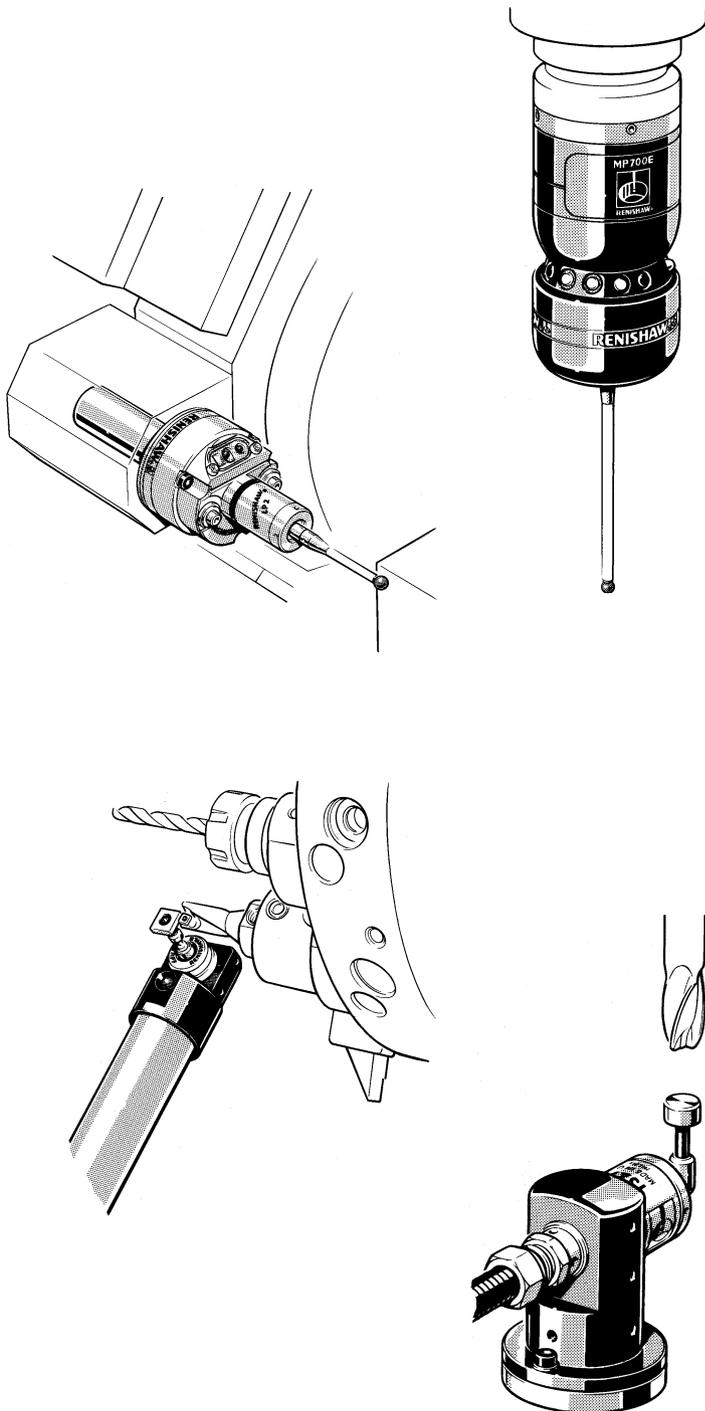


# Probe software for machine tools

## - program features



### NEWS BULLETIN

AVAILABLE NOW

- EasyProbe basic software
- Non-contact tool setting
- Software packages for a wide range of controllers, please see current list H-2000-2298 at

[www.renishaw.com](http://www.renishaw.com)

Machine tool products

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[Probe software for machine](#)

[tools - program selection list](#)

# Software overview

	Page
<b>Software features</b>	
Illustrations in this publication demonstrate typical applications and features. They are not a complete specification for all software packages. Please refer to the program manual supplied with each software package for specific details.	
<b>User documentation</b>	
Program manuals are supplied in the English language, but other languages are available for some packages. When ordering, please state the language of your choice. If available the additional documentation will also be supplied.	
<b>Tool setting software for lathes</b> (including Y axis capability).	3
<b>Inspection software for lathes</b> (including Y axis capability).	4
<b>EasyProbe inspection software for machining centres</b>	6
EasyProbe software for machining centres provides simple and fast job setup and measuring routines, for operators with minimal programming skill.	
<b>Standard inspection software for machining centres</b>	8
Basic inspection/job setup software with the ability to set work offsets, update tool offsets and print inspection results (where this control option is available). Suitable for use by an operator or part programmer.	
<b>Additions to standard inspection software for machining centres</b>	9
Several packages to enhance and extend the capabilities of the standard inspection software. Includes vector measuring and angle measure, plus a 5-axis option.	
<b>Inspection Plus software for machining centres</b>	12
A totally integrated package of software that includes vector and angle measure options, print options (where this control option is available) and an extended range of cycles. Including an SPC cycle, 1 or 2 touch probing option, tool offset compensation by percentage of error and output data stored in an accessible variable stack.	
<b>Multi-axis inspection software for machining centres</b> (NOT ILLUSTRATED)	—
Orientate in alternative planes.	
<b>Rotating tool setting software for machining centres</b>	17
Uses the industry standard TS27R probe, which suits the majority of applications.	
<b>Non-contact tool setting software for machining centres</b>	18
Preferred for applications using delicate tools, and other applications where the probe must not obstruct the machine's working envelope.	
Non-standard applications are available on request, subject to confirmation.	

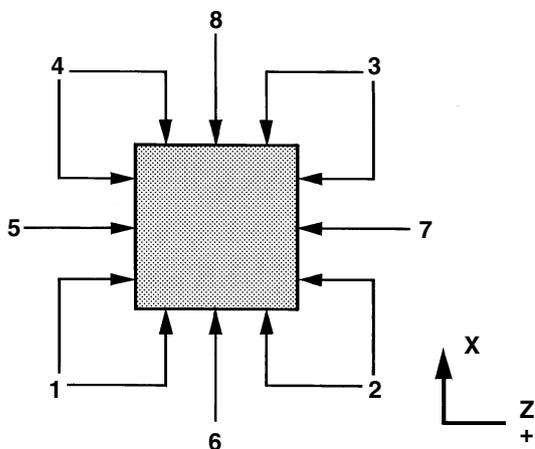
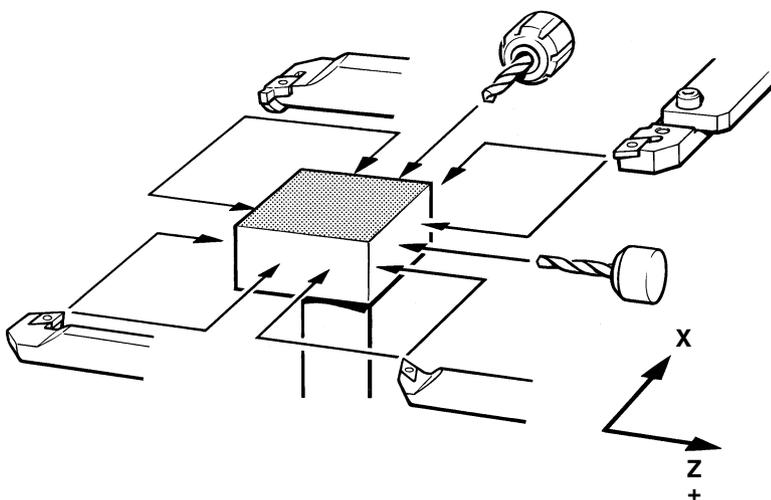
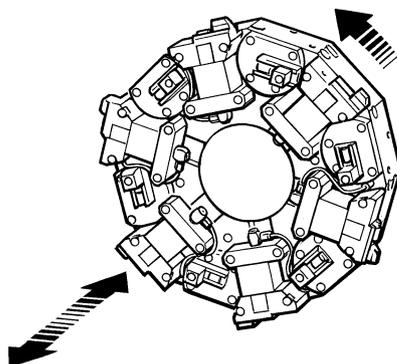
# Tool setting software for lathes

## Cycle features

- Tool length setting**  
With automatic offset correction

**Tool diameter, centre line and length offset setting of static and powered tools**
- Broken tool detection**

**Complete turret of tools can be set for length, centre line and diameter**  
With automatic offset correction



TOOL NOSE VECTOR DIRECTION

### PROGRAM INPUTS DESCRIPTION

- H tool nose vector/datuming direction.  
 T tool offset to be updated.  
 C cutter diameter to compensate tool offset by the radius amount.

### MANUAL TOOL SETTING

The tool is positioned in front of the cube manually before running the following example in MDI mode.

*Example*

```
%
G65 P9011 H3. T1.
M30
```

### AUTOMATIC TOOL SETTING

The current tool is moved towards the cube for setting and automatically retracts to the home or start position when finished.

*Example*

```
AUTO MODE
%
G28 U0 W0
G98
T0101
G125 T1. H3.
T0202
G125 T2. H7.
T0303
G125 T3. H8.
T0313
G125 T3. H7. C20.
T0404
G125 T4. H4.
T0505
G125 T5. H2.
T0606
G125 T6. H1.
M30
```

# Inspection software for lathes

## Cycle descriptions

### RADIUS MEASUREMENT

The internal and external diameter is measured using a single point touch. The results can be used to compensate a tool offset and store the error.

*Example*

G65 P9015 X30.5 T6. M16.

### DIAMETER MEASUREMENT

The feature is measured at 2 points on opposite sides of the diameter. The results can be used to compensate a tool offset and store the error.

The Z input indicates an outside diameter will be measured.

*Example*

G65 P9019 D50.5 Z-30.0 T5.

### RIB / GROOVE MEASUREMENT

This cycle measures the width and position of a rib or groove around the diameter before updating the relevant tool offsets.

*Example*

G65 P9016 D55.0 X45.0 T10. M11.

*Example*

```

%
G80 G90 G00
T0101
T0101 X100. Z60. (co-ordinate system)
1. G65 P9010 X0 Z10. F1000
2. G65 P9019 D50. Z-5. T5. M6. (diameter)
3. G65 P9010 Z-10.0
4. G65 P9015 X40. T7. M8. (diameter 1 point)
5. G65 P9010 Z5.
6. G65 P9010 X45. (Length)
7. G65 P9018 Z0. M9. E1. (set Z datum)
8. G65 P9010 X70.
9. G65 P9010 Z-15.
10. G65 P9015 X65. T10. M11. (diameter 1 point)
11. G65 P9010 X100. Z60.
G28 U0 W0
M30.
  
```

### LENGTH MEASUREMENT

The single point Z measure cycle determines the surface position for compensating tool offset or updating the component workpiece datum position.

*Example*

G65 P9018 Z30.0 E1.

### TOLERANCE BAND

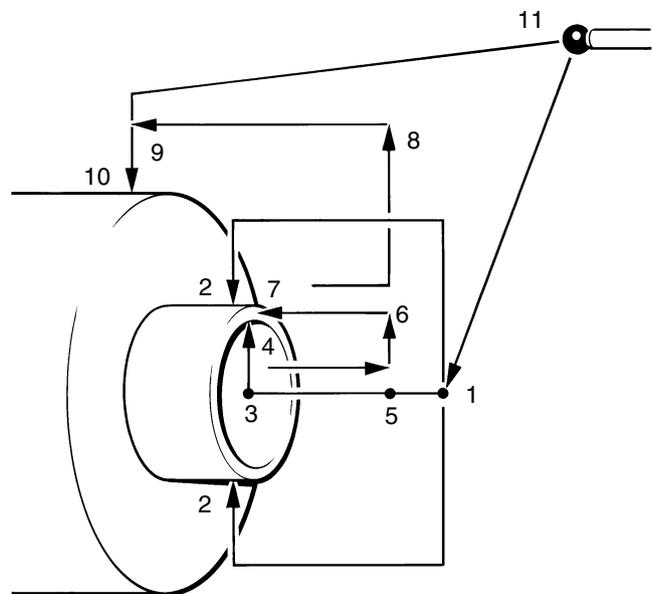
Can be set to give an alarm if the feature is out of tolerance. An upper tolerance limit can be set so that no tool offset corrections are performed if the error found is above the limit specified.

### PRINT RESULTS

On completion of each measurement cycle it is possible to print out feature size and position, through the RS232 to a printer or via a computer using the input V on the program call line.

### PROGRAM INPUTS DESCRIPTION

- X radial dimension.
- D diameter of feature.
- Z ± dimension or depth.
- T tool offset to be updated with error of size e.g. T10.
- M tool offset to store error.
- E work offset to be updated for position e.g. E1. for G54.
- H tolerance band for no offset correction.
- V print results of measurement.

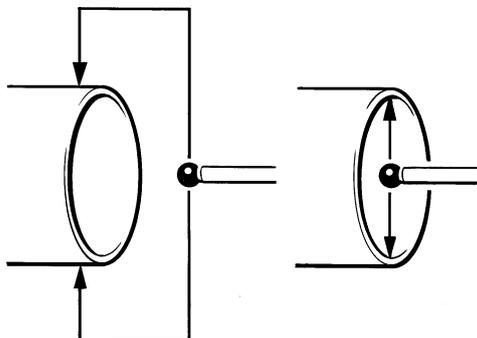


# Inspection software for lathes

## Cycle features

- ❑ **Size control**  
Tool offsets can be corrected automatically.
- ❑ **Position control**  
Work offsets can be updated for accurate component positioning.
- ❑ **Measurement error**  
Can be stored in a spare tool offset.
- ❑ **Tolerance band**  
Can be set to give an alarm if the feature is out of tolerance.
- ❑ **Measurement results**  
Can be printed out through the RS232 to a printer or computer.

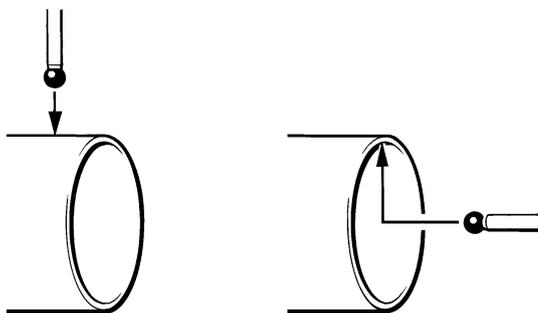
### 2 POINT DIAMETER MEASURE



*Example*

G65 P9019 D50. Z-10. M20.

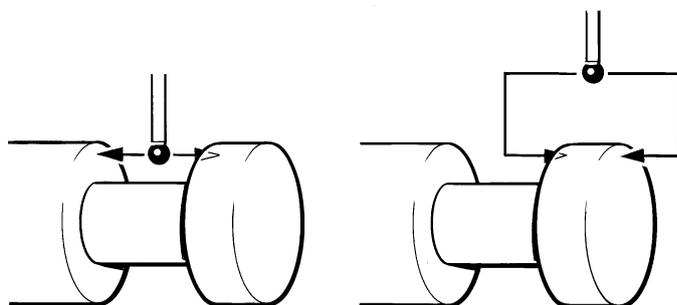
### SINGLE POINT DIAMETER MEASURE



*Example*

G65 P9015 X50. M20.

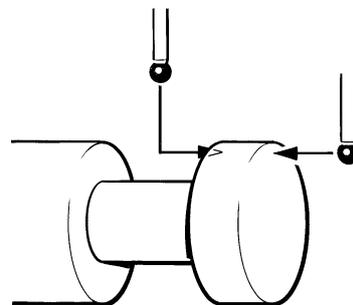
### RIB / GROOVE MEASURE



*Example*

G65 P9016 D20. T10.

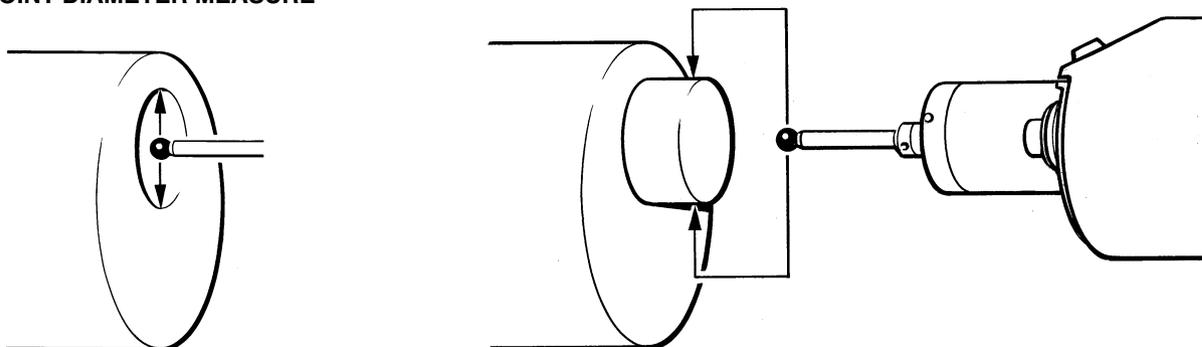
### Z SURFACE / DATUM POSITION MEASURE



*Example*

G65 P9018 Z0 T10.

### 2 POINT DIAMETER MEASURE



*Example*

G9010 X50. Z20.  
G65 P9019 D30. Z-5. E20.

# EasyProbe inspection software for machining centres

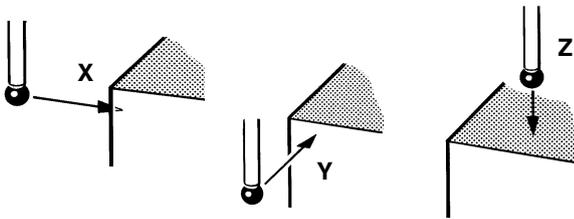
EasyProbe software cycles are designed for use by the operator for simple job set-up and measuring tasks on machining centres. The software can be easily configured, using a supplied installation utility, to suit the machine tool configuration.

Probe positioning is by using the machine handwheel/jog function and cycles run via M.D.I.  
Alternatively probe positioning and cycles can be written into a part program and run automatically.

## Cycle features

- ❑ **Position control**  
Work offsets can be updated for accurate component positioning.
- ❑ **Measurement results / error**  
Results and errors are stored in a macro variable list.
- ❑ **Angle find**  
The angle of a surface can be found to update a 4th axis or enable G68 co-ordinate rotation.

### X / Y / Z SURFACE MEASURE



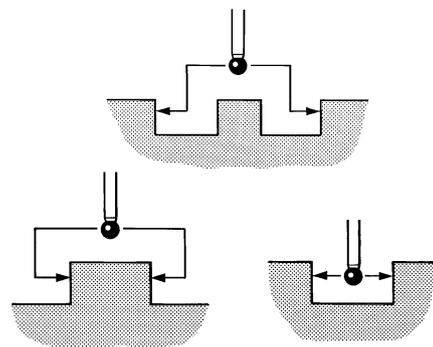
The cycle is used to measure a single surface feature. It is also used to calibrate the length of a probe.

#### Example

G65 P9023 X10. S54.

Set the G54 to the X surface position.

### WEB / POCKET CYCLE



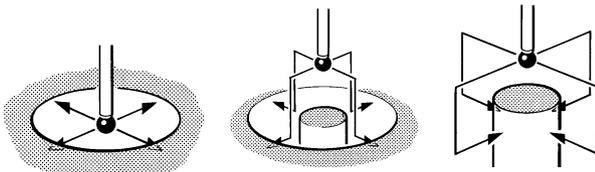
This cycle is used to measure the feature width and centre position using 2 points parallel to the X or Y axis. The error of size and centre position can then be stored or used to update the relevant work offset registers.

#### Example

G65 P9023 D50. Y1. Z-15. S54.

Set the G54 offset to the centre of the web in the Y axis.

### BORE / BOSS CYCLE



This cycle is used to measure the feature width and centre position using 4 points parallel with the X and Y axis, to determine the diameter size and centre position.

The error of size and centre position can be stored or used to update the relevant work offset registers.

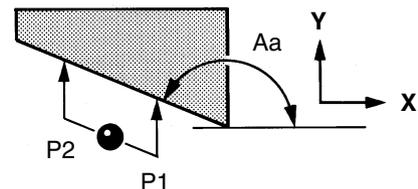
It is also used to calibrate the XY axis offsets of a probe and the radii of a probe stylus ball.

#### Example

G65 P9023 D50. S59. I50. J50.

Set the centre at X=50 and Y=50 relative to G59 X0 Y0

### ANGLE MEASURE



The angle of a surface can be found by running to two single surface measure routines, the second with an 'A' input to calculate the angle between the two points.

The angle found can then be used to update a 4th axis

#### Example

G65 P9023 Y10.  
G0 G91 X-50. Y15

G65 P9023 A160. Y10.

G68 G90 X0.R#144

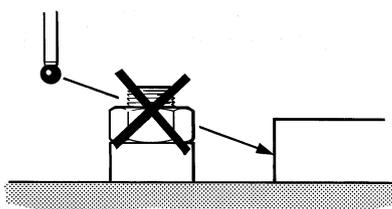
Y- single surface measure P1.  
Move from P1 to P2. Use either the jog or handwheel mode.

Y- single surface P2 measure to find the angle error.  
Stored in #144.

Apply rotation

# EasyProbe inspection software for machining centres

## PROTECTED POSITIONING



A protected positioning move stops the machine when a collision occurs from moving the probe to a target position entered on the program line.

### Example

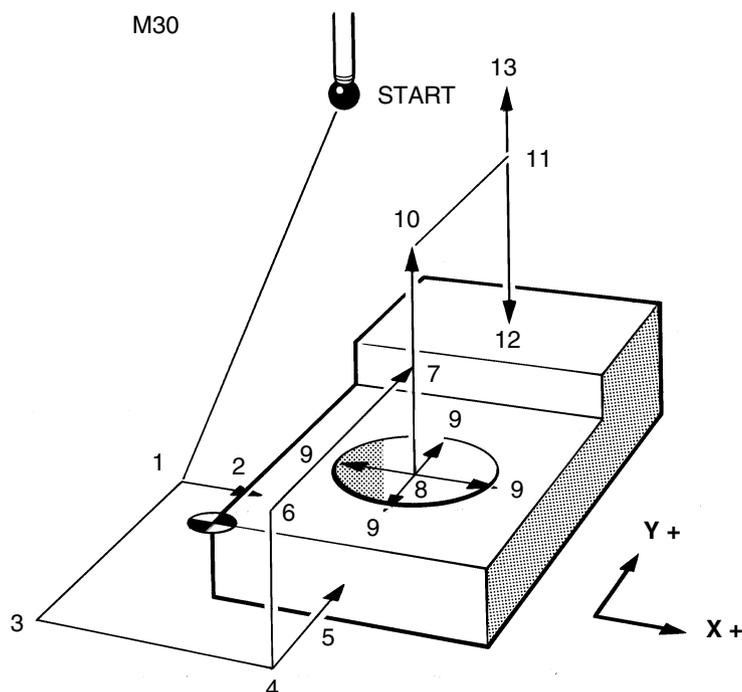
G65 P9770 X0 Y-25. Z10. F5000.

## PROGRAM INPUTS DESCRIPTION

- A± Angle input for measuring an angle.
- C Indicates a calibration cycle.
- D The nominal size of the feature for measuring a bore/boss or a web/pocket.
- I± Required X set position of the feature when setting a work offset.
- J± Required Y set position of the feature when setting a work offset.
- K± Required Z set position of the feature when setting a work offset.
- M Used to control probe switching options.
- Q Probe overtravel distance.
- R± Radial clearance between the stylus and the side of a feature. Can be negative for an internal web or boss cycle.
- S Work offset to be updated for position. i.e. S54 for G54.
- X+ Approximate distance and direction to the X surface.
- or
- X1. Indicates measuring a web/pocket in the X axis.
- Y± Approximate distance and direction to the Y surface.
- or
- Y1. Indicates measuring a web/pocket in the Y axis.
- Z± Approximate distance and direction to the Z surface.

### Example

- %
- G80 G90 G00
- T01
- M06
- G54 X0 Y0
- G43 H1 Z100.
- G65 P9023 M1. (switch on probe)
- G65 P9770 X-10.0 Y10.0 Z-5.0 F1000 (protected move)
  - G65 P9023 X10.0 S54.  
(single surface measure, set G54 X)
  - G65 P9770 Y-10.
  - G65 P9770 X10
  - G65 P9023 Y10. S54. (single surface measure, set G54 Y)
  - G0 Z10. (clearance move)
  - G65 P9770 X50. Y50.
  - G65 P9770 Z-5.
  - G65 P9023 D40. H0.2 (bore measure)
  - G0 Z20.0.
  - G65 P9770 Y90.
  - G65 P9023 Z-20. S54. K5.  
(single surface measure, set G54 Z)
  - G28 Z100
- M30

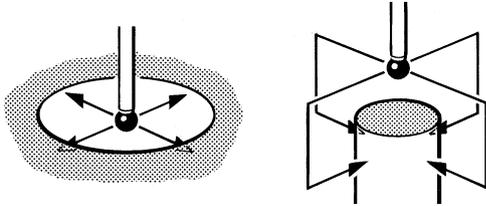


# Standard inspection software for machining centres

## Cycle features

- ❑ **Size control**  
Tool offsets can be corrected automatically.
- ❑ **Position control**  
Work offsets can be updated for accurate component positioning.
- ❑ **Measurement error**  
Can be stored in a spare tool offset.
- ❑ **Tolerance band**  
Can be set to give an alarm if the feature is out of tolerance.
- ❑ **Measurement results**  
Can be printed out through the RS232 to a printer or computer.

### BORE / BOSS CYCLE

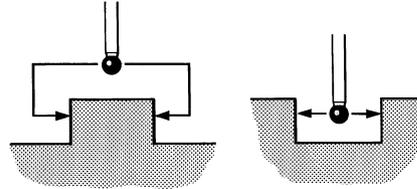


The bore / boss cycle measures a diameter using 4 points parallel with the X and Y axis to determine the diameter size and centre position. The boss measure is indicated by a Z input on the program line.

#### Example

G65 P9019 D20. T12. S1. H0.2

### WEB / POCKET CYCLE

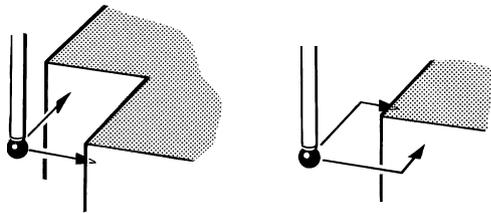


This cycle determines the features, width and centre position using 2 points parallel to the X or Y axis. The error of size and centre position can then be stored or updated in the relevant tool and work offsets.

#### Example

G65 P9010 X20. T12. H0.2

### INTERNAL / EXTERNAL CORNER CYCLE

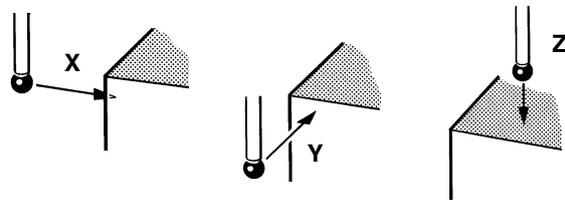


This cycle is used to find and update the work offset for the corner position. A single point is taken on both X and Y surfaces.

#### Example

G65 P9012 X0. Y0. S2.

### X / Y / Z SURFACE MEASURE

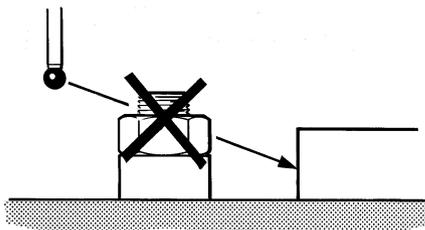


A single point touch is made to determine the surface position in X, Y, or Z before updating the work or tool offset.

#### Example

G65 P9013 X10. S2.

### PROTECTED POSITIONING



A protected positioning move stops the machine when a collision occurs from moving the probe to a target position entered on the program line.

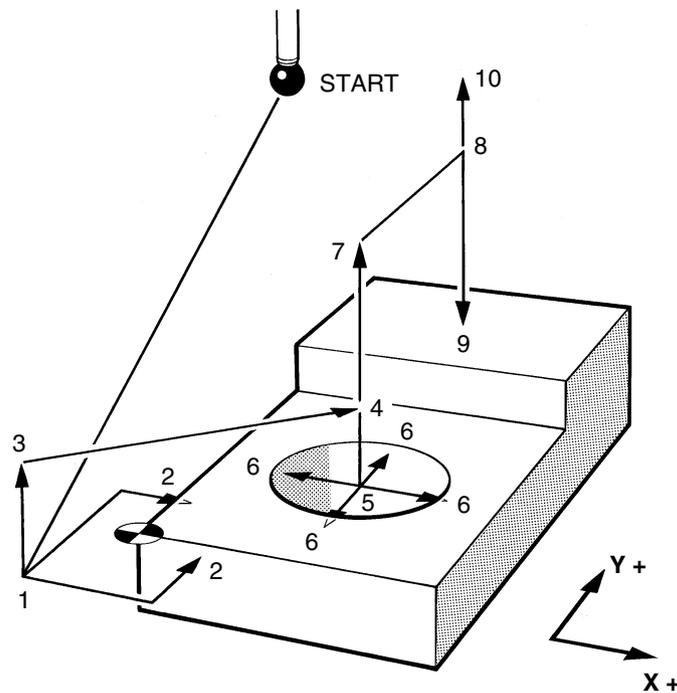
#### Example

G65 P9014 X10. Y30. Z-10. F1000.

### PROGRAM INPUTS DESCRIPTION

- X ± direction and dimension.
- Y ± direction and dimension.
- D diameter of feature.
- Z ± Z depth for boss measure.
- T tool offset to be updated with error of size e.g. T10.
- M tool offset to store error.
- S work offset to be updated for position e.g. S1 for G54.
- H tolerance band for "OUT OF TOL machine alarm.
- V & W print results of measurement.

# Standard inspection software for machining centres



## Example

```

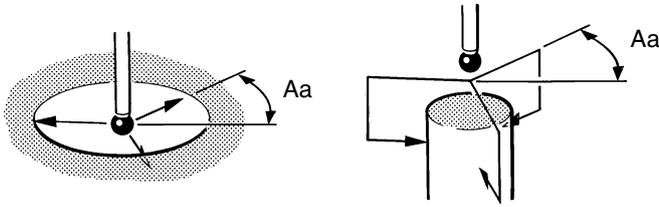
%
G80 G90 G00
T01
M06
G54 X0 Y0
G43 H1 Z100.0
1. G65 P9014 X-10.0 Y-10. Z-5.0 F1000 (protected move)
2. G65 P9012 X0.0 Y0.0 S1. (corner measure)
3. G65 P9014 Z10.0
4. G65 P9014 X50.0 Y40.0
5. G65 P9014 Z-5.0
6. G65 P9019 D40.0 T10 M20 H0.2 (bore measure)
7. G65 P9014 Z20.0
8. G65 P9014 Y90.
9. G65 P9018 Z5.0 S2. (Z measure)
10. G65 P9014 Z50.0
G28 Z100.0
M30.

```

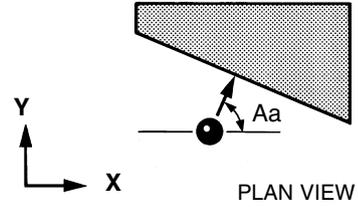
# Additions to standard software packages for machining centres

## Standard software vector measure option

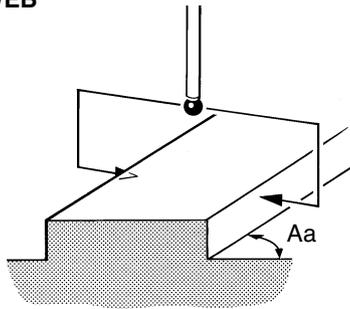
3 POINT BORE / BOSS



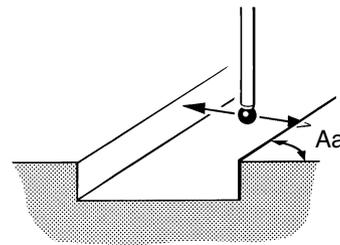
ANGLED SURFACE



ANGLED WEB

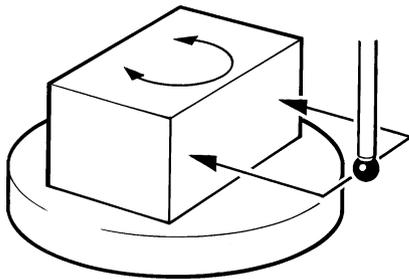


ANGLED POCKET

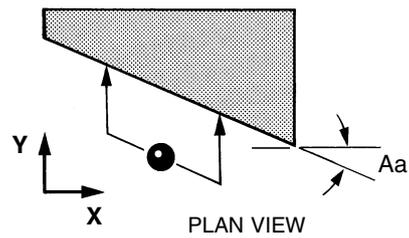


## Standard software angle measure option

4th AXIS MEASURE

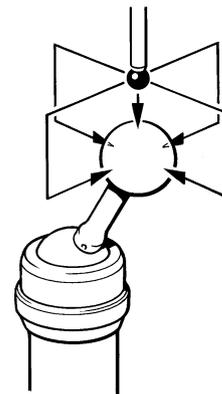
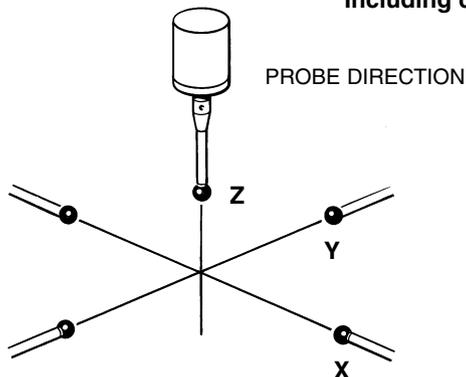


ANGLED SURFACE



## Multi-axis inspection package (complete)

Standard inspection features in 5 axis directions.  
Including calibration on a sphere.



# Standard inspection software for machining centres

## Print macro function for standard software

pages 8-10

On completion of each cycle, it is possible to print out the feature size and position, via the RS232 port, to a printer or computer with suitable communications interface.

By using the inputs 'V' or 'W' (when fitted) on the measuring macro call line, the print out will appear in different formats as shown below.

Alternatively, the print macro can be programmed directly to print out measured results.

*Example*

G65 P9019 D20. M99. V2. H0.1 (bore measure and print results in offset 99)

or

G65 P9730 D15. E0.055 M99. V2. (print results in offset 99)

### Machining centre or lathe 'V2' input (print heading)

COMPONENT No. 1				
OFFSET NO	NOMINAL DIMENSION	TOLERANCE	DEVIATION FROM NOMINAL	COMMENTS
99	15.000	0.100	0.055	

### Machining centre or lathe 'V1' input (no heading)

99	15.000	0.100	0.055	
----	--------	-------	-------	--

### Machining centre 'W2' input (print heading)

COMPONENT No. 1		
WORK OFFSET	NOMINAL POSITION	DEVIATION FROM NOMINAL
G54	X – 135.155	– 0.155
	X – 85.235	– 0.235

### Machining centre 'W1' input (no heading)

G54	X – 135.155	– 0.155
	X – 85.235	– 0.235

# Inspection Plus software for machining centres

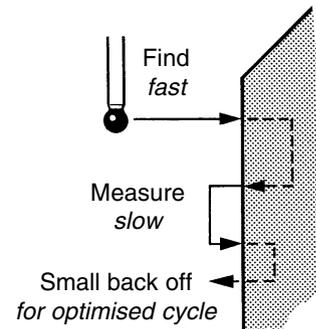
## Benefits - compared with standard software

- \* All cycles in one package (no options).
- \* Improved output data information stored in variables, and print report generation.
- \* Improved print macro data.
- \* Cycles with additional capability.  
i.e. Angle corner find.  
Internal boss/web.
- \* Feature to feature relationship measurement.
- \* Additional cycles list - *see illustrations*.
- \* Optional 1 or 2 touch probing (included).

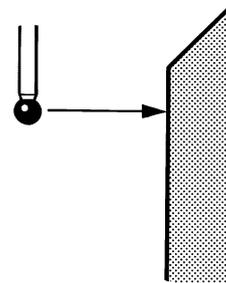
## Cycle features

- Protected positioning.
- Size and position calculated for internal/external features.
- Tolerances can be applied to size and position.
- Error bands set for no offset compensation.
- Offsets compensated for by % of error.
- Statistical Process Control (SPC) feedback based on trend analysis and average readings.
- Process errors can be applied to measurement results.
- Print results out through the RS232 serial port.
- 1-Touch measuring option.  
(for machines with high speed probe input signal).
- 2-Touch measuring option.  
(for general applications, and use on machines with standard input signal).

### 2-TOUCH PROBING - STANDARD



### 1-TOUCH PROBING - OPTIONAL Includes false trigger recovery

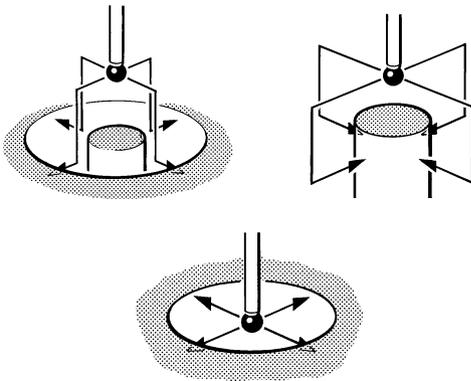


# Inspection Plus software for machining centres

## List of cycles

- X or Y or Z single surface measure.
- Web / pocket measure.
- 4 point bore / boss measure.
- Internal/external corner.  
(3 point measure for right angled corners).  
(4 point measure for intersection of angled surfaces).
- 3 point bore / boss vector measure.  
(approach angles are specified for each point).
- Angled web / pocket measure.
- Angled XY surface measure.
- Holes on a pitch circle diameter (PCD).
- 4th Axis measure.  
(component, fixture or machine table can be compensated for alignment).
- Stock allowance.  
(maximum metal condition can be measured to eliminate any unnecessary fresh air cutting).
- Multi-stylus calibration.  
(several stylus ball configurations can be calibrated and stored).
- Feature to feature measure.
- Angled XY surface (angle find).
- Statistical process control (SPC) macro for tool offset updates.

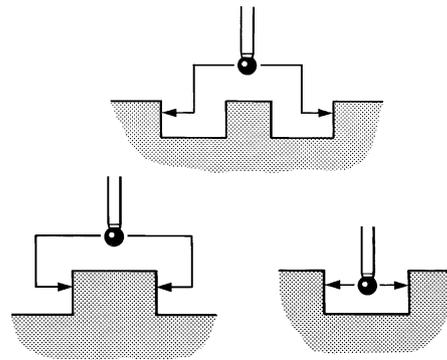
### BORE / BOSS



Example

G65 P9814 D50. Z-10. S4.

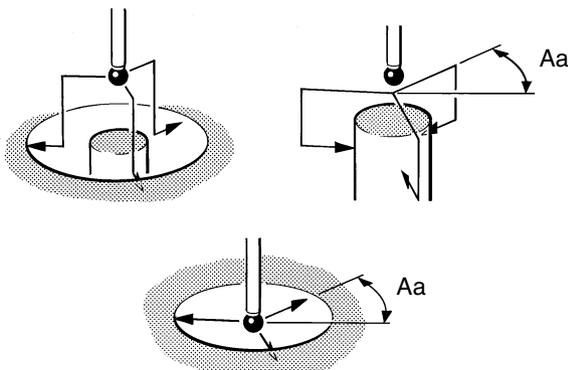
### WEB / POCKET



Example

G65 P9812 X50. Z-10. S4.

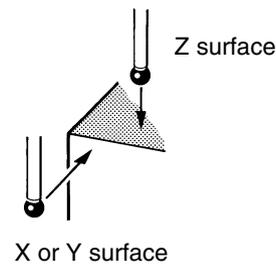
### 3 POINT BORE / BOSS



Example

G65 P9823 A0 B120. C-120. D50. S4.

### X / Y / Z SURFACE MEASURE

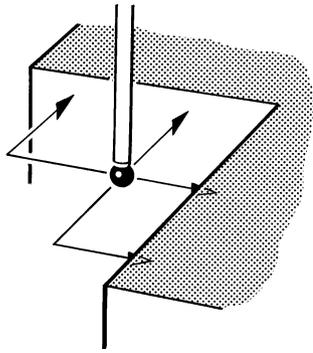


Example

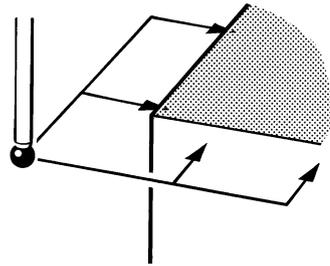
G65 P9811 X30. T20.

# Inspection Plus software for machining centres

## INTERNAL / EXTERNAL CORNER

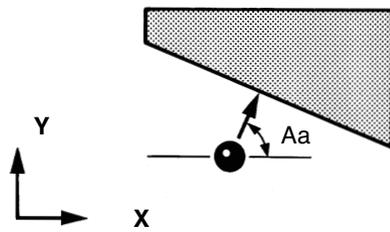


*Example*  
G65 P9815 X0 Y0 I20. J20. S6.



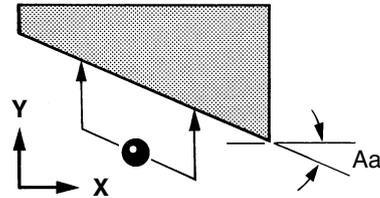
*Example*  
G65 P9816 X0 Y0 I20. J20. S6.

## ANGLED SURFACE



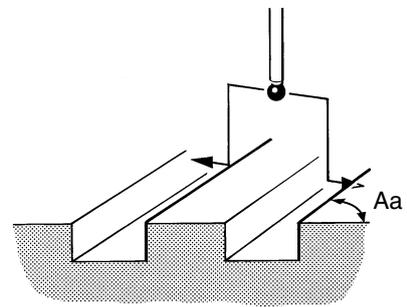
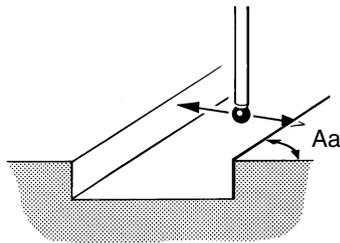
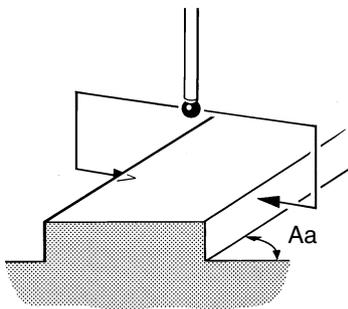
*Example*  
G65 P9821 A60. D30.

PLAN VIEW



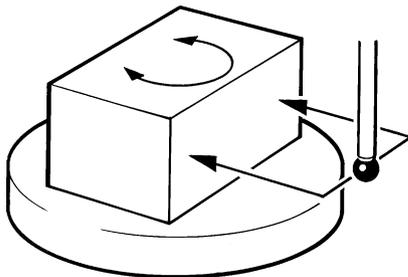
*Example*  
G65 P9843 Y50. D30. A-30.

## ANGLED WEB / POCKET



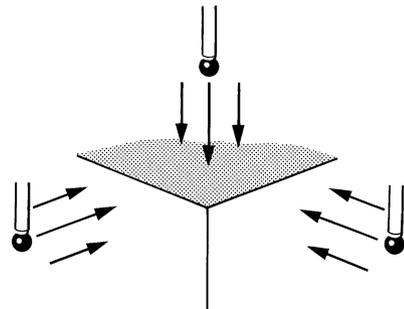
*Example*  
G65 P9822 D50. Z-10. A45.

## 4th AXIS MEASURE CYCLE



*Example*  
G65 P9817 X100. Z50. S1.

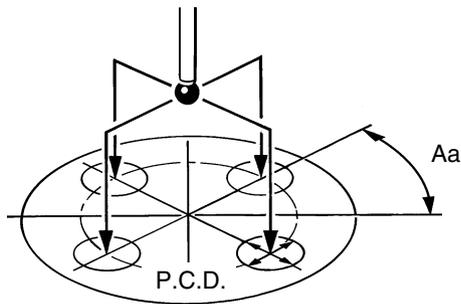
## STOCK ALLOWANCE



*Example*  
G65 P9820 Z0 I20. I20 I30. J30 I40. J40. S6.

# Inspection Plus software for machining centres

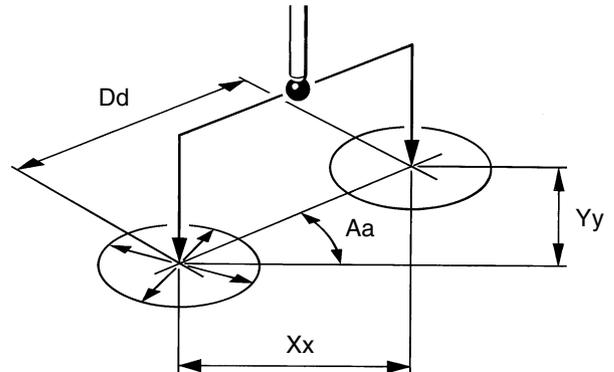
## BORE / BOSS ON P.C.D. CYCLE



### Example

G65 P9819 C200. D25. K-10. B4. A45.

## FEATURE TO FEATURE



### Example

G65 P9810 X0 Y0 F5000.  
G65 P9814 D20.  
G65 P9834  
G65 P9810 X50.  
G65 P9814 D20.  
G65 P9834 X50.

# Inspection Plus software for MP700 probe

Inspection Plus software for the MP700 probe comprises the cycles and features described on pages 5, 6, 7 and 8 with the additional cycles and features shown below.

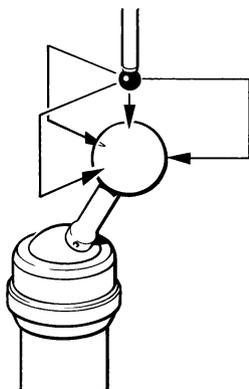
## Additional cycles

- Calibration on a sphere.
- XYZ single surface measurement (3D measure).
- 3D measuring application capability.

## Additional features

- Simplified calibration and calculation routines based on a constant stylus ball radius for all directions.  
This feature is unique to the MP700 probe.

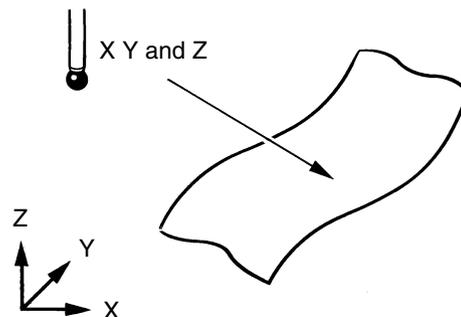
## SPHERE CALIBRATION



### Example

G65 P9804 X200. Y100. Z50. D30. S6. T20.

## X / Y / Z SINGLE SURFACE MEASURE - 3D MEASURE



### Example

G65 P9821 X50. Y30. Z50. C1.

# Inspection Plus software for machining centres

## Print macro function for Inspection Plus software pages 12-15

On completion of each cycle, it is possible to print out the measured results, via the RS232 port, to a printer or computer with suitable communications interface.

Use the 'W1' input on the measuring macro call line.

- W1. Increment the feature number only.
- W2. Increment the component number, and reset the feature number.

### Example

G65 P9834 X45. Y-65. W2. (feature to feature)

G65 P9810 X-135. Y-65. F3000.

G65 P9814 D71. W1. (bore measure)

Machining Centre		Using 'W2.' and 'W1.' INPUT	
COMPONENT NO 31	FEATURE NO 1		
POSN R79.0569	ACTUAL 79.0012	TOL TP 0.2000	DEV-0.0557
POSN X-45.0000	ACTUAL -45.1525	TOL TP 0.2000	DEV-0.1525
POSN Y-65.0000	ACTUAL -64.8263	TOL TP 0.2000	DEV-0.1737
+++++OUT OF POS++++ERROR TP 0.1311 RADIAL			
ANG-124.6952	ACTUAL-124.8578	DEV-0.1626	
COMPONENT NO 31	FEATURE NO 2		
SIZE D71.0000	ACTUAL 71.9072	TOL 0.1000	DEV 0.9072
+++++OUT OF TOL+++++ERROR 0.8072			
POSN X-135.0000	ACTUAL -135.3279	DEV-0.3279	
POSN Y-65.0000	ACTUAL -63.8201	DEV-1.1799	

# Rotating tool setting software for machining centres

## Cycle features

- Tool length setting**  
With automatic offset correction
- Rotating tool length setting of single and multiple tip tools**
- Broken tool detection**
- Rotating tool diameter setting of single and multiple tip tools**
- Fully automated measurement cycle**  
With tool change positioning and offset correction.

### TOOL LENGTH SETTING



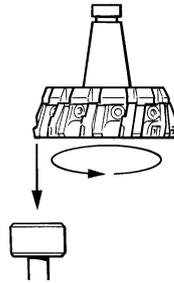
#### TOOL LENGTH / DIAMETER SETTING

The tool is manually positioned over the stylus within 10mm of the surface. The following example program is then executed.

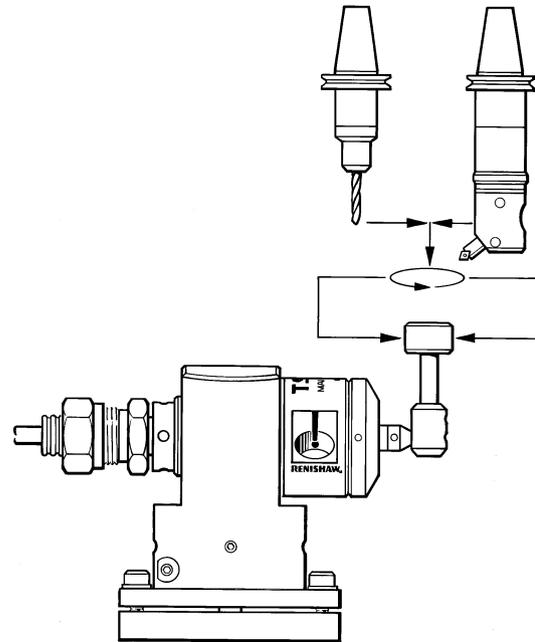
#### Example

1. G65 P9851 T1. (tool length setting).
2. G65 P9852 D21. (tool diameter setting).

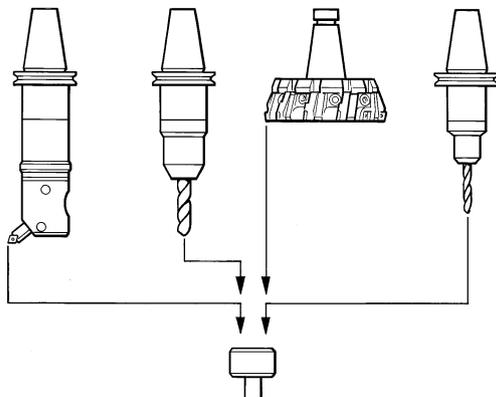
### ROTATING LENGTH SETTING



### ROTATING DIAMETER SETTING



### AUTOMATIC TOOL MEASUREMENT



The tool will be selected automatically from the tool change magazine positioned over the stylus, then measure the length and/or diameter before returning to the home position and updating the relevant offsets.

#### Example

1. G65 P9853 B3. T01.001 D11.  
(selects tool 1 and automatically measures length offset No. 1 and diameter offset No. 11).

### BROKEN TOOL DETECTION



After machining, the tool is positioned by the program over the stylus before running the following cycle to check the length or diameter offset.

#### Example

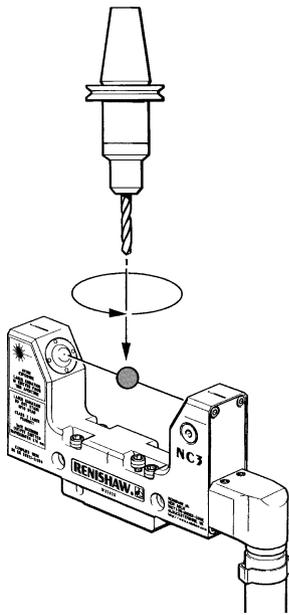
1. G65 P9853 B1. T1. H0.2  
(tool breakage tolerance  $\pm 0.2\text{mm}$ ).

# Non-contact tool setting software for machining centres

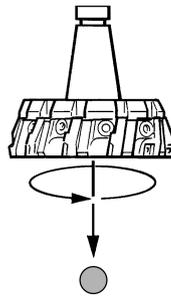
## Cycle features

- Tool length setting**  
With automatic offset correction
  - Rotating tool length setting of single and multiple tip tools**
  - Broken tool detection**
  - Rotating tool diameter setting of single and multiple tip tools**
  - Cutter radius and linear profile checking**  
Cutter edge/missing tooth checking
  - Temperature compensation checking**
- 
- Program examples for broken tool detection using the NC2 probe are available as a download from the Renishaw web site**  
[www.renishaw.com/NC2 software](http://www.renishaw.com/NC2_software)  
**Downloads**
- 

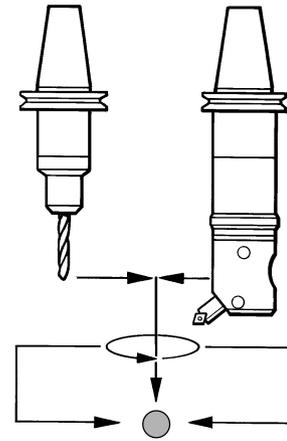
### TOOL LENGTH SETTING



### ROTATING LENGTH SETTING



### ROTATING DIAMETER SETTING



#### TOOL LENGTH / DIAMETER SETTING

The tool is automatically positioned over the laser beam.

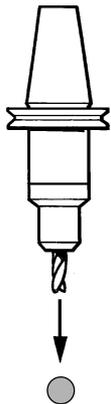
The two following example programs can then be executed.

#### Examples

1. G65 P9862 (tool length setting).
2. G65 P9862 B3. D31. (tool length and diameter setting).

# Non-contact tool setting software for machining centres

## BROKEN TOOL DETECTION

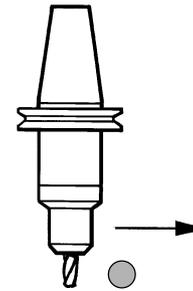


PLUNGE CHECK

When running the following cycle after machining, the tool is automatically positioned over the laser beam. It is then plunged into the beam to check its overall length. With the following example, both long and short tool conditions can be checked to a tolerance of 0.5 mm.

*Example*

G65 P9863 H-0.5



RADIAL CHECK

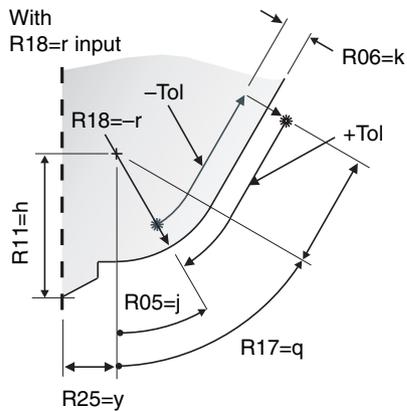
When running this cycle, the tool should first be moved to a safe, clear position in the Z, X and Y axis. The cycle will position the tool in the Z axis on one side of a beam and check its length by a rapid move radially through the beam. It can only check a short tool condition.

*Example*

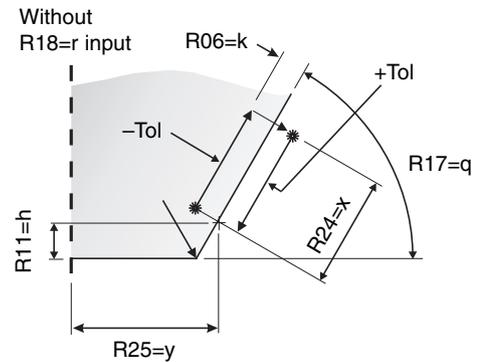
G65 P9864

## CUTTER RADIUS AND LINEAR PROFILE CHECKING

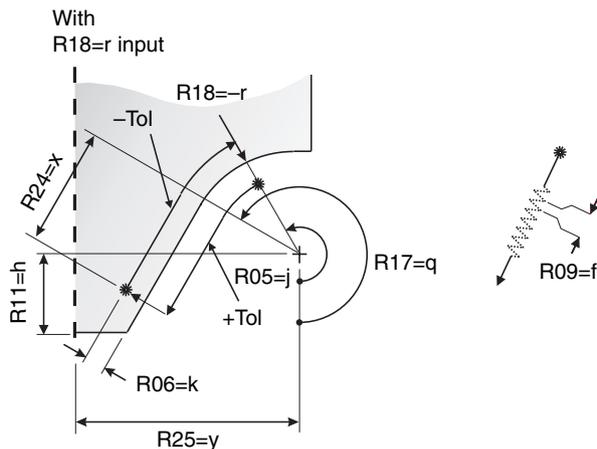
### Checking a form with a convex corner radius



### Checking a form with a linear profile



### Checking a form with a concave radius



This cycle is used to check the profile of ballnose cutters, cutters with corner radii, and cutters with linear profiles.

The profile is checked to find out if it is within a specified form tolerance.

*Example*

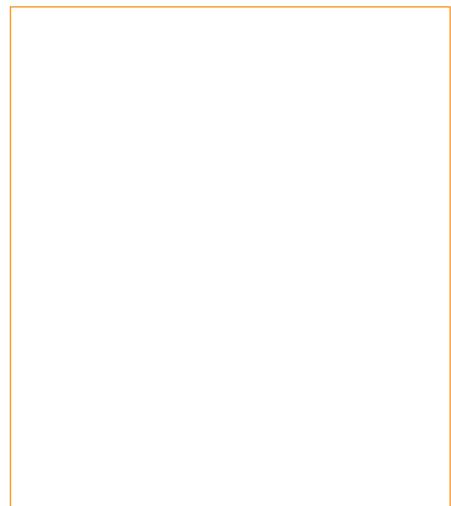
G65 P9865 B3. H0 J0.5 Q90. R5. X10.

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