Geomet

User Guide

Version 6.66
March 2007

Covering:

U/V Rotary Axis Setup and Use

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Introduction and Setup – U/V Rotary Table

The U/V Rotary Table is designed to integrate with DCC and manual style CMMs adding the capability to measure an artifact on all sides, and all access directions while maintaining single part coordinate system integrity.

By maintaining coordinate system integrity, all measured features, scanned data clouds and constructed geometry retain their position integrity eliminating the need to establish multiple coordinate systems and casting features between coordinate systems.

The U/V Rotary Table is manual in its operation and requires the operator to position the table to various positions. The supplied locks keep the table in position.

The rotary table requires a one-time setup procedure that identifies the individual axis of rotation. The CMM software, Geomet, contains the necessary tools to guide the operator through the setup process.

Once the setup has been completed, Geomet retains the axis parametric data in it's System Options for retrieval after system restarts. The setup data is valid as long as the U/V table has not been moved. If the table has been moved, repeat the setup procedure.
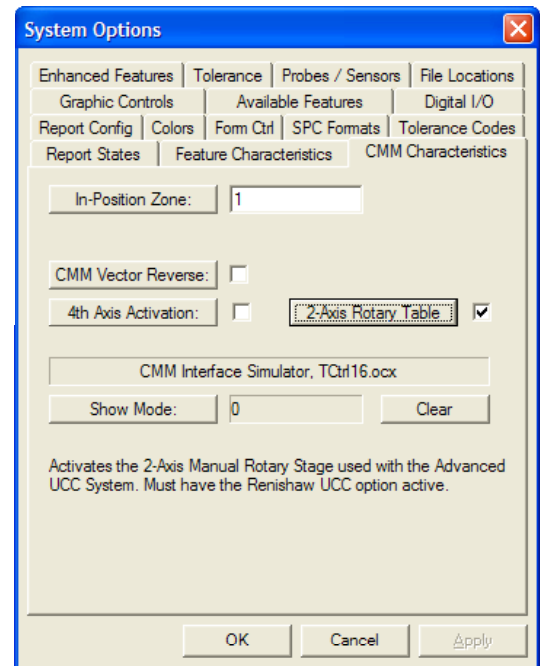
Chapter 1 – Introduction and Setup

Activating the U/V Rotary Table

The first step to adding the rotary table support to Geomet is to set the System Options to look for and use the table. This is accomplished by pressing the **<f9>** function keystroke or from the main drip-down menu:

[System→System Options]

Locate the "CMM Characteristics" tab and place a check next to the "2-Axis Rotary Table" label.

Save your selection by pressing **<Apply>** and **<Ok>**.

Chapter 1 – Introduction and Setup

U/V Encoder Scale Factors

The scale factor is the counts per revolution for each axis. This is done by consulting the manufacturer specifications for the encoder model or from the supplied CMM information packet. The CMM system utilizes the ProCounter II CMM Interface card that incorporates a quadrature digital counter to processes the counting of the encoder signals.

To determine the counts per revolution that will be entered in the setup control, multiply the encoder counts as stated in the manufacturer specifications by 4.

To enter this data, from the main drop down menus choose:

[System→U/V Rotary Table Tools→Setup U/V Scale factor]

Enter the counts per revolution in the setup control and press **<Ok>** when finished.

In this example, the encoder specification for counts per revolution was 3,600. Multiply that value by 4 to obtain the 14,400 counts per revolution that is then entered into the setup control, *see example*.

In some cases the actual encoder counts per revolution may need to be adjusted to compensate for any deviation of the encoder. This is normally done by a calibration service after they have determined the actual counts per revolution.
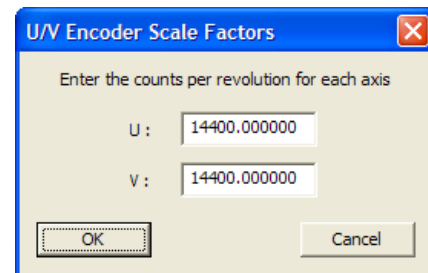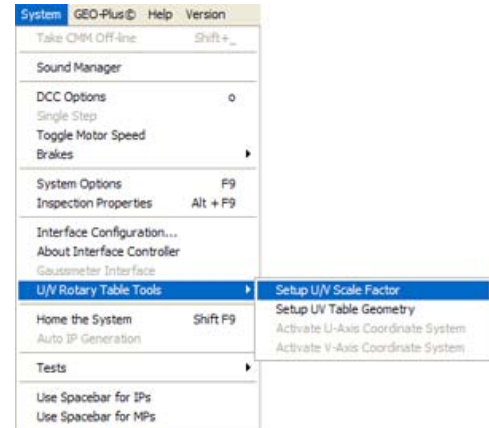
Chapter 1 – Introduction and Setup

Rotary Axis Setup

The next step in preparing the U/V Rotary Table for use is to identify the axial characteristics. This is accomplished by measuring five spheres in various locations. The Geomet setup tool will calculate the rotary axis and directions from these measured spheres.

To start the setup process, ensure the rotary table is securely fastened to the CMM table. Movement of the rotary table will only lead to poor calculations when used in the inspection process.

To begin the setup routine, from the main drop down menus choose:

[System→U/V Rotary Table Tools→Setup U/V Table Geometry]

The setup tool will step you through a series of measurements for the selected axis. To begin the process, press **<Start Auto Steps>**. A message will appear indicating you are about to start the setup process.

Using the U-Axis for our example, rotate the axis until the front of the rotary table is all the way down. The setup sphere that is mounted on the frame is then at its lowest position. Geomet will prompt you with a message:
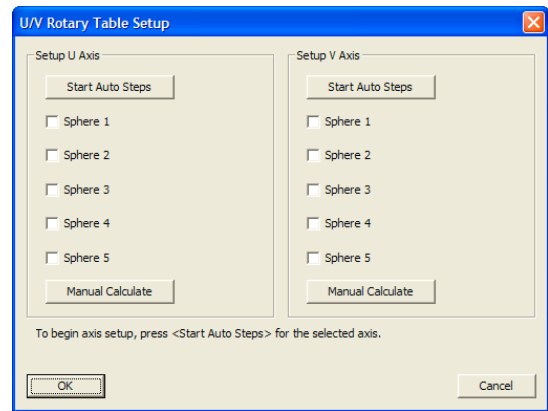
Measure data point 1 of 5 on Sphere 1

Each sphere will require five data points. Four data points captured around the equator and one on top. When you have completed capturing the five data points, rotate the table upward about halfway between the current location and its level position. Continue capturing five data points on each sphere location until all five spheres have been measured, *see illustration*. The setup tool will place a check next to the most recent completed sphere. If you capture an errant data point, press the <✕ **Take Point>** button on the joystick.
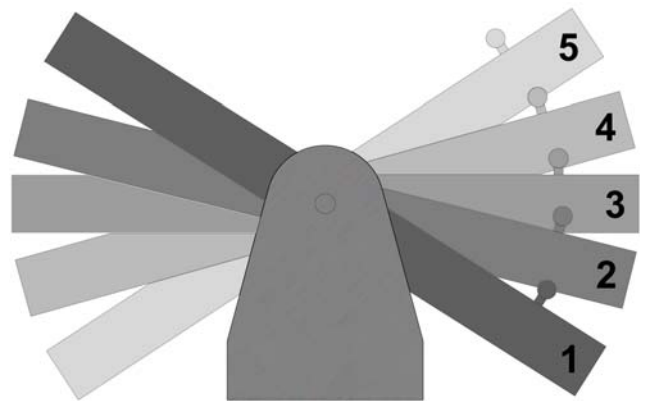
To ensure the greatest success, always spread your five spheres out to the full extent of rotational travel.

Chapter 1 – Introduction and Setup

Geomet will calculate the rotational axis geometry and save that information to be recalled and applied to your measurements.

When the U-Axis setup procedure has been completed, return the rotary table level with the CMM table. Repeat the setup process for the V-Axis by pressing the **<Start Auto Steps>** button under Setup V-Axis. A message will appear indicating you are about to start the setup process. Upon accepting the message, Geomet will prompt you:

Measure data point 1 of 5 on Sphere 1

Rotate the V-Axis to a position that represents the extreme position to the clockwise rotation that allows the CMM probe to access the sphere. Capture the five data points and then rotate the V-Axis counter clockwise to a new position and repeat the data point capturing. When finished with all five sphere positions, Geomet will calculate the rotational axis parameters.

The U/V Rotary Table setup is now completed.

Chapter 2 – U/V Rotary Table Usage

The Measurement Process

During the measurement process, the U/V Rotary Table can be enabled or disabled based on the needs of the inspection. When Geomet is started, the rotary table is **NOT** activated.

Displaying the U/V Axis Readout

The Geomet Digital Readout tool (DRO) provides the current position of the rotary table. As shown in the example at right, the U/V current location is shown in the lower section of the DRO.

Before the position can be displayed, the DRO must be configured to use the rotary table. This is accomplished using the DRO Setup tool, which is accessed by right clicking on the DRO.

When the rotary table has been installed through the System Options, the "Show Rotary Axis" check is displayed in the General / Global Setup group.

Place a check next to "Show Rotary Axis" and accept the change by clicking the **<Ok>** button. This is a global setting and will remain active until the check is removed.

The display precision is controlled through Geomet's System Options and is found on the Tolerance tab. For a complete description visit System Options in the Geomet manual or the Geomet web site found here.
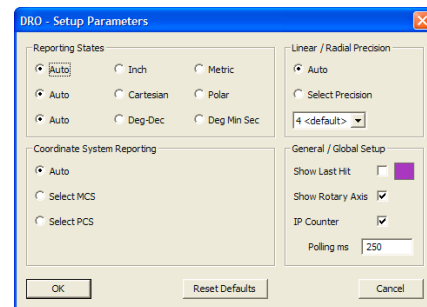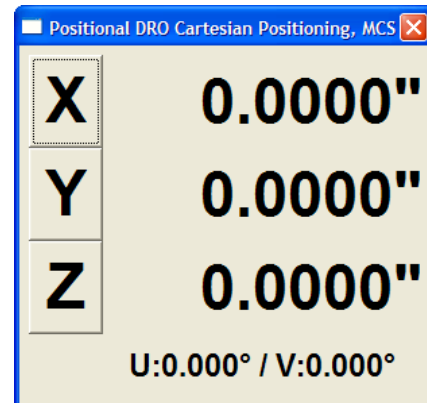
Chapter 2 – U/V Rotary Table Usage

Activating the U/V Rotation Table

When the inspection process is underway, you can activate one or both rotational axes through the main drop-down menu at:

[System→U/V Rotary Table Tools→Activate U-Axis Coordinate System]
[System→U/V Rotary Table Tools→Activate V-Axis Coordinate System]

This will activate the specified rotation axis and you can now rotate your inspection part while maintaining coordinate system integrity. A check in the menus will indicate the active status of the axis.

Inspection Techniques – Building the Coordinate System

The key to a successful inspection is the strength of your coordinate system. This is especially true when you add additional axes to the calculation. The Part Coordinate System should be built using features that represent the furthest extents of the part being measured.

Should you establish the Orient with a feature that represents only 10% of the length, then the potential error is magnified 10x over the full length. Should that error be 0.0001", then the error at the full length of the part is 0.001"! When you add in the U/V axes, the error magnifies. For example, if you are using a 14,400 count per revolution encoder, each count represents a table movement of 0.0052" at 12.0" from the rotation axis!

When specifying the rotary table, always calculate the allowable error at the maximum dimension you expect to inspect at. If the 14,400 counts per revolution that delivers a potential error of 0.0052" at 12.0" might exceed your requirements, consider a change to the encoder. An encoder that offers 40,000 counts per revolution results in a 0.0019" error at 12.0".

When you build the part coordinate system, it is recommended that you minimize table rotations. By eliminating the U/V axes from the calculations, the part coordinate system becomes more stable and you will have a higher certainty of the reported results.

Chapter 2 – U/V Rotary Table Usage

The Inspection Process - Applying Rotation

The real benefit of the U/V Rotary Axis Table is the ability to rotate the inspected part to access any feature at any orientation. Thus expanding your inspection and reducing the time it takes to perform an inspection.

When the table is rotated, Geomet updates the incoming XYZ data to reflect the change in U/V rotation. This can be demonstrated simply by watching the DRO when the axis is rotated. While the XYZ position of the CMM is not moved, the rotation of either axis shows the XYZ reported position changing with regard to the current coordinate system.

During the inspection process, when you spread the data points evenly around a feature, such as a cylinder, you ensure the greatest possible accuracy. For best results, the data points should be distributed the full length of the cylinder and around the circumference of the cylinder a full 360°. Without the assistance of the rotary table it is not always possible to reach the full extent of the cylinder due to limited access to the feature, or the relationship to the orientation of the probe.

In the case of an inside diameter cylinder passing through a part, rotating the part to align the axis of the cylinder with the alignment of the probe you can then capture data points on one end of the cylinder over the full 360° circumference. Then rotate the part to provide access to the opposite end and complete the data point capturing. Now the data points are spread over the full extent of the cylinder. This will provide better position, size and form reporting of the cylinder.