Programming manual

RENISHAW
apply innovation™

AxiSet™ Check-Up with auto update for Brother table/table machines

This page is intentionally left blank.

Software safety

This software controls the movements of a machine tool and makes the machine operate in a specified manner under operator control. It has been configured for a particular combination of machine tool hardware and controller.

WARNING: Renishaw has no control over the exact program configuration of the controller with which the software is to be used, nor of the mechanical layout of the machine. Therefore, it is the responsibility of the end user to:

- make sure that all machine safety guards are in position and are working correctly before commencement of operation;
- make sure that any manual overrides are disabled before commencement of operation;
- verify that the program steps invoked by this software are compatible with the intended controller;
- make sure that any moves which the machine will be instructed to make under program control would not cause the machine to inflict damage upon itself or upon any person in the vicinity;
- be thoroughly familiar with the machine tool and its controller, and understand the operation of work co-ordinate systems, tool offsets, program communication (uploading and downloading) and the location of all emergency stop switches.

CAUTION: This software makes use of controller variables in its operation. During its execution, adjustment of these variables, including those listed within this manual, or of tool offsets and work offsets, may lead to malfunction. Make sure that all variable and program numbers required and/or used by the Renishaw system are not used by any other function or software package already installed on the CNC machine tool.

CAUTION: Brother high-accuracy mode setting

High-accuracy modes can include NC read-ahead functionality to increase machining performance. Renishaw macro software utilises the M159 (prohibit read-ahead) command, but the correct operation of macro logic cannot be guaranteed when high-accuracy modes are enabled.

To ensure correct operation of Renishaw macro software, it is recommended that high-accuracy modes are cancelled before use of Renishaw cycles and re-enabled afterwards, if required.

High-accuracy modes may include the following:

- High-accuracy mode AIII, M260-M268 – cancelled by M269.
- High-accuracy mode B, M280-M288 – cancelled by M289.
- High-accuracy mode, M298L1-L23 – cancelled by M299.

NOTE: It is a prerequisite that Renishaw Inspection Plus software is installed and functioning on the CNC machine tool. This software package will use elements of Inspection Plus to capture measurement results and process data.

Contents

Intended use 3
About the software 3
About this manual 3
Measurement values used in this manual 3
Read-ahead control 3
Use of inch/mm units 3
Software kit part no. A-5642-4161 4
General information 5
Accuracy 5
Machine configuration types 6
AxiSet™ Check-Up with auto update process 7
Installing the software 8
Macro software 8
Manual configuration of the software 8
Macro variable usage (#500 series) 9
Configuring the macro software 10
Pre-cycle checks and software settings 10
Data capture set-up 11
Maximising accuracy 11
Mounting the datum sphere 11
Probe calibration 12
Sphere and feeler or table surface method 12
Sphere calibration 13
Running AxiSet™ Check-Up: Spindle alignment 16
Macro settings 17
Running AxiSet™ Check-Up : Table-type rotary axis 20
Macro settings 21
Appendix A – Configuring setting macros 26
Setting O8104 macro for the machine type 26
Metric/inch machine parameters 27
Appendix B – Auto-reading of pivot point data 28
Manual setting of pivot point values 29
Appendix C – 3 + 1 axis machine set-up 30
Appendix D – Checking the tool setter 31

Appendix E – Calculation methods 32
Appendix F – Macro alarm list..... 33

Intended use

Renishaw AxiSet™ Check-Up with auto update software must only be used as intended. The software is only intended for use with Renishaw touch-trigger probes.

Use of the software with non-Renishaw probes is not supported. This version of the software is for use only on machines that are fitted with Brother controllers.

About the software

The Renishaw AxiSet™ Check-Up with auto update software described in this manual is for use on machines that are fitted with Brother controllers.

About this manual

This programming manual contains detailed information about how to use the AxiSet™ Check-Up with auto update software for programming, operating and controlling your machine tool.

Measurement values used in this manual

Throughout this manual metric units of measurement (for example, millimetres) are used in the examples. Where appropriate, the equivalent imperial values (for example, inches) are shown in brackets.

Read-ahead control

Fast machining or smoothing control options can cause problems with block read-ahead when running a cycle. Refer to the associated Inspection Plus manual for details.

Use of inch/mm units

All inputs (unless otherwise stated) described in this manual are to be inserted using the current machine units.

CAUTION: It is a feature of this software that all unit-dependent probe data is stored in metric (mm) units, regardless of the current machine units. When this data is read, it is converted as required to suit the active machine units.

Software kit part no. A-5642-4161

The software media contains the following files and folders:

\Readme.txt	This is an information file.
\Macros\<files>	This folder contains various source files, including alternative language files for messages.
\Documentation\<files>	This folder contains software documentation.

General information

AxiSet™ Check-Up is a macro software package designed to take on-machine measurements of a datum sphere and output resulting data to an accompanying software program running on a PC.

This auto update package also allows for the on-machine correction of errors calculated when the measurements over the datum sphere have been taken.

Additionally, when auto calculating/updating pivot point parameters, the output file can still be used by the AxiSet™ Check-Up app for analysis and comparison purposes.

To compare results from many tests (using the View History function), it is vital that the datum sphere is in the same position on the machine table for each test.

Tests should be run with the machine at working temperature. If the machine has been left standing for an extended period, we recommend you run a machine warm-up cycle before testing.

All references to #535 to #546 will change if the base storage number in the setting macro (O8104 #18) is changed.

CAUTION: Changes to machine system variables should only be performed by authorised personnel.

Renishaw recommends the use of non-lobing probes for the best metrology performance. Use of probes that do not contain strain-gauge technology will result in decreased performance.

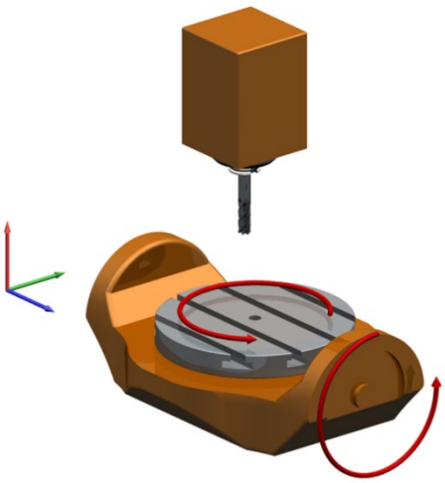
Renishaw does not support the use of non-Renishaw probes with this software.

Accuracy

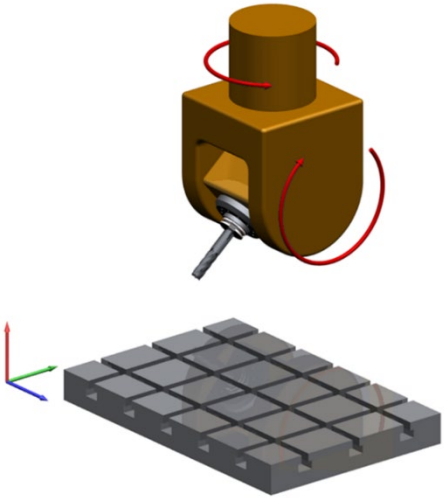
The accuracy of the errors calculated by AxiSet™ Check-Up are dependent on a number of factors including probe calibration, sphere set-up, machine functions, machine alignments and machine working temperature.

Machine configuration types

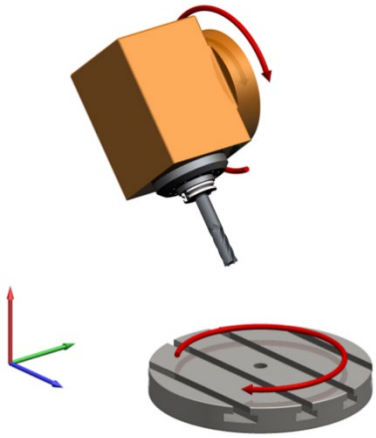
Multi-axis machines are those with XYZ linear axes and one or more rotary axes. Generally, a multi-axis machine will fall into one of the following configuration types:



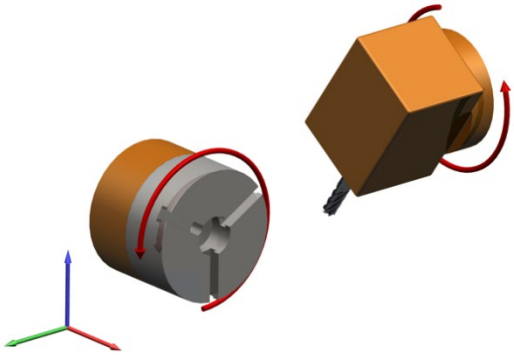
Table/Table



Head/Head



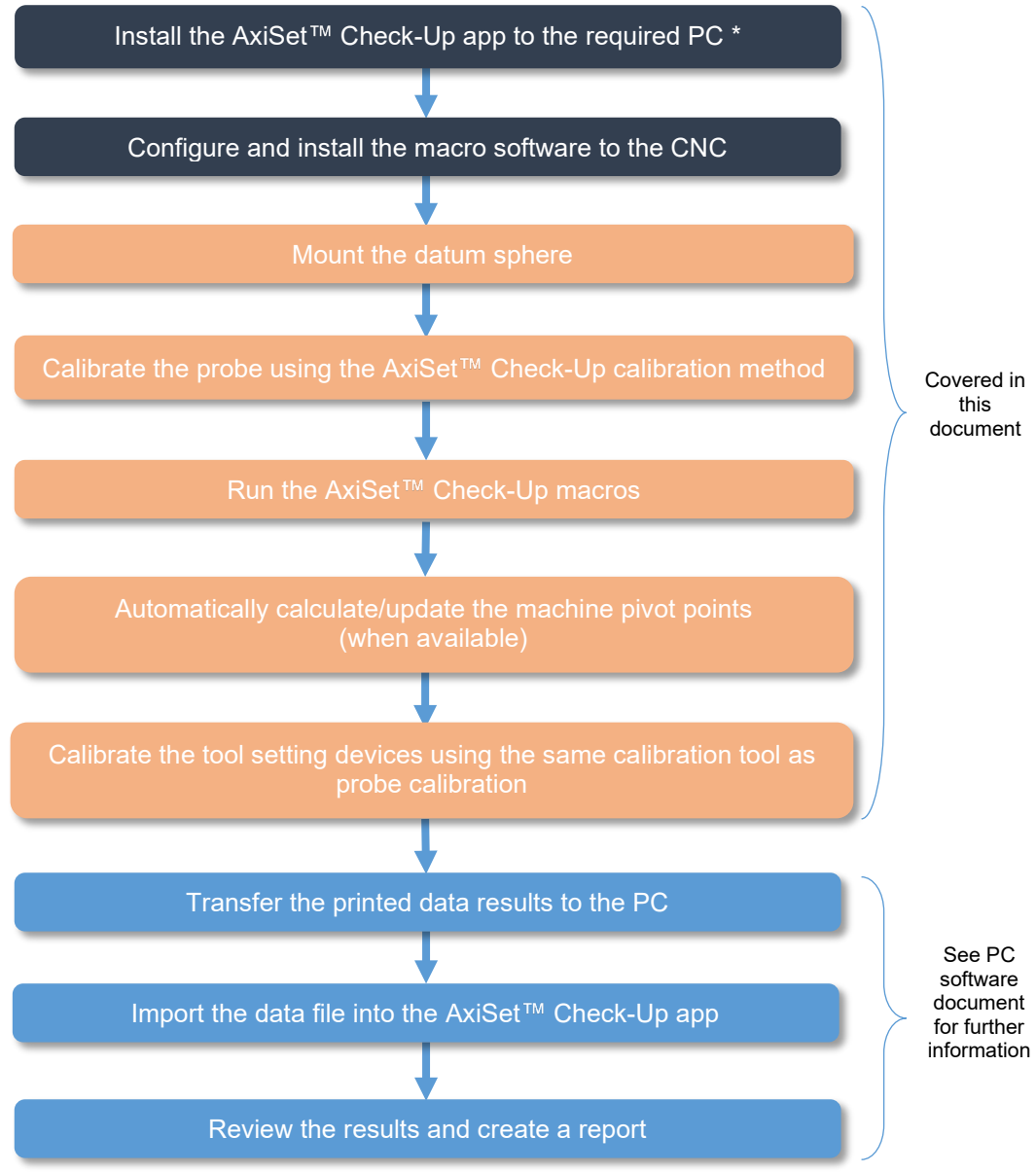
Head/Table



Multi-tasking
(Turn-mill Head/Table variant)

Selection of the correct program for the axis configuration is important when selecting and running AxiSet™ Check-Up cycles.

AxiSet™ Check-Up with auto update process



These steps are only required on initial use of AxiSet™ Check-Up software.

* AxiSet™ Check-Up software requires a PC with Microsoft Windows 7 or later.

Installing the software

It is important that this software is installed correctly. This means selecting the appropriate cycles and configuring them to run properly on the machine. An installation wizard is provided to prepare the software for installing.

CAUTION: This AxiSet™ Check-Up package is only compatible with version **0M** or later of the Inspection Plus software (A-4012-1028). If an earlier version of Inspection Plus is loaded to the machine tool controller, contact your local Renishaw representative for further information.

Macro software

AxiSet™ Check-Up can only be installed using the installation wizard. Changes to the macros can be made after the output of the macros from the installation wizard.

Category	Cycles	
Basic programs and cycles	O8103 O8104 O8105 O8106 O8107 O8109	Auto set of WCS Settings Fit circle calculation Dynamic Offset WCS Error Print
Calibration cycles	O8101	Sphere calibration
AxiSet™ Check-Up spindle alignment cycles	O8110	Spindle alignment
AxiSet™ Check-Up rotary axis measuring cycles	O8121 O8122 O8123	A-axis table B-axis table C-axis table

Manual configuration of the software

As the software is issued using an installation wizard, no further adjustments should be required. However, useful information can be found in appendices A to F.

Macro variable usage (#500 series)

Axiset Check-Up and Inspection Plus share the same probe calibration data.

The default storage location for calibration data is #500 to #519.

The software also requires 12 consecutive free variables in the range #520 to #900 (default value #535 assumed) to store pivot point data.

If the auto update function is required, a further range of storage variables is needed in the range #520 to #900 (default value #550 assumed): the number of variables required can be determined as ‘number of measuring points × 3’.

Description	Number of variables required	Standard variables used
Probe calibration (with vector calibration) Program O8724 of Inspection Plus #111=500. (BASE*NUMBER)	20 common retained variables	#500 to #519
Pivot point storage Program O8104 of AxiSet Check-Up with auto update #18=535. (STORAGE*BASE*NO.)	12 common variables	#535 to #546
Auto update storage Program O8104 of AxiSet Check-Up with auto update #19=550.(AUTO*STORAGE*BASE*NO.)	No. of measure points × 3 (minimum of 9)	#550 onwards

NOTE: Ensure the variable base numbers (#111 of O8724 and #18 and #19 of O8104) are set to avoid interference.

Configuring the macro software

Pre-cycle checks and software settings

Checking multi-axis machine functionality is a complex process. To obtain comprehensive results, it is necessary to follow the documented checking procedure exactly.

Before running any measurement cycles, you must do the following:

Check macro O8104(REN*SETTINGS)

Information on the settings in this macro can be found in “Setting O8104 macro for the machine type” in “Appendix A – Configuring setting macros”.

Calibrate the probe

Ensure the probe is correctly calibrated. Probe length and XY offsets are especially important. If you suspect that the probe may be incorrectly calibrated, run a calibration cycle before using the AxiSet™ Check-Up software.

NOTE: Any inaccuracies in probe length setting will introduce an equivalent error into your AxiSet™ Check-Up with auto update results.

It is recommended that your probe is recalibrated:

- if a new stylus is fitted;
- if it is suspected that the stylus has become distorted or a probe crash has occurred;
- at regular intervals to compensate for mechanical changes to your machine tool.

Data capture set-up

You may wish to create a test program to verify the communications are working before running the cycle.

Example

```
O500
POPEN
DPRNT[**HELLO**]
PCLOS
M99 (or M30 for a single output execution)
```

Maximising accuracy

To optimise accuracy, it is recommended that the angular range be extended to the maximum permissible for the machine and axis configuration under test.

For a typical machine, recommended test parameters would be:

- Head-type axis: angular range of at least 90° with four data points (0°, 30°, 60° and 90°).
- Table-type axis: 360° angular range with five data points (0°, 90°, 180°, 270° and 360°).

Mounting the datum sphere

The datum sphere must be positioned on the machine table at a suitable height and location to allow access by the measuring probe/stylus at all angles required to perform the test. Check carefully for possible collisions.

To provide the clearance required for the stylus to measure the sphere, position the datum sphere stem at 45° to the machine's axes.

NOTE: Depending on user-defined test ranges and sphere, the machine rotary axes may position at the extremes of their travel.

Probe calibration

An optional calibration cycle is provided with AxiSet Check-Up.

It is not necessary to re-calibrate the probe if it has already been calibrated using Inspection Plus or the supplementary ACS-1 product and associated cycle.

However, if there is any doubt regarding the accuracy of the calibration data, it is advisable to calibrate again using the method below.

Determining a very accurate probe length is vital to ensure AxiSet™ Check-Up returns the correct result.

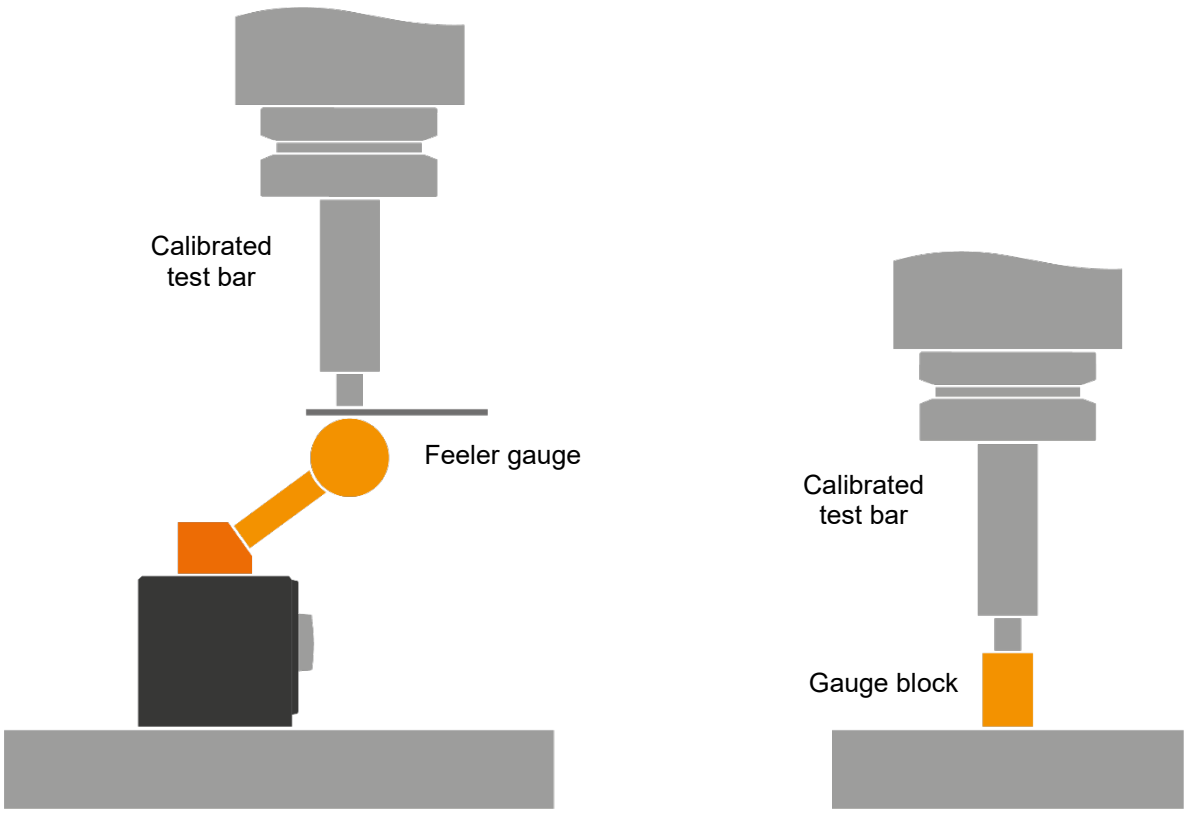
NOTE: The Z calibration surface should be established using a test bar of known length. Typically, this is etched on the bar itself or provided on a calibration certificate.

Sphere and feeler or table surface method

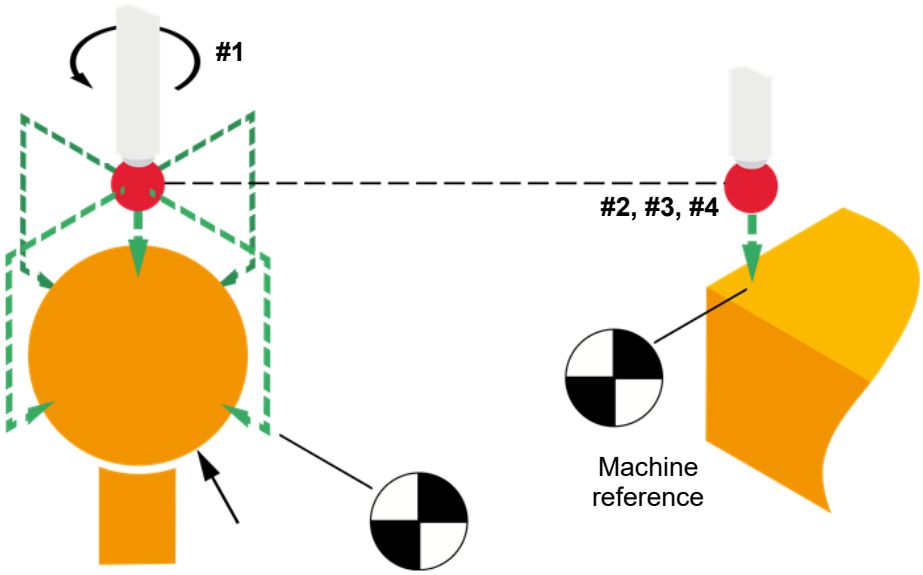
The following methods for establishing the known Z position may be used:

Sphere method: **Z work co-ordinate system (WCS)** = machine position − test bar − **f**eeler gauge − sphere radius

Table method: **#4 (O8101)** = machine position − gauge block − test bar



Sphere calibration

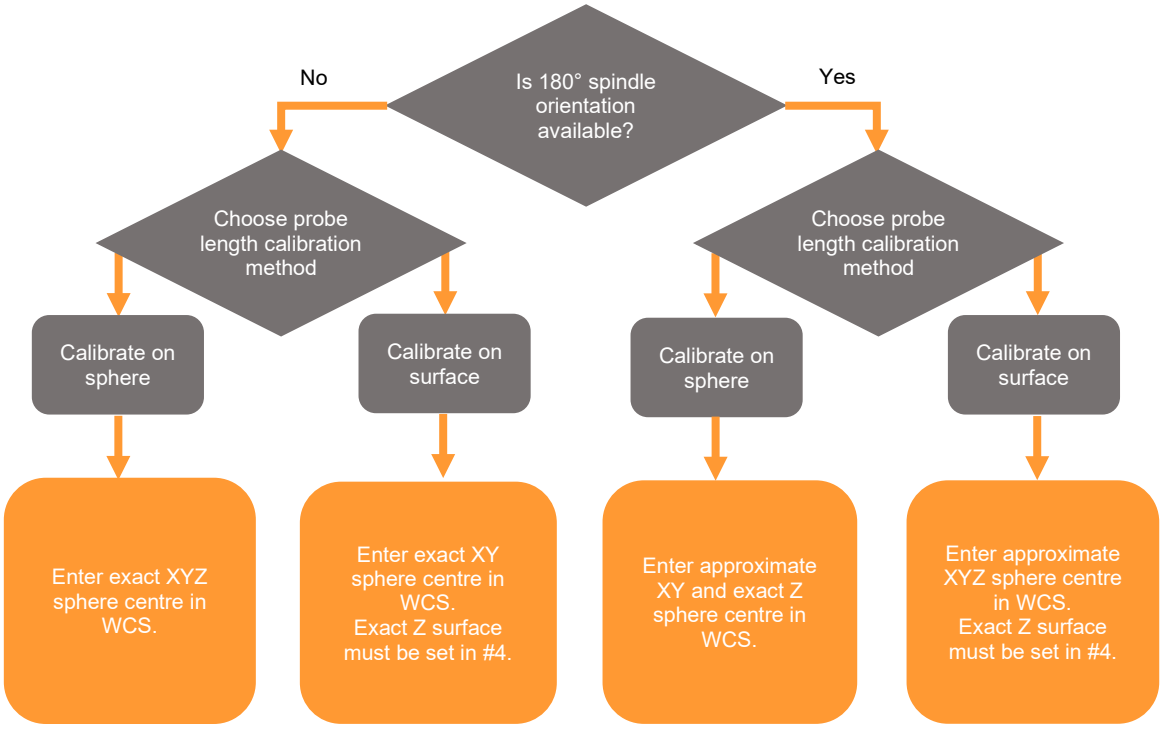


Cycle

O8101(REN*SPHERE*CAL)

Description

Several calibration options are provided. The value entered in the work co-ordinate system (WCS) differs for each method. Use the flowchart below to ensure the correct values are entered.



This cycle provides a complete calibration solution, calibrating the probe length, stylus offset and stylus radius. Depending on cycle inputs, the probe length will be calibrated on the sphere or Z surface.

NOTE: The supplied sphere calibration cycle is the recommended method for probe calibration.

The cycle will overwrite any pre-existing Inspection Plus calibration data and update the probe length. It is not necessary to calibrate again using the Inspection Plus cycles, as the data created is common to both packages.

Calibration is required if the probe is being used for the first time, a new stylus has been fitted or a probe collision has occurred.

It is advised that the probe is recalibrated prior to running any AxiSet™ Check-Up cycles to maximise accuracy. If the probe calibration is known to be correct, calibration is not required before running AxiSet™ Check-Up cycles.

Application

Select program O8101 and edit the appropriate inputs. Load an approximate value into the relevant tool offset. Move the machine to a safe start position before cycle start.

O8101(REN*SPHERE*CAL)

#1=#0(CAL*TYPE*#0=STD*3.=ROTATING*180.=180*DEG*ORIENT) ***** edit 1**

#2=#0(X*MC*POS*FOR*TABLE*TOUCH) ***** edit 2**

#3=#0(Y*MC*POS*FOR*TABLE*TOUCH) ***** edit 3**

#4=#0(DISTANCE*Z*REF*TO*Z*SURFACE) ***** edit 4**

(----------)

***** edit 1 #1=#0(CAL*TYPE*#0=STD*3.=ROTATING*180.=180*DEG*ORIENT)**

Select the probe calibration method and set #0 to suit.

#1=#0 Traditional method; sphere centre must be accurately established in X, Y and Z.

#1=3. Rotating probe.

#1=180. 180° probe orientation.

***** edit 2 #2=#0(X*MC*POS*FOR*TABLE*TOUCH)**

Enter the X machine position where length calibration will take place; the value recorded when the Z-surface position was calculated.

NOTE: If #2=#0, the cycle assumes length calibration will take place on the sphere.

***** edit 3 #3=#0(Y*MC*POS*FOR*TABLE*TOUCH)**

Enter the Y machine position where length calibration will take place; the value recorded when the Z-surface position was calculated.

NOTE: If #3=#0, the cycle assumes length calibration will take place on the sphere.

***** edit 4 #4=#0(DISTANCE*Z*REF*TO*Z*SURFACE)**

Distance from Z reference to Z touch surface; established using a qualified test bar.

NOTE: If #4=#0, the cycle assumes length calibration will take place on the sphere.

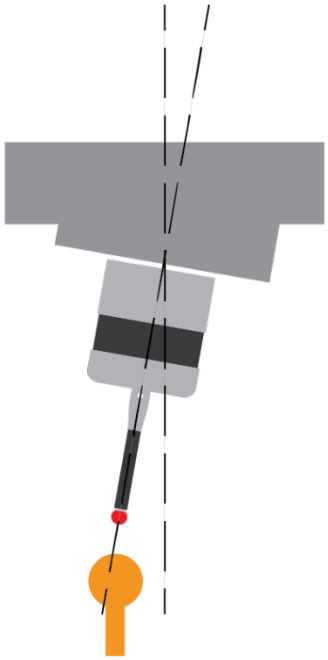
Outputs

#500 X-axis stylus ball radius (XRAD)
#501 Y-axis stylus ball radius (YRAD)
#502 X-axis stylus offset (XOFF)
#503 Y-axis stylus offset (YOFF)
#510 30° stylus ball radius (VRAD)
#511 60° stylus ball radius (VRAD)
#512 120° stylus ball radius (VRAD)
#513 150° stylus ball radius (VRAD)
#514 210° stylus ball radius (VRAD)
#515 240° stylus ball radius (VRAD)
#516 300° stylus ball radius (VRAD)
#517 330° stylus ball radius (VRAD)
#518 Z calibration radius used for 3D vector measuring (ZRAD)
#519 Nominal stylus radius used for 3D vector measuring (SRAD)

Tool offset update

NOTE: Variables depend on the base number setting as defined in O8724. Default variables are listed.

Running AxiSet™ Check-Up: Spindle alignment



Cycle

O8110

Description

This cycle determines the centre line in XY on the sphere using the stylus ball and finds a second centre line in XY on the sphere using the stylus stem. From these readings, the angular alignment of the spindle to the Z axis can be established. Resulting data is reported and provides historic diagnostic information on machine capability and set-up. Typically, data is output to a file via a flash card or USB device, depending on the machine configuration.

Application

CAUTION: Ensure all pre-checks and settings are completed before running the cycles. The probe must be mounted in the spindle and turned on.

For flexibility, cycles can be run using two different methods. If the AxiSet™ Check-Up cycle is integrated into a cutting program, the G65 method can be used. Alternatively, each cycle can run directly in automatic mode if, for example, AxiSet™ Check-Up is to be used as a regular maintenance check.

Tool offset is automatically applied during operation, but a tool change is never programmed.

Mount the sphere in the desired location. Position the probe approximately 10 mm (0.393 in) above the sphere centre with all rotary axes at 0, select the appropriate program and edit the inputs as desired.

The cycle will automatically reset the sphere work offset accurately before taking measurements using the stylus ball and stylus stem, the distance below the sphere being defined by the cycle configuration. The resulting data is output to a file as it is gathered.

Macro settings

Example

O8110(REN*AXISET CHECK-UP*SPINDLE*ALIGNMENT)

(----------)

#1=5.(SPHERE*CLEARANCE*VALUE) ***** edit 1**

#2=4.5(PROBE*STEM*DIAMETER) ***** edit 2**

#3=20.(DEPTH*OF*MEASURE) ***** edit 3**

#4=10.(MCS*CLEARANCE*SAFE*Z*POSITION) ***** edit 4**

#5=1.(PRINT*0=N0*1=YES) ***** edit 5**

#7=1.(TOLERANCE) ***** edit 6**

(----------)

or

Format: G65 P8110 Mm [Ww]

[ ] denotes optional inputs

Example: G65 P8110 M99. W1.

For the G65 method the following applies:

M99. Flag for direct automatic mode or G65 method.

Ww If a W1. input is entered, positioning the probe 10 mm (0.393 in) above the sphere centre is not required. The cycle assumes the stored value in work offset (#14 macro O8104) is the approximate sphere centre.

Configuration details

***** edit 1 #1=5.(SPHERE*CLEARANCE*VALUE)**

Enter the radial clearance value from the nominal target surface prior to a Z-axis move. This is to allow clearance of the stylus ball and stem from the sphere prior to the Z-axis movement to measure using the stem.

***** edit 2 #2=4.5(PROBE*STEM*DIAMETER)**

Enter the probe stylus stem diameter.

***** edit 3 #3=20.(DEPTH*OF*MEASURE)**

Enter the measurement depth in Z for the test, this being the distance up the stylus stem from the stylus ball centre at which the stem measurement is to take place.

CAUTION: Ensure there is sufficient clearance between the probe body and the sphere when selecting the measure depth. A larger measure depth will achieve a more accurate result.

***** edit 4 #4=10.(MCS*CLEARANCE*SAFE*Z*POSITION)**

Enter a suitable clearance position in the MCS Z axis for the moves around the sphere.

***** edit 5 #5=1.(PRINT*0=N0*1=YES)**

Setting #5=1.(PRINT*0=N0*1=YES) provides the option to disable print results.

Use, for example, where only macro testing mode is required and the communications port is not configured or running in auto update mode only.

***** edit 6 #7=1.(TOLERANCE)**

Set the maximum allowed head alignment error. An alarm is generated if the amount is greater than the tolerance.

NOTE: Use the correct unit value for inch/metric mode.

Output file format

SPINDLE ALIGNMENT

A-5642-4161-0B

DATE 2023 06 28

TIME 14 35 49

PLEN 188.4619

-----DEPTH OF MEASURE 20.0000 MM-----

DIFFERENCE OVER DEPTH

X=-0.003 DEG

Y= 0.003 DEG

ANGULAR ERROR

X=-0.0010 MM

Y= 0.0010 MM

-----PARALLELISM BETWEEN SPINDLE AND Z AXIS MOTION-----

XZ PLANE OVER 100MM 0.0050 MM

YZ PLANE OVER 100MM 0.0050 MM

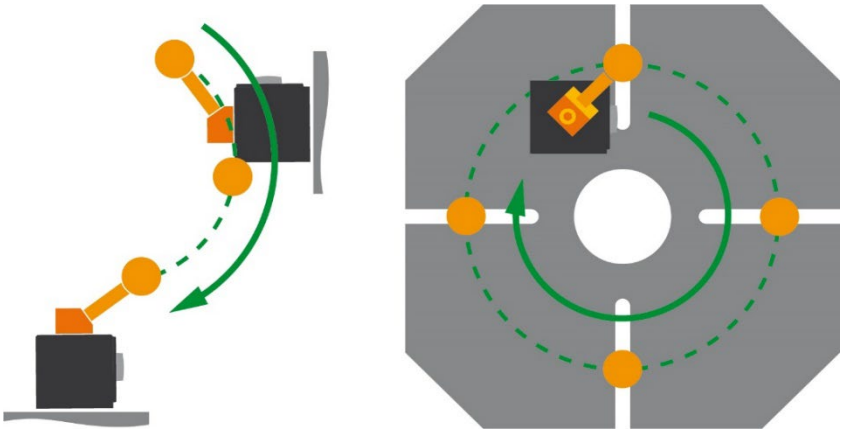
XZ PLANE OVER 300MM 0.0150 MM

YZ PLANE OVER 300MM 0.0150 MM

END OF FILE----------

NOTE: The displayed parallelism results are interpolated from the calculated error over the measurement span.

Running AxiSet™ Check-Up : Table-type rotary axis



Cycles

O8121 (A axis)

O8122 (B axis)

O8123 (C axis)

Description

These cycles determine the XYZ machine position of the sphere when measured at a range of rotary axis positions. Resulting data is reported and can be used to calculate and auto update the machine. The print files created, when processed by the AxiSet™ Check-Up app, provide historic diagnostic information on machine capability and set-up. Typically, data is output to file via flash card or USB device, depending on the machine configuration.

Application

CAUTION: Ensure all pre-checks and settings are completed before running the cycles. The probe must be mounted in the spindle and turned on.

For flexibility, cycles can be run using two different methods. If the AxiSet™ Check-Up cycle is integrated into a cutting program, the G65 method can be used. Alternatively, each cycle can run directly in automatic mode if, for example, AxiSet™ Check-Up is to be used as a regular maintenance check.

A tool offset is automatically applied during operation, but a tool change is never programmed.

Mount the sphere in the desired rotary axis location. Position the probe approximately 10 mm (0.393 in) above the sphere centre with all the rotary axes at 0, select the appropriate program and edit the inputs as desired.

The cycle will automatically reset the sphere work offset accurately before taking measurements at every rotary axis position defined by the cycle configuration. The resulting data is output to a file as it is gathered.

Macro settings

Example

O8123(REN*C-AXIS*TABLE)

#1=0.(START*ANGLE) ***** edit 1**

#2=270.(END*ANGLE) ***** edit 2**

#3=90.(ANG*INC) ***** edit 3**

(----------)

#4=−1.(MCS*CLEARANCE*SAFE*Z*POSITION) ***** edit 4**

#5=1.(PRINT*0=N0*1=YES) ***** edit 5**

#6=1.(AUTO*CALCULATE*OR*UPDATE*OF*PIVOTS) ***** edit 6**

#7=0.1(AUTO*UPDATE *TOLERANCE) ***** edit 7**

#8=1.(CALC*METHOD*1=LSF*3=90CW*4=90CCW*5=AC*6=180) ***** edit 8**

#9=2000.(ROTARY*AXIS*FEED*DEGREE*MIN) ***** edit 9**

#10=1.(ROTARY*AXIS*DIRECTION) ***** edit 10**

#33=1.(1=PRIMARY*AXIS*2=SECONDARY*AXIS) ***** edit 11**

(----------)

NOTE: Program number and description vary depending on the axis under test.

Configuration details

***** edit 1 #1=0.(START*ANGLE)**

Enter the starting axis angle for the first measuring position.

***** edit 2 #2=270.(END*ANGLE)**

Enter the end axis angle for the final measuring position.

***** edit 3 #3=90.(ANG*INC)**

Enter the angular increment between each measuring position. This must be divisible into the angular range specified by the start and end angles.

***** edit 4 #4=−1.(MCS*CLEARANCE*SAFE*Z*POSITION)**

Enter a suitable clearance position in the MCS Z axis for the initial moves in Z. The value entered is the machine position in G53.

***** edit 5 #5=1.(PRINT*0=N0*1=YES)**

Enter ‘0’ to disable the creation of a print file of the measured data.

Enter ‘1’ to enable the creation of a print file of the measured data for the purpose of evaluation or inserting into the AxiSet Check-Up app.

***** edit 6 #6=1.(AUTO*CALCULATE*OR*UPDATE*OF*PIVOTS)**

Enter ‘0’ to prevent any *Auto calculation or Auto update*. A standard printout can still be created.

Enter ‘1’ to allow *Auto update* of the machine pivot points. A print file can still be created.

Enter ‘2’ to allow *Auto* c*alculation* of the machine pivot points. No auto update will occur. A print file can still be created.

***** edit 7 #7=0.1(AUTO*UPDATE*TOLERANCE)**

Set the maximum allowed update amount of the machine pivot points. An alarm is generated if the update amount is greater than the tolerance.

***** edit 8 #8=1.(CALC*METHOD*1=LSF*3=90CW*4=90CCW*5=AC*6=180)**

Select the suitable calculation method for calculating the pivot centre errors using the points measured. See “Appendix E – Calculation methods”.

Enter ‘1’ to use the Least Squares Fit method.

Enter ‘3’ to use the 90° clockwise method.

Enter ‘4’ to use the 90° counter clockwise method.

Enter ‘5’ to use the ACUTE method.

Enter ‘6’ to use the 180° method.

***** edit 9 #9=2000.(ROTARY*AXIS*FEED*DEGREE*MIN)**

Set #9 to the rotary axis positioning feedrate value in degrees/min.

***** edit 10 #10=1.(ROTARY*AXIS*DIRECTION)**

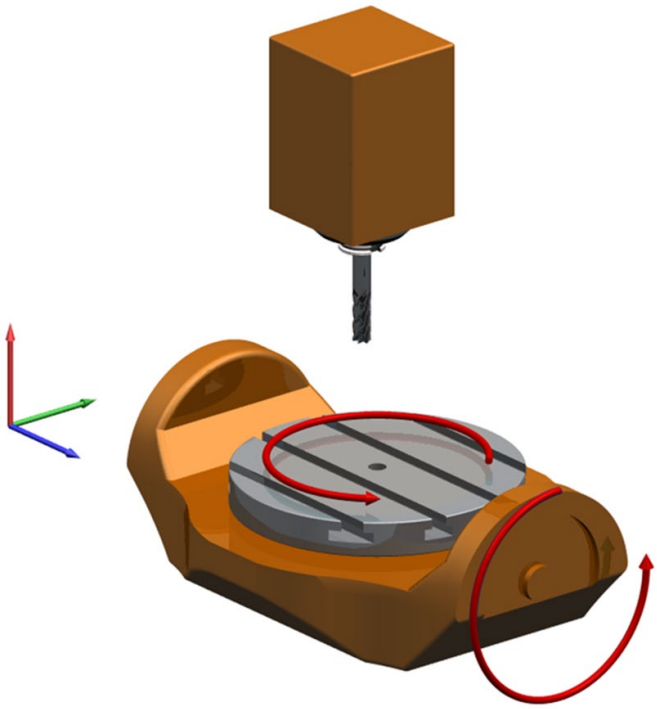
In some instances, the rotary axis and the spindle axis will not align for measurement. Changing the #10 value will correct this.

Enter ‘1’ for clockwise about the X axis from −90° to +90°

Enter ‘−1’ for counterclockwise about the X axis from +90° to −90°

***** edit 11 #33=1.(1=PRIMARY*AXIS*2=SECONDARY*AXIS)**

Determine if the A, B or C axis is primary or secondary. Typically, the secondary axis sits on top of the primary axis. In the example below, the A axis is primary and the C axis is secondary.



Notes

- The end angle must be a more positive value than the starting angle:

  End angle > Start angle

- The increment angle must divide exactly into the total angle:

  (Start angle − End angle) / Angular increment = Integer value

- The only limit to the number of measuring angles is file size. The more measuring angles, the longer the cycle time.
- The minimum angle between the start angle and end angle is 90°.
- Use the correct unit value for inch/metric mode.

Output file format

AXISET----------

C-AXIS TABLE

A-5642-4161-0B

DATE 2023 06 28

TIME 14 46 30

PLEN 188.4619

AXISLABELS A B C X Y Z

- 250.0000 - 220.0000 0.0000

0 0 0 - 285.7169 - 332.5670 131.6049

0 0 90 - 362.5710 - 184.2930 131.6059

0 0 180 - 214.3000 - 107.4360 131.5980

0 0 270 - 137.4430 - 255.7129 131.5980

END DATA

OPTIONSA 21B 2C 2031D 1E 1F 0G 1H 1I 0J 0

PIVOT POINTS MC PRM

- 250.0000 MM - 220.0000 MM

- 9.8425 IN - 8.6614 IN

OLD PIVOT POINTS USER PRM 130012 & 130013

- 0.0040 MM - 0.0010 MM

- 0.0002 IN - 0.0000 IN

CALCULATED PIVOT POINTS USER PRM 130012 & 130013

- 0.0062 MM - 0.0026 MM

- 0.0002 IN - 0.0001 IN

===PARAMETERS UPDATED ===

Variable output

	A axis	B axis	C axis
	O8121	O8122	O8123
#135		X pivot point	X pivot point
#136	Y pivot point		Y pivot point
#137	Z pivot point	Z pivot point	
#140		X error	X error
#141	Y error		Y error
#142	Z error	Z error	

Sub-program call method

The cycles can be called as a sub-program to include the AxiSet™ Check-Up cycles in an automated process.

Format: G65 P8121 Mm [Ww]

[ ] denotes optional inputs

Example: G65 P8121 M99. W1.

For the G65 method the following applies:

M99. Flag for direct automatic mode or G65 method.

Ww If a W1. input is entered, positioning the probe 10 mm (0.393 in) above the sphere centre is not required. The cycle assumes the stored value in work offset (#14 macro O8104) is the approximate sphere centre.

Appendix A – Configuring setting macros

Setting O8104 macro for the machine type

Macro O8104 contains all the common settings for the AxiSet™ Check-Up software. The settings must be checked and edited where necessary before running any AxiSet™ Check-Up cycles.

O8104(REN*SETTINGS)

(----------)

#11=#0(SPHERE*DIA) ***** edit 1**

#12=#0(TOOL*OFFSET*NUMBER) ***** edit 2**

#14=#0(WCS*FOR*SPHERE*1=54*101=54.1P1) ***** edit 3**

#15=6.(STYLUS*DIAMETER) ***** edit 4**

#18=535.(PIVOT*POINT*STORAGE*BASE*NO) ***** edit 5**

#19=550.(AUTO*CALCULATION*OR*UPDATE*STORAGE*BASE*NO) ***** edit 6**

#20=4.(PRIMARY*AXIS*NUMBER) ***** edit 7**

#21=5.(SECONDARY*AXIS*NUMBER*0=NO*SECONDARY*AXIS) ***** edit 8**

(----------)

Configuration details

***** edit 1 #11=#0(SPHERE*DIA)**

Enter the diameter of the datum sphere (typically 19 mm [0.748 in]).

***** edit 2 #12=#0(TOOL*OFFSET*NUMBER)**

Enter the appropriate tool offset number where the probe length is stored.

***** edit 3 #14=#0(WCS*FOR*SPHERE*1=54*101=54.1P1)**

Select the work offset number to be used:

1 to 6	G54 to G59
101 to 400	G54.1P1 to G54.1P300 (additional offsets option)

***** edit 4 #15=6.(STYLUS*DIAMETER)**

Enter the nominal stylus ball diameter (typically 6 mm [0.2362 in]).

***** edit 5 #18=535.(PIVOT*POINT*STORAGE*BASE*NO)**

Base number for storing machine pivot point data.

***** edit 6 #19=550.(AUTO*CALCULATION*OR*UPDATE*STORAGE*BASE*NO)**

The base number for storing auto update calculation data.

The total number of variables required for auto update calculations can be determined as: ‘number of measuring points × 2’.

***** edit 7 #20=4.(PRIMARY*AXIS*NUMBER)**

Typically, the primary axis is the 4th axis. Refer to the machine manufacturer’s information for axis numbers.

***** edit 8 #21=5.(SECONDARY*AXIS*NUMBER*0=NO*SECONDARY*AXIS)**

Typically, the secondary axis is the 5th axis. Refer to the machine manufacturer’s information for axis numbers. If there is no secondary axis, set #21=0.

Metric/inch machine parameters

Machines can be set up using metric units (mm) or imperial (inch) units (in).

AxiSet™ Check-Up can be run in metric (G21/G71) or inch (G20/G70) modes.

When reading or writing to pivot point parameters in these modes, some machines automatically convert the values into the units the machine is set up in. In other cases, the machines do not convert the units.

Due to the variation of machine set-ups and functionality, a conversion variable is available to change the values into the correct units, if required.

Macro O8104 contains a variable which allows the conversion of the calculated pivot point values, if required.

#128=1.(MACHINE*UNITS*1=MM*1/25.4=INCH) ***** edit 9**

Configuration details

***** edit 9 #128=1.(MACHINE*UNITS*1=MM*1/25.4=INCH)**

Enter the required unit value to convert the calculated pivot point values into the correct units.

NOTE: The changing of this variable is only required if the auto update function inputs the incorrect values into the parameters.

Appendix B – Auto-reading of pivot point data

On some machines, it is possible to read the pivot point data automatically into common variables. If this is not possible, the pivot points must be entered manually before cycles are run.

NOTE: The availability of the parameter read function depends on the system software version. If it is not available, an alarm will result when the code is read.

#[#18]=[#39029](MC PRM 12000036)
#[#18+1]=[#39030](MC PRM 12000037)
#[#18+2]=[#39031](MC PRM 12000038)
#[#18+3]=[#39032](MC PRM 12000039)
#[#18+4]=[#39033](MC PRM 12000040)
#[#18+5]=[#39034](MC PRM 12000041)
#[#18+6]=[#39009](USER PRM 130009)
#[#18+7]=[#39010](USER PRM 130010)
#[#18+8]=[#39011](USER PRM 130011)
#[#18+9]=[#39012](USER PRM 130012)
#[#18+10]=[#39013](USER PRM 130013)
#[#18+11]=[#39014](USER PRM 130014)

CAUTION: Check the values returned before running the complete cycle to ensure that the decimal place position is correct. This may also need to be adjusted depending on the least increment settings of the machine tool.

Manual setting of pivot point values

Current pivot point data is usually stored as metric values in machine system parameters MC PRM 12000036 to MC PRM 12000041 and USER PRM 130009 to USER PRM 130014. If the machine is set up in inch mode, convert these values when copying them to the macro base number variable, but do not change the original system parameter values.

CAUTION: Do not convert or alter system parameters such as MC PRM 12000036 to MC PRM 12000041 or USER PRM 130009 to USER PRM 130014 in the CNC controller.

Example when #18=535:

#535 Enter the machine parameter for the Rotation centre X coordinate for tilt axis 1: MC PRM 12000036.

#536 Enter the machine parameter for the Rotation centre Y coordinate for tilt axis 1: MC PRM 12000037.

#537 Enter the machine parameter for the Rotation centre Z coordinate for tilt axis 1: MC PRM 12000038.

#538 Enter the machine parameter for the Rotation centre X coordinate for tilt axis 1: MC PRM 12000039.

#539 Enter the machine parameter for the Rotation centre Y coordinate for tilt axis 1: MC PRM 12000040.

#540 Enter the machine parameter for the Rotation centre Z coordinate for tilt axis 1: MC PRM 12000041.

#541 Enter the USER parameter for the Rotation centre X coordinate offset for tilt axis 1: USER PRM 130009.

#542 Enter the USER parameter for the Rotation centre Y coordinate offset for tilt axis 1: USER PRM 130010.

#543 Enter the USER parameter for the Rotation centre Z coordinate offset for tilt axis 1: USER PRM 130011.

#544 Enter the USER parameter for the Rotation centre X coordinate offset for tilt axis 1: USER PRM 130012.

#545 Enter the USER parameter for the Rotation centre Y coordinate offset for tilt axis 1: USER PRM 130013.

#546 Enter the USER parameter for the Rotation centre Z coordinate offset for tilt axis 1: USER PRM 130014.

Appendix C – 3 + 1 axis machine set-up

AxiSet™ Check-Up software is compatible with machines having an indexer (or rotary axis) without 3+2 or 5-axis functions installed.

CAUTION: Although all cycles run in the same manner, be aware that the parameters MC PRM 12000036 to MC PRM 12000041 and USER PRM 130009 to USER PRM 130014, which are normally provided to support 5-axis work, may not have been set or may only contain nominal values (not accurately determined).

If this is the case, check and determine the values by other means, and enter the macro variables provided.

For example, when #18=535 in setting macro O8104, set the values as shown below:

First nominal pivot point data used for the primary rotary axis:

#535=Rotation centre X coordinate for tilt axis 1

#536=Rotation centre Y coordinate for tilt axis 1

#537=Rotation centre Z coordinate for tilt axis 1

Second nominal pivot point used for the secondary rotary axis:

#538=0

#539=0

#540=0

First fine pivot point data used for the primary rotary axis:

#541=Rotation centre X coordinate offset for tilt axis 1

#542=Rotation centre Y coordinate offset for tilt axis 1

#543=Rotation centre Z coordinate offset for tilt axis 1

Second fine pivot point used for the secondary rotary axis:

#544=0

#545=0

#546=0

NOTE: Settings #538, #539 and #540 are XYZ offsets to the secondary rotary axis from the machine reference (MCS) position (#535, #536 and #537).

Appendix D – Checking the tool setter

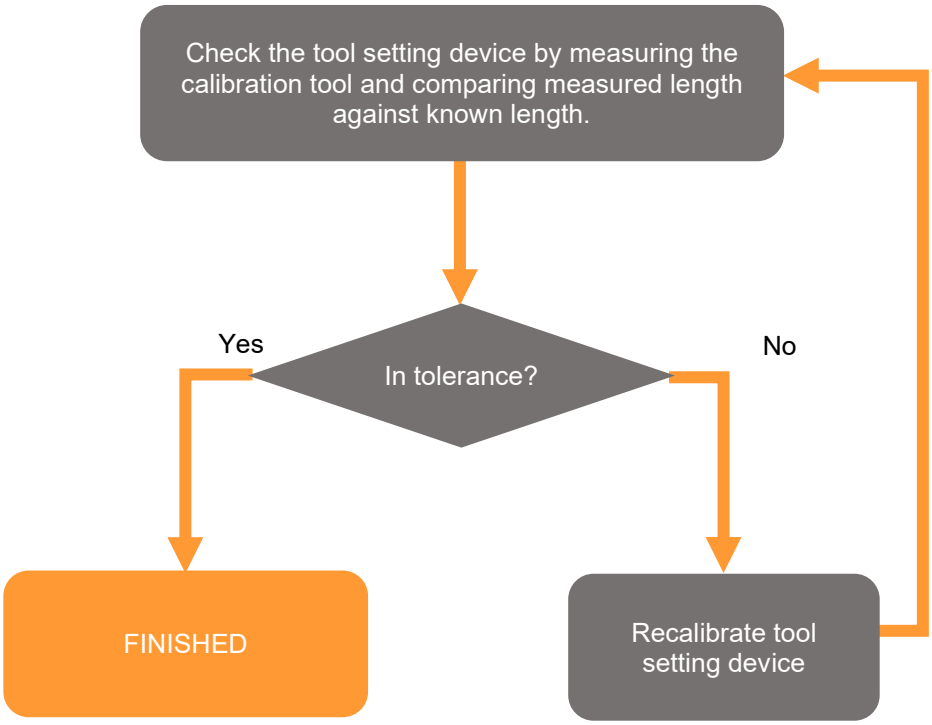
After running AxiSet™ Check-Up with auto update macros, the tool setting device must be checked to ensure it is calibrated correctly. Calibrate the tool setting device with the same calibration tool as used for probe length calibration.

NOTE: If the tool setting device is found to be out of tolerance and is subsequently recalibrated, all tools in the machine must be remeasured.

Checking with a test bar of known length

The flowchart below outlines the method of checking the tool setting device prior to running any of the cycles described in this document on the machine.

Refer to the manufacturer's documentation regarding calibration of the tool setting device.

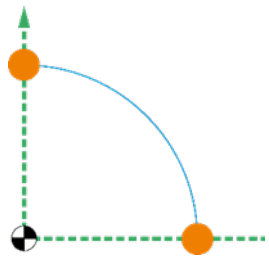


When this process is complete, the probe and cutting tool lengths will be referenced to the spindle gauge point.

Appendix E – Calculation methods

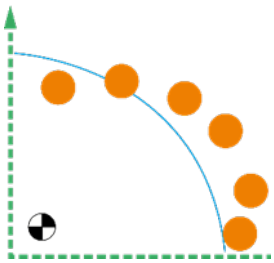
Different calculation strategies are available to determine actual pivot points (and therefore centring error). Selection of the calculation method is determined by the number of points, angular range and output requirements on the machine.

90° (CW or CCW)



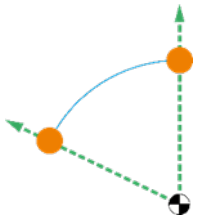
- Arc of points less than 180°, two positions 90° apart.
- Typically, 0° and ±90°points are used for calculation.
- Mimics the typical methods by which machines are manually configured.
- Robust over test angles of less than 180°.
- Preferred method for horizontal and vertical machining processes (prismatic parts).

Least squares fit ‘LSF’



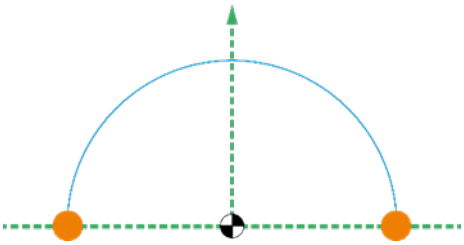
- Arc of points greater than 180°.
- Every measured point used when calculating the actual pivot point.
- Includes any possible mechanical errors in calculations (form error).
- For best results, the test should be conducted over the widest possible angle.
- Preferred method for interpolation (contouring) machining processes.

Acute



- Arc of points less than 90°, two positions.
- 0° and start/end angle points are used for calculation.
- Removes complex manual methods for setting pivot point data.
- Preferred method for Head machines with limited angular range of movement.

180°



- Two points 180° apart, typically −90° to 90°.
- ±90° start and end angle points used for calculation.
- Mimics the typical methods by which machines are manually configured.
- Preferred method for Head machines with 180° (−90° to 90°) of movement.

Appendix F – Macro alarm list

When an error occurs during use of the AxiSet™ Check-Up software, an alarm number or message is generated and may be displayed on the screen of the controller. This section describes:

- How to identify an alarm number that may be displayed on the controller.
- What the error means.
- How to solve the problem.

NOTE: To change the alarm language, edit macro file O8107, line GOTO1 (1=EN*2=DE*3=FR*4=IT). Set GOTO1 to the language required.

Alarm	**#3000=91(ANGLE*FORMAT*ERROR)**
Meaning	Occurs if the following conditions are not met: • Total angle / angular increment must be a whole number equal to or greater than 2.0. • 90 / angular increment must be a whole number equal to or greater than 1.0.
Action	Edit the start, end or increment angles to meet these conditions. This is a reset condition.
Alarm	**#3000=92(START*ANGLE*FORMAT*ERROR)**
Meaning	Occurs if the start angle input is not in the range −360° to 360°.
Action	Edit the program and start again with angle between −360° and 360°. This is a reset condition.
Alarm	**#3000=93(END*ANGLE*FORMAT*ERROR)**
Meaning	Occurs if the end angle input is not in the range −360° to 360°.
Action	Edit the program and start again with angle between −360° and 360°. This is a reset condition.
Alarm	**#3000=94(TOTAL*ANGLE*FORMAT*ERROR)**
Meaning	The total angle must be equal to or greater than 90° but less than 360°.
Action	Edit the program and start again with an angular difference (end – start angle) between 90° and 360°. This is a reset condition.

Alarm **#3000=95 (INCORRECT*CALC*METHOD*USED)**

Meaning The calculation method selected is incorrect for measured points.

Action Select an alternative calculation method. Refer to “Appendix E – Calculation methods”.

This is a reset condition.

Alarm **#3000=96 (UPDATE*OUT*OF*TOLERANCE)**

Meaning The calculated pivot point centre error exceeds the maximum allowed amount to continue with correcting pivot point parameters.

Action Confirm correct measured points, calculation type and tolerance settings.

This is a reset condition.

Alarm **#3000=97(AXIS*NUMBER*NOT*SET*O8104)**

Meaning Occurs if variables #20 or #21 in macro O8104 have not been set.

Action Edit program O8104 and set the primary and secondary axis numbers. Check the machine configuration before assigning the axis numbers.

This is a reset condition.

Alarm **#3000=100(ROTARY*AXIS*MUST*BE*AT*ZERO)**

Meaning Occurs if the primary axis is not at the zero position when starting a cycle.

Action Move the primary axis to the zero position and restart the cycle.

Alarm **#3000=101 (BASE*NUMBER*NOT*SET*#18/#19)**

Meaning Occurs if inputs have not been set in O8104.

Action Edit the program to include the missing input variable(s).

This is a reset condition.

Alarm **#3000=102 (#33*NOT*SET)**

Meaning Occurs if #33 has not been set to specify a primary/secondary axis type.

Action Edit the main program to include the missing input variable(s).

This is a reset condition.

Alarm **#3000=103 (STYLUS*DIAMETER*NOT*SET*O8104)**

Meaning Occurs if inputs have not been set in O8104.

Action Edit the program to include the missing input variable(s).

This is a reset condition.

This page is intentionally left blank.

RENISHAW
apply innovation™

www.renishaw.com/contact

#renishaw

+44 (0) 1453 524524 uk@renishaw.com

Part no.: H-5642-8681-04-A
Issued: 10.2024