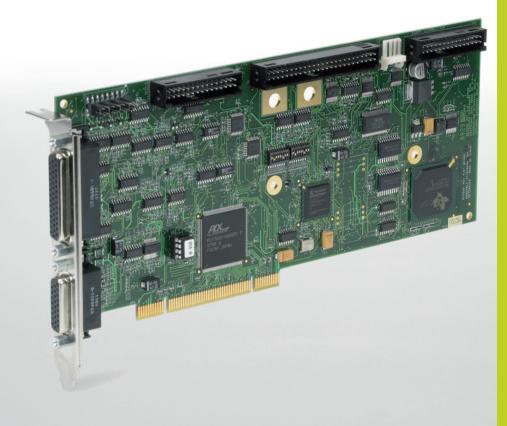


HEIDENHAIN



Operating Instructions

IK 5000 QUADRA-CHEK

(QC 5000)

Manual 3D Systems

English (en) 2/2010

Quadra-Chek® 5000 User's Guide

Proprietary notice

Proprietary notice		
	All information set forth in this document tion, any and all inventions disclosed hereir be granted by employing the materials, meth described herein are the exclusive property Bedford, New Hampshire.	n and any patents that might nods, techniques or apparatus
	No part of this document may be reproducted tem, or transmitted in any form or by any me photocopying, recording, or otherwise, with Metronics Incorporated. The information only for use with the Quadra-Chek 5000 Me Incorporated is not responsible for any use of to any other apparatus.	eans, electronic, mechanical, hout the prior permission of contained herein is designed etrology Software. Metronics
Disclaimer	The information contained in this docume out notice. Metronics Incorporated assumes for any errors or inaccuracies contained here quential damage in connection with the fur of this guide.	s no responsibility or liability in, or for incidental or conse-
	Metronics Inc. shall not be liable to the purc parties for damages, losses, costs, or expens or third parties as a result of: accident, misus unauthorized modifications, repairs, or alter- ure to strictly comply with Metronics Incorp tenance instructions.	es incurred by the purchaser se, or abuse of this product or ations to this product, or fail-
Trademarks		
	Metronics, Quadra-Chek, Quadra-Chek 50 tered trademarks of Metronics Incorporated	
	Other product names used herein are for and may be trademarks of their respective of rated disclaims any and all rights to those m	owners. Metronics Incorpo-
Printing History		
5 5	April 2001 Revision 1.0	First Printing
	Part Number:	11A10516
	Software Version 2.2	
	Printed in the USA.	

hap	oter 1: Overview	
_	come to the QC5000	
Abo	out This Guide	
	Chapter 1: Overview	
	Chapter 2: Using Probes	
	Chapter 3: General Measuring	
	Chapter 4: Advanced Measuring & Output	
	Chapter 5: Programming	
	Chapter 6: System Setup & Configuration	
	Index	
lcor	ns and Type Faces	
	Warning	
	Caution	
	Note	
	Italics	
Stai	rting The QC5000	
	To open the QC5000	
Win	dows and Toolbars	
QC5	000 Windows	
	DRO	
The	Results Window	
	Feature Specifications	
	To move information from the results window to the features list	
	Locked/unlocked features	
	To unlock a feature	
	To lock a feature	
	Feature type diagram /feature stamp	
	To open the feature stamp window	
The	Part View Window	
	Single pane part view	
	Four pane part view	
Viev	v Rotator	
	To use the view rotator	
Tem	plate Windows	
i Cili	To separate template windows	
	To nest template windows	
Stat	tus Bar	
Stu	To add items to the status bar	
	To delete items from the status bar	
Mai	n Meny Bar	
wai	File	
	File Edit	
	Edit	
	view Measure	
	Datum	
	Probe	

Contents

	Tools	
	Windows	
	Help	
Т	Toolbars	
	Datum toolbar	
	Measure toolbar	
	Probe toolbar	
	View toolbar	
	Tolerance toolbar	
	Program toolbar	
	File toolbar	
	To place a toolbar on the QC5000 desktop	
	To remove a toolbar from the QC5000 desktop	
	To add buttons to a toolbar	
	To remove buttons to a toolbar	
Ch	hapter 2: Quick Start	
	Quick Start	
	Set machine zero	
	Create a reference frame	
	Measure a line (minimum 2 points)	
	Measure a circle (minimum 3 points)	
	Measure a cone (minimum 6 points)	
	Measure a cylinder (minimum 6 points)	
	Measure a distance	
	Save a part file	
Ch	hapter 3: Using Probes	43
P	Probing Technique	
	Good probing techniques	
-	Bad probing techniques	
F	Probe Toolbar	
	Probe teach	
	Probe compensation off	
	Cardinal probe compensation	
	Polar probe compensation	
	Auto enter	
-	Probe library	
F	Probe compensation	
	Probe compensation off	
	Cardinal probe compensation	
	Polar probe compensation	
	To activate probe compensation	
F	Auto Enter	
	To activate auto enter	
P	Probe Library	47
P	Probe Families & Groups	
	HardProbe group	
	TouchProbe group	
	StarProbe group	
	To create a new probe group	
P	Probe Calibration	
•	Master probe tips	
	To teach (qualify) a master probe tip	
	To teach (qualify) a non-master probe tip	
	-> ceaen (quant), a neu master prove de manimum manimum	

Chai	nging Probes	55
	To view the probes in a group	55
	To change the current probe tip	55
	To add probe tips	57
	To delete probe tips	
	e Results Window	
Chap	oter 4: General Measuring	63
	ing Started	
	Set machine zero	
	To set machine zero	
	Reference Frame	66
	Projection planes	
	Machine coordinates	
	Part coordinates	68
	To create a reference frame	69
Mea	suring 2D Features	72
	To probe a point	
	To probe a line (2 points)	
	To probe an arc (3 points)	
	To probe a circle (3 points)	
	To probe a slot (5 points)	
	To probe a plane (3 points)	
Mea	suring 3D Features	78
	To probe a cone (3 points)	
	To probe a cylinder (6 points)	
	To probe a sphere (5 points)	
Con	structing Features	81
Poin	t Constructions	81
	To construct a center point	81
	To construct an apex point	
	To construct an application point	83
	To construct an anchor point	84
	To construct bounding points	85
	To construct a point from 2 intersecting lines	86
	To construct a closest point of approach point	
	To construct points from intersecting circles	
	To construct a midpoint from two circles	89
	To construct a point from the intersection of a line and a circle	
	To construct a midpoint from 2 positional features	
	To construct a perpendicular point from a positional feature and a plane	
	To construct a point from a linear feature and a plane	
	To construct a point from the intersection of 3 planes	
Line	Constructions	
	To construct an axis line from a linear feature	
	To construct a plane axis line (Normal Line)	
	To construct a midline from the sides of a slot	
	To construct a 2 point line from two positional features	
	To construct a tangent line from 2 radial positional features To construct a line from the intersection of 2 planes	
	To construct a line from the intersection of 2 planes	
	To construct a Disector of 2 linear features	
	To construct a perpendicular disector of 2 mean reactives	
	To construct a line from a positional feature perpendicular to a linear feature	
	To construct a line parallel to a linear feature using a positional feature	

Contents

To construct a perpendicular line through a plane and a positional feature	
To construct a rotated line from the leg of an angle and the angle	
To construct a gage line	
To construct a line by projecting an existing line on a new projection plane	
Circle Constructions	115
To construct a circle from a sphere	
To construct a circle from a cone	
To construct a circle from an intersecting plane and cylinder	
To construct a circle from an intersecting cylinder and cone	
To construct a circle tangent to 2 intersecting lines	
To change the location of a tangent circle	
Plane Constructions	
To construct a plane from the midpoint of a line	
To construct a plane from a line and a positional feature	
To construct a midplane from 2 planes	
To construct a perpendicular midplane from 2 planes	
Sphere Constructions	
•	
To construct a sphere from a cone	
Cylinder Constructions	
To construct a cylinder from to 2 co-axial circles	
Cone Constructions	127
To construct a cone from 2 co-axial circles	127
Measuring Relations	128
Distance	
Angle	
Distance Constructions	
To construct the length of an axis	
To construct a duplicate distance	
To construct a reverse direction distance	
To construct an absolute distance	
To construct a center to center distance	
To construct a farthest edge distance	
To construct a narriest edge distance	
To construct a distance from a positional feature perpendicular to a linear feature	
To construct the nearest to line distance	
To construct the farthest to line distance	
To construct a distance from a positional feature to a plane	
To construct a center to plane distance from a sphere	
To construct the nearest plane distance from a sphere	
To construct the farthest plane distance from a sphere	
To construct a bounded line distance from 2 lines	
To construct a nearest bounded line distance from 2 lines	
To construct a farthest bounded line distance from 2 lines	
To construct a furthest bounded fine distance from 2 linear features	
To construct a distance between 2 co-axial planes	
Angle Constructions	
To construct an angle from 2 linear features	
Saving Your Work	
To save a part file	
To export to a CAD file	
To export to SPC software	
To export to Microsoft Access	158

Datum Magic	
To create a datum using datum magic	
Measure Magic	
To measure a point using measure magic	
To measure a line using measure magic (2 points)	
To measure an arc using measure magic (3 points)	
To measure a circle using measure magic (3 points)	
To measure a plane using measure magic (3 points)	
To measure a cone using measure magic (6 points)	
To measure a cylinder using measure magic (6 points)	
To measure a sphere using measure magic (4 points)	
Layers	
To create a new layer	
Current Layer	
To set a layer as current	
To assign features to new layers	
Displaying Layers	
To hide a layer	
To show a hidden layer	
To turn off a layer	
To turn on a layer	
To assign a color to a layer	
Alternate Datums	
To rotate the reference frame (datum)	
Offset Alignments	
To perform an offset alignment (primary plane)	
To perform an offest alignment (secondary line)	
To perform an offest alignment (secondary line)	
Tolerancing	
Tolerance Toolbar	
To view the tolerance toolbar	
Bi-directional tolerance (circles, points, arcs, spheres)	
To perform a bi-directional tolerance	
Pass/ Fail Displays	
True position tolerance (circles, points arcs, spheres)	
To perform a true position tolerance	
MMC/LMC tolerance (circles, points arcs, spheres)	
To perform a MMC tolerance	
To perform a LMC	
Concentricity tolerance (circles, arcs)	
To perform a concentricity tolerance	
Straightness tolerance (lines)	
To perform a straightness tolerance (lines)	
Circularity/sphericity tolerance (circles, spheres)	
To perform a circularity tolerance	
To perform a sphericity tolerance	
Cylindricity tolerance (cylinders)	
To perform a cylindricty tolerance	
Flatness tolerance (planes)	
To perform a flatness tolerance	
Perpendicularity tolerance (lines, cylinders, cones)	
To perform a perpendicularity tolerance	
Parallelism/Co-planarity tolerance (linear features)	

Contents

To perform a parallelism tolerance	
To perform a co-planarity tolerance	
Circular runout tolerance	
To perform a circular runout tolerance	
Angle tolerance	
To perform an angle tolerance	
Width tolerance	
To perform a width tolerance	
napter 6: Templates	
Templates	
Features Template	23
To open the features template	
Adding Data to	23
Templates	
To drag and drop a single results window field into the features list	
To drag and drop a multiple results window fields into the features list	
Sorting the Features List	
To sort data in the features list	
Reports Template	
To open the reports template	
Adding Data to the Reports Template	
To drag and drop a single results window field into the reports template	
To drag and drop a multiple results window fields into the reports template	
Sorting Data in the Reports Template	
To sort data in the reports template	
Report Headers	
To show a report header	
Customizing Report Headers	
To place a graphic in a report header	
To arrange text and graphics in a report header	
Automated Text Input & Prompting	
Overlays	
To save a report header as an overlay	
To place an overlay in a report header	
Program Template	
To open the program template	
Template Properties	
To access the template features dialog box	
Template Features Dialog Box	
Display tab	
Filters tab	
To create a filter	
To modify a filter	
To remove a filter	
Misc tab (miscellaneous)	
Column Properties	
Standard column properties	
Appearence tab	
Formulas tab	
Parantheses()	
Brackets []	
	<i>L</i> /
Quote marks "" Min/Max	

	To create the sample formula	
	To modify a formula	
	To remove a formula	
Ru	uns Template	
	To open the runs template	
	To add data to the runs template	
N	esting Template	
W	/indows	
	To nest template windows	
	To separate template windows	
Cı	reating New Templates	
	To create a new template	
E	xport	
	• To export a tab delimited file to a spreadsheet	
	To export a CSV (comma separated value) file to a spreadsheet	
Cha	apter 7: Programming	
Pi	rogramming Overview	293
Tł	he Program Toolbar	
	Record/Edit Program	
	Pause Program	
	New Run	
	Run Program From Current Step	
_	Run Just Current Step	
Re	ecording a Program	
	To create a program	
_	To open a saved program	
Ru	unning A Program	
	To run a program	
Sa	ample Program	299
	To record the sample program	
Cı	reating User Messages	
	To Insert A User Message	
E	xpanding the Program Toolbar	
	Toggle Break Point	
	Program Comment	
	Edit Steps	
	If-Goto	
	If-Then	
	Else	
	Else-If	
	Super Step	
	Goto Label Offset Positions	
	Toggle Break Point	
	Program Comment	
	Edit Steps	
	If-Goto	
	If-Then	
	Else	
	Else-If	
	Super Step	
	Goto Label	
	Offset Positions	

To add buttons to a toolbar	
To delete buttons from a toolbar	
Conditional Statements	
Test Conditions	
Actions	
Arithmetic Operators	
If-Goto Statement	
If-Then Statement	
Else Statement	
Else-If Statement	
Parantheses()	
Brackets []	
Quote marks ""	
Quote marks Min/Max	
Chapter 8: System Setup & Configuration	327
Before You Begin	
-	
Hardware Setup	
Encoder Setup	
To setup encoders	
Troubleshooting	
Encoder Setup	
Encoder setup shows continual errors, beeps, or inconsistent wave output	
Encoder setup shows continual errors, beeps, of meonssterit wave output	
Encoder setup show one of two errors after calibrating an axis	
Wave (amplitude) calibrates, phase does not calibrate	
TTL encoders will not calibrate	
Status bar freezes during calibration or other error message	
Encoder setup icon is missing	
QC5000 counts double, half, or wrong	
Supervisor Password	
To enter the supervisor password	
To restrict access to general options tabs	
General Options	352
Buttons	
To set a button function	
Display	
Encoders	
To enter encoder resolution	
General	
To set machine zero	
Measure	
Part view	
Probes	
To enter the diameter of a qualification sphere	
Point Filtration	
Files	
SLEC (segmented linear error correction)	
To enter SLEC data	
Sounds	
Square	
To test for squareness	
To square axes	
Index	

Chapter 1 Overview

Welcome to the QC5000

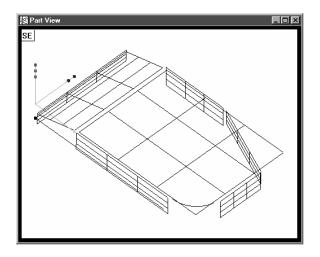
The Quadra-Chek 5000 software suite is an advanced software application for coordinate measurement machines (CMM). It features a graphical user interface for simple point and click operation. Point the cursor to a feature on the measure toolbar and click.



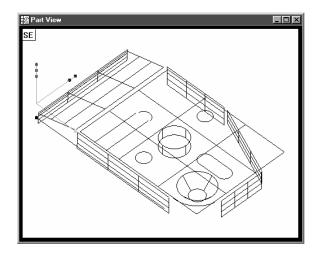
The QC5000 measures part features using the simplest geometric components: points. Lines can be created from two points, circles from three points, and cones from six points. Simply probe the points and the QC5000 measures the feature.



Once the required number of points are entered the QC5000 displays the feature in the part view window.



The QC5000 continues building the part in the part view window as features are added.



It is easy to use the QC5000 because each measurement requires only a few points. All geometry and mathematics are handled by the software. Once the basic measuring principles are understood the QC5000 can be programmed to handle repetitive measuring tasks. Finally, inspection and quality reports can be produced to document your results.

About This Guide

This guide is intended for end users of the QC5000 metrology software, supervisory, and installation personnel. A basic familiarity with the Windows computing environment and coordinate measuring machine (CMM) operation is assumed. Material in this guide is divided into six chapters covering everything from basic operation to system configuration. Keep this guide in a convenient location for future reference.

Chapter 1: Overview

It all begins here, just point and click. There are only two things in the QC5000 interface: windows and toolbars. This chapter tells you which is which and what to do with them. Understanding each window and toolbar helps you get the most from the QC5000.

Chapter 2: Quick Start

This chapter gets you up and running quickly. Use this chapter to learn the most basic QC5000 tasks. Each task in this chapter is described in greater detail elsewhere in this guide.

Chapter 3: Using Probes

If it's about probes, it's in this chapter. The probe is where the QC5000 and the coordinate measuring machine (CMM) meet. Learn proper probing techniques and you can't go wrong.

Chapter 4: General Measuring

A solid knowledge of how to create and combine features to form a part is essential: this chapter helps you get it. Working from the basic to the complex, this chapter describes features and their relationships.

Chapter 5: Advanced Measuring & Output

Picking up where chapter 4 leaves off this chapter covers datum magic, measure magic, layers, offset alignments, and tolerancing. This chapter also describes how to export QC5000 data to other software.

Chapter 6: Templates

The QC5000 organizes and present data in a number of formats. For your convenience there are several data templates you can use to organize and present your results. Use this chapter to learn how to use templates more efficiently.

Chapter 7: Programming

Programming puts it all together. This chapter shows you how to create a streamlined, computer-prompted procedure to handle repetitive inspections with speed and accuracy. Use the programming feature to maximize your productivity with the QC5000.

Chapter 8: System Setup & Configuration

Everything you need to setup and configure the QC5000. This final chapter gives setup procedures for shift supervisors and OEMs. End users should apply the information in this chapter ONLY at the direction of a supervisor, distributor, or OEM.

Index

There's nothing worse than skimming through a user guide looking for something when you're in a hurry. To save you the hassle we indexed this guide. Simply flip to the back, find your topic, and off you go. This guide uses the following icons and type faces to highlight information:

🚺 Warning

The lighting bolt icon warns of situations or conditions that can lead to personal injury or death. Do not proceed until you read and thoroughly understand a warning message. Warning messages are shown in bold type.

Caution

The exclamation point icon indicates situations or conditions that can lead to measurement error, equipment malfunction or damage. Do not proceed until you read and fully understand a caution message. Caution messages are shown in bold type.

DNote

The note icon indicates additional or supplementary information about an activity or concept. Notes are shown in bold type.

Warnings, cautions, and notes are shown in this typeface.

Italics

Italics indicate menu items or button icons. For example,

Step 1

Select *customize* from the tools menu.



The italics instruct the user that *customize* is an item on the tools pull-down menu.

Starting The QC5000

To open the QC5000

Step 1



Double-click the QC5000 icon on the Windows NT desktop.

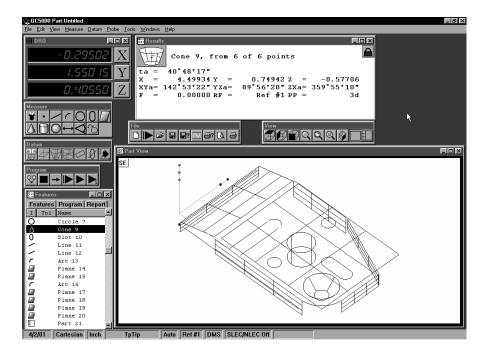
The following screen indicates that the program is loading. It takes a couple seconds for the program to load completely.



Chapter 1 Overview Windows and Toolbars

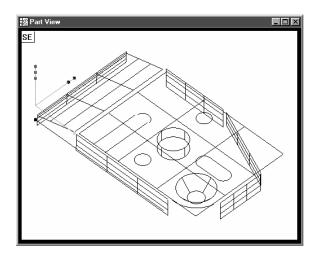
The QC5000 uses a graphical user interface which means that instead of typing in a bunch of complicated commands you can do things by pointing and clicking the mouse.

In this manual we'll refer to the graphical user interface as the QC5000 desktop. Although setups may vary, a typical QC5000 desktop looks like this.



There are only two things to point and click at on the QC5000 desktop: windows and toolbars. Here's how to tell them apart.

Windows display information. Some windows contain buttons or require input but their basic function is to display information. For example, the part view window displays a graphic of the part.



Quadra-Chek[®] 5000

Toolbar contains buttons that execute common tasks. For example, the *measure* toolbar contains buttons for various measurement functions. To perform a measurement, click on the desired feature button (line, circle, plane, etc.).



The QC5000 desktop has four windows: DRO (digital readout), results, part view, and features list.

DRO

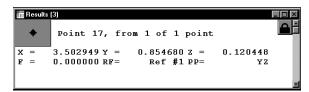
The DRO window displays the location of the X, Y, and Z axes (in mm or inches) from the datum. Click the button beside the respective axis to zero it.



The Results Window

The results window displays the results of a feature measurement. This window contains the following:

- Feature specifications
- Lock/unlock feature
- Feature type diagram / feature stamp



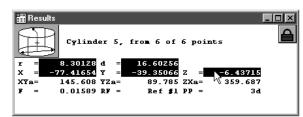
Feature Specifications

Feature information is displayed in the results window. Use the results window to add information to the features list.

To move information from the results window to the features list

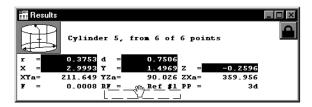
Step 1

Highlight the desired information in the results window.



Step 2

Hold down the left mouse button and drag the information to the features list.



Step 3

Release the mouse button.

	Name	Datum	1	-
	Plane 1	Primary		
-	Line 2	Skew		
-	Line 3			
	Point 4	Zero		
)	Cylinder			

Step 4

Click the *as multiple new columns* button in the dialog box.



The feature window now displays the new parameters.

1	T Name	Datum	r	d	X	Y	Z
Э	Cylinder		0.3753	0.7506	2.9993	1.4969	-0.2596
	Plane 1	Primary			3.2507	1.5083	0.0000
/	Line 2	Skew			0.0000	1.4749	-0.5019
/	Line 3				2.0797	-0.0014	-0.5082
•	Point 4	Zero			0.0000	0.0000	-0.5051

Information in this window is dependent on the type of feature. For example, the window shows radius/diameter values for spherical features but not for linear ones.

Locked/unlocked features

Some parts use more than one reference frame to measure all its features. Locked features are displayed in their own reference frame. Unlocked features are displayed in the current reference frame.

To unlock a feature

Step 1 Click the lock icon in the results window.



To lock a feature

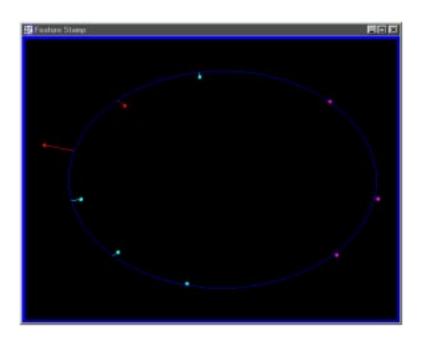
Step 1 Click the lock icon in the results window.



Quadra-Chek[®] 5000

Feature type diagram /feature stamp

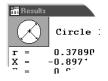
Clicking on the feature stamp icon opens the feature stamp window. The feature stamp window shows a graphic display of the feature and the distibution of the measurement points. Points discarded from the measurement are shown in red. Use the view toolbar to change the perspective in the feature stamp window.



To open the feature stamp window

Step 1

Click the *feature stamp* button in the results window.



The Part View Window

The part view window displays a graphical representation of the part and its features. Use the view toolbar to change the appearence of the part view window.

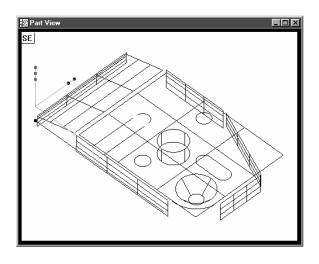


This is a typical view toolbar. Remember that QC5000 toolbars can be customized. Toolbars pictured in this guide may vary from those on your system.

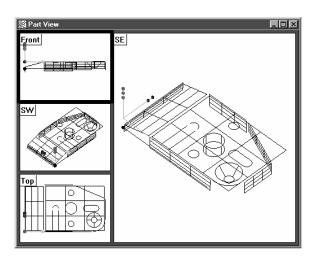
Four pane part view displays the part from four separate vantage points. Highlighted panes are outlined in blue. Place the cursor on the pane and click to highlight. Only one pane can highlighted at a time.

The most common part view window appearences are shown here.

Single pane part view



Four pane part view



View Rotator

Change the display angle of the part view window with the view rotator.

To use the view rotator

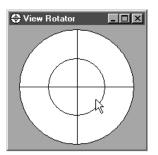
Step 1



Click the *view rotator* button on the view toolbar OR select *view rotator* from the view menu..

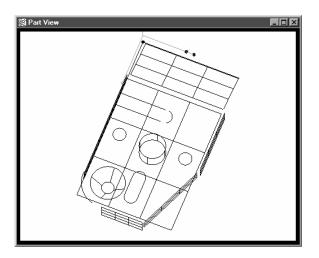
Step 2

Place the cursor over the view rotator window as shown.





Move the cursor over the view rotator window until the part is displayed as desired.



Chapter 1 Overview Template Windows

Template windows display data output from QC5000 measurements and programs. See Chapter 4: *Advanced Measuring & Output* for more information on using template windows.

Nest templates windows as shown to conserve space on the QC5000 screen. For example, the window below contains the features, program, and report templates nested in a single window. View the desired template by selecting the proper tab. In the example below, the feature tab is selected.

cu	tures Program Report				
E 7	T Name Datum	d	X	Y	r
-	Arc 22	0.3746	1.9987	1.4973	0.1873
4	Plane 3 Primary		3.2493	1.5449	
-	Line 4 Skew		0.0000	1.4876	
-	Line 5		2.1888	-0.0020	
•	Point 6 Zero		0.0000	0.0000	
1	Plane 7		0.6532	1.5274	
	Plane 8		2.8808	0.0133	
-	Arc 9	1.5157	4.4896	0.7543	0.7578
	Plane 10		5.2461	1.4748	
	Plane 11		4.2478	2.5456	
	Plane 12		2.1925	2.9965	
Э	Cylinder	0.7532	2.9991	1.4966	0.3766
\$	Cone 15		4.4987	0.7451	0.1758
)	Slot 16	0.3766	4.3122	1.4958	0.1883
5	Circle 17	0.3748	2.9987	0.4980	0.1874
5	Circle 18	0.3753	3.0002	2.4955	0.1877
-	Line 19		2.1875	0.7438	
-	Line 20		1.8106	0.7482	

To separate template windows

Step 1

Place the cursor over the desired tab as shown.

涯 Fe	atures		
Feat	ures Progra	am Report	
ΙT	Name	Datum	
<u> </u>	Arc 22		
	Plane 3	Primary	
-	Line 4	Skew	
-	Line 5		
•	Point 6	Zero	
	Plane 7		
100	Plane 8		

Step 2

Hold the left mouse button and drag the tab outside the current window as shown.

滬Fee	atures								
Fea	tures	Program]							
I.	T Name	Datum	d	x	Y			r -	
C	Arc		0.3746	1.9	987	1.497	3	0.187	
	Pla	a Report							- 🗆 ×
12	Lin Lin	# Featur	re Position/Dim	m. S	lize 🗸	Orient	ation	Form/Dim.	Spec 🔺
1.	Poi			3.2493		XY<	0.000	F 0.0000	1000
in a	Pla	Plane 3		1.5449			90.000		
	Pla		Z	0.0000		2X<	0.000		
17	Arc	4	x	0.0000		XY<	90.000	F 0.0000	
	Pla	Line 4	Y	1.4876		¥Z<	0.000		
0000			Z	-0.5046		ZX<	0.000		
18	Pla	5	x	2.1888			179.947	F 0.0000	
<u> </u>	Pla	Line 5	Y	-0.0020		YZ<	0.000		
ЦÅ.	Cyl		Z	-0.5042		ZX<	90.000		
4	Con	6	x	0.0000				F 0.0000	
0	S10	Point 6	Y	0.0000					
Q.	Cir		Z	-0.5044		XY< I	180.350	F 0.0000	
0	Cir	Plane 7	X Y	1.5274			90.093	2 0.0000	
1	Lin	Fiane /	z	-0.1672			90.093		
1	10000	8	X	2.8808			69.913	r 0.0000	
		Plane 8	Ŷ	0.0133			176.801	1 0.0000	
		Figure 0	Z	-0.2467			158.459		
		9	X	4.4896 0	1.5157			L3d 0.0550	
		Arc 9	Ŷ	0.7543 ±				F 0.0000	
			1.						
									Conception in the local distance of the loca

Step 3 Release the left mouse button.

Report									
£	Testince	Position/Nim.		Hite		Ortes	tetim	Firm/1	Spec.
			3.2490				0,800		8.0000
Plane 1			1-5945				90,100		
		2	0.0008			225	0,800		
4	1	Σ	0.0008			23<	90,000		1.0000
Lise 4	1	2	1.4976			52<	0,800		
		2	-05046			22<	0,000		
5		Σ	2.188#			23<	179.547		1.0000
Lise 5		2	-0.0021			52<	0,000		
		2	-0.5042			22<	90,800		
6		Σ	0.0008					P	1.0000
Puint é		1	0.0008						
		2	-0.5014			_		-	
	1	2	0.6512			23<	180,150		1.0000
Plase 1		1	1.5274			12<	90,193		
		2	-0.1672			22<	045,007		
		2	2.8808			23<	169.513		1.0000
Plane H		1	0.0133			12< 22<	176,801		
	1	4				445	200,900		
Arc 5		2	44896 07543		1.5157			E3d. P	1.0550
820.2	1	13	0.7913	L	0.1576			r	810000
									8

To nest template windows

Step 1

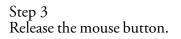
Place the cursor over the desired template window as shown.

🚝 Report	_ b -		
#	Feature	Position/Dim.	
3		X	3.2493
Plane 3		Y	1.5449
		Z	0.000
4		X	0.00
Line 4		Y	1.4
		Z	-C
5		X	
Line 5		Y	
		Z	
6		v	



Step 2 Hold the left mouse button and drag the template over the desired window.

-	s Program	atum	d	x	- T	y			r		
	10 22	Jacum	a 0.3746		.9987	r	1.4	072	r 0.1	07	
	a 注 Repo		0.3748	1.	.9907		1.4	915		.07	- 1
	in in the pol										_
	n #	Feature	Position/Di	.m.	Size	V	Orie	ntation	Form/1	Dim.	Spe
Po			x	3.2493			XY<	0.000		0.0000	
	Plane			1.5449				90.000			
				0.0000				0.000			
	La	4	X	0.0000			XY<	90.000	F	0.0000	
	C Line	4	Y	1.4876			YZ<	0.000			
	La		Z	-0.5046			ZX<	0.000			
	la	5	X	2.1888			XY<	179.947	F	0.0000	
	la Line	5	Y	-0.0020			YZ<	0.000			
C	71		Z	-0.5042			ZX<	90.000			
	n	6	X	0.0000					F	0.0000	
S.	Lo Point	6	Y	0.0000							
C:	r		Z	-0.5044							
C:	r	7	X	0.6532			XY<	180.350	F	0.0000	
L	Plane	7	Y	1.5274			YZ<	90.093			
			Z	-0.1672			ZX<	345.007			
		8	X	2.8808			XY<	269.913	F	0.0000	
	Plane	8	Y	0.0133			YZ<	176.801			
			Z	-0.2467			2X<	358.459			
		9	X	4.4896	d	1.5157			L3d	0.0550	
	Arc	9	Y	0.7543	r	0.7578	1		7	0.0000	



泪F	eatures				
Fea	tures Program Report				
I	T Name Datum	d	x	Y	r 🔺
r	Arc 22	0.3746	1.9987	1.4973	0.1873
13	Plane 3 Primary		3.2493	1.5449	
1	Line 4 Skew		0.0000	1.4876	
1	Line 5		2.1888	-0.0020	
•	Point 6 Zero		0.0000	0.0000	
	Plane 7		0.6532	1.5274	
	Plane 8		2.8808	0.0133	
C.	Arc 9	1.5157	4.4896	0.7543	0.7578
	Plane 10		5.2461	1.4748	
	Plane 11		4.2478	2.5456	
	Plane 12		2.1925	2.9965	
0	Cylinder	0.7532	2.9991	1.4966	0.3766
0	Cone 15		4.4987	0.7451	0.1758
0	Slot 16	0.3766	4.3122	1.4958	0.1883
0	Circle 17	0.3748	2.9987	0.4980	0.1874
0	Circle 18	0.3753	3.0002	2.4955	0.1877
1	Line 19		2.1875	0.7438	
1	Line 20		1.8106	0.7482	•
•					<u> </u>

The staus bar runs across the bottom of the screen and displays such as:

- Date
- Type of coordinates (Polar/Cartesian)
- Selected units of measurement (in./mm)
- Active Layer
- Active probe tip
- Projection Plane
- Active Reference Frame
- Angle Display Mode
- SLEC Status
- Recording or Editing Mode



Use the status bar to toggle between settings. Place the cursor over the mm/inch section of the status bar. Click the mouse to toggle between inches and millimeters. This is a quick way to change the units of measure. Other settings in the status bar can be toggled in the same way.

To add items to the status bar

Step 1 Select *customize* from the tools menu.

<u>T</u> ools		
<u> </u>	lerance	۲
Pro	ogramming	۲
<u> </u>	stomize	
_ <u>√2</u> p	tions	•
Lar	nguage	•

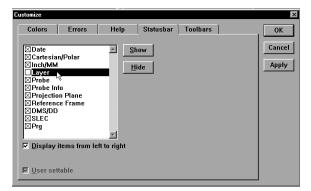


Select the *status bar* tab as shown.

Customize		×
Colors Errors	Help Statusbar Toolbars	ОК
QC5000 Window Results Text Results Window DR0 Digits DR0 Ax/s DR0 Window Part View Window	E Set Color	Cancel Apply
☑ <u>U</u> ser settable		

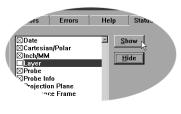
Step 3

Highlight the desired item as shown.



Items currently in the status bar have an 'X' in the box next to them. An empty box indicates the item is currently not on the status bar.

Step 4 Click the *show* button.



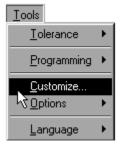
Step 5 Click OK.



To delete items from the status bar

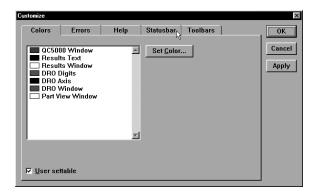
Step 1

Select *customize* from the tools menu.



Step 2

Select the *status bar* tab as shown.

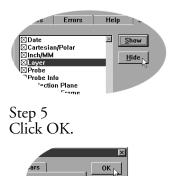


Step 3

Highlight the desired item as shown.

Customize	X
Customize Colors Errors Help Statusbar Toolbars Colors Errors Help Statusbar Toolbars Cartesian/Polar Inch/MM Hide Probe Info Probe Info Projection Plane Reference Frame ObMS/DD SLEC Prg F Display items from left to right F User settable	Cancel Apply
	J

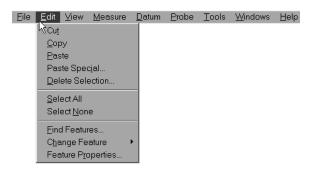
Items currently in the status bar have an 'X' in the box next to them. An empty box indicates the item is currently not on the status bar. Step 4 Click the *hide* button.



Cancel Apply

Main Menu Bar

This section shows the content of the QC5000 pull-down menus. A discussion of the various menu commands follows in later chapters. Use this section to familiarize yourself with the menus. Place the cursor over the desired menu and click to view pull-down menus.



The main menu bar contains the following pull down menus:

File



Use the *file* menu to access the following commands:

- New
- Open
- Save
- Save As
- Import
- Export
- DDE Output (dynamic data exchange)
- Page Setup
- Print Preview
- Print
- Exit

Edit

Ed	it
2	Cut
	Copy
	Paste Paste Special
	Paste Specjal Delete Selection
	Delete Selection
	<u>S</u> elect All
	Select <u>N</u> one
	Find Features
	C <u>h</u> ange Feature 🔹 🕨
	Feature Properties

Use the *edit* menu to access the following commands:

- Cut
- Сору •
- Paste •
- •
- Paste Special Delete Selection
- Select All
- Select None
- Find Features
- Change Feature
- Features Properties

View

View
Coom All
Zoom <u>W</u> indow
Zoom Sp <u>e</u> cial
<u>P</u> an
Prese <u>t</u> View
<u>S</u> et Viewpoint
<u>V</u> iew From Probe
View Rotat <u>o</u> r
 Show Position Indicator
✓ Show Reference Frame Indicator
Layer Control
<u>T</u> oolbars
<u>U</u> nits •

Use the *view* menu to access the following commands:

- Zoom All •
- Zoom Window •
- Zoom Special •
- Pan
- Preset View
- Set Viewpoint
- View From Probe
- View Rotator •
- Show Position Indicator •
- Show Reference Frame Indicator •
- Layer Control •
- Toolbars.... •
- Units

Measure

Measure	
Measure Magic	F2
<u>P</u> oint	F3
Line	F4
A <u>r</u> c	F5
<u>C</u> ircle	F6
Slo <u>t</u>	F7
Distance	F9
<u>A</u> ngle	F11
Pla <u>n</u> e	Ctrl+F3
Cylinder	Ctrl+F4
Sphere	Ctrl+F5
Con <u>e</u>	Ctrl+F6
Magnetic Plane	Ctrl+F7
<u>O</u> ther	+

Use the *measure* menu to access the following commands:

- Measure Magic •
- Point •
- Line •
- Arc
- Circle
- Slot •
- Distance •
- Angle Plane
- •
- Cylinder
- Sphere Cone •
- Magnetic Plane
- Other

Datum

<u>D</u> atum		
🖓 Datum Magic		
Primary	Non feat	F
<u>S</u> econdary	Non feat	
<u>Z</u> ero	Non feat	
Projection	Auto	F
Magnetic Planes	Off	F
<u>R</u> otate		
R <u>e</u> ference Frame	Temp	F

Use the *datum* menu to access the following commands:

- Datum Magic
- Primary •
- Secondary •
- Zero •
- Projection •
- Magnetic Planes •
- Rotate
- **Reference** Frame •

Probe

Probe		
Contact Probes	None	F
Probe Compensation	Cart	F
Teach		
Probe Library		
✓ Auto Enter		

Use the *probe* menu to access the following commands:

- Contact Probes
- Probe Compensation
- Teach
- Probe Library
- Auto Enter

Tools

Tools	
	F
<u>P</u> rogramming	۲
<u>C</u> ustomize	
<u>Options</u>	۲
Language	•

Use the *tools* menu to access the following commands:

- Tolerance
- Programming
- Customize
- Options
- Language

Windows

W	indows
¥	DRO 🖓
4	Part View
~	<u>R</u> esults
	<u>N</u> ew Template
	Open Template
	Save Templates
	Save Template <u>A</u> s
~	Features
~	Program
¥	Report

Use the *windows* menu to access the following commands:

- DRO
- Part View
- Results
- New Template...
- Open Template...
- Save Templates As
- Features
- Program
- Report

Help

<u>H</u>elp

→ <u>W</u> hat's New?
<u>B</u> ackup Settings <u>R</u> estore Settings
<u>A</u> bout QC-5000

Use the *help* menu to access the following commands: • What's New? • Backup Settings • Restore Settings • About QC5000

Toolbars contain buttons that execute common tasks. Use toolbars instead of hunting through pull-down menus for commands. Simply click the desired button and the task is begun. Toolbars correspond to the main menu. For example, buttons in the view toolbar correspond to commands on the view menu.

Datum toolbar

Use the *datum* toolbar to establish datums and reference frames. Buttons in the *datum* toolbar correspond to items on the *datum* menu.



Measure toolbar

Use the *measure* toolbar to measure and construct features. Buttons on the *measure* toolbar correspond to items on the *measure* menu.



Probe toolbar

Use the *probe* toolbar to access probe functions and settings. Buttons on the *probe* toolbar correspond to items on the *probe* menu.



View toolbar

Use the *view* toolbar to adjust the part view window. Buttons on the *view* toolbar correspond to items on the *view* menu.



Tolerance toolbar

Use the *tolerance* toolbar to perform tolerances on selected features. Buttons on the *tolerance* toolbar correspond to items on the *tools* menu.



Program toolbar

Use the *program* toolbar to access programming functions. Buttons on the *program* toolbar correspond to items on the *tools* menu.



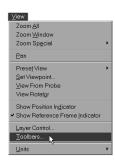
File toolbar

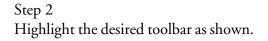
Use the *file* toolbar to access file functions. Buttons on the *file* toolbar correspond to items on the *file* menu.

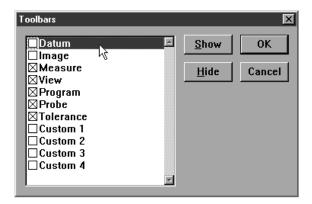


To place a toolbar on the QC5000 desktop

Step 1 Select *toolbars* from the view menu.

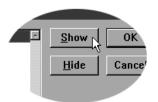






Toolbars on the QC5000 desktop have an 'X' in the box next to them. An empty box indicates the item is currently NOT on the desktop.

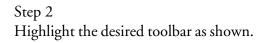
Step 3 Click the *show* button.

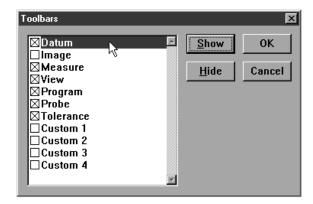


To remove a toolbar from the QC5000 desktop

Step 1 Select *toolbars* from the view menu.

N.C
View
Zoom <u>A</u> ll
Zoom <u>W</u> indow
Zoom Sp <u>e</u> cial
Pan
Preset/View +
Set Viewpoint
⊻iew From Probe
View Rotat <u>o</u> r
Show Position Indicator
 Show Reference Frame Indicator
Layer Control
Toolbars
Units •





Toolbars on the QC5000 desktop have an 'X' in the box next to them. An empty box indicates the item is currently NOT on the desktop.

Step 3 Click the *hide* button.



Quadra-Chek[®] 5000

Customize your toolbars by adding or deleting buttons. Add buttons for common tasks . Delete seldom used buttons to keep toolbar size manageable.

To add buttons to a toolbar

Step 1

Select *customize* from the tools menu.



Step 2

Select the *toolbars* tab in the customize dialog box.

stomize					
Colors	Errors H	lelp 🛛 Stat	usbar Toolbars]	ОК
Toolbars Datum Image Measure View Program Probe Tolerance Custom 1 Custom 2 Custom 3 Custom 3 Custom 4	Remov	n Toolbar P P	All Possible Buttor Measure Magic Point Line Arc Circle Slot Plane Cone Nagnetic Plane Distance Distance	ns *	Cancel Apply



Highlight the desired toolbar in the *toolbars* list as shown.



Step 4 Highlight the desired button in the *all possible buttons* list.



Step 5 Click the <i>copy</i> button.
Transparent/Solic
Step 6 Click OK.
s ОК

Cancel

Apply

•

To remove buttons to a toolbar

Step 1

Select *customize* from the tools menu.

<u>T</u> ools	
<u>T</u> olerance	۲
<u>P</u> rogramming	۲
<u>C</u> ustomize Options	¢,
Language	۲

Step 2

Select the *toolbars* tab in the customize dialog box.

Customize				×
Colors	Errors	Help Sta	atusbar Toolbars	ОК
Toolbars Datum Image Measure View Program Probe Tolerance Custom 1 Custom 2 Custom 3 Custom 4		ons in Toolbar	All Possible Buttons All Possible Buttons Point Line Arc Circle Slot Plane Cylinder Sphere Cone Magnetic Plane Distance	Cancel Apply
⊠ ∐ser sett		emove	<- Сору	

Step 3

Highlight the desired toolbar in the *toolbars* list as shown.





Step 4 Highlight the desired button in the *buttons in toolbar* list.



Step 5 Click the *remove* button.



Chapter 1 Overview





Chapter 2 Quick Start

Quick Start

Use the *quick start* chapter to begin using the QC5000 immediately. This chapter will describe the most common user tasks associated with the QC5000. More detailed explanations for each task are found in subsequent chapters of this guide.

Set machine zero

Step 1 Double-click the QC5000 icon on the Windows NT desktop.



Step 2

Move the axes of the CMM to the machine zero position (consult the CMM user guide for more information) when the dialog box appears o the screen.

QC5000		×
0	Move the stage to the machine zero position, and select \ensuremath{Ok}	ОК
		Cancel

Step 3

Click OK in the dialog box.

Set machine zero every time you begin a QC5000 session. Machine zero is used by QC5000 for SLEC (segmented linear error correction) functions. If machine zero is not set, SLEC functions will not work properly.

Create a reference frame

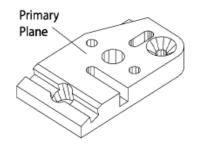
Step 1

Click the primary plane button on the datum toolbar.



Step 2

Measure three points on the plane as shown.



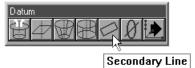


Click OK in the dialog box.

📰 Primary Plane				
	3	Pts		
	tp-	-tip		
<u>0</u> k	<u>E</u> n	iter Pt		<u>R</u> emove Last
Cancel			Cre	e <u>a</u> te

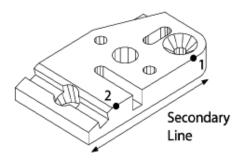
Step 4

Click the secondary line button on the datum toolbar.



Step 5

Probe two points on the secondary line. Space the points close to the opposite ends of the line.



Step 6 Click OK in the dialog box.



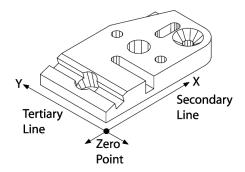
Step 7

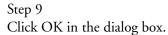
Click the line button on the measure toolbar.



Step 8

Probe two points along the tertiary alignment as shown.





🗒 Measure Line		
	2 Pts	
	tp-tip	
	Enter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te



Click the zero point button on the datum toolbar.



Step 11

Use the mouse to highlight the secondary and tertiary lines in the features list.

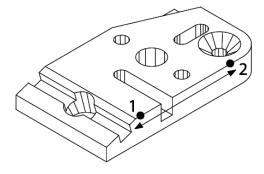
0.00000 10.16752 5.08376 0.00000 0.00000
0.00000
0.00000
0.00000
0.00000
0.00000

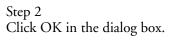
Step 12 Click OK in the dialog box.

🛱 2 Features		- D ×
To measure a zero poi	nt, you may probe a	point or construct a 🔺
<u>0</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
Cancel	🔽 Auto Zero	🗖 X Axis
🗖 Y Axis	🗖 Z	Axis

Measure a line (minimum 2 points)

Step 1 Probe two points on the line as shown.



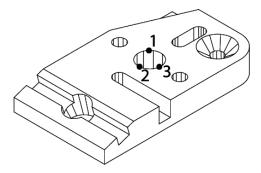




Measure a circle (minimum 3 points)

Step 1

Probe three points on the circle as shown.

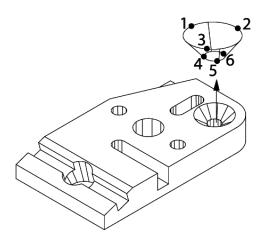


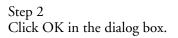
Step 2 Click OK in the dialog box.

🗒 Measure Magic		
	3 Pts	
	tip_1	
<u>O</u> k	Enter Pt	<u>R</u> emove Last
- W	<u>C</u> ancel	

Measure a cone (minimum 6 points)

Step 1 Probe six points on the cone as shown.

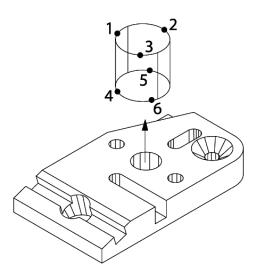


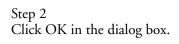


🗒 Measure Magic		
	6 Pts	
	tip_1	
<u>0</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	<u>C</u> ancel	

Measure a cylinder (minimum 6 points)

Step 1 Probe six points on the cylinder as shown.





🗒 Measure Magic		
	6 Pts	
	tip_1	
<u>k</u>	Enter Pt	<u>R</u> emove Last
1/2	<u>C</u> ancel	

Measure a distance

Step 1 Highlight two linear feature on the features list.

Feat	ures						
I To	l Name	Datum	r	d	X	Y	Z
	Plane 1	Primary			3.21940	1.40751	0.00000
-	Line 2	Skev			2.22907	0.00000	-0.40450
/	Line 3				-0.00088	1.45417	-0.40650
•	Point 4	Zero			0.00000	0.00000	-0.40550
-	Line 5				2.83906	0.00060	-0.21955
2	Cone 9		0.19768		4.49936	0.74999	-0.57635
5	Circle 10	N	0.38563	0.77125	2.99767	1.49980	0.02220
9	Cylinder 11	45	0.38563	0.77127	2.99371	1.50066	-0.21655
→	Distance 12				1.50120	0.74918	0.00200

Step 2 Click the distance button on the measure toolbar.



Step 3 Click OK in the dialog box.

🛱 1 Feature		- D ×		
To measure a distance, you may probe the distance (using two points) or construct the distance from previously measured features. When probing a distance, probe compensation				
<u>Ok</u> <u>Enter Pt</u> <u>R</u> emove Last				
<u>C</u> ancel		Cre <u>a</u> te		

Save a part file

Step 1

Select save as from the file menu.

<u>F</u> ile
<u>N</u> ew ►
<u>0</u> pen
<u>S</u> ave
Save <u>A</u> s
Import
<u>E</u> xport
DDE Output
Page Set <u>u</u> p
Print Pre <u>v</u> iew
<u>P</u> rint
E <u>x</u> it
<u>1</u> . A:\TEST123.5PA
 A:\adb.cpktest.5pa



Type a name for the part file in the file name text box in the dialog box.

Save Part As		? ×
File_name: file_name datrack4xn.5PA datrack4xp.5PA datrack4yp.5PA datrack4yp.5PA	Eolders: c:\qc5000 C> c:\ C QC5000	OK Cancel
datrack6xn.5PA datrack6xp.5PA datrack6yn.5PA datrack6yp.5PA Save file as <u>type:</u> Part Files	Drives:	▼ Network

Step 3

Select a storage location for the file using the folders box and/or drives box.

Save Part As		? ×
File <u>n</u> ame: file_name	Eolders: c:\qc5000_parts_files	OK Cancel
Save file as type: Part Files	Drives:	Net <u>w</u> ork

Step 4 Click OK in the dialog box.

Save Part As	? ×
File_name	Eolders: c:\qc5000_parts_files c:\ c:\ c:\ c:\ cancel
Save file as <u>type:</u> Part Files	Drives:

Chapter 3 Using Probes

Probing Technique

Probing technique refers to the method of moving CMM axes and entering point data with a touch probe. All features are made up of points and all points are taken with probes. In order to get good results from the QC5000 software it is important to use proper probe technique and to input proper probe settings.

Good probing techniques

- approach the feature from a 90 degree angle
- approach the feature from a distance of at least 1mm
- do not probe a feature from an angle of 45 degrees or less

Bad probing techniques

- dragging probe across a part
- dropping probe off the edge of a part

Probe Toolbar

The probe toolbar contains several buttons for intitiating probe functions.

Probe

- Probe teach
- Probe compensation
- Cardinal probe compensation
- Polar probe compensation
- Auto enter
- Probe library

Probe teach



Click the probe teach button to begin the calibration of a probe tip.

Probe compensation off



Click the probe compensation button to toggle off probe compensation.

Cardinal probe compensation



Cardinal Probe Compensation

Click the cardinal probe compensation button to toggle on/off probe cardinal compensation. Use cardinal probe compensation for general measuring of features to apply compensation for the probe tip radius in the probe direction.

Polar probe compensation



Click the polar probe compensation button to toggle on/off polar probe compensation. Use polar probe compensation for probing point features in polar coordinate mode.

Auto enter



Click the auto enter icon to toggle on/off auto enter. Use auto enter to automatically enter a point from a touch probe upon contact.

Probe library



Probe Library

Click the probe library button to access the probe library window.

Probe compensation

Use the probe compensation feature to allow for less than perfect probe technique. It is simple enough to use good probe technique when measuring flat features. Features on angled surfaces are more difficult.

Since perfect technique is difficult to achieve even on flat surfaces use probe compensation all measurements. Probe compensation makes up for less than perfect probe technique; it does not make up for bad probe technique.

Click the probe compensation button on the probe toolbar to toggle on/off probe compensation. Probe compensation is the amount of offset applied for the diameter of the probe tip. The direction compensation is applied is determined by the direction the probe travels immediately before taking a point.

Probe compensation off



No Probe Compensation

Click the probe compensation button to toggle off probe compensation. Use porbe compensation off to turn off probe or cardinal compensation.

Cardinal probe compensation



Click the cardinal probe compensation button to toggle on/off probe cardinal compensation. Use cardinal probe compensation for general measuring of features to apply compensation for the probe tip radius in the probe direction.

Polar probe compensation



Polar Probe Compensation

Click the polar probe compensation button to toggle on/off polar probe compensation. Use polar probe compensation for probing point features in polar coordinate mode.

To activate probe compensation

Step 1

Click the *polar* or *cardinal probe compensation* button on the probe toolbar.





Polar Probe Compensation

OR

Step 1

Select probe compensation from the probes menu.

<u>P</u>robe

✓ <u>C</u> ontact Probes tip_NR	•
Probe Compensation Polar	▶ <u>O</u> ff
Teach Contact Probe Probe Library	<u>C</u> ardinal ✓ <u>P</u> olar Pt
Auto Enter	



Select cardinal or polar from the submenu as shown.

<u>P</u>robe

			9
✓ Contact Probes	tip_NR	×	
Probe Compensation	Polar	×	<u>O</u> ff
Teach Contact Probe		_	<u>C</u> ardinal
Probe Library			✓ <u>P</u> olar Pt
		_	~
<u>A</u> uto Enter			

Auto Enter

The simplest way to enter points is to use Auto Enter. Auto Enter records each probe hit as a point. This allows point entry without keyboard, mouse, or footswitch input after each probe hit.

ONOTE Auto Enter does not work with hard probes.

To activate auto enter

Step 1 Click the *auto enter* button on the probe toolbar.



The *auto enter* button remains depressed on the probe toolbar while activated.

OR

Step 1 Select *auto enter* from the probes menu.

Probe



A check-mark appears next to auto enter on the menu when active.

Probe Library

Probe library organizes all the probes used with the QC5000 software. Use probe library to set up and manage probes and probe settings.

Probe set up functions include

- creating probe groups
- designating a master probe

Management functions include

- storing reference offset data
- storing probe qualification data
- adding/deleting probes from groups

Chapter 3 Using Probes Probe Families & Groups

Click the tool library button on the probe toolbar to view the tool library dialog box. Probes are organized into families and groups. Families consist of groups. Groups consist of probes.

Probe families organize similar probe groups. For example, the contact probes family contains the groups: HardProbe, TouchProbe, StarProbe.

QC5000 metrology software for manual CMMs uses only the contact probes family. New probe families cannot be created.

Click on the plus (+) sign next to the contact probes family.



Observe the three default probe groups: HardProbe, TouchProbe, StarProbe.



HardProbe group



Hard probes have no internal switching mechanism to detect contact with the part. User simply position a hard probe in contact with the part and manually enters the point.

TouchProbe group

Probe Library				
Probes ContactProbes Hardhobe StarProbe StarProbe	Name hp_1 hp_2	Date 3/7/01 3/7/01	Who Administrator Administrator Administrator	New Delete Set Current Disqualify OK

Touch probes have an internal switch that sends an electronical signal when the probe contacts the part. This electronic signal allows the auto-enter feature of the QC5000 to automatically enter the point.

StarProbe group

Probes Name Date Who New In ContactProbes Bottom	
HardProbe Left - Delete	
TouchProbe Right	_
StarProbe Pront	
- State Contraction Contraction	
Set Currer	-
	nt
Disqualify	Уİ
ОК	

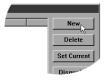
Star probes are actually a variant of touch probes. Each star probes have five tips arranged bottom, left, right, front, and back. These tips appear by default in the StarProbe group.

To create a new probe group

Step 1 Highlight the desired probe family for the new group.



Step 2 Click on the *new* button.



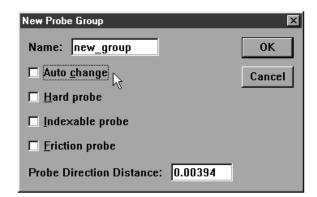
Step 3

Type a name for the group in the *name* text box.

New Probe Group	×
Name: new_group	OK
Auto <u>c</u> hange	Cancel
☐ <u>H</u> ard probe	
☐ <u>I</u> ndexable probe	
Eriction probe	
Probe Direction Distance: 0.00394	

Step 4

Check the *auto change* box for probes interchangeable with other groups. If using an indexable or friction probe check the appropriate box otherwise proceed to step 4.



Step 4

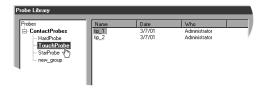
Enter the distance the probe must travel in a direction prior to making contact with the part in the probe direction distance text box.

New Probe Group		×
Name: new_group		ОК
🗖 Auto <u>c</u> hange		Cancel
Hard probe		
□ <u>I</u> nde×able probe		
<u>Friction probe</u>		
Probe Direction Distance:	0.00394	3

Probe direction distance determines in which direction probe compensation is applied.

There are two factors that influence probe measurements: the radius of the probe tip and the spatial (X, Y, and Z) position of the probe tip. All measurements are based on the location of the center of the probe tip. Probe compensation applies a calculation to correct for the radius of the probe on each measurement. The compensation for each probe tip is calculated automatically when the probe is taught.

Click on the TouchProbe group and observe the probes in the right-hand data box. The following information appears in the probe data box by default name of the probe, date of probe qualification, and the name of the person who performed the qualification.



The date and the name of the person qualifying the probe are taken from the Windows system clock and login respectively.

Probe qualification, or probe teaching, refers to the process of establishing the dimension of the probe tip. This process typically involves taking a number of probe hts on a qualification sphere with a known diameter. Qualifying, or teaching, a probe also provides offsets for probe compensation.

Master probe tips

Teaching a probe also establishes the spatial (X, Y, and Z) position of the probe tip (master probe tip) or the X,Y, and Z offsets (non-master tips) from the master tip. Each probe group has one master probe tip. The X, Y, and Z values of each probe in a group is compared to the master probe. The difference becomes the X, Y, and Z offset value for each non-master probe tip.

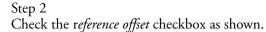
For example, a star probe group has five probe tips: one master tip and four non-master tips. The X, Y, and Z position on the non-master tips are all calculated by their X, Y, and Z offset from the master tip. Since the tips on a star probe are fixed and repeatable simply re-teaching the master tip is sufficient to update the entire group.

The same holds true for index probes that can be moved into various repeatable positions. Each position can be entered into probe library as a new tip. Establishing one position as the master tip allows all the non-master tips (positions) to update when the master tip is re-taught.

To teach (qualify) a master probe tip

Step 1 Highlight the desired probe as shown.

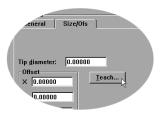






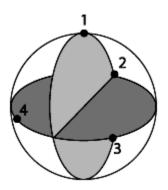
Step 3

Click on the *teach* button.





Probe the qualification sphere as shown.



4 points are the minimum required for a sphere measurement. Use more points to increase the accuracy of your measurements.

Step 5 Click OK in the dialog box.

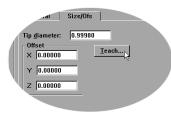
🖫 Reference Probe Bottom		
	4 Pts	
	Bottom	
<u>0</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
<u>_</u>	<u>C</u> ancel	

To teach (qualify) a non-master probe tip

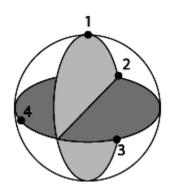
Step 1 Highlight the desired probe as shown.



Step 2 Click the *teach* button.



Step 3 Probe the qualification sphere as shown.



4 points are the minimum required for a sphere measurement. Use more points to increase the accuracy of your measurements.

Step 4 Click OK in the dialog box.



Changing Probes

There are a number of ways to select different probes. This section shows how to view available probes, change probes, and add/delete probes.

To view the probes in a group

Step 1

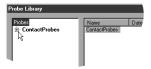
Click the probe library button on the probe toolbar.



Probe Library

Step 2

Click on the plus sign to view the groups in the family.



To change the current probe tip

Step 1 Click the *probe library* button on the probe toolbar.

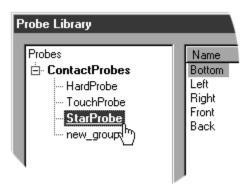


Step 2

Click on the plus sign next to the desired group in the left-hand box.



Step 3 Highlight the desired group.



Step 4

Highlight the new probe tip as shown.



Step 5

Click the *set current* button



Step 6 Click OK.



OR

Step 1 Place the cursor over the status bar as shown.

3/8/01	Cartesian	Inch	Bottom	Aut
			N	

Step 2

Ī

Click until the desired probe appears in the status bar.

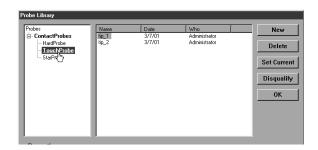
		Active	Probe
3/8/01	Cartesian Inch	Left	Auto

To add probe tips

Step 1 Click the *probe library* button on the probe toolbar.



Step 2 Highlight the desired group.



Step 3 Click the *new* button.



Step 4

Type a name for the probe tip in the *name* text box.

New Probe Tip			×
Tip <u>n</u> ame:	new_tip1		0K
<u>Т</u> уре:	Spherical	•	Cancel
🗹 Show thi	s probe in the	Probe	Menu

Step 5

Select the appropriate probe type from the pull down list.

New Probe Tip			×
Tip <u>n</u> ame:	new_tip1		0K
<u>Т</u> уре:	Spherical	•	Cancel
🔽 Show this	Spherical Cylinder	i≏ De l	Menu
	Disk Height Optical Xhair	v	

Step 7 Check the *show this probe in the probe menu* box.

New Probe Tip		X		
Tip <u>n</u> ame:	new_tip1	ОК		
<u>Т</u> уре:	Spherical 🔹	Cancel		
Show this probe in the <u>P</u> robe Menu				
Step 8 Click OK.				

New Probe Tip	ı	×	
Tip <u>n</u> ame:	new_tip1	ОК	
<u>T</u> ype:	Spherical 🔹	Cancel	
Show this probe in the Probe Menu			

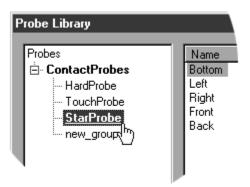
To delete probe tips

Step 1 Click the *probe library* button on the probe toolbar.



Step 2

Click on the plus sign next to the desired group in the left-hand box.



Step 3 Highlight the probe tip to be deleted.

es	Name	Date	Who
ContactProbes	tip_1	3/7/01	Administrator
HardProbe	tip_2	3/7/01	Administrator
TouchProbe	new_tip1		
StarProbe	1		
new group	Ŭ,		



Click on the *delete* button.

Name	Date	Who	New
tip_1	3/7/01	Administrator	
tip_2	3/7/01	Administrator	Delete
new_tip1			Delett
			Set Curr
•			
			Disqual

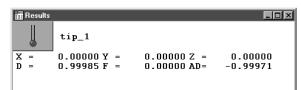
Step 5 Click *yes* in the dialog box.

QC5000	×
Are you sure you want to delete the selected item?	Yes
	No

The QC5000 does not permit the probe in current use to be deleted. The current can be deleted only after a new probe tip is assigned as current.

The results window displays the following information for probe qualification

- X,Y,Z offsets (measured from the center of the probe)
- probe diameter
- form (a numerical representation of the deviance from the nominal form)
- qualification sphere diameter



The qualification results window is a view only window. No information can be dragged into other windows from the qualification results window.

If the F (form) value shown in the *probe results* window is large re-teach the probe. In general, an *F value* larger than the resolution of the encoders is considered large. For example, an *F value* of 3 microns is large if using 2 micron encoders.

Chapter 4 General Measuring

Getting Started

Set machine zero

Machine zero is the location where all three axes of the coordinate measuring machine (CMM) read zero. This is an arbitrary point usually selected because it is at the end of negative travel for each axis. Since the machine zero position can vary from machine to machine, consult the distributor or manufacturer information for the specific procedure.

To set machine zero

Step 1 Double-click the QC5000 icon on the Windows NT desktop.



Step 2

Move the axes of the CMM to the machine zero position (consult the CMM user guide for more information) when the dialog box appears o the screen.

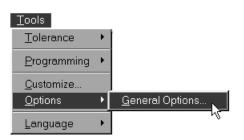
QC5000	Þ
1 Move the stage to the machine zero position, and select Ok	ОК
	Cancel

Step 3 Click OK in the dialog box.

Use the following procedure if the QC5000 software is already running and machine zero is not set.

Step 1

Select options, then general options, from the tools menu.





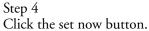
Select the general tab in the general options window.

neral Options				
Measure	Part View	Point Filtration	Probes	OK
Runs	SLEC	Sounds	Supervisor	
Square		ľ		Cancel
Buttons	Display	Encoders	General	
External button as				
Narrow Footswitch	Button Measure:	Remove Last	<u> </u>	
Wide Footswitch B	utton Measure:	Ok	Ŧ	
User settable				



If the general tab is greyed out, enter the supervisor password on the supervisor tab. Step 3 Select hard stop in the machine zero box.

Measure	Part View	Point Filtration	Probes	01
Runs	SLEC	Sounds	Supervisor	ון 🚞
Square	, l	· · · · · · · · · · · · · · · · · · ·		Can
Buttons	Display	Encoders	General	
	ature	nine zero ard stop one t Now ary alignment here are no alignmen	ts	



al Ont Probes Runs SLEC Sounds 0K Supervisor Buttons Square Display Cancel Encoders Files General Measure Part View Point Filtration User settings <u>Save now</u> Save on exit Machine zero ⊙ <u>H</u>ard stop Serial output <u>с</u>ом #: 1 O <u>N</u>one Delimiter: 10 Set no<u>w</u>... Send on new feature ☑ Include labels Move datum on a primary or secondary alignment 🗖 Start Datum Magic on a probe hit if there are no alig 🗖 User settable

Step 5

Move the axes of the CMM to the machine zero position (consult the CMM user guide for more information) when the dialog box appears o the screen.



Step 6

Step 7

Click OK in the general options window.

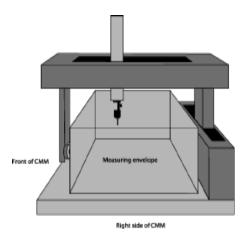
eneral Options						1
Measure	Part View		Point Filtrati	on	Probes] ок "
Runs	SLEC	T	Sounds	T	Supervisor	↓ → ⁴
Square				T		Cancel
Buttons	Display		Encoders		General	
		<u>H</u> an <u>N</u> on Set N	<u>Vow</u> y alignment	nent	s	



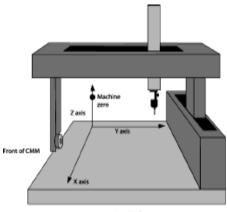
Set machine zero every time you begin a QC5000 session. Machine zero is used by QC5000 for SLEC (segmented linear error correction) functions. If machine zero is not set, SLEC functions will not work properly.

Reference Frame

Parts are made up of features. Features are made up of points. Points are locations within the measuring envelope of the CMM. The measuring envelope is the area of the CMM that can be reached by the probe.



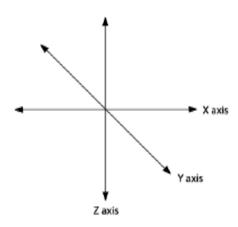
The machine coordinate system defines all the points in the measuring envelope starting a machine zero. Machine zero is the beginning of positive travel on each axis.



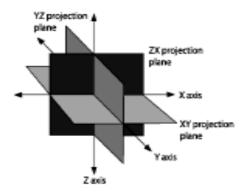
Right side of CMM

Projection planes

A projection plane is the lateral extension of one axis along another axis in the machine coordinate system.



For example, the XY plane is the lateral extension of the X axis along the Y axis.



Machine coordinates

Machine coordinates describe the distance of points within the measuring envelope from machine zero. Until a reference frame is created the QC5000 displays machine coordinates in the DRO window. Once a reference frame is established the DRO display part coordinates.

Part coordinates

Part coordinates describe the distance of points from the datum, or zero point, of the reference frame. Reference frames are created by probing a primary plane, a secondary line, and a zero point.



Set machine zero before establishing a reference frame and be sure the current probe is qualified.

To create a reference frame

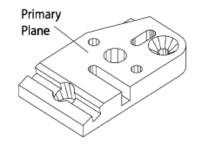
Step 1

Click the primary plane button on the datum toolbar.



Step 2

Measure three points on the plane as shown.



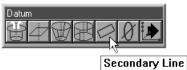


Click OK in the dialog box.

🗒 Primary Plane		- 🗆 🗵
	3 Pts	
	tp-tip	
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te

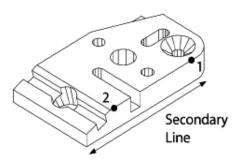
Step 4

Click the secondary line button on the datum toolbar.



Step 5

Probe two points on the secondary line. Space the points close to the opposite ends of the line.



Step 6

Click OK in the dialog box.

🛱 Secondary Line		
	2 Pts	
	tip_1	
	<u>E</u> nter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te

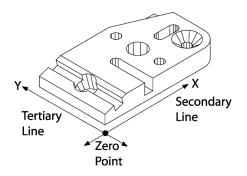
Step 7

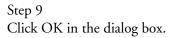
Click the line button on the measure toolbar.



Step 8

Probe two points along the tertiary alignment as shown.

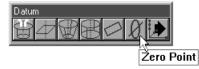




🗒 Measure Line		
	2 Pts	
	tp-tip	
	Enter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te



Click the zero point button on the datum toolbar.



Step 11 Use the mouse to highlight the secondary and tertiary lines in the features list.

Т	Name	Datum	X	Y	Z	d	r V
	Circle 8		-76.11695	-12.66581	0.00000	10.16752	5.08376
	Line 6		0.04394	-37.55966	0.00000		
	Point 7	Zero	0.00000	0.00000	0.00000		
	Plane 4	Primary	-81.41003	-38.34949	0.00000		
	Line 5	Skew	-56.13519	0.00000	0.00000		
	~						

Step 12 Click OK in the dialog box.

🛱 2 Features		- - ×
To measure a zero po	oint, you may probe a	point or construct a 🔺
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
Cancel	🗹 Auto Zero	🗖 X Axis
🗖 Y Axis	Z	Axis

To probe a point

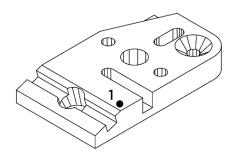


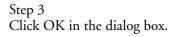
Click the point button on the measure toolbar.

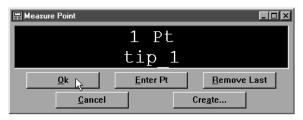


Step 2

Probe the point as shown.







To probe a line (2 points)

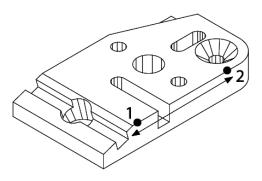


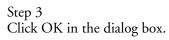
Step 1 Click the line button on the measure toolbar.



Step 2

Probe two points on the line as shown. Space the points close to the opposite ends of the line.





🗒 Measure Line		
	2 Pts	
	tip 1	
	<u>E</u> nter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te

To probe an arc (3 points)

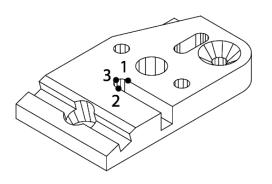
٢	

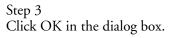
Step 1 Click the arc button on the measure toolbar.



Step 2

Probe three points on the arc in the order shown.





🗒 Measure Arc		_ D ×
	3 Pts	
	tip_1	
	Enter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te

To probe a circle (3 points)

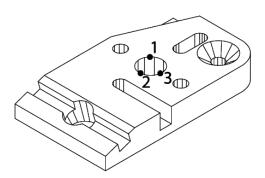


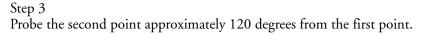
Step 1

Click the circle button on the measure toolbar.



Step 2 Probe a point on the edge of the circle





Step 4

Probe the third point approximately 120 degrees from the second point.

Step 5



To probe a slot (5 points)



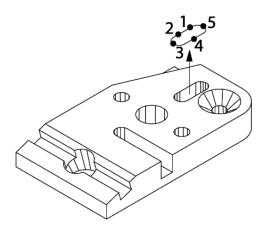
Click the slot button on the measure toolbar.

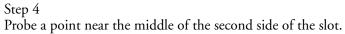


Step 2 Probe the first two points as shown.

Step 3

Probe a point, as near the center as possible, on the first arc.





Step 5

Probe a point, as near the center as possible, on the second arc.

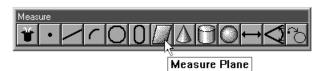
Step 6

📰 Measure Slot		
	5 Pts	
	1	
	Enter Pt	<u>R</u> emove Last
,	<u>C</u> ancel	

To probe a plane (3 points)

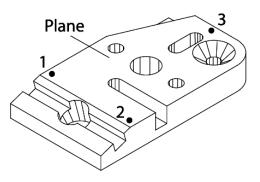


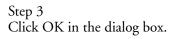
Step 1 Click the plane button on the measure toolbar.



Step 2

Measure three points on the plane as shown.





🚆 Measure Plane		_ 🗆 🗵
	3 Pts	
	tp-tip	
<u>O</u> k	Enter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te

To probe a cone (3 points)



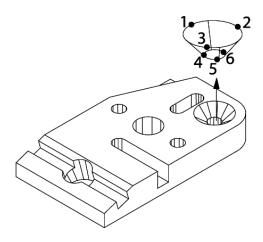
Step 1

Click the cone button on the measure toolbar.



Step 2

Probe three points around the top of the cone spacing the points evenly as shown.





Probe three points around the bottom of the cone spacing the points evenly as shown.

Step 4 Click OK in the dialog box.

To probe a cylinder (6 points)

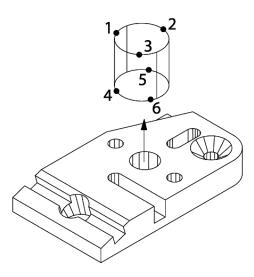


Step 1 Click the cylinder button on the measure toolbar.



Step 2

Probe 3 points around the top of the cylinder spacing the points evenly as shown.





Probe 3 points around the bottom of the cylinder spacing the points evenly as shown.

Step 4

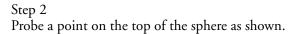
🗒 Measure Cylinder		
	6 Pts	
	tip_1	
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te

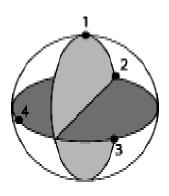
To probe a sphere (5 points)



Click the sphere button on the measure toolbar.









Probe 3 points around the equator of the sphere as shown.

Step 4



Constructing Features

It is sometimes useful to construct a new feature from existing features. This section demonstrates all feature constructions.

Point Constructions



To construct a center point

Step 1

Use the mouse to highlight a slot, circle, or other positional feature on the features list.

IJ	Name	Datum	X	Y	Z	d	r V
)	Circle 8		-76.11695	-12.66581	0.00000	10.16752	5.08376
)	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115
/	Line 6		0.04394	-37.55966	0.00000		
•	Point 7	Zero	0.00000	0.00000	0.00000		
8	Plane 4	Primary	-81.41003	-38.34949	0.00000		
-	Line 5	Skew	-56.13519	0.00000	0.00000		

Step 2

Click point button on the measure toolbar.



Measure Point

Step 3

🚆 1 Feature		
To measure a point, you from previously measur default probe compensa	ed features. Whe	n probing a point, 👘 👘
<u>Ok</u> <u>C</u> ancel	Enter Pt	Remove Last



To construct an apex point

Step 1

Use the mouse to highlight a cone or an angle on the features list.

Pro	gram TruePo	s Features R	eport				
I '	T Name	Datum	X	¥	Z	d	r 🔻
5	Circle 8		-76.11695	-12.66581	0.00000	10.16752	5.08376
3	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Slot 9	1	-109.49386	-38.08729	0.00000	9.56230	4.78115
^	Line 6		0.04394	-37.55966	0.00000		
	Point 7	Zero	0.00000	0.00000	0.00000		
0	Plane 4	Primary	-81.41003	-38.34949	0.00000		
^	Line 5	Skew	-56.13519	0.00000	0.00000		

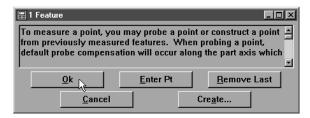
Step 2

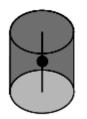
Click the point button on the measure toolbar.



Measure Pu

Step 3





Application Point

Midpoint of a linear feature or plane

To construct an application point

Step 1

Use the mouse to highlight a linear feature or plane on the features list.

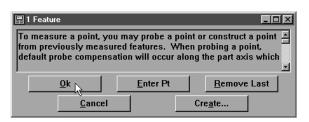
T		s Features F	<u> </u>				
	Name	Datum	X	Y	Z	d	r
).	Cylinder		-76.03881	-38.02763	-8.08435	18.96087	9.48043
ᡔ	Circle 8		-76.11695	-12.66581	0.00000	10.16752	5.08376
\$	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115
-	Line 6		0.04394	-37.55966	0.00000		
	Point 7	Zero	0.00000	0.00000	0.00000		
2	Plane 4	Primary	-81.41003	-38.34949	0.00000		
-	Line 5	Skew	-56.13519	0.00000	0.00000		

Step 2

Click the point button on the measure toolbar.



Step 3





To construct an anchor point

Step 1

Use the mouse to highlight a linear feature on the features list.

Pro	gram TruePo	s Features R	eport				
I	T Name	Datum	X	Y	Z	d	r V
2	Circle 8		-76.11695	-12.66581	0.00000	10.16752	5.08376
8	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115
/	Line 12		-105.22909	-65.87156	0.00000		
^	Line 6 W	6	0.04394	-37.55966	0.00000		
•	Point 7	Zero	0.00000	0.00000	0.00000		
1	Plane 4	Primary	-81.41003	-38.34949	0.00000		
/	Line 5	Skew	-56.13519	0.00000	0.00000		



Click the point button on the measure toolbar.



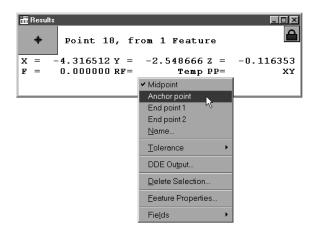
Step 3

Click OK in the dialog box.

📰 1 Feature		
To measure a point, you from previously measu default probe compensa	red features. When j	probing a point, 👘 👘
<u>Ok</u>	Enter Pt	Remove Last

Step 4

Right click in the results window and select anchor point from the list.





To construct bounding points

Step 1

Use the mouse to highlight a linear feature on the features list.

Program TruePos Features Report									
ΙI	Г Name	Datum	X	Y	Z	d	r V		
9	Cylinder		-76.03881	-38.02763	-8.08435	18.96087	9.48043		
С	Circle 8	43	-76.11695	-12.66581	0.00000	10.16752	5.08376		
۵.	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
0	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115		
/	Line 12		-105.22909	-65.87156	0.00000				
/	Line 6		0.04394	-37.55966	0.00000				
•	Point 7	Zero	0.00000	0.00000	0.00000				
	Plane 4	Primary	-81.41003	-38.34949	0.00000				
í	Line 5	Skew	-56.13519	0.00000	0.00000				



Click the point button on the measure toolbar.



Measure Point

Step 3

Click OK in the dialog box.

🗒 1 Feature		
To measure a point, you from previously measu default probe compensa	red features. When	probing a point, 👘 👘
<u>O</u> k	Enter Pt	Remove Last
<u>C</u> ancel		Cre <u>a</u> te

Step4

Right click in the results window and select endpoint 1 (top) or endpoint 2(bottom) from the list.

∰Results ✦ Point 19, fro	om 1 Feature	
X = -3.078601 Y = F = 0.000000 RF=	-1.460228 z = Temp PP=	-0.262281 3d
	 ✓ Midpoint Anchor point End point 1 End point 2 Name Tolerance 	
	DDE Output Delete Selection Eeature Properties Fields	



To construct a point from 2 intersecting lines

Step 1

Use the mouse to highlight two intersecting lines on the features list.

-10	· · · · · · · · · · · · · · · · · · ·	s Features R	epond				
E	T Name	Datum	X	Y	Z	d	r V
\$	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115
1	Line 12		-105.22909	-65.87156	0.00000		
1	Line 6		0.04394	-37.55966	0.00000		
	Point 7 ^h	S Zero	0.00000	0.00000	0.00000		
1	Plane 4	Primary	-81.41003	-38.34949	0.00000		
-	Line 5	Skew	-56.13519	0.00000	0.00000		

Step 2

Click the point button on the measure toolbar.



Measure Point

Step 3

🚆 2 Features		
To measure a point, you from previously measur default probe compensa	red features. When	probing a point, 👘 🦳
<u>Ok</u> <u>C</u> ancel	Enter Pt	<u>R</u> emove Last Cre <u>a</u> te



To construct a closest point of approach point

Step 1

Use the mouse to highlight two linear features on the features list.

Program TruePos Features Report									
I	[Name	Datum	X	Y	Z	d	r V		
۵	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
0	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115		
/	Line 13		-133.27126	-35.43994	0.00000				
/	Line 12		-105.22909	-65.87156	0.00000				
/	Line 6	1	0.04394	-37.55966	0.00000				
•	Point 7	Zero	0.00000	0.00000	0.00000				
	Plane 4	Primary	-81.41003	-38.34949	0.00000				
/	Line 5	Skew	-56.13519	0.00000	0.00000				

Step 2

Click the point button on the measure toolbar.



Step 3

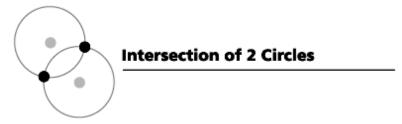
Click OK in the dialog box.

🛱 2 Features		
To measure a point, you from previously measur default probe compensa	ed features. When	probing a point, 👘 👘
<u>O</u> k <u>C</u> ancel	Enter Pt	<u>R</u> emove Last Cre <u>a</u> te

Step 4

Right click in the results window and select closest point of approach from the list.

I Results		_O×
+ Point 21, fr	om 2 features	
$\mathbf{x} = 0.000000 \mathbf{y} =$	0.000000 z = -0	.361966
F = 0.00000 RF =	✓ Intersection point	XY
	Closest pt of approach	
<u>.</u>	<u>N</u> ame K	
	Tolerance	
	DDE Output	
	Delete Selection	
	<u>F</u> eature Properties	
	Fie <u>l</u> ds •	



To construct points from intersecting circles

Step 1

Use the mouse to highlight two overlapping circles on the features list.

Program TruePos Features Report									
E []	r Name	Datum	X	Y	Z	d	r V		
)	Circle 15		-76.13007	-12.66557	0.00000	10.69196	5.34598		
)	Circle 8		-76.11695	-12.66581	0.00000	10.16752	5.08376		
1	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
)	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115		
\rangle	Circle 14		-76.12630	-63.46472	0.00000	9.52985	4.76492		
-	Line 13	43	-133.27126	-35.43994	0.00000				
^	Line 12		-105.22909	-65.87156	0.00000				
-	Line 6		0.04394	-37.55966	0.00000				
	Point 7	Zero	0.00000	0.00000	0.00000				



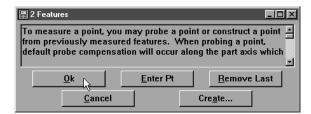
Click the point button on the measure toolbar.



Measure Point

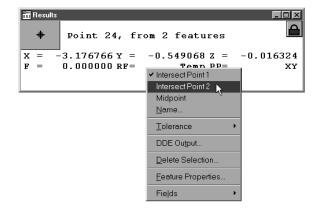
Step 3

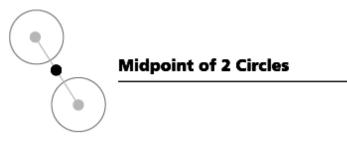
Click OK in the dialog box.



Step 4

Right click in the results window and select intersect point 1 or intersect point 2 from the list.





To construct a midpoint from two circles

Step 1

Use the mouse to highlight two circles on the features list.

Program TruePos Features Report									
-	T Name Datum	x	Y	Z	d	r 🗸			
ЪĒ	Circle 15	-76.13007	-12.66557	0.00000	10.69196	5.34598			
5	Circle 8	-76.11695	-12.66581	0.00000	10.16752	5.08376			
Ā	Cone 10	-114.21462	-19.04309	-14.66127		5.02601			
0	Slot 9	-109.49386	-38.08729	0.00000	9.56230	4.78115			
)	Circle 14	-76.12630	-63.46472	0.00000	9.52985	4.76492			
-	Line 13 🔧	-133.27126	-35.43994	0.00000					
/	Line 12	-105.22909	-65.87156	0.00000					
-	Line 6	0.04394	-37.55966	0.00000					
•	Point 7 Zero	0.00000	0.00000	0.00000					

Step 2

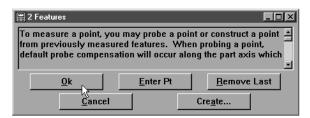
Click the point button on the measure toolbar.



Measure Point

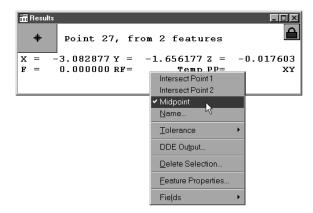
Step 3

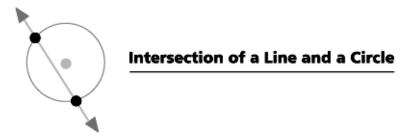
Click OK in the dialog box.



Step 4

Right click in the results window and select midpoint from the list.





To construct a point from the intersection of a line and a circle

Step 1

Use the mouse to highlight a circle and an intersecting line on the features list.

E Fostures									
Program TruePos Features Report									
ΙI	Name Datum	X	Y	Z	d	r V			
2	Circle 8	-76.11695	-12.66581	0.00000	10.16752	5.08376			
\$	Cone 10	-114.21462	-19.04309	-14.66127		5.02601			
0	Slot 9	-109.49386	-38.08729	0.00000	9.56230	4.78115			
)	Circle 14	-76.12630	-63.46472	0.00000	9.52985	4.76492			
1	Line 18	-37.29759	-0.00602	-0.56098					
	Point 17 😾	-74.59538	-0.01205	0.00000					
•	Point 16	-76.37987	-76.13874	0.00000					
-	Line 13	-133.27126	-35.43994	0.00000					
-	Line 12	-105.22909	-65.87156	0.00000					

Step 2

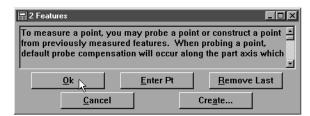
Click the point button on the measure toolbar.



Measure Point

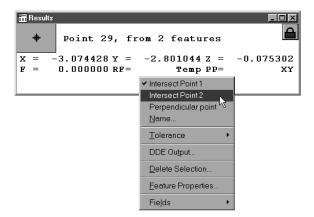
Step 3

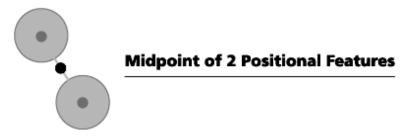
Click OK in the dialog box.



Step 4

Right click in the results window and select intersect point 1 or intersect point 2 from the list.





To construct a midpoint from 2 positional features

Step 1

Use the mouse to highlight two positional (circles, spheres, cylinders, etc.) features on the features list.

繮 Fe	eatures					_ 🗆 🗵			
Program TruePos Features Report									
I	T Name Dat	um X	Y	Z	d	r 🗸			
0	Circle 8	-76.11	695 -12.66581	0.00000	10.16752	5.08376			
Δ	Cone 10	-114.21	462 -19.04309	-14.66127		5.02601			
0	Slot 9	-109.49	386 -38.08729	0.00000	9.56230	4.78115			
0	Circle 14	-76.12	630 -63.46472	0.00000	9.52985	4.76492			
/	Line 18 ば	-37.29	759 -0.00602	-0.56098					
•	Point 17	-74.59	538 -0.01205	0.00000					
•	Point 16	-76.37	987 -76.13874	0.00000					
/	Line 13	-133.27	126 -35.43994	0.00000					
<.	Line 12	-105.22	909 -65.87156	0.00000		T			
٩						•			

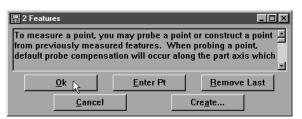
Step 2

Click the point button on the measure toolbar.



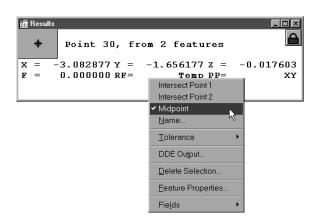
Step 3

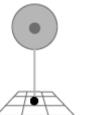
Click OK in the dialog box.



Step 4

Right click in the results window and select midpoint from the list.





Perpendicular Point Constructed from a Plane and a Positional Feature

To construct a perpendicular point from a positional feature and a plane

Step 1

Use the mouse to highlight a plane and a positional feature on the features list.

汨 Fe	atures						_ 🗆 ×
Prog	gram TruePos Feature	s Report					
IJ	f Name Datum		X	Y	Z	d	r 🗸
0	Sphere 19		0.20608	0.89845	57.09007	25.38728	12.69364
θ	Cylinder	-*	76.03881	-38.02763	-8.08435	18.96087	9.48043
0	Circle 15	-*	76.13007	-12.66557	0.00000	10.69196	5.34598
۵.	Cone 10	-1:	14.21462	-19.04309	-14.66127		5.02601
0	Slot 9	-10	09.49386	-38.08729	0.00000	9.56230	4.78115
0	Circle 14	-*	76.12630	-63.46472	0.00000	9.52985	4.76492
•	Point 7 Zero		0.00000	0.00000	0.00000		
	Plane 4 Primary	-6	31.41003	-38.34949	0.00000		
í.	Line 5 Skew	ч с – з	56.13519	0.00000	0.00000		

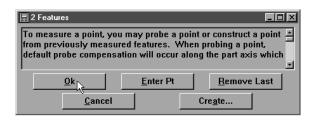
Step 2

Click the point button on the measure toolbar.



Measure Point

Step 3



To construct a point from a linear feature and a plane



Step 1

Use the mouse to highlight a linear feature and a plane on the features list.

溫 Features							
>	Sphere 19	20.20608	0.89845	57.09007	25.38728	12.69364	
)	Cylinder	-76.03881	-38.02763	-8.08435	18.96087	9.48043	
)	Circle 15	-76.13007	-12.66557	0.00000	10.69196	5.34598	
\$	Cone 10	-114.21462	-19.04309	-14.66127		5.02601	
)	Slot 9	-109.49386	-38.08729	0.00000	9.56230	4.78115	
)	Circle 14	-76.12630	-63.46472	0.00000	9.52985	4.76492	
•	Point 7 Zero	0.00000	0.00000	0.00000			
4	Plane 4 Primary	-81.41003	-38.34949	0.00000			
	Line 5 ^W Skew	-56.13519	0.00000	0.00000			

Step 2

Click the point button on the measure toolbar.



Step 3

🗒 2 Features		_ D ×
To measure a point, you from previously measur default probe compensa	ed features. When p	probing a point, 👘 🗖
	<u>E</u> nter Pt	<u>R</u> emove Last



To construct a point from the intersection of 3 planes

Step 1

Use the mouse to highlight 3 planes on the features list.

Prog	gram TruePos	Features	eport				
C []	r Name	Datum	X	Y	Z	d	r V
6	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
0	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115
D	Circle 14		-76.12630	-63.46472	0.00000	9.52985	4.76492
1	Plane 21		-107.46508	-64.91925	-6.46801		
4	Plane 20		-57.07450	-76.15658	-7.38423		
•	Point 7	Zero	0.00000	0.00000	0.00000		
4		Primary	-81.41003	-38.34949	0.00000		
-	Line 5 📈	Skew	-56.13519	0.00000	0.00000		

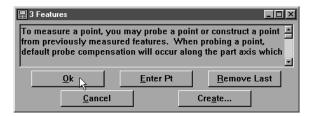
Step 2

Click the point button on the measure toolbar.

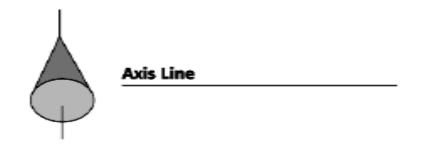


2

Step 3



Line Constructions



To construct an axis line from a linear feature

Step 1

Use the mouse to highlight a linear feature in the features list.

Proj	gram TruePo	s Features F	leport				
I '	T Name	Datum	X	Y	Z	d	r V.
5	Cone 10	N	-114.21462	-19.04309	-14.66127		5.02601
)	Slot 9	43	-109.49386	-38.08729	0.00000	9.56230	4.78115
С	Circle 14	l .	-76.12630	-63.46472	0.00000	9.52985	4.76492
0	Plane 21		-107.46508	-64.91925	-6.46801		
2	Plane 20		-57.07450	-76.15658	-7.38423		
•	Point 7	Zero	0.00000	0.00000	0.00000		
0	Plane 4	Primary	-81.41003	-38.34949	0.00000		
/	Line 5	Skew	-56.13519	0.00000	0.00000		



Click the line button on the measure toolbar.





🖀 1 Feature		. D X
To measure a line, you from previously measur probe compensation is	red features. When	probing a line, 👘
<u>Qk</u> Cancel	Enter Pt	<u>R</u> emove Last Cre <u>a</u> te



To construct a plane axis line (Normal Line)

Step 1

Use the mouse to highlight a plane on the features list.

Program TruePos Features Report							
:	T Name	Datum	X	Y	Z	d	r
>	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115
)	Circle 14	ł	-76.12630	-63.46472	0.00000	9.52985	4.76492
ġ.	Plane 21		-107.46508	-64.91925	-6.46801		
1	Plane 20	15	-57.07450	-76.15658	-7.38423		
	Point 7	Zero	0.00000	0.00000	0.00000		
2	Plane 4	Primary	-81.41003	-38.34949	0.00000		
^	Line 5	Skew	-56.13519	0.00000	0.00000		

Step 2

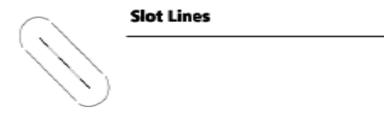
Click the line button in the measure toolbar.



Measure Line

Step 3

🗒 1 Feature		
To measure a line, you from previously measu probe compensation is	red features. When	probing a line, 👘 📕
<u>Ok</u> Cancel	Enter Pt	<u>R</u> emove Last Cre <u>a</u> te



To construct a midline from the sides of a slot

Step 1

Use the mouse to highlight a slot on the features list.

Prog	ram TruePos	Features Re	eport				
I I	Name	Datum	X	Y	Z	d	r V
2	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115
)	Circle 14	-¢	-76.12630	-63.46472	0.00000	9.52985	4.76492
	Plane 21		-107.46508	-64.91925	-6.46801		
	Plane 20		-57.07450	-76.15658	-7.38423		
	Point 7	Zero	0.00000	0.00000	0.00000		
	Plane 4	Primary	-81.41003	-38.34949	0.00000		
^	Line 5	Skew	-56.13519	0.00000	0.00000		

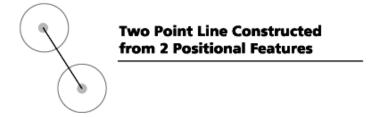


Click the line button in the measure toolbar.





🛱 1 Feature		
To measure a line, you from previously measu probe compensation is	red features. When	probing a line, 👘 👘
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last



To construct a 2 point line from two positional features

Step 1

Use the mouse to highlight two positional features on the features list.

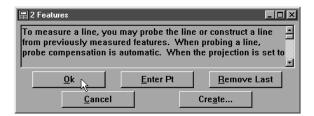
Program TruePos Features Report								
I 7	T Name	Datum	X	Y	Z	d	r V	
)	Circle 1	5	-76.13007	-12.66557	0.00000	10.69196	5.34598	
5	Cone 10		-114.21462	-19.04309	-14.66127		5.02601	
0	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115	
0	Circle 1	1	-76.12630	-63.46472	0.00000	9.52985	4.76492	
	Plane 21	45	-107.46508	-64.91925	-6.46801			
3	Plane 20		-57.07450	-76.15658	-7.38423			
•	Point 7	Zero	0.00000	0.00000	0.00000			
	Plane 4	Primary	-81.41003	-38.34949	0.00000			
<u></u>	Line 5	Skew	-56.13519	0.00000	0.00000			



Click the line button on the measure toolbar.



Step 3





To construct a tangent line from 2 radial positional features

Step 1

Use the mouse to highlight two radial positional features on the features list.

涯 Fe	eatures						_ 🗆 🗵		
Program TruePos Features Report									
I 7	T Name	Datum	X	Y	Z	d	r V		
0	Circle 15		-76.13007	-12.66557	0.00000	10.69196	5.34598		
۵.	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
0	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115		
0	Circle 14	L	-76.12630	-63.46472	0.00000	9.52985	4.76492		
	Plane 21	NC	-107.46508	-64.91925	-6.46801				
6	Plane 20		-57.07450	-76.15658	-7.38423				
•	Point 7	Zero	0.00000	0.00000	0.00000				
	Plane 4	Primary	-81.41003	-38.34949	0.00000				
<u></u>	Line 5	Skew	-56,13519	0.00000	0.00000		ļ		
٩									



Click the line button on the measure toolbar.



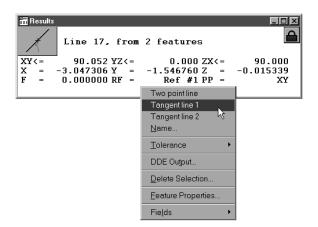
Measure Line

Step 3

🛱 2 Features		_O×
To measure a line, you from previously measur probe compensation is a	red features. When j	probing a line, 👘 👘
04.	Enter Pt	Remove Last
	Enter Pt	<u>H</u> emove Last

Step 4

Right click in the results window and select tangent 1 or tangent 2 from the list.





To construct a line from the intersection of 2 planes

Step 1

Use the mouse to highlight two planes on the features list.

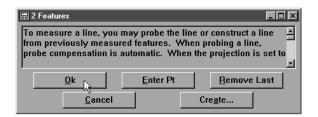
汨 Fe	atures					_ 🗆 ×
Prog	gram TruePos Features R	eport				
II	r Name Datum	X	Y	Z	d	r V 🔺
0	Circle 15	-76.13007	-12.66557	0.00000	10.69196	5.34598
Δ	Cone 10	-114.21462	-19.04309	-14.66127		5.02601
0	Slot 9	-109.49386	-38.08729	0.00000	9.56230	4.78115
0	Circle 14	-76.12630	-63.46472	0.00000	9.52985	4.76492
\Box	Plane 21	-107.46508	-64.91925	-6.46801		
\Box_{-}	Plane 20	-57.07450	-76.15658	-7.38423		
•	Point 7 ¹ Sero	0.00000	0.00000	0.00000		
	Plane 4 Primary	-81.41003	-38.34949	0.00000		
<u> </u>	Line 5 Skew	-56.13519	0.00000	0,00000		-
•						•



Click the line button on the measure toolbar.



Step 3





To construct a bisector of 2 linear features

Step 1

Use the mouse to highlight two linear features on the features list.

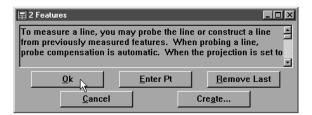
I	T Name	Datum	X	¥	Z	r	d
/	Line 2	Skew	-68.40934	0.00000	0.00000		
/	Line 3		0.02896	-38.65587	0.00000		
•	Point 4	Zero	0.00000	0.00000	0.00000		
С	Circle 5		-76.11771	-38.07186	0.00000	9.95266	19.90532
/	Line 6		-133.28028	-36.05004	0.00000		
/	Line 7		-109.75734	-63.95045	0.00000		
/	Line 8	2	-59.14086	-76.14959	0.00000		



Click the line button on the measure toolbar.



Step 3





To construct a perpendicular bisector of 2 linear features

Step 1

Use the mouse to highlight two positional features on the features list.

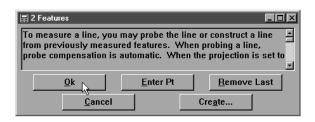
Program TruePos Features Report							
E []	Г Name	Datum	X	¥	Z	r	d
/	Line 2	Skew	-68.40934	0.00000	0.00000		
-	Line 3		0.02896	-38.65587	0.00000		
•	Point 4	Zero	0.00000	0.00000	0.00000		
)	Circle 5		-76.11771	-38.07186	0.00000	9.95266	19.90532
/	Line 6		-133.28028	-36.05004	0.00000		
/	Line 7		-109.75734	-63.95045	0.00000		
<hr/>	Line 8 K	2	-59.14086	-76.14959	0.00000		



Click the line button on the measure toolbar.

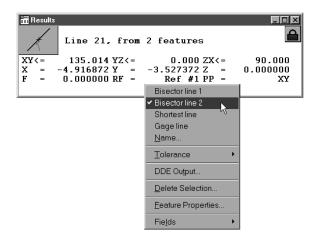


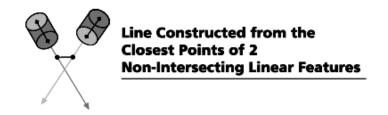
Step 3



Step 4

Right click in the results window and select bisector 2 from the list.





To construct a closest point of approach line from 2 linear features

Step 1

Use the mouse to highlight two linear features on the features list.

[]	Name	Datum	X	Y	Z	d	r V
)	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115
)	Circle 1	1	-76.12630	-63.46472	0.00000	9.52985	4.76492
/	Line 24		-109.03745	-64.26587	0.00000		
1	Line 23		-54.93788	-76.16538	0.00000		
-	Line 22	¢	0.00000	-76.28605	-9.86449		
	Point 7	Zero	0.00000	0.00000	0.00000		
	Plane 4	Primary	-81.41003	-38.34949	0.00000		
-	Line 5	Skew	-56.13519	0.00000	0.00000		

Step 2

Click the line button on the measure toolbar.



MCasule Lill

Step 3 Click OK in the dialog box.

2 Features

To measure a line, you may probe the line or construct a line
from previously measured features. When probing a line,
probe compensation is automatic. When the projection is set to

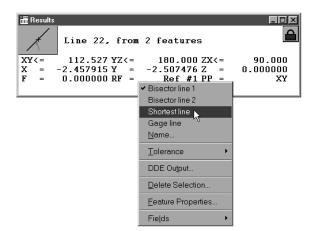
Ok

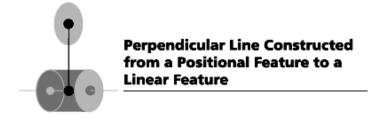
Cancel

Create...

Step 4

Right click in the results window and select closest from the list.





To construct a line from a positional feature perpendicular to a linear feature

Step 1

Use the mouse to highlight a positional feature and a linear feature on the features list.

🖀 Features 📃 🗖							
Program TruePos Features Report							
I	T Name I	atum	X	Y	Z	d	r 🔻
0	Sphere 19		20.20608	0.89845	57.09007	25.38728	12.69364
Θ	Cylinder		-76.03881	-38.02763	-8.08435	18.96087	9.48043
0	Circle 15		-76.13007	-12.66557	0.00000	10.69196	5.34598
4	Cone 10	16	-114.21462	-19.04309	-14.66127		5.02601
0	Slot 9		-109.49386	-38.08729	0.00000	9.56230	4.78115
0	Circle 14		-76.12630	-63.46472	0.00000	9.52985	4.76492
/	Line 24		-109.03745	-64.26587	0.00000		
/	Line 23		-54.93788	-76.16538	0.00000		
\leq	Line 22		0.0000	-76.28605	-9.86449		
•							•



Click the line button on the measure toolbar.



Step 3

🛱 2 Features							
To measure a line, you may probe the line or construct a line from previously measured features. When probing a line, probe compensation is automatic. When the projection is set to							
	Enter Pt	Remove Last					
<u>Cancel</u>		Create					



To construct a line parallel to a linear feature using a positional feature

Step 1

Use the mouse to highlight a positional feature and a linear feature on the features list.

Program TruePos Features Report								
I '	T Name Datum	x	Y	Z	d	r V		
0	Sphere 19	20.20608	0.89845	57.09007	25.38728	12.69364		
9	Cylinder	-76.03881	-38.02763	-8.08435	18.96087	9.48043		
С	Circle 15	-76.13007	-12.66557	0.00000	10.69196	5.34598		
۵.	Cone 10 📉	-114.21462	-19.04309	-14.66127		5.02601		
0	Slot 9	-109.49386	-38.08729	0.00000	9.56230	4.78115		
С	Circle 14	-76.12630	-63.46472	0.00000	9.52985	4.76492		
/	Line 24	-109.03745	-64.26587	0.00000				
/	Line 23	-54.93788	-76.16538	0.00000				
<u> </u>	Line 22	0.00000	-76.28605	-9.86449				

```
Step 2
```

Click the line button on the measure toolbar.



Measure Line

Step 3

🛱 2 Features		
To measure a line, you from previously measu probe compensation is	red features. Whe	n probing a line, 👘 🗖
<u>Qk</u> <u>C</u> ancel	Enter Pt	Remove Last

Step 4 Right click in the results window and select parallel from the list.

Eine 23, from	2 features	
XY<= 90.020 YZ<= X = -3.048046 Y = F = 0.000000 RF =	-1.048189 Z = Ref #1 PP =	
L	 Perpendicular line Parallel line Name 	
	Tolerance DDE Output	•
	Delete Selection	
	<u>F</u> eature Properties Fie <u>l</u> ds	•



Perpendicular Line Constructed from a Positional Feature and a Plane

To construct a perpendicular line through a plane and a positional feature

Step 1

Use the mouse to highlight a positional feature and a plane on the features list.

E []	T Name	Datum		X	Y	Z	d	r V
)	Slot 9			-109.49386	-38.08729	0.00000	9.56230	4.78115
)	Circle 1	4		-76.12630	-63.46472	0.00000	9.52985	4.76493
-	Line 24			-109.03745	-64.26587	0.00000		
^	Line 23			-54.93788	-76.16538	0.00000		
-	Line 22			0.00000	-76.28605	-9.86449		
	Point 7	Zero		0.00000	0.00000	0.00000		
4	Plane 4	Primary		-81.41003	-38.34949	0.00000		
/	Line 5	Skew	5	-56.13519	0.00000	0.00000		

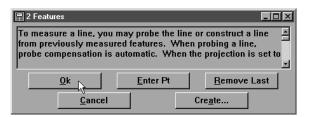
Step 2

Click the line button on the measure toolbar.



Measure Line

Step 3





To construct a rotated line from the leg of an angle and the angle

Step 1

Use the mouse to highlight an angle and a leg of an angle on the features list.

Program TruePos Features Report							
1	T Name	Datum	X	Y	Z	d	r V
٤	Angle 25						13.96928
>	Sphere 19		20.20608	0.89845	57.09007	25.38728	12.69364
)	Cylinder		-76.03881	-38.02763	-8.08435	18.96087	9.48043
)	Circle 15		-76.13007	-12.66557	0.00000	10.69196	5.34598
	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Circle 14		-76.12630	-63.46472	0.00000	9.52985	4.76492
•	Line 24		-109.03745	-64.26587	0.00000		
	Line 23		-54.93788	-76.16538	0.00000		
· .	Line 22	M	0.00000	-76.28605	-9.86449		



Click the line button on the measure toolbar.



Measure Line

Step 3

🚆 2 Features							
To measure a line, you may probe the line or construct a line from previously measured features. When probing a line, probe compensation is automatic. When the projection is set to							
<u>O</u> k <u>C</u> ancel	Enter Pt	<u>R</u> emove Last Cre <u>a</u> te					



To construct a gage line

Step 1

Use the mouse to highlight 2 lines on the features list.

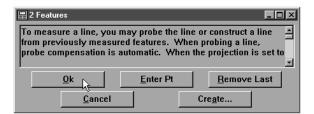
Program TruePos Features Report								
E []	Name	Datum	X	Y	Z	d	r V	
2	Cone 10		-114.21462	-19.04309	-14.66127		5.02601	
)	Circle 1	4	-76.12630	-63.46472	0.00000	9.52985	4.76492	
/	Line 27		-55.52301	-19.03383	0.00000			
/	Line 26		-45.96094	-19.50256	0.00000			
-	Line 22	45	0.00000	-76.28605	-9.86449			
	Point 7	Zero	0.00000	0.00000	0.00000			
2	Plane 4	Primary	-81.41003	-38.34949	0.00000			
-	Line 5	Skew	-56.13519	0.00000	0.00000			

Step 2

Click the line button on the measure toolbar.



Step 3



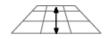
Step 4

Right click in the results windowand select gage line from the list.

Eine 29, from 2	features	
XY<= 145.533 YZ<= X = -4.271158 Y = - F = 0.000000 RF =		90.000 000000 XY
	Tolerance DDE Output Delete Selection Eeature Properties Fields	

Enter a length in the gage line dialog box and click OK if the lines are not parallel.

Gage Line		X
Enter gage length:	.5	ок
		Cancel



Projection of a Line to a Plane

To construct a line by projecting an existing line on a new projection plane

Step 1

Use the mouse to highlight a line on the features list.

Program TruePos Features Report									
I	T Name	Datum	X	Y	Z	d	r V		
6	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
D	Circle 14	1	-76.12630	-63.46472	0.00000	9.52985	4.76492		
/	Line 27		-55.52301	-19.03383	0.00000				
/	Line 26	4	-45.96094	-19.50256	0.00000				
-	Line 22		0.00000	-76.28605	-9.86449				
•	Point 7	Zero	0.00000	0.00000	0.00000				
	Plane 4	Primary	-81.41003	-38.34949	0.00000				
^	Line 5	Skew	-56.13519	0.00000	0.00000				

Step 2

Click on the projection box in the status bar until the desired projection (XY, YZ, ZX) plane appears.



```
Step 3
```

Click the line button on the measure toolbar.



Step 4

🚆 1 Feature									
To measure a line, you may probe the line or construct a line from previously measured features. When probing a line, probe compensation is automatic. When the projection is set to									
Ok N	Enter Pt	Remove Last							
		<u>Homoro Edot</u>							

Circle Constructions



To construct a circle from a sphere

Step 1

Use the mouse to highlight a sphere on the features list.

汇Fe	eatures						_ 🗆 ×		
Program TruePos Features Report									
I	T Name	Datum	X	Y	Z	d	r 🗸		
0	Sphere 19		20.20608	0.89845	57.09007	25.38728	12.69364		
θ	Cylinder	N	-76.03881	-38.02763	-8.08435	18.96087	9.48043		
0	Circle 15		-76.13007	-12.66557	0.00000	10.69196	5.34598		
۵	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
0	Circle 14		-76.12630	-63.46472	0.00000	9.52985	4.76492		
/	Line 27		-55.52301	-19.03383	0.00000				
/	Line 26		-45.96094	-19.50256	0.00000				
/	Line 22		0.00000	-76.28605	-9.86449				
•	Point 7	Zero	0.00000	0.00000	0.0000		Ĺ		
I							•		



Click on the projection box in the status bar until the desired projection (XY, YZ, ZX) plane appears.

					Projection Plane
1/27/01	Cartesian	lach	Contact Probes	5p_1	XY, Ref #1 00
#Start P	QC5008 Par	t Untilled			ł

Step 3

Click the circle button on the measure toolbar.



Measure Circle

Step 4 Click OK in the dialog box.

🛱 1 Feature		- D ×					
To measure a circle, you may probe the circle or construct it from previously measured features. When probing a circle, probe compensation is automatic. When the projection is set to							
<u>Ok</u> <u>Cancel</u>	Enter Pt	<u>R</u> emove Last Cre <u>a</u> te					



To construct a circle from a cone

Step 1

Use the mouse to highlight a cone on the features list.

Program TruePos Features Report									
IT	Name Da	tum	X	Y	Z	d	r V		
0	Sphere 19		20.20608	0.89845	57.09007	25.38728	12.69364		
Э	Cylinder		-76.03881	-38.02763	-8.08435	18.96087	9.48043		
)	Circle 15		-76.13007	-12.66557	0.00000	10.69196	5.34598		
5	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
D	Circle 14	¢	-76.12630	-63.46472	0.00000	9.52985	4.76492		
-	Line 27		-55.52301	-19.03383	0.00000				
^	Line 26		-45.96094	-19.50256	0.00000				
-	Line 22		0.00000	-76.28605	-9.86449				
•	Point 7 Ze	ro	0.00000	0.00000	0.00000				

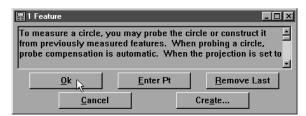
Step 2

Click the circle button on the measure toolbar.



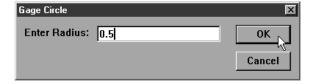
Step 3

Click OK in the dialog box.



Step 4

Enter the desired radius in the gage circle dialog box and click OK.





To construct a circle from an intersecting plane and cylinder

Step 1

Use the mouse to highlight a cylinder and a plane on the features list.

Program TruePos Features Report									
I	T Name Ds	atum	X	Y	Z	d	r V		
>	Sphere 19		20.20608	0.89845	57.09007	25.38728	12.69364		
)	Cylinder		-76.03881	-38.02763	-8.08435	18.96087	9.48043		
2	Circle 15		-76.13007	-12.66557	0.00000	10.69196	5.34598		
1	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
)	Circle 14		-76.12630	-63.46472	0.00000	9.52985	4.76492		
^	Line 22		0.00000	-76.28605	-9.86449				
	Point 7 Ze	ro	0.00000	0.00000	0.00000				
3	Plane 4 Pr	imary	-81.41003	-38.34949	0.00000				
<u></u>	Line 5 Sk	tew K	-56.13519	0.00000	0.00000				



Click the circle button on the measure toolbar.



Step 3

📰 2 Features								
To measure a circle, you may probe the circle or construct it from previously measured features. When probing a circle, probe compensation is automatic. When the projection is set to								
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last						
<u>C</u> ancel		Create						



Circle Constructed from an Intersecting Cylinder and Cone

To construct a circle from an intersecting cylinder and cone

Step 1

Use the mouse to highlight a cylinder and a cone on the features list.

Program TruePos Features Report									
E []	Г Name	Datum	X	Y	Z	d	r V		
>	Sphere 19		20.20608	0.89845	57.09007	25.38728	12.69364		
9	Cylinder		-76.03881	-38.02763	-8.08435	18.96087	9.48043		
)	Circle 15		-76.13007	-12.66557	0.00000	10.69196	5.34598		
3	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
)	Circle 14	43	-76.12630	-63.46472	0.00000	9.52985	4.76492		
-	Line 22		0.00000	-76.28605	-9.86449				
•	Point 7	Zero	0.00000	0.00000	0.00000				
8	Plane 4	Primary	-81.41003	-38.34949	0.00000				
_	Line 5	Skev	-56.13519	0.00000	0.00000				

Step 2

Click the circle button on the measure toolbar.



Step 3

📰 2 Features								
To measure a circle, you may probe the circle or construct it from previously measured features. When probing a circle, probe compensation is automatic. When the projection is set to								
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last						
<u>C</u> ancel	C	re <u>a</u> te						



To construct a circle tangent to 2 intersecting lines

Step 1

Use the mouse to highlight 2 intersecting lines on the features list.

Program TruePos Features Report									
I 1	Name	Datum	X	Y	Z	d	r V		
۵	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
0	Circle 14	1	-76.12630	-63.46472	0.00000	9.52985	4.76492		
/	Line 29		-107.37187	-64.74135	0.00000				
/	Line 28		-57.14258	-75.89689	0.00000				
/	Line 22	h}	0.00000	-76.28605	-9.86449				
•	Point 7	Zero	0.00000	0.00000	0.00000				
	Plane 4	Primary	-81.41003	-38.34949	0.00000				
/	Line 5	Skew	-56.13519	0.00000	0.00000				

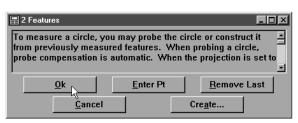
Step 2

Click the circle button on the measure toolbar.



Step 3

Click OK in the dialog box.



Step 4

Enter the desired radius in the gage circle dialog box and click OK.

Tangent Circle		×
Enter Radius:	0.50000000000	ок
		Cancel



To change the location of a tangent circle

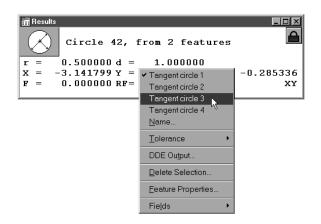
Step 1

Use the mouse to highlight the tangent circle on the features list.

Proé	gram TruePo	os Features A	leport				
I 7	T Name	Datum	X	Y	Z	d	r V
C	Circle 1	4	-76.12630	-63.46472	0.00000	9.52985	4.76492
С	Circle 30) N	-80.78039	-74.90525	0.00000	2.00000	1.00000
/	Line 29	45	-107.37187	-64.74135	0.00000		
/	Line 28		-57.14258	-75.89689	0.00000		
-	Line 22		0.00000	-76.28605	-9.86449		
•	Point 7	Zero	0.00000	0.00000	0.00000		
0	Plane 4	Primary	-81.41003	-38.34949	0.00000		
-	Line 5	Skew	-56.13519	0.00000	0.00000		



Right click in the results window and select tangent 1, tangent 2, tangent 3, or tangent 4 from the list.



Plane Constructions



To construct a plane from the midpoint of a line

Step 1

Use the mouse to highlight a line on the features list.

Program TruePos Features Report								
1	Name	Datum	X	Y	Z	d	r V	
)	Circle 1	1	-76.12630	-63.46472	0.00000	9.52985	4.76492	
)	Circle 3)	-80.78039	-74.90525	0.00000	2.00000	1.00000	
	Line 29		-107.37187	-64.74135	0.00000			
	Line 28	4	-57.14258	-75.89689	0.00000			
-	Line 22		0.00000	-76.28605	-9.86449			
	Point 7	Zero	0.00000	0.00000	0.00000			
7	Plane 4	Primary	-81.41003	-38.34949	0.00000			
^	Line 5	Skev	-56.13519	0.00000	0.00000			

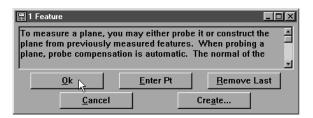


Click the plane button on the measure toolbar.



Measure Plane

Step 3





To construct a plane from a line and a positional feature

Step 1

Use the mouse to highlight a line and a positional feature on the features list.

Program TruePos Features Report								
I.	r Name	Datum	X	¥	Z	r	d	
/	Line 2	Skew	-68.40934	0.00000	0.00000			
/	Line 3		0.02896	-38.65587	0.00000			
•	Point 4	Zero	0.00000	0.00000	0.00000			
0	Circle 5		-76.11771	-38.07186	0.00000	9.95266	19.90532	
/	Line 6	13	-133.28028	-36.05004	0.00000			
/	Line 7		-109.75734	-63.95045	0.00000			
/	Line 8		-59.14086	-76.14959	0.00000			

Step 2

Click the plane button on the measure toolbar.



Step 3

🚆 2 Features		
To measure a plane, yo plane from previously r plane, probe compensa	neasured features. '	When probing a 🚽
<u>O</u> k <u>C</u> ancel	Enter Pt	<u>R</u> emove Last Cre <u>a</u> te



To construct a midplane from 2 planes

Step 1

Use the mouse to highlight 2 planes on the features list.

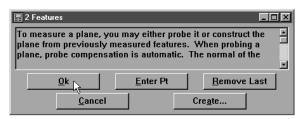
Pro	gram TruePo	s Features F	leport				
I	T Name	Datum	X	Y	Z	d	r v
0	Circle 30)	-80.78039	-74.90525	0.00000	2.00000	1.00000
	Plane 31		-15.87173	-38.02728	-4.47516		
/	Line 29		-107.37187	-64.74135	0.00000		
/	Line 28		-57.14258	-75.89689	0.00000		-
/	Line 22		0.00000	-76.28605	-9.86449		
•	Point 7	Zero	0.00000	0.00000	0.00000		
2	Plane 4	Primary	-81.41003	-38.34949	0.00000		
/	Line 5	Skew 🧏	-56.13519	0.00000	0.00000		

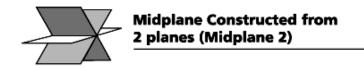
Step 2

Click the plane button on the measure toolbar.



Step 3





To construct a perpendicular midplane from 2 planes

Step 1

Use the mouse to highlight 2 planes on the features list.

Program TruePos Features Report								
I 1	Name	Datum		Х	Y	Z	d	r V
5	Circle 3	5		-80.78039	-74.90525	0.00000	2.00000	1.00000
2	Plane 31			-15.87173	-38.02728	-4.47516		
/	Line 29			-107.37187	-64.74135	0.00000		
/	Line 28			-57.14258	-75.89689	0.00000		
/	Line 22			0.00000	-76.28605	-9.86449		
•	Point 7	Zero		0.00000	0.00000	0.00000		
4	Plane 4	Primary	× .	-81.41003	-38.34949	0.00000		
/	Line 5	Skew	19	-56.13519	0.00000	0.00000		

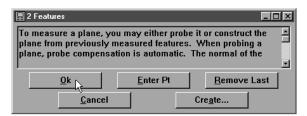
Step 2

Click the plane button on the measure toolbar.



Step 3

Click OK in the dialog box.



Step 4

Right click in the results window and select midplane 2 from the list.

Plane 12, from X = -1.354069 Y = XY<= 0.432 YZ<= F = 0.000000 RF =	-1.532073 Z = 273.277 ZX<=	97.515
	Midplane 1 ✓ Midplane 2 <u>N</u> ame	
	Tolerance	•
	DDE Output	
	Delete Selection	
	Eeature Properties	
	Fie <u>l</u> ds	•

Sphere Constructions



To construct a sphere from a cone

Step 1

Using the mouse to highlight a cone on the features list.

涯 Fe	atures						_ 🗆 🗵
Prog	gram TruePos Fo	eatures Re	port				
II	T Name Dat	um	X	¥	Z	d	r 🗸
0	Circle 15		-76.13007	-12.66557	0.00000	10.69196	5.34598
8	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
0	Circle 14 🕅		-76.12630	-63.46472	0.00000	9.52985	4.76492
0	Circle 30		-80.78039	-74.90525	0.00000	2.00000	1.00000
	Plane 31		-15.87173	-38.02728	-4.47516		
/	Line 29		-107.37187	-64.74135	0.00000		
/	Line 28		-57.14258	-75.89689	0.00000		
/	Line 22		0.00000	-76.28605	-9.86449		
• .	Point 7 Zer	0	0.00000	0.00000	0.00000		
							•



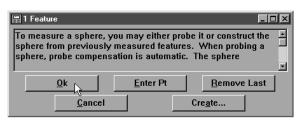
Click the sphere button on the measure toolbar.



Measure Sphere

Step 3

Click OK in the dialog box.





Enter the desired radius in the gage ball dialog box and click OK.





To construct a cylinder from to 2 co-axial circles

Step 1

Use the mouse to highlight 2 co-axial circles on the features list.

Program TruePos Features Report								
I 7	ſName Datum	x	Y	Z	d	r V		
5	Cone 10	-114.21462	-19.04309	-14.66127		5.02601		
)	Circle 34	-76.23422	-63.52187	-0.46010	9.53067	4.76534		
)	Circle 36	-76.21164	-63.52140	-10.45210	9.50805	4.75402		
2	Circle 30 🕅	-80.78039	-74.90525	0.00000	2.00000	1.00000		
/	Line 5 Skew	-56.13519	0.00000	0.00000				
1	Plane 31	-15.87173	-38.02728	-4.47516				
-	Line 29	-107.37187	-64.74135	0.00000				
-	Line 28	-57.14258	-75.89689	0.00000				
_	Line 22	0.00000	-76.28605	-9.86449				

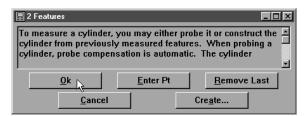
Step 2

Click the cylinder button on the measure toolbar.



Measure Cylinder

Step 3



Cone Constructions



To construct a cone from 2 co-axial circles

Step 1

Use the mouse to highlight 2 co-axial circles (with different diameters) on the features list.

Program TruePos Features Report								
	T Name Datum	x	¥	Z	d	r V		
>	Cone 10	-114.21462	-19.04309	-14.66127		5.02601		
)	Circle 34	-76.23422	-63.52187	-0.46010	9.53067	4.76534		
)	Circle 36	-76.21164	-63.52140	-10.45210	9.50805	4.75402		
>	Circle 30 😾	-80.78039	-74.90525	0.00000	2.00000	1.00000		
-	Line 5 Skew	-56.13519	0.00000	0.00000				
8	Plane 31	-15.87173	-38.02728	-4.47516				
-	Line 29	-107.37187	-64.74135	0.00000				
-	Line 28	-57.14258	-75.89689	0.00000				
<u></u>	Line 22	0.00000	-76.28605	-9.86449				



Click the cone button on the measure toolbar.



Step 3 Click OK in the dialog box.

🖫 2 Features		_ 🗆 🗵
To measure a cone, you cone from previously m cone, probe compensati	easured features.	When probing a 🚽 🚽
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te

There are two types of relations used by the QC5000 software: distances and angles. Distances describe how far one feature is from another and angles describe where one feature lies in relation to another.

Distance

Distances are constructed using previously measured features. The simplest distance to construct is between two points. More complex distances can be constructed between two circles or by a combination of features such as a circle and a point. The basic method for constructing distances is the same as below.

Angle

Angles are constructed using previously measured features. The simplest angle to construct is between two lines. More complex angles can be constructed between two planes or by a combination of features such as a cylinder and a plain. The basic method for constructing angles is the same as below.

Distance Constructions



To construct the length of an axis

Step 1

Use the mouse to highlight a linear feature on the features list.

1 100	gram TruePos Features					
I 7	T Name Datum	X	Y	Z	d	r V
5	Cone 10	-114.21462	-19.04309	-14.66127		5.02601
)	Circle 34	-76.23422	-63.52187	-0.46010	9.53067	4.76534
)	Circle 36	-76.21164	-63.52140	-10.45210	9.50805	4.75402
2	Circle 30 🗏	-80.78039	-74.90525	0.00000	2.00000	1.00000
-	Line 5 Skew	-56.13519	0.00000	0.00000		
	Plane 31	-15.87173	-38.02728	-4.47516		
^	Line 29	-107.37187	-64.74135	0.00000		
-	Line 28	-57.14258	-75.89689	0.00000		
1	Line 22	0.00000	-76.28605	-9.86449		

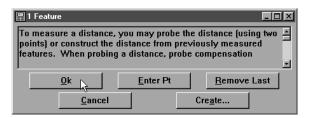


Click the distance button on the measure toolbar.



Measure Distance

Step 3





To construct a duplicate distance

Step 1 Use the mouse to highlight a distance on the features list.

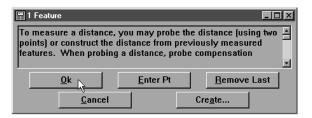
Program TruePos Features Report								
I 1	r Name	Datum	x	Y	Z	d	r	V
÷	Distance		0.00000	75.89689	0.00000			
/	Line 5	skew 🗟	-56.13519	0.00000	0.00000			
	Plane 31		-15.87173	-38.02728	-4.47516			
/	Line 29		-107.37187	-64.74135	0.00000			
/	Line 28		-57.14258	-75.89689	0.00000			
/	Line 22		0.00000	-76.28605	-9.86449			
•	Point 7	Zero	0.00000	0.00000	0.00000			
	Plane 4	Primary	-81.41003	-38.34949	0.00000			

Step 2

Click the distance button on the measure toolbar.



Step 3 Click OK in the dialog box.





To construct a reverse direction distance

Step 1

Use the mouse to highlight a duplicate distance on the features list.

Program TruePos Features Report								
ΙŢ	ſName Datum	X	Y	Z	d	r 🗸		
C	Circle 30	-80.78039	-74.90525	0.00000	2.00000	1.00000		
↔	Distance	0.14133	0.09306	16.16870				
⇒	Distance	0.14133	0.09306	16.16870				
/	Line 5 Skew	\$ -56.13519	0.00000	0.00000				
	Plane 31	-15.87173	-38.02728	-4.47516				
/	Line 29	-107.37187	-64.74135	0.00000				
/	Line 28	-57.14258	-75.89689	0.00000				
/	Line 22	0.00000	-76.28605	-9.86449				
•	Point 7 Zero	0.00000	0.00000	0.00000		ĺ		

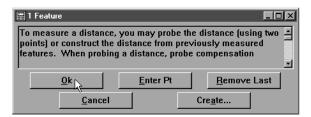
Step 2

Click the distance button on the measure toolbar.



Step 3

Right click in the results window and select reverse distance from the list.





To construct an absolute distance

Step 1

Use the mouse to highlight a duplicate distance on the features list.

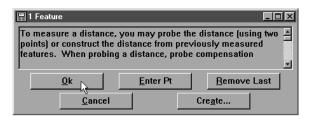
涯 Fe	atures						_ 🗆 🗵	
Program TruePos Features Report								
I	T Name Dat:	am	X	Y	Z	d	r 🗸	
0	Circle 30		-80.78039	-74.90525	0.00000	2.00000	1.00000	
↔	Distance		0.14133	0.09306	16.16870			
↔	Distance		0.14133	0.09306	16.16870			
/	Line 5 Ske	, K	-56.13519	0.00000	0.00000			
	Plane 31		-15.87173	-38.02728	-4.47516			
/	Line 29		-107.37187	-64.74135	0.00000			
/	Line 28		-57.14258	-75.89689	0.00000			
/	Line 22		0.00000	-76.28605	-9.86449			
i	Point 7 Zer		0.00000	0.00000	0.00000		i i i i i i i i i i i i i i i i i i i	

Step 2

Click the distance button on the measure toolbar.

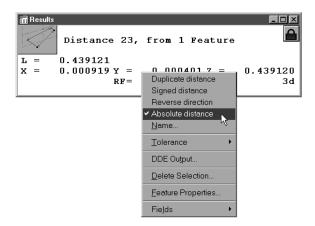


Step 3 Click OK in the dialog box.



Step 4

Right click in the results window and select absolute distance from the list.





To construct a center to center distance

Step 1

Use the mouse to highlight 2 positional features on the features list.

Program TruePos Features Report								
I	T Name	Datum	X	Y	Z	d	r V	
>	Sphere 19		20.20608	0.89845	57.09007	25.38728	12.69364	
\$	Cone 10		-114.21462	-19.04309	-14.66127		5.02601	
)	Circle 43		-76.22959	-63.52107	0.00000	9.52508	4.76254	
)	Circle 40		-76.42521	-12.78369	0.00000	9.51376	4.75688	
)	Circle 30	13	-80.78039	-74.90525	0.00000	2.00000	1.00000	
^	Line 5	Skew	-56.13519	0.00000	0.00000			
7	Plane 31		-15.87173	-38.02728	-4.47516			
^	Line 29		-107.37187	-64.74135	0.00000			
<u>_</u>	Line 28		-57.14258	-75.89689	0.00000			

Step 2

Click the distance button on the measure toolbar.



Measure Distance

Step 3 Click OK in the dialog box.

🚆 2 Features		
To measure a distance points) or construct the features. When probin	distance from previ	iously measured 👘 👘
<u>Ok</u> Cancel	Enter Pt	Remove Last



To construct a farthest edge distance

Step 1

Use the mouse to highlight 2 positional features on the features list.

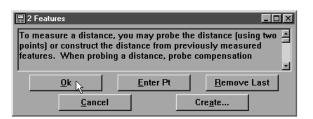
Program TruePos Features Report								
I	T Name	Datum	X	Y	Z	d	r V	
0	Sphere 19		20.20608	0.89845	57.09007	25.38728	12.69364	
۵.	Cone 10		-114.21462	-19.04309	-14.66127		5.02601	
С	Circle 43		-76.22959	-63.52107	0.00000	9.52508	4.76254	
С	Circle 40		-76.42521	-12.78369	0.00000	9.51376	4.75688	
С	Circle 30	13	-80.78039	-74.90525	0.00000	2.00000	1.00000	
-	Line 5	Skew	-56.13519	0.00000	0.00000			
0	Plane 31		-15.87173	-38.02728	-4.47516			
/	Line 29		-107.37187	-64.74135	0.00000			
<	Line 28		-57.14258	-75.89689	0.00000			
•								

Step 2

Click the distance button on the measure toolbar.

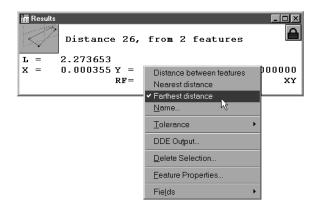


Step 3 Click OK in the dialog box.



Step4

Right click in the results window and select farthest distance from the list.





To construct a nearest edge distance

Step 1

Use the mouse to highlight 2 positional features on the features list.

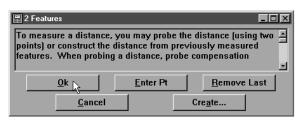
Program TruePos Features Report									
I 7	Г Name	Datum	X	Y	Z	d	r V		
>	Sphere 19		20.20608	0.89845	57.09007	25.38728	12.69364		
\$	Cone 10		-114.21462	-19.04309	-14.66127		5.02601		
)	Circle 43		-76.22959	-63.52107	0.00000	9.52508	4.76254		
)	Circle 40		-76.42521	-12.78369	0.00000	9.51376	4.75688		
)	Circle 30	13	-80.78039	-74.90525	0.00000	2.00000	1.00000		
-	Line 5	Skew	-56.13519	0.00000	0.00000				
	Plane 31		-15.87173	-38.02728	-4.47516				
^	Line 29		-107.37187	-64.74135	0.00000				
_	Line 28		-57.14258	-75.89689	0.00000				

Step 2

Click the distance button on the measure toolbar.



Step 3 Click OK in the dialog box.



Step4

Right click in the results window and select nearest distance from the list.

Besults Distance 26,	, from 2 features	
L = 1.722053 X = 0.000269 Y = RF=	1.722053 z = 0. Ref #1 PP=	. 000000 XY
<u> </u>	Distance between features ✓ Nearest distance Farthest distance <u>N</u> ame	
	Tolerance	-
	Delete Selection	-
	Fie <u>l</u> ds •	



To construct a distance from a positional feature perpendicular to a linear feature

Step 1

Use the mouse to highlight a positional feature and a linear feature on the features list.

	atures ram TruePos						
Prog							
II	Name I)atum	X	Y	Z	d	r V
۵.	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
0	Circle 43		-76.22959	-63.52107	0.00000	9.52508	4.76254
0	Circle 40		-76.42521	-12.78369	0.00000	9.51376	4.75688
С	Circle 30		-80.78039	-74.90525	0.00000	2.00000	1.00000
/	Line 5 S	škev	-56.13519	0.00000	0.00000		
	Plane 31		-15.87173	-38.02728	-4.47516		
/	Line 29		-107.37187	-64.74135	0.00000		
/	Line 28	N	-57.14258	-75.89689	0.00000		
<u></u>	Line 22	43	0.00000	-76.28605	-9.86449		
							2

Step 2

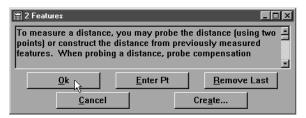
Click the distance button on the measure toolbar.



Measure Distance

Step 3

Click OK in the dialog box.





To construct the nearest to line distance

Step 1

Use the mouse to highlight a circle (or arc) and a line on the features list.

繮Fe	atures					
Prog	gram TruePos Features	Report				
1 3	T Name Datum	X	Y	Z	d	r 🗸
0	Cone 10	-114.21462	-19.04309	-14.66127		5.02601
0	Circle 43	-76.22959	-63.52107	0.00000	9.52508	4.76254
0	Circle 40	-76.42521	-12.78369	0.00000	9.51376	4.75688
0	Circle 30	-80.78039	-74.90525	0.00000	2.00000	1.00000
/	Line 5 Skew	-56.13519	0.00000	0.00000		
	Plane 31	-15.87173	-38.02728	-4.47516		
/	Line 29	-107.37187	-64.74135	0.00000		
/	Line 28	-57.14258	-75.89689	0.00000		
í.	Line 22 V	0.00000	-76.28605	-9.86449		

Step 2

Click the distance button on the measure toolbar.



Step 3 Click OK in the dialog box.

2 Features
 To measure a distance, you may probe the distance (using two points) or construct the distance from previously measured features. When probing a distance, probe compensation

Step 4

Right click in the results window and select nearest to line distance from the list.

Results	Distance 29,	from 2 features	
L = X =	0.410985 0.000020 Y = RF=	Center to line distance Vearest to line distance Farthest to line distance Name Iolerance DDE Output Delete Selection Eeature Properties Fields Veare	000000 XY



To construct the farthest to line distance

Step 1

Use the mouse to highlight a circle (or arc) and a line on the features list.

Cone 10 -114.21462 -19.04309 -14.66127 O Circle 43 -76.22599 -63.52107 0.00000 9.525 O Circle 40 -76.42521 12.78369 0.00000 9.513	Program TruePos Features Report									
Cone 10 -114.21462 -19.04309 -14.66127 Circle 43 -76.22599 -63.52107 0.00000 9.525 Circle 40 -76.42529 -63.52107 0.00000 9.513 Circle 30 -76.42521 -112.78369 0.00000 9.513 Circle 30 -80.78039 -74.90525 0.00000 2.000 Line 5 Skew -56.13519 0.00000 0.00000 Plane 31 -15.87173 -38.02728 -4.47516	r V	d	Z	Y	X	Datum	Name	Т		
Circle 43 -76.22959 -63.52107 0.00000 9.525 Circle 40 -76.42521 -12.78369 0.00000 9.513 Circle 30 -80.78039 -74.90525 0.00000 2.000 Line 5 Skew -56.13519 0.00000 0.00000 Plane 31 -15.87173 -38.02728 -4.47516	8 12.69364	25.38728	57.09007	0.89845	20.20608)	Sphere 19)		
Circle 40 -76.42521 -12.78369 0.00000 9.513 Circle 30 -80.78039 -74.90525 0.00000 2.000 Line 5 Skew -56.13519 0.00000 0.00000 Plame 31 -15.87173 -38.02728 -4.47516	5.02601		-14.66127	-19.04309	-114.21462		Cone 10	5		
Circle 30 1 → -80.78039 -74.90525 0.00000 2.000 Line 5 Skew -56.13519 0.00000 0.00000 Plane 31 -15.87173 -38.02728 -44.47516	8 4.76254	9.52508	0.00000	-63.52107	-76.22959		Circle 43)		
Line 5 Skew -56.13519 0.00000 0.00000 Plane 31 -15.87173 -38.02728 -4.47516	6 4.75688	9.51376	0.00000	-12.78369	-76.42521		Circle 40)		
Plane 31 -15.87173 -38.02728 -4.47516	0 1.00000	2.00000	0.00000	-74.90525	-80.78039) K	Circle 30)		
			0.00000	0.00000	-56.13519	Skew	Line 5	-		
Line 29 -107.37187 -64.74135 0.00000			-4.47516	-38.02728	-15.87173		Plane 31	2		
			0.00000	-64.74135	-107.37187		Line 29	-		
Line 28 -57.14258 -75.89689 0.00000	_		0.00000	-75.89689	-57.14258		Line 28			

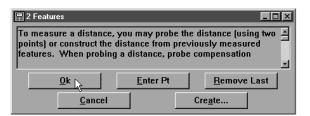
Step 2

Click the distance button on the measure toolbar.



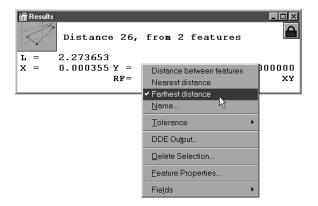
Step 3

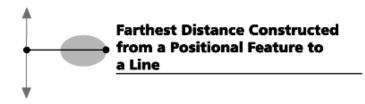
Click OK in the dialog box.



Step 4

Right click in the results window and select farthest to line distance from the list.





To construct a distance from a positional feature to a plane

Step 1

Use the mouse to highlight a positional feature and a plane on the features list.

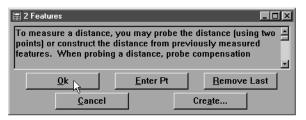
Т	Name	Datum	X	Y	Z	d	r V
1	Circle 43	3	-76.22959	-63.52107	0.00000	9.52508	4.76254
)	Circle 40)	-76.42521	-12.78369	0.00000	9.51376	4.75688
•	Line 5	Skew	-56.13519	0.00000	0.00000		
	Line 22		0.00000	-76.28605	-9.86449		
	Point 7	Zero	0.00000	0.00000	0.00000		
i	Plane 4	Primary	-81.41003	-38.34949	0.00000		

Step 2

Click the distance button on the measure toolbar.



Step 3 Click OK in the dialog box.





To construct a center to plane distance from a sphere

Step 1

Use the mouse to highlight a sphere and a plane on the features list.

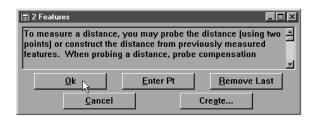
700	gram TruePo:	s Features R	eport				
1	r Name	Datum	X	Y	Z	d	r V
)	Sphere 45		-116.84195	-20.68549	1515.49623	2000.00000	1000.00000
1	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Circle 43		-76.22959	-63.52107	0.00000	9.52508	4.76254
)	Circle 40		-76.42521	-12.78369	0.00000	9.51376	4.75688
-	Line 5	Skew	-56.13519	0.00000	0.00000		
-	Line 22		0.00000	-76.28605	-9.86449		
	Point 7	Zero	0.00000	0.00000	0.00000		
j.	Plane 4	Primary	-81.41003	-38.34949	0.00000		

Step 2

Click the distance button on the measure toolbar.



Step 3 Click OK in the dialog box.





To construct the nearest plane distance from a sphere

Step 1

Use the mouse to highlight a sphere and a plane on the features list.

Prog	ram TruePos I	Features Repo	rt				
: Т	Name Da	itum	x	Y	Z	d	r V
	Sphere 45		-116.84195	-20.68549	1515.49623	2000.00000	1000.00000
	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Circle 43		-76.22959	-63.52107	0.00000	9.52508	4.76254
)	Circle 40		-76.42521	-12.78369	0.00000	9.51376	4.75688
	Line 5 Sk	ew	-56.13519	0.00000	0.00000		
	Line 22		0.00000	-76.28605	-9.86449		
	Point 7 Ze	ro	0.00000	0.00000	0.00000		
	Plane 4 Pr	imary	-81.41003	-38.34949	0.00000		
		4					

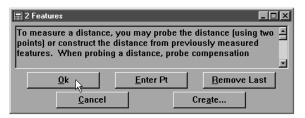
Step 2

Click the distance button on the measure toolbar.



Step 3

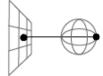
Click OK in the dialog box.



Step 4

Right click in the results window and select nearest plane distance from the list.

I Results	
Distance 34,	from 2 features 💻
L = 1.647266	
X = 0.00000 Y =	0.000000 z = 1.647266
RF=	Center to plane distance 3d
<u> </u>	 Nearest plane distance
	Farthest plane distance 🕅
	Name
	Tolerance
	DDE Output
	Delete Selection
	<u>F</u> eature Properties
	Fields



Distance Constructed from the Farthest Point on a Sphere to a Plane

To construct the farthest plane distance from a sphere

Step 1

Use the mouse to highlight a sphere and a plane on the features list.

rog	gram TruePo:	s Features F	leport				
Т	ſ Name	Datum	X	Y	Z	d	r V
)	Sphere 45		-116.84195	-20.68549	1515.49623	2000.00000	1000.00000
5	Cone 10		-114.21462	-19.04309	-14.66127		5.02601
)	Circle 43		-76.22959	-63.52107	0.00000	9.52508	4.76254
)	Circle 40		-76.42521	-12.78369	0.00000	9.51376	4.75688
-	Line 5	Skew	-56.13519	0.00000	0.00000		
-	Line 22		0.00000	-76.28605	-9.86449		
	Point 7	Zero	0.00000	0.00000	0.00000		
1	Plane 4	Primary	-81.41003	-38.34949	0.00000		

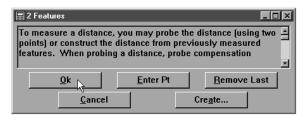
Step 2

Click the distance button on the measure toolbar.



Step 3

Click OK in the dialog box.



Step 4

Right click in the results window and select farthest plane distance from the list.

Distance 34,	from 2 features	
L = 2.746320 X = 0.000000 Y = RF=	Center to plane distance Nearest plane distance ✓ Farthest plane distance	746320 3d
	Name K	
	DDE Output Delete Selection Eeature Properties	
	Fields	



To construct a bounded line distance from 2 lines

Step 1

Use the mouse to highlight 2 lines on the features list.

- 1		s Features R	<u> </u>		- 1		
I	T Name	Datum	X	Y	Z	d	r
С	Circle 43	3	-76.22959	-63.52107	0.00000	9.52508	4.76254
С	Circle 40)	-76.42521	-12.78369	0.00000	9.51376	4.75688
<u>.</u>	Plane 48		-82.99210	-38.44109	-0.00015		
/	Line 47		-46.23867	-17.24484	0.00000		
/	Line 46		-55.79286	-19.50746	0.00000		
/	Line 5	Skew 🗟	-56.13519	0.00000	0.00000		
/	Line 22		0.00000	-76.28605	-9.86449		
•	Point 7	Zero	0.00000	0.00000	0.00000		

Step 2

Click the distance button on the measure toolbar.



Step 3 Click OK in the dialog box

🛱 2 Features		_ 🗆 🗵
To measure a distance, y points) or construct the d features. When probing	listance from previo	usly measured 🛛 🗖
<u>0</u> k N	Enter Pt	Remove Last



To construct a nearest bounded line distance from 2 lines

Step 1

Use the mouse to highlight 2 lines on the features list.

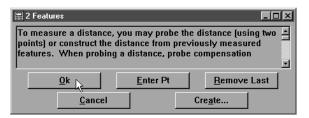
Prog	gram TruePo:	s Features Re	eport				
I '	Г Name	Datum	X	Y	Z	d	r V
5	Circle 43		-76.22959	-63.52107	0.00000	9.52508	4.76254
)	Circle 40		-76.42521	-12.78369	0.00000	9.51376	4.75688
2	Plane 48		-82.99210	-38.44109	-0.00015		
	Line 47		-46.23867	-17.24484	0.00000		
/	Line 46	N	-55.79286	-19.50746	0.00000		
/	Line 5	Skew	-56.13519	0.00000	0.00000		
-	Line 22		0.00000	-76.28605	-9.86449		
•	Point 7	Zero	0.00000	0.00000	0.00000		

Step 2

Click the distance button on the measure toolbar.

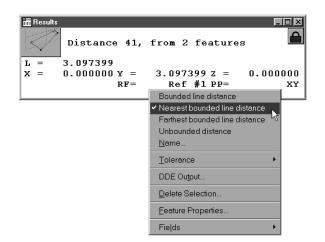


Step 3 Click OK in the dialog box.



Step 4

Right click in the results window and select nearest bounded line distance from the list.





To construct a farthest bounded line distance from 2 lines

Step 1

Use the mouse to highlight 2 lines on the features list.

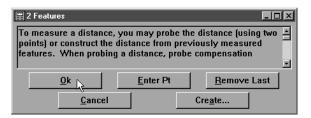
Pro	gram TruePo	s Features Re	:port				
I I	T Name	Datum	X	Y	Z	d	r V
2	Circle 43)	-76.22959	-63.52107	0.00000	9.52508	4.76254
D	Circle 40)	-76.42521	-12.78369	0.00000	9.51376	4.75688
9	Plane 48		-82.99210	-38.44109	-0.00015		
1	Line 47		-46.23867	-17.24484	0.00000		
/	Line 46		-55.79286	-19.50746	0.00000		
/	Line 5	Skew	-56.13519	0.00000	0.00000		
^	Line 22		0.00000	-76.28605	-9.86449		
•	Point 7	Zero	0.00000	0.00000	0.00000		

Step 2

Click the distance button on the measure toolbar.

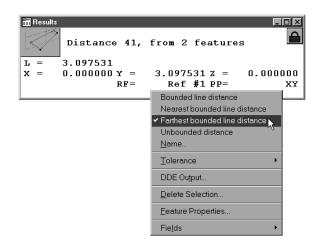


Step 3 Click OK in the dialog box.



Step 4

Right click in the results window and select farthest bounded line distance from the list.





To construct an unbounded distance from 2 linear features

Step 1 Use the mouse to highlight 2 linear features on the features list.

Prog	jram TruePo	s Features R	eport				
I.	Г Name	Datum	X	Y	Z	d	r 🗸
5	Circle 43		-76.22959	-63.52107	0.00000	9.52508	4.76254
С	Circle 40	1	-76.42521	-12.78369	0.00000	9.51376	4.75688
/	Line 49		-108.33709	-43.04111	0.00000		
	Plane 48		-82.99210	-38.44109	-0.00015		
/	Line 46	N	-55.79286	-19.50746	0.00000		
/	Line 5	Skew 🗟	-56.13519	0.00000	0.00000		
^	Line 22		0.00000	-76.28605	-9.86449		
•	Point 7	Zero	0.00000	0.00000	0.00000		

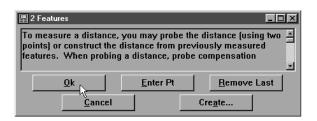
Step 2

Click the distance button on the measure toolbar.



Measure Distance

Step 3 Click OK in the dialog box.



Step 4 Right click in the results window and select unbounded distance from the list.

Results	•	, from 2 features
T =		
x =		0.000000 z = 0.000000 Ref #1 PP= XY
		Bounded line distance Nearest bounded line distance Farthest bounded line distance V Unbounded distance Name Tolerance
		DDE Output
		Delete Selection
		<u>F</u> eature Properties
		Fie <u>l</u> ds •



Distance Constructed from the Nearest Point on a Sphere to a Plane

To construct a distance between 2 co-axial planes

Step 1

Use the mouse to highlight 2 co-axial planes on the features list.

Program TruePos Features Report								
I 7	Г Name	Datum	X	Y	Z	d	r V	
\$	Cone 10		-114.21462	-19.04309	-14.66127		5.02601	
Â	Plane 51		-81.19483	-38.76607	46.02579			
3	Plane 48		-82.99210	-38.44109	-0.00015			
/	Line 5	SKÉW	-56.13519	0.00000	0.00000			
-	Line 22		0.00000	-76.28605	-9.86449			
•	Point 7	Zero	0.00000	0.00000	0.00000			

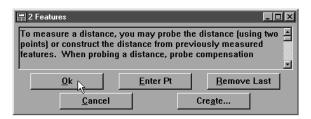
Step 2

Click the distance button on the measure toolbar.



Measure Distance

Step 3 Click OK in the dialog box.



Angle Constructions



To construct an angle from 2 linear features

Step 1 Use the mouse to highlight 2 linear features on the features list.

1	T Name	Datum	x	Y	Z	d	r
>	Cone 10		-114.21462	-19.04309	-14.66127		5.02603
	Line 53		-108.66420	-33.48240	0.00000		
	Line 52	N	-46.21031	-18.64324	0.00000		
	Plane 48	NS.	-82.99210	-38.44109	-0.00015		
-	Line 5	Skew	-56.13519	0.00000	0.00000		
^	Line 22		0.00000	-76.28605	-9.86449		
	Point 7	Zero	0.00000	0.00000	0.00000		



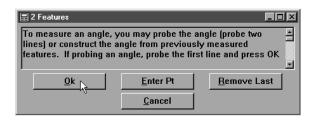
Click the angle button on the measure toolbar.



Measure Angle

Step 3

Click OK in the dialog box.



Each part file you create is an electronic record of the part and its inspection results. For this reason it is important to save a new part file for each part you inspect.



Create a new file for each part inspected. This ensure a unique record for every inspection. Failing to create a new file for each part will result in loss of data and records.

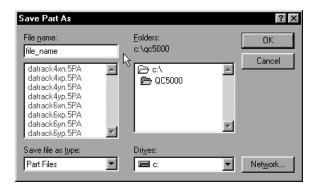
To save a part file

Step 1 Select save as from the file menu.

<u>F</u> ile
<u>N</u> ew ►
<u>O</u> pen
<u>S</u> ave
Save <u>A</u> s
Import
Export
DDE Ou <u>t</u> put
Page Set <u>u</u> p
Print Pre <u>v</u> iew
<u>P</u> rint
E <u>x</u> it
<u>1</u> . A:\TEST123.5PA
 A:\adb cpktest.5pa



Type a name for the part file in the file name text box in the dialog box.



Step 3 Select a storage location for the file using the folders box and/or drives box.

Save Part As		? ×
File <u>n</u> ame: file_name	<u>F</u> olders: c:\qc5000_parts_files	ОК
×	C:\ A c:\ A c:\ A c:SOU0_parts_files	Cancel
Save file as <u>type:</u> Part Files	Drives:	Network



Step 4 Click OK in the dialog box.

Save Part As		? ×
File <u>n</u> ame: file_name	Eolders: c:\qc5000_parts_files	ОК
A	🗁 c:\ 🗾 🗡	Cancel
	•	
Save file as <u>t</u> ype: Part Files	Drives:	Net <u>w</u> ork

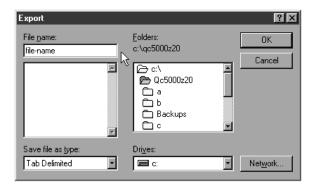
To export to a CAD file

Step 1 Select export from the file menu.

<u>F</u> ile
<u>N</u> ew •
<u>O</u> pen
<u>S</u> ave
Save <u>A</u> s
Import
Export
DDE Output
Page Set <u>u</u> p
Print Pre⊻iew
<u>P</u> rint
E <u>x</u> it



Type a name for the part file in the file name text box in the dialog box.





Select DXF in the save file as type pull down list.

Export			? ×
File <u>n</u> ame: file-name	<u>F</u> olders: c:\qc5000z20	OK Cancel	
375804.DXF CTARGET.DXF QUICKIE.DXF v vv.DXF XHAIR.DXF	[← c:\		
Save file as type:	Dri <u>v</u> es:	▼ Net <u>w</u> ork	
Access Database CSV DXF IGS Points (CSV) Points (DXF) Tab Delimited			

Step 4 Select a storage location for the file using the folders box and/or drives box.

Export		? ×
File <u>n</u> ame: file-name	<u>F</u> olders: c:\qc5000z20	ОК
r	C c:\ D Qc5000z20 a b B Backups c c	Cancel
Save file as <u>type:</u> Tab Delimited	Dri <u>v</u> es:	Network



Export		? ×
File <u>n</u> ame: file-name	<u>F</u> olders: c:\qc5000z20	ОК
375804.DXF CTARGET.DXF QUICKIE.DXF v vv.DXF XHAIR.DXF	C c:\ C Qc5000z20 a b Backups c c	Cancel
Save file as type: DXF	Drives:	▼ Net <u>w</u> ork

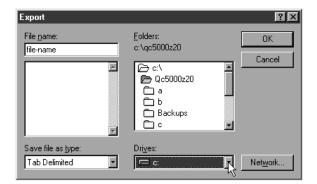
To export to SPC software

Step 1 Select export from the file menu.

<u>F</u> ile
<u>N</u> ew •
<u>O</u> pen
<u>S</u> ave
Save <u>A</u> s
Import
Export
DDE Output
Page Set <u>u</u> p
Print Pre⊻iew
<u>P</u> rint
E <u>x</u> it



Type a name for the part file in the file name text box in the dialog box.





Select tab delimited (or other format specified by SPC software) in the save file as type pull down list.

Export		? ×
File <u>n</u> ame: file-name.mdb	<u>F</u> olders: c:\qc5000z20	ОК
×	 C:\ C:\ Qc5000z20 a b Backups c 	Cancel
Save file as <u>t</u> ype:	Dri <u>v</u> es:	
Tab Delimited Access Database CSV DXF IGS Points (CSV) Points (DXF) Tab Delimited	Ξ α:	Network

Step 4 Select a storage location for the file using the folders box and/or drives box.

Export		?×
File <u>n</u> ame: file-name	<u>F</u> olders: c:\qc5000z20	ОК
	C c:\ C Qc5000z20 a b Backups c c	
Save file as <u>type:</u> Tab Delimited	Dri <u>v</u> es:	Network



Export		?×
File <u>n</u> ame: file-name	<u>F</u> olders: c:\qc5000z20	ОК
375804.DXF CTARGET.DXF QUICKIE.DXF v vv.DXF XHAIR.DXF	C c:\ C Qc5000z20 a b Backups c c	Cancel
Save file as type: DXF	Dri <u>v</u> es:	▼ Net <u>w</u> ork

To export to Microsoft Access



Make sure Access is open before exporting. QC5000 data cannot be exported if Access is closed.

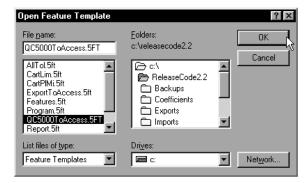
Step 1

Select open template from the windows menu.



Step 2

Open the QC5000ToAccess. 5ft template as shown.



NOTE

The QC5000ToAccess.5ft template is located in the *c:\qc5000* directory.

The QC5000ToAccess. 5ft templates appears as shown.

Name	r	d	X	Y	Z
Plane 1			3.25083	1.60275	0.00000
Line 2			2.79112	0.00000	-0.03383
Line 3			-0.00297	1.55535	-0.36903
Point 4			0.00000	0.00000	-0.20143
Cylinder 5	0.32619	0.65238	3.03047	1.53875	-0.27432
Cone 7	0.16165		4.53097	0.78854	-0.55130
Slot 10	0.13918	0.27837	4.34276	1.53850	-0.05525
Circle 13	0.15932	0.31865	3.02648	2.53612	-0.01553
Line 22			4.25858	2.64892	-0.05597
Plane 24			0.64873	1.57736	0.00000

Step 3 Select *export* from the file menu.



Step 4

Select the desired database as shown and click OK.

Export		? ×
File <u>n</u> ame: QC5000_AC97.MDB	Eolders: c:\releasecode2.2\exports	ок
QC5000.MDB QC5000_AC2000_mdb QC5000_AC97.MDB	C:\ ReleaseCode2.2 Exports	Cancel
Save file as <u>type:</u> Access Database	Drives:	Net <u>w</u> ork

There are three pre-defined exportable databases. Use QC5000_AC2000.mdb and QC5000_AC97.MDB to export to Access2000 and Access97 respectively. Use QC5000.mdb to export to all other database applications.

Pre-defined databases are stored in the *c:\qc5000\exports* directory.

Step 5

Enter the table name as shown and click OK.

Export To	Table	×
Table:	featuresdata1	ОК
		Cancel

Type the name featuresdata1 when using the pre-defined QC5000 databases.

Step 6

Open Access to view the data in the table.

ID	Name	X	Y	Z	Q	R	D
	Point 1	0.00000	0.00000	0.00000		0	0
	2 Arc 16	4.49915	0.75079	-0.00452		0.74760	1.49519
	3 Cylinder 5	2.99987	1.50005	-0.26897		0.37559	0.75117
	4 Cone 9	4.49934	0.74942	-0.57706		0.19402	0
	5 Circle 7	2.99767	2.49862	0.00879		0.19065	0.38130
	6 Slot 10	4.31206	1.49972	-0.02523		0.18841	0.37682
	7 Plane 1	3.24942	1.60329	0.00000		0	0
	8 Line 2	2.25594	0.00000	-0.39735		0	0
	9 Line 3	-0.00069	1.46248	-0.39766		0	0
	10 Point 4	0.00000	0.00000	-0.39751		0	0
	11 Cylinder 5	2.99987	1.50005	-0.26897		0.37559	0.75117
	12 Circle 6	2.99943	0.50170	-0.03398		0.18747	0.37493
	13 Circle 7	2.99767	2.49862	0.00879		0.19065	0.38130
	14 Cone 9	4.49934	0.74942	-0.57706		0.19402	0
	15 Slot 10	4.31206	1.49972	-0.02523		0.18841	0.37682

Chapter 5 Advanced Measuring & Output

Datum Magic

Datum magic is an automated tool designed to help the user create a datum. A series of dialog boxes guides the user to create the primary plane, secondary alignment, and tertiary alignment. Using datum magic is the fastest and easiest way to establish a datum on most parts.

Datum magic requires the use of a primary plane. Primary cones and cylinders are not allowed with datum magic.

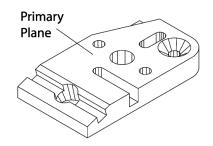
To create a datum using datum magic

Step 1 Click the *datum magic* button on the datum toolbar.



Step 2

Measure three points on the plane as shown.



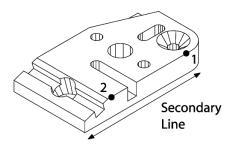


Click OK in the dialog box.



Step 4

Probe two points on the secondary line as shown.

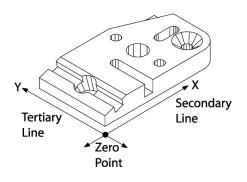


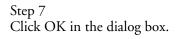
Step 5 Click OK in the dialog box.

🚆 Datum Magic		
	2 Pts	
	tip_1	
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	<u>C</u> ancel	



Probe two points on the tertiary alignment as shown.





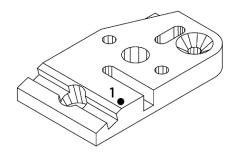
📰 Datum Magic		- D ×
	2 Pts	
	tip_1	
	Enter Pt	<u>R</u> emove Last
ry.	<u>C</u> ancel	

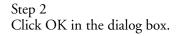
Measure Magic

Measure magic is an automated tool designed to help the user measure features. Activate measure magic by probing a feature. Click OK in the measure magic dialog box to complete the measurement. The new feature will appear in the part view window and on the features list. Use measure magic to measure the following types of features: points, lines, arcs, circles, planes, cones, cylinders, spheres. Measure magic cannot measure slots, distances, or angles.

To measure a point using measure magic

Step 1 Probe the point as shown.



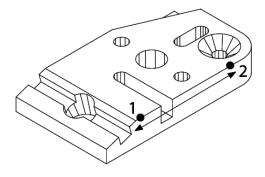


🚆 Measure Magic		
	1 Pt	
	tip_1	
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	<u>C</u> ancel	

To measure a line using measure magic (2 points)

Step 1

Probe two points on the line as shown.

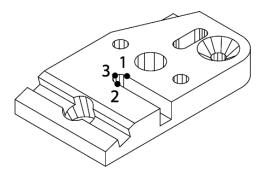


Step 2 Click OK in the dialog box.

🗒 Measure Magic		
	2 Pts	
	tip_1	
	<u>E</u> nter Pt	<u>R</u> emove Last
· · · ·	<u>C</u> ancel	

To measure an arc using measure magic (3 points)

Step 1 Probe three points on the arc as shown.



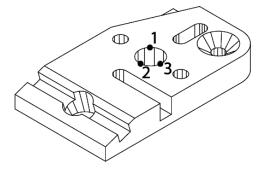
Step 2 Click OK in the dialog box.

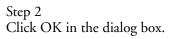
🚆 Measure Magic		
	3 Pts	
	tip_1	
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	<u>C</u> ancel	

To measure a circle using measure magic (3 points)

Step 1

Probe three points on the circle as shown.

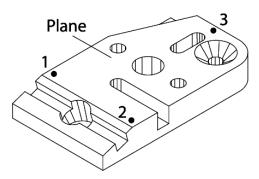






To measure a plane using measure magic (3 points)

Step 1 Probe three points on the plane as shown.

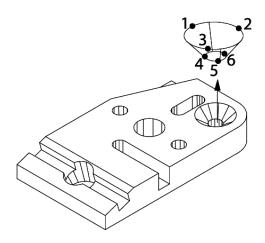


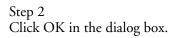
Step 2 Click OK in the dialog box.

📰 Measure Magic		
	3 Pts	
	tip_1	
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	<u>C</u> ancel	

To measure a cone using measure magic (6 points)

Step 1 Probe six points on the cone as shown.

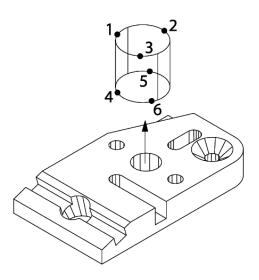


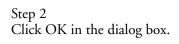


🗒 Measure Magic		
	6 Pts	
	tip_1	
<u>0</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	<u>C</u> ancel	

To measure a cylinder using measure magic (6 points)

Step 1 Probe six points on the cylinder as shown.

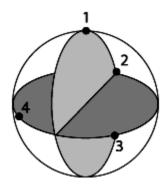




🛱 Measure Magic		
	6 Pts	
	tip_1	
<u>k</u>	<u>E</u> nter Pt	<u>R</u> emove Last
- K	<u>C</u> ancel	

To measure a sphere using measure magic (4 points)

Step 1 Probe four points on the sphere as shown.



Step 2 Click OK in the dialog box.

🗒 Measure Magic		
	4 Pts	
	tip_1	
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	<u>C</u> ancel	

The part view window is made up of layers similar to a CAD drawing. Each layer contains features and can be displayed alone or with other layers. This allows the user to sort features into related groups and assign them to one layer. Layers can be hidden from view, turned on/off, and assigned colors.

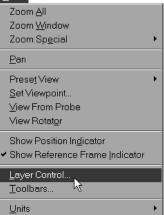
Assign features that are related or likely to be viewed together to the same layer. This allows features to be selected as layer instead of selecting each feature individually.

The features in the following procedures are for demonstration purposes only. These procedures will work with any features you choose.

To create a new layer

Step 1 Select *layer control* from the view menu.

⊻iew





Click the *new* button in the dialog box.

Layer Control		×
√☆ Default Layer ⊗ World	<u>N</u> ew	ОК
Ref #1	Delete	Cancel
	<u>R</u> ename	Apply
	<u>S</u> et Current	
	Set <u>C</u> olor	
□ <u>O</u> ff □ Hide In <u>P</u> art View □ <u>I</u> ransparent		

Step 3

Type the desired name of the new layer in the text box and click OK.

New Lay	er	X
Name	new_layer	ОК
		Cancel

This demonstration uses layers named as follows:

- Primary Layer
- Cylinders
- Distances

Create these layers to follow along with this demonstration.

Current Layer

All new features are assigned to the current layer.

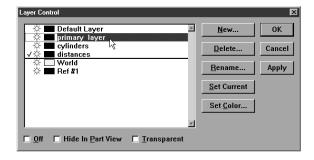
To set a layer as current

Step 1 Select *layer control* from the view menu.

⊻iew
Zoom <u>A</u> ll
Zoom <u>W</u> indow
Zoom Sp <u>e</u> cial •
<u>P</u> an
Prese <u>t</u> View
<u>S</u> et Viewpoint
⊻iew From Probe
View Rotat <u>o</u> r
Show Position In <u>d</u> icator
 Show Reference Frame Indicator
Layer Control
Toolbars 🕅
<u>U</u> nits ►

Step 2

Highlight the desired layer as shown.



Step 3 Click the *set current* button. A checkmark indicates that the layer is now the current layer.

Layer Control	×
Default Layer	<u>N</u> ew OK
	Delete Cancel
☆	<u>R</u> ename Apply
	Set Current
	Set <u>C</u> olor
🗖 Off 🔲 Hide In Part View 🔲 Iransparent	



Step 4 Click OK in the dialog box.

Layer Control		×
	<u>N</u> ew	ОК
Cylinders	Delete	Cancel
☆	<u>R</u> ename	Apply
	Set Current	
	Set <u>C</u> olor	
v		
🗖 Off 🔲 Hide In Part View 🔲 <u>T</u> ransparent		

To assign features to new layers

Step 1

Select the desired features from the features list.

1	[Name	Datum		X	Y	Z	d	r
7	Plane 1	Primary		3.21868	1.62520	0.00000		
~	Line 2	Skew		0.00000	1.49036	-0.39204		
	Line 3			2.17580	-0.00110	-0.39047		
	Point 4	Zero		0.00000	0.00000	-0.39125		
)	Cylinder		43	3.00304	1.54838	-0.19314	0.75196	0.375
5	Cone 12			4.48106	0.75825	-0.57692		0.206
	Slot 13			4.31398	1.51320	-0.05594	0.37630	0.188
•	Line 14			1.79343	0.82693	-0.04518		
-	Line 16			2.16950	0.81308	-0.04561		
	Arc 18			2.00142	1.57309	-0.09430	0.37594	0.187
1	Plane 19			2.83072	0.06706	-0.14923		

Hold down the ctrl key to make multiple selections.

Step 2

Right click and select *features properties* from the list.

扫 Fee							
ΙT	Name	Datum	X	Y	Z	d	r 🔺
	Plane 1	Primary	3.21868	1.62520	0.00000		
1	Line 2	Skew	0.00000	1.49036	-0.39204		
<u> </u>	Line 3		2.17580	-0.00110	-0.39047		
•	Point 4	Zero	Feature Properti	p.00000	-0.39125		
0	Cylinder		- realare rippena		-0.19314	0.75196	0.3759
0	Cone 12		Cuţ).75825	-0.57692		0.2065
Ō	Slot 13		Copy	51320	-0.05594	0.37630	0.1881
<u> </u>	Line 14		Delete Selection		-0.04518		
-	Line 16			.81308	-0.04561		
<u>_</u>	Arc 18		Select All	57309	-0.09430	0.37594	0.1879
	Plane 19		C <u>h</u> ange Feature	• 06706	-0.14923		•
			Print Selection				
			Template Prope	rties			
			New Template				
			Open Template.				
			Save Templates				
			Save Template	4.s			



Select the desired layer from the layers pull down list.

eature Properties General				ОК
Name:	Type:	Flavor:	Run:	Cancel
Projection: * Display	Reference Frame Ref #1	∶Layer: Default Layer ⊂Default Layer		
☐ Hidden ☑ Phantom ☐ Guide	Show Note Show Name	primary_layer cylinders distances	Quantization:	
Note:		12.000000000		

Step 4 Click OK in the dialog box.

General				ОК
Name:	Туре:	Flavor:	Run:	Canc
*		*	0	
Projection:	Reference Frame:	Layer:		
*	Ref #1	primary_layer	🗖 Unlocked	
Display		Point Filtration		
☐ Hidden	Show Note	Filtered		
Phantom	🗆 Show Name	Sigma factor:	Quantization:	
🗖 Guide		2.0000000000	0.00012	
Note:				

Chapter 5 Advanced Measuring & Output Displaying Layers

Hiding a layer allows the user to remove a layer (and its features) from the part view window. This allows other layers to be viewed without additional features cluttering the part view. Hidden features remain in the features list even though they are not visible in the part view window.

To hide a layer

Step 1

Select layer control from the view menu.

⊻iew
Zoom <u>A</u> ll
Zoom <u>W</u> indow
Zoom Sp <u>e</u> cial •
<u>P</u> an
Prese <u>t</u> View
<u>S</u> et Viewpoint
⊻iew From Probe
View Rotat <u>o</u> r
Show Position In <u>d</u> icator
 Show Reference Frame Indicator
Layer Control
<u>T</u> oolbars ゆ
<u>U</u> nits ►



Highlight the desired layer as shown.

Layer Control		X
	<u>N</u> ew	0К
	Delete	Cancel
World Ref #1	<u>R</u> ename	Apply
14	<u>S</u> et Current	
	Set <u>C</u> olor	
🗖 Off 🗖 Hide In Part View 🗖 Transparent		

Step 3

Check the *hide in part view* box as shown.

Layer Control			X
Default Layer	×	<u>N</u> ew	OK
V ↔ ■ primary_layer ↔ ■ cylinders		Delete	Cancel
☆ ■ distances ☆ □ World			
☆ 🔜 Ref #1		<u>R</u> ename	Apply
		Set Current	
		Set <u>C</u> olor	
	Y		
□ Off □ Hide In Part View □	[ransparent		

Step 4 Click OK in the dialog box.

Layer Control		X
Default Layer	<u>N</u> ew	ОК
	Delete	Cancel
☆ □ ustances ☆ □ World ☆ ■ Ref #1	Rename	Apply
	Set Current	
	Set Color	
☐ Off ► Hide In Part View ☐ Transparent		

To show a hidden layer

Step 1 Select *layer control* from the view menu.

⊻iew
Zoom <u>A</u> ll
Zoom <u>W</u> indow
Zoom Sp <u>e</u> cial
<u>P</u> an
Prese <u>t</u> View
<u>S</u> et Viewpoint
⊻iew From Probe
View Rotat <u>o</u> r
Show Position In <u>d</u> icator
 Show Reference Frame Indicator
Layer Control
Toolbars 🕅
Units



Highlight the desired layer as shown.

Layer Control		×
☆ ■ Default Layer ✓ ★ ■ primary layer	<u>N</u> ew	0K
	<u>D</u> elete	Cancel
Image: World Image: World Image: World	<u>R</u> ename	Apply
ht i	<u>S</u> et Current	
	Set <u>C</u> olor	
□ Off ☑ Hide In Part View □ Iransparent		

Step 3

Uncheck the *hide in part view* box as shown.

Layer Control		X
☆ ■ Default Layer ✓ ☆ ■ primary layer	<u>N</u> ew	0K
↔	Delete	Cancel
☆	<u>R</u> ename	Apply
	<u>S</u> et Current	
	Set <u>C</u> olor	
□ Off □ Hide In Part View □ Iransparent		



Click OK in the dialog box.

Layer Control		X
	<u>N</u> ew	ОК
Cylinders	<u>D</u> elete	Cancel
☆ 🗖 World ★ 🔳 Ref#1	<u>R</u> ename	Apply
	Set Current	
	Set <u>C</u> olor	
×		
🗖 Off 🗖 Hide In Part View 🗖 Iransparent		

Turning a layer off completely removes the layer (and its features) the the part view window and the part file itself. Features onlayers that are off are no longer displayed in the features list. Turn the layer on to restore the features to the features list and the part file.

To turn off a layer

Step 1

Selct *layer control* from the view menu.

⊻iew
Zoom <u>A</u> ll
Zoom <u>W</u> indow
Zoom Sp <u>e</u> cial
<u>P</u> an
Prese <u>t</u> View
<u>S</u> et Viewpoint
⊻iew From Probe
View Rotat <u>o</u> r
Show Position In <u>d</u> icator
✓ Show Reference Frame Indicator
Layer Control
Toolbars パ
<u>U</u> nits ▶

Step 2

Highlight the desired layer as shown.

Layer Control		X
☆ ➡ Default Layer ✓ ✓ ➡ primary layer	<u>N</u> ew	0К
	Delete	Cancel
Image: Second state Image: Second state Image: Second state Image: Second state	<u>R</u> ename	Apply
Ч¢	<u>S</u> et Current	
	Set <u>C</u> olor	
×		
🗖 Off 🔲 Hide In Part View 🔲 Iransparent		



Step 3 Check the *off* box as shown

Layer Control		×
☆ ■ Default Layer ✓ ☆ ■ primary layer	<u>N</u> ew	ОК
→ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	Delete	Cancel
→ World → Ref #1	<u>R</u> ename	Apply
	Set Current	
	Set Color	
F Off ☐ Hide In Part View ☐ Iransparent		

Step 4 Click OK in the dialog box.

Layer Control		×
☆	<u>N</u> ew	ОК
↔	<u>D</u> elete	Cancel
☆	<u>R</u> ename	Apply
	<u>S</u> et Current	
	Set <u>C</u> olor	
🗹 🔟 Hide In Part View 🔲 Transparent		

To turn on a layer

Step 1

Select *layer control* from the view menu.

⊻iew
Zoom <u>A</u> ll
Zoom <u>W</u> indow
Zoom Sp <u>e</u> cial
<u>P</u> an
Preset View
<u>S</u> et Viewpoint
⊻iew From Probe
View Rotat <u>o</u> r
Show Position In <u>d</u> icator
✓ Show Reference Frame Indicator
Layer Control
Toolbars 🕅
<u>U</u> nits ►

Step 2

Highlight the desired layer as shown.

Layer Control		×
Default Layer	<u>N</u> ew	OK
	Delete	Cancel
	Rename	Apply
茶 — Ref #1	Set Current	
	Set <u>C</u> olor	
🗹 Off 🔲 Hide In Part View 🔲 Iransparent		



Step 3 Uncheck the *off* box as shown.

Layer Control		×
☆ ■ Default Layer ▲ √☆ ■ primary layer	<u>N</u> ew	ОК
Cylinders	<u>D</u> elete	Cancel
☆ World ☆ Ref #1	<u>R</u> ename	Apply
	Set Current	
	Set Color	

Step 4

Click OK in the dialog box.

Layer Control		×
	<u>N</u> ew	ОК
	<u>D</u> elete	Cancel
☆ World ☆ ■ Ref #1	<u>R</u> ename	Apply
	Set Current	
	Set <u>C</u> olor	
-		
🗖 Off 🔲 Hide In Part View 🗖 Transparent		

Assign colors to distinguish layers from one another. For example, features used to construct the reference frame can be assigned to a layer. This layer can be assigned the color black. All features of this layer appear black in the part view window.

To assign a color to a layer

Step 1

Select *layer control* from the view menu.

⊻iew
Zoom <u>A</u> ll
Zoom <u>W</u> indow
Zoom Sp <u>e</u> cial
<u>P</u> an
Prese <u>t</u> View
<u>S</u> et Viewpoint
⊻iew From Probe
View Rotat <u>o</u> r
Show Position In <u>d</u> icator
✓ Show Reference Frame Indicator
Layer Control
Toolbars り
<u>U</u> nits ▶

Step 2

Highlight the desired layer as shown.

Layer Control		X
Default Layer	<u>N</u> ew	ОК
√☆ primary layer ☆ □ cylinders √ ☆ □ distances	<u>D</u> elete	Cancel
☆	<u>R</u> ename	Apply
	<u>S</u> et Current	
	Set <u>C</u> olor	
🗖 Off 🔲 Hide In <u>P</u> art View 🔲 <u>T</u> ransparent		

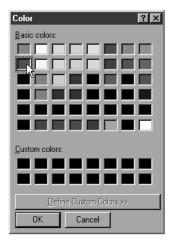


Step 3 Click the *set color* button.

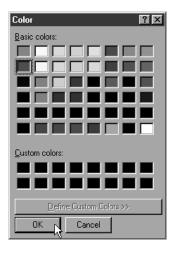
Layer Control		X
Default Layer	<u>N</u> ew	ОК
✓	Delete	Cancel
☆ 🗖 World ☆ ■ Ref #1	<u>R</u> ename	Apply
	<u>S</u> et Current	
	Set <u>C</u> olor	÷
× ×		
☐ Off ☐ Hide In Part View ☐ Iransparent		

Step 3

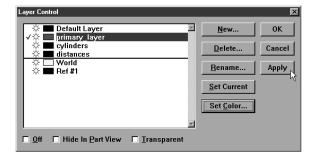
Select the desired color.











Step 6 Click OK.

Layer Control		×
☆ ■ Default Layer ✓ ☆ ■ primary layer	<u>N</u> ew	ОК
cylinders distances	Delete	Cancel
☆	<u>R</u> ename	Apply
	<u>S</u> et Current	
	Set <u>C</u> olor	
×		
☐ Off ☐ Hide In <u>P</u> art View ☐ <u>T</u> ransparent		

Chapter 5 Advanced Measuring & Output Alternate Datums

Use the rotate function to rotate the current reference frame. Note the position of the reference frame indicator (RFI) in the part view window. Its relationship to the measured part changes after rotation.

To rotate the reference frame (datum)

Step 1

Select *rotate* from the datum menu.

<u>D</u> atı	ım	
-		

Datum Magic		
Primary	Plane 1	۲
<u>S</u> econdary	Line 2	
<u>Z</u> ero	Point 4	
Projection	Auto	۲
<u>P</u> rojection Magnetic Planes	Auto Off))
	1	•



Select the axis the reference frame will rotate around as shown.

Rotate Coordinate System	×
Rotate O X axis	ОК
♥ axis ○ Z axis	Cancel
Angle to rotate 0	

Step 3

Enter the amount of rotation in degrees.

Rotate Coordinate System	×
Rotate O X axis	ОК
⊙ Y axis	Cancel
O Z axis	
Angle to rotate 45	

Step 4 Click OK in the dialog box.

Rotate Coordinate System	×
Rotate C X axis	ОК
⊙ Y axis	Cancel
O Z axis	
Angle to rotate 45	

Chapter 5 Advanced Measuring & Output Offset Alignments

Offset alignments require the nominal location of three points. Use non-projected (projection plane is indicated as 3d or off) positonal features.



For example, the nominal center points of three positional features is acceptable.

To perform an offset alignment (primary plane)



It may be simpler to delete all other features from the features list before beginning the offeset alignment. This is optional and is NOT required.

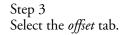
Click the *primary plane* button on the datum toolbar.



Step 2

Click on *create*.

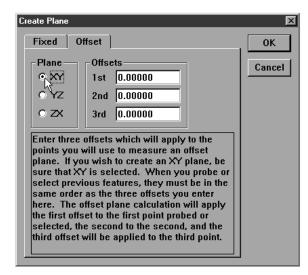
🗒 Primary Plane		
To measure a primary construct the plane fror probing a plane, probe	n previously measu	ired features. When 🚽
0k	Enter Pt	Remove Last
2	<u>_</u>	itemove case

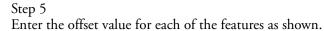


ОК
Cance
y to the offset ' plane, be ou probe or st be in the ou enter will apply bed or d, and the nird point.
con

Step 1

Step 4 Select the desired plane (XY, YZ, ZX) as shown.





eate Plane		
Fixed	Offset	ОК
Plane —	Offsets	Cancel
© XY	1st 0.05	
O YZ	2nd 0.05	
0 ZX	3rd 0.05	
points yo plane. If sure that select pro same ord here. The the first of selected,	ee offsets which will apply to the u will use to measure an offset you wish to create an XY plane, be XY is selected. When you probe or evious features, they must be in the ler as the three offsets you enter e offset plane calculation will apply ffset to the first point probed or the second to the second, and the et will be applied to the third point.	

Step 6

Click OK in the dialog box.

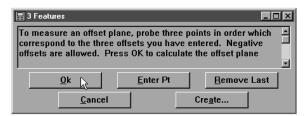
eate Plane		
Fixed	Offset	OK
-Plane	Offsets	Cance
© XY	1st 0.05	
0 YZ	2nd 0.05	
0 ZX	3rd 0.05	
Enter three	offsets which will apply to the	
	will use to measure an offset	
	ou wish to create an XY plane, be	
	Y is selected. When you probe or vious features, they must be in the	
same orde	r as the three offsets you enter	
	offset plane calculation will apply	
	set to the first point probed or	
-	he second to the second, and the will be applied to the third point.	



× Features D 0.00000 -0.39204 -0.39047 Plane 1 3.21868 1.62520 0.00000 2.17580 0.00000 1.49036 -0.00110 0.00000 Line 2 Line 3 -0.39125 -0.19314 -0.17094 0.38027 Point 3.00304 2.97445 3.47501 1.54838 0.54941 1.10018 Point 29 Point 30

Step 8

Click OK in the measure offset plane dialog box.



To perform an offest alignment (secondary line)

Step 1 Click the secondary line button on the datum toolbar.



Step 2 Click on create.

📰 1 Feature		
construct a line from	ndary alignment you m n previously measured y alignment, probe cor	l features. When 🚽
<u>0</u> k	<u>E</u> nter Pt	Remove Last

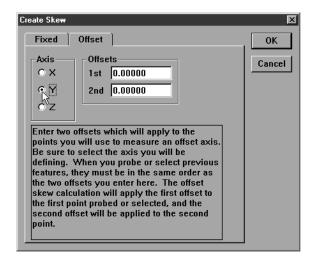


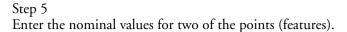
Step 3 Select the offset tab.

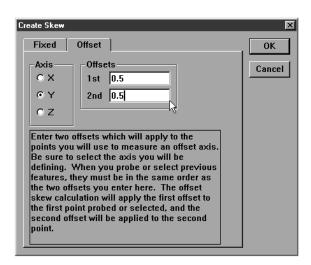
eate Ske w		
Fixed	Offset	ОК
Axis O X O Y O Z	Offsets 1st 0.00000 2nd 0.00000	Cancel
points you Be sure to defining. features, t the two off skew calc the first po	offsets which will apply to the a will use to measure an offset axis. a select the axis you will be When you probe or select previous they must be in the same order as fsets you enter here. The offset ulation will apply the first offset to bint probed or selected, and the fset will be applied to the second	

Step 4

Set the axis as shown.







Use the nominal values for the axis that is NOT the skew. For example, if the skew is the X axis enter the Y nominal.

Step 6 Click OK in the dialog box.

eate Skew		
Fixed	Offset	_ ОК
Axis OX OY	Offsets 1 st 0.5 2nd 0.5	Cance
points yo Be sure t defining. features, the two of skew calo the first p	offsets which will apply to the u will use to measure an offset axis. o select the axis you will be When you probe or select previous they must be in the same order as fsets you enter here. The offset ulation will apply the first offset to oint probed or selected, and the ffset will be applied to the second	

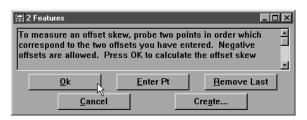


Highlight the skew points (entered in Step 4) in the features list.

II	Name :	Datum	X	Y	Z	d	r
	Plane 1		3.21868	1.62520	0.00000		
/	Line 2		0.00000	1.49036	-0.39204		
/	Line 3		2.17580	-0.00110	-0.39047		
•	Point 4		0.00000	0.00000	-0.39125		
•	Point 29		3.00304	1.54838	-0.19314		
	Point 30		2.97445	0.54941	-0.17094		
•	Point 32		3.47501	1.10018	0.38027		
		43					

Step 8

Click OK in the secondary line dialog box.



To perform an offest alignment (zero point)

Step 1

Click the zero point button on the datum toolbar.

Datum	
BYWDVNL	
<u>\</u>	I
Zero F	Point

Step 2

Highlight one of the three original points (features) in the features list.

-				- 1		
I	T Name Datum	X	Y	Z	d	r -
	Plane 1	3.21868	1.62520	0.00000		
/	Line 2	0.00000	1.49036	-0.39204		
/	Line 3	2.17580	-0.00110	-0.39047		
•	Point 4	0.00000	0.00000	-0.39125		
•	Point 29	3.00304	1.54838	-0.19314		
•	Point 30	2.97445	0.54941	-0.17094		

Step 3

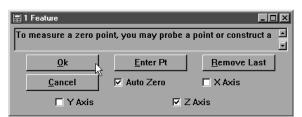
Check the axis to be zeroed as shown.

<u>⊞</u> .	l Feature		
To	measure a zero p	oint, you may probe a	point or construct a 🔺
	<u>0</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	<u>C</u> ancel	🔽 Auto Zero	🗖 X Axis
	🗖 Y Axis	Z	Axis

Check the axis used as the skew in (secondary line) Step 4. For example, if you input Y nominals in (secondary line) Step 4, check the X axis.

Step 4

Click OK in the dialog box.



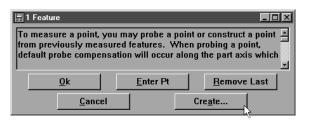
Step 5

Click the *point* button on the measure toolbar.



Step 6

Click the *create* button.



Step 7

Click OK in the dialog box.

Create Point	×
Position	ОК
Y O	Cancel
ZO	

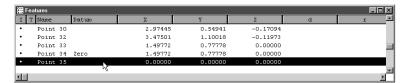
Step 8

Click the zero button on the datum toolbar.



Step 9

Highlight the point created in Step 6.



Step 10

Click OK in the dialog box.

1	1 Feature		
To	measure a zero poi	int, you may probe a j	point or construct a 🔺
	<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	Cancel	🗹 Auto Zero	🗖 X Axis
	🗖 Y Axis	⊠ Z <i>i</i>	Axis

Tolerancing

Tolerance is the acceptable amount of deviation from the perfect, or nominal, values of a part. For example, a bi-directional tolerance states how much (+ or -) the location of a feature may deviate from its nominal location. Use the tolerancing function to calculate positions, orientations, and bonuses to keep tolerancing simple and manageable. It is not even necessary to thoroughly understand tolerancing to succesfully use it with the QC5000.

Tolerance Toolbar



Use the tolerance toolbar to activate any of the 12 tolerance functions supported by the QC5000.

Tolerance is feature dependent. This means that only certain tolerance functions apply to certain features. For example, a cylindricity tolerance cannot be performed on a point.

To view the tolerance toolbar

Step 1 Select *toolbars* from the view menu.

View
Zoom <u>A</u> ll
Zoom <u>W</u> indow
Zoom Sp <u>e</u> cial •
<u>P</u> an
Prese <u>t</u> View
Set Viewpoint
⊻iew From Probe
View Rotat <u>o</u> r
Show Position In <u>d</u> icator
 Show Reference Frame Indicator
Layer Control
Toolbars
Units V

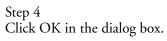
Step 2 Highlight tolerance as shown.

Toolbars			×
⊠Datum	A	<u>S</u> how	OK
⊠File □Image		Hide	Cancel
⊠Measure ⊠View			
⊠Program ⊠Probe			
Tolerance			
Custom 3			



Step 3 Click the *show* button. An 'X' appears next to tolerance.

Toolbars	X
□ Datum □ File □ Image ○ Measure ○ View ○ Program ○ Probe □ Tolerance ○ Custom 1 □ Custom 3 □ Custom 4	<u>Show</u> OK <u>H</u> ide Cancel



Toolbars		×
⊠Datum ▲ ⊠File □Image ⊠Measure ⊠View	<u>S</u> how <u>H</u> ide	OK Cancel
⊠Program ⊠Probe ☐Tolerance ⊠Custom 1		
Custom 2 Custom 3 Custom 4		

Bi-directional tolerance (circles, points, arcs, spheres)

Use bi-directional tolerance to specify nominal position and size for a selected feature, specify upper and lower deviation allowed from nominal position and size, and calculate pass/fail results. Bi-directional tolerance compares the measured location of a center point (on at least one axis) to the nominal location of that feature's center point.

To perform a bi-directional tolerance

Step 1

Highlight the desired feature in the features list.

æ	eatures						
I	T Name	Datum	X	Y	Z	d	r 🔺
•	Point 4	Zero	0.00000	0.00000	-0.32781		
Θ	Cylinder		2.98345	1.47448	-0.22281	0.75133	0.3756
0	Circle 6		2.98822	2.47395	-0.02521	0.37471	0.1873
0	Circle 7		× 2.97902	0.47526	0.00343	0.37796	0.1889
4	Cone 8		4.48092	0.71760	-0.57746		0.1997
0	Slot 9		4.29664	1.46776	-0.10389	0.37576	0.1878
	Plane 10		5.23194	1.37758	-0.25282		
	Plane 11		3.29730	-0.00788	-0.17703		
	Plane 12		4.25071	2.51275	-0.18908		
	Plane 13		2.20031	2.97443	-0.23446		
	Plane 14		0.64736	1.47401	-0.16478		
C.	Arc 15		4.48262	0.71749	-0.01184	1.49333	0.7466
1	Line 16		2.16830	0.73663	-0.02645		-
•							P I

Use only a circle, point, arc, or sphere. Bi-directional tolerances do not apply to other types of features.

```
Step 2
```

Click the *bi-directional* button on the tolerance toolbar.



Bi-Directional

Step 3

Type the nominal X and Y values for your part in the boxes as shown.

B	i-Directi	onal Tolerance	Entry		X
	-Positi	ion ———			ок .
		Nominal	Nom -	Nom +	
	×	3.0	0.006	0.006	Cancel
	Y	2.5	0.006	0.006	Delete
	Ζ	-0.02521			
	-Size-				
		Nominal	Nom -	Nom +	
	R	0.1875	0.006	0.006	

Step 4

Type in the nominal + and nominal - values for your feature as shown.

Bi-Directional Tolerance Entry	×
Position	
Nominal Nom - Nom +	ОК
X 3.0 0.006 0.006	Cancel
Y 2.5 0.006 0.006	Delete
Z -0.02521	
Size	
Nominal Nom - Nom +	
R 0.1875 0.006 0.006	



Nominal + and - values are the same as the tolerance value for the feature. For example, if a feature has a tolerance of + or - 0.006 inches then the nominal + and n0minal - values are 0.006 inches.

Enter tolerance values in the appropriate units of measurement. For example, if you are measuring in metric (mm) enter tolerance data in metric (mm).

Step 5

Click OK in the dialog box.

Bi-Direction	al Tolerance	Entry		×
Position	n			
	Nominal	Nom -	Nom +	ОК
X	3.0	0.006	0.006	Cancel
Y	2.5	0.006	0.006	Delete
z	0.02521			
Size				
	Nominal	Nom -	Nom +	
R	D.1875	0.006	0.006	

The tolerance result window appears as shown.

Bi	-Direc	ctional Tolerance	Results					×
ſ	Pos	ition ———						
		Nominal	Actual	Deviation	Low limit	High limit		ОК
	×	3.00000	2.98822	-0.01178	2.99400	3.00600	F	<u>E</u> dit
	Y	2.50000	2.47395	-0.02605	2.49400	2.50600	F	
	Z	-0.02521	-0.02521	0.00000			Р	
	Size							
		Nominal	Actual	Deviation I	Low limit I	High limit		
	R	0.18750 0	.18736 -	0.00014 0.	18150 0	.19350	P	

Pass/ Fail Displays

A green pass symbol in the features list indicates the feature is within its tolerances.

🔚 Features							
I T Name Datum	X	Y	Z	d	r L		
 Point 4 Zero 	0.00000	0.00000	-0.32781				
🖯 Cylinder	2.98345	1.47448	-0.22281	0.75133	0.3756		
🔿 🚯 Circle 6	2.98822	2.47395	-0.02521	0.37471	0.1873		
Circle 7	2.97902	0.47526	0.00343	0.37796	0.1889		
A Cone 8	4.48092	0.71760	-0.57746		n.1997		

Red symbols indicate the feature failed one or more tolerances.

🔚 Features								
ITI	Name	Datum	X	Y	Z	d	r 🔺	
• 1	Point 4	Zero	0.00000	0.00000	-0.32781			
0 (Cylinder		2.98345	1.47448	-0.22281	0.75133	0.3756	
0.0	Circle 6		2.98822	2.47395	-0.02521	0.37471	0.1873	
	Circle 7		2.97902	0.47526	0.00343	0.37796	0.1889.	
•							Þ	

True position tolerance (circles, points arcs, spheres)

Use true position tolerance to specify nominal position and size for a selected feature, specify upper and lower deviation allowed from nominal position and size, and calculate pass/fail results. True position tolerance compares the measured location of a center point (on at least one axis) to the nominal location of that feature's center point and separately compares the size of that feature. True position tolerancing is regardless of size tolerancing. This means that position and size are calculated independently and do produce true position bonuses.

To perform a true position tolerance

Step 1

Highlight the desired feature in the features list.

涯 Fe	atures						
II	Name	Datum	X	Y	Z	d	r 🔺
•	Point 4	Zero	0.00000	0.00000	-0.32781		
0	Cylinder		2.98345	1.47448	-0.22281	0.75133	0.3756
0	Circle 6		2.98822	2.47395	-0.02521	0.37471	0.1873
0	Circle 7		2.97902	0.47526	0.00343	0.37796	0.1889
4	Cone 8	45	4.48092	0.71760	-0.57746		0.1997
0	Slot 9		4.29664	1.46776	-0.10389	0.37576	0.1878
	Plane 10		5.23194	1.37758	-0.25282		
	Plane 11		3.29730	-0.00788	-0.17703		
	Plane 12		4.25071	2.51275	-0.18908		
	Plane 13		2.20031	2.97443	-0.23446		
	Plane 14		0.64736	1.47401	-0.16478		-
-	• •-						

Use only a circle, point, arc, or sphere. True position tolerances do not apply to other types of features.

Step 2

Click the true position/MMC/LMC button on the tolerance toolbar.



Step 3

Type the nominal X and Y values for your part in the boxes as shown.

True Position Tolerance Entry	×
Position —	
Nominal	ОК
X 3.0 Tol. Dia.	Cancel
Y 0.5 0.006	Delete
Z 0.00343	
Size	
Nominal Nom - Nom	+
R 0.1875 0.006 0.006	



Enter the specified diameter as shown.

T	rue Pos	ition Tolerance	Entry		×
	-Posit	ion ———	٦	ок ,	
		Nominal			
	X	3.0	Tol. Dia.		Cancel
	Y	0.5	0.006		Delete
	Ζ	0.00343			
	-Size-				
		Nominal	Nom -	Nom +	
	R	0.1875	0.006	0.006	



Type in the nominal + and nominal - values for your feature as shown.

True Position Tolerance		×	
Position ———	٦	ОК.	
Nominal			
× 3.0	Tol. Dia.		Cancel
Y 0.5	0.006		Delete
Z 0.00343			
Size			
Nominal	Nom -	Nom +	
R 0.1875	0.006	0.006	

Nominal + and - values are the same as the tolerance value for the feature. For example, if a feature has a tolerance of + or - 0.006 inches then the nominal + and n0minal - values are 0.006 inches.

Enter tolerance values in the appropriate units of measurement. For example, if you are measuring in metric (mm) enter tolerance data in metric (mm).

Step 5

Click OK in the dialog box.

True Position Tolerance	Entry		×
Position —		1	
Nominal			ОК
× 3.0	Tol. Dia.		Cancel
Y 0.5	0.006		Delete
Z 0.00343			
Size		-	
Nominal	Nom -	Nom +	
R 0.1875	0.006	0.006	

The tolerance results window appears as shown.

True Position Tolerance Results	X
Position	
Nominal Actual	OK
X 3.00000 2.97902 Error Dia. Tol. Dia.	<u>E</u> dit
Y 0.50000 0.47526 0.06488 0.07000	P
Z 0.00343 0.00343	
Size	
Nominal Actual Deviation Low limit Hig	h limit
R 0.18750 0.18898 0.00148 0.18150 0.19	350 P

Position and size may have a different pass/fail result from each other. A red fail marker will appear in the features list if either parameter fails.

MMC/LMC (maximum material condition/least material condition) tolerance (circles, points arcs, spheres)

Use MMC/LMC tolerances for bores and bosses to specify nominal X, Y, and Z positions for a selected feature, specify nominal diameter, specify nominal size, specify bore or boss setting, and calculate pass/fail results. MMC/LMC tolerancing factors true position bonus into its calculations.

To perform a MMC tolerance

Step 1

Highlight the desired feature in the features list.

Т	Name	Datum	X	Y	Z	d	r
1	Plane 13		2.20031	2.97443	-0.23446		
7	Plane 14		0.64736	1.47401	-0.16478		
	Arc 15		4.48262	0.71749	-0.01184	1.49333	0.74
	Line 16		2.16830	0.73663	-0.02645		
	Line 17		1.79161	0.71654	-0.02664		
	Arc 18		1.98363	1.47844	-0.02823	0.37580	0.18
)	Circle 19		2.98317	1.47526	-0.05573	0.75111	0.37
		48					

Use only a circle, point, arc, or sphere. MMC tolerances do not apply to other types of features.

Step 2

Select *tolerance* then MMC from the tools menu.

Tools						
<u>T</u> olerance	×	<u>B</u> i-Directional				
Programming		✓ <u>T</u> rue Position				
Liogrammig		<u>M</u> MC				
<u>C</u> ustomize		LMC K				
<u>O</u> ptions	×	R <u>u</u> nout				
<u>Lanquaqe</u>	•	<u>C</u> ircularity				
Foundaria	_	Concentricity				



Type the nominal X and Y values for your part in the boxes as shown.

М	MC Tol	erance Entry			x
	-Positi	on Nominal		Type O Boss	ОК
	X	3.0	Tol. Dia.	• Bore	Cancel
	Y	1.5	0.006		Delete
	Z	-0.05573	J		
	-Size-				
		Nominal	Nom -	Nom +	
	R	0.375	0.006	0.006	

Step 4 Enter the specified diameter as shown.

MMC Tolerance Entry X Position Type — O Boss 0K Nominal Bore
 Bore Cancel х 3.0 Tol. Dia. Y 1.5 0.006 Delete -0.05573 Ζ Size Nominal Nom -Nom + R 0.375 0.006 0.006



Type in the nominal + and nominal - values for your feature as shown.

MMC Tolerance Entry			X
Position Nominal		Type O Boss	ОК
× 3.0	Tol. Dia.	Bore	Cancel
Y 1.5	0.006		Delete
Z -0.05573			
Size			
Nominal	Nom -	Nom +	
R 0.375	0.006	0.006	

NOTE

Nominal + and - values are the same as the tolerance value for the feature. For example, if a feature has a tolerance of + or -0.006 inches then the nominal + and n0minal - values are 0.006 inches.



CAUTION

Chapter 5 **Advanced Measuring & Output**

Step 6

Select boss or bore as shown.

MMC Tolerance Entry			×
Position		Туре	ОК
Nominal		O Boss	
X 3.0	Tol. Dia.	Bore	Cancel
Y 1.5	0.006		Delete
Z -0.05573			
Size			
Nominal	Nom -	Nom +	
R 0.375	0.006	0.006	



Step 7 Click OK in the dialog box.

MMC Tolerance Entry			×
Position Nominal		Type O Boss	ОК
× 3.0	Tol. Dia.	• Bore	Cancel
Y 1.5	0.006		Delete
Z -0.05573			
Size			
Nominal	Nom -	Nom +	
R 0.375	0.006	0.006	

M	мс т	olerance Results						×
	Pos	ition						
l		Nominal	Actual					ОК
l	x	3.00000	2.98317	Error Dia.	Tol. Dia.	Bonus	Bonus + Tol.	<u>E</u> dit
l	Y	1.50000	1.47526	0.05984	0.06000	0.01312	0.07312 P	
l	Z		-0.05573					
	Siz	e						
		Nominal	Actual	Deviation	Low limit	High limit		
	R	0.37500 0.	37556	.00056 0	.36900 0	.38100	P	

To perform a LMC

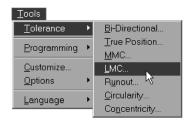
Step 1

Highlight the desired feature in the features list.

I T Name Datum					_ 🗆 🗵
	X	Y	Z	d	r 🔺
Plane 13	2.20031	2.97443	-0.23446		
Plane 14	0.64736	1.47401	-0.16478		
Arc 15	4.48262	0.71749	-0.01184	1.49333	0.7466
Line 16	2.16830	0.73663	-0.02645		
Line 17	1.79161	0.71654	-0.02664		
Arc 18	1.98363	1.47844	-0.02823	0.37580	0.1879
O Circle 20	2.98323	1.47509	-0.00851	0.75178	0.3756

Use only a circle, point, arc, or sphere. MMC tolerances do not apply to other types of features.

Step 2 Select *tolerance* then *LMC* from the tools menu.



Step 3

Type the nominal X and Y values for your part in the boxes as shown.

LMC Tolerance Entry			×
Position Nominal		Type O Boss	ОК
× 3.0	Tol. Dia.	• Bore	Cancel
Y 1.5	0.06		Delete
Z -0.00851	h		
Size			
Nominal	Nom -	Nom +	
R 0.37589			

Chapter 5 Advanced Measuring & Output

Step 4

Enter the specified diameter as shown.

LMC Tolerance Entry			×		
Position	Type O Boss	ОК			
Nominal	Nominal				
× 3.0	Tol. Dia.	• Bore	Cancel		
Y 1.5	0.06		Delete		
Z -0.00851					
Size					
Nominal	Nom -	Nom +			
R 0.375	0.006	0.006			
		h	5		



Type in the nominal + and nominal - values for your feature as shown.

LMC Tolerance Entry			X
- Position Nominal		Type O Boss	ОК
× 3.0	Tol. Dia.	 Bore 	Cancel
Y 1.5	0.06		Delete
Z -0.00851			
Size			
Nominal	Nom -	Nom +	
R 0.375	0.006	0.006	

Nominal + and - values are the same as the tolerance value for the feature. For example, if a feature has a tolerance of + or - 0.006 inches then the nominal + and n0minal - values are 0.006 inches.



Step 6 Select *boss* or *bore* as shown.

LMC Tolerance Entry			X
Position Nominal		Type O Boss	ОК
× 3.0	Tol. Dia.	• Bore	Cancel
Y 1.5	0.06		Delete
Z -0.00851			
Size			
Nominal	Nom -	Nom +	
R 0.375	0.006	0.006	



Step 7 Click OK in the dialog box.

LMC Tolerance Er	itry		×
Position Nom	inal	Type O Boss	ОК
× 3.0	Tol. Dia.	• Bore	Cancel
Y 1.5	0.06		Delete
Z -0.008	51		
Size			
Nom	inal Nom -	Nom +	
R 0.375	0.006	0.006	

L	MC Tol	lerance Results							X
	-Posi								OK
		Nominal	Actual	_					3
	×	3.00000	2.98323	Error Dia.	Tol. Dia.	Bonus	Bonus + Tol.		<u>E</u> dit
	Y	1.50000	1.47509	0.06006	0.06000	0.01022	0.07022	Ρ	
	z		-0.00851						
	Size								
		Nominal	Actual	Deviation	Low limit	High limit			
	R).37500 0	.37589	0.00089	.36900 0	.38100	P		

Concentricity tolerance (circles, arcs)

Use concentricity tolerancing to compare the measured position of a feature to the measured position of another concentric feature (reference feature). The measured position of the of the basis feature is the nominal of the feature being toleranced.

To perform a concentricity tolerance

Step 1

Highlight the desired feature in the features list.

I T Name Datum	X	Y	Z	d	r
Plane 14	0,64736	1,47401	-0.16478		
Arc 15	4.48262	0.71749	-0.01184	1.49333	0.7466
Line 16	2.16830	0.73663	-0.02645		
Line 17	1.79161	0.71654	-0.02664		
Arc 18	1.98363	1.47844	-0.02823	0.37580	0.1879
🕽 😰 Circle 20	2.98323	1.47509	-0.00851	0.75178	0.3758
Circle 22	4.47870	0.71779	0.03316	1.02300	0.5115
Circle 24	4.48052	0.71670	-0.37234	0.37391	0.1869
k					

Use only a circle or arc. Concentricity tolerances do not apply to other types of features.

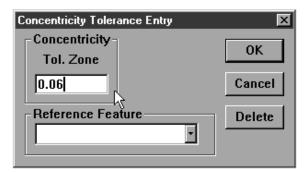
```
Step 2
```

Click the *concentricity* button on the tolerance toolbar.



Step 3

Enter a value in the tolerance zone box as shown.



The center point of the tolerance feature must lie within the tolerance zone to pass. The tolerance zone is defined by the diameter specified in the tolerance zone box. This is the tolerance value.

Enter tolerance values in the appropriate units of measurement. For example, if you are measuring in metric (mm) enter tolerance data in metric (mm).

```
Step 4
```

Select the reference feature as shown.

Concentricity Tolerance Entry	×
Concentricity -	
Tol. Zone	ОК
0.06	Cancel
Reference Feature	Delete
•	
Point 4	
Circle 6	
Circle 7	
Arc 15	
Arc 18	
Circle 20	
Circle 22	

If no features appear in the reference feature list concentricity tolerancing is not possible.

Step 5

Click OK in the dialog box.

Concentricity Tolerance Entry	×
Concentricity	
Tol. Zone	ОК
0.06	Cancel
Reference Feature	Delete
Circle 22	

Chapter 5 Advanced Measuring & Output

Concentricity Tolerance Results	×
Concentricity Tol. Zone Actual 0.06000 0.00424 P	OK <u>E</u> dit
Reference Feature	

Straightness tolerance (lines)

Use straightness tolerancing to calculate the straightness of a line and pass/fail results. Each point probed on a line is checked against the straightness tolerance. A minimum of three points distributed along the line are required (more points increase accuracy).

It is possible to perform a straightness tolerance on a line with only two points. This tolerance is meaningless because it is impossible for either point to be 'out' of the tolerance zone. Use a mimimum of three points when performing a straightness tolerance.

To perform a straightness tolerance (lines)

Step 1 Highlight the desired feature in the features list.

T Name Da	atum	X	Y	Z	d	r
Line 17		1.79161	0.71654	-0.02664		
Arc 18		1.98363	1.47844	-0.02823	0.37580	0.1879
😰 Circle 20		2.98323	1.47509	-0.00851	0.75178	0.3758
Circle 22		4.47870	0.71779	0.03316	1.02300	0.5115
😰 Circle 24		4.48052	0.71670	-0.37234	0.37391	0.1869
' Line 25	L.	4.21414	2.52898	-0.06075		

Use a line only. Straightness tolerances do not apply to other types of features.

Step 2

Click the *straightness button* on the tolerance toolbar.



Step 3

Enter a value in the tolerance zone box as shown.

Straightness Tolerance Entry 🗙			
- Form			
Tol. Zone	OK		
0.006	Cancel		
10.0001			
	Delete		



Enter tolerance values in the appropriate units of measurement. For example, if you are measuring in metric (mm) enter tolerance data in metric (mm).

```
Step 4
Click OK in the dialog box.
```

Straightness Tolerance Entry 🗵		
Form	ок	
Tol. Zone		
0.00600	Cancel	
	Delete	

Straightness Tolerance Results	X
Form Actual Tol. Zone Actual 0.00600 0.00019 P	OK Edit

Circularity/sphericity tolerance (circles, spheres)

Use circularity/sphericity as form tolerance for circles and spheres. This tolerance defaults to circularity when the selected feature is a circle and sphericity when the selected feature is a sphere. A minimum of four points is required for a circularity tolerance and five points for a sphericity tolerance. The more points used in the tolerance the more accurate the fianl result.

To perform a circularity tolerance

Step 1

Highlight the desired feature in the features list.

T Name Datum	X	Y	Z	d	r
Circle 20	2.98323	1.47509	-0.00851	0.75178	0.375
Circle 22	4.47870	0.71779	0.03316	1.02300	0.511
😰 Circle 24	4.48052	0.71670	-0.37234	0.37391	0.186
😰 Line 25	4.21414	2.52898	-0.06075		
Circle 26	5.75342	3.75782	-0.05241	0.75179	0.375
Circle 27	7.31711	3.15484	0.01377	0.98428	0.492
Circle 28	7.32008	3.15812	-0.38132	0.37426	0.187
	hg.				

Use a circle only. Circularity tolerances do not apply to other types of features.

Step 2

Click the *circularity/sphericity* button on the tolerance toolbar.



Step 3

Enter a value in the tolerance zone box as shown.

Circularity Toleranc	e Entry 🗵
Form Tol. Zone	ОК
0.06	Cancel
	Delete

Chapter 5 **Advanced Measuring & Output**

Step 4 Click OK in the dialog box.

Circularity Tolerance Entry 🛛 🔀		
Form —	ок.	
Tol. Zone		
0.06	Cancel	
	Delete	

Circularity Tolerance Results	×
Form Tol. Zone Actual 0.06000 0.00000 P	<u>OK</u> <u>E</u> dit

To perform a sphericity tolerance

Step 1

Highlight the desired feature in the features list.

🔚 Features					
I T Name Datum	X	Y	Z	d	r 🔺
🔿 🖗 Circle 20	2.98323	1.47509	-0.00851	0.75178	0.3758
O Circle 22	4.47870	0.71779	0.03316	1.02300	0.5115
🔿 🕲 Circle 24	4.48052	0.71670	-0.37234	0.37391	0.1869
🛹 🤁 Line 25	4.21414	2.52898	-0.06075		
O Circle 26	5.75342	3.75782	-0.05241	0.75179	0.3759
O Circle 27	7.31711	3.15484	0.01377	0.98428	0.4921
🔿 🕲 Circle 28	7.32008	3.15812	-0.38132	0.37426	0.1871
O Sphere 29	4.48000	0.71786	0.18807	1.00000	0.5000
	M.				
					*
					E State

Use a circle only. Sphericity tolerances do not apply to other types of features.

Step 2

Click the *circularity/sphericity* button on the tolerance toolbar.



Step 3

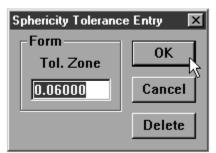
Enter a value in the *tolerance zone* box as shown.

Sphericity Tolerance Entry 🛛 🗙				
Form Tol. Zone	ОК			
0.06	Cancel			
	Delete			



Enter tolerance values in the appropriate units of measurement. For example, if you are measuring in metric (mm) enter tolerance data in metric (mm).

Step 4 Click OK in the dialog box.



Chapter 5 Advanced Measuring & Output

Sphericity T	olerance Resu	ults	×
Form-			ОК
Tol. Zo		tual	
0.0600	0 0.000)00 P	<u>E</u> dit
			1

Cylindricity tolerance (cylinders)

Use cylindricity to compare the measured form of a cylinder to a specifiec tolerance zone and calculate pass/fail results. Cylinder measurement requires a mimium of six points. Enter additional points to increase the accuracy of your measurements.

To perform a cylindricty tolerance

Step 1

Highlight the desired feature in the features list.

🚝 Features					_ 🗆 🗵
I T Name Datum	X	Y	Z	d	r
🖊 😰 Line 25	4.21414	2.52898	-0.06075		
O Circle 26	5.75342	3.75782	-0.05241	0.75179	0.3759
O Circle 27	7.31711	3.15484	0.01377	0.98428	0.4921
🔿 🤮 Circle 28	7.32008	3.15812	-0.38132	0.37426	0.1871
🔘 😰 Sphere 29	4.48000	0.71786	0.18807	1.00000	0.5000
O Circle 30	5.75060	3.75804	0.03074	0.78381	0.3919
🖯 Cylinder	5.75350	3.75831	-0.21500	0.75249	0.3762
O Circle 32 😽	5.75441	3.75904	-0.01261	0.75167	0.3758
					Þ

Use a cylinder only. Cylindricity tolerances do not apply to other types of features.

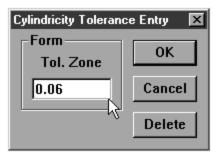
Step 2

Click the *cylindricity* button on the tolerance toolbar.



Step 3

Enter a value in the tolerance zone box as shown.





Chapter 5 **Advanced Measuring & Output**

Step 4 Click OK in the dialog box.

Cylindricity Tolerance Entry 🛛 🔀		
- Form	ок	
Tol. Zone		
0.06	Cancel	
	Delete	

C	ylindricity Tolera	nce Results		×
	Form Tol. Zone 0.06000	Actual	Р	OK Edit
	10.00000	0.00183		<u></u> un

Flatness tolerance (planes)

Use flatness to specify form tolerance for planes. Flatness tolerances require a minumum of four points. Enter additional points to increase the accuracy of your measurements.

To perform a flatness tolerance

Step 1

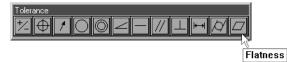
Highlight the desired feature in the features list.

æF	eatures					_ 🗆 🗵
I	T Name Datum	X	Y	Z	d	r 🔺
	Plane 10	5.23194	1.37758	-0.25282		
	Plane 11	3.29730	-0.00788	-0.17703		
	Plane 12	4.25071	2.51275	-0.18908		
	Plane 13	2.20031	2.97443	-0.23446		
\Box	Plane 14	0.64736	1.47401	-0.16478		
<u> </u>	Arc 15	√ 4.48262	0.71749	-0.01184	1.49333	0.7466
1	Line 16	2.16830	0.73663	-0.02645		
-	Line 17	1.79161	0.71654	-0.02664		
C.	Arc 18	1.98363	1.47844	-0.02823	0.37580	0.1879
0	😰 Circle 20	2.98323	1.47509	-0.00851	0.75178	0.3758
0	Circle 22	4.47870	0.71779	0.03316	1.02300	0.5115
<u>î</u> l	A		· ·			

Use a plane only. Flatness tolerances do not apply to other types of features.

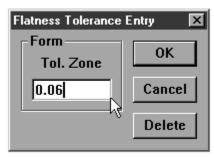
Step 2

Click the *flatness* button on the tolerance toolbar.



Step 3

Enter a value in the tolerance zone box as shown.





Chapter 5 **Advanced Measuring & Output**

Step 4 Click OK in the dialog box.

Flatness Tolerance Entry 🛛 🔀		
Form	ОК ,	
Tol. Zone		
0.06	Cancel	
	Delete	

Fla	tness Toleranc	e Results		×
	Form Tol. Zone 0.06000	Actual	P	<u>OK</u> <u>E</u> dit

Perpendicularity tolerance (lines, cylinders, cones)

Use perpendicularity to establish an orientation tolerance between linear features. Perpendicularity tolerancing compares the axial orientation of the selected feature to the axis of a reference feature. The actual tolerance zone is a cylindrical area around the axis of the tolerence feature. Specify the diameter of the cylindrical tolerance zone to create the tolerance.

To perform a perpendicularity tolerance

Step 1

Highlight the desired feature in the features list.

ТТ	Name	Datum	X	v	2	d	~
				· · · · ·	-	ŭ	
	Point 4	Zero	0.00000	0.00000	-0.32781		
Θ	Cylinder		2.98345	1.47448	-0.22281	0.75133	0.3756
0.	Circle 6	K.	2.98822	2.47395	-0.02521	0.37471	0.1873
0 🛛	Circle 7		2.97902	0.47526	0.00343	0.37796	0.1889
4	Cone 8		4.48092	0.71760	-0.57746		0.1997
0	Slot 9		4.29664	1.46776	-0.10389	0.37576	0.1878
	Plane 10		5.23194	1.37758	-0.25282		
	Plane 11		3.29730	-0.00788	-0.17703		
	Plane 12		4.25071	2.51275	-0.18908		
	Plane 13		2.20031	2.97443	-0.23446		
🖉 🕑	Plane 14		0.64736	1.47401	-0.16478		

NOTE

Use a linear features only. Perpendicularity tolerances do not apply to other types of features.

Step 2

Click the *perpendicularity* button on the tolerance toolbar.



Perpendicularity

Step 3

Enter a value in the tolerance zone box as shown.

Perpendicularity Tolerance Entry	×
Orientation —	ок
Tol. Zone	
0.06	Cancel
Reference Feature	Delete



Chapter 5 **Advanced Measuring & Output**

Step 4

Select a reference feature from the pull down list.

Perpendicularity Tolerance Entry	×
Orientation —	ок
Tol. Zone	
0.06	Cancel
Reference Feature	Delete
_	
Plane 1	



Step 5 Click OK in the dialog box.

Perpendicularity Tolerance Entry	×
- Orientation	ок
Tol. Zone	
0.06	Cancel
Reference Feature	Delete
Plane 1	

Perpendicularity Tolerance Results	×
Orientation Tol. Zone Actual 0.06000 0.00173 P	OK Edit
Reference Feature	

Parallelism/Co-planarity tolerance (linear features)

Use parallelism as an orientation tolerance for cylinders, cones, and lines. Parallelism tolerancing compares the axial orientation of the selected feature to the axis of a reference feature. The actual tolerance zone is a cylindrical area around the axis of the tolerence feature. Specify the diameter of the cylindrical tolerance zone to create the tolerance.tolerancing compares the orientation of the axis of the toleranced feature to a reference feature.

Use co-planarity as an orientation tolerance between planes. Two planes spaced evenly apart with the same orientation are said to be co-planar.

To perform a parallelism tolerance

Step 1

Highlight the desired feature in the features list.

🚝 Features					_ _ _ ×
I T Name Datum	X	Y	Z	d	r 🔺
Plane 12	4.25071	2.51275	-0.18908		
Plane 13	2.20031	2.97443	-0.23446		
Plane 14	0.64736	1.47401	-0.16478		
Arc 15	4.48262	0.71749	-0.01184	1.49333	0.746ϵ
 Line 16 	2.16830	0.73663	-0.02645		
- Line 17	1.79161	0.71654	-0.02664		
 Arc 18 ^{NS} 	1.98363	1.47844	-0.02823	0.37580	0.1879
🔿 🕲 Circle 20	2.98323	1.47509	-0.00851	0.75178	0.3758
O Circle 22	4.47870	0.71779	0.03316	1.02300	0.5115
🔿 😰 Circle 24	4.48052	0.71670	-0.37234	0.37391	0.1869
🛹 😰 Line 25	4.21414	2.52898	-0.06075		
f					

NOTE

Use a linear features only. Parallelism tolerances do not apply to other types of features.

Step 2

Click the *parallelism/co-planarity* button on the tolerance toolbar.



Parallelism/Coplanarity

Step 3

Enter a value in the tolerance zone box as shown.

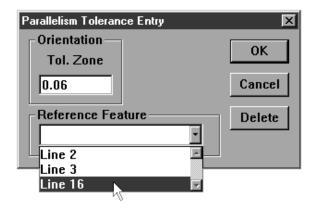
Parallelism Tolerance Entry	×
Orientation —	ок
Tol. Zone	
0.06	Cancel
Reference Feature	Delete



CAUTION

Step 4

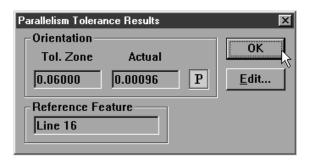
Select a reference feature from the pull down list.





Click OK in the dialog box.

Parallelism Tolerance Entry	X
Orientation —	OK
Tol. Zone	ОК
0.06	Cancel
Reference Feature	Delete
Line 16	



To perform a co-planarity tolerance

Step 1

Highlight the desired feature in the features list.

🚈 Features					
I T Name Datum	X	Y	Z	d	r 📥
🔘 😰 Circle 28	7.32008	3.15812	-0.38132	0.37426	0.1871
🔘 😰 Sphere 29	4.48000	0.71786	0.18807	1.00000	0.5000
O Circle 30	5.75060	3.75804	0.03074	0.78381	0.3919
🖯 😰 Cylinder	5.75350	3.75831	-0.21500	0.75249	0.3762
O Circle 32	5.75441	3.75904	-0.01261	0.75167	0.3758
 Line 33 	7.09668	3.70053	-0.00320		
- Line 34	7.04016	4.07377	-0.01127		
13					
					-
					F

NOTE

Use a plane only. Co-planarity tolerances do not apply to other types of features.

Step 2

Click the *parallelism/co-planarity* button on the tolerance toolbar.



Parallelism/Coplanarity

Step 3

Enter a value in the *tolerance zone* box as shown.

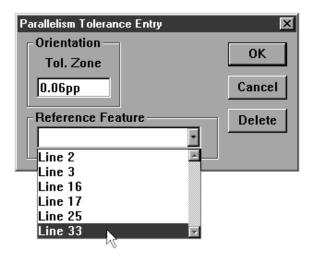
Parallelism Tolerance Entry	×
Orientation —	
Tol. Zone	ОК
0.06	Cancel
Reference Feature	Delete

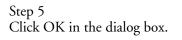


Chapter 5 Advanced Measuring & Output

Step 4

Select a reference feature from the pull down list.





Parallelism Tolerance Entry	×
Orientation —	ОК
Tol. Zone	
0.06pp	Cancel
Reference Feature	Delete
Line 33	

Parallelism Tolerance Results	×
Orientation	
Tol. Zone Actual	
0.06000 0.00022 P	<u>E</u> dit
Reference Feature	
Line 33	

Circular runout tolerance

Use circular runout to set a tolerance of how far circular features may deviate from the center of a reference feature in 360 degrees of rotation.

To perform a circular runout tolerance

Step 1

Highlight the desired feature in the features list.

I T Name Datum	X	Y	Z	d	r
🕽 🤁 Sphere 29	4.48000	0.71786	0.18807	1.00000	0.5000
Circle 30	5.75060	3.75804	0.03074	0.78381	0.3919
🗿 😰 Cylinder	5.75350	3.75831	-0.21500	0.75249	0.3762
Circle 32	5.75441	3.75904	-0.01261	0.75167	0.3758
Line 33	7.09668	3.70053	-0.00320		
🖊 😰 Line 34	7.04016	4.07377	-0.01127		
Circle 35	7.31997	3.15897	-0.00215	0.95651	0.4782
Circle 36	7.32025	3.15833	-0.31064	0.42460	0.2123
	4				
					F

Use a circle only. Circular runout tolerances do not apply to other types of features.

Step 2

Click the *circular runout* button on the tolerance toolbar.



Step 3

Enter a value in the *tolerance zone* box as shown.

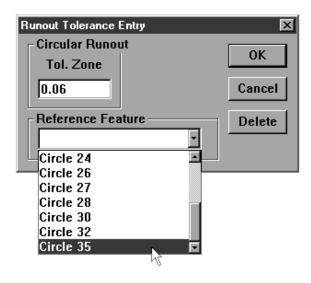
Runout Tolerance Entry	×
Circular Runout	
Tol. Zone	ОК
0.06	Cancel
Reference Feature	Delete
•	



Chapter 5 Advanced Measuring & Output

Step 4

Select a reference feature from the pull down list.



Step 5 Click OK in the dialog box.

Runout Tolerance Entry	×
- Circular Runout	
Tol. Zone	ОК
0.06	Cancel
Reference Feature	Delete
Circle 35	

Runout Tolerance Results	×
Circular Runout	
Tol. Zone Actual	
0.06000 0.00117 P	<u> </u>
Reference Feature	
Circle 35	

Angle tolerance

Use angle tolerance to set tolerance values for angles in a specified plane. Enter the respective nominal values for the angle according to its plane. For example, enter XY nominal values for angles in the XY plane.

To perform an angle tolerance

Step 1

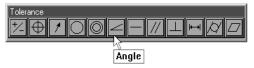
Highlight the desired angle in the features list.

Т	Name	Datum	X	Y	Z	d	r
)	Circle 32		5.75441	3.75904	-0.01261	0.75167	0.375
-	Line 33		7.09668	3.70053	-0.00320		
· @	Line 34		7.04016	4.07377	-0.01127		
)	Circle 35		7.31997	3.15897	-0.00215	0.95651	0.478
) (P	Circle 36		7.32025	3.15833	-0.31064	0.42460	0.212
-	Line 37		7.99189	3.95174	0.00106		
	Line 38		6.83584	4.94320	-0.01459		
[Angle 39	13					0.556

Use angles only. Angle tolerances do not apply to other types of features.

Step 2

Click the *angle* button on the tolerance toolbar.



Step 3

Enter the nominal values as shown.

A	ngle Tolerano	ce Entry			X
	-Angles		Nom -	Nom +	0K
		Nominal	Nom -	Nom +	
	Angle	113°50'	0.6	0.6	Cancel
	XY Angle	113'50'	0.6	0.6	Delete
	YZ Angle	0°			
	ZX Angle	0°			

Chapter 5 **Advanced Measuring & Output**

Step 4

Enter the nominal + and nominal - values as shown.

A	ngle Toleranc	e Entry			×
	Angles —	ОК			
		Nominal	Nom -	Nom +	
	Angle	113'50'	0.6	0.6	Cancel
	XY Angle	113°50'	0.6	0.6	Delete
	YZ Angle	0°			
	ZX Angle	0°			
		0	J		



Step 5 Click OK in the dialog box.

A	ngle Tolerand	ce Entry			×
	-Angles —			1	ОК
		Nominal	Nom -	Nom +	
	Angle	113'50'	0.6	0.6	Cancel
	XY Angle	113"50'	0.6	0.6	Delete
	YZ Angle	0°			
I	ZX Angle	0°			

A	ngle Tolerand	ce Results						X
	-Angles							
		Nominal	Actual	Deviation	Low limit	High limit		ОК
	Angle	113'50'	112'51'03''	0'58'57''	112'50'	114°50'	Р	<u>E</u> dit
	XY Angle	113'50'	112"51'03"	0'58'57''	112'50'	114°50'	Ρ	
	YZ Angle	0°	0"	0"			Ρ	
	ZX Angle	0°	0"	0°			Ρ	
	1							

Width tolerance

Use the width tolerance to establish the amount of deviation in the distance between two linear features.

To perform a width tolerance

Step 1

Highlight the desired distance in the features list.

T Name Datum	X	Y	Z	d	r
) Circle 35	7.31997	3.15897	-0.00215	0.95651	0.478
) 😰 Circle 36	7.32025	3.15833	-0.31064	0.42460	0.212
Line 37	7.99189	3.95174	0.00106		
Line 38	6.83584	4.94320	-0.01459		
🛿 😰 Angle 39					0.556
Line 40	5.01678	2.95610	-0.12519		
Line 41	4.64559	2.88707	-0.14009		
Distance	0.37435	0.03673	0.00000		
	43				

Use a distance only. Width tolerances do not apply to other types of features.

Step 2

Click the *width* button on the tolerance toolbar.



Step 3

Enter the nominal values as shown.

	ance Entry			X
-Length-	Nominal	Nom -	Nom +	OK
Length	0.375			Cancel
×	0.375			Delete
Y	0.03673			
Z	0.00000			
				1

Chapter 5 **Advanced Measuring & Output**

Step 4

Enter the nominal + and nominal - values as shown.

/idth Tolera	ance Entry			X
-Length-	Nominal	Nom -	Nom +	ОК
Length	0.375	0.06	0.06	Cancel
×	0.375	0.06	0.06	Delete
Y	0.03673			
Z	0.00000			



Step 5 Click OK in the dialog box.

	/idth Toler - Length -	ance Entry			×
l	-	Nominal	Nom -	Nom +	ОК
l	Length	0.37500	0.06	0.06	Cancel
	×	0.37500	0.06	0.06	Delete
	Y	0.03673			
	Z	0.00000			

Ulerance	Results						×
gth ———							
No	ominal	Actual	Deviation	Low limit	High limit		ОК
gth 0.37	7500	0.37615	0.00115	0.31500	0.43500	P	<u>E</u> dit
0.37	7500	0.37435	-0.00065	0.31500	0.43500	Ρ	
0.03	3673	0.03673	0.00000			Ρ	
0.00)000	0.00000	0.00000			Ρ	
	No 9th 0.37 0.37 0.37	Nominal gth 0.37500 0.37500 0.03673	Nominal Actual gth 0.37500 0.37615 0.37500 0.37435 0.03673 0.03673	Nominal Actual Deviation gth 0.37500 0.37615 0.00115 0.37500 0.37435 -0.00065 0.03673 0.03673 0.00000	Nominal Actual Deviation Low limit gth 0.37500 0.37615 0.00115 0.31500 0.37500 0.37435 -0.00065 0.31500 0.03673 0.03673 0.00000	Nominal Actual Deviation Low limit High limit gth 0.37500 0.37615 0.00115 0.31500 0.43500 0.37500 0.37435 -0.00065 0.31500 0.43500 0.03673 0.03673 0.00000	Nominal Actual Deviation Low limit High limit gth 0.37500 0.37615 0.00115 0.31500 0.43500 P 0.37500 0.37435 -0.00065 0.31500 0.43500 P 0.03673 0.03673 0.00000 P

Chapter 6 Templates

Templates

Templates control the format of output. There are four templates used by the QC5000:

- Features Template
- Report Template
- Program Template
- Runs Template

Features and report templates are associated with data output. Use the features template to format data for output to other software applications.

繮F	eatures		_ 🗆 🗵
I	T Name	Datum	<u> </u>
	Plane 1	Primary	
-	Line 2	Skew	
-	Line 3		
•	Point 4	Zero	
•	Point 5		
-	Line 6		
c	Arc 7		
0	Circle 8		
•	Point 9		
Θ	Cylinder		
0	Sphere 11		
			_
•			

Format print output using the report template.

🔚 Report						
# 🔺	Feature	Position/Dim.	Size	Orientation	Form/Dim.	Special 🔺
1	Plane 1	X 3.22598		XY< 0°00'00"	F 0.00000	
		Y 1.56296		YZ< 90°00'00″		
		z 0.00000		ZX< 0°00'00"		
2	Line 2	x 0.00000		XY< 90°00'00″	F 0.00000	
		Y 1.47039		YZ< 0°00'00"		
		Z -0.45201		ZX< 0°00'00"		
3	Line 3	X 2.26751		XY<179°57'53″	F 0.00000	
		Y -0.00139		YZ< 0°00'00″		
		Z -0.45531		ZX< 90°00'00″		
4	Point 4	x 0.00000			F 0.00000	
		Y 0.00000				
		Z -0.45366				
5	Point 5	X 3.57722			F 0.00000	
		Y 1.48131				
		Z 0.00010				
6	Line 6	X 1.81104		XY< 89°58'23″	F 0.00000	
		Y 0.71418		YZ<180°00'00″		
		Z -0.21084		ZX< 90°00'00″		
7	Arc 7	X 4.49242	d 1.51415		L3d 0.05810	
		¥ 0.75257			F 0.00000	
		Z -0.01497				•
•						F

Program and runs templates are associated with QC5000 functions. Use the program template to construct, edit, and monitor your parts programs.

涯 Program	Program								
Status	Cx Action					Data			A
									-

Compare program results from one run to the next using the runs template.

🔚 Runs	
Run 🔺	•
	-
•	Þ

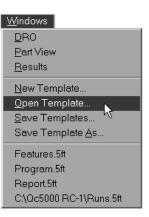
Features Template

Use the features template to create the features list. The features list displays feature data and prepares it for export to other software applications.

To open the features template

Step 1

Select open template from the windows menu.





Select *features. 5ft* from the file name list box. The file path is c:\qc5000\templates.

Open Feature Template		? ×
File name: Features.5ft All Tol.5ft CartLim.5ft CartLim.5ft ExportToAccess.5ft Features.5ft Program.5ft QC5000ToAccess.5FT Report.5ft	Eolders: c:\qc5000 rc-1	OK Cancel
List files of type: Feature Templates	Dri <u>v</u> es: C:	▼ Network



Open Feature Template						
File name: Features.5/t All Tol.5/t CartPiNi.5/t Export ToAccess.5/t Features.5/t Program.5/t QC5000ToAccess.5FT Report.5/t	Eolders: c:\qc5000 rc-1 C:\ Qc5000 RC-1 Backups Coefficients Exports Imports	Cancel				
List files of type: Feature Templates	Dri <u>v</u> es: E c:	▼ Network				

Step 1 Select features.5ft from the windows menu.

<u>W</u> indows			
<u>D</u> RO			
<u>P</u> art∨iew			
<u>R</u> esults			
<u>N</u> ew Template			
<u>O</u> pen Template			
<u>S</u> a∨e Templates			
Save Template <u>A</u> s			
Features.5ft			
Program.5ft 📉			
Report.5ft			
C:\Qc5000 RC-1\Runs.5ft			

Adding Data to Templates

Add data to the features list by dragging and dropping information from the results window.

To drag and drop a single results window field into the features list

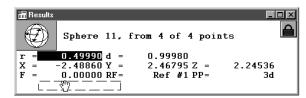
Step 1

Highlight the desired field in the results window.

🏭 Results			
Ð	Sphere 11	, from 4 of 4 poin	ts
r =	0.49990 d	- 0.99980	
X = 7	-2.48860 Y	= 2.46795 Z =	2.24536
F =	0.00000 RF	= Ref #1PP=	3d

Step 2

Hold down the left mouse button and move the field over the features list.





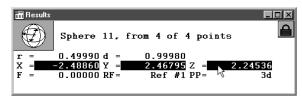
Release the left mouse button.

æ٢	E Features							
I	T Name	Datum		1				<u> </u>
	Plane 1	Primary		-0				
-	Line 2	Skew						
<u> </u>	Line 3							
•	Point 4	Zero						
•	Point 5							
-	Line 6							
(r.)	Arc 7							
0	Circle 8							
•	Point 9							
Θ	Cylinder							
0	Sphere 11							
								-
•								Þ

To drag and drop a multiple results window fields into the features list

Step 1

Highlight the desired fields in the results window.



Step 2

Hold down the left mouse button and move the fields over the features list.

开 Results	
Ð	Sphere 11, from 4 of 4 points
r =	0.49990 d = 0.99980
X =	-2.48860 Y = 2.46795 Z = 2.24536
F =	0.00000 RF = Ref #1 PP = 3d

Step 3

Release the left mouse button.

盨F	🖀 Features 📃 🗆 🗶						
I	T Name	Datum	r	- (N)			
	Plane 1	Primary					
<u> </u>	Line 2	Skew					
<u> </u>	Line 3						
•	Point 4	Zero					
•	Point 5						
<u> </u>	Line 6						
(r.	Arc 7		0.75707	7			
0	Circle 8		0.18866	5			
· ·	Point 9						
Θ	Cylinder		0.37522	2			
0	Sphere 11		0.49990				
				-			
•							

Step 4

Click the as multiple new columns button in the dialog box.



Use the as 1 new column button if the fields are intended to occupy only one column.

Sorting the Features List

Sort data in the features list by clicking on the column header. Each data column can be arranged from high to low, low to high, or by order entered.

To sort data in the features list

Step 1

Place the cursor on the desired column header.

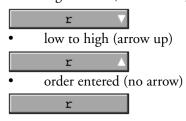
1	Γ Name	Datum	r	X V	Y	Z
	Point 9		N.	4.53139	0.74913	-0.16713
	Arc 7		0.75707	4.49242	0.75257	-0.01497
	Point 5			3.57722	1.48131	0.00010
	Plane 1	Primary		3.22598	1.56296	0.00000
1	Cylinder		0.37522	3.00035	1.49760	-0.26424
)	Circle 8		0.18866	2.99882	2.49648	0.00203
^	Line 3			2.26751	-0.00139	-0.45531
-	Line 6			1.81104	0.71418	-0.21084
^	Line 2	Skew		0.00000	1.47039	-0.45201
	Point 4	Zero		0.00000	0.00000	-0.45366
\sim	Sphere 11		0.49990	-2.48860	2.46795	2.24536



Click on the column header.

Plane 1 Primary N 3.22598 1.56296 0.00000 Line 2 Skew 0.00000 1.47039 -0.45201 Line 3 2.26751 -0.00139 -0.45201 Point 4 Zero 0.00000 0.00000 -0.45361 Point 5 3.57722 1.48131 0.0010 Line 6 1.81104 0.71418 -0.21084 Point 9 4.53139 0.74913 -0.16713 Circle 8 0.18866 2.99882 2.49648 0.00203 Cylinder 0.37522 3.00035 1.49760 -0.26244 Sphere 11 0.49990 -2.48860 2.46795 2.24536	I 1	Name	Datum	r 🔥 🔺	X	Y	Z
Line 3 2.26751 -0.00139 -0.45531 Point 4 Zero 0.00000 0.00000 -0.45361 Point 5 3.57722 1.48131 0.0010 Line 6 1.81104 0.71418 -0.21084 Point 9 4.53139 0.74913 -0.16713 Circle 8 0.18866 2.99882 2.49468 0.00203 Cylinder 0.37522 3.00035 1.49760 -0.26424 Sphere 11 0.49990 -2.48860 2.46795 2.24536	0	Plane 1	Primary	14	3.22598	1.56296	0.00000
• Point 4 Zero 0.00000 0.00000 -0.45366 • Point 5 3.57722 1.48131 0.00010 Line 6 1.81104 0.71418 -0.21084 • Point 9 4.53139 0.74913 -0.16713 • Circle 8 0.188666 2.99882 2.49648 0.00203 • Cylinder 0.37522 3.00035 1.49760 -0.26424 • Sphere 11 0.49990 -2.48860 2.45755 2.24536	-	Line 2	Skew		0.00000	1.47039	-0.45201
Point 5 3.57722 1.48131 0.00010 Line 6 1.81104 0.71418 -0.21084 Point 9 4.53139 0.74913 -0.16713 O Circle 8 0.18866 2.99882 2.49648 0.00203 O Cylinder 0.37522 3.00035 1.49760 -0.26424 O Sphere 11 0.49990 -2.48860 2.46795 2.24536	-	Line 3			2.26751	-0.00139	-0.45531
Line 6 1.81104 0.71418 -0.21084 Point 9 4.53139 0.74913 -0.16713 Circle 8 0.18866 2.99882 2.49648 0.00203 Cylinder 0.37522 3.00035 1.49760 -0.26424 Sphere 11 0.49990 -2.48860 2.46795 2.24536	•	Point 4	Zero		0.00000	0.00000	-0.45366
Point 9 4.53139 0.74913 -0.16713 Circle 8 0.18866 2.99882 2.49648 0.00203 Cylinder 0.37522 3.00035 1.49760 -0.26424 Sphere 11 0.49990 -2.48860 2.446795 2.24536	•	Point 5			3.57722	1.48131	0.00010
Circle 8 0.18866 2.99882 2.49648 0.00203 Cylinder 0.37522 3.00035 1.49760 -0.26424 Sphere 11 0.49990 -2.48860 2.46795 2.24536	-	Line 6			1.81104	0.71418	-0.21084
Cylinder 0.37522 3.00035 1.49760 -0.26424 Sphere 11 0.49990 -2.48860 2.46795 2.24536	•	Point 9			4.53139	0.74913	-0.16713
) Sphere 11 0.49990 -2.48860 2.46795 2.24536)	Circle 8		0.18866	2.99882	2.49648	0.00203
	Э.	Cylinder		0.37522	3.00035	1.49760	-0.26424
Arc 7 0.75707 4.49242 0.75257 -0.01497)	Sphere 1	1	0.49990	-2.48860	2.46795	2.24536
	-	Arc 7		0.75707	4.49242	0.75257	-0.01497

A small arrow to the right of the column label indicates the arrangement: • high to low (arrow down)



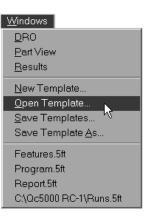
Chapter 6 Templates Reports Template

Use the reports template to prepare data in a standard print format. The reports template displays the same feature data as the features template in a printer-friendly format. Add data to the reports template by dragging and dropping information from the results window.

To open the reports template

Step 1

Select open template from the windows menu.

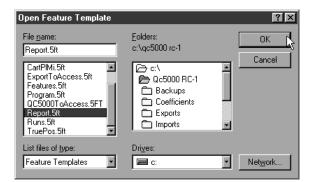


Step 2

Select *report.5ft* from the file name list box. The file path is c:\qc5000\templates.

Open Feature Template		?×
File name: Report.5ft CartPIMi.5ft Export ToAccess.5ft Program.5ft QC5000ToAccess.5FT Report.5ft Runs.5ft TruePos.5ft	Eolders: c:\qc5000 rc-1 C c:\ Qc5000 RC-1 Backups Coefficients Exports Imports	OK Cancel
List files of <u>type:</u> Feature Templates	Drives:	Net <u>w</u> ork

Step 3 Click OK.



Step 1 Select *reports.5ft* from the windows menu.



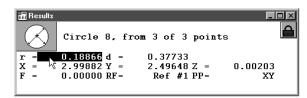
Adding Data to the Reports Template

Add data to the reports template by dragging and dropping information from the results window.

To drag and drop a single results window field into the reports template

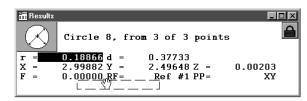
```
Step 1
```

Highlight the desired field in the results window.



Step 2

Hold down the left mouse button and move the field over the reports template.





Release the left mouse button.

	Feature	P	osition/Dim.	Size		Orientation	Form/	Dim.	
6	Line 6	X	1.81104			XY< 89°58'23″	F	0.00000	
		Y	0.71418			YZ<180°00'00"			
		Z	-0.21084			ZX< 90°00'00"			
7	Arc 7	Х	4.49242	d	1.51415		L3d	0.05810	
		Y	0.75257	r	0.75707		F	0.00000	
		Z	-0.01497						
8	Circle 8	X	2.99882	d	0.37733		F	0.00000	
		Y	2.49648		0.18866				
			0.00203						
9	Point 9	X	4.53139				F	0.40007	
		Y	0.74913						
		Z	-0.16713						

To drag and drop a multiple results window fields into the reports template

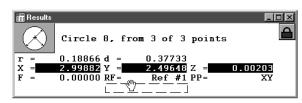
Step 1

Highlight the desired fields in the results window.

涯 Repo	rt			
	Orientation	Form/Dim.	r	
	XY< 89°58'23" YZ<180°00'00" ZX< 90°00'00"		D	
51415 75707		L3d 0.0581 F 0.0000		
37733 18866		F 0.0000	0 0.18866	
		F 0.4000	7	
		1	1	24 2



Hold down the left mouse button and move the fields over the reports template.





Release the left mouse button.

🔚 Repo	rt				
	Orientation	Form/	Dim.	r	
	XY< 89°58'23" YZ<180°00'00" ZX< 90°00'00"	F	0.00000		
51415 75707		L3d F	0.05810 0.00000	0.75707	
37733 18866		F	0.00000	0.18866	
		F	0.40007		T



Click the as multiple new columns button in the dialog box.

QC5000	×
How do you want the fields added to this template?	As 1 New Column
☐ Include labels with data	As Multiple New Columns

Use the as 1 new column button if the fields are intended to occupy only one column.

Sorting Data in the Reports Template

Sort data in the reports template by clicking on the column header. Each data column can be arranged from high to low, low to high, or by order entered.

To sort data in the reports template

Step 1

Place the cursor on the desired column header.

Report								
on/Dim.	Size		Orientation	Form,	/Dim.	rN	X 🔺	Z -
1.81104			XY< 89°58'23″	F	0.00000	N	1.81104	-0.2
0.71418			YZ<180°00'00"					
0.21084			ZX< 90°00'00"					
2.26751			XY<179°57'53″	F	0.00000		2.26751	-0.4
0.00139			YZ< 0°00'00"					
0.45531			ZX< 90°00'00"					
2.99882	d (0.37733		F	0.00000	0.18866	2.99882	0.0
2.49648	r (0.18866						
0.00203								
3.00035	d (0.75044	XY<153°51'02″	F	0.00115	0.37522	3.00035	-0.2
1.49760	r (0.37522	YZ< 89°53'05″					
0.26424			ZX<359°45'53″					
ا ا								Þ

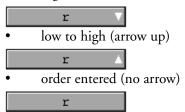
Step 2

Click on the column header.

on/Dim. Size	Orientation	Form/Dim.	r 📐 🛆	X	Z _
2.26751 D.00139 D.45531	XY<179°57'53" YZ< 0°00'00" ZX< 90°00'00"		72	2.26751	-0.4
0.00000 0.00000 0.45366		F 0.00000		0.00000	-0.4
3.57722 1.48131 0.00010		F 0.00000		3.57722	0.0
1.81104 D.71418 D.21084	XY< 89°58'23" YZ<180°00'00" ZX< 90°00'00"			1.81104	-0.2

A small arrow to the right of the column label indicates the arrangement:

• high to low (arrow down)



Report Headers

Report headers contain additional information that is placed at the top of the first report page. Users can customize report headers to suit specific application or documentation needs.

To show a report header

Step 1

Right click on the reports template.

on/Dim. Size	Orientation	Form/Dim.	r 🔺	X	Ζ.
2.26751	X¥<179°57'53″	F 0.00000		2.26751	-0.4
D.00139	YZ< 0°00'00"				
D.45531	ZX< 90°00'00"				
0.00000		F 0.00000)	0.00000	-0.4
0.00000					
0.45366					
3.57722		F 0.00000		3.57722	0.0
1.48131					
0.00010					
1.81104	XY< 89°58'23"	F 0.00000		1.81104	-0.2
0.71418	YZ<180°00'00"				
0.21084	ZX< 90°00'00"				

Step 2

Select template properties from the list.

Report 🔚					
on/Dim. Size	Orientation	Form/Dim.	r	X	Z 📥
2.26751 0.00139 0.45531	XY<179°57'53" YZ< 0°00'00" ZX< 90°00'00"		Properties	2.26751	-0.4
0.00000 0.00000 0.45366		F Cut	r-Ioberges	0.00000	-0.4
3.57722 1.48131 0.00010			Selection	3.57722	0.0
1.81104 0.71418 0.21084	XY< 89°58'23" YZ<180°00'00" ZX< 90°00'00"	C <u>h</u> ange	e Feature 🔹 🕨	1.81104	-0.2
1	224 30 00.00.	Print Se	ate Properties		T T
		<u>N</u> ew Te	emplate		
		_	emplates emplate <u>A</u> s		



Use the mouse to check the show report header check box.

Template Properties	×
Display Filters Misc Display Grid Snap To Grid Vertical Lines Expand Images Sections Sections Show Report Header Show Page Header Show Page Footer Show Page Footer Show Page Footer	OK Cancel

Step 4 Click OK in the dialog box.

emplate Properties		
Display ✓ Horizontal Lines	isc Grid Snap To Grid Grid Size 10 Set Text Color Set Line Color Font Size 10	Cancel

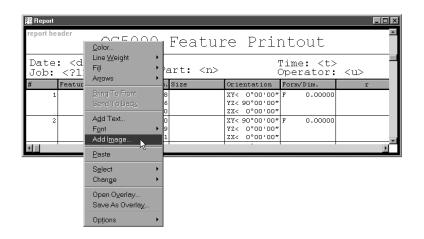
Customizing Report Headers

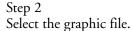
Users can edit report headers to suit individual needs. Report headers can include text and graphics.

To place a graphic in a report header

Step 1

Right click on the report header and select add image from the list.

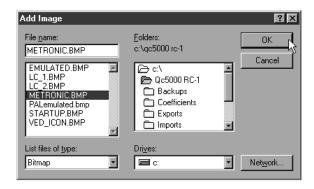




Add Image		? ×
File name: METRONIC.BMP	Eolders: c:\qc5000 rc-1	OK Cancel
LC_1.BMP LC_2.BMP METRONIC.BMP PALemulated.bmp STARTUP.BMP VED_ICON.BMP	Qc5000 RC-1 Backups Coefficients Exports Imports	
List files of type: Bitmap	Drives:	Network

Step 3

Click OK in the dialog box.



To arrange text and graphics in a report header

Step 1

Click on the text or graphic to be moved.

Repor								
report	Ç)C5	5000	Featur	ce	Pri	ntout	-
	e: <d> <?1></d>		Ρđ	art: <n></n>			Fime: <t> Operator:</t>	
#	Feature	Pos	sition/Dim.	Size	Ori	entation	Form/Dim.	r
	1 Plane	1 X	3.22598			0°00'00"	F 0.00000	
		Y	1.56296			90°00'00"		
		Z	0.00000		ZX<	0°00'00"		
	2 Line	2 X	0.00000		XY<	90°00'00"	F 0.00000	
		Y	1.47039		YZ<	0°00'00"		
		Z	-0.45201		ZX<	0°00'00"		-
	1	1			1	•		



Hold down the mouse button and drag the object to the desired location.

\begin{split} Report report he	ader	C5000	Featur	re Prin	ntout	<u> </u>
		h Pa	ime: <t> art: <n></n></t>		Operator:	<u></u>
#	Feature	Position/Dim.	Size	Orientation	Form/Dim.	r
1	Plane 1	X 3.22598 Y 1.56296 Z 0.00000		XY< 0°00'00" YZ< 90°00'00" ZX< 0°00'00"		
2	Line 2	X 0.00000 Y 1.47039 Z -0.45201		XY< 90°00'00" YZ< 0°00'00" ZX< 0°00'00"		
-	1	I	1	l .	I	



Release the mouse button.

Report report he	ader Q(C5000	Featur	re Prim	ntout	R
	: <d> <?1></d>		ime: <t>F art: <n></n></t>		Operator:	<u></u>
#	Feature	Position/Dim.	Size	Orientation	Form/Dim.	r
1	Plane 1	X 3.22598 Y 1.56296 Z 0.00000		XY< 0°00'00" YZ< 90°00'00" ZX< 0°00'00"		
2	Line 2	X 0.00000 Y 1.47039 Z -0.45201		XY< 90°00'00" YZ< 0°00'00" ZX< 0°00'00"		

Automated Text Input & Prompting

Use automated text input and prompting to automatically supply text input or to request it from the user. The QC5000 recognizes these automated text inputs:

- <u> prints the user name from login
- <n> prints the part name
- <d> prints the date
- <t> prints the current time
- <x> prints the max number of pages
- prints the current page number

Automated text inputs are case sensitive. For example, $\langle U \rangle$ is NOT the same as $\langle u \rangle$.

Use automated input prompts to request text entry from the user. For example,

Part number: <?1>

prompts the user to enter the part number in the report header before printing.

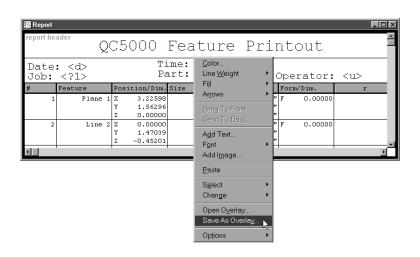
Enter automated input prompts sequentially. For example, if <?1> is used for prompting the part number use <?2> for the next input prompt.

Save headers for repeated use as overlays. Using an overlay saves the time and trouble of creating the same header for each new job.

To save a report header as an overlay

Step 1

Right click on the report header and select save as overlay from the list.

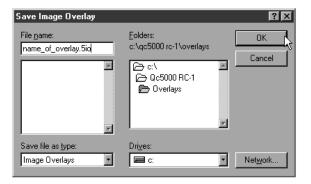




Type a name for the overlay as shown.

Save Image Overlay		? ×
File <u>n</u> ame: name_of_overlay.5io	Eolders: c:\qc5000 rc-1\overlays C c:\ Qc5000 RC-1 Overlays	OK Cancel
Save file as <u>type:</u> Image Overlays	Drives:	Net <u>w</u> ork

Step 3 Click OK in the dialog box.

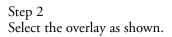


To place an overlay in a report header

Step 1

Right click on the report header and select open overlay from the list.

	200000 10	ature	Pr	intout 📫
Date: <d> Job: <?1> # Feature</d>	Time Part Position/Dim. Siz	<u>C</u> olor Line <u>W</u> eight Fi <u>l</u> l Ar <u>r</u> ows)))	Operator: <u> n Form/Dim. r</u>
	-	<u>B</u> ring To Front Send To Bac <u>k</u>		
× .		A <u>d</u> d Text F <u>o</u> nt Add I <u>m</u> age	,	× (
	_	<u>P</u> aste		
		S <u>e</u> lect Change	*	
		Open Overlay Save As Overlay Options	R -	



Load Image Overlay		?×
File name: saved_overlay.5io saved_overlay.5io	Eolders: c:\qc5000 rc-1\overlays c:\ Qc5000 RC-1 Currentlys Overlays	OK Cancel
List files of <u>type:</u> Image Overlays	Drives:	Network



Step 3 Click OK in the dialog box.

Load Image Overlay			? ×
File name: saved_overlay.5io saved_overlay.5io	Eolders: c:\qc5000 rc-1\overlays C c:\ C Qc5000 RC-1 Overlays	1 F	Cancel
List files of type: Image Overlays	Drives:	•	Net <u>w</u> ork

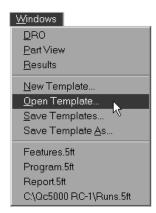
Program Template

Use the program template to monitor the steps of a parts program. Green checkmarks indicate steps succesfully completed and a blue arrow points to the current step. Loop counts are displayed in the data column. Programs can be set to run a certain number of times. This is referred to as 'looping' and each individual run is a 'loop.'

Program templates display information only. No data from the features list can be imported to the the program template.

To open the program template

Step 1 Select *open template* from the windows menu.



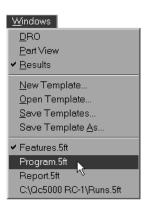
Step 2

Select *program.5ft* from the file name list box. The file path is c:\qc5000\templates.

Open Feature Template		? ×
File name: Program.5ft AllTol.5ft CartLin.5ft CartPIMi.5ft ExportToAccess.5ft Program.5ft QC5000ToAccess.5FT Report.5ft	Eolders: c:\qc5000 rc-1 C:\ Qc5000 RC-1 Backups Coefficients Exports Imports	Cancel
List files of type: Feature Templates	Dri <u>v</u> es:	▼ Network

OR

Step 1 Select *program.5ft* from the windows menu.

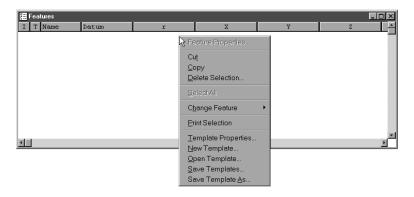


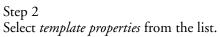
Template Properties

Standard template features can be modified by the user. Use the template properties dialog box to modify QC5000 templates to suit your application.

To access the template features dialog box

Step 1 Right click on any template.





I 7 Sout Intus	£	Σ	Ŧ	8	
	Out Gopy Delete S Scientifi				
4	Change Brief Sal	lection			2 2
	<u>N</u> ewTer Open Te Save Te	le Proposition			

Template Features Dialog Box

The template features dialog box contains three tabs: display, filters, and misc (miscellaneous). Click on the *display* tab to modify template display features.

Template Properties	×
Display Filters Misc Display Grid Horizontal Lines Vertical Lines Expand Images Sections Show Report Header Show Page Header Show Page Footer Show Page Footer Show Page Footer	OK Cancel

Display tab

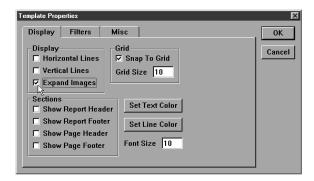
Use the mouse to place check in the horizontal lines check box to display horizontal separator line between each template row.

Display Filters Misc OK Display Grid F Horizontal Lines Grid Vertical Lines Cold Size Line	Template Properties		×
Expand Images Sections Show Report Header Show Page Header Show Page Footer Show Page Footer	Display Filters Mi Display Filters Mi Horizontal Lines Vertical Lines Expand Images Sections Show Report Header Show Report Footer Show Page Header	rid Snap To Grid rid Size 10 Set Text Color Set Line Color	ОК

Check the vertical lines box to display vertical separator lines between each template column.

emplate Properties	×
Display Filters Misc	OK
Display Grid Horizontal Lines Image: Sections Sections Set Text Color	Cancel
Show Report Header Set Text Color Show Page Header Set Line Color Show Page Footer Font Size	

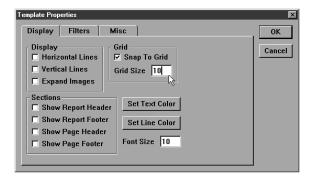
Display partview/image features in a template by checking the expand images box.



Check the *snap to grid* box to activate the alignment grid in the template. When *snap to grid* is checked fields in the template are automatically aligned to the nearest grid intersection.

Template Properties	×
Display Filters Misc Display Grid Horizontal Lines Vertical Lines Expand Images Sections Show Report Header Show Page Header Show Page Footer Show Page Footer Show Page Footer Show Page Footer	OK Cancel

Set the size of the grid squares using the grid size text box.



Display a report header at the top of a template by checking the *show report header* box. The report header can include custom text and graphics. Report headers print at the top of the first page of a report.

Template Properties	×
Display Filters Misc Display Filters Misc Horizontal Lines Vertical Lines Expand Images Sections Show Report Footer Show Page Header Show Page Footer Show Page Footer Show Page Footer	OK Cancel

Create a report footer at the bottom of a template by checking the *show report footer box.* Report footers can include custom text and graphics. The report footer prints at the end of a report.

Display Filters Misc Display Grid Horizontal Lines V Snap To Grid	OK
☐ Horizontal Lines ☑ Snap To Grid	
Vertical Lines Grid Size Expand Images	Cancel
Sections Show Report Header Show Report Footer Show Page Header Show Page Footer Show Page Footer	

Display a page header at the top of each report page by checking the *show page header* box. The page header can include custom text and graphics.

Template Properties	×
Template Properties Display Filters Display Grid Image: Horizontal Lines Filters Image: Sections Set Text Color Image: Sections Set Line Color Image: Show Page Footer Font Size Image: Show Page: Footer Font Size	OK Cancel

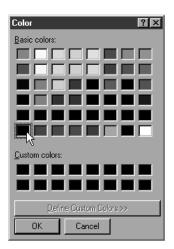
Create a page footer at the bottom of each report page by checking the *show page footer box*. Page footers can include custom text and graphics.

Template Properties	X
Template Properties Display Filters Display Grid Forzontal Lines F Snap To Grid Vertical Lines Grid Size Expand Images Sections Show Report Header Set Text Color	OK Cancel
Show Report Footer Set Line Color Show Page Header Font Size Show Page Footer Font Size	

Click on the set text color button to change the color of text in the template.

Template Properties	×
Display Filters Misc Display Grid Horizontal Lines Image: Solution of the section of th	OK Cancel

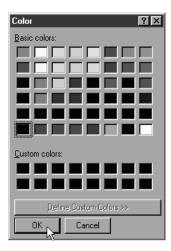
Select a color from the *color* window as shown.



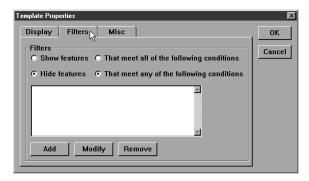
Click on the *set line color* button to change the color of horizontal and vertical lines in the template.

Template Properties	×
Display Filters Misc	ОК
Display Horizontal Lines Vertical Lines Expand Images Sections Show Report Header Show Page Header Show Page Footer Show Page Footer Font Size 10	Cancel

Select a color from the *color* window as shown.



Filters are conditions (or sets of conditions) that determine what features appear (or do not appear) on a template. Use the filters tab to establish the conditions features must meet to be included or excluded from the template.



For example, if a part drawing calls for a circle to have a diameter of 0.375 inches with a tolerance of 0.006 inches, you can create a template that displays only circles with a diameter greater than 0.381 inches or less than 0.370 inches. This filter allows the user to track features that fail to meet specifications without having to sort through all the features.

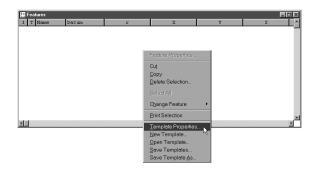
To create a filter



This filter is based on the example above but steps can be varied to suit specific applications. Once you have created this filter it is easy to create other filters for your applications.

Step 1

Right click on the template and select template properties from the list.





Select the *filters* tab in the dialog box.

Template Properties	×
Display Filters Misc	ОК
Filters © Show features © That meet all of the following conditions	Cancel
Hide features That meet any of the following conditions	
Add Modify Remove	

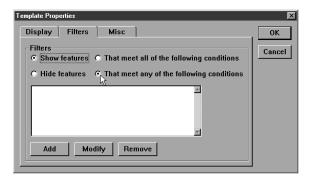


Click on the *show features* button.

Template Properties	X
Display Filters Misc	ОК
Filters Show features © That meet all of the following conditions C Hide features © That meet any of the following conditions	Cancel
Add Modify Remove	

Step 4

Click on the *that meet any conditions* button.



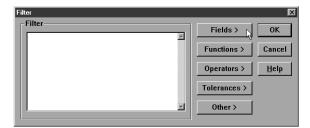


Click the *add* button.

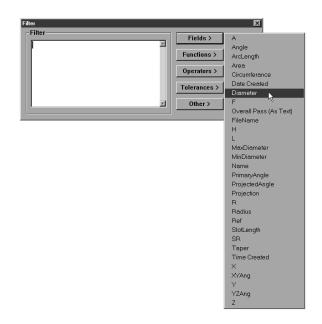
Template Properties	X
Template Properties Display Filters G Show features O That meet all of the following conditions Hide features That meet any of the following conditions Hide features That meet any of the following conditions Image: Add modify Remove	OK Cancel

Step 6

Click the *fields*> button in the filter dialog box.



Step 7 Select *diameter* from the list.

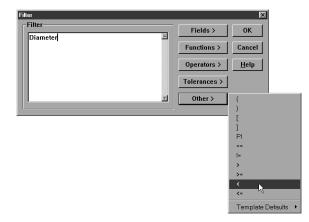


Step 8 Click the *other*> button.

Filter Diameter	<u> </u>	Fields >	0K
		Functions >	Cance
		Operators >	<u>H</u> elp
		Tolerances >	



Select the < (less than) symbol from the list.



Step 10

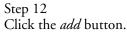
Type 0.370 in the text box as shown.

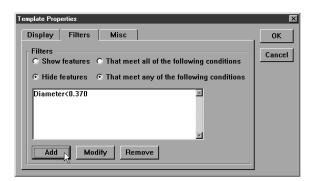


Step 11

Click OK in the filter dialog box.

Filter		X
Filter Diameter<0.370	Fields >	ОК
	Functions >	Cancel
	Operators >	<u>H</u> elp
	Tolerances >	
	Other >	



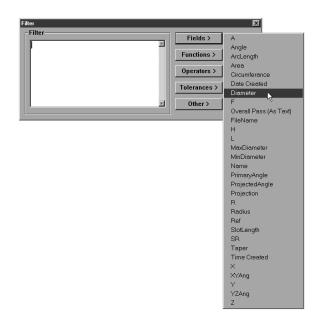




Click the *fields*> button in the filter dialog box.

Filter		X
Filter	Fields >	ОК
	Functions >	Cancel
	Operators >	<u>H</u> elp
	Tolerances >	
	Other >	
]	

Step 14 Select *diameter* from the list.

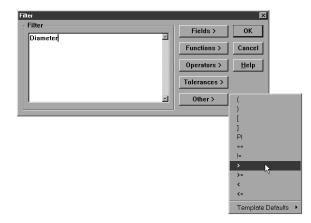


Step 15 Click the *other*> button.

Diameter	 Fields >	0K
	Functions >	Cance
	Operators >	<u>H</u> elp
	Tolerances >	



Select the > (greater than) symbol from the list.



Step 17

Type 0.381 in the text box as shown.



Step 18 Click OK in the filter dialog box.

Filter		×
Filter Diameter>0.381	Fields >	ОК
	Functions >	Cancel
	Operators >	<u>H</u> elp
	Tolerances >	
	Other >	



Click OK in the template properties dialog box.

Template Properties	×
Display Filters Misc	ОК
Filters	Cancel
Show features	
• Hide features • That meet any of the following conditions	
Diameter<0.370	
Diameter>0.381	
Add Modify Remove	

To modify a filter

Step 1

Highlight the desired filter.



Step 2

Click the *modify* button on the filters tab (template properties dialog box).

Template Properties	×
Display Filters Misc	OK
Filters C Show features C That meet all of the following conditions	Cancel
Hide features F That meet any of the following conditions	
Diameter>0.370 🗖	
Add Modify Remove	

Step 3

Type in the modification.

Filter		×
Filter	Fields >	ОК
	Functions >	Cancel
	Operators >	<u>H</u> elp
	Tolerances >	
	Other >	

Step 4

Click OK in the filters dialog box.

Filter		×
Filter	Fields >	ОК
	Functions >	Cancel
	Operators >	<u>H</u> elp
	Tolerances >	
	Other >	

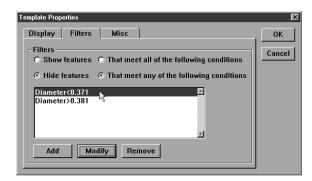
Step 5 Click OK in the template properties dialog box.

<u> </u>	
Filtero	ncel

To remove a filter

Step 1

Highlight the desired filter on the *filters* tab (template properties dialog box).





Click the *remove* button.

Template Properties	×
Display Filters Misc	ок
Filters O Show features O That meet all of the following conditions Image: Hide features Image: That meet any of the following conditions	Cancel
Diameter>0.371	
Add Modify Remove	

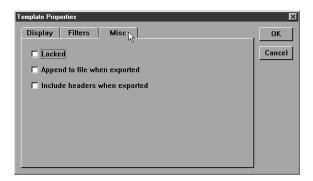
Step 3

Click yes in the dialog box.



Misc tab (miscellaneous)

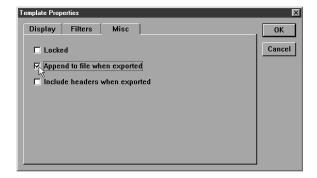
The miscellaneous tab contains three check boxes.



Place a check in the *locked* box to require the supervisor password before templates are editied.

Template Properties	×
Templato Properties Display Filters Misc OK V_Locked Cance Cance Include headers when exported Include headers when exported Cance	

Place a check in the *append to file when exported* box to export template properties.



Place a check in the *include headers when exported* box to export report and page headers.

Column Properties

Columns in each template have properties that can be modified to suit specific application needs. Standard column properties apply to columns in every template. Additionally, there a column properties unique to specific templates.

Standard column properties

Right click on any template and select column properties from the list. This brings up the column properties dialog box.

Column Properties	×
Appearance Formulas	ОК
Name X	Cancel
Width 120	
Title Alignment	
○ Left ⊙ Center ○ Right	
Data Alignment	
○ Left ○ Center ○ Right	

Appearence tab

The appearence tab allows the user to assign a name to the column, establish column width, title alignment, and data alignment.

Column Properties	×
Appearance Formulas	ОК
X F Add Modify Remove	Cancel

Formulas tab

Column formulas are conditions (or sets of conditions) that determine what labels appear (or do not appear) with features in a column. Use the formulas tab to establish the conditions features must meet to be labeled.

Use formulas to customize column data and perform calculations. For example, a formula a formula can be written to display the 'X' value of a feature.

A more complex formula can be written to display the standard deviation of several diameters.

Parantheses()

Use parantheses to order mathmetical equations. For example, in the following equation

6*(4+2) = 36

the 4 and 2 are added together before being multiplied by the 6.

The same equation without the parantheses is as follows:

6*4+2 = 26

Here 6 is multiplied by 4 then added to 2.

Work from the innermost set of parantheses to the outermost set in equations using multiple sets of parantheses.

For example,

((4+2)*(4+2)+1) = 37

Here the addition in the innermost parantheses is performed first, then the two sums are multiplied and added to 1.

The mathemetical order of operations is always multiplication, division, addition, subtraction.

Parantheses can also be used to call functions such a squares, square root, max, min, etc. For example,

sqrt(100) = 10

the function (square root) is performed on the number in the parantheses (100).

Brackets []

Use brackets to recall previously measured features for a formula. For example,

[Circle 1]x

recalls the 'x' value of Circle 1.

A more complex equation might be

sqr([Circle 1]radius)*PI

Here the radius of Circle 1 is squared and multiplied by pi which produces the area of Circle 1.

Quote marks "

Use quote marks to indicate an output in a formula. For example,

If([Circle 1]radius<=2.0,"Small")

prints the word "Small" in the column if the radius of Circle 1 is less than or equal to 2.0.

A more complex equation might be

If([Circle 1]radius<=2.0,"Small","Big")

Here the "Small" is printed if the radius of Circle 1 is less than or equal to 2.0 and "Big" is printed if it is greater than 2.0.

Use empty quote marks "" to show no output. For example,

If([Circle 1]radius>2.0,"","Small")

gives the same output as

If([Circle 1]radius<=2.0,"Small")

using a slightly different formula.

Min/Max

Use the min and max functions to find the minimum or maximum parameter for a series of features. For example,

Max(-1,-10,"Diameter")

will produce the maximum diameter of the last 10 circles measured.

The following example creates a formula to group circle features into by size.

Use the formula:

If(Diameter<0.381,"Small","Large")

to sort circle features into two groups: large or small.

To create the sample formula

This formula is an example. Steps can be varied to suit specific applications. Once you have created this formula it is easy to create other formulas for your applications.

Step 1

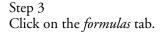
Right click at the top of the template column as shown.

I	T Name	Datum	X	Y	Z	d N	r
/	Line 3		2.17580	-0.00110	-0.39047	N.	
•	Point 4	Zero	0.00000	0.00000	-0.39125		
)	Circle 5		3.00058	2.49767	-0.03907	0.37424	0.1871
)	Circle 7		2.99938	0.49964	-0.00901	0.37484	0.1874
)	Circle 6		3.00032	1.49831	-0.02468	0.75131	0.3756
Ϋ́,	a. , ,		1 10005				

Step 2

Select column properties from the list.

	atures						
II	Name	Datum	X	Y	Z	d	Feature Properties
-	Line 3		2.17580	-0.00110	-0.39047		reduier jopenies
1:	Point 4	Zero	0.00000	0.00000	-0.39125		Cut
Q	Circle 5		3.00058	2.49767	-0.03907	0	Copy
	Circle 7		2.99938	0.49964	-0.00901	0	Delete Selection
0	Circle 6		3.00032	1.49831	-0.02468	0	
<u>Î</u>			1 10005	0 74040	0 00101		Select All
							Change Feature
							Print Selection
							<u>T</u> emplate Properties <u>N</u> ew Template
							Open Template
							Save Templates
							Save Template <u>A</u> s
							Column <u>P</u> roperties
							Delete Column
							Charts +
						-	



Column Properties	×
Appearance Formulas	ОК
Diameter	Cancel

Step 4 Click *add*.

Column Properties	Þ
Appearance Formulas	ОК
Diameter Add Modify Remove	Cancel

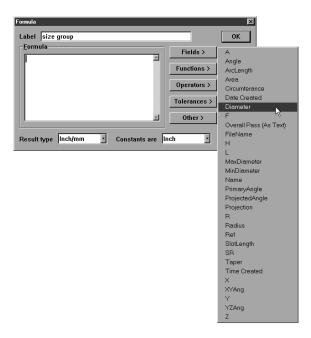
Step 5 Type 'size group' in the label text box.

Formula		×
Label size group		ОК
Eormula	Fields >	Cancel
	Functions >	<u>H</u> elp
	Operators >	
	Tolerances >	
	Other >	
Result type Inch/mm Constants are	nch 📩	

Step 6 Click on the *fields*> button.

Formula		×
Label size group		0K
Eormula E	Fields >	Cancel
	Functions >	<u>H</u> elp
	Operators >	
	Tolerances >	
Y	Other >	
Result type Inch/mm Constants are Ir	nch	

Step 7 Select *diameter* from the list.

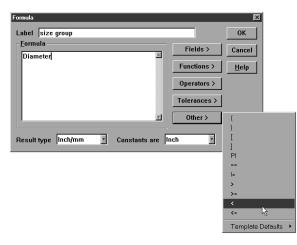


Step 8 Click on the *other*> button.

Formula Label size group		<u>х</u> 0К
Eormula Diameter	Fields >	Cancel
	Functions > Operators >	<u>H</u> elp
	Tolerances >	
Result type Inch/mm Constants are Ir	Other >	;



Select the < (less than) symbol from the list.



Step 10

Type 0.381 in the text box as shown.

Formula		×
Label size group		ОК
Eormula Diameter<0.381	Fields >	Cancel
	Functions >	Help
	Operators >	
	Tolerances >	
	Other >	
Result type Inch/mm 📩 Constants are I	nch 🗾	

Step 11 Type in the rest of the formula as follows: If(Diameter<0.381,"Small","Large")

Formula		×
Label size group		ОК
Formula IffDiameter<0.381,"Small","Large"	Fields >	Cancel
	Functions >	<u>H</u> elp
	Operators >	
	Tolerances >	
×	Other >	
Result type Inch/mm Constants are	nch 🔹	

Step 12 Select *text* from the result type list box.

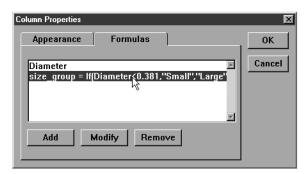
Formula		X
Label size group		ОК
Formula	Fields >	Cancel
lf(Diameter<0.381,"Small","Large") 🛛 🖻	Functions >	<u>H</u> elp
	Operators >	
	Tolerances >	
	Other >	
Result type Inch/mm Constants are I	nch 🔽	
Angular Numeric		
Te×t Inch/mm Sõua		
Inch/mm Cube Inch/mm or Te;⊯		

Step 13 Click OK in the formula dialog box.

Formula		X
Label size group		ОК
Formula If(Diameter<0.381,''Small'',''Large'']	Fields >	Cancel
	Functions >	<u>H</u> elp
	Operators >	
	Tolerances >	
	Other >	
Result type Text Constants are	nch	

To modify a formula

Step 1 Highlight the desired formula.



Step 2

Click the *modify* button on the formulas tab (column properties dialog box).

Formula		×
Label size_group		ОК
Formula	Fields >	Cancel
	Functions >	<u>H</u> elp
	Operators >	
	Tolerances >	
	Other >	
Result type Text Constants are	nch 🗾	

Step 3

Type in the modification.

Formula		×
Label size_group		ОК
Eormula If(Diameter<0.381,"Small","Big()	Fields >	Cancel
	Functions >	<u>H</u> elp
	Operators >	
	Tolerances >	
	Other >	
Result type Text Constants are	nch 🔹	

Step 4

Click OK in the formulas dialog box.

Formula		×
Label size_group		ОК
Formula If(Diameter<0.381,"Small","Bigi')	Fields >	Cancel
	Functions >	<u>H</u> elp
	Operators >	
	Tolerances >	
	Other >	
Result type Text Constants are	nch 💽	

Step 5 Click OK in the column properties dialog box.

Column Properties	X
Appearance Formulas	ОК
Diameter size_group = If(Diameter<0.381,''Small'',''Big'')	Cancel
Add Modify Remove	

To remove a formula

Step 1

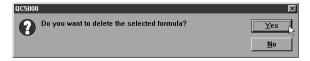
Highlight the desired formula in the text box on the formula tab (column properties dialog box).

Column Properties	×
Appearance Formulas	ОК
Diameter size_group [©] If(Diameter<0.381,''Small'',''Big') ▼	Cancel
Add Modify Remove	

Step 2 Click the *remove* button.

Column Properties	X
Appearance Formulas	ОК
Diameter size_group = If(Diameter<0.381,''Small'',''Big')	Cancel
Add Modify Remove	

Step 3 Click *yes* in the dialog box.



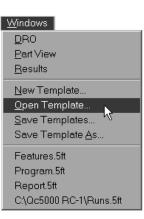
Chapter 6 Templates Runs Template

Use the runs template to track critical features from one program run to the next. Data in the runs is restricted to one feature attribute per column. For example, a column may display only the 'x' value for a given circle.

To open the runs template

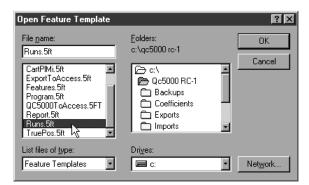
Step 1

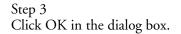
Select open template from the windows menu.

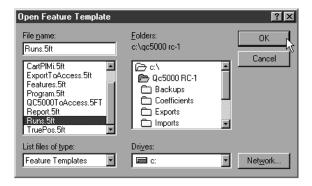




Select *runs. 5ft* from the file name list in the open template dialog box.







To add data to the runs template

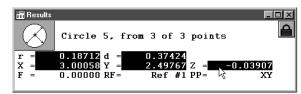
Step 1

Highlight a feature in the features list.

I 7	[Name	Datum	X	Y	Z	d 🗸	r
5	Circle 7		2.99938	0.49964	-0.00901	0.37484	0.187
)	Circle 5		3.00058	2.49767	-0.03907	0.37424	0.187
	Plane 1	Primary	3.21868	1.62520	0.00000		
•	Point 4	Zero	0.00000	0.00000	-0.39125		
/	Line 3		2.17580	-0.00110	-0.39047		

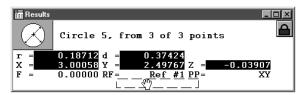
Step 2

Click on the desired fields in the results window to highlight them.



Step 3

Place the cursor over the highlighted fields and hold down the left mouse button.

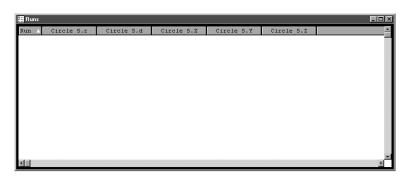


Step 4

Drag the fields into the runs template.



The new fields appear in the template as shown.



Chapter 6 Templates

Nesting Template Windows

Up to ten can be open at one time. Nest templates within a single window to organize the desktop. Use the tabs to view nested windows.



Do not open unneeded templates. System speed decreases as more templates are opened. Use the minimum number of templates required for fastest processing.

To nest template windows

Step 1

Place the cursor over the title bar of the template window.



Step 2

Hold down the left mouse button and drag the window another template window.

Name Datum	X	Y	Z	d 🔻	r 🔺
Circle 7	2.99938	0.49964	-0.00901	0.37484	0.18
Circle 5	3.00058	2.49767	-0.03907	0.37424	0.18
Plane 1 Primary	3.21868	1.62520	0.00000		
Point 4 Zero	0.0000	0.0000	-0.39125		
Lin 🔚 Report	<u> </u>				
report header	QC5000	Featur	e Prin	tout	
Date: <d> Job: <?1></d>		ime: <t>Pp art: <n></n></t>		oerator: <	(u>



Release the left mouse button.

Date: CD Time: CD Job: <1> Part: Operator: <u></u>	Report 🗧		
QC5000 Feature Printout Date: <d> Time: <t>Ppp</t></d>	Features Report		
Date: (a)	report header	QC5000 Feature Printout	-

To separate template windows

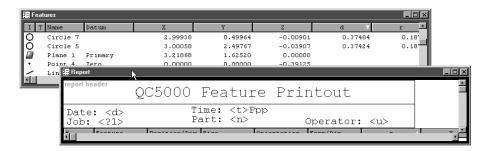
Step 1

Place the cursor of the desired template tab.

🔁 Report		
Features Report		
report header 🛛 🕷	QC5000 Feature Printout	-
Date: <d> Job: <?1></d>	Time: <t>Ppp Part: <n> Operator: <u></u></n></t>	

Step 2

Hold down the left mouse button and drag the template out of the window.





Release the mouse button.

	atures						
I 1	[Name	Datum	X	Y	Z	d V	r.
)	Circle 7		2.99938	0.49964	-0.00901	0.37484	0.18′
)	Circle 5		3.00058	2.49767	-0.03907	0.37424	0.18
2	Plane 1	Primary	3.21868	1.62520	0.00000		
•	Point 4	Zero	0.00000	0.00000	-0.39125		
-	Line 3		2.17580	-0.00110	-0.39047		[

report header	QC5000 Feature Printout	
Date: <d> Job: <?1></d>	Time: <t>Ppp Part: <n> Operator: <u></u></n></t>	

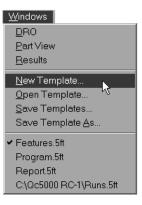
Creating a new template allows you to customize report formats and information in the features list. For example, templates can be designed to export data in a certain format.

To create a new template

Δ	Feature		Position/Dim.	Size		Orientation	Form	/Dim.	Special
1	Plane 1	L	X 3.21868			XY< 0°00'00"	F	0.00000	
			Y 1.62520			YZ< 90°00'00″			
			z 0.00000			ZX< 0°00'00"			
2	Line 2	2	x 0.00000			XY< 90°00'00"	F	0.00000	
			Y 1.49036			YZ< 0°00'00"			
			Z -0.39204			ZX< 0°00'00"			
3	Line 3	3	X 2.17580			XY<179°58'14″	F	0.00000	
			Y -0.00110			YZ< 0°00'00″			
			Z -0.39047			ZX< 90°00'00"			
4	Point 4	ł	x 0.00000				F	0.00000	
			Y 0.00000						
			Z -0.39125						
5	Circle 5	5	X 3.00058	d	0.37424		F	0.00000	
- ¹		ģ							1

Step 1

Select new template from the windows menu.





Type a name for the template in the file name text box.

New Template Name		? ×
File name:	Eolders: c:\qc5000 rc-1\templates C:\ Qc5000 RC-1 Templates	OK Cancel
Save file as type: Feature Templates	Drives:	Net <u>w</u> ork

Step 4 Click OK in the new template name dialog box.

New Template Name		? ×
File name: new_template.5ft	Eolders: c:\qc5000 rc-1\templates C c:\ C Qc5000 RC-1 T emplates	Cancel
Save file as type: Feature Templates	Drives:	Net <u>w</u> ork



Step 5 Select type of template to create in the dialog box.

New Template	X
Template Type O <u>F</u> eature List	ОК
C <u>R</u> uns Database	Cancel
© <u>P</u> rogram Listing	
Report	
☑ <u>U</u> se Defaults	

To export a tab delimited file to a spreadsheet

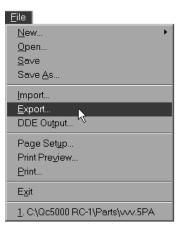
Step 1

Select the features to be exported from the features list.

2	Fea	tures						_ _ _ _ ×
I	Т	Name	Datum	X	Y	Z	d	r 🔺
		Plane 1	Primary	3.21868	1.62520	0.00000		
\leq		Line 2	Skew	0.00000	1.49036	-0.39204		
\sim		Line 3		2.17580	-0.00110	-0.39047		
<u>۰</u>		Point 4	Zero	0.00000	0.00000	-0.39125		
0		Circle 5		3.00058	2.49767	-0.03907	0.37424	0.1871
0		Circle 6		3.00032	1.49831	-0.02468	0.75131	0.375€
0		Circle 7		2.99938	0.49964	-0.00901	0.37484	0.1874
0		Circle 8	νζ.	4.49935	0.74810	0.02104	1.00052	0.5002
•	1							

Hold down the ctrl key to select features that are not listed sequentially in the features list.

Step 2 Select *export* from the file menu.





Select tab delimited from the save file as type list in the export dialog box.

Export		? ×
File <u>n</u> ame: *.mdb	Eolders: c:\ 5-K backup 5-k manual 5-K notemp Backup 5K	OK Cancel
Save file as <u>type</u> : Access Database	Drives:	 Net <u>w</u> ork
Access Database CSV DXF IGS Points (CSV) Points (DXF) Tab Delimited		

Step 4

Type the name of the file in the file name text box.

Export		? ×
File name:	Eolders: c:\ 5-K backup 5-k manual 5-Knotemp Backup 5K Beta	OK Cancel
Save file as <u>type:</u> CSV	Dri <u>v</u> es:	Network



Use the *folders* box and drives list to select the storage location for the file.

Export		? ×
File name: tabd_export.tdf	Eolders: c:\ 5-K backup k 5-K manual 5-Knotemp Backup 5K Beta	OK Cancel
Save file as <u>type:</u> Tab Delimited	Dri <u>v</u> es:	Net <u>w</u> ork

Step 6

Click OK in the export dialog box.

Export		? ×
File name: tabd_export.tdf	Eolders: c:\ 5-K backup 5-K manual 5-Knotemp Backup 5K Beta	Cancel
Save file as <u>type:</u> Tab Delimited	Drives:	▼ Network

Step 7

Open the spreadsheet application and open the saved file.

🔀 Microsoft E	xcel - tabd_o	export.tdf								
Eile Edit	: ⊻iew <u>I</u> nse	ert F <u>o</u> rmat	<u>T</u> ools <u>D</u> at							_ & ×
0 🗳 🖬	i 🖓 🖗	2 B	10	* CH * 🝓	φ Σ.	f≈ Ž↓ Z↓	10 🔮 4	100% -	2	
Arial	• 1	0 💌 🖪	<u>Ι</u> <u>Π</u> ≣		\$ %	00. 0.+ 00.+ 00. e	使使	- 🕭 -	<u>A</u> -	
A1	-	=								
A	В	С	D	E	F	G	Н	I	J	КТ
1]	Line 3		2.1758	-0.0011	-0.39047				
2	-	Circle 5		3.00058	2.49767	-0.03907	0.37424	0.18712		
3		Circle 7		2.99938	0.49964	-0.00901	0.37484	0.18742		
4										
5										
6										
7										
8										
9										
10										•
III I P PI tabd	export /						_			
Ready								NUN	1	

To export a CSV (comma separated value) file to a spreadsheet

Step 1

Select the features to be exported from the features list.

Т	Name	Datum	X	Y	Z	d	r
1	Plane 1	Primary	3.21868	1.62520	0.00000		
-	Line 2	Skew	0.00000	1.49036	-0.39204		
-	Line 3		2.17580	-0.00110	-0.39047		
	Point 4	Zero	0.00000	0.00000	-0.39125		
)	Circle 5		3.00058	2.49767	-0.03907	0.37424	0.187
)	Circle 6		3.00032	1.49831	-0.02468	0.75131	0.375
)	Circle 7	N	2.99938	0.49964	-0.00901	0.37484	0.187
)	Circle 8	45	4.49935	0.74810	0.02104	1.00052	0.500

Hold down the ctrl key to select features that are not listed sequentially in the features list.

Step 2

Select *export* from the file menu.

<u>F</u>ile

<u>N</u> ew •
<u>O</u> pen
<u>S</u> ave
Save <u>A</u> s
Import
Export
DDE Ou <u>t</u> put ¹⁴
Page Set <u>u</u> p
Print Pre⊻iew
<u>P</u> rint
E <u>x</u> it
1. C:\Qc5000 RC-1\Parts\vvv.5PA

Step 3 Select *CSV* from the save file as type list in the export dialog box.

Export		? ×
File name: *.mdb	Eolders: c:\ 5-K backup 5-k manual 5-k manual 5-k notemp Backup 5K Beta	 OK Cancel
Save file as type: Access Database	Dri <u>v</u> es: E c:	Net <u>w</u> ork
CSV DXF IGS Points (CSV) Points (DXF) Tab Delimited		



Type the name of the file in the file name text box.

Export		? ≍
File name:	Eolders: c:\ 5-K backup 5-K backup 5-K manual 5-K notemp Backup 5K Beta	OK Cancel
Save file as type: CSV	Drives:	▼ Network



Use the *folders* box and drives list to select the storage location for the file.

Export		? ×
File name:	Eolders: c:\ 5-K backup k 5-k manual 5-K notemp Backup 5K Beta	OK Cancel
Save file as type: CSV	Drives:	Net <u>w</u> ork

Step 6 Click OK in the export dialog box.

Export		? ×
File <u>n</u> ame: csv_export.csv	<u>F</u> olders: c:\	ОК
Csv export.csv	C C:\ 5-K backup 5-K manual 5Knotemp Backup 5K Beta	Cancel
Save file as <u>t</u> ype: CSV	Dri <u>v</u> es:	Network



Step 7 Open the spreadsheet application and open the saved file.

📉 Mi	icrosoft Ex	kcel - csv_e	export.csv								_ 🗆 🗡
	Eile Edit View Insert Format Tools Data Window Help						_ 8 ×				
∥Ľ	*	a 🕫	1 B 6	1 🖋 🗠	* CH * 🔞	🦉 Σ.	f≈ Ž↓ Z↓	10 🖤 4	100% -	2	
Aria	ıl	• 1	10 🔹 🖪	I <u>U</u> ≣		\$ %	•.0 .00 •.0 •.0	t≡ t≡	- 🕭 -	<u>A</u> -	
	A1	•	=								
	Α	B	С	D	E	F	G	Н	1	J	К
1			Line 3		2.1758	-0.0011	-0.39047				
2		1	Circle 5		3.00058	2.49767	-0.03907	0.37424	0.18712		
23			Circle 7		2.99938	0.49964	-0.00901	0.37484	0.18742		
4											
5											
6											
7											
8											
9											
10											•
	N csv_e	aport /									
Read	dy				[NUM	1	

Chapter 7 Programming

The QC5000 is user programmable. Users can enter a series of steps and save it as a program for later use. When the program is executed the QC5000 prompts the user to perform the necessary steps for the inspection of the part. This function is useful for repetitive measuring of large quantities of parts. QC5000 programs are part specific, that is each program is for a specific part. A sample program and instructions to create it are included in this chapter.

Programming Overview

The QC5000 programming feature works like a tape recorder. The following sections explain programming features and demonstrate how to create, save, and run a program. To avoid confusion, use the QC5000 demo part for the following sections. Any multi-feature part may be substituted in later programs.

Keep in mind that QC5000 programs execute sequentially. If a step references a feature, that feature must already be measured. Here are two simple tips for hassle free programming:

- Only reference features that have been measured prior to the step that references them.
- Do not delete a features that are part of a construction.

In this section all instructions refer to the program toolbar. The same procedures can be performed using the pull down menus at the top of the screen as well.

Toolbars in the QC5000 software can be customized. This manual attempts to display the most common toolbar arrangements. Some users may find the toolbar setup on their system varies from those shown here.

To display the program toolbar select 'toolbars' from the View pull down menu. In the Toolbars dialog box, click on 'program' in the list box on the left then click the Show button. Click the OK button to continue.

Record/Edit Program



Click the record/edit button to start recording a program. The QC5000 software will record all actions from this point as a new program or as an addition to an existing program. To stop recording, click the Pause Program button (see below).

Pause Program



Click the Pause Program button to stop a currently running program or to stop recording/editing a program. The last step executed before the program was paused is highlighted in the program window.

New Run



Click the New Run button to run a program from the first step. When New Run is clicked the program begins from the first step regardless of the step selected in the program window.

Run Program From Current Step



Click the Run Program From Current Step button to run a program from the currently selected step in the program window.

Run Just Current Step



Click the Run Just Current Step to execute only the currently selected step and then pause the program.

Recording a Program

To create a program

Step 1

Select new from the file menu. Then select part.

<u>F</u> ile	
<u>N</u> ew ▶	<u>P</u> art
<u>O</u> pen	<u>R</u> un 🗟
<u>S</u> ave	
Save <u>A</u> s	
Import	
<u>E</u> xport	
DDE Output	
Page Set <u>u</u> p	
Print Pre <u>v</u> iew	
<u>P</u> rint	
E <u>x</u> it	
1. C:\Qc5000 RC-1\Parts\vvv.5PA	

Step 2

Click the record/edit button on the program toolbar.



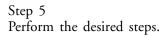
Step 3

Type a progam name as shown.

Save Part As		?×
File name: new_program.5pa	C:\ C:\ 5-K backup 5-K manual 5-K manual 5-K manual 5-K manual 5-K manual 5-K manual 5-K manual 5-K manual 5-K backup 5-K	OK Cancel
Save file as type: Part Files	Dri <u>v</u> es: E c:	▼ Net <u>w</u> ork

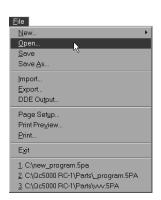
Step 4 Click OK.

Save Part As		? ×
File <u>n</u> ame: new_program.5pa ppp.5PA	Eolders: c:\ 5-K backup 5-K manual 5-Knotemp Backup 5K Beta	Cancel
Save file as <u>type:</u> Part Files	Drives:	▼ Network



To open a saved program

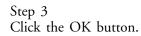
Step 1 Select *open* from the file menu.



Step 2

Highlight the desired program as shown.

Open Part		? ×
File <u>name:</u> new_program.5pa new_program.5pa ppp.5PA	Eolders: c:\ 5-K backup 5-K manual 5-Knotemp Backup 5K Beta	OK Cancel
List files of <u>type</u> : Part Files	Drives:	Net <u>w</u> ork



Open Part		?×
File name: new_program.5pa new_program.5pa ppp.5PA	Eolders: c:\ 5-K backup 5-K manual 5-K notemp Backup 5K Beta	Cancel
List files of <u>type:</u> Part Files	Drives:	Network

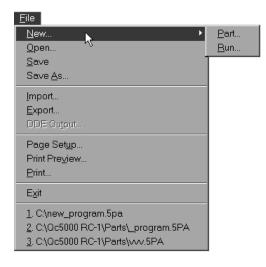
Chapter 7 Programming

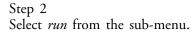
Running A Program

Running a saved program is easy. Open the part file using the method shown in above.

To run a program

Step 1 Select *new* from the file menu.





Eile	
<u>N</u> ew ►	<u>P</u> art
<u>O</u> pen	<u>R</u> un
<u>S</u> ave	L
Save <u>A</u> s	
Import	
<u>E</u> xport	
DDE Output	
Page Set <u>u</u> p	
Print Pre⊻iew	
<u>P</u> rint	
E <u>x</u> it	
<u>1</u> . C:\new_program.5pa	
2. C:\Qc5000 RC-1\Parts_program.5PA	
3. C:\Qc5000 RC-1\Parts\vvv.5PA	

OR

Step 1 Click the *new run button* on the program toolbar.

Progr	Program				
99		+			
			Ľ,		
				lew I	Dun
				CW I	ιuli

Sample Program

The following demonstration shows the entire programming process from start to finish. Use the QC5000 demonstration part to avoid confusion, but a program for any multi-feature part can be made with this method. This program will prompt the user to:

- Construct a circle
- Construct a pierce point
- Measure three dimensional features (cylinder and cone)
- Measure two dimensional features (circles and planes)
- Perform a True Position on a circle
- Perform a perpendicularity tolerance
- Perform a width tolerance
- Enter a conditional statement
- Enter a label

Follow the steps straight through to avoid confusion. Each procedure in the program is described in detail elsewhere in this manual. For more information on a particular step consult the index.

To record the sample program

Step 1 Click the *record/edit button* on the program toolbar.



Record/Edit Program

Step 2

Type a name for the program as shown.

Save Part As		?×
File name: sample_part.5pa new_program.5pa ppp.5PA	Eolders: c:\ 5-K backup 5-K manual 5-Knotemp Backup 5-K Beta	OK Cancel
Save file as <u>type:</u> Part Files	Drives:	Network



Click OK in the dialog box.

Save Part As		? ≍
File name: sample_part.5pa new_program.5pa ppp.5PA	Eolders: c:\ 5-K backup 5-K manual 5Knotemp Backup 5K Backup 5K	OK Cancel
Save file as <u>type:</u> Part Files	Drives:	▼ Net <u>w</u> ork

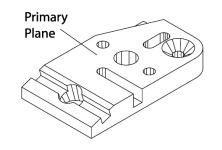
Step 4

•

Click the datum magic button on the datum toolbar.

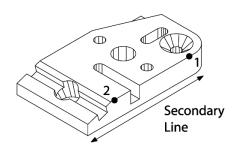


create the primary plane



📰 Datum Magic		
	3 Pts	
	tip_1	
<u>O</u> k	Enter Pt	<u>R</u> emove Last
	<u>C</u> ancel	

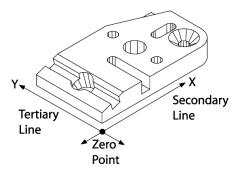
• create the secondary line



📰 Datum Magic		-DX
	2 Pts	
	1	
<u>O</u> k	Enter Pt	<u>R</u> emove Last
	<u>C</u> ancel	

create the zero point

•



🗒 Datum Magic		
	2 Pts	
	tip_1	
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
	<u>C</u> ancel	

Step 5

Click the cone button on the measure toolbar.



measure the cone using 9 points



Step 6

٠

Click the cylinder button on the measure toolbar.



Measure Cylinder

measure the cylinder using 9 points

🗒 Measure Cylinder		
	9 Pts	
	tip 1	
<u>0</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te

Step 7

•

Click the *plane button* on the measure toolbar.



measure the plane using 6 points

🗒 Measure Plane		
	6 Pts	
	tip_1	
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
<u>C</u> ancel		Cre <u>a</u> te

Step 8

•

Click the circle button on the measure toolbar.

Measure	
	1
	4

Measure Circle

measure the circle using 6 points

🗒 Measure Circle		
	6 Pts	
	tip_1	
<u>O</u> k	Enter Pt	<u>R</u> emove Last
<u>C</u> ancel	Cr	e <u>a</u> te

Step 9

Click the circle button on the measure toolbar.



measure the circle using 6 points

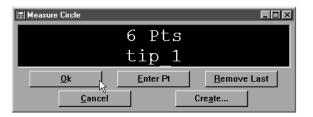




Click the circle button on the measure toolbar.



measure the circle using 6 points



Step 11

•

٠

Construct a center-to-center distance between the circles 8 and 9.
Highlight circles 8 and 9 in the features list

I T	Name	Datum		r	X	Y	Z
	Plane 1	Primary			3.21180	1.57037	0.00000
	Line 2	Skew			0.00000	1.48930	-0.44084
	Line 3				2.23952	-0.00162	-0.44220
	Point 4	Zero			0.00000	0.00000	-0.44152
	Cone 5			0.20431	4.49858	0.74741	-0.57702
	Cylinder			0.38153	2.99915	1.49738	-0.20639
	Plane 7				0.62116	1.50161	-0.17548
	Circle 8			0.18719	2.99890	2.49711	-0.02906
	Circle 9			0.18732	2.99815	0.49914	-0.04305
	Circle 10)	13	0.18726	2.99813	0.49913	-0.06724

Click the measure distance button on the measure toolbar



- _____
- Click OK in the dialog box

🛱 2 Features		
To measure a distance, points) or construct the features. When probing	distance from previo	usly measured

Step 12

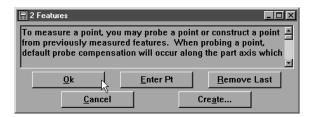
- Construct a point from the cylinder and the primary plane.
- Highlight the cylinder and the primary plane in the features list

1	Name	Datum	r	X	Y	Z
	Plane 1	Primary		3.21180	1.57037	0.00000
	Line 2	Skew		0.00000	1.48930	-0.44084
	Line 3			2.23952	-0.00162	-0.44220
	Point 4	Zero		0.00000	0.00000	-0.44152
	Cone 5		0.20431	4.49858	0.74741	-0.57702
)	Cylinder		0.38153	2.99915	1.49738	-0.20639
1	Plane 7	-0		0.62116	1.50161	-0.17548
	Circle 8		0.18719	2.99890	2.49711	-0.02906
1	Circle 9		0.18732	2.99815	0.49914	-0.04305
	Circle 10)	0.18726	2.99813	0.49913	-0.06724
	Distance			0.00075	1.99797	0.00000

Click the point button on the measure toolbar



Click OK in the dialog box



Step 13

•

Construct an angle between the primary plane and plane 7.

Highlight the primary plane and plane 7in the features list

r X Y Z	
3.21180 1.57037 0.0000	
0.00000 1.48930 -0.4408	
2.23952 -0.00162 -0.44220	
0.00000 0.00000 -0.4415	
0.20431 4.49858 0.74741 -0.5770	
0.38153 2.99915 1.49738 -0.2063	
0.62116 1.50161 -0.1754	
0.18719 2.99890 2.49711 -0.0290	
0.18732 2.99815 0.49914 -0.0430	
0.18726 2.99813 0.49913 -0.06724	
0.00075 1.99797 0.0000	
0.00075 1.99797 0.0000	

Click the angle button on the measure toolbar

Measure	
	1 77
	1 X O
,	

Measure Angle

Click OK in the dialog box

🗒 2 Features		
To measure an angle, y lines) or construct the a features. If probing an	ingle from previous	ly measured
<u>O</u> k	<u>E</u> nter Pt	<u>R</u> emove Last
/\		

Step 14

Enter a true position tolerance for circle 8.

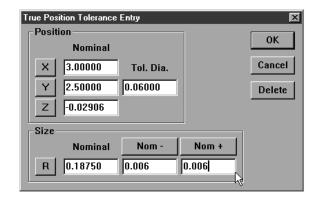
• highlight circle 8 in the features list

IJ	Г Name	Datum	r	X	Y	Z	
	Plane 1	Primary		3.21180	1.57037	0.00000	
/	Line 2	Skew		0.00000	1.48930	-0.44084	
/	Line 3			2.23952	-0.00162	-0.44220	
•	Point 4	Zero		0.00000	0.00000	-0.44152	
۵.	Cone 5		0.20431	4.49858	0.74741	-0.57702	
0	Cylinder		0.38153	2.99915	1.49738	-0.20639	
	Plane 7			0.62116	1.50161	-0.17548	
0	Circle 8		0.18719	2.99890	2.49711	-0.02906	
0	Circle 9		ゆ 0.18732	2.99815	0.49914	-0.04305	
0	Circle 10		0.18726	2.99813	0.49913	-0.06724	
↔	Distance			0.00075	1.99797	0.00000	
	- · · · ·						1

click the true position/MMC/LMC button on the tolerance toolbar



enter the tolerance data as shown



Click OK

٠

True Position Tolerance Entry		×
Position Nominal X 3.00000 Tol. Dia. Y 2.50000 0.06000 Z -0.02906		OK Cancel Delete
Size		
Nominal Nom -	Nom +	
R 0.18750 0.006	0.006	

Click OK in the tolerance results window

True Position Tolerance Results	×
Position	OK
Nominal Actual	
X 3.00000 2.99890 Error Dia. Tol. Dia.	<u>E</u> dit
Y 2.50000 2.49711 0.00618 0.06000 P	
Z -0.02906 -0.02906	
Size	
Nominal Actual Deviation Low limit High limit	
R 0.18750 0.18719 -0.00031 0.18150 0.19350 P	

Step 15

Enter a width tolerance for the distance.

• highlight the distance in the features list

I T Name Datum	r	X	Y	Z	
Cone 5	0.20431	4.49858	0.74741	-0.57702	
Cylinder	0.38153	2.99915	1.49738	-0.20639	
Plane 7		0.62116	1.50161	-0.17548	
🕽 😰 Circle 8	0.18719	2.99890	2.49711	-0.02906	
Circle 9	0.18732	2.99815	0.49914	-0.04305	
Circle 10	0.18726	2.99813	0.49913	-0.06724	
→ Distance		0.00075	1.99797	0.00000	
Point 12		2.99813	1.49833	0.00000	
🔇 Angle 13	0.48437				

click the *width* button on the tolerance toolbar



enter the tolerance data as shown

	n Tolera ength –	ance Entry			×
	,ingui	Nominal	Nom -	Nom +	ОК
Le	ength	2.000	0.006	0.006	Cancel
	x	0.00075			Delete
	Y	1.99797			
	Z	0.00000			

click OK

۷	/idth Tolera - Length -	ance Entry			×
I		Nominal	Nom -	Nom +	ОК
I	Length	2.000	0.006	0.006	Cancel
I	x	0.00075			Delete
I	Y	1.99797			
I	Z	0.00000			

• click OK in the tolerance results window

w	idth Toler	ance Results						X
Г	Length-							
		Nominal	Actual	Deviation	Low limit	High limit		ОК
	Length	2.00000	1.99797	-0.00203	1.99400	2.00600	Ρ	<u>E</u> dit
	х	0.00075	0.00075	0.00000			Ρ	
	Y	1.99797	1.99797	0.00000			Р	
	Z	0.00000	0.00000	0.00000			Ρ	
- L								

Step 16

•

Enter a perpendicularity tolerance for the primary plane.

• highlight the primary plane in the features list

繮 Fe	atures						
I	T Name	Datum	r	X	Y	Z	
	Plane 1	Primary		3.21180	1.57037	0.00000	
/	Line 2	Skew		0.00000	1.48930	-0.44084	
/	Line 3			2.23952	-0.00162	-0.44220	
•	Point 4	Zero		0.00000	0.00000	-0.44152	
8	Cone 5		0.20431	4.49858	0.74741	-0.57702	
0 (👂 Cylinder	43	0.38153	2.99915	1.49738	-0.20639	
	Plane 7			0.62116	1.50161	-0.17548	
0 (👂 Circle 8		0.18719	2.99890	2.49711	-0.02906	
0	Circle 9		0.18732	2.99815	0.49914	-0.04305	
0	Circle 10)	0.18726	2.99813	0.49913	-0.06724	
↔ (👂 Distance			0.00075	1.99797	0.00000	
	- · · · ·						F

click the *perpendicularity* button on the tolerance toolbar



enter the tolerance zone (0.008 inches) as shown

Perpendicularity Tolerance Entry	×
Orientation	ок
Tol. Zone	
0.008	Cancel
Reference Feature	Delete

select the cylinder from the reference feature list

Perpendicularity Tolerance Entry	×
Orientation —	
Tol. Zone	ОК
0.008	Cancel
Reference Feature	Delete
-Plane 1	

click OK

٠

•

•

Perpendicularity Tolerance Entry	×
- Orientation	ОК
Tol. Zone	
0.008	Cancel
Reference Feature	Delete
Plane 1	

click OK in the tolerance results window

Perpendicularity Tolerance Results	×
Orientation	OK
Tol. Zone Actual	
0.00800 0.00018 P	<u>E</u> dit
Reference Feature	
Plane 1	

Chapter 7 Programming

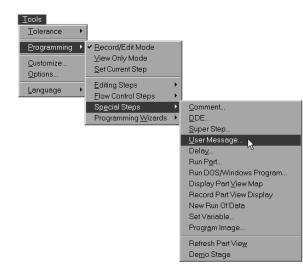
Creating User Messages

A user message is an onscreen message that is a part of a program. For example, it may be useful to remind an operator to check a certain feature in a particular way. To do this you might insert the message "Make sure to take points clockwise from the left." User messages can say anything, even "Have a nice day."

To Insert A User Message

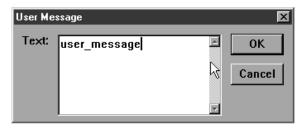
Step1

Select programming then special steps then user message from the tools menu.



Step 2

Type the desired message as shown.



Step 3

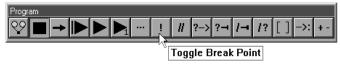
Click OK in the dialog box.



Expanding the Program Toolbar

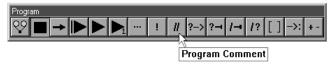
This section describes buttons commonly added to the program toolbar by QC5000 users. A procedure for adding buttons to a toolbar follows this section.

Toggle Break Point



Click the Toggle Break Point button to attach a marker to the currently selected step. A marker instructs the program to stop at a step in the program. To remove a marker, select the step with the marker and click the Toggle Break Point button. Markers can be placed on more than one step within a program.

Program Comment



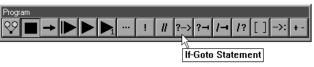
Click to enter a note into the program for future reference. Program comments are simply to explain a step or add information that might hellp later. Comments do not perform functions.

Edit Steps



Click the Edit Steps button to edit the currently selected step. The options presented depend on which functionality is associated with the currently selected step. For example, if the current step is the following options are presented, ...

If-Goto



Click to place an If-Goto statement in a program, see the Conditional Statements section for more information.

lf-Then



Click to place an If-Then statement in a program, see the Conditional Statements section for more information.

Else



Click to place an Else statement in a program, see the Conditional Statements section for more information.

Else-If



Click to place an Else-If statement in a program, see the Conditional Statements section for more information.

Super Step



Click to group a selection of steps into a collapsible group (SuperStep). This organizes and shortens the display of large programs in the Program window.

Goto Label



Click to create a Goto Label for use with an If- Goto conditional statement. The Goto Label is the action carried out if the test condition is true.

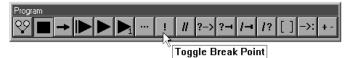
Offset Positions



Click to manually enter a coordinate that will offset the current coordinate. This feature is useful for inspecting multiple parts mounted on a fixture. ed Program Toolbar

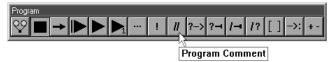
This section describes other buttons that users commonly place on the program toolbar. A procedure for adding buttons to the toolbar follows this section.

Toggle Break Point



Click the Toggle Break Point button to attach a marker to the currently selected step. A marker instructs the program to stop at a step in the program. To remove a marker, select the step with the marker and click the Toggle Break Point button. Markers can be placed on more than one step within a program.

Program Comment



Click to enter a note into the program for future reference. Program comments are simply to explain a step or add information that might hellp later. Comments do not perform functions.

Edit Steps



Click the Edit Steps button to edit the currently selected step. The options presented depend on which functionality is associated with the currently selected step. For example, if the current step is the following options are presented, ...

lf-Goto



Click to place an If-Goto statement in a program, see the Conditional Statements section for more information.

lf-Then



Click to place an If-Then statement in a program, see the Conditional Statements section for more information.

Else



Click to place an Else statement in a program, see the Conditional Statements section for more information.

Else-If



Click to place an Else-If statement in a program, see the Conditional Statements section for more information. **Super Step**



Click to group a selection of steps into a collapsible group (SuperStep). This organizes and shortens the display of large programs in the Program window.

Goto Label



Click to create a Goto Label for use with an If- Goto conditional statement. The Goto Label is the action carried out if the test condition is true.

Offset Positions



Offset Positions

Click to manually enter a coordinate that will offset the current coordinate. This feature is useful for inspecting multiple parts mounted on a fixture.

To add buttons to a toolbar



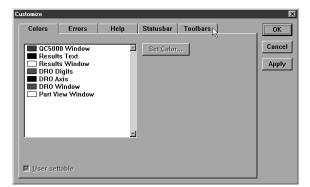
Step 1

Select customize from the tools down menu.



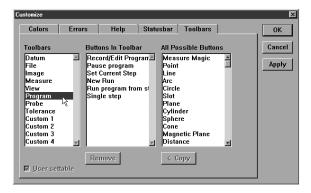
Step 2

Select the toolbars tab.



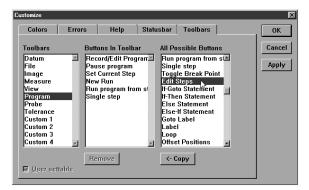
Step 3

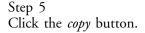
Highlight the desired toolbar as shown.

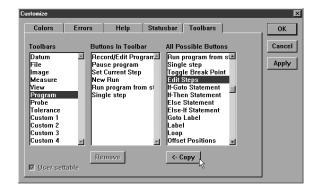


Step 4

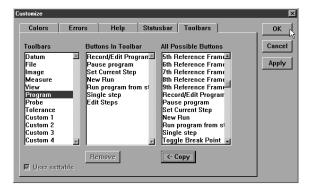
Click on the desired button in the all possible buttons list.







Step 6 Click OK.



The new button appears in the toolbar.



To delete buttons from a toolbar



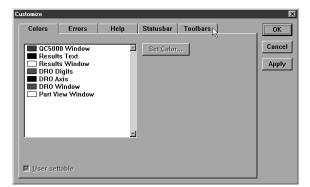
Step 1

Select customize from the tools down menu.



Step 2

Select the toolbars tab.



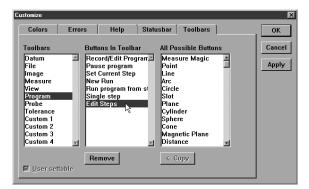
Step 3

Highlight the desired toolbar as shown.

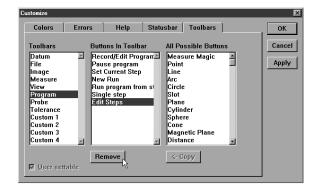


Step 4

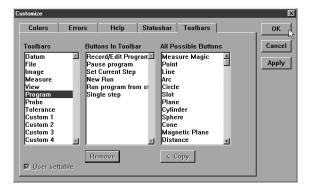
Click on the desired button in the buttons in toolbar list.







Step 6 Click OK.



The button is removed from the toolbar.



Conditional Statements

Conditional statements can be a handy way to handle many inspection tasks. For example, if a feature fails to meet specifications a conditional statement can stop the inspection or require a second inspection. A conditional statement can also check that a feature is within a tolerance by using arithmetical operators (more on this later).

The two basic elements of a conditional statement are the test condition and the action. Essentially conditional statements check the test condition and then do something if the test condition is true and something else if it is false.

Test Conditions

Test conditions are the inspected feature of the part and any arithmetical operations required by the user. If that seems a bit complex take a look at the conditional statement below.

In this example, 'If Input_1 > 5mm' is the test condition. 'Input_1' is the inspected feature and '> 5mm' is the arithmetical operation. If you were to read the test condition out loud it would be: If Input_1 is greater than 5mm. This is the test condition. All that is needed now is an action.

Actions

Actions are any steps to be carried out by the program or a labeled line. If-Then statements carry out the steps described and If-Goto statements skip to the labeled line. Both types are shown below.

In this example, 'Measure_1' is the action.

The types of conditional statements used in QC5000 programs are: If-Goto, If-Then, Else, and Else-If. Else and Else-If statements can only be used with an If-Then statement for example: If-Then Else or If-Then Else-If.

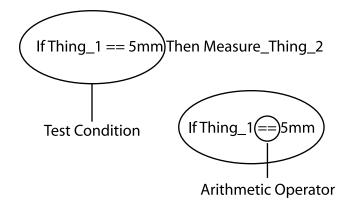
Arithmetic Operators

Test conditions are essentially mathematical equations. The chart below lists the arithmetical operators used in the QC5000 software.

Operator	Function
+	addition
-	subtraction
*	multiple
/	division
PI	pi =3.14
==	equals
!=	not equal to
>	greater than
<	less than
>=	greater than or equal to
<=	less than or equal to

QC5000 Arithmetic Operators

Arithmetic operators determine what happens in the test condition. Take a look at the following test condition to get a better understanding.

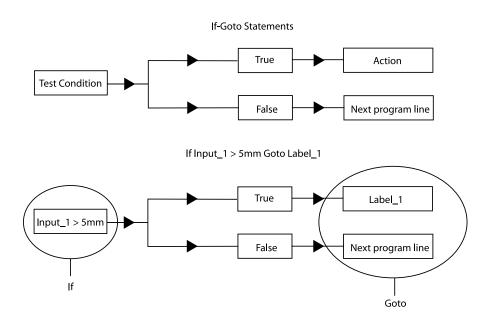


In this example, the '==' arithmetic operator determines that Thing_1 must equal 5mm for the test condition to be true. The entire test condition reads: if Thing_1 is equal to 5mm. This means the action Measure_Thing_2 will only be carried out if Thing_1 equals 5mm.

Changing the arithmetic operator changes the entire test condition. For example, if the '==' in the example is changed to '<=' Thing_1 must be less than or equal to 5mm for the test condition to be true.

If-Goto Statement

If-Goto statements check the test condition and, if it is true, go to a labeled line within the program. Use an if-Goto statement to skip ahead in a program if the test condition is true.

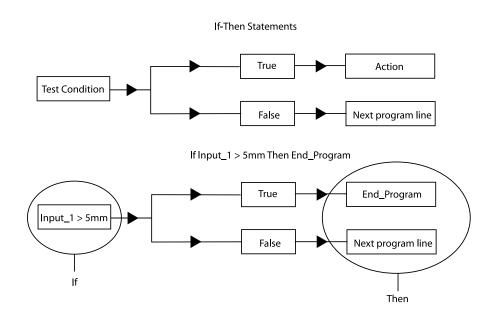


In this example, if the feature measures greater than 5mm the program goes to the line labeled 'Label_1.'

To place an If-Goto statement in a program, click the If-Goto Statement button in the program toolbar.

If-Then Statement

If-Then statements check the test condition and, if it is true, carries out the action and proceeds to the next program line. If the test condition is false the program continues to the next line without carrying out the action.



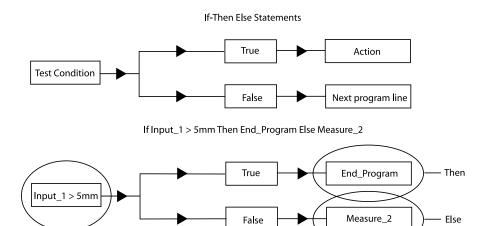
In this example, if the feature measures greater than 5mm the program carries out the action 'End_Program.' If the feature measures less than 5mm the program continues to the next line.

To place an If-Then statement in a program, click the If-Then Statement button in the program toolbar.

Else Statement

lf

Else statements are used in conjunction with an If-Then statement. If the test condition for the If-Then statement is false the program carries out the 'else' action.



In this example, if the feature measures greater than 5mm the program then carries out the action 'End_Program.' If the feature measures less than 5mm the program carries out the action 'Measure_2.'

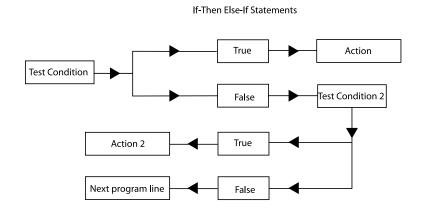
False

To place an Else statement in a program, click the Else Statement button in the program toolbar.

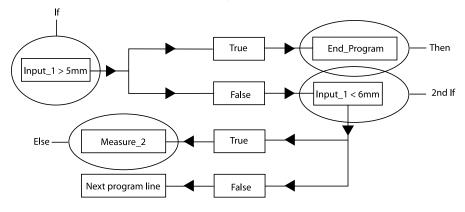
Else

Else-If Statement

Else-If statements are also used in conjunction with an If-Then statement. If the test condition for the If-Then statement is false the program skips the 'then' action and checks the second test condition. If the second test condition is true the program carries out the second action and if it is false the program continues to the next line.



If Input_1 > 5mm Then End_Program Else Measure_2 If Input_1 < 6mm



In this example, if the feature measures greater than 5mm the program carries out the action 'End_Program.' If the feature measures less than 5mm the program checks the second test condition. If the feature measures less than 6mm the program carries out the action "Measure_2' and if greater than 6mm goes to the next program line.

To place an Else-If statement in a program, click the Else-If Statement button in the program toolbar. Test conditions are constructed as formulas. Use the following information to help construct useful test conditions.

Parantheses()

Use parantheses to order mathmetical equations. For example, in the following equation

6*(4+2) = 36

the 4 and 2 are added together before being multiplied by the 6.

The same equation without the parantheses is as follows:

6*4+2 = 26

Here 6 is multiplied by 4 then added to 2.

Work from the innermost set of parantheses to the outermost set in equations using multiple sets of parantheses.

For example,

$((4+2)^*(4+2)+1) = 37$

Here the addition in the innermost parantheses is performed first, then the two sums are multiplied and added to 1.

The mathemetical order of operations is always multiplication, division, addition, subtraction.

Parantheses can also be used to call functions such a squares, square root, max, min, etc. For example,

sqrt(100) = 10

the function (square root) is performed on the number in the parantheses (100).

Brackets []

Use brackets to recall previously measured features for a formula. For example,

[Circle 1]x

recalls the 'x' value of Circle 1.

A more complex equation might be

sqr([Circle 1]radius)*PI

Here the radius of Circle 1 is squared and multiplied by pi which produces the area of Circle 1.

Quote marks ""

Use quote marks to indicate an output in a formula. For example,If([Circle 1]radius<=2.0,"Small")

prints the word "Small" in the column if the radius of Circle 1 is less than or equal to 2.0.

A more complex equation might be

If([Circle 1]radius<=2.0,"Small","Big")

Here the "Small" is printed if the radius of Circle 1 is less than or equal to 2.0 and "Big" is printed if it is greater than 2.0.

Use empty quote marks "" to show no output. For example,

If([Circle 1]radius>2.0,"","Small")

gives the same output as

If([Circle 1]radius<=2.0,"Small")</pre>

using a slightly different formula.

Min/Max

Use the min and max functions to find the minimum or maximum parameter for a series of features. For example,

Max(-1,-10,"Diameter")

will produce the maximum diameter of the last 10 circles measured.

Chapter 8 System Setup & Configuration

Before You Begin

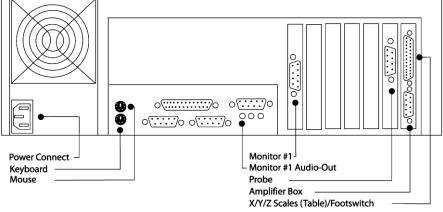
You will rarely need to alter settings in the system and encoder setups. The information in this chapter mainly applies to initial setup. It is recommended that system settings be changed only on direction of your dealer or OEM.

Do not change settings in the encoder setup program or supervisor setup options experimentally. Changing these settings can cause serious measurement errors. Contact your dealer or OEM before making an changes to setup functions.

Scale errors cannot be caused by the QC5000. Input from the CMM is read by the software and measurements are performed accordingly. Make certain the CMM is mechanicly sound and properly calibrated before installing QC5000.

Hardware Setup

Follow the diagram to connect axis and probe cables to the rear of the CPU.



Chapter 8 Setup Encoder Setup

Use the encoder setup program to detect scale errors and calibrate encoders. Double click on the encoder setup icon to open the program.

To setup encoders

Step 1 Shut down the QC5000

<u>F</u> ile
<u>N</u> ew •
<u>O</u> pen
<u>S</u> ave
Save <u>A</u> s
Import
<u>E</u> xport
DDE Output
Page Set <u>u</u> p
Print Pre⊻iew
<u>P</u> rint
Exit
1. C:\new_program.5pa
2. C:\Qc5000 RC-1\Parts_program.5PA
3. C:\Qc5000 RC-1\Parts\vvv.5PA

```
Step 2
Double-click the encoder setup icon.
```



Shortcut to Encsetup.exe

Step 3 Click OK in the dialog box.

Step 4

Select the desired axis as shown.

Custom Encoder Set	tup Version: 1.32	Date: Octo	ber 19, 1999		E
+5.0				MAX:	1.26
+3.75				MIN:	1.19
				OFFSET:	1.22
+2.5				RANGE:	0.07
					3.78
+1.25				MIN:	3.68
					3.73
0.0					
XAxis Display Type	·Wave (Running)				
C Z Axis	xis Scale Type Current (Heidenhain) Voltage TTL Pseudo-Sinusoidal	Interpolation x1 x2 x5 C x10	Display Type Wave Phase Counter	Freeze Calibrate	OK Cancel

Step 5 Select the scale type as shown.

Custom Encoder Setup	Version: 1.32	Date: Octo	ber 19, 1999		Þ
+5.0				MAX:	1.24
+3.75				MIN:	1.19
. on a Martando-World				OFFSET:	1.22
+2.5				RANGE:	0.05
					3.76
+1.25				MIN:	3.68
					3.72
0.0					0.08
XAxis Display Type - Wav	e (Running)				
O Y Axis O Volta	ent (Heidenhain)	Interpolation © ×1 © ×2 © ×5 © ×10	Display Type © Wave © Phase Counter	Freeze Calibrate	Cancel

ONOTE Consult your distributor/OEM for scale type.

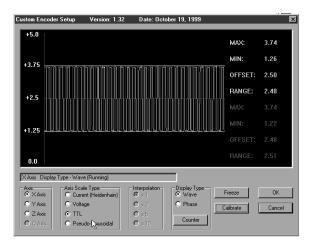
Step 6 Click the *calibrate button*.

istom Encode	er Setup Version: 1.32	Date: Octo	ber 19, 1999		
+5.0				MAX:	3.76
+3.75				MIN:	3.70
				OFFSET:	3.73
+2.5				RANGE:	0.06
+1.25				MIN:	
0.0					
XAxis Display	Type - Wave (Running)		_		
Axis • X Axis	Axis Scale Type C Current (Heidenhain)	Interpolation S × 1	Display Type • Wave	Freeze	OK
O Y Axis	C Voltage	C ×2	C Phase	Calibrate	Cancel
O Z Axis O Q Axis	TTL Pseudo-Sinusoidal	O x5 O x10	Counter		

Step 7 Click OK.



Step 8 Move the encoder back and forth along the selected axis.



The custom encoder setup window indicates that the calibration is complete and reports the number of scale errors.

Step 9 Click OK to accept calibration results.

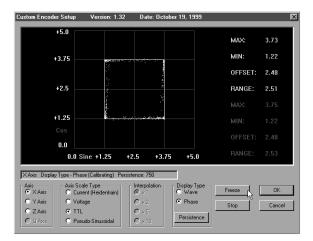
Custom Encoder Setup	×
× -37846	
Scale Errors Since Calibration: 0	
OK Recalibrate Cancel	

Use the phase mode to determine if the encoder's two waveforms are adjusted to each other. Properly adjusted encoders results in a circle as shown.

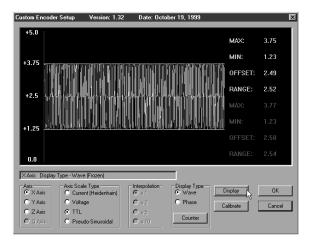
Custom Encoder Setup	Version: 1.32	Date: Octo	ber 19, 1999		×
+5.0					
13.0				MAX:	3.73
+3.75	(1 9400).00-0-0-0			MIN:	1.22
	19 11 14	in lances		OFFSET:	2.48
+2.5	27 			RANGE:	2.51
	Survey Branch				3.75
+1.25	·	· · · · · · · · · · · · · · · · · · ·			1.22
Cos				OFFSET:	2.48
0.0					2.53
0.0 \$	Sine +1.25 +2	2.5 +3.7	5 +5.0	TO IT OLI	2100
XAxis Display Type - Pha	se (Calibrating) Persis	ence: 750			
	ale Type rent (Heidenhain)	Interpolation × 1	Display Type C Wave	Freeze	OK
O Y Axis O Volt	age	O x2	Phase	Stop	Cancel
O Z Axis O TTL		C ×5	Persistence		
O Q Axis O Pse	udo-Sinusoidal	C ×10	reisistence		
				- <u>}-</u>	

Encoder reader heads may need re-alignment if the wave display appears correct but the phase display does not.

Use the freeze button to freeze the display and examine encoder signals.



Click the display button to reactivate the display.



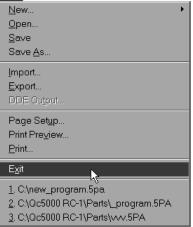
Do not use the encoder setup program for TTL encoders. Only use the encoder setup program for analog encoders.

Chapter 8 Setup Troubleshooting Encoder Setup

Encoder setup shows continual errors, beeps, or inconsistent wave output

Step 1 Make sure the QC5000 is closed.

<u>F</u>ile





Close the encoder setup program.

Custom Encode	er Setup Version: 1.32	Date: Octo	ber 19, 1999		×
+5.0				MAX:	1.25
+3.75				MIN:	1.19
				OFFSET:	1.22
+2.5				RANGE:	0.06
					1.25
+1.25		andar et an der gehalt transport geh		MIN:	1.18
					1.22
0.0				RANGE:	0.07
XAxis Display	y Type • Wave (Running)				
Axis • X Axis	Axis Scale Type O Current (Heidenhain)	Interpolation S x 1	Display Type Wave	Freeze	ОК
O Y Axis O Z Axis	 Voltage TTL 	O ×2 O ×5	O Phase	Calibrate	Cancel
C Q Axis	O Pseudo-Sinusoidal	O x10	Counter		

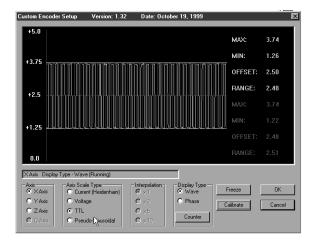
Step 3 Re-open the encoder setup program.



Check the Windows NT taskbar to be certain no other copies of QC5000 or Encoder Setup are running.

Encoder setup show one or two errors after calibrating an axis

Move the axis in a smooth, continuous, back-and-forth motion while calibrating. Uneven, stop/start motion can result in errors.





NOTE

One or two errors that do not count continually should not affect your measurements. Follow the procedure below for four or more errors.

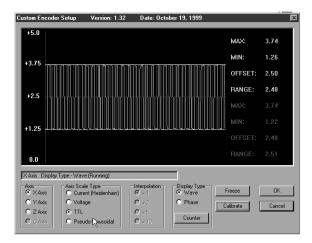
Encoder setup shows numerous errors after calibrating an axis



Check the Windows NT taskbar to be certain no other copies of QC5000 or Encoder Setup are running.

Step 1

Re-calibrate the axis using a smooth, continuous, back-and-forth motion.



If re-calibrating the axis does not solve the problem continue to step 2.

Step 2 Check all other axes for calibration problems.



Discontinue troubleshooting and contact your distributor/OEM if no axis will calibrate properly.

Step 3 Turn off the QC5000 computer.



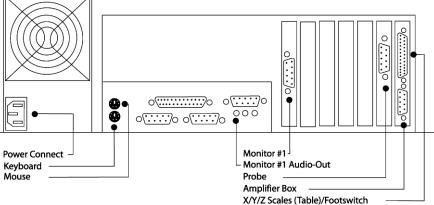


Do not disconnect QC5000 cables while the computer is on. This can result in damage to the system.

Step 4

Disconnect the axis cables for the axes calibrating properly.





Step 5

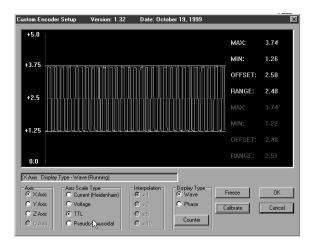
Disconnect the malfunctioning axis cable and connect it to one of the properly calibrating axis ports. For example, if the X axis calibrates properly and the Y does not, connect the Y axis to the X axis port.

Step 6 Turn on the computer and open encoder setup.



Step 7

Calibrate the desired axis. For example, if you have moved the Y axis cable to the X axis, calibrate the X axis.



Discontinue troubleshooting and contact your distributor/OEM if the axis will not calibrate properly. There is an error on the CMM/encoder side of the system that may require repair.



Discontinue troubleshooting and contact your distributor/OEM if the axis calibrates properly. There is an error on QC5000 axis port that may require repair.

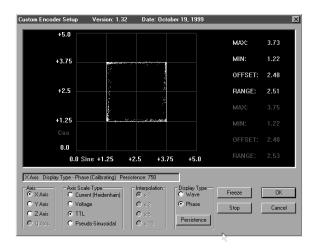
Wave (amplitude) calibrates, phase does not calibrate

If the phase display appears not to calibrate but the axis is not showing errors the system is functioning.

Check the Windows NT taskbar to be certain no other copies of QC5000 or Encoder Setup are running.

Step 1

Re-calibrate the axis using a smooth, continuous, back-and-forth motion.



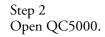
TTL encoders will not calibrate



TTL encoders do not require encoder setup. Use the following procedure.

Step 1 Close encoder setup.

Custom Encode	er Setup Version: 1.32	Date: Oct	ober 19, 1999		×
+5.0				MAX:	1.25
+3.75				MIN:	1.19
				OFFSET:	1.22
+2.5				RANGE:	0.06
12.0					1.25
+1.25				MIN:	1.18
					1.22
0.0					0.07
XAxis Display	• Type • Wave (Running)		_		
Axis • X Axis	Axis Scale Type C Current (Heidenhain)	Interpolation	Display Type Wave	Freeze	OK)
C Y Axis	O Voltage	O ×2	C Phase	Calibrate	Cancel
O Z Axis O Q Avis	 TTL Pseudo-Sinusoidal 	O ×5 O ×10	Counter		





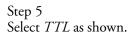
Step 3

Select options then general options from the tool menu.

<u>T</u> ools		
Tolerance	•	
<u>P</u> rogramming	۲	
<u>C</u> ustomize		
<u>O</u> ptions	·	<u>G</u> eneral Options
Language	•	

Step 4 Select the *encoders* tab.

General Options				X
General	Measure	Part View	Point Filtration	ОК
Probes	Runs	SLEC	Sounds	
Supervisor	Square]]	Cancel
Buttons	Display	Encoders	Files	
Encoder setup Resolution × 0.002 Y 0.002 Z 0.002	Ømm □ reverse Ømm □ reverse Ømm □ reverse	₩ ttl ref		
□ <u>U</u> ser settable				



Gener	al Options				×
	General	Measure	Part View	Point Filtration	ок
	Probes	Runs	SLEC	Sounds	
	Supervisor	Square			Cancel
	Buttons	Display	Encoders	Files	
FE X Y Z	0.002	년 mm 티 revers 년 mm 티 revers 년 mm 티 revers	e ⊡ [™] ttiref		
	<u>U</u> ser settable				

Status bar freezes during calibration or other error message

Step 1 Close encoder setup.

Custom Encode	er Setup Version: 1.3	2 Date: Octol	per 19, 1999		×
+5.0				MAX:	1.25
+3.75				MIN:	1.19
13.13				OFFSET:	1.22
+2.5				RANGE:	0.06
12.5					1.25
+1.25					1.18
11.23 mm	an a	an a	an a	OFFSET:	1.22
0.0					0.07
XAxis Display	v Type - Wave (Running)		_		
	Axis Scale Type C Current (Heidenhain)	Interpolation	Display Type Wave	Freeze	OK
O Y Axis	C Voltage	O ×2	C Phase	Calibrate	Cancel
O Z Axis O Q Axis	 TTL Pseudo-Sinusoidal 	O x 5 O x 10	Counter		

Check the Windows NT taskbar to be certain no other copies of QC5000 or Encoder Setup are running.

Step 2 Open encoder setup.



Step 3

Calibrate the desired axis.

Custom En	coder Setup	Version: 1.32	Date: Octob	er 19, 1999		×
+5.0					MAX:	3.74
+3.75					MIN:	1.26
13.75		سر به در در مرد مرد مرد م	ويعدي بر فروني	י דע מי ייך אי ער אין די יי	OFFSET:	2.50
+2.5					RANGE:	2.48
					MAX:	3.74
+1.25					MIN:	1.22
.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						2.48
0.0					RANGE:	2.51
XAxis D	isplay Type - Wav	e (Running)				
Axis O X Axi O Y Axi O Z Axi O Q Axi	is O Volta	ent (Heidenhain)	Nterpolation	Oisplay Type Wave O Phase	Freeze Calibrate	OK Cancel

Discontinue troubleshooting and contact your distributor/OEM if the problem persists.

Encoder setup icon is missing

Step 1 Click the Windows NT *start button*.

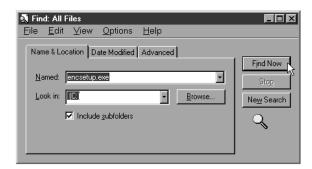


Select *find*.



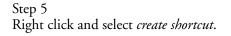
Step 3

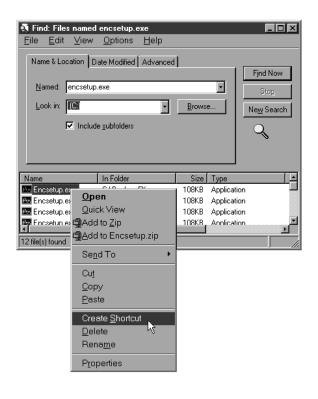
Type in the name *encsetup.exe* and click the *find now* button.



Step 4 Highlight the *encsetup.exe* file.

I Find: Files name <u>F</u> ile <u>E</u> dit <u>V</u> iew			_	
<u>N</u> amed: encsetu Look in:	Date Modified Advanc b.exe de <u>s</u> ubfolders	ed		Find Now Stop ew Search
Name	In Folder	Size	Туре	
Encsetup.exe	C:\Backup 5K	108KB	Application	'
Encsetup.exe	C:\BetaZ31	108KB	Application	
Encsetup.exe	C:\emulasted	108KB	Application	
Encsetun exe	C:\Pater\Z30	108KB	Application	• •
12 file(s) found				





Step 6 Click *yes* in the dialog box.



QC5000 counts double, half, or wrong



This process requires the EXACT resolution of the scales. Contact the manufacturer for this information if it is unavailable.

Step 1 Select *options* from the tools menu.



Step 2 Select the *encoders* tab.

General	Measure	Part View	Point Filtration) ок
Probes	Runs	SLEC	Sounds	
Supervisor	Square	i li		Cance
Buttons	Display	Encoders	Files	
Ecoder setup Resolution X 0.002 Y 0.002 Z 0.002	☑ mm □ revers ☑ mm □ revers ☑ mm □ revers	e 🔽 ttl ref		
User settable				

Step 3

Check the *mm check box* if the encoder resolution is metric. Remove the check if encoder resolution is english.

General Options				×
General	Measure	Part View	Point Filtration	ок
Probes	Runs	SLEC	Sounds	
Supervisor	Square		, I	Cancel
Buttons	Display	Encoders	Files	
Encoder setup Resolution X 0.002	🖳 mm 🗖 reverse	tti ref		
Y 0.002	⊠mm ⊑ reverse			
Z 0.002	🔽 mm 🗖 reverse	🔽 ttl ref		
<u>U</u> ser settable				

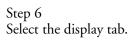


Step 4 Enter the proper resolution for each axis as shown.

General Options				×
General	Measure	Part View	Point Filtration	ок
Probes	Runs	SLEC	Sounds	
Supervisor	Square			Cancel
Buttons	Display	Encoders	Files	
Encoder setup Resolution × [0.002] Y [0.002 Z [0.002	⊽mm □ reverse ⊽mm □ reverse ⊽mm □ reverse	🗹 ttl ref		
User settable				

Step 5 Select the proper encoder type.

General Options				×
General	Measure	Part View	Point Filtration	ок
Probes	Runs	SLEC	Sounds	Constal 1
Supervisor	Square	, L	,	Cancel
Buttons	Display	Encoders	Files	
Encoder setup Resolution X [0.002] Y [0.002 Z [0.002	i⊽mm □ reverse i⊽mm □ reverse i⊽mm □ reverse	🗹 ttl ref		
<u> </u>				



General Options				X
General Probes Supervisor Buttons Display resolution	Measure Runs Square Display	Part View SLEC	Point Filtration Sounds Files	OK Cancel
Inch 0.00001 Metric 0.0001	Deg. Min. <u>S</u> ec Decimal Deg.	0.001		
	Month/Day/Year Day/Month/Year	Angle © Deg. Min. <u>S</u> ec. © <u>D</u> ecimal Deg.		
<u>User settable</u>			P	

Step 7 Set display resolutions the same as the encoder resolutions.

General Options				X
General Options General Probes Supervisor Buttons Display resolution Inch 0.00001 Metric 0.002	Measure Runs Square Display s Deg. Min. Se Decimal Deg		Point Filtration Sounds Files	OK Cancel
C 13:15 C	Month/Day/Year Day/Month/Year	Angle G Deg. Min. Sec. C Decimal Deg.		
<u>User settable</u>				



General Options				X
General Probes Supervisor	Measure Runs Square	Part View SLEC	Point Filtration Sounds	OK Cancel
	Deg. Min. <u>Ser</u> Decimal Deg. te Month/Day/Year Day/Month/Year		Files	
□ <u>U</u> ser settable				



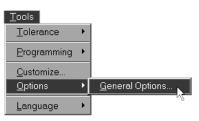
Measure a gage block to check the new settings. If the result is half the standard, repeat this procedure and double the resolution settings.

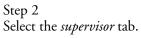
System level functions in the QC5000 are password protected. The supervisor password must be entered before changes can be made in these areas.

Contact your Metronics distributor or OEM for lost or misplaced passwords.

To enter the supervisor password

Step 1 Select *options* then *general options* from the tools menu.

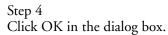




General Options				×
Buttons	Display	Encoders	Files	ОК
General	Measure	Part View	Point Filtration	
Probes	Runs	SLEC	Sounds	Cancel
Supervisor	Square			
- Password				
	_			
		1. I.		
☑ Keep privileges	until program is e	xited		
Change Password	1			
Change Password				
				μ
			-	J
			4	

Step 3 Enter the password as shown.

General Options				×
Buttons	Display	Encoders	Files) ок (
General	Measure	Part View	Point Filtration	
Probes	Runs	SLEC	Sounds	Cancel
Supervisor	Square			
Password				
*****	_			
✓ Keep privileges	until program is evi	ited		
Tech husinedes	unui program is ex			
Change Password	1			
	J			
				_



Buttons General Probes Supervisor	Display Measure Runs	Encoders Part View	Files	ОК ,
Supervisor			Point Filtration	
Supervisor		SLEC	Sounds	Cancel
	Square	ľ	1	
Password				
*****	_			
🗹 Keep privileges u	until program is ex	ited		
<u>Change</u> Password				
	-			
			Ιμ	
			Ц	



Click the verify button and place a check in the *keep privilieges until program is exited* box to continue supervisor access until exiting the QC5000.

Supervisors may restrict access to any portion of the options window.

To restrict access to general options tabs

This demonstration uses the *display* tab but the steps may be used to restrict access to any tab in the options window.

Step 1 Click on the desired tab.

Probes Runs SLEC Sounds Supervisor Square OK Buttons Display Encoders Files General Measure Part View Point Filtration User settings Save now Save now Save now Save now Save now Save now Save now Serial output Machine zero Hard stop Send on new feature None Set now Very datum on a primary or secondary alignment Start Datum Magic gn a probe hit if there are no alignments	General Options				<u> </u>
Delimiter: 10 Send on new feature Set now Image: Comparison of the set of the	Probes Supervisor Buttons General User settings Save now I♥ Save on exit Serial output	Square Display Measure Ma	Encoders Part View	Files	
User settable	COM #: 1 Definiter: 10 Send on new fe Conclude labels Move datum on a Start Datum Mag	ature	Hard stop None Set now	ients	

Step 2 Remove the check from the *user settable* box.



NOTE

If there is no check in the box the tab is already restricted.

Step 3 Click OK.

General Options Probes Supervisor	Runs	SLEC	Sounds	ОК
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
User settings Save now Save no exit Serial output COM #: 1 Delimiter: 10 Send on new fea Include labels Move datum on a Start Datum Magic	ture	chine zero — Hard stop None iet now dary alignment there are no alignm	ents	

Chapter 8 Setup General Options

Use the general options window to manage and change QC5000 settings. Tabs in the general options windows are:

- Buttons Display •
- •
- Encoders •
- General
- Measure
- Part view
- Probes
- SLEC •
- Sounds
- Supervisor
- Square •

Buttons

Use the buttons tab to set the function of external input buttons (footswitch, etc).

General	Measure	Part View	Point Filtration	
Probes	Runs	SLEC	Sounds	11 ==
Supervisor	Square	T,		Ca
Buttons 💦 🗌	Display	Encoders	Files	
External button as	sianments			
Narrow footswitch		: Remove Last		
Narrow rootswitch	button <u>present</u>			
Wide footswitch b	utton Measure	:: 0k	•	

Select one of the following functions to be executed by external devices:

- Measure: OK
- Measure: Enter
- Measure: Remove Last
- Measure: Cancel
- View From Probe

General Options				×
General	Measure	Part View	Point Filtration) ок (
Probes	Runs	SLEC	Sounds	
Supervisor	Square			Cancel
Buttons	Display	Encoders	Files	
-External button as	signments			
Narrow footswitch	button Measure:	Remove Last	-	
Wide footswitch b			<u> </u>	
	No Assign Measure: (nent אר	-	
	Measure: I	Enter Pt	5	
	Measure: I Measure: 0	Remove Last		
	View From		-	
			_	
User settable			- P	

For example, set button 1 to Measure: OK. Each time button 1 is pressed during a measurement it is the same as clicking OK in the measure dialog box.

To set a button function

Step 1

Select the desired function from the pull down list.

General Options				×
General	Measur	e Part View	Point Filtration	ОК
Probes	Runs	SLEC	Sounds	
Supervisor	Square	, j	1	Cancel
Buttons	Display	Encoders	Files	
⊢External button a	ssignments			
Narrow footswitc	h button Measur	e: Remove Last	•	
	No Assi	gnment	5	
Wide footswitch		e: Ok e: Enter Pt		
	Measur	e: Remove Last	▶	
		e: Cancel om Probe	[∼]	
	VICWIII			
User settable			μ	



eral Options					Þ
General	1	Measure	Part View	Point Filtration	ОК
Probes	1'	Runs	SLEC	Sounds	
Supervisor	S	quare		1	Cancel
Buttons	Dis	play	Encoders	Files	
External button as	ssianme	nts			
Narrow footswitch		-	Remove Last		
Wide footswitch b	utton	Measure: ()k		
					J
<u>U</u> ser settable				μ	

Display

Use the display tab to manage display resolutions, time/date display, and angle units display.

Enter the resolution of the CMM's encoders in the display resolution boxes. Make sure to enter the values in the proper units. For example, do not enter a metric (unconverted) resolution in the inch display resolution box.

General Options			×
General Probes Supervisor Buttons Display resolution Inch (2000) Metric (0.002 Time (2.115 PM) (2.1	Deg. Min. Sec Decimal Deg. Ate Month/Day/Year Day/Month/Year	 Point Filtration Sounds Files	OK Cancel
– User settable			

Select the time and date display from the radial button options.

General Options				×
General	Measure	Part View	Point Filtration	ОК
Probes	Runs	SLEC	Sounds	
Supervisor	Square	l I	1	Cancel
Buttons	Display	Encoders	Files	
Display resolutions				
Inch 0.0001	Deg. Min. S	ec. 0.00.01	1	
<u>M</u> etric 0.002	Decimal De	g. 0.001		
Time Dat	e	Angle		
© 1:15 PM 🛛 💿 I	Month/Day/Year	O Deg. Min. Sec.		
0 ⁵ 13:15 O I	Day/Month/Year	O Decimal Deg.		
Lock window posit	tions		-	
				μ
User settable				

Select angle units to be displayed as degrees/minutes/seconds OR decimal degrees.

General Options				×
General Probes	Measure Runs	Part View SLEC	Point Filtration Sounds	ок
Supervisor	Square		J	Cancel
Buttons	Display	Encoders	Files	
Display resolution Inch 10001 Metric 0.002 Time Da c 1:15 PM C c 13:15 Lock window pos	s Deg. Min. Su Decimal Deg ite Month/Day/Year Day/Month/Year	ec. 0.00.01	Files	
User settable			P	

Check the *lock windows position* box to lock QC5000 windows in their current locations.

Genera	al Options	:				X
	Ge Pro Superv Buttons	eneral bes isor s	Measure Runs Square Display	Part View SLEC Encoders	Point Filtration Sounds Files	X OK Cancel
	Ich letric me : 115 Pl 13:15 Lock win	Idow positi	lonth/Day/Year lay/Month/Year			
	<u>U</u> ser set	ttable				

Encoders

Use the encoders tab to enter the encoder resolution. Enter the resolution values carefully; incorrectly entered resolutions will result in inaccurate measurements.

General	Measure	Part View	Point Filtration) ок
Probes	Runs	SLEC	Sounds	
Supervisor	Square	ľ	'	Cancel
Buttons	Display	Encoders	Files	
Encoder setup Resolution X 0.002		e 🔽 ttl ref		
Y 0.002	mm revers			
Z 0.002	mm revers	e 🔽 ttiref		

ONOTE Enter the resolution in the proper units (mm or inches).

Check the *mm* box if encoder units are metric.

General Options				×
General	Measure	Part View	Point Filtration) ок
Probes	Runs	SLEC	Sounds	
Supervisor	Square	ſ	·]	Cancel
Buttons	Display	Encoders	Files	
Encoder setup Resolution X [0.002 Y [0.002 Z [0.002	₩mm Γ reverse ₩mm Γ reverse ₩mm Γ reverse	🔽 ttl ref		
<u>User settable</u>				

Check the *reverse* box to reverse the count direction of an axis.

eneral Options				
General	Measure Runs	Part View SLEC	Point Filtration	OK
Probes Supervisor		SLEU	Sounds	Cancel
Buttons	Square Display	Encoders	Files	
Encoder setup Resolution X 0.002 Y 0.002 Z 0.002 Z 0.002	□ □ mm □ reverse □ □ mm □ Yeverse □ □ mm □ reverse	🗹 ttl ref		
🗆 User settable				

To enter encoder resolution

Step 1

Type the encoder resolution for the desired axis box as shown.

General	Measure	Part View	Point Filtration	OK
Probes	Runs	SLEC	Sounds	
Supervisor	Square	`	<u> </u>	Cance
Buttons	Display	Encoders	Files	
Encoder setup Resolution Resolution 2 0.002 2 2 0.002	₩ mm F reverse	ttl ref		
□ User settable				



General Options				×
General Probes	Measure Runs	Part View SLEC	Point Filtration Sounds	ОК
Supervisor	Square			Cancel
Buttons	Display	Encoders	Files	
Encoder setup Resolution × 0.002 y 0.002 z 0.002 z 0.002	⊽mm □ reverse ⊽mm □ reverse ⊽mm □ reverse	🗹 ttl ref		

General

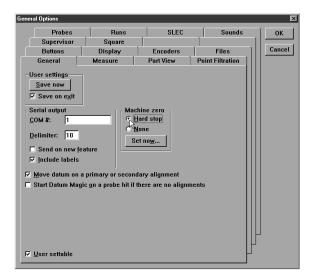
Use the general tab to save option settings without exiting the options window and specify machine zero method.

ieneral Options				×
Probes Supervisor	Runs Square	SLEC	Sounds	OK
Buttons General User settings Save now V Save on exit Serial output COM #: 1 Delimiter: 10 Send on new fe V Include labels V Move datum on a Start Datum Mag	eature		Files Point Filtration	Cancel

To set machine zero

Step 1

Select *hard stop* in the machine zero box.



Step 2 Click the *set now* button.

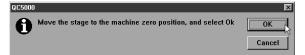
Probes Supervisor	Runs	SLEC	Sounds	ОК
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
User settings Save now Save on exit Serial output COM #: 1 Delimiter: 10 F Send on new fe F Include labels Move datum on a Start Datum Magi	ature	thine zero	ients	

Step 3

Move the axes of the CMM to the machine zero position.

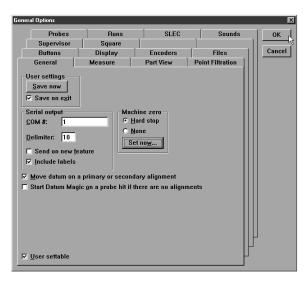
Step 4

Click OK in the dialog box.



Step 5

Click OK in the general options window.



Measure

General Options				X
Probes	Runs	SLEC	Sounds) ок (
Supervisor	Square	۲ [′]	ľ	
Buttons	Display	Encoders	Files	Cancel
General	Measure 🕞	Part View	Point Filtration	
	antom 🗖 Hidden antom 🗖 Hidden antom 🗖 Hidden	🗖 Show name		
Created 🗖 Ph	antom 🗖 Hidden	🗆 Show name		
Start Measure Ma Allow pre-selectio Always display di Ireat work planes Automatically finit	n of features for co stance values as p as magnetic plane	ositive s	t	
<u> U</u> ser settable]

Use the measure tab to establish the default display characteristics in the part view window. Defaults established on this tab apply to all features in the slected category:

- probed
- relations
- constructed
- created

Individual feature display characteristics (as opposed to groups of features) can be modified using feature properties.

Select *phantom* to show features as dotted lines in the part view window.

General Options				×
Probes	Runs	SLEC	Sounds) ok (
Supervisor	Square	ľ	ľ	
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
Relations Ph Constructed Ph Created Ph Start Measure Ma Allow pre-selectio Always display di I reat work planes	aantom T Hidden aantom T Hidden aantom Hidden ngic on a probe hit an of features for co istance values as a s magnetic plan	positive	đ	
⊻ <u>U</u> ser settable]

Check *hidden* to remove a feature from the part view window; hidden features still appear in the features list.

General Options				×
Probes	Runs	SLEC	Sounds) ок (
Supervisor	Square	T.	1	
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
Relations P P Constructed P P Created P P Start Measure M Start Measure M Allow pre-selectic Always display d I reat work planes	nantom Hidden nantom Hidden nantom Hidden antom Hidden Agic on a probe hit on of reatures for co istance values as s as magnetic plan sh a point measure	Show name Show name Show name		
☑ User settable				

Display the feature name by placing a check in the *show name* box.

General Options				×
Probes	Runs	SLEC	Sounds	ок
Supervisor	Square	ľ	ľ	
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
Relations	on of features for co listance values as s as magnetic plan	Show name Show name Show name	t	
⊻ User settable				ļ

Check *start measure magic on a probe hit* to start measure magic at the first point probed.

	X	x		
Probes	Runs	SLEC	Sounds	ОК
Supervisor	Square	, I		
Buttons	Display	Encoders	Files	Cance
General	Measure	Part View	Point Filtration	
Feature defaults				
Probed 🗆 🖡	Phantom 🗖 Hidden	🗆 🗆 Show name		
Relations 🔽 F	Phantom 🗖 Hidden	🗆 🗖 Show name		
Constructed 🗹 🛛	Phantom 🗖 Hidden	🗆 🗆 Show name		
Created E	Phantom 🗖 Hidden	Show name		
7. Start Measure k	Angic on a probe bit			
12	lagic on a probe hit			
Allow pre-select	ion of features for c	onstructions		
 Allow pre-select Always display 	ion of features for c distance values as	onstructions positive		
Allow pre-select Always <u>d</u> isplay Ireat work plan	ion of features for c distance values as es as magnetic plan	onstructions positive nes		
Allow pre-select Always <u>d</u> isplay Ireat work plan	ion of features for c distance values as	onstructions positive nes	ıt	
Allow pre-select Always <u>d</u> isplay Ireat work plan	ion of features for c distance values as es as magnetic plan	onstructions positive nes	nt	
Allow pre-select Always <u>d</u> isplay Ireat work plan	ion of features for c distance values as es as magnetic plan	onstructions positive nes	nt	
Allow pre-select Always <u>d</u> isplay Ireat work plan	ion of features for c distance values as es as magnetic plan	onstructions positive nes	nt	
Allow pre-select Always <u>d</u> isplay Ireat work plan	ion of features for c distance values as es as magnetic plan	onstructions positive nes	nt	
Allow pre-select Always <u>d</u> isplay Ireat work plan	ion of features for c distance values as es as magnetic plan	onstructions positive nes	nt	
Allow pre-select Always <u>d</u> isplay Ireat work plan	ion of features for c distance values as es as magnetic plan	onstructions positive nes	nt	
Allow pre-select Always <u>d</u> isplay Ireat work plan	ion of features for c distance values as es as magnetic plan	onstructions positive nes	ıt	

Check *allow pre-selection of features for construction* to permit users to select features for a construction then select the type of construction.

General Options				×
Probes	Runs	SLEC	Sounds) ок (
Supervisor	Square	1	- l'	
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
Feature defaults Probed F Relations F Constructed F Created F Start Measure M Start M	Measure Phantom ☐ Hidden Phantom ☐ Hidden Phantom ☐ Hidden Iagic on a probe hit ion of features for ce distance values as is as magnetic plan hish a point measure	Show name Show name Show name Show name		
☑ <u>U</u> ser settable				ŀ

Check *always display distance values as positive* to show distance measurements in positive numbers regardless of the actual direction of measurement.

General Options				×
Probes	Runs	SLEC	Sounds) ок
Supervisor	Square			
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
Feature defaults Probed f Relations F Constructed F Created f Start Measure M Allow pre-select Always display Treat work plane	Phantom F Hidden Phantom Hidden Phantom Hidden Phantom Hidden Phantom Hidden Aagic on a probe hit Gistance values as j cs as magnetic plan nish a point measure	Show name Show name Show name Show name		
✓ User settable				

Check *treat work planes as magnetic* to snap two-dimensional figures to the current plane.

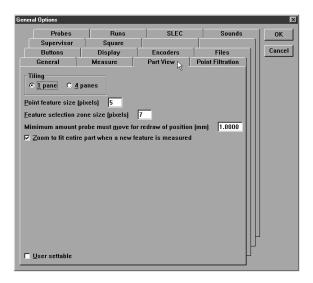
eneral Options				D
Probes	Runs	SLEC	Sounds) ок
Supervisor	Square	ľ	T,	
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
Relations 🗹 I	Phantom 🗖 Hidder Phantom 🗖 Hidder	n 🗖 Show name		
	Phantom 🗖 Hidder Phantom 🗖 Hidder			
Allow pre-select	fagic on a probe hit ion of features for c distance values as	constructions		
, _ , ,	es as magnetic plar	•		
.2		rement after 1st poir		
- Adomaticany In	nsir a pont incaso			
☑ <u>U</u> ser settable				

Quadra-Chek[®] 5000

Check *automatically finish a point measurement after the 1st point* to limit point measurements to one probe hit.

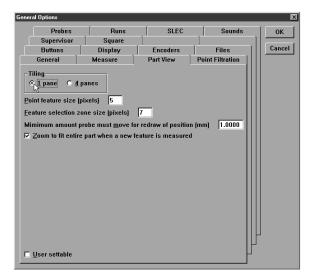
neral Options				ſ
Probes	Runs	SLEC	Sounds	ОК
Supervisor	Square	T.		1
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
- Feature defaults				
Probed 🗆 Ph	antom 🔲 Hidden	🗖 Show name		
Relations 🔽 Ph	antom 🔲 Hidden	🗖 Show name		
Constructed 🗹 Ph	antom 🔲 Hidden	🗖 Show name		
Created 🗖 Ph	antom 🗖 Hidden	Show name		
Treat work planes	stance values as as magnetic plan	es		
Automatically finit	sh a point measure	ement after 1st poi		
,				
]
✓ User settable			Ļ	

Part view

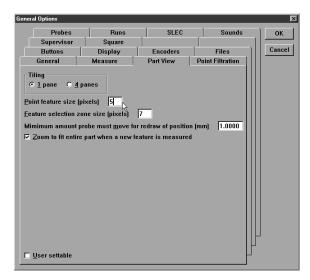


Use the part view tab to toggle the part view window between 1 pane and 4 pane mode, set the pixel size of points in the part view, and set the amount of probe movement required to redraw the part view (view from probe mode).

Click the radial button to select 1 pane or 4 pane part view.



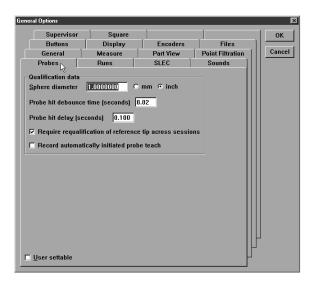
Enter a value for the size of a point (in pixels) in the part view window.



Enter the distance the probe must move for the part view to be re-drawn.

General Options				×
Probes	Runs	SLEC	Sounds	ОК
Supervisor	Square		T.	
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
Tiling C 1 pane C 4 (Point feature size (p Eeature selection zo Minimum amount p I Zoom to fit entire	one size (pixels) robe must <u>m</u> ove fo		· · · N	
User settable				J

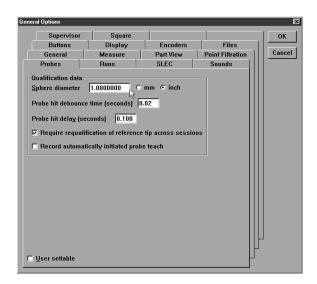
Probes



Use the probes tab to enter the diameter of qualification spheres, set probe hit de-bounce time, and set probe direction threshold.

To enter the diameter of a qualification sphere

Step 1 Type the resolution in as shown.

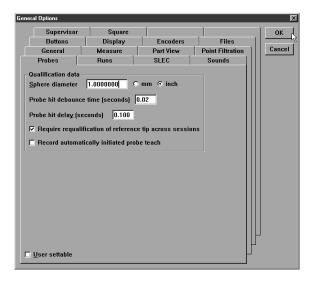




Check the mm box if units are metric, otherwise leave unchecked.

General Options				
Supervisor Buttons	Square Display	Encoders	Files	ок
General	Measure	Part View	Point Filtration	Cancel
Probes	Runs	SLEC	Sounds	
Qualification data Sphere diameter Probe hit debound Probe hit delay (s IZ Require requal	1.0000000 000 0000000000000000000000000	mm Cinch 0.02		

Step 3 Click OK



Check *require re-qualification of reference tip across sessions* to prompt the user to teach the reference tip at startup.

General Options				×
Supervisor	Square	1		ок
Buttons	Display	Encoders	Files	
General	Measure	Part View	Point Filtration	Cancel
Probes	Runs	SLEC	Sounds	
Qualification data Sphere diameter Probe hit debound Probe hit delay (s	[1.0000000] C	mm © inch 1.02 e tip across sessio		
User settable				

Quadra-Chek[®] 5000

Check *record automatically initiated probe teach* to record a teach program when an unqualified probe tip is selected.

eneral Options				×
Supervisor	Square		1) ок (
Buttons	Display	Encoders	Files	ון 💳 און
General	Measure	Part View	Point Filtration	Cancel
Probes	Runs	SLEC	Sounds	
Qualification data – Sphere diameter Probe hit debounce Probe hit delay (se I Require requalit Record automat	time (seconds) conds) 0.100	e tip across session	ns	
디 <u>U</u> ser settable				

Point Filtration

General Options				×
Probes	Runs	SLEC	Sounds	ОК
Supervisor	Square	ľ	ľ	
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
🗹 Enable point filt	ration		~	
Quantization factor	0.0030000000			
Sigma factor	2.0000000000			
Proportion factor	0.7500000000			
□ <u>U</u> ser settable			-	

Use the point filtration tab to remove outlier points from measurements. Enter the following values on this tab: • quantization factor (absolute threshold for outlier points)

	×
Probes Runs SLEC Sounds	ок
Supervisor Square	
Buttons Display Encoders Files	Cancel
General Measure Part View Point Filtration	
☑ Enable point filtration	
Quantization factor 0.0030000000	
Sigma factor 2.000000000	
Proportion factor 0.7500000000	
411	
User settable	

sigma factor (number of standard deviations points must lie within)

General Options				
Probes	Runs	SLEC	Sounds	ОК
Supervisor	Square	ľ		
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
🔽 Enable point fil	tration			
Quantization facto	r 0.0030000000			
Sigma factor	2.0000000000			
Proportion factor	0.750000000			
User settable				

٠

•

proportion factor (percentage of original points that must be retained)

Probes	Runs	SLEC	Sounds	ок
Supervisor	Square	ľ) '	1
Buttons	Display	Encoders	Files	Cancel
General	Measure	Part View	Point Filtration	
🗹 Enable point filtr				
Quantization factor	0.0030000000			
Sigma factor	2.0000000000			
Proportion factor	0.7500000000			
	·			
				μ
🗖 User settable				

Files

Use the files tab to manage QC5000 system specific files. Determine default directories for system files on this tab.

eneral Options				×
General	Measure	Part View	Point Filtration	ок
Probes	Runs	SLEC	Sounds	
Supervisor	Square	l i i i i i i i i i i i i i i i i i i i		Cancel
Buttons	Display	Encoders	Files 💦	
Default file location	ons			
Backups Ba	:kups		Browse	
Coefficients Coe	fficients		Browse	
Exports Exp	oorts		Browse	
Imports Imp	orts		Browse	
Overlays Over	erlays		Browse	
Parts Par	ts		Browse	
Templates Ter	nplates		Browse	
			ЦЦ	
<u>U</u> ser settable				

SLEC (segmented linear error correction)

Use the SLEC tab to setup and enter SLEC data. SLEC applies linear error correction coefficients to segments of each axis to compensate for encoder and machine travel variations. Use a standard to measure each axis and compare the measured (observed) values to the nominal (standard) values to generate correction coefficients. Correction coefficients are generated for each segment that deviates from the standard value and provide linear compensation for that segment.

General Options				×
Supervisor Buttons General	Square Display Measure	Encoders	Files	OK Cancel
Probes	Runs	· · · · ·	Sounds	
Segment Values Standard 0.00 Offsets × 0.0000 Y 0.0000 Z 0.0000	00	SLEC Rew X New Y New Z Delete		

Enter the zero point first for each axis. This does not mean that each axis must start a zero: negative values can be entered. For example, you can enter the zero point for the X axis and then enter standard and observed values for -2.

Correction for the final point on each axes continues in constant manner. Thus a correction applied to the final point continues for all points past the final point. Likewise, if no correction is applied to the final point, no correction applies to points beyond it.



NOTE

Do not use SLEC if your CMM does NOT have a repeatable machine zero. SLEC requires a repeatable machine zero point.

To enter SLEC data

Step 1 Move the CMM to machine zero.

neral Options				_
Supervisor Buttons General Probes	Square Display Measure Runs	Encoders Part View SLEC	Files Point Filtration Sounds	OK Canc
		New X New Y New Z Delete		
Segment Values Standard 0.000 Observed 0.000	0	Y		
Offsets × 0.0000 Y 0.0000 _Z_0.0000	Corrections X <u>a</u> xis on Y axis on Z axis on			



Step 2 Disable (uncheck) *corrections* on the X, Y, and Z axes on the SLEC tab.

General Options				×
Supervisor	Square	I		ОК
Buttons	Display	Encoders	Files	
General	Measure	Part View	Point Filtration	Cancel
Probes	Runs	SLEC	Sounds	
Segment Values Standard 0.0 Observed 0.0 Offsets X X 0.0000 Y 0.0000 Z 0.0000	000	E New X New Y New Z Delete		

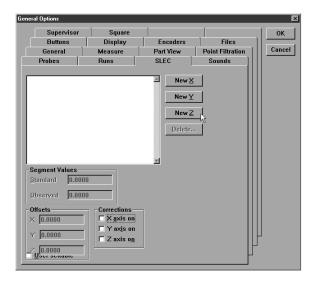
Step 3 Click *new X*.

General Options				×
Supervisor Buttons General	Square Display Measure	Encoders Part View	Files Point Filtration	OK Cancel
Probes	Runs	SLEC	Sounds	
Segment Values Standard 0.00 Observed 0.00 Offsets × 0.0000 Y 0.0000 Z 0.0000	00	E New X New Y Delete		



eneral Options				×
Supervisor	Square	, I	, Î) ок
Buttons	Display	Encoders	Files	
General	Measure	Part View	Point Filtration	Cancel
Probes	Runs	SLEC	Sounds	
Segment Values - Standard Observed 0.000 Y 0.0000 Z		A New X New Y New Z Delete		

Step 5 Click *new Z*.

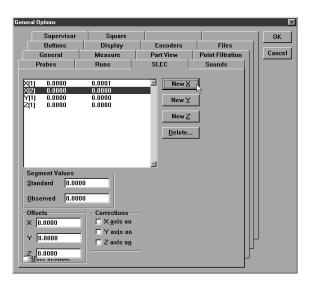




Enter the standard and observed value for the first point on the X axis as shown.

o 10.°			
General Options			×
Supervisor Square Buttons Display General Measure Probes Runs X(1) 0.0000	Encoders Part View SLEC	Files Point Filtration Sounds	OK Cancel
Y(1) 0.0000 0.0000 Z(1) 0.0000 0.0000	New Y New Z Delete		
Segment Values Standard 0.0000 Observed 0.0001 Offsets X [0.0000 Y 0.0000 Z 0.0000 Z axis on Z axis on			

Step 7 Click *new X*.



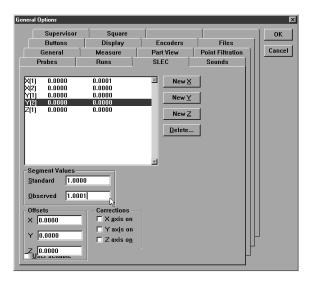
ONOTE Repeat steps 6 and 7 until all points are entered.

Step 8

Enter the standard and observed value for the first point on the Y axis as shown.

General Options				×
Supervisor	Square		Ţ	ок
Buttons	Display	Encoders	Files	
General	Measure	Part View	Point Filtration	Cancel
Probes	Runs	SLEC	Sounds	
- Segment Values Standard 0.00 Observed 0.00 - Offsets 		E New X New Y New Z Delete		

Step 9 Click *new Y*.



Repeat steps 8 and 9 until all points are entered.

Step 10

Enter the standard and observed value for the first point on the Z axis as shown.

General Options				×
Supervisor Buttons General Probes	Square Display Measure Runs	Encoders Part View SLEC	Files Point Filtration Sounds	OK Cancel
X[1] 0.0000 X[2] 0.0000 Y[1] 0.0000 Y[2] 1.0000 Z[1] 0.0000 Z[2] 0.0000 Z[2] 0.0000 Z[2] 0.0000 Z[2] 0.0000 Z[2] 0.0000 Standard 1.00 Observed 1.00 Offsets X X 0.0000 Z 0.0000 Z 0.0000		E New X New Y New Z Delete		

Step 11 Click *new Z*.

Supervisor Square OK Buttons Display Encoders Files General Measure Part View Point Filtration Probes Runs SLEC Sounds New X New Y New Z Delete Stendard 0.0000 Display Encoders Observed 0.0000 Counstiene Encoders
Offsets Corrections × 0.0000 × xxis on × 0.0000 × xxis on Z 0.0000

ONOTE Repeat steps 10 and 11 until all points are entered.

Step 12 Enable corrections on the X, Y, and Z axes as shown.

Gene	eral Options				×
	Supervisor Buttons General Probes	Square Display Measure Runs	Encoders Part View SLEC	Files Point Filtration Sounds	OK Cancel
	(1) 0.0000 (2) 0.0000 (2) 0.0000 (2) 1.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000 (2) 0.0000		E New X New Y Delete		

Step 13 Click OK.

General Options				X
Supervisor Buttons General Probes	Square Display Measure Runs	Encoders Part View SLEC	Files Point Filtration Sounds	OK Cancel
X[1] 0.0000 X[2] 0.0000 Y[2] 0.0000 Y[2] 0.0000 Z[2] 0.0000 Z[2] 0.0000 Z[2] 0.0000 Z[2] 0.0000 Z[2] 0.0000 Observed 1.000 Offsets X Y 0.0000 Z[0.0000 Z		E New X New Y New Z Delete		

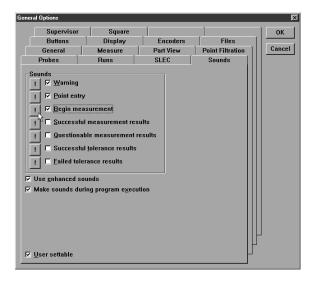
Sounds

Supervisor Square Buttons Display Encoders Files General Measure Part View Point Filtration Probes Runs SLEC Sounds 1 If Point entry 1 If Begin measurement	General Options				×
Probes Runs SLEC Sounds I I IP Point entry	Buttons	Display	2 I		
Sounds I I I Warning I I I Point entry					Cancer
I © Successful measurement results I © Questionable measurement results I © Successful tolerance results I © Eailed tolerance results I © Eailed tolerance results I © Eailed tolerance results I © Make sounds I Ø Make sounds I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø Ø I Ø<	Sounds I V Marning I V Point entr I I Begin me I I Successful I Questiona I I Successful I Falled told V Use gnhanced su V Make sounds du	y asurement Il measurement re ble measurement Il tolerance results crance results punds	suits resuits	Sounds	
	<u>v</u> aci settable				

Use the *sound* tab to toggle on/off various system sounds. Place a check beside any item to enable the sound.

General Options				×		
Supervisor Square Buttons Display Encoders Files General Measure Part View Point Filtration Probes Runs SLEC Sounds 1 V Morning 1 V Morning 1 V Morning 1 V Morning 1 V Morning 1 Successful measurement 1 V Successful measurement results 1 Successful tolerance results 1 Successful tolerance results 1 Eailed tolerance results 1 Failed tolerance results 1 Vese gnhanced sounds						
Image: Second		ution	_			

Preview sounds by clicking on the exclamation point as shown.



Check *make sounds during program execution* to enable sounds while running a parts program.

General Options				×
Supervisor Buttons General Probes	Square Display Measure Runs	Encoders Part View SLEC	Files Point Filtration Sounds	OK Cancel
I □ Success I □ Question I □ Success I □ Eailed to V Use gnhanced	ful measurement ful measurement re table measurement ful tolerance results lerance results	results s		

Square

Use the square tab to correct for small deviations from 'squareness' in the geometry of the CMM.

To test for squareness

ONOTE Use a bar-ball standard to perform this test.

Step 1

Disable (uncheck) current squareness correction as shown.

Gen	eral Options				×
	Buttons General Probes Supervisor	Display Measure Runs Square	Encoders Part View SLEC	Files Point Filtration Sounds	OK Cancel
	TYZ plane 100.	al Tangent .000000 [100.0000 .000000 [100.0000 .000000 [100.0000	00 90'00'00''		
Γ	<u>U</u> ser settable				

Step 2

Place the bar-ball on the XY plane of the CMM at angle 45 degrees to the X axis.

Step 3

Measure the length of the bar-ball.

Step 4

Place the bar-ball on the XY plane of the CMM at angle 135 degrees to the X axis.

Step 5 Measure the length of the bar-ball.

Use this procedure to test squareness of each plane (XY, YZ, and ZX).

Compare the two measurement results. Results that vary significantly indicate the axes are out square.

To square axes

Step 1

Enter the length of the bar-ball at the 45 degree orientation in the radial text box for the XY plane.

Step 2

Enter the length of the bar-ball at the 135 degree orientation in the tangent text box for the XY plane.



Use the same procedure to square the other axes.

Index

A

absolute distance 132 Alternate Datums 184 Angle 128. See also Relations Angle Constructions 151 angle from 2 linear features 151 Arcs 74 To probe an arc 74 Arithmetic Operators 318. See also Programming Auto Enter 47 auto enter button 44 Automated Text Input & Prompting 249

B

bounded line distance from 2 lines 143 Buttons To remove buttons to a toolbar 32

C

CAD files 154 **Cardinal probe compensation** 45 cardinal probe compensation button 44 center to center distance 133 center to plane distance from a sphere 140 **Changing Probes 55** Circles 75 To probe a circle 75 Cones To probe a cone 78 **Constructing Features 81** Angle Constructions 151 To construct an angle from 2 linear features 151 Circle Constructions 115 To change the location of a tangent circle 120 To construct a circle from a cone 116 To construct a circle from a sphere

115 To construct a circle from an intersecting cylinde 118 To construct a circle from an intersecting plane a 117 To construct a circle tangent to 2 intersecting li 119 Cone Constructions 127 To construct a cone from 2 coaxial circles 127 Cylinder Constructions 126 To construct a cylinder from to 2 co-axial circles 126 **Distance Constructions 129** To construct a bounded line distance from 2 lines 143 To construct a center to center distance 133 To construct a center to plane distance from a sph 140 To construct a distance between 2 co-axial planes 150 To construct a distance from a positional feature 136, 139 To construct a duplicate distance 130 To construct a farthest bounded line distance from 146 To construct a farthest edge distance 134 To construct a nearest bounded line distance from 144 To construct a nearest edge distance 135 To construct a reverse direction distance 131 To construct an absolute distance 132 To construct an unbounded distance from 2 linear f 148 To construct the farthest plane distance from a sp 142 To construct the farthest to line distance 138 To construct the length of an axis 129 To construct the nearest plane distance from a sph 141 To construct the nearest to line distance 137 Line Constructions 95 To construct a 2 point line from two positional fe 98 To construct a bisector of 2 linear features 102, 103 To construct a closest point of approach line fro 105

To construct a gage line 112 To construct a line by projecting an existing line 114 To construct a line from a positional feature perp 107 To construct a line from the intersection of 2 pla 101 To construct a line parallel to a linear feature u 108 To construct a midline from the sides of a slot 97 To construct a perpendicular line through a plane 110 To construct a plane axis line (Normal Line) 96 To construct a rotated line from the leg of an ang 111 To construct a tangent line from 2 radial position 99 To construct an axis line from a linear feature 95 Plane Constructions 121 To construct a midplane from 2 planes 123 To construct a perpendicular midplane from 2 plane 124 To construct a plane from a line and a positional 122 To construct a plane from the midpoint of a line 121 Point Constructions 81 To construct a center point 81 To construct a closest point of approach point 87 To construct a midpoint from 2 positional features 91 To construct a midpoint from two circles 89 To construct a perpendicular point from a position 92 To construct a point from 2 intersecting lines 86 To construct a point from a linear feature and a p 93 To construct a point from the intersection of 3 pl 94 To construct a point from the intersection of a li 90 To construct an anchor point 84 To construct an apex point 82 To construct an application point 83 To construct bounding points 85 To construct point from intersecting circles 88 Sphere Constructions 125 To construct a sphere from a cone

125 **Cylinders** To probe a cylinder 79

D

Datum Magic 161 To create a datum using datum magic 161 Datum Menu 24 Datum toolbar 27 Datums Alternate Datums 184 To rotate the reference frame (datum) 184 Distance 128. See also Relations distance between 2 co-axial planes 150 distance from a positional feature to a plane 139 DRO 8. See also Windows duplicate distance 130. See also Constructing Features: Distance Constructions: To construct a duplicate distance

E

Edit Menu 22 encoder resolution 358 Encoder Setup 328 To setup encoders 328 Troubleshooting Encoder Setup 332 Export 154, 156, 288 To export a CSV (comma

separated value) file to a 290 To export a tab delimited file to a spreadsheet 288 To export to a CAD file 154 To export to SPC software 156

F

farthest bounded line distance from 2 lines 146 farthest edge distance 134 farthest plane distance from a sphere 142 farthest to line distance 138 Feature stamp 11 To open the feature stamp window 11 Features Template 235. See

also Templates: Features Templates: Features To open the features template 235 File Menu 22 File toolbar 28

G

General Options 350, 352 buttons tab 352 display tab 355 encoders tab 358 To enter encoder resolution 360 files tab 376 general tab 361 measure tab 363 part view tab 368 point filtration tab 374 probes tab 370 To enter the diameter of a qualification sphere 371 SLEC tab 377 sound tab 385 square tab 387 To square axes 388 To test for squareness 387 To restrict access to general options tabs 350

Η

HardProbe group 48 Hardware Setup 327 Help Menu 26

L

Layers 169

Displaying Layers 174 To assign a color to a layer 181 To assign features to new layers 172 To create a new layer 169 To hide a layer 174 To set a layer as current 170 To show a hidden layer 175 To turn off a layer 177 To turn on a layer 179 Lines To probe a line 73 Locked/unlocked features 10 To lock a feature 10 To unlock a feature 10

Μ

Machine coordinates 68 Machine Zero

To set machine zero 361 machine zero 33, 63

Main Menu Bar 22

datum menu 24 edit menu 22 file menu 22 help menu 26 probe menu 25 tools menu 26 view menu 23 windows menu 26 Master probe tips 52 Measure Magic 163 To measure a circle 165 To measure a cone 166 To measure a cylinder 167 To measure a line 164 To measure a plane 165 To measure a point 163 To measure a sphere 168 To measure an arc 164 Measure Menu 24 measure menu 24 Measure toolbar 27 Microsoft Access 158. See also Export: To export to **Microsoft Access**

Ν

nearest bounded line distance from 2 lines 144 nearest edge distance 135 nearest plane distance from a sphere 141 nearest to line distance 137 Nesting Template Windows 284. See also Templates: Nesting Template Windows

0

Offset Alignments 186. See also Alternate Datums

To perform an offest alignment (secondary line) 189 To perform an offest alignment (zero point) 192 To perform an offset alignment (primary plane) 186 **Overlays 250.** *See also* **Report Headers** To place an overlay in a report header 251 To save a report header as an

overlay 250

P

Part coordinates 68 Part View Window 12 Planes To probe a plane 77 **Points** To probe a point 72 **Polar probe compensation** 45 **Probe Calibration 52** To teach (qualify) a master probe tip 53 To teach (qualify) a non-master probe tip 54 **Probe compensation 45** Cardinal probe compensation 44 Polar probe compensation 44 Probe compensation off 43 To activate probe compensation 46 Probe compensation off 45 probe compensation off button 43 **Probe Families & Groups 48** Probe Library 47 Changing Probes 55 HardProbe group 48 Master probe tips 52 Probe Calibration 52 Probe Results Window 60 StarProbe group 49 To add probe tips 57 To change the current probe tip 55 To create a new probe group 50 To delete probe tips 59 To view the probes in a group 55 TouchProbe group 49 **Probe library 44** probe library button 44 Probe Menu 25 **Probe Results Window 60** probe teach button 43 Probe Toolbar 43 Auto enter 44 Cardinal probe compensation 44 Polar probe compensation 44 Probe compensation off 43 Probe library 44 Probe teach 43 Probe toolbar 27 **Probes** Auto Enter 47 Auto enter 44 To activate auto enter 47 Cardinal probe compensation 44 Changing Probes 55

Master probe tips 52 Polar probe compensation 44 Probe Calibration 52 probe compensation off 43 Probe library 44 probe teach 43 probing technique 43 **Probing Technique 43** Program Template 252. See also Templates To open the program template 252 Program Toolbar 294. See also Toolbars Program toolbar 27 **Programming 295 Conditional Statements 317** Arithmetic Operators 318 Else Statement 321 Else-If Statement 322 If-Goto Statement 319 If-Then Statement 320 Running A Program 298 Sample Program 299 To record the sample program 299 To create a program 295 To open a saved program 297 User Messages 308 To Insert A User Message 308 **Projection planes 67**

R

Reference Frame 34, 66, 69 To create a reference frame 69 **Relations 128** Angle 128 Distance 128 Report Headers 245. See also **Templates: Reports Tem**plate Customizing Report Headers 247 To arrange text and graphics in a report header 248 To place a graphic in a report header 247 To show a report header 245 Reports Template 240. See also Templates: Reports Template reverse direction distance 131. See also Constructing Features: **Distance Constructions: To** construct a reverse direction distance

Runs Template 282. See also

Templates: Runs Template

S

Saving Your Work 41, 152 To export to a CAD file 154 To export to SPC software 156 To save a part file 152 **SLEC** (segmented linear error correction) 377 To enter SLEC data 378 SLEC tab. See SLEC (segmented linear error correction) Slots To probe a slot 76 Sorting the Features List 239 SPC software 156 Spheres To probe a sphere 80 StarProbe group 49 Starting The QC5000 5 To open the QC5000 5 Status Bar 17 To add items to the status bar 18 To delete items from the status bar 19 Supervisor Password 348 To enter the supervisor password 348 Т **Template Features Dialog Box** 255 Display tab 255 Filters tab 260 To create a filter 261 To modify a filter 267 To remove a filter 269 Misc tab (miscellaneous) 270 **Template Properties 254** To access the template features dialog box 254 **Template Windows 14 Templates 233**

Adding Data to Templates 237 To drag and drop a multiple results window fields 238 **Column Properties 271** Appearence tab 271 Column formulas 271 Formulas tab 271 Standard column properties 271 To create the sample formula 274 To modify a formula 279 To remove a formula 281 Creating New Templates 286

To create a new template 286 Features Template 235 Sorting the Features List 239 To drag and drop a single results window field int 237 To open the features template 235 Nesting Template Windows 284 To nest template windows 284 To separate template windows 284 Program Template 252 **Reports Template 240** Adding Data to the Reports Template 242 **Report Headers 245** Sorting Data in the Reports Template 244 To drag and drop a multiple results window fields 243 To drag and drop a single results window field int 242 To open the reports template 240 To sort data in the reports template 244 **Runs Template 282** To add data to the runs template 283 To open the runs template 282 **Three-dimensional features** 3D Features 78 To add buttons to a toolbar 30 To open the QC5000 5 To save a report header as an overlay 250 **Tolerance toolbar 27 Tolerancing** 194 Angle tolerance 229 To perform an angle tolerance 229 Bi-directional tolerance (circles, points, arcs, s 196 To perform a bi-directional tolerance 196 Circular runout tolerance 227 To perform a circular runout tolerance 227 Circularity/sphericity tolerance (circles, spheres 213 To perform a circularity tolerance 213 To perform a sphericity tolerance 215 Concentricity tolerance (circles, arcs) 208 To perform a concentricity tolerance 208

Cylindricity tolerance (cylinders) 217To perform a cylindricty tolerance 217 Flatness tolerance (planes) 219 To perform a flatness tolerance 219 MMC/LMC (maximum material condition/least material 202 To perform a LMC 205 To perform a MMC tolerance 202 Parallelism/Co-planarity tolerance (linear feature 223 To perform a co-planarity tolerance 225 To perform a parallelism tolerance 223 Perpendicularity tolerance (lines, cylinders, cone 221 To perform a perpendicularity tolerance 221 Straightness tolerance (lines) 211 To perform a straightness tolerance (lines) 211 Tolerance Toolbar 194 To view the tolerance toolbar 194 True position tolerance (circles, points arcs, sph 199 To perform a true position tolerance 199 Width tolerance 231 To perform a width tolerance 231 Toolbars 6, 27 datum toolbar 27 file toolbar 28 measure toolbar 27 probe toolbar 27 probing technique 43 Program Toolbar 294 Edit Steps button 309, 311 Else button 310, 311 Else-If button 310, 311 Goto Label button 310, 312 If-Goto button 309, 311 If-Then button 309, 311 New Run button 294 Offset Positions button 310, 312 Pause Program button 294 Program Comment button 309, 311 Record/Edit Program button 294 Run Just Current Step button 294 Run Program From Current Step button 294 Super Step button 310, 312

Toggle Break Point 309, 310 Program toolbar 27 program toolbar 27 To add buttons to a toolbar 315 To add buttons to a toolbar 30 To place a toolbar on the QC5000 desktop 28 To remove a toolbar from the QC5000 desktop 29 To remove buttons to a toolbar 32 tolerance toolbar 27 view toolbar 27 Tools Menu 26 TouchProbe group 49

U

unbounded distance from 2 linear features 148 User Messages 308. *See also* **Programming**

V

View Menu 23 View Rotator 13 To use the view rotator 13 View toolbar 27

W

Windows 6 DRO 8 Part View Window 12 Results Window 8 To move information from the results window to the 9 Template Windows 14 To nest template windows 16 To separate template windows 14 Windows Menu 26

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH

Dr.-Johannes-Heidenhain-Straße 5 83301 Traunreut, Germany +49 8669 31-0 +49 8669 5061 E-mail: info@heidenhain.de

www.heidenhain.de