Minolta Scanner Plugin

For a list of Minolta digitizers and Geomagic software products with which this plugin is compatible, see *Release Notes for Geomagic Minolta Plugin*.

Document Version E. Copyright © 2006, Geomagic, Inc.

The Minolta devices that are compatible with this plugin are non-contact 3D digitizers that scan an object on or without a turntable. [See Konica Minolta Photo Imaging U.S.A., Inc. at www.minoltausa.com.]

The purpose of this (or any) scanner plugin is to eliminate the need to import scan data into Geomagic products. With the plugin, scanned data exists in the Geomagic Model Manager immediately after the data capture process.

In This Chapter

- For reference information on the controls and indicators of the Minolta Scanning plug-in, see Controls and Indicators on page 1.
- For sample scanning procedures, see Step-by-Step Procedures.

Controls and Indicators

The **Minolta Scan** dialog has the following controls and indicators.

- **Scan** group - controls the scanner.
  - **Name** (text field) - is the name assigned to the next scan, in the form *text*-*degree*, where *degree* is 0 to 360. If a turntable is installed, the *degree* part increments by the amount configured at **Rotation Step** (in the **Turntable** group) each time the **Next** button is pressed.
  - **Scan** button - initiates a laser scan named in the **Name** field. To re-scan an object from a given angle, press **Scan** instead of **Next**.
  - **Next** button - saves the previous scan in the Geomagic Model Manager. If a turntable is installed, the function of **Next** depends on the **Scan Mode** in the **Turntable** group:
    - when **Scan Mode** is Single, saves the previous scan in the Geomagic Model Manager.
    - when **Scan Mode** is MultiShot, saves the previous scan in the Geomagic Model Manager, increments the *degree* part of **Name** by the amount configured at **Rotation Step**, and rotates the turntable by that amount. When you are ready for the next scan, click **Scan**.
    - when **Scan Mode** is Continuous, saves the first scan in the Geomagic Model Manager, increments the *degree* part of **Name** by the amount

configured at **Rotation Step**, rotates the turntable by that amount, initiates another laser scan, and continues according to the description of continuous scan mode below.

- **Abort** button - aborts any scan that was started when the **Scan Mode** in the **Turntable** group of controls is Continuous.
- **Show Current Scan Only** checkbox - specifies whether to show only the most recent scan in the Viewing Area, or a composite of all scans. This is useful in determining the quality of the most recent scan.
- **Show Live Image Window** checkbox - specifies whether to display a separate Image Viewer window containing a color image of the object and a color-encoded range map of the object.
  - Color Image panel and **Update Color Image** button - updates the color image now.
  - Color Image panel and **Update Range and Color Image** button - updates both the color image and the color-encoded range map now.
  - **Enable Streaming Video** checkbox - specifies whether to update the color image in real time, useful while the operator positions an object in the scanner's field of view.
- **Camera Control** group (when Advanced Options > Configure > Vivid Model is **9i**) -
  - **Image Focus** button **-** automatically focuses the camera on the subject.
  - **Auto Focus** checkbox - Specifies whether the camera uses automatic focusing. When **Auto Focus** is turned off, use the **Distance** control to focus manually.
    - **Distance** integer field (600 to 3000 millimeters; applicable when **Auto Focus** is Off) - specifies the distance between the lens and the focal point.
  - **Auto Intensity** checkbox (default On) - specifies that the beam intensity be selected by software based on reflectivity of the object. When deactivated, set **Laser Power** and **Gain** by hand.
    - **Laser Power** integer field (0 to 100; applicable when Auto Intensity is off) - controls the intensity of the laser beam. Higher intensity is suitable for darker colors, lower intensity for lighter colors.
    - **Gain** integer field (0 to 100; applicable when **Auto Intensity** is off and **Laser Power** is at 100) - controls the intensity of the CCD gain. Use CCD gain only when Laser Power of 100 is insufficient because the object reflects light, transmits light, or has low reflectance for red and similar colors.
  - **Auto Brightness** radio button and thumbwheel - specifies that image brightness be set automatically, or allows manual setting in the range 0 to 14.
  - **Photogrammetry** group **-**
    - **Photogrammetry** button - activates a feature that assembles multiple scans of a large physical object into a single data object, based on the registration of target points that are affixed to the

physical object. The first result of pressing this button is a prompt that asks how multiple scans should be registered:

- **Specify Target Location (.csv file)** radio button - The user browses the file system and loads a .csv file that describes the locations of registration points that are affixed to the physical object. By this method, multiple scans will be registered and created in the Geomagic Model Manager as a single object.
- **Detect Targets For Target Registration (no .csv file)** radio button - The user will create multiple scans. Each target that is affixed to the object will become a Point Target Datum. The user will use Tools > Registration > Target Registration to register the multiple scans manually. The advantage of this technique is that it does not require a .csv file.

When the prompt has been answered, the following dialog appears. But if the **Photogrammetry** button is pressed when **Scan Mode** is Continuous, the same prompt for automatic or manual registration appears, the following dialog does *not* appear, and the data collection process runs unattended with default parameters.

- **Work** screen - presents a real-time streaming image of the object.
  - **Mono** radio button - presents a monchrome image on the Work screen.
  - **Color** radio button - presents a color image on the Work screen.
  - **Pitch** radio button - presents a color-encoded map of distance from the lens.
- **Store** screen - presents one of many scans that have been stored by means of the **Store** button.
  - **<<Prev** button - recalls the previous image from the set.
  - **Next>>** button - recalls the next image from the set.
  - **Delete** button - deletes the current image from the set.
- Other controls -
  - **Auto Focus** button - automatically focuses the lens.
  - **Distance** checkbox and integer field - overrides automatic focus by setting the distance to the object.
  - **Intensity** checkbox - activates the following beam settings.
    - **Laser Power** integer field (0 to 100; applicable when Auto Intensity is off) - controls the intensity of the laser beam. Higher intensity is suitable for darker colors, lower intensity for lighter colors.
    - **Gain** integer field (0 to 100; applicable when Auto Intensity is off and Laser Power is at 100) - controls the intensity of the CCD gain. Use CCD gain only when Laser

Power of 100 is insufficient because the object reflects light, transmits light, or has low reflectance for red and similar colors.

- **Scan** button - scans the object and displays it on the Work screen.
- **Store** button - transfers the most recent scan from the Work screen to the Store screen and to the Viewing Area.
- **Import** button (or **Read Next** on subsequent use) - presents a dialog for the loading of a Minolta scan file (.cdk) onto the Work screen. This photogrammetery tool aligns the multiple imported scans.
- **Color Read** button (available after **Scan** and before **Store**) - overlays a new color image onto the scan. A scan can be successful even in darkness, but will not have visible color.
- **OK** button - transfers stored scans to the Model Manager and closes the photogrammetry tool.
- **Cancel** button - closes the photogrammetery tool without saving images to the Model Manager.
- **Export** button - saves all stored scans to a single Minolta Vivid format file (.vvd).
- **Option**s button - opens a page of settings that are downloaded to and retrieved from the camera.
- **Calibration** button - calibrates the camera, the same function as **Calibrate New Lens** in the Camera Control group of the main dialog. Be sure to install the calibration fixture before pressing this button.

- **Use Target Registration** checkbox and **Matching Sensitivity** slider - causes every new scan to be registered with the one or more existing scans. Each new scan must have three or more stickers in common with an existing scan. The slider controls the perfectness of the match that must exist between the three (or more) stickers in common. Typically, leave the slider in the middle.

- **Camera Control** group (when Advanced Options > Configure > Vivid Model is **700**) -
  - **Zoom** slider (8 degrees from Min to Max) - adjusts the zoom of the lens on the camera.
  - **Auto Focus** checkbox - Specifies whether the camera uses automatic focusing. When **Auto Focus** is turned off, use the **Distance** control to focus manually.
    - **Distance** thumbwheel (500 to 3000 millimeters; applicable when **Auto Focus** is Off) - specifies the distance between the lens and the focal point.
  - **Auto Intensity** checkbox (default On) - specifies that the beam intensity be selected by software based on reflectivity of the object. When deactivated, set **Laser Power** and **Gain** by hand.

- **Laser Power** integer field (0 to 100; applicable when Auto Intensity is off) - controls the intensity of the laser beam. Higher intensity is suitable for darker colors, lower intensity for lighter colors.
- **Gain** integer field (0 to 100; applicable when **Auto Intensity** is off and **Laser Power** is at 100) - controls the intensity of the CCD gain. Use CCD gain only when Laser Power of 100 is insufficient because the object reflects light, transmits light, or has low reflectance for red and similar colors.

- **Camera Control** group (when Advanced Options > Configure > Vivid Model is **910/900**) -
  - **Fine Scan** and **Fast Scan** radio buttons - specify a slower, higher-resolution scan or a faster, lower resolution scan.
    - **Dynamic Range Expansion Mode** checkbox (applicable with **Fast Scan**; default On) - specifies that 3 varying-intensity passes of the laser beam be made at every angle to improve color detection.
  - **Auto Focus** checkbox - Specifies whether the camera uses automatic focusing. When **Auto Focus** is turned off, use the **Distance** control to focus manually.
    - **Distance** thumbwheel (500 to 3000 millimeters; applicable when **Auto Focus** is Off) - specifies the distance between the lens and the focal point.
  - **Auto Intensity** checkbox (default On) - specifies that the beam intensity be selected by software based on reflectivity of the object. When deactivated, set **Laser Power** and **Gain** by hand.
    - **Laser Power** integer field (0 to 100; applicable when Auto Intensity is off) - controls the intensity of the laser beam. Higher intensity is suitable for darker colors, lower intensity for lighter colors.
    - **Gain** integer field (0 to 100; applicable when **Auto Intensity** is off and **Laser Power** is at 100) - controls the intensity of the CCD gain. Use CCD gain only when Laser Power of 100 is insufficient because the object reflects light, transmits light, or has low reflectance for red and similar colors.
  - **Variable Distance Mode** checkbox -
    - No. of Scans integer field (2 or 3) -
    - Distance Increment decimal field (0 to 1000 mm) -
- **Turntable** group (only when a turntable is installed) -
  - **Current Position** decimal field (0.0 to 360.0) - is an indicator *and* control of the current position of the turntable with respect to the zero position.
  - **Rotation Step** field (1 to 359; default 45; applicable when **Scan Mode** is MultiShot or Continuous) - specifies the number of degrees of rotation of the turntable per click of the **Next** button.
  - **Scan Mode** (Single, Multishot, Continuous):
    - **Single** - This mode can be used to take individual shots, and is the only mode available when the turntable is disabled.

- **MultiShot** - causes the turntable to rotate by Rotation Step degrees and a new scan to take place every time the user presses **Next**. During a MultiShot process, click **Next** to move on to the next scan, or adjust the parameters and click **Scan** to re-scan the object at its current position.
- **Continuous** - is similar to MultiShot mode except that scanning and rotation are non-stop (without pressing **Next**) until the **Current Position** reaches 360 degrees or less (until **Rotation Step** would cause **Current Position** to exceed 360 degrees).
- **Reset Zero** button - defines the current position of the turntable as the home (zero) position.
- **Calibrate Axis** button - prompts the user to install the black and white axis calibration "chart" onto the turntable, performs the calibration, and displays the turntable axis in the Viewing Area.
- **Advanced Options** button - activates the following controls:
  - **Configure** group - describes the hardware setup:
    - **Vivid Model** (900/910 or 700) - specifies the Minolta model in use.
    - **SCSI Id** field - indicates the address of the Minolta device detected at system boot. Do not modify.
    - **Turntable Model** - The choices in the pulldown menu correspond to Minolta-supported model numbers.
    - **Turntable COM Port** (COM1, 2, 3, or 4) - specifies the serial port to which the turntable is connected.
    - **Disable Turntable** checkbox - specifies whether to disable the turntable (and the turntable controls and the MultiShot and Continuous Scan Modes in the Minolta Scan dialog).
    - **Always Prompt User for Axis Calibration** checkbox - specifies whether Studio/Qualify prompts the user to calibrate the turntable axis every time the Minolta Scan plugin is started. Experienced users can disable the prompt with this option. To perform the calibration, see the explanation of the **Calibrate Axis** button.
  - **Scan Filter Angle** group - describes behavior of the scanner:
    - **Angle (degrees)** (0 to 90 degrees; default 75) - specifies the "maximum divergence from perpendicular" of surfaces whose points are to be captured. A point whose surface normal is more than **Angle** degrees away from parallel to the beam direction will be ignored. Example: If you are scanning a ball at an **Angle** of 75 degrees, scan data would be collected from points whose normal is up to 75 degrees away from the closest point to the camera (for a total of 150 degrees across the face of the ball).
  - **Advanced Camera Control** group (applies only to the Minolta 9i) -
    - **Calibrate New Lens** button - Press this after installing a new lens on the camera. Be sure to install the calibration fixture before pressing this button.

- **Multi Power Setting** radio button and integer field - specifies that *n* varying-intensity passes of the laser beam be made at every angle to improve color detection.
  - **Filter** dropdown - specifies the type of hardware filter to use: None, Noise Filter, High Quality Filter, or both.
  - **Remove** dropdown - activates a hardware-based scan angle filter. A scan angle filter removes data points whose normal exceeds a given angle away from the camera's direction of view.
  - **Version** group - displays the version number of this plugin.
    - **Version** indicator - indicates the version of this Minolta Scan software plugin for this Geomagic product.
  - **Done** button - stores configuration changes and returns to the main dialog. Most changes on the Advanced Options sub-dialog also require that the main dialog be closed and restarted.
- **OK** button - saves a scanned object to the Model Manager and closes the Minolta dialog.
- **Cancel** button - terminates the Minolta dialog without saving data to the Model Manager.

Step-by-Step Procedures

-
-
-

Simple Scan with Turntable

1. Click the Minolta icon , or select **Plugins > Minolta Scan** on the Geomagic toolbar.
2. Place the black and white calibration chart on the turntable, click **Calibrate Axis**, wait for the center axis to appear in the Viewing Area, and remove the chart from the turntable.
3. Set the values in the Minolta Scan dialog appropriately. Most notably, set **Scan Mode** to Multishot and **Rotation Step** to 45.
4. Place an object on the turntable.
5. Set the **Show Image Window** checkbox, and set **Enable Streaming Video** on the Image Window, and move the object on the turntable until the object is well framed in the Image Window.
6. Disable **Enable Streaming Video** and **Show Image Window**.
7. Press the **Scan** button in the dialog. See the first scan in the Viewing Area.
8. Press **Next**. The table rotates 45 degrees, a scan is performed, and the second set of scan data appears in the Viewing Area.

9. Set **Show Current Scan Only** to see a separation of the first scan and second scan.
10. Un-set **Show Current Scan Only**.
11. Perform additional scans at new angles by pressing **Next** several more times, allowing time for each scan to complete.
12. The several scans appear in the Viewing Area to be a single merged object, but they are not. They are simply a set of scans that occupy the same position in space.
13. Press **OK**. Click the Model Manager tab to see that each individual scan appears as a separate object. To create a single merged object, use **Points > Merge**.

Photogrammetry With .CSV File

This procedure assumes familiarity with photogrammetry, including how to apply target stickers/magnets to the object.

1. Click the Minolta icon , or select **Plugins > Minolta Scan** on the Geomagic toolbar.
2. Place the black and white calibration chart on the turntable, click **Calibrate Axis**, wait for the center axis to appear in the Viewing Area, and remove the chart from the turntable.
3. Verify that the **Use Target Registration** checkbox is *not* checked (because this function would override the registration that will be performed by the Minolta scanner).
4. Press the **Photogrammetry** button in the Camera Control group.
5. At the prompt, click **Specify Target Location** and click **OK**. Enter the name of a .csv file to load. This file contains target information from a digital camera.
6. Using the live image in the Work screen as a guide, place the object in the camera's field of view. Ensure that three or more targets are visible to the camera.
7. Focus the camera as necessary.
8. Press **Scan**.
9. In the Work screen, verify that the three or more targets were identified and numbered by the software.
10. Press **Store** to add this scan to the set of stored scans.
11. If necessary, use the **<<Prev** and **Next>>** buttons to review the set of stored scans, and the **Delete** button to remove a stored scan.
12. Repeat steps 7 through 10 until all needed data has been collected.
13. Press **OK**. All individual scans are saved to the Model Manager.
14. On the main Minolta Scan dialog, press **OK** to accept the photogrammetry session and close the plugin.
15. The several already-registered scans appear in the Model Manager and Viewing Area.

16. To create a single merged object, use **Points > Merge**.

Photogrammetry With Manual Registration

This procedure assumes familiarity with photogrammetry, including how to apply target stickers/magnets to the object.

1. Click the Minolta icon , or select **Plugins > Minolta Scan** on the Geomagic toolbar.
2. Place the black and white calibration chart on the turntable, click **Calibrate Axis**, wait for the center axis to appear in the Viewing Area, and remove the chart from the turntable.
3. If you want the upcoming scans to be registered automatically, check the **Use Target Registration** checkbox. If not, you will register them manually at Step 16. In most cases, check the checkbox.
4. Press the **Photogrammetry** button in the Camera Control group.
5. At the prompt, click **Detect Targets For Target Registration**, then click **OK**.
6. Using the live image in the Work screen as a guide, place the object in the camera's field of view. Ensure that three or more targets are visible to the camera.
7. Focus the camera as necessary.
8. Press **Scan**.
9. In the Work screen, verify that the three or more targets were identified and numbered by the software.
10. Press **Store** to add this scan to the set of stored scans.
11. If necessary, use the **<<Prev** and **Next>>** buttons to review the set of stored scans, and the **Delete** button to remove a stored scan.
12. Repeat steps 7 through 10 until all needed data has been collected.
13. Press **OK**. All individual scans are saved to the Model Manager.
14. On the main Minolta Scan dialog, press **OK** to accept the photogrammetry session and close the plugin.
15. The several scans appear in the Model Manager and Viewing Area.
16. Only if the **Use Target Registration** checkbox was not checked, register the Point Datums on the several scans by using **Tools > Registration > Target Registration**, then create a composite object by using **Points > Merge**.