Point Cloud Tools

User manual for the PointCloudSolutions plugin suite for AutoCAD

Software version 1.6.2 | Manual revision 3, 30 July 2026 | 3D Solution

Point Cloud Tools turns a laser scan into usable AutoCAD geometry. You attach a point cloud, isolate the part you want to see, and then trace pipes, steel profiles and concrete directly on the points — or run an automatic floor flatness or volume analysis on them.

The suite consists of five modules that install together and appear as separate ribbon tabs in AutoCAD. Base Tools is free; the other four modules are unlocked per module with a licence key. This manual describes every ribbon button, the command behind it, and the working method for each tool.

Contents

1. About this manual

This manual describes PointCloudSolutions version 1.6.2 and was written from the shipping software itself, so the button names, panel names and command names below are exactly what you see on your screen.

How to read the tables

Every module chapter starts with a table of its ribbon panels and buttons. The columns are the icon as it appears on the ribbon, the button label, the AutoCAD command behind it, and what the button does. You can always type the command on the AutoCAD command line instead of clicking the button — the result is identical.

A button marked with (licence) only works when a valid licence or an active trial is present. Without one, a registration window appears offering to open the registration dialog.

Conventions

- Commands are shown in capitals, for example 3DS_B_ATTACH. Type them on the command line and press Enter or Space.
- All dimensions are in millimetres unless stated otherwise. Volume analysis works in the units of your drawing; for cubic metres the drawing must be in metres.
- Where the software asks a question on the command line, the default answer is shown between angle brackets, and pressing Enter accepts it.

Prices and availability

This manual deliberately contains no prices. Module prices, bundles and renewal rates change, and the current list is always on 3d-solution.shop. That way the manual stays valid when the price list changes.

2. System requirements and installation

System requirements

- AutoCAD for Windows, 64-bit. The plugin is built against the AutoCAD .NET API and loads into the full desktop version; AutoCAD LT does not support plugins and cannot run it.
- Windows 64-bit. There is no 32-bit build.
- A graphics card and amount of RAM sufficient for the point cloud you want to work with. Point cloud display is handled by AutoCAD itself, so if your scan already displays smoothly in AutoCAD, the plugin will keep up.
- For Volume Analysis and Floor Analysis: enough working memory for the grid. Large scans with a small cell size use a lot of memory; increase the cell size if you run into it.

Administrator rights are not required. The installer writes to your own user profile only.

Installing

1. Close AutoCAD.
2. Run PointCloudSolutions_Setup.exe. The installer is code-signed by 3D Solution.
3. Accept the licence agreement and confirm the installation. No options need to be chosen — all five modules are installed together.
4. Start AutoCAD. The plugin loads automatically; the Point Cloud Tools tab appears on the ribbon by itself.
5. Type REGISTER on the command line to enter a licence key or to start the free 30-day trial.

What gets installed where

The plugin installs as an AutoCAD application bundle in your own profile, which is why it loads without any manual NETLOAD and without administrator rights:

- The bundle folder: %APPDATA%\Autodesk\ApplicationPlugins\PointCloudSolutions.bundle
- Five module libraries in the Contents subfolder: PointCloudSolutions.dll (Base Tools), PointCloudPiping.dll, PointCloudConstruct.dll, PointCloudSolutions.FloorAnalysis.dll and PointCloudVolumeAnalysis.dll, plus the MathNet.Numerics maths library and the 3ds_slice.lsp LISP helper.
- The steel profile database: %USERPROFILE%\3DS_Data\Profiles.csv. Construct reads this file to recognise profiles. You may extend it with your own profiles; keep a copy elsewhere, because the folder is removed when you uninstall.
- Your licence and settings: registry key HKEY_CURRENT_USER\Software\3DSolution\PointCloudTools.

Updating

Install the new version over the old one; the installer replaces the module libraries. Your licence stays valid because it lives in the registry, not in the program folder. Close AutoCAD before updating, otherwise the libraries are in use and cannot be replaced.

Uninstalling

Uninstall PointCloudSolutions through Windows Settings or Control Panel. This removes the bundle, the registry key with your licence, and the 3DS_Data folder including Profiles.csv. Back up your own profile additions first.

If the ribbon does not appear

- Check that AutoCAD was restarted after installation. The plugin only loads at start-up.
- Check that you are running the 64-bit full version of AutoCAD, not LT.
- Type REGISTER. If the registration window opens, the plugin is loaded and the tab is simply hidden — right-click the ribbon and check Show Tabs.
- The tabs of licensed modules are only built after the licence check has completed. On a slow start-up this can take a few seconds.

3. Licence and activation

Base Tools is free and stays usable without a licence, apart from four functions listed below. Piping, Construct, Floor Analysis and Volume Analysis need their own licence, which can be bought individually or as a bundle.

Starting the free trial

1. Type REGISTER on the AutoCAD command line.
2. Choose the trial option. The trial runs for 30 days from that moment and unlocks all modules.
3. When the trial has expired, the paid modules stop responding; Base Tools keeps working.

The trial can be started once per computer. Reinstalling does not reset it.

Entering a licence key

1. Type REGISTER.
2. Enter the licence key you received by e-mail, together with the e-mail address the licence was issued to.
3. Confirm. The modules covered by the key become available immediately; if a tab is missing, restart AutoCAD once.

How the licence is bound

A licence is tied to one computer. The plugin derives a computer identifier from Windows and stores it with the licence key in your own registry hive. This means the licence follows your Windows user account on that machine, not a network account or a dongle.

Because the identifier is machine-bound, a new PC needs the licence to be released and reissued. Send the request to info@3d-solution.nl with your licence key and the reason.

Checking the licence status

Open Plugin Info on the Point Cloud Tools tab and go to the License Status tab. It shows the status, the licence type, the expiry date and the e-mail address the licence was issued to, and then one line per module — Basic Tools, Piping, Construct, Floor Analysis and Volume Analysis — so you can see exactly which modules are unlocked.

Functions in Base Tools that need a licence

Four functions in the otherwise free Base Tools module are only available with a valid licence or an active trial:

- Smart Slice (3DS_B_SLICE_PICK)
- Show Scan Positions (3DS_B_SCANPOS)
- Create Plane (3DS_B_PLANE)
- Support Portal (the ticket portal link on the Plugin Info panel)

Clicking one of these without a licence opens a window explaining that registration is required, with a button that takes you straight to the registration dialog.

Renewal

A licence includes a period of updates and support. When that period ends, the software you have keeps working; new versions require a renewal. Renewal rates are on 3d-solution.shop.

4. The ribbon

Each module adds its own tab to the AutoCAD ribbon. The tabs always appear in the same order, whichever module happens to load first, so the layout does not shift between sessions:

Tab	Module	What it is for
Point Cloud Tools	`Base Tools`	Attaching, viewing and isolating point clouds. Free.
Point Cloud Piping	`Piping`	Modelling pipes, bends, reducers, T-joints, flanges and valves.
Point Cloud Construct	`Construct`	Modelling steel profiles and concrete beams and columns.
Floor Analysis	`Floor Analysis`	Floor flatness and levelness to DIN 18202, ASTM E1155 and TR34.
Volume Analyse	`Volume Analysis`	Cut and fill volumes and heatmaps from a point file.

A tab for a module you have no licence for is not built at all, so an unlicensed installation shows only the tabs you can actually use.

Working with the tabs together

The modules are separate licences but one program. A typical job runs left to right across the ribbon: attach and clean up the scan on Point Cloud Tools, then move to Piping or Construct to trace geometry on the isolated points, and use the analysis tabs where the job calls for measurement rather than modelling.

Every module has its own Plugin Info button on the right-hand end of its tab. Each one contains a short built-in manual for that module, so the reference is always available inside AutoCAD.

5. Point Cloud Tools (Base Tools)

Base Tools is the foundation of the suite and is free. It attaches the scan, gives you control over what is visible, and provides the reference planes and sections that the modelling modules build on.

Ribbon panels and buttons

Panel: Point Clouds

	Button	Command	Function
	Attach RCP	3DS_B_ATTACH	Attach a ReCap point cloud (.rcp or .rcs) to the drawing. You choose the file, the insertion point, the scale and the rotation.
	Point Cloud Manager	POINTCLOUDMANAGER	Overview window of all attached point clouds. Toggle visibility, select a cloud, detach it, or double-click it to zoom to it.
	ON/OFF Point Cloud	3DS_B_PC_TOGGLE	Show or hide the point cloud in one click, without detaching it.
	Show Scan Positions (licence)	3DS_B_SCANPOS	Place a 3D sphere at every scanner position, so you can see where the scanner stood and judge the coverage of the survey.

Panel: Smart Slice

	Button	Command	Function
	Smart Slice (licence)	3DS_B_SLICE_PICK	Cut a horizontal slice out of the cloud at a height you pick on screen. You enter the slice thickness first.
	Up	3DS_B_SLICEUP	Move the active slice up by one slice thickness.
	Down	3DS_B_SLICEDOWN	Move the active slice down by one slice thickness.
	Clear	3DS_B_SLICECLEAR	Remove the slice and show the whole cloud again.

Panel: Crop Box

	Button	Command	Function
	Crop Box	POINTCLOUDCROP	Crop the cloud to a rectangular region. Select the point cloud manually before starting the command.
	Remove all Crops	3DS_B_UNCROP	Undo every crop at once and show the complete cloud.
	Polygonal Crop	3DS_B_CROP_POLY	Crop to a free polygon instead of a rectangle. Pick the corner points and press Enter to close the shape.

Panel: Clipping Box

	Button	Command	Function
	Clipping Box	3DS_B_CLIPBOX	Place a three-dimensional box around the part of the scan you want to work on. Everything outside the box is hidden. The box has grips, so you can adjust it afterwards.

Panel: Extract Section

	Button	Command	Function
	Extract Section	3DS_B_SECTION	Place a section plane through the cloud.
	Move Section	MOVE	Move the section plane with the standard AutoCAD MOVE command.
	Section Lines	3DS_B_SECTION_NOW	Extract the 2D linework at the current position of the section plane, for use as a drawing base.

Panel: Reference Planes

	Button	Command	Function
	Create Plane (licence)	3DS_B_PLANE	Create a reference plane through three points you pick on the cloud. The plane is drawn on the REFERENCE_PLANE layer.
	UCS to Plane	3DS_B_UCS_PLANE	Align the drawing coordinate system with a reference plane, so you can draw flat on a sloping or rotated surface.
	UCS to Last	3DS_B_UCS_LAST	Switch between the last two planes used. Handy when you are working alternately on two faces.
	UCS to World	3DS_B_UCS_WORLD	Return the coordinate system to the world system.
	Delete Planes	3DS_B_PLANE_CLEAR	Delete all reference planes.
	ON/OFF Planes	3DS_B_PLANE_TOGGLE	Show or hide the reference planes without deleting them.

Panel: Plugin Info

	Button	Command	Function
	Plugin Info	3DS_B_INFO	Information window with three tabs: plugin information, the built-in manual, and the licence status per module.
	FAQ	opens the website	Frequently asked questions on 3d-solution.nl.
	Training	opens the website	Instruction videos on 3d-solution.shop.
	Support Portal (licence)	opens the website	Ticket portal for support requests.

Attaching a point cloud

1. Click Attach RCP or type 3DS_B_ATTACH.
2. Browse to your .rcp or .rcs file. An .rcp is a ReCap project with one or more scans; an .rcs is a single scan.
3. Give the insertion point, the scale and the rotation. If the scan is already georeferenced or set up on the correct coordinates, accept the defaults.
4. Use Point Cloud Manager to check that the cloud is attached and visible.

If the cloud does not appear, zoom to the drawing extents with ZOOM E. A scan on real-world coordinates often lands far away from the drawing origin.

Point Cloud Manager

1. Click Point Cloud Manager or type POINTCLOUDMANAGER.
2. The window lists all point clouds attached to the drawing.
3. Per cloud you can switch visibility on and off, select the cloud for a following command, or detach it from the drawing.
4. Double-click a cloud to zoom to it.

Point Cloud Manager is the fastest way to select a cloud for commands that need a selection, such as Crop Box.

Smart Slice

Smart Slice shows a horizontal band out of the scan. This is the tool you use to draw a floor plan: set a band at the right height and you see the walls cut through, without anything above or below in the way.

1. Click Smart Slice or type 3DS_B_SLICE_PICK.
2. Enter the thickness of the slice. The default is 200 mm; a thinner slice gives a sharper cut, a thicker one shows more context.
3. Click a point on the cloud at the height you want the slice. The slice is created around that height.
4. Use Up and Down to shift the slice by one thickness at a time — going up floor by floor, for example.
5. Clear removes the slice and brings the whole cloud back.

Clipping Box

1. Click Clipping Box or type 3DS_B_CLIPBOX.
2. Pick two opposite corners of the area you want to keep.
3. Everything outside the box disappears from view.
4. The box has grips: select it and drag a grip to enlarge, shrink or move the box.

Use the Clipping Box when you want to isolate a room or a piece of installation in all three directions. Use Smart Slice when only the height matters.

Crop Box and Polygonal Crop

1. Select the point cloud first. The Crop Box command needs a cloud that is already selected.
2. Click Crop Box or type POINTCLOUDCROP.
3. Define the rectangular region to keep.
4. For an irregular shape, use Polygonal Crop (3DS_B_CROP_POLY) instead: pick the corner points of the polygon and press Enter to complete it.
5. Remove all Crops (3DS_B_UNCROP) undoes every crop in one go.

Extract Section

Extract Section converts a cut through the cloud into real 2D lines you can dimension and draw on.

1. Click Extract Section or type 3DS_B_SECTION to place the section plane.
2. Position the plane where you want the section. Move Section moves it with the standard MOVE command.
3. Click Section Lines (3DS_B_SECTION_NOW) to extract the linework at the current position.
4. Repeat for each section you need. The plane can stay in place; you extract at every position you want.

Reference planes and the UCS

Scans are rarely aligned with the world coordinate system. A wall runs at an angle, a roof slopes, a vessel stands askew. Reference planes solve this: create a plane on the surface, set the UCS to it, and you draw flat on that surface.

1. Click Create Plane or type 3DS_B_PLANE.
2. Pick three points on the surface in the cloud. Three points define the plane, so pick them well apart from each other for the best accuracy.
3. The plane is drawn on the REFERENCE_PLANE layer.
4. Click UCS to Plane (3DS_B_UCS_PLANE) to align the coordinate system with the plane. Drawing, orthogonal snap and hatching now follow the surface.
5. UCS to Last (3DS_B_UCS_LAST) switches back and forth between the last two planes, for working on two faces alternately.
6. UCS to World (3DS_B_UCS_WORLD) returns to the world coordinate system when you are done.
7. Delete Planes (3DS_B_PLANE_CLEAR) removes the planes; ONN/OFF Planes (3DS_B_PLANE_TOGGLE) only hides them.

Show Scan Positions

1. Click Show Scan Positions or type 3DS_B_SCANPOS.
2. A 3D sphere is placed at each scanner position recorded in the ReCap project.

This tells you how the survey was made: where there are many positions the coverage is dense and the geometry reliable; areas far from every position have been scanned at an angle and from a distance, and are less accurate. Use it to judge whether a part of the scan is good enough to model on, and to see where an extra scan position would be needed.

Training videos

Short instruction videos for this module. Click a link to open the video on YouTube; the Training button in the Plugin Info panel opens the overview page with all videos in one place.

- Smart Slice — https://youtu.be/TYFEDheLPHU
- Crop — https://youtu.be/GgipG-n9wts
- Reference planes — https://youtu.be/TQU5KA1mEJM
- All training videos on one page — https://3d-solution.shop/pages/training-videos

6. Point Cloud Piping

Piping models pipework directly on the scan. You indicate points on the surface of the pipe in the cloud and the module calculates the diameter and the axis from them, then draws a solid pipe with a centreline. Bends, reducers, T-joints, flanges and valves connect to it and adjust the connected pipes automatically.

Ribbon panels and buttons

Panel: Piping

	Button	Command	Function
	Piping	3DS_P_PIPE	Draw a straight pipe from points on the point cloud.
	Bend	3DS_P_BEND	Place a bend between two pipes and shorten them to fit.
	Reducer	3DS_P_REDUCER	Place a reducer between two pipes of different diameter.
	T-Joint	3DS_P_TJOINT	Connect a branch pipe to a main pipe as a T-joint or a Y-joint.
	Segment Bend	3DS_P_SEGMENTBEND	Place a segmented bend, built up from straight segments.

Panel: Flange / Valve

	Button	Command	Function
	Flange (drop-down)	3DS_P_FLANGE	Flange pair. The drop-down also holds Single Flange (3DS_P_SFLANGE) and Expansion Joint (3DS_P_EXPJOINT).
	Valve (drop-down)	3DS_P_VALVE	Valve. The drop-down holds Butterfly (3DS_P_BVALVE), Gate (3DS_P_GVALVE), Check (3DS_P_CVALVE) and Safety valve (3DS_P_SVALVE).
	Copy	COPY	Copy a component with the standard AutoCAD command; the pipe data travels with it.
	Move	3DS_P_FLANGEMOVE	Move a flange or valve along the pipe.
	Delete	3DS_P_FLANGEDEL	Delete a flange or valve and close the pipe again.

Panel: Edit

	Button	Command	Function
	Pipe Press/Pull	3DS_P_EDIT	Lengthen or shorten a pipe by dragging the end.
	Pipe Diameters	3DS_P_SYNC_DIAMETER	Set several pipes to the same diameter at once.
	Grip Edit	3DS_P_GRIP_EDIT	Edit a pipe by its grip points.
	Split Pipe	3DS_P_SPLITPIPE	Split a pipe into two parts at two split points.
	Join Pipe	3DS_P_JOIN	Join two collinear pipes into one.
	Align Pipe	3DS_P_ALIGN	Align a pipe with the X, Y or Z axis without changing its length.

Panel: Layer Controls and Piping Info

	Button	Command	Function
	ON/OFF 3D Piping	3DS_P_LAYER_3D	Show or hide the 3D pipe layer.
	ON/OFF Point Cloud	3DS_P_LAYER_PC	Show or hide the point cloud.
	Piping List	3DS_P_LIST	List of all pipe components with diameters and connected runs; export to CSV.
	Plugin Info	3DS_P_INFO	Information window with the built-in Piping manual.

Drawing a straight pipe

The module derives the diameter from the points you pick, so the pipe follows the scan instead of a value you type in.

1. Click Piping or type 3DS_P_PIPE.
2. Pick three points on the front face of the pipe, spread around the circumference. From these three points the software calculates the circle and therefore the diameter and the centre.
3. Pick three points on the far end of the pipe in the same way.
4. The pipe is drawn between the two calculated centres. The diameter used is the average of the two measured diameters, which cancels out small measurement differences.

Pick the three points well apart from each other, roughly a third of the circumference each. Three points close together give a circle that is mathematically correct but very sensitive to scan noise.

Bends

1. Draw the two pipes that need to meet, each in its own direction. They do not need to touch.
2. Click Bend or type 3DS_P_BEND.
3. Select the two pipes.
4. Choose the bend factor: 1.0, 1.5 or 2.0 times the diameter. The default is 1.5 D, which corresponds to a standard long-radius bend.
5. The bend is placed and both pipes are automatically shortened to the start of the bend, so no material overlaps.

Segment Bend (3DS_P_SEGMENTBEND) does the same for a bend made of straight segments, as found in large-diameter ducting. Choose the number of segments, from three to five.

Reducers

1. Draw both pipes with their own diameter.
2. Click Reducer or type 3DS_P_REDUCER.
3. Select the two pipes. The reducer is created as a loft between the two diameters.

The pipes themselves are left unchanged, so you can adjust the reducer or delete it without having to redraw the pipes.

T-joints and Y-joints

1. Draw the main pipe and the branch pipe.
2. Click T-Joint or type 3DS_P_TJOINT.
3. Select the main pipe first, then the branch.

4. Enter the extension factor E, between 0.1 and 0.5. The default of 0.25 works for most fittings; it determines how far the branch runs into the main pipe.

The branch diameter must be equal to or smaller than the main pipe diameter. At an angle of 75 degrees or more the module creates a T-joint; below 75 degrees it creates a Y-joint.

Flanges, expansion joints and valves

1. Click Flange (3DS_P_FLANGE) for a flange pair, or open the drop-down for Single Flange (3DS_P_SFLANGE) or Expansion Joint (3DS_P_EXPJOINT).
2. Select the pipe and indicate the position.
3. For valves, use the Valve drop-down and choose the type: standard, butterfly, gate, check or safety valve.
4. Move Flange (3DS_P_FLANGEMOVE) moves a placed component along the pipe; Delete (3DS_P_FLANGEDEL) removes it and closes the pipe again.

Editing pipes

- Pipe Press/Pull (3DS_P_EDIT) lengthens or shortens a pipe by dragging the end face, the same way you would push and pull a solid.
- Split Pipe (3DS_P_SPLITPIPE) cuts a pipe in two. You indicate two split points and preview circles show where the cut lands before you confirm.
- Join Pipe (3DS_P_JOIN) merges two pipes into one. They must lie on the same axis; if the diameters differ you get a warning, because joining them means choosing one diameter.
- Pipe Diameters (3DS_P_SYNC_DIAMETER) sets a whole run to the same diameter at once, which is useful after modelling a run from a noisy scan where each measurement came out slightly different.
- Align Pipe (3DS_P_ALIGN) straightens a pipe onto an axis. Pick the end that stays fixed, choose X, Y or Z, and the pipe rotates onto that axis with its length unchanged.
- Grip Edit (3DS_P_GRIP_EDIT) edits a pipe by its grips: one at each end and one in the middle.

Pipes keep their data through COPY and MOVE, so a copied pipe is still a real pipe in the list and not a plain solid.

The piping list

1. Click Piping List or type 3DS_P_LIST.
2. The first tab lists every component with its diameter and dimensions.
3. The second tab shows the connected runs, so you can see which components form one chain.
4. Double-click a row to zoom to that component in the drawing.
5. Export the list to CSV for use in a spreadsheet or a bill of materials.

Output

Piping draws 3D solids on the 3D_PIPING layer. No 2D lines are drawn; the layer is created automatically. Use ON/OFF 3D Piping and ON/OFF Point Cloud to switch between checking your model against the scan and viewing the model on its own.

2D and P&ID

Under development — test purposes only.

These commands have no ribbon button; type them on the command line.

3DS_P_CENTERLINE walks over every component you have placed and draws the schematic behind the model: centrelines with the CENTER linetype on the 3DS_PIPE_CENTERLINE layer, and on the 3DS_PIPE_LINESPEC layer one line specification tag per run, valve tags, reducer tags, markers on open ends and flow direction arrows. The line specification is an attribute block in the form diameter-material-number-class, DN100-CS-101-A1 by default; double-click a tag to edit it. Running the command again replaces the centrelines and tags but keeps the specifications you have filled in, because they are stored with the component.

3DS_P_FLOWFLIP turns a flow arrow around. Pick the arrow you want to reverse.

3DS_P_LAYER_2D switches the 2D_CENTERLINE layer on and off, the same way the ON/OFF buttons do for the 3D and point cloud layers.

Training videos

Short instruction videos for this module. Click a link to open the video on YouTube; the Training button in the Plugin Info panel opens the overview page with all videos in one place.

- Piping — https://youtu.be/yacu9dPWA_Q
- Bend — https://youtu.be/7-44DS6GbpY
- Segment bend — https://youtu.be/4eRSTtDxYGo
- T-joint — https://youtu.be/rIKiw7hGA30
- Reducer — https://youtu.be/mfZSNcoJS2M
- Grip Edit — https://youtu.be/NIkmN41WmUw
- Press / Pull and diameters — https://youtu.be/4SkEB6nW9DE
- Piping list — https://youtu.be/fBrBvtIurZQ
- PCF export — https://youtu.be/HHpCtkw9Kag
- All training videos on one page — https://3d-solution.shop/pages/training-videos

7. Point Cloud Construct

Construct models steel profiles and concrete elements on the scan. You click the corners of the profile in the cloud, the module measures the dimensions and searches the profile database for the matching standard profile, and then draws it as a solid.

Ribbon panels and buttons

Panel: Steel Profiles

	Button	Command	Function
	H/I Profiles 3D	3DS_C_HI_PROFILE	H and I profiles, such as HEA, HEB and IPE.
	U Profiles	3DS_C_U_PROFILE	U and channel profiles.
	L Profiles (drop-down)	3DS_C_L_PROFILE	Angle profiles. The drop-down also holds T Profiles (3DS_C_T_PROFILE) and Strip Profiles (3DS_C_STRIP_PROFILE).
	Hollow Section Profiles 3D	3DS_C_KOKER_PROFILE	Square and rectangular hollow sections.
	Round Profiles	3DS_C_CHS_PROFILE	Round hollow sections (CHS).

Panel: Concrete

	Button	Command	Function
	Concrete Profile (rectangular)	3DS_C_RECT_CONCRETE	Rectangular concrete beam or column. Tolerance 10 mm, rounded to steps of 50 mm.
	Concrete Profile (round)	3DS_C_CIRC_CONCRETE	Round concrete column. Tolerance 15 mm.

Panel: Edit

	Button	Command	Function
	Extend To..	3DS_C_EXTEND	Lengthen or shorten a profile up to a point or a face.
	Repeat last Profile	3DS_C_REPEAT	Place the same profile again, with the same size and the same method.
	Resize Profile	3DS_C_RESIZE	Replace a placed profile with a different size.
	Copy	COPY	Copy with the standard AutoCAD command; the profile data travels with it.
	Move	MOVE	Move with the standard AutoCAD command.
	Edit Grip Point	3DS_C_GRIP_EDIT	Edit a profile by its grip points.

Panel: Layer Controls

	Button	Command	Function
	ON/OFF 3D Profiles	3DS_C_LAYER_PROFILES	Show or hide the steel profile layer.
	ON/OFF 3D Concrete	3DS_C_LAYER_CONCRETE	Show or hide the concrete layer.

	Button	Command	Function
	ON/OFF Point Cloud	3DS_C_LAYER_PC	Show or hide the point cloud.
	Profile List	3DS_C_LIST	List of all placed profiles; export to CSV.
	Plugin Info	3DS_C_INFO	Information window with the built-in Construct manual.

The two recognition methods

Every profile command asks which method you want to use. The choice determines how you pick the points, and picking the right one saves a lot of clicking.

STRAIGHT — for profiles that stand upright or lie level (the default; press Enter to accept)

Use this for columns and beams that run along the drawing Z axis. You click the four corners of the profile section, and after the first click the height is locked, so the following clicks cannot slip away in Z. Then you click once more to set the length.

ANGLED — for profiles at any angle in space

Use this for braces, diagonals and anything that runs askew. You pick two points on the near end face and two points on the far end face; the module derives the direction and the section from those four points.

Placing a steel profile

1. Click the button for the profile family you need, for example H/I Profiles 3D.
2. Choose the method: press Enter for STRAIGHT, or choose ANGLED.
3. Click the four corners of the profile in the point cloud.
4. Click to set the length of the profile.
5. The module compares the measured dimensions with the profile database and proposes the closest standard profile. The search tolerance is 5 mm.
6. Correct the proposal if you need to: Smaller and Larger step through the neighbouring sizes in the database, and Rotate turns the profile by 90 degrees.
7. Accept the profile, or press Enter, to place it.

The database is the file Profiles.csv in the 3DS_Data folder in your user profile. You can add your own profiles to it; keep a copy somewhere else, because uninstalling removes the folder.

Placing concrete

1. For a rectangular beam or column, click the rectangular Concrete Profile button (3DS_C_RECT_CONCRETE). The workflow is the same as for steel: four corners and a length. Concrete is measured with a 10 mm tolerance and rounded to steps of 50 mm, because a poured element is never exactly on size.
2. For a round column, click the round Concrete Profile button (3DS_C_CIRC_CONCRETE) and pick three points on the circumference. The tolerance here is 15 mm.

Editing profiles

- Extend To.. (3DS_C_EXTEND) lengthens or shortens a profile. The command asks whether you want to extend to a point or to a face, you can select several profiles at once, and the element under the cursor is highlighted so you can see what you are about to change. The profile data is preserved.
- Resize Profile (3DS_C_RESIZE) swaps a placed profile for another size without redrawing it.

- Repeat last Profile (3DS_C_REPEAT) remembers the profile name, the size and the recognition method of the last profile you placed. When you are modelling a row of identical columns this is much faster than going through the recognition each time.
- Copy and Move use the standard AutoCAD commands. The profile data and the custom grips are preserved, so a copied profile stays a real profile.
- Edit Grip Point (3DS_C_GRIP_EDIT) edits a profile by its grips.

The profile list

1. Click Profile List or type 3DS_C_LIST.
2. The list shows the type and name of each profile, its dimensions, its layer and its drawing handle.
3. Click a column heading to sort, double-click a row to zoom to the profile.
4. Export to CSV for a material list.

Output

Steel profiles are drawn on the 3D_PROFILES layer, concrete on 3D_CONCRETE. Both layers are created automatically.

Training videos

Short instruction videos for this module. Click a link to open the video on YouTube; the Training button in the Plugin Info panel opens the overview page with all videos in one place.

- H/I profiles — https://youtu.be/BgzfV1gYomI
- Angled beam — https://youtu.be/EVx30u0Vk_Y
- U profiles — https://youtu.be/fJlPMv7ZykQ
- Extend To.. — https://youtu.be/uzwjX0nxTZs
- All training videos on one page — https://3d-solution.shop/pages/training-videos

8. Floor Analysis

Floor Analysis measures the flatness and levelness of a floor from a point cloud and tests it against three standards: DIN 18202, ASTM E1155 and TR34. Each standard has its own button, its own report and its own classification, because they measure fundamentally different things.

Note: only the DIN 18202 analysis is finished. The ASTM E1155 and TR34 analyses are still under development and are suitable for test purposes only — do not use their results for acceptance, hand-over or any other decision.

Ribbon panels and buttons

Panel: Analysis

	Button	Command	Function
	DIN 18202 Analysis	`3DS_F_DIN18202`	Analysis to DIN 18202:2013-04 (German standard, tolerance classes Zeile 1 to 4).
	HTML Report	`3DS_F_DIN_HTML`	DIN report as an HTML page, opens in the browser.
	Word Report	`3DS_F_DIN_WORD`	DIN report as a Word document.
	CSV Export	`3DS_F_DIN_CSV`	DIN measurement data as a CSV file.
	ASTM E1155 Analysis	`3DS_F_ASTM`	Analysis to ASTM E1155 (F-numbers FF and FL).
	HTML Report	`3DS_F_REPORT`	ASTM report as an HTML page.
	Word Report	`3DS_F_ASTM_WORD`	ASTM report as a Word document.
	CSV Export	`3DS_F_ASTM_CSV`	ASTM measurement data as a CSV file.
	TR34 Analysis	`3DS_F_TR34`	Analysis to TR34, 4th edition (British standard, classes FM1 to FM4).
	HTML Report	`3DS_F_TR34_HTML`	TR34 report as an HTML page.
	Word Report	`3DS_F_TR34_WORD`	TR34 report as a Word document.
	CSV Export	`3DS_F_TR34_CSV`	TR34 measurement data as a CSV file.

Plugin Info

	Button	Command	Function
	Plugin Info	`3DS_F_INFO`	Information window with the built-in manual and the full tolerance tables for all three standards.

Input and settings

The module reads .pts, .xyz, .e57 and .las files. Export the floor from your scan software as one of these formats, keeping only the floor surface — walls, machines and pallets in the file distort the result.

Before the analysis runs you set the grid spacing and how much of the edge to exclude. Excluding the edge matters: the first few centimetres against a wall are almost always out of tolerance and are not part of the usable floor in any of the three standards. Outliers are filtered automatically, so a few stray points do not fail an otherwise good floor.

Which standard to use

- DIN 18202 is the usual choice for building work in Germany, the Netherlands and Belgium. It measures the deviation under a straightedge over a range of lengths, from 100 mm to 15 metres.
- ASTM E1155 is the standard for warehouse floors, particularly where American specifications apply. It produces two F-numbers: FF for flatness and FL for levelness.
- TR34 is the British standard for warehouse floors with defined traffic, and is the one usually specified for narrow-aisle racking with high-lift trucks.

DIN 18202

DIN 18202 defines four quality levels, referred to as Zeile 1 to Zeile 4, from the most stringent to the most tolerant. The permitted deviation depends on the measurement length. The values in millimetres:

Length	Zeile 1	Zeile 2	Zeile 3	Zeile 4
0.1 m	10	5	2	1
1.0 m	15	8	4	3
4.0 m	20	12	10	9
10.0 m	25	15	12	12
15.0 m	30	20	15	15

For levelness, the permitted deviation from the intended level is 2 mm over 1 m, 10 mm over 4 m, 20 mm over 10 m and 25 mm over 15 m.

The measurement follows the straightedge method: with a straightedge resting on two contact points A and B, the gap at the middle point M is the deviation, calculated as the height at M minus the average of A and B. The analysis uses a base grid of 100 by 100 mm and a measurement grid of 1000 by 1000 mm, with a contact patch of 50 mm diameter, matching the physical measuring equipment the standard describes.

1. Click DIN 18202 Analysis or type 3DS_F_DIN18202.
2. Select the point file and set the grid spacing and edge exclusion.
3. Choose the quality level (Zeile) the floor must meet.
4. The analysis runs and produces a heatmap in the drawing showing where the floor is inside and outside tolerance.
5. Generate the report: HTML for a quick look, Word for a document you can hand over, CSV for the raw measurements.

DIN 18202 has some extra commands without a ribbon button: 3DS_F_DIN_STATUS shows the status of the last analysis, 3DS_F_DIN_CLEAR clears the results, and 3DS_F_DIN_DEBUG and 3DS_F_DIN_VERIFY are diagnostic commands for checking a result.

ASTM E1155

Under development — test purposes only.

ASTM E1155 expresses the floor in two numbers. FF is the flatness number, calculated as 3 divided by the standard deviation of the curvature readings. FL is the levelness number, 12.5 divided by the standard deviation of the elevation differences. A higher number is a better floor.

The method measures curvature over 24-inch (610 mm) intervals and levelness over 10-foot (3048 mm) spans, with readings every 12 inches. A measurement line needs at least 11 readings to be valid, so short lines in a small room may be rejected.

The common classifications:

Class	FF minimum	FL minimum
Superflat, defined traffic	100	50
Superflat	60	40
Very flat	45	35
Flat	35	25
Moderately flat	25	20
Conventional	20	15

1. Click ASTM E1155 Analysis or type 3DS_F_ASTM.
2. Select the point file and set the grid and edge exclusion.
3. The analysis calculates FF and FL and classifies the floor.
4. Generate the report with HTML Report (3DS_F_REPORT), Word Report or CSV Export.

TR34

Under development — test purposes only.

TR34, 4th edition, distinguishes two floor properties. Property E is measured on a 3 metre grid and covers the overall levelness; Property F is measured over 300 mm and covers the local curvature. Results are assessed at the 95th percentile, so a single bad spot does not determine the classification but a consistently poor area does.

The four classes, in millimetres:

Class	Property E	Property F
FM1	3.0	1.5
FM2	5.0	2.5
FM3	8.0	4.0
FM4	12.0	6.0

1. Click TR34 Analysis or type 3DS_F_TR34.
2. Select the point file and set the grid and edge exclusion.
3. The analysis reports Property E and Property F and the resulting FM class.
4. Generate the report with HTML Report, Word Report or CSV Export. 3DS_F_TR34_SVG additionally exports the graph as an SVG drawing.

Reading the results

All three analyses produce a heatmap in the drawing. This is usually more informative than the numbers on their own: a floor that fails its class shows immediately whether the problem is one bad bay, a slope across the whole floor, or scattered local dips. The first can be ground down, the second usually cannot.

The reports contain the tolerance table for the chosen standard alongside your measured values, so the report is self-explanatory to a client who does not know the standard by heart.

Training videos

Short instruction videos for this module. Click a link to open the video on YouTube; the Training button in the Plugin Info panel opens the overview page with all videos in one place.

- DIN 18202 floor analysis — https://youtu.be/iuy_hb_mTcc
- All training videos on one page — https://3d-solution.shop/pages/training-videos

9. Volume Analyse

Volume Analysis calculates cut and fill volumes from a point file and visualises the result as a 3D heatmap. Use it to measure a stockpile, to determine how much soil has been excavated, or to plan the levelling of a site.

Ribbon panel and buttons

Panel: Volume Calculations

	Button	Command	Function
	Volume Analyse	3DS_V_ANALYSE	Start the volume analysis: read the point file, calculate cut and fill, and build the heatmap.
	HTML Report	3DS_V_HTML	Report of the last analysis as an HTML page, opens in the browser.
	Word Report	3DS_V_DOCX	Report of the last analysis as a Word document.
	Info	3DS_V_INFO	Information window with the calculation method, the colour legend and guidance on choosing a reference level.

How the calculation works

The module lays a grid over the point file. Every cell takes the average Z of the points that fall inside it; cells with no points are shown in grey and are left out of the calculation. The volume of a cell is the height difference to the reference level multiplied by the cell area, and the cell volumes are added up:

Volume = (cell Z − reference Z) × cell area

Cells above the reference level count as cut and are positive; cells below it count as fill and are negative. The net volume is cut minus fill, which is what you need to know when levelling a site. The total volume is the absolute cut plus the absolute fill, which is what you need when hiring transport, because soil moved from a high spot to a low spot still has to be moved.

Cell size

The default cell size is 50 mm and can be set between 10 and 1000 mm. In metres, the practical range is:

- 0.3 to 0.5 m for detail work and for smaller stockpiles.
- 0.5 to 1.0 m for speed on a large site.
- 0.8 to 1.5 m when the analysis is slow or runs out of memory.

A smaller cell follows the surface more closely but costs memory and time, and on a sparse scan it produces more empty cells. If the result looks implausible, run the analysis again at two different cell sizes; if the volumes agree closely the grid is fine enough.

Choosing the reference level

The reference level determines what the numbers mean, and it is the setting that most often produces a wrong answer. There are three options:

- Minimum Z takes the lowest point in the file as the reference. This is the right choice for a stockpile on level ground: the cut volume then equals the volume of the heap.
- Average Z takes the average height. Useful when you want to know how much material has to move to level a site with no fixed target height.

- Manual lets you enter a level yourself, for example a datum level or a design level. This is the choice for an excavation, where you compare against the original ground level, and for cut and fill planning, where you compare against the intended level.

Three typical jobs

Measuring a stockpile

Scan the heap including a strip of the surrounding ground, export to a point file, and analyse with the reference at minimum Z. The cut volume is the volume of the heap. Scanning the surrounding ground matters: without it the lowest point lies somewhere on the flank of the heap and the volume comes out too low.

Measuring an excavation

Analyse with a manual reference at the original ground level. The fill volume is the amount excavated.

Cut and fill planning

Analyse with a manual reference at the intended level. Cut is what has to be removed, fill is what has to be brought in, and the net volume tells you whether the job balances or needs import or export.

Running an analysis

1. Click Volume Analyse or type 3DS_V_ANALYSE.
2. Select the point file. PTS is the usual format, with the layout X Y Z, optionally followed by intensity and RGB.
3. Set the cell size.
4. Choose the reference level: minimum, average or manual.
5. Choose whether to create the visualisation. Switch it off for a faster run on a very large file.
6. The result appears as a heatmap in the drawing and the volumes are reported.
7. Generate a report with HTML Report or Word Report.

The colour legend

Cut is shown in warm colours and fill in cool colours, with the intensity of the colour indicating the size of the deviation. Cut runs from yellow through orange to red as the height above the reference grows; fill runs from cyan through blue to dark blue as the depth below it grows. Cells without data are grey.

Accuracy

- For a stockpile, a cell size of 25 to 50 mm is accurate enough; for open terrain, 100 to 200 mm.
- Always scan a strip of the ground around the object, so the reference level is based on real ground and not on the object itself.
- Check that the drawing is in metres if you want the result in cubic metres. A drawing in millimetres gives a number a billion times larger.
- Look at the heatmap for grey cells before you trust the number. Large grey areas mean the scan has holes and the volume there is being ignored.
- If the visualisation does not appear, type ZOOM E to zoom to the drawing extents. Point files on real-world coordinates often land far from the drawing origin.
- If the file gives no points, check the file format: the first three values on each line must be X, Y and Z.

10. Layers used

The modules create their own layers and place their geometry on them. The layers are made automatically the first time they are needed, so you do not have to set anything up. Keeping the geometry separated this way means you can switch the model and the scan on and off independently, and it keeps your own drawing layers untouched.

Layer	Module	Content
REFERENCE_PLANE	Base Tools	Reference planes created with Create Plane.
3D_PIPING	Piping	3D solids of pipes, bends, reducers, T-joints, flanges and valves.
3D_PROFILES	Construct	3D solids of the steel profiles.
3D_CONCRETE	Construct	3D solids of the concrete elements.

Every module has its own layer buttons on its ribbon tab, which switch these layers on and off in one click without going through the layer manager.

Modelled elements carry their own data in the drawing: a pipe knows its diameter, a profile knows its name and size. That data survives copying and moving, which is why a copied pipe still appears in the piping list with the right diameter. If you explode an element, the data is lost and it becomes an ordinary solid.

11. Appendix A — Command reference

Every function can be typed on the AutoCAD command line. Commands are grouped by module; the prefix tells you which module a command belongs to.

General

Command	Function
REGISTER	Enter a licence key or start the free trial.

Base Tools (3DS_B)

Command	Function
3DS_B_ATTACH	Attach a ReCap point cloud.
POINTCLOUDMANAGER	Point Cloud Manager.
3DS_B_PC_TOGGLE	Show or hide the point cloud.
3DS_B_PC_SELECT	Select the point cloud.
3DS_B_PC_HIDE	Hide the point cloud.
3DS_B_SCANPOS	Show scan positions (licence).
3DS_B_SLICE_PICK	Smart Slice (licence).
3DS_B_SLICEUP	Move slice up.
3DS_B_SLICEDOWN	Move slice down.
3DS_B_SLICECLEAR	Remove slice.
3DS_B_CLIPBOX	Clipping Box.
POINTCLOUDCROP	Crop Box.
3DS_B_CROP_POLY	Polygonal crop.
3DS_B_UNCROP	Remove all crops.
3DS_B_CROP_TOGGLE	Show or hide crop reference lines.
3DS_B_CROP_CLEAR	Remove crop reference lines.
3DS_B_CROP_AUTO	Automatic crop.
3DS_B_SECTION	Place section plane.
3DS_B_SECTION_NOW	Extract section lines.
3DS_B_PLANE	Create reference plane (licence).
3DS_B_UCS_PLANE	UCS to plane.
3DS_B_UCS_LAST	UCS to last plane.
3DS_B_UCS_WORLD	UCS to world.
3DS_B_PLANE_CLEAR	Delete reference planes.
3DS_B_PLANE_TOGGLE	Show or hide reference planes.
3DS_B_INFO	Plugin information and built-in manual.

Piping (3DS_P)

Command	Function
3DS_P_PIPE	Straight pipe.
3DS_P_BEND	Bend.
3DS_P_SEGMENTBEND	Segmented bend.
3DS_P_REDUCER	Reducer.
3DS_P_TJOINT	T-joint or Y-joint.
3DS_P_FLANGE	Flange pair.
3DS_P_SFLANGE	Single flange.
3DS_P_EXPJOINT	Expansion joint.
3DS_P_VALVE	Valve.
3DS_P_BVALVE	Butterfly valve.
3DS_P_GVALVE	Gate valve.
3DS_P_CVALVE	Check valve.
3DS_P_SVALVE	Safety valve.
3DS_P_FLANGEMOVE	Move flange or valve.
3DS_P_FLANGEDEL	Delete flange or valve.
3DS_P_EDIT	Pipe press/pull.
3DS_P_SPLITPIPE	Split pipe.
3DS_P_JOIN	Join pipes.
3DS_P_ALIGN	Align pipe to an axis.
3DS_P_SYNC_DIAMETER	Synchronise diameters.
3DS_P_GRIP_EDIT	Grip editing.
3DS_P_LAYER_3D	Show or hide 3D piping layer.
3DS_P_LAYER_PC	Show or hide point cloud.
3DS_P_LIST	Piping list.
3DS_P_INFO	Plugin information.

Construct (3DS_C)

Command	Function
3DS_C_HI_PROFILE	H and I profiles.
3DS_C_U_PROFILE	U profiles.
3DS_C_L_PROFILE	L profiles.
3DS_C_T_PROFILE	T profiles.
3DS_C_STRIP_PROFILE	Strip profiles.
3DS_C_KOKER_PROFILE	Hollow sections.
3DS_C_CHS_PROFILE	Round hollow sections.
3DS_C_RECT_CONCRETE	Rectangular concrete.
3DS_C_CIRC_CONCRETE	Round concrete.

Command	Function
3DS_C_EXTEND	Extend or shorten to point or face.
3DS_C_RESIZE	Resize profile.
3DS_C_REPEAT	Repeat last profile.
3DS_C_GRIP_EDIT	Grip editing.
3DS_C_LAYER_PROFILES	Show or hide profile layer.
3DS_C_LAYER_CONCRETE	Show or hide concrete layer.
3DS_C_LAYER_PC	Show or hide point cloud.
3DS_C_LIST	Profile list.
3DS_C_INFO	Plugin information.

Floor Analysis (3DS_F)

Command	Function
3DS_F_DIN18202	DIN 18202 analysis.
3DS_F_DIN_HTML	DIN HTML report.
3DS_F_DIN_WORD	DIN Word report.
3DS_F_DIN_CSV	DIN CSV export.
3DS_F_DIN_STATUS	Status of the last DIN analysis.
3DS_F_DIN_CLEAR	Clear DIN results.
3DS_F_DIN_VERIFY	Verify DIN result.
3DS_F_DIN_DEBUG	DIN diagnostics.
3DS_F_ASTM	ASTM E1155 analysis.
3DS_F_REPORT	ASTM HTML report.
3DS_F_ASTM_WORD	ASTM Word report.
3DS_F_ASTM_CSV	ASTM CSV export.
3DS_F_TR34	TR34 analysis.
3DS_F_TR34_HTML	TR34 HTML report.
3DS_F_TR34_WORD	TR34 Word report.
3DS_F_TR34_CSV	TR34 CSV export.
3DS_F_TR34_SVG	TR34 SVG export.
3DS_F_INFO	Plugin information and tolerance tables.

Volume Analysis (3DS_V)

Command	Function
3DS_V_ANALYSE	Volume analysis.
3DS_V_HTML	HTML report.
3DS_V_DOCX	Word report.
3DS_V_INFO	Plugin information and calculation method.

12. Support and contact

Every module has a Plugin Info button containing a built-in manual for that module. That is the quickest answer to a question about a specific command, and it is always up to date with the version you have installed.

Common questions

- The ribbon tab is missing. Restart AutoCAD; the plugin only loads at start-up. A tab for a module you have no licence for is not created at all.
- A command does nothing. Check the licence status in Plugin Info. Commands from an unlicensed module are cancelled without an error message.
- Nothing is visible after attaching or after an analysis. Type ZOOM E to zoom to the drawing extents. Scans on real-world coordinates sit far from the drawing origin.
- Crop Box does not start. Select the point cloud first; the command needs an existing selection.
- An analysis runs out of memory. Increase the cell size or the grid spacing, or reduce the point file first.
- A steel profile is not recognised. Check that the four corner points were picked accurately, and check whether the profile is in Profiles.csv in the 3DS_Data folder. You can add profiles to that file yourself.

Contact

Support, licences and questions: info@3d-solution.nl

Telephone: +31 6 23 09 58 39

Website and shop: 3d-solution.nl and 3d-solution.shop

Frequently asked questions, instruction videos and the ticket portal can also be reached directly from the Plugin Info panel on the Point Cloud Tools tab.

About 3D Solution

3D Solution, trading name of 3D-Care, Rika Hopperstraat 10, 7558 SW Hengelo, the Netherlands. Chamber of Commerce 88314448.

Point Cloud Tools is developed in the Netherlands for daily use in engineering, installation work and surveying. Suggestions and problem reports from users are the main source of new functions; if something in your workflow is awkward, let us know. info@3d-solution.nl