

Welcome to CloudWorx 3.2 Tutorial

[CloudWorx](#) is the high-performance point cloud solution that enables you to load, render, analyze and extract information from high-definition surveying (HDS) 'point cloud' data in AutoCAD®.

The enhanced functions allow you to:

- View millions of points within your AutoCAD environment
- View proposed construction over existing conditions
- Model proposed construction over existing conditions to meet and exceed clearances and specifications
- Create maps using AutoCAD commands

For in-depth explanations and definitions on High Definition Surveying terms, please refer to the CloudWorx Online Help files and user manuals. This tutorial assumes that you are familiar with AutoCAD and have completed Section I of these tutorials.

Section II - CloudWorx 3.2 Pro: Plant Applications

This Section describes some of the advanced functionality offered in CloudWorx 3.2 Pro that may be used in the process of creating industrial plant deliverables. The database **Plant Exercise_Day2.imp**, located on the CD, is provided for use with this Section. Building on the work performed in Section I on Hiding and Clipping point clouds (section views and slices), you will also learn how to:

- Use CloudWorx viewing tools to prepare AutoCAD files for piping
- Grow pipes from the point cloud
- Connect pipes
- Perform interference checking of design objects against the point cloud

Configure Database / Load ModelSpace

Save the **Plant Exercise_Day2.imp** database file, located on the *Cyclone* CD, to your hard drive under **C:\Program Files\Leica Geosystems\Cyclone\Databases**. Refer to **Section I** of these tutorials and review how to configure the database and load the ModelSpace highlighted in *Figure 1*.

1. Create a **new drawing**; units to be **English** (feet and inches).
2. Set up two viewports in AutoCAD to see the data from the top and front view.
3. Configure the database **Plant Exercise_Day2.imp** (see Section I: CloudWorx Basic).
4. Load the highlighted ModelSpace View (see Section I: CloudWorx Basic).

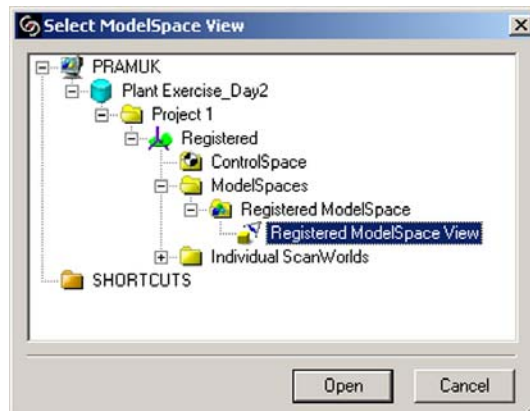


Figure 1.

9. The coordinate system to load is the only one available, "(Default)(current)". This coordinate system has been previously set with the +Z axis defining the "up" direction.
10. In the **Open ModelSpace View** dialog, change the distance units to **Inches**.
11. Zoom extents

Viewing tools

HideRegions

Using the front and top view, hide the points that exist outside of the rectangular extents of the plant.

1. Activate **Front View**. Manipulate it (zoom and pan) to obtain a good viewpoint to be able to draw a rectangular fence around the rectangular extents of the plant.
2. Select **CloudWorx | Hide/Restore Point Cloud | Hide Outside**
3. Define a rectangular fence encompassing the rectangular shape of the plant. Exclude any extraneous data.
4. Repeat steps 1-3 in the Top viewport.

Create Limit boxes

1. View the plant from an isometric view as shown in *Figure 2*.
2. Select **CloudWorx | Clip Point Cloud | Limit Box**
3. Select a point representing one corner of the desired 3D limit box; use the point labeled *First pick point* in *Figure 3*.
4. Select point representing opposite corner of desired limit box; use the point labeled *Second pick point* in *Figure 3*.

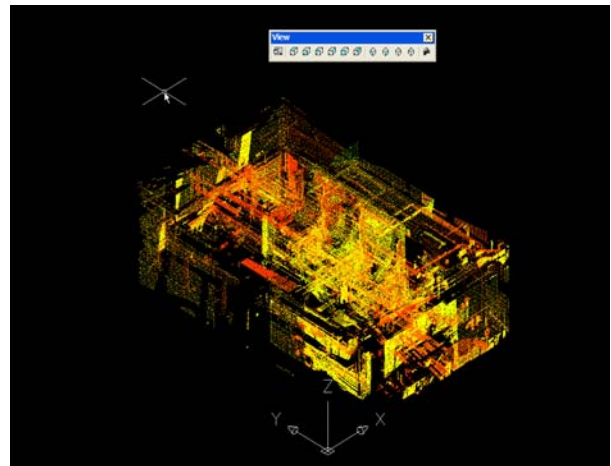


Figure 2.

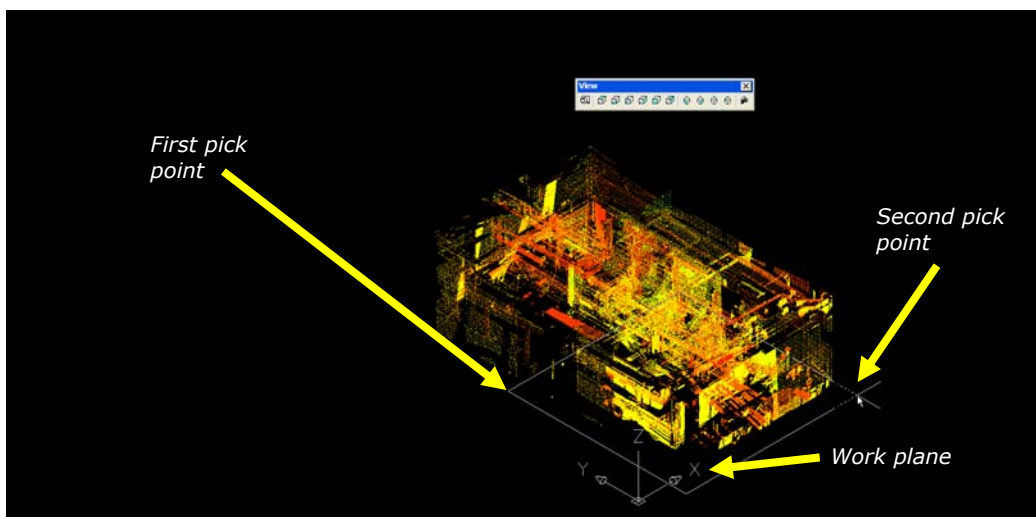


Figure 3.

5. Position the crosshair and select a point to determine the height of the limit box.
6. Points outside the boundaries of the box are hidden from view; your screen should resemble *Figure 4*.

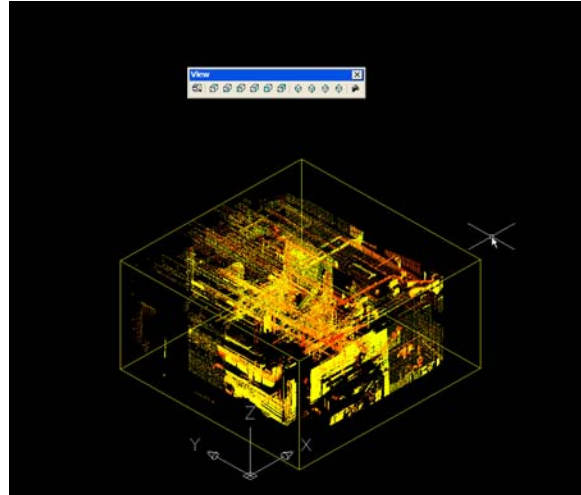


Figure 4.

7. To turn off or create additional limit boxes, select **CloudWorx | Clip Point Cloud | Limit Box Manager**. The new limit box shown is the one you just created. Un-check **Enable Limit box**, then click **OK** to turn off the limit box, revealing the points previously hidden.

Point Clipping



Point Clipping can be used to create several slices along the length of the plant's warehouse and to isolate several of the repeated bays. For this section, only two slices are needed.

1. Make the Top viewport active.
2. Select **CloudWorx | Clip Point Cloud | Slice | Y axis**
3. Specify the parallel extents of the slice with two left mouse clicks. The slice should be in the approximate area highlighted in *Figure 5*.

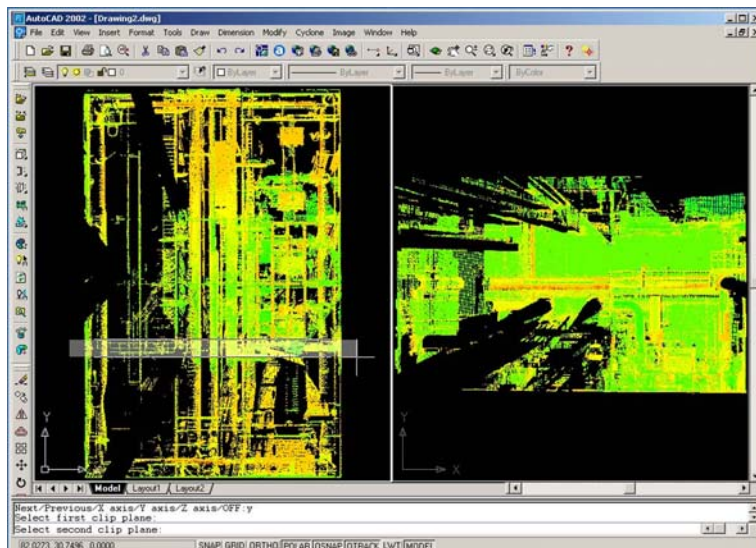


Figure 5.

Next, create the plane view slice:

1. Make the Front viewport active.
2. Select **CloudWorx | Clip Point Cloud | Cutplane Manager**
3. In **Cutplane Manager**, click **New** to make a new slice named "Slice 1_copy"
4. Rename "Slice 1_copy" to "Plane Slice".
5. Make "Plane Slice" the current cutplane.
6. Uncheck the **Show** checkmark disable this new slice, displaying all points.
7. Select **CloudWorx | Clip Point Cloud | Slice | Y axis**
8. Specify parallel extents of the slice with two mouse clicks in the Front viewport. The slice should be in the approximate area highlighted in *Figure 6*.



Figure 6.

Layers

When a ModelSpace View is loaded into CloudWorx, the layers in that ModelSpace View are mapped into AutoCAD's **Layer Properties Manager**, preceded by a "~". To see this, open the **Layer Properties Manager**. Notice the layer named "~Default". This is the layer that the clouds belong to, and it behaves just as any AutoCAD layer does. To open and create layers:

1. In the **Layer Properties Manager**, click **New**
2. Name the layer "**Slice 1**" and press **Enter**
3. Make it current by clicking the **Current** button.
4. Click **OK** in the **Layer Properties Manager**. The modeled centerlines that will be created in the next section will automatically be assigned to the layer named "Slice 1"

Fit Pipes



In this section, you will create pipe centerlines. From these pipe centerlines, distances can be measured and dimensions added. CloudWorx is able to fit a cylinder object to a point cloud or multiple clouds based on a pick point or fence. This can be used to generate a piping run centerline, or to obtain a tie-point coordinate. You have three options when fitting a pipe to the point clouds:

- Cylindrical cone object (ACIS solid)
- Centerline (line or line string)
- Attach a Diameter Annotation

Create Pipe from pick point

1. Make the Top viewport active.
2. With the "Plane Slice" cutplane still active, zoom in on the area indicated by an arrow below in *Figure 7*.

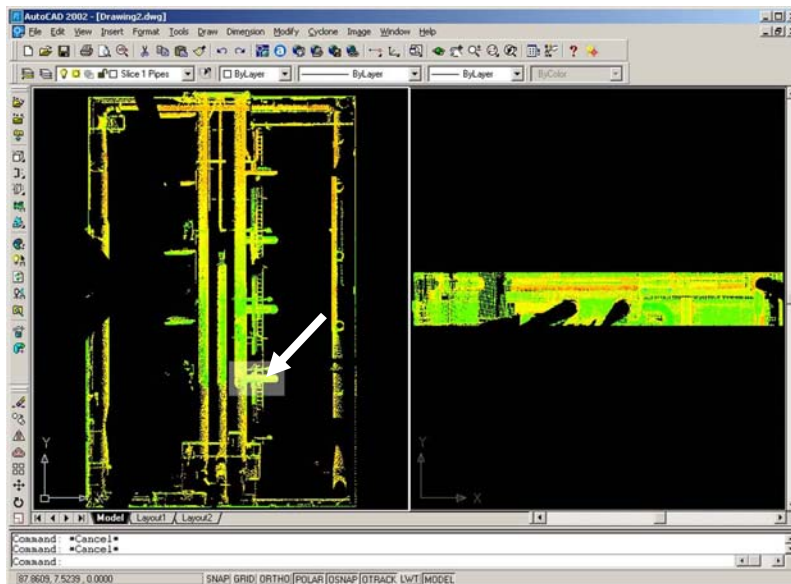


Figure 7.

3. To display more points, Select **CloudWorx | Regenerate Point Cloud**
4. Select **CloudWorx | Clip Point Cloud | Cutplane Manager**
5. Highlight "Plane Slice"
6. Click **Set Current**
7. Click the **OK** button.
8. Make the Front viewport active.
9. Zoom in to the main piping structures, as in *Figure 8*.
10. Select **CloudWorx | Fit Point Cloud | Pipes**
11. In the **Fit Pipes** dialog, check the **Centerline** option, then click **Pick Points>>**

CloudWorx 3.2 Pro Tutorial – Section II
High-Definition Surveying

12. Snap to a node on the point cloud to serve as the “seed point”, for example, see *Figure 8*. A cylinder will be “grown” from this pick point.

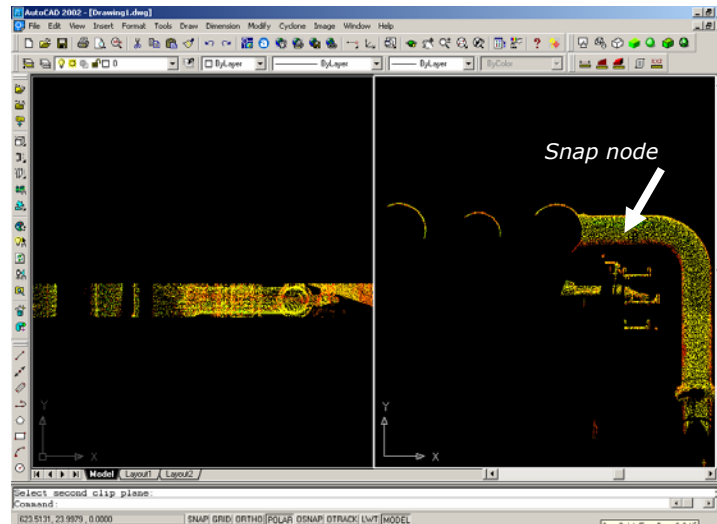


Figure 8.

Fit Pipe Centerline from Fence

1. Make the Front viewport active.
2. Select **CloudWorx | Fit Point Cloud | Pipes**
3. In the **Fit Pipes** dialog, check the **Centerline** option, then click **Fence>>**
4. Type “P” at the command prompt to make a polygonal fence, then press **Enter**
5. Define the polygonal fence’s shape by selecting all of the points that will be used in the fit. See *Figure 9*.

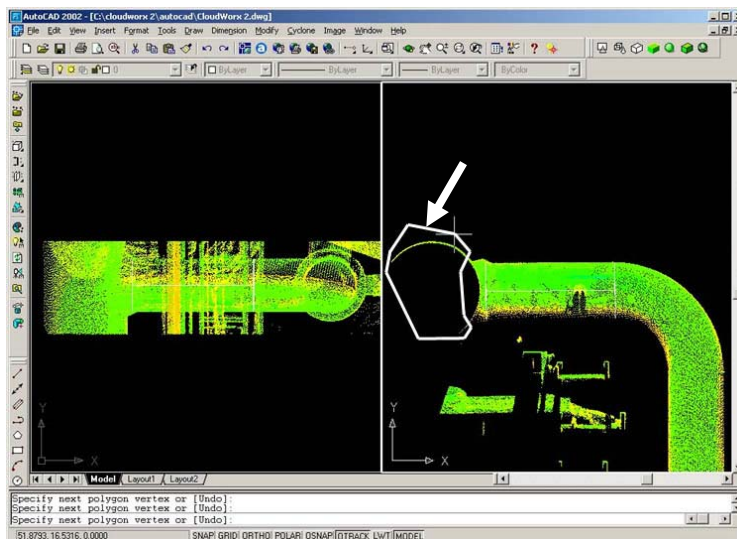


Figure 9.

6. Right-mouse button click and select **Enter**. The pipe will be fit based on the points that lie on the inside of the fence.
7. Pan the Front viewport a little to the right to see the points that represent the vertical pipe connecting to the horizontal pipe just fit.
8. Fit the vertical pipe perpendicular to the first pipe using either the fence or pick method.

View newly created piping only

1. Click **CloudWorx | Snap/Visibility...**
2. Make a check next to the "Hide all point clouds" option. Click **OK**. None of the point clouds will be visible.

Connect pipes

This connects two intersecting centerlines (e.g., at an elbow) to each another.

1. Select **CloudWorx | Snap/Visibility...**
2. Uncheck the "Hide all point clouds" option.
3. Select **CloudWorx | Fit Point Cloud | Connect Pipes**
4. Select the **Centerline** option, then click **Pick Pipes>>**
5. Pick both centerline objects, then right-click. The intersection of both centerlines is calculated and a new centerline object is created.

Interference Check

The following section discusses performing Interference Checks with an actual drawing and point clouds directly in AutoCAD.

1. Copy, then open the file **"Proposal A.dwg"** from the CD. See *figure 10*.
2. Load the point cloud as discussed in the previous sections. Select **"Inches (US Survey)"** for units.

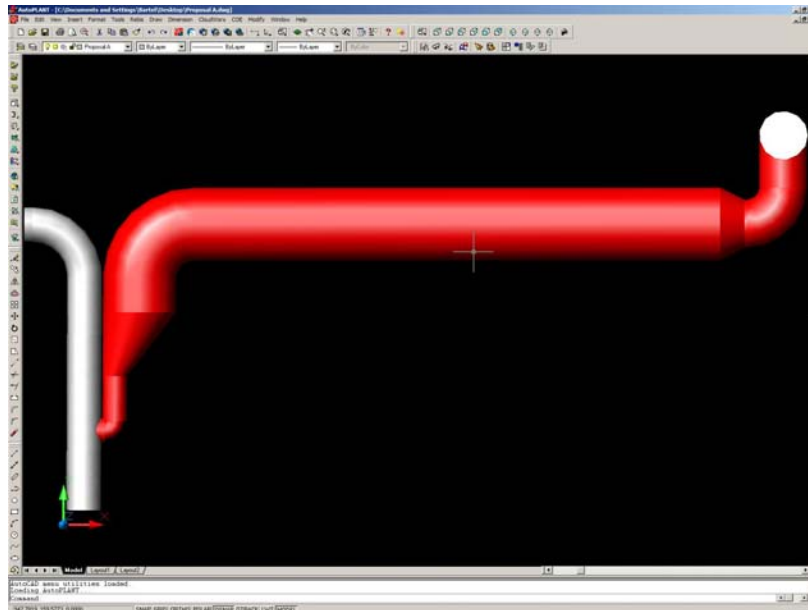


Figure 10.

3. Hide the Regions displayed in *Figures 11 and 12*. Use the "Hide Points Outside" tool for this.



Figure 11.

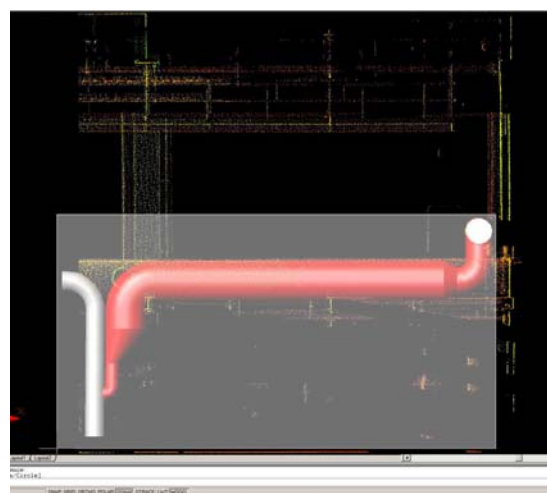


Figure 12.

4. Select **CloudWorx | Interference | Interference Check...**

CloudWorx 3.2 Pro Tutorial – Section II
High-Definition Surveying

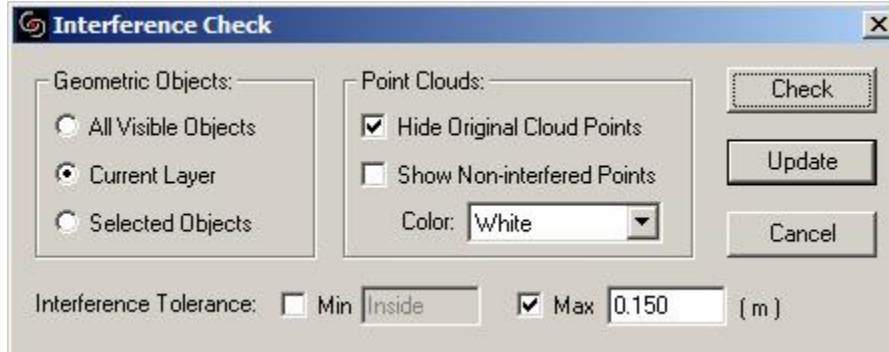
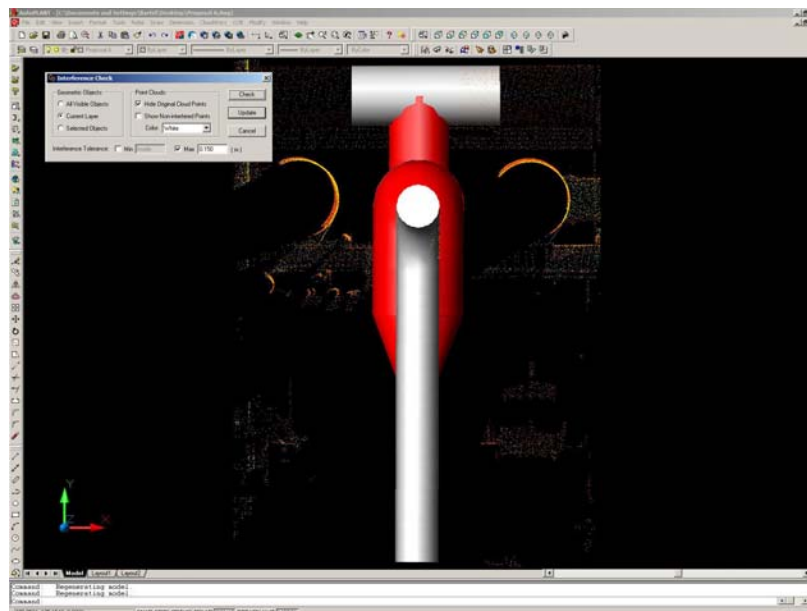


Figure 12.

5. Check the **Hide Original Cloud Points** option; this helps you focus only on the interfering points by hiding all non-interfering points.
6. Set the maximum **Interference Tolerance** to “0.15m” and click the **Check** button. The interfering points are displayed in white.
7. Re-route the pipes so that they no longer interfere against the as-built point clouds.



- ☐ When delivering a DWG file created using CloudWorx to an end-user who does not have CloudWorx, you should first “purge” the DWG to remove all references to CloudWorx objects that may be stored in the DWG. To do this, select **CloudWorx | Purge**, then save the DWG with a different filename.
- ☐ When delivering a DWG file with an IMP database to an end-user, the end-user will need to configure the database on their computer before the clouds can be loaded. When loading the DWG file, CloudWorx looks for the database name stored in the DWG on the local SERVER.