

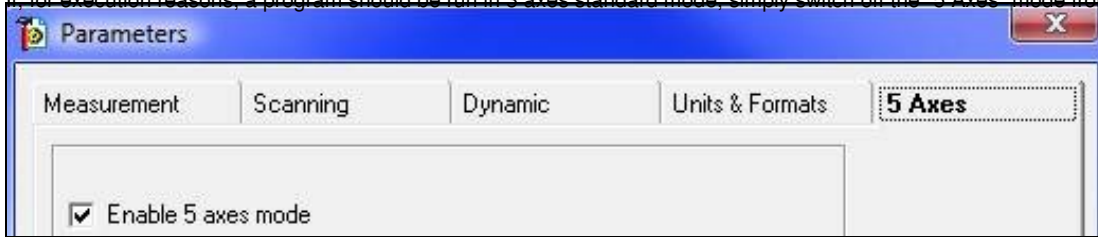
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1 Activation 5 Axes Mode

When "5 Axes" mode is enabled (default), the system executes or creates the program according to the correct syntax for handling multi axis.

If, for execution reasons, a program should be run in 3 axes standard mode, simply switch off the "5 Axes" mode from the options panel.



Warning!!

Disabling the 5 axes mode and execution of the 3 axes mode on an existing program, could create incompatibility of execution as the head could not reposition itself in the expected position.

Commands for the management of PH20 mode are:

```
VA (5AXES_ON)=ALGDEF/ ' 5AXESMODE' , .TRUE.  
VA (5AXES_OFF)=ALGDEF/ ' 5AXESMODE' , .FALSE.  
SNSET/VA (5AXES_ON)  
SNSET/VA (5AXES_OFF)
```

2 Calibrate a Tool With UCC Server

To **create and calibrate a Tool using UCC Server** it is necessary to:

- Create a Component
- Create a Tool
- Calibrate the Tool

In order to create the new tool, Arco shall be off and UCC Server shall be run.

2.1 Create a Component

1. Make sure the **"View"** tab on the right side on UCC Server Interface is activated
2. Select the **"Machine"** tab
3. In the any blank space: *right click -> Add Component...*: the **"Builder"** is activated
4. Build the component by selecting the correspondent items from the list
5. When the component is built, click **"Save Component"** icon
6. Type the name of the component and press **"v"** to confirm
7. Click on **"Restart Tool Assembly"** icon to create a new component or finish (press *Yes* to confirm). At this stage, if a new tool is being creating it is possible to *jump* at step 5 of the **"Create Tool"** procedure.
8. Select the **"Machine"** tab

2.2 Create a Tool

1. Make sure the **"View"** tab on the right side on UCC Server Interface is activated
2. Select the **"Machine"** tab
 - ♦ In the any blank space: *right click -> Add Tool...*: select **"Assembly Tool"** and press **"v"** to confirm
3. Select a previously defined component from the list and press the **"+"** button to add it
4. Click on **"Create as New Tool"** icon and give the tool a name. Press **"v"** to confirm
5. Click on **"Restart Tool Assembly"** to finish (press *Yes* to confirm)
6. Select the **"Machine"** tab

2.3 Calibrate the Tool

1. Right Click on a previously created Tool
2. Select **"Change Tool"** to activate (if a tool changer is present the change tool operation will be automatically performed, if it is not present, then the software will ask to detach the current component and attach the correct one if needed). **The head will rotate without any extra warning.**
3. Right Click on the current tool (identified by a *"tick"* on its name)
4. Select **"Calibrate"** and follow the procedure shown by the *messages* to perform the calibration.

3 Goto Graphics 5Axes

GOTO graphics can also be created in 5-axis mode.



The screenshot shows a 'GOTO' dialog box with three main sections: 'GOTO', 'Delta', and 'PH20'. The 'GOTO' section contains input fields for X (-4.1443), Y (-86.7716), and Z (1.1577). The 'Delta' section contains input fields for DX (0.0000), DY (0.0000), and DZ (0.0000). The 'PH20' section contains input fields for A (19.5738) and B (0.0000). At the bottom, there are three buttons: 'Make GOTO', 'Apply', and 'Close'.

The angles A and B, that the head will have to take at the end of the GOTO, can be defined by the graphic panel. The produced command, according to the standard **DMIS**, is the following:

```
GOTO/CART,-4.1443,-86.7716,1.1577,HEADCS,60.0,45.0
```

4 Measure Block editor from Measuring Panel

By activating the edit of a measure block from context menu of the editor it is possible to define the command PTMEAS in its completeness according to the standard DMIS.

CRDT	CART
x	0.1539
y	-21.6720
z	0.0000
WJ	WJ
i	0.00000000
j	0.00000000
k	1.00000000
MODE	PCS
Ez1	90.0000
Ey	21.0000
Ez2	-90.0000
TCH	ALLAXESTOUCH

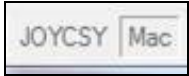
OK Cancel

In this mode, as well as conversions between measurement types, it is possible to define and modify both the coordinates of the points and the angles of the head.

5 Move of joystick with I++

With controllers that use I++ protocol it is possible to manage the movement of the joystick in the three reference systems available:

- Machine system (default)
- Current piece system
- Probe system (Z = head direction)



It is possible to choose from the status bar which reference system must be used simply do a "Double Click" on the dedicated icon in the status bar.

The function is based on the actual implementation of each controller, this may vary depending on the server used and anyway available only for the I++ communication.

6 PH20

5 Axis Motorized head from Renishaw Plc. See details [\[here\]](#).

7 PTMEAS HEADCS management

When using an I++ Server that supports this feature, it is possible to create DMIS programs with the alignment of the touch probe in the HEADCS manner defined by DMIS.

```
F (PLA_2)=FEAT/PLANE,CART,-11.5270,-3.2166,0.0000,0.00000000,0.00000000,1.00000000
MEAS/PLANE,F (PLA_2),3
  PTMEAS/CART,-19.0074,29.7687,0.0000,0.00000000,0.00000000,1.00000000,HEADCS,-0.0,29.4,ALLAXESTOUCH
  PTMEAS/CART,-23.0884,1.1283,0.0000,0.00000000,0.00000000,1.00000000,HEADCS,-0.0,29.4,ALLAXESTOUCH
  PTMEAS/CART,7.5149,-40.5469,0.0000,0.00000000,0.00000000,1.00000000,HEADCS,-0.0,28.7,ALLAXESTOUCH
ENDMES
```

standard

8 PTMEAS HEADTOUCH management

When using an I++ Server that supports this feature, it is possible to create DMIS programs with the alignment of the probe in the HEADTOUCH manner defined by DMIS.

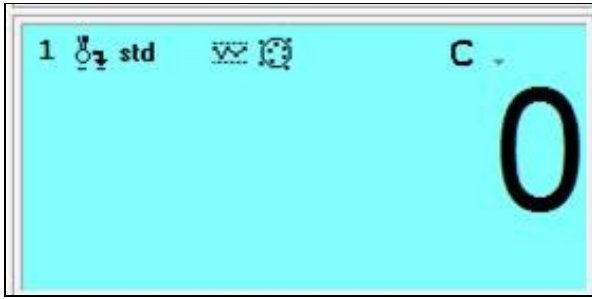
```
F (PLA_1)=FEAT/PLANE,CART,-6.5667,-0.6908,-0.5612,-0.21418034,0.38404300,0.89813015
MEAS/PLANE,F (PLA_1),3
    PTMEAS/CART,13.5868,16.3364,0.0000,0.00000000,0.00000000,1.00000000,HEADTOUCH
    PTMEAS/CART,-11.2397,-13.1364,0.0000,0.00000000,0.00000000,1.00000000,HEADTOUCH
    PTMEAS/CART,-22.9827,-4.2616,0.0000,0.00000000,0.00000000,1.00000000,HEADTOUCH
ENDMES
ENDFIL
```

standard.

9 PTMEAS management during the Measure

When using an I++ Server that supports the 5-axes measurement, it is possible to program the type of PTMEAS during the measure choosing different measurement mode from the Quick Programmer panel.

9.1 CMM Touch

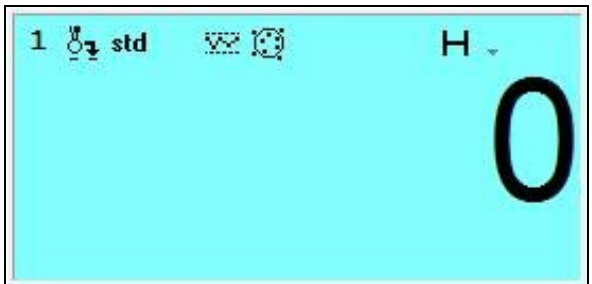


Selecting the "CMM TOUCH" mode, which is represented by the "C" icon, the points are measured as a traditional 3-axes machine.

The produced command, according to the standard [DMIS](#), is the following:

```
PTMEAS/CART,13.5868,16.3364,0.0000,0.00000000,0.00000000,1.00000000
```

9.2 Head Touch

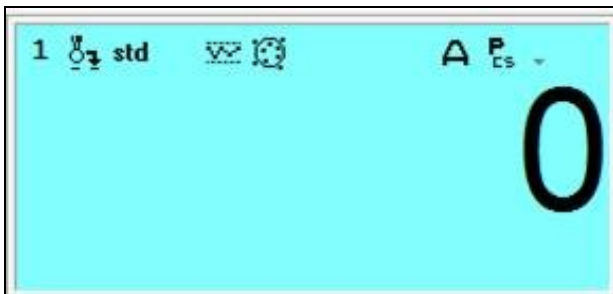


Selecting the "HEAD TOUCH" mode, which is represented by the "H" icon, the points are measured by moving only the motorized head and maintaining in fixed position the CMM. If the target point cannot be reached from the head, the user receives an error.

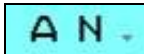
The produced command, according to the standard [DMIS](#), is the following:

```
PTMEAS/CART,13.5868,16.3364,0.0000,0.00000000,0.00000000,1.00000000,HEADTOUCH
```

9.3 All Axes Touch



Selecting the "ALL AXES TOUCH" mode, which is represented by the "A" icon, the points are measured moving both the motorized head that the CMM axes. This function allows the definition of two subtypes of measurement:

-  ALL AXES Touch + None: it is the 5 Axes standard mode of the control in use, the 5 axes interpolation of the movement is determined by the controller, based on the best path.

This can perform a series of non predictable movements because, on the basis of the initial and final position, the path is autonomously decided "run time" from the controller. The produced command, according to the standard [DMIS](#), is the following:

```
PTMEAS/CART,-26.5831,-51.6800,0.0000,0.00000000,0.00000000,1.00000000,ALLAXESTOUCH
```

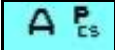
-  ALL AXES Touch + HEADCS: it is the 5 Axes mode in which the operator sets the angles with which the point is measured.

The angles of measurement are defined in absolute direction (HEAD CS).

The interpolation of the 5-axis movement is decided by the controller, on the basis of best path between the start and the end position, considering that the stylus must travel in a straight line.

The produced command, according to the standard **DMIS**, is the following:

```
PTMEAS/CART,0.1539,-21.6720,0.0000,0.00000000,0.00000000,1.00000000,HEADCS,-0.0,21.0,ALLAXESTOUCH
```

- ALL AXES Touch + PCS:  it is the 5 Axes mode in which the operator sets the angles with which the point is measured.

The angles of measurement are defined in PCS mode using Euler angles and the current system.

The interpolation of the 5-axis movement is decided by the controller, on the basis of best path between the start and the end position, considering that the stylus must travel in a straight line.

The produced command, according to the standard **DMIS**, is the following:

```
PTMEAS/CART,-4.1443,-84.8830,0.0000,0.00000000,0.00000000,1.00000000,PCS,90.0,20.3,-90.0,ALLAXESTOUCH
```

10 PTMEAS PCS management

When using an I++ Server that supports this feature, it is possible to create DMIS programs with the alignment of the touch probe in the PCS manner defined by DMIS standard.

```
F (PIANO_3)=FEAT/PLANE,CART,-11.5260,-15.7730,0.0000,0.00000000,0.00000000,1.00000000
MEAS/PLANE,F (PIANO_3),5
PTMEAS/CART,-21.8481,-84.6997,0.0000,0.00000000,0.00000000,1.00000000,PCS,42.2,-135.0,0,ALLAXESTOUCH
PTMEAS/CART,22.5840,-42.7005,0.0000,0.00000000,0.00000000,1.00000000,PCS,40.8,-135.0,0,ALLAXESTOUCH
PTMEAS/CART,-8.6432,25.7977,0.0000,0.00000000,0.00000000,1.00000000,PCS,40.8,-135.0,0,ALLAXESTOUCH
PTMEAS/CART,-28.5671,33.2965,0.0000,0.00000000,0.00000000,1.00000000,PCS,39.7,-135.0,0,ALLAXESTOUCH
PTMEAS/CART,-21.1554,-10.5599,0.0000,0.00000000,0.00000000,1.00000000,PCS,38.3,-135.0,0,ALLAXESTOUCH
ENDMES
```

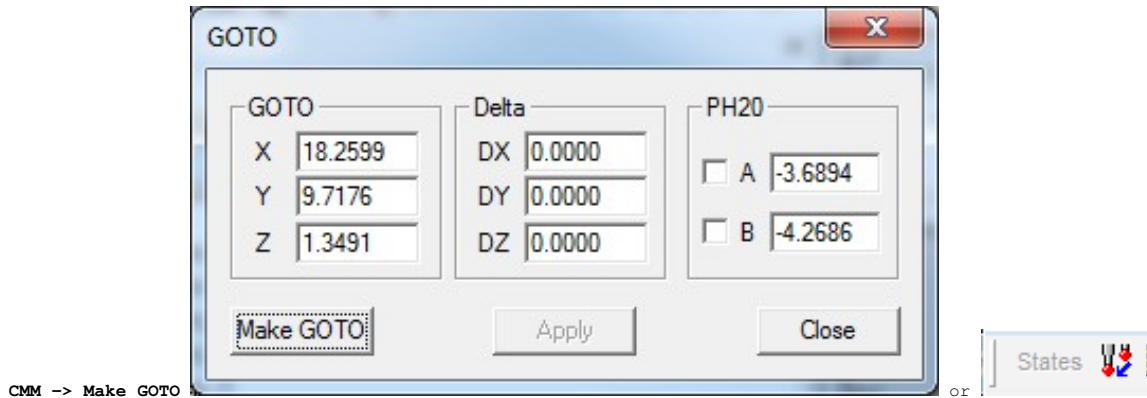
11 Rotate PH20 Head to New Angles

To Rotate the PH20 Head to a new Position there are two methods:

- By ARCO user interface
- By DMIS command

11.1 ARCO User Interface

- Set the CMM to CNC Mode
- Make sure the CAD Window is selected
- Open the Menu



-

- Check the label for A and B angle in the PH20 Frame
- Fill the text box with the angles to be reached by the head
- Click the button

Make GOTO

PLEASE BE AWARE THAT THE CMM WILL PERFORM A 5 AXIS MOVE!
Consider the space around the head in order to avoid collision.

11.2 DMIS Command

With CMM in CNC Mode use one of the following DMIS Statement

- GOTO/HEADCS,AngB, AngA

Where
AngB: Angle B that the head will reach
AngA: Angle A that the head will reach

Example:
GOTO/HEADCS, 0.0, 0.0

- GOTO/VEC,i,j,k

Where
i: is the I component of the direction of the head after the rotation
j: is the J component of the direction of the head after the rotation
k: is the K component of the direction of the head after the rotation

Example:
GOTO/VEC, 1.0, 0.0, 0.0

- GOTO/PCS,rZ,rY,rZ

Where
rZ,rY,RZ are the DMIS Euler Transformation of the current reference system in order to have the Z axis pointing along the desired direct

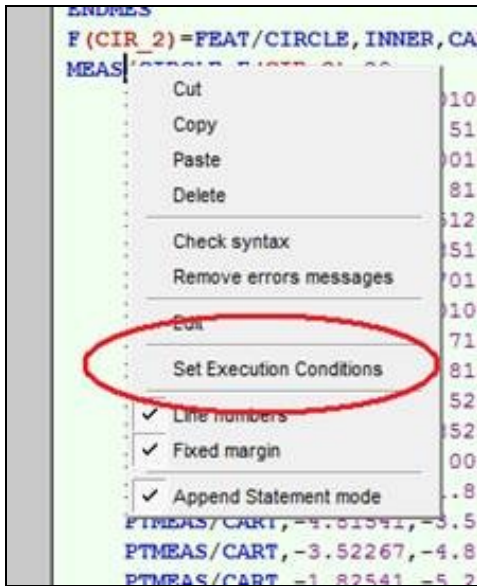
Example:

GOTO/PCS,0.0000,90.0000,0.0000

PLEASE BE AWARE THAT THE CMM WILL PERFORM A 2 AXIS MOVE!
Consider the space around the head in order to avoid collision.

12 Setting Execution Conditions

At any point of the editor, by selecting the line with right mouse button, it is possible, from the contextual menu, to restore all the necessary conditions for the execution of the program from there.



Activating this command, ARCO restores the execution parameters for that line according to what is specified in the program.

In particular, the restored parameters are relative to:

- Current Reference System
- Dynamic parameters of velocity and acceleration
- Measurement Parameters (Approach, etc)
- Security Plan
- Sensor
- Scanning parameters
- State of the control
- CAD synchronism
- Direction of the Sensor if using a 5 Axes head

13 Synchronization Tools UCC Server

When using Renishaw UCC Server, the graphic tools are synchronized automatically without having to manually redefine them in ARCO. To use this function, version 4. 8 or higher (4.9.2 recommended) of the UCC Server must be installed.

