

## CHAPTER 5

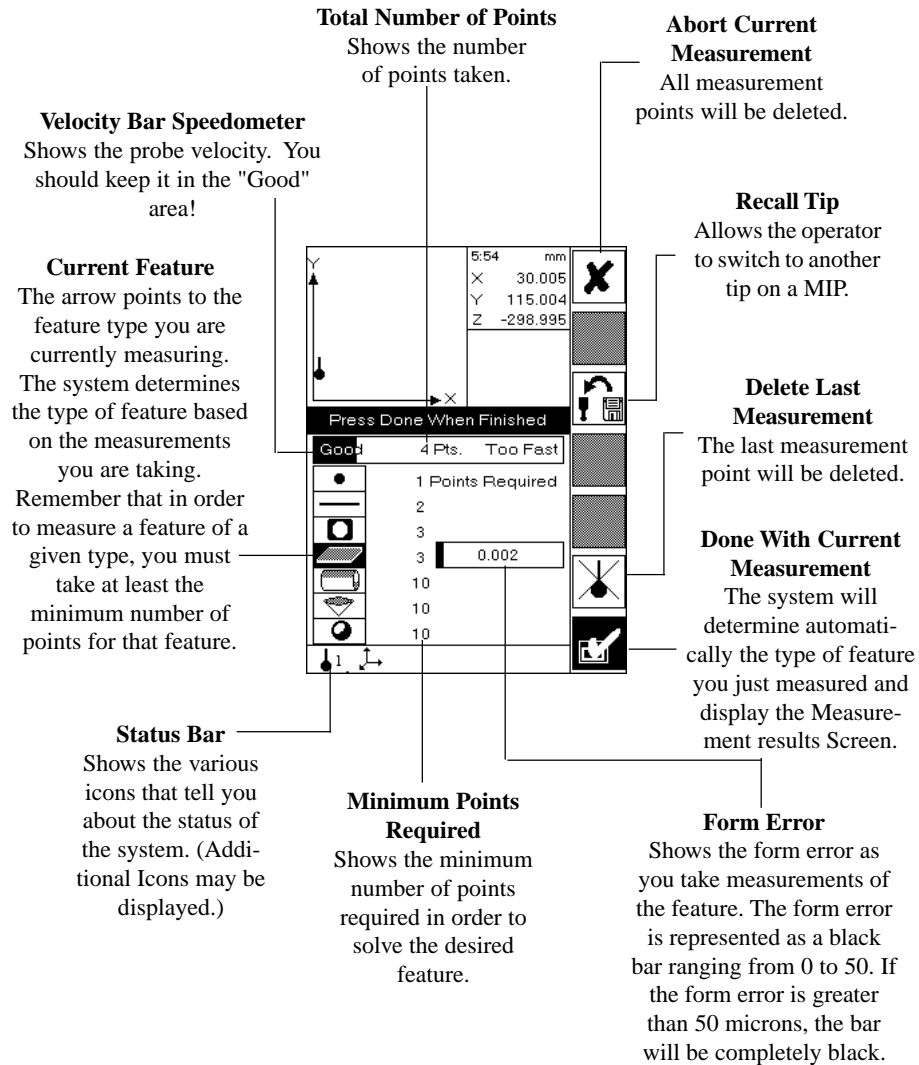
# Measurement Mode

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# Measurement Mode

## The TTP Preview Screen



Measurement Mode

# Measurement Mode

## The Hard Probe Scanning Screen

**Measurement Speedometer**  
Shows the velocity of the probe as it moves along the surface of the feature. Try to keep the bar in the "Good" area!

**Total Number of Points**  
Shows the number of measurement points you have taken. Remember you must take at least the minimum number of points per feature type as follows:

Feature	Points Req.
Point	1
Line	2
Plane	3
Circle	3
Cylinder	10
Cone	10
Sphere	10

**Abort Current Measurement**  
All measurement points will be deleted.

**Delete Last Measurement**  
The last measurement point will be deleted.

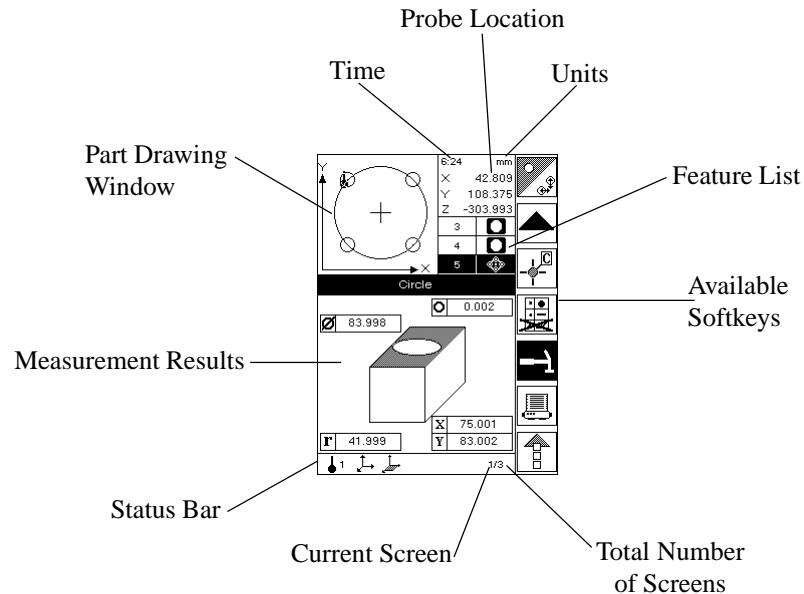
**Done With Current Measurement**  
The system will determine automatically the type of feature you just measured and display the Measurement results Screen.

**Status Bar**  
Shows the various icons that tell you about the status of the system.  
(Additional Icons may be displayed.)

# Measurement Mode

## Measurement Results Screen

After a measurement has been taken, the system determines the feature's properties and displays them as shown below.

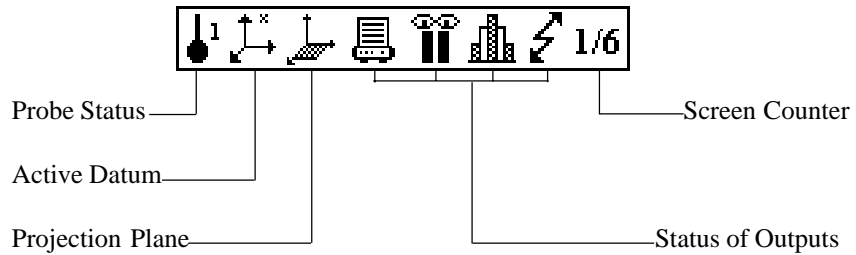


<b>Current Screen</b>	The identification number of the current screen.
<b>Total Number of Screens</b>	The total number of possible screens. Use the right arrow softkey to view the other possible screens.
<b>Probe Location</b>	The XYZ coordinates of the probe's center. This location is also shown graphically as the "flying probe" in the Part Drawing Window.
<b>Feature List</b>	This list displays the current and previous features. Only the last 100 features are saved for playback.
<b>Part Drawing Window</b>	This window displays a drawing of the measured features. The system automatically scales this drawing, based on the selected machine type, to fit the area.
<b>Status Bar</b>	This area represents the current status of the system's probes, datums, etc.
<b>Measurement Results</b>	The computed results of a measured feature, such as diameter, form error, or true position, are displayed.





# Measurement Mode

## The Status Bar




The Status Bar displays information about the current state of the system.



**Probe Status** Indicates the current active probe / probe tip. The probe status icons are:

-  Hard probe, or TTP tip number 1 is currently active. Up to 9 TTP tips may be qualified.
-  Edge probe with zero diameter
-  Tapered probe
-  Optical Probe




**Datum Status** Indicates the current datum system. The datum status icons are:

-  No datum system active. The system is using the machine coordinates.
-  The datum system has been modified but not saved.
-  Up to 9 datum systems can be created. These systems can be saved and recalled within the same inspection.





# Measurement Mode

## The Status Bar

**Projection Plane** Indicates the plane into which the feature was projected.

-  The feature was projected into the Top (XY) plane
-  The feature was projected into the Side (YZ) plane
-  The feature was projected into the Front or Back (ZX) plane

**Output Status** Indicates the status of output devices. Once a block is sent to an output device, selecting it again will disable the output during the playback mode. The output devices are:

-  Output to printer
-  Output to internal statistics
-  Output to serial port
-  During playback, pause to view measurement results.

**Note:** These outputs are configured in page 3 of the system options. See section 10-11 for more info.

**Screen Counter** Displays the current screen, as well as the total number of possible screens.

## Feature List Blocks

After a feature has been measured, the system assigns it a sequential number and stores it in the feature list. The system also stores other functions such as probe qualification and datums manipulations in the feature list. A maximum of 100 program blocks are stored for playback. After the 100th block, you will still be allowed to continue measuring, but, if you decide to save this program, only the last 100 features will be stored.

# Measurement Mode Softkeys

After a feature has been measured, the system will display various results screens. These screens have the following softkeys available:



*Single Feature*

## **Single Feature Display Mode**

When this softkey is toggled to "Single Feature", only the results of the previous measured feature are displayed.



*Relationships*

## **Relationship Display Mode**

When this softkey is toggled to "Relationships", the calculated results between the previous 2 features are displayed.



*Scroll Up*

## **Scroll Up**

This softkey lets you display the results of previous features by scrolling back through the Feature List.



*Next Screen*

## **Next Screen**

This softkey brings you to the next available result screen. Notice the status bar's screen counter increment as this softkey is pressed.



*Tolerance*

## **Tolerance**

When this softkey is pressed, the system displays a screen for entering nominal and tolerance information.



*Output*

## **Output**

This softkey can do multiple operations: Print (shown), serial out, send to internal statistics, playback stop, or any combination of these 4 options.



*Lower Menu*

## **Lower Menu**

When this softkey is pressed, you are brought to the lower result screen menu.



*Upper Menu*

## **Upper Menu**

When this softkey is pressed, you are brought to the upper result screen menu.



*Tools Menu*

## **Tools Menu**

This softkey displays the system's "Tools" menu. Operations such as constructions, probe qualifications, and Relationship between 2 non-sequential features can be executed from this menu.

**Note:** For more information about Measurement Mode softkeys, see Chapter 3's Measurement Mode Tutorial.

# Measurement Mode Softkeys



*Change Feature Type*

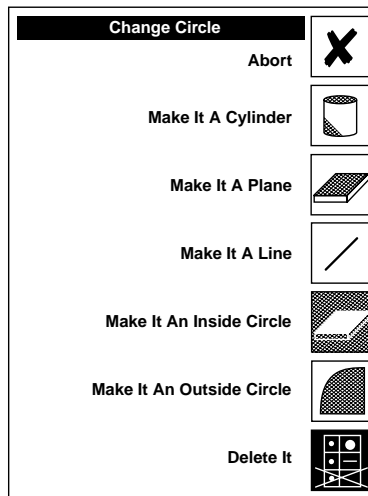
## Change Feature Type

The Change Feature Type softkey allows you to override the system's feature recognition results for the last measured feature. For example, the system solves the measured feature as a circle when the operator really meant for the feature to be a cylinder.

The following table summarizes the features that can be changed into other features:

	Line	Circle	Plane	Cylinder	Cone
Line		X	X		
Circle	X		X	X	
Plane	X	X			
Cylinder		X			X
Cone	X	X	X	X	
Sphere			X		

When the Change Feature Type softkey is selected, the system displays a screen similar to the following:



# Measurement Mode Softkeys



*Set Level*

**Set Level:** This softkey creates new reference plane (Datum A) and corresponding major and minor axes from the measured features.

<b>Feature Type</b>	<b>Description</b>
Any Point	Because a point has no direction component (vector), this option is disabled.
Any Line*	For a line, this softkey rotates the reference plane (Datum A) to the line's perpendicular. Also, the origin is projected into the new reference plane.
Plane	For a plane, this softkey rotates the Datum A to the measured plane. Also, the origin is projected into the new reference plane.
Circle	Because a circle has no direction component (vector), this option is disabled.
Cylinder	For a cylinder, this softkey rotates the reference plane (datum A) to the plane perpendicular to the cylinder's centerline. The origins are also translated to the cylinder's pierce point.
Cone	For a cone, this softkey rotates the reference plane (datum A) to the plane perpendicular to the cone's centerline. The origin is also translated to the cones apex.
Sphere	Because a sphere has no direction component (vector), this option is disabled.

\* Note: For a measured line, the level (third axis zero point) is set at the centroid of the points taken to create the line. Setting a known origin (datum C) is suggested.

# Measurement Mode Softkeys



*Set Axis*

## **Set Axis:**

This softkey rotates the current datum system to the current measured feature (Datum B). The datum axis closest to the measured feature is rotated. The general direction (sign) of the datum axis is not changed.

<b>Feature Type</b>	<b>Description</b>
Any Point	This option is disabled because a point does not have a direction component (vector).
Line	This softkey projects the line into the current Datum A, then rotates the closest datum axis to be parallel with it.
Plane	This softkey projects the line perpendicular to the plane into the current Datum A, then rotates the closest datum axis to be parallel with it.
Circle	This option is disabled because a circle does not have a direction component (vector).
Cylinder	This softkey projects the cylinder's centerline into the current Datum A, then rotates the closest datum axis to be parallel with it.
Cone	This softkey projects the cone's centerline into the current Datum A, then rotates the closest datum axis to be parallel with it.
Sphere	This option is disabled because a sphere does not have a direction component (vector).

# Measurement Mode Softkeys



*Set Origin*

## **Set Origin:**

This softkey translates the origin (Datum C) of the datum system as follows:

<b>Feature Type</b>	<b>Description</b>
Any Line or Plane	Because there is no repeatable single point created by a line or plane, this option is disabled.
Measured Point	Translates the origin to the point's tip compensated location.
Constructed Point	Translates the origin to the point's location.
Point Measured with Tapered Probe	Translates the origin to the point's location.
Circle	Translates the origin to the circle's center.
Cylinder	Translates the origin to the cylinder's pierce point.
Cone	Translates the origin to the cone's apex.
Sphere	Translates the origin to the sphere's center.

# Measurement Mode Softkeys



*Delete Block*

## Delete Last Block

This option deletes the last program block. The block can be a measured feature or a system function. When you delete a non-feature block, the system restores the previous block values as follows:

Block Type	Operation
Any Feature	Feature is deleted
Probe Qualification	Qualification file is cleared Probe from last block is recalled
Recall Tip	Probe/Tip from last block is recalled
Tapered Probe	Probe from last block is recalled
Save Datum	Saved datum is cleared Recall datum from previous block
Recall Datum	Recall datum from previous block
New Level	Recall datum from previous block
New Axis	Recall datum from previous block
New Origin	Recall datum from previous block



*Store Relationship*

## Store Relationships

This option is only available when the current displayed relationship creates a feature. The relationship is stored at the end of the feature list. The following are the relationships that create a feature:

Relationship	Description
Point/Point	2D Line & Midpoint
Line/Line	Intersection Point & Midpoint
Line/Plane	Intersection Point
Line/Circle	Intersection Points
Line/Cylinder	Halfway Point
Line/Cone	Halfway Point
Plane/Plane	Intersection Line
Plane/Circle	Intersection Points
Plane/Cylinder	Pierce Point
Plane/Cone	Pierce Point
Plane/Sphere	Intersection Point
Circle/Circle	2D Line & Intersection Points
Circle/Cylinder	2D Line
Circle/Cone	2D Line
Cylinder/Cylinder	Halfway Point
Cylinder/Cone	Halfway Point
Cone/Cone	Halfway Point
Cone/Sphere	3D Perpendicular Line

# Measurement Mode



Tolerance

## Tolerancing Results

To tolerance a feature result, nominals and tolerance values must be entered in the tolerance screen shown below.

Result Description

Output Format  
Nominal  
Tolerances

Current Result

Next Item  
Change Tolerance  
Next Result

Output	Measured	X
Nominal	88.500	
Upper Tol.	0.050	
Lower Tol.	0.050	

Cone		
⊙	0.013	⊕ ⊖
△	9.879	0.005

X	Y	Z
88.073	99.997	-63.445

The output choices are as follows: "Measured" (default), "Full", "Tol. Band", "Out of Tol.", "None". Each choice changes the display on the screen, as well as the "Print Format" style printout / serial output. When this value is set to "None", that result disappears from the screen and will not be printed or sent out of the serial port.

The softkeys available in the tolerance screen are as follows:



Abort

### Abort

The system discards the changes made in the tolerance screen and returns you to the Result screen.



Next Item

### Next Item

This softkey advances the highlight to the next item (Output, Nominal, Upper Tol., Lower Tol.).



ISO Tolerance

### ISO Tolerance Table

This softkey is only available when entering tolerance information for circle or cylinder diameters. The system displays ISO Tolerance Codes and Grades based on the nominal size of the circle or bore and whether the measurement is internal or external (bore or pin).



Next Result

### Next Result

This option advances the highlight to the next result.

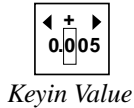
# Measurement Mode



## Cycle Option

In the tolerance screen, the cycle option softkey is used to choose the desired tolerance type. Below are examples of the 5 tolerance types in "Print Format:"

<b>Measured:</b> ==> Circle (1) ..: Circle Diameter 15.018 ===*===	<b>Tol Band:</b> ==> Circle (1) ..: Circle Diameter ===*===	<b>None:</b> (The value is not outputted or displayed on the screen)														
<b>Full:</b> ==> Circle (1) ..: Circle <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 15%;">MEASURED</th> <th style="width: 15%;">NOMINAL</th> <th style="width: 15%;">UPPER TOL</th> <th style="width: 15%;">LOWER TOL</th> <th style="width: 15%;">DEVIATION</th> <th style="width: 15%;">OUT/TOL</th> </tr> </thead> <tbody> <tr> <td>Diameter</td> <td>15.018</td> <td>15.018</td> <td>0.020</td> <td>-0.020</td> <td>-0.000</td> <td></td> </tr> </tbody> </table> ===*===				MEASURED	NOMINAL	UPPER TOL	LOWER TOL	DEVIATION	OUT/TOL	Diameter	15.018	15.018	0.020	-0.020	-0.000	
	MEASURED	NOMINAL	UPPER TOL	LOWER TOL	DEVIATION	OUT/TOL										
Diameter	15.018	15.018	0.020	-0.020	-0.000											
<b>Out-Of-Tol:</b> ==> Circle (1) ..: Circle <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 15%;">MEASURED</th> <th style="width: 15%;">NOMINAL</th> <th style="width: 15%;">UPPER TOL</th> <th style="width: 15%;">LOWER TOL</th> <th style="width: 15%;">DEVIATION</th> <th style="width: 15%;">OUT/TOL</th> </tr> </thead> <tbody> <tr> <td>Diameter</td> <td>15.018</td> <td>15.018</td> <td>0.020</td> <td>-0.020</td> <td>-0.000</td> <td></td> </tr> </tbody> </table> ===*=== (Same as Full format except the results are only outputted when the feature is out of tolerance.)				MEASURED	NOMINAL	UPPER TOL	LOWER TOL	DEVIATION	OUT/TOL	Diameter	15.018	15.018	0.020	-0.020	-0.000	
	MEASURED	NOMINAL	UPPER TOL	LOWER TOL	DEVIATION	OUT/TOL										
Diameter	15.018	15.018	0.020	-0.020	-0.000											



**Note:** For a listing of all of the serial outputs, see section 10-12

## Keyin Value:

This softkey is used for entering nominal and tolerance values. Use the +1, -1, and +/- softkeys, followed by the Done softkey to change a nominal or tolerance value.



## Done:

All changes are accepted and you are returned to the Measurement Mode result screen.

**Important:** The system will approximate the nominal value based on the measured value using the "Nom. Nearest" option in the system options. The next time a similar feature is measured, the system will reuse the nominal used the previous time.

# Measurement Mode

## GD&T Symbols

The results of most measurements are referenced with a GD&T (Geometric Dimensioning & Tolerancing) symbol. The following is a description of GD&T symbols that the system uses:

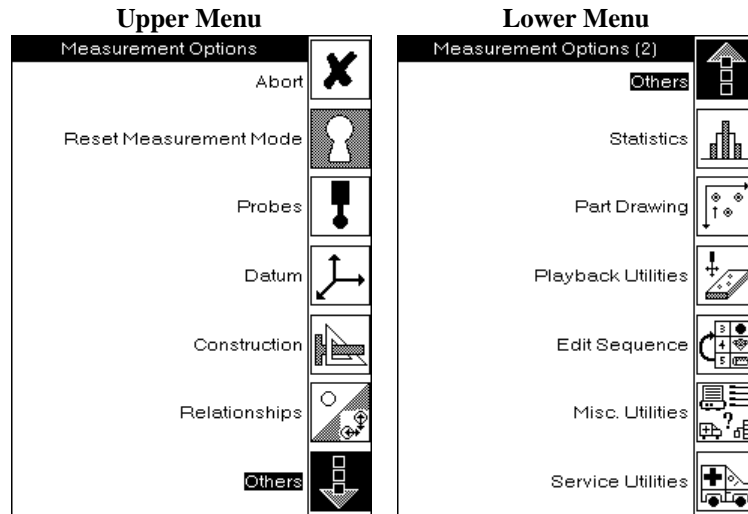
Symbol	Result Description
X	Location along the X axis
Y	Location along the Y axis
Z	Location along the Z axis
U	Polar coordinate - radial distance from the origin
V	Polar coordinate - angle with major axis of ref. plane
∅	Diameter
r	Radius
L	Length of slot
W	Width of slot
ΔX	Distance along X axis between two features
ΔY	Distance along Y axis between two features
ΔZ	Distance along Z axis between two features
ΔXY	2D distance between two features along the Top (XY) plane
ΔYZ	2D distance between two features along the Side (YZ) plane
ΔZX	2D distance between two features along the Front or Back (ZX) plane
ΔXYZ	3D distance between two features
⊥Δ	Perpendicular distance between two features
⊥Δ⊕	Perpendicular distance between a feature and the origin of the datum
○	Form error: roundness
▱	Form error: flatness
—	Form error: straightness
⊘	Form error: cylindricity
⊙	Form error: cones and spheres
∠ X	Included angle with X axis
∠ Y	Included angle with Y axis
∠ Z	Included angle with Z axis
∠ XY	Included angle with Top (XY) plane
∠ YZ	Included angle with Side (YZ) plane
∠ ZX	Included angle with Front or Back (ZX) plane
∠	Included angle between two features
∅⊕(M)	True position: MMC with diametrical tolerance zone
∅⊕(S)	True position: RFS with diametrical tolerance zone
⊥	Perpendicularity or squareness
∥	Parallelism
∠	Angularity
◎∅	Concentricity with diametrical tolerance zone

# The Tools Menu



Tools

The Tools Menu is accessed by pressing the tools softkey in Measurement Mode. The menu is in two levels:



Abort

### Tools Menu: Abort:

When this softkey is pressed, all changes are aborted and you are returned to the Measurement Mode.



Reset Measurement Mode

### Tools Menu: Reset Measurement Mode:

The Reset Measurement Mode softkey is used to clear completed work by restoring the Measurement Mode to default conditions. After the Reset Measurement Mode screen appears, press the "Done" softkey to reset the system or "Abort" to cancel. When the Measurement Mode is reset, the following operations are performed:

1. Delete All Features
2. Clear the Datum
3. Activate Probe Tip 1
4. Reset Statistics
5. Reset Tolerances

# The Tools Menu - Probes



*Probes*

## Tools/Probe Menu: Select Probe Type

The probe menu's "Select Probe Type" softkey is used to qualify a probe. A probe can be qualified with a qualification sphere or by keying in the probe's diameter and offsets. In addition to the probe qualification steps listed here, you should review the Startup Tutorials probe qualification procedure in Chapter 2.



*Select Probe Type  
(Begin Qualification)*

1. Select the probe type from the following list:

TTP: Touch trigger probe  
Ball probe <sup>ac</sup>: Solid probe with spherical tip (hard probe)  
Taper probe <sup>abcd</sup>: Solid probe with conical tip  
Edge probe <sup>abcd</sup>: Solid probe with flat edge  
Optical probe <sup>abcd</sup>: Camera style probe with monitor  
Scribe probe <sup>acd</sup>: Solid probe with sharp tip.

- a - Not currently available for Mistral machines.
- b- Not available on horizontal machines.
- c- Can not be used in DCC playback on DCC machines.
- d- Not available on arm machines.



*Keyin Value*

**Note:** For a picture of each of the above probes, see appendix 4-2.

2. By default, when the diameter and offsets are set to "Qualify", the system will automatically calculate those values. But, by using the change option softkey, you can key in values for the diameter and offsets. The offsets are measured from the bottom of the Z rail to the center of the probe tip. With a MIP, the offsets is to the center of the first tip.
3. The system will now guide you through the probe qualification process using the following screens:
  - a. The "Remove Probe" & "Locate Sphere" screen
  - b. The "Reinsert Probe" screen
  - c. The "Measure Sphere" screen
  - d. The "Qualification Results" screen



*Change Option*

## The Tools Menu - Probes



*Probes*

4. While measuring the qualification sphere, it is recommend that you take at least 12 points as described in the Startup Tutorial's Chapter 2.

**Troubleshooting:** If you are consistently getting "Can Not Solve" errors in the probe qualification screen, it is probably because the system is not seeing movement in an axis. See Chapter 11, "Troubleshooting" for more information.



*Remeasure Tip*

5. After you are done measuring the sphere, the system displays the qualification results screen. If the results are not satisfactory, press the "Remeasure Sphere" softkey. If you have a multi-tip probe, press the "Qualify Next Tip" softkey to qualify an additional tip.



*Next Tip*

**Note:** - When qualifying a multi-tip probe, record the probe tips orientation. This information will be needed during measuring.



*Recall Tip*

### **Tools/Probe Menu: Recall Probe Tip**

This softkey lets you recall a previously qualified probe tip when using a multitip probe. When this softkey is selected, the Recall Tip screen is displayed. Use the arrow softkeys to select the desired tip number. Note: For multitip probes, the current active tip number is displayed in the status bar.



*Qualify Additional Tip*

### **Tools/Probe Menu: Qualify Additional Tip**

With a multitip probe, this option allows you to qualify a new tip.



*Save Startup Probe*

### **Tools/Probe Menu: Save Startup Probe**

This softkey allows you to save a startup probe. This feature tells the system to skip the startup sequence's probe qualification the next time the system is started. This function can also be accessed from screen 1 of the System Options.

# The Tools Menu - Datums



*Datum Menu*



*Save Datum*



*Recall Datum*



*Translate Datum*



*Rotate Datum*

## **Tools/Datum Menu: Save Datum**

This softkey lets you store the current datum for later use. With the exception of transferring datums to other measuring modes, if you plan the measurement sequence correctly, this softkey is seldom used.

**Note:** When the power is turned off, the saved datums are lost.

**Note:** Many first time operators use the Save Datum softkey incorrectly. After an alignment, you do not need to save a datum unless you plan to do an additional alignment, and then return to the current alignment.

## **Tools/Datum Menu: Recall Datum**

This softkey lets you recall a previously saved datum. In addition to user-created datums, you can also recall the machine datum system.

## **Tools/Datum Menu: Translate Current Datum**

This softkey lets you translate the origin to a keyed in location or the location of the last measured feature. A value of 0 in a particular axis will cause that axis not to be translated.

## **Tools/Datum Menu: Rotate Current Datum**

This softkey lets you rotate the current datum system. You can use a keyed in angle, or keyed in offsets to achieve the desired rotation.

**Note:** After the 2 offset values are entered, the system displays the calculated rotation angle.

**Note:** In playback, the operations listed above will be executed automatically.

# The Tools Menu - Construction



*Construction*



*Select Feature*



*Construct a Line*

## To construct a feature:

1. Measure the features needed for the constructed feature.
2. Select the desired construction softkey from the Construction Menu.
3. Use the arrow softkeys to move the highlight over the features to be used in the construction and press the Select key. Press the key a second time to deselect a feature. As a feature is highlighted, a cross is displayed over that feature in the part drawing window. When the feature is selected, it is remarked with a double cross.
4. When features are selected, press the Done softkey to construct the desired feature.

## Tools/Construction Menu: Constructing a Line

This softkey lets you construct a line through the center of previously measured features. For a given feature, the system constructs a line as follows:

<b>Feature Type</b>	<b>Description</b>
Point	Uses the XYZ location of the measured point
Circle	Uses the XYZ of the center of the circle
Cylinder	Uses the XYZ of the pierce point of the cylinder
Cone	Uses the XYZ of the pierce point of the cone
Sphere	Uses the XYZ of the center of the sphere

If all selected features were projected into the same reference plane, a 2D line will be created in that plane.

If all selected features weren't projected into the same reference plane, you will be asked to select a reference plane or to make it a 3D line.

# The Tools Menu - Construction



*Construct a circle*

## **Tools/Construction Menu: Constructing a Circle (Bolt Hole Pattern)**

This softkey lets you construct a circle through the center of previously measured features. For a given feature, the system constructs a circle as follows:

<b>Feature Type</b>	<b>Description</b>
Point	Uses the XYZ location of the measured point
Circle	Uses the XYZ of the center of the circle
Cylinder	Uses the XYZ of the pierce point of the cylinder
Cone	Uses the XYZ of the pierce point of the cone
Sphere	Uses the XYZ of the center of the sphere

To construct a circle, follow the procedure on the previous page. If all selected features weren't projected into the same reference plane, you will be asked to select a reference plane.



*Construct a plane*

## **Tools/Construction Menu: Constructing a Plane**

This softkey lets you construct a plane through the center of previously measured features. For a given feature, the system constructs a plane as follows:

<b>Feature Type</b>	<b>Description</b>
Point	Uses the XYZ location of the measured point
Circle	Uses the XYZ of the center of the circle
Cylinder	Uses the XYZ of the pierce point of the cylinder
Cone	Uses the XYZ of the pierce point of the cone
Sphere	Uses the XYZ of the center of the sphere

To construct a plane, follow the procedure on the previous page.



*Symmetry Point*

## **Tools/Construction/Symmetries Menu: Symmetry Point**

This softkey lets you construct a point halfway between two measured features. For a given feature, the system constructs a symmetry point as follows:

<b>Feature Type</b>	<b>Description</b>
Point	Uses the XYZ location of the measured point
Circle	Uses the XYZ of the center of the circle
Sphere	Uses the XYZ of the center of the sphere

To construct a symmetry point, follow the procedure on the previous page.

# The Tools Menu - Construction



*Symmetry Line*

## Tools/Construction/Symmetries Menu: Symmetry Line

This softkey lets you construct a symmetry line through the center of previously measured features. For a given feature, the system constructs a symmetry line as follows:

Feature Type	Description
Line	Uses the XYZ centroid of the line
Cylinder	Uses the XYZ of the pierce point of the cylinder
Cone	Uses the XYZ of the pierce point of the cone



*Symmetry Plane*

## Tools/Construction/Symmetries Menu: Symmetry Plane

This softkey lets you construct a symmetry plane through the center of previously measured features. For a given feature, the system constructs a symmetry plane as follows:

Feature Type	Description
Line	Uses the XYZ centroid of the line
Cylinder	Uses the XYZ of the pierce point of the cylinder
Cone	Uses the XYZ of the pierce point of the cone



*Projection Point*

## Tools/Construction Menu: Projection Point

This softkey lets you construct a point by projecting a point, circle or sphere into a line, plane, cylinder or cone. A point type feature (point, circle or sphere) and a vector type feature (line, plane, cylinder or cone) must be selected.



*Construct From Datum*

## Tools/Construction Menu: Construct From Datum

This softkey lets you construct a feature by copying one of the current datum system components. You can create a point from the origin, a line from one of the datum axes, and a plane (offset if desired) from one of the datum planes.

# The Tools Menu - Relationships



*Relationships*

## **Tools Menu: Relationships:**

The Measurement Mode's Relationship softkey lets you view the relationship between the last 2 measured features. This softkey lets you view the relationship between any 2 non-sequential previously measured features.

This function does not operate by creating a new block. Rather, it copies the first selected block to the end of the list and sets the other as a temporary reference feature. Because of this the block sequence may appear out of order. For example:

Suppose you measured the following sequence:

1. Circle
2. Plane
3. Line
4. Circle
5. Cylinder
6. Cone

After completing this sequence, you would like to see the relationship between Circle 1 and Circle 4. Press the Tool menu's Relationships softkey, select Circles 1 and 4 and then press the Done softkey. The new sequence would be as follows:

1. Circle
2. Plane
3. Line
4. Circle
5. Cylinder
6. Cone

**Tip:** Think for a moment. Because Circle 1 and Circle 4 are not new measured or constructed features, it does not make sense to create a new block for them. The system simply references the existing blocks.

1. Circle
4. Circle

(This is with Relationships turned on)

If you turn off the Relationships softkey before continuing, the sequence would look like this.

1. Circle
2. Plane
3. Line
4. Circle
5. Cylinder
6. Cone

(This is with Relationships turned off)

1. Circle

(Notice that the lower Circle 4 is no longer visible. The next measured feature will be block 7.)

# The Tools Menu - Statistics



Statistics



Lower Menu



Upper Menu



Enable Statistics



Add Record



Delete Record



Summary Data



Run Chart



Histogram.



Copy Mean

## Tools Menu: Others:

Because not all softkeys could fit into one menu, they have been broken up into an upper level tools menu and a lower level tools menu.

## Tools Menu: Statistics:

The Internal Statistics softkey lets you perform a statistical evaluation on a number of part measurements. The system provides summary reports, run charts and histograms of the measured features.

## Collecting Statistics Data:

1. Enable internal statistics using the "Enable Statistics" softkey.
2. Measure a desired feature. Press the Add Record softkey. At the "Adding New Record" screen, press the "Done" softkey.
3. Continue measuring. Each time a new feature is measured, an "Adding new Record" screen is displayed. When an existing feature is measured, an "Adding Observation" screen is displayed. The system can store up to 5 records with 100 observations in each. All measurements in a record must be within 10% of the mean value. If not, a new record is created.
4. To delete a record, press the "Delete Record" softkey.

## Display Reports and Charts:

1. Press the "Summary Data" softkey to enter nominal and tolerance values for the desired features.
2. At any point after you begin taking data, a statistical summary, histogram, or run chart can be displayed. To do so, select either the "Summary Data", "Run Chart", or "Histogram" softkeys from the Statistics menu.
3. The system now asks you to select a desired feature. Use the scroll up and scroll down softkeys to select a feature.
4. Finally, the system will ask you to select a desired characteristic of the selected feature. Use the scroll up and scroll down softkeys to select the desired characteristic.

## Copy Mean:

To save time, you can use the "Copy Mean" softkey to copy the computed mean to the nominal.

**Note:** If you desire more advanced statistical functions, consider purchasing an external statistic package such as DataPage™.

# The Tools Menu - Part Drawing



*Part Drawing Menu*

## **Tools Menu: Part Drawing:**

From the Part Drawing menu, you can select 2 different methods for making a printout of the part. The first method involves printing either the top, front, or side views. The second method, called digitize outline allows you to select specific regions to be displayed. The softkeys that are available from the Part Drawing menu are as follows:



*Print Top View*

## **Tools/Part Drawing: Print Top View (XY)**

When you select the Print Top View softkey, all features measured in the top plane, as well as all 3D features are printed.



*Print Front View*

## **Tools/Part Drawing: Print Front View (ZX)**

When you select the Print Front View softkey, all features measured in the front plane, as well as all 3D features are printed.



*Print Side View*

## **Tools/Part Drawing: Print Side View (YZ)**

When you select the Print Side View softkey, all features measured in the side plane, as well as all 3D features are printed.



*Digitize Outline*

## **Tools/Part Drawing: Digitize Outline:**

The Digitize Outline softkey lets you print out a specific region of a part in either the top, side, or front planes. After this softkey is selected, a "Scan outline of the part" screen appears. When you complete scanning the outline of the part, the Print softkey appears. Press the Print softkey to begin part printout or the Abort softkey to exit.

# The Tools Menu - Playback Utilities



Playback

## Playback overview:

The Playback Mode facilitates the inspection of frequently measured parts. For example, if you need to inspect multiple parts, all of which are the same, you would write a program to aid the measurement process.

Although you may not realize it, every time you perform a measurement sequence, you are creating a part program. You simply have not chosen to save or replay the program. After completing an inspection sequence, you have 2 choices:

1. Replay the part program immediately (without saving it).
2. Store Program- Store the current inspection sequence for later replay.

Understanding and using the playback capabilities of this software are extremely important. Because steps such as manipulating datums, entering nominal and tolerance information, and outputting results are executed automatically, part inspection time is significantly reduced. The chances of making a mistake are also reduced.

## Planning the Inspection Sequence

The following should be considered when planning a part inspection:

1. Review the part print and mark all features you wish to measure and their order. A playback program can have at most 200 blocks. If more blocks are needed, create and store a separate inspection sequence.
2. Identify all callouts and note datums, nominals and tolerances.
3. Identify the probe tips/orientations needed for this part.
4. For more complicated parts, use the power of alignments to your advantage. Some part alignments are easy to visualize. Other parts, with their compound angles and odd datum surfaces, are not as easy. Remember, if the system can measure a part in one orientation, it can also measure that part in another orientation. If you are having trouble writing a program, align the part so it is easy to visualize. When you have the desired results in that orientation, rewrite the program in the orientation which facilitates part clamping.

# The Tools Menu - Playback Utilities

## Creating the Inspection Sequence

When the inspection sequence is planned, create it as follows:

1. Enter screen 3 of the System Options to setup the output devices to be used: Printer, Serial Output, Playback Pause. Consider enabling Statistics also.
2. Clear the system of all previous work by selecting the Reset Measurement Mode softkey from the Tools Menu.
3. Clamp the part to the table and insert the proper probe.
4. Always start the inspection sequence with a probe qualification block. This prompts you to qualify the correct probe tips in the correct orientations.
5. Begin measuring features. Enter nominals and tolerances and output results. The system will replay these steps in the order they were measured.



*Reset Measurement Mode*



*Playback (Without Saving)*

## Executing a Playback Program

When the inspection sequence is complete, you can choose to replay that program by selecting the Playback softkey. This will not save the program. The next time you select the Reset Measurement Mode softkey, or the power is shut off, the program will be lost.

The system will prompt you to measure the required features in the order they were created. Blocks that don't prompt you to measure will be executed automatically.

### Blocks which execute automatically:

The system automatically executes the following blocks without prompting:

Datum Features	Stored Features	Constructed Features

# The Tools Menu - Playback Utilities

## Playback Error Recovery:

When there is an error during the Playback Mode, the system displays the Error Message screen. The possible playback error screens are:

Error Message	Cause of Error	Recommended Solution
Can Not Solve	The measured element or relationship could not be computed	Ensure you are measuring the correct element Re-execute the current block
Qualification Failed	A computation error was detected while qualifying the probe	Ensure you are measuring the qualification sphere. Re-execute the current block
Abort Selected	This is not an error. When you press Abort from any screen, the system will display the error screen so you can execute a specific block or exit Playback	Select the proper option



*Execute Block*

### Execute Block:

The Execute Block softkey allows you to execute a specific program block. This softkey is often used to remeasure a block when you are not satisfied with the previous measurement results.



*Exit Playback*

### Exit Playback:

The Exit Playback softkey exits playback and returns you to the Measurement Mode.



*Re-run Program*

### Re-run Program:

The Re-run program softkey appears at the end of a playback program. Simply clamp down a new part and press this softkey to begin inspection again.



*Jump to below alignment*

### Re-run Program, Jump to below alignment:

This softkey, is intended for fixture programming. See Chapter 12 for more information.

## The Tools Menu - Playback Utilities



*Save Program*

### To Store a Program:

The Store Program softkey allows you to save an inspection sequence to the storage card. The program must be 100 blocks or less. To store a program to the storage card:

1. Verify that the storage card is inserted. (If you have only one machine, this card should always be inserted. If you have multiple machines, storage cards are sometimes interchanged to transfer programs from one system to another.)
2. From the Tools menu, select Playback Utilities, followed by Store Program. Enter a program name that describes the measured part. Similar to MS-DOS convention, program names can have up to 8 characters, with no spaces, or special characters allowed. If the program name already exists, you will be told that the program already exists and asked whether or not to overwrite it.

**Note:** Because the structure of smart cards vary from type to type, Brown & Sharpe only supports the use of official 2 meg RefleX Smart Cards. To purchase additional storage cards, contact your local sales person. See Appendix 4 for the part number.

**Note:** Because the size of a program varies, depending on number of blocks, tolerance information, and screens marked, there is no fixed number of programs that will fit on a card. On average a smart card will hold about 50 non-DCC programs.

**Note:** To backup your programs obtain storage cards from your Brown & Sharpe distributor. Save a copy of your program to your regular card. Insert the backup card into the system and repeat the save process. RefleX storage cards cannot be read or backed up on a PC.

# The Tools Menu - Playback Utilities



*Recall Program*

## Recall Program

The Recall Program softkey lets you recall a program stored on the storage card.

**Important** - A recalled program will overwrite any inspection sequence on the system. Use the Store Program softkey to save an existing sequence before recalling a new program.

To recall a program from a storage card:

1. Verify that the storage card is inserted. (If you have only one machine, this card should always be inserted. If you have multiple machines, storage cards are sometimes interchanged to transfer programs from one system to another.)
2. From the Tools menu, select Playback Utilities, followed by Recall Program. Select the desired program using the up and down arrows. Press the Done softkey.



*Delete Program*

## Delete Program

The Delete Program softkey lets you delete a program from the storage card.

To delete a program from the storage card:

1. Verify that the storage card is inserted. (If you have only one machine, this card should always be inserted. If you have multiple machines, storage cards are sometimes interchanged to transfer programs from one system to another.)
2. From the Tools menu, select Playback Utilities, followed by Delete Program. Select the desired program using the up and down arrows. Press the Done softkey.

**Note:** When a program is deleted from the storage card, the %full graph will not change immediately, due to hardware implementations. When the card is about 90% filled, the system performs a storage reclamation process. The previously deleted programs are realized and an increase in space is shown.

# The Tools Menu - Playback Utilities



*List Programs*

## List Programs

The List Programs softkey lets you list all programs saved on a storage card. To display a program listing:

1. Verify that the storage card is inserted. (If you have only one machine, this card should always be inserted. If you have multiple machines, storage cards are sometimes interchanged to transfer programs from one system to another.)
2. From the Tools Menu, select Playback Utilities, followed by List Programs. Use the Print softkey to print out a listing.



*Format Card*

## Format card

This password-protected "Format Card" softkey lets you format a standard Brown & Sharpe storage card. Although the storage card that comes with the machine has been formatted at the factory, all subsequently purchased storage cards must be formatted before they can be used.

**Important** - When a card is formatted, all programs will be destroyed!!!

To format a data card:

1. Verify that the storage card is inserted. (If you have only one machine, this card should always be inserted. If you have multiple machines, storage cards are sometimes interchanged to transfer programs from one system to another.)
2. From the Tools Menu, select Playback Utilities, followed by Format Card. The system will ask for a confirmation for the format operation. Press Done to format the card.
3. While formatting, do not remove the card from the card slot.

# The Tools Menu - Edit Sequence

The edit sequence menu is disabled until at least 2 blocks are measured and after 200 blocks are measured.



*Edit Sequence Menu*

## **Edit Sequence**

The edit sequence menu allows you to delete, move, and replace blocks in your sequence. This menu only becomes available after 2 or more blocks have been measured.



*Delete Any Block*

## **Delete Any Measured Block**

This softkey allows you to delete any measured block in the sequence. For simply removing the last measured block, using the main menu's delete last block softkey is faster.



*Move Block*

## **Move Last Measured Block**

This softkey allows you to move the last measured block above a selected block.

## **Move Any Measured Block**

This softkey allows you to move any selected measured block above another selected block.

**Important:** Do not attempt to move or replace blocks across datum or probe blocks. The datum and probe aspects of the moved block are not recalculated after movement.



*Replace Block*

## **Replace Any Measured Block**

Although you can do a "Delete Any Measured Block" and then a "Move Last Measured Block" to achieve the same results, using this "Replace Any Measured Block" softkey is faster.

# The Tools Menu - Misc. Utilities



*Printing Headers*

### Print Headers:

The Print Headers softkey lets you print identifying headers at any point in the measuring sequence. If enabled, this printout process will only happen when a playback program is executed, or when this softkey is pressed.

### Enabling Headers:

Enter screen 3 of the system options. Enable the desired headers by either selecting the 'blank' option, which must be filled in with pen or pencil later, or by keying in a valid entry. Below are examples of possible headers:

Company: ACME Parts Inc.

Name: John Smith

Part Name: DemoBlk1

Date: 1/1/98

Time: 12:53 PM

Note: Measured By RefleX

**Note:** Older controllers from before Oct. 1999 do not have the hardware to keep track of time and date. In this case, the time and date have to be keyed in.



*Select Reference Feature*

### Reference Features:

The Select Reference Feature softkey lets you select a previously measured feature to be used in all future relationship calculations.

### Selecting a Reference Feature:

1. Press the Select Reference Feature softkey from the Tools Menu. The Select Reference Feature screen is displayed.
2. Use the arrow softkeys to move the highlight over the feature to be used as the reference feature. Press the Select softkey and then the Done softkey. To deselect a feature, press the Select softkey while the highlight is over a selected feature.



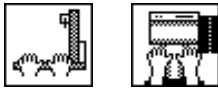
*Select*

## The Tools Menu - Misc. Utilities



### Moving A Machine and Porting Features:

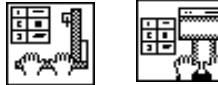
The "Move Machine" and "Port Features" softkeys are used only with arm and horizontal machines. This functionality is often called "Leap Frog" by other software packages. To users of all other types of machines, these functions will not be available, as they do not apply. These two softkeys allow a user to measure one side of a part, move the machine, reestablish the previous datum, and continue measuring. In this way, the Arm and Horizontal users are now able to measure larger parts.



*Move Machine*

### Move Machine:

The "Move Machine" softkey is used for the first part of the of the leap frog process. The user will then move the machine to the it's new location, and press done.



*Port Features*

### Port features:

After remeasuring his original alignment, the user will then press the "Port Features" softkey. After which, relationships between features measured in the two machine positions will be able compatible.



*Create Work  
Instruction / Feature  
Labeling*

### Create Work Instruction / Feature Labeling:

This softkey is used to either instruct an operator during playback, or to customize a printout. Use the standard "Playback Pause", "Mark for Printing", or "Mark for Serial" softkeys to choose.



*Service Utilities*

### Service Utilities:

The Service Utilities softkey is used to diagnose or repair the system. This password protected area is the same area available at the Home screen. Do not enter this area unless instructed by a qualified service person.

