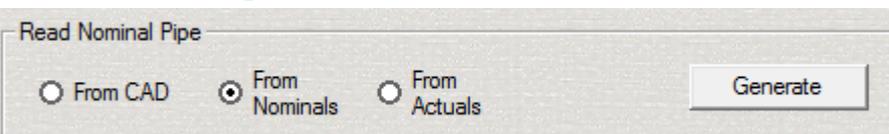
7 Points for 180 Bends



Points for 180 Bends

Used to set number of U turns on a pipe. If there will be any bends with a U turn with 180 degree, then additional points will be used to measure these segments.

8 Read Nominal Pipe

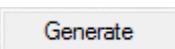


Read Nominal Pipe

From CAD
 From Nominals
 From Actuals

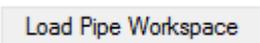
Used to generate a nominal pipe using the existing data. The pipe data can be extracted from a **CAD**, **NOMINAL** or by reverse engineering an existing pipe.

9 Generate



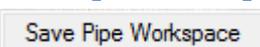
Generates a nominal pipe.

10 Load Pipe Workspace



Loads an existing pipe workspace.

11 Save Pipe Workspace



Saves current pipe workspace for later use.

12 Reset



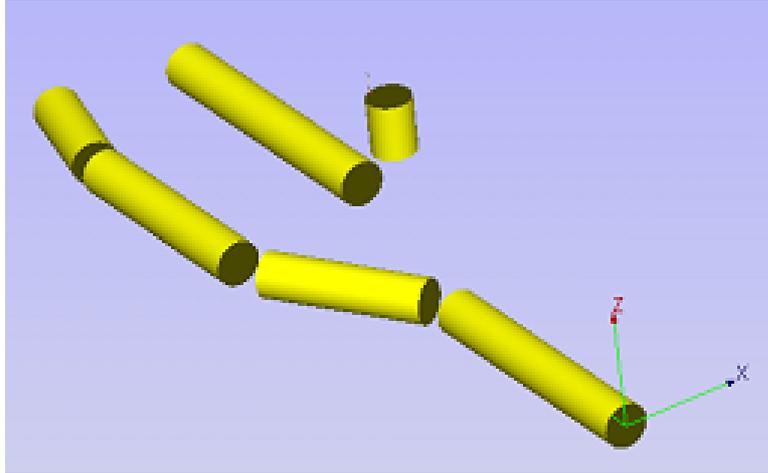
Resets the settings.

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Generating Pipes and Tubes

Generating Pipes and Tubes Using Nominal Data

Pipe data can be extracted from a set of nominals entered manually or extracted from a CAD. This nominal data can be in the form of cylinders or just points representing the intersection points of all the links.



MAKE NOMINAL - (CYLINDER)

Label: 

Inner Outer

Coordinates

Top X

Bottom Y

Z

Axis Direction

I

J

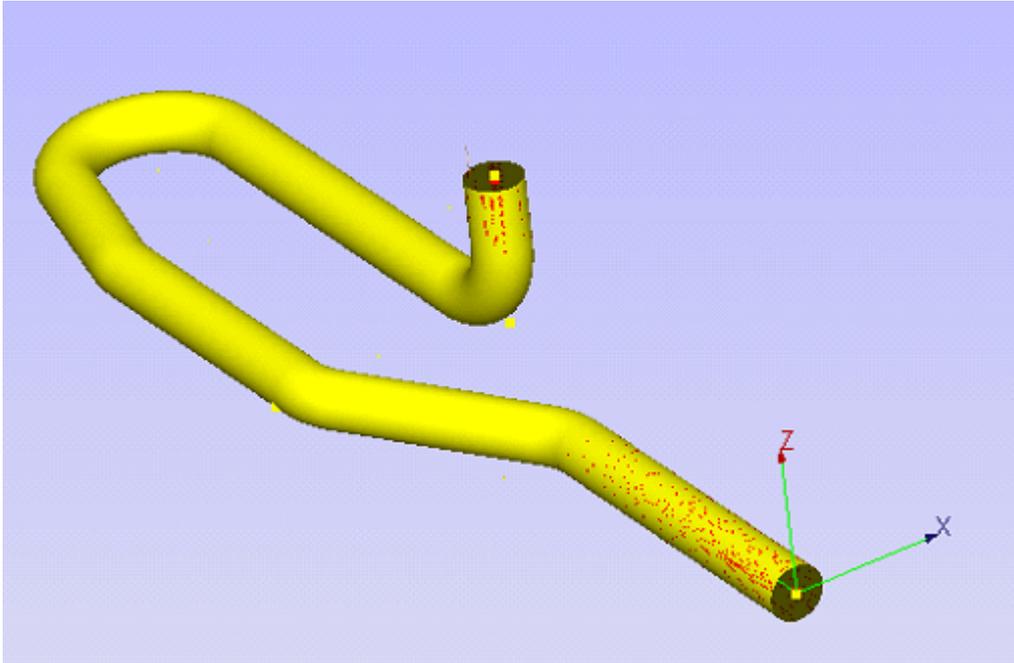
K

Diameter

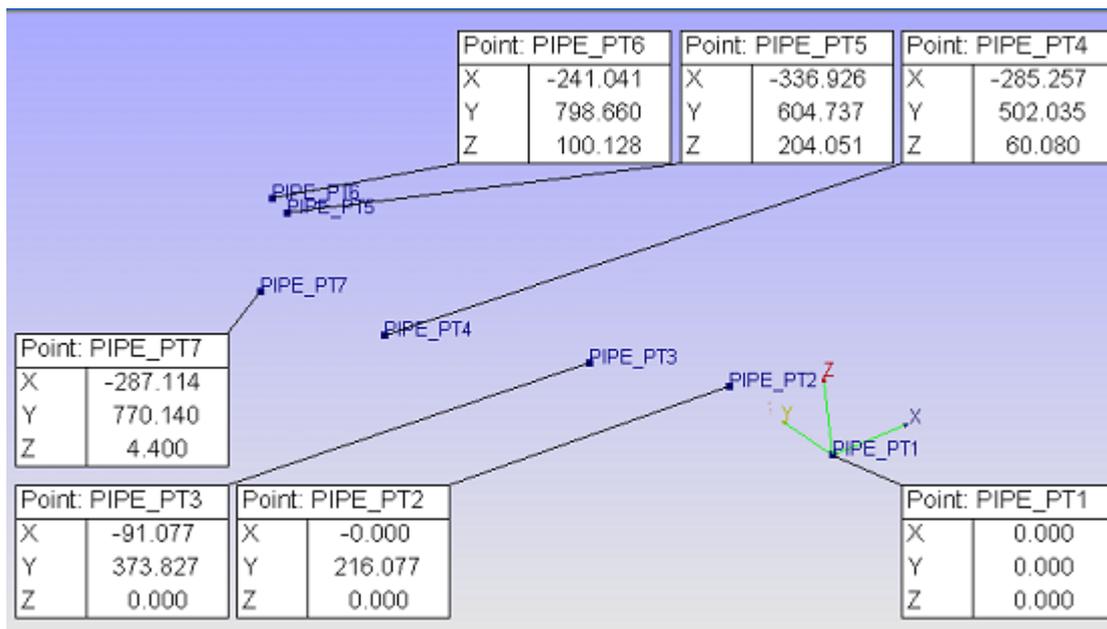
Length

OK Cancel

A set of nominal cylinder data can be entered and displayed in graphics. Once these elements are selected in the [Nominal Tree View](#), the **READ** option can be used to generate this pipe. The following tube is generated using this method:



If only **XYZ** points of data is available, they can be entered into graphics:



Read Nominal Pipe

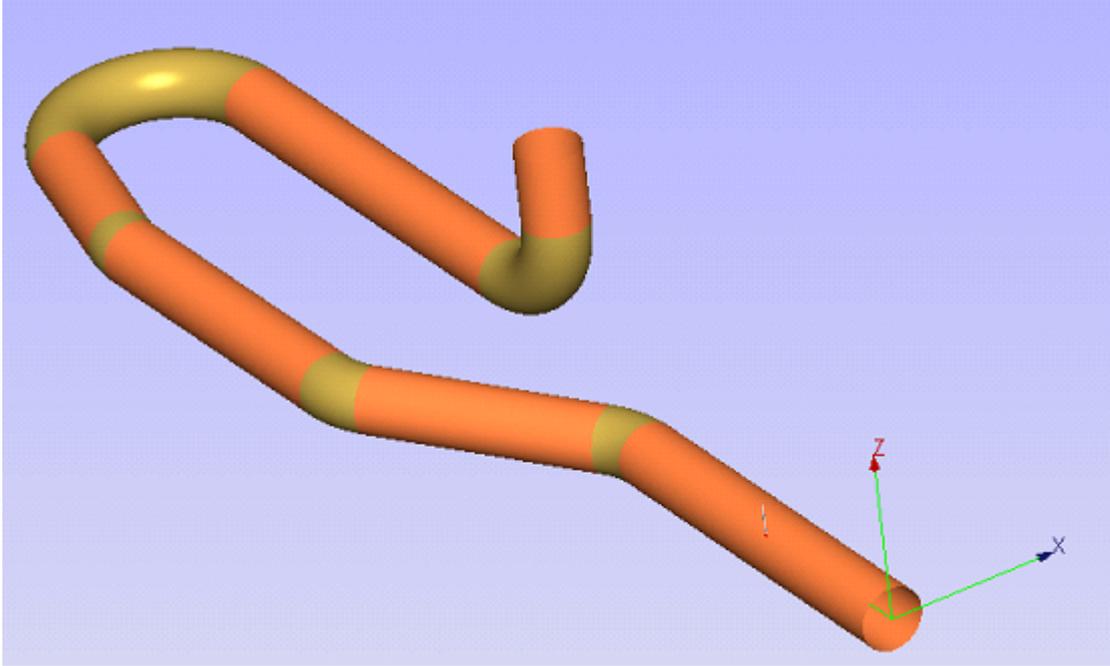
From CAD
 From Nominals
 From Actuals

Generate

When the point nominal data is selected in the nominal tree view, a pipe will be calculated and designed as soon as **Generate** button is clicked.

Extracting Pipes and Tubes Using CAD Data

If a CAD file is available, pipe data can be extracted from it. To do so, simply highlight all the **links (cylinders)** of the CAD for where the pipe will be fit.



At this time, using the **Generate** button will generate pipe data from the CAD model.

Reading Pipes and Tubes Input From a File

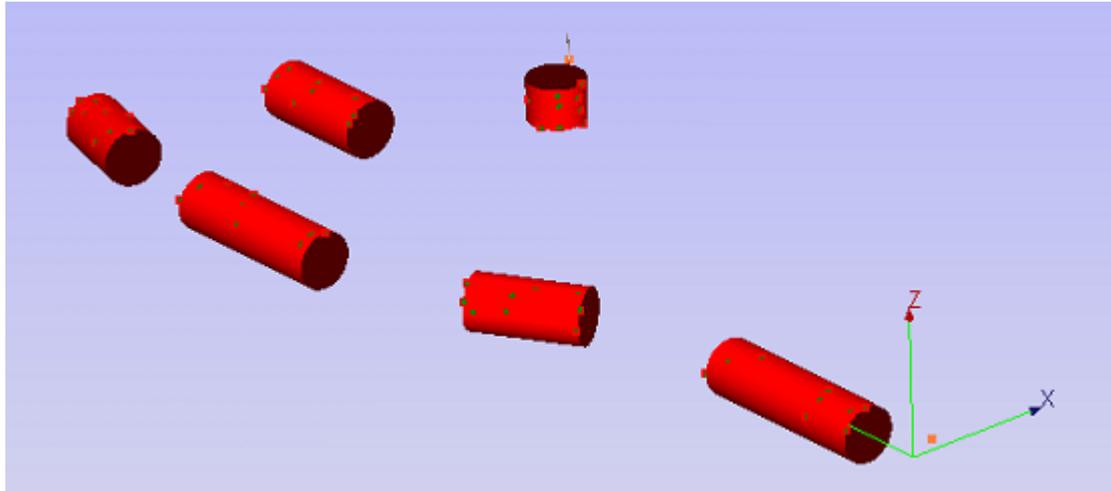
Pipe data can be saved and loaded from several types of files. The **YBC** or **XYZ** data can be saved as a text file and **READ** from these files. The format of the file is very simple and editable.

DATA	TYPE	#YBC#		
250.000	0.000	30.000	40.000	
150.000	180.000	30.000	40.000	
200.000	0.000	15.000	40.000	
100.000	-90.000	90.000	40.000	
50.000	0.000	0.000	40.000	

DATA	TYPE	#XYZ#		
0.000	0.000	0.000	40.000	
0.000	266.077	0.000	40.000	
-91.077	423.827	0.000	40.000	
-91.077	647.803	0.000	40.000	
54.805	1192.242	0.000	40.000	
54.805	416.496	0.000	40.000	
54.805	416.496	110.000	40.000	

Reverse Engineering Pipes and Tubes

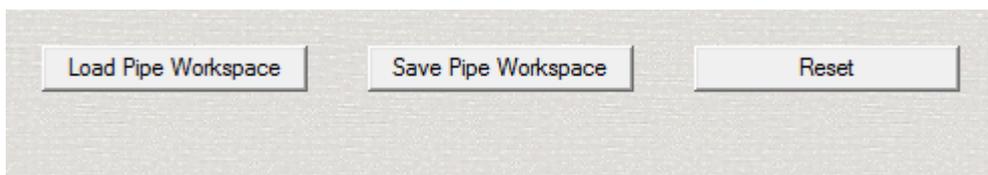
If a pipe is available with no CAD or known data, it can be reverse engineered. For this, simply measure all the cylinders in sequence without even worrying about an alignment. If necessary, also measure the bends with torus or extra points for **180 degree U turns**. Once the data is collected, now start the **PIPE** and choose **Read Nominal Pipe - From Actuals** to generate the pipe data. The generated pipe can then be saved as a CAD model.



Make sure to measure the first point to indicate the beginning of the pipe and the last as the end in order to get the limits properly.

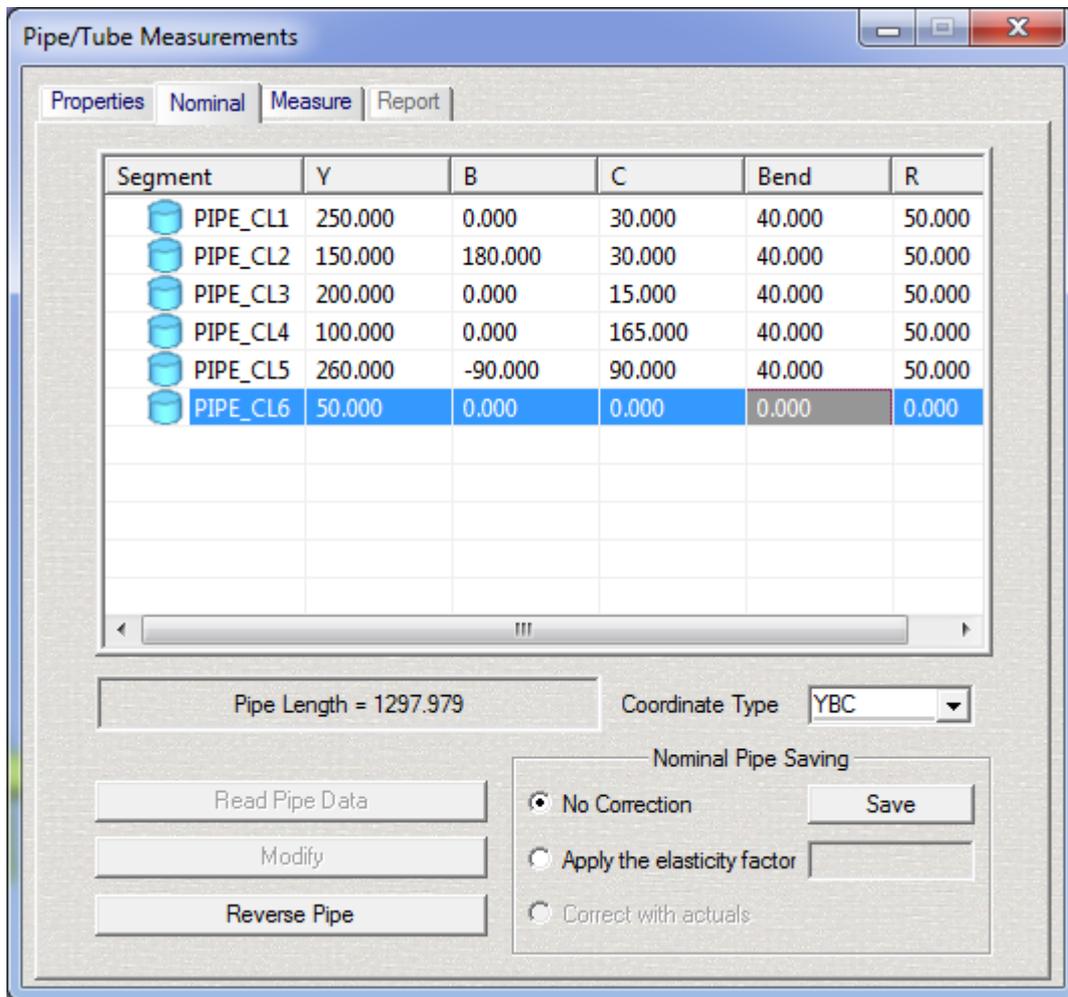
Pipe Work Space

A pipe work space can be saved which includes all the measurements and reporting options selected for this pipe. The extension for this is **(.pipe)**. The difference between saving a txt pipe data and workspace is that workspace includes all the measurements along with the design data.



Manual Entry or Modification of Pipe Data

In the nominal page, the pipe data can be viewed, created from scratch by entering or modified.



Note that the first link has **B=0** and the last link has **B** and **C=0**. This view shows all designed link data in **YBC** or **XYZ** coordinates. The coordinates can be changed by choosing the drop list.

The nominal data can also be saved to a text file in **YBC** or **XYZ** format and loaded back later.

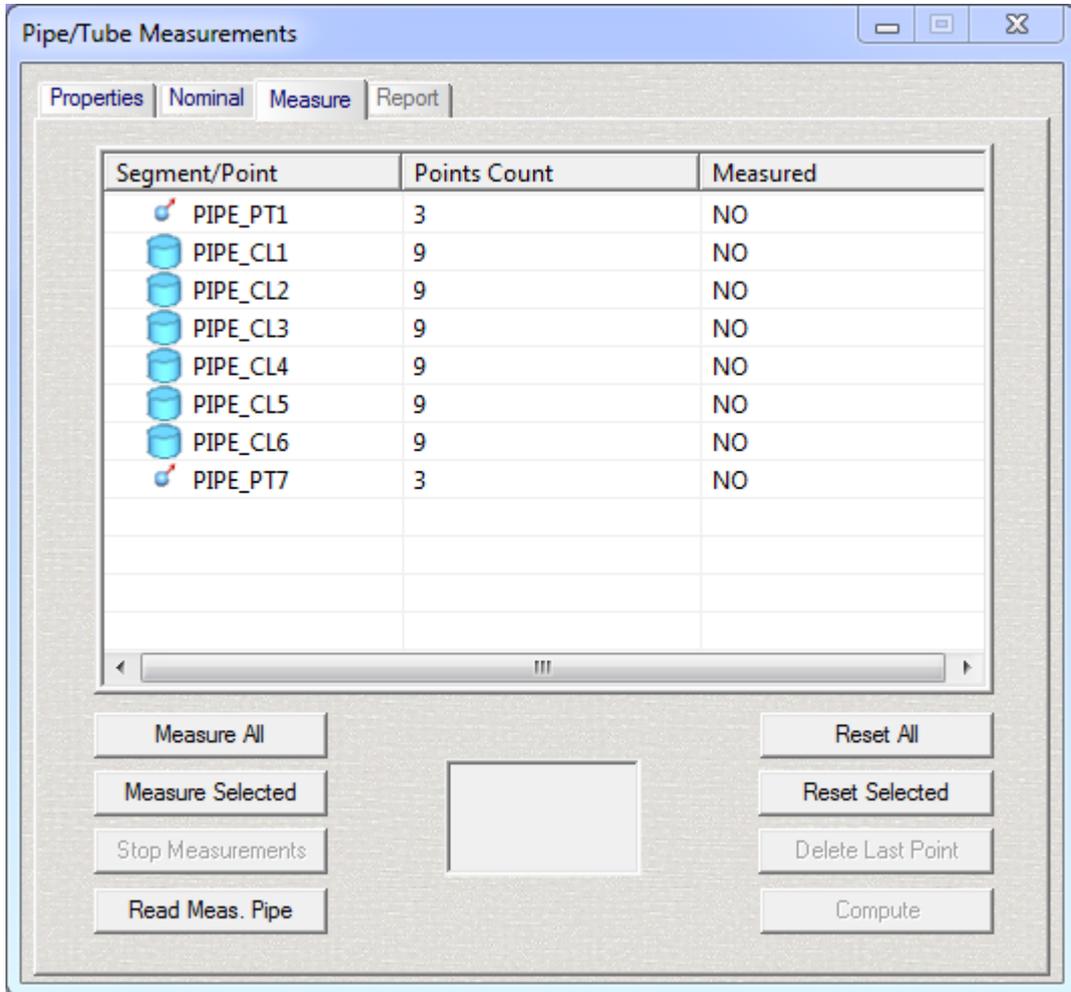
If a previous data is being modified, after changing any one of the parameter, the graphics will be updated after clicking on the **Modify** button.

Reset will remove any previously pipe data.

[Measuring Pipes and Tubes](#)

Measuring Pipes and Tubes

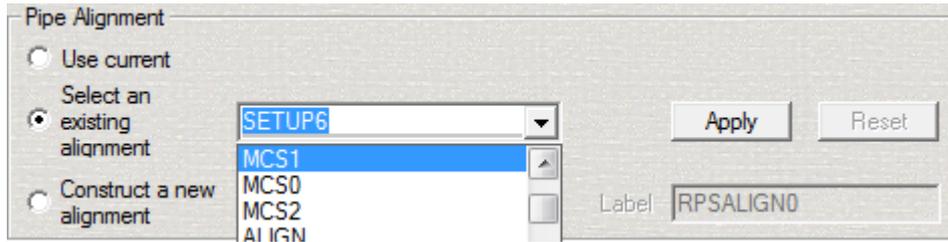
After a pipe data is created, it can now be measured directly from the **Measure** tab. This is the easiest method of measuring but if it is so desired, the pipe segments can be measured using CAPPs and loaded into this page as well.



All the segments can be measured together or one segment can be measured individually to replace a previous measurement.

After all the measurements are done, choose **Compute** to calculate the pipe parameters.

Fit Using a Previous Alignment



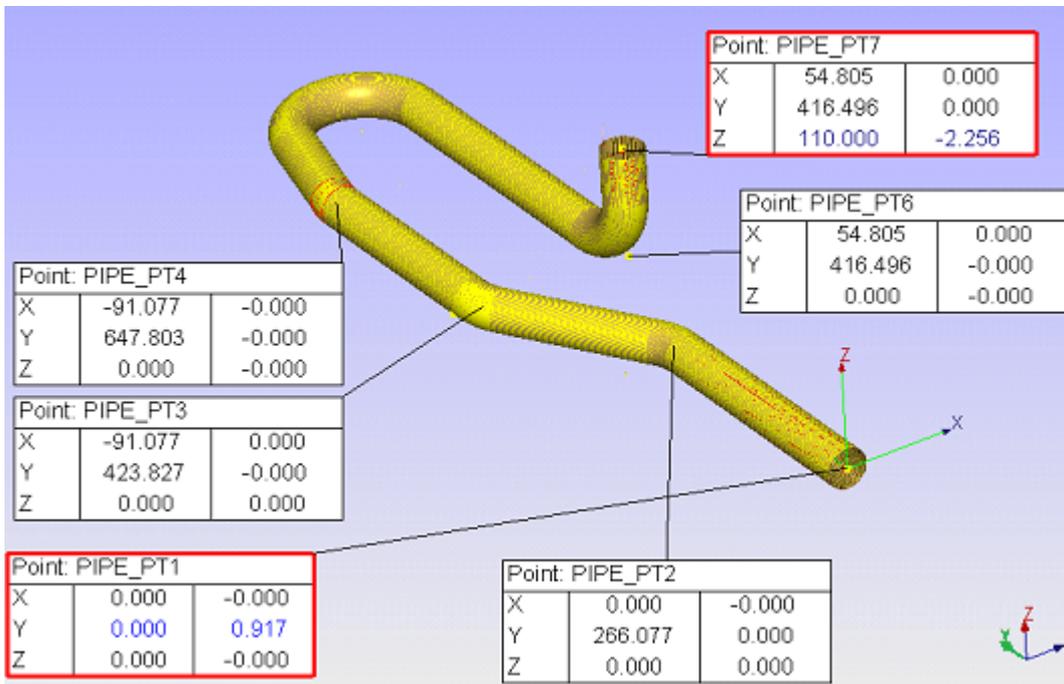
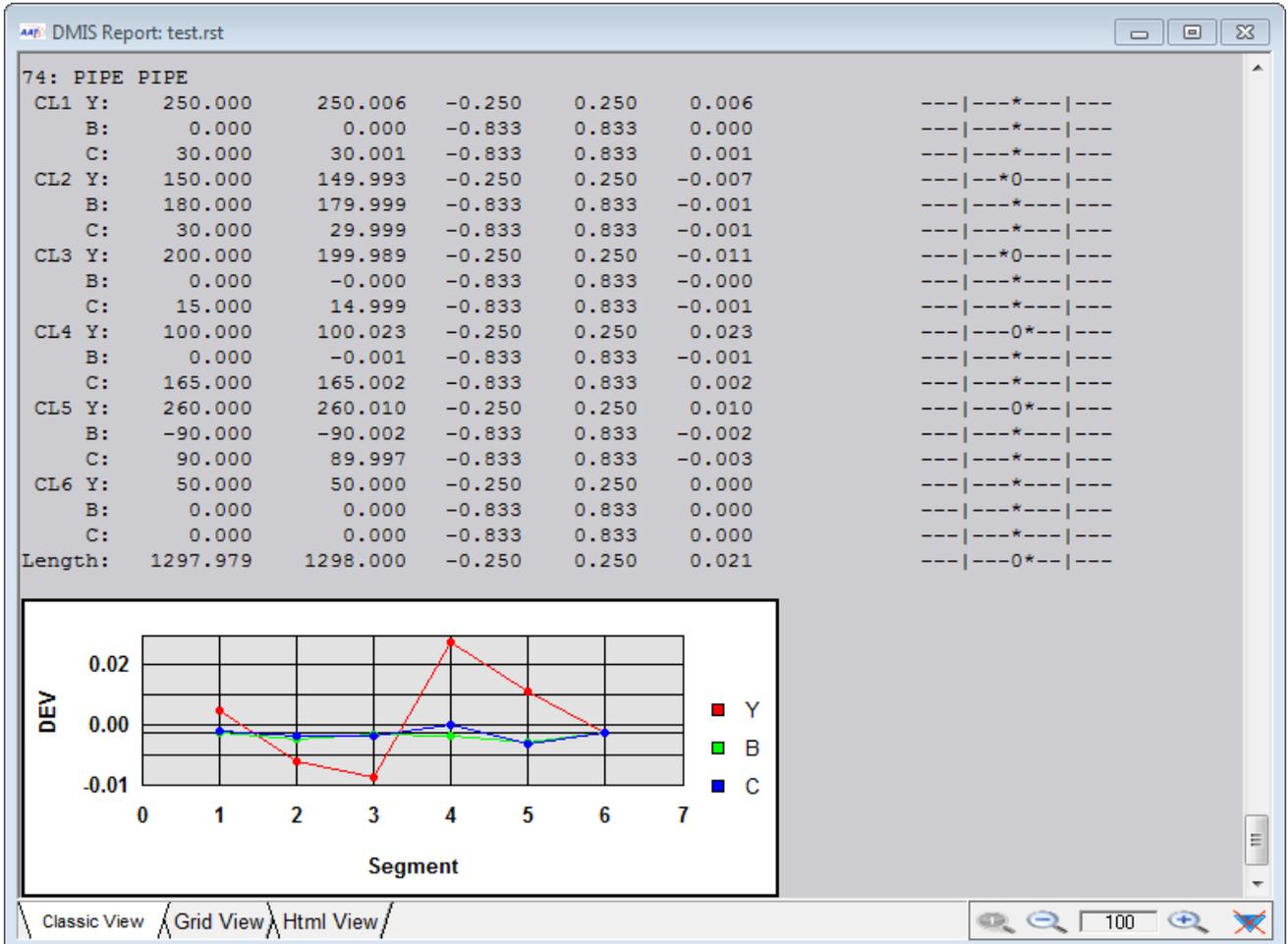
If the user decides to make an alignment using CAPPs's alignment features, this alignment can be selected instead of fitting a new alignment.

Once the **Align** or **Apply** options is used depending on the method, the report will be calculated and displayed in the reporting section of the dialog.

		NOM	ACT	DEV	OUT OF T.
PIPE_CL1	Y	250.000	250.006	0.006	
	B	0.000	0.000	0.000	
	C	30.000	30.001	0.001	
PIPE_CL2	Y	150.000	149.993	-0.007	
	B	180.000	179.999	-0.001	
	C	30.000	29.999	-0.001	

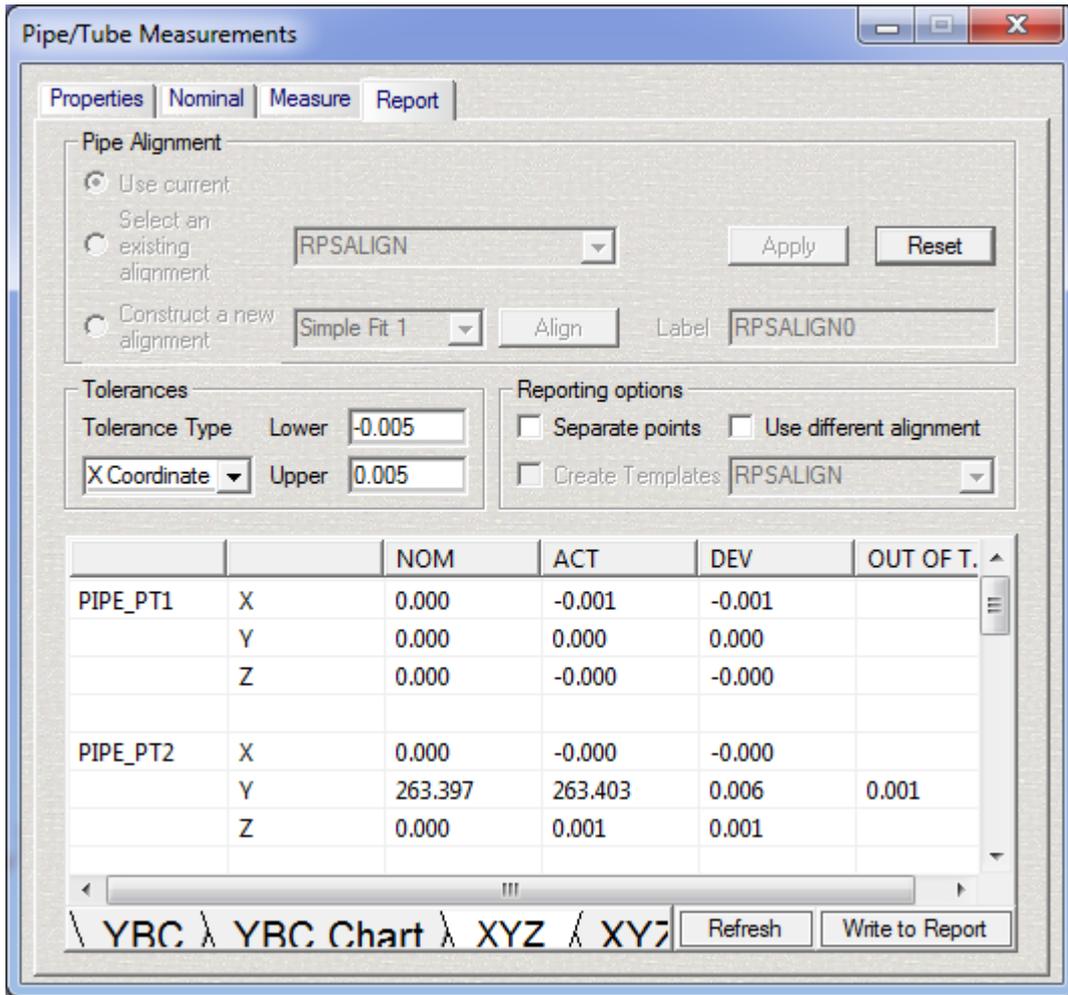
YBC / YBC Chart \ XYZ \ XYZ Chart / Refresh Write to Report

From here, the user can choose how this report will be copied to the CAPPs reporting window. The following are examples of different reports.

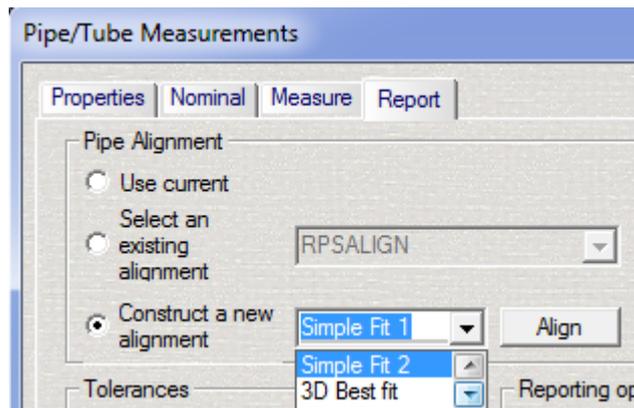


Measuring Pipes and Tubes

Reporting Pipes and Tubes



In order to generate reports, first an alignment procedure has to be selected. The easiest way is to choose one of the methods to align the measurement data with the pipe design data using one of two methods:



Simple Fit:	This option will fit the pipe using the first two links and calculate an alignment.
3DBestFit:	This will consider all the links and calculate a best fit of the measured data to the pipe design.

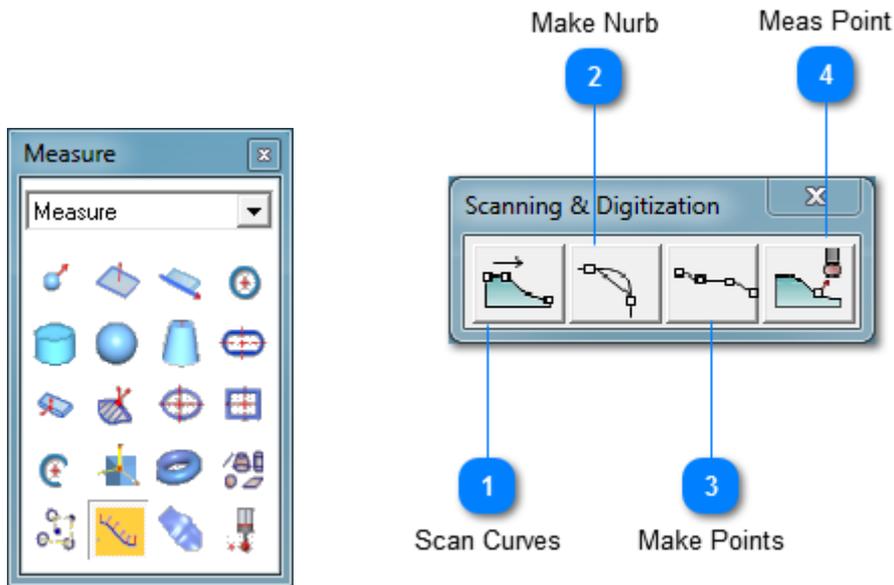
[Measuring Pipes and Tubes](#)

Scanning and Digitizing

CAPPS DMIS allows scanning of part surfaces for the purpose of reverse engineering or for gathering information about part data for profile examination or actual data comparison to nominal. CAPPS DMIS supports several types of scanning operations.

- Touch Probe scanning
- Analog Scanning
- Laser Scanning

Touch Probe Scanning



1 Scan Curves



This will give options to scan manually (single line), automatically (single line), or surface scan (multiple lines).

2 Make Nurb



This option will create N.U.R.B. curves out of already existing copious curves.

3 Make Points



This option works to create nominal points on the wire frame section without underlying CAD surface data. Approach vector of 0,0,1 will be default. This option will use the scan increment settings when setting distance between nominal points. Conversely if accurate nominal vector information is required, surface data is required. The Advanced Surface Point option will be useful in creating accurate nominal vector information where 3D surfaces are present. For more information also see the section on Advanced Surface Point operations in the Creating Nominal Data section of the documentation.

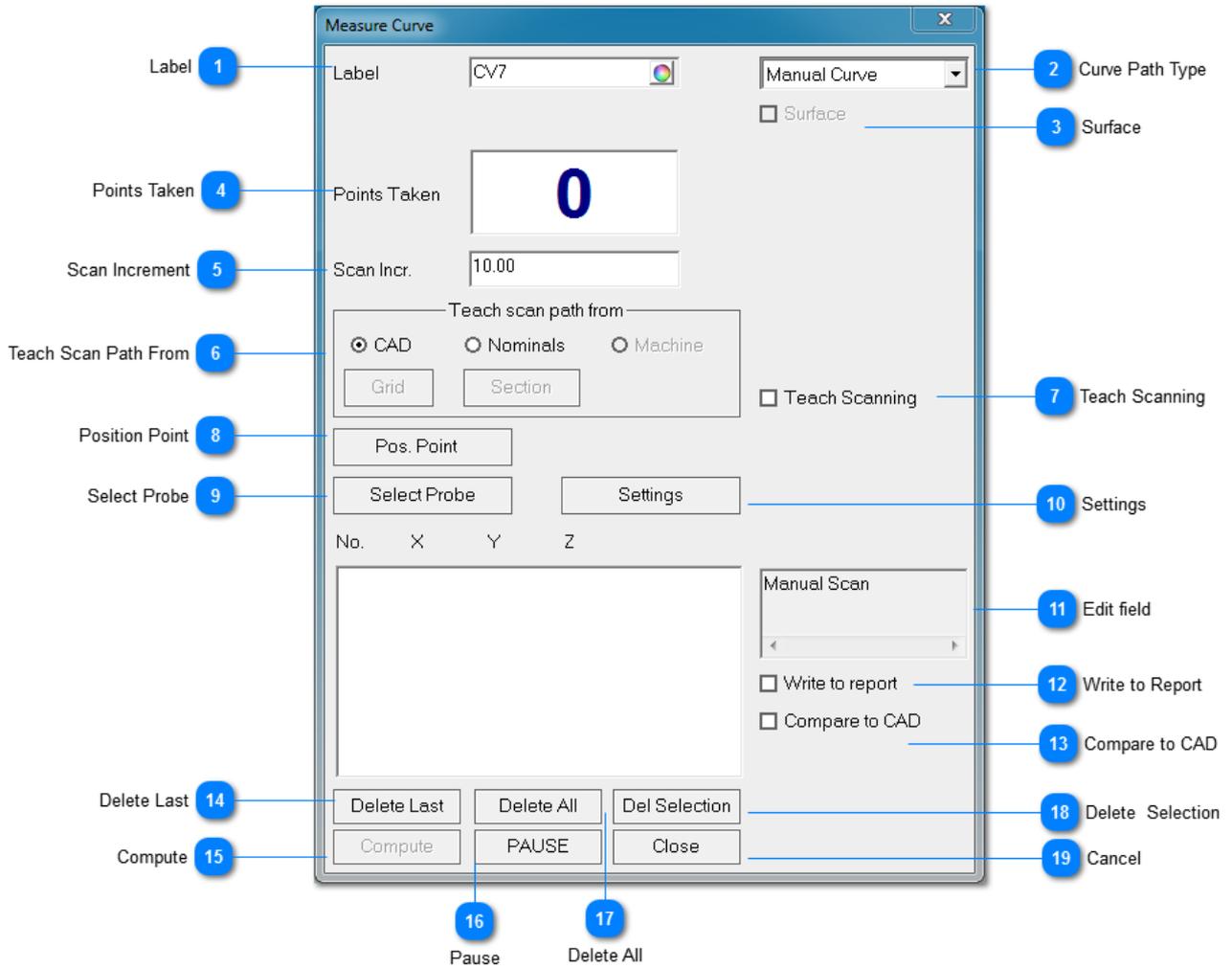
4 Meas Point



This allows the user to measure a series of data points using the CAD wire frame curve as nominal. A good application for this may be when checking a trim line layout on a fixture, or when checking a plastic or sheet metal part trim line where surface data is not available.

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Touch Scanning Dialog Box



1 Label



Used to input an alpha numeric name for the feature. Spaces and wildcard characters should be avoided when naming a feature. However dashes and underscores may be used.

2 Curve Path Type

Manual Curve

Manual Curve:	Allows the user to take each touch point on the scan line manually. This would be more applicable in a manual CMM application.
Automatic Curve:	The user will take 3 hits to initialize an automatic curve. A start, direction, and end point are required. Once these 3 hits are taken, click on the Compute button to begin scanning.
Surface Scan:	This option is for taking multiple scan lines in one operation. Required points are start, direction, first boundary, second boundary, and end. Once these 5 hits are taken, click on the Compute button to begin scanning. For more details on how to use this option, see the section in this document on Surface touch scanning.

3 Surface

Surface

Check this box to enable surface function of the selected scan type.

4 Points Taken

Points Taken

Acts as a point counter for the scan touches.

5 Scan Increment

Scan Incr. 10.00

Spacing between point touches on the scan line. This can also be configured in the settings menu.

6 Teach Scan Path From

Teach scan path from

CAD
 Nominals
 Machine

Used to specify how the scan path will be generated.

7 Teach Scanning

Teach Scanning

Writes the DMIS code for scanning without actually performing the scanning.

8 Position Point

Pos. Point

Allows the user to pause scanning and insert position moves for DMIS mode execution.

9 Select Probe

Select Probe

Allows the user to pause scanning and insert and probe changes for DMIS mode execution.

10 Settings

Settings

Used to open the [Scanning Settings](#) window.

11 Edit field

Manual Scan

Display the type of the active scanning type.

12 Write to Report

Write to report

Used to write the curve data to the [Results Window](#).

13 Compare to CAD

Compare to CAD

Used to drop the curve on the CAD model surface after finishing the scanning.

14 Delete LastA rectangular button with a light gray background and a thin black border, containing the text "Delete Last" in a standard sans-serif font.

Deletes the last point from the list.

15 ComputeA rectangular button with a light gray background and a thin black border, containing the text "Compute" in a standard sans-serif font.

Used to compute the scanning path.

16 PauseA rectangular button with a light gray background and a thin black border, containing the text "PAUSE" in a standard sans-serif font.

Used to pause the scanning process.

17 Delete AllA rectangular button with a light gray background and a thin black border, containing the text "Delete All" in a standard sans-serif font.

Deletes all the points from the list.

18 Delete SelectionA rectangular button with a light gray background and a thin black border, containing the text "Del Selection" in a standard sans-serif font.

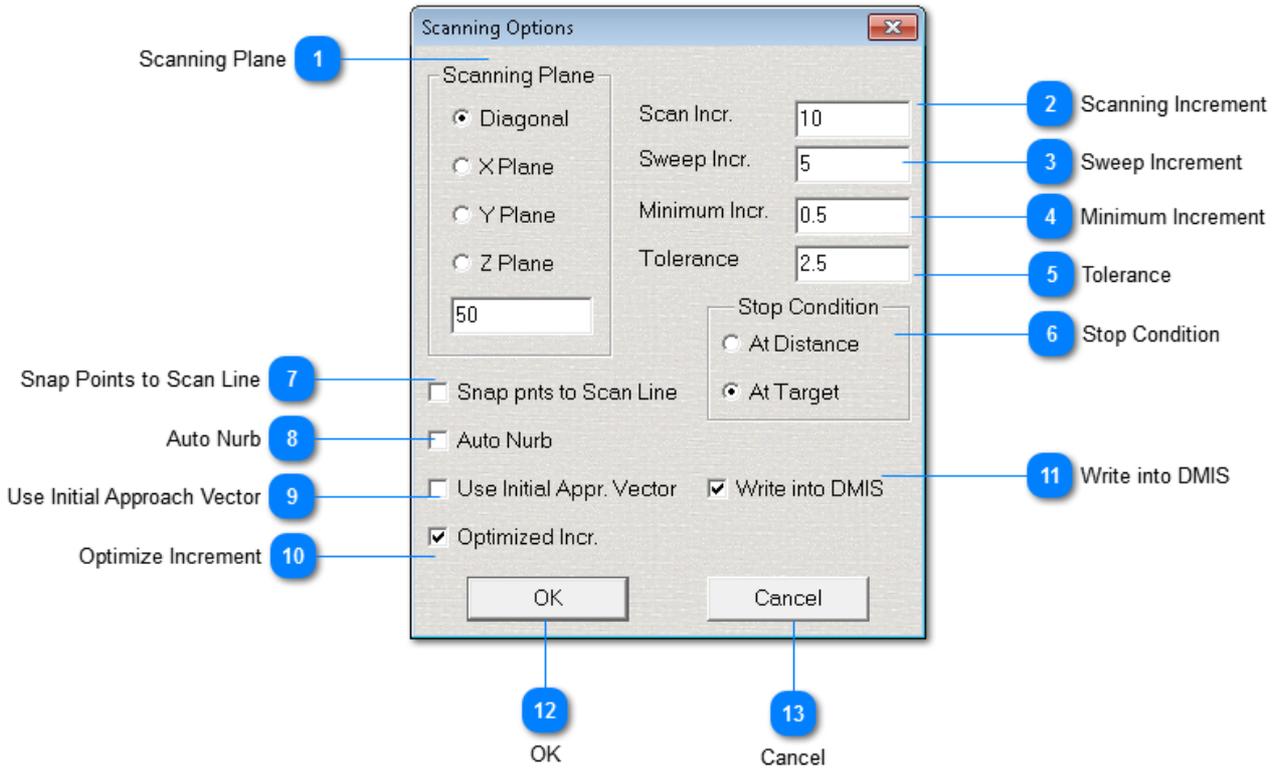
Deletes the selected point from the list.

19 CancelA rectangular button with a light gray background and a thin black border, containing the text "Close" in a standard sans-serif font.

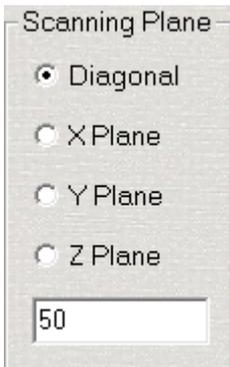
Cancel the changes and close the dialog.

[Scanning and Digitizing](#)

Scanning Settings



1 Scanning Plane



Diagonal:	Creates a diagonal plane for scanning based on the start point, direction point and the end point.
X Plane:	Creates a plane along the X axis at the value in the Location Box.
Y Plane:	Creates a plane along the Y axis at the value in the Location Box.
Z Plane:	Creates a plane along the Z axis at the value in the Location Box.
Location Box:	Used to specify the location along the selected axis.

2 Scanning Increment

Scan Incr.

3 Sweep Increment

Sweep Incr.

In a grid scan its the opposite side increment other than the scanning increment.

4 Minimum Increment

Minimum Incr.

Used to set Minimum Increment between scanning points.

5 Tolerance

Tolerance

Used to define a tolerance value for the scanning curve. If the points are out of the tolerance, CAPPS automatically reduce/increase the number of points for the section. This comes handy for scanning of the curved edges and by increasing the points for the edge makes the curve as accurate as possible.

6 Stop Condition

Stop Condition
 At Distance
 At Target

At Distance:	Defines the end point of the scan based on the distance away from the start point through the direction point.
At Target:	Defines the end point of the scan directly at the end point through the direction point.

7 Snap Points to Scan Line

Snap pnts to Scan Line

Used with arms. This function will take a point every time the probe crosses the scanning plane defined in the [Scanning Plane](#) menu.

8 Auto Nurb Auto Nurb

Used to create spline curves.

9 Use Initial Approach Vector Use Initial Appr. Vector

Used to set the approach direction for all points of the scan.

10 Optimize Increment Optimized Incr.

This option will automatically adjust the Scanning Increment based on the complexity of the surface. This option uses the Minimum Increment and Tolerance.

11 Write into DMIS Write into DMIS

Writes DMIS codes for scanned curves.

12 OK

OK

Applies the changes.

13 Cancel

Cancel

Cancel the changes and close the dialog.

[Touch Scanning Dialog Box](#)

Statistical Process Control (SPC)

Statistical Process Control (SPC) allows engineers to understand and monitor process variation through control charts. Control charts are constructed by plotting a product's quality variable over a period of time on a sequence plot. The variable plotted can be either a quantitative characteristic (diameter) or a qualitative attribute (defective or non defective light bulb) of a manufactured product.

The power of SPC control charts lies in its ability to separate two types of variation in a product's quality characteristic:

- 1) Variation due to assignable causes.
- 2) Random variation.

Variations due to assignable causes are produced due to factors such as wear in a metallic cutting machine, wear in an abrasive wheel, and changes in the humidity and temperature in the production area, worker fatigue and so on.

Even when variation due to assignable causes is accounted for, measurements taken on a product's quality characteristic tend to vary in a random manner from one point to another. This second category of variation – random (or chance) variation is caused by minute and random changes in raw materials, worker behavior and so on.

A production process is said to be in control when the quality characteristic of a product are subject only to random variation.

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Variable Control Charts

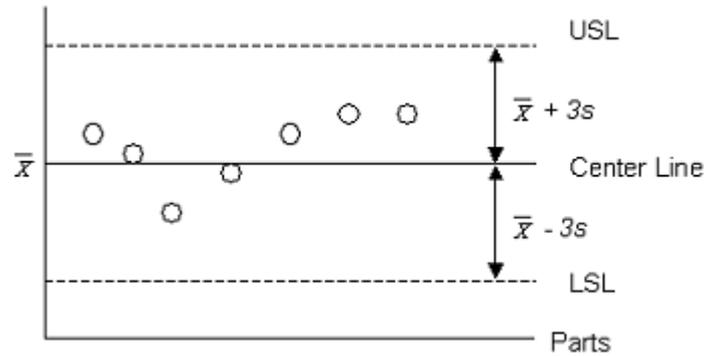
A variable control chart consists of a centerline and a set of control limits established by the part manufacturer.

The centerline for a variable control chart is the mean (\bar{X}) of the sample measurements.

The Lower Specification (control) Limit (LSL) and upper specification limit (USL) for a variable control chart is calculated as follows:

$$LSL = \bar{X} - 3s \quad USL = \bar{X} + 3s$$

where s is the standard deviation of the sample measurements.



Variable Control Charts

Control Charts For Means

A control chart constructed to monitor quantitative quality characteristics is usually based on random samples of several units of the product rather than individual industrial units. A plot showing the mean of samples, one mean corresponding to each point in time, is called a control chart for means.

For the mean control charts, process parameters are estimated depending on the sample size. For example, the process standard deviation σ is usually unknown, but can be estimated from a large sample of data collected while the process is in control. Prior to advent of computers, it was common to estimate σ by first computing the sample range R , the difference between the largest and smallest measurements. The process standard deviation σ was then estimated by dividing the average \bar{R} of k sample ranges by a constant d_2 , the value which depend on the sample size n .

$$USL = \bar{X} + A_2 * R \quad \text{Center Line} = \bar{X} = \frac{\sum_{i=1}^k \bar{x}_i}{k}$$

$$LSL = \bar{X} - A_2 * R \quad \text{Range} = \bar{R} = \frac{\sum_{i=1}^k R_i}{k}$$

where,

k = Number of samples, each of size n

\bar{x}_i = Sample mean for the i^{th} sample

R_i = Range of the i^{th} sample

d_2 and A_2 = constants whose values are given in tables.

Example 1: Suppose the process for manufacturing electrical shafts is in control. At the end of each hour, for a period of 20 hours, the manufacturer selected four shafts at random and measured the diameter for each. The measurements (in inches) for the 20 samples are recorded. Construct a control chart for the sample means.

Samples of $n=4$ shaft diameters are illustrated in **Table 1**.

Sample Number	Sample Measurements (in)	Sample Mean, \bar{x}_i	Range, \bar{R}_i			
1	1.505	1.499	1.501	1.488	1.4983	0.17
2	1.496	1.513	1.512	1.501	1.5055	0.17
3	1.516	1.485	1.492	1.503	1.4990	0.031
4	1.507	1.492	1.511	1.491	1.5003	0.020
5	1.502	1.491	1.501	1.502	1.4990	0.011
6	1.502	1.488	1.506	1.483	1.4948	0.023
7	1.489	1.512	1.496	1.501	1.4995	0.023
8	1.485	1.518	1.494	1.513	1.5025	0.033
9	1.503	1.495	1.503	1.496	1.4993	0.008
10	1.485	1.519	1.503	1.507	1.5035	0.034
11	1.491	1.516	1.497	1.493	1.4993	0.025
12	1.486	1.505	1.487	1.492	1.4925	0.019
13	1.510	1.502	1.515	1.499	1.5065	0.016
14	1.495	1.485	1.493	1.503	1.4940	0.018
15	1.504	1.499	1.504	1.500	1.5018	0.005
16	1.499	1.503	1.508	1.497	1.5018	0.011
17	1.501	1.493	1.509	1.491	1.4985	0.018
18	1.497	1.510	1.496	1.500	1.5008	0.014
19	1.503	1.526	1.497	1.500	1.5065	0.029
20	1.494	1.501	1.508	1.519	1.5055	0.025

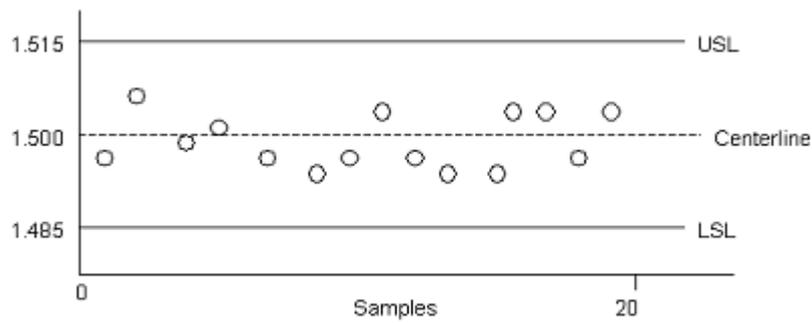
$$\text{Center Line} = \bar{x} = \frac{\sum_{i=1}^k \bar{x}_i}{k} = \frac{(1.4983 + 1.5055 + 1.4990 + \dots + 1.5055)}{20} = 1.50045$$

$$\text{Range} = \bar{R} = \frac{\sum_{i=1}^k R_i}{k} = \frac{(0.017 + 0.017 + 0.031 + \dots + 0.025)}{20} = 0.01985$$

The value 1.50045 locates the centerline on the control chart. To find the upper and lower specification limits, we need the value of the control limit factor **A2**. For **n=4** and **sample size 20**, this value is **0.729**.

$$\text{Hence, USL} = \bar{x} + A2 * \bar{R} = 1.50045 + (0.729) * (0.01985) = 1.51492$$

$$\text{LSL} = \bar{x} - A2 * \bar{R} = 1.50045 - (0.729) * (0.01985) = 1.48598$$



Means Control Charts

[Statistical Process Control \(SPC\)](#)

Control Chart For Process Variation

In quality control, it is important to control not only the mean value of some quality characteristic, but also its variability. An increase in the process standard deviation σ means that the quality characteristic variable will vary over a wider range, thereby increasing the probability of producing an inferior product.

The variation in a quality characteristic is monitored using a range chart or **R-chart**. Thus, in addition to calculating mean \bar{X} for each sample, we also calculate and plot the **sample range R**. As with an \bar{X} -chart, an **R-chart** also contains a centerline and lines corresponding to the upper and lower control limits.

$$\text{Centerline} = \text{Range} = \bar{R} = \frac{\sum_{i=1}^k R_i}{k}$$

$$\text{UCL} = D4 * \bar{R}$$

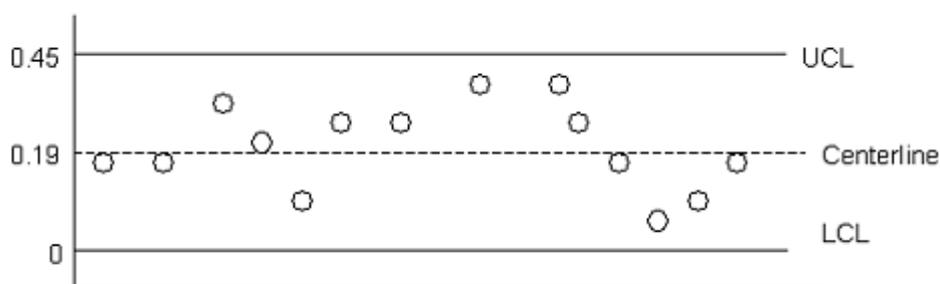
$$\text{LCL} = D3 * \bar{R}$$

D3 and **D4** are constants that depend on the **sample size n**.

In **Example 1**, we calculated the mean of the **20 sample ranges** as $\bar{R} = 0.01985$; this value is the centerline. For **n=4**, the values of **D3** and **D4** given in tables as **D3=0** and **D4=2.282**. Then, upper and lower control limits for the \bar{R} chart are:

$$\text{UCL} = D4 * \bar{R} = (2.282) * (0.01985) = 0.45298$$

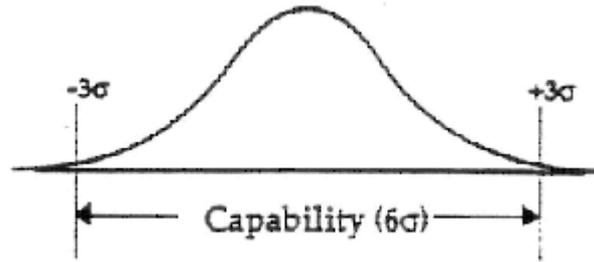
$$\text{LCL} = D3 * \bar{R} = 0$$



Range Control Charts

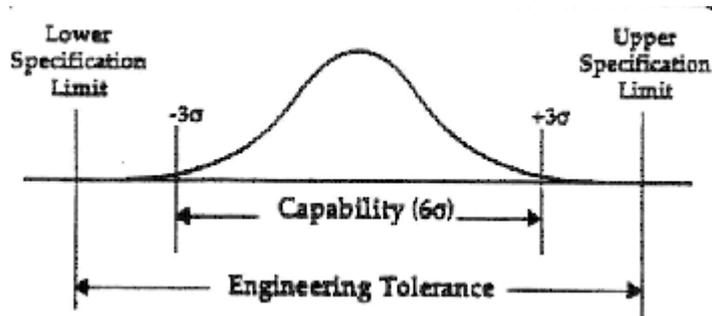
Process Capability

The capability (or spread) in a process is defined as the common cause variation of the population. It can be viewed as the width of the histogram, and can be interpreted as the limits within which all individual process measurements can be expected to fall.



Process Capability

Mathematically, capability is defined as the six sigma (6σ) spread calculated from a set of individual measurements. By comparing the capability of a process to required engineering tolerances, one can determine whether the process is going to produce our tolerance product. This type of comparison is called a Process Capability Study.



Engineering Tolerance and Process Capability

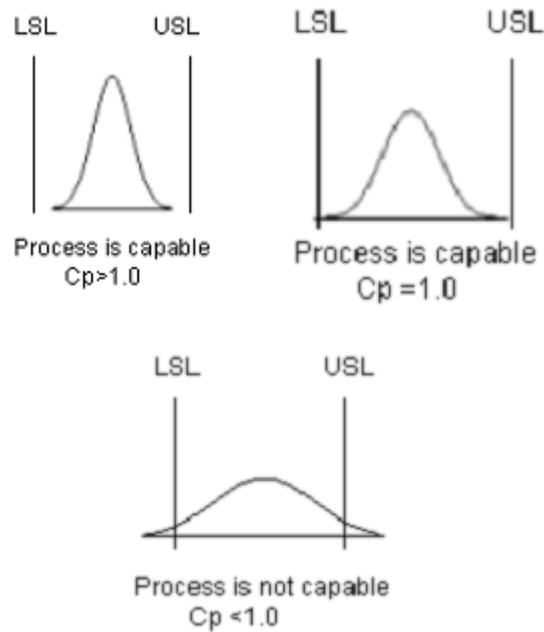
[Statistical Process Control \(SPC\)](#)

Cp & Cpk Ratio

Cp Ratio

The **Cp Ratio** is the engineering tolerance divided by the 6σ spread in the output of the process.

$$Cp = \frac{\text{Engineering Tolerance}}{6\sigma}$$

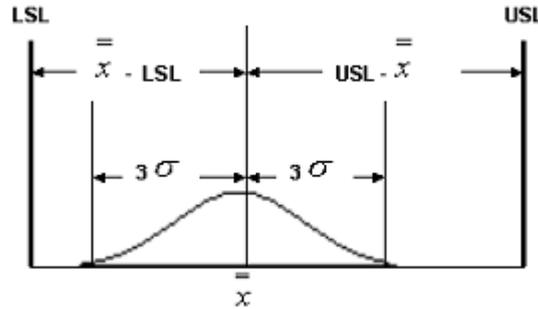


Cp Ratio

The **Cp** compares the width of the engineering tolerance with the width of the histogram. There is no information on the centering of the histogram. The **Cp** identifies if the dispersion of the process data is too wide to meet the tolerance and only provides an indication of potential fallout if the process were centered. The **Cp Ratio** is sometimes called the process potential.

Cpk Ratio

The **Cpk** is a capability ratio that takes into account the width of the process as well as the centering and compares them to each of the specifications. Also, the **Cpk** focuses on **the worst case scenario** which is the specification limit that is closest to the process average. If the **Cpk** indicates that a process is not capable then both the location (process average) and dispersion are candidates for improvement.

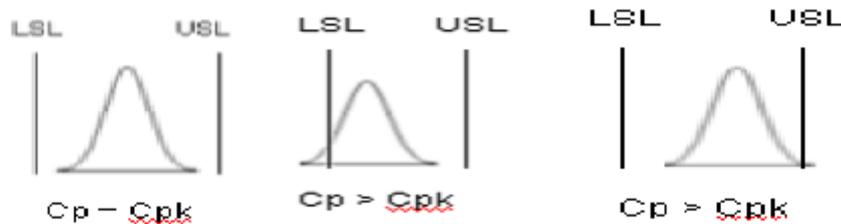


Cpk Ratio

The Reported Cpk = The Minimum of [Cpk (upper), Cpk (lower)]

$$Cpk \text{ (upper)} = \frac{UpperSpec - \bar{x}}{3\sigma} \qquad Cpk \text{ (lower)} = \frac{\bar{x} - LowerSpec}{3\sigma}$$

A **Cpk** is always less than or equal to the **Cp**. They are only equal when the process is centered. The closer the **Cp** and **Cpk**, the more centered the process.

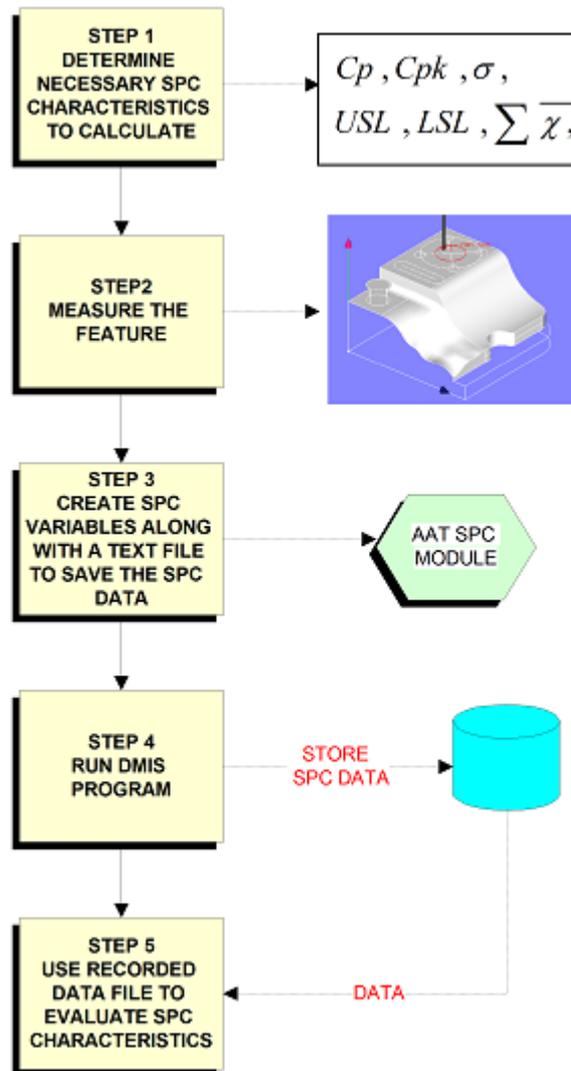


Relationship between Cp and Cpk

[Statistical Process Control \(SPC\)](#)

AAT Statistical Process Control(SPC) Unit

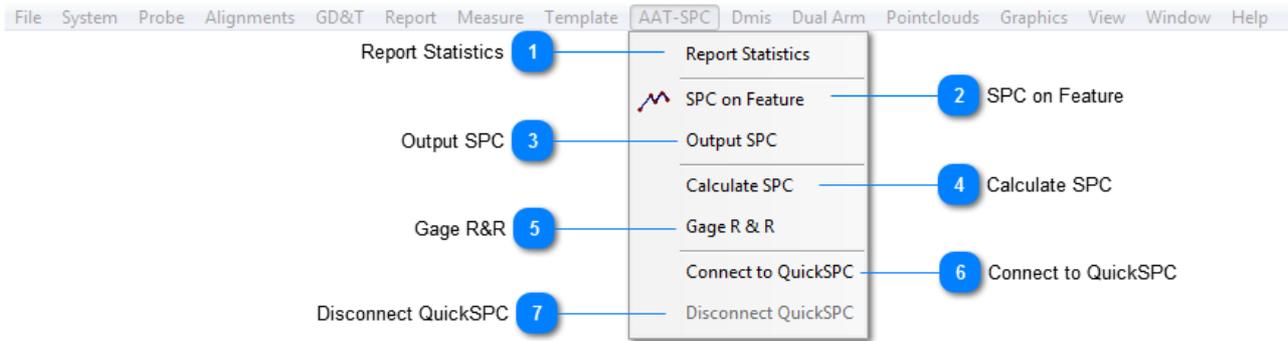
Statistical parameter(s) of a measured feature are calculated from database files located at **Capps6(or CappsDmis)\Files\SPC**. When a feature's **SPC** parameters are configured CAPPs will create the necessary files in the folder and use these to calculate **SPC** parameters. These files will be updated by CAPPs whenever the program is run. We can summarize the usage of AAT SPC module as follows:



Process of Calculating SPC Data in CAPPs

Statistical parameters can only be calculated for features that have an appropriate database file in the SPC folder. AAT SPC module is used to perform process capability, gage reliability and reproducibility studies. It has the ability to create samples from CAPPs results file and permit the user to edit, delete or insert samples any time during analysis.

Independent menu system allows the user to track several processes concurrently, without having to quit one before selecting another. This also provides complete flexibility in inputting data, creating SPC files quickly for analysis, plotting charts and making SPC outputs available any time during analysis.



1 Report Statistics

Report Statistics

This function is used to perform SPC calculations using the information contained in the current report. There is also an option to load an existing report for analysis.

2 SPC on Feature

SPC on Feature

This function is used to obtain the, create a database file, obtain the measurement data, and write it to the SPC database file.

3 Output SPC

Output SPC

This function is used read the data from the SPC database file and calculate the desired SPC outputs (i.e. **Cp**, **CpK**, **Range**, **Min**, **Max**.....).

4 Calculate SPC

Calculate SPC

This function is used to read the data from the selected SPC database file and calculate desired SPC outputs (i.e. **Cp**, **CpK**, **Range**, **Min**, **Max**.....) real time. Currently this function only creates report data and charts; no DMIS code is created with this function.

5 Gage R&R

Gage R & R

This function is used to read the data from a selected SPC database file and create **Gage R&R** reports.

6 Connect to QuickSPC

Connect to QuickSPC

Used to connect to **QuickSPC**.

7 Disconnect QuickSPC

Disconnect QuickSPC

Used to disconnect from **QuickSPC**.

[Statistical Process Control \(SPC\)](#)

Report Statistics

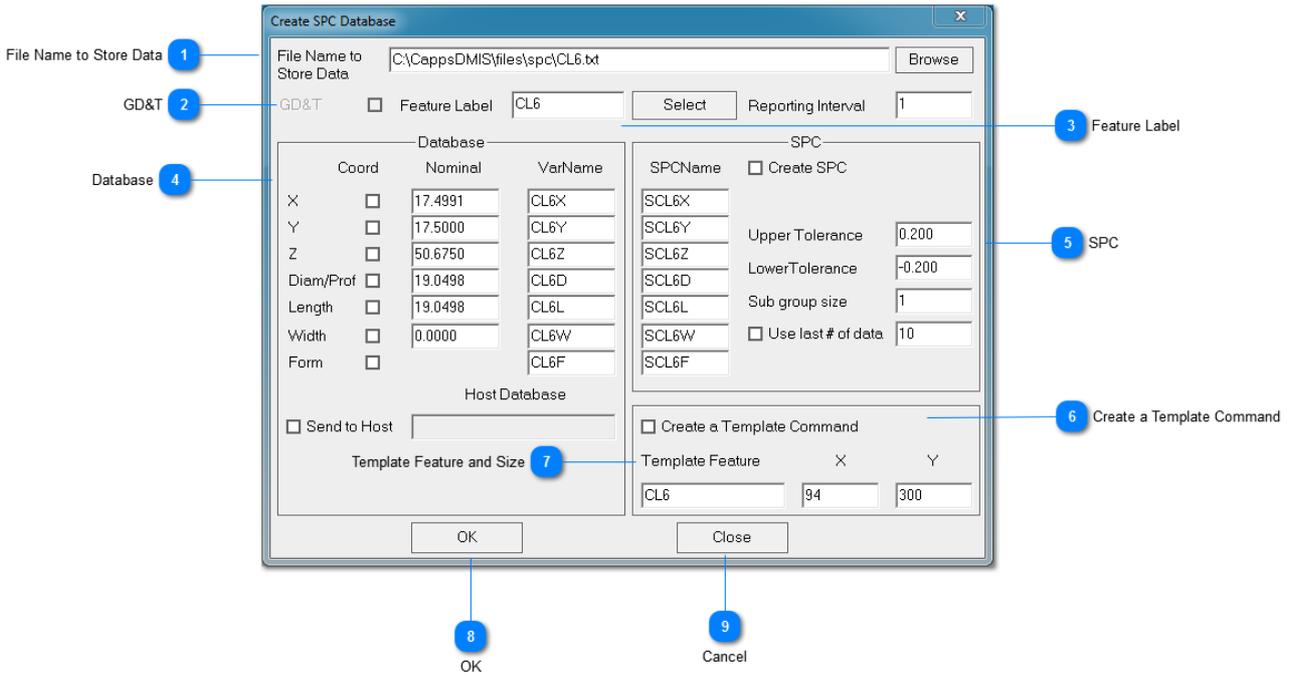
The **Report Statistics** function is used to create **SPC** outputs based on the actual measured dimensions or deviation from nominal of a selected axis or profile if points are used. The data used for calculation is either obtained from the current report or a selected saved report.

Important Note: This function does **NOT** write DMIS code to the program and is only designed to add SPC outputs and charts to the current report.

CAPPS results files are input directly into an **SPC database**. These SPC files can be updated at any time, saving data entry time for multiple feature parts. The menu driven user interface allows the operator to start analyzing data immediately. AAT SPC incorporates a mouse driven user interface and features efficient interval file management. Data is transferable to spreadsheets and other database programs.

[Statistical Process Control \(SPC\)](#)

Create SPC Database Window

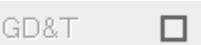


1 File Name to Store Data



Enter the filename and path to store the database file. The default location is **C:\Capps6(or CappsDmis)\Files \SPC** and the default file name is the feature label. Note: both the file name and the location may be changed.

2 GD&T



Check this box to change the Database selections to output the **GD&T** related to the feature type selected (i.e. **T.P. for Circle**)

3 Feature Label

Feature Label

Shows the feature selected for SPC data collection. Click the Select button to select from the actual feature list.

4 Database

Database

	Coord	Nominal	VarName
X	<input type="checkbox"/>	<input type="text" value="17.4991"/>	<input type="text" value="CL6X"/>
Y	<input type="checkbox"/>	<input type="text" value="17.5000"/>	<input type="text" value="CL6Y"/>
Z	<input type="checkbox"/>	<input type="text" value="50.6750"/>	<input type="text" value="CL6Z"/>
Diam/Prof	<input type="checkbox"/>	<input type="text" value="19.0498"/>	<input type="text" value="CL6D"/>
Length	<input type="checkbox"/>	<input type="text" value="19.0498"/>	<input type="text" value="CL6L"/>
Width	<input type="checkbox"/>	<input type="text" value="0.0000"/>	<input type="text" value="CL6W"/>
Form	<input type="checkbox"/>		<input type="text" value="CL6F"/>

Host Database

Send to Host

This section is used to set which feature dimensions will be written to the database file, the nominal dimension, and the variable used in the DMIS code.

Coord:	Use the check boxes to select which dimensions are written to the database file.
Nominal:	This value is automatically input based on the nominal used for feature measurement. If a different nominal is to be used simply type it in the box.
VarName:	This variable is used in the DMIS code to store the dimensional information. If a different variable name is to be used simply type it in the box.

5 SPC

SPC

SPCName Create SPC

SCL6X

SCL6Y Upper Tolerance 0.200

SCL6Z Lower Tolerance -0.200

SCL6D Sub group size 1

SCL6L Use last # of data 10

SCL6W

SCL6F

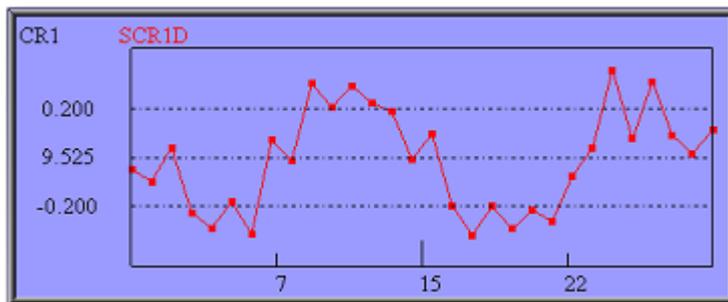
This section is used to create SPC for the features selected in the Database section of the dialog.

Create SPC:	This box MUST be checked if the data written to the database file is going to be used to SPC analysis.
SPCName:	This variable is used in the DMIS code to store the SPC information pertaining to the dimensional information. If a different variable name is to be used simply type it in the box
Upper Tolerance:	Upper tolerance applied to the feature dimensions.
Lower Tolerance:	Lower tolerance applied to the feature dimensions.
Subgroup Size:	Subgroup size used for process capability calculations.
Use Last # of Data:	Use this option to select only use the last set of data in a database file.(i.e. use the last 30 sets of a database file with 100 entries)

6 Create a Template Command

Create a Template Command

Check this box to create a template command for a run chart. See figure below for an example.



SPC Graphical Run Chart

7 Template Feature and Size

Template Feature	X	Y
CL6	94	300

This is automatically set to the feature selected in the **Feature Label**. Length and width of the **SPC Graphical Run Chart Template**.

8 OK

Click **OK** to accept the information set in this dialog.

9 Cancel

Cancel the changes and close the dialog.

DMIS code generated by the SPC on feature function.

```

$$ Writing Database commands -----
DECL/STRING,DATE,TIME
DATE=OBTAIN/DATE
TIME=OBTAIN/TIME
DECL/REAL,CR1X,CR1Y,CR1Z,CR1D
CR1X=CR1.X
CR1Y=CR1.Y
CR1Z=CR1.Z
CR1D=CR1.D
DID(FSPCCR1)=DEVICE/STOR,'C:\Capps6\files\spc\CR1.txt'
OPEN/DID(FSPCCR1),DIRECT,OUTPUT,APPEND
WRITE/DID(FSPCCR1),DATE,TIME,CR1X,CR1Y,CR1Z,CR1D
CLOSE/DID(FSPCCR1),KEEP
$$$$
$$$SPC=VarName,VarNom,-T,+T,GroupSize
OPEN/DID(FSPCCR1),DIRECT,INPUT,APPEND
SPC(SCR1X)=SPC/STDDEF,CR1X,29.5038,-0.2000,0.2000,1
EVAL/SPC(SCR1X),DID(FSPCCR1),3
SPC(SCR1Y)=SPC/STDDEF,CR1Y,95.4962,-0.2000,0.2000,1
EVAL/SPC(SCR1Y),DID(FSPCCR1),4
SPC(SCR1Z)=SPC/STDDEF,CR1Z,62.5000,-0.2000,0.2000,1
EVAL/SPC(SCR1Z),DID(FSPCCR1),5
SPC(SCR1D)=SPC/STDDEF,CR1D,25.4000,-0.2000,0.2000,1
EVAL/SPC(SCR1D),DID(FSPCCR1),6
CLOSE/DID(FSPCCR1),KEEP
CAPPS/TEMPLT,SPCHRT,SPC(SCR1X),SPC(SCR1Y),SPC(SCR1Z),FA(SCR1D),FACR1,0,600

```

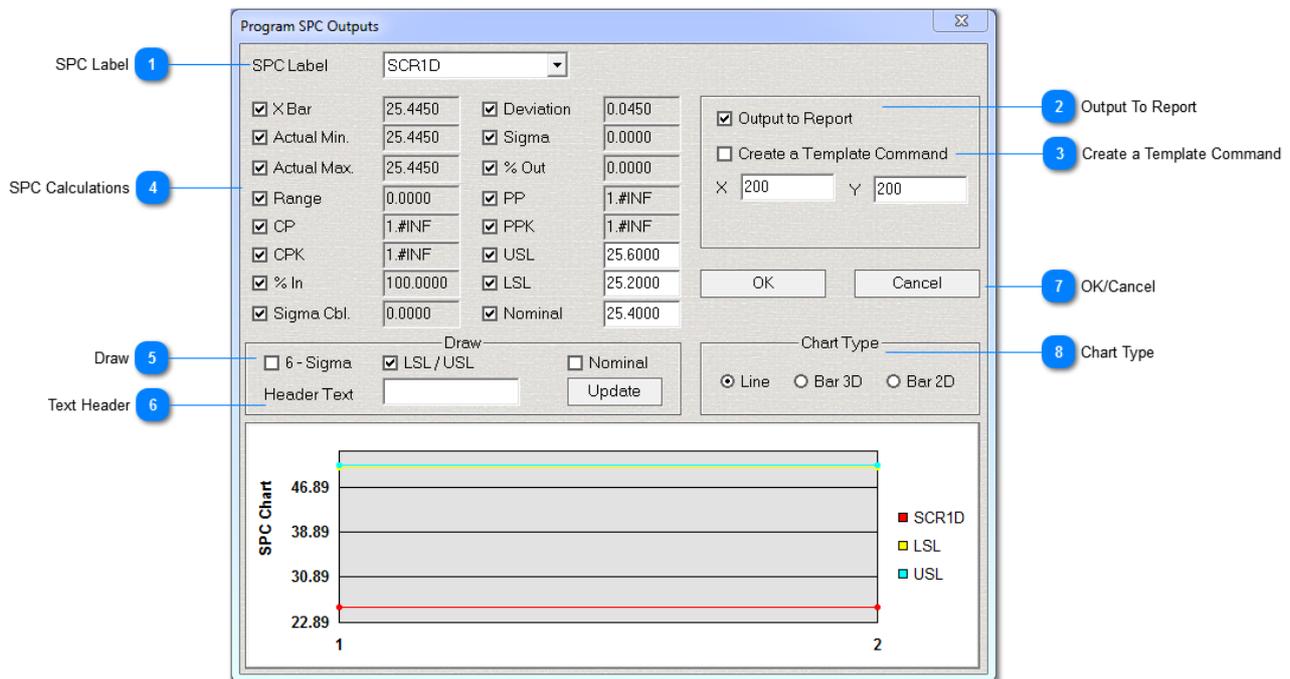
SPC data file after program execution:

1/21/2010	15:32:57	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:32:59	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:00	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:02	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:03	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:04	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:06	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:07	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:08	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:09	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:11	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:12	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:13	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:15	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:16	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:17	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:19	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:20	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:22	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:23	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:24	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:26	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:27	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:28	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:30	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:31	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:33	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:34	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:35	11.5432	113.4568	62.5000	9.5250
1/21/2010	15:33:37	11.5432	113.4568	62.5000	9.5250

[Statistical Process Control \(SPC\)](#)

Output SPC

[Output SPC](#) is located in the [AAT SPC Unit](#), the output SPC function is designed to use the measured data in the SPC data file and calculate SPC data. The calculated SPC information is added to the DMIS program and the report.



1 SPC Label

SPC Label

Use this option to select the set of data to perform SPC calculations. Based on the information set in section 1.7 of this document, SPC on Feature four choices are available; **X Coordinate (SCR1X)**, **Y Coordinate (SCR1Y)**, **Z Coordinate (SCR1Z)**, and **Diameter (SCR1D)**. Select the desired SPC label, the information will be calculated automatically. Please note that the calculations are based on the subgroup size and tolerance set in the [SPC on Feature](#) dialog.

2 Output To Report

Output to Report

Check this box to add all of the selected SPC calculations to the report.

3 Create a Template Command

Create a Template Command

Check this box to create an **SPC Text** style template which includes all of the selected SPC calculations. The numbers below this item designate the size of the template.

4 SPC Calculations

<input checked="" type="checkbox"/> X Bar	25.4450	<input checked="" type="checkbox"/> Deviation	0.0450
<input checked="" type="checkbox"/> Actual Min.	25.4450	<input checked="" type="checkbox"/> Sigma	0.0000
<input checked="" type="checkbox"/> Actual Max.	25.4450	<input checked="" type="checkbox"/> % Out	0.0000
<input checked="" type="checkbox"/> Range	0.0000	<input checked="" type="checkbox"/> PP	1.#INF
<input checked="" type="checkbox"/> CP	1.#INF	<input checked="" type="checkbox"/> PPK	1.#INF
<input checked="" type="checkbox"/> CPK	1.#INF	<input checked="" type="checkbox"/> USL	25.6000
<input checked="" type="checkbox"/> % In	100.0000	<input checked="" type="checkbox"/> LSL	25.2000
<input checked="" type="checkbox"/> Sigma Cbl.	0.0000	<input checked="" type="checkbox"/> Nominal	25.4000

Check the box next to the desired SPC calculations. This information will be added to the report if the [Output To Report](#) option is selected.

5 Draw

Draw

6 - Sigma
 LSL / USL
 Nominal

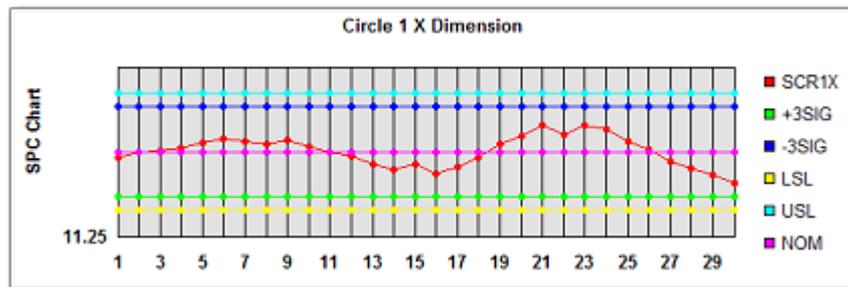
Header Text

6 Sigma	Check this option to show the 6 Sigma boundary lines on the chart.
LSLUSL	Check this option to show the USL\LSL boundary lines on the chart.
Nominal	Check this option to show the USL\LSL boundary lines on the chart.

6 Text Header

Header Text

Used to enter a header for the chart.



The chart to the above is an example of a chart with all of the items enabled.

7 OK/Cancel

Press the **OK** Button to accept **Output SPC**, **Cancel** to cancel the changes and close the dialog.

8

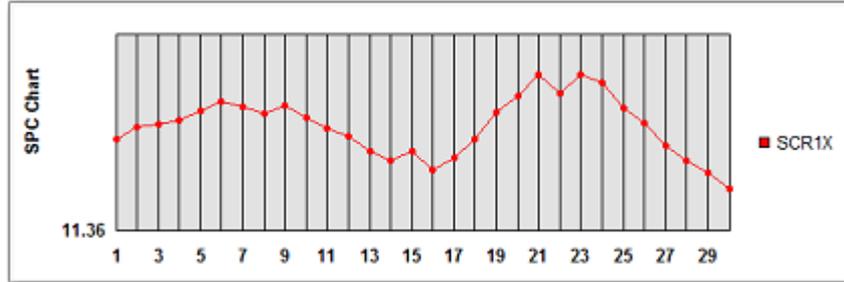
Chart Type

Chart Type

Line Bar 3D Bar 2D

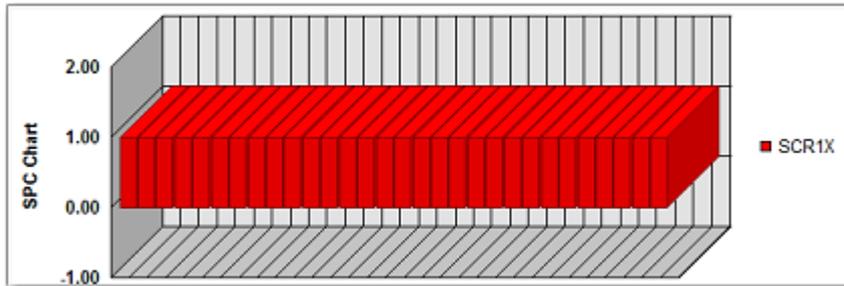
Line

Select this option to see the chart shown below.



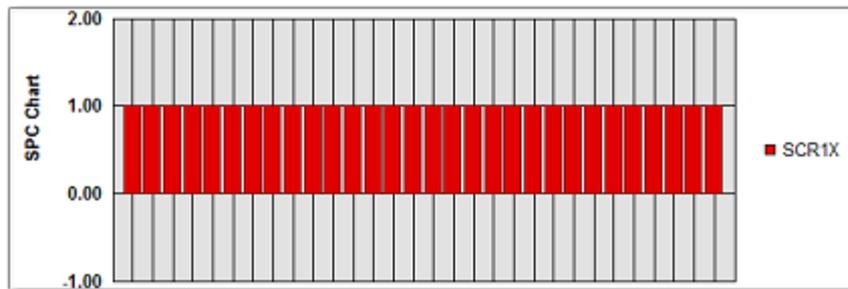
Bar 3D

Select this option to see the chart shown below.



2D Bar

Select this option to see the chart shown below.



[Statistical Process Control \(SPC\)](#)

Gage R&R

The [Gage R&R](#) function in CAPPS uses a text file output from a run program to calculate the desired data. This document will explain how to generate this file and use it to calculate this information.

This section is set up in three parts:

- Generating the data file
- Calculating the data using the Gage R&R option.
- Outputting the computed Gage R&R report.

Generating The Data

Typically, a program used to obtain **Gage R&R** information on a feature is run in a **loop**. This means that the same feature measurement and is run over and over a certain number of times to obtain, and write, the correct amount of information. This section focuses on that method but there are other ways to obtain the **Gage R&R** information.

- Start a learn program
- Set up the part to measure the feature for the **Gage R&R** study.
- Click on the DMIS drop down menu and select the **DoLoop** option. This opens the **Do Loop** and should be the last thing done right before measuring the feature to be used in the **Gage R&R** study.
- Measure the feature you want to use for the **Gage R&R** study.
- Click on the [AAT SPC Menu](#) and select the [SPC On Feature](#) option.

- The following dialog box will appear. Notice the dialog is filled up with information pertaining to the last feature measured, however, the dialog can be updated to reflect any feature in the nominal list by clicking on the Select button. The filename for the data file can be changed as well by editing the **File Name To Store Data** box. However, the location of the data file cannot be changed and must remain as default.

Calculate SPC Parameters [X]

<input checked="" type="checkbox"/> X Bar	<input type="text"/>	<input checked="" type="checkbox"/> Deviation	<input type="text"/>	Sub Group	<input type="text" value="1"/>
<input checked="" type="checkbox"/> Actual Min.	<input type="text"/>	<input checked="" type="checkbox"/> Sigma	<input type="text"/>	Column No.	<input type="text" value="3"/>
<input checked="" type="checkbox"/> Actual Max.	<input type="text"/>	<input checked="" type="checkbox"/> % Out	<input type="text"/>	<input type="checkbox"/> Don't Report SPC Chart	
<input checked="" type="checkbox"/> Range	<input type="text"/>	<input checked="" type="checkbox"/> PP	<input type="text"/>	Select All	
<input checked="" type="checkbox"/> CP	<input type="text"/>	<input checked="" type="checkbox"/> PPK	<input type="text"/>	Unselect All	
<input checked="" type="checkbox"/> CPK	<input type="text"/>	<input checked="" type="checkbox"/> USL	<input type="text" value="0.5"/>	Output	
<input checked="" type="checkbox"/> % In	<input type="text"/>	<input checked="" type="checkbox"/> LSL	<input type="text" value="-0.5"/>	Close	
<input checked="" type="checkbox"/> Sigma Cbl.	<input type="text"/>	<input checked="" type="checkbox"/> Nominal	<input type="text" value="0.0"/>	Generate SPC	

Calculate SPC

C:\CappsDMIS\Files\Spc

Label

Draw

6 - Sigma LSL / USL Nomina

Comment

Select SPC

Chart Type

Line Bar 3D Bar 2D

- Select the information to be written to the data file by checking the correct checkbox. In this example the diameter of **CIR1** is the selected feature but more information about **CIR1** may be selected if the user desires. None of the information on the right side of the dialog should be checked (**SPC section**).
- After all information has been selected click **OK**.
- Click on the [DMIS Menu](#) and click again on the [DoLoop option](#). This will close the **Do Loop** and complete the program. At this time, the only way to change the number of times the **Do Loop** will loop is to edit the DMIS code. To change this, simply change the second number of the **DO/1,40,1** line to the number of times the loop should run. Below is the sample code of the just the do loop generated by this example.

```

DECL/INTGR, I,
DO/I, 1, 40, 1
F(CIR1)=FEAT/CIRCLE, INNER, CART, $
    11.5432, 113.4568, 62.5000, -0.000, 0.000, 1.000, 9.5250
MEAS/CIRCLE, F(CIR1), 4
GOTO/8.5432, 113.4568, 72.5000
PTMEAS/CART, 16.3057, 113.4568, 57.5000, -1.0000, -0.0000, -0.0000
PTMEAS/CART, 11.5432, 118.2193, 57.5000, -0.0000, -1.0000, 0.0000
PTMEAS/CART, 6.7807, 113.4568, 57.5000, 1.0000, -0.0000, 0.0000
PTMEAS/CART, 11.5432, 108.6943, 57.5000, 0.0000, 1.0000, -0.0000
GOTO/11.5432, 116.4568, 72.5000
ENDMES
OUTPUT/FA(CIR1), TA(X1), TA(Y1), TA(Z1), TA(DIA_TOL)
$$ Writing Database commands -----
DECL/STRING, DATE, TIME,
DATE=OBTAIN/DATE
TIME=OBTAIN/TIME
DECL/REAL, CIR1D,
CIR1D=OBTAIN/FA(CIR1), 4
DID(FSPCCIR1)=DEVICE/STOR, 'C:\Capps6\files\spc\CIR1GRR.txt'
OPEN/DID(FSPCCIR1), DIRECT, OUTPUT, APPEND
WRITE/DID(FSPCCIR1), DATE, TIME, CIR1D
CLOSE/DID(FSPCCIR1), KEEP
$$-----
ENDDO

```

- Below is an example of the data file generated by this code.

Date/Time	Column 2	Column 3
4/10/2006 8:24:35		9.353
4/10/2006 8:24:36		9.067
4/10/2006 8:24:37		9.875
4/10/2006 8:24:37		9.649
4/10/2006 8:24:38		9.246
4/10/2006 8:24:39		9.995
4/10/2006 8:24:40		10.088
4/10/2006 8:24:40		9.486
4/10/2006 8:24:41		9.735
4/10/2006 8:24:42		9.949
4/10/2006 8:24:43		9.424
4/10/2006 8:24:43		9.140
4/10/2006 8:24:44		9.708
4/10/2006 8:24:45		9.673
4/10/2006 8:24:46		9.062
4/10/2006 8:24:46		9.704
4/10/2006 8:24:47		10.140
4/10/2006 8:24:48		9.235
4/10/2006 8:24:49		9.673
4/10/2006 8:24:49		9.914
4/10/2006 8:24:50		9.004
4/10/2006 8:24:51		9.287
4/10/2006 8:24:51		9.521
4/10/2006 8:24:52		9.074
4/10/2006 8:24:53		9.009
4/10/2006 8:24:54		10.002
4/10/2006 8:24:54		9.821
4/10/2006 8:24:55		9.728
4/10/2006 8:24:56		10.106
4/10/2006 8:24:57		10.008
4/10/2006 8:24:58		9.705
4/10/2006 8:24:58		9.492
4/10/2006 8:24:59		9.534
4/10/2006 8:25:00		9.436
4/10/2006 8:25:01		9.103
4/10/2006 8:25:01		9.780
4/10/2006 8:25:02		10.110
4/10/2006 8:25:03		9.430
4/10/2006 8:25:04		9.845
4/10/2006 8:25:04		10.179

- Note that the actual measurement information is in the third column. This information will come in handy later in this document.
- This next example has more than one bit of information obtained from a feature measurement. This time **X, Y, Z, & Dia** was obtained and added in columns in that order. The information about these different bits show up in columns **3, 4, 5, & 6** respectively.

Date/Time	Column 2	Column 3	Column 4	Column 5	Column 6
1/21/2010 16:42:41	11.5220	77.6495	62.5000	9.7111	
1/21/2010 16:42:42	11.5430	77.4075	62.5000	9.6952	
1/21/2010 16:42:43	11.5466	77.6422	62.5000	9.6908	
1/21/2010 16:42:45	11.5547	77.5354	62.5000	9.7590	
1/21/2010 16:42:47	11.5715	77.4327	62.5000	9.7463	
1/21/2010 16:42:48	11.5879	77.5223	62.5000	9.4703	
1/21/2010 16:42:50	11.5787	77.6357	62.5000	9.4248	
1/21/2010 16:42:51	11.5668	77.3498	62.5000	9.4335	
1/21/2010 16:42:53	11.5813	77.4142	62.5000	9.4718	
1/21/2010 16:42:55	11.5585	77.5772	62.5000	9.1953	
1/21/2010 16:42:56	11.5412	77.4116	62.5000	9.3380	
1/21/2010 16:42:58	11.5262	77.3987	62.5000	9.4212	
1/21/2010 16:42:59	11.4995	77.4891	62.5000	9.5690	
1/21/2010 16:43:01	11.4828	77.6381	62.5000	9.4519	
1/21/2010 16:43:02	11.4996	77.4086	62.5000	9.6445	
1/21/2010 16:43:04	11.4685	77.5551	62.5000	9.7703	
1/21/2010 16:43:05	11.4883	77.5094	62.5000	9.5973	
1/21/2010 16:43:07	11.5222	77.4144	62.5000	9.7829	
1/21/2010 16:43:09	11.5679	77.6857	62.5000	9.7487	
1/21/2010 16:43:10	11.5970	77.5430	62.5000	9.8658	
1/21/2010 16:43:12	11.6344	77.6790	62.5000	9.6012	
1/21/2010 16:43:13	11.6008	77.4010	62.5000	9.6231	
1/21/2010 16:43:15	11.6337	77.3353	62.5000	9.5285	
1/21/2010 16:43:17	11.6211	77.6647	62.5000	9.4279	
1/21/2010 16:43:19	11.5758	77.5143	62.5000	9.1968	
1/21/2010 16:43:21	11.5504	77.4371	62.5000	9.3062	
1/21/2010 16:43:22	11.5094	77.6506	62.5000	9.3036	
1/21/2010 16:43:24	11.4835	77.7150	62.5000	9.3937	
1/21/2010 16:43:26	11.4626	77.5564	62.5000	9.6181	
1/21/2010 16:43:27	11.4345	77.5399	62.5000	9.7293	

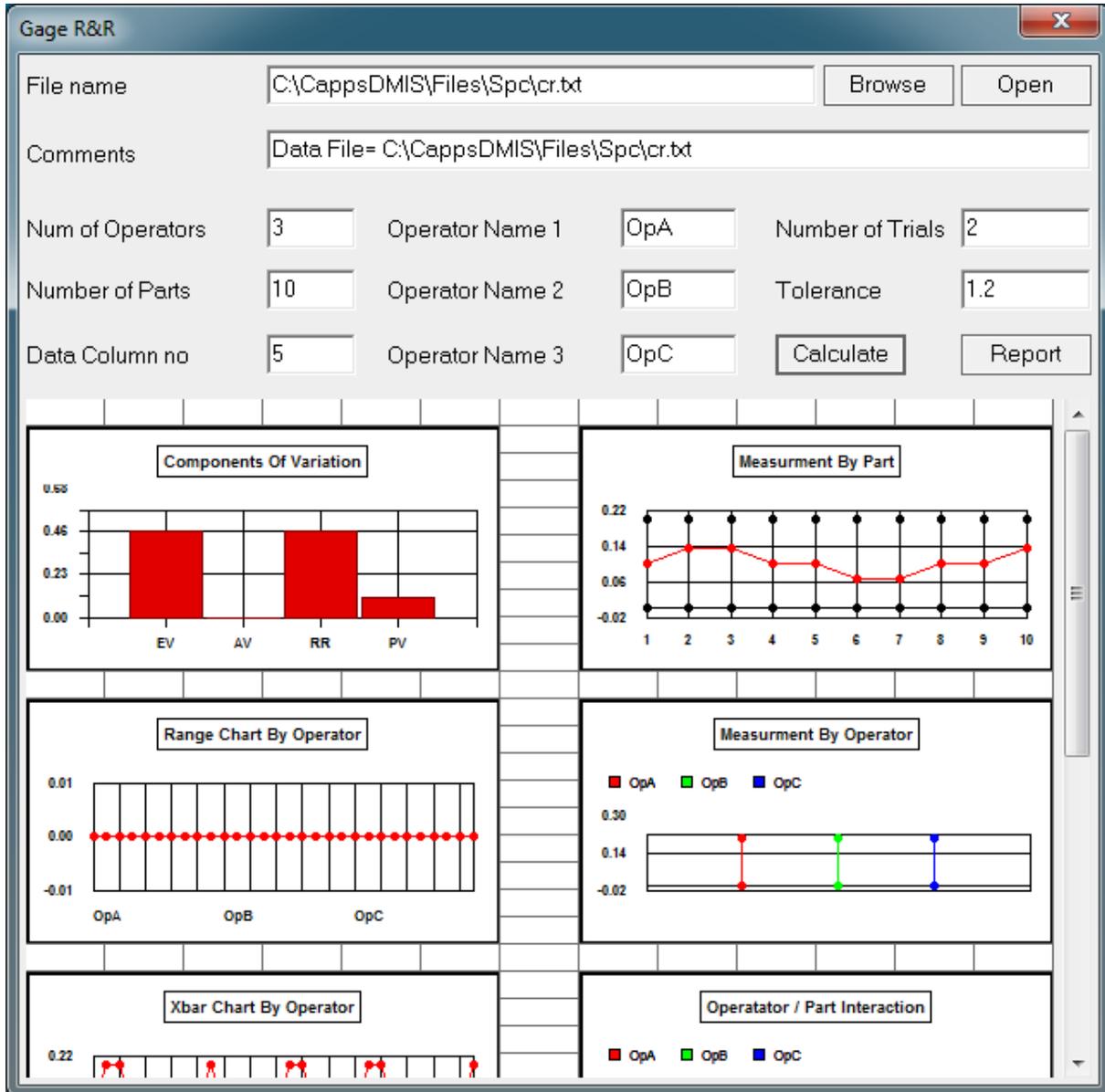
- The information should be arranged in the document in the following order to insure proper **Gage R&R** calculation. Please make sure to keep this order when running the program to obtain the **Gage R&R** information. This example uses **2 Operators, 2 Trials, 10 Parts**.

Date	Time	Value	Operator	Run	Part
4/10/2006	14:24:32	10.115	Operator 1	Run 1	1
4/10/2006	14:24:32	9.711	Operator 1	Run 1	2
4/10/2006	14:24:32	9.658	Operator 1	Run 1	3
4/10/2006	14:24:33	8.996	Operator 1	Run 1	4
4/10/2006	14:24:34	9.196	Operator 1	Run 1	5
4/10/2006	14:24:34	9.761	Operator 1	Run 1	6
4/10/2006	14:24:35	9.494	Operator 1	Run 1	7
4/10/2006	14:24:35	10.009	Operator 1	Run 1	8
4/10/2006	14:24:36	9.968	Operator 1	Run 1	9
4/10/2006	14:24:36	9.607	Operator 1	Run 1	10
4/10/2006	14:24:37	9.914	Operator 1	Run 2	1
4/10/2006	14:24:37	9.783	Operator 1	Run 2	2
4/10/2006	14:24:38	9.094	Operator 1	Run 2	3
4/10/2006	14:24:38	9.667	Operator 1	Run 2	4
4/10/2006	14:24:39	9.090	Operator 1	Run 2	5
4/10/2006	14:24:40	9.089	Operator 1	Run 2	6
4/10/2006	14:24:40	9.708	Operator 1	Run 2	7
4/10/2006	14:24:41	9.738	Operator 1	Run 2	8
4/10/2006	14:24:41	9.792	Operator 1	Run 2	9
4/10/2006	14:24:42	10.495	Operator 1	Run 2	10
4/10/2006	14:24:42	10.106	Operator 2	Run 1	1
4/10/2006	14:24:43	10.077	Operator 2	Run 1	2
4/10/2006	14:24:43	9.935	Operator 2	Run 1	3
4/10/2006	14:24:44	9.697	Operator 2	Run 1	4
4/10/2006	14:24:44	9.359	Operator 2	Run 1	5
4/10/2006	14:24:45	9.516	Operator 2	Run 1	6
4/10/2006	14:24:46	8.859	Operator 2	Run 1	7
4/10/2006	14:24:46	9.565	Operator 2	Run 1	8
4/10/2006	14:24:47	9.769	Operator 2	Run 1	9
4/10/2006	14:24:47	10.038	Operator 2	Run 1	10
4/10/2006	14:24:48	10.314	Operator 2	Run 2	1
4/10/2006	14:24:48	10.150	Operator 2	Run 2	2
4/10/2006	14:24:49	9.885	Operator 2	Run 2	3
4/10/2006	14:24:49	9.681	Operator 2	Run 2	4
4/10/2006	14:24:50	9.203	Operator 2	Run 2	5
4/10/2006	14:24:50	9.321	Operator 2	Run 2	6
4/10/2006	14:24:51	8.723	Operator 2	Run 2	7
4/10/2006	14:24:52	9.748	Operator 2	Run 2	8
4/10/2006	14:24:52	9.277	Operator 2	Run 2	9
4/10/2006	14:24:52	9.887	Operator 2	Run 2	10

Statistical Process Control (SPC)

Calculating The Data Using The Gage R&R Option

Once the information has been obtained and written to a data file the **Gage R&R** information can be calculated. Click on the [Gage R&R option](#) located in the [AAT SPC Menu](#) in CAPPS. The following dialog box will appear.

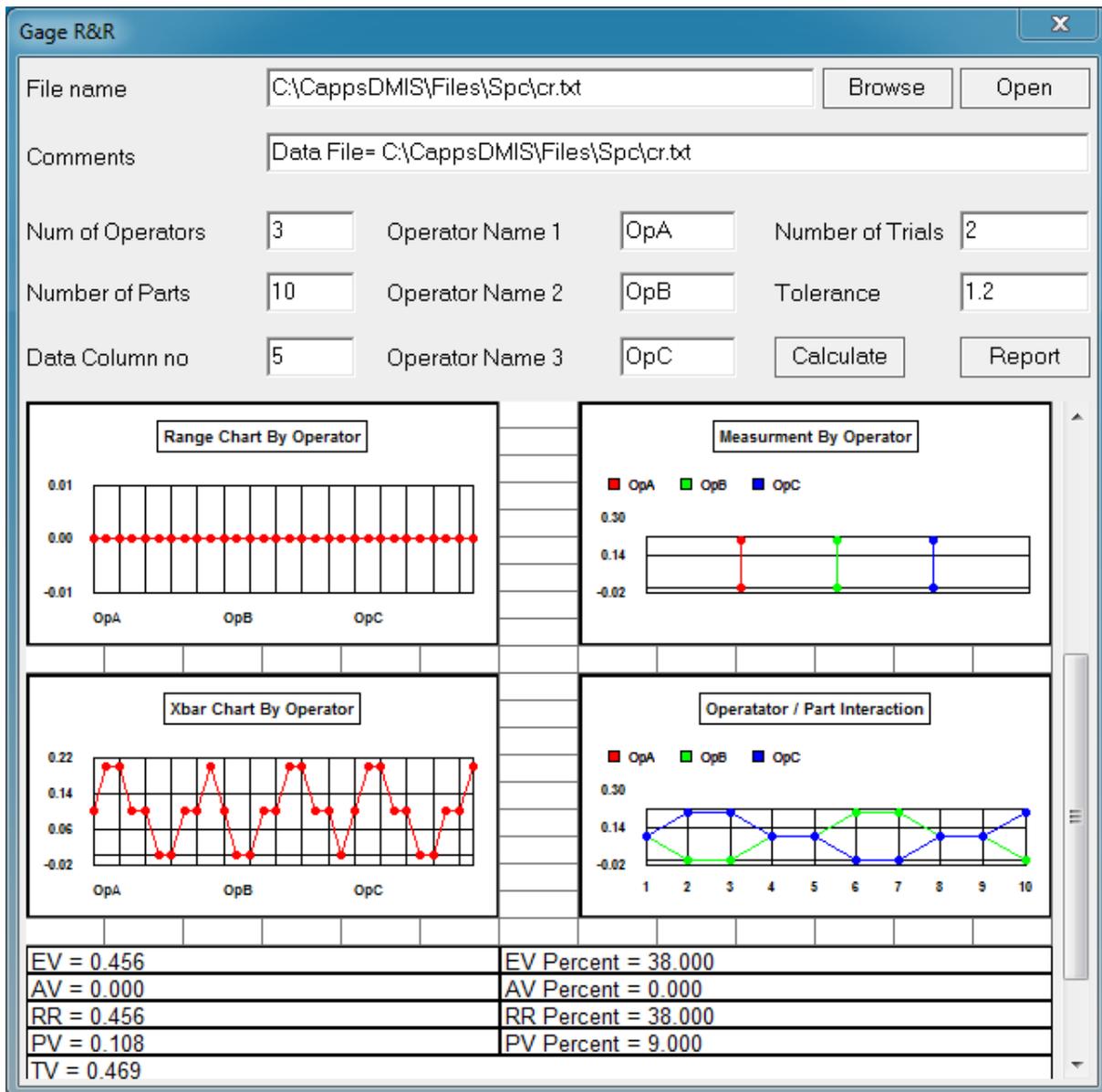


Important Note: At this time CAPPS can only calculate **Gage R&R** data for studies with the following parameters.

3 Operators	3 Operators	2 Operators	2 Operators
3 Trials	2 Trials	3 Trials	2 Trials
10 Parts	10 Parts	10 Parts	10 Parts

Follow the steps below to calculate the **Gage R&R** data.

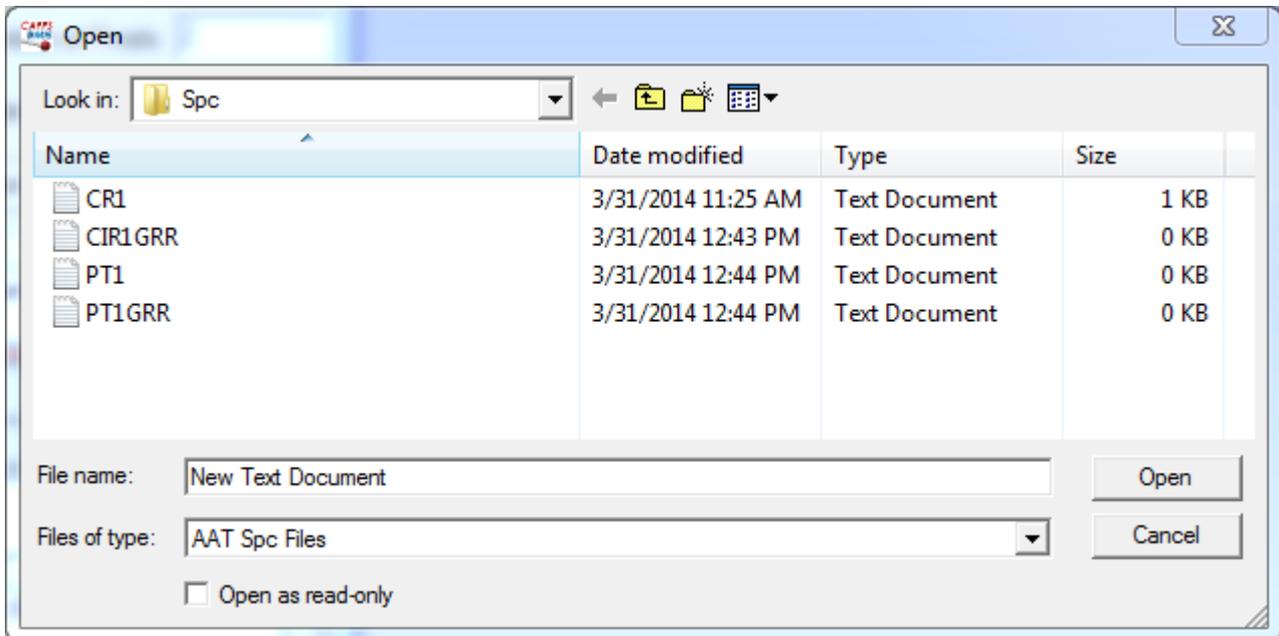
- Browse and select the **Data File**
- Enter the Comments or use the default comment
- Set the number of operators (3 or 2)
- Set the number of Parts (3 or 2)
- Set the data Column No (3 or Higher)
- Set the part tolerance (Lower Tolerance + Upper Tolerance)
- Set Operator Name 1, Operator Name 2 , and Operator Number 3
- Set the number of trials (1 or Higher)
- Click calculate
- Close the dialog and reopen if another Gage R&R calculation is desired
- Below is an example of the dialog after the calculate button is pressed.



[Gage R&R](#)

Outputting The Computed Gage R&R Report

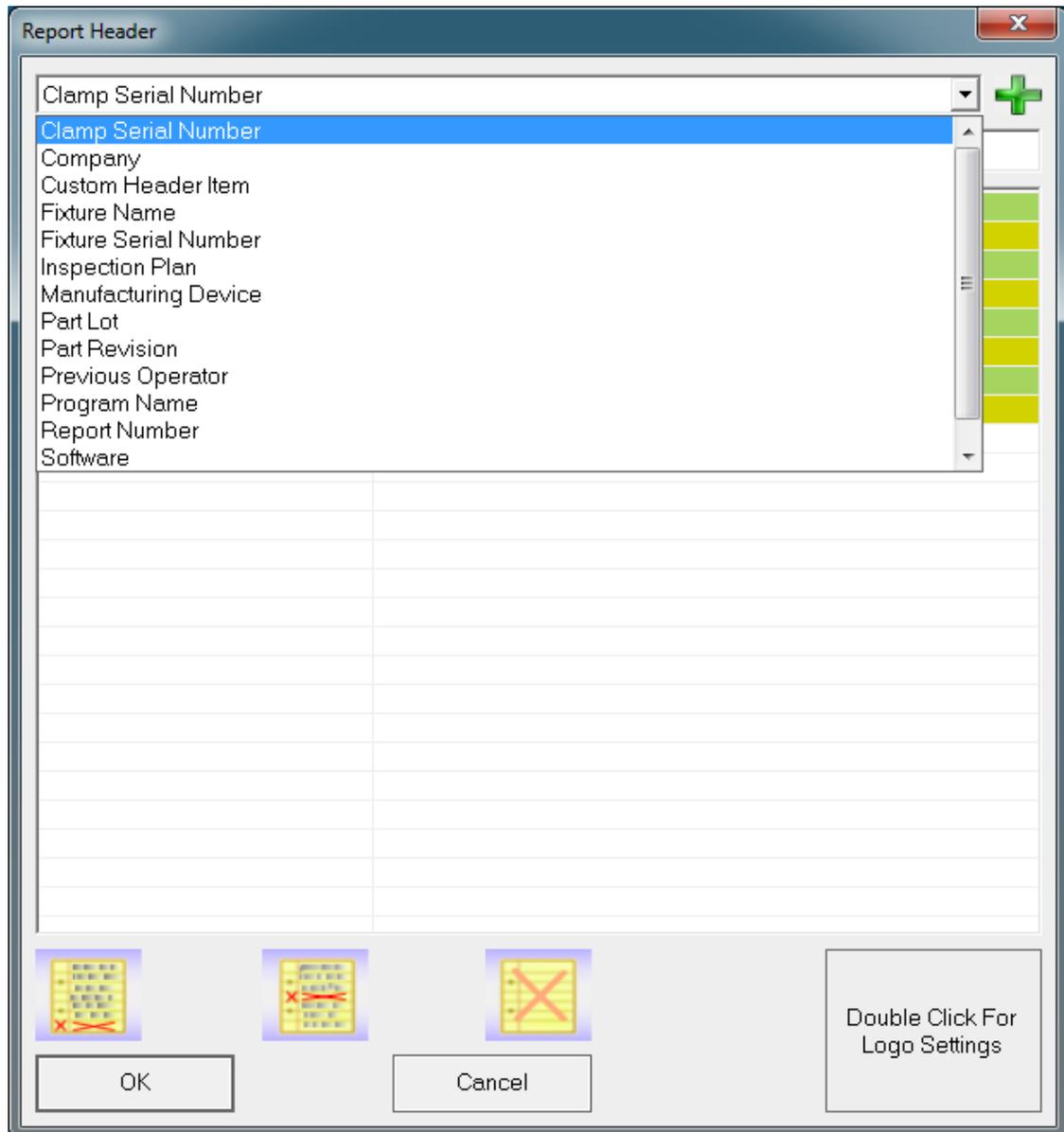
- Click on the **Report** button, the following **Open** dialog will appear.



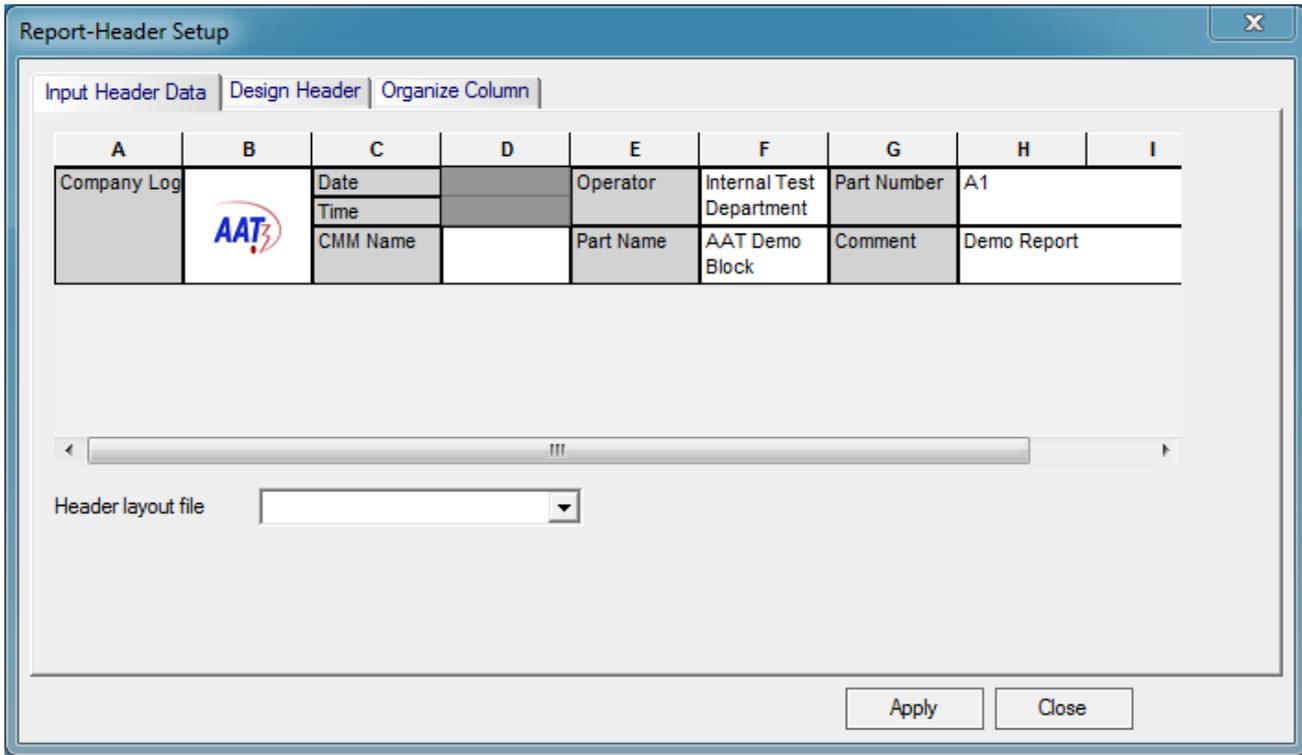
- Type the name for the **Gage R&R** report (**CIR1GRR for example**) and click on **Open**. If a name is not entered the existing data file (**CIR1.txt in this case**) will be used. The data will be over written and replaced by the report file. So, it is a good idea to always enter a report name before clicking on the **Open** button.

[Gage R&R](#)

This menu may also be expanded for more default header options.



Grid Report Header



Input Header Data:	If the grid report option is configured, the header input dialog will appear as shown above. Input the necessary data into the cells.
Header Layout File:	Gives the user the option of loading in a previously saved header file. To create a new header style for the Grid report, click on the Design Header tab. The following menu will appear.

Report-Header Setup

Input Header Data | Design Header | Organize Column

A	B	C	D	E	F	G	H	I
Company Logo		Date	Operator		Part Number			
		Time						
		CMM Name	Part Name		Comment			

Merge Selected:	This option will allow the user to merge 2 or more cells, much like an excel spreadsheet document. Once a merge operation is done with 2 or more cells, that cell will now have a drop down menu. The drop down menu will contain selections for field type.
Add Column:	Will add a column to the spreadsheet header style.
Add Row:	Will add a row to the spreadsheet header style.
Clear Layout:	Will clear the current header layout and allow the user to build a new style.
Unmerge Selected:	Will unmerge cells that have already been merged.
Remove Column:	Will remove a column that has been added.
Remove Row:	Will remove a row that has been added.
Save Layout:	Will save the current layout for use at a future time.

[Table of Contents](#)

Working With The Report Window

Set Outputs

Set Outputs

Output Features

Comments

OUTFIL OPER MAN Report Auto Reset

X Axis TX2: -0.2000 * 0.2000 Form

Y Axis TY2: -0.2000 * 0.2000 Flatness FLAT2: 0.2000

Z Axis TZ2: -0.2000 * 0.2000 Straightness LSTRGHT2: 0.2000

VectDir/Profile TP2: -0.2000 * 0.2000 Circularity LCIRLTY2: 0.2000

Edge Profile TPS2: -0.2000 * 0.2000 Cylindricity LCYLCTY2: 0.2000

Dia/Rad D R TD2: -0.2000 * 0.2000 Sphericity LSPHCTY2: 0.2000

Length TL2: -0.2000 * 0.2000 IJK Vector Angle

Width TW2: -0.2000 * 0.2000 Measured Curve Report All points

Report Table Position Reverse position sign

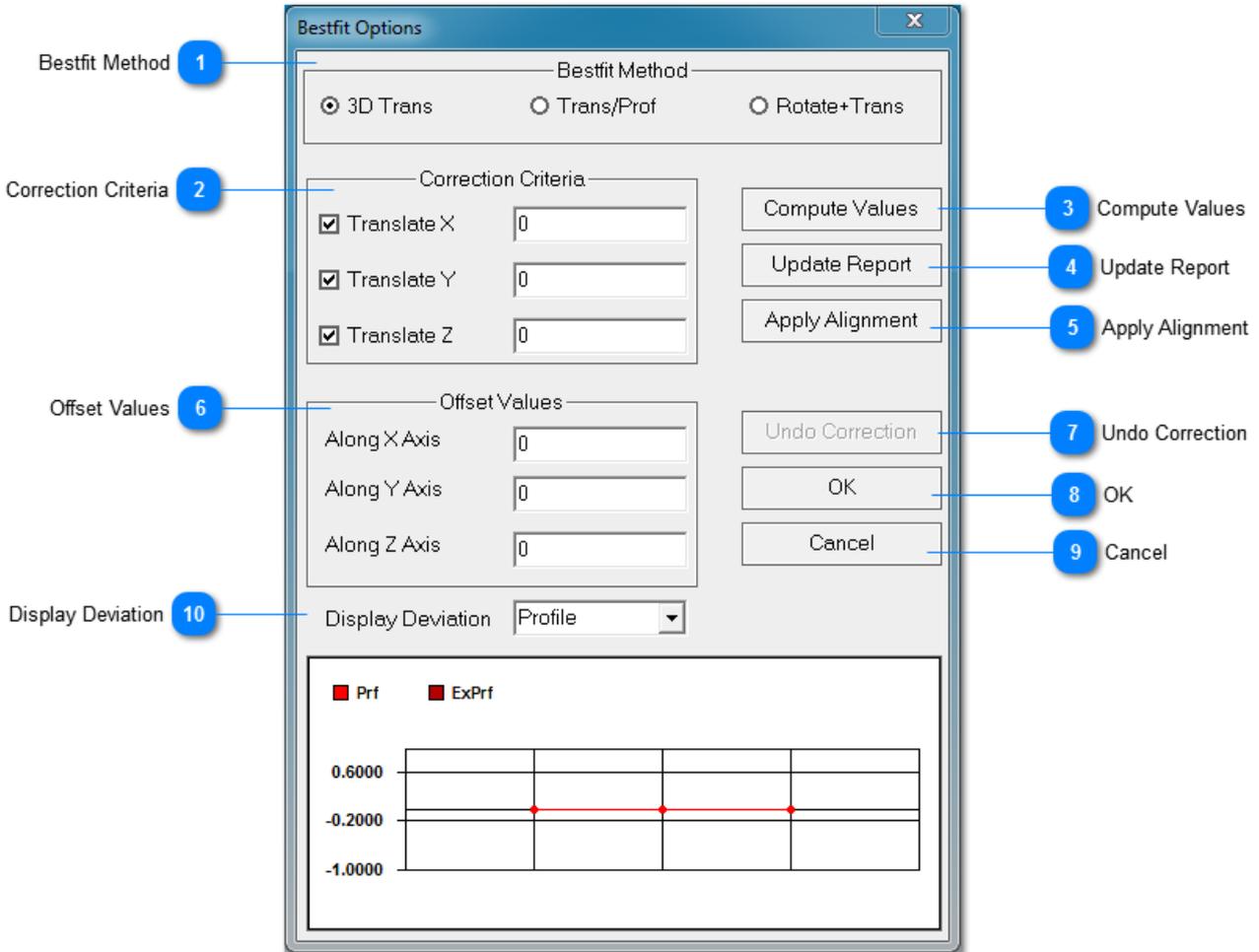
Set All Clear All OK Cancel

The set outputs dialog allows configuration of what will be output to the report window. It is also possible to choose a tolerance setting for each axis on dimensional outputs while in this menu. If no outputs are desired in the report window, uncheck the **Output Features** setting at the top of this menu.

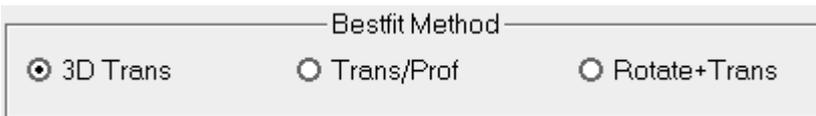
[Reporting Options](#)

Auto Bestfit

The [Auto Bestfit](#) option works to best fit the errors in the report. This is known as a post process fit based on the results. The changes that are made may or may not need to be applied to the alignment.



1 Bestfit Method



3D-Trans:	This option will best fit the visible report data in a linear fashion.
Trans/Prof:	This option will best fit the visible report data using only the profile outputs.
Rotate + Trans:	This option will best fit the visible report data in both a linear and it will also rotate the alignment matrix to achieve the best possible fit.

2 Correction Criteria

Correction Criteria	
<input checked="" type="checkbox"/> Translate X	0
<input checked="" type="checkbox"/> Translate Y	0
<input checked="" type="checkbox"/> Translate Z	0

Translate X, Y, Z: These input boxes will be populated automatically when used in conjunction with the **Compute Values** button. The populated values will reflect the best possible shift for each axis based on the current report data.

3 Compute Values

Compute Values

This function will auto compute offset values to achieve the best possible fit based on the visible data in the report.

4 Update Report

Update Report

Once the offset values are known, either by auto compute or by manual input, the update report button will apply the changes to the report, thereby best fitting the data.

5 Apply Alignment

Apply Alignment

Used to apply the best fit changes to the alignment in addition to the report.

6 Offset Values

Offset Values	
Along X Axis	0
Along Y Axis	0
Along Z Axis	0

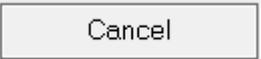
Along X, Y, Z: These input boxes are for manual input by the user when the amount of shift is known to achieve the best possible fit for the data.

7 Undo CorrectionA rectangular button with a light gray background and a thin black border, containing the text "Undo Correction" in a standard sans-serif font.

Used to undo any corrections that have been made to the report as long as this dialog remains active.

8 OKA rectangular button with a light gray background and a thin black border, containing the text "OK" in a standard sans-serif font.

Will accept any changes that have been applied and close the best fit dialog box.

9 CancelA rectangular button with a light gray background and a thin black border, containing the text "Cancel" in a standard sans-serif font.

Cancel the changes and close the dialog.

10 Display DeviationA dropdown menu with a light gray background and a thin black border. The text "Display Deviation" is on the left, and "Profile" is selected in the dropdown box on the right, with a small downward-pointing arrow.

Will display the deviation of the features in the report in the graph

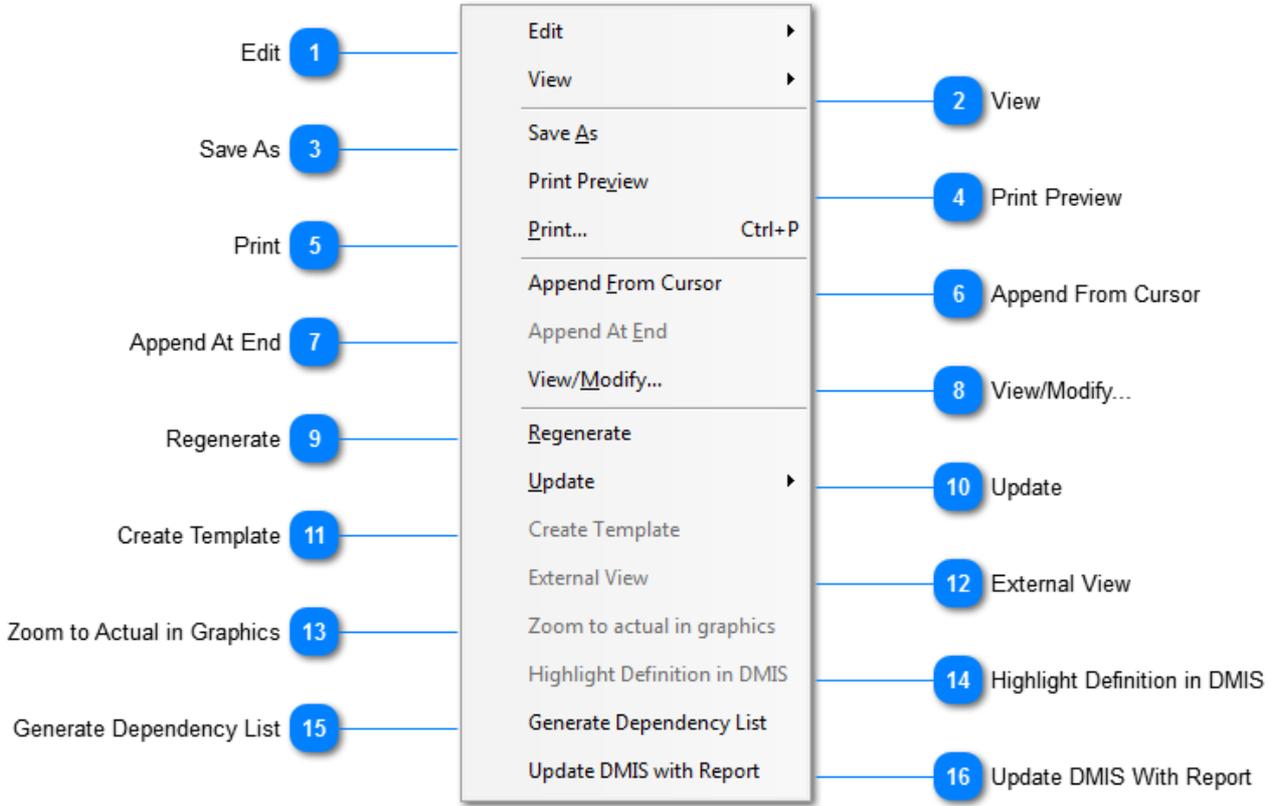
[Reporting Options](#)

Report Statistics

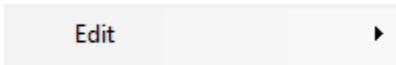
For more information regarding **Report Statistics**, please refer to the section on [Statistical Process Control \(SPC\)](#) in **CAPPS DMIS User Manual**.

[Reporting Options](#)

Right Click Menu

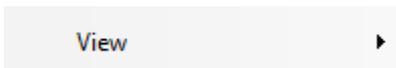


1 Edit



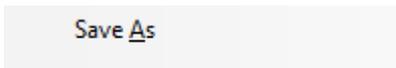
Used to select many of the standard **Microsoft Windows** options such as **Cut, Copy, Paste, Delete Selected etc.**

2 View



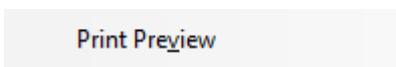
Used to select the options to **Choose Font, Set Tap Stops etc.**

3 Save As

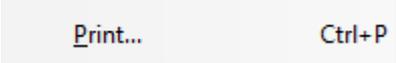


Allows the user to save the report file as a text file with an **(.rpt)** extension. This is a text file that may be edited in most text editing software.

4 Print Preview



Will give the option of previewing the report before printing.

5 Print

 Print... Ctrl+P

Used to print the report.

6 Append From Cursor

 Append From Cursor

Used to append the measurements to the current location of the cursor in the report.

7 Append At End

 Append At End

Used to resume the results output at the end of file.

8 View/Modify...

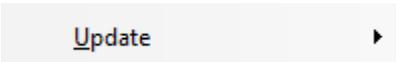
 View/Modify...

Used to edit a feature. Place cursor on feature to be edited and right click the mouse. Choose **View/Modify** and the edit dialog will appear. This may also be accomplished by double clicking the feature in the report window.

9 Regenerate

 Regenerate

Will regenerate any changes to the report that do not take effect immediately.

10 Update

 Update

Contains options that can be used to modify report formatting.

11 Create Template

 Create Template

Creates templates for the features in the report on [Graphics Window](#).

12 External View

 External View

It is used to display bitmap images in a separate window.

13 Zoom to Actual in Graphics

Zoom to actual in graphics

Zoom to the actual in the [Graphics Window](#) for the highlighted feature in the report.

14 Highlight Definition in DMIS

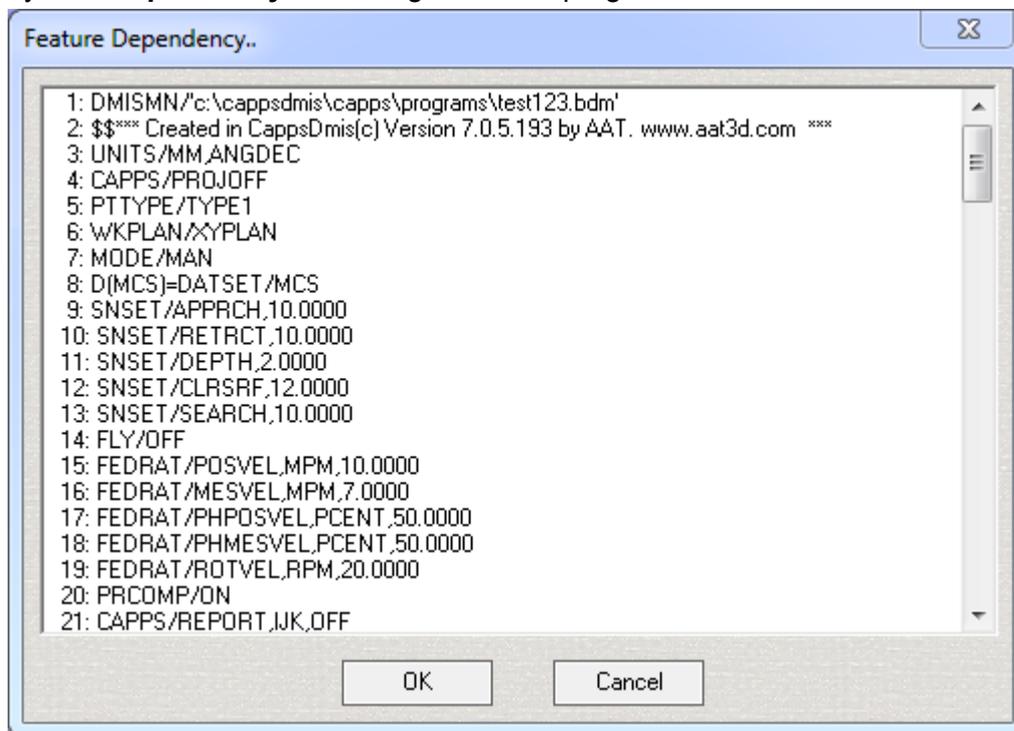
Highlight Definition in DMIS

Used to highlight the DMIS code in [Program Window](#) for the highlighted feature in the report.

15 Generate Dependency List

Generate Dependency List

Generates a line by line **Dependency List** using the DMIS program shown below:



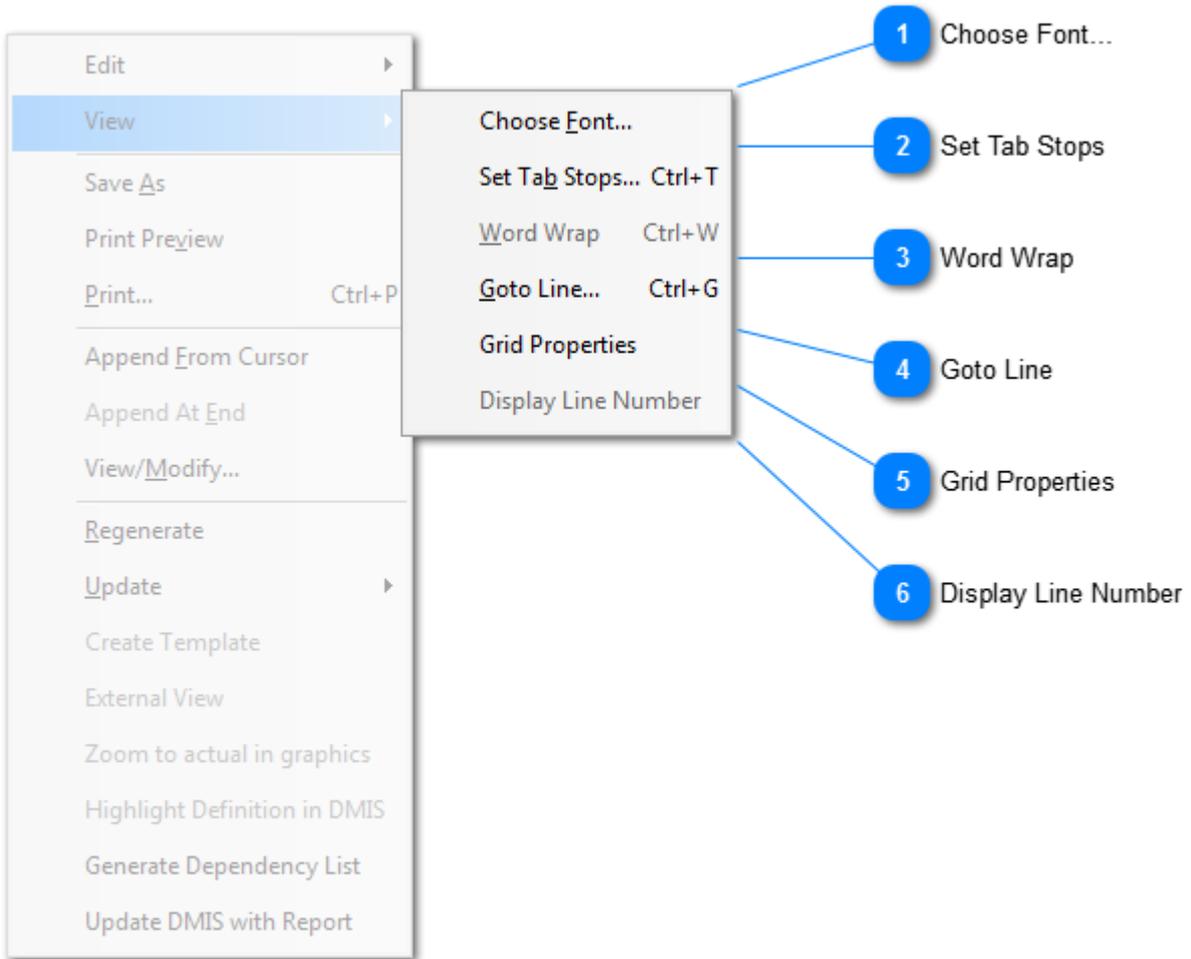
16 Update DMIS With Report

Update DMIS with Report

Used to update DMIS nominals with the report nominals.

[Reporting Options](#)

View



1 Choose Font...

Choose Font...

Used to select report font.

2 Set Tab Stops

Set Tab Stops... Ctrl+T

Used to set tab properties in **Tab Delimited Format**.

3 Word Wrap

Word Wrap Ctrl+W

Allows continuing in a new line if the feature output is longer than one line.

4 Goto Line

Goto Line... Ctrl+G

Used to enter a line value to go in the report.

5 Grid Properties

Grid Properties

Used to set **Grid View** properties.

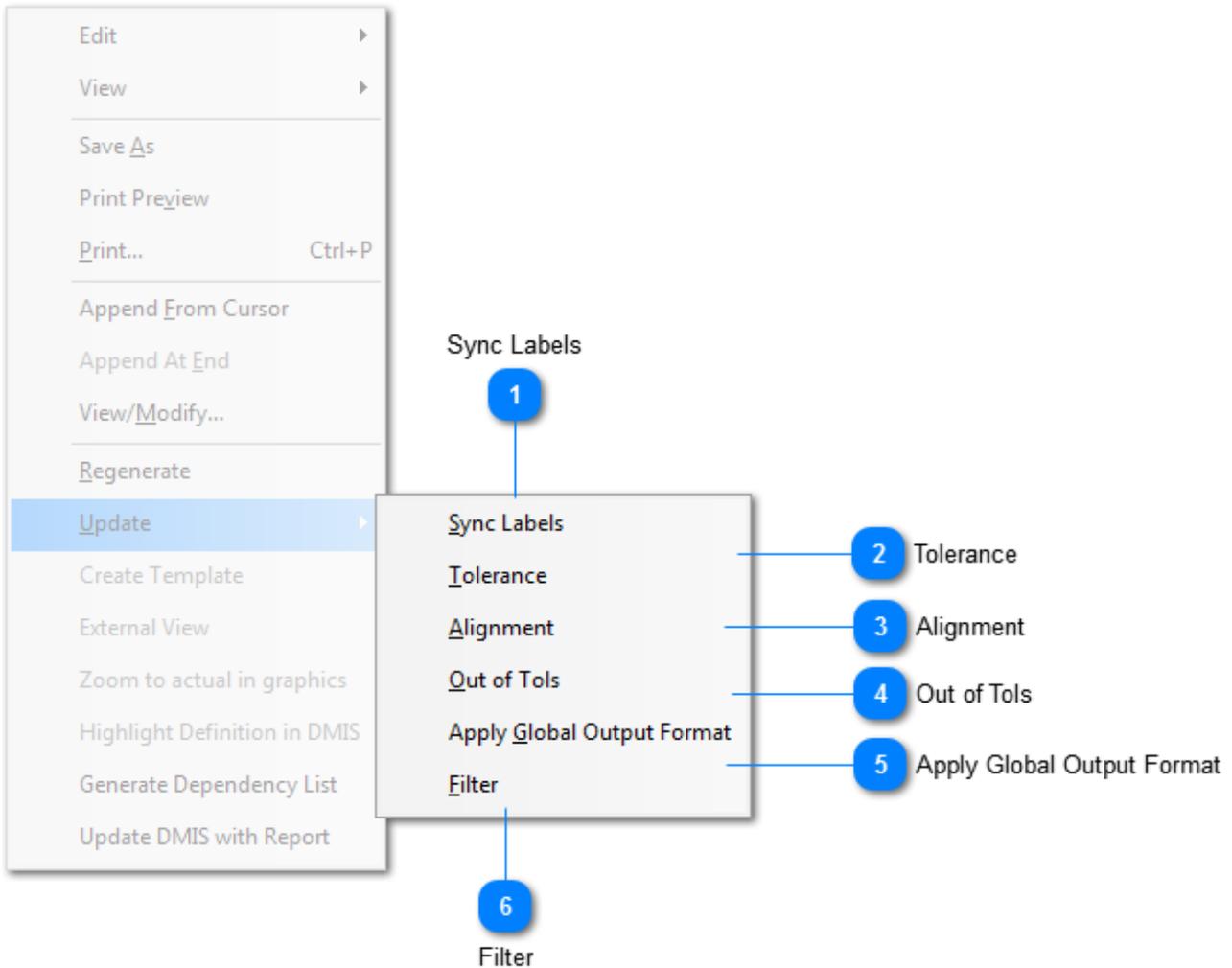
6 Display Line Number

Display Line Number

Used to turn on/off the line numbers.

[Right Click Menu](#)

Update



1 Sync Labels

Sync Labels

This option will update the feature labels to match the index labels. This is very useful after the report has been cleaned up, and is ready for final output. This is also useful where there is a conflict between the label sequence and the index sequence.

2 Tolerance

Tolerance

This allows the global update of the tolerance in the report page. This is a very useful function if all the features have been measured, and it is discovered that the active tolerance was set incorrectly for the measured features.

3 Alignment

Alignment

This option is available for use if the report must be output in a new alignment frame. Choose the alignment frame from the datum list, and then update the report to reflect the new datum.

4 Out of Tols

Out of Tols

After choosing this option, only the out of tolerance features will be displayed on the report page.

5 Apply Global Output Format

Apply Global Output Format

If changes are made to the set output format, this option will globally update the report to reflect the changes.

6 Filter

Filter

This option will display a dialog box which will allow the user to select which features are shown either by selecting them from a list or choosing by type of feature.

[Right Click Menu](#)

Standard Reporting Styles and Formats

For **Standard Reporting Styles** please refer to the section [Navigating The User Interface - Results Window](#) in **CAPPS DMIS User Manual** or simply click on the links for them below.

Classic View

[The Classic View](#) is otherwise known as the AAT format.

Grid View

[The Grid View.](#)

HTML View

[The HTML View.](#)

Other formats used with the **Classic View** has shown below:

AAT Format

ELEM#	NOMINAL	ACTUAL	LOW_TOL	UPP_TOL	DEV	OUT_OF_TOL	CONTROL
DATE : 4/1/2014							
TIME : 11:10:50 AM							
PART NAME : CONSTPT_ACTUALS							
PART NUMBER : 123456							
OPERATOR : AAT INTERNAL TESTING DEPARTMENT							
COMMENT : Point Construction Test							

1: POINT PT1 [MCS]							
X :	26.048	26.038	-0.200	0.200	-0.010		--- ---*0--- ---
Y :	69.590	69.580	-0.200	0.200	-0.010		--- ---*0--- ---
Z :	62.495	62.492	-0.200	0.200	-0.003		--- ---*--- ---
Prof:		-0.003	-0.200	0.200			--- ---*--- ---
2: INNER CIRCLE CR2 [MCS]							
X :	29.514	29.504	-0.200	0.200	-0.010		--- ---*0--- ---
Y :	95.498	95.496	-0.200	0.200	-0.002		--- ---*--- ---
Z :	62.500	62.500	-0.200	0.200	0.000		--- ---*--- ---
Diam:	25.410	25.400	-0.200	0.200	-0.010		--- ---*0--- ---
3: OUTER CYLINDER CL3 [MCS]							
X :	17.499	17.499	-0.200	0.200	0.000		--- ---*--- ---
Y :	17.510	17.500	-0.200	0.200	-0.010		--- ---*0--- ---
Z :	50.665	50.665	-0.200	0.200	0.000		--- ---*--- ---
Diam:	19.050	19.050	-0.200	0.200	0.000		--- ---*--- ---
4: INNER SLOT SL4 [MCS]							
X :	29.917	29.919	-0.200	0.200	0.002		--- ---*--- ---
Y :	54.634	54.636	-0.200	0.200	0.002		--- ---*--- ---
Z :	62.500	62.500	-0.200	0.200	0.000		--- ---*--- ---

Tab Delimited

ELEM#	NOMINAL	ACTUAL	LOW_TOL	UPP_TOL	DEV	OUT_OF_TOL
DATE : 4/1/2014						
TIME : 11:10:50 AM						
PART NAME : CONSTPT_ACTUALS						
PART NUMBER : 123456						
OPERATOR : AAT INTERNAL TESTING DEPARTMENT						
COMMENT : Point Construction Test						
1	POINT PT1		[MCS]			
X	26.048	26.038		-0.200	0.200	-0.010
Y	69.590	69.580		-0.200	0.200	-0.010
Z	62.495	62.492		-0.200	0.200	-0.003
Prof		-0.003		-0.200	0.200	
2	INNER CIRCLE	CR2	[MCS]			
X	29.514	29.504		-0.200	0.200	-0.010
Y	95.498	95.496		-0.200	0.200	-0.002
Z	62.500	62.500		-0.200	0.200	0.000
Diam	25.410	25.400		-0.200	0.200	-0.010
3	OUTER CYLINDER	CL3	[MCS]			
X	17.499	17.499		-0.200	0.200	0.000
Y	17.510	17.500		-0.200	0.200	-0.010
Z	50.665	50.665		-0.200	0.200	0.000
Diam	19.050	19.050		-0.200	0.200	0.000
4	INNER SLOT	SL4	[MCS]			
X	29.917	29.919		-0.200	0.200	0.002
Y	54.634	54.636		-0.200	0.200	0.002
Z	62.500	62.500		-0.200	0.200	0.000

Space Delimited

```

DATE           : 4/1/2014
TIME           : 11:10:50 AM
PART NAME      : CONSTPT_ACTUALS
PART NUMBER    : 123456
OPERATOR       : AAT INTERNAL TESTING DEPARTMENT
COMMENT        : Point Construction Test
ELEM# NOMINAL ACTUAL LOW_TOL UPP_TOL DEV OUT_OF_TOL
1 POINT PT1 [MCS]
X 26.048 26.038 -0.200 0.200 -0.010
Y 69.590 69.580 -0.200 0.200 -0.010
Z 62.495 62.492 -0.200 0.200 -0.003
Prof -0.003 -0.200 0.200

2 INNER CIRCLE CR2 [MCS]
X 29.514 29.504 -0.200 0.200 -0.010
Y 95.498 95.496 -0.200 0.200 -0.002
Z 62.500 62.500 -0.200 0.200 0.000
Diam 25.410 25.400 -0.200 0.200 -0.010

3 OUTER CYLINDER CL3 [MCS]
X 17.499 17.499 -0.200 0.200 0.000
Y 17.510 17.500 -0.200 0.200 -0.010
Z 50.665 50.665 -0.200 0.200 0.000
Diam 19.050 19.050 -0.200 0.200 0.000

4 INNER SLOT SL4 [MCS]
X 29.917 29.919 -0.200 0.200 0.002
Y 54.634 54.636 -0.200 0.200 0.002
Z 62.500 62.500 -0.200 0.200 0.000

```

Excel CSV

```

DATE           : 4/1/2014
TIME           : 11:10:50 AM
PART NAME      : CONSTPT_ACTUALS
PART NUMBER    : 123456
OPERATOR       : AAT INTERNAL TESTING DEPARTMENT
COMMENT        : Point Construction Test
ELEM#, ,NOMINAL,ACTUAL,LOW_TOL,UPP_TOL,DEV,OUT_OF_TOL,
1,POINT,PT1,, [MCS]
  X ,      26.048,      26.038,   -0.200,    0.200,   -0.010,
  Y ,      69.590,      69.580,   -0.200,    0.200,   -0.010,
  Z ,      62.495,      62.492,   -0.200,    0.200,   -0.003,
  Prof,      ,      -0.003,   -0.200,    0.200,,
2,INNER CIRCLE,CR2,, [MCS]
  X ,      29.514,      29.504,   -0.200,    0.200,   -0.010,
  Y ,      95.498,      95.496,   -0.200,    0.200,   -0.002,
  Z ,      62.500,      62.500,   -0.200,    0.200,    0.000,
  Diam,      25.410,      25.400,   -0.200,    0.200,   -0.010,
3,OUTER CYLINDER,CL3,, [MCS]
  X ,      17.499,      17.499,   -0.200,    0.200,    0.000,
  Y ,      17.510,      17.500,   -0.200,    0.200,   -0.010,
  Z ,      50.665,      50.665,   -0.200,    0.200,    0.000,
  Diam,      19.050,      19.050,   -0.200,    0.200,    0.000,
4,INNER SLOT,SL4,, [MCS]
  X ,      29.917,      29.919,   -0.200,    0.200,    0.002,
  Y ,      54.634,      54.636,   -0.200,    0.200,    0.002,
  Z ,      62.500,      62.500,   -0.200,    0.200,    0.000,

```

Compact Report

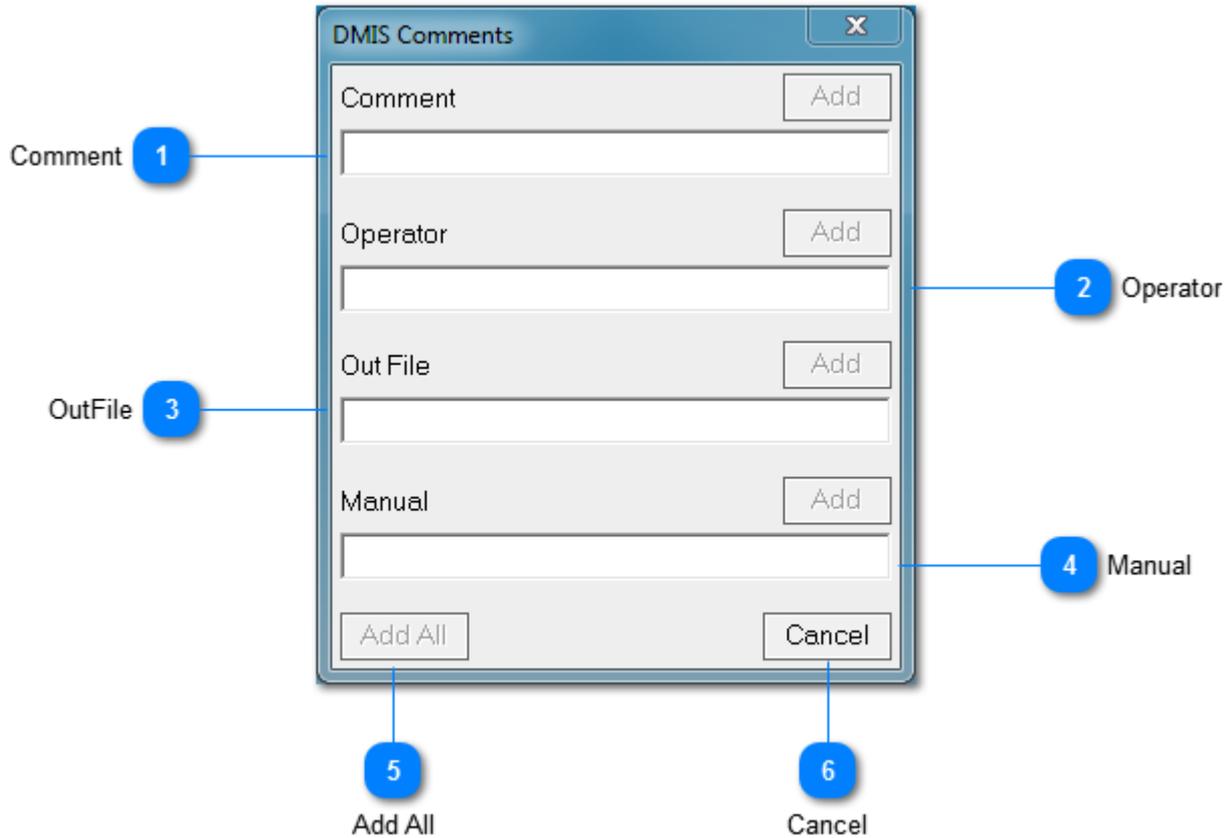
```

DATE       : 5/19/2014
TIME       : 10:17:37 AM
PART NAME  : CONSTPT_ACTUALS
PART NUMBER : 123456
OPERATOR   : AAT INTERNAL TESTING DEPARTMENT
COMMENT    : Point Construction Test
DATE       : 5/19/2014
TIME       : 10:18:10 AM
PART NAME  : CONSTPT_ACTUALS
PART NUMBER : 123456
OPERATOR   : AAT INTERNAL TESTING DEPARTMENT
COMMENT    : Point Construction Test
  
```

LABEL	XM	XN	DX	YM	YN	DY	ZM	ZN	DZ	DEV.	dir
PT1	26.047	26.048	-0.001	69.583	69.590	-0.007	62.501	62.495	0.006	0.006	Z+
CR2	29.501	29.504	-0.003	95.500	95.496	0.004	60.503	62.500	-1.997	0.009	Z+
CL3	17.497	17.499	-0.002	17.508	17.500	0.008	50.669	50.675	-0.006	0.016	Z+
SL4	29.909	29.919	-0.010	54.638	54.636	0.002	60.504	62.500	-1.996	0.021	Z+

[Reporting Options](#)

Working With Comments



1 Comment

Comment Add

This option is simply used as a programming note or some other type of comment in the **Program Window**. This type of comment is not executed.

2 Operator

Operator Add

This option is used to prompt the operator to perform a specific task or function.

DMIS Syntax:

TEXT/OPER,'Place Part on CMM with mounting face parallel to the X axis'

3 OutFile

Out File

This option places a comment above the feature output in the report.

DMIS Syntax:

TEXT/OUTFIL,'DATUM [-B-] HOLE LOCATION'

```
DATUM [-B-] HOLE LOCATION
13: INNER CIRCLE CR12
X   :   47.464   | 47.464  -1.000   1.000   0.000   ---|---*---|---
Y   :   77.536   | 77.536  -1.000   1.000   0.000   ---|---*---|---
Z   :   62.500   | 62.500  -1.000   1.000   0.000   ---|---*---|---
Diam:   9.525   | 9.525  -25.400  25.400   0.000   ---|---*---|---
Circularity:   :   0.000                   0.201   ---|---*---|---
```

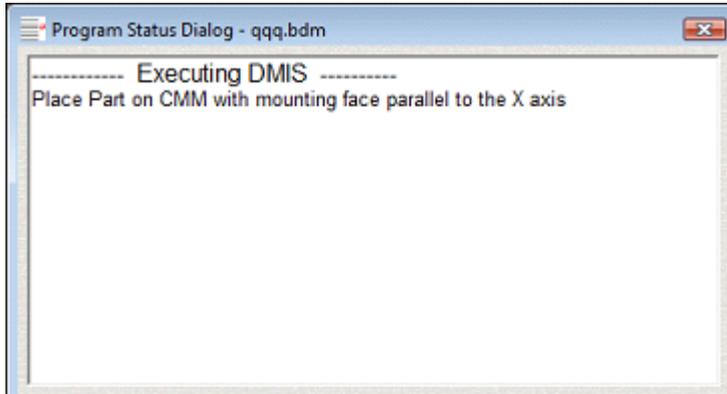
4 Manual

Manual

This comment style is used to display a message in the run dialog box as opposed to a separate message being displayed on the screen.

DMIS Syntax:

TEXT/MAN,'Place Part on CMM with mounting face parallel to the X axis'



5 Add All

Add all comments written.

6 Cancel

Cancel

Cancel the changes and close the dialog.

Report

This option is found in the dialog when using manual labeling or when using the **GD&T Menu - Output - Comment** or **Report Menu - Set Outputs - Report** functions shown below. The difference between this style comment and the **TEXT/OUTFIL** command is that it places the comment on the same line as the feature identifier.

REPORT- SLOT ✕

Label

Set Output	Nominals	Actuals	Low Tol	Upp Tol	Deviation	Out of Tol	Control
<input checked="" type="checkbox"/> X	<input type="text" value="29.917"/>	<input type="text" value="29.919"/>	<input type="text" value="-0.200"/>	<input type="text" value="0.200"/>	<input type="text" value="0.002"/>	<input type="text" value="0.000"/>	<input type="text" value="— * —"/>
<input checked="" type="checkbox"/> Y	<input type="text" value="54.634"/>	<input type="text" value="54.636"/>	<input type="text" value="-0.200"/>	<input type="text" value="0.200"/>	<input type="text" value="0.002"/>	<input type="text" value="0.000"/>	<input type="text" value="— * —"/>
<input checked="" type="checkbox"/> Z	<input type="text" value="62.500"/>	<input type="text" value="62.500"/>	<input type="text" value="-0.200"/>	<input type="text" value="0.200"/>	<input type="text" value="0.000"/>	<input type="text" value="0.000"/>	<input type="text" value="— * —"/>
<input type="checkbox"/> Length	<input type="text" value="50.238"/>	<input type="text" value="50.138"/>	<input type="text" value="-0.200"/>	<input type="text" value="0.200"/>	<input type="text" value="-0.100"/>	<input type="text" value="0.000"/>	<input type="text" value="— *0 —"/>
<input type="checkbox"/> Width	<input type="text" value="12.685"/>	<input type="text" value="12.695"/>	<input type="text" value="-0.200"/>	<input type="text" value="0.200"/>	<input type="text" value="0.010"/>	<input type="text" value="0.000"/>	<input type="text" value="— 0* —"/>
<input type="checkbox"/> Vector	Length	I <input type="text" value="0.000"/>		J <input type="text" value="0.000"/>		K <input type="text" value="1.000"/>	
	Width	I <input type="text" value="-1.000"/>		J <input type="text" value="-0.000"/>		K <input type="text" value="0.000"/>	

Comment:

Set Outputs [?] [X]

Output Features

Comments

OUTFIL OPER MAN Report

Auto Reset

X Axis TX2:-0.2000 * 0.2000

Y Axis TY2:-0.2000 * 0.2000

Z Axis TZ2:-0.2000 * 0.2000

VectDif/Profile TP2:-0.2000 * 0.2000

Edge Profile TPS2:-0.2000 * 0.2000

Dia/Rad D R TD2:-0.2000 * 0.2000

Length TL2:-0.2000 * 0.2000

Width TW2:-0.2000 * 0.2000

Form

Flatness FLAT2:0.0000

Straightness LSTRGHT2:0.0000

Circularity LCIRLTY2:0.0000

Cylindricity LCYLCTY2:0.0000

Sphericity LSPHCTY2:0.0000

IJK Vector Angle

Measured Curve Report All points

Report Table Position Reverse position sign

Set All Clear All

OK Cancel

DMIS Syntax:

TEXT/REPORT,'DATUM [-B-] HOLE LOCATION'

```

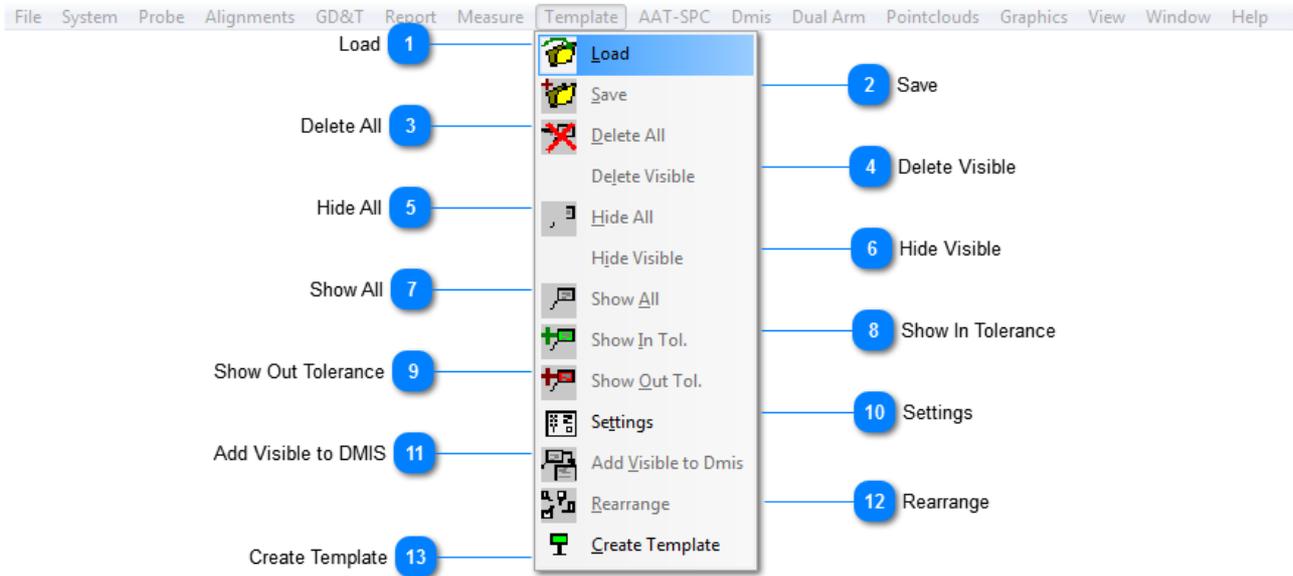
14: INNER CIRCLE CR12 DATUM [-B-] HOLE LOCATION
X   :    47.464    47.464   -1.000    1.000    0.000    ---|---*---|---
Y   :    77.536    77.536   -1.000    1.000    0.000    ---|---*---|---
Z   :    62.500    62.500   -1.000    1.000    0.000    ---|---*---|---
Diam:    9.525     9.525   -25.400    25.400    0.000    ---|---*---|---
Circularity: :      0.000                0.201    0.000    ---|---*---|---

```

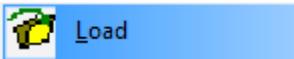
[Reporting Options](#)

Graphical Report Templates

Graphical Report Templates give an overview of the inspection results in a visible easy to see roadmap format. Below is an example of how a graphical template might look in CAPPS DMIS.



1 Load



Loads a **(.tpl)** file (see save) for a multiple part run. When the **(.tpl)** file is loaded, the templates will be updated to reflect the current report. This will eliminate the need to create a template for each individual part.

2 Save



Saves all the templates, and their locations, on the screen to a **(.tpl)** file. These templates can then be recalled and attached to the next run of the same part. This option is useful for multiple part runs where it is not feasible to create templates for each run of a part. This option also saves settings that were particular to that template, both local and global settings, and loading it at a later time.

3 Delete All



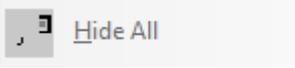
This is what is considered to be a global parameter. This feature will delete all the flags that point to the actuals in one broad sweep. Use extra caution when using this feature, so as to not delete any needed features. The template flags may be deleted one at a time by double clicking on them. This is a local setting and will delete only that feature.

4 Delete Visible



This option will delete all the visible templates that appear on the [Graphics Window](#).

5 Hide All



Hides all of the templates on the screen. These features are not deleted they are simply hidden from view. This option could be useful if the templates take up too much of the screen. A picture could be printed with half of the templates in place then they could be hidden. The second half of the templates could be put on and a second picture could be printed. This feature could also be used to experiment with different types of layout for the templates without deleting a whole group of features permanently.

6 Hide Visible



This option will hide all the visible templates that appear on the **Graphics Window**.

7 Show All



This option will show all of the templates, regardless of an in or out of tolerance condition.

8 Show In Tolerance



This feature may be used after templates have been created. By using this feature, only the templates for the in tolerance features will be shown. This can be used in addition with the next option (show out of tolerance) to streamline a graphical report therefore making it easier to see what is out of tolerance and what is in tolerance.

9 Show Out Tolerance



This feature may also be used after templates have been created. By using this feature, only the templates for the out of tolerance features will be shown. This may be particularly helpful when the majority of the templated points are already in tolerance, and the customer only wants to see the problem points.

10 Settings



[Template Settings.](#)

11 Add Visible to DMIS



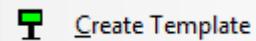
This option will write a line of code to the DMIS for every template on the screen so that when the program is run the templates are put on the screen automatically. Below is an example of this template and the DIMS code that is generated.

12 Rearrange



This function will organize the templates around the perimeter of the [Graphics Window](#).

13 Create Template



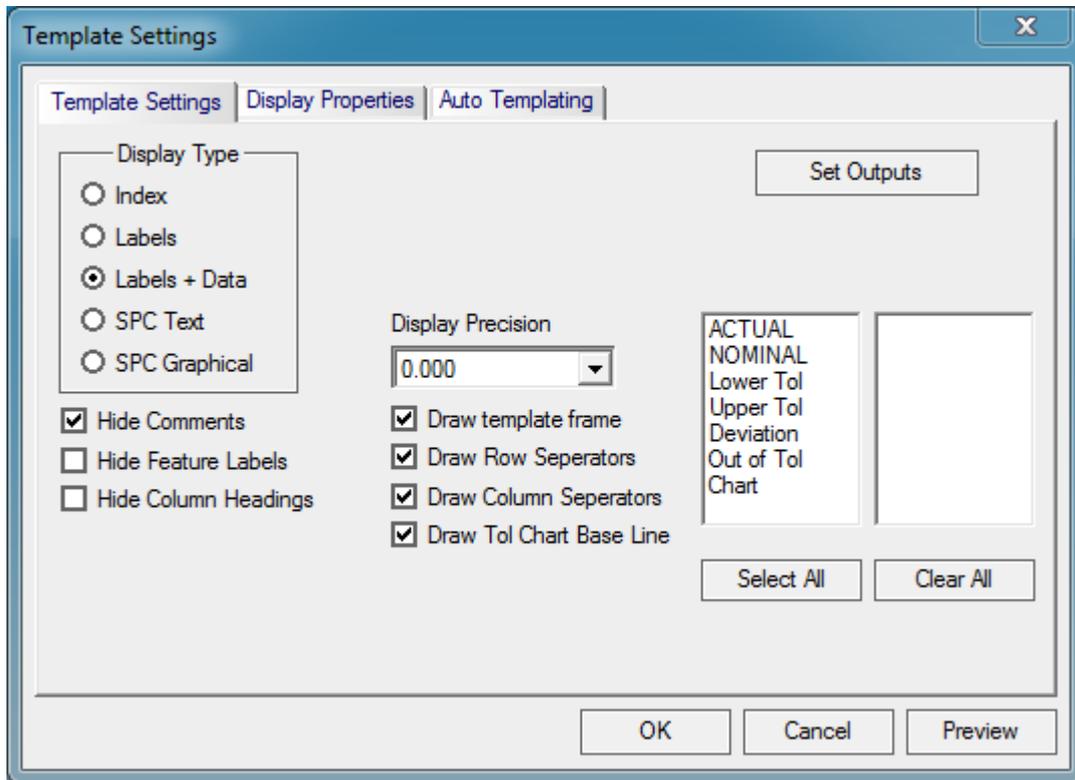
This option will display a menu that will allow the user to filter feature type for the template being created, or pick individual features from a list.

[Reporting Options](#)

Template Settings

There are 3 tabs in the **Template Settings Window** and this section will describe the options in each tab.

Template Settings

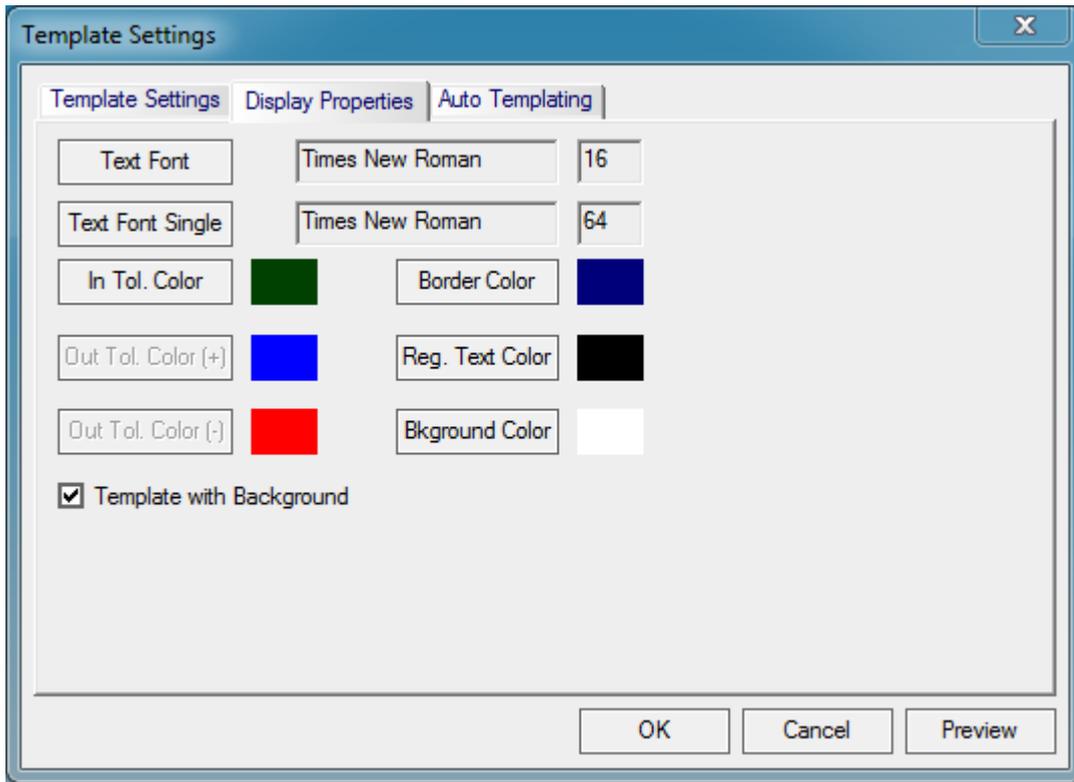


Display Type	
Index:	This option is used to display the index number from the report page (That is, the far left hand number from the report page) .
Labels:	Used to display the point labels that are assigned to each point measure in the template box.
Labels and Data:	Used to display the point labels and the data that have been chosen to display with the set outputs option.
SPC Text:	Used to display SPC information in text format.
SPC Graphical:	Used to display SPC information in graphical format.
Set Outputs:	Used to display a dialog that allows the user to configure what will be shown in the template.

Display Precision:	Used to configure the template to numerically display a specific number of places past the decimal.
Hide Comments:	If this box is unchecked, any comments that were added using the comment line during a manual labeling operation, the GD&T Output option, or by using the TEXT/REPORT option will be displayed in the template.
Hide Feature Labels:	Hides feature labels in templates.
Hide Column Headings:	Hides column headings in templates.
Draw Template Frame:	Draws template frame.
Draw Row Separators:	Draws row separators.
Draw Column Separators:	Draws column separators.
Draw Tolerance Chart Base Line:	Will do what is implied by the name. Chart must be displayed on the template in order for this configuration to be effective.

[Graphical Report Templates](#)

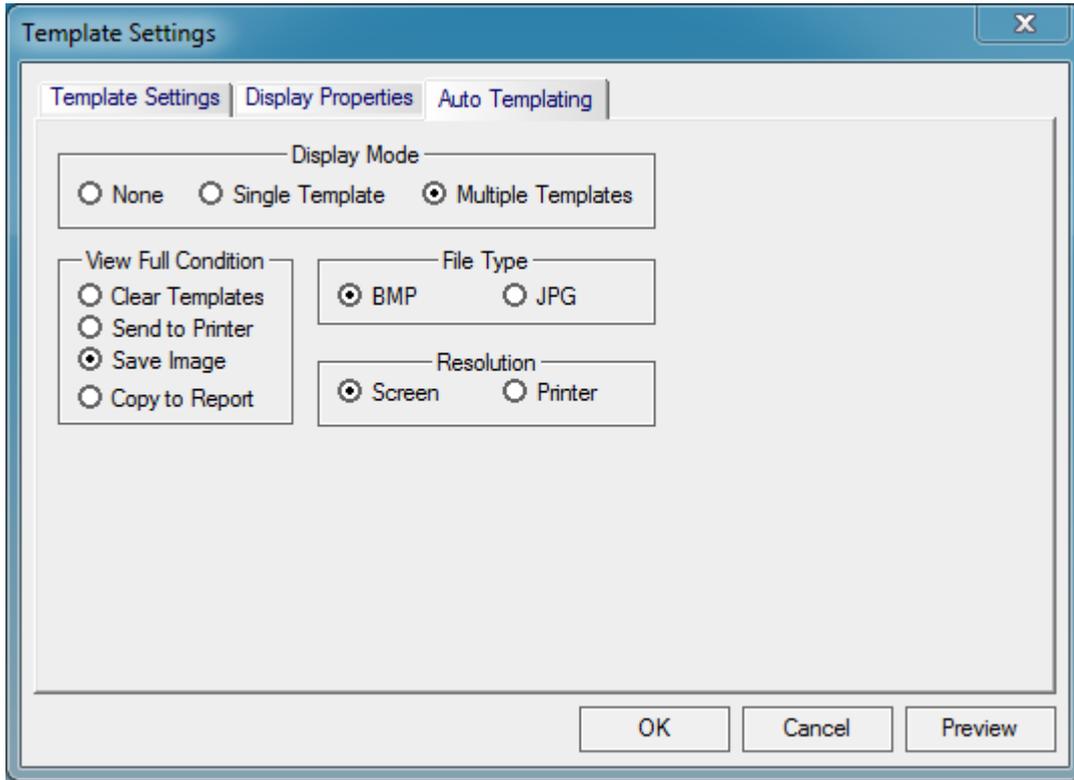
Display Properties



Display Properties are used to set **Text Font, Text Colors, Border Colors etc.** which is considered as visual settings for the templates.

[Graphical Report Templates](#)

Auto Templating



Display Mode	
None:	Used to be the default option when not wanting to display auto templates.
Single Template:	Used to display one template on the Graphics Window at a time, whose data is replaced each time a new feature is measured. This works in teach mode or execute mode.
Multiple Templates:	Used to display multiple templates while features are being measured. This option will work whether teaching or executing a program.
View Full Condition	All the options are accessible when the Multiple Templates option is picked. It designates what happens if the screen gets full of templates in the middle of learning or running a program with auto templates turned on.

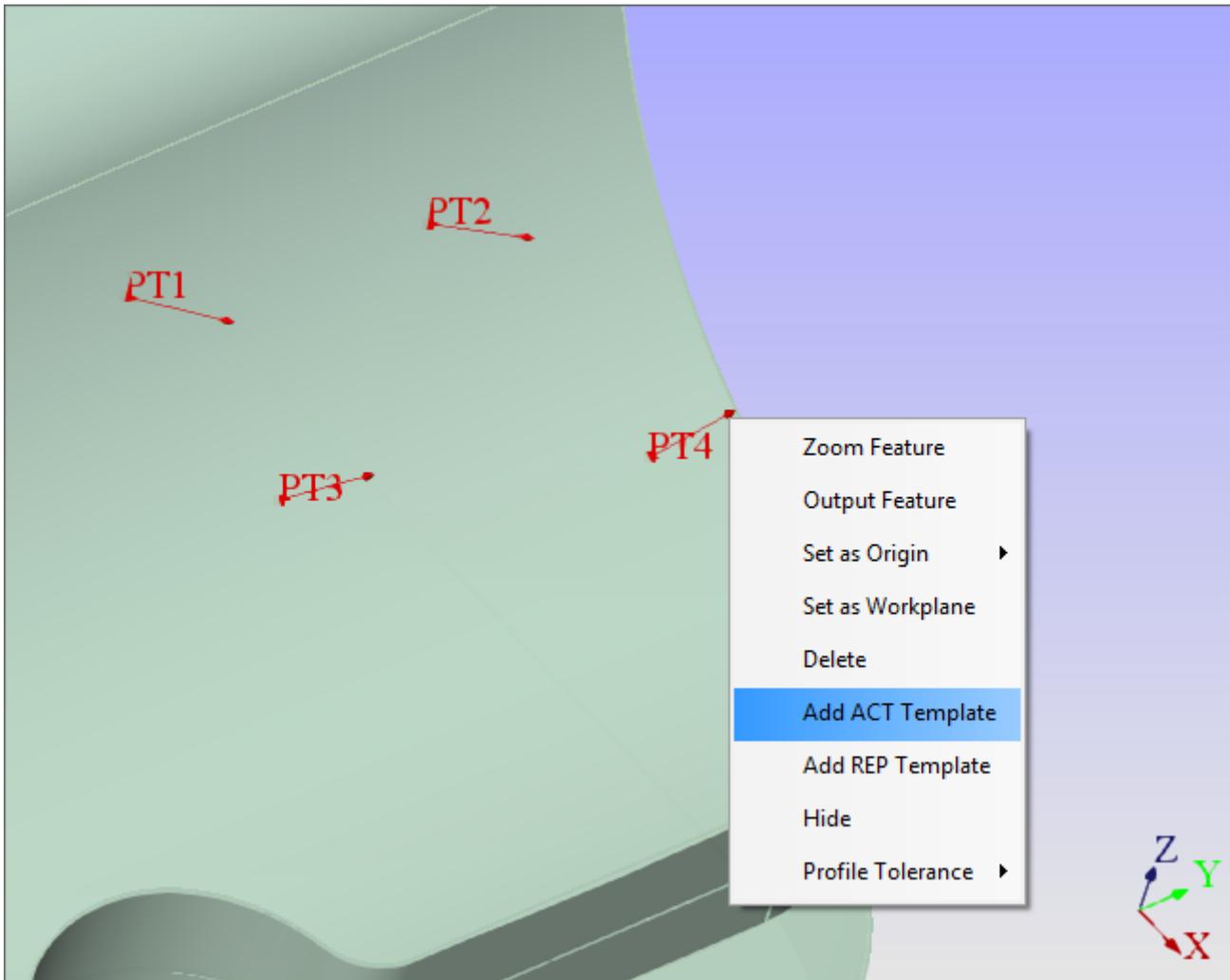
Clear Templates:	This option is used to clear the templates from the screen and delete them when the screen gets full. They are not saved or printed out they are just replaced. Be aware that this is the default option and must be changed if the templates are to be saved or printed out.
Send to Printer:	Used to send the visible picture to the printer once the view full condition has been achieved.
Save Image:	Once the view full condition has been achieved, the image will be saved in either a (.bmp) or (.jpg) format.
Copy to Report:	Once the view full condition has been achieved, the graphical image with templates will be captured and sent to the report.
File Type	
BMP:	Saves image in (.bmp) format.
JPG:	Saves image in (.jpg) format.
Resolution	
Screen:	Sets the resolution of the images according to screen settings.
Printer:	Sets the resolution of the images according to printer settings.

[Graphical Report Templates](#)

Adding Templates

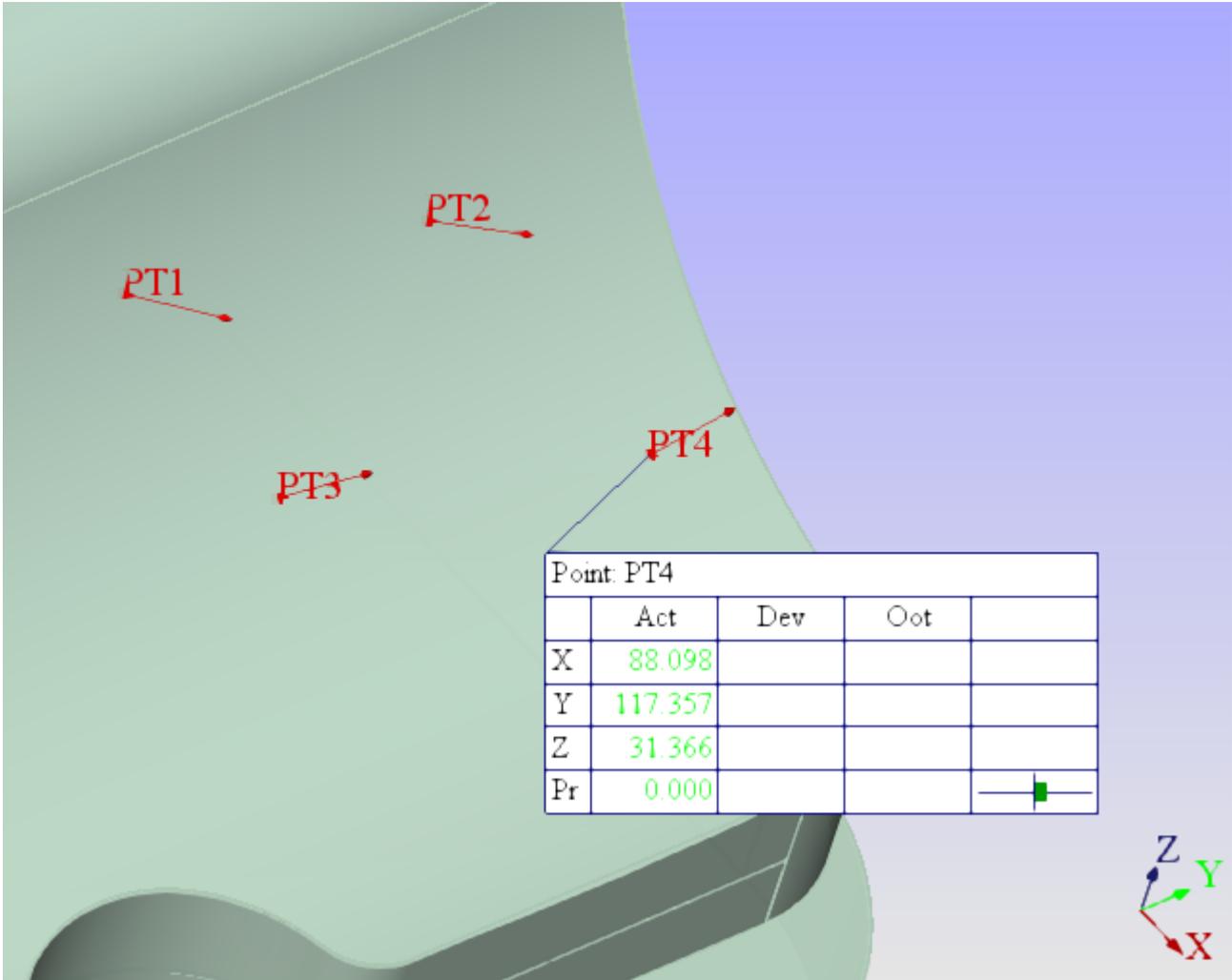
Double Click on Single Feature

To add a template to a single feature, simply double click the feature in the **Graphics Window**. You will see the following options.



Add ACT Template:	Used to add a template based on the actual data. Actual data output must be configured in the template settings in order for the data to show up in the template.
Add Report Template:	Used to add a template based on the report data including a control chart if it is configured as such in the template settings.

Once a template has been added to the **Graphics Window**, each template may be edited individually by double clicking the template.

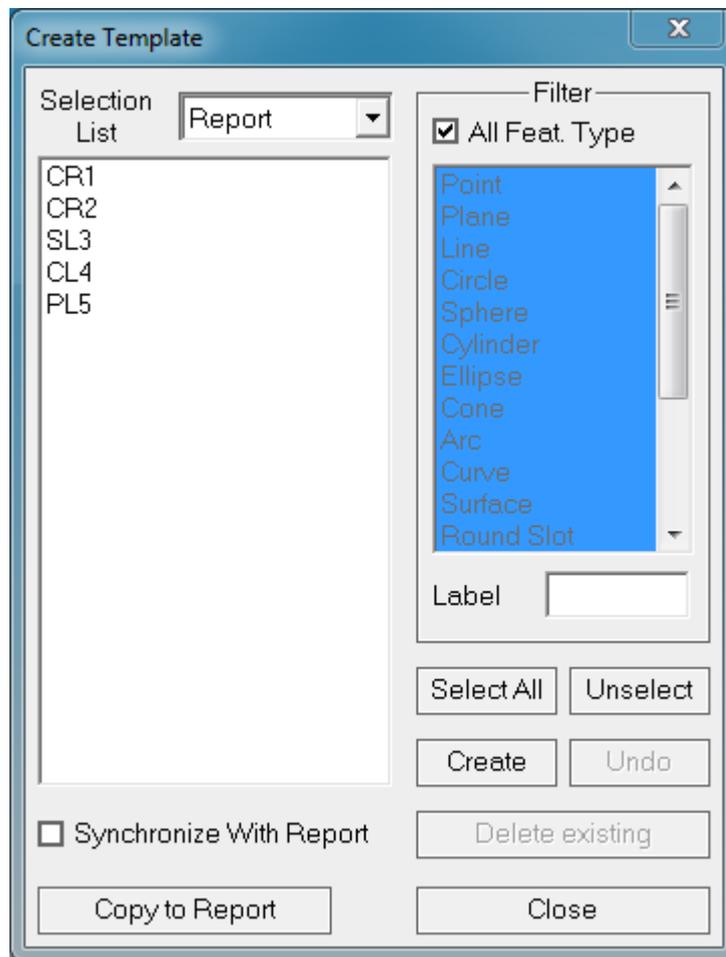


Configure:	Used to display the template settings dialog box.
Hide:	Used to hide the template from the screen.
Delete:	Used to delete the template from the Graphics Window .
Add to DMIS:	Used to add code to the Program Window to display the template during a run program.

[Reporting Options](#)

Group Selection

Adding templates may also be achieved by adding them from the create template dialog box. This is usually a more efficient way of adding templates when dealing with more than just a few features. To display the create template dialog box, go to [Template Menu - Create Template](#). The following dialog will appear:



Selection List:	The selection list will be based on either Report, Actuals or Nominals .
Synchronize with Report:	Synchronizes the templates with the report if there have been tolerance changes in the report.
Filter:	If this option is checked, then all feature types will be displayed in the selection list. If unchecked then the user will be able to pick the feature type that will be used to filter the list.
Label:	Another way to filter the feature type if user defined labels are being used for feature names.
Select All:	Selects all the features in the feature selection list.
Unselect:	Unselects all the selected features.
Create:	Used to create templates based on the selection.
Undo:	Used to undo the template generation from the Graphics Window after clicking the create button.

[Adding Templates](#)

Report Selection

Another way of plotting templates on the **Graphics Window** is to select a group of features from the report, right click the mouse and choose the create template option.

ELEM#	NOMINAL	ACTUAL	LOW_TOL	UPP_TOL	DEV	OUT_OF_TOL	CONTROL
DATE : 4/1/2014							
TIME : 11:10:50 AM							
PART NAME : CONSTPT_ACTUALS							
PART NUMBER : 123456							
OPERATOR : AAT INTERNAL TESTING DEPARTMENT							
COMMENT : Point Construction Test							

1: POINT PT1 [MCS]							
X :	26.048	26.038	-0.200	0.200	-0.010		--- ---*0--- ---
Y :	69.590	69.580	-0.200	0.200	-0.010		--- ---*0--- ---
Z :	62.495	62.492	-0.200	0.200	-0.003		--- ---*--- ---
Prof:		-0.003	-0.200	0.200			--- ---*--- ---

2: INNER CIRCLE CR2 [MCS]							
X :	29.514	29.504	-0.200	0.200	-0.010		--- ---*0--- ---
Y :	95.498	95.496	-0.200	0.200	-0.002		--- ---*--- ---
Z :	62.500	62.500	-0.200	0.200	0.000		--- ---*--- ---
Diam:	25.410	25.400	-0.200	0.200	-0.010		--- ---*0--- ---

3: OUTER CYLINDER CL3 [MCS]							
X :	17.499	17.499	-0.200	0.200	0.000		--- ---*--- ---
Y :	17.510	17.500	-0.200	0.200	-0.010		--- ---*0--- ---
Z :	50.665	50.665	-0.200	0.200	0.000		
Diam:	19.050	19.050	-0.200	0.200	0.000		

4: INNER SLOT SL4 [MCS]							
X :	29.917	29.919	-0.200	0.200	0.002		
Y :	54.634	54.636	-0.200	0.200	0.002		
Z :	62.500	62.500	-0.200	0.200	0.000		

5: INNER SLOT SL4 [MCS] [asdad]							
X :	29.917	29.919	-0.200	0.200	0.002		
Y :	54.634	54.636	-0.200	0.200	0.002		
Z :	62.500	62.500	-0.200	0.200	0.000		

Edit ▶

View ▶

Save As

Print Preview

Print... Ctrl+P

Append From Cursor

Append At End

View/Modify...

Regenerate

Udate ▶

Create Template

External View

Adding Templates

Printing Reports

Header and Footer Options

Text Report

To access the Header and Footer setting for the text report, go to [File - Report Printing - Header and Footer](#).

Header & Footer Settings

Header Settings

Enable Header

Header Macros:

Header Placement:

Draw line under header

Footer Settings

Enable Footer

Footer Macros:

Footer Placement:

Draw line above footer

Draw frame around the page

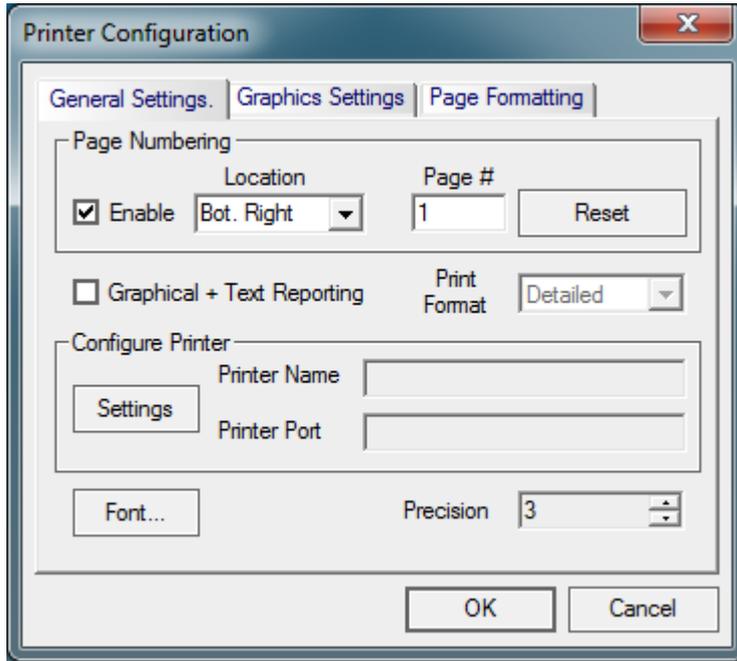
Add to DMIS

Once the configurations have been made, click the **OK** button and then go to [File - Report Printing - Print Preview](#) to see the results.

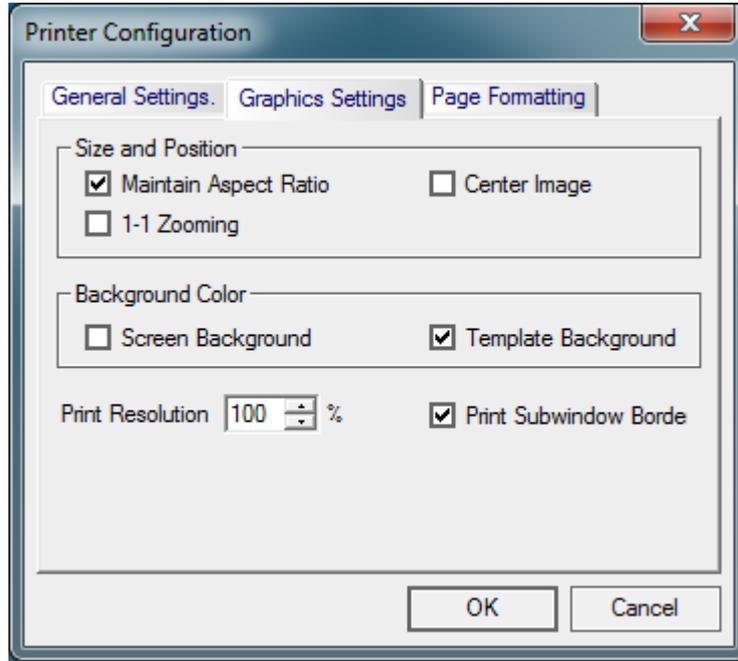
[Reporting Options](#)

Graphical Printing

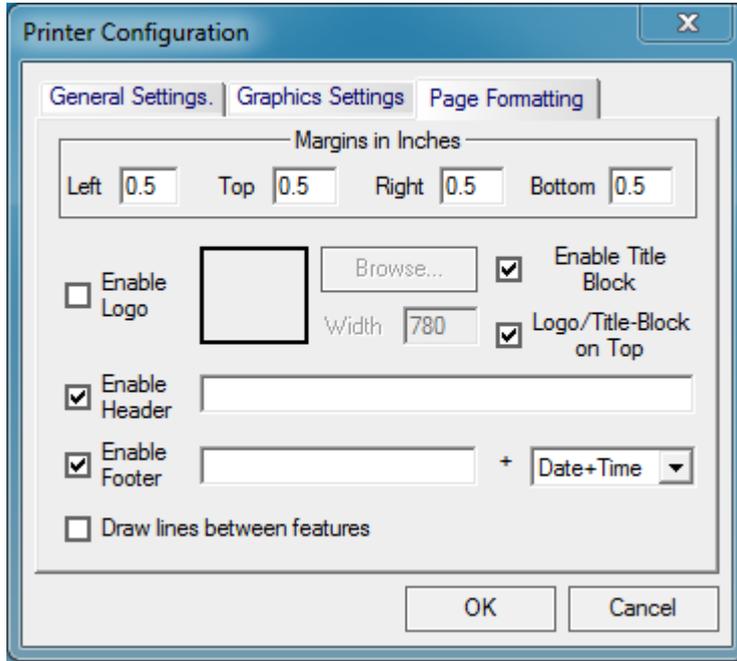
Graphical Printing dialog box can be accessed through [File - Graphics Printing - Print Settings](#).



Page Numbering:	If this box is checked, any reports or pictures that are printed will have page numbers on them. The location of the numbers can be selected from the dropdown menu. Page number is for pictures, for example, if multiple views need to be output from the same program and page numbering is enabled the pictures will be auto numbered. If the reset button is clicked, the page number will be reset to one.
Graphical + Text Reporting:	This option will print text results along with a graphical screen dump.
Print Format:	Used to select either the Detailed or Compact formats.
Settings:	Used to configure printer settings.
Font:	Used to configure the font style.
Precision:	Used to configure places past the decimal for feature outputs.



Maintain Aspect Ratio:	This option will maintain the ratio as it is seen on the Graphics Window in CAPPs. In other words, the size of the picture as stated in the Graphics Window , is the size the picture will be in the printed document.
Center Image:	This option will center the image of the part on the screen during the printing operation.
1-1 Zooming:	Used to print graphics in their original size.
Screen Background:	Used to show the screen background color on the graphical printout.
Template Background:	Used to show the template background color on the graphical printout.
Print Resolution:	Used to change the print resolution.
Print Subwindow Border:	This option will print a border around the measurement results on the printout.

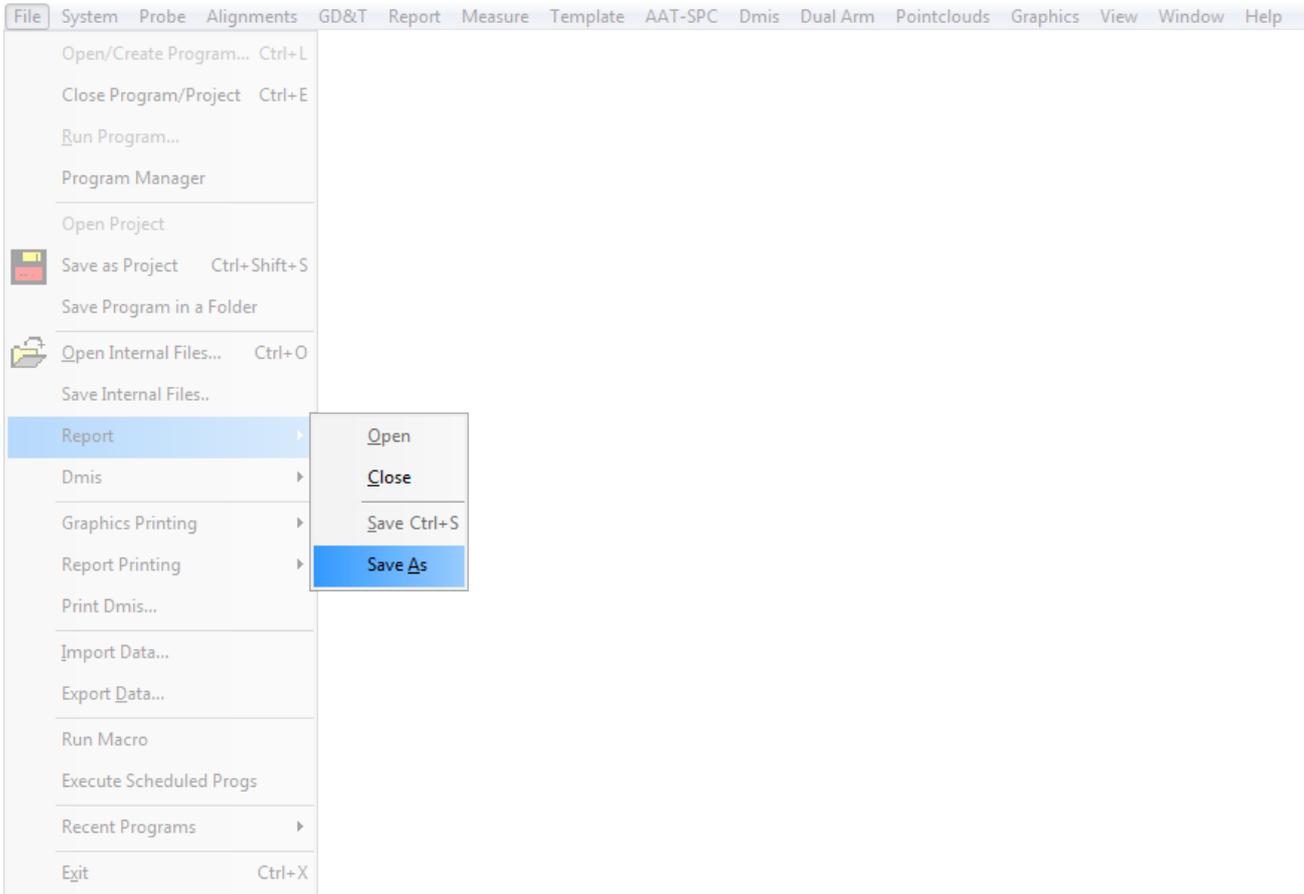


Margins:	Margins may be set using these inputs.
Enable Logo:	Allows the user to display a logo on the graphical printout. This is typically a company logo or something similar.
Enable Title Block:	Used to enable the title block area which will contain the header information from the report.
Logo/Title Block on Top:	If this option is not checked then the title block will appear at the bottom of the page instead of the top of the page.
Enable Header:	This option is used to print an additional header line on the printout.
Enable Footer:	This option is used to print a footer line at the bottom of the page.
Draw Lines Between Features:	This option is used to draw a line between the feature results, making them easier to read.

[Reporting Options](#)

Saving Reports

Reports can be saved through [File - Report - Save As](#) shown below:



or from the [Right Click Menu - Save As](#) shown below:

ELEM#	NOMINAL	ACTUAL	LOW_TOL	UPP_TOL	DEV	OUT_OF_TOL	CONTROL
DATE : 4/1/2014							
TIME : 11:10:50 AM							
PART NAME : CONSTPT_ACTUALS							
PART NUMBER : 123456							
OPERATOR : AAT INTERNAL TESTING DEPARTMENT							
COMMENT : Point Construction Test							

1: POINT PT1 [MCS]							
X :	26.048	26.038	-0.200	0.200	-0.010	---	---*0---
Y :	69.590	69.580	-0.200	0.200	-0.010	---	---*0---
Z :	62.495	62.492	-0.200	0.200	-0.003	---	---*---
Prof:		-0.003	-0.200	0.200		---	---*---

2: INNER CIRCLE CR2 [MCS]							
X :	29.514	29.504	-0.200	0.200	-0.010	---	---*0---
Y :	95.498	95.496	-0.200	0.200	-0.002	---	---*---
Z :	62.500	62.500	-0.200	0.200	0.000	---	---*---
Diam:	25.410	25.400	-0.200	0.200	-0.010	---	---*0---

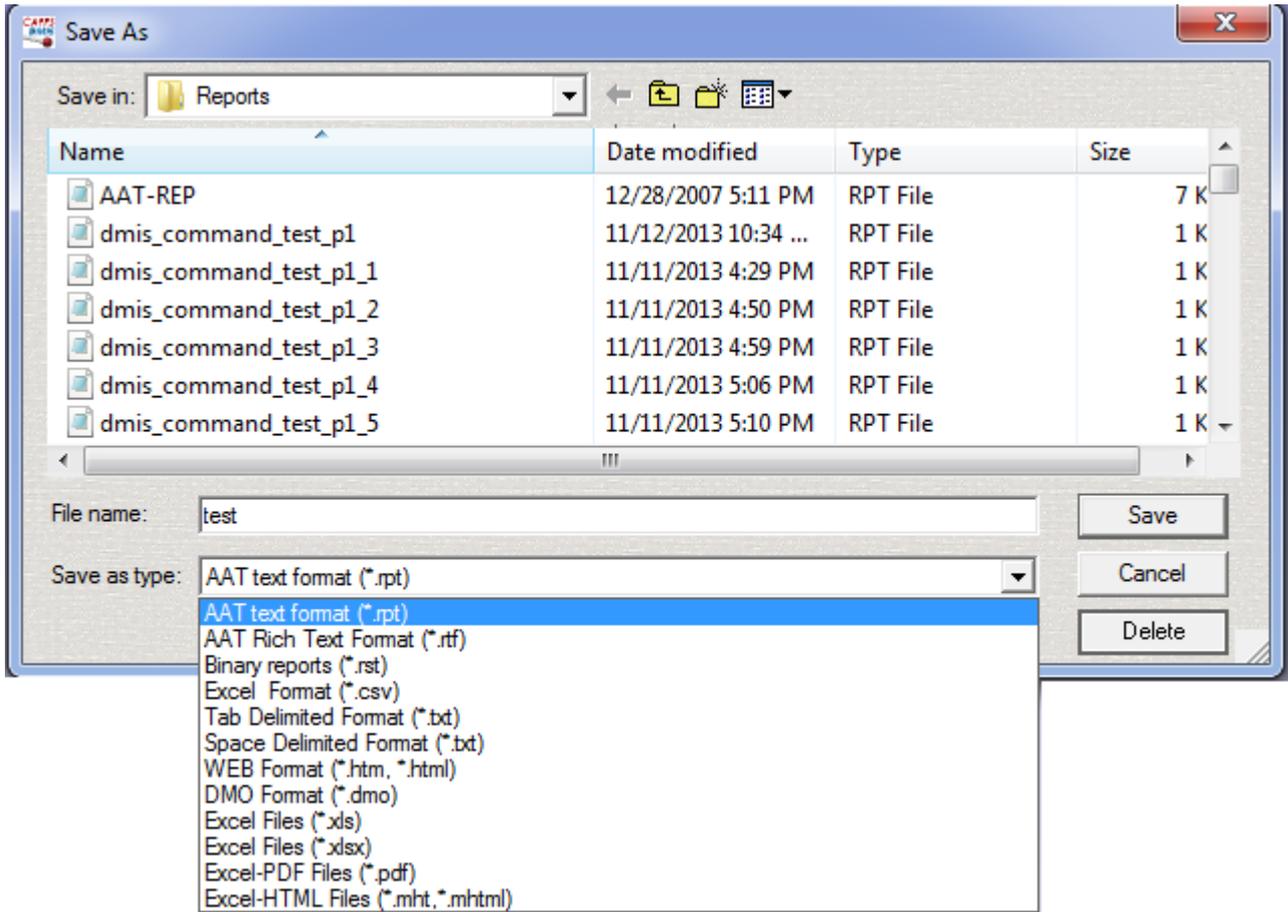
3: OUTER CYLINDER CL3 [MCS]							
X :	17.499	17.499	-0.200	0.200	0.000	---	---*---
Y :	17.510	17.500	-0.200	0.200	-0.010	---	---*0---
Z :	50.665	50.665	-0.200	0.200	0.000	---	---*---
Diam:	19.050	19.050	-0.200	0.200	0.000	---	---*---

4: INNER SLOT SL4 [MCS]							
X :	29.917	29.919	-0.200	0.200	0.002	---	---*---
Y :	54.634	54.636	-0.200	0.200	0.002	---	---*---
Z :	62.500	62.500	-0.200	0.200	0.000	---	---*---

5: INNER SLOT SL4 [MCS] [asdad]							
X :	29.917	29.919	-0.200	0.200	0.002	---	---*---
Y :	54.634	54.636	-0.200	0.200	0.002	---	---*---
Z :	62.500	62.500	-0.200	0.200	0.000	---	---*---

- Edit ▶
- View ▶
- Save As
- Print Preview
- Print... Ctrl+P
- Append From Cursor
- Append At End
- View/Modify...
- Regenerate
- Update ▶
- Create Template
- External View
- Zoom to actual in graphics
- Highlight Definition in DMIS
- Generate Dependency List
- Update DMIS with Report

CAPPS will allow the report to be saved in the following formats.



For more information on the report types listed above, please refer to [Standard Reporting Styles and Formats](#) .

[Reporting Options](#)

Program (DMIS) Window

Language Overview

The objective of the **Dimensional Measuring Interface Standard (DMIS)** is to provide a standard language for the bidirectional communication of inspection data between computer systems and inspection equipment. The specification is a vocabulary of terms, which establish a neutral format for inspection programs and inspection results data. While primarily designed for communication between automated equipment, DMIS is designed to be both man readable and man writable, allowing inspection programs to be written and inspection results to be analyzed without the aid of a computer.

The DMIS language is similar in syntax to the **APT NC** programming language, with major and minor words separated by slashes. **Output data formats** are similar to **Input data formats**. Translators for the DMIS language can be simple single pass interpreters or complex multiple pass compilers, depending on the implementation method which each individual vendor has chosen.

There are two basic types of DMIS statements: process oriented commands and geometry oriented definitions. Process commands consist of motion statements, machine parameter statements, and other statements, which are unique to the inspection process itself. Definitions, on the other hand, are used to describe geometry, tolerances, coordinate systems, and other types of data, which may be included in a CAD database. At present, part models do not include all of the data needed in the DMIS interface, so supplementary data must be added manually. The evolution of CAD systems, though, is heading in the direction of complete part models, and DMIS has been designed to be compatible with this growth path.

The inspection of a part often has dual objectives. Verification of the acceptance status of the part is usually the prime objective. The development of an inspection program is another common objective. Performance of any inspection activity within CAPPs automatically generates a DMIS program as a by product. Not every activity performed on the CMM is recorded in an inspection program written in DMIS language. The DMIS language is the standard used throughout the industry and is a valuable tool for any CMM operator using CAPPs.

Manual Machines

Users of **manual machines** often underestimate the value of a DMIS program for their application. The utility of DMIS is viewed as being limited to providing information to operators that helps assure consistency. While this is a useful function, it is not the most valuable.

The execution of a DMIS program on a **manual machine** can greatly reduce the inspection time required by eliminating interaction with the menu system. The operator executes the measurement commands and the software uses the information in the program to process the data as required.

DCC Machines

For the user of a **DCC machine**, the DMIS program can greatly enhance the productivity of machine and operator alike. A well developed program for a specific part will allow complete automatic inspection without input from the operator.

Once an alignment is established, the machine can be set in **DCC Mode** ([MEASCAD Mode](#)) to execute the inspection program while the operator works on another project. To maximize production in any inspection department, it is common to have an offline station available where the next inspection program can be developed while one is being executed.

CAD Data

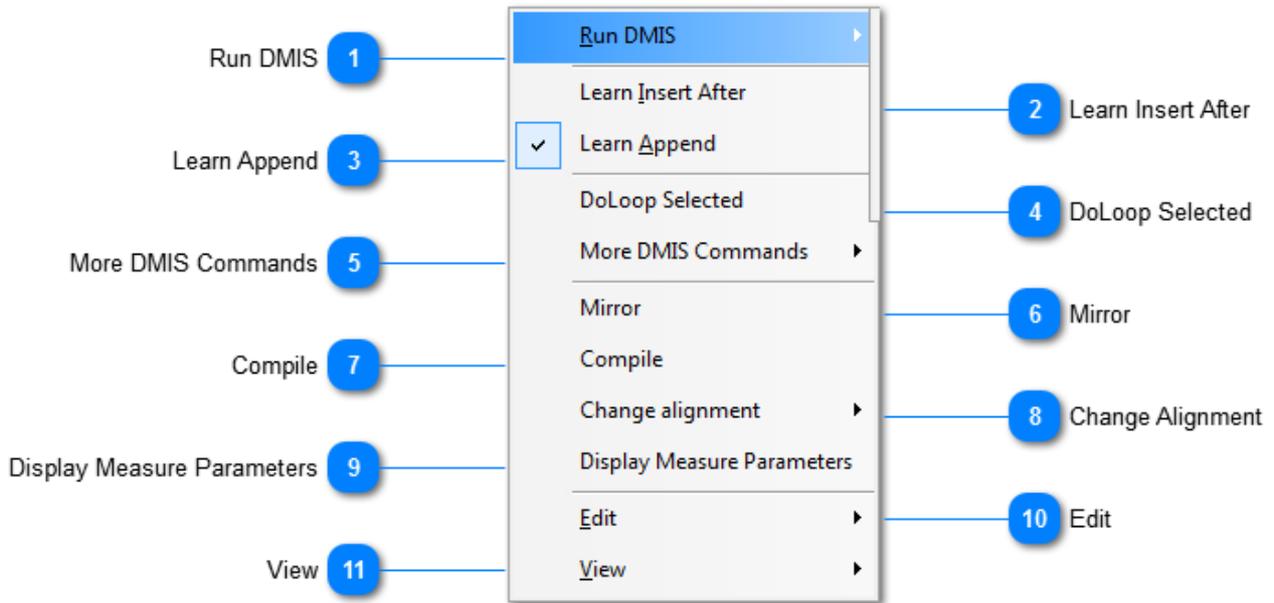
If there is no CAD data available for the part, generation of the DMIS program will be the same regardless of whether the machine is **manual** or **DCC**. Typically, a **manual machine** operator performs an alignment on the part and begins to measure features. A **DCC machine** operator operates the DCC machine in [Measure Mode](#) under the Joystick control, performs an alignment on the part, and begins to measure features. This mode of operation is the only alternative for the user of either type of machine when no CAD data is available.

The differences between these machine types become evident with the availability of CAD data for the part. While there is little change in the operation of the **manual machine**, the **DCC machine** becomes much more productive and consistent.

The user of the **DCC machine** may only be required to perform an alignment before directing the machine to inspect the entire part. Features can be selected from the graphics and the machine will automatically drive to them, take measurements, and create the DMIS program at the same time. The IJK vector information included in the CAD data enables the software to drive the machine along the assigned nominal vector of a point or feature and deliver very accurate measurement results.

[Table of Contents](#)

Right Click Menu



1 Run DMIS



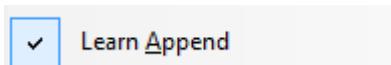
Used to specify running options.

2 Learn Insert After



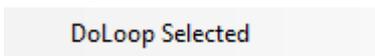
Used to insert DMIS code after a specified line.

3 Learn Append



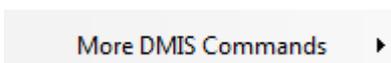
Used to insert DMIS code at the end of the program.

4 DoLoop Selected



Used to create a **DoLoop** function around selected lines of DMIS code.

5 More DMIS Commands



Used to show additional DMIS commands.

6 Mirror

Mirror

Used to [Mirror](#) the written DMIS code using an axis.

7 Compile

Compile

Used to compile recently generated DMIS code.

8 Change Alignment

Change alignment

Used to display [Change Alignment](#) options.

9 Display Measure Parameters

Display Measure Parameters

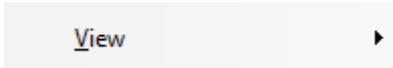
Used to display the **Measure Parameters** used in the program.

Depth	Search	Approach	Retract	Clear Surf
2.000	10.000	10.000	10.000	12.000
Meas Speed	Pos. Speed	No Approach	Start Ang.	Total Ang.
7.000	10.000	<input type="checkbox"/>	0.000	360.000
Alignment	Probe	Pt Count		
MCS	PA0B0	—		
X	Y	Z	D	
—	—	—	—	
I	J	K		
—	—	—		

10 Edit

Edit

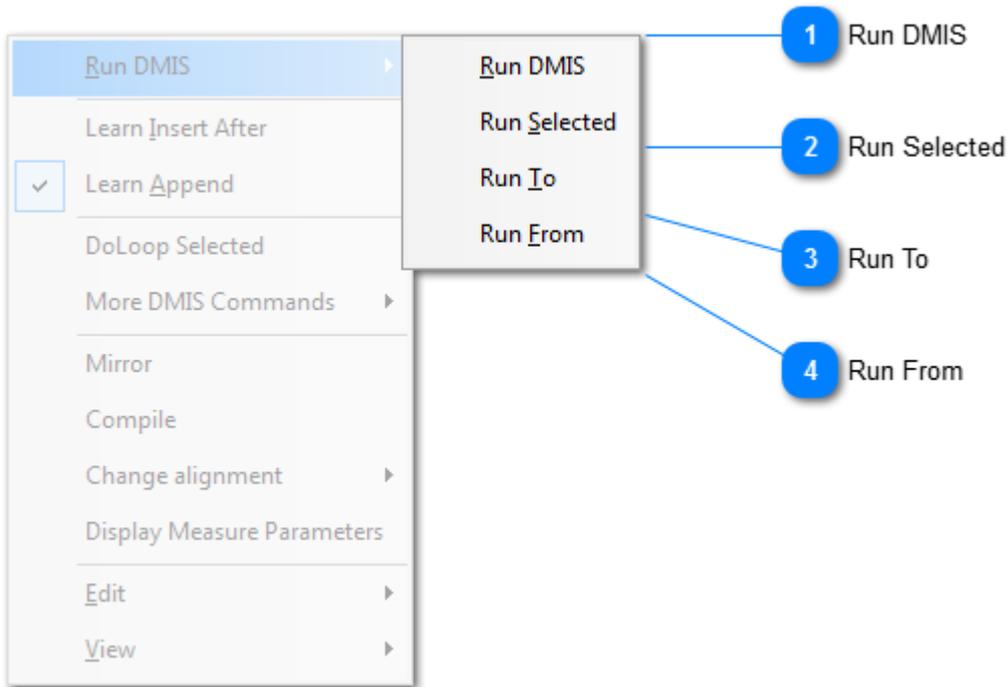
Used to display **Edit** options which contains mostly **Microsoft Windows Right Click Menu** functions.

11 View

Used to display [View](#) options.

[Program \(DMIS\) Window](#)

Run DMIS



1 Run DMIS

Run DMIS

Runs DMIS program **from the beginning to the end.**

2 Run Selected

Run Selected

Runs **the selected (highlighted) lines** in [DMIS\(Program\) Window](#) only.

3 Run To

Run To

Runs the program **from the beginning to the selected (highlighted) line** in [DMIS\(Program\) Window](#).

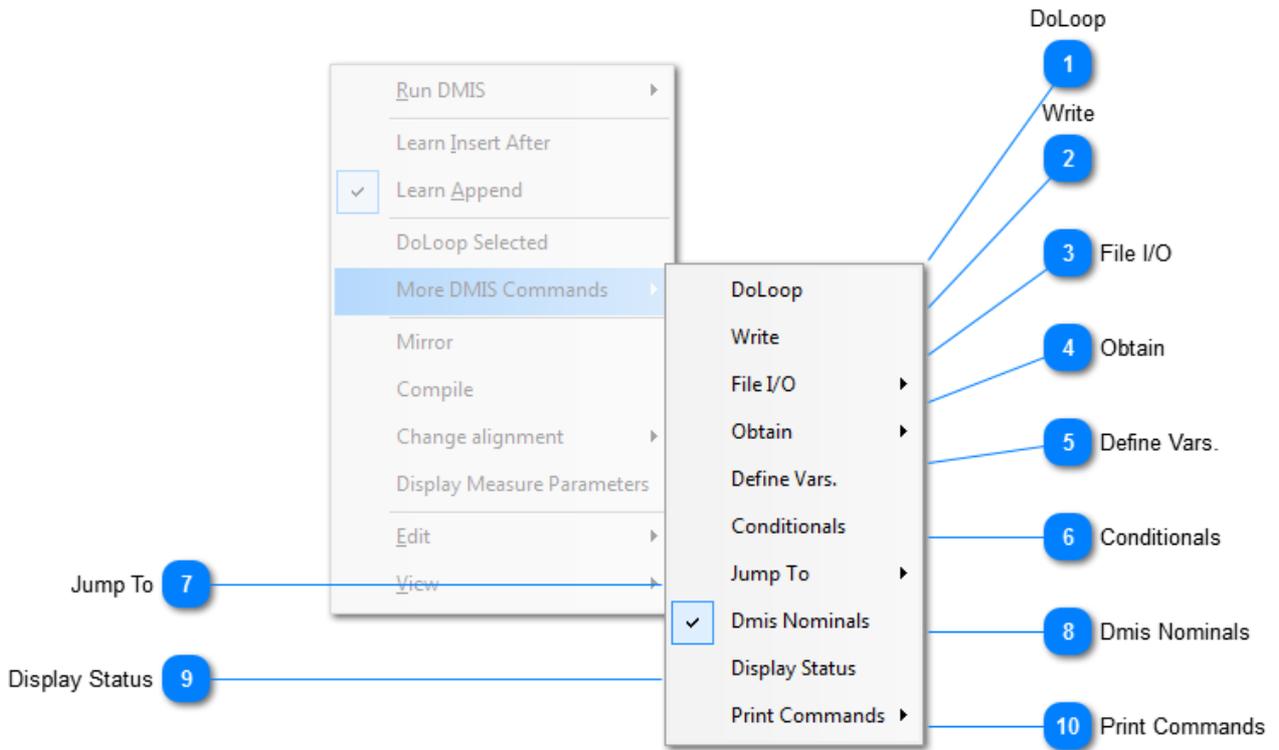
4 Run From

Run From

Runs the program **from the selected (highlighted) line** in [DMIS\(Program\) Window](#).

[Right Click Menu](#)

More DMIS Commands



1 DoLoop

DoLoop

Opens up **DoLoop** dialog box where the user can create a **DoLoop** without writing the codes manually.

Start a New Loop:	Used to write the following commands into the Program Window . Loop variable is required. DO/A,1,10,1 A is an integer variable declared before the DoLoop statement.
End an Existing Loop	Used to write the following commands into the Program Window : ENDDO
Complete Empty Loop	Used to write both of the above commands.
Complete Loop Around Selected DMIS:	Used if portions of the Program Window have been selected.
Loop Variable:	Can be any alpha numeric character. Used to write the following command: DECL/INTGR,A Which declares an integer variable before the DoLoop statement.
Loop Offset:	It adds an offset value in the selected axis each time the loop runs.

2 Write

Write

Writes the following code in the **Program Window** and writes data into a declared device storage or to the standard output window based on obtained features.

WRITE/DID(FILEX),X

Please refer to [DMIS Commands Manual](#) for more information on **WRITE** command.

3 File I/O

File I/O ▶

Used to write a basic programming code for **File I/O Functions**.
Please refer to [DMIS Commands Manual](#) for more information on **FILE I/O**.

4 Obtain

Obtain ▶

Used to obtain specific values from DMIS features.
Please refer to [DMIS Commands Manual](#) for more information on **OBTAIN** command.

5 Define Vars.

Define Vars.

Used to define variables.
Please refer to [DMIS Commands Manual](#) for more information on **Defining Variables**.

6 Conditionals

Conditionals

Used to create **IF** conditions in **Program Window**.
Please refer to [DMIS Commands Manual](#) for more information on **Conditionals**.

7 Jump To

Jump To ▶

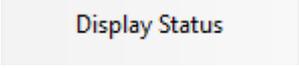
Used to create a **JumpTo** statement that jumps over a specified line of code in **Program Window**.
Please refer to [DMIS Commands Manual](#) for more information on **JUMPTO** command.

8 Dmis Nominals

Dmis Nominals

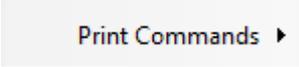
Used to turn report nominals on and off. This is checked by default.

9 Display Status

A screenshot of a rectangular button with a light gray background and the text "Display Status" centered on it.

Used to open [Display Status Window](#).

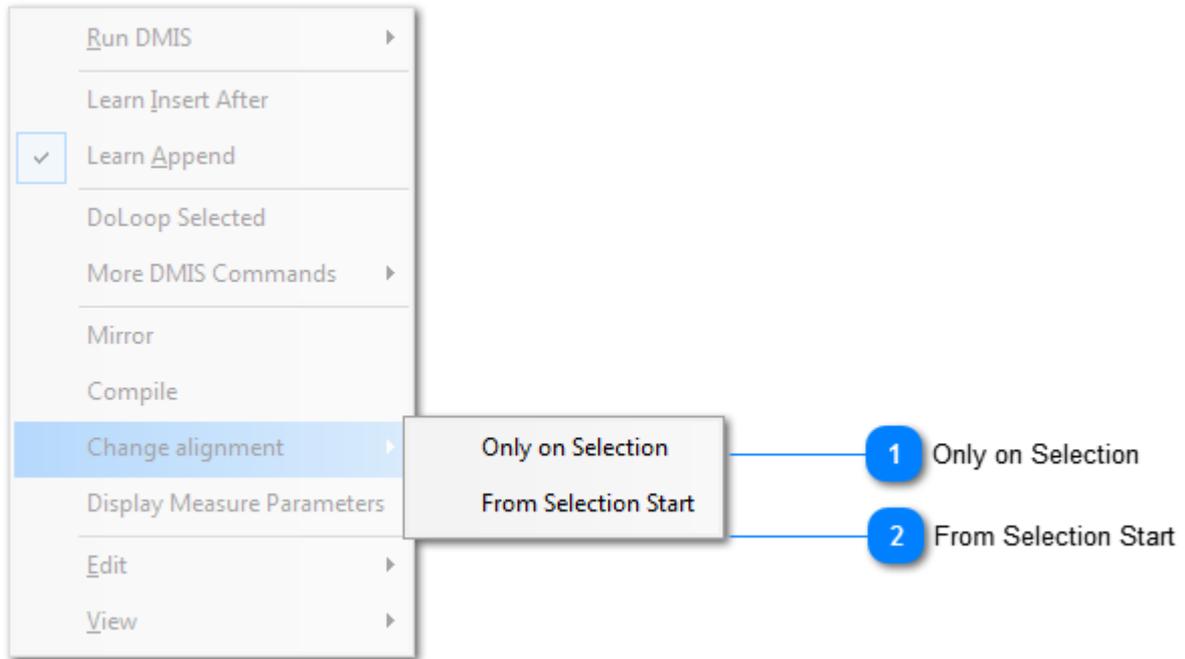
10 Print Commands

A screenshot of a rectangular button with a light gray background and the text "Print Commands" followed by a right-pointing arrow.

Used to display **Print Commands**.

[Right Click Menu](#)

Change Alignment



1 Only on Selection

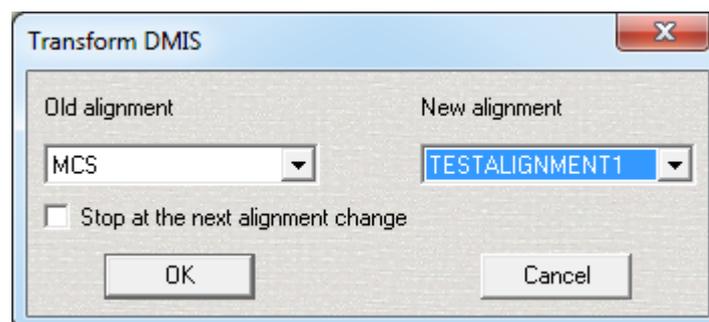
Only on Selection

Used to change the alignment for the highlighted section of DMIS program with another alignment from the [Datum List](#).

```

52 T (LCYLCTY2)=TOL/CYLCTY,0.0000
53 T (LCIRLTY2)=TOL/CIRLTY,0.0000
54 T (LSPHCTY2)=TOL/SPHCTY,0.0000
55 $$DATE: 4/14/2014
56 $$TIME: 12:26:34 PM
57 OP(1)=OPERID/'AAT INTERNAL TESTING DEPARTMENT'
58 PN(1)=PARTID/'CONSTPT_ACTUALS'
59 PS(1)=PARTSN/'123456'
60 CM(1)=COMMNT/'Point Construction Test'
61 R(1)=REPORT/DATE,TIME,OP(1),PN(1),CM(1),CS(1)
62 OUTPUT/R(1)
63 $$SELECT PROBE PA0B0 AT A=0.0,B=0.0
64 SNSLCT/SA(PA0B0),0.00000,0.00000,1.00000
65 CAPP/LOCKPART
66 CAPP/NOMREP,ON
67 F(PT1)=FEAT/POINT,CART, 70.9962, 82.0142, 47.0153, 0.8262, 0.0002, 0.5634
68 MEAS/POINT, F(PT1), 1
69 PTMEAS/CART, 70.9962, 82.0142, 47.0153, 0.8262, 0.0002, 0.5634
70 ENDMES
71 OUTPUT/FA(PT1),TA(TX2),TA(TY2),TA(TZ2),TA(TP2)
72 F(PT2)=FEAT/POINT,CART, 73.1003, 106.8271, 44.1411, 0.7848, 0.0003, 0.6198
73 MEAS/POINT, F(PT2), 1
74 PTMEAS/CART, 73.1003, 106.8271, 44.1411, 0.7848, 0.0003, 0.6198
75 ENDMES
76 OUTPUT/FA(PT2),TA(TX2),TA(TY2),TA(TZ2),TA(TP2)

```



Important Note: If there is an alignment change in the highlighted area, CAPP/ will automatically stop transforming DMIS program to new alignment in case of **Stop At The Next Alignment Change** check box is checked.

2 From Selection Start

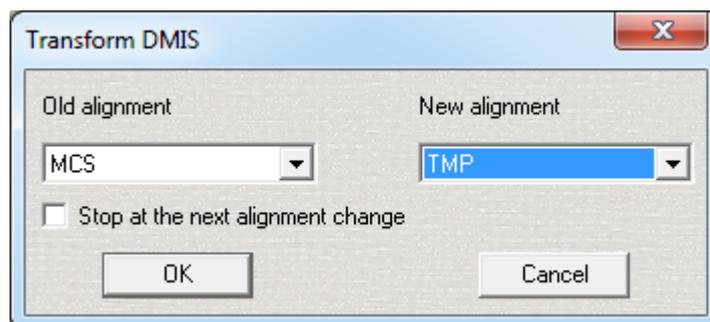
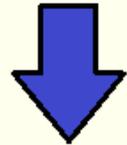
From Selection Start

Used to change the alignment for rest of the DMIS program starting from the highlighted line with another alignment from the [Datum List](#).

```

67 F (PT1)=FEAT/POINT,CART, 70.9962, 82.0142, 47.0153, 0.8262, 0.0002, 0.5634
68 MEAS/POINT, F (PT1), 1
69 PTMEAS/CART, 70.9962, 82.0142, 47.0153, 0.8262, 0.0002, 0.5634
70 ENDMES
71 OUTPUT/FA (PT1), TA (TX2), TA (TY2), TA (TZ2), TA (TP2)
72 F (PT2)=FEAT/POINT,CART, 73.1003, 106.8271, 44.1411, 0.7848, 0.0003, 0.6198
73 MEAS/POINT, F (PT2), 1
74 PTMEAS/CART, 73.1003, 106.8271, 44.1411, 0.7848, 0.0003, 0.6198
75 ENDMES
76 OUTPUT/FA (PT2), TA (TX2), TA (TY2), TA (TZ2), TA (TP2)
77 F (PT3)=FEAT/POINT,CART, 82.3307, 89.4492, 35.1231, 0.6013, 0.0005, 0.7991
78 MEAS/POINT, F (PT3), 1
79 PTMEAS/CART, 82.3307, 89.4492, 35.1231, 0.6013, 0.0005, 0.7991
80 ENDMES
81 OUTPUT/FA (PT3), TA (TX2), TA (TY2), TA (TZ2), TA (TP2)
82 F (PT4)=FEAT/POINT,CART, 88.0982, 117.3570, 31.3662, 0.4839, 0.0006, 0.8752
83 MEAS/POINT, F (PT4), 1
84 PTMEAS/CART, 88.0982, 117.3570, 31.3662, 0.4839, 0.0006, 0.8752
85 ENDMES
86 OUTPUT/FA (PT4), TA (TX2), TA (TY2), TA (TZ2), TA (TP2)
87 CAPPS/TEMPLT, RESET
88 OUTPUT/BITMAP (C:\CappsDmis\Capps\GFX\AATLOGO.jpg.gif), 100.00, 100.00, 1
89 DMESW/COMAND, 'WMPLAYER C:\CappsDmis\W4MC.AVI'
90 DMESW/COMAND, 'WMPLAYER C:\CappsDmis\W4MC.AVI'
91 DMESW/COMAND, 'WMPLAYER C:\CappsDmis\W4MC.AVI'
92 CAPPS/REPFMT, AATCMPQ1
93 CAPPS/REPFMT, AAT
94 CAPPS/REPFMT, AATCMPQ1
95 CAPPS/REPFMT, CSV
96 CAPPS/REPFMT, AATCMPQ1

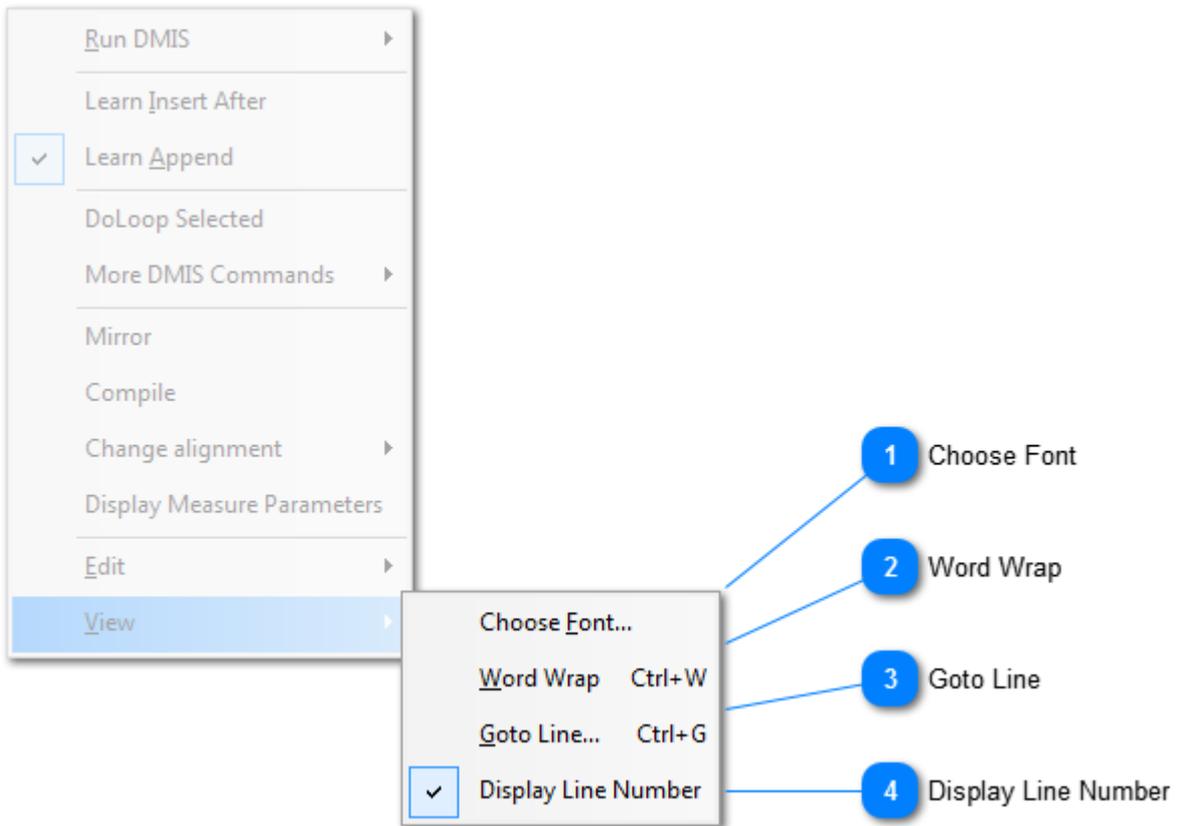
```



Important Note: If there is an alignment change in the highlighted area, CAPPS will automatically stop transforming DMIS program to new alignment in case of **Stop At The Next Alignment Change** check box is checked.

[Right Click Menu](#)

View



1 Choose Font

Choose Font...

Used to choose **Program Window** font.

2 Word Wrap

Word Wrap Ctrl+W

Allows continuing in a new line if the feature output is longer than one line.

3 Goto Line

Goto Line... Ctrl+G

Used to open a dialog where the user enters the line number s/he desires to go in **Program Window**.

4 Display Line Number

Display Line Number

Display line numbers along **Program Window**.

[Right Click Menu](#)

Description of Program Window

When CAPPs is started, the first portion of the DMIS program is written immediately. The software will utilize the most recent information to establish the default values. These values include [Probe Settings](#), [Standard Tolerances](#), [Units](#), [Modes](#), and [Machine Speeds](#). CAPPs displays a DMIS program in color coded form to facilitate recognition of the separate commands and functions. The [Program Window](#) in CAPPs is known as a real time editor. This means that statements can be put in using the CAPPs interface or, depending on the DMIS knowledge of the CAPPs user, typed in with the keyboard. The following example shows an example of the DMIS syntax and the color codes for the different types of DMIS statements:

```

DMISMN/'c:\cappsdmis\capps\programs\test.bdm'
$$$$ Created in CappsDmis(c) Version 7.0.5.193 by AAT. www.aat3d.com $$$
UNITS/MM,ANGDEC
CAPPs/PROJOFF
PTTYPE/TYPE1
WKPLAN/XYPLAN
MODE/MAN
D (MCS) =DATSET/MCS
SNSET/APPRCH,10.0000
SNSET/RETRCT,10.0000
SNSET/DEPTH,2.0000
SNSET/CLRSRF,12.0000
SNSET/SEARCH,10.0000
PRCOMP/ON
CAPPs/REPORT,IJK,OFF
Vectors)
CAPPs/TEMPLT,AUTO,OFF
CAPPs/NOMREP,OFF
WKPLAN/XYPLAN
CAPPs/DIR,CCW
CAPPs/STRANG,0.00
CAPPs/TOTANG,360.00
CAPPs/CYLOFF,0.0000
Settings)
CAPPs/SECSSTAANG,0.00
CAPPs/SECSTOTANG,360.00
CAPPs/TOPOFF,0.0000
MESPAR/SMPRAD,10.0000
CAPPs/EDGOFF,1.0000
Settings)
CAPPs/LNLNOFF,0.0000
CAPPs/LNSHIFT,0.0000
CAPPs/ROTLMEASPTH,OFF
T (TP2) =TOL/PROFP,-0.2000,0.2000
T (TPS2) =TOL/PROFS,-0.2000,0.2000
T (TPL2) =TOL/PROFL,-0.2000,0.2000
T (TX2) =TOL/CORTOL,XAXIS,-0.2000,0.2000
T (TY2) =TOL/CORTOL,YAXIS,-0.2000,0.2000
T (TZ2) =TOL/CORTOL,ZAXIS,-0.2000,0.2000
T (TR2) =TOL/CORTOL,RADIUS,0.2000,0.2000
T (TA2) =TOL/CORTOL,ANGLE,-0.200,0.200
T (TD2) =TOL/DIAM,-0.2000,0.2000
T (TRAD2) =TOL/RAD,-0.2000,0.2000
T (TL2) =TOL/LENGTH,-0.2000,0.2000
T (TW2) =TOL/WIDTH,-0.2000,0.2000,SHORT

```

(Location of DMIS Program)

**(Units of Measurement)
(Projection On/Off)**

**(Current Workplane)
(Available Mode)
(Current Coordinate System)**

(Default Sensor Settings)

**(Probe Compensation On/Off)
(Report Setting For IJK)**

(Default Template Settings)

(Default Direction and Angle)

(Default Offset and Shift)

(Default Tolerance Settings)

```

T (ANGLE) =TOL/ANGL, 0.000, 0.000
T (FLAT2) =TOL/FLAT, 0.0000
T (LSTRGHT2) =TOL/STRGHT, 0.0000
T (LCYLCTY2) =TOL/CYLCTY, 0.0000
T (LCIRLTY2) =TOL/CIRLTY, 0.0000
T (LSPHCTY2) =TOL/SPHCTY, 0.0000
$$DATE: 4/3/2014
$$TIME: 01:47:34 PM
OP(1)=OPERID/'AAT INTERNAL TESTING DEPARTMENT'
PN(1)=PARTID/'CONSTPT_ACTUALS'
PS(1)=PARTSN/'123456'
CM(1)=COMMNT/'Point Construction Test'
R(1)=REPORT/DATE, TIME, OP(1), PN(1), CM(1), CS(1)
OUTPUT/R(1)
$$SELECT PROBE PA0B0 AT A=0.0, B=0.0
SNSLCT/SA(PA0B0), 0.00000, 0.00000, 1.00000
RECALL/PART, 'C:\CappsDmis\Capps\Parts\Aat.mdl'
CAPPS/LOCKPART
CAPPS/NOMREP, ON
F(PT1)=FEAT/POINT, CART, 26.2333, 73.0882, 62.4924, 0.0001, -0.0000, 1.0000
    MEAS/POINT, F(PT1), 1
    PTMEAS/CART, 26.2333, 73.0882, 62.4924, 0.0001, -0.0000, 1.0000
    ENDMES
OUTPUT/FA(PT1), TA(TX2), TA(TY2), TA(TZ2), TA(TP2)

```

(Report Header Syntax)**(Probe Sensor Selection)**

The following explains the measurement block in DMIS:

(Nominal Feature Statement is in Red)

```
F(PT1)=FEAT/POINT, CART, 26.2333, 73.0882, 62.4924, 0.0001, -0.0000, 1.0000
```

(Measurement Command is in Dark Blue)

```
MEAS/POINT, F(PT1), 1
```

(Actual Point Measurement in Light Purple)

```
PTMEAS/CART, 26.2333, 73.0882, 62.4924, 0.0001, -0.0000, 1.0000
```

(End Measurement Command is in Dark Blue)

```
ENDMES
```

(Output Command in Black which includes default tolerance values)

```
OUTPUT/FA(PT1), TA(TX2), TA(TY2), TA(TZ2), TA(TP2)
```

Important Note: Please refer to [DMIS Commands Manual](#) in [Help Menu](#) for detail information for all DMIS commands used in CAPPS.

[Program \(DMIS\) Window](#)

Applied Automation Technologies, Inc.

DMIS Modes

Inserting the proper mode line is very critical in DMIS programming. Knowing how each mode line works, will help to ensure a smooth running program. The DMIS code below shows how these lines are written as part of an ordinary DMIS program. One or all of these lines may be used in any program. Knowing when, why, and how to use them is the key to success with any part inspection.

Mode/Man

```
DMISMN/'c:\capps6\capps\programs\test.bdm'
UNITS/MM,ANGDMS
CAPPS/PROJOFF
WKPLAN/XYPLAN
MODE/MAN
D(MCS)=DATSET/MCS
SNSET/APPRCH,2.500
SNSET/RETRCT,2.500
SNSET/DEPTH,2.000
SNSET/CLRSRF,2.500
SNSET/SEARCH,5.000
PRCOMP/ON
T(lprofpt76)=TOL/PROFP,-0.3800,0.3800
T(lprofsf76)=TOL/PROFS,-0.3800,0.3800
```

The example above shows that the mode in any DMIS program by default is **Manual Mode**. This means that any measurements after this line are measured by using the joystick. In the case of a **Manual CMM**, this will typically be the mode used in all measurements.

```
$$SELECT PROBE AT TIP=0
$$SNSLCT/VECTOR,-0.000,-0.500,0.866
SNSLCT/S (PRB1)
```

Mode/Prog,Man

MODE/PROG,MAN

```
F(PT1)=FEAT/POINT,CART,26.2333,73.0882,62.4924,0.0001,-0.0000,1.0000
  MEAS/POINT,F(PT1),1
  PTMEAS/CART,26.2333,73.0882,62.4924,0.0001,-0.0000,1.0000
  ENDMES
OUTPUT/FA(PT1),TA(TX2),TA(TY2),TA(TZ2),TA(TP2)
```

The example above shows the **Program Mode** line inserted before the measurement. Because CAPPS uses a real time text editor for the **Program Window**, this can be inserted using the keyboard. This can also be inserted by using the CAPPS interface as well through [DMIS Menu - Modes](#). In either case, the objective of **Program Mode** is to observe the **PTMEAS** statements exactly as they are written for the current part run.

Mode/Auto,Prog,Man

MODE/AUTO,PROG,MAN

```

F(CR2)=FEAT/CIRCLE, INNER, CART, 29.5038, 95.4962, 62.5000, -0.0000, -0.0000, 1.0000, 25.4000
MEAS/CIRCLE, F(CR2), 4
GOTO/31.2037, 95.4962, 74.5000
PTMEAS/CART, 42.2037, 95.4962, 60.5000, -1.0000, 0.0000, -0.0000
PTMEAS/CART, 29.5038, 108.1962, 60.5000, -0.0000, -1.0000, -0.0000
PTMEAS/CART, 16.8038, 95.4962, 60.5000, 1.0000, -0.0000, 0.0000
PTMEAS/CART, 29.5038, 82.7962, 60.5000, 0.0000, 1.0000, 0.0000
GOTO/29.5038, 93.7962, 74.5000
ENDMES
OUTPUT/FA(CR2), TA(TX2), TA(TY2), TA(TZ2), TA(TD2)

```

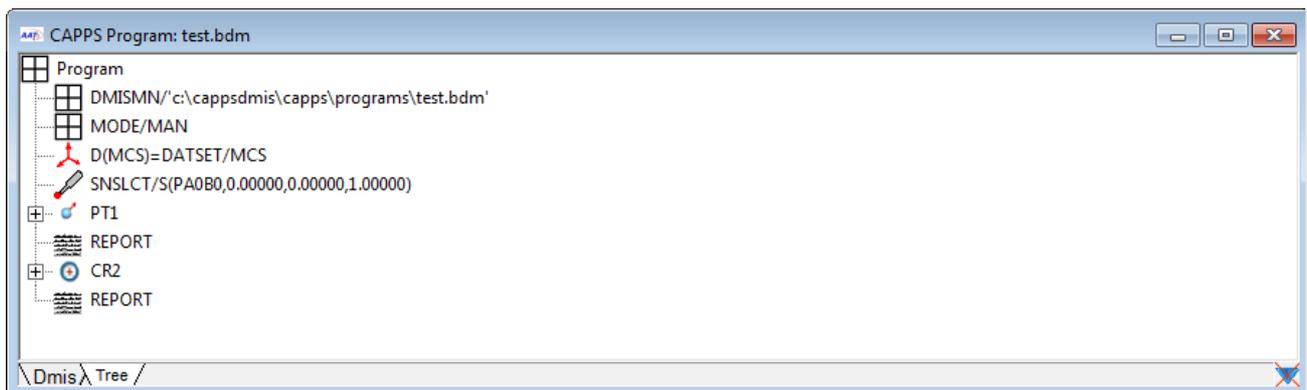
The example above shows the **Auto Mode** line inserted before the measurement. Because CAPPs uses a real time text editor for the **Program Window**, this can be inserted using the keyboard. This can also be inserted by using the CAPPs interface as well through [DMIS Menu - Modes](#). In either case, the objective of **Auto Mode** is to **ignore** the **PTMEAS** statements and observe only the nominal statement for the measurement. Based on the nominal definition, the system will decide for itself the best measurement sequence for the feature. This mode must be used for performing a **Relative Measurement** routine, and when performing a 5 point edge point measurement.

[Program \(DMIS\) Window](#)

Working With the DMIS Tree View

Working in the tree view offers another style of working with the program. To view the program in **Tree Mode**, click the [Tree Tab](#) in the lower left corner of the [DMIS\(Program\) Window](#). Each feature is icon based, so it makes editing of the program a bit more transparent to the user.

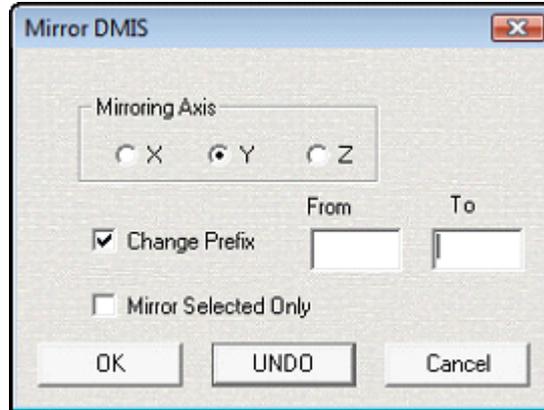
Working in the **Tree View** offers one more distinct advantage. If the user highlights a feature and hits the delete key, the system will give the option of deleting just the DMIS code for the feature or all related features including the report and actuals.



[Program \(DMIS\) Window](#)

Mirroring DMIS Program

The [Right Click Menu](#) in the **Program Window** has the [Mirror](#) option which may be used to mirror the whole program or mirror selected (highlighted) features.



Mirroring Axis:	May be selected as X, Y, or Z as needed.
Change Prefix:	Normally this is used to distinguish between right and left handed items so that confusion is kept to a minimum.
Mirror Selected Only:	If the user highlights a measured feature block then this option will be available to the user. This would only mirror that selected portion of the DMIS.

[Program \(DMIS\) Window](#)

Temperature Compensation

The temperature compensation in CappsDMIS is used to compensate for temperature deviations that relate to less than optimum measuring environments. The compensation can be done in real time using a series of sensors placed on the machine and the part, or an ambient temperature can be used if sensors are not available.

Temperature Sensor

CAPPS supports thermal compensation by using a **Pico pt104** temperature sensor. Reading from scales and part is adjusted based on reading from temperature sensor.

Configuration

Each sensor location should be assigned before measurement with temperature compensation turned on. The configurations are done through **capps.ini** file. For reading the temperature of the machine axes and the part, CappsDMIS looks for the following INI parameter: If the sensor type used is

- **PicoTempRead** (or Picosnsr), and Pico temperature sensors. In this case, CappsDMIS will look for the file PicoTempRead.dll (or PicoSnsr.dll). This DLL relies on Pico-supplied DLL Pt10432.dll

[Temperature Sensor]

SensorType=PicoTempRead

Axis = C1, C2, C3

Part = C1, C2, C3

ReadingFrequency=3000

C1 = COM Port the sensor box is connected to on the PC

C2 = (CH) on the sensor box, the individual sensor is connected to

C3 = Number of wires connecting the sensor to the sensor box

ReadingFrequency = How often Capps updates the temperature readings from the sensors. This setting is in milliseconds.

SensorType=PicoTempRead1

X_AXIS1=1,1,4

X_AXIS2=1,2,3

Y_AXIS1=1,3,3

Y_AXIS2=1,4,3

Z_AXIS1=1,4,3

Z_AXIS2=1,4,3

PART1=1,4,3

PART2=1,4,3

ReadingFrequency=3000

- **Manual** it means that CappsDMIS reads the temperature from Capps.INI through the parameters:

[Temperature Sensor]
SensorType=Manual

[Thermal Compensation]
 PartTemperature = 25.0
 XAxisTemperature = 25.0
 YAxisTemperature = 25.0
 ZAxisTemperature = 25.0

- **Controller Interface**, it means that the temperature readings are read through the controller interface defined in Capps.ini through the INI parameter:

[Machine]
Interface DII=cpucc

This method needs special configuration in the controller interface INI file, as shown below-

TemperatureReadingInterface	Currently, the only acceptable values are None: No temperature sensors Controller: The temperature is read through the controller.
NumberOfTemperatureSensors	Specifies number of sensors that are connected to the controller
TempInterpMethodForPart TempInterpMethodForXAxis TempInterpMethodForYAxis TempInterpMethodForZAxis	Currently, the only acceptable values are Zero(0): Average sensor readings if more than one sensor is used for the same axis/part One(1): Use linear interpolation readings if more than one sensor is used for the same axis. This method should be used for axes only. Also, the location of the sensors along the axis is very important.
TemperatureReadingFrequency	1 if the readings are in Fahrenheit
TemperatureReadingIsInFahrenheit	How often to read the temperature.

[Parameters]

.....
 TemperatureReadingInterface=Controller
 NumberOfTemperatureSensors=4
 TempInterpMethodForPart=0
 TempInterpMethodForXAxis=0
 TempInterpMethodForYAxis=0
 TempInterpMethodForZAxis=0
 TemperatureReadingFrequency=30
 TemperatureReadingIsInFahrenheit=0

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Sensor Type

Currently CAPPS supports **Pico** temperature sensors. But it has the capability of supporting variety of temperature sensors. This field display active temperature sensor. At this point value of this field should be **PicoTempRead**. If entry in this field is not correct the (.dll) which control temperature sensor will not be loaded and no temperature compensation will be applied to measurements.

Reading Frequency

This field modify time interval that temperature reading occur in the system. This field should have numeric value in millisecond resolution. An entry 3000 means temperature reading occurs in every 3 seconds. The rest of the fields are related to assigning and configuring a each sensor which is explained in the following section in detail.

Sensor Configuration

Communication through **Pico Sensor Box** and CAPPS is handled by **rs232** communication. **Pico Sensor Box** can have the capability of supporting 4 temperature sensors. CAPPS can support up to 8 sensors. This means that user should use more than one **COM port** if more than 4 sensors are needed. Sensors in the CAPPS are called. Sensor1, Sensor2... Sensor8. Each Sensor can be assigned and configured via 4 corresponding combo boxes.

Sensor Configuration Fields

Each Sensor has 4 combo boxes which assign and configure that sensor. Here are the 4 combo box and their meaning.

Assigned Loc:	This field display location of the sensor. Reading from the sensor will be applied to selected location in this field. Part means sensor is located on the part. X Axis, Y Axis Z Axis means sensor is on the corresponding axis. NONE means sensor is not assigned to any location which means that reading from this sensor will not be used in any temperature compensation adjustment.
COM Port:	This field displays what is the communication port for the sensor. Each sensor is connected to a box and box is connected to computer by COM port. The COM port that corresponding sensor box is connected should be selected in this combo box.
Use Channel:	Each temperature box can support up to 4 sensors. Each sensor has a channel. This field display which channel is used for current sensor. If a sensor is connected to a channel labeled CH1 on Pico pt 104 boxes , 1 should be selected in this filed for that sensor.
Num of Wires:	This field displays what kind of sensor is being used. Options in this field are 3 or 4 means 3 wires sensor or 4 wires sensor.

Temperature Sensor in CAPPS

After a sensor is connected and correctly configured CAPPS apply temperature compensation to every measurement. User can control and see the affect of the compensation from temperature page which can be fired from [System Configurations](#). Temperature page in fired configuration sheet is the location that all control and displays are located.

[Temperature Compensation](#)

Temperature Compensation Modes

There are two modes online mode and offline for temperature compensation.

[Online Mode](#) is when there is a temperature sensor exists and configured in the system. CAPPs get into online mode automatically if sensors exist in the system. CAPPs attempts to make connection to the sensor at the very beginning of the execution. This may take around 30 second. CAPPs displays a message during the connection process and notify user connection operation is in progress. In **Online Mode** CAPPs reads temperature from the sensors and updates all measurements.

[Offline Mode](#) is the mode that user can mimic behavior of temperature sensor by manually entering temperature in corresponding fields. User can get into offline mode by pressing manual entry button. **Offline Mode** is disabled temperature sensor exist and connected correctly to the system.

[Temperature Compensation](#)

Display in Temperature Page

A panel in temperature page displays all temperature readings for all sensors. This panel has an entry for each sensor and it indicate that whether that sensor is connected or not and necessary reading for the sensor if it connected.

A typical reading for a connected sensor looks like as follow:

Sensor3 Y Axis 23.56 C 1.0005

Which means sensor 3 is connected on **Y axis**, current temperature on this sensor is **23.56 Celsius** and calculated thermal compensation **coefficient for this axis is 1.0005**.

If sensor is assigned for a location but there is no reading for that sensor, **Display Line** for the sensor appear like below:

Sensor3 Y Axis xx.xxx C 1.0000

Star instead of digits display no reading. Since there is no reading thermal compensation **coefficient calculated as 1.0000** which means no compensation. If there is no temperature reading compensation parameters has to be 1.000000

If no sensor is assigned for a location or a sensor is assigned but there is no **COM** port connection. This case will be reflected on display as follow :

Sensor3 Disconnected

Last case is when there is a manual compensation applied:

Sensor3 Y Axis Manual 1.0005

[Temperature Compensation](#)

Controls in Temperature Page

System Configuration

Machine | Settings | Report | Sensor | Calibration | Files Locations | Rotary Table

Tool/Tip Changer | Dual Arm | Temperature

Temperature Compensation

Apply Temperature Compensation

Sensor1	Part	20.000°C	1.000000
Sensor2	Part	20.000°C	1.000000
Sensor3	X Axis	20.000°C	1.000000
Sensor4	X Axis	20.000°C	1.000000
Sensor5	Y Axis	20.000°C	1.000000
Sensor6	Y Axis	20.000°C	1.000000
Sensor7	Z Axis	20.000°C	1.000000
Sensor8	Z Axis	20.000°C	1.000000

Nominal Temperature: 20.00

Ambient Temperature: 20.00

Celcius | Connect | Refresh

Refresh Rate: *****

Material Type: Aluminium

Material Thermal Expn Coefficient: 0.000024

XAxis Thermal Expn Coefficient: 0.000000

YAxis Thermal Expn Coefficient: 0.000000

ZAxis Thermal Expn Coefficient: 0.000000

Manual Temperature Entry

X Axis: 20.000 | Y Axis: 20.000

Z Axis: 20.000 | Part: 20.000

OK | Cancel | Apply

Apply Temperature Compensation:	This check box controls compensation itself. If check box is not checked the (.dll) that controls the temperature sensor will not be loaded. User has to check this box and restart the CAPPS for temperature compensated reading.
Display Pane:	Display in Temperature Page
Nominal Temperature:	This temperature is the temperature in the room when the machine is calibrated. We suggest using 20.00 C which is room temperature if calibration temperature is not known by the user. This field is disabled and only access to this field is from (.ini) file itself.

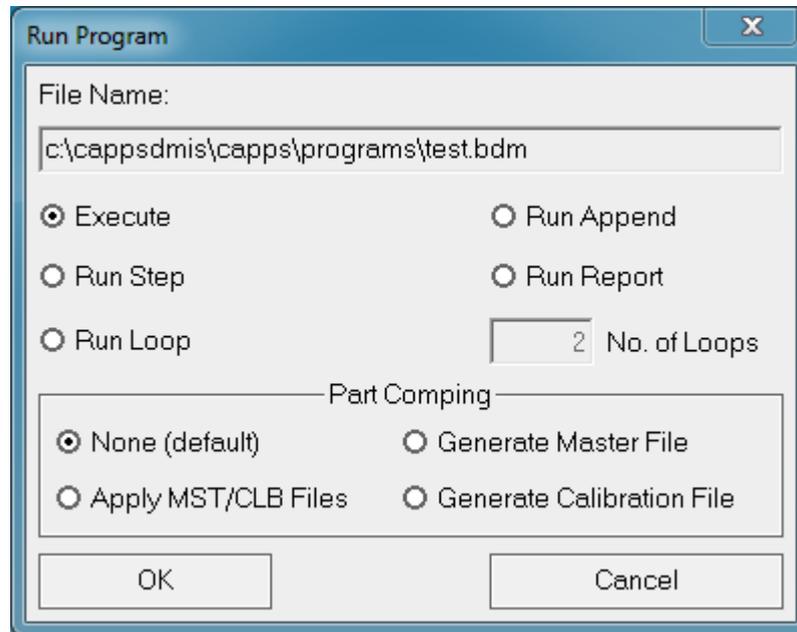
Ambient Temperature:	This field is not visible if temperature sensor is connected to system. If there is no sensor and Manual Temperature Entry check box is checked temperature in this field will be used as default temperature in case of no temperature entry for axis and part temperature.
Temperature Type Combo Box:	Convert readings to Celsius or Fahrenheit based on selection in this box.
Refresh Button:	This button is enabled only if temperature sensor exist. It updates the temperature reading and calculated compensation coefficients of all enabled axis and part.
Material Type:	Name of the material under the inspection.
Material Thermal Expansion Coefficient Box:	Expansion coefficient for the material.
X Axis Thermal Expansion Coefficient Box:	Expansion coefficient for X Axis .
Y Axis Thermal Expansion Coefficient Box:	Expansion coefficient for Y Axis .
Z Axis Thermal Expansion Coefficient Box:	Expansion coefficient for Z Axis .
Manual Entry:	This field enabled if there is no sensor in the system. User can mimic behavior of temperature sensor. Enabling this field pops up four edit box. User can enter temperature in each X, Y, Z and part field. CAPPS make calculations as if there is temperature sensor in the system.

[Display in Temperature Page](#)

Running a Program

CAPPS can run (execute) programs directly through the [File Menu - Run Program](#) window shown below:

Run Options



Run Execute

This option will execute a program in its entirety. This is usually a good option when the program has been proven out to run without crashing or difficulty.

Run Step

This option allows the user to run the program a step at a time. In this mode, the system will execute each measurement block and then stop until a keystroke from the user resumes the program. This can be a valuable tool for debugging a program; however, it may take a very long time to run the program using this method.

Run Loop

This option is used to run a program repeatedly. It is very useful for inspecting similar parts that can be located reliably, such as on a fixture. At the end of each loop, the machine will stop automatically and another part is positioned on the fixture. With a keystroke, the program begins again. When using this method, it is also a good idea to have a position point away from the part at the very end of the program. This will allow enough room to take the old part off, and place a new part on the fixture without damaging the probe head.

Run Append

This option is used to add a segment to the end of an existing program. After executing a program using **Run Append**, the system will automatically be placed in Learn mode. It will now be possible to add on to the existing program.

Run Report

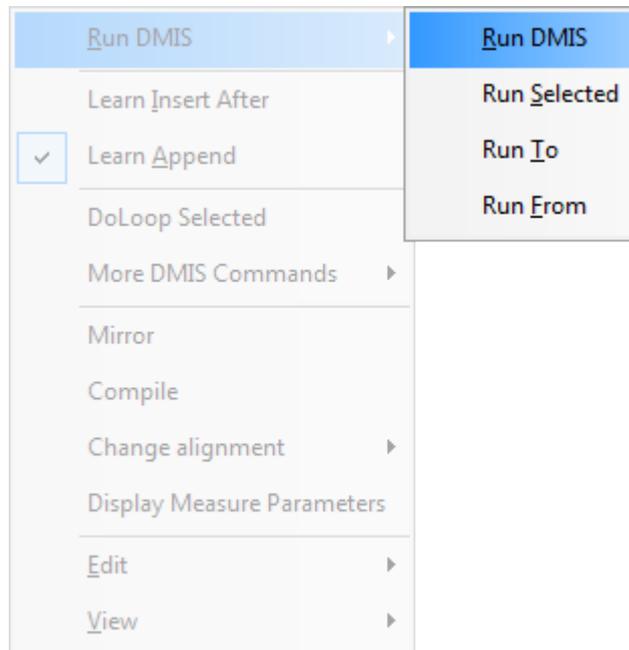
Using **Run Report** is very similar to using **Run Append**. It is also the case that, after running the program, the system will automatically be placed in **Learn(teach) Mode**. This allows the opportunity to save the report file to a specific name of choice.

Important Note: There will be no DMIS code generated for the program while using the **Run Report** method, however, any additional measurements will be added to the report page.

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Run From the Program Window

CAPPS also offers the ability to run a program several different ways from inside of the **Learn(teach) Mode**. The picture below gives the run options from the right click menu inside of the **Program Window**. A description of each follows:



Run DMIS

Using the **Run DMIS** option will run the program completely from the top of the program, all the way to the end. This will attach all measurements to the current report. This may come in useful if all the measurements from every part need to be on one report. The user will be given the choice of starting in **MODE/PROG**, **MODE/AUTO**, or **MODE/MAN**.

Run Selected

To use the run selected option, simply highlight the area of DMIS measurement to run. This may be a single measurement, or a group of measurements. After highlighting the desired measurements, use the right click option and choose the run selected option. The user will be given the choice of starting in **MODE/PROG**, **MODE/AUTO**, or **MODE/MAN**.

Run To

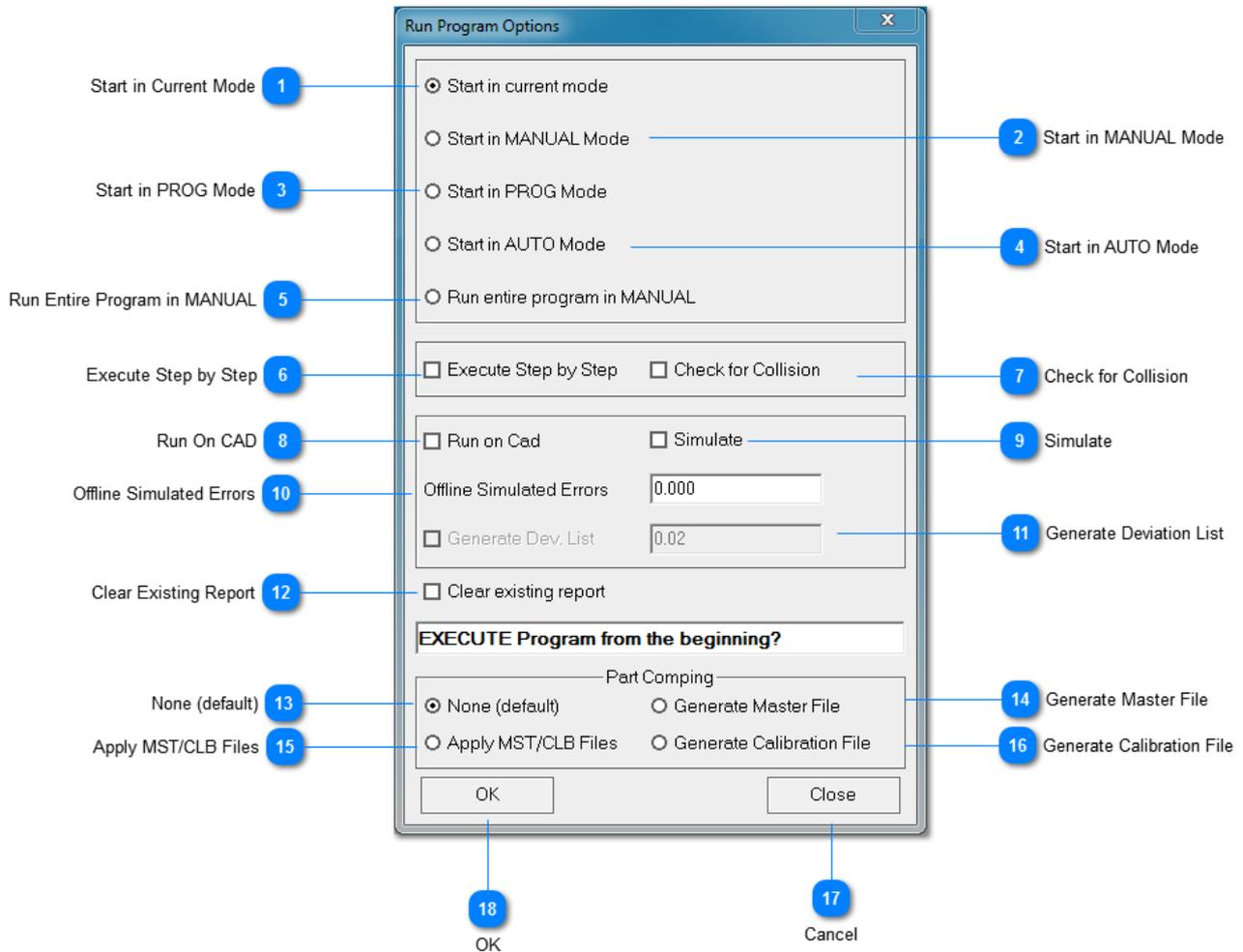
To use the run to option, simply place the cursor at the end of the last line for the program to be run to, use the right click option, and choose run to. The user will be given the choice of starting in **MODE/PROG**, **MODE/AUTO**, or **MODE/MAN**.

Run From

To use the run from option, simply place the cursor at the end of the first line for the program to be run from, use the right click option, and choose run from. The user will be given the choice of starting in **MODE/PROG**, **MODE/AUTO**, or **MODE/MAN**.

[Running a Program](#)

Run Program Options



1 Start in Current Mode

Start in current mode

Starts in current mode set in DMIS program, it can be any of the following: **MODE/PROG**, **MODE/AUTO**, or **MODE/MAN**

2 Start in MANUAL Mode

Start in MANUAL Mode

Starts program in **Manual Mode**.

Important Note: If CAPPS comes along with a mode change command (**MODE/MAN** - **MODE/PROG,MAN** - **MODE/AUTO,PROG,MAN**) through the program it will switch to specified mode immediately.

3 Start in PROG Mode

Start in PROG Mode

Starts program in **Program Mode**.

Important Note: If CAPPS comes along with a mode change command (**MODE/MAN** - **MODE/PROG,MAN** - **MODE/AUTO,PROG,MAN**) through the program it will switch to specified mode immediately.

4 Start in AUTO Mode

Start in AUTO Mode

Starts program in **Auto Mode**.

Important Note: If CAPPs comes along with a mode change command (**MODE/MAN - MODE/PROG,MAN - MODE/AUTO,PROG,MAN**) through the DMIS program it will switch to specified mode immediately.

5 Run Entire Program in MANUAL

Run entire program in MANUAL

Runs entire program in **Manual Mode**.

Important Note: Unlike above modes, CAPPs keeps running the entire program in **Manual Mode**, no matter if it comes along with a mode change command or not through the DMIS program.

6 Execute Step by Step

Execute Step by Step

Executes the entire program step by step manner.

7 Check for Collision

Check for Collision

Checks collisions if execute using **Program** or **Auto Mode**.

8 Run On CAD

Run on Cad

Used to search CAD surface to detect points after altering the CAD data.

9 Simulate

Simulate

Simulates the program in offline mode.

10 Offline Simulated Errors

Offline Simulated Errors

Used to include error in the report when running

11 Generate Deviation List

Generate Dev. List

Used to generate a deviation list between the original CAD data and altered CAD data. It is used in perform together with [Run On CAD](#) option.

12 Clear Existing Report

Clear existing report

Clears existing report at the beginning of program execution.

13 None (default) None (default)

None is the default option for running a DMIS program. Which does not apply any **Part Comping** features while running a DMIS program.

14 Generate Master File Generate Master File

Generates a master file to be used with Renishaw's Equator.

15 Apply MST/CLB Files Apply MST/CLB Files

Used to apply master and calibration files for Renishaw's Equator.

16 Generate Calibration File Generate Calibration File

Generates a calibration file to be used with Renishaw's Equator.

17 Cancel

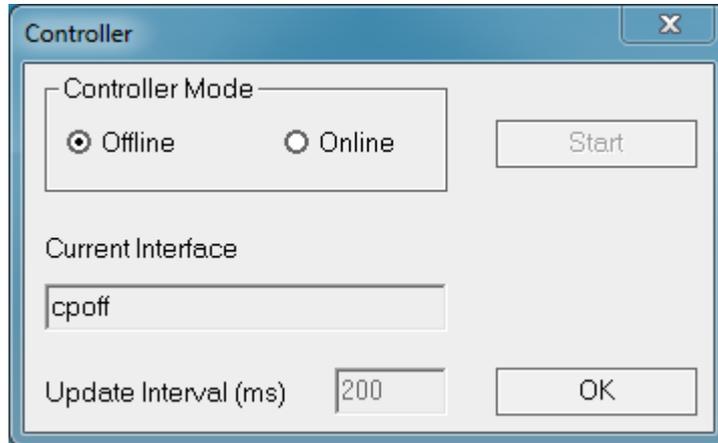
Cancel the changes and closes the dialog.

[Run From the Program Window](#)**18 OK**

Applies the changes.

Program Simulation

Every interface with CAPPS has the option of going offline using [System Menu - Controller - Offline](#). This gives the user the ability to stop communication with the machine. Programs can be run in offline mode to test for collisions and errors.



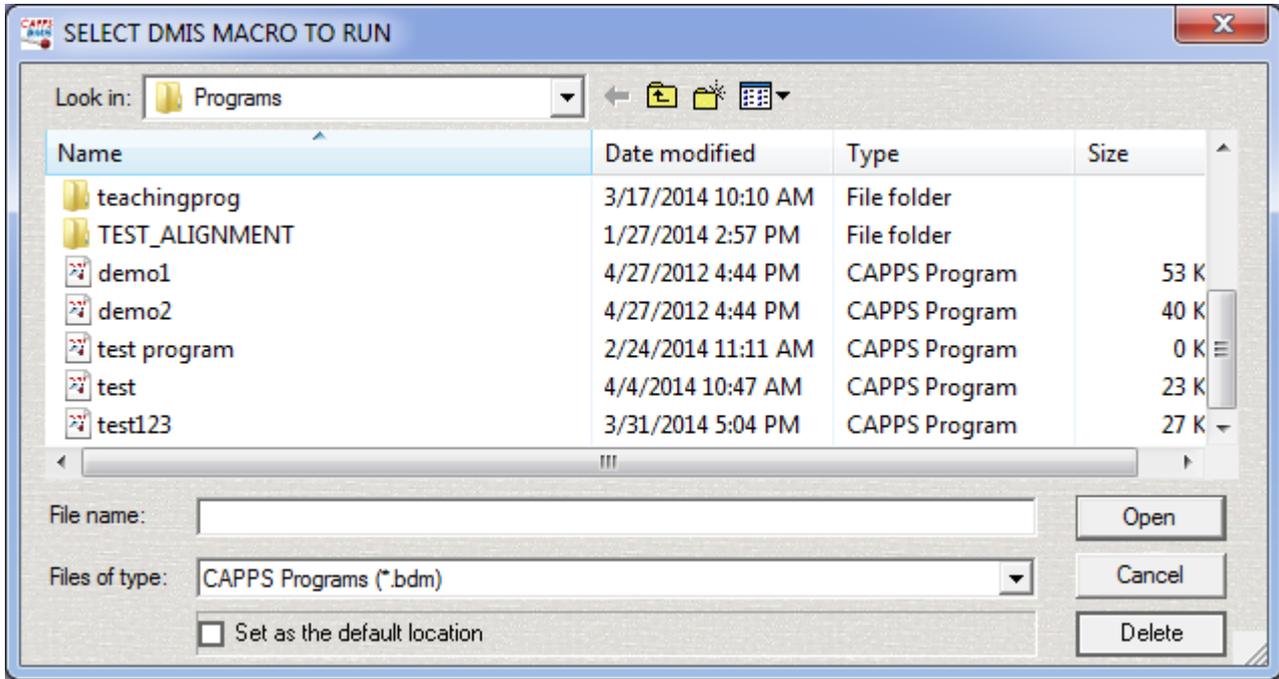
CAPPS can also simulate programs using [Run Program Options - Simulate](#).

[Running a Program](#)

Working with Macros

Any DMIS program may be run as a macro. A macro is simply a call to an external program. When the external program has completed its run, CAPPs will return to the main program and finish running in the main program. A macro can be inserted automatically to run at the beginning of every program. A macro can also be inserted somewhere in the middle.

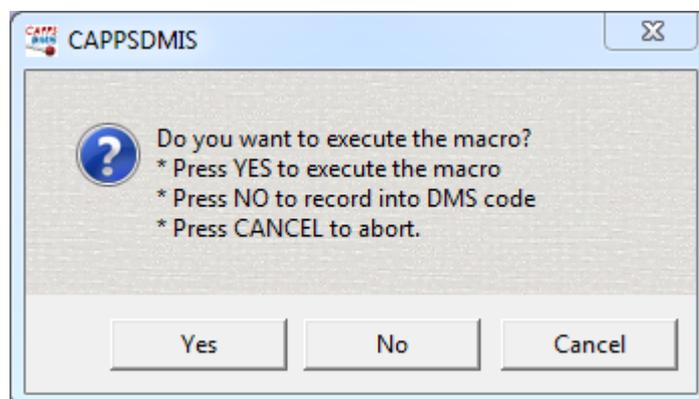
To run a macro go to [File Menu - Run Macro](#) and select any DMIS program from the list.



To call a macro from somewhere in the middle of the program insert the following lines into the program where **macro1** is the name of the program.

```
EXTERN
EXTFIL/DMIS, 'C:\CappsDmis\Capps\Programs\macro1.bdm'
ENDXTN
```

This can also be achieved by going to **File Menu - Run Macro**. The following menu will appear:



[Running a Program](#)