ZWSOFT

Point Cloud Assistant User Guide

ZWCAD Application R&D Dept.

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Introduction

Three-dimensional point clouds can be acquired through various contact and non-contact measurement methods, such as coordinate measuring machines (CMM), laser scanning, photogrammetry, LiDAR, and others. These methods provide advantages such as high data sampling rates, high resolution, and high accuracy, making them ideal for capturing detailed three-dimensional information of objects or environments.

A three-dimensional point cloud is a collection of numerous 3D coordinate points, where each point contains positional information in three-dimensional space, along with possible additional attributes such as color and intensity. Three-dimensional point clouds offer an intuitive and precise representation of real-world environments, enabling designers and engineers to better understand the complexity and features of the represented scenes.

In CAD software, the application of point cloud data enables users to obtain highly accurate geometric information, aiding in more precise modeling, measurement, and analysis. For instance, in the architecture and land planning industries, point cloud data can be used to rapidly create floor plans and 3D models of buildings. This approach significantly reduces the need for manual drafting processes, thereby increasing efficiency and accuracy. In environmental surveying and mapping, point cloud data can rapidly reconstruct high-precision terrain models, enabling efficient and highly accurate digital analysis and planning. Additionally, three-dimensional point clouds find wide application in fields such as interior design, heritage and cultural artifact preservation, and reverse engineering.

Based on the aforementioned background, ZWCAD 2025 now supports the Point Cloud Assistant. Through this guide, you can quickly understand the specific functionalities and usage methods of the Point Cloud Assistant.

Based on the aforementioned background, ZWCAD 2025 now includes a Point Cloud Assistant. This guide will help you quickly understand the specific functionalities and usage methods of the Point Cloud Assistant.

Thank you for reading. We hope this document proves helpful to you. Should you have any questions during the usage process, please do not hesitate to consult with relevant technical colleagues.

Recommended System Requirements

Operating System	**Microsoft® Windows 10** **Microsoft® Windows 11**
Processor	Intel® Core™ i5-10400 or AMD® Ryzen™ 5 3600 CPU or better
RAM	16 GB (or better)
Graphics	4 GB (or better), supports OpenGL 4.2 or higher
Recommended Models	NVIDIA® GeForce™ GTX 1060 or AMD® Radeon™ RX580 Series or better
Storage	8 GB OS Disk Available Space
Display	1920x1080 or higher

Tips: If your computer's graphics card supports an OpenGL version lower than 4.2, it will be unable to display point cloud data.

Feature Introduction

1 Point Cloud Tab

1: Attach Point Cloud to the current drawing.

2: Perform Batch Conversion on point cloud files in formats such as E57, LAS, LAZ, PTS, TXT.

3: Align Point Cloud to the current UCS.

4: Create a UCS using methods such as Wall + Wall, Floor + Wall, or Wall.

5: Save UCS.

6: Open the UCS Manager to manage the UCS.

7: Reset to WCS.

8: Open the Slice Manager to manage point cloud slices.

9: UCS Slice.

10: Multiple Slice.

11: Detect Floor and automatically output point cloud slices for each floor.

12: Adjust Slice Position and Thickness.

13: Set Slice Increment.

14: Fit Wall Line.

15: Track Wall Line, supporting the tracing of polylines and splines.

16: Detect Wall Line on the visible portion of the selected point cloud and automatically output all detected wall lines.

17: Align Polyline.

18: Extract Intersection Line, Extract Corner Point, Extract Cylinder Axis and Extract Sphere Center.

19: Fit Plane based on a selected point cloud node.

20: Fit Cylinder, Fit Cone and Fit Sphere.

21: Display the Point Information of the selected point cloud node.

22: Measure Distance and Measure Angle.

23: Distance Dimension and Angular Dimension.

24: Create an Orthographic Image from the visible portion of the selected point cloud.

25: Image Vectorization.

26: Analyze Plane Deviation.

27: Export Point Cloud to PTS or RCS format.

28: Settings.

2 Attach

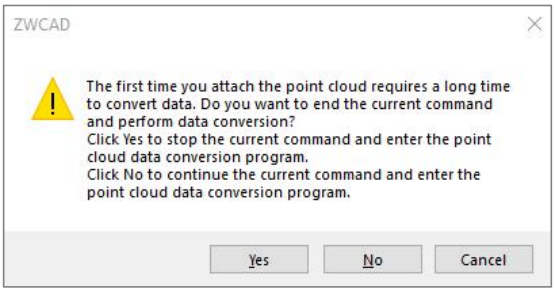
2.1 Attach Point Cloud

Execute the POINTCLOUDATTACH command to attach a point cloud to the drawing.

2.1.1 Select Point Cloud File

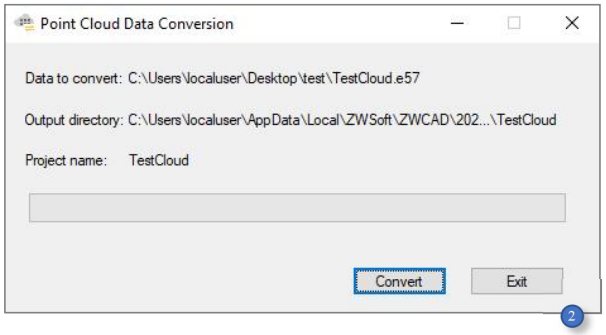
First, you need to select a point cloud file. ZWCAD currently supports six formats: RCS, RCP, E57, LAS, LAZ, and PTS.

Note that E57, LAS, LAZ, and PTS file require format conversion before they can be loaded. For large-volume point clouds, the conversion requires a long time. You can choose whether to stop the current command and enter the point cloud data conversion program.



Tips: If the point cloud data exceeds 1GB, it is recommended to click "Yes". The conversion will not affect other operations on the ZWCAD. After the conversion is complete, run the PCATTACH command again to attach the point cloud. If the point cloud data is less than 1GB, you can click "No", and the attachment will be completed immediately after the conversion is finished.

2.1.2 Point Cloud Data Conversion

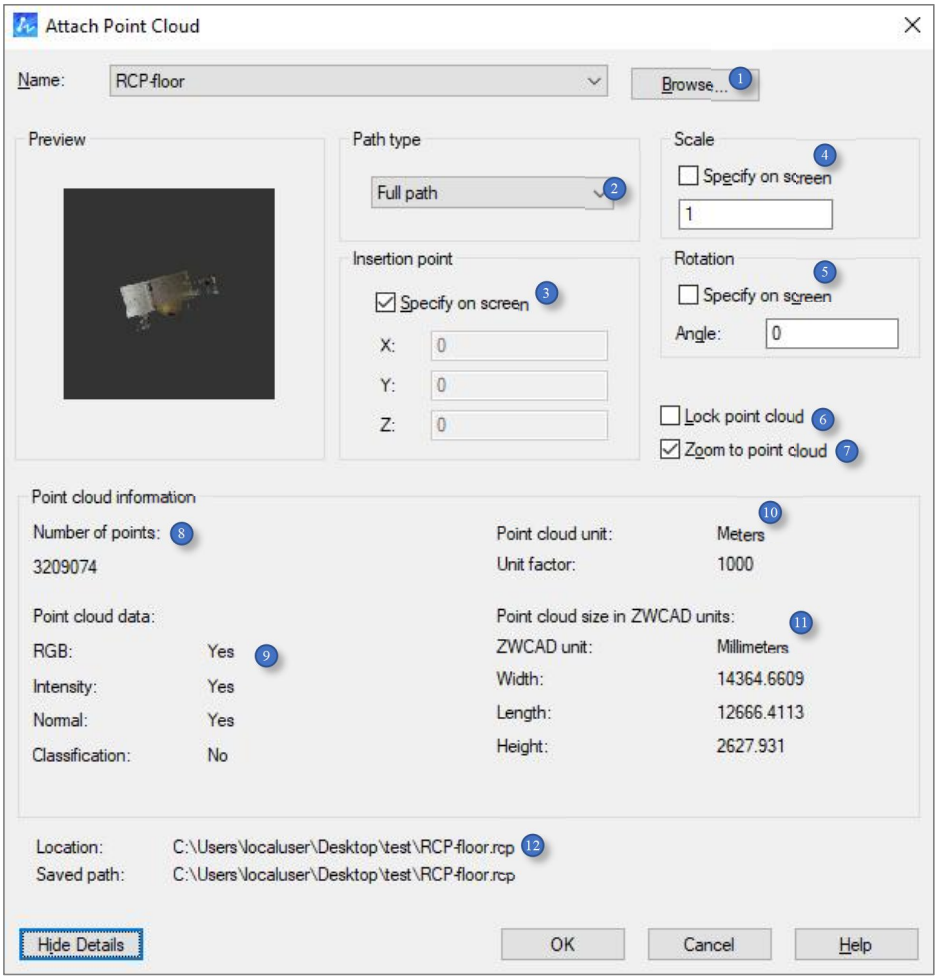


1: The selected point cloud file path.

2: The output path for the point cloud after conversion. This path can be modified in Options - File - Point Cloud Cache File Location.

2.1.3 "Attach Point cloud" Dialog Box

After selecting the point cloud file, the "Attach Point Cloud" dialog box will display, allowing you to set the attachment parameters within the dialog.



1: Display the name of the selected point cloud, Click the "Browse" button to reselect the point cloud file.

2: Select path type.

3: Set the insertion point for the point cloud.

4: Set Scale.

5: Set Rotation.

6: Lock the point cloud after attachment.

7: Zoom to the global extent of the point cloud after attachment.

8: Show the number of points in the point cloud.

9: Show whether the point cloud includes RGB, normal, intensity, and classification.

10: Show the point cloud unit.

11: Show the ZWCAD unit and the point cloud size in ZWCAD units.

12: Show the current location of the point cloud file and the storage path corresponding to the current path type.

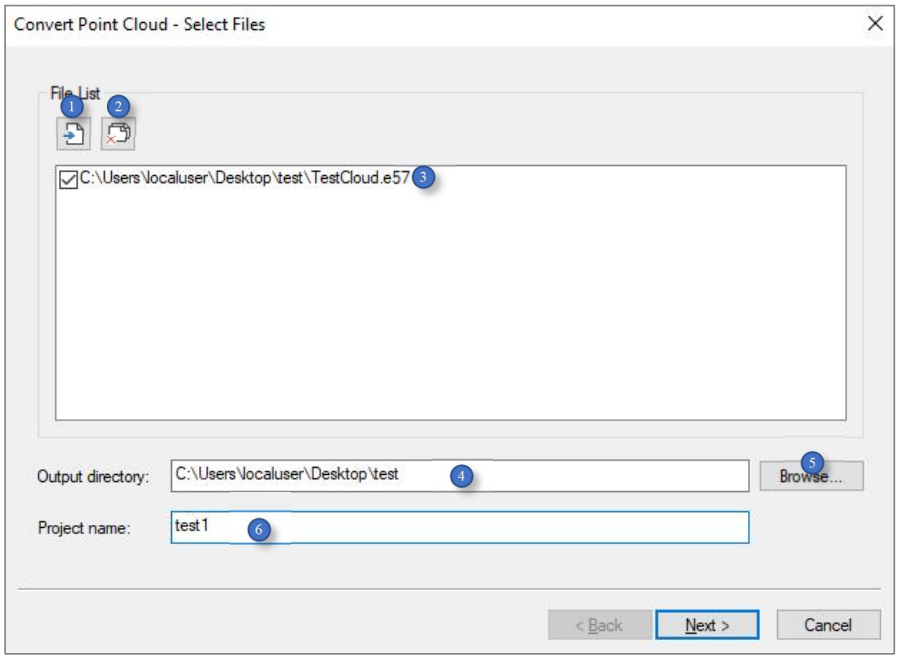
After completing the above settings, click OK to attach the point cloud to the drawing.

Tips: If the point cloud unit differ from ZWCAD unit, the point cloud size will be converted to match ZWCAD unit, which can be set by the INSUNITS system variable.

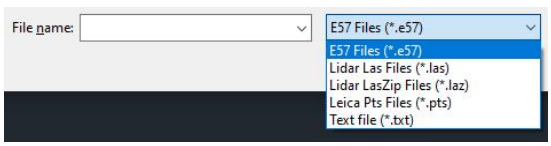
2.2 Batch Conversion

Convert multiple point cloud files of the same format (such as E57, LAS, LAZ, PTS, TXT) into an RCP file.

(1) Convert Point Cloud - Select Files



1: Select Point cloud files that need to be converted, with supported file formats including E57, LAS, LAZ, PTS, and TXT.



2: Remove the checked files from the list.

3: Display the imported point cloud files.

4: Select the output directory.

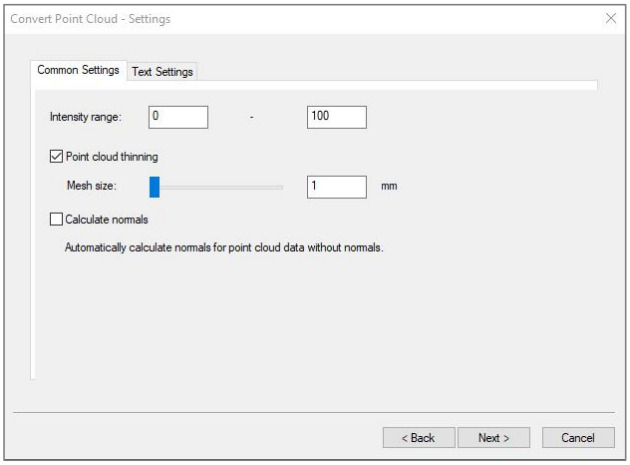
5: Set the output directory.

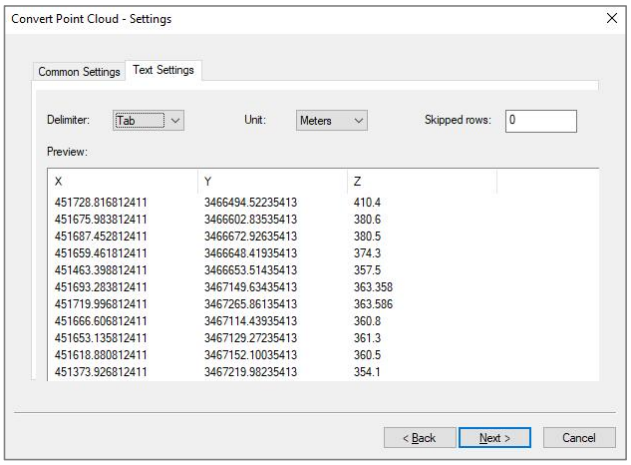
6: Input the project name.

Check the files you want to convert, then click "Next" to proceed to the settings interface.

(2) Convert Point Cloud - Settings

If the file format is E57, LAS, LAZ, or PTS, only the 'Common Settings' tab is displayed in the dialog box. If the file format is TXT, both the 'Common Settings' and 'Text Settings' tabs are shown.





1: Input the lower and upper limits of the intensity range to extract only the point cloud data within this intensity range.

2: Enable point cloud thinning. Create a cubic grid over the point cloud data based on the specified grid size, and extract one point cloud node from each grid cell, thereby achieving point cloud thinning. The grid size ranges from 1 to 100, with smaller grid size resulting in higher point cloud density after conversion, but also leading to longer processing times.

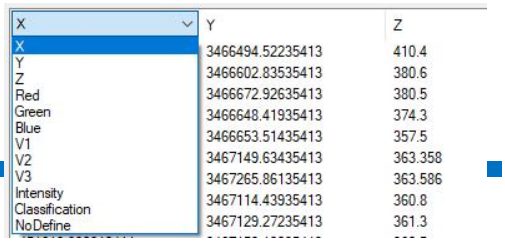
3: Automatically calculate normals for point cloud data that do not have normals.

4: Select the delimiter, including tab, space, comma, and semicolon. The preview will update in real-time to reflect your selection.

5: Select a unit, including kilometers, meters, centimeters, millimeters, miles, inches, and feet.

6: Set the number of rows to skip during data extraction.

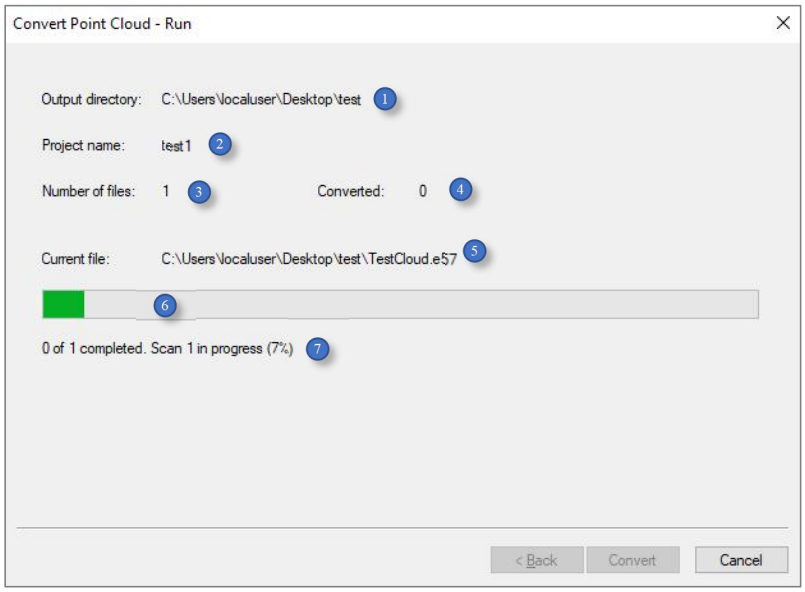
7: Click the column header to set the meaning of the data in that column, including X, Y, Z, Red,



Green, Blue, V1, V2, V3, Intensity, Classification, and NoDefine.

8: Preview the data according to the set parsing rules, displaying only the first 50 rows of the file (excluding skipped rows).

(3) Convert Point Cloud - Run



1-4: Show the output directory, project name, number of files, and the number of files that have been converted.

5: Show the name of the point cloud file currently being converted.

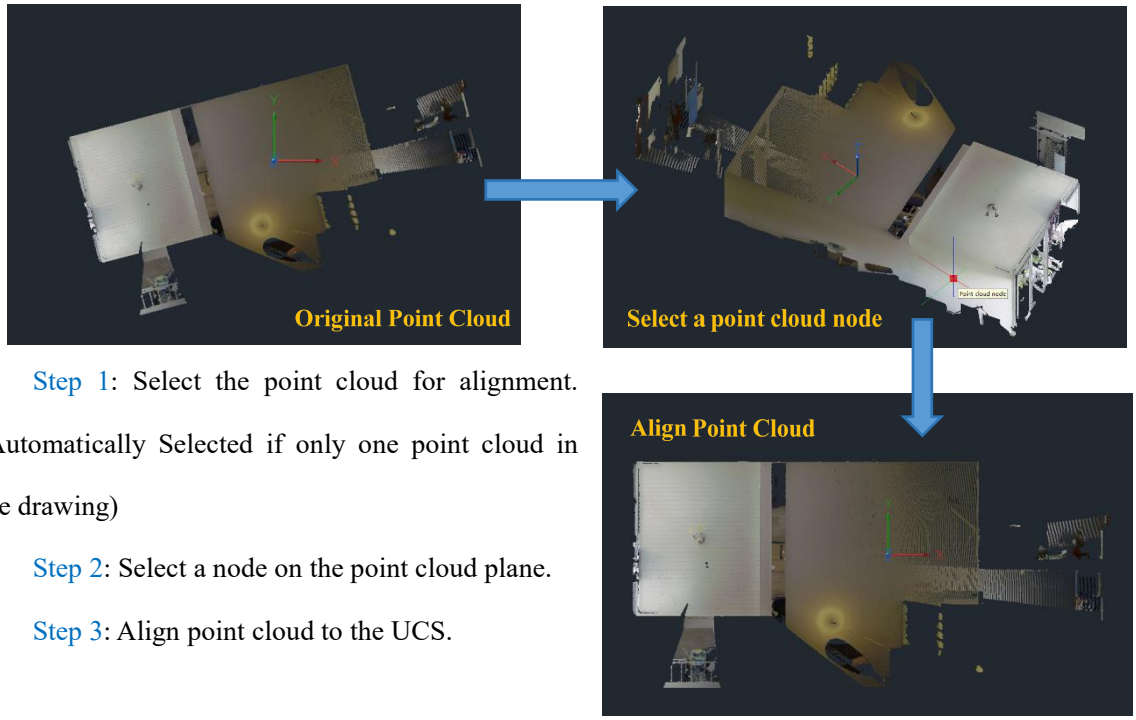
6: Show the progress bar indicating the conversion progress of the current file.

7: Show the scanning file progress and the percentage completed.

3 Orientation

3.1 Align Point Cloud

Automatically rotate the point cloud to align with the most matching axis of the current UCS.



Step 1: Select the point cloud for alignment. (Automatically Selected if only one point cloud in the drawing)

Step 2: Select a node on the point cloud plane.

Step 3: Align point cloud to the UCS.

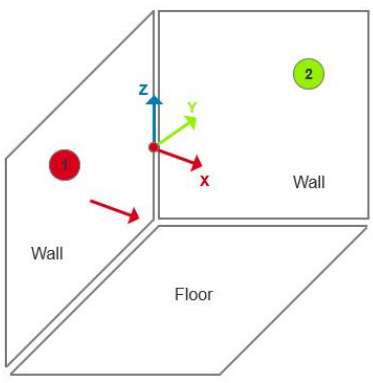
Tips: Select a node on the point cloud to fit a plane, then align the point cloud to the UCS by rotating it by the smallest angle based on the plane's normal, with the rotation base point being the selected point cloud

3.2 UCS Settings

Create a UCS based on the wall and floor in the point cloud using one of the following methods: Wall + Wall, Floor + Wall, or Wall.

3.2.1 Wall + Wall

The origin of the UCS is located at the projection of the first selected wall node onto the intersection line of the two walls. The first specified wall is set to the YOZ plane, with the X direction pointing towards the point cloud side,

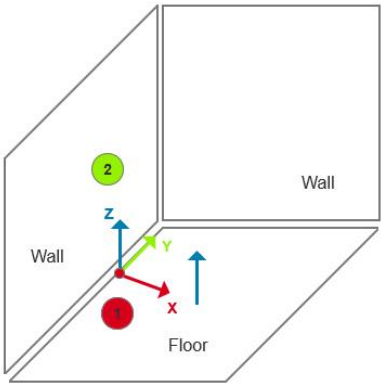


determined by the center of the point cloud's bounding box. The second wall is set to the XOZ plane, with the Z direction always aligned with the Z direction of the WCS. The Y direction is then determined using the right-hand rule.

The two selected walls must be perpendicular. When the angle between the walls is between 80° and 100°, they are considered perpendicular. The second wall is then adjusted to ensure it is perfectly perpendicular to the first wall.

3.2.2 Floor + Wall

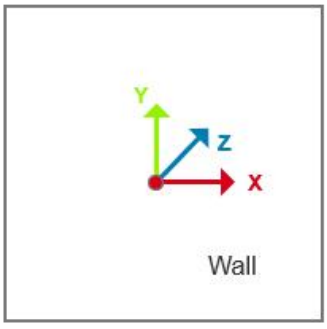
The origin of the UCS is located at the projection of the first selected floor node onto the intersection line of the floor and wall. The floor is set to the XOY plane, with the Z direction always aligned with the Z direction of the WCS The wall is set to the YOZ plane, with the X direction pointing towards the point cloud side, determined by the center of the point cloud's bounding box. The Y direction is then determined using the right-hand rule.



The selected floor and wall must be perpendicular. When the angle between the floor and wall is between 80° and 100°, they are considered perpendicular. The wall is then adjusted to ensure it is perfectly perpendicular to the floor.

3.2.3 Wall

The origin of the UCS is located at the selected node. The wall is set to the XOY plane, with the X and Y directions defined by the length and width of the rectangular bounding box fitted to the wall. The Z direction points outward from the point cloud, determined by the center of the point cloud's bounding box.



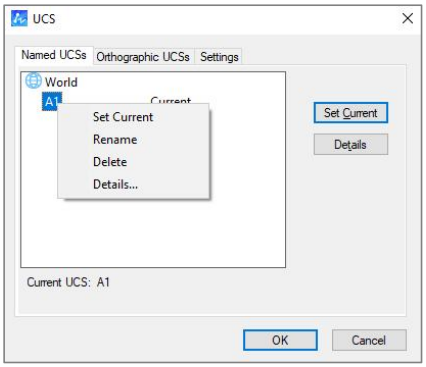
3.3 UCS Management

3.3.1 Save UCS

Save the current UCS and name it. (ZWCAD command: UCS)

3.3.2 UCS Manager

Open the UCS Manager. (ZWCAD command: UCSMAN)



Specific features are as follows:

1) Set the selected UCS to be the current UCS.
2) Rename the selected UCS.
3) Delete the selected UCS.
4) View the details of the selected UCS.

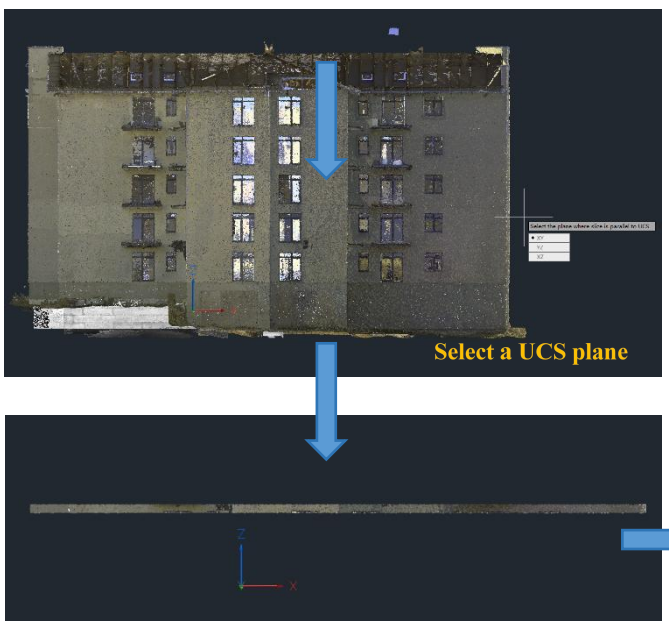
3.3.3 Reset to WCS

Change the current coordinate system to WCS. (ZWCAD command: UCS -W)

4 Slice

4.1 UCS Slice

Select a plane of the current UCS (such as the XY, YZ, or XZ plane) and specify two points to create a slice that is parallel to the chosen UCS plane within the range defined by the two points. You can save the current slice using the "Save" button in the Slice Manager.

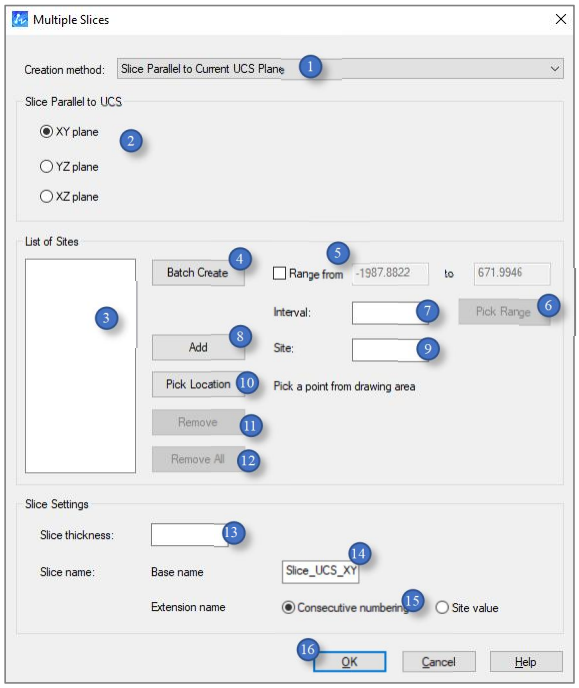


4.2 Multiple Slice

You can use Multiple Slice to create multiple slices, and the created slices will be automatically saved in the Slice Manager. Multiple Slice offers three modes: Slice Parallel to Current UCS Plane, Slice Perpendicular to Curve, and Slice along Polyline Elevation. You can choose the mode that best suits your work requirements.

(1) Slice Parallel to Current UCS Plane

Create multiple slices parallel to the UCS coordinate plane at specified sites.



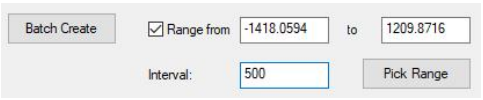
1: Select the creation method as "Slice Parallel to Current UCS Plane". After switching the method, the input parameters will dynamically adjust accordingly.

2: Choose the UCS plane for slice to be parallel to, including the XY plane, YZ plane, and XZ plane.

3: List of Sites for creating Multiple Slices.

4: According to the specified interval, automatically create a batch of sites within the predefined upper and lower limits.

5: Set the upper and lower limits for batch creation the default range is defined by the point cloud bounding box along the direction normal to the selected UCS plane.



Tips: Batch create can only be performed when the list of sites is empty.

6: Pick two points from the drawing area to determine the upper and lower limit range.

7: Set the interval value for batch creation.

8: Add the entered site to the list.

9: Set the site value.

10: Pick a point from the drawing to add to the list.

11: Remove the selected site from the list.

12: Clear the list of sites.

13: Set the slice thickness.

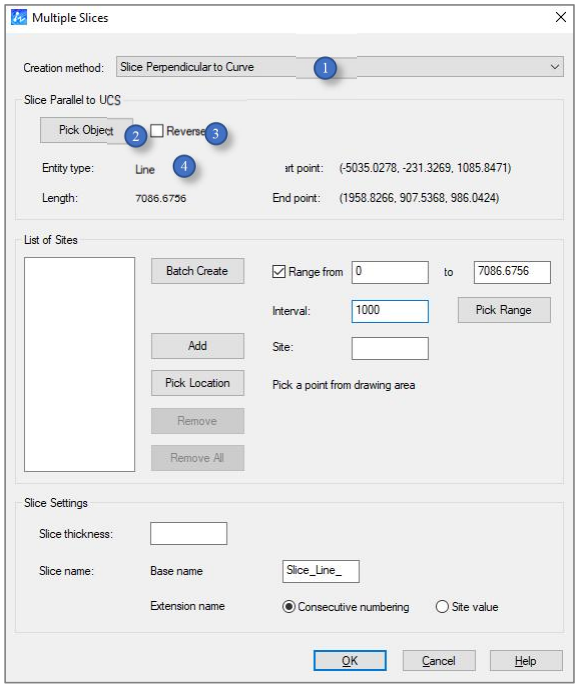
14: Set the prefix for the slice name.

15: Select extension name: Consecutive numbering or Site value.

16: Based on the input parameters, batch create slices and save them to the Slice Manager, naming them with the base name plus extension name.

(2) Slice Perpendicular to Curve

Batch create slices perpendicular to the curve along its direction.



1: Select the creation method as "Slice Perpendicular to Curve". After switching the method, the input parameters will dynamically adjust accordingly.

2: Select a curve object from the drawing, where the object types include line, polyline, 3D polyline, arc, circle, ellipse, and spline.

3: Multiple Slice along the curve in reverse direction.

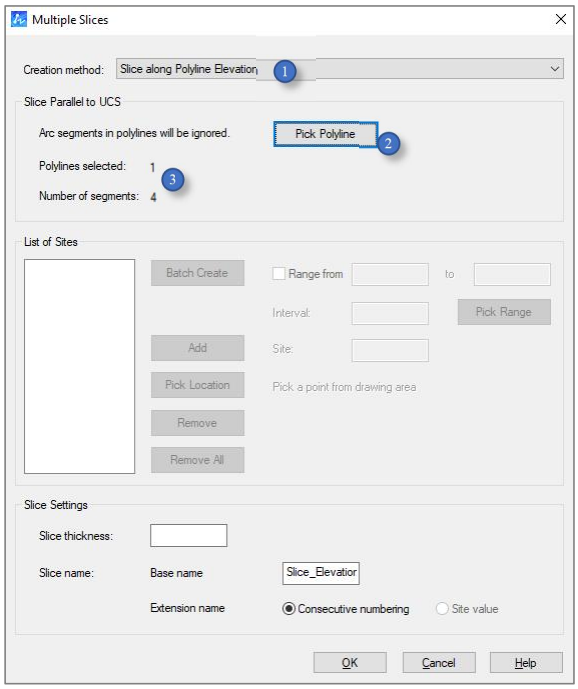
4: Show the type, length, start point coordinates, and end point coordinates of the curve.

The remaining functions are consistent with "Slice Parallel to Current UCS Plane".

(3) Slice along Polyline Elevation

Perpendicular to the current UCS XY plane, create multiple slices along the segments of one or more polylines, with a specified slice thickness, where each slice is perpendicular to one

segment of its respective polyline.



1: Select the creation method as "Slice along Polyline Elevation". After switching the method, the input parameters will dynamically adjust accordingly.

2: Pick one or more polylines from the drawing.

3: Show the number of selected polylines and the total number of segments.

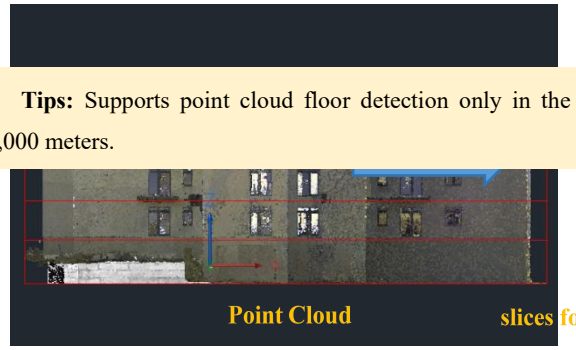
The remaining functions are consistent with "Slice Parallel to Current UCS Plane".

4.3 Detect Floor

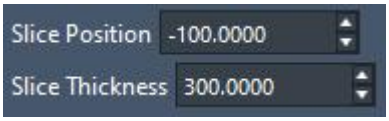
The Detect Floor feature automatically detects building floor information within the specified range in the selected point cloud. If the point cloud contains floor characteristics, output slices for each detected floor and add these slices to the Slice Manager.

The parameter settings for floor detection are detailed in the "Detect Floor Parameters" chapter.

Tips: Supports point cloud floor detection only in the Z direction, with a ma
10,000 meters.



4.4 Slice Position and Thickness



After selecting a slice in the Slice Manager, you can adjust the position and thickness of that slice to achieve the optimal display effect for the sliced point cloud.

Once you select the input box, you can quickly adjust the slice position and thickness using the mouse scroll wheel. In the "Set Slice Increments" dialog box, you can modify the values by which the slice position and thickness increase or decrease with each adjustment.

In addition to adjusting through the ribbon interface, you can also enter the following commands to make adjustments:

PCSLICESITE: Set the slice position.

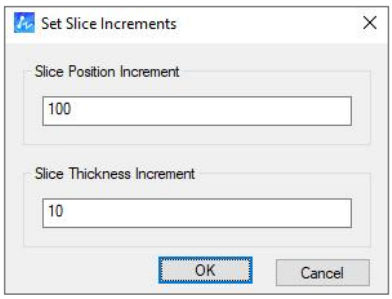
PCSLICESITEUPDOWN: Move the slice up or down.

PCSLICETHICKNESS: Set the slice thickness.

PCSLICETHICKNESSUPDOWN: Increase or decrease the thickness of the slice.

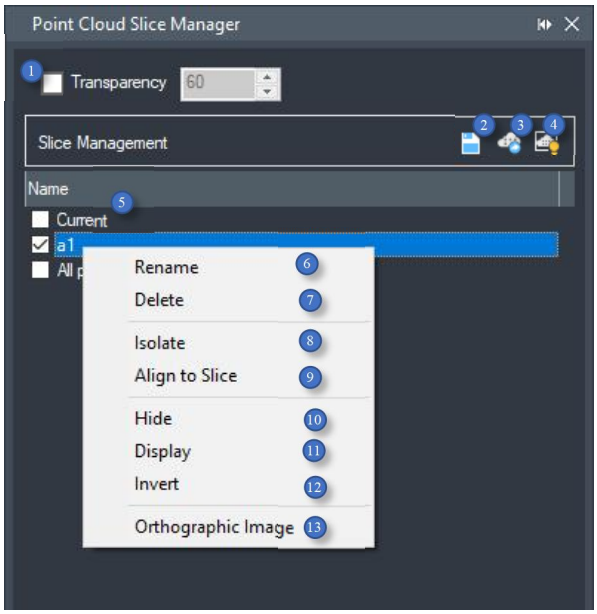
4.5 Set Slice Increments

Set the increment for slice position and thickness in drawing unit. If your drawing unit is meters, you should reduce the increment values for slice position and thickness to ensure sensitivity during adjustments.



4.6 Slice Manager

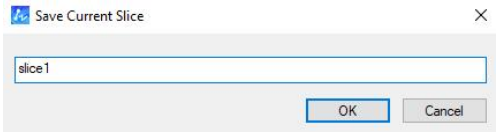
Slices created through methods such as UCS Slice, Multiple Slice, and Detect Floor will all be managed in the Slice Manager. The global functions of the Slice Manager include: set transparency, save slice, export point cloud data, and display/hide slice bounding box. The right-click menu functions for slice include: rename, delete, isolate, align to slice, hide, display, invert, and orthographic image.



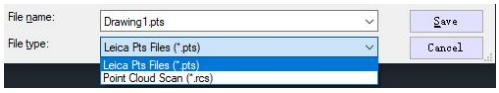
1: Set the transparency of all point clouds in the drawing.

When the checkbox is selected, it automatically sets the transparency of all point clouds to match the transparency value specified in the panel. Adjusting the transparency value in the panel will modify the transparency of all point clouds together. Modifying the transparency of an point cloud within the drawing will not change the transparency value set in the Slice Manager.

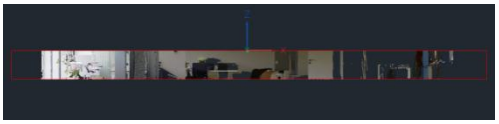
When the checkbox is deselected, the transparency of all point clouds will be set to 0.



2: Save the current slice, you can also save it by renaming the "Current" node.



3: Export the point cloud data within the currently checked slice as a pts or rcs file. If no slices are checked, then export all point cloud data.



4: Display/Hide slice bounding box. When this option is enabled, selecting a slice in the Slice Manager will show the slice's bounding box (represented by a red wireframe).

5: Manage all saved slices in the slice list. Checking a node will display the corresponding slice, while unchecking a node will hide the corresponding slice.

6: Rename the selected slice.

7: Delete the selected slice.

8: Isolate the selected slice to display only it, hiding all other slices.

9: After aligning to the selected slice, the current slice will be automatically isolated, and a UCS matching the slice will be created. The origin of the UCS will be located at the projection of the current origin onto the slice plane, and the XY plane will align with the slice plane.

10: Hide the currently selected slice, and the node will be unchecked.

11: Display the currently selected slice, and the node will be checked.

12: Invert the slice filter effect to toggle the display of point cloud data inside or outside the slice.

13: Export an orthographic image of the selected slice in a top-down view, and support attaching the orthographic image to the slice plane. For detailed operation instructions, refer to the "Orthographic Image" chapter.

5 Floor Plan

After creating a point cloud slice, you can proceed to draw the floor plan based on the slice. The clearer the walls are in the slice, the better the wall line fitting will be. Therefore, by performing operations such as point cloud clipping, adjusting the slice position and thickness, and hiding noise and irrelevant parts of the point cloud, you can improve the efficiency and quality of floor plan drafting.

5.1 Fit Wall Line

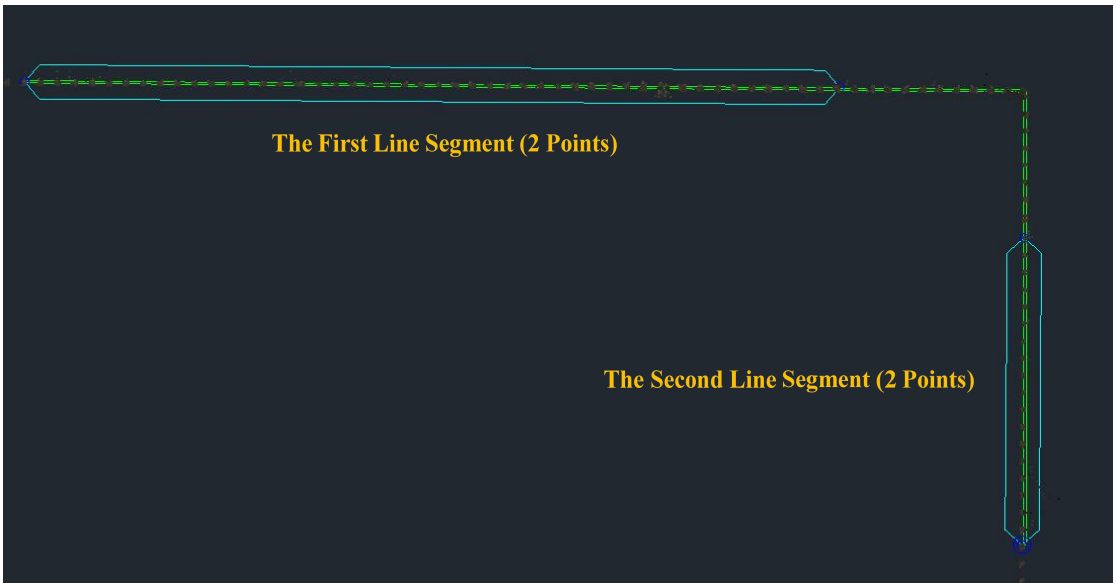
Fit Wall Line is a semi-automatic method for drawing wall lines. It can automatically fit polylines that closely follow the point cloud data based on the point cloud nodes you select in the drawing area.

When performing Fit Wall Line on a point cloud for the first time, it is recommended that you first enter the keyword "S" to set parameters such as point cloud spacing and fit area width. This will help improve the effectiveness of the fit.

Fit Wall Line includes three modes: 2 Points, Ortho, Corner. The specific descriptions are as follows:

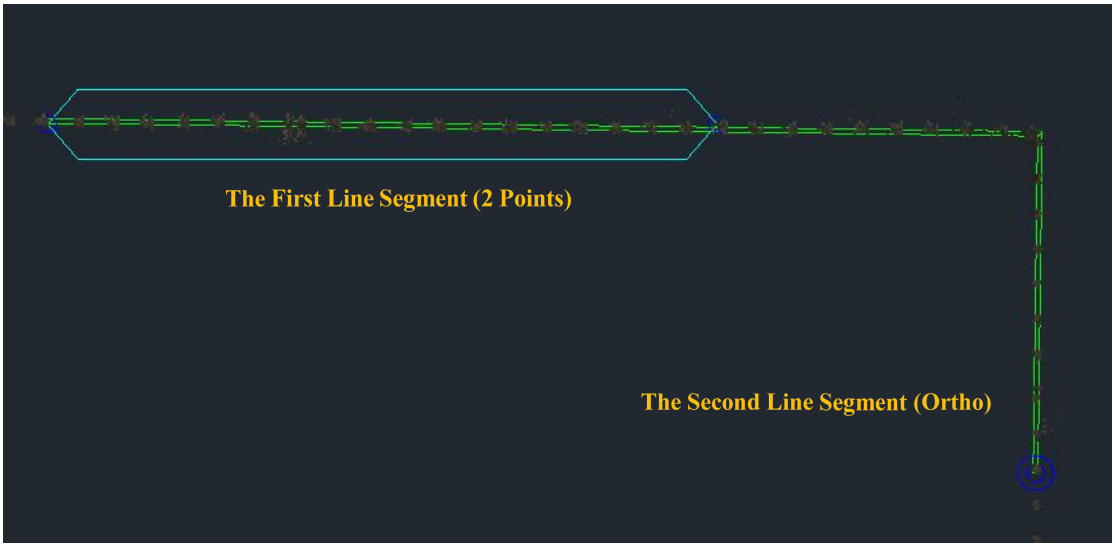
2 Points: Draw a line segment based on the two selected points. When the fitting function is enabled, it will fit the line segment according to the point cloud data within the range of these two

points. Once the line segment is created, it will connect to the previous line segment.



Tips: The first line segment can only be created using the 2 Points mode, while subsequent segments can switch to Ortho or Corner modes.

Ortho: Draw a line segment that is perpendicular to the previous line segment from the selected point.



Corner: Draw a line segment that connects the selected point to the endpoint of the previous line segment."

The command branches for Fit Wall Line are described as follows:

Fit on/Fit off (F): When the fit on, the line segment will be adjusted based on the point cloud surrounding the selected points to optimally fit the point cloud data.

2 Points (P): Switch to 2Points mode.

Ortho (O): Switch to Ortho mode.

Corner (R): Switch to Corner mode.

Close (C): When the number of line segments is greater than two and the first and last segments are not parallel (with a tolerance of 10°), the wall line will automatically close. If you do not want the wall line to close, you can press Esc to exit directly.

Undo (U): Return to the state before the last point selection.

Settings (S): Set the parameters for Fit Wall Line, detailed instructions are provided in the "Settings" chapter.

5.2 Track Wall Line

Track the point cloud data surrounding the selected point to automatically generate all wall lines in that area, supporting both polyline and spline curve types. The generated wall lines will default to the XY plane of the UCS. The effectiveness of Track Wall Line is influenced by parameters, detailed instructions are provided in the "Track Wall Line" chapter.

5.3 Detect Wall Line

Detect Wall Line is a fully automatic method for drawing wall lines, suitable for building point clouds where walls are clearly defined and there are few indoor obstructions. By detecting the visible portion of the selected point cloud, automatically output all wall lines, with the wall lines defaulting to the XY plane of the UCS.

The effectiveness of Detect Wall Line is influenced by parameters, detailed instructions are provided in the "Detect Wall Line" chapter.

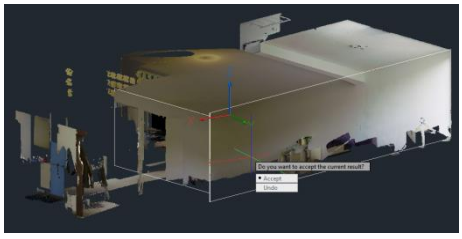
5.4 Align Polyline

To align an already drawn polyline so that it conforms as closely as possible to the shape of the surrounding point cloud. After fitting, a new polyline will be generated while the original polyline remains unchanged. Align Polyline only modifies the relative positions of the existing vertices without increasing the number of vertices.

6 3D Drawing

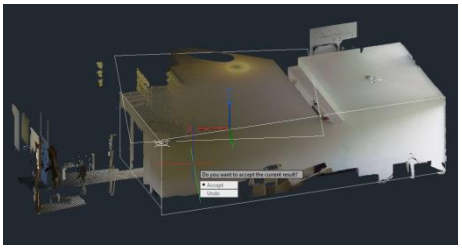
6.1 Extract Intersection Line

Sequentially select two point cloud nodes, and automatically fit a plane at each node. If the two fitted planes intersect, extract the intersection line of the planes.



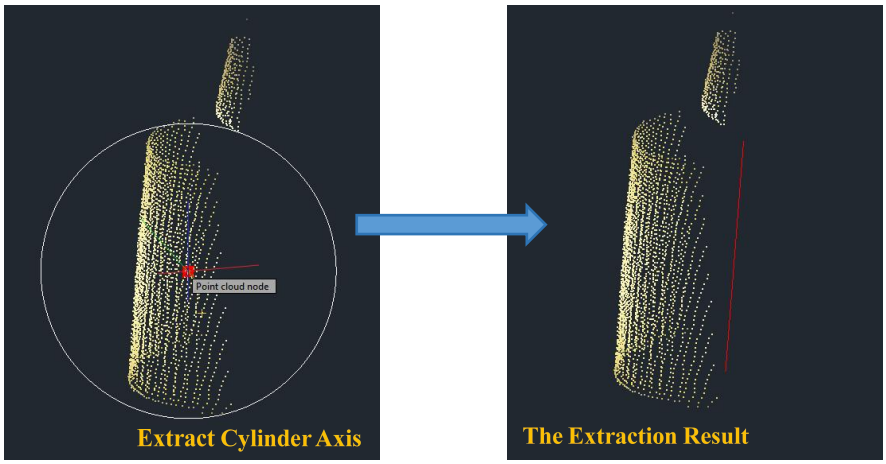
6.2 Extract Corner Point

Sequentially select three point cloud nodes, and automatically fit a plane at each node. If the three planes intersect, the intersection point of the three planes is identified as a corner point.



6.3 Extract Cylinder Axis

Set the fitting region by adjusting the preview circle's size using "Shift + mouse scroll wheel". Select a node on the cylindrical point cloud surface within this region for cylinder fitting, and finally extract the cylinder's axis.



6.4 Extract Sphere Center

Set the fitting region by adjusting the preview circle's size using "Shift + mouse scroll wheel". Select a node on the spherical point cloud surface within this region for sphere fitting, and finally extract the sphere's center.

6.5 Fit Plane

Set the fitting region by adjusting the preview circle's size using "Shift + mouse scroll wheel". Select a point cloud node to automatically create a planar 3D solid (region). The scope and edge form of the plane fitting can be adjusted through branches in the command, as follows:

The plane fitting scope has two options: full extraction and local extraction. The full extraction refers to the entire plane that contains the selected point, while the local extraction refers to the preview circle area.

The plane fitting edge form has two options: rectangle edge and outline edge. The rectangle edge refers to the rectangular bounding box around the point cloud plane, while the outline edge refers to the polygonal approximation of the edge of the point cloud plane.

6.6 Fit Cylinder

(1) Single Point

Set the fitting region by adjusting the preview circle's size using "Shift + mouse scroll wheel". Select a node on the cylindrical point cloud surface within this region to fit a cylinder. The single point method is suitable for fitting a short cylindrical segment.

(2) Double Point

Select two nodes on the cylindrical point cloud surface to fit a cylinder within the range of these two points. The double point method is suitable for fitting a long cylindrical segment.

6.7 Fit Cone

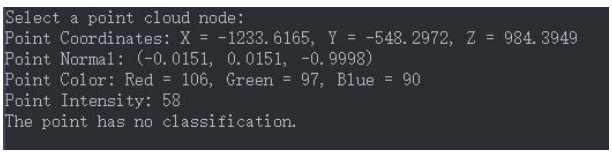
Set the fitting region by adjusting the preview circle's size with 'Shift + mouse scroll wheel', then select a node on the conical point cloud surface within this region to fit a cone.

6.8 Fit Sphere

Set the fitting region by adjusting the preview circle's size with 'Shift + mouse scroll wheel', then select a node on the spherical point cloud surface within this region to fit a sphere.

7 Measure & Dimension

7.1 Point Information

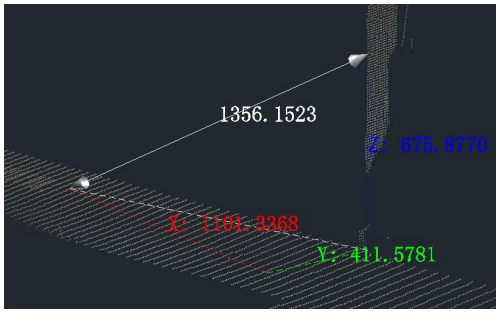


Output the information for the selected point cloud node, including the 3D coordinates, normal vector, color, intensity, and classification of the point. If any type of information does not exist, indicate that this type of information is unavailable.

7.2 Measure Distance

Measure the horizontal, vertical, and 3D spatial distances between two points in the UCS, corresponding to the distance on the XY plane, the distance along the Z-axis, and the actual three-dimensional distance.

7.3 Distance Dimension

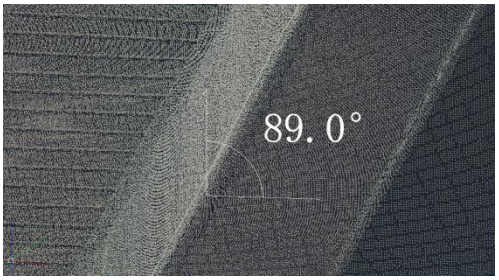


Annotate the horizontal, vertical, and 3D spatial distances between two points. You can set the size of the annotation text, with a default size of 50.

7.4 Measure Angle

Sequentially select two point cloud nodes, and automatically fit a plane at each node. Measure the spatial angle between the two planes.

7.5 Angular Dimension



Sequentially select two point cloud nodes, and automatically fit a plane at each node. Annotate the spatial angle between the two fitted planes. You can set the size of the annotation text, with a default size of 50.

8 Orthographic Image

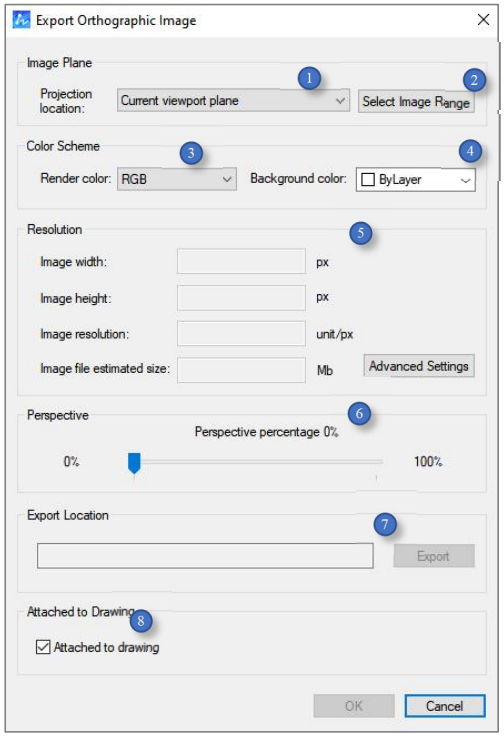
Project the point cloud onto a specified plane to create an orthographic image. This function supports two scenarios: based on the entire point cloud and based on a slice.

(1) Orthographic Image based on the point cloud

Specify the orthographic image area as a rectangular plane, and project all

visible point clouds in the current model space onto this plane according to the specified color style and projection parameters.

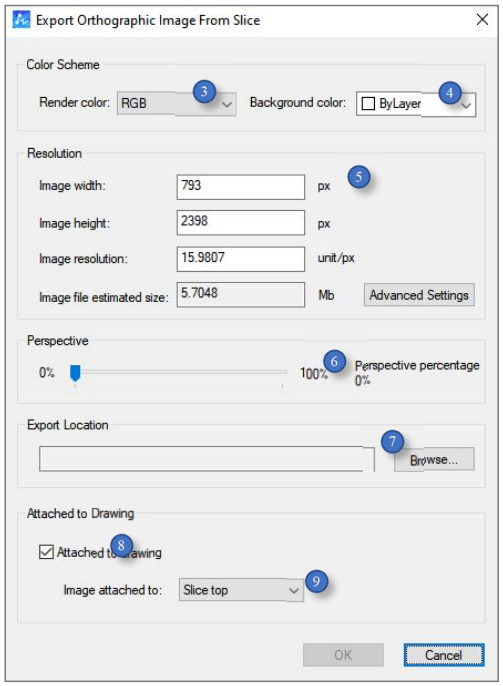
Function Entry: Access this feature through the ribbon button or by using the PCORTHOIMAGE command.

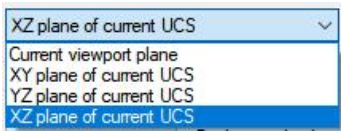


(2) Orthographic Image based on a slice

Select a slice in the Slice Manager, and perform an orthographic projection of the visible point clouds within this slice.

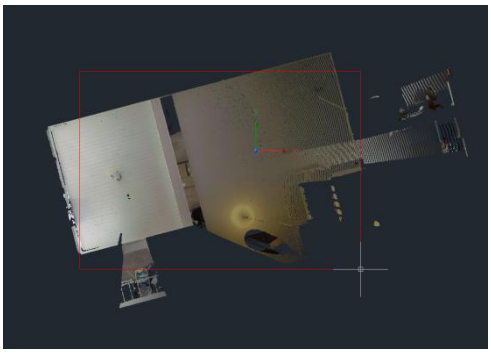
Function Entry: Access this feature through the right-click menu of a slice in the Slice Manager.





1: The projection location includes four options: Current viewport plane, XY plane of current UCS, YZ plane of current UCS, and XZ plane of current UCS

2: Select image range



Enter the model space, adjust the viewport direction as needed, and then draw a rectangular area in the current viewport. If the selected projection location is not the current viewport plane, the system will project the defined area onto the corresponding UCS plane and recalculate the image bounds accordingly. The image bounds can be previewed during command execution as a red outline.

3: Choose the Render color for projecting the point cloud onto the orthographic image, including options for RGB, Intensity, Elevation, and Object color.

4: Set the background color for the orthographic image.

5: Display the resolution of the orthographic image.

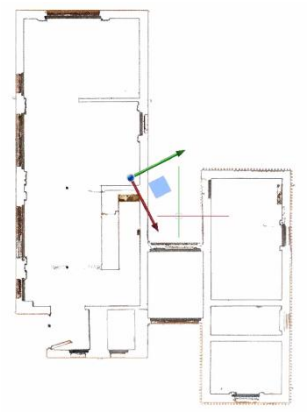
Set the image width (px), height (px), and resolution (unit/px). The width and height specify the size of the image, while the resolution indicates the size in three-dimensional space that one pixel in the orthographic image corresponds to. (px: Pixel of the orthographic projection image;

Unit: Consistent with the point cloud unit)

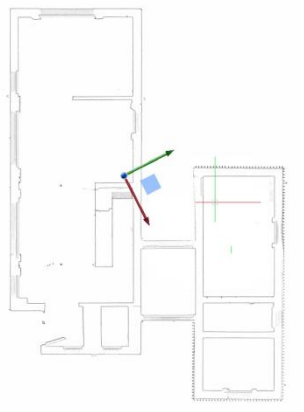
After selecting the image range, the program will automatically calculate an appropriate resolution. If you are not satisfied with the calculated resolution, you can manually modify it. Note that, since the image range has already been determined, the aspect ratio of the image's height to width is fixed.

6: Set the perspective percentage using a slider, with a range of 0-100%. If the perspective percentage is set to 0%, you will obtain a true-color image of the point cloud. If the perspective percentage is set to 100%, areas behind dense points in the image will appear darker, while less dense areas will appear brighter, enhancing the rendering effect of internal structural walls.

Point Cloud



perspective percentage 0%



perspective percentage 100%

7: Set the export image file format and the export file location. Currently supported formats include: *.bmp; *.rle; *.dib; *.jpg; *.jpeg; *.png; *.tif; *.tiff.

8: Attach the orthographic image to the projection location.

9: Set the attachment location for the orthographic image, including slice top, slice plane, slice bottom.

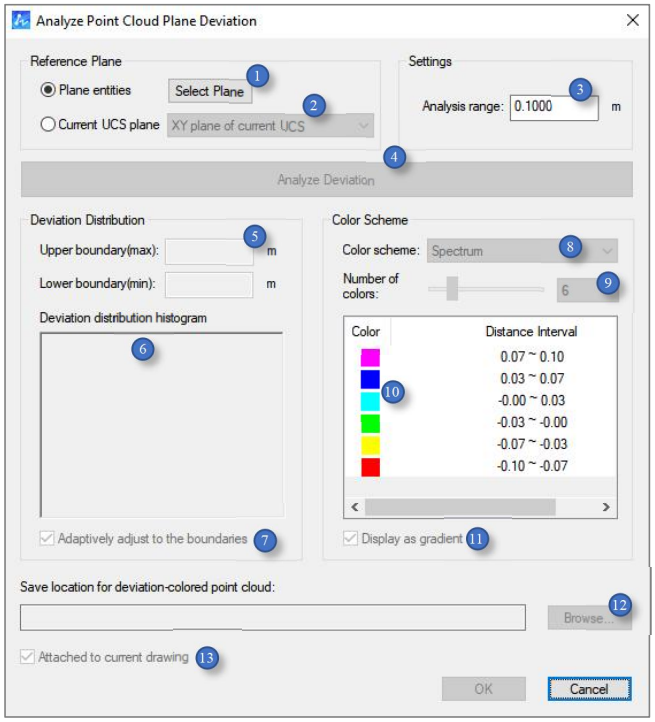
9 Image Vectorization

Execute the "vectorization" command on the platform to convert selected raster image objects into vector graphics. For detailed instructions, refer to the ZWCAD's help documentation.

10 Analyze Plane Deviation

Analyze Plane Deviation creates a new point cloud where the colors reflect the distances

between the selected point cloud and a specified reference plane (e.g., walls or floors). Using this feature, you can quickly grasp the undulations of building surfaces, evaluate surface flatness, and identify structural features.



1: Select a plane from the drawing area to serve as the reference plane for the deviation analysis. You can create a plane using the Fit Plane function.

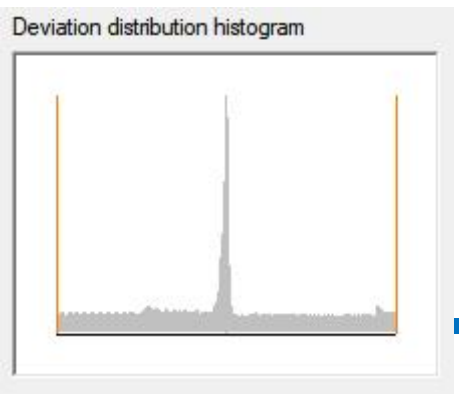
2: Select Current UCS plane to serve as the reference plane for the deviation analysis. Options include the XY plane, YZ plane, or XZ plane.

3: Set the analysis range, where point cloud data within the specified range above and below the reference plane will be used as the analysis objects.

4: Analyze plane deviation, and display the results of the deviation distribution in the dialog box, including the upper boundary, lower boundary, and the deviation distribution histogram.

5: Display the upper and lower boundaries of the point cloud data obtained from the deviation analysis.

6: Based on the point cloud data within the analysis range, calculate the distance from each point to the reference plane and plot a normal distribution graph according to the distances within different ranges. The



x-axis represents the distance range, and the y-axis represents the number of points within each distance range.

7: The histogram will adaptively adjust to the boundaries.

8: Choose a color scheme, including options for Hydro, Grayscale, Earth, Blues, Greens, Spectrum, and Reds.

9: Set the number of colors, with a range from 2 to 25.

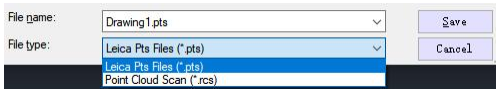
10: Set the distance intervals based on the number of colors and assign display colors accordingly. Click the color squares to reselect colors.

11: Display the boundaries between distance intervals as gradient colors.

12: Set the export location for the deviation-colored point cloud and save it in RCS format.

13: Attach the deviated point cloud to the drawing.

11 Export Point Cloud

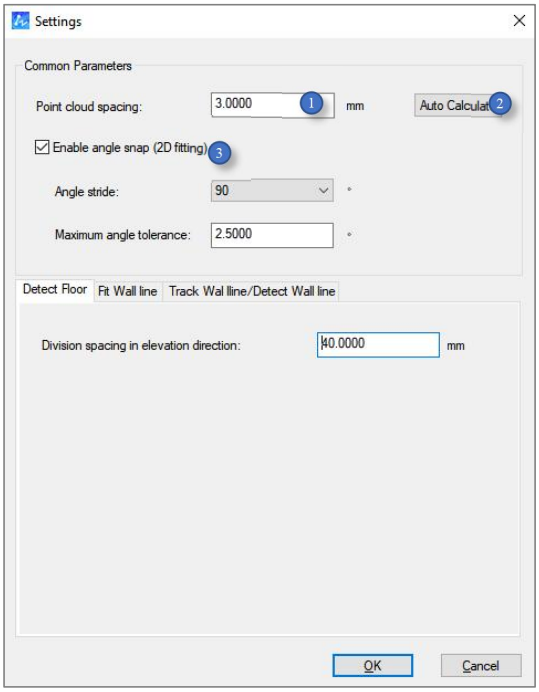


Save the visible portion of the selected point cloud(s) (one or multiple) as a point cloud in Pts or Rcs format. The Level of Detail (LOD) is set to the maximum value of 31, and the unit for the exported point cloud data will be uniformly meters.

Tips: The coordinate system for the exported point cloud data is the current drawing's WCS, not the original point cloud's Object Coordinate System (OCS).

12 Settings

The Settings dialog comprises modules for Common Parameters, Detect Floor, Fit Wall Line, and Track Wall Line/Detect Wall line. The Common Parameters module provides common settings for all related algorithms.



1: Point Cloud Spacing: This parameter represents the distance between points and affects the results of Fit Wall Line, Track Wall Line, and Detect Wall line. The smaller the spacing, the more details are detected, but wall lines are more likely to become disconnected.

For the tracking and detection functions, point cloud spacing will affect the connection effect of line segments. You can use Auto Calculate to obtain uniform point cloud spacing. If the point spacing on the wall line generation plane is uneven, it is recommended to appropriately increase this value. (You can refer to the automatically calculated point cloud spacing and increase it by 1-3 times as appropriate. For areas where detection or tracking fails but clearly exhibit linear features, you can measure the horizontal distance between connected points to use as the point cloud spacing.)

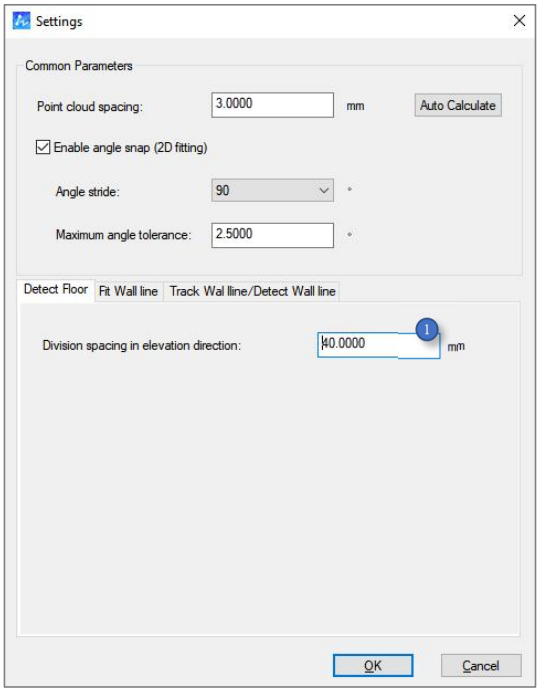
2: Calculate the average distance between the selected node and its surrounding nodes (up to 500 points). Upon successful calculation, the point cloud spacing in the interface will be updated synchronously.

3: Angle snap: This feature influences functions like Fit Wall Line and Track Wall Line. When the angle between adjacent segments of the fitted wall line differs from the angle step by less than the maximum angle tolerance, the segments will be adjusted to ensure the angle between them is a multiple of the angle step value. Supported angle steps are: 90°, 45°, and 30°.

12.1 Detect Floor Parameters

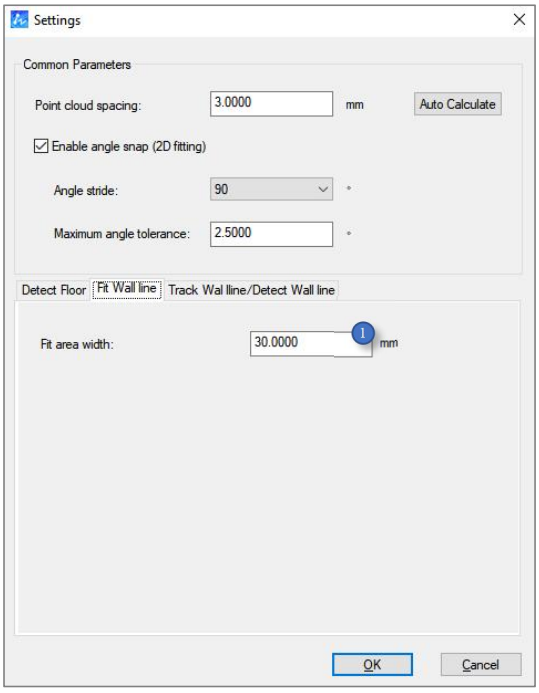
1: Division spacing in elevation direction: This parameter represents the minimum floor detection interval in the elevation direction (the Z-axis of the UCS). It primarily accounts for the fact that floors or ceilings are not perfectly flat and can have a fluctuation range.

The larger this value, the greater the elevation range for detecting floor information, which may result in decreased precision. However, it ensures detection effectiveness in situations where the floor is sloped or uneven. For flat floors or ceilings, this value can be appropriately reduced.

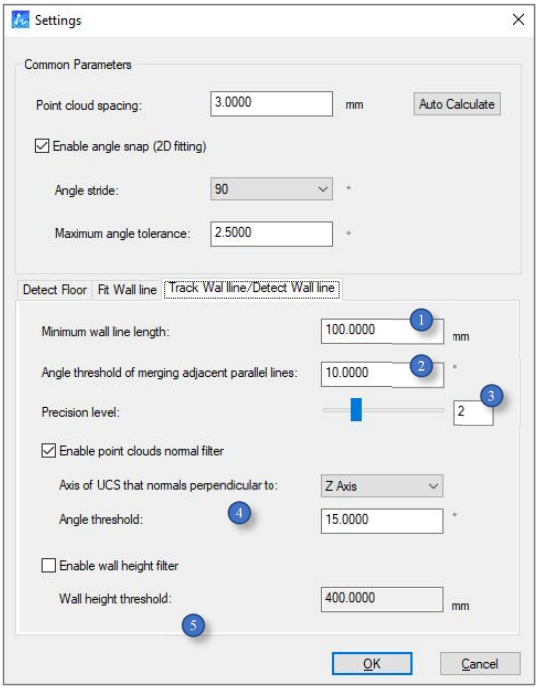


12.2 Fit Wall Line Parameters

1: Fit area width: Controls the width of the point cloud region involved in Fit Wall Line. (This width is consistent with the diameter of the preview circle in the Fit Wall Line command workflow.)



12.3 Track Wall Line/Detect Wall Line Parameters



1: Set the minimum wall line length to filter out short wall lines.

2: During the process of Track Wall Line and Detect Wall Line, when the angle between adjacent line segments falls within this threshold, the two line segments will be merged into a single line segment.

3: Precision level ranges from 1 to 5, with higher levels resulting in more precise wall line tracking and detection. However, increased precision also means greater memory usage and longer processing times.

4: When the point cloud normal filter is enabled and the point cloud data contains normal information, the Track Wall Line and Detect Wall Line processes will automatically filter out points that do not satisfy the normal conditions. This enhances the accuracy of wall line generation.

You can adjust the normal direction and angle threshold. Points with normal angles within the threshold range are considered to meet the normal conditions.

Tips: If the point cloud does not contain normal information, the normal filter will not be effective.

5: After enabling wall height filter, point cloud areas with a height lower than the wall height threshold along the Z-axis of the UCS will not participate in wall line tracking and detection.

Tips: When setting the wall height threshold, the thickness of the slice must be taken into account. If the wall height threshold is set higher than the slice thickness, it could lead to the wall itself being excluded from the wall line tracking and detection processes.

APPENDIX

Feature	Command	Ribbon	Toolbar	Menu
Attach Point Cloud	POINTCLOUDATTACH	PC Assistant - Attach -Attach point Cloud	PC Assistant - Attach point Cloud	PC Assistant - Attach point Cloud
Batch conversion	PCCONVERT	PC Assistant - Attach - Convert Point Cloud	PC Assistant - Convert Point Cloud	PC Assistant - Convert Point Cloud
Align Point Cloud	PCALIGN	PC Assistant - Orientation - Align	PC Assistant - Align Point Cloud	PC Assistant - Align Point Cloud
Wall + Wall	PCUCSWALLWALL	PC Assistant - Orientation - Wall + Wall	PC Assistant – Wall + Wall	PC Assistant - UCS Settings - Create UCS – Wall + Wall
Floor + Wall	PCUCSFLOORWALL	PC Assistant - Orientation - Floor + Wall	PC Assistant – Floor + Wall	PC Assistant - UCS Settings - Create UCS – Floor + Wall
Wall	PCUCSWALL	PC Assistant - Orientation - Wall	PC Assistant - Wall	PC Assistant - UCS Settings - Create UCS - Wall
Save UCS	UCS -S	PC Assistant - Orientation - Save UCS	PC Assistant - Save UCS	PC Assistant - UCS Settings - Save UCS
UCS Manager	UCSMAN	PC Assistant - Orientation - UCS Manager	PC Assistant - UCS Manager	PC Assistant - UCS Settings - UCS Manager
Reset to WCS	UCS -W	PC Assistant - Orientation - Reset to WCS	PC Assistant - Reset to WCS	PC Assistant - UCS Settings - Reset to WCS
Slice Manager	PCSLICEMAN	PC Assistant - Slice - Slice Manager	PC Assistant - Slice - Slice Manager	PC Assistant - Slice Manager
UCS Slice	PCSLICEUCS	PC Assistant - Slice - UCS Slice	PC Assistant - Slice - UCS Slice	PC Assistant - UCS Slice
Multiple Slices	PCSLICEMULTI	PC Assistant - Slice - Multiple Slices	PC Assistant - Slice - Multiple Slices	PC Assistant - Multiple Slices
Detect Floor	PCDETECTFLOORS	PC Assistant - Slice - Detect Floor	PC Assistant - Slice - Detect Floor	PC Assistant - Detect Floor
Set Slice Position	PCSLICESITE	PC Assistant - Slice - Slice Position	PC Assistant - Slice - Set Slice Position	PC Assistant - Slice Position and Thickness - Set Slice Position
Adjust Slice Position	PCSLICESITEUPDOWN	PC Assistant - Slice - Slice Position	PC Assistant - Slice - Adjust Slice Position	PC Assistant - Slice Position and Thickness - Adjust Slice Position
Set Slice Thickness	PCSLICETHICKNESS	PC Assistant - Slice - Slice Thickness	PC Assistant - Slice - Set Slice Thickness	PC Assistant - Slice Position and Thickness - Set Slice Thickness
Adjust Slice Thickness	PCSLICETHICKNESSUPDOWN	PC Assistant - Slice - Slice Thickness	PC Assistant - Slice - Adjust Slice Thickness	PC Assistant - Slice Position and Thickness - Adjust Slice Thickness
Set Slice Increment	PCSLICESET	PC Assistant - Slice - Set Slice Increment	-	-
Fit Wall Line	PCFITWALL	PC Assistant - Floorplan - Fit Wall Line	PC Assistant - Extract and Fit - Fit Wall Line	PC Assistant - Floorplan - Fit Wall Line
Track Wall Line	PCTRACKWALL	PC Assistant - Floorplan - Track Wall Line	PC Assistant - Extract and Fit - Track Wall Line	PC Assistant - Floorplan - Track Wall Line
Detect Wall Line	PCDETECTWALLS	PC Assistant - Floorplan - Detect Wall Line	PC Assistant - Extract and Fit - Detect Wall Line	PC Assistant - Floorplan - Detect Wall Line
Align Polyline	PCALIGNPOLYLINE	PC Assistant - Floorplan - Align Polyline	PC Assistant - Extract and Fit - Align Polyline	PC Assistant - Floorplan - Align Polyline
Extract Intersection Line	PCEXTRACTEDGE	PC Assistant - 3D Drawing - Extract Intersection Line	PC Assistant - Extract and Fit - Extract Intersection Line	PC Assistant - 3D Drawing - Extract Line - Extract Intersection Line
Extract Corner Point	PCEXTRACTCORNER	PC Assistant - 3D Drawing - Extract Corner Point	PC Assistant - Extract and Fit - Extract Corner Point	PC Assistant - 3D Drawing - Extract Point - Extract Corner Point
Extract Cylinder Axis	PCEXTRACTCENTERLINE	PC Assistant - 3D Drawing - Extract Cylinder Axis	PC Assistant - Extract and Fit - Extract Cylinder Axis	PC Assistant - 3D Drawing - Extract Line - Extract Cylinder Axis
Fit Plane	PCFITPLANE	PC Assistant - 3D Drawing - Fit Plane	PC Assistant - Extract and Fit - Fit Plane	PC Assistant - 3D Drawing - Fit Plane
Fit Cylinder	PCFITCYLINDER	PC Assistant - 3D Drawing	PC Assistant - Extract and Fit	PC Assistant - 3D Drawing

		- Cylinder	- Fit Cylinder	- 3D Modeling - Fit Cylinder
Fit Cone	PCFITCONE	PC Assistant - 3D Drawing - Cone	PC Assistant - Extract and Fit - Fit Cone	PC Assistant - 3D Drawing - 3D Modeling - Fit Cone
Fit Sphere	PCFITSPHERE	PC Assistant - 3D Drawing - Sphere	PC Assistant - Extract and Fit - Fit Sphere	PC Assistant - 3D Drawing - 3D Modeling - Fit Sphere
Point Information	PCPOINTINFO	PC Assistant - Measure - Point Information	PC Assistant - Measure and Analyze - Point Information	PC Assistant - Measure - Point Information
Measure Distance	PCDIST	PC Assistant - Measure - Measure Distance	PC Assistant - Measure and Analyze - Measure Distance	PC Assistant - Measure - Measure Distance
Measure Angle	PCANG	PC Assistant - Measure - Measure Angle	PC Assistant - Measure and Analyze - Measure Angle	PC Assistant - Measure - Measure Angle
Distance Dimension	PCDIMALIGNED	PC Assistant - Dimension - Distance Dimension	PC Assistant - Measure and Analyze - Distance Dimension	PC Assistant - Dimension - Distance Dimension
Angular Dimension	PCDIMANGULAR	PC Assistant - Dimension - Angular Dimension	PC Assistant - Measure and Analyze - Angular Dimension	PC Assistant - Dimension - Angular Dimension
Orthographic Image	PCORTHOIMAGE	PC Assistant - Tools - Orthographic Image	PC Assistant - Measure and Analyze - Orthographic Image	PC Assistant - Orthographic Image
Analyze Plane Deviation	PCPLANEDEVIATION	PC Assistant - Tools - Analyze Plane Deviation	PC Assistant - Measure and Analyze - Analyze Plane Deviation	PC Assistant - Analyze Plane Deviation
Export Point Cloud	PCEXPORT	PC Assistant - Export - Export Point Cloud	PC Assistant - Export Point Cloud	PC Assistant - Export Point Cloud
Settings	PCSETTINGS	PC Assistant - Help - Settings	PC Assistant - Settings	PC Assistant - Help - Settings