



User Guide
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Hemel Engineering Products, Inc.

6520 Lockport Road
Niagara Falls, NY 14305

(716) 297-8644

(716) 297-9405 fax

www.hemel.com

www.geomet-cmm-software.com



Universal CMM Software

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Helmel Engineering Products, Inc.

6520 Lockport Road
Niagara Falls, NY 14305
(716) 297-8644
(716) 297-9405 fax

www.helmel.com
www.geomet-cmm-software.com

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By
Edward R. Yaris
Software Development Manager

Hemel Engineering Products, Inc.
6520 Lockport Road
Niagara Falls, NY 14305
(716) 297-8644
(716) 297-9405 fax

www.hemel.com
www.geomet-cmm-software.com

Welcome to Geomet LE ...

Introduction

Over the past twenty five years, Geomet LE has evolved into a widely used CMM Software package. At its inception Geomet LE was the first and only true, 3-D CMM software in the country, perhaps in the world. It is a powerful and efficient system used with manual and motorized coordinate measuring machines to facilitate precise and comprehensive geometric analysis in the measurement of precision manufactured parts.

Keeping it Simple

Keeping to our core philosophy, Geomet LE brings to the user an efficient and clean presentation on the monitor eliminating the clutter of multiple Windows. Most operations can be handled by a simple press of an iconic label attached to the keyboard eliminating excess motion required through the handling of the mouse. Geomet LE was the first to bring to the workplace the idea of a simple, and singular, key press of most functions. In fact it is a trademark called Keystroke Magic™.

Geomet Limited Edition

Geomet LE is the base level CMM Software Solution from the Geomet LE family. It is designed to assist in basic CMM setup procedures and simple demonstrations. Geomet LE is distributed without a license or security modules.

www.geomet-cmm-software.com

We have developed a dedicated web site to help keep our customers informed. Geomet LE links directly with the web site to obtain the latest help from the Knowledgebase. By pressing the minus key <->, while performing many of Geomet's function will automatically link to the help pages and deliver the latest help on the current operation.

Through the web site, the latest news and downloads are at your disposal. We therefore suggest that the Geomet LE workstation be installed with access to the Internet.

Geomet LE User Interface

The Geomet LE User Interface is divided into three main groups:

Keystroke Magic, Iconic labels attached to the keyboard providing efficient and fast access to the most popular commands.

Graphic Toolbars, Windows standard graphic toolbars organized by function.

Menus, standard Windows drop-down menu structures.

Keystroke Magic



Most common features are available using the Keystroke Magic. By selecting one of the Iconic buttons you access a measuring tool without the need to navigate menus. Here we show the the measure Circle command Icon.

Common functions are grouped together to form a highly efficient system of choosing commands. The lower row offers access to all feature measurement commands. The yellow group forms a left-to-right command structure to establish and utilize coordinate system commands.

Most keystrokes offer more than one command. For example a circle request is the lower case <z> utilizing the system default number of data points. The circle icon shows a bold “n” located on the upper left corner. This indicates the circle command can have an optional dialog box appear to specify the number of data points to be used when measuring a circle.

After a short time of using these key presses, you will find just how Keystroke Magic is used to help you build a better inspection.



Chart of Common Keystroke Magic Commands

Summary of Feature Measurement Keys

v	.....	.Sphere
Shift + V	.....	.Multi-Point Sphere
<hr/>		
1	.....	.-Y 1D Point
2	.....	.-Z 1D Point
4	.....	.-X 1D Point
6	.....	.+X 1D Point
8	.....	.+Y 1D Point
9	.....	.+Z 1D Point

Summary Coordinate System Commands

l (lowercase L)	.....	.Origin
'	.....	.Coordinate System Manager
Shift + L	.....	.Fixture Coordinate System Manager

Feature Construction and Selection

sDistance
---	-------	-----------

Program Editing

h	.....	.Recall a Program Step
i	.....	.Delete Program Step
Ctrl + t	.....	.Edit Tolerance
Ctrl + u	.....	.Undo Last Program Step

Report States

eCartesian / Polar
Shift + EInch / Metric
rToggle Tolerance On / Off

Stylus Management

wStylus Manager
Shift + WPH9 Position Controls
Alt + wStylus Rack Manual Controls
Ctrl + wReQualify Current Stylus
Ctrl + Alt + wStylus DataBase Manager

Miscellaneous Functions

Ctrl + dOn Screen Digital ReadOut
Ctrl + gReRun Program Steps (Manual CMM)
oDCC Global Settings
uEnable / Disable Auto Direction Sensing
[.....Load Last Inspection Program
]Attach "Save at End" Command
-Launch Geomet LE Web Site

Geomet LE Tool Bars

Geomet LE has one ToolBar to assist accessing various features with the click of the mouse. This ToolBar can be toggled on or off through the use of the system menu, or by right clicking your mouse in the status bar.

- 1) On the main menus, select **System** and click on **ToolBar**. This will toggle the toolbar between the visible and hidden states.
- 2) When the tool bar is already displayed, right-click on the toolbar and it will hide. Activate the toolbar by right-clicking on the Status bar located on the bottom of the Geomet LE window.

NOTE: The Toolbar Sub-menu will self configure based on the characteristics of your CMM. A DCC style CMM will have an additional toolbar available called "Motion Control Ribbon".

Resizing Toolbars

Resizing a toolbar involves dragging a new shape out of a visible toolbar. As you move your mouse over the border of a toolbar it changes shape to a double arrow. Once you have this pointer, hold down your left mouse button, and upon moving your mouse, will resize that toolbar. A outline will appear showing you the new size once you release the left mouse button, see figure 1.

The buttons of the toolbar will reorder themselves according to the outline of the new shape.

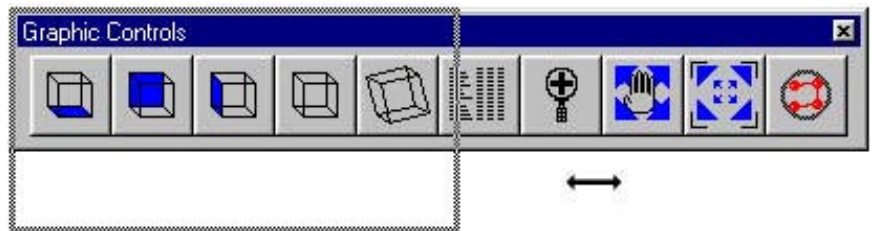


figure 1, Resizing Toolbars

Moving and Docking Toolbars

Geomet LE toolbars can be moved to any location on the display. These toolbars can also be docked to the top or right side of the Geomet LE main window. To move a toolbar that currently is undocked, place your mouse in the Title area of your toolbar or next to a toolbar button, inside the border, see figures 2 and 3.



Figure 2



figure 3

Hold you left mouse button down, which will take control of the toolbar and allow you to move it to a new location. Once in place release the mouse button.

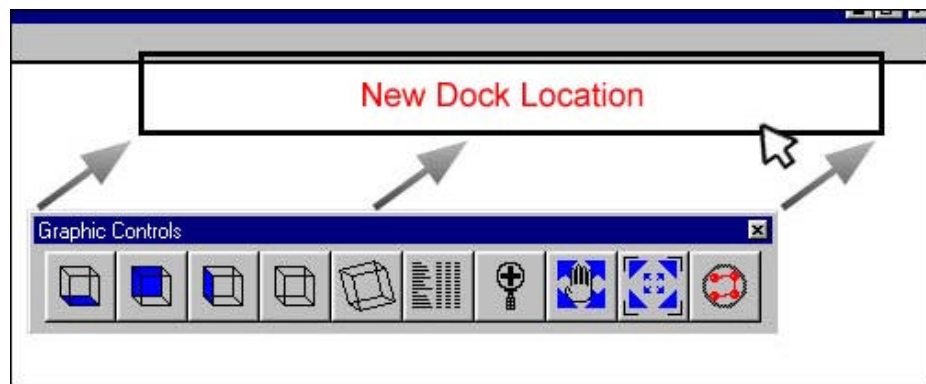


figure 4, Docking a Toolbar

If you move the toolbar in close proximity to the top or right side of the Geomet LE view, it will “dock” to that location, *see figure 4*. This allows you to create a clean working environment. A toolbar that is docked can be moved along the edge using the same method as moving a undocked toolbar.

NOTE: double clicking on any toolbar frame of title will toggle its location between the last stored position and its docked position.



Ball Bar Toolbar

Measure a Point.

Measure a Sphere.

BallBar Distance Macro.

Fixture Coordinate Manager.

ICS to PCS.

Coordinate System Manager.

Establish a 6-Point PCS.

Origin.


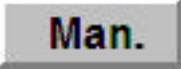
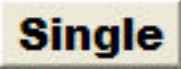




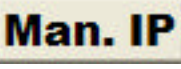
Print.

Execute the Inspection Program.

Undo the last command.



The motion control ribbon provides a quick visual indication of the status of your DCC style CMM as well as access to the most common controls.

Control	Description
	Toggles between the Motor On and Motor Off states. The button face is Red when off, Green when On.
	This indicator provides a visual state between the 3 possible modes. Man: Motors Off, Joystick : Motors On and Joysticks are active, and DCC : CMM is under system control.
	Single Step Mode - Not available in Geomet LE .
	CMM Homing Function. When the CMM requires a homing procedure, this button will appear on the ribbon.
	Provides access to the motion control variables. This includes: Stand-Off and Over-Travel distances and speeds.
	This button toggles between the three fixed speed percentages. This include Normal, Slow and Extra-Slow.
	The drop down tool provides controls the back-off distance of the Joystick control. This is the distance the CMM will retract after taking a manual data point under Joystick control.
	This button inserts one Interim Point into the motion map at the current XYZ position the CMM is located at.

Geomet LE Main Menus

The Geomet LE Main Menus provide shortcut commands to many commands with a single click of a mouse button. The following sections describes in detail the use of each shortcut menu.

Some functions shown in the menus will be disabled, or “grayed-out”. When the menus are activated, there are command handlers behind-the-scenes that validate your current or last feature and determines what commands will work in the current environment. For example, if your last feature was measuring a 2D Circle, then the Orient command will be disabled. You will find this validation process is very helpful in preventing errant commands.

File Menu

- New**Starts a new Inspection.
- Open**Opens an existing Inspection.
- Save**Saves the current Inspect under the existing name or prompts for a new name if none exists.
- Save As**Saves the current Inspection under a new name.
- Run**Auto Runs the current Inspection.
- Page Setup**This command provides access to the printer characteristics.
- Print**Prints the current Inspection.
- Exit**Closes Geomet LE and prompts to save any current open inspection report that has changed.

Qualify

- Stylus Manager** . .Activates the Stylus Manager which provides the necessary tools to qualify, activate a qualified stylus and manage all stylus operations.

PCS

- One-Step PCS** . . .Activates the 6-Point PCS macro used to build a basic Part Coordinate System based on the 3-2-1 system.
- ICS=>PCS**Forces a completion of the current Interim Coordinate System to form a Part Coordinate System.
- PCS Manager**This command activates the Coordinate System Manager which provides access to recalling Part Coordinate Systems, Fixture Coordinate System, Machine Coordinate Systems and when available, DCC Vector Drive Coordinate Systems.
- FCS Manager**Activates the Fixture Coordinate System Manager. The FCS Manager provides access for tools to append, activate and control coordinate systems that are stored as coordinate system geometry and recalled for part inspection use.

Measure

- Point**Places Geomet LE into single point capture mode. These data points report in 1D directions only.
- Sphere**Places Geomet LE into Sphere measurement mode.
- BallBar Macro**Activates the 10-Point BallBar Macro mode. The solution reported is the center distance between two spheres.
- Cartesian / Polar Toggle** Toggles between reporting in Polar and Cartesian modes.
- Inch / Metric Toggle** Toggles between reporting in Inch or Metric values.

Construct

- Distance**Reports the distance between the last two measured features.
- Recall Feature** . . .Creates a new feature from a previously measured or constructed feature and places it as the last step in your inspection program.

Modify

(Un)DeleteToggles the delete flag on a specified feature.

Delete all records after....Removes all records after a specified record number.

Delete Permanently Removes the highlighted feature from the inspection report and renumbers the report.

InsertInserts a new feature after a specified place in the inspection report.

Jump to Feature No Prompts the operator to enter a feature number which will jump to the top of the visible display of features.

Edit Motion Points Activates the Motion Edit Tool which is used to adjust motion within the motion map.

UndoRemoves the last feature from the inspection report.

Report Controls Menu

Report Header . . .Activates the Report Header.

View

On-Screen DRO . .Activates the digital readout.

ToolbarToggles the visible state of the BallBar Toolbar.

System

Sound Manager . .Tests the sound files assigned to specific features such as Measurement Points with the Windows Sound system.

DCC Settings . . .Activates the global setting dialog for motion speeds and distances.

Toggle Motor Speed Toggles between Normal > Slow > X-Slow > Normal...

System Options . .Activates the Geomet LE System Options Tool.

Interface Configuration Used with Interfaces that accept custom configurations.

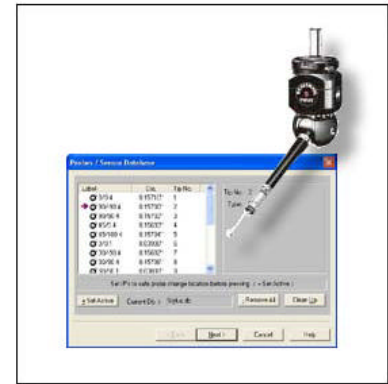
About Interface Controller Identifies the current CMM Interface.

Home the System Activates the Home Tool.

Geomet LE Stylus Management Tools

Stylus Manager

Geomet LE maintains a database of known, qualified styli. Each stylus is qualified against a standard reference sphere to identify the size and MCS location. Knowing the size and location allows Geomet LE to properly apply compensation to all measured features. Knowing the location allows the switching of the styli between positions in a cluster or an articulating probe head such as the motorized Renishaw PH10.



Stylus Management consists of a Stylus Manager that contains all the tools necessary for qualifying, re-qualifying and choosing a stylus for use in measuring. The configuration of all your stylus hardware is maintained in the **System Options->Probes and Sensors** page.

Stylus Manager		
w	Qualify>Stylus Manager	
<i>Keyboard</i>	<i>Main Menu</i>	<i>Icon / Toolbar</i>

Probe Qualification Process

When qualifying the first stylus, Geomet LE maintains that position as the reference position for the entire stylus database. When adding additional styli, Geomet LE maintains the relationship between the newly qualified stylus and the first stylus, commonly referred to as the *Primary Tip*. This relationship is applied when setting any stylus active and allows correct compensation to use any qualified position, even in the same feature, without loss of accuracy.

Qualifying a Basic Ball Stylus, Manual CMM

This Qualification process is based on the hardware configuration consisting of a ball stylus touch probe on an electronic probe head. This configuration is similar to a Renishaw TP-ES or a PH1 with a TP2 probe body.



Step 1

To start the qualification process, activate the stylus manager by pressing the <w> key on the keyboard or the **Qualify->Stylus Manager** from the drop down menus. To add a new stylus qualification, press the <Next> button found on the Stylus

Manager. Note: For more efficient operations, the <Next> button is also the <Enter> key on the keyboard.

Step 2

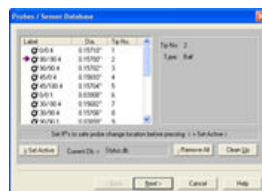
This step will prompt you to enter the qualification type. This describes the type of stylus attached to your system. The choices are ball, taper, cylinder, video cross hair and manually entered diameter. By default the qualification type will show "Ball". To continue the qualification process, press the <Next> button on this dialog or <Enter> key on the keyboard.

Step 3

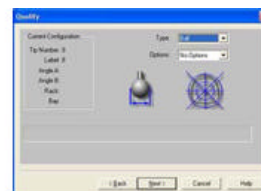
The final step will prompt you to proceed capturing the data points required to solve the qualification of the stylus.

We are prompted to capture the current default number of data points required. At this time, capture the data points on the reference sphere and the count required would descend until all data points have been captured.

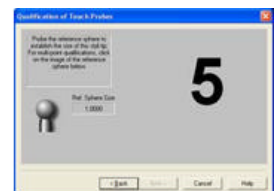
The process used to capture the data points will influence the quality of the solution. If you were to capture your data points close together, or with inconsistent speed, there can be error introduced in the end result of size and location.



Step 1



Step 2



Step 3

We recommend that when using 5 data points, the first point should be taken on the top of the reference sphere and the remaining 4 taken at the equator.

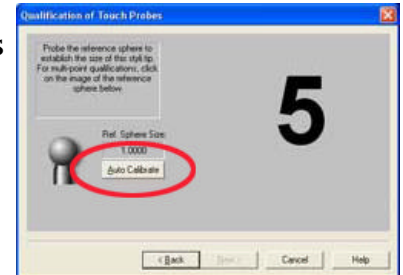
Should you require to abort a single data point that has been captured, press the <F2> key on the keyboard and the required count of data points will increase as it discards the last data point in the buffer.

Qualifying a Basic Ball Stylus, DCC CMM

This Qualification process for DCC style CMMs contains the same steps as noted in *Qualifying a Basic Ball Stylus, Manual CMM*, however Step 3 offers an optional Auto Calibration function.

Auto Calibration

When you have a DCC style CMM, the qualification countdown screen includes a button labeled <Auto Calibration>, see figure 1. This is used to qualify under DCC control a single ball stylus in the down position. To auto calibrate, move your ball stylus directly over the reference sphere and press the <Auto Calibration> button.



Qual Step 1, Auto Calibration

You will be prompted to manually capture a data point directly on top of the reference sphere. Once you have captured the data point, you will be prompted to begin the calibration. Geomet LE will automatically capture 13 data points on the reference sphere under DCC control.

Auto Calibration Setup

The default setting for the Auto Calibration routine is 3 rings of 4 data points each plus 1 data point on top for a total of 13 data point. This is sufficient for most applications. Should you want to change these characteristics, launch the setup dialog found in the menu: **Qualify, Auto Qualification Setup**, see figure 2.

You can control the number of data points per ring and the standoff distance the motion controller will use. The number of rings, 3, is fixed for this routine.

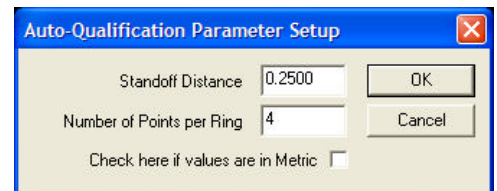


figure 2, Auto Qualification Setup

Qualifying Ball Styli in Multiple Positions

This Qualification example is based on the hardware configuration consisting of a ball stylus touch probe in different locations attached to one or more electronic touch probes. One example would be a manual articulating electronic probe head such as the Renishaw MH8 shown below. Another example would be a cluster probe located on an electronic probe with multiple ball styli installed.



Stylus Cluster



MH8 Articulating Probe



Multiple Probe Body

The process of qualifying more than one physical location involves the same steps as described above in *Qualifying a Basic Ball Stylus*. The first probe would be qualified exactly as stated in steps 1-3 on the previous pages. When the first probe has been qualified, you are returned to the main screen of the Stylus Manager. To add another position on a cluster, or another location on an articulating probe, follow steps 1-3 for each stylus required.

Geomet LE will qualify the MCS location and size and assign the next stylus tip number to the stylus database. The location it stores is the XYZ variation from stylus tip number 1.

Using a Motorized Probe Head

The qualification of a motorized probe head such as the Renishaw PH10T or similar involves another step which provides access to setting the A / B position of the head.

Geomet LE automatically adds a step to the qualification process when it has been configured to use a motorized probe head. The configuration can be found in **System Options, Probes and Sensors**.

Setting the articulated angle of the PH9/10 / 50 can be accomplished by using the optional Renishaw supplied hand control, or through the use of Geomet's *Manual Articulating Control*, see figure 3.



KeyStroke	Function
2	-B Angle Change
4	-A Angle Change
5	Return to Defined "Home"
6	+B Angle Change
8	+A Angle Change
<i>Keystroke Function Table</i>	

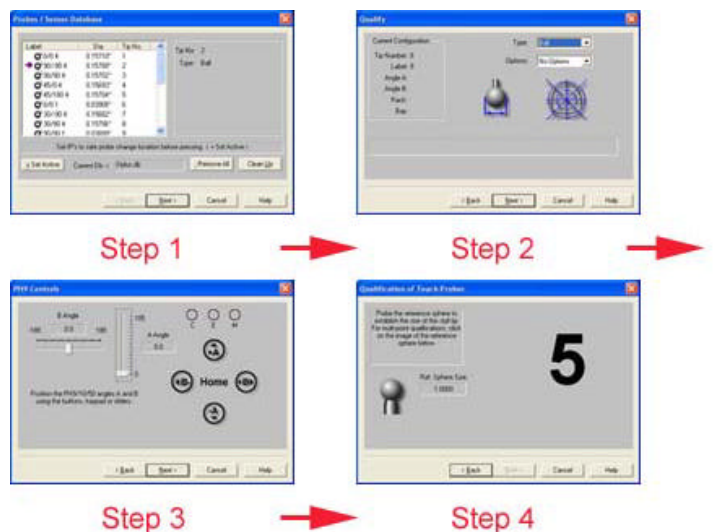


figure 3, Manual Articulating Control

Through the use of the dialog, you can use the sliders for the A / B angles by left-clicking and holding down on the pointer associated with the angle you wish to change and moving or "sliding" to a new location. An optional method involves left-clicking on the symbols **+A**, **-A**, **+B**, **-B**, and **Home**. With each click, the probe angle will change one position. NOTE: The symbols are also mapped to the number key pad on the keyboard. The *Keystroke Function Table* shows all the mapped keys.

Qualify Steps

To Qualify a new articulated position, start with steps 1 & 2 from the *Qualifying a Basic Ball Stylus* section. When you press **<Next>** in step 2, the *Manual Articulating Control* will show as a new step 3. Choose the A / B Angle settings and press **<Next>** to proceed to capturing the assigned number of data points.



Note: It is not necessary to have all stylus positions qualified when you start teaching an Inspection Program. You can add new positions at any time during the teach phase.

Using a Stylus Change Rack

Qualifying a stylus while using a Stylus Change rack such as the Renishaw MCR20 or SCR200, *shown here*, involves an additional step which provides assigning a stylus to a bay position on the rack.



Before you can use a Stylus Rack, it must first have been installed and aligned using the setup procedure found in **System Options, Probes and Sensors** page. Once the alignment procedure has been completed, Geomet LE will add a page to the qualification steps which allows you assign a new stylus tip to the rack and then qualify that stylus.

Qualify Steps

To Qualify a new stylus, start with steps 1 & 2 from the *Qualifying a Basic Ball Stylus* section. When you press <Next> in step 2, the *SCR200/MCR20 Bay Assignments* page will show as a new step 3. The Bay Assignment page will allow you to choose a stylus module that is already installed on the rack, or add a new module.

The Bay Assignment page consists of a graphical view of the probe body and the rack. The probe body located in the upper left will represent the current status of the probe which is attached to the CMM. In this example there is no module attached to the CMM.

The first step in qualifying a new stylus will be to assign the module to the rack. This can be done simply by clicking on the bay number graphic in *figure 4*. The bay numbers are also mapped to the number pad of the keyboard. Once the bay has been assigned, Geomet LE will determine if this is an open bay, or already contains a module.

If Geomet LE determines that the bay was empty, a prompt will appear asking to attach a new module on the CMM. Place the module on the probe and proceed to the Qualification page by pressing <Next>.

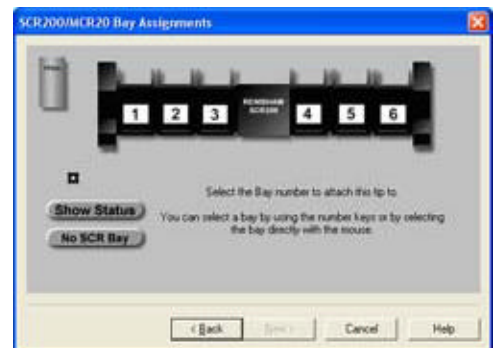


Figure 4, SCR200 Bay Assignments Page

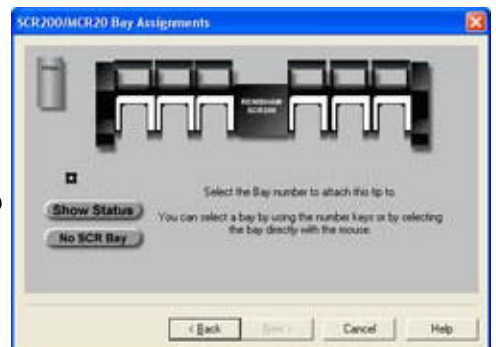


figure 5, Show Status

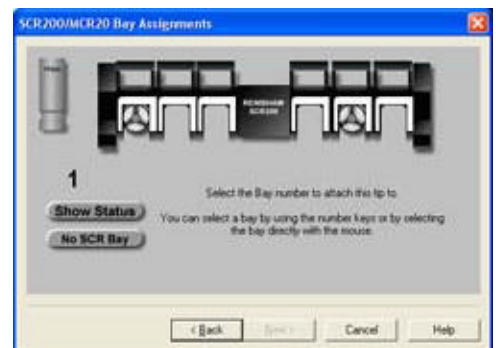


figure 6, Assigned Bays

If the bay already contained a module, Geomet LE will park any module on the probe and retrieve the requested module if necessary.

The SCR200 Bay Assignment Page also contains buttons to view the rack in an open state. The open state would be the same view if you manually opened every door on the rack. To open the rack press <**Show Status**>, see figure 5 Show Status. In this figure, we show no bays contain assigned modules and there is no module attached to the probe on the CMM.

In figure 6, the Show Status page illustrates that modules are assigned to bays 1 and 5 and the probe on the CMM has the module assigned to bay 1 attached to it.

Manual Adjustments to the Stylus Rack

While in the Show Status view, you can manually make adjustments to the rack by adding or removing modules. To add a module to a bay, *without qualifying it*, left-click on a bay and it will toggle the symbol of the attached module by adding or removing the assignment.

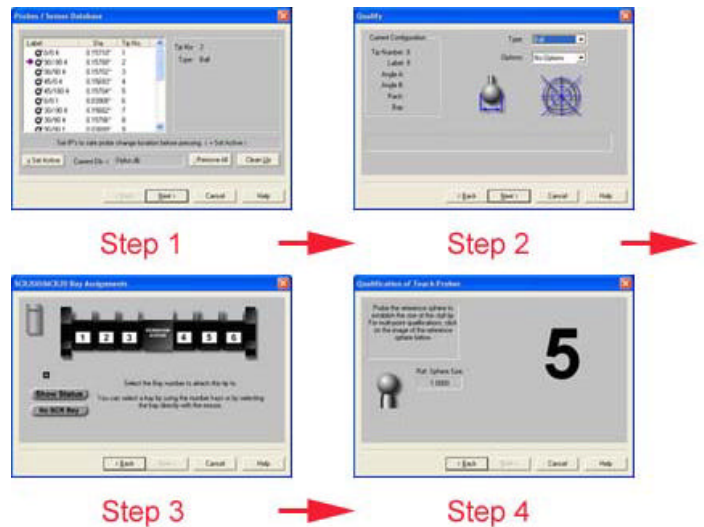
Should the probe on the CMM have a module attached, you can left-click on the symbol to remove it.

The process of manually changing the rack should only be done by an experienced operator. The adding and removing of bay assignments under this mode does not ensure that each module is placed in the bay under CMM control. Placing the actual module into a bay by hand does not ensure the orientation of the module will mate with the probe on the CMM. Which can lead to errant results when returning to CMM control.

Summary

Qualifying a stylus when using a stylus rack involves four basic steps, as shown here.

NOTE: It is possible to attach a cluster to the stylus module. When you proceed to step 3, request the same bay for qualification and Geomet LE will assign the same bay number to additional stylus tip numbers. For example, bay number 3 may have a stylus tips 4, 5 and 12 attached to it.



Summary Stylus Rack Qualification Steps

Stylus Rack Motion

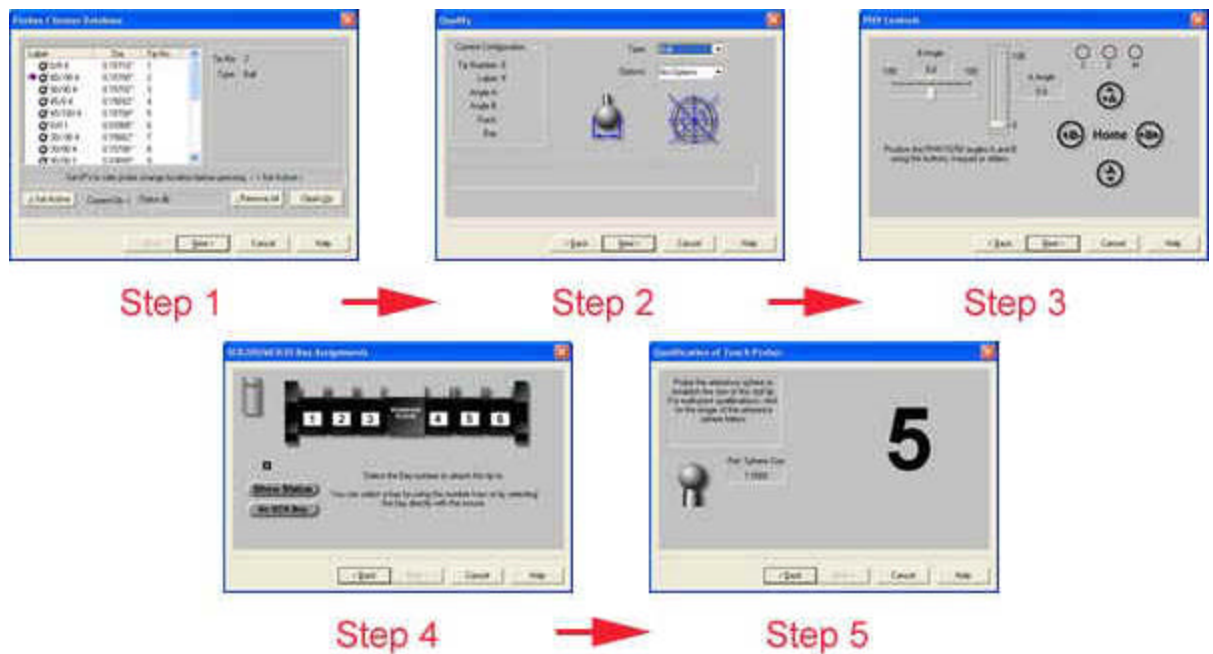
The motion assigned to a stylus rack is defined by tables found in the rack setup tools in **System Option, Probes and Sensors**. The rack has a staging point which is a safe point defined by the operator where the motion from this point to the rack is unobstructed.

When a request is made to change the stylus module, teach a safe path to the staging area point. Once at the position, Geomet LE builds the necessary motion to transit from the staging point to the bay position of the currently assigned module. The motion will then park the module and transit to the requested module, pickup the module and return to the staging area.

You are not required to teach motion to pickup the modules. All motion from the staging area until it returns to the staging area is controlled by Geomet. Therefore it is important that you ensure there is no obstructions in that area.

Using a Motorized Probe and Stylus Change Rack

Qualifying with a probing configuration that includes a Motorized Probe Head and a Stylus Rack requires 5 steps to complete. These steps are as follows:



To Qualify a new stylus, start with steps 1 & 2 from the *Qualifying a Basic Ball Stylus* section. When you press <Next> in step 2 you can choose the A / B Angle settings for the stylus and press <Next> to proceed to choosing the bay number on the rack. The final step is to capture the data points on the reference sphere.

The Stylus Database Manager

Command Activation:

Re-Qualification Command		
Ctrl + Alt + w	Qualify>Stylus Db Manager	
<i>Keyboard</i>	<i>Main Menu</i>	<i>Icon / Toolbar</i>

The Stylus db Manager provides tools to access more than 1 stylus database. Through the use of separate stylus database files, you can build specific stylus configurations based on your inspection needs and keep your stylus database manageable.

For example, it is not necessary to build one large stylus database that covers all your part inspection needs. It is also not efficient to clear out and build the stylus database with every unique part inspection. Therefore, Geomet LE can maintain separate stylus database files assigned to a part inspection.

The Stylus db Manager performs a test to a part program file when it is opened. This test looks for the original stylus database in use when the part program was created and compares it against the current stylus database in use, see *Loading a Part Program below*.

The Stylus db Manager provides the tools to:

- Create a new stylus database
- Import a stylus database file
- Delete a stylus database listing
- Set active a stylus database

Geomet LE maintains a listing by name of available Stylus database files in the Windows Registry under the Geomet LE 101 key. The Stylus db files are stored in the Geomet LE system folder. To ensure registry integrity only use the Stylus db Manager to add, import, delete or set active stylus databases.

Create a New Stylus Database

To create a new stylus database, the <**Append**> function is used. In figure 7, the stylus database "new.db" is the current stylus database in use. To create a new database and set it active, enter the new name for the database in the control "Enter Name ->". This example we will use "Left Bank", note: it is not necessary to add ".db" to the file new name name.

Press the <**Append**> button and the current database will be copied and given the name "Left Bank.db". The Stylus db Manager will update the registry and set "Left Bank" as the new active stylus database.

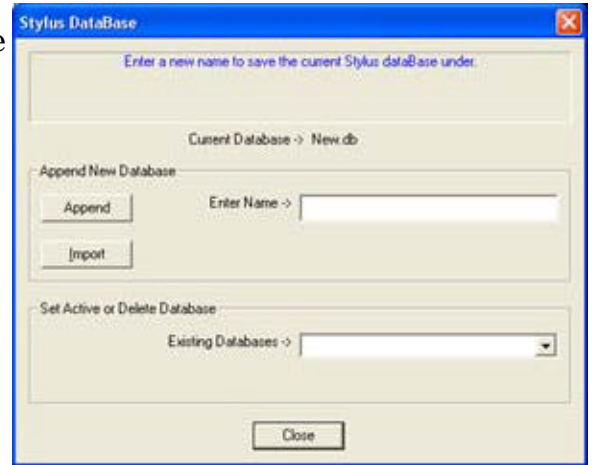


figure 7, Stylus db Manager

Import a Stylus Database

The Import function allows you to copy and register an existing stylus database in Geomet. For example, should you have more than 1 CMM and require matching stylus databases to be used for both CMMs, you can create the stylus database on CMM #1 then copy it over to CMM #2.

Once the stylus database has been copied to the correct location on CMM #2, see **System Options, File Locations**, press the <**Import**> function and the file navigation tool will display, see figure 8. Locate the copied stylus database and select <**Open**>. Geomet LE will add this database to the registry and set it active.

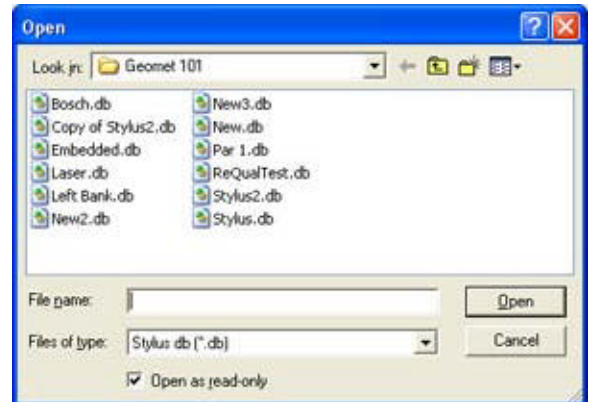


figure 8, Import a Stylus Database

Delete a Stylus Database

The process of deleting a stylus database will remove the listing in the registry. This will not delete the actual file. Geomet LE will no longer see the file.

To delete a stylus database from use in Geomet, drop down the list of files in the "Existing Databases ->" control, *see figure 9*. In this example, we will choose "New2". To complete the delete process, press the **<Delete>** button.

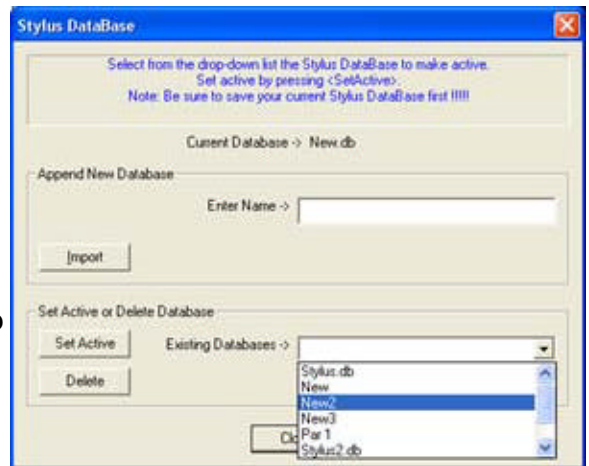


figure 9, Selecting a Stylus Database

Should you try to delete the current stylus database in use, the Stylus db Manager will default to "Stylus.db" as the new active stylus database.

Set Active a Stylus Database

To manage what stylus database is to be used, drop down the list of files in the "Existing Databases ->" control, *see figure 3*. Locate the database to be set active and press the **<Set Active>**. Geomet LE will now display and use the stylus configurations from this file in your inspection report.

When you change stylus databases it is a good practice to re-qualify the individual stylus tips. This should be done if you are not sure other changes have been made such as re-mounting the probe head or changing stylus tips associated with different configurations of a particular stylus database.

NOTE: You should not switch the stylus database during a part inspection. This can cause loss of accurate data.

Test for Stylus Database on Loading a Part Program

When a part program is loaded, Geomet LE will perform a test to verify that the current stylus database matches the stylus database used when the part program was created. Should Geomet LE find that the part program requests a stylus database that is different than the current stylus database, one of two warnings will appear.

Warning 1 - Switching Stylus db

The first test looks for a match using the stylus database embedded in the part program with the current active stylus database. If they do not match, then it checks the list of available stylus databases found registered with Geomet. Should a match be found Geomet LE will display the available options, *see figure 10*. There are three choices available:

Switch - Sets active the stylus database referenced in the part program.

Use Current - Continues opening the part program using the current stylus database.

Cancel - Aborts the opening of the file.

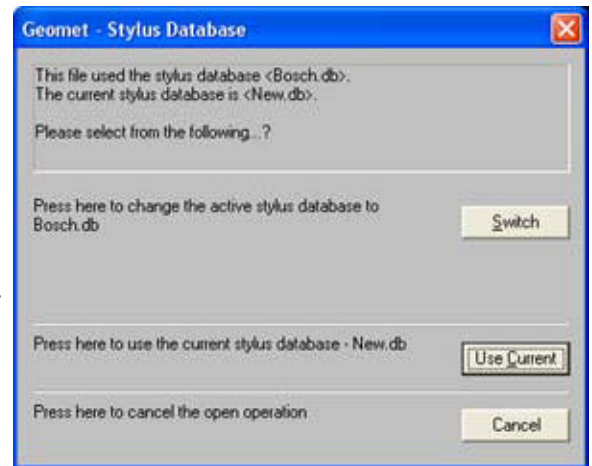


figure 10, Activate the Stylus Database

Warning 2 - Embedded stylus database not found

In this condition, the stylus database embedded in the part program is not found to be registered with Geomet. This condition can happen when a previous stylus database has been deleted through the Stylus db Manager, or if the part program was copied over from an archive or another CMM.

As shown in figure 11, a warning is shown that the part program references a stylus database that is not registered in Geomet.

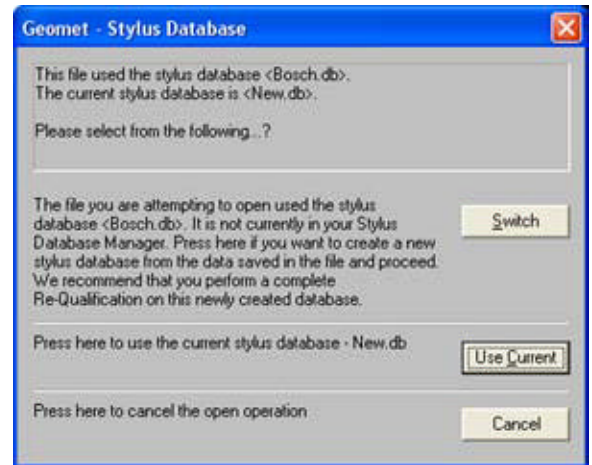


figure 11, Missing Stylus Database

Switch - Part programs contain a copy of the original stylus database when it was first taught. This database information can be extracted to create a new database. Select **<Switch>** if you want to create a data stylus database file and set it active. In this condition, it is recommended that a re-qualification be done to ensure accuracy.

Use Current - Continues opening the part program using the current stylus database.

Cancel - Aborts the opening of the file.


Geomet LE Coordinate Systems

Coordinate System Support Tools

Geomet LE provides limited access to Coordinate System setup tools. This support is limited to establishing a Part Coordinate System (PCS) using the 3-2-1 data point system, Origin command, ICS->PCS and Fixture Coordinate Systems.

One-Step PCS

Command Activation :

Re-Qualification Command		
	PCS>One-Step PCS	
<i>Keyboard</i>	<i>Main Menu</i>	<i>Icon / Toolbar</i>

Definition :

A One-Step PCS consists of an Orientation, Alignment and Origin. All of which are calculated with 6 captured data points. The Orientation requires 3 data points that have been captured on a single feature, normally a plane. The Alignment is determined by a line passing through two data points and the Origin is established by a combination of the calculated Orient and Alignment, plus a single data point.

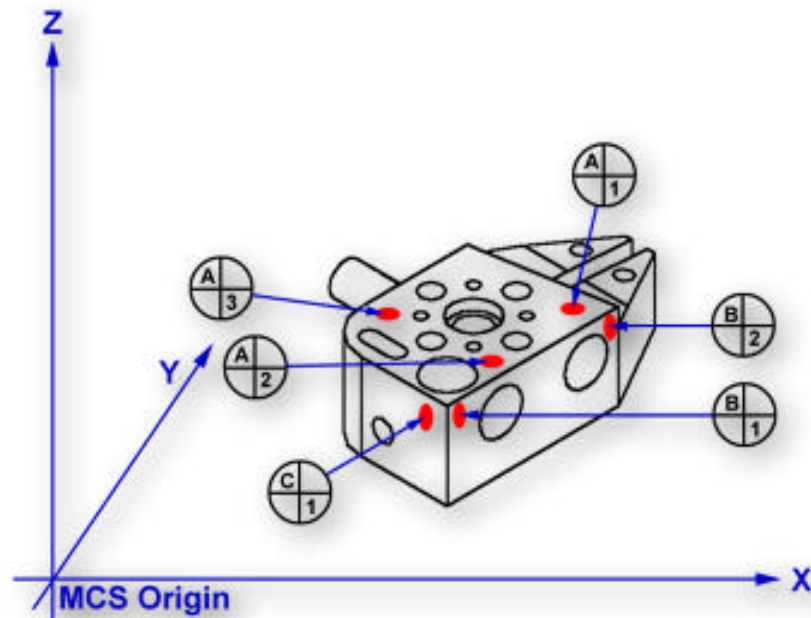


figure 1, One Step PCS Data Point Distribution

As shown in figure 1, there are 6 data points representing a well defined coordinate system. Data points A/1-3 builds the Orientation, data points B/1-2 form the alignment and data point C/1 establishes the Origin.

Data point direction is important to ensure you calculated surface points. When Auto-Direction is deactivated, Geomet LE will prompt the operator to select the probing directions, *see figure 2*.

There are 3 unique probe directions that must be set. Start by choosing the probe direction used for the Orient. You can then click on <Next> or the <Align> button and select the probe direction for the alignment. Finally set the probe direction for the Origin. In this example we have a probe direction of -Z for the first 3 data points followed by a -X direction for the 2 point alignment and finally -Y for the Origin. Geomet LE will retain these directions until you change them.



figure 2, Probe Directions

Capturing the Data Points:

Once the probing directions have been established, Geomet LE will prompt you to capture 3 data points, *see figure 3*. Referring to figure 1, capture data points A/1-3 on the top surface, using a probing direction of -Z.



figure 3, Data Point Prompt for establishing the Orient.

After the capture of 3 data points, the prompt will change to reflect the new probe direction used for Alignment data points B/1-2, *see figure 4*.



figure 4, Data Point Prompt for establishing the Alignment.

To complete the One-Step PCS, the prompt for final data point used for the Origin will appear after the 2 Alignment data points have been captured, *see figure 5* and the complete PCS reported in the inspection plan, *see figure 6*.

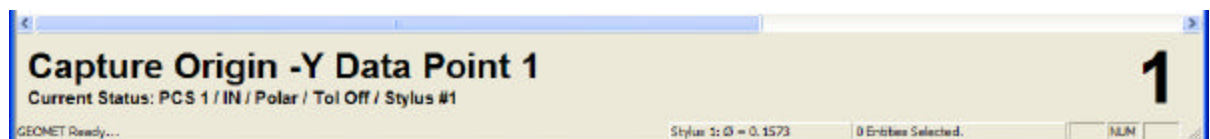


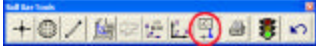
figure 5, Data Point Prompt for establishing the Origin.

No.	Feature	ACTUALS	Dev.Tol.	Dev.Nom.	NOMINALS	+TOL.	-TOL.
1	Current stylus is 1: [Ball - 0.15732"]						
2	Set ICS to PCS						
3	PCS 1 Established						
4	Established a 6-Point PCS (#2). [6 pts]						

figure 6, Complete PCS.

Origin Command

Command Activation:


Origin Command		
I	PCS>Origin	
<i>Keyboard</i>	<i>Main Menu</i>	<i>Icon / Toolbar</i>

The Origin Command is available when there is a valid measured or constructed feature as the last step in your inspection report. For Geomet LE, valid features include the Sphere and 1D Points.

To establish a new Origin on the last feature, activate the Origin command. In the case of a 1D Point, the new Origin will translate from its current position along the defined axis, and to the position reported by the 1D Point. When establishing a new Origin on a Sphere, you can select any combination of X, Y and Z Axes to the position of the centroid of the Sphere.

Incremental Coordinate System (ICS->PCS) Command

Command Activation:

ICS->PCS Command		
shift + “	PCS->”ICS->PCS”	
<i>Keyboard</i>	<i>Main Menu</i>	<i>Icon / Toolbar</i>


Definition:

The ICS is a coordinate system that has not been completed to the status of a PCS. For example, when Geomet LE begins a part inspection, the only coordinate system available is the MCS. Should the part to be inspected have the orient applied to it, Geomet LE creates an ICS based on the orient vector data and brings forward the alignment and origin data from the MCS.

During the inspection process, reported results on features are hidden until the PCS is completed. Only then will the reported data be meaningful.

Fixture Coordinate System Manager

Command Activation:

ICS->PCS Command		
shift + L	PCS->FCS Manager	
<i>Keyboard</i>	<i>Main Menu</i>	<i>Icon / Toolbar</i>

A FCS is a previously measured coordinate system saved away for recall and used in part inspection programs. The use of an FCS allows a repeatable location in the CMM measuring cube where inspections take place. An example would be a cradle fixture that holds a production part in one orientation and fixed location.

The use of an FCS requires that the CMM have a known home position which is common on all DCC CMMs and on few manual CMMs.


The process of creating a FCS entails establishing a PCS on the fixture and then activating the FCS Manager to append the specific geometry values associated with the established PCS to the FCS database. Using an FCS requires recalling the FCS by the assigned number through the Coordinate System Manager.

Geomet LE Feature Measurement

Geomet LE has a limited set of measurement features. These include 1D Points and Spheres and a BallBar macro.

1D Point

Command Activation:

ICS->PCS Command		
see Table	Measure->Point	
Keyboard	Main Menu	Icon / Toolbar

1D Points report 1D locations. There are 6 1D point routines, designated $\pm X$, $\pm Y$ and $\pm Z$ PCS directions. Pressing one of assigned keys, *see table 1*, prepares Geomet LE to measure a single point on a planar surface. The report consists of the location of the center of the stylus corrected by the stylus radius in the PCS probing direction. Problems arise if the planar surface is not parallel to a PCS base plane.

Keystroke	1D Point
1	-Y
2	-Z
4	-X
6	+X
8	+Z
9	+Y

Table 2, Point feature Keystroke Magic Assignment

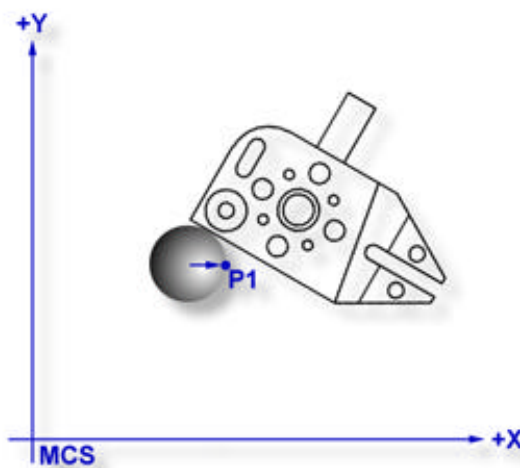


figure 1, 1D Compensation in the MCS

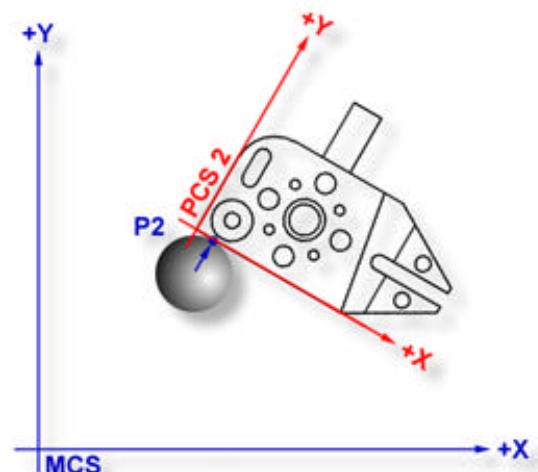


figure 2, Compensation in the PCS

Figures 1 and 2, illustrate a 1D point measurement of one and the same planar surface of the Widget prior to alignment (MCS) and after alignment (PCS).

Although the stylus center is at the same XYZ location in both cases, the calculated points, P1 and P2 are quite different. P1 resulted from a probe correction parallel to the X-axis of the MCS. P2 resulted from a probe radius correction parallel to the Y-axis of PCS 2. This illustrates how measurements of a surface in an unaligned PCS can produce erroneous results.

Single 1D Point measurements can only be used to determine the locations of planar surfaces, which are **parallel** to the PCS base planes. Pairs of 1D Point measurements on planar surfaces that are parallel to PCS base planes may serve to determine the Distance between the surfaces or the location of the Bisector of surfaces.

Pairs of 1D Point measurements on simply skewed planar surfaces, meaningless in themselves, may be used to define a Line on a surface or to Align the current PCS to be parallel to the surface.

Single and multiple 1D Point measurements on compound skewed plane or curved surfaces provide meaningless data.

To measure a 1D Point, press the corresponding Point direction key, *see table 1*, and gather a data point on your work piece. If you have Auto-Direction enabled, you will be prompted "Measure Auto-Dir Point" and your approach vector to the work piece will identify the probing vector.

Using Auto-Direction with 1D Points

Using auto direction on 1D Points can lead to erroneous reported values if used incorrectly. Auto direction relies on a smooth approach, from you the operator, in the capturing of a data point. The process of determining the approach vector involves an understanding of the CMM interface card (ProCounter Series, Tech 80 or PMAC) to maintain a rolling IJK vector based on the last five reported values. These interface cards update the current position in the MCS on a time interval from 20 to 200 milli-seconds.

When you are approaching your work piece, it is required that you make contact while remaining in a $\pm 45^\circ$ approach, see figure 3. In this example, if we remained in the approach zone we will capture a data point that will be reported as a +Y point. If the operator did not remain in the approach zone the 1D Point will report as a $\pm X$ Point from which we will have to correct the probe compensation error. Most common occurrence of a erroneous data point comes from operators who approach the surface, and then pause during the approach and attempt to make contact under extremely slow speeds, which while approaching causes variations in the path toward the surface.

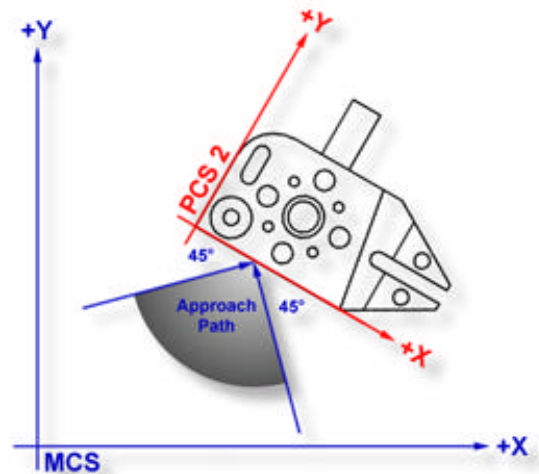
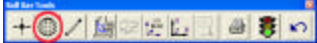


figure 3, Approach Vector

Sphere

Command Activation:

ICS->PCS Command		
v	Measure->Sphere	
<i>Keyboard</i>	<i>Main Menu</i>	<i>Icon / Toolbar</i>

A sphere is the trail left by a point travelling in every conceivable direction at a constant distance from another point called its center. A sphere is also the surface generated by a rotating circle about a coplanar axis through its center. The sphere is characterized by its size as a Radius or Diameter and a three dimensional center location.

To measure a sphere, press the < v > key for the default number of data points as established in System Options, or < shift > + < V > for a multi-point sphere.

If auto-direction is not enabled, Geomet LE will prompt you for the characteristic of the sphere, ID, OD, IR or OR. After the data points have been captured, Geomet LE will test the form error and if exceed, will prompt you to < Accept > or < Re-Meas >.

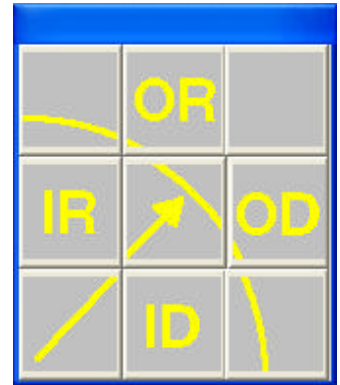



figure 4, Type Selection

BallBar Macro

Command Activation:

ICS->PCS Command		
	Measure->BallBar Macro	
<i>Keyboard</i>	<i>Main Menu</i>	<i>Icon / Toolbar</i>

The BallBar Macro is designed to deliver only the distance between two 5-Point Spheres without regard to sphere size. When you activate the command, Geomet LE will prompt you to capture the data points against the Spheres. Should there be an errant data point, press <F2> which will delete the last captured data point and reset the measurement prompt.



figure 5, BallBar Measurement Prompt

Should the calculated form of one or both of the spheres result in a poor fit, Geomet LE will prompt you to either Accept or Re-Measure the spheres.

```
No. | Feature | ACTUALS | Dev.Tol. | Dev.Nom. | NOMINALS | +TOL. | -TOL.
1 | Current stylus is 1: [Ball - 0.15732"]
2 | Set ICS to PCS
3 | PCS 1 Established
4 | Ball Bar Distance [10 pts]
   | Dist= 10.0000"
```

figure 6, BallBar Measurement Prompt

Geomet LE Utility Features

Copy and Append

The Copy and Append feature provides a tool to copy one or more selected features and insert copies as new features at the end of the current inspection report.

For example; your inspection requirement call for the measuring of an OD Sphere 10 times to test for repeatability. Measure the OD Sphere one time building a proper motion map (see hint below). When the sphere has been completed, highlight the sphere in the report area and right-click to activate the feature sub-menu and choose “Copy and Append ‘x’ number of features”.

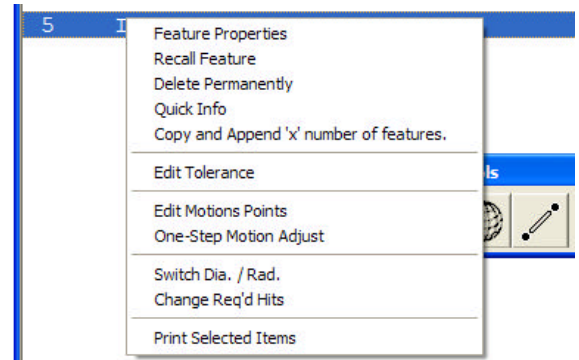


figure 1, Copy and Append

Geomet LE will prompt you for a count of new features to create. In our example we will enter ‘9’ and upon accepting that value, Geomet LE will create 9 new features complete with motion data.

HINT: When creating features with motion that will be copied, ensure the exit motion IP has a direct path to the start IP.