Composer 1.3 Handbook

Asiga

June 22, 2022

Contents

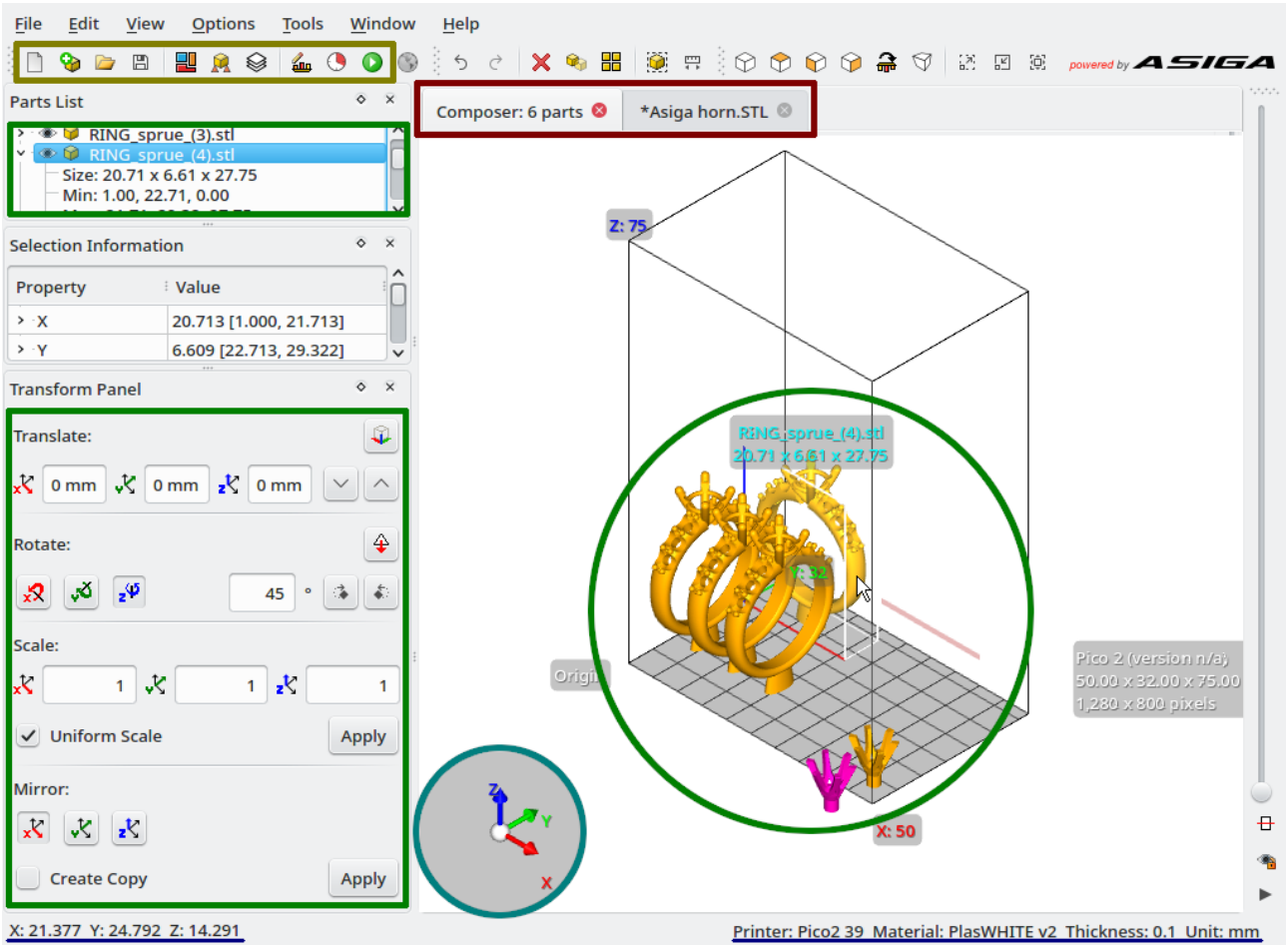
Chapter 1

Overview

Composer is your software to submit 3D models to your Asiga 3D printer. It enables users to prepare builds that consists of multiple parts. Each part should be positioned within the printable volume, oriented to preserve features and shallow slopes well supported. This overview will not cover the support structure topic, see the “Support Structures” chapter.

The build preparation state in Composer is stored as a Project. Each project contains information about the 3D printer, 3D models and layout. The chosen printer and files can be changed so you may reuse an existing layout. Further details about Composer projects are available in the “Projects” chapter.

The main interface of Composer is divided into the menubar, toolbars, panels, viewport and statusbar. The first screen when Composer starts does not display panels and viewport, the welcome screen is visible instead. Only the toolbars and panels can be freely repositioned around the main window.



1.1 Viewport

The 3D graphical interface that visualizes your parts layout and the 3D printable volume. The printable volume is represented as a wireframe box with the crucial platform table filled in. All models contained within the printable volume are painted in the same colour to easily distinguish from models that are out of bounds.

Camera navigation within the viewport requires a three-button mouse and mouse-drag gestures. Use the right-mouse-button to rotate the camera around the point where the button was pressed. Camera panning is done in opposite movement direction with the left-mouse-button. The middle-mouse-button zooms the camera towards a point, that can also be done using the mouse wheel.

The 3Dconnexion SpaceNavigator 3D mouse is supported on Linux and Windows and may be used for camera navigation as well.

The 3D axes x, y and z are colored red, green and blue respectively. You will find the camera world axes located on the bottom-left corner of the viewport. The status bar in the bottom left displays the 3D position of your mouse cursor within the Viewport.

The clipping bar along the right edge is explained in chapter 3.

1.2 Parts List

The parts list panel is located in the top left corner of the window. This is your primary panel that controls model selection and contextual actions for your models. Part selection can be modified by the <*Control*> key to select multiple parts in the list individually or the <*Shift*> key to select a range of parts in the list. The keyboard modifier buttons also applies to part selection within the 3D Viewport.

Parts are sorted in lexicographical order with distinct icons between the model and support structure. Support structures are always listed after the corresponding model, selecting a linked model or support will select both parts. Different icons will be shown should a model and support group's link be broken or active.

Several controls are available to the left of the part names. Part attributes may be shown or hidden by clicking on the expander button. Part visibility within the Viewport may be toggled by clicking on the eye icon. It may be beneficial to hide complex models once they have been positioned on the platform for faster Viewport drawing performance.

1.3 Transform Panel

Most of the time it is sufficient to use the mouse within the Viewport to move and rotate parts. The transform panel allows you to position, orient and resize your parts with accuracy. Some transformations in particular rotation around X or Y are unavailable for parts with support structure and SLC files.

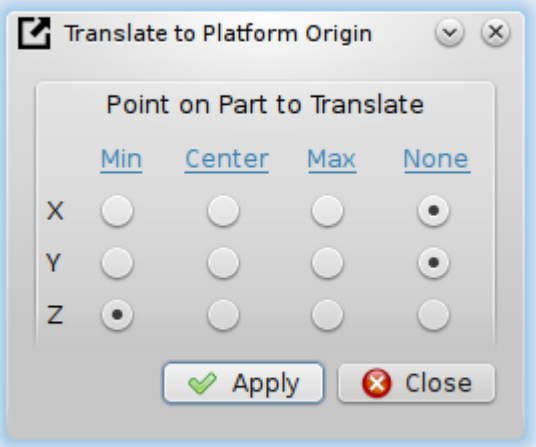
1.3.1 Translate

Move selected parts along the X, Y and Z axes using Translate. Input the distance to move by within the boxes and click the up or down arrows to move the parts positively or negatively respectively.

Up arrow <*Enter*> Move selected parts by the specified offset.

Down arrow <*Shift*> + <*Enter*> Move selected parts by the negative offset.

Translate to Platform Origin Choose which point on the selected parts to be at the origin.



1.3.2 Rotate

Accurately rotate selected parts around X, Y or Z axis using Rotate. Activate the axis to rotate by clicking on an axis toolbutton, specify the rotation amount in degrees and click on the left turn or right turn arrows.

Up arrow <*Enter*> Rotate selected parts around the axis counterclockwise.

Down arrow <*Shift*> + <*Enter*> Rotate selected parts around the axis clockwise.

Rotate Facet Downwards Click on the surface of an STL part to orient the surface to be facing down. Applies to all selected parts.

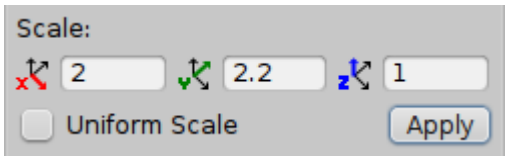
1.3.3 Scale

Scale selected parts by specific X, Y and Z factors. You would generally scale your parts equally over all axes, however it is possible to uncheck “Uniform Scale” and specify different factors. Parts are scaled towards the base of selection to keep the minimum Z bounds intact.

Apply scale <*Enter*> Scale selected parts by the specified factor.

Inverse scale <*Shift*> + <*Enter*> Scale selected parts by the inversed factor.

Maintain factors <*Alternate*> Hold down this key to maintain the scale factors after applying, otherwise they will be reset to 1.



1.3.4 Mirror

Selected parts can be mirrored along the X, Y or Z axis using Mirror. Activate the axis to mirror by clicking on an axis toolbutton and hit “Apply”. Check “Create Copy” to keep the original parts while creating the mirrored copy.

1.4 Status Bar

The right half of the status bar denotes the printer settings and unit of measurement. You can right-click on the unit of measurement to quickly swap Inches with Millimeters.

The left half of the status bar displays information about menu items or what is under the mouse pointer. Moving the mouse over a model displays the 3D coordinate.

1.5 Undo History

Composer remembers all actions applied to parts and projects. The history is stored in memory and may forever grow increasingly through common usage. You may clear the undo history by confirming *Edit → Clear Undo History…*

Undo <*Control* + *Z*>

Redo <*Control* + *Shift* + *Z*>

1.6 Clipboard Control

Composer can handle list of files when interacting with the clipboard.

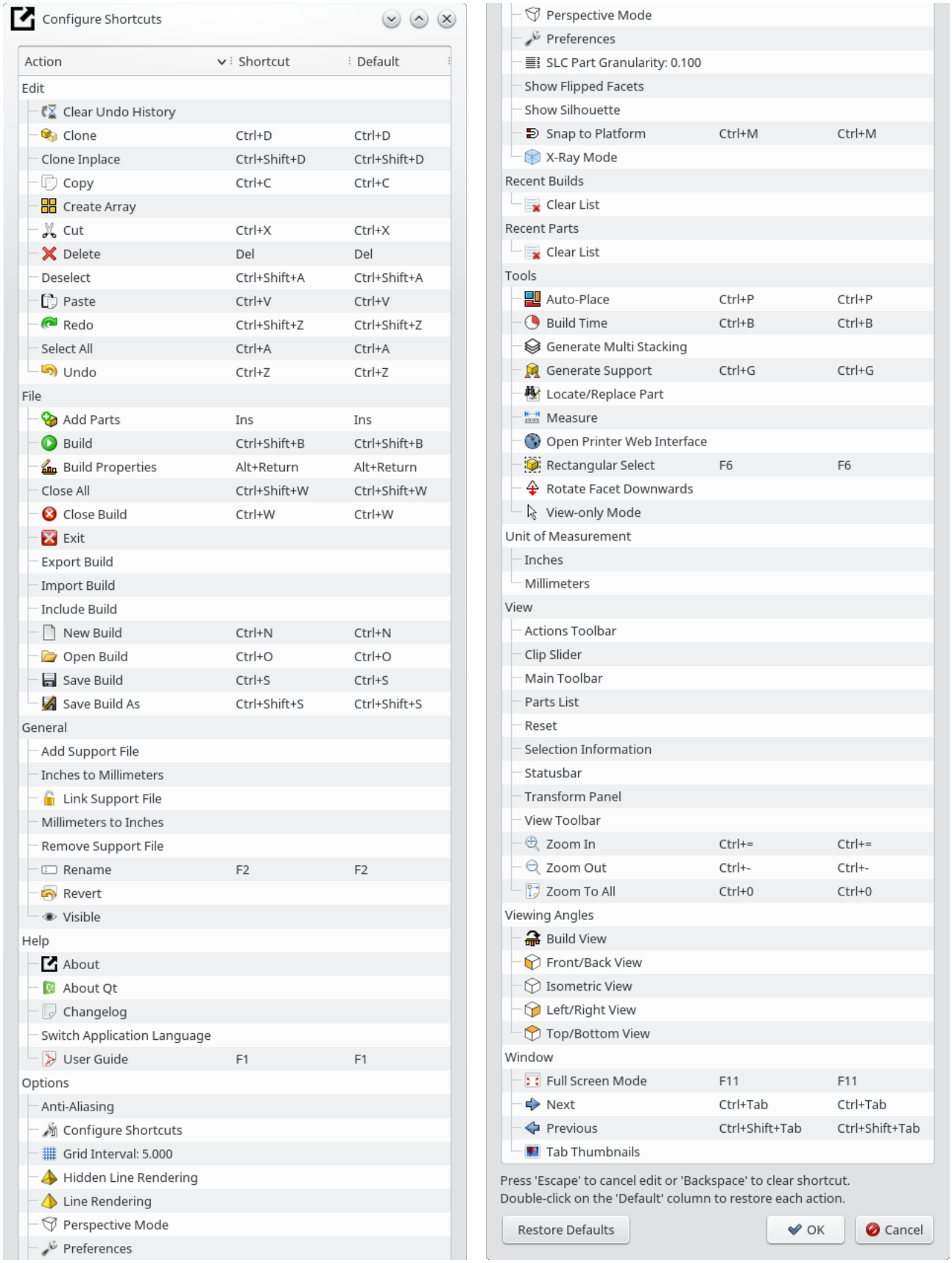
Copy <*Control* + *C*> Populates the clipboard with the file paths of the selected parts. You may paste the clipboard content in Composer, your system's file browser or other programs that handles "text/uri-list" mimetype.

Cut <*Control* + *X*> Same as copy above, but will also delete the selected parts.

Paste <*Control* + *V*> Retrieve file paths from the clipboard and add into Composer. You will be prompted with the *Add Parts* dialog, should the files were copied from other programs.

1.7 Shortcuts

Standard intuitive keyboard and mouse shortcuts are available by default. You will find shortcuts written near actions throughout this manual. Keyboard shortcuts can be configured from *Options* → *Configure Shortcuts…*


Configure Shortcuts
Action
Shortcut
Default
Edit
Clear Undo History
Clone Ctrl+D Ctrl+D
Clone Inplace Ctrl+Shift+D Ctrl+Shift+D
Copy Ctrl+C Ctrl+C
Create Array
Cut Ctrl+X Ctrl+X
Delete Del Del
Deselect Ctrl+Shift+A Ctrl+Shift+A
Paste Ctrl+V Ctrl+V
Redo Ctrl+Shift+Z Ctrl+Shift+Z
Select All Ctrl+A Ctrl+A
Undo Ctrl+Z Ctrl+Z
File
Add Parts Ins Ins
Build Ctrl+Shift+B Ctrl+Shift+B
Build Properties Alt+Return Alt+Return
Close All Ctrl+Shift+W Ctrl+Shift+W
Close Build Ctrl+W Ctrl+W
Exit
Export Build
Import Build
Include Build
New Build Ctrl+N Ctrl+N
Open Build Ctrl+O Ctrl+O
Save Build Ctrl+S Ctrl+S
Save Build As Ctrl+Shift+S Ctrl+Shift+S
General
Add Support File
Inches to Millimeters
Link Support File
Millimeters to Inches
Remove Support File
Rename F2 F2
Revert
Visible
Help
About
About Qt
Changelog
Switch Application Language
User Guide F1 F1
Options
Anti-Aliasing
Configure Shortcuts
Grid Interval: 5.000
Hidden Line Rendering
Line Rendering
Perspective Mode
Preferences
Perspective Mode
Preferences
SLC Part Granularity: 0.100
Show Flipped Facets
Show Silhouette
Snap to Platform Ctrl+M Ctrl+M
X-Ray Mode
Recent Builds
Clear List
Recent Parts
Clear List
Tools
Auto-Place Ctrl+P Ctrl+P
Build Time Ctrl+B Ctrl+B
Generate Multi Stacking
Generate Support Ctrl+G Ctrl+G
Locate/Replace Part
Measure
Open Printer Web Interface
Rectangular Select F6 F6
Rotate Facet Downwards
View-only Mode
Unit of Measurement
Inches
Millimeters
View
Actions Toolbar
Clip Slider
Main Toolbar
Parts List
Reset
Selection Information
Statusbar
Transform Panel
View Toolbar
Zoom In Ctrl+= Ctrl+=
Zoom Out Ctrl+- Ctrl+-
Zoom To All Ctrl+0 Ctrl+0
Viewing Angles
Build View
Front/Back View
Isometric View
Left/Right View
Top/Bottom View
Window
Full Screen Mode F11 F11
Next Ctrl+Tab Ctrl+Tab
Previous Ctrl+Shift+Tab Ctrl+Shift+Tab
Tab Thumbnails
Press 'Escape' to cancel edit or 'Backspace' to clear shortcut.
Double-click on the 'Default' column to restore each action.
Restore Defaults
OK
Cancel

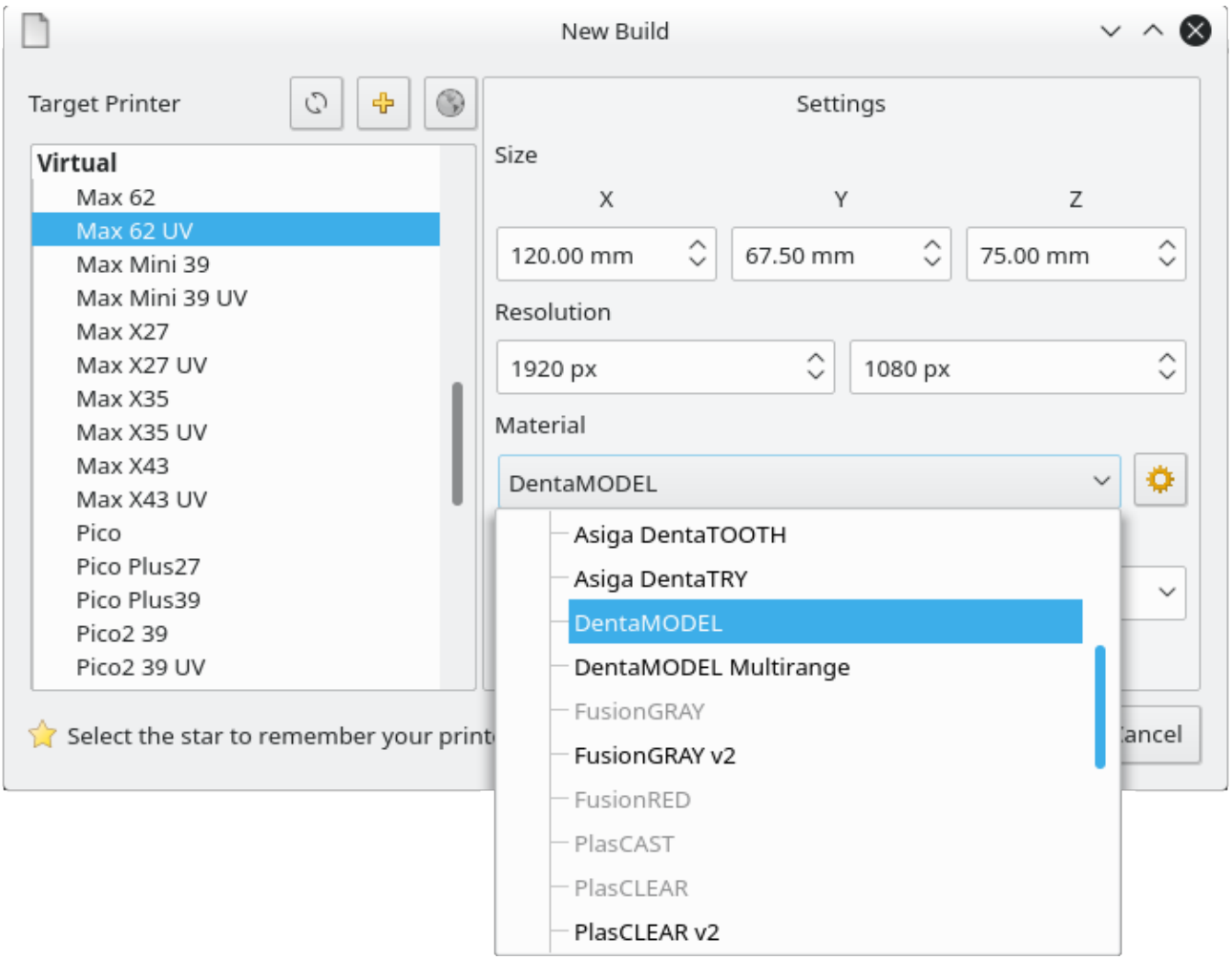
Chapter 2

Projects

A Composer project stores the build layout of your 3D models. It references files by relative and absolute path in order for Composer to reload the models at a later stage.

2.1 New Project

 New Build <*Control + N*> Opens the “New Build” dialog for a selection of available printers on your network, material options and slice thicknesses. Composer will query your selected 3D printer to determine available slice thicknesses for the selected material.



2.1.1 Target Printer

Composer loads the list of supported printer models and parameters on startup. Read the *Printers INI Definitions* section within the *Appendix* for more information.

Refresh Listing Updates the printer listing using network autodetection and reloads virtual printers.

Add IP Address The IP address of the printer is accessible via the printer front panel menu.

Open Webpage Available under *Tools → Open Printer Web Interface…*

Favorite Remember printers even when you cannot connect to it within the local network.

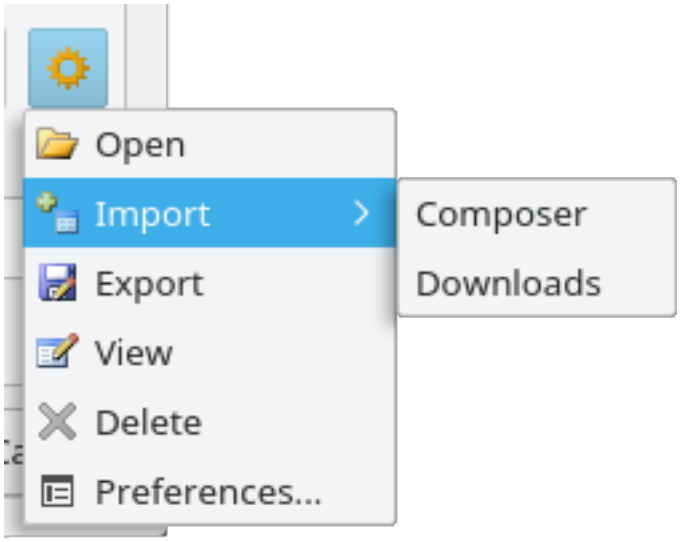
Build Properties <*Alternate + Return*> Change the target printer, material and slice thickness of the current project. This action is available under *File → Build Properties…* (the item is also available under *Edit*, which will be removed in later versions).

2.1.2 Virtual printer

Virtual printers are defined within the *<Composer Install>/Virtual* folder inside each INI file. Choose a virtual printer when your target printer is unavailable on the network. Once a virtual printer is selected, the settings section will allow you to edit the build size.

2.1.3 Materials

By default, Composer loads material files from *<Composer Install>/Materials* only. You can configure additional directories from the Preferences dialog, please read the *Materials* subsection in the *Settings* chapter for more information. The "Asiga Material Library" button opens web browser window to download the latest material INI files.



Click on the material tool button to access the following actions.

Open Browse the currently selected material's directory, allowing you to manage material INI files freely. You must close and reopen the dialog after you have modified any INI file.

Import Choose one or more INI files to copy into a material directory and reload the material listing. Composer will confirm to replace any existing files of the same name as the one you are importing.

Export Save a copy of the currently selected material into a location of your choice.

View Opens the currently selected material INI file using the operating system's default text editor. You must close and reopen the dialog after you have modified the INI file.

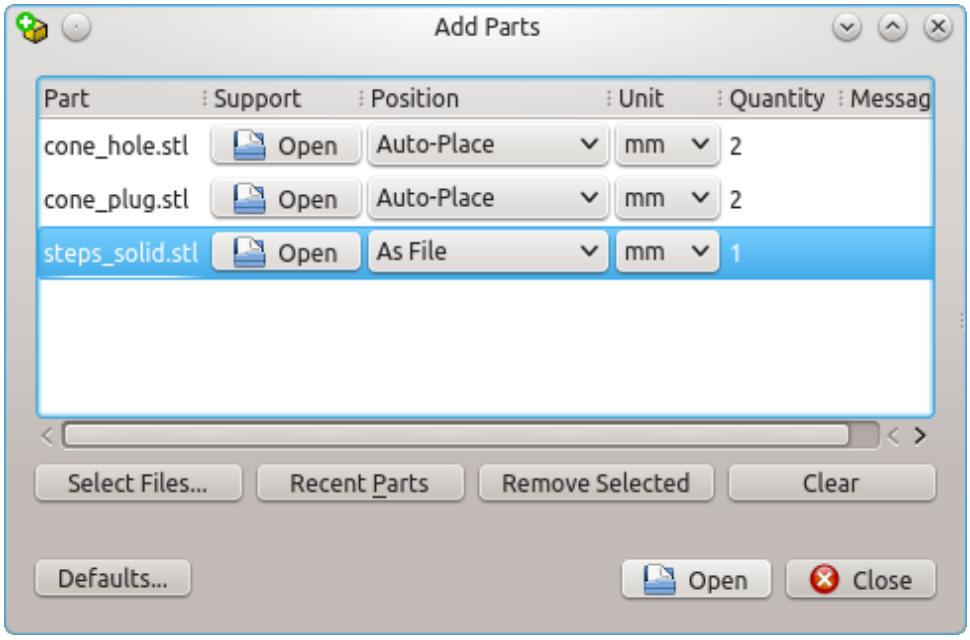
Delete Remove the currently selected *User Material* from the directory and the listing. This action is unavailable for *Systemwide Materials*.

2.1.4 Slicing Thickness

The available range of slicing thickness is dependant upon the printer type, printer state and material type. Composer remembers the last used slicing thickness for the currently selected printer and material.

2.2 Adding Parts

Add Parts <*Insert*> Compile the list of parts to be loaded onto Composer. Click on "Select Files..." to open the file browser to select STL, SLC, PLY or STM files. You may load an existing support structure file with your part by clicking "Browse..." next to the part file name.

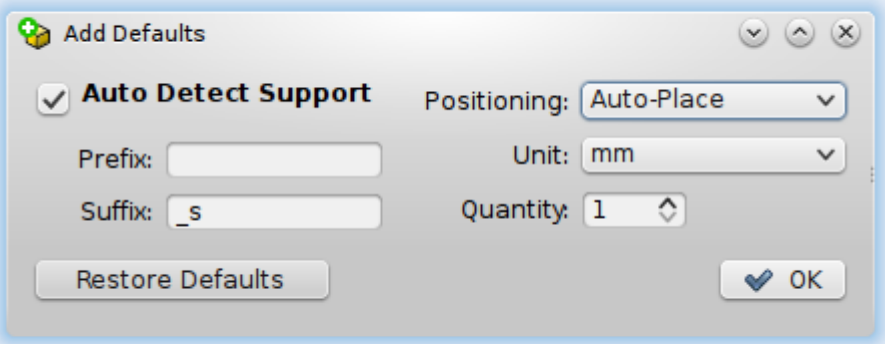


See chapter 4 for further explanations.

Recent Parts is accessible from the File menu, Parts List context menu and within the Add Parts dialog.

2.2.1 Add Defaults

The “Defaults…” button opens default configuration how newly chosen parts should be loaded. The fields shown in this dialog are shown as the table columns within the “Add Parts” dialog. For example, should you wish to load five copies of all new parts, then set the “Quantity” field to 5, click OK and select your files.



2.2.2 Positioning

For each part, the “Position” option controls where it will be located once loaded. There are four options in the combobox described as follows:

As File Positions the part as defined in the file.

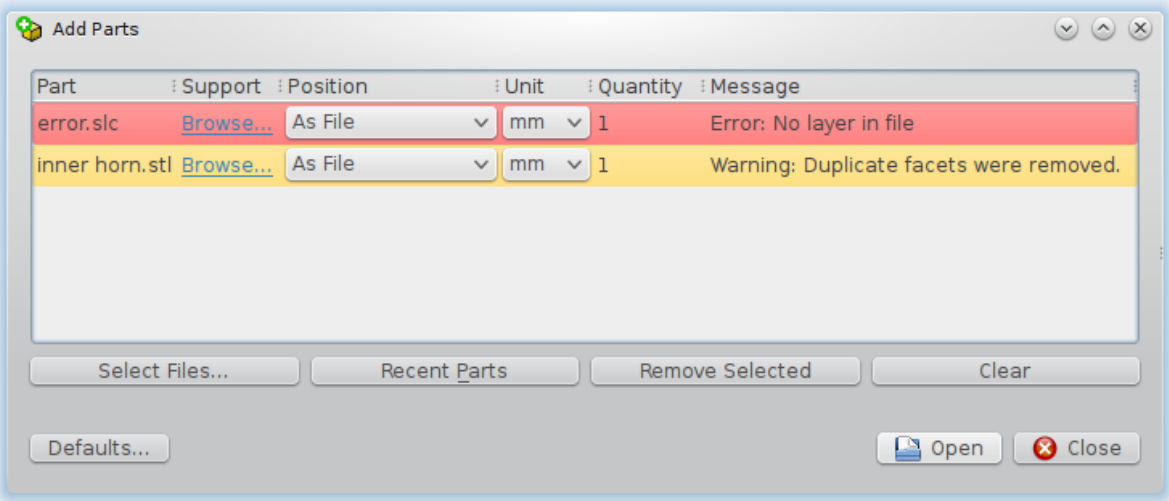
Origin Aligns the minimum X, Y and Z extents to zero.

Platform Center Aligns the X and Y center of the part with the platform center.

Auto-Place Arrange affected parts using the settings defined in the Autoplace dialog.

2.2.3 Messages

File errors that are detected during reading are shown under the “Message” column. Parts with warnings are painted with a yellow background, while parts with errors are painted with a red background. Parts with warnings are allowed to be loaded into the Project, but please refer to the message for the problem and correct the file when possible.



2.2.4 Alternative Add Parts Methods

Clipboard Paste The standard paste shortcut <*Control* + *V*> forwards the files that were previously copied onto the clipboard into the "Add Parts" dialog.

Drag and Drop Composer handles drag and drop event of files by opening the "Add Parts" dialog. The files table will be populated with the files that you have dropped into Composer.

ZIP Import Composer can extract part files from a ZIP file to be loaded directly inside Composer. You can follow the same steps as Project Import, which will then show you the "Add Parts" dialog to continue when the ZIP file does not contain "build.combld".

2.3 Opened Projects

Composer represents projects as tabs located above the viewport. Projects are also enumerated under the "Window" menu.

Activate a specific Project by selecting it from the tabs or the window menu. Switching to an adjacent tab can be done by pressing <*Control* + *Tab*> or <*Control* + *Shift* + *Tab*> for previous or next respectively.

Allow time for Composer when switching projects that contains complex parts. Composer tries to minimize memory usage by freeing up resources from inactive tabs. 3D models of an activated project may need to be reanalyzed for optimized rendering.

2.3.1 Tab Thumbnails

Enable *Window → Tab Thumbnails* to ease tab identification and picking when many projects are opened. The thumbnail of each projects are shown as you hover the mouse over each tab, with the exception of the currently active project.

Thumbnail image frames are captured at full resolution allowing zoom and panning. Use the mouse scrollwheel to zooming within the thumbnail. Hold down <*Control*> while dragging with the left-mouse-button for panning.

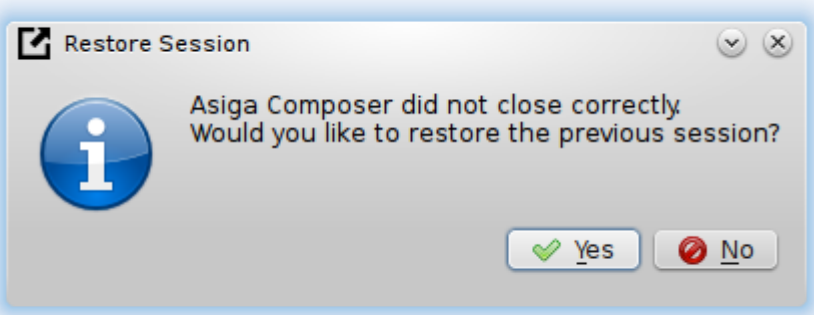
2.3.2 Closing Projects

Projects can be closed from the tab bar, Window menu and File menu. Standard keyboard shortcuts <*Control + W*> and <*Control + Shift + W*> will close current Project and close all Projects respectively.

Changed projects are marked with asterik (*) prepended to the project name. Composer will confirm to save or discard the changed Project.

2.3.3 Crash Recovery

Composer keeps a program session state each time a change is done on any of your opened projects. Should Composer or your computer crash abruptly, you will be prompted to restore the last session in the recovery dialog the next time you start Composer.



2.4 Saved Projects

Composer saves the file paths of all parts as well as their transformation within the build.

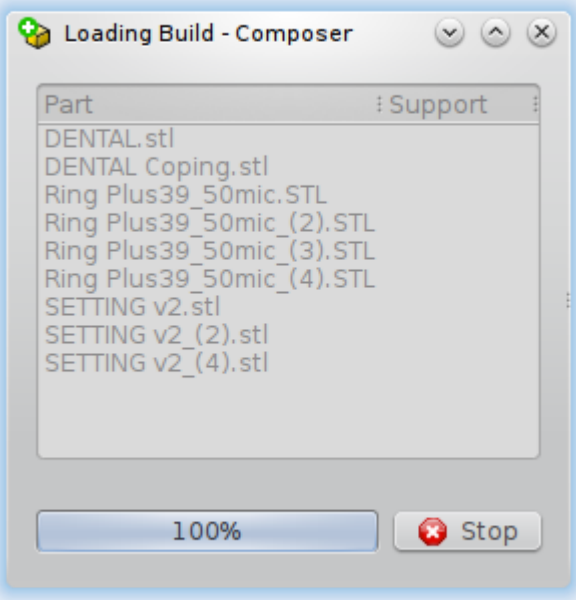
Save Build <*Control* + *S*> Stores the project into disk, overwriting the previous project file. A file save dialog will be shown should you use this function on an new project.

Save Build As <*Control* + *Shift* + *S*> A file save dialog will always be shown to allow you to choose the directory and the name of the Project.

Open Build <*Control* + *O*> Choose a previously saved Project to be opened in a new tab. Composer may fail to open a build that was saved using a later version of Composer.

Include Build Choose a previously saved Project to include into the current tab. All parts from the included Project will be loaded.

Recent Builds is accessible from the File menu, remembers up to ten latest projects.



2.4.1 File References

Composer stores the absolute file path for each part as well as the absolute file path of the saved Project file. A relative path can be determined for each part in relative to the saved

Project file by comparing the absolute paths. To handle multiple cases where files might have been moved about, Composer will check the following locations when attempting to load parts:

1. Relative path from where the Project file is located
2. Absolute path that was stored in the Project file
3. Within the same directory as where the Project file is located

2.4.2 File Verification

The unique identifier of files are saved in a Project to be verified when the files are reopened at another time. Composer will warn you when it detects that the file had changed.

Any missing files while opening a Project will prompt the user for a replacement. By referencing files using its absolute path and relative path to the project, Composer can handle most cases of file movements. It is best to export the Project should you wish to transfer between computer systems (see chapter 2).

2.4.3 Material Matching

Composer projects stores the name of the material as well as its directory path. The following order of precedence is applied to choose the material when opening a project.

1. Name and directory matched
2. Name matched from any directory with the latest date modified
3. Similarly named material by comparing the sequence of letters
4. First available material for the printer

2.4.4 Alternative Open Build Methods

Clipboard Paste Project files that were copied to clipboard will be opened in new tabs.

Drag and Drop You may open projects by dragging and dropping Composer project files from your file browser into Composer's window.

2.5 Exported Projects

A full project export is required when transferring a project to be opened on another computer or network. An exported project is simply a compressed ZIP archive containing a copy of every file referenced within the Project. Composer will save the actual Project file as “build.combld” within the ZIP file.

2.5.1 Project Export

Firstly ensure that all changes on the Project is saved to disk. Once done, simply click on *File → Export Build* to open a file dialog to name the exported file.

2.5.2 Project Import

Composer can load your previously exported builds into a temporary project. Select the ZIP file from *File → Import Build* or drag and drop the ZIP file from your file browser.

2.5.3 Exoprint Import

Exocad Exoprint software can create a print request file (*.printRequest) for Asiga 3D printers. An Exoprint file is simply an XML file that contains a list 3D model files and their orientations.

Within DentalCAD With DentalCAD program configured properly, choose action “Transfer to 3D Printer”, select the parts to print and click “Proceed to printing”.

Drag and Drop You may import Exoprint 3D models by dragging an Exocad Print Request file from your file browser and dropping it into Composer’s window.

Include Build Choose an Exocad Print Request filter and file from *File → Include Build*.

Chapter 3

Settings

Composer remembers the settings that you have changed during the running of the program. This chapter explores the various settings and how you can manage them.

3.1 Options

Open the “Options” menu to customize your Composer usability experience.

Grid Interval Spacing between the lines drawn across the platform base. Specify 0 to disable grid.

Snap to Platform Align the bounds of selected parts to the inner-edges of the platform when moving parts with mouse.

Show Silhouette Projects the model onto the ground to aid in positioning and coordination.

3.1.1 STL Triangles

The STL solid surface is defined over many triangles and the simplest closed volume is preferred for processing. Composer can render the backfaces of triangles using a different color (red by default) by enabling “Show Flipped Facets”.

Enable “ Line Rendering” to view triangle mesh. Line rendering will only affect STL models. For Composer versions older than 1.2.4, Line rendering has no effect when X-Ray mode is active.

Line rendering is a prerequisite to “ Hidden Line Rendering”. Hidden line rendering will draw the edges of all triangles even on the other side of the model and within hollow models. It is not necessary to turn on this option when X-Ray mode is active.

3.1.2 SLC Contours

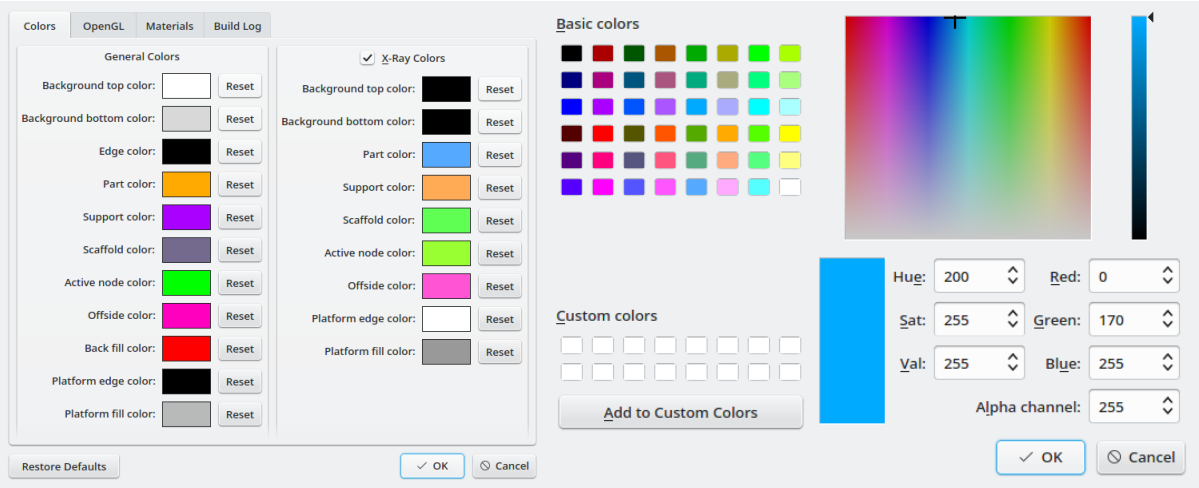
The SLC lineworks is shaded horizontally to represent the external surface at the “ SLC Part Granularity” thickness. Composer limits the layer density primarily to improve mouse cursor detection over the models. Lower the granularity for finer layers at the expense of rendering time and mouse manipulation chance as you will need to click on the finer lines.

3.2 Preferences

Open the Preferences dialog from *Options* → *Preferences…*

3.2.1 Colors

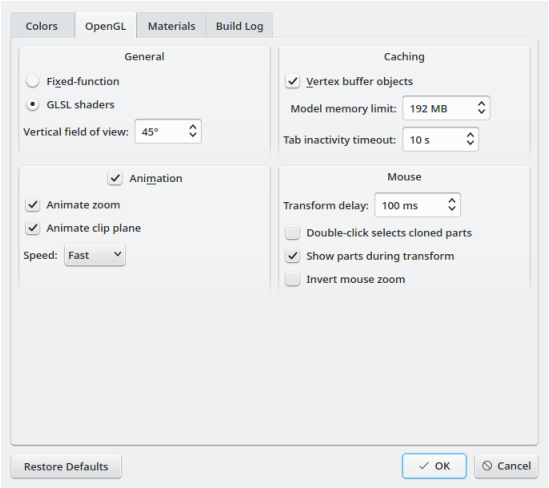
Most colors within the viewport are customizable. The table of colors are located under the *Colors* tab.



Transparency control are applicable for a selection of colors. Specify an “Alpha channel” value between 0 and 255 to represent fully transparent and fully opaque respectively. Alpha channels for parts during X-ray mode controls the color depth instead of opacity.

3.2.2 OpenGL

Some 3D graphics options are available under the *OpenGL* tab.



Fixed-function Legacy OpenGL 1.0 support where lighting are computed using built-in formulae.

GLSL shaders Lighting and colors are computed with custom formulae bundled inside Composer. This option is required for X-ray shading.

Caching Composer will process raw 3D model data into a format suitable for OpenGL. The main memory (RAM) will be the first target location. Temporary files will be used to store the model data when you change to another project.

Vertex buffer objects Some 3D model data will be stored in the graphics memory where possible. Use this for discrete graphics.

Model memory limit Maximum memory usage for a single 3D model. Your disk storage will be used for models larger than this limit.

Tab inactivity timeout How long to retain 3D models in memory after you have changed to another tab or project.

Animate zoom Composer will smoothly move and rotate the camera.

Animate clip plane Clipping plane fade effect.

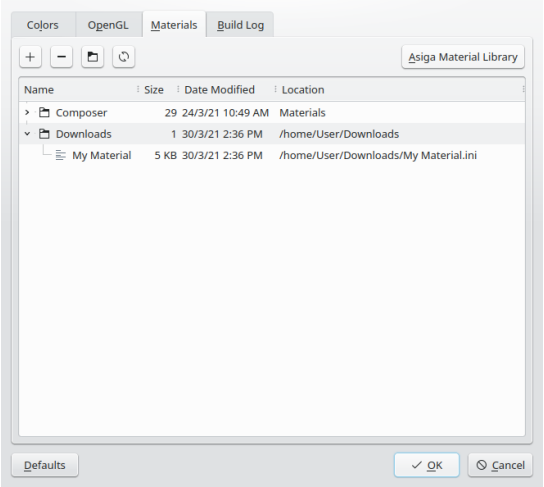
Transform delay Time in milliseconds before Composer assumes the user wishes to move, rotate or scale the selected parts.

Invert mouse zoom Scroll the mouse down to zoom in and scroll the mouse up to zoom out.

3.2.3 Materials

Starting from Composer 1.2.8, you can configure additional material directories for Composer to load. Composer will automatically include *User Materials* that were imported

during previous versions, you will need to remove the directory yourself to make Composer stop loading this directory.



The *Materials* tab contains the following actions:

Add Browse for a directory to add.

Remove Remove the currently selected directory from Composer. Does not remove the directory from your filesystem.

Open Open the currently selected directory or file.

Reload Reloads all material directories.

Asiga Material Library Open web browser window to download the latest material INI files.

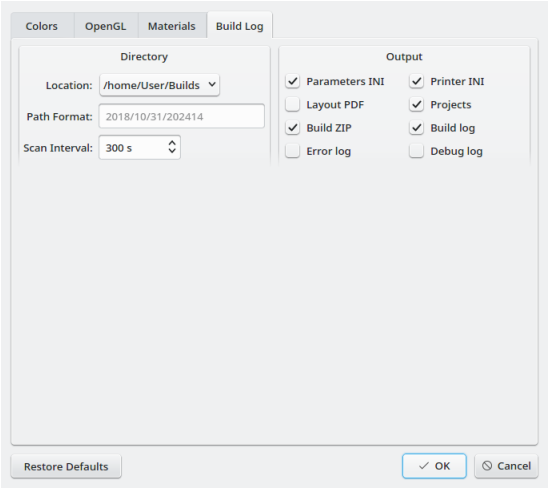
Drag and Drop You can change the ordering of directories by dragging and dropping.

Doubleclick You can doubleclick on a directory or a file to open.

Select and Click You can relabel a directory or change the directory by clicking on the name or location of a selected directory respectively.

3.2.4 Build Log

Starting from Composer 1.2.10, you can configure build logging to store submitted builds into a directory.



Location Choose, Open or Clear the directory location.

Path Format Datetime format string that is added to Location. The specifiers are similar to C / Java / Python / Ruby (see Text Formatting in the appendix).

Scan Interval How often should Composer check printers to download Build, Error or Debug logs.

Parameters INI Same as clicking “Export Parameters” in the Build Wizard as “parameters.ini”.

Printer INI Saves the “printer.ini” file from the printer.

Layout PDF Same as clicking “Export Part Map” in the Build Wizard as “layout.pdf”.

Projects Saves the projects that is part of the build into “projects” subdirectory.

Build ZIP Saves the build as “build.zip”.

Build log Periodically retrieve and log “BuildLog.ini” from the printer.

Error & Debug log Periodically retrieve and log “debug” from the printer.

3.3 Settings Management

By default, Composer will use your operating system’s native storage for software settings.

Windows Registry *HKEY_CURRENT_USER\Software\Asiga\Composer*

MacOS X File *~/Library/Preferences/com.Asiga.Composer.plist*

Linux File *~/.config/Asiga/Composer.conf*

3.3.1 Configuration Profiles

Composer can be started up to use a specific profile directory. Specify a command argument *--profile=[<profile path>]* when starting up Composer. The actual settings file will be saved as "Asiga/Composer.conf" within the profile directory.

Portable Install When you are running Composer from a USB and you wish to carry the same settings wherever you go. Use *--profile=* as an argument.

Shared Settings When you want multiple users to use the same settings. Use *--profile=<directory>* as an argument.

Enclose the whole argument in double quotes should you have any space character in the path.

The path separator can be forward slash "/" on Windows so that you do not need to escape the path separator. For instance, rather than specifying "--profile=C:\\Users\\Public", you can specify "--profile=C:/Users/Public".

3.3.2 Reset Settings

You can clear all Composer settings to restore everything to default. Specify command argument *--profile-reset* when starting up Composer. The reset will apply to the configuration profile, should you also specified it, otherwise it will reset the settings in the native location.

3.3.3 Installation Settings

By default, Composer version 1.2.7 and later will attempt to read a *<Composer Install>/Composer.ini* file on startup. Everything under the *Settings* section of this file will be imported to the settings. Please read the *Composer INI Definition* section within the *Appendix* for more information.

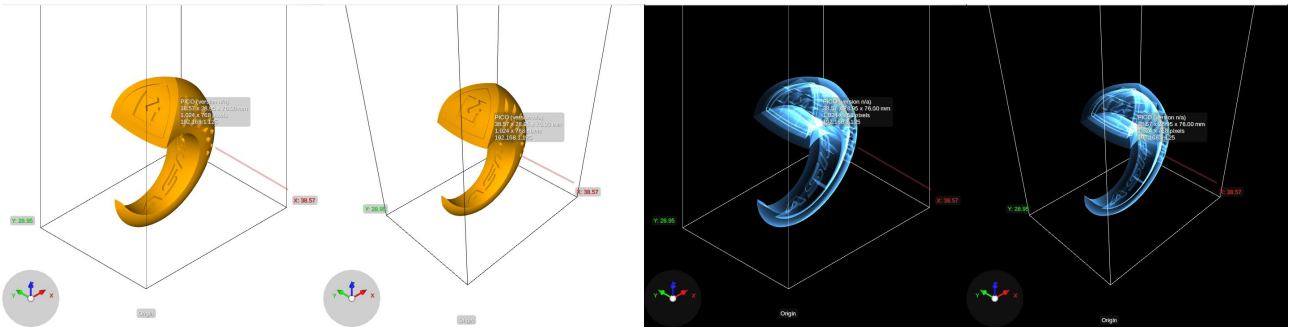
Chapter 4

Viewport Controls

Composer allows users to navigate the 3D world, transform parts and personalize rendering aspects. This chapter extends on the (Viewport) section in chapter 1.

4.1 Viewing Modes

The default viewing mode displays parts in diffuse color without any diminishing point for parallel lines. Composer supports "Perspective Mode" and "X-Ray Mode" both of which are not exclusive to each other. In other words, you can have X-Ray and Perspective enabled at the same time.



You may control the perspective angle of sight from *Options → Preferences… → OpenGL → Vertical field of view*. Field of view values closer to zero begins to emulate an orthographic view, whereas larger values increases overall viewing volume at the expense of greater distortion.

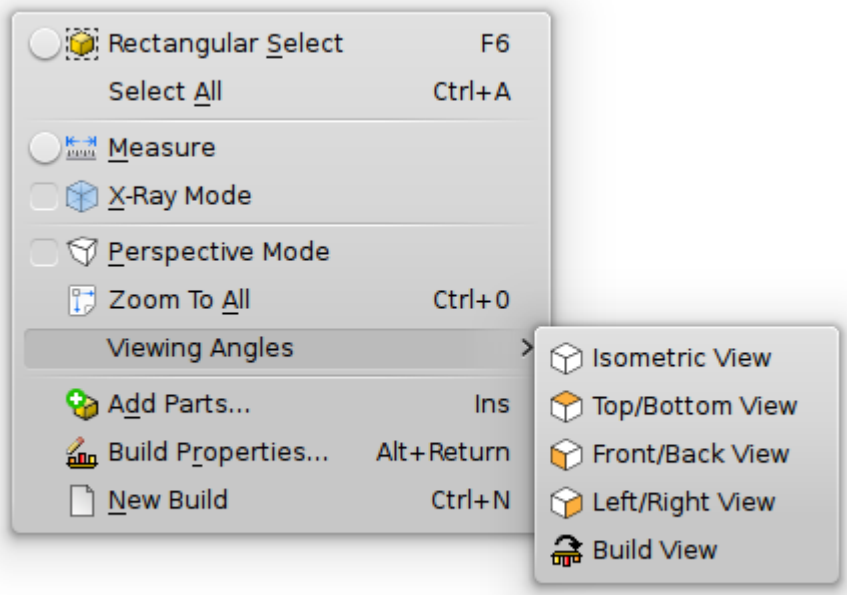
X-Ray mode requires "GLSL shaders" support, which all modern display adaptors supports. Any failure to enable GLSL may suggest an incorrectly installed graphics drivers (see Troubleshooting).

Fullscreen Mode *<F11>*

Use for small screen displays to hide window decorations, panels and toolbars. You can still access the menubar, project tabs, statusbar and "Clip Slider".

4.2 Viewing Angles

Preset camera angles are available on the toolbar and within the viewport context menu. You may bind keyboard shortcuts to activate each viewing angle (see Shortcuts).



Each viewing angles (except for the “Build View”) are overloaded with two presets, which can be achieved by activating the viewing angle menu again. For instance, when manually adding supports it is best to view parts from underneath, which can be achieved by activating the “Top/Bottom View” menu one or more times.

4.3 Camera Control

Adjust the view by using your three-button-mouse inside the viewport.

Camera Panning Left mouse button

Camera Orbitting Right mouse button

Camera Zooming Middle mouse button

4.3.1 Modes

How the mouse actions within the viewport behaves relies on the current user activity. The normal mouse mode enables the user to travel within the 3D world and to manipulate

parts.

Viewing Only Disables all part transformation by mouse (translate, rotate and scale).

Rectangular Select Pauses camera actions and only allow mouse drag to draw a rectangle.

Measurement Disables all part manipulation by mouse (selection, translate, rotate and scale) and enable ruler measurement points (see Tools → Measurement).

Surface Selections Composer may expect the user to click on the surface of a part for the following activities:

- Rotate Facet Downwards
- Add Support
- Adjust Flexible Support
- Remove Support

4.3.2 Lookaround

The default rotation mode by using the right-mouse-button orbits the camera around the initial mouse position. By holding down the <*Shift*> key while rotating the view, you can lookaround from the current camera position. This feature is best used when "Perspective Mode" is enabled.

4.4 Zooming

The easiest way to zoom (or move fore/back in "Perspective Mode") is to use the mouse scrollwheel. You may choose to reverse the zoom movement by enabling *Options → Preferences... → OpenGL → Invert mouse zoom*. Standard keyboard shortcuts for zooming are as follows.

Zoom in <*Control* + => Zoom into the center of the screen.

Zoom out <*Control* + ->

Zoom to all <*Control + 0*> Calculates the best fitting zoom to show all parts in the viewport.

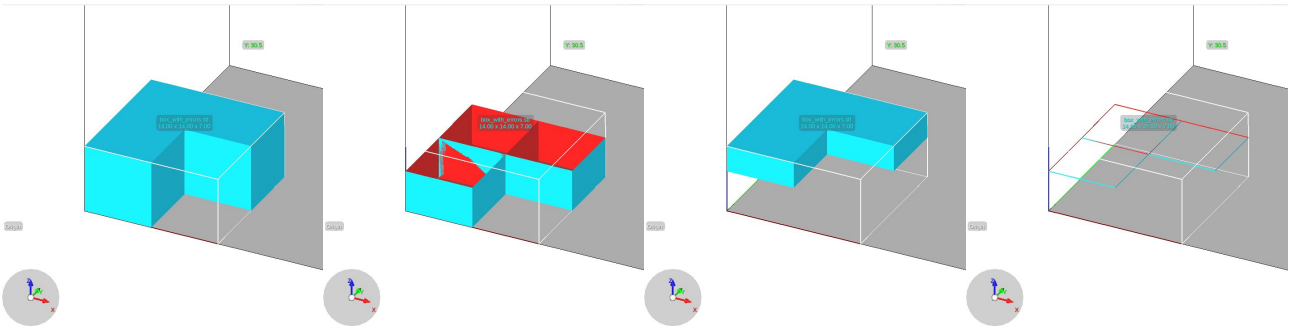
Rectangular Select <*F6*> Draw a rectangle with the middle-mouse-button to zoom into the box.

4.5 Tools

4.5.1 World Clipping

Composer supports clipping using a moveable horizontal plane. The clipping controls are located along the right edge of the window by default. The clipping button cycles through four modes of operation in sequence.

1. Clipping disabled, normal rendering
2. Clip top, render parts under the plane
3. Clip bottom, render parts over the plane
4. Clip both, render the slice at the plane

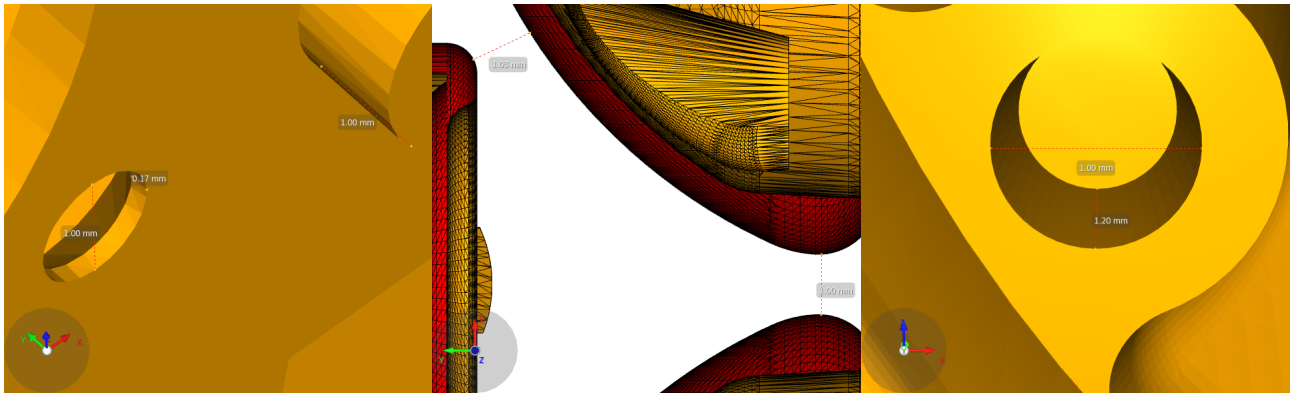


Whence clipping is active, you may slide the vertical slider between zero and the build platform's maximum Z. The camera can be locked with the movement of the vertical slider as it may aid in visually identifying changes throughout your models by focusing your eye on a constant point. Use your mouse scrollwheel and hold down <*Control*> to step a one layer or hold down <*Shift*> to step ten layers.

4.5.2 Measurement

Composer allows you to draw multiple measurements between points on the surface of your parts. Measurements should be done when attempting to closely pack parts together to avoid fusion and after scaling models to check wall thicknesses. We recommend gaps

and walls to be around 1 mm when spanning over large areas. However, it is possible to work with around 100 µm features provided that the surrounding areas are sufficiently strong.



Add your measurement endpoints by clicking on the surface with the left-mouse-button. Use the right-mouse-button to undo new measurements or to relocate an endpoint.

Chapter 5

Part Manipulation

Parts can be moved about, orientated, scaled, copied and removed. Parts are represented in the Parts List as "  <*filename*>".

5.1 Selection

Using the mouse, select a part within the viewport with left-click. The bounding box extents are shown for each selected part.

The default selection behavior is to replace the current selection. Hold down <*Control*> keyboard button to select multiple parts.

 **Rectangular Select <*F6*>** Draw a rectangle with the left-mouse-button to select visible parts touched by the area within the viewport.

Select All <*Control* + *A*> Selects all parts including hidden and those that failed to load.

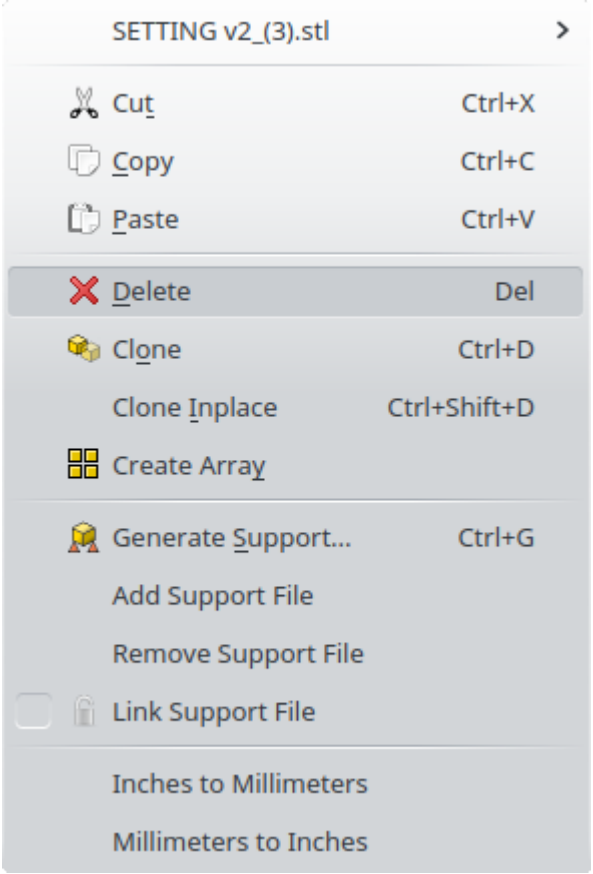
Deselect <*Control* + *Shift* + *A*> Clears current selection, which can also be triggered alternatively by pressing <*Escape*>.

Select Clones <*Double-Click*>

Enable this feature by opening *Options* → *Preferences…* → *OpenGL* and ticking "Double-click selects cloned parts".

5.2 Part Management

This section extends the Add Part section in chapter 2. You can add parts by activating the "Add Parts" action, drag-dropping or copy-pasting files into Composer. Essential management features are available inside the part context menu and main toolbar.



Delete Selected <*Delete*> Removes all selected parts from the Project, but not from the memory. See chapter 1 Undo History section.

5.2.1 Part Submenu

Access the submenu for the current focused part by following the context menu of selected parts. The focused part is the most recently selected part. The context menu is available from either the Parts List or the Viewport. Position the mouse cursor over the selection and then right-clicking or pressing the <*Menu*> key.

Rename <*F2*> Change the part name within Composer. You may also select and click the names in the Parts List to rename.

Visible Show or hide selected parts within the viewport. This feature is also available on the Parts List.

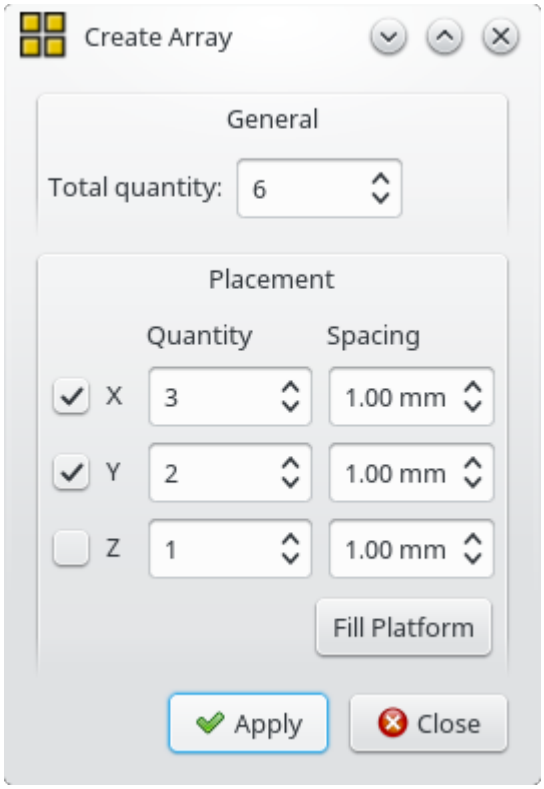
Revert Part Removes all transformations applied to selected parts, leaving it as the original model data.

Locate / Replace Part Open a file browser to choose a new 3D model inplace of the existing part. This action is also available in *Tools → Locate / Replace Part…*

5.2.2 Copies of Parts

Composer distinctively identifies different models by their overall file data. Any duplicated 3D model within the same project will be treated as clones and no additional memory will be used. How the models are finally displayed and built relies on transformations of the original model data. Please beware that the following features ignores model collision and it is up to you to move colliding models apart.

Clone Selected <*Control* + *D*> Creates a duplicate for each selected part with an offset along the X and Y axes. Hold down <*Shift*> to clone without offset.



Create Array Systematically duplicate each selected part along any axis. The Create Array dialog provides configurable spacing between parts and the number of copies to be added along the X, Y and Z axes. Click “Fill Platform” to let Composer create as many parts as possible within the build platform.

5.3 Mouse Controls

Parts are manipulated using mouse-drag gestures over selected parts within the viewport. There is a time delay involved before part transformation is active, which can be customized in *Options* → *Preferences...* → *OpenGL* → *Transform delay*. Camera manipulation will apply should you have moved the mouse before the timeout.

The standard mouse transform maps pixel-accurate changes from the initial mouse pressed point. Users can hold down the <*Shift*> key to break the continuous transformation into discrete steps. Press the <*Escape*> key to cancel any mouse controlled part manipulation.

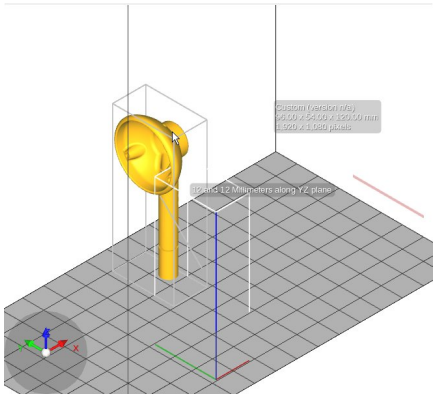
Composer intuitively determines the default translation plane (or axis for rotation) based on the camera and cursor positions. All transforms can be explicitly constrained to use a specific axis by holding down one of the <*X*>, <*Y*>, <*Z*> or <*C*> keys.

5.3.1 Instant Mouse Transform

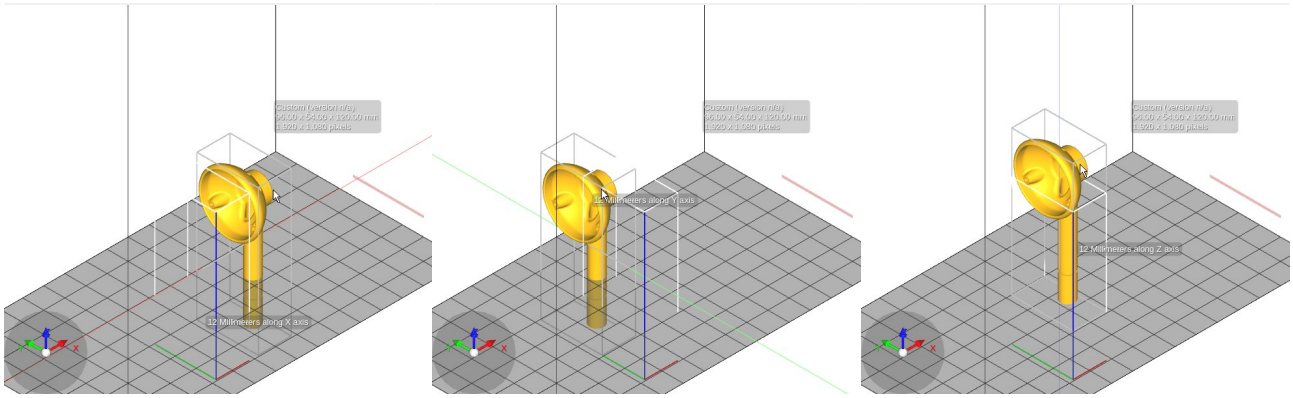
You can set the "Transform delay" to zero to allow instant manipulation of selected parts. Hold down the <*Alternate*> key to suspend all manipulation of selected parts.

View-only Mode Disable mouse control over selected parts while this mode is active. This action is located in *Tools* → *View-only Mode*, which you can bind a keyboard shortcut to (see Section 1.6).

5.3.2 Translate (Move)

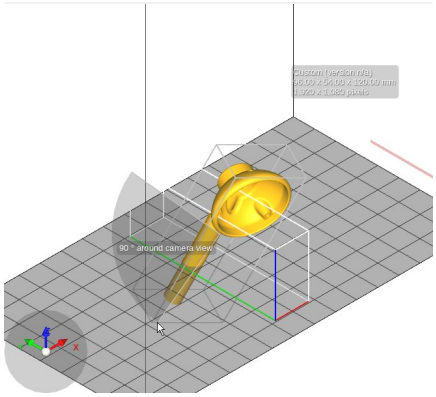


Use the left-mouse-button to drag selected parts.

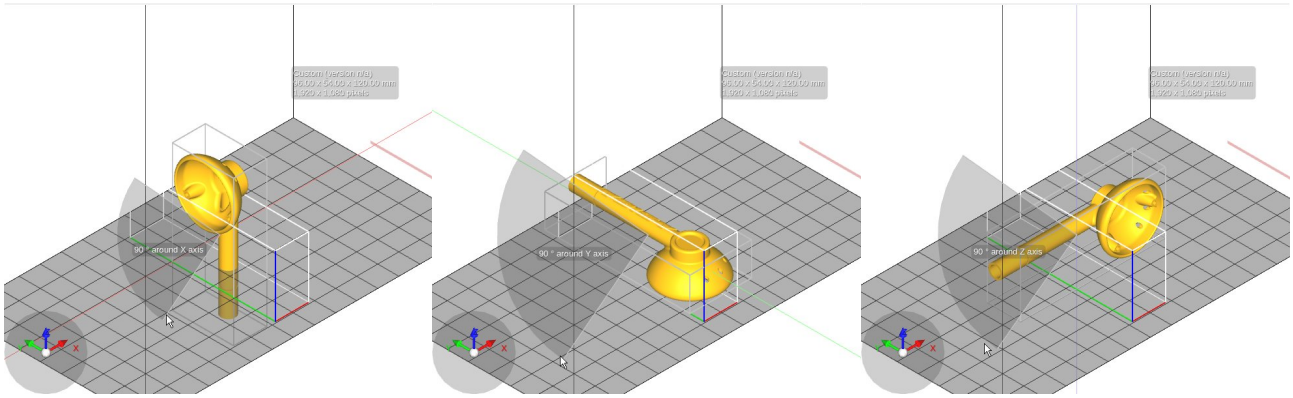


Lines are drawn to represent the offset. Enable snapping to bounds *Options → Snap to Platform*. The <*Shift*> key enforces snapping to platform edges and steps any movements in "Grid interval" increments. The <*C*> key allows you to move parts over a virtual plane perpendicular to the camera view.

5.3.3 Rotate (Turn)

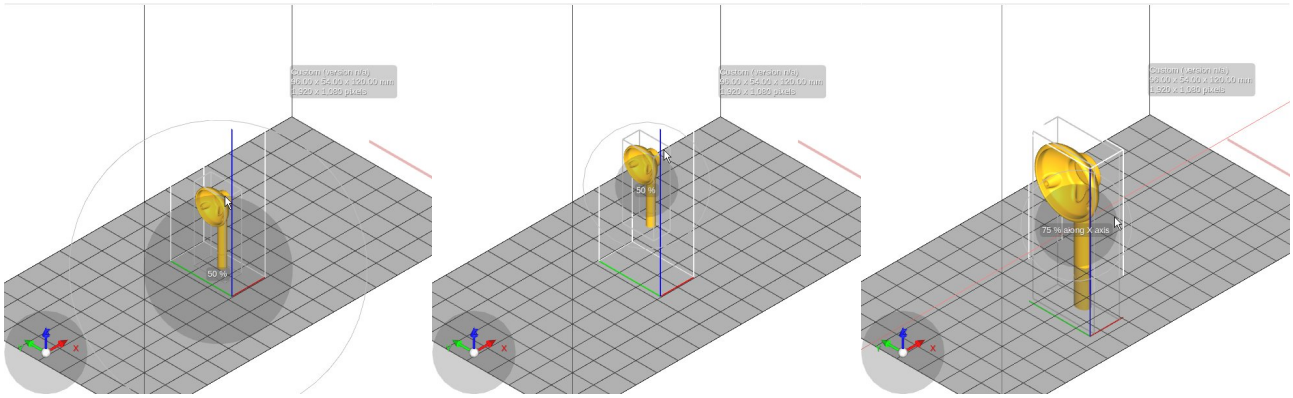


Use the right-mouse-button to orient selected parts.



A pie figure is drawn to represent the angle of rotation. The axis of rotation is the calculated from the average positions of parts. Move the mouse around the center of selection like a clock to express the turning angle. The <*Shift*> key steps the rotation in 15° increments. The <*C*> key will pivot parts around the line between the camera and the center of selection.

5.3.4 Scale (Shrink / Grow)



Use the middle-mouse-button (the scrollwheel) to scale selected parts. The circle outline represents the initial scale, whereas the filled in circle represents the target scale. Control the size of the target scale by adjusting the cursor distance from the center of the circle.

Scaling would typically require a higher control requirement than to set the position or orientation of your parts. The <*Shift*> key steps the factors in powers or fractions of 2 or 4. A greater control of accuracy for scaling is available in the "Transform Panel". The <*C*> key changes the center of the circle from the base of selection to the center of selection.

5.4 Restrictions

Certain transformations are not allowed based on file type or status.

Translate (move) along Z Column (fixed) support structures or any part linked to one.

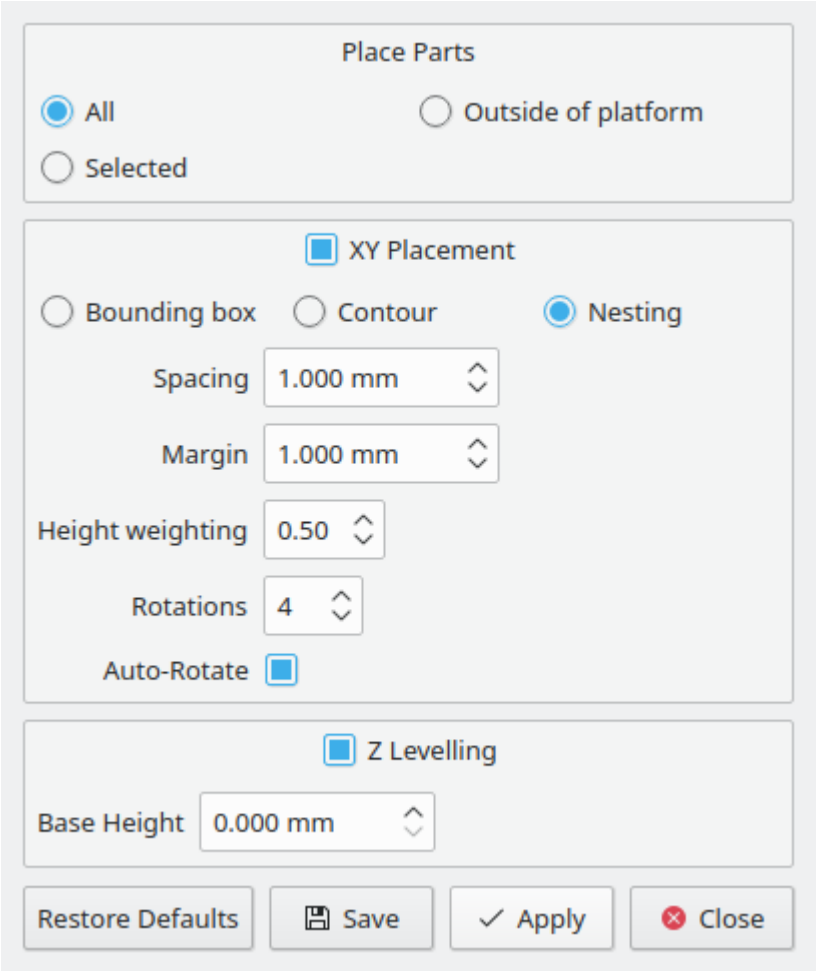
Rotate (turn) around X or Y Column (fixed) support structures, non-STL files or any part linked to one.

Scale non-uniform Any support structure or any part linked to one.

Mirror along Z Lattice (flexible) support structures or any part linked to one.

5.5 Automatic Placement

The "Auto-Place" dialog is separated into groups named Place Parts, XY Placement and Z Leveling. The checkable groups XY Placement and Z Leveling provides flexibility to partially utilize the autoplacement feature.



Auto-Place <*Control + P*> Also available under *Tools → Auto-Place…*

Bounding Box Simple box packing method.

Contour Physics-based vibration packing method.

Nesting Place parts around the centre of the platform.

Spacing Minimum distance between each parts.

Margin Clearance from the edges of the build area.

Height weighting Prioritize part placement by Z height rather than XY area.

Rotations Number of orientations to try for “Nesting” method and when “Auto-Rotate” is on.

Auto-Rotate Activates rotation for “Nesting” method or allow 90° rotation for “Bounding Box” method.

Base Height Clearance from the platform base. Optional should you use automated support generator.

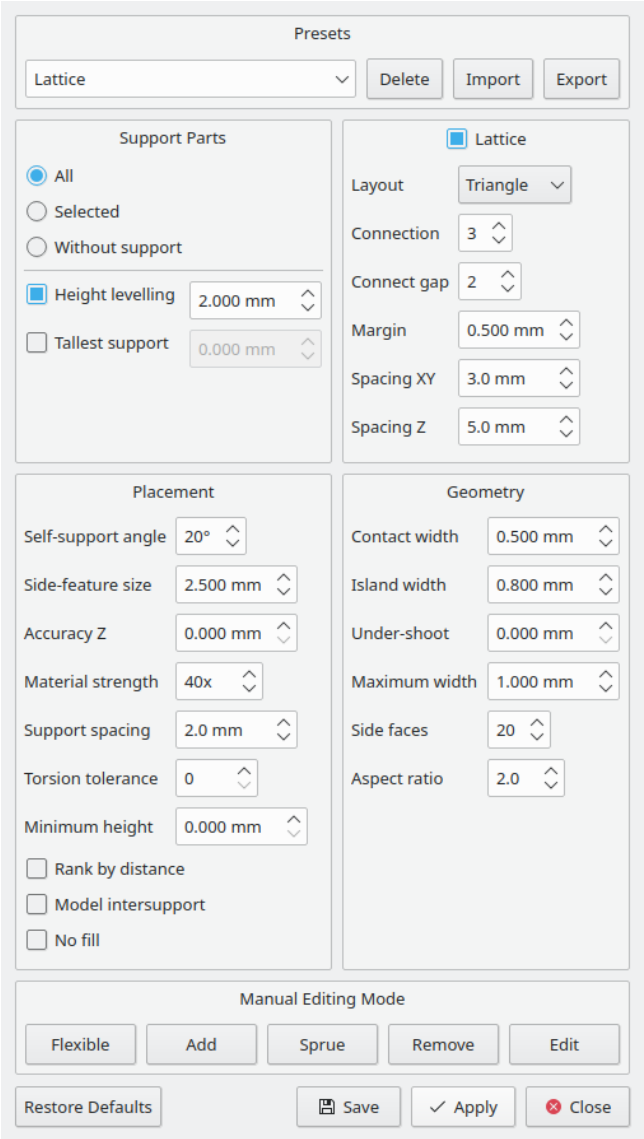
Chapter 6

Support Structures

The success of 3D printing a part depends on its geometry and all physical connections to the build platform. Support structures are required for downward-facing surfaces / points and for side-features details that protrude a certain distance from a surface. You can create and edit support structures within Composer.

6.1 Generate Support

The “Generate Support” dialog is separated into groups named Presets, Support Parts, Lattice, Placement, Geometry and Manual Editing Mode. All sections are utilized for the automatic support generation algorithm.



Generate Support... <*Control* + *G*> Opens the “Generate Supports” dialog to manually edit supports or apply automatic supports. Accessible via *Tools* → *Generate Support...*

6.1.1 Presets

Added in Composer 1.3.4, multiple support structure setting presets may be managed or shared. Click on “Save” to store the presets for the next time the dialog is opened, you must click this button to remember new presets, commit deletion or accept imported INI. Click on “Restore Defaults” to clear all custom presets. By default, Composer will have “Default”, “Lattice” and “Flexible” presets available.

Selection box Select a preset to load its settings or enter a new name to create a new preset”.

Delete Deletes the currently active preset except for the “Default” preset.

Import Load a SupportDialog INI file to import.

Export Save a SupportDialog INI file to export.

The Support section of SupportDialog INI file is compatible with the Support section of Material INI file.

6.1.2 Support Parts

Support parts filters where the automatic support generation applies.

All Generate support for all parts and replaces existing.

Selected Generate support selection and replaces existing.

Without support Generate support for all parts without an existing support.

Height leveling Applies a Z-margin between the parts and the platform. This margin may be necessary to support low-hanging areas.

Tallest support Ignores any feature to support above the specified height. When you are confident that your parts are self-supporting above the height.

6.1.3 Lattice

Starting from Composer 1.3.4, the “Lattice” support structure generates an interconnected network of supporting beams around the model. You may use the preset to apply a tailored settings for lattice structures, see the Presets section.

Layout How nodes are spread over XY positions.

Connection Number of nodes to connect on the lattice level below. Setting this value to 0 will create flexible supports.

Connect gap Number of lattice levels to suppress connection after a vertical connection was found (available).

Margin Additional collision avoidance distance from model.

Spacing XY Distance between nodes over XY plane.

Spacing Z Distance between lattice levels over Z axis.

6.1.4 Placement

Self-support angle The angle between 1° and 50° at which layers will be self supporting.

Side-feature size The distance a detail can protrude from a surface without being supported.

Material strength Multiplies with the supported surface area. For example, a supported surface of 2 mm^2 and strength of 30 will be enough to support 60 mm^2 area.

Support spacing Distance between support points of the same body.

Torsion tolerance Angular moment in squared distance units.

Minimum height Avoid adding re-intersecting supports if their height is less than the specified height.

Rank by distance Prefer to add points furthest away from previous layer rather than by its corner or edge angle.

Model intersupport Allow support columns that will reintersect and stand on the part. See Intersupport section.

No fill Large overhanging areas will not be filled with contact points.

6.1.5 Lattice Geometry

Geometry when Lattice group box is checked.

Contact width Width of contact ball as it contacts the part.

Island width Width of contact ball upon first contact for each part body.

Undershoot Distance from contact point where the structure begins to taper to a point.

Maximum width Limits the width of support structures at the base.

Aspect ratio Controls the widening rate of support structures.

Side faces Defines the number of side faces for new support structures.

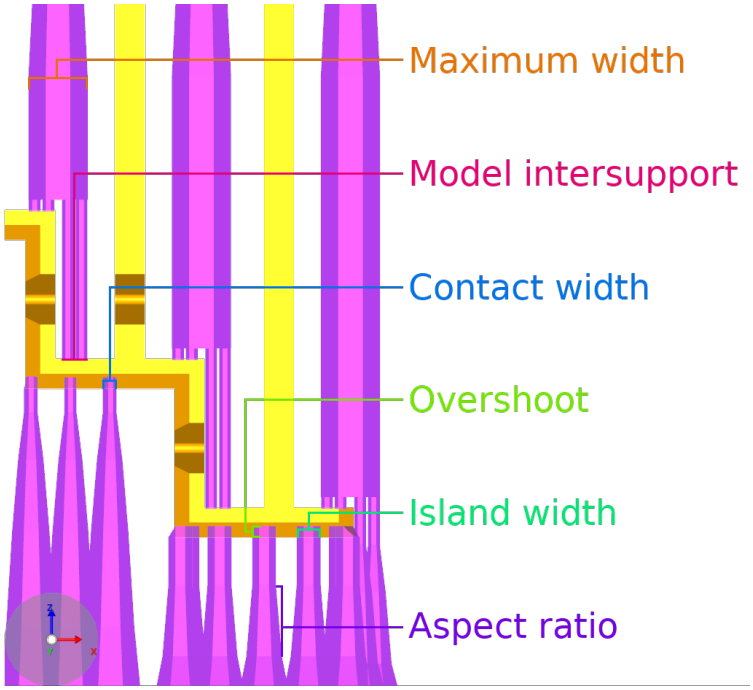
When automatically generating lattice support points, Composer will attempt to connect with the lattice structure by the following preference:

1. Nearest node that is not under the current layer, which is typically positioned outside the model.

2. Nearest node that would form the most vertical structure.
3. Delayed attempt to connect with the node structure by forming a vertical column.

6.1.6 Column Geometry

Geometry when Nodes group box is unchecked.



Contact width Width of support structure as it contacts the part.

Island width Width of support structure upon first contact with the part.

Overshoot The maximum injected distance where the support point enters the part. Composer 1.2.2 applies *conservative overshoot* for normal and sprue supports.

Maximum width Limits the width of support structures at the base.

Aspect ratio Controls the widening rate of support structures.

Side faces Defines the number of side faces for new support structures.

6.1.7 Sprue Geometry

Geometry options when Sprue addition mode is active.

Contact width X Width of sprue along X axis as it contacts the part.

Contact width Y Width of sprue along Y axis as it contacts the part.

Keep aspect ratio Maintains ratio between contact width X and Y.

Overshoot The maximum injected distance where the sprue enters the part.

6.2 Intersupport

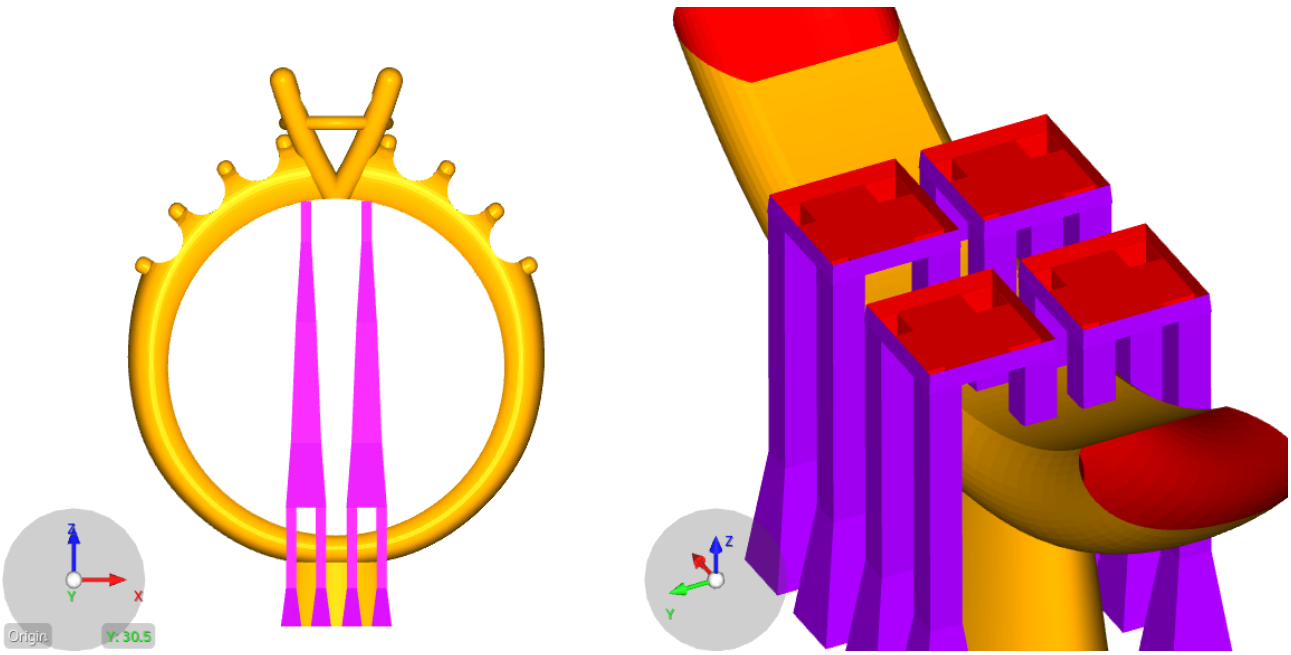
Support structures may need to intersect and rest on the model it is supporting if it cannot avoid it.

6.2.1 Lattice Intersupport

The lattice support structure will attempt to avoid the model by connecting to nodes around the model. When an intersection cannot be avoided, a spherical contact point will be added onto the model underneath the structure. Users may activate Edit mode and move intersupport contact points around to better positions.

6.2.2 Column Intersupport

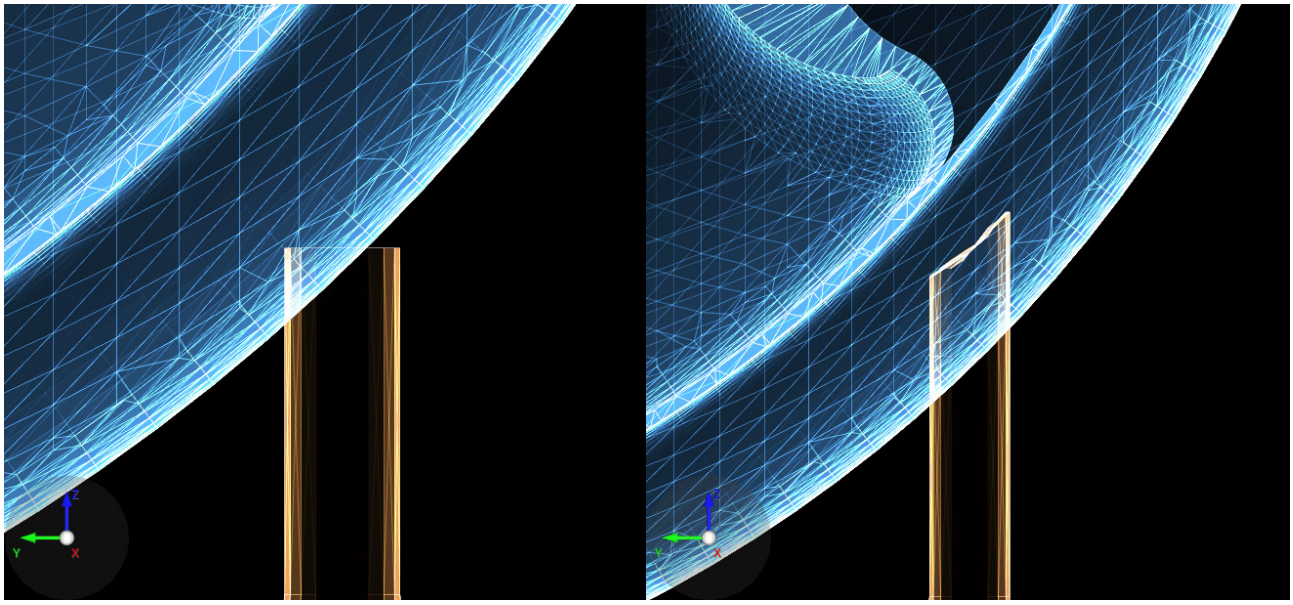
Parts with hollows or caves may cause your support structures to touch or intersect the model. The column support structure will end its base at the intersection region creating a bridge for the same model. Composer will attempt to minimize the cross-sectional region at the base of these internal standard supports.



Partial intersections of supports may branch the column at the corner points. The “Aspect ratio” setting affects the widening rate, which affects the chance of branching. The branched structure will widen again as if it was a normal support structure.

6.3 Overshoot

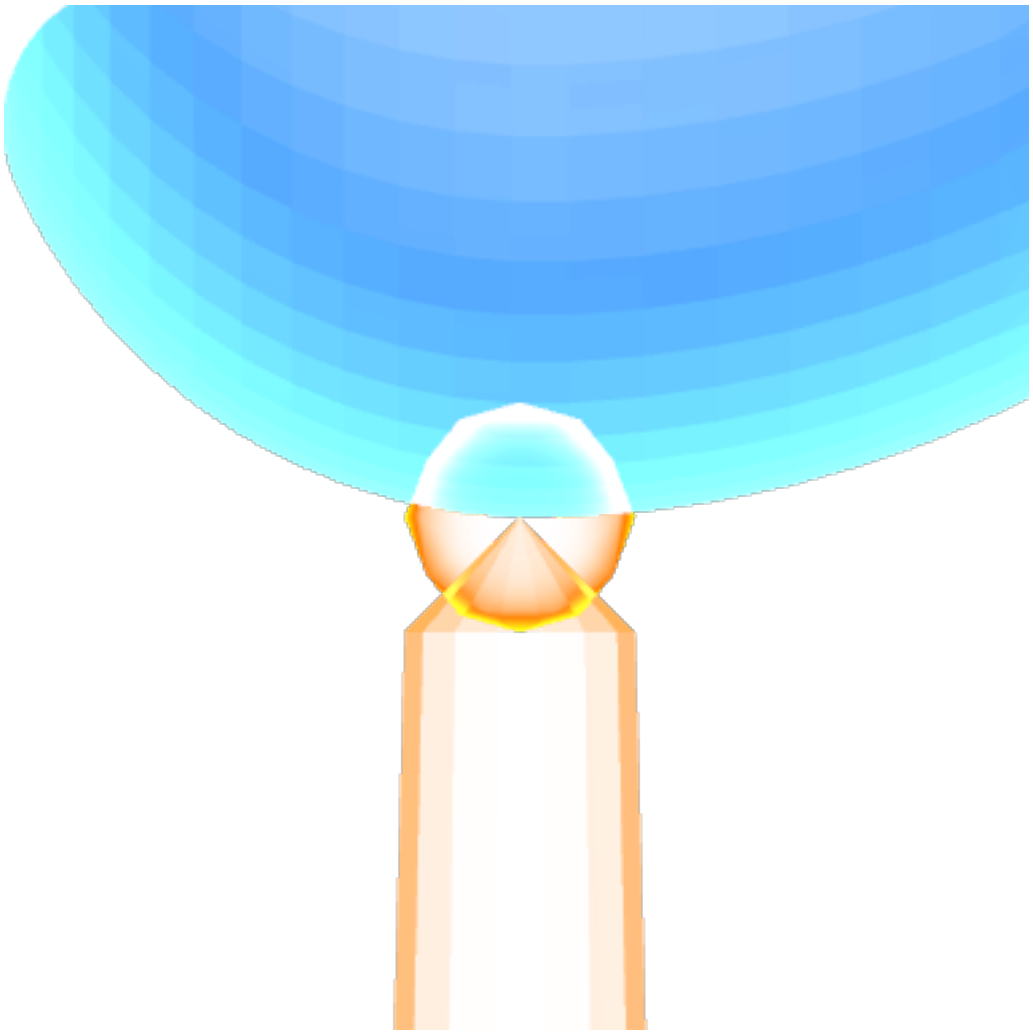
Column (fixed) support point overshoot is necessary to ensure complete contact between a support column and its model. When a support point without overshoot is added to a steep wall, you will have a reduced contact area between the support and model (see left image below).



From Composer version 1.2.2 or later, the overshoot segment of column support structures or sprues are trimmed to avoid punctures (see right image above). This effect is noticable when support points are added at a steep overhanging wall of your models. It is recommended to use large overshoot values when adding non-flexible supports and allow Composer to trim the overshoot.

The overshoot trimming works by adjusting the Z height of the center and each corner points of the polygon. Composer would determine the entry and exit heights, then use the midpoint from the entry height to either the exit or overshoot height, whichever is smaller.

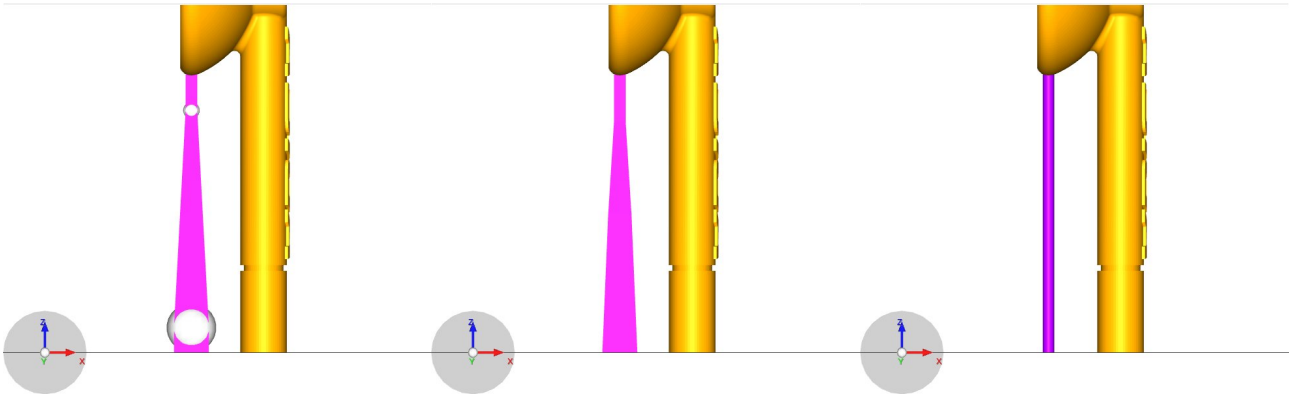
6.4 Undershoot



Lattice support structures are connected to the model using spheres. The undershoot value forms a tapering cone away from the center of the sphere to form easy break points away from the model.

6.5 Manual Editing Mode

Composer can only edit support structures created within the program itself. Support structures are colored magenta by default, unless their bounding box exceeds the buildable area. Any externally created support files are not editable. When manually adding supports, all existing supports will be faded out and you can click through to models.



Flexible Activates “Flexible” preset for flexible supports that consists of movable contact, joint and platform points.

Add Support point and structure that utilizes all parameters within Geometry. You may click Apply to automatically generate additional support points. Lattice support structures will be hidden in this mode.

Sprue Fixed diameter cylinder controlled by “Diameter” and “Over-shoot” only. Sprues are atypical requirement in metal casting and should have circular cross-section for optimal fluid movements. Lattice support structures will be hidden in this mode.

Remove Click on columns to removes any support structures beit automatically generated or manually added. No support dialog sections are used for “Remove” supports.

Edit Modify existing support structures. Click nodes to select, hold down Shift to select all nodes along a vertical column, hold down Ctrl to toggle selection. Apply new geometry settings to active node set. Double-click on contact points to adjust its diameter. Freely rotate or move the model up or down.

In manual editing mode, support structures can be added or removed by clicking with the left-mouse-button. Part manipulation via the Viewport is disabled during editing, however you may still interact with selections using the Parts List.

6.5.1 Flexible Support

Added in Composer 1.1 the flexible supports introduces two joints / nodes between the support point and the platform. Flexible supports will remain independent or isolated from lattice structures and to other flexible supports. See Edit Support section to move nodes.

Add a Flexible support by clicking on the model surface with the left-mouse-button. Composer will orient newly added Flexible supports away from the contact point and you should ensure that the structure is well cleared from all parts. You are allowed to add

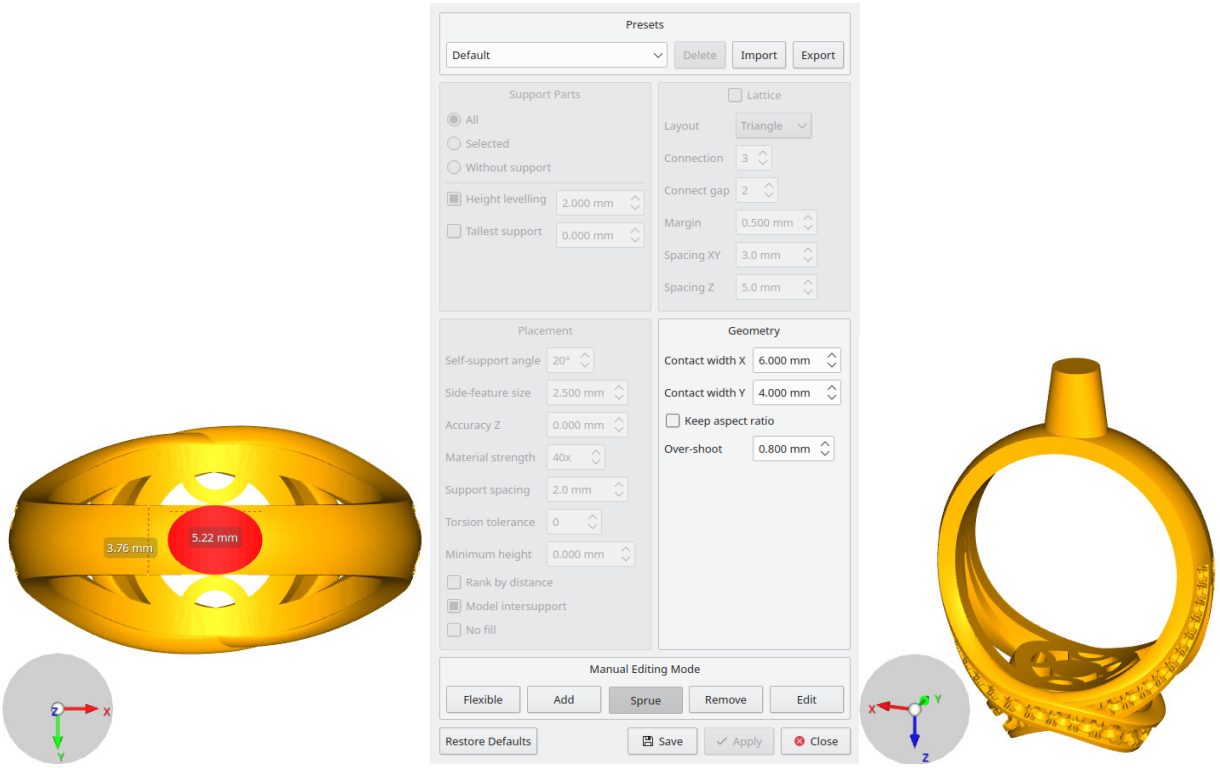
Flexible supports on a completely vertical face, but beware that you should adjust the joints to form a buildable slope.

6.5.2 Add Support

Depending on whether Lattice group box is active or not, Composer may add a lattice node contact point or a static column contact point. Click on the model surface to add a contact point, which may fail if Composer is unable to form a self-supporting structure. From Composer 1.3.4, you may now generate additional support points by clicking Apply when Add mode is active. The “Add” mode may ignore Height leveling and Lattice group if there is an existing structure.

6.5.3 Sprue Support

Sprue structures are necessary when building models for investment casting. Sprues act as a channel for metal flow so it is important to have rounded edging and coherent contact area. The X & Y contact widths can be adjusted independently to aid in spreading the metal. Only the Geometry section is used for manually adding “Sprue” supports.



Contact width X Contact width along X axis.

Contact width Y Contact width along Y axis.

Keep aspect ratio Updates the complementary contact width value with previous ratio.

6.5.4 Edit Support

Starting from Composer 1.3.4, lattice support point nodes are not overt and modifiable unless Edit mode is active. Edit mode allows you to manually modify nodes, freely transform models or click Apply to adjust the structure with a different geometry settings. Static column supports are not editable.

White Inactive structural node.

Orange Inactive contact node.

Pink Inactive strength or torsion contact node.

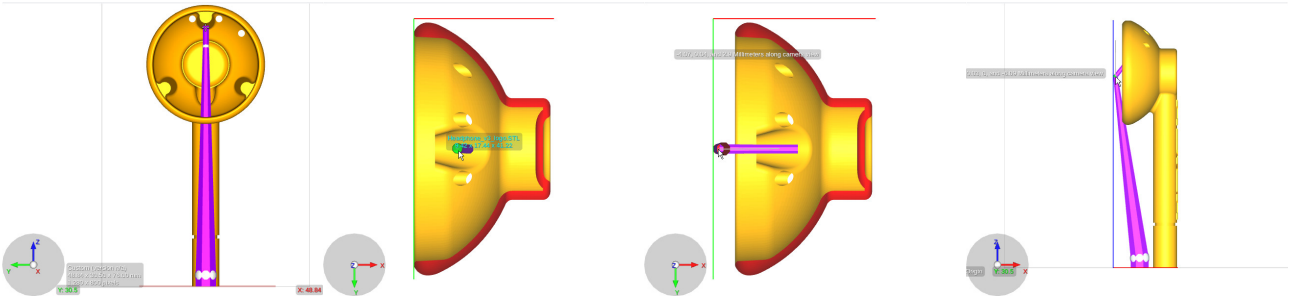
Red Inactive essential contact node or unsupported moved node.

Green Active node.

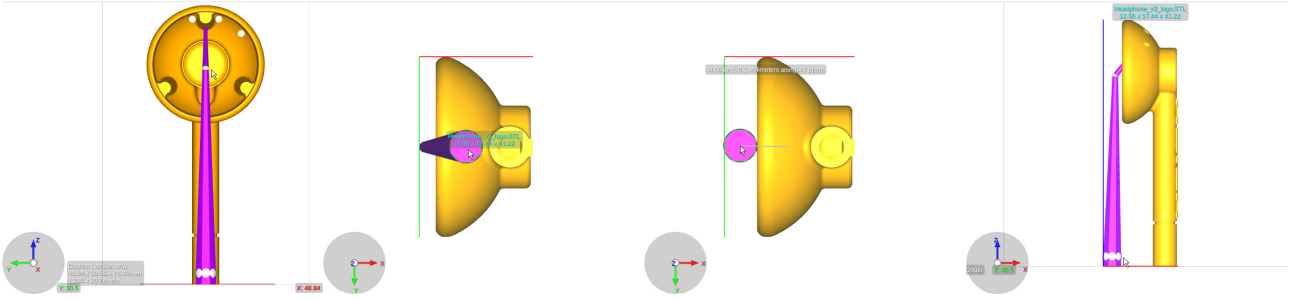
Light red Selected essential contact node.

Lime Selected node.

Select nodes by clicking on them. Hold down <*Shift*> and click to select all structural nodes that are connected vertically along the Z axis. Hold down <*Ctrl*> and click to toggle the selection state of nodes.



Handle the nodes by pressing the left-mouse-button and keeping it pressed as you move the mouse around the viewport. Contact nodes may be moved on the model while structural nodes may be moved freely in any direction. Currently moved nodes will turn red should the angle to any of its connected nodes falls below the self-support angle, which will be refused by Composer. It is also possible to constraint the movement axis of structural nodes by pressing down the <*X*>, <*Y*> or <*Z*> keys. Press <*Escape*> at any time to cancel node movements.



Lattice support structures without any static columns can be rotated around any axis or be moved up or down along the Z axis. Once a transform is done, any contact nodes below the platform will be removed and a new structure will be regenerated with all remaining contact nodes.

Double-click a contact node to adjust its width.

Amend the geometry of active nodes by entering new values in the Geometry section and click Apply.

6.6 Support Management

Managing support structures for any selected parts are available from the context menu and under the “Edit” menu.

Add Support File Choose an existing file to be the support structure for the current model.

Remove Support File Removes support structure from all selected parts.

Unlink Support File Unbound all selected parts to allows independent selection and transformation of either model or support.

Link Support File Binds all seleceted parts so models and supports will be selected or transformed together.

6.6.1 Parts List Representation

All supports in the parts list are paired with its related model. The paired items are typically linked together so they share selected state and will move together. The icons shown next to the name denotes the state of the paired items:

- Linked Model
- Linked Support
- Unlinked Model
- Unlinked Support

6.6.2 Transform Limitations

Linked items are not allowed to be transformed in any way that may change its base. You are only allowed to move horizontally over the platform, rotate around the Z axis or scale towards the base. Exception to the rotation and translation rules applies when transforming models linked with completely lattice support structure.

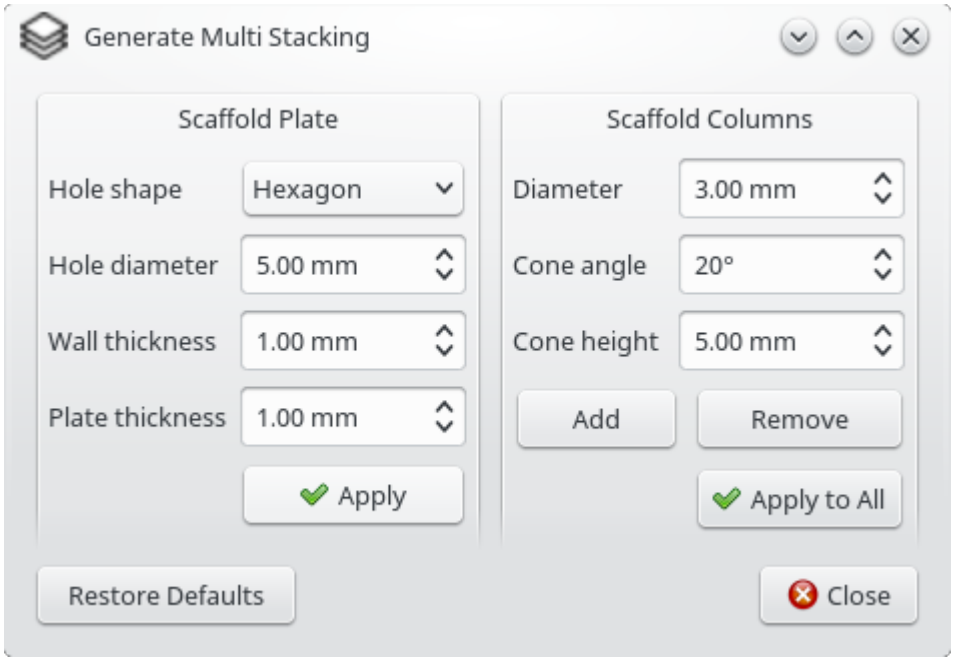
Chapter 7

Multi Stacking

Multi Stacking allows builds to be stacked on top of each other to build consecutively without manual intervention between builds. This allows users to take advantage of the available Z height in all Asiga 3D Printers. To use Multi Stacking the user will follow the procedure:

1. Prepare multiple builds separately in different build tabs, one for each level in the stack. Each build should have the same target printer, material and slice thickness.
2. Generate a multi stacking scaffold for each build. The multi stacking scaffold allows builds to be stacked on top of each other. A multi stacking scaffold is not required for the last build in a stack and will be ignored if present.
3. Select in the Build Wizard which builds to include and their stacking order (see chapter on Build Compilation).

7.1 Generate Multi Stacking



Generate Multi Stacking...

Opens the “Generate Multi Stacking” dialog to generate or edit a multi stacking scaffold. Accessible via *Tools → Generate Multi Stacking...*

This dialog provides the tools for adding a multi stacking scaffold to a build so that another build can be stacked on top of it.

The generated multi stacking scaffold appears in the Parts List as Scaffold.comscf. Only one multi stacking scaffold can exist for a build at a time. If an attempt to add more than one multi stacking scaffold is made, the existing scaffold will be replaced. When a build is saved, the scaffold will be saved in the same location with the name of the build and the .comscf file extension.

7.1.1 Scaffold Plate

Hole shape Shape of the holes in the plate - Hexagon, Triangle or Square

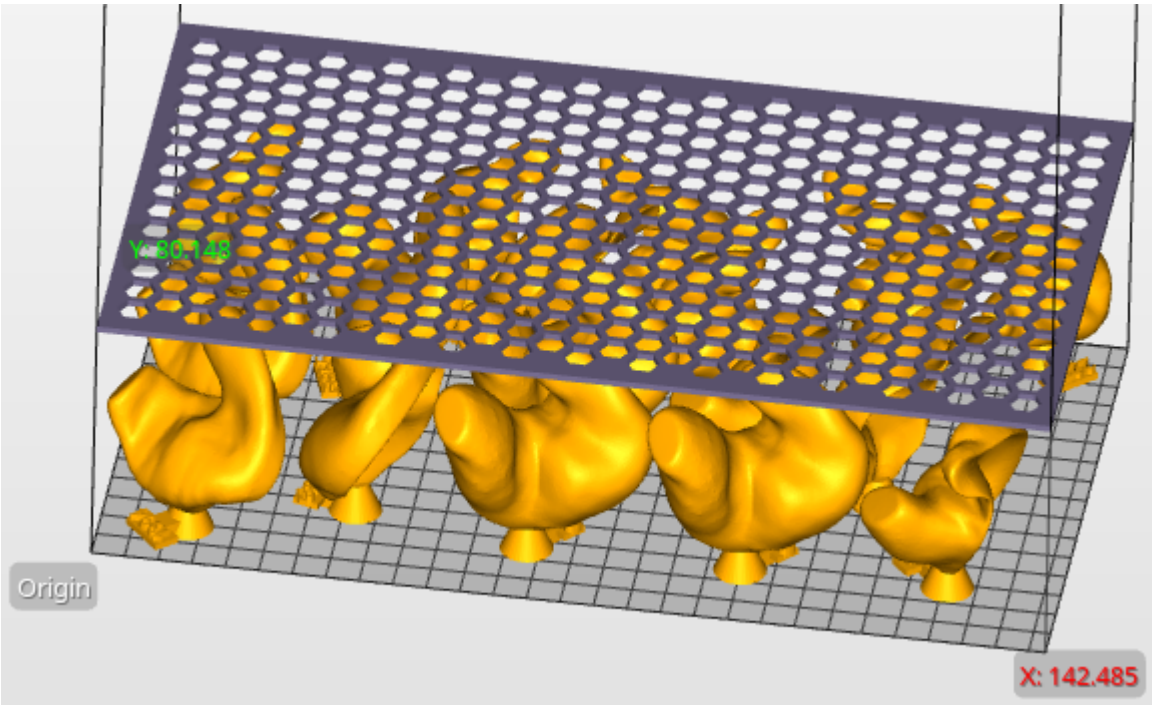
Hole diameter Diameter of holes in the plate

Wall thickness Thickness of wall between holes in the plate and minimum distance between perimeter of plate and its holes

Plate thickness Vertical thickness of the plate

Apply Applies the above parameters to the scaffold plate, creating one if a scaffold plate doesn’t exist yet

Note that clicking Apply will position the scaffold plate at a distance of “Cone height” (see Scaffold Columns) above the maximum Z extent.



7.1.2 Scaffold Columns

Scaffold columns need to be added by the user to support the scaffold plate. Each column can have its own diameter, cone angle and cone height though in most cases it is sufficient to have the parameters the same for all scaffold columns.

Diameter Diameter of the column

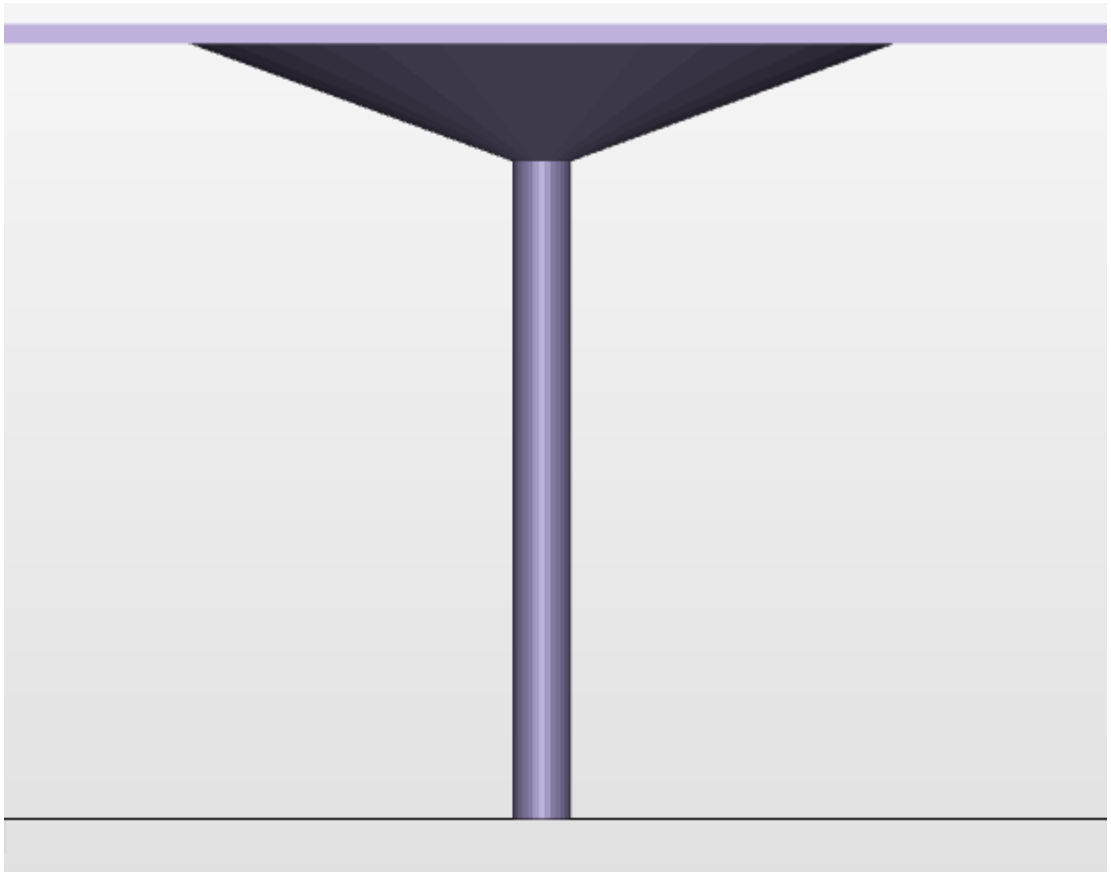
Cone angle Angle in degrees at which the cone at the top of the column contacts the plate

Cone height Height of the cone at the top of the column

Add Add a scaffold column

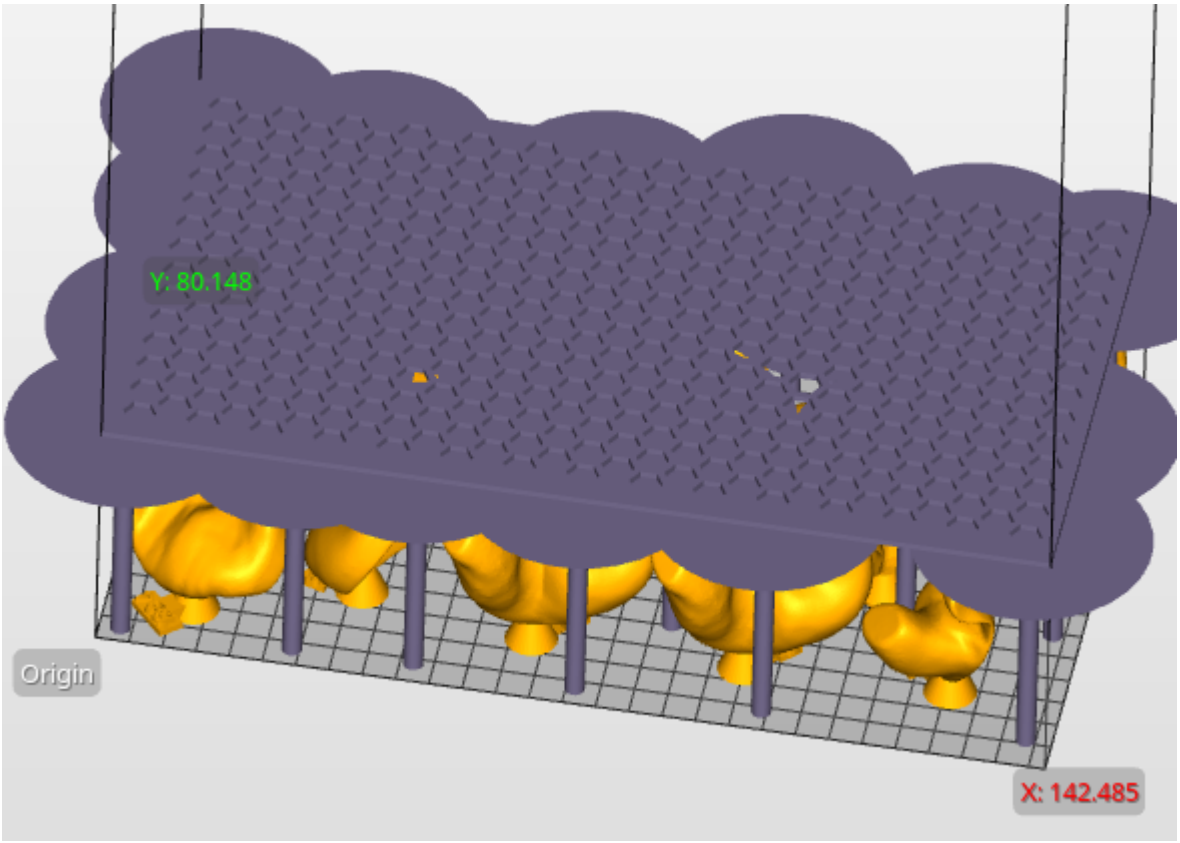
Remove Remove a scaffold column

Apply to all Apply scaffold column parameters to all existing scaffold columns

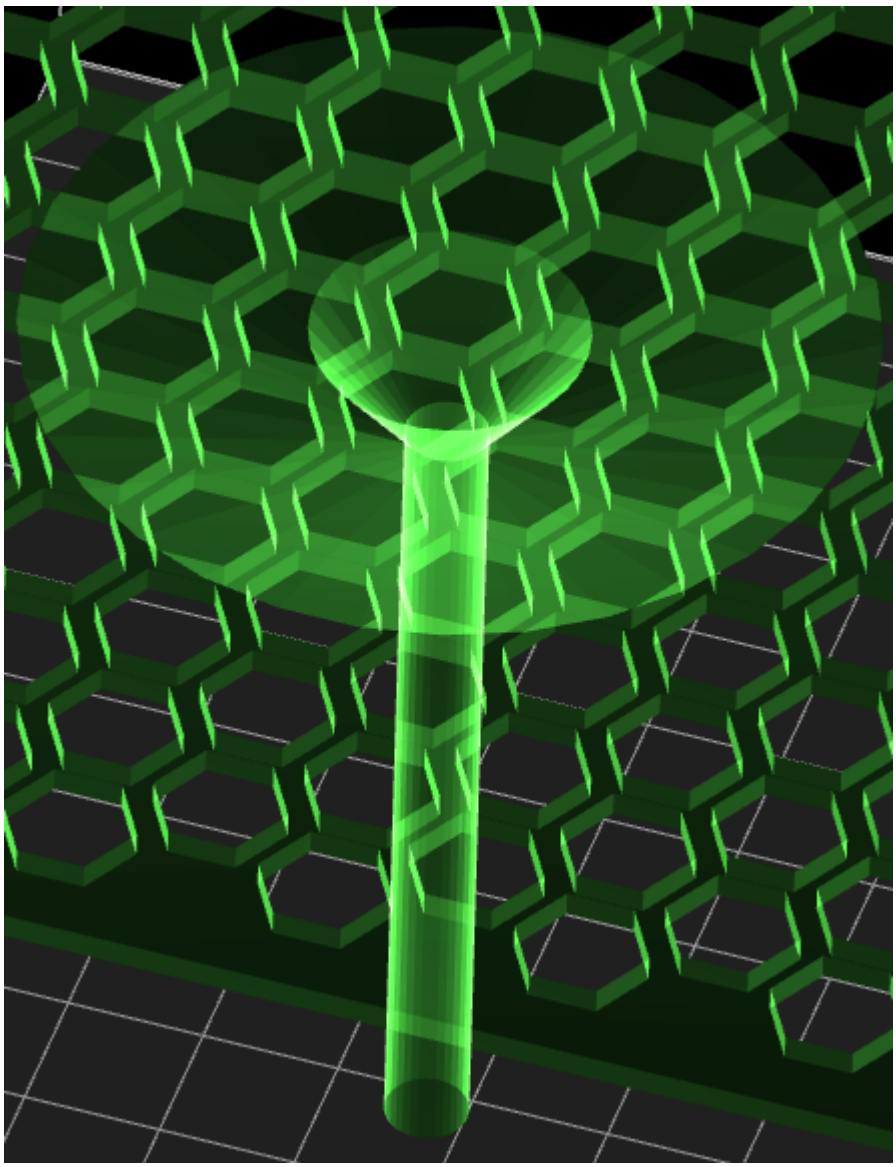


Scaffold columns are added by pressing the "add" button to enable the add mode and then left-clicking anywhere on the multi stacking scaffold plate. The add mode is disabled by clicking the "add" button again. Scaffold columns are removed by pressing the "remove" button and then left-clicking anywhere on an existing column. The remove mode is disabled by clicking again on the "remove" button.

Scaffold columns should be placed in gaps between parts such that the cones cover the majority of the plate.



Inside the scaffold column there is a hidden inner cone with a diameter of twice the plate's hole diameter that is viewable using X-Ray Mode or the Clip Slider. During the build process, the scaffold plate holes will cut through the outer cone but not the inner cone or the column supporting it. This reduces the material consumption and separation forces for multi stacking during the build process. The inner cone ensures that the column does not fall through the plate holes.

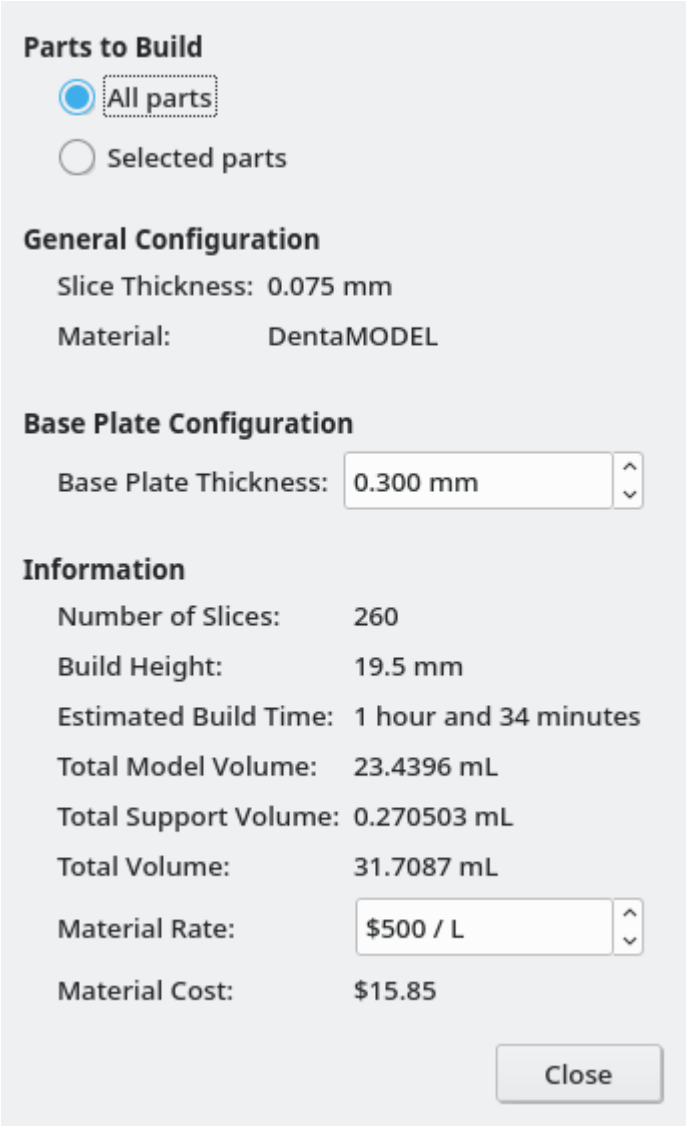


Chapter 8

Build Compilation

8.1 Build Time

 **Build Time <*Control + B*>** Calculates the build height, build time, material usage and material cost. The volumes are shown in milliliters and liters only. The currency is taken from the system's regional settings, which is independent to the language that you chose for Composer.

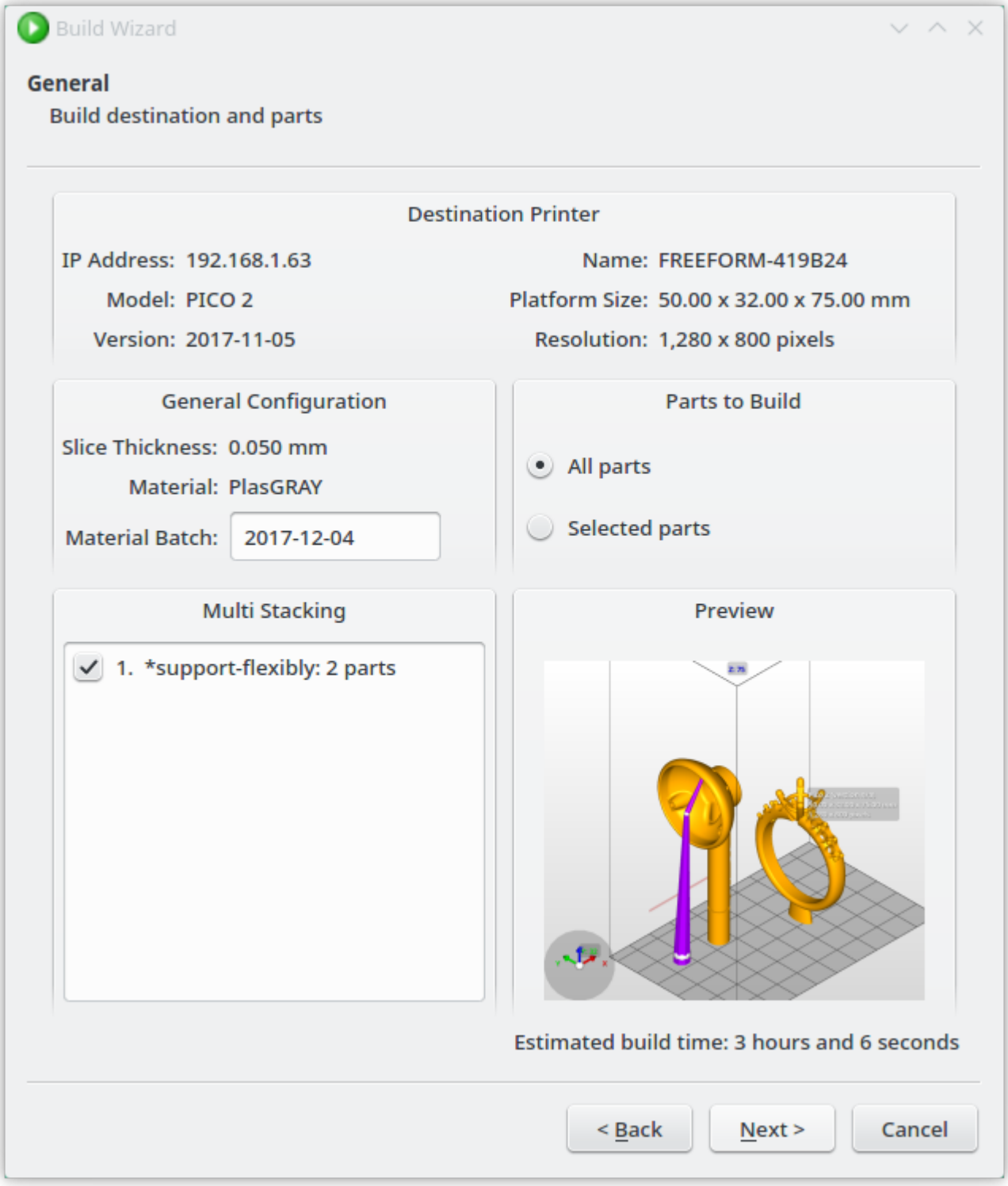


8.2 Build

All your final build parameters will be specified in the wizard. Parts can be preselected to be built before launching the build wizard.

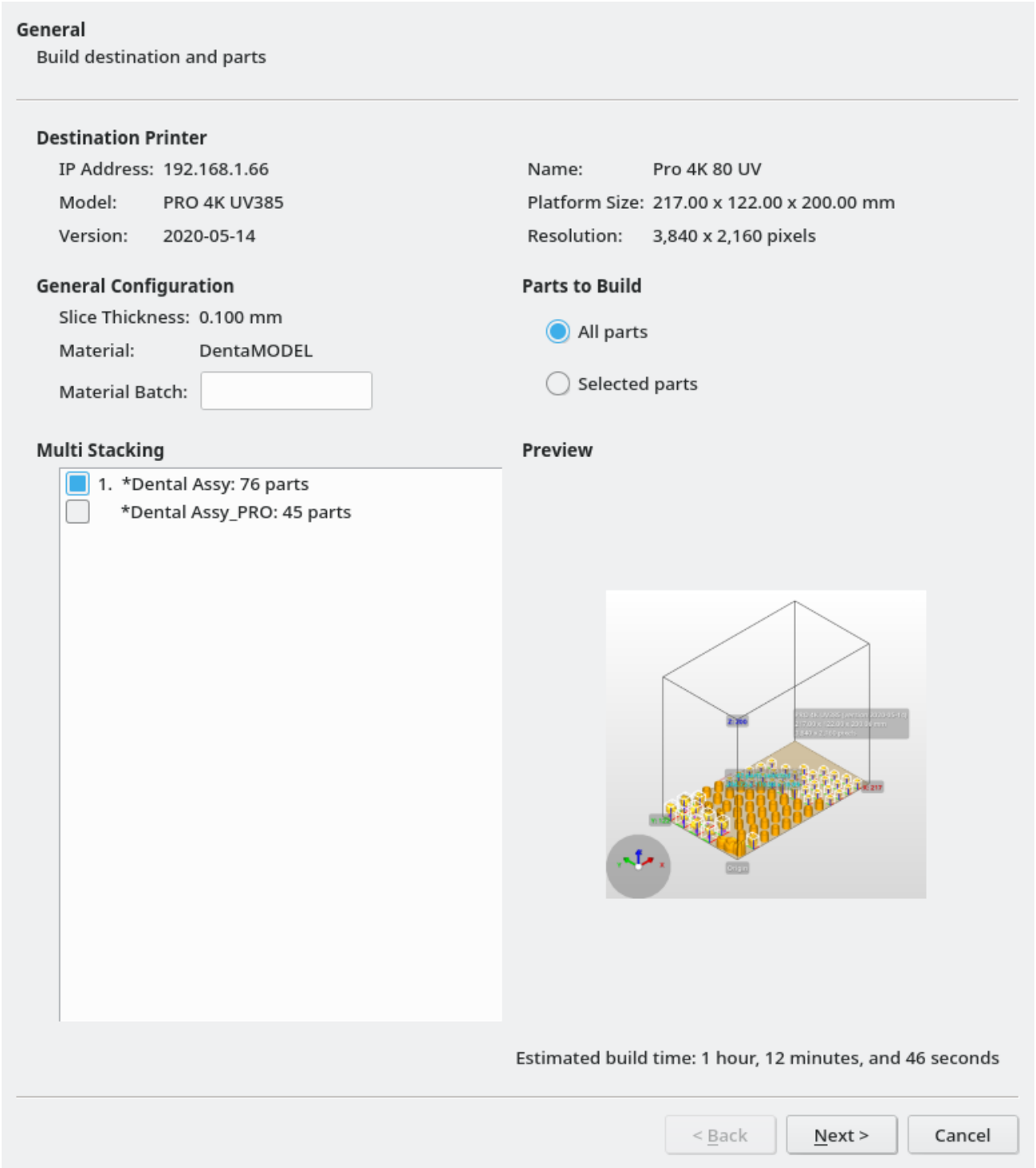
Build Wizard <Control + Shift + B> Start the build wizard.

8.3 General

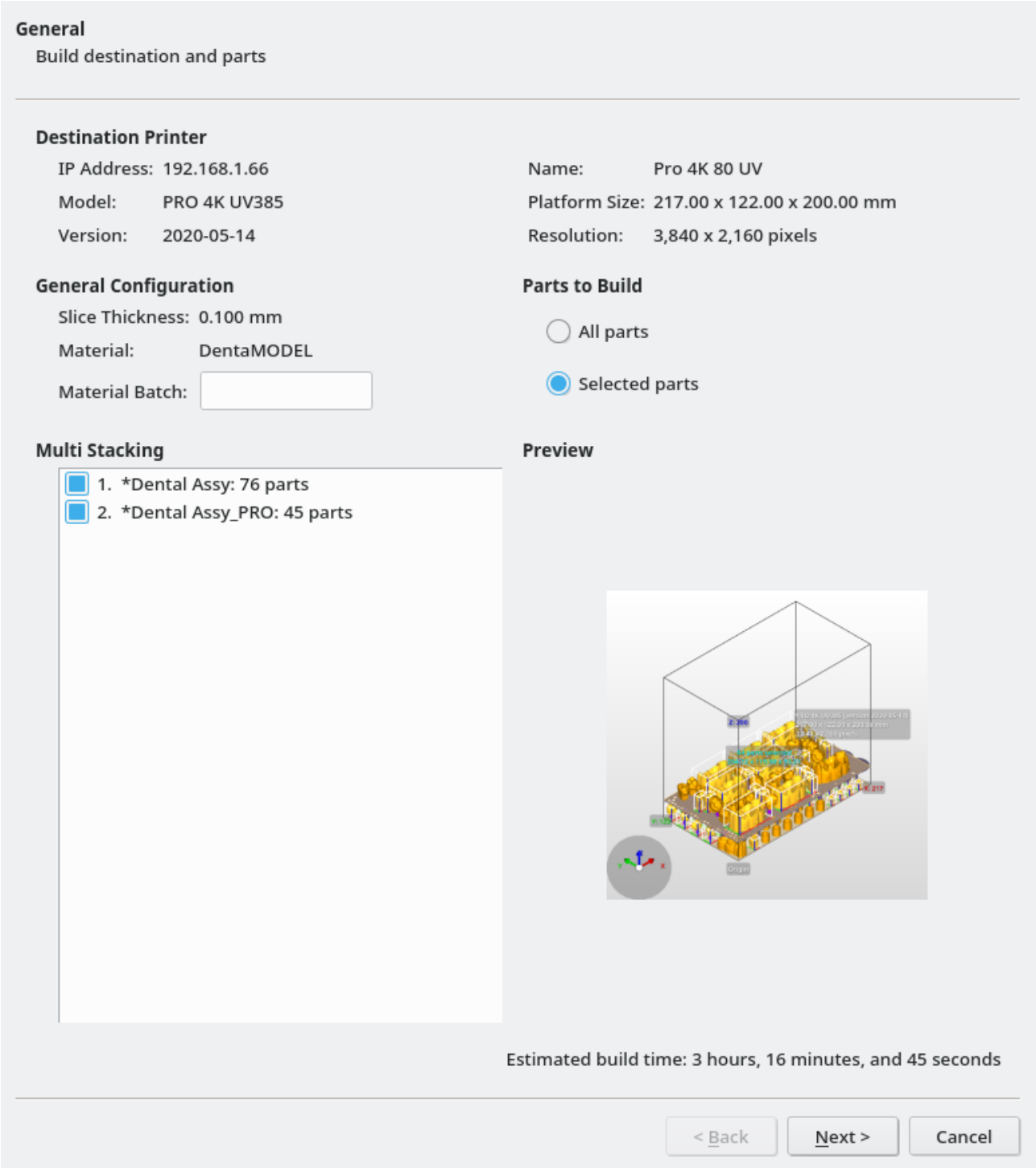


The first page confirms the destination printer information, slicing thickness, material and the set of parts to build. You may update parts selection by clicking on the parts on the 3D viewport behind the wizard window. The material batch is an optional field that you can later read off the build INI file for tracking or review purposes.

8.3.1 Multi Stacking



The Multi Stacking list allows you to select multiple builds that are targeted to the same printer to stack on top of each other using the checkboxes. The order of the builds in the Multi Stacking list can be changed using drag and drop. The first checked build at the top of the Multi Stacking list will be the first build to print. All checked builds except the last one must have a multi stacking scaffold.



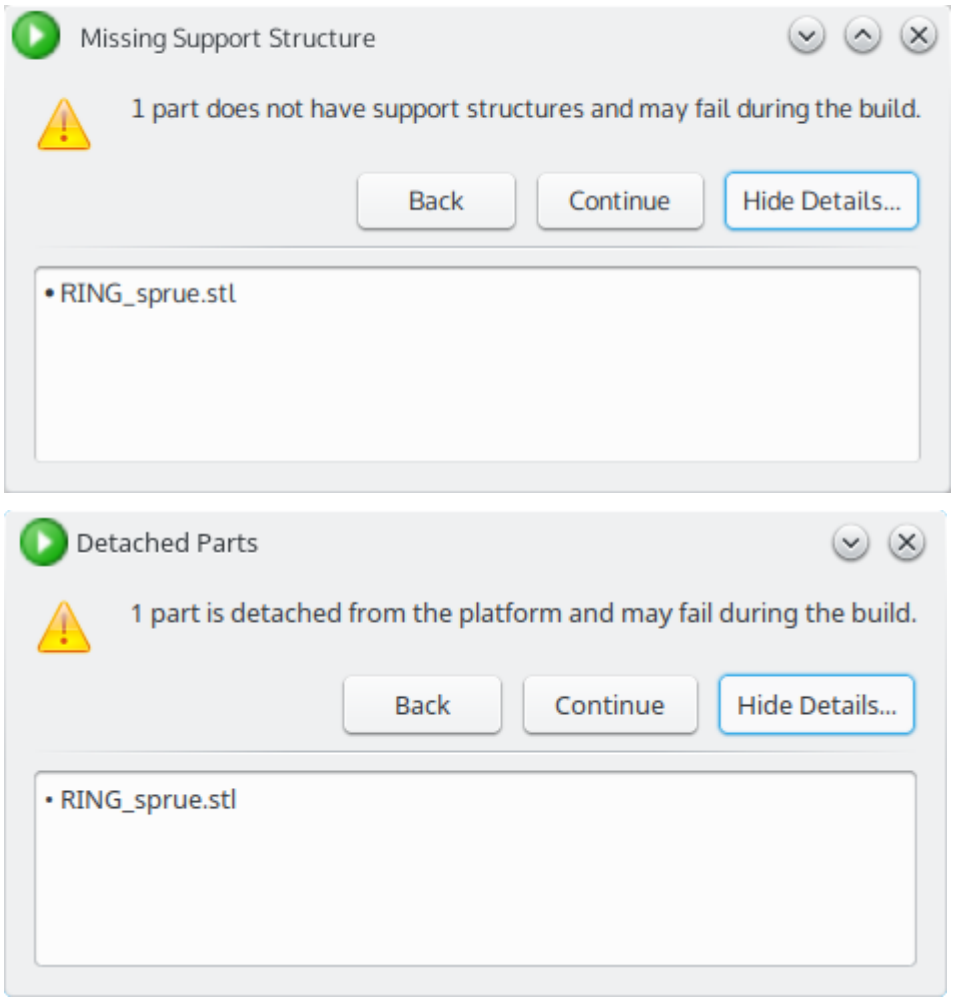
If the last checked build has a multi stacking scaffold, it will not be included as it is not necessary. Clicking “Next” will validate the parts to build and warn you of any potential problems.

8.3.2 Selected Parts

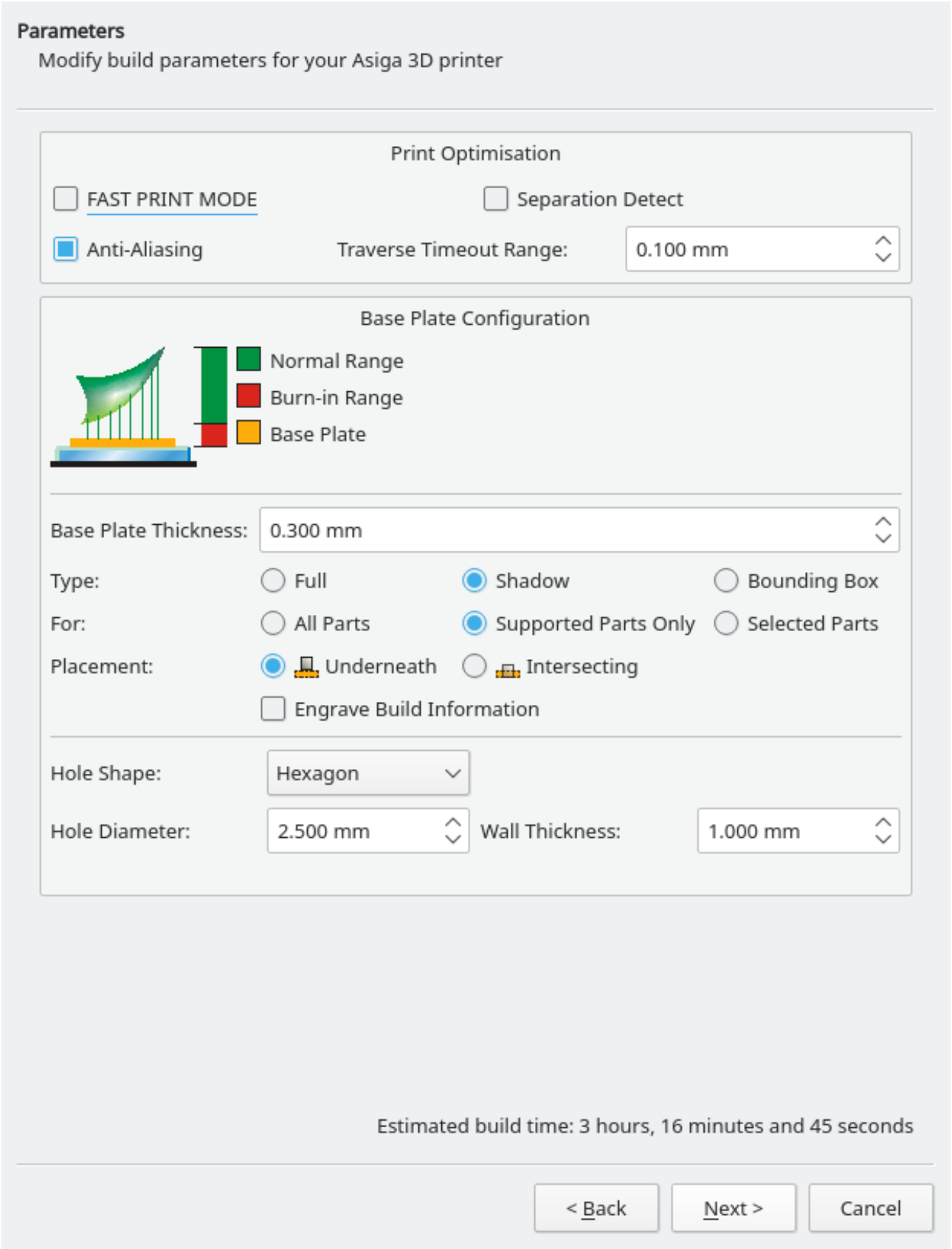
You can select a subset of parts to build by choosing “Selected parts”. Whilst you are on the first page, you may select or deselect parts in the 3D view behind the build wizard to update the selection. The selection during the build wizard will not be cleared should you

have clicked on nothing, use the <*Control*> key to toggle selections. You can select parts progressively for Multi Stacking builds as each stack maintains their own independent list of selected parts.

8.3.3 Validations



8.4 Parameters

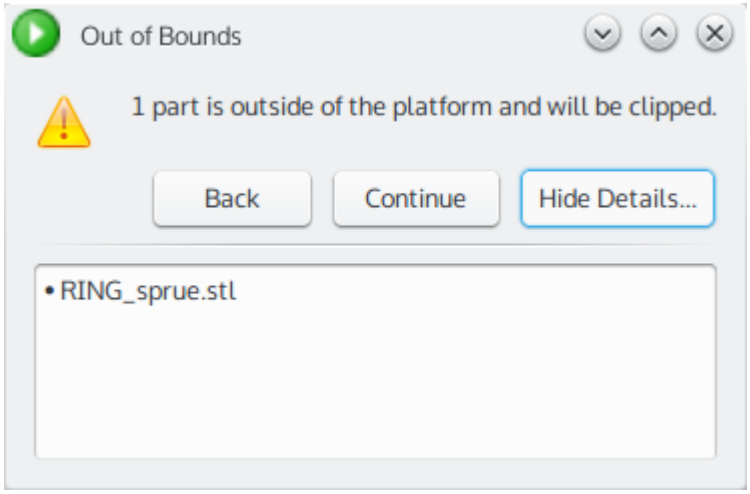


A “base plate” is an area to be printed directly on the platform. This is required when building parts with support structures as it helps bond the supports to the build plate. The base plate can also ease the task to remove the build from the platform after the

printing is finished.

For builds with multi stacking, the first build in the stack will always have a full base plate. Builds after the first build in the stack will always have the base plate placed underneath the parts regardless of the selected placement and use the selected base plate type with a thickness of 1 mm or the specified base plate thickness, whichever is greater. Multi stacking builds have slightly different behavior for the shadow and bounding box base plate types to ensure parts and columns don't fall through the holes of the multi stacking scaffold plate from the previous build in the stack. Shadow base plate in a multi stacking build will take the first layer of the build and expand it by the hole diameter of the scaffold from the previous build in the stack. Bounding box base plate in a multi stacking build will take the bounding box of the parts and expand it by the hole diameter of the scaffold from the previous build in the stack. A base plate is always added under the parts for builds after the first build in the stack regardless of whether "Supported Parts Only" or "Selected Parts" is checked.

Clicking "Next" will validate the parts to build and warn you of any parts outside the platform that will be clipped.



8.4.1 Base Plate Configuration

Base Plate Thickness Determines the height of the base plate in mm. Set to zero to disable this feature.

Engrave Build Information Write the build name and XYZ resolution in µm onto the base plate.

8.4.2 Base Plate Type

Full Cover the whole platform with a base plate. Easy to remove the whole build off the platform, but uses more material than required.

Shadow Minimal base plate for regions directly covered by the models. Can be difficult to remove individual parts off the platform.

Bounding Box Rectangular cover over each part's bounding box.

8.4.3 Base Plate For (Parts)

All Parts All parts should have base plate.

Supported Parts Only Excludes parts without supports to have base plate for the first stack only.

Selected Parts Select parts in the 3D view to have base plate for the first stack only. Hold the Ctrl key to progressively select parts.

8.4.4 Base Plate Placement

Underneath Shifts all parts and supports with base plate to be completely above the base plate.

Intersecting The base plate and parts or supports will be combined together for the first stack only.

8.4.5 Base Plate Holes

Hole Shape None, Hexagon, Triangle or Square. Selecting a shape other than None will add a pattern of holes in the base plate of the selected shape similar to the scaffold plates generated by Multi Stacking. To ensure that parts do not fall through holes, the first layer of each part is offset outward by the hole diameter and added to the base plate.

Hole Diameter Diameter of holes.

Wall Thickness Thickness of walls between the holes.

8.4.6 Slider Function

The slider function section is visible on PRO 2 systems and allows you to easily enable the smart slide function.

Standard Perform a slide for every layer (default).

Smart Slide Perform a slide when the cross-sectional area is greater than or equal to the Smart Slide Threshold.

Threshold Minimum part cross-sectional area in mm^2 required to activate the slider.

Lag Vertical distance in mm over which the slider is activated once the part cross-sectional area exceeds the Smart Slide Threshold. For example, a build that has a 0.025 mm slice thickness and a smart slide lag of 0.25 mm with will activate the slider for 10 layers after the Smart Slide Threshold is exceeded regardless of the part cross-sectional area in those layers. Smart Slide Lag is triggered at the start of the build as the build platform is assumed to exceed the Smart Slide Threshold.

8.4.7 Print Optimisations

This section is called “Miscellaneous” in Composer versions older than 1.2.12.

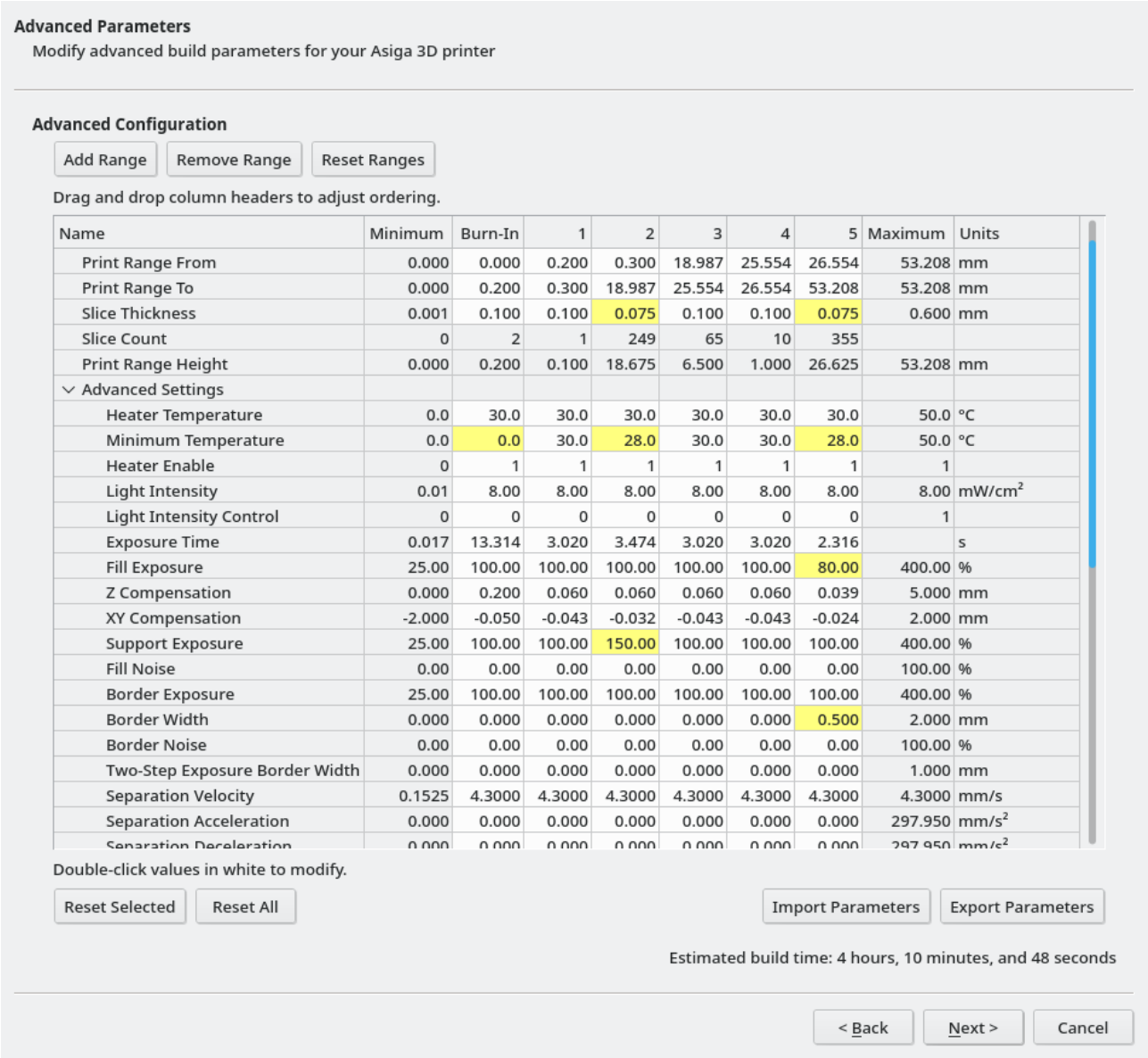
Antialiasing Reduces jagged edges around the contour to produce a smoother surface.

Separation Detect Enables/disables detection of separation on MAX and PRO 4K systems by adjusting the “Separation Velocity”, “Separation Distance”, “Separation Detect Window” and “Separation Detect Window Time” parameters (see Appendix for information about these parameters).

FAST PRINT MODE Increases “Separation Deceleration”, “Approach Acceleration”, “Approach Deceleration” & “Tare Interval” parameters on supported printers. “Separation Detect” is automatically enabled but can be manually disabled afterward if needed.

8.5 Advanced Parameters

The parameters table is defined and documented differently for each printer model. Advanced users may adjust the parameters that affects build time, part quality and success rate.



Add Range Add another printing parameter column after the currently focused column.

Remove Range Remove the currently focused printing parameter column.

Reset Ranges Restore to the standard Burn-In and Normal range. For newer printer firmware, Scaffold and Normal range will be added for each multi stack build.

Navigate around the table by using the arrow keys on the keyboard or the Tab key. The 3D viewport of the main window will be updated to show the range of the currently selected cell. Hover over the numbered column headers to identify which tab the range belongs to.

Activate the parameter editor by double-clicking or select-clicking on the cell under the numbered columns (1, 2, 3, ...). The editor will restrict the values that you enter to be between “Minimum” and “Maximum” inclusive. The new value will be applied to all selected cells. Changed values are highlighted in yellow and can be reset back to default by clicking “Reset Selected”.

8.5.1 Print Range

The following parameters defines where the build parameters applies.

Print Range From Position (mm) in Z where the range begins. Changing this value will update the preceeding print range.

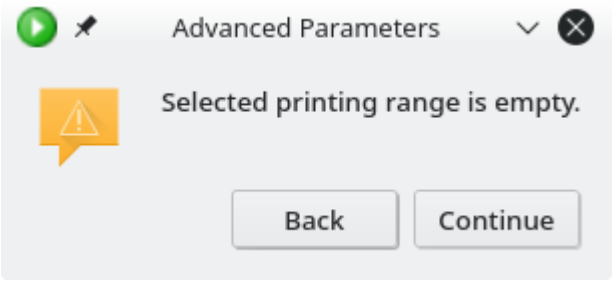
Print Range To Position (mm) in Z where the range ends. Changing this value will update the succeeding print range.

Print Range Height Height (mm) in Z of the range.

The default stop points of printing range depends on the number of ranges and the number of multi build stacks counts.

Stop point	< 2 × stack #	2 × stack #	3 × stack #	> 3 × stack #
Burn-In / Scaffold	Yes	Yes	Yes	Yes
Base Plate	No	No	Yes	Yes
Supports	No	No	No	Yes
Parts	No	Yes	Yes	Yes

The print range values will be rounded to the range slice thickness when the “Next” button is clicked.



You will be warned about empty print ranges. Clicking “Continue” will ignore or skip empty ranges.

8.5.2 Slicing Parameters

The following parameters defines how Composer should extract the image layers from the Project.

Slice Thickness Step size (mm) in Z for the range.

Z Compensation Prevent exposing voxels that are shallower than the specified depth (mm). Composer will generate an image that contains the minimum pixel value out of the latest set of images.

XY Compensation Boundary offset adjustment (mm) to compensate for shrinkage and growth. This does not apply to support structures.

XY Scale Scales (multiplier) all models on the XY axes.

8.5.3 Rendering Parameters

The following parameters apply to the “Normal” exposure range only and may require modification to Composer’s Printer INI files to be visible.

Support Exposure Relative energy (%) that is applied to supports. Typical usage is to overexpose (>100%) supports for increased rigidity. The default “Exposure Time” will be increased relatively.

Fill Exposure Relative energy (%) that is applied to within the border of parts. Typical usage is to underexpose (<100%) inner regions to reduce heat deformation.

Fill Noise Adjusts fill pixel values by the desired random amount (%). Typically used in conjunction with “Fill Exposure”.

Border Exposure Relative energy (%) that is applied to the border of parts. Typical usage is to maintain or be slightly higher (≥100%) than “Fill Exposure”.

Border Width Distance (mm) from edge of parts that is treated as the border that is unaffected by “Fill Exposure” or “Fill Noise”.

Border Noise Adjusts border pixel values by the desired random amount (%). Typically used to form natural matte surface.

The final pixel value of the border may be adjusted by the Z-Compensation function as it will prefer to expose the lowest pixel value out of all the affected layers.

A normal distribution random value generator is used to add noise to the pixel values. A normal distribution means the adjusted pixel value will most likely remain closer to the original pixel value.

8.5.4 Temperature Parameters

The following parameters defines temperature control parameters for the build.

Heater Temperature Desired temperature (°C) to reach during printing. Firmware versions < 2019-10-16 will wait before beginning the print.

Heater Enable Activate heater or temperature control parameters.

Minimum Temperature Enforced temperature (°C) to reach before printing begins. Requires firmware versions ≥ 2019-10-16.

8.5.5 Projection Parameters

Light Intensity Latest light sensor value (mW/cm²·s) on the printer, affects Exposure Time. This is a readonly value for firmware versions < 2017-03.

Light Intensity Control Activate the adjusted light intensity value, otherwise the build will be printed at maximum intensity.

Exposure Time Standard duration (s) for each layer, which will affect the default values of Z and XY Compensation.

Wait Time (After Exposure) Increase for materials that require time to solidify.

8.5.6 Vertical Stage Parameters

The actual velocity that is realized during the print may not accurately reflect the provided value in Composer.

Shrinkage Compensation Enable Set to 1 to perform exposure in two steps by exposing fill first and then the perimeter afterwards. Note that this will double the time required for exposure. This parameter is replaced by “Two-Step Exposure Border Width” in 2017-06-08 firmware and later.

Two-Step Exposure Border Width Set border width of the perimeter in mm to perform exposure in two steps by exposing fill first and then the perimeter afterwards. Note that this will double the time required for exposure.

Separation Velocity Desired vertical speed (mm/s) at which the build platform separates each layer from the curing surface. Reduce for large cross-sections.

Separation Distance Desired vertical distance (mm) the build platform moves out after exposure.

Wait Time (After Separation) Increase for viscous materials and large cross-sections to allow material inflow.

Approach Velocity Desired vertical speed (mm/s) the build platform moves into position for the next layer. Reduce for large cross-sections.

Wait Time (After Approach) Increase for viscous materials and large cross-sections to allow material outflow.

8.5.7 Leveling Slider Parameters

The film leveling slider parameters is only available on PICO and PRO printers.

Slides Per Layer Number of slides per layer to realign the curing surface. Setting this to 0 will enable *Sliderless Mode* on the PRO2.

Slide Velocity Desired horizontal speed (mm/s) of the alignment slider.

Wait Time (After Slide) Enable for large cross-sections in PRO to allow material outflow.

8.5.8 Sliderless Mode Mechanical Parameters

The following parameters are used only for PRO2 sliderless mode, which is activated by setting “Slides Per Layer” to 0. In sliderless mode, the current to the **vertical axis** motor is monitored to determine when the vertical axis has settled at the target position.

Motor Current Limit The maximum current (mA) to the vertical axis motor during approach and separation.

Motor Settling Current Target current (mA) level during approach.

Motor Timeout Number of seconds allowed for the vertical axis motor to settle. The machine will pause the build when the timeout is triggered.

To enable sliderless mode for the PRO 1, you will need to update the *printer.ini* that resides on the machine itself. Please consult with your local reseller or our online support ticket system for more information.

8.5.9 Smart Slide Mechanical Parameters

Smart slide is a feature supported by the Pico 2 and PRO 2 that allows you to reduce the build time by only activating the slider for large cross-sectional areas. It is supported by firmware version 2016-07-06 and later. For Pico 2, it controls whether to perform a slide before exposing. For PRO 2, the printer will slide in before exposing and smart slide will control whether to perform a slide out after exposing.

Smart slide is most beneficial on PRO 2 which has long slide times that can be avoided without impacting the build quality in many cases. Smart slide on Pico 2 is to be used with caution as the build tray film can be deflected with relatively small part cross-sectional area. This can result in reduced build quality or build failure.

Smart slide works by analyzing the slice images generated by the build process and finding the the approximate largest filled-in area (holes are treated as filled-in).

Large cross-sectional areas may require the slider to continue to activate even after cross-sectional area is reduced. The number of layers for which slider activation continues is specified in the Smart Slide Lag parameter.

Note that when smart slide is enabled, the estimated build time shown in the build wizard will not be updated until the build has been uploaded. After the build has been uploaded, Composer will show a message box indicating the build was uploaded and the estimated build time in the build wizard dialog will be updated.

Smart Slide Threshold Minimum part cross-sectional area in mm^2 required to activate the slider.

Smart Slide Lag Vertical distance in mm over which the slider is activated once the part cross-sectional area exceeds the Smart Slide Threshold. For example, a build that has a 0.025 mm slice thickness and a smart slide lag of 0.25 mm with will activate the slider for 10 layers after the Smart Slide Threshold is exceeded regardless of the part cross-sectional area in those layers. Smart Slide Lag is triggered at the start of the build as the build platform is assumed to exceed the Smart Slide Threshold.

8.5.10 MAX and PRO 4K Parameters

The following parameters are available only on the MAX and PRO 4K.

Separation Acceleration Desired vertical acceleration (mm/s^2) as the build platform separates from each layer. Setting this to 0 will use the same value as Separation Velocity (e.g. if Separation Velocity is 4.3 mm/s, then Separation Acceleration is 4.3 mm/s^2).

It is supported by 2019-02-11 firmware and later.

Separation Deceleration Desired vertical deceleration (mm/s^2) as the build platform reaches the separation distance. Setting this to 0 will use the same value as Separation Velocity (e.g. if Separation Velocity is 4.3 mm/s, then Separation Deceleration is 4.3 mm/s^2).

It is supported by 2019-02-11 firmware and later.

Separation Pressure Limit Maximum amount of pressure in g/cm^2 to apply during first 2 mm of separation.

Approach Acceleration Desired vertical acceleration (mm/s^2) as the build platform begins its approach to the next layer. Setting this to 0 will use the same value as Approach Velocity (e.g. if Approach Velocity is 4.3 mm/s, then Approach Acceleration is 4.3 mm/s^2).

It is supported by 2019-02-11 firmware and later.

Approach Deceleration Desired vertical deceleration (mm/s^2) as the build platform reaches the next layer position. Setting this to 0 will use the same value as Approach Velocity (e.g. if Approach Velocity is 4.3 mm/s, then Approach Deceleration is 4.3 mm/s^2).

It is supported by 2019-02-11 firmware and later.

Approach Pressure Limit Maximum amount of pressure in g/cm^2 to apply during approach.

Tare Interval Height interval in mm at which the zero reference for the position encoders is remeasured. Remeasuring is needed to compensate for changes in material weight affecting the position encoder readings. Setting the interval to 0 will remeasure only once at the start of the build. Setting the interval to a value less than or equal to the slice thickness for a build will remeasure for every layer. Setting the interval to a value greater than the slice thickness will remeasure at the start of the build and every n layers after (where n is the slice thickness divided by the tare interval rounded down to the nearest whole number).

Pausing and resuming a build will remeasure the position encoders and restart the tare interval to account for any changes in material weight (e.g. adding more material).

It is supported by 2019-03-21 firmware and later.

Pressure Hysteresis If approach/separation pressure limit is exceeded, vertical axis movement will stop until it drops to a value that is Pressure Limit * (100% - Pressure Hysteresis) before continuing movement.

Layer Tolerance Wait a short amount of time for deflection of platform to settle to within a given tolerance % of the slice thickness before exposing.

Viscosity Range The Viscosity Range parameter quantifies how viscous a material is. Its units are in millimeters. In practical terms, it measures the distance at which a surface exerts pressure against a target plate when moved towards it.

It is supported by 2017-11-02 firmware and later.

Motor Timeout Maximum amount of time in seconds allowed for an approach/separation movement before the build is paused.

Traverse Timeout Range The Traverse Timeout Range parameter allows layers which are not formed within the Motor Timeout time to be skipped. The exposure time of the next layer is then extended by the exposure time of the skipped layer in order to bridge the gap. This is referred to as "traversing" the layer.

The maximum number of layers which may be traversed consecutively is the Traverse Timeout Range divided by the Slice Thickness, rounded to the nearest whole number. For example, if the slice thickness is 50 microns and the Traverse Timeout Range is 100 microns, up to two layers may be traversed resulting in a maximum layer thickness of 150 microns.

Setting non-zero values for Traverse Timeout Range has the potential to reduce the resolution of the build and should be used with caution. A count of the number of layers traversed is displayed on user interface touchscreen at the end of every print. If any traversed layer is higher than 2mm from the base of the first layer of the model, an asterisk is displayed next to the “Traversed layer count”.

It is supported by 2017-11-13 firmware and later.

Separation Detect Window Maximum change in weight (grams) allowed to detect separation.

It is supported by 2018-01-31 firmware and later.

Separation Detect Window Time Minimum amount of time in seconds that the weight must be within the separation detect window. During separation the weight becomes more negative as the newly exposed layer lifts up off the build tray film. Once the separation has completed, the exposed layer is no longer pulling up on the build tray film and the weight will settle. For example, setting Separation Detect Window to 10 g and Separation Detect Window Time to 0.2 seconds means that while moving up to “Separation Distance” to separate, if the printer observes the weight has changed by no more than 10 g in the last 0.2 seconds then it will detect separation as having been completed and stop moving up early to save time.

It is supported by 2018-01-31 firmware and later.

Separation Detect Hard Stop If set to 1, the vertical axis will stop immediately instead of decelerating when separation is detected to reduce build time.

It is supported by 2018-02-22 firmware and later.

8.5.11 Saved Parameters

Composer will save the options of the build wizard upon clicking “Next” from the “Advanced Parameters” page. The current parameter values will be discarded when you change the multi build stacking list on the first page, click “Cancel” or close the wizard window.

You can save the options of the build wizard to an INI file of your own choice by clicking “Export Parameters”. You can reapply the exported parameters by clicking “Import Parameters”.

Starting from Composer 1.2.12 the parameters are saved to an INI file within the user settings directory. This feature allows you to easily import parameters that was used for another printer or another material. The file path used consists of “Parameters/(Printer Class)/(Material Name).ini”.

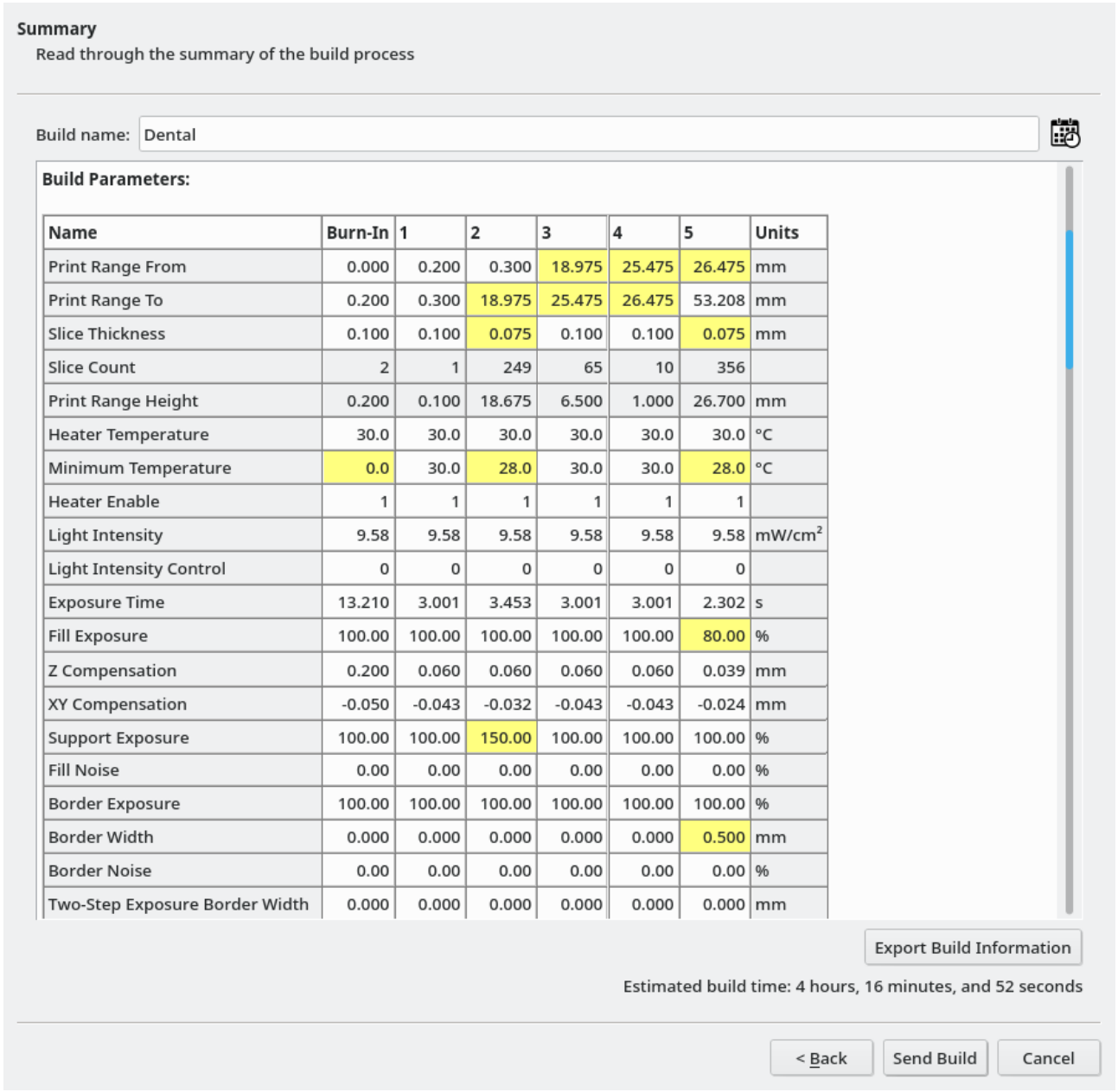
The current parameter INI file version contains the following structure:

- Base Plate
  - Thickness
  - Type
  - Parts
  - Placement
  - Engraved
  - Supported Only
  - Hole
    - Shape
    - Diameter
    - Wall Thickness
- Smart Slide
  - Threshold
  - Lag
- Miscellaneous
  - Antialiasing
  - Adjusted
  - Traverse Timeout Range
  - Separation Detect

- Parameters
  - Number of range
  - Default of each parameter
  - Value of each edited parameter

8.6 Summary and Submission

The following page in the wizard allows you to specify the name of the print job and review the summary before pressing “Send Build”.



Name	Burn-In	1	2	3	4	5	Units
Print Range From	0.000	0.200	0.300	18.975	25.475	26.475	mm
Print Range To	0.200	0.300	18.975	25.475	26.475	53.208	mm
Slice Thickness	0.100	0.100	0.075	0.100	0.100	0.075	mm
Slice Count	2	1	249	65	10	356	
Print Range Height	0.200	0.100	18.675	6.500	1.000	26.700	mm
Heater Temperature	30.0	30.0	30.0	30.0	30.0	30.0	°C
Minimum Temperature	0.0	30.0	28.0	30.0	30.0	28.0	°C
Heater Enable	1	1	1	1	1	1	
Light Intensity	9.58	9.58	9.58	9.58	9.58	9.58	mW/cm²
Light Intensity Control	0	0	0	0	0	0	
Exposure Time	13.210	3.001	3.453	3.001	3.001	2.302	s
Fill Exposure	100.00	100.00	100.00	100.00	100.00	80.00	%
Z Compensation	0.200	0.060	0.060	0.060	0.060	0.039	mm
XY Compensation	-0.050	-0.043	-0.032	-0.043	-0.043	-0.024	mm
Support Exposure	100.00	100.00	150.00	100.00	100.00	100.00	%
Fill Noise	0.00	0.00	0.00	0.00	0.00	0.00	%
Border Exposure	100.00	100.00	100.00	100.00	100.00	100.00	%
Border Width	0.000	0.000	0.000	0.000	0.000	0.500	mm
Border Noise	0.00	0.00	0.00	0.00	0.00	0.00	%
Two-Step Exposure Border Width	0.000	0.000	0.000	0.000	0.000	0.000	mm

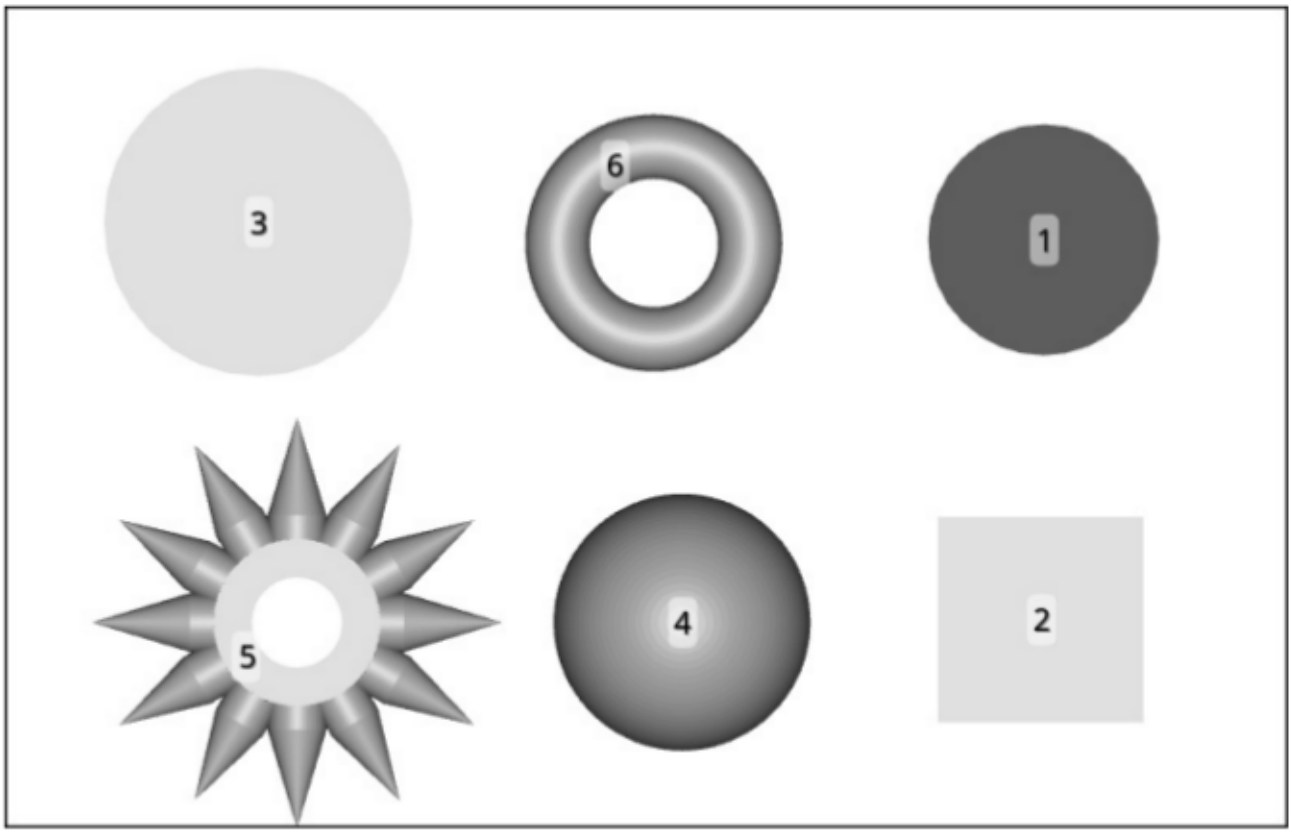
The date/time toggle button to the right of “Build name” allows you to choose whether to set the build name to the current date/time by default (e.g. 20180316-1632).

Build names will be cleaned by Composer to ensure that they are valid Windows filenames. This process applies on Mac and Linux as well to support downloading files back to Windows machines.

8.6.1 Export Part Map

The “Export Part Map” button allows you to export a PDF containing a numbered top-down view of parts to assist in locating them on the build platform after the build has finished. The volume of each part in milliliters is displayed next to the part name.

Build Name: Shapes
Created: 2016-10-19 04:03:48 PM
Printer: Pico2 39 (Pico 2)
Height: 12.000 mm
Model Count: 6

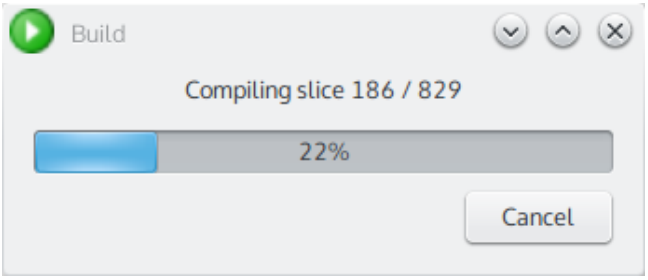


Model List

1. cone.stl 0.190 mL
2. cube.stl 0.512 mL
3. cylinder.stl 1.348 mL
4. sphere.stl 0.523 mL
5. star.stl 0.174 mL
6. torus.stl 0.115 mL

8.6.2 Send Build

After clicking the “Send Build” button, your build will be compiled and uploaded to the printer over the network. You will be warned should Composer had detected any faults while processing your models.

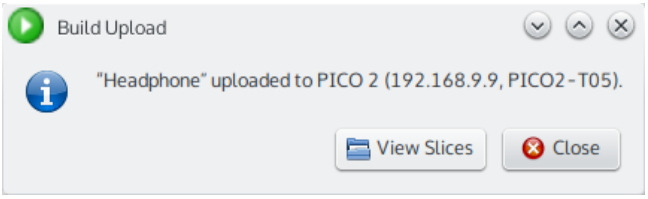


Your build may be split into multiple submission when:

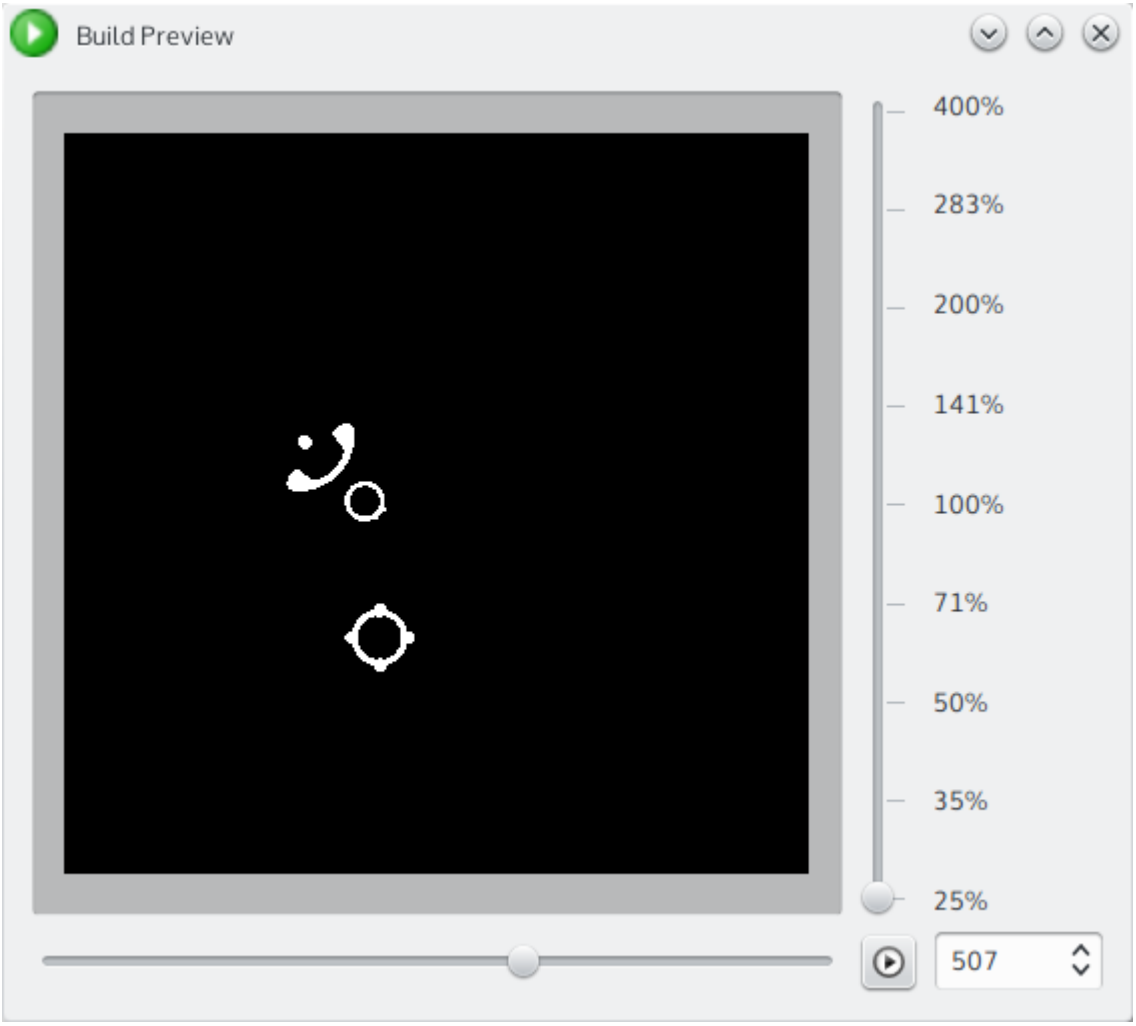
- Your print ranges has different slice thickness values
- You have specified more than two print ranges

8.7 Submitted Build

The following final confirmation dialog will be shown when the build is uploaded onto your 3D printer.



Click on “View Slices” to preview the build in Composer. The build preview displays the submitted images for printing and it is useful to verify your expectations.



8.7.1 Diamond Pixel Projectors

3D Printers with accessible diamond pixel arrangement on their projector chip will be displayed at 45° angle. The following printer models are currently known to apply the diamond pixel arrangement:

- Pico 2 (excludes HD)
- Max Mini

8.7.2 Build Preview Controls

Panning Drag the image with left mouse button or any mouse scrollwheel.

Zoom <Control + + or -> Use the vertical slider or the vertical mouse scrollwheel on image.

Layer Use the horizontal slider or change the layer number textbox.

Copy <Control + C> Copies the current image to clipboard.

Save <Control + S> Prompts you to save the image to a file.

8.7.3 ZIP Import

You can review the slices from a previously submitted build ZIP file. Follow the same steps as Project Import, which will then open "Build Preview" dialog when the ZIP file contains "build.ini" and numbered "slice.png" files.

8.7.4 Build Logging

Starting from Composer 1.2.10, you can assign a directory where Composer should store various build information. The main log file of your submitted build is saved as:

```
(Location)/(Path)#(Printer Serial)/(Build Name).log
```

If we consider the following values:

Location S:/Builds

Path Format %Y/%V/%u %a/%H%M%S%L

Current Date 2016-10-19 04:03:47.098 PM

Path 2016/42/3 Wed/160347098

Printer Serial 70B3D5531234

Build Name Shapes

Then the build log file will be saved as:

```
S:/Builds/2016/42/3 Wed/160347098#70B3D5531234/Shapes.log
```

Composer will rename build log files prior to opening them by changing the file extension to ".log~". The rename operation ensures that only one Composer program can open the build log file at a time even when logging to a network location.

The log entries in the log file is formatted as:

```
(Timestamp) (Name)@(Host) (App)[(AppId)] (Severity) (MsgId): (Msg)
```

The file may initially contain the following:

```
2016-10-18T16:03:47.098Z Shapes@Pico2%2039 Pico 2[70B3D5531234]
INFO Upload: Received "Shapes.zip" as "Shapes.zip" (932068 bytes)
2016-10-18T16:03:48.075Z User@Computer Composer[6258] DEBUG
BuildWizard: Layout PDF saved.
2016-10-18T16:03:48.164Z User@Computer Composer[6258] DEBUG
BuildWizard: Projects saved projects/Shapes.combld.
```

The first line stores what the printer returns to Composer after submission. Should there had been an existing build named “Shapes”, the printer would have returned “Shapes (2).zip”, which will be used by Composer as the actual build name.

Then once the build is finished on the printer, Composer may update the file with:

```
2016-10-18T16:10:15.000Z Shapes@Pico2%2039 Pico 2[70B3D5531234]
NOTICE BuildLog: Build started.
2016-10-18T16:10:16.653Z Shapes@Pico2%2039 Pico 2[70B3D5531234]
DEBUG VerticalMotor: Move to position completed
2016-10-18T16:10:16.670Z Shapes@Pico2%2039 Pico 2[70B3D5531234]
DEBUG Build: CheckPause
...
2016-10-18T17:27:44.826Z Shapes@Pico2%2039 Pico 2[70B3D5531234]
DEBUG Build: Finish
2016-10-18T17:27:45.000Z Shapes@Pico2%2039 Pico 2[70B3D5531234]
NOTICE BuildLog: Start power 21.41.
...
2016-10-18T17:27:45.000Z Shapes@Pico2%2039 Pico 2[70B3D5531234]
NOTICE BuildLog: Build ended.
```

At each “Scan interval” period and when Build, Error or Debug log is active, Composer will undertake the following steps:

1. Autodetect printers on the network
   If Composer is still busy from the previous period, then it will skip period
2. Find all “.log” files in the build log “Location”
   Changing “Path format” does not affect this process
   Changing “Location” does
3. Group log files for each printer together
   Printer serial is read off the directory name (after “#”)
4. Download “BuildLog.ini” from each printer
5. Download “debug” from each printer when Error or Debug log is active
   This process may take a few minutes

6. Determine which build belongs to which log file
   The name of the build is matched by the file name
   The time of the build is matched by reading the timestamps in the file

7. Write new entries into log files

Chapter 9

Troubleshooting

Composer accepts additional command-line options to assist in troubleshooting. See the Startup Options section in Appendix and the Log Files subsection here.

9.1 Filesystem Access

Composer requires write access to the following standard paths. Please beware that in MacOS X and Linux, the directory and file names are case sensitive.

9.1.1 Data Directory

The application data directory is defined differently base on the operating system:

Windows Open Explorer path *%LOCALAPPDATA%\Asiga\Composer*

MacOS X Open Finder path *~/Library/Application Support/Asiga/Composer*

Linux Open file browser path *~/.local/share/Asiga/Composer*

9.1.2 Temporary Directory

Composer 1.2.12 or later will create a directory within the temporary directory to be self-isolated from other processes.
If possible, a directory named “Composer.~” will be used, otherwise six random characters will be tried using the format “Composer.??????.~”.

The temporary directory is accessed differently depending on your operating system:

Windows Open Explorer path *%TEMP%*

MacOS X Open Terminal and enter *open $TMPDIR*

Linux Open file browser path *$TMPDIR* or */tmp/*

9.1.3 Cache Directory

Composer saves computed data within the application cache directory:

Windows Open Explorer path *%LOCALAPPDATA%\Asiga\Composer\cache*

MacOS X Open Finder path *~/Library/Caches/Asiga/Composer*

Linux Open file browser path *~/.cache/Asiga/Composer*

9.1.4 Log Files

Composer 1.2.12 or later will log activities and errors to a log file by default. The default location of the log file is within the *Temporary Directory*:

Composer.log The main log file, everything except Inter-Process Communication (IPC) logs.

IPC.log Logs communication between Composer instances, such as scripting or command forwarding.

9.2 Software Errors

Composer requires SSE2 support on the CPU, which means at least Intel Pentium 4 or AMD Athlon 64 and OpenGL 2 support for 3D graphics.

9.2.1 Operation System Requirements

Composer 1.3 and later requires at least:

- Windows 7 SP1
- MacOS 10.13
- Linux with Qt 5.12.8 (Ubuntu 20.04 LTS)

Recommended operating systems:

- Windows 10
- MacOS 10.15
- KDE Neon 5.21 / Fedora KDE 33

9.2.2 Runtime Library Requirements

Composer 1.3 and later requires the following libraries:

- Visual C++ 2019 on Windows or Clang 12 on MacOS or GNU C++ 2.31 on Linux
- OpenGL 2.0
- OpenGL Utility (GLU) 1.2
- OpenSSL 1.0.2 or LibreSSL 2.2.2
- ZLib 1.2.11
- Qt 5.15 or Qt 5.12.8 on Linux with the following Qt modules and their dependancies
  - Concurrent (Base)
  - OpenGL (Base)
  - PrintSupport (Base)
  - QML GraphicalEffects
  - QuickWidgets (Declarative)
  - Script
  - Sqlite
  - Svg
- QuaZip 0.9.1 bundled
- QtPropertyBrowser bundled
- Libnest2d 4.11 bundled

The Windows installer is bundled with:

- Visual C++ 2019
- OpenSSL 1.1.1
- Mesa OpenGL 3.0 when hardware OpenGL is unavailable such as remote desktop

- Qt 5.15 libraries
- ZLib 1.2.11 built-in with Qt

The MacOS installer is bundled with:

- Qt 5.15 libraries

9.2.3 Data Loading

Composer requires valid printer and material definitions from the executable directory. Ensure that you have compatible printer, material and virtual printer definitions installed in Printers, Materials and Virtual subdirectories respectively. Please read the Appendix chapter about Legacy Printer INI Definitions to use INI files from another version.

9.2.4 Slicing Errors

Composer will merge error slices with the nearest valid slice. To alleviate this problem, you will need to replace the model with a clean and booleaned STL / PLY file.

9.2.5 Duplicated Facets

Composer detects triangle surface that has been defined more than once. You should choose Discard for booleaned models or Keep for non-booleaned models.

9.2.6 Software Exits when Starting Composer

Only one instance of Composer can be running for each user at any one time. Please check your taskbars and/or other monitors for any currently running Composer window. Should the problem persists, you may try deleting the single-instance lock file *qtsingleapp-AsigaC-...-lockfile* from your temporary directory.

9.3 Printer Errors

9.3.1 Autodetection Fails

Composer uses UDP broadcast on port 42511, ensure your firewall is configured to allow incoming and outgoing connections.

9.3.2 OpenSSL Configuration

Printers are verified by checking SSL certificate using RSA 1024-bit key and SHA-1 (80-bit) digest, ensure your OpenSSL / LibreSSL configuration has *CipherString = DEFAULT:@SECLEVEL=1*. Composer applies *~/.config/Asiga/ComposerOpenSSL.cnf* (subject to *OPENSSL_CONF* environment variable and *--profile* argument) on startup, which is automatically created on Debian-based operating systems for compatibility.

9.3.3 Network Profile

Your firewall system may also have profiles or zones for specific network connections. If the firewall settings is insufficient, you may also choose a network profile.

Windows Private or Domain

FirewallD Trusted

9.3.4 Insufficient Light Intensity

All Asiga projector systems uses LED light source for its projector. The printer periodically tests the power output to be working above the minimum specifications. Please consult with our online support system to resolve this issue. From version 1.1.8 Composer will use the user entered “LED sensor value” if the “LED sensor status” is disabled.

9.3.5 Could Not Connect

Composer requires to communicate with the printer over the network and had encountered a connection error. Reselect the target printer by pressing <*Alt* + *Enter*> and double-click on the printer entry. Also read the OpenSSL Configuration section and ensure you have a compatible OpenSSL configuration if it had been updated.

9.3.6 Build Upload Failed

Composer uses TCP connection to port 42512 on the printer to upload builds, ensure your firewall is configured to allow. This error may falsely occur when uploading to a Pico 2 machine over wireless and you should double check the print queue before resending build. The storage drive on the printer may be disconnected or has failed and require a replacement.

9.4 Graphics Errors

Computers and laptops with multiple video cards must beware to ensure the system does not switch between different hardware while Composer is running. Windows and Linux users may opt to use software (CPU) rendering when the hardware or driver is causing issues, see “Software Rendering” in the “Startup Options” of the “Appendix”.

9.4.1 Dull STL Model

Triangles that are defined more than once in the STL file will be drawn dull within Composer. You will be warned of the duplicated facet definition whenever Composer is required to process such parts.

9.4.2 Opaque Platform Ground

You can disable the transluscent fill for the build platform by opening *Options → Preferences → Platform fill color*. Set “Alpha channel” to 0 and click “Ok” on both dialogs.

9.4.3 Model Drawn as Box

There was an issue with the 3D graphics driver attempt to draw the model. It may be due to the model data size or incorrectly installed graphics driver. Try running Composer using fixed-function rendering mode in *Options → Preferences → OpenGL → Fixed-function*. Try disabling caching on the graphics card by unchecking *Options → Preferences → OpenGL → Vertex buffer objects*.

9.4.4 Software Crash when Creating or Opening a Project

Your 3D graphics driver may have failed when preparing “GLSL shaders”. Try running Composer using fixed-function rendering mode in *Options → Preferences → OpenGL → Fixed-function*. Older versions of Composer would still have crashed as the shaders were always prepared even when disabled. Ensure you have GLU installed (*glu32.dll* / *libGLU.dylib* / *libGLU.so*), which is provided by the operating system.

Chapter 10

Appendix

10.1 Startup Options

Composer reads environment variables and command line options at startup and during its runtime. There are different ways to start Composer from command line, it depends on operating system and installation location. Here we assume Composer is installed at the default system location.

Windows (PowerShell) start $env:ProgramFiles\Asiga\Composer\composer.exe

Windows (Cmd) "%ProgramFiles%\Asiga\Composer\composer.exe"

MacOS /Applications/Composer.app/Contents/MacOS/Composer

Linux asiga-composer

10.1.1 Command Line Options

The following options may change between Composer versions and you should use *--help* to retrieve the available options.

-- End of options marker, treat next arguments as files.

--version Print application version to standard output and exit.

--help Print this message and exit.

--headless Run Composer without any graphical elements.

--cache=[DIR] Use specific cache path.

--profile=[DIR] Use specific CONF path to store settings.

--profile-reset[=DIR] Clears all settings and optionally backup to CONF.

--locale=LOCALE Start with the specified language.

--window-size=[WIDTH,HEIGHT] Start with the specified size rather than maximized.

--output-log=[FILENAME|-] Saves Composer log output to file, defaults to temp folder.

--output-debug[=CLASSFUNC] Specify class functions or leave blank for everything.

--output-msec Output timestamps with milliseconds accuracy.

--output-utc Output timestamps in UTC timezone rather than localtime.

--properties-import=FILENAME Applies dialog properties on show event.

--properties-export=FILENAME Incrementally exports dialog properties on show event.

--ipc-log=[FILENAME|-] Saves IPC / JSONRPC messages to file, defaults to temp folder.

--ipc-timeout=MSEC Tune IPC / JSONRPC message timeout (4000).

--ipc-socket=FILENAME Socket name for IPC / JSONRPC messaging or disabled if empty.

--jsonrpc-server Enables Javascripting over JSONRPC over socket.

--jsonrpc-request=[FILENAME|-] Javascript input to send to a running server and exit.

--jsonrpc-params=ARG JSON params to bind into Javascript input on server.

--threads=COUNT Tune maximum number of threads to use.

10.1.2 Running Multiple Instances

You can run more than Composer instance by specifying different cache, profile folders and socket name for each instance.

```
--cache=Instance1/cache --profile=Instance1 --ipc-socket=ComposerInstance1
```

10.1.3 Environment Variables

Common Qt environment variables can be specified to adjust the way Composer runs. Some environment variables and their values are only available for certain operating systems.

Windows (PowerShell) $env:NAME = "VALUE"

Windows (Cmd) set NAME=VALUE

MacOS / Linux export NAME=VALUE

Some environment variables that can be specified to workaround specific problems or to improve usability.

QT_AUTO_SCREEN_SCALE_FACTOR 0|1

QT_SCALE_FACTOR 1|1.25|1.5|2

QT_USE_PHYSICAL_DPI 0|1

QT_FONT_DPI 72|96|150|300

QT_OPENGL desktop|software

QT_OPENGL_DLL file path

QT_QPA_FONTDIR directory path

QT_QPA_PLATFORM cocoa|direct2d|offscreen|vnc|windows|xcb

QT_STYLE_OVERRIDE breeze|fusion|macintosh|windows|windowsvista

QT_USE_NATIVE_WINDOWS 0|1

QT_WINVER_OVERRIDE WINDOWS7|WINDOWS8|WINDOWS8_1|WINDOWS10

QT_PLUGIN_PATH directory path

QT_BUNDLED_LIBS_PATH directory path

QT_NO_CPU_FEATURE sse2|sse3|...|avx|avx2|...

10.1.4 Software Rendering

Use built-in software renderer for OpenGL drawing by specifying environment variables.

Windows (PowerShell) $env:QT_OPENGL="software"

Windows (Cmd) set QT_OPENGL=software

Linux export LIBGL_ALWAYS_SOFTWARE=1

10.2 INI Files

Composer reads and writes configurations using an extended INI format. INI files can be viewed or modified using a plain text editor. The configurations are specified using pathed values.

10.2.1 Format

INI files requires us to use specific characters to denote specific directives.

Encoding Unicode 8-bit (UTF-8) is used to read and write INI files. However, it can autodetect 16-bit or 32-bit Unicode encodings as well.

Escape Character Prefix any reserved characters with backslash "\".

Comments Begin your comments with a semicolon ";".

Quoting Texts with spaces should be placed between two double quotes """ characters.

10.2.2 Path or Name

A path defines the location for each value.

Separator Forwardslash "/" is used to denote groups.

Delimiter Equal sign "=" is used to separate the path from its value.

Quoting Double quote """ is optional to wrap the path.

Case Sensitivity Paths are matched case insensitively.

```
Group/Sub Group/Name=<value>
"Quoted"=<value>           ; Quoted
Escape\=Equal=<value>      ; Escape=Equal
"Escape \"Quoted\"=<value> ; Escape "Quoted"
Spaced Key = <value>       ; Spaced Key
```

10.2.3 Groups or Sections

A group is used to declare that any following keys should be prefixed with the group path. It is totally valid to have an INI file without any group lines, that the file only contains keys.

Character Set Any UTF-8 characters.

Escape Character Backslash “\” is used to escape characters that follows.

Quoting Double quote “"” is optional to wrap the group.

Case Sensitivity Groups are matched case insensitively.

```
[Group/Sub Group]          ; Group/Sub Group
["Quoted/Group"]           ; Quoted/Group
[Escaped Subscript\[1\]]   ; Escaped Subscript[1]
[]                         ; resets the group
```

10.2.4 Values

The value of each key are serialized into plain text. The datatype of the value can be asserted by wrapping the value inside specific characters:

Number Nothing should be added.

Truth Saved as true or false.

Text It is best practice to wrap your text in double quotes “"” and it is necessary when the text contains spaces.

Array Square brackets “[” “]” are used to wrap arrays, delimited with comma “,”. Each element of an array is then read as one of the datatypes listed here, including nested arrays.

```
Integer = 5
Positive = 6.7
Negative = -3.6
Half = .5              ; you can omit the zero
Infinite = inf
Not a Number = nan
Hexadecimal = 0x3f     ; 63
Octal = 0764           ; 500
True = true
False = false
Word = Composer        ; Composer
Words = "multi word"   ; multi word
Odd = [1, 3, 5, 7, 9]
Nested = [[aa], b,[ca, cd]]
```

10.2.5 Multivalues

Sometimes it is necessary to define multiple values, such as when specifying a tabular dataset. Multivalues are stored by specifying duplicated names over contiguous lines. If the software was not expecting multivalued path, it will simply choose the last defined value.

```
Position/X = 0
Position/X = .3
Position/X = .8
Position/X = 1.5
Position/X = 2.0 ; {0, 0.3, 0.8, 1.5, 2.0}
Name = nan       ; specifying another name or
[Position]       ; a group declaration will reset Multivalue
X = 2.5
X = 3.0
X = 3.5
X = 3.8
X = 4.0 ; {2.5, 3.0, 3.5, 3.8, 4.0}
XY = [0.368, -1.0]
XY = [0.736, -0.307]
XY = [1.104, 0.099] ; {[0.367, -1.0], [0.736, -0.307], [1.104, 0.099]}
```

10.3 Printers INI Definitions

Beginning with Composer 1.1.2, the build parameters for Asiga printers are defined outside of the software. The printer definitions were isolated to provide flexibility in future changes to printer features and/or firmware changes. The INI files are located in *<Composer Install>/Printers*.

10.3.1 Evolution

Version=1 Initial version, silently added extension for "#/<Firmware Version>/Build Estimation" in Composer 1.2.1.

Version=2 Parameter filtering by comparing actual printer firmware with "Firmware Version<" and "Firmware Version>".

Version=3 JavaScript build time estimation code at "Build Estimation/@".

Version=4 Include other INI files by “General/Include”, parameter display “Before”, “After” and “Visibility”.

Version=5 Parameter aliasing by specifying another parameter with “@”, active preset “@...”, inactive preset “!...”, whether it is “Visible” in the build wizard & whether it is “Used” by the printer.

10.3.2 General

Information about what this INI file applies to.

Class Defines the name of this printer class, which will be matched with Material INI “General/Printer Classes”.

Models List of printer models that can be handled by this class.

Firmware Version Oldest compatible printer firmware.

Include Load another file to include with this INI file. You can blacklist keys from other files by specifying “-” as its first multivalue.

10.3.3 Parameters

Definitions of printer build parameters for the Build Wizard in Composer. A printer parameter is defined with the “@” key and the siblings of the group defines the attributes of the parameter.

@ Defines the default value or refer to another parameter as an alias.

@<*preset name*> Defines a preset value when it is turned on in the build wizard. Preset name can be as follows:

Separation Detect Preset value for MAX or PRO 4K Separation Detect checkbox

Fast Print Mode Preset value for MAX or PRO 4K Fast Print Mode checkbox

1 Preset for build tray ID 1

2 Preset for build tray ID 2

!<*preset name*> Defines a preset value when it is turned off in the build wizard.

Alias Parameter name provided to the printer, specify “-” to omit this parameter.

Firmware Version< Last printer firmware version that supports this parameter.

Firmware Version> First printer firmware version that supports this parameter.

Before Places this parameter to be before the specified parameter name.

After Places this parameter to be after the specified parameter name.

Visible Can be seen in Build Wizard. Specify “false” to hide.

Editable Can be modified in Build Wizard. Specify “false” to make readonly.

Used Required by the printer firmware to print the build. Specify “false” to omit parameter from the build instructions.

Decimals Number of decimal places. Specify “-1” for built-in defaults.

Visibility Level to be shown in Build Wizard. Specify “-1” to always hide, which is the default for alias. (Obsolete in version 5, use “Visible”)

Minimum Lowest allowed value, which is zero by default. Specify “-inf” to disable constraint.

Maximum Highest allowed value, which is “inf” by default (no constraint).

Units The parameter units shown in the Build Wizard, which is an integer parameter by default.

% Percentage value

C Temperature in Celsius

s Time in seconds

mA Current in milliamperes

mm Distance in millimeters

mm/s Speed in millimeters per second

mm/s^2 Acceleration in millimeters per second per second

mm^2 Area in square millimeters

mW/cm^2 Intensity in milliwatts per square centimeter

g Mass in grams

g/cm^2 Pressure in grams per square centimeter

As an example, the following lines defines a parameter “Thermostat” in Celsius with aliases “Temperature” and “Temp”. The example parameter range is between -5 and 50 with a default value of 25.

```
[Parameters]
General/Thermostat/@=25
General/Temperature/@="General/Thermostat"
```

```
General/Temp/@="General/Thermostat"

[Parameters/General/Thermostat]
Units=C
Minimum=-5
Maximum=50

[Parameters/General/Temperature]
Firmware Version>=2019-02-02
```

10.3.4 Build Estimation

Starting from Composer 1.2.8 (INI version 3), the estimation formula is evaluated in JavaScript. Composer will translate older version INI files (version 1 & 2) into the JavaScript version in memory. This subsection will not introduce JavaScript programming, but rather how it is used in Composer.

The “Parameters” object contains all the parameters from the Build wizard, Printer’s INI and calculated values. Since JavaScript is a case-sensitive environment, all keys should be in lowercase. You can also access the “Parameters” object by using the “this” keyword. This object is defined as follows:

```
Parameters = {
  // Build wizard parameters
  '<lowercased key>': <number>,
  ...
  // Printer's INI file
  'printer/<lowercased key>': <number or string>,
  ...
  // Composer-calculated variables
  'build/slice count': <integer>,
  'build/model volume': <number as millimeter cube>,
  'build/support volume': <number as millimeter cube>,
  'build/total volume': <number as millimeter cube>,
  'build/burn-in skipped slide in count': <integer>,
  'build/burn-in skipped slide out count': <integer>,
  'build/burn-in skipped slide count': <integer>,
  'build/normal skipped slide in count': <integer>,
  'build/normal skipped slide out count': <integer>,
  'build/normal skipped slide count': <integer>,
  'build/two-step exposure enable': <integer>,
```

```
};
```

The “value” function returns the first finite number from one or more arguments. Each text argument will be resolved through the “Parameters” object case-insensitively. This function is defined as follows:

```
function value() {
  for (var i = 0; i < arguments.length; ++i) {
    var arg = arguments[i];
    if (typeof arg === 'string')
      arg = Parameters[arg.toLowerCase()];
    if (typeof arg === 'number' && isFinite(arg))
      return arg;
  }
  return NaN;
}
```

The JavaScript code is read from the multivalued “Build Estimation/@” key in the Printer INI file. Should the printer has this section defined on its INI file, then the printer’s formula will take precedence. The final statement of the script will be treated as the total result in seconds. An example script as how it is written inside “Printers/Include/Base.ini” file:

```
[Build Estimation]
@="this.moveTime = function(distance, prefix) {"
@="  if (distance <= 0) return 0;"
@="  var speed = value(this['mechanics/' + prefix + ' velocity'], 0);"
@="  var accel = value(this['mechanics/' + prefix + ' acceleration'], 0);"
@="  var decel = value(this['mechanics/' + prefix + ' deceleration'], 0);"
@="  if (speed <= 0) speed = distance;"
@="  if (accel <= 0) accel = speed;"
@="  if (decel <= 0) decel = speed;"
@="  var ta = isFinite(accel) ? Math.min(Math.sqrt(distance / accel), speed
@="  var td = isFinite(decel) ? Math.min(Math.sqrt(distance / decel), speed
@="  if (ta) ta = 0.5 * accel * ta * ta;"
@="  if (td) td = 0.5 * decel * td * td;"
@="  var ts = Math.max(0, distance - ta - td) / speed;"
@="  return Math.max(0, ta + ts + td);"
@="};"
@="this.layerTime = function() {"
@="  var distance = value(this['mechanics/separation distance'], 0);"
```

```
@="  var layerTime = value(this['curing/exposure time'], 0);"
@="  layerTime += value(this['delays/wait time (after exposure)'], 0);"
@="  layerTime += this.moveTime(distance, 'separation');"
@="  layerTime += value(this['delays/wait time (after separation)'], 0);"
@="  distance -= value(this['general/slice thickness'], 0.001);"
@="  layerTime += this.moveTime(distance, 'approach');"
@="  layerTime += value(this['delays/wait time (after approach)'], 0);"
@="  layerTime += value(this['printer/build estimation/layer time compensat
@="  return Math.max(0, layerTime);"
@="};"
@="this.layerTime() * value(this['general/slice count'], 0);"
```

10.3.5 Build Estimation for Version < 3

Composer 1.1.2 combines the current build information, material parameters and progressively evaluates all the formulae under “Build Estimation”. Formula values are calculated through an array of numbers and operators. The evaluated result of each formula can be referenced for later use.

```
[Parameters/Build]
Slice Count=<calculated internally>
Model Volume=<calculated internally as millimeter cube>
Support Volume=<calculated internally as millimeter cube>
Total Volume=['Model Volume', +, 'Support Volume']
```

All build parameters are accessible within the formulae including keys defined within the material INI. A value of “nan” (not a number) will be used for unknown parameters.

```
[Build Estimation]
Normal Layer Count=['Build/Slice Count', -, 'Curing/Burn-In Layers']
```

Arrays of numbers without any operator in between will be tested for validity. The first finite number will be returned.

```
V=[-inf, nan, 7, inf, 4]
V=7
```

Mathematical operators (+, -, *, /, ^) are not evaluated in order or precedence. Use sub-arrays to isolate calculations.

```
Y=[1, -, 3, /, 4]
Y=-0.5
Y=[1, -, [3, /, 4] ]
Y=0.25
```

In addition to the mathematical operator characters, Composer also supports “max” and “min” when placed between two numbers.

```
M=[3, max, 2]
M=3
M=[-5, min, 0]
M=-5
```

Composer requires the result to be saved under an “@” group.

```
Build Estimation/@/Normal=<seconds>
Build Estimation/@/Burn-In=<seconds>
```

10.4 Firmware-specific Printer Definition

The available printer parameters and build estimation formula may vary between printer firmware versions. The variations are typically made in conjuction to any feature changes in the firmware.

10.4.1 Parameter Availability

Composer needs to know when a parameter for a specific machine is available. The earliest firmware version to support a parameter is noted down by its “Firmware Version>” attribute. The latest firmware version to support a parameter is noted down by its “Firmware Version<” attribute.

```
[Parameters/Mechanics/Burn-In Separation Velocity]
@=1.5
Units=mm/s
Firmware Version>=2016-08-04
Firmware Version<=2016-09-01
```

In the example above, the parameter “Mechanics/Burn-In Separation Velocity” will only be available for printer firmware versions between 2016-08-04 and 2016-09-01 inclusive.

Composer version 1.2.8 supports reading in parameter definitions directly from the printer. The printer itself would update Composer about what parameters are available or about the minimum and maximum values.

10.4.2 Estimation Formulae

Composer version 1.2.1 to 1.2.7 allows customizing the build estimation formula based on the printer's firmware version. Composer will prefer to use a versioned "Build Estimation" group over the unversioned group.

```
[#/2016-07-05/Build Estimation]
...
@/Normal=<seconds>
@/Burn-In=<seconds>
```

The firmware version is matched with its formula by finding the exact match or the immediately previous version.

```
[#/2016-07-08/Build Estimation]
...
[#/2016-08-10/Build Estimation]
...
```

Should the printer's "System/Firmware Version" be "2016-08-09", Composer will use "#/2016-07-08/Build Estimation" formula.

Composer version 1.2.8 with its JavaScript environment can handle specific firmware versions within the JavaScript code itself. The printer's firmware version is accessible as "this['printer/firmware version']", which is a string that can be compared with another string such as "2018-02-02".

```
[Build Estimation]
@="if (this['printer/firmware version'] >= '2017-07-07') {"
@="  ..."
@="} else if (this['printer/firmware version'] >= '2016-08-10') {"
@="  ..."
@="}"
```

10.5 Materials INI Definitions

Material definitions files exists since Composer 1.0 in *<Composer Install>/Materials*. Composer will try to load older versions defined under printer classed subdirectory (Pico or PRO).

10.5.1 Evolution

Throughout the evolution of Composer, its Material INI file format had also evolved as summarized below:

Version=1 Handles the printing property differences only by placing printer-specific Material INI file within subdirectories.

Version=2 Integrates the “subdirectories” logic of *Version=1* inside each Material INI file. Whitelisting is implemented by specifying “General/Printer Classes”.

Version=3 Extends on *Version=2* and implements *Group Definitions* logic to enable sharing traits between different printer classes.

Version=4 Reintroduced ability to define “Minimum” and “Maximum” values for each parameter and added curing sample intensity.

Version=5 New “General/Names” key to load a single Material INI file for multiple material names.

Version=6 Read preset values “@<name>”, “!<name>” and prefers “@” for default value, curing table tray intensity.

10.5.2 User Materials

From version 1.1.12 and onwards, Composer will also load materials from the user’s *<Data Directory>/Materials*. This means you do not require administrative privileges to add new materials or modify the bundled materials.

Windows *%LOCALAPPDATA%\Asiga\Composer\Materials*

MacOS X *~/Library/Application Support/Asiga/Composer/Materials*

Linux *~/.local/share/Asiga/Composer/Materials*

You can access the user material directory from the *“Build Properties” dialog* → ⚙ → 📂 *Open*.

From version 1.2.8 and onwards, Composer can be configured to load materials from any directory. Composer will automatically include the *User Materials* directory when there loadable INI files inside it.

10.5.3 General

Names Array of material names to show in Composer.

Name Singular material name, which can be omitted if Names is given.

Printer Classes Array of printer classes that can print using this material. Optional for material INI version 3, if all classes are specified in the *Group Definitions*.

Slice Thickness Nominal slice thickness of material, which will be used the first time the material is chosen.

Slice Thickness Presets Array of slice thicknesses in millimetres to show in Composer.

Heater Temperature Nominal air temperature (C) during printing in Celsius.

Minimum Temperature Required temperature (C) before printing can be started.

Revision Optional information for people to identify when the INI file was made.

10.5.4 Base Plate

The base plate parameters in the build wizard may be controlled by the Material INI file.

Thickness Specify base plate thickness (mm).

Type Specify base plate region 0 (full), 1 (shadow), 2 (bounding box).

Parts Specify which parts should have base plate 0 (all), 1 (supported only), 2 (selected).

Placement Specify if the base plate should be 1 (intersecting) or not 0 (under).

Hole Shape Hole polygon number of sides, accepts 0 (none), 3 (triangle), 4 (square), 6 (hexagon).

Hole Diameter Specify hole diameter (mm).

Wall Thickness Specify wall thickness separating holes (mm).

10.5.5 Curing

Material curing properties for a successful build. The *XY* and *Z* multivalue definitions are selectively processed by Composer to ensure positive correlation and validated against negative energy values. The *Z* multivalue definition is additionally validated against negative cured values. You may read the *Curing Example* subsection in the *Build Parameters* section.

Light Intensity Light intensity used to calculate exposure times. The default value is obtained from the printer and updated whenever light is shown. Changing this value requires firmware version ≥ 2017-03-27. If the value is different from the default value, the light intensity will be adjusted to the specified Light Intensity when the build is started.

Build Tray Transmittance Percentage of Light Intensity that actually reach the material due to tray film or basin absorbance.

Z Multivalued tabular data that maps energy (mW/cm²·s) to cured layer thickness (mm) at a specified intensity (mW/cm²).

Multiplier Curing thickness coefficient when looking up the Z table.

Offset Curing thickness offset when looking up the Z table.

Z Compensation Specify non-zero default Z Compensation (mm).

XY Multivalued tabular data that maps energy (mW/cm²·s) to edge widening radius (mm) at a specified intensity (mW/cm²). At least two data points are required to enable this feature.

XY Compensation Specify non-zero default XY offset (mm).

Burn-In Layers Opaque materials may require additional layers.

Burn-In Exposure Depth of exposure (mm) to be mapped in the Z table. Composer would simply replace the build layer thickness.

Burn-In XY Compensation Specify non-zero default XY offset (mm) for burn-in layers.

Scale Part [X, Y, Z] dimensions are scaled by this vector when a part is added or material is changed.

XY Scale Part X and Y dimensions are scaled by this value when a part is added or material is changed. Composer 1.2.3 parameter, new files should simply use Scale.

10.5.6 Mechanics

Mechanical parameters to control motor speed, acceleration and forces. The available parameters will depend on the printer model and firmware version, please inspect the Printers INI file.

Approach Acceleration Acceleration (mm/s²) of the build platform as it begins to move down.

Approach Velocity Speed (mm/s) of the build platform as it moves down.

Approach Deceleration Deceleration (mm/s^2) of the build platform as it reaches the printing layer.

Approach Pressure Limit Maximum pressure (g/cm^2) to apply as the build platform is reaching the printing layer.

Burn-In Approach Acceleration Acceleration (mm/s^2) of the build platform as it begins to move down for burn-in range.

Burn-In Approach Velocity Speed (mm/s) of the build platform as it moves down for burn-in range.

Burn-In Approach Deceleration Deceleration (mm/s^2) of the build platform as it reaches the printing layer for burn-in range.

Burn-In Approach Pressure Limit Maximum pressure (g/cm^2) to apply as the build platform is reaching the printing layer for burn-in range.

Burn-In Separation Acceleration Acceleration (mm/s^2) of the build platform as it pulls up for burn-in range.

Burn-In Separation Velocity Speed (mm/s) of the build platform as it pulls up for burn-in range.

Burn-In Separation Deceleration Deceleration (mm/s^2) of the build platform as it reaches the separation distance for burn-in range.

Burn-In Separation Pressure Limit Maximum suction (g/cm^2) to apply as the build platform is pulling up for burn-in range.

Burn-In Separation Distance Height (mm) for the build platform to move away from the printing layer for burn-in range.

Motor Current Limit Maximum current (mA) of the vertical axis motor during approach and separation for PRO2.

Motor Settling Current Current (mA) of the vertical axis motor as the build platform is reaching the printing layer for PRO2.

Motor Timeout Time (s) allowed for vertical axis motor current as the build platform is reaching the printing layer.

Traverse Timeout Range Total height (mm) that can be skipped if the build platform is unable to reach the printing layer.

Tare Interval Height (mm) interval to recalibrate weight measurements.

Slides Per Layer Number of times the film should be leveled for printers with sliders.

Slide Velocity Speed (mm/s) of the leveling slider horizontally for printers with sliders.

Smart Slide Threshold Area (mm^2) of previous layers required to activate leveling slider.

Smart Slide Lag Height (mm) from previous layers to determine if leveling slider should be activated.

Separation Acceleration Acceleration (mm/s^2) of the build platform as it pulls up.

Separation Velocity Speed (mm/s) of the build platform as it pulls up.

Separation Deceleration Deceleration (mm/s^2) of the build platform as it reaches the separation distance.

Separation Pressure Limit Maximum suction (g/cm^2) to apply as the build platform is pulling up.

Separation Distance Height (mm) for the build platform to move away from the printing layer.

Separation Detect Window Time Time (s) interval of weight samples during separation.

Separation Detect Window Weight (g) threshold between minimum and maximum samples as the film has separated and settled.

Separation Detect Hard Stop Immediately stop and begin the next layer after separation has been detected.

10.5.7 Delays

Timing delays between actions to permit material flow, cooloff.

Burn-In Wait Time (After Approach) Time (s) after build platform reached printing layer for burn-in range.

Burn-In Wait Time (After Slide) Time (s) after the film is leveled for printers with sliders for burn-in range.

Burn-In Wait Time (After Exposure) Time (s) after layer is exposed for burn-in range.

Burn-In Wait Time (After Separation) Time (s) after build platform reached separation distance for burn-in range.

Normal Wait Time (After Approach) Time (s) after build platform reached printing layer for non-burn-in range.

Normal Wait Time (After Slide) Time (s) after the film is leveled for printers with sliders for non-burn-in range.

Normal Wait Time (After Exposure) Time (s) after layer is exposed for non-burn-in range.

Normal Wait Time (After Separation) Time (s) after build platform reached separation distance for non-burn-in range.

Wait Time (After Approach) Time (s) after build platform reached printing layer.

Wait Time (After Slide) Time (s) after the film is leveled for printers with sliders.

Wait Time (After Exposure) Time (s) after layer is exposed.

Wait Time (After Separation) Time (s) after build platform reached separation distance.

10.5.8 Support

Material-specific default values shown in the “Generate Support” dialog. The parameters in this section are optional and does not get validated upon reading the INI file. The group names of parameters are also optional, Composer will match by name.

SupportParts/Leveling Enable “Height leveling”, true or false.

SupportParts/Leveling Height Default “Height leveling” distance.

SupportParts/Tallest Enable “Tallest support”, true or false.

SupportParts/Tallest Height Default “Tallest support” length, at least 0.

Lattice/Enabled Enable “Lattice” structure, true or false.

Lattice/Layout Default “Layout” shape number of sides, 3, 4, 6 sides or 0 for circle.

Lattice/Connection Default “Connection” between levels, greater than 0.

Lattice/Connect Gap Default “Connect gap” level count, at least 0.

Lattice/Margin Default “Margin” millimeters, at least 0.

Lattice/Spacing XY Default “Spacing XY” millimeters, at least 1.

Lattice/Spacing Z Default “Spacing Z” millimeters, at least 1.

Placement/Slope Default “Self-support angle” degrees, between 1 and 50.

Placement/Side Feature Default “Side-feature size” length, greater than zero.

Placement/Accuracy Default “Accuracy” millimeters, at least 0.

Placement/Strength Default “Material strength” multiplier, greater than 1.

Placement/Spacing Default “Support spacing” distance, at least 1.

Placement/Torsion Default “Torsion tolerance” force, greater than zero.

Placement/Minimum Height Default “Minimum height” millimeters, at least 0.

Placement/Rank Distance Enable “Rank by distance”, true or false.

Placement/Intersupport Enable “Model intersupport”, true or false.

Placement/No Fill Enable “No fill”, true or false.

Geometry/Contact Default “Contact width” diameter, at least 0.1.

Geometry/Island Default “Island width” diameter, at least 0.1.

Geometry/SprueX Default “Contact width X” diameter, at least 0.1.

Geometry/SprueY Default “Contact width Y” diameter, at least 0.1.

Geometry/Overshoot Default “Over-shoot” length, at most 5.

Geometry/Undershoot Default “Undershoot” length, at least 0.

Geometry/Maximum Width Default “Maximum width” length, at least *Contact* value.

Geometry/Side Faces Default “Side faces” count, at least 3.

Geometry/Aspect Ratio Default “Aspect ratio” factor, between 1.5 and 25.

Presets may be defined by starting the preset name with “@”, for example the “Lattice” preset.

```
Lattice/Enabled/@Lattice=true
Placement/Intersupport/@Lattice=false
Geometry/Maximum Width/@Lattice=1
```

10.6 Advanced Material INI Definitions

The available material and printing properties varies between different printers models. The compatible variations between printer and material can be attributed to projector wavelength or build area.

10.6.1 Group Definitions

A special prefix ":" is used to manage group definitions. Each distinct subgroups under ":" will be treated as a new group should they contain the key "General/Printer Classes". Within each group definition, everything except for the key "General/Name" can be overridden.

```
[:/Valid Group]
General/Printer Classes=[Pico, "Pico 2"]
Mechanics/Slider Velocity=15

[:/Invalid Group]
Mechanics/Slider Velocity=15
```

Each printer class may be included into multiple groups with attributes of the last defined inclusion taking effect.

```
[Curing]
Offset=0.25 ; #1

[:/Gen-1]
General/Printer Classes=[Pico, PRO]
Mechanics/Slider Velocity=20 ; #2

[:/Gen-2]
General/Printer Classes=["Pico 2", "Pico UV385", "PRO UV405",
"PRO UV385"]
Mechanics/Slider Velocity=15 ; #3

[:/405nm]
General/Printer Classes=["Pico 2", "PRO UV405"]
Curing/Offset=0.2 ; this will override #1 for Gen-2, 405nm

[:/385nm]
General/Printer Classes=["Pico UV385", "PRO UV385"]
Curing/Offset=0.1 ; this will override #1 for 385nm

[:/Pico-area]
General/Printer Classes=[Pico, "Pico 2", "Pico UV385"]
; the following will override #2 or #3 for the classes specified
Mechanics/Slider Velocity=17
```

```
[:/PRO-area]
General/Printer Classes=[PRO, "PRO UV405", "PRO UV385"]
; the following override #2 or #3 for the classes specified
Mechanics/Slider Velocity=11
```

10.6.2 Minimum and Maximum Adjustments

You are able to refine the valid range for each printer parameter. Simply add *Minimum* or *Maximum* sub-key to adjust each parameter's minimum or maximum value respectively. A parameter will be considered read-only should its minimum and maximum values be equal.

For example, the following lines are inside Printer INI.

```
[Parameters/Curing]
Light Intensity/Firmware Version>=2017-03-01
Light Intensity/Units=mW/s
Light Intensity/@=30
Light Intensity/Minimum=5
Light Intensity/Maximum=30
```

Then inside Material INI, you can adjust the limit.

```
[Curing]
Light Intensity=10
Light Intensity/Minimum=5
Light Intensity/Maximum=12
```

Composer will ignore new limits that are outside the limits defined in the Printer INI.

```
[Curing]
Light Intensity/Maximum=35 ; this maximum value will be ignored
```

Grouping should work as normal, for instance the lines below will apply to group 405nm.

```
[:/405nm/Curing]
Light Intensity/Minimum=8
Light Intensity/Maximum=16
```

10.6.3 Preset Value Adjustments

You are able to define a preset value for each printer parameter. Add a sub-key with the preset name prefixed with @ to specify a preset value. Composer 1.3 currently has the following preset names:

- Fast Print Mode
- Separation Detect

For example, the following lines are inside Printer INI.

```
[Parameters/Mechanics]
Approach Acceleration/@=0
Approach Acceleration/Units=mm/s^2
Approach Acceleration/@Fast Print Mode=20
```

Then inside Material INI, you can adjust the “Fast Print Mode” preset.

```
[Mechanics]
Approach Acceleration/@Fast Print Mode=5
```

A preset off value may be specified inside Material INI.

```
[Mechanics]
Approach Acceleration=5
Approach Acceleration/!Fast Print Mode=0
```

10.7 Legacy Materials INI Definitions

There were several material INI changes between Composer 1.0 and Composer 1.1. Composer 1.0 will not load material INI written for Composer 1.1 due to the INI changes. Composer 1.1 supports reading older material INI format from Composer 1.0 provided that they are located within a subdirectory named by a printer class.

10.7.1 Array Values

In Composer 1.0, arrays values are ambiguously defined to be optionally surrounded by square brackets *[ ]*. Some definitions can be read differently by Composer based on the array length. This subsection examplifies the arrays of different length and how they were treated.

1, mm Defines current value *1* and optional units *mm*.

1, 2, mm Defines current value *1*, factory default *2* and optional units *mm*.

1, 2, 4, 3, mm Defines minimum constraint *1*, current value *2*, maximum constraint *4*, factory default *3* and optional units *mm*.

[1, 2] Defines a pair of values *1* and *2*.

In Composer 1.1, all arrays are to be surrounded by square brackets *[ ]* with permission to add any white spaces (including new lines) around each value. The definitions of minimum and maximum constraints as well as units were moved to the printers INI.

10.7.2 Removed Keys

Many definitions of Composer 1.0 material INI are specifically related to machine control and has no effect when curing different materials. However, you may still override the printer defaults within the material INI of Composer 1.1.

```
[General]
Slice Thickness
Separation Distance
Separation Velocity
Approach Velocity
Slide Velocity
Slides per Layer

[Burn-in]
Exposure Time
Wait Time (After Slide)
Wait Time (After Exposure)
Wait Time (After Separation)
Wait Time (After Approach)

[Normal]
Exposure Time
Wait Time (After Slide)
Wait Time (After Exposure)
Wait Time (After Separation)
Wait Time (After Approach)
```

10.7.3 Changed Keys

In Composer 1.0:

```
[General]
Presets=0.01,0.025,0.05,0.075,0.1,0.15,mm
Temperature=0,degrees,maximum,default,C
Burn-In Layers=count,default

[Curing]
Burn-In Thickness=depth
Thickness=[cured0,energy0]
Thickness=[cured1,energy1]
Thickness Multiplier=coefficient
Thickness Offset=curethrough
```

General/Burn-in Thickness does not actually cause the printer to print each burn-in layer at the specified thickness. The thickness value is only used to calculate the exposure time while curing a layer at the build's slice thickness.

In Composer 1.1:

```
[General]
Presets=[0.01, 0.025, 0.05, 0.075, 0.1, 0.15]
Heater Temperature=degrees

[Curing]
Burn-in Layers=count
Burn-in Exposure=depth
Z=[cured0, energy0]
Z=[cured1, energy1]
Multiplier=coefficient
Offset=curethrough
```

General/Presets is an optional definition with the default list shown above.

In Composer 1.2.5:

```
[Curing]
Z=[energy0, cured0, intensity0]
Z=[energy1, cured1, intensity1]
```

```
XY=[energy0, radius0, intensity0]
XY=[energy1, radius1, intensity1]
```

Curing tables can have a third column to represent the light intensity at the curing plane when the table was sampled. Composer will use the nearest printer light intensity for calculations. An intensity value of 0 will be used if it's not specified.

In Composer 1.2.12:

```
[Curing]
Z=[energy0, cured0, intensity0, tray0]
Z=[energy1, cured1, intensity1, tray1]
XY=[energy0, radius0, intensity0, tray0]
XY=[energy1, radius1, intensity1, tray1]
```

Curing tables can have a fourth column to represent the light intensity on the tray when the table was sampled. Composer will use the ratio between printer light intensity and tray light intensity. A tray value of 0.94 × intensity value will be used if it's not specified.

10.7.4 Added Keys

```
[General]
Printer Classes=[Pico, PRO]
Heater Enable=false

[Curing]
XY=[energy0, radius0]
XY=[energy1, radius1]
```

10.8 SupportDialog INI Definitions

Starting from Composer 1.3.4, the parameters for the support dialog are saved as INI files inside Composer Data Directory and may be exported or imported.

Type Must be "SupportDialog".

Version 1.

10.8.1 Geometry

Aspect Ratio At least 0.

Contact At least 0.1 millimeters.

Island At least 0.1 millimeters.

Maximum Width At least 0.1 millimeters.

Overshoot At least 0 millimeters.

Side Faces At least 3.

Undershoot At least 0 millimeters.

10.8.2 Lattice

Connect Gap At least 0 levels.

Connection At least 0 nodes.

Enabled True or false.

Layout 0 = circle, 3 = triangle, 4 = square, 6 = hexagon.

Margin At least 0 millimeters.

Spacing XY At least 1 millimeters.

Spacing Z At least 1 millimeters.

10.8.3 Placement

Accuracy At least 0 millimeters.

Intersupport True or false.

Minimum Height At least 0 millimeters.

No Fill True or false.

Rank Distance True or false.

Side Feature At least 0 millimeters.

Slope Between 1 and 50 degrees.

Spacing At least 1 millimeters.

Strength At least 0 times.

Torsion At least 0.

10.8.4 SupportParts

Leveling True or false.

Leveling Height At least 0 millimeters.

Tallest True or false.

Tallest Height At least 0 millimeters.

10.8.5 Presets

All preset values of the parameters above has keys starting with “@” character. The default preset has a blank name so its key is exactly “@”.

Preset Name of preset.

10.9 Parameters INI Definitions

Starting from Composer 1.2.12, the parameters for the build wizard are saved as INI files inside Composer Data Directory and may be exported or imported.

Type Must be “BuildWizard”.

Version 2 to 4, see Evolution.

10.9.1 Evolution

Version=2 First official version.

Version=3 Always save base plate hole shape to file even when disabled.

Version=4 Supports base plate parts radio buttons for All, Supported only or Selected only.

10.9.2 Base Plate

Thickness In millimetres.

Type -2 = full, -3 = shadow, -4 = bounding.

Hole Shape Index to combo box / select option.

Supported Only For version < 4.

10.9.3 Miscellaneous

Antialiasing For antialiasing rendering checkbox.

Separation Detect For separation detect mode in MAX and PRO 4K.

Fast Print Mode For fast print mode in MAX and PRO 4K.

10.9.4 Parameters

The Parameters section stores the default and actual value for each value cell in multi range print parameters table. The actual value of each parameter cell are omitted (not stored) if it is the same as the default value.

size The number of print range, the name is kept in lower case for QSettings in MacOS compatibility.

 # Print Range Defines the Start and End heights of each print range.

10.10 Build Calculations

This section documents how Composer calculates values internally.

10.10.1 Curing Example

This subsection will show how Composer calculates its default build parameters. The sample codes are written in JavaScript to allow anyone with a web browser to test their datasets.

Starting with an extract from a Material INI file.

```
[Curing]
; dataset at 10 mW/cm2, standard 0.15 mm film
Z=[20, 0.05, 10] ; Z(intensity, energy) interpolates thickness
Z=[40, 0.09, 10] ; Z'(intensity, thickness) interpolates energy
Z=[80, 0.13, 10]
Z=[160, 0.17, 10]
; dataset at 25 mW/cm2, coloured film
Z=[25, 0.04, 25] ; Z(intensity, energy) interpolates thickness
Z=[50, 0.08, 25] ; Z'(intensity, thickness) interpolates energy
Z=[100, 0.11, 25]
Z=[150, 0.14, 25]
Multiplier=1.5   ; M
Offset=0.05      ; O
XY=[25, -0.02]   ; XY(energy) interpolates radius
XY=[50, 0]
XY=[100, 0.02]
XY=[150, 0.04]
XY=[200, 0.05]
```

The equivalent JavaScript code for the curing table definitions would be.

```
Z = [
  [ 20, 0.05, 10],
  [ 40, 0.09, 10],
  [ 80, 0.13, 10],
  [160, 0.17, 10],
  [ 25, 0.04, 25],
  [ 50, 0.08, 25],
  [100, 0.11, 25],
  [150, 0.14, 25]
];
XY = [
  [ 25,-0.02],
  [ 50, 0.00],
  [100, 0.02],
  [150, 0.04],
  [200, 0.05]
];
```

Using the following Map class, which is sorted by the first column of each item (row).

```
Map = function(items) {
```

```
  this.items = []; // [[key, value], ...]
  for (var i in items)
    this.insert(items[i]);
  return this;
};
Map.prototype.lowerBound = function(keyOrValue, isValue) {
  var l = 0, u = this.items.length, c = isValue || 0;
  while (l < u) {
    var m = Math.floor((l + u) / 2);
    if (this.items[m][c] < keyOrValue)
      l = m + 1;
    else
      u = m;
  }
  return l;
};
Map.prototype.insert = function(item) {
  this.items.splice(this.lowerBound(item[0]), 0, item);
};
Map.prototype.lerp = function(keyOrValue, isValue) {
  var i = this.lowerBound(keyOrValue, isValue), c = isValue || 0;
  i -= i == this.items.length; // extrapolate using last range
  i += i == 0; // extrapolate using first range
  var lower = this.items[i - 1], upper = this.items[i];
  var slope = upper[1 - c] - lower[1 - c];
  slope /= upper[c] - lower[c];
  return slope * (keyOrValue - lower[c]) + lower[1 - c];
};
```

Load the tables into a Map of Maps structure using the following function. Basically, it groups the rows based on the intensity column.

```
function loadTable(table) {
  var map = new Map();
  for (var row in table) {
    row = table[row]; // [energy, thickness or widening, intensity]
    if ((row[2] || 0) > 0 && (row[3] || 0) > 0) {
      row[3] *= 0.97 / intensity;
      row[0] *= row[3];
      row[2] *= row[3];
    }
```

```
    var intensity = row[2] || 0;
    var i = map.lowerBound(intensity);
    if (i == map.items.length || map.items[i][0] != intensity)
      map.insert([intensity, new Map()]);
    map.items[i][1].insert(row);
  }
  return map;
}
curingZ = loadTable(Z), curingXY = loadTable(XY);
```

The following functions are used to evaluate a linearly interpolated value from the maps.

```
function curingMap(map, intensity, key, isValue) {
  if (map.items.length == 0)
    return 0;
  else if (map.items.length == 1 || intensity <= map.items[0][0])
    return map.items[0][1].lerp(key, isValue);
  else {
    var i = map.lowerBound(intensity);
    if (i == map.items.length)
      return map.items[i - 1][1].lerp(key, isValue);
    var l = map.items[i - 1], u = map.items[i];
    var lv = l[1].lerp(key, isValue), uv = u[1].lerp(key, isValue);
    return (uv - lv) / (u[0] - l[0]) * (intensity - l[0]) + lv;
  }
}
function thicknessEnergy(intensity, thickness) {
  return curingMap(curingZ, intensity, thickness, 1);
}
function energyThickness(intensity, energy) {
  return curingMap(curingZ, intensity, energy);
}
function energyWidening(intensity, energy) {
  return curingMap(curingXY, intensity, energy);
}
```

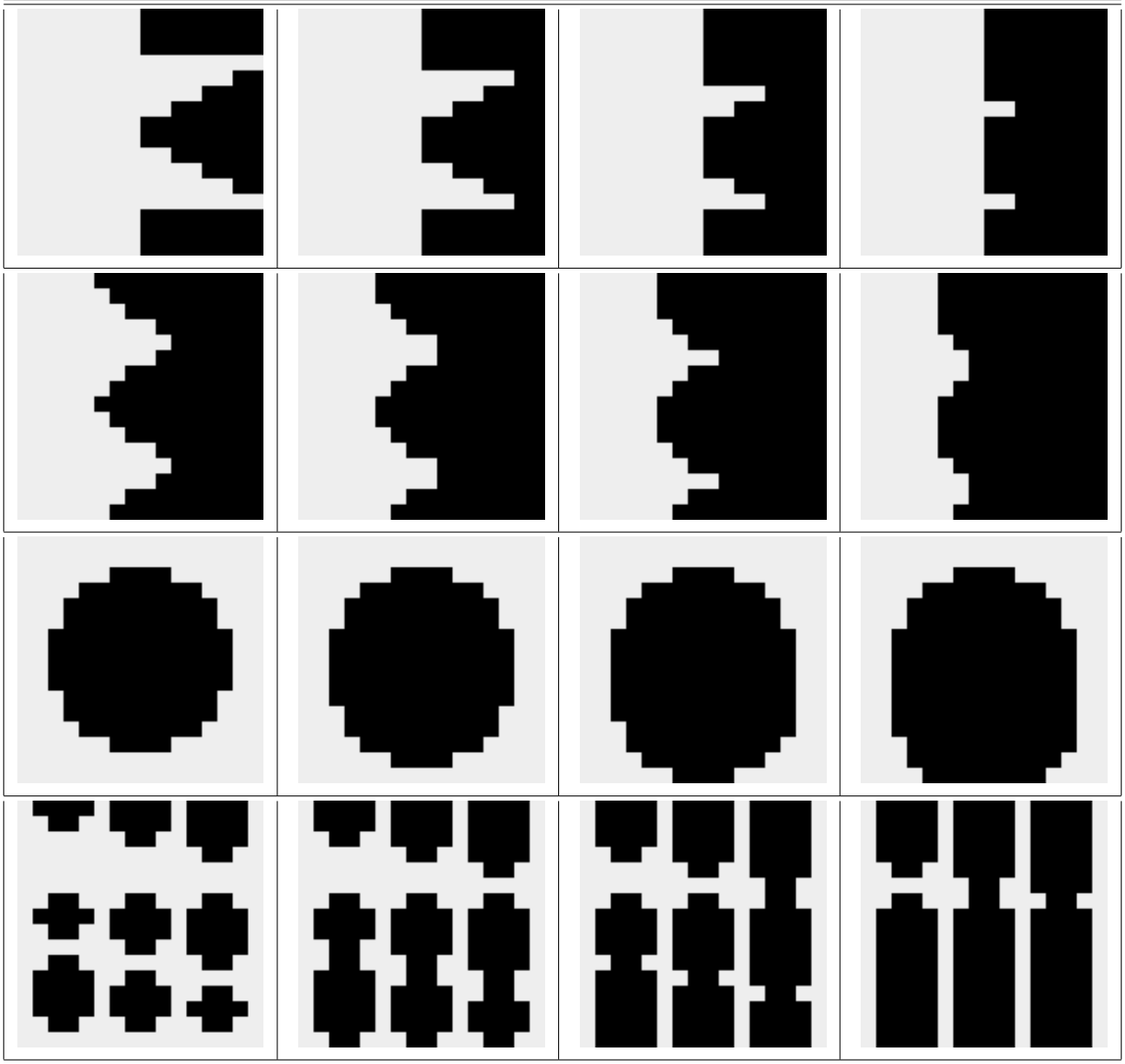
Parameter	Formula	Example Values				
Light Intensity	I	10	15	15	20	25
Slice Thickness	Ts	0.030	0.030	0.080	0.080	0.080
Cure Thickness	Tc = Ts × M + O	0.095	0.095	0.170	0.170	0.170
Cure Energy	W = Z'(I, Tc)	45	55	173.3	186.6	200
Exposure Time	t = W ÷ I	4.5	3.667	11.56	9.333	9
Z Compensation	Cz = Z(I, I × t) - Ts	0.065	0.068	0.089	0.089	0.090
Compensated Layers	Cl = ||Cz ÷ Ts||	2	2	1	1	1
XY Compensation	Cxy = -XY(I, I × t)	0.004	-0.002	-0.045	-0.047	-0.047

The default value for *Exposure Time* is calculated whenever the *Light Intensity* parameter is changed. Likewise, the default values for *Z Compensation* and *XY Compensation* are calculated whenever the *Exposure Time* or the *Light Intensity* parameter is changed.

You can specify a non-zero value for *Z Compensation* or *XY Compensation* within the Material INI file. Composer will simply use the defined values as the default values and will not calculate them.

10.10.2 Z Compensation Example

This subsection explains how Composer's Z compensation algorithm works by way of examples. As shown in the calculations of the previous subsection (Curing Example), the goal of Z compensation is to counteract the additional cure depth that is introduced by Multiplier and Offset parameters. The figures below depicts side crosssection view of the layers where the build platform is at the top and the projector is at the bottom.

Original	1 Layer	2 Layer	3 Layer
			

10.10.3 Height, Lag, Traverse Example

The terms above are used in parameter names interchangeably. Parameters with any of the above term controls how many layers back to apply a certain feature. The number of layers affected is the value divided by thickness rounded to nearest whole number.

Value (mm)	Thickness (mm)	Value ÷ Thickness	Number of Layers
0.025	0.050	0.50	1
0.075	0.050	1.50	2
0.100	0.050	2.00	2
0.125	0.050	2.50	3
0.174	0.050	3.48	3
0.037	0.075	0.49	0
0.038	0.075	0.51	1
0.200	0.075	2.67	3
0.150	0.100	1.50	2
0.250	0.100	2.50	3

10.11 Composer INI Definition

Beginning with Composer 1.2.7, businesses can customize the user interface and the default settings of Composer. By default, Composer will attempt to read *<Composer Install>/Composer.ini* file. You can point Composer to use a different path by specifying *--properties-import=<path>* command argument.

10.11.1 Widgets

All user interface items are structured within a hierarchy of widgets. Almost all widgets are named and you would build a path of widget names from the top-level widget such as the mainwindow or a dialog. The widget paths are matched case-insensitively, so the following lines matches the same widget.

```
[MainWindow/newsToolBar]
[mainwindow/newstoolbar]
```

10.11.2 Properties

The available properties for each widget are determined by the type of the widget. The properties will be applied once, when the top-level widget is being shown. A list of common widgets' properties:

- enabled
- visible
- maximumHeight

- maximumWidth
- minimumHeight
- minimumWidth
- statusTip
- toolTip
- windowOpacity
- readOnly
- checked
- value
- text

```
[MainWindow/newsToolbar]
visible=false
```

10.11.3 Exporting Properties

The available widget names and properties are not guaranteed to remain the same between different Composer versions. You can export the widget names and properties of the current Composer version by specifying *--properties-export=<file path>* command argument to export into an INI file. The resulting file should be compatible to be used as the Composer INI file, but it is best to only keep properties that you want to change.

10.11.4 Settings

Composer settings can be defined within a Settings section of the INI file. You will need to investigate the settings keys and valid values on your own to get your desired effect. For example, the lines below will alwasy enable platform edge snapping when you start Composer.

```
[Settings]
Platform/Snapping=true
```

10.12 Composer Scripting

A scripting backend is available from Composer 1.2.9. The scripting protocol communicates in JSONRPC (JavaScript Object Notation Remote Procedure Call) over a local socket. The scripting language itself is naturally JavaScript.

10.12.1 Protocol

Socket Name "AsigaComposer<*username*>" located in the pipe directory on Windows and user runtime directory on Unix.

Socket IO The first four bytes denotes the length of the message in machine endian and then followed by the message that is encoded in UTF-8.

Test Alive Sending an empty message to the server should return an empty message.

Request The "method" member of JSONRPC Request object is used to encapsulate JavaScript code. Composer server will return JSONRPC Response object.

Notify A JSONRPC Request object without "id". Composer server will return empty message.

10.12.2 Server

Composer can be started up to enable scripting. Specify a command argument *--jsonrpc-server* when starting up Composer.

Windows Composer.exe --jsonrpc-server

MacOS X open -a Composer.app --args --jsonrpc-server

Linux asiga-composer --jsonrpc-server

The standard limit of one Composer application per user applies. You will need to close a currently running Composer before starting as a server. Additionally, you cannot run another Composer application whilst the server application is running.

10.12.3 Client

Composer can be started up to control an running instance. Specify a command argument *--jsonrpc-request=[-|<script file>]* when starting up Composer. You can run multiple Composer instances in client mode.

Interactive Passing "--jsonrpc-request=-" will enable interactive mode scripting. The prompt is ">>>" and will change to "..." on incomplete code.

Script file When a script file is passed as the request, the client will perform a quick syntax check before uploading the file to the server for evaluation.

10.12.4 Environment

The scripting environment contains the common JavaScript global variables as well as the following:

Composer Represents the Composer server application as a JavaScript object.

dir([object]) Lists all accessible properties and children of the passed object.

help([object]) Classifies the various properties of dir() into methods, attributes and children.

QColor([red,green,blue,alpha]) 4 component color object.

QPoint([x,y]) 2D point object.

QQuaternion([x,y,z,w]) 4D quaternion object.

QVector3D([x,y,z]) 3D vector object.

The scripting environment is subject to change between versions so it is recommended to inspect it interactively when trying new versions.

10.12.5 Logging

All IPC (Inter Process Communication) messages can be logged. Specify a command argument *--output-ipc=<logfile>* when starting up Composer. The messages are timestamped and marked with < or > to represent message sent or received respectively.

10.12.6 Example

This subsection will show communication example between client and server. The message level is represented by the numbers of < or > from Socket, RPC and script level. The Socket level representation displays the the message length in plain text when in fact it is a 4-byte integer.

```
>>>dir();
>>{"jsonrpc":"2.0","id":1,"method":"dir();"}
>[42{"jsonrpc":"2.0","id":1,"method":"dir();"}]
<[195{"jsonrpc":"2.0","id":1,"result":["Composer","QColor()",...]}]
<<{"jsonrpc":"2.0","id":1,"result":["Composer","QColor()",...]}
<<<["Composer", "QColor()", "QPoint()", "QRect()", "QSize()", ...]
>>>Composer.applicationVersion;
>>{"jsonrpc":"2.0","id":3,"method":"Composer.applicationVersion;"}
>[64{"jsonrpc":"2.0","id":3,"method":"Composer.applicationVersion;"]
<[41{"jsonrpc":"2.0","id":3,"result":"1.2.9"}]
<<{"jsonrpc":"2.0","id":3,"result":"1.2.9"}
<<<"1.2.9"
>>>Composer.mainWindow.hide();
>>{"jsonrpc":"2.0","id":4,"method":"Composer.mainWindow.hide();"}
>[63{"jsonrpc":"2.0","id":4,"method":"Composer.mainWindow.hide();"}]
<[43{"jsonrpc":"2.0","id":4,"result":undefined}]
<<{"jsonrpc":"2.0","id":4,"result":undefined}
<<<undefined
```

10.13 Language Translations

Change displayed text translations via *Help → Switch application language...* Once the language is selected you should restart Composer to ensure all texts are initialized properly. At the time of writing Composer is bundled with French and Polish languages.

You can expand Composer language translations online at https://www.asiga.com/translate/projects/ or any of our other projects at https://www.asiga.com/translate/. Credits for any translations done are visible online at the same website. Language translations should be at least 95% complete before they are included in any release.

10.14 Model File Formats

10.14.1 Stereolithography STL

The binary STL format is defined to have the following sequence.

```
<header 80-bytes>
<facet count uint32>
<normal float[3]> <vertices float[9]> <attribute uint16>
...
```

Normal, vertices and attribute are repeated up to facet count amount.

The ASCII STL (STLA) format is defined to have the following sequence.

```
solid <name>
  facet normal <x> <y> <z>
    outer loop
      vertex <x> <y> <z>
      vertex <x> <y> <z>
      vertex <x> <y> <z>
    endloop
  endfacet
  ...
endsolid <name>
```

For simplicity, Composer only reads lines starting with “solid”, “vertex” and “endsolid” keywords.

The facet normal direction that is defined in both STL formats are ignored by Composer. The three vertices that defines each triangle will be used to compute its normal.

10.14.2 Slice SLC

The Slice format defines two-dimensional polygons or lines at specified Z positions. The SLC format is defined to have the following sequence.

Header Up to 2048 bytes of ASCII characters

Reserved 256-byte unused

Sample Count uint8

Sample Entries float[4] each

Contour Z float

Boundary Count uint32 for Contour Z

Vertex Count uint32 for each Boundary

Gap Count uint32 for each Boundary

Vertex float[2] for each Vertex

Composer understands the following headers:

UNIT INCH or MM only, defaults to MM

TYPE PART or SUPPORT only, does not support WEB

10.14.3 Polygon PLY

The Polygon format defines its own sequence of elements, attributes and datatypes in the file header. Composer accepts the following keywords:

format Encoding ascii, binary_little_endian, binary_big_endian

comment ASCII printable characters or percent-encoded characters

element Names vertex, face

attribute Data types char, short, int, uchar, ushort, uint, int8, int16, int32, uint8, uint16, uint32, float, float32, double, float64, list

vertex.attributes Names x, y, z

face.attributes Names starting with vertex_ind*, attr*

For best parsing performance, the following arrangement and datatype is recommended. Face attribute is optional and a value of zero will be used if it's undefined.

```
PLY
format binary_little_endian 1.0
element vertex <count>
attribute float32 x
attribute float32 y
attribute float32 z
element face <count>
attribute list uint8 uint32 {vertex_index,vertex_indices}
attribute uint32 {attr,attribute}
end_header
```

10.15 Text Formatting

Composer may expose configurable text formatting that is used to interpret text as a set of values. The formatting is largely based on Python, which is based on C.

```
%[(key)][flags][width][.precision]conversion
```

10.15.1 String Conversions

b Binary number

c One character

d Whole number

e E Scientific number

f Decimal number

g G Adaptive whole, decimal or scientific number

o Octal whole number

p P Hexadecimal pointer

r Debug representation

s String of characters

u Unsigned whole number

x X Hexadecimal whole number

10.15.2 Datetime Conversions

C 2-digit century

Y 4-digit year, ISO 8601

y 2-digit year

B Full month name

b Abbreviated month name

m 2-digit month

d 2-digit day of month, ISO 8601

e Space-leaded 2-characters day of month

U 2-digit week of year, starts on Sunday

V 2-digit week of year, starts on Monday, ISO 8601

W 2-digit week of year, starts on Monday

A Full day name

a Abbreviated day name

u 2-digit day of week, starts on Monday, ISO 8601

w 2-digit day of week, starts on Sunday

j 3-digit day of year

H 2-digit 24-hour, ISO 8601

I 2-digit 12-hour

M 2-digit minute

S 2-digit second

L 3-digit millisecond, based on Java / Ruby

P Lowercase am / pm

p Uppercase AM / PM

Z Timezone name

z Timezone offset from UTC, ISO 8601

10.15.3 Flags

- Left aligned text when text is shorter than width

Alternate format

+ Show sign for positive numbers

Space-leading for positive numbers

0 Zero padded text when text is shorter than width

, Show thousand separator for numbers, based on Java

$ Currency format for numbers

’ Wrap text in quotes

10.16 Manual Changelog

10.16.1 2022-06-22

- Update “Flexible” section in “Generate Support”

10.16.2 2022-05-03

- Removed “Flexible Supports” section in “Generate Support”
- Add “Presets” section in “Generate Support”
- Update “Lattice” section in “Generate Support”
- Update “Support” section in “Material INI Definitions”
- Add “SupportDialog INI Definitions” in “Appendix”

10.16.3 2022-02-21

- Update “Automatic placement” section in “Part manipulation”
- Renamed and update “Nodes” to “Lattice” in “Generate Support”
- Update “Operating system requirements” section in “Troubleshooting”
- Add “Duplicated facets” section in “Troubleshooting”

10.16.4 2021-12-21

- Update “Automatic Placement” section in “Part Manipulation”
- Add “Nodes” and update “Sprue” subsections in “Generate Support”

10.16.5 2021-11-24

- Update “Rotate” section in “Overview”
- Update “Generate Support”, “Sprue” and “Support Management” sections in “Support Structures”
- Added “Multiple Running Instances” and “Software Rendering” subsections in “Appendix”

10.16.6 2021-10-05

- Update “Parameters” section in “Build Compilation”
- Added “Base Plate” subsection in “Materials INI Definitions”
- Update “Troubleshooting”
- Update “Curing” and “Mechanics” subsection in “Materials INI Definitions”

10.16.7 2021-05-27

- Rewrite “Software Errors” section in “Troubleshooting”
- Added “Startup Options” section in “Appendix”
- Populate “Materials INI Definitions” section in “Appendix”
- Rename “Printer-Specific Materials Definitions” to “Advanced Material INI Definitions”

10.16.8 2021-03-31

- Update “Troubleshooting” chapter
- Update “Materials” section in “Settings”
- Update “Support” subsection in “Materials INI Definitions”
- Moved “Evolution” section from “Printer-Specific Material Definitions” to “Materials INI Definitions” section

10.16.9 2020-09-16

- Update “Geometry” subsection in “Support Sturctures”

10.16.10 2020-05-22

- Added subsections to the “General” section in “Build Wizard”
- Update screenshots in the “Build Wizard”

10.16.11 2020-03-30

- Update “Material INI Definitions” section in “Appendix”
- Removed “Print Range” subsection in Build Wizard “Parameters” section
- Renamed “Miscellaneous” subsection to “Print Optimisations” in Build Wizard “Parameters” section

10.16.12 2019-10-15

- Update “Advanced Parameters” and “Summary and Submission” sections in “Build Wizard”
- Update “Printer INI Definitions” section in “Appendix”
- Added “Exoprint Import” in “Projects”

10.16.13 2019-05-30

- Update “Material INI Definitions” section in “Appendix”

10.16.14 2019-04-02

- Added “Approach Acceleration”, “Approach Deceleration”, “Separation Acceleration”, “Separation Deceleration”, “Tare Interval” to “MAX Parameters” section
- Added "FAST PRINT MODE" to "Miscellaneous" subsection of "Parameters" section

10.16.15 2018-10-30

- Added “Build Log” subsection in “Preferences”
- Update “Summary and Submission” section
- Added “Build Logging” subsection in “Submitted Build”
- Added “Text Formatting” section in “Appendix”
- Update screenshots for “Preferences” and “Summary and Submission”

10.16.16 2018-08-20

- Split the “Transform Panel” sections into subsections
- Move “Build Parameters” section to “Build Compilation” chapter as “Advanced Parameters”
- Add “Rendering Parameters” subsection to “Build Parameters”

10.16.17 2018-07-25

- Update “Material INI” section on User Material and noted “Slice Thickness Presets”
- Update “Build Time” section with material cost option
- Modify“Materials” subsection in “Settings”
- Move “Zip Import” subsection to “Adding Parts”
- Add “Diamond Pixel Projectors”, “Build Preview Controls” & “Zip Import” subsection in “Build Compilation”
- Add “Model File Formats” section

10.16.18 2018-06-01

- Add “Separation Detect Hard Stop” to MAX Parameters

10.16.19 2018-03-16

- Update “Build Compilation” section to document date/time toggle button for build name
- Update “Printers INI Definitions” section with new version 4
- Update “Curing Example” subsection due to change in behaviour
- Add “Composer Scripting” section in the “Appendix”

10.16.20 2018-03-02

- Add “Settings” chapter
- Add “Composer INI Definition” section in the “Appendix”
- Update “Printers INI Definition” section with new version 3

10.16.21 2018-02-27

- Note that 3Dconnexion SpaceNavigator 3D mouse is supported on Linux and Windows in “Viewport” section
- Add “Separation Detect Window” and “Separation Detect Window Time” parameters in “MAX Parameters” section
- Noted “Separation Detect” feature in “Build Compilation” for MAX systems

10.16.22 2017-12-07

- Add “Viscosity Range” and “Traverse Timeout Range” to “MAX Parameters” section
- Update “Build Compilation/General” with new material batch field

10.16.23 2017-10-06

- Add “Z Compensation Example” subsection in “Build Parameters” section
- Remove note about positive correlation for Curing/XY table
- Add “INI Files” section to introduce what an INI file is

10.16.24 2017-09-01

- Add “Flexible Overshoot” subsection in “Support” section
- Update “Material INI Definitions” section with defineable compensation values

10.16.25 2017-07-05

- Remove “Curing/Light Intensity Control” parameter from “Material INI Definitions” section

10.16.26 2017-06-08

- Add “Curing/Two-Step Exposure Border Width” in “Mechanical Parameters” section
- Add “MAX Parameters” section in “Build Parameters” section

10.16.27 2017-03-10

- Add “Curing/Scale” and “Curing/Light Intensity” parameters in “Material INI Definitions” section
- Add “Minimum and Maximum Adjustments” in “Printer-Specific Material” section
- Update “Saved Projects” in “Projects” chapter with improved behavior
- Update “Curing Example” subsection with changes on “Curing/Z” and “Curing/XY”

10.16.28 2017-01-23

- Add “Burn-In XY Compensation” parameter in “Build Parameters” section
- Add “Overshoot” section in “Support Structures” chapter
- Update “Generate Support” section in “Support Structures” chapter
- Update “Support” section in “Materials INI Definitions” with new parameters
- Update “STL Triangles” section about X-Ray and Line Rendering
- Update “Materials” subsection in “New Projects” section about confirming to replace file

10.16.29 2016-10-19

- Add “Sprue Support” section in “Manual Editing Mode”
- Add “Curing/XY Scale” parameter in “Material INI Definitions” section
- Add “Firmware-specific Printer Definition” section in “Appendix”
- Add “Curing Example” in “Build Parameters” section to show how Composer calculates the default values
- Add “Base Plate Holes” section in “Build Compilation” chapter
- Update screenshot for “Parameters” in “Build Compilation”
- Add “Slider Function” section in “Build Compilation” chapter
- Update screenshot for “Summary and Submission” in “Build Compilation”
- Add documentation for “Export Part Map” button in “Build Compilation”

10.16.30 2016-07-08

- Add mm^2 to units list in “Parameters” section of “Printer INI Definitions”
- Update “Multi Stacking” chapter to clarify that multiple builds in separate tabs need to be prepared for multi stacking and how to use the Add/Remove buttons
- Add “Smart Slide” section under Build Parameters

10.16.31 2016-05-17

- Update screenshot for “Create Array” dialog in “Part Manipulation” chapter
- Update screenshot for “Build Time” dialog in “Build Compilation” chapter

10.16.32 2016-05-12

- Update “New project” section in “Projects” chapter to explain User Materials
- New “Printer-specific Material Compatibility” section in “Appendix” to explain the new Material INI format

10.16.33 2016-05-02

- Updated main interface screenshot in “Overview” to include “Generate Multi Stacking” icon on toolbar
- Updated screenshot for “Shortcuts” section in “Overview” to include “Generate Multi Stacking” action
- Updated screenshot for “Options” section in “Viewport Controls” to include new “Scaffold color” preference
- New “Multi Stacking” chapter
- Updated screenshot for “General” section in “Build Compilation” to include Multi Stacking selection
- Noted “Multi Stacking” feature for “General” section in “Build Compilation”
- Moved “Out of Bounds” validation of parts from General build wizard page to Parameters build wizard page

10.16.34 2016-04-01

- Rearranged “Build parameters” into categories (slicing, projector, burn-in, mechanical)
- Noted “Import Build” feature
- Update shortcuts and preferences dialog screenshots
- New “Clipboard” section in “Overview”
- New “OpenGL” section in “Viewport Controls”
- New “Manual Changelog” section

10.16.35 2016-01-22

- Noted “Antialiasing” feature in “Build Compilation”
- Added “Motor Parameters” section for PRO2 machines

10.16.36 2015-12-23

- Noted “Virtual Printers” when choosing a printer

10.16.37 2015-10-23

- Added more “Troubleshooting” sections about folders and crashes

10.16.38 2015-08-21

- Noted keyboard modifier keys when using clipping
- New “View Slices” section in “Build Compilation”
- Added more “Build Compilation” screenshots

10.16.39 2015-07-15

- Rewritten manual for Composer 1.1

10.16.40 2012-09-17

- Initial manual released for Composer 1.0