

3D Printing in CAM Help

December 15, 2016

Version #1

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Additive Manufacturing

The Additive Manufacturing application offers data preparation tools for the 3D printing with powder bed process.



The software allows you to:

- Define 3D printer characteristics (e.g. build tray geometry)
- Optimize parts locations in the build tray.
- Prepare parts for 3D printing by generating support structures.
- Develop an optimal build strategy (e.g. build speed, material consumption).
- Integration with numerous 3D printers: using Materialise build processors we offer seamless integration with numerous machines from different machine vendors.

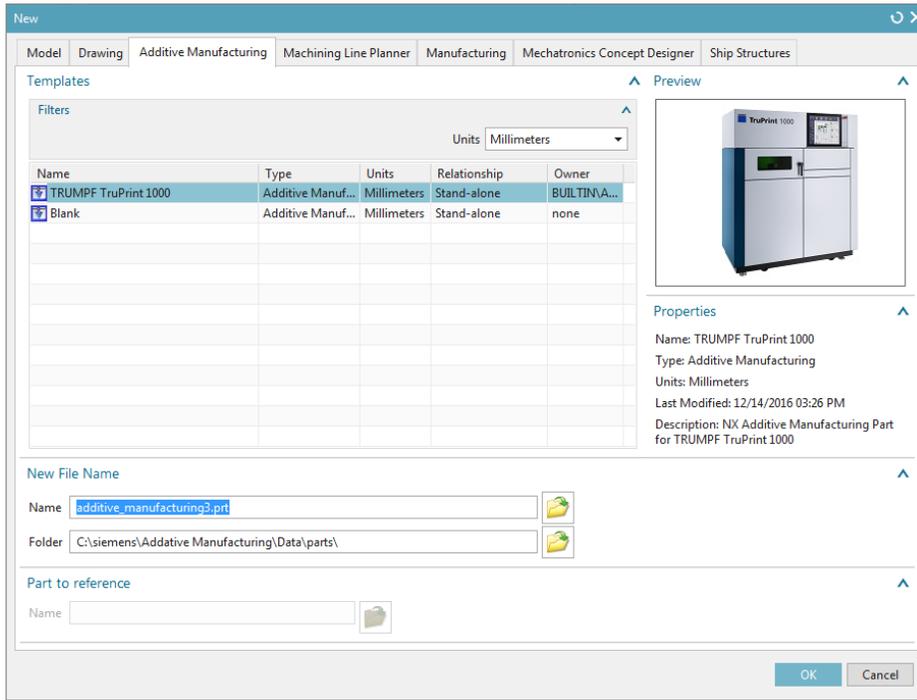
Where do I find it?

Command Finder	Additive Manufacturing
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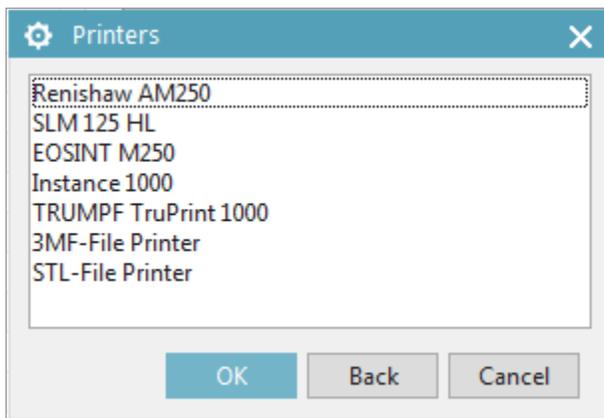
Additive Manufacturing workflow

The following is the basic workflow for preparing a build tray for 3D printing:

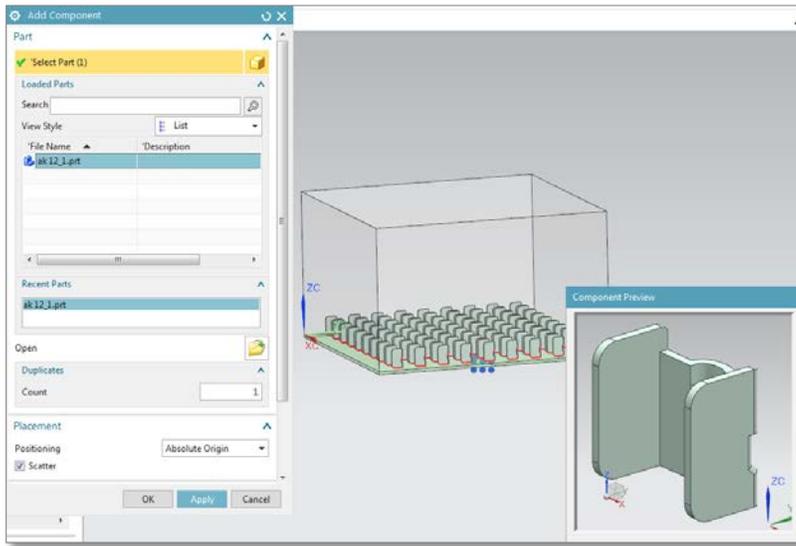
1. Create new Additive Manufacturing part by using the **New...** command.



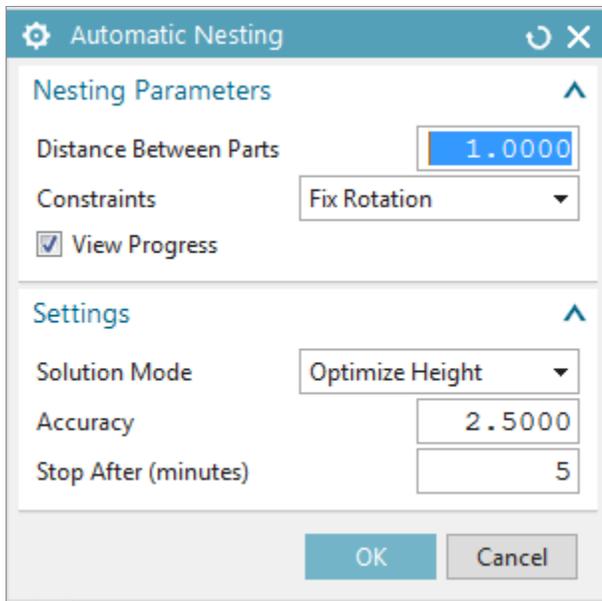
2. Use the **Select 3D Printer** command to set the target 3D printer.



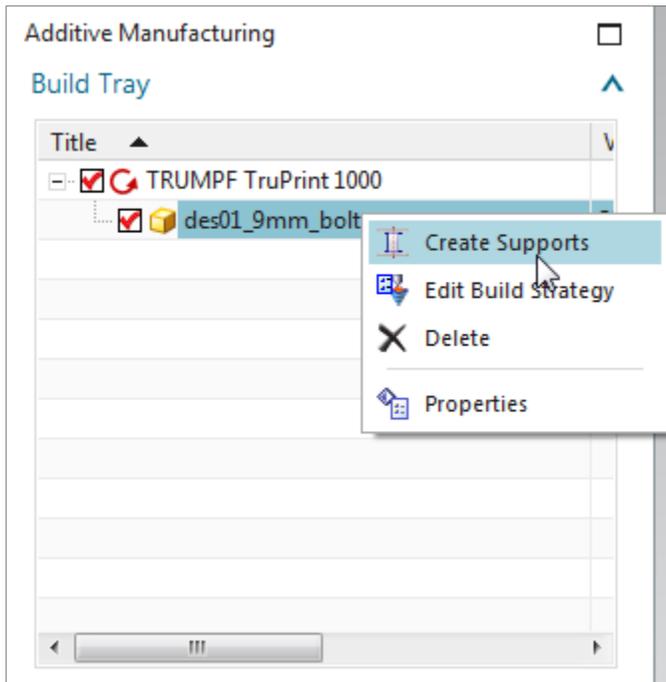
3. Add parts to 3D printer build tray using the **Add** command.



4. Optimize parts locations using the **Pattern Component** or **Automatic Nesting** commands.



5. Automatically generate support structures to the loaded parts using the **Create Supports** command.



6. Using the **Properties** command, optimize the support structure by updating the support generation parameters.
7. Use the **Edit Build Strategy** command to define and assign specific build strategy to the build tray and parts.



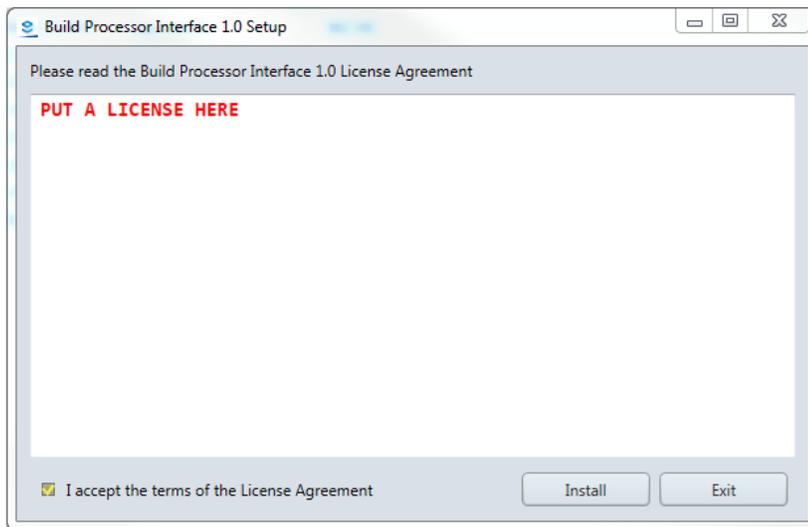
8. Generate machine's specific input files using the **Generate** command.
9. View slices and hatches using the **View Slices** command.

Build Processor installation

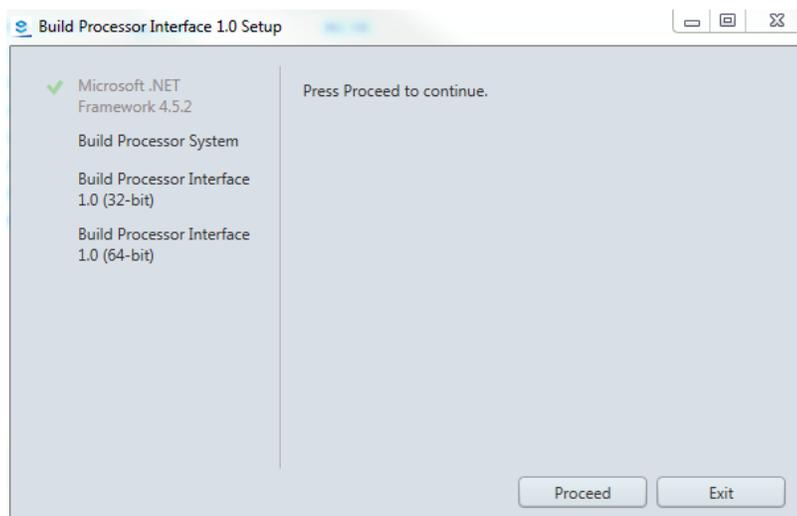
In order to communicate with specific machine from different vendors, one has to install a dedicated build processor for the required machine.

The following procedure describes the required steps for the build processor installation:

1. Install Build processor interface:
 - A. Run `$UGII_BASE_DIR\mach\auxiliary\mfgam\BuildProcessorInterface.exe`
 - B. Accept the License Agreement terms and click Install (no license is required).



- C. Click Proceed to start installation.

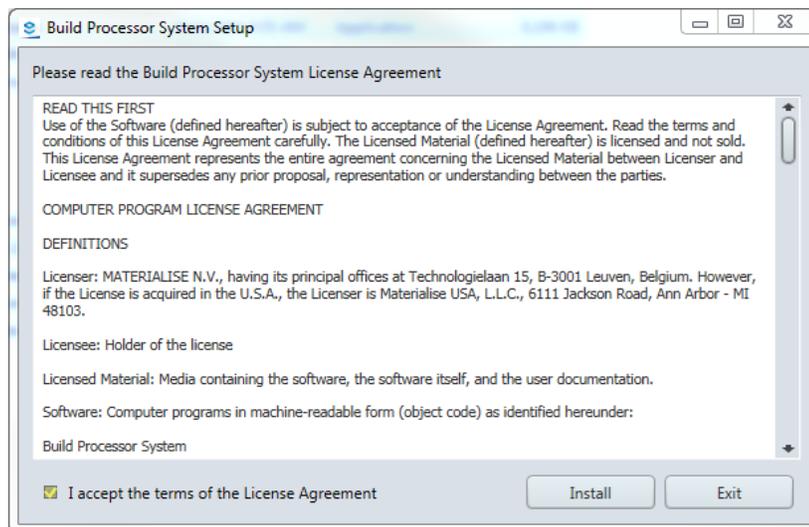


- D. Click Finish.

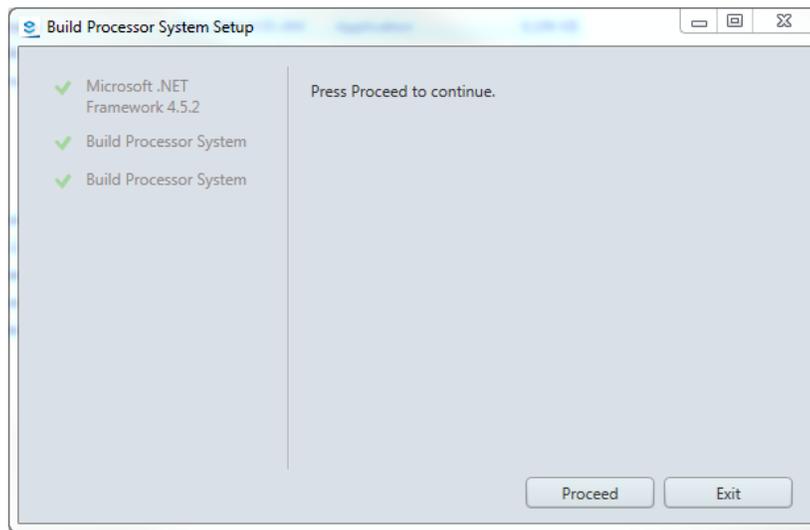
2. Install Build processor System:
 - A. Run %UGII_BASE_DIR%\mach\auxiliary\mfgam\BuildProcessorSystem.exe
 - B. Choose the required language and click Continue.



- C. Accept the License Agreement terms and click Install.

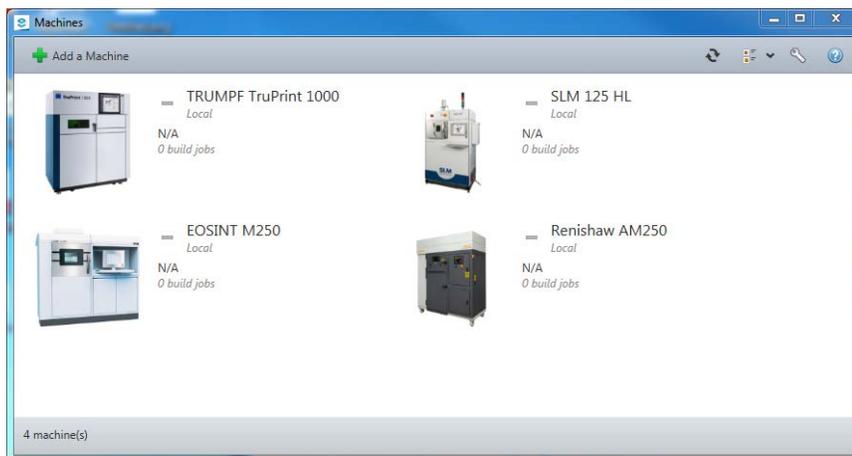


D. Click Proceed to start installation.

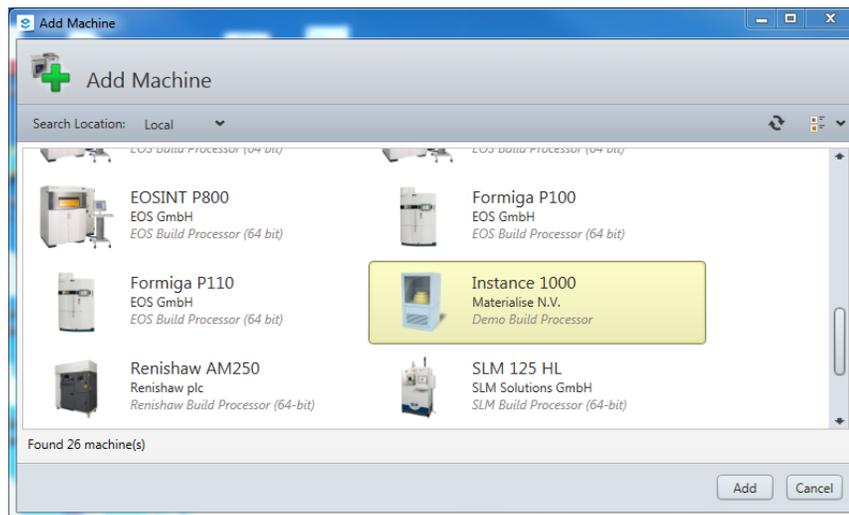


E. Click Finish.

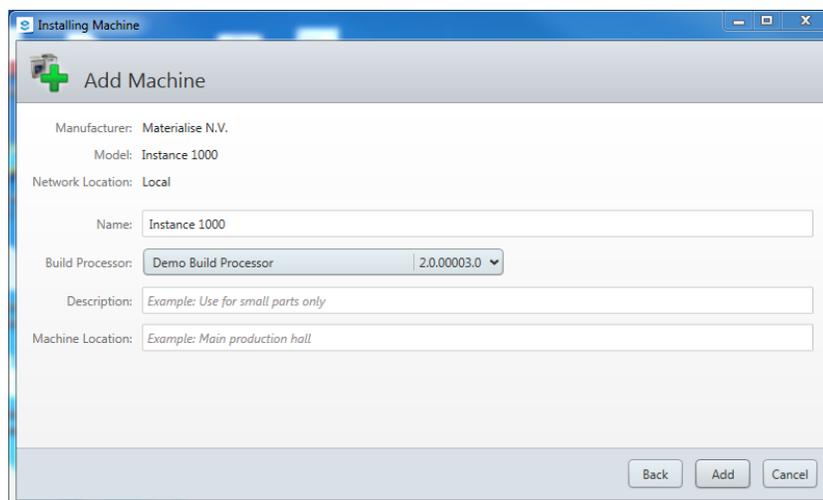
3. Install the specific build processor purchased from Materialise.
4. Restart the machine.
5. Add the machine to the build processor manager:
 - A. Launch the Build Processor Manager application.
 - B. Click the **Add a Machine** command.



C. Select the required machine and click Add.

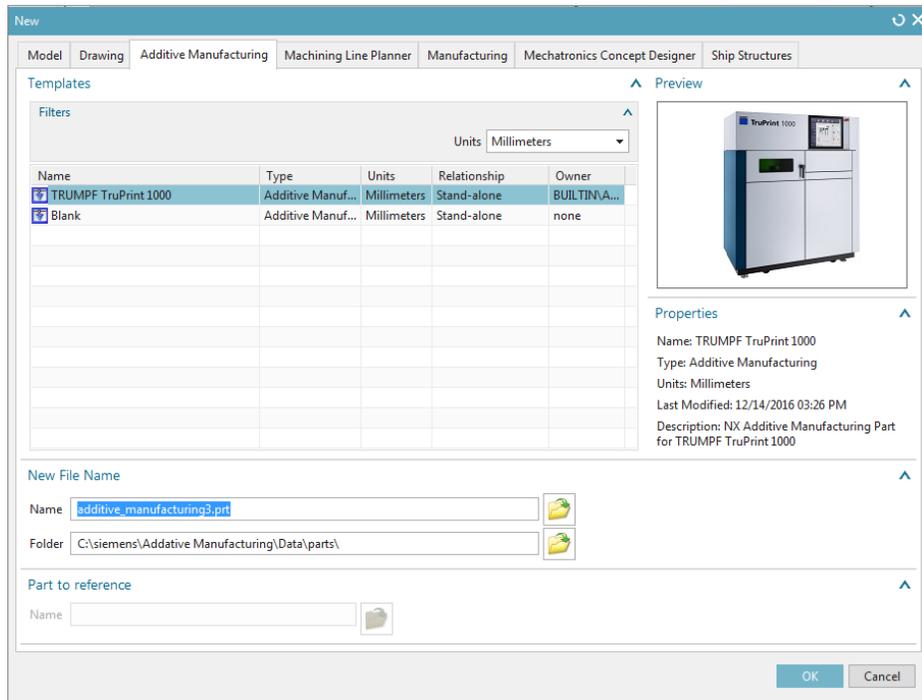


D. View the machine details and click Add.



E. Click close.

Create New Additive Manufacturing file



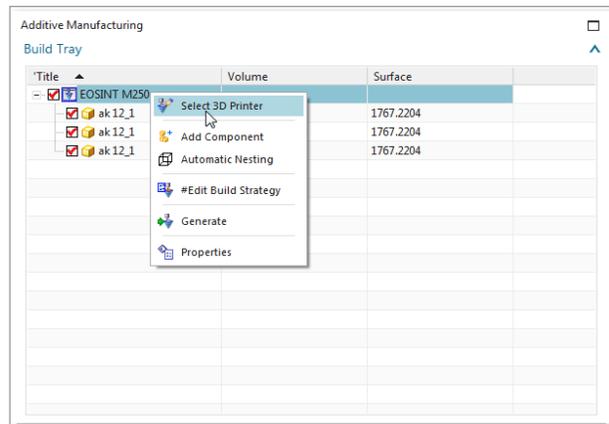
Use the **New** command to create a new Additive Manufacturing file.

Additive Manufacturing file allow you to prepare your design for 3D printer: Define the printer and its parameters, position your parts on the build tray, create support structures and generate the machines input file.

In order to create a new Additive Manufacturing file:

1. Choose **File** tab → **New**
2. Ensure that the **Additive Manufacturing** tab is selected.
3. Select the Additive Manufacturing template according to your machine vendor.
4. Enter a file name and a folder in the **New File Name** fields.
5. Click **OK**.

Select 3D Printer

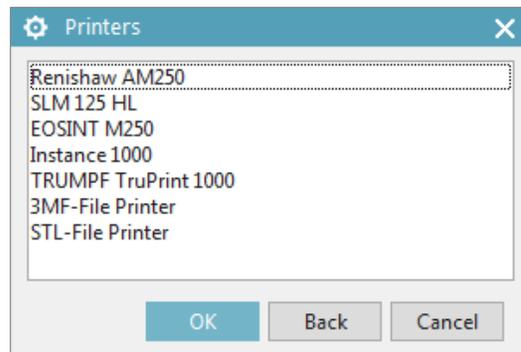


Use **Select 3D Printer** command to define the specific 3D printer you are going to use in order to build your assembly. Setting the printer adjust accordingly the build tray and build strategy properties.

The command allows the user to select a 3d printer according to the installed build processors.

In order to select 3D Printer:

1. In the Additive Manufacturing Viewer right click on the build tray
2. Select the **Select 3D Printer** command from the right click menu.
3. Select the target printer.



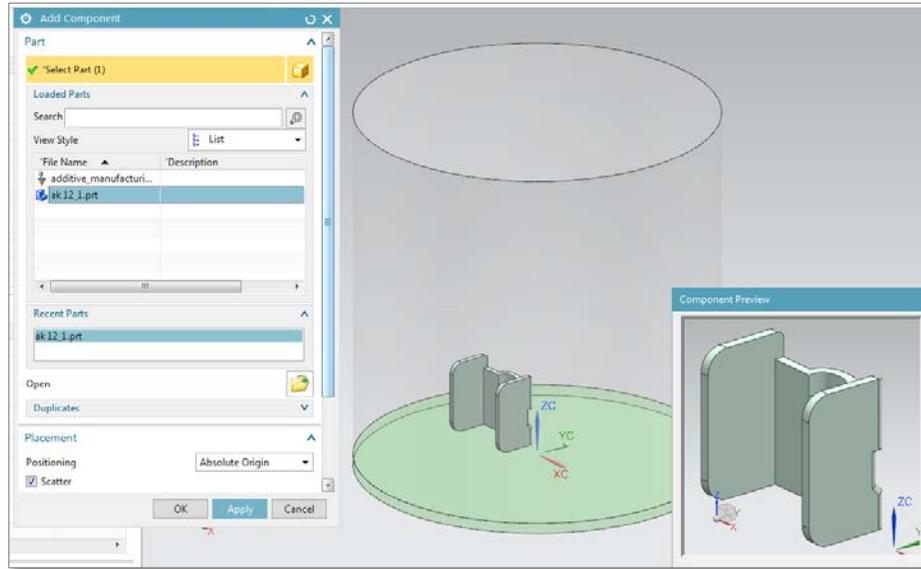
4. Click **OK**.

Where do I find it?

Application	Additive Manufacturing
Prerequisite	Additive Manufacturing part file
Additive Manufacturing Navigator	Build tray Right click menu

Add component

Use the NX **Add** command to add new components that you would like to the build tray.



In order to add components to the build tray:

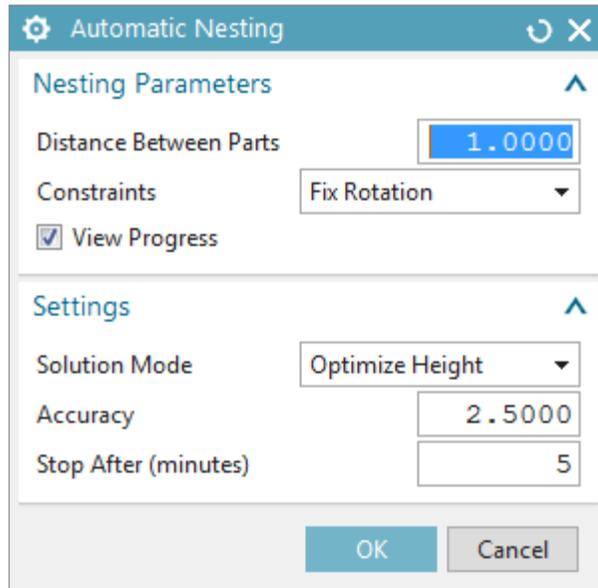
1. Create New Additive Manufacturing part file.
2. In the Ribbons Home Tab click on the **Add** command.
3. Select the prt CAD file using the **Open...** command.
4. Place the part using the **Placement** options.
5. Click **OK**.

For additional information please refer to NX documentation.

Where do I find it?

Application	Additive Manufacturing
Prerequisite	Additive Manufacturing part file
Additive Manufacturing Navigator	Build tray Right Click menu

Automatic Nesting



Use **Automatic Nesting** to automatically position the parts in the build tray in an optimal way. The automatic nesting command helps to maximize the 3D printer output by saving powder and time.

You can do the following with this command:

- Increase nest density and automatically pack more parts into the same build tray.
- Decrease your build time by minimizing build height.
- Reduce build failures by avoiding collisions and interlocking.

In order to use the **Automatic Nesting** command:

1. Create New Additive Manufacturing part file.
2. Add more than one component to the build tray.
3. Select the build tray in the Additive Manufacturing viewer.
4. In the Build tray Right Click menu select the **Automatic Nesting** command.
5. Set the nesting parameters.
6. Click **OK**.

Where do I find it?

Application	Additive Manufacturing
Prerequisites	<ul style="list-style-type: none"> • Additive Manufacturing part file • More than one part were added to the build tray
Additive Manufacturing Navigator	Build tray Right Click menu

Automatic Nesting dialog box

Nesting parameters		
Set geometric constraints to the automatic nesting solution.		
Distance between parts	Required distance between the parts. The minimum value depends on the available Nesting license	
Constraints	Free	Parts are free to rotate and translate.
	Fix Z Direction	Parts are free to translate, rotate around z and rotate 180 degrees around other axes.
	Fix Bottom Plane	Parts are free to translate and to rotate around z only.
	Rotate 180	Parts are free to translate and rotate 180 degrees over any axis.
	Fix Bottom And XY	Parts are free to translate, rotate 180 degrees around z only.
	Fix Rotation	Parts are free to translate only.
	Fixed	Parts are fixed in place and will not be optimized.
View Progress	Review the nesting process in the graphics.	
Settings		
Selection Mode	Optimize Height	Minimize building height, to minimize build times and material consumption
	Distribute in Height	Uniformly distribute the parts over the height of the container
	Optimize Slice Volume	The volume of the slices is made as identical as possible amongst the maximal used height of the platform.
	Optimize Height and Slice Volume	The volume of the slices is made as identical as possible and the height of the platform is brought back to its minimum. This calculation method will take some more time than the other options.
Accuracy	Define the accuracy of the Automatic nesting algorithm. A smaller value will increase the accuracy of the nesting process but will take a longer time to achieve the optimal results.	
Stop After (minutes)	Stop criteria for the Automatic Nesting optimization. Define the Maximum duration of the optimization process.	

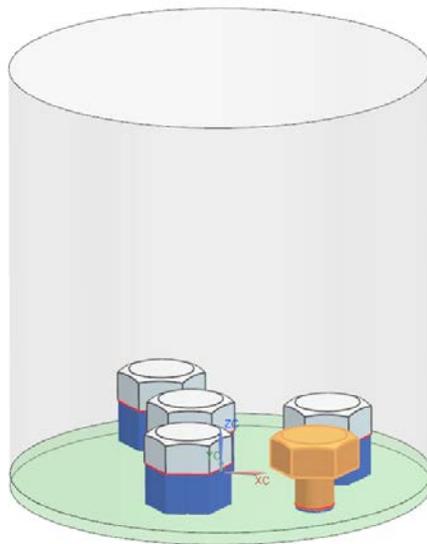
Create supports

Use **Create Supports command** to automatically create support structures for the selected parts.

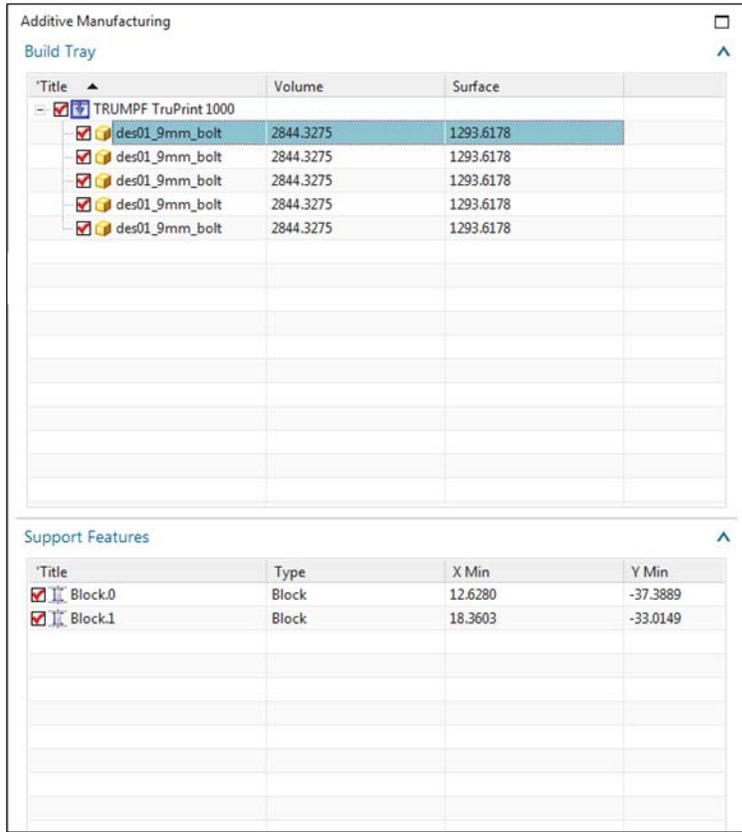
Additive manufacturing processes such as Powder Bed Fusion require support structures for overhanging part areas during the powder solidification. During the support generation process we simultaneously strive to reduce support areas in order to decrease production cost, while enhancing the part quality and stability by increasing the support stiffness.

Fixed Plane Additive Manufacturing application offers automatic support generation based on the user defined parameters. During the part export to the 3MF format, the application includes and slices the support as well.

The application generates supports of type block, line and point.



You can start the support generation by selecting one or more parts in the Additive Manufacturing viewer. In the right click menu select the **Create Supports** command.



Once the support generation process is over, by selecting the part, you can view its support structure for in the support features panel.

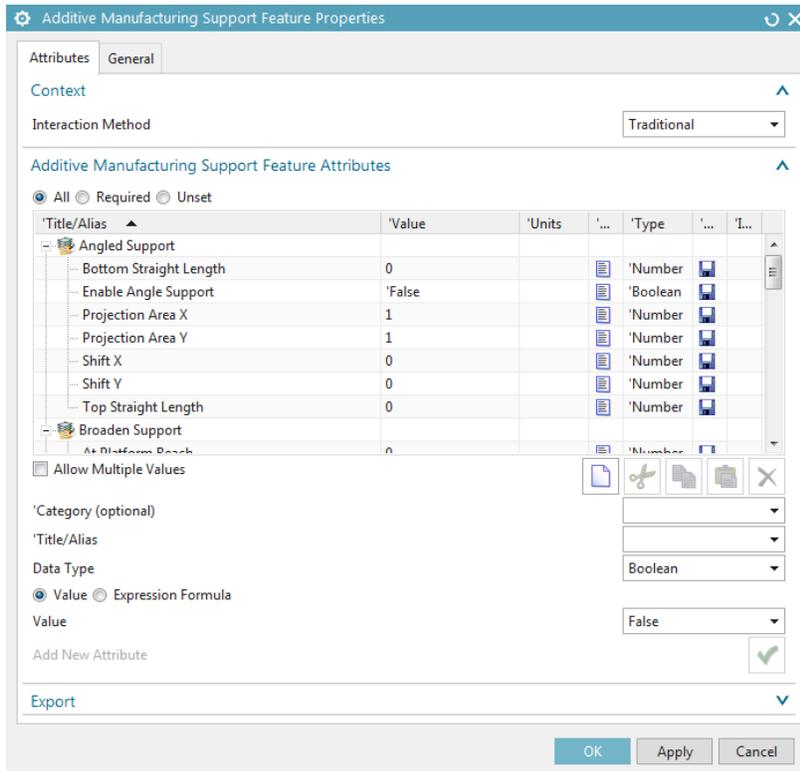
To learn more about the support structure generation see also Support **Feature Properties**.

Where do I find it?

Application	Additive Manufacturing
Prerequisite	One or more parts selected in the Additive Manufacturing Viewer
Additive Manufacturing Navigator	Right click menu

Support Feature Properties

Use the **Support Feature Properties** command to edit the support feature properties.



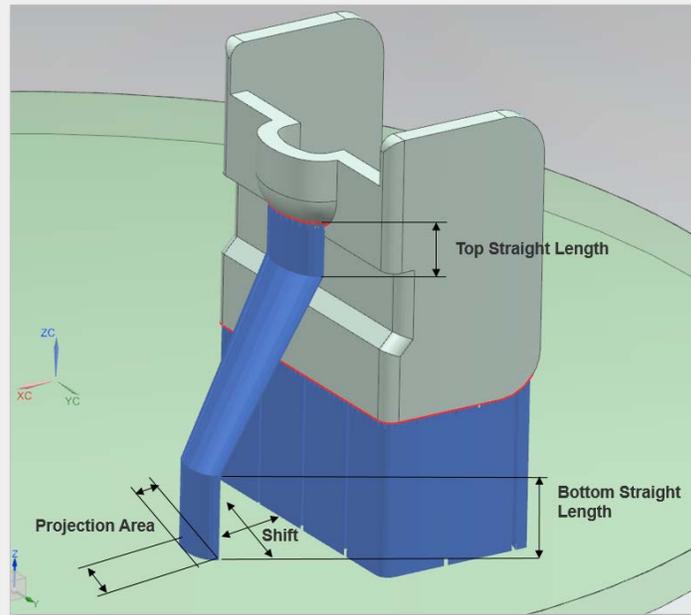
By right click on a support feature and execute the **Properties** command, the user can modify the supports by editing its properties and execute the **Regenerate Support** command.

In NX11.0.1 we introduce Support Structures of type block, line and point.

Common properties

Angled Support

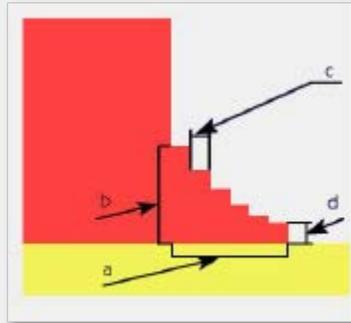
Angled supports allows you to avoid contacting unnecessary surfaces on the part and reduce the amount of post processing work by angling out the support structure from the vertical plane.



Bottom Straight Length	Add a straight support section at the bottom of the support structure in a given length.
Enable Angle Support	By enabling the angle support, you can create a support structure with a certain angle from the vertical plane.
Projection Area X	Extend or shrink the bottom of the support structure by the user defined factor figure multiply the top support length along the X axes. Negative values are possible if you want to make the bottom connection a smaller surface than the top connection.
Projection Area Y	Extend or shrink the bottom of the support structure by the user defined factor figure multiply the top support length along the Y axes. Negative values are possible if you want to make the bottom connection a smaller surface than the top connection.
Shift X	Shift the bottom of the support structure from the vertical plan along the X axes in a given distance.
Shift Y	Shift the bottom of the support structure from the vertical plan along the Y axes in a given distance.
Top Straight Length	Add a straight support section between the part and the support structure in a given length.

Broaden Support

Extend the area of the support at the bottom of the support structure.



At Platform Reach (a)	Width of the additional support area.
At Platform Spacing (c)	Distance between each additional support segment.
Enable Broaden support At Platform	By enabling the broaden support, the base of the support structure will be extended in a stepwise manner.

Lowest Line

When placing a support under a curved surface, it can happen that the lowest line (the imaginary line connecting the lowest points of the surface) is not supported correctly. This can cause problems when building the part with some RP-techniques. When lowest line is checked, an extra line of support will be placed so that this lowest line is correctly supported.

Enable Draw lowest line	By enabling the “Draw lowest line”, an extra line of support will be added to the external surface of the part.
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Offset

Lower Z offset	<p>All the supports can have a certain offset into the part in order to ensure a better contact between part and support. Positive values ensure the support penetrates the part.</p> <p>Distance between the support and the lower surface.</p> <p>Required when the support rest on the part itself and not on the build tray.</p>
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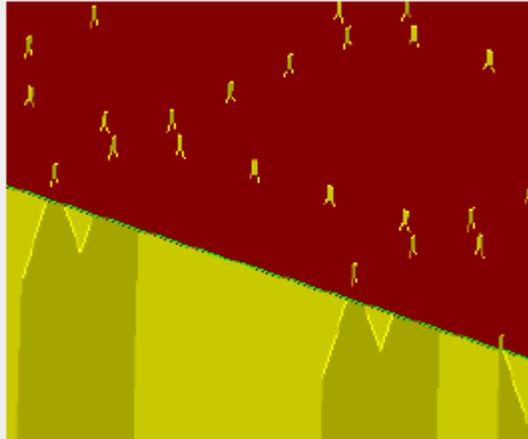
No Support offset	Defines a distance from a vertical wall, where no supports are required.
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Upper Z offset

All the supports can have a certain offset into the part in order to ensure a better contact between part and support. Positive values ensure the support penetrates the part.

Distance between the support and the upper surface.

**Surface angle**

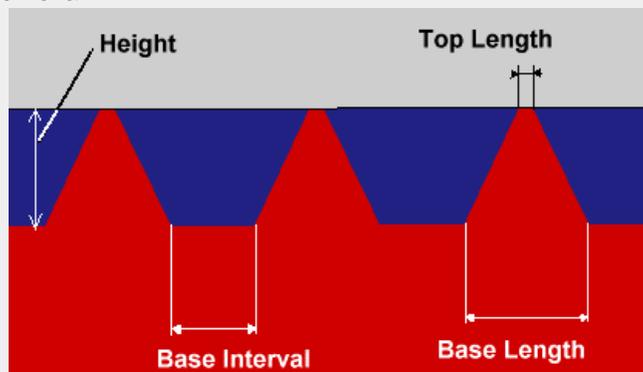
The Surface Angle defines which surfaces of the printed part require supports. The Surface Angle is the angle between the horizontal XY plane and the surface. Any surface that its angle to the horizontal XY plane is bigger than the selection angle is considered as self-supporting and does not require support structure.

Selection angle

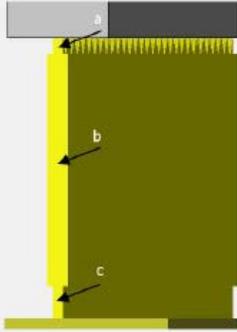
The Surface Angle defines which surfaces of the printed part require supports. The Surface Angle is the angle between the horizontal XY plane and the surface. Any surface that its angle to the horizontal XY plane is bigger than the selection angle is considered as self-supporting and does not require support structure.

Teeth

Teeth parameter allows you to create a profile for the teeth at the top and the bottom of the support structure to facilitate its removal.

**Base Interval**

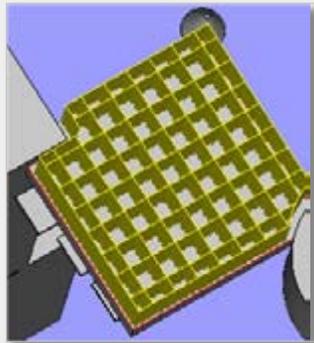
Distance between two consecutives teeth.

Base Length	Length of the teeth base at the contact point with the support
Create Teeth at platform	By enabling create teeth at platform, teeth profile will be created at the bottom of the support in the conjunction with the platform.
Enable Teeth	By enabling teeth, teeth profile will be created at the top of the support in the conjunction the part. Lower teeth will be created only if the support is trimming on another part.
Height	Height of the teeth.
Top Length	Length of the teeth at the contact point with the part.
Thickness	
	
Enable Thickness	By enabling Thickness, the user can set the thickness to the non-solid support type.
Thickness	Set the thickness of the support walls and teeth.

Block support properties

Hatching

Block Supports are made with a grid of X and Y lines. The distance between the lines is defined by the hatching parameter.

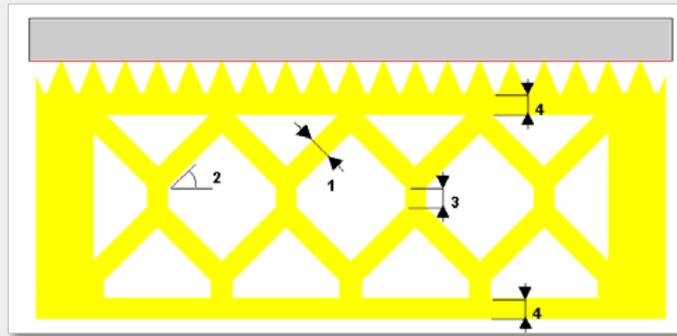


X Hatching	Distance between the lines along the X axes in block support.
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Y Hatching	Distance between the lines along the Y axes in block support.
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Perforation

Define whether the support structure will be solid or perforated. Currently only Diamond shape perforation is supported. Perforation reduces the amount of material that is used for the support structure and enables easy removal of the block support.



Angle (2)	Angle of the diamond-shaped perforation.
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Bean thickness (1)	Thickness of the perforation wall.
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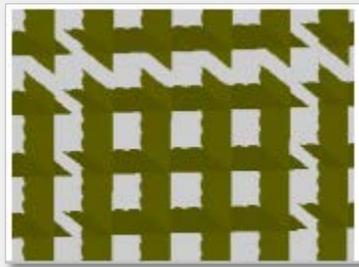
Perforation	By enabling perforation the support structure will be perforated.
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Solid height (4)	Height of the solid structure that connect the perforation support to the platform and to the upper surface.
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Height (3)	The height of the vertical segment at the diamond-shaped perforation.
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Fragmentation

Fragmentation separates the supports to several blocks. Fragmentation enables easy removal of the block support.



Fragmentate Borders Interval	Length of the border support between each gap.
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Fragmentate borders	By enabling Fragmentate borders, gaps will be generated in the border of the support structure.
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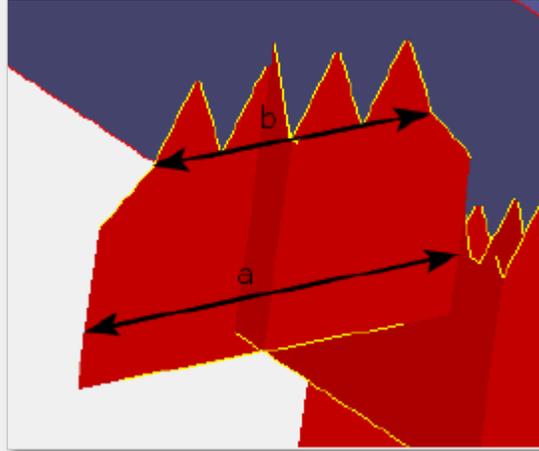
Interval	Length of the support (along X and Y axes) between each gap
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Line support properties

Cross Line

Cross line interval

Set the length of the crossing lines.



Maximum Contact Length (b)

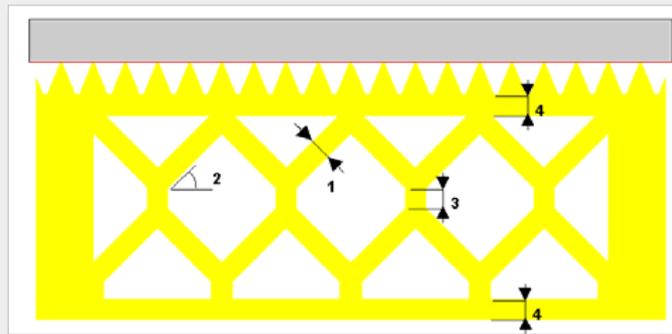
Maximum contact Length limits the length of the contact between the support and the surface.

Minimum Rib Length (a)

The Minimum Rib Length determines the length of the cross line. Larger ribs are more stable but may be harder to remove.

Perforation

Define whether the support structure will be solid or perforated. Currently only Diamond shape perforation is supported.



Angle (2)

Angle of the diamond-shaped perforation

Bean thickness (1)

Thickness of the perforation wall

Perforation

By enabling perforation the support structure will be perforated

Solid height (4)

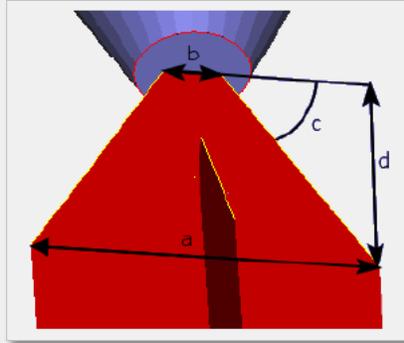
Height of the solid structure that connect the perforation support to the platform and to the upper surface.

Height (3)

The height of the vertical segment at the diamond-shaped perforation.

Point support properties

Contact Length



Maximum Contact Length (b)	Define whether to support the complete surface or only a certain Contact Length.
Minimum Rib Length (a)	Set the length of the ribs. You need a minimal length in order to have enough stability and to prevent the support from falling through the platform grid.
Vertical Distance (d)	Set the distance from the support to the part.

Reinforcement

Reinforce a support by adding an extra contour.



Enable Reinforcement	By enabling Reinforcement, set an extra contour to the support.
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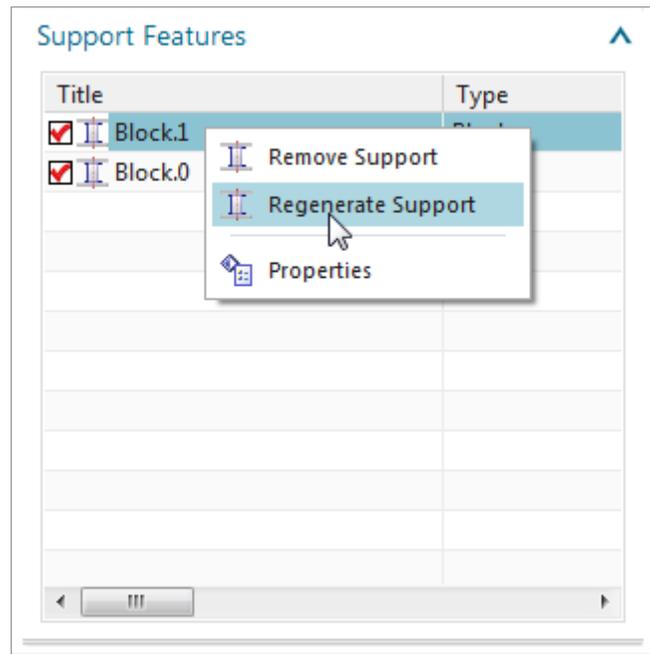
Rib

Number of Ribs	Determine the number of the ribs.
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Regenerate Support

Use **Regenerate Support** command to update the selected support feature after making changes to the part or to the support feature's properties.



In order to use the **Regenerate Support** command:

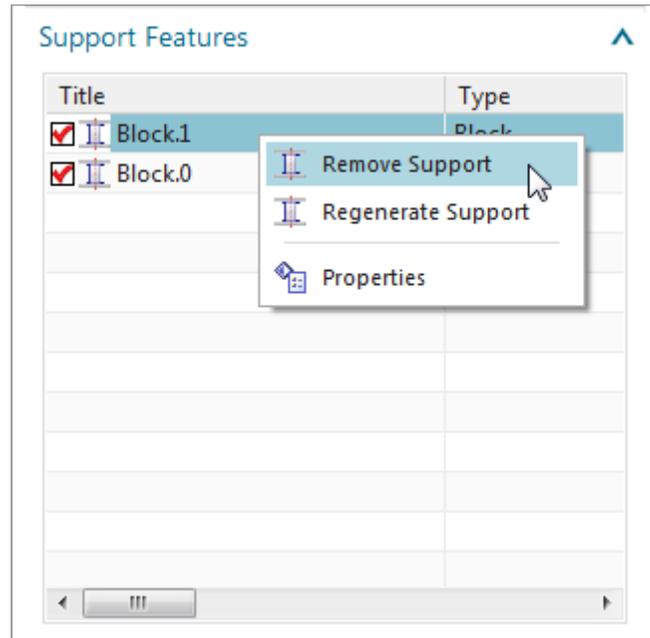
1. Select one or more support features at the Support Feature panel or in the graphic viewer. To simplify the selection of the support in the graphic a new Type Filter support was added. For more information refer to the **Support Type Filter**.
2. Using the Right Click menu select the **Regenerate Support** command.

Where do I find it?

Application	Additive Manufacturing
Prerequisite	One or more support features selected
Additive Manufacturing Navigator	Right click menu on a support feature

Remove Support

Use **Remove Support** to delete one or more support features.



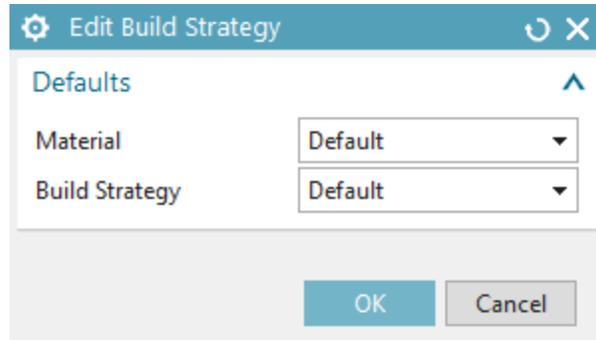
In order to use the **Remove Support** command:

1. Select one or more support features at the Support Feature panel or in the graphic viewer. To simplify the selection of the support in the graphic a new Type Filter support was added. For more information refer to the **Support Type Filter**.
2. Using the Right Click menu select the **Remove Support** command.

Where do I find it?

Application	Additive Manufacturing
Prerequisite	One or more selected Support Features
Additive Manufacturing Navigator	Right click on the selected support features

Edit Build Strategy



Use **Edit Build Strategy** to assign different build strategy to the entire build tray, or for a specific component.

Converting your digital CAD model into a physical part requires a translation to a layer-by-layer representation that can be interpreted and built by the machine. This translation, build strategy, directly affects the behavior of the machine (e.g. build speed, material consumption) and the properties of the physical parts (e.g. strength, weight).

In order to create, edit or view build strategies:

1. Launch the Build Processor Manager application.
2. Select the target machine
3. Execute the Configure command 

4. In the Configure Printer dialog click on the Edit Profiles command. 

Where do I find it?

Application	Additive Manufacturing
Prerequisite	Select the build tray or one or more parts.
Additive Manufacturing Navigator	Right click menu on the build tray or on the selected parts

Generate

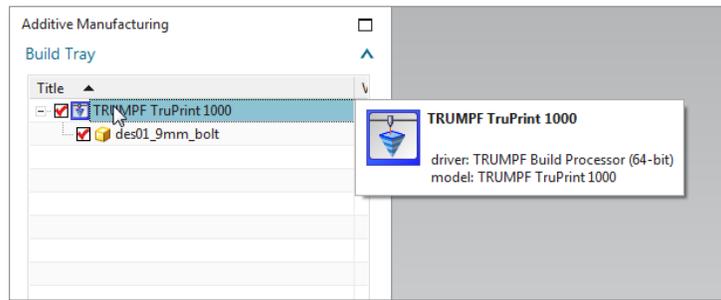
Use **Generate** to start the 3D printer build processor and to translate the assembly and its support structures to the machine file format.

The default output folder is the parts location.

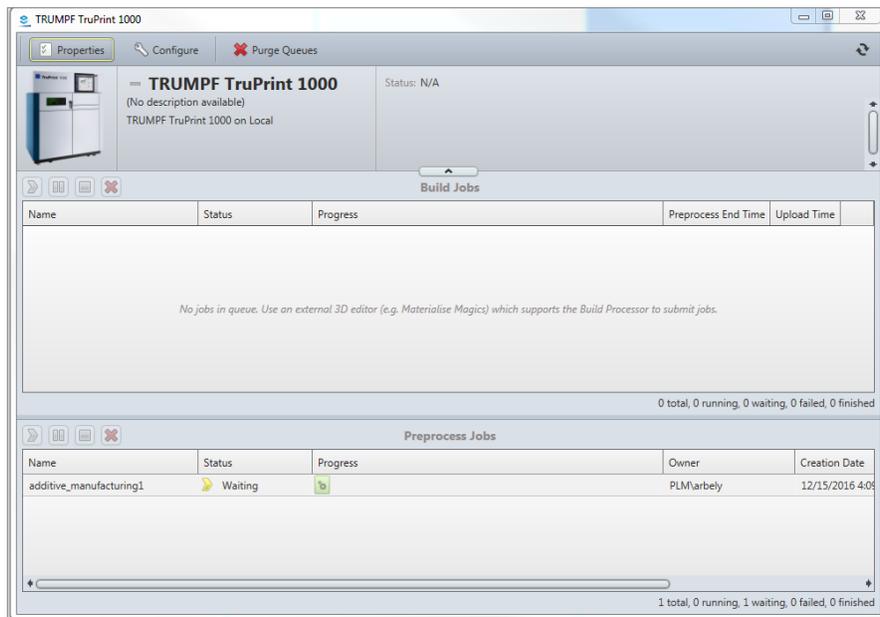
In order to Generate the machine's output file, Right Click on the build tray and select the **Generate** command.

The **Generate** process can be time consuming operation. You can view its progress by:

- By hovering over the build tray object in the Additive Manufacturing viewer a tooltip with the machine information and the job status is displayed.



- In the **Build Processor Manager** application, at the machine's queue

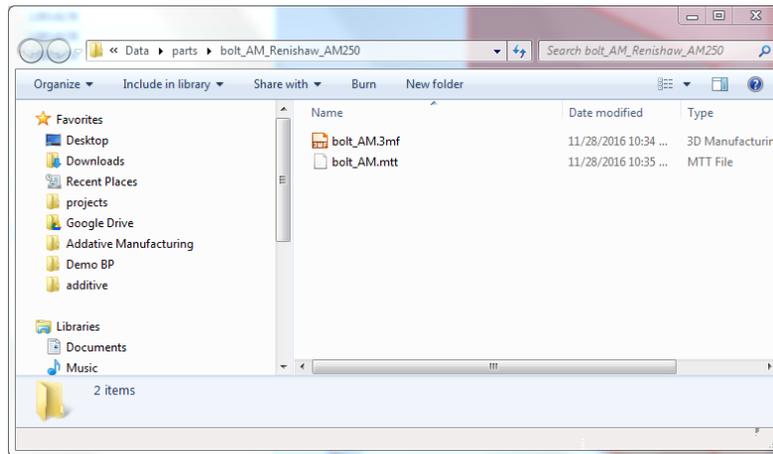


Where do I find it?

Application	Additive Manufacturing
Additive Manufacturing Navigator	Right click menu on the build tray

Explore output Directory

Use **Explore Output Directory** command to inspect the output files generated by the **Generate** command. The command opens the windows explorer at the last **Generate** command output folder.

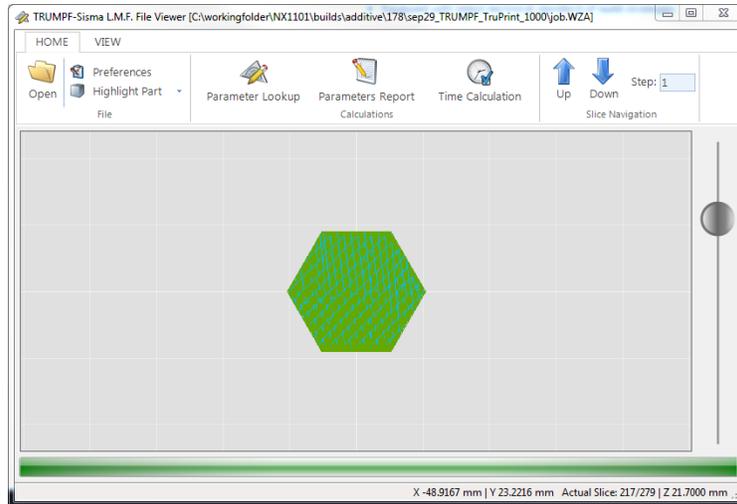


In order to **Explore output directory** Right click on the build tray object.

Where do I find it?

Application	Additive Manufacturing
Prerequisite	The user generated the machines output files.
Additive Manufacturing Navigator	Right click menu on the build tray object.

View Slices



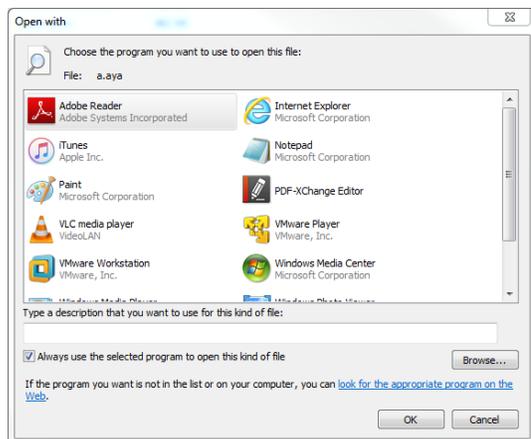
Use **View Slices** command to view slices and hatches with the slice viewer.

Different printers require dedicated slice viewer software. The slice viewer should be supplied by Materialise with the dedicated build processor.

In order to install the slice viewer please follow the following steps:

1. Generate the Machines' output file
2. Run the View Slices command
3. On first Load in the Open with dialog click the browse command and select the dedicated machine exe file that you received from Materialise.

Check the always use the selected program to open this kind of file and click ok.



Where do I find it?

Application	Additive Manufacturing
Prerequisite	The machine output file were generated
Additive Manufacturing Navigator	View Slices

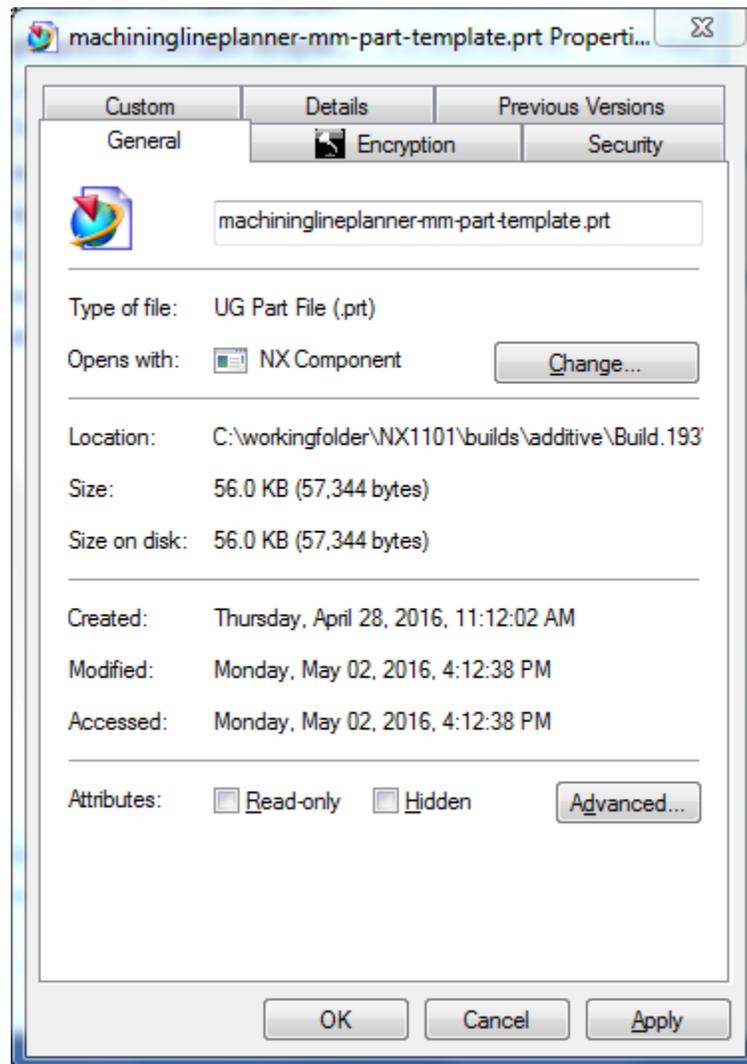
How to edit a template with specific 3D Printer information

When the user creates a new Additive Manufacturing part file using the out of the box Vendors templates, in order to start pre-processing the build, one must set first the target printer.

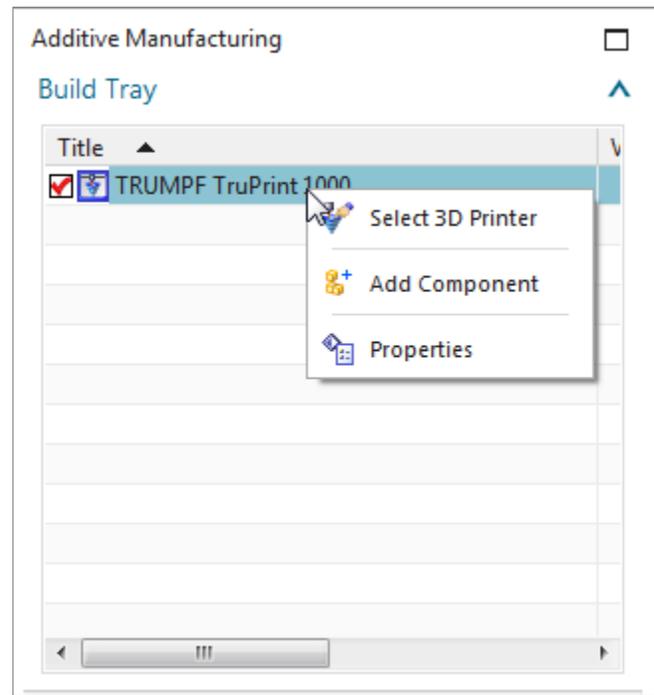
In order to avoid the need to select the 3D printer each time you create a new part file, you can add the 3D printer information to the template. Adding the 3D printer information will still allow you to change later the target printer.

You can set the printer definition in the template following these steps:

1. In the \$UGII_BASE_DIR\mach\templates folder remove the Read only flag from the template that you would like to modify.



2. Open the selected template in NX using **Open...** command.
3. Select the required printer using the **Select 3D Printer** command.



4. Save the Template using the **Save** command.
5. **Close all parts.**

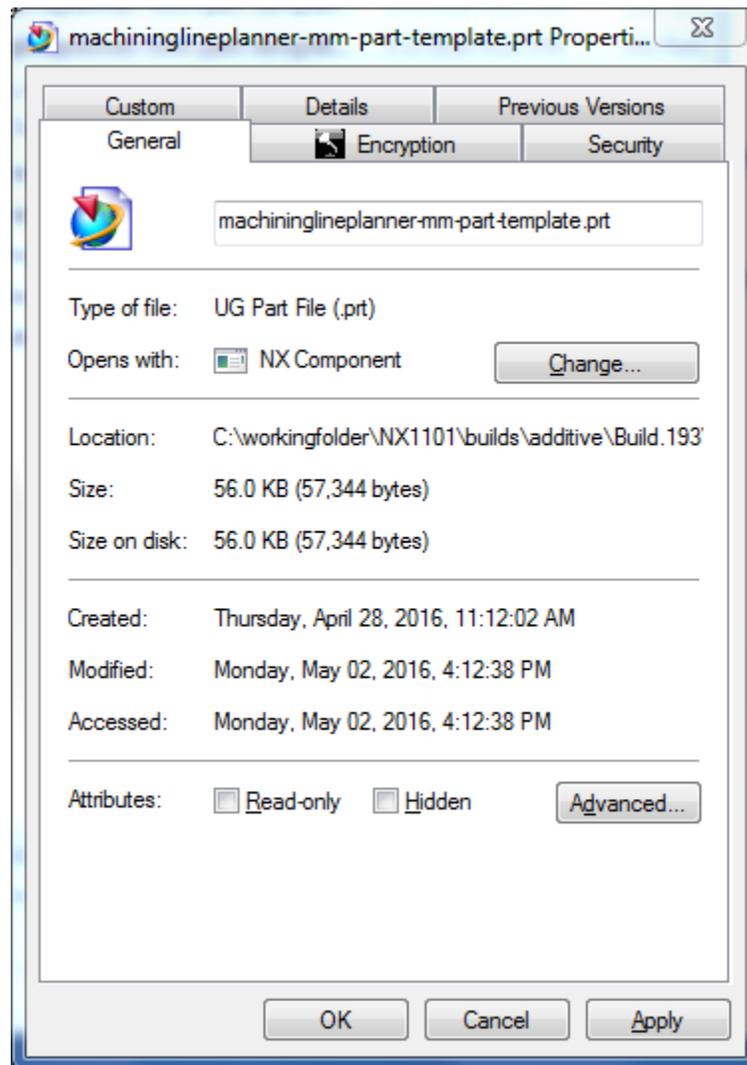
How to add no build zone to the template

To visualize the No Build zones in addition to the build tray geometry, one can modify the machine's build tray geometry in the Template.

Please note that No Build Zone geometry can be used for visualization and in collision detection, however currently the automatic nesting ignores it.

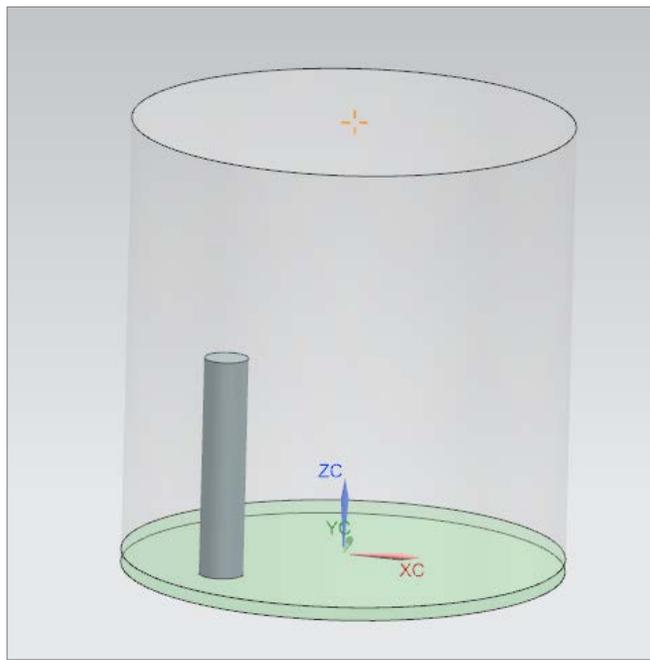
In order to add No Build Zones to the template please follow these steps:

1. In the \$UGII_BASE_DIR\mach\templates folder remove the Read only flag from the template that you would like to modify.



2. Update the template with the specific 3D printer definition. For more information please refer to **How to edit a template with specific 3D Printer information**.
3. Open the selected template in NX using **Open...** command.
4. Start the **Modeling** application.

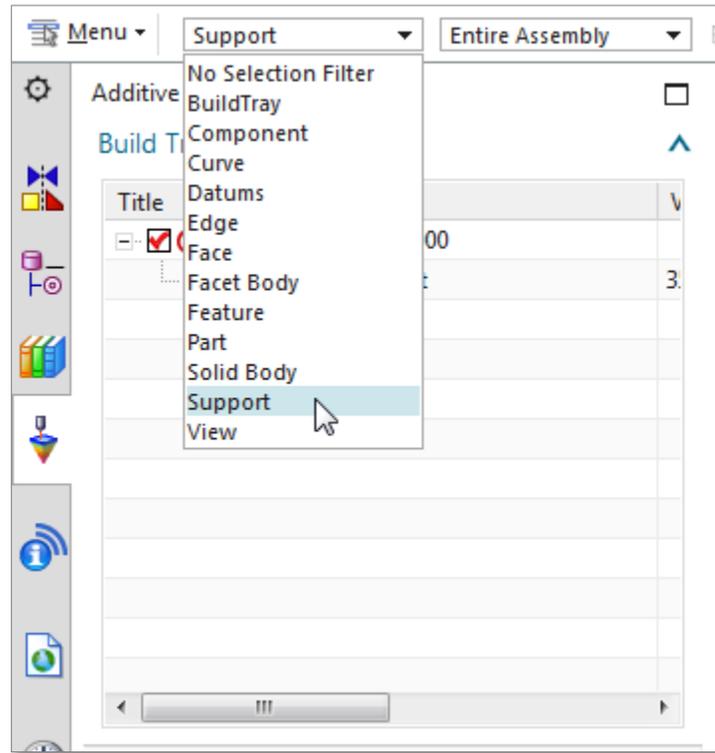
5. Modify the build tray geometry.



6. Save the Template using the **Save** command.
7. **Close all parts.**

Support Type Filter

To simplify the support feature selection a new type **Support** was added to the **Type Filter** command.



Set the **Support** type filter, to directly select the supports in the graphic.

Global Technical Access Center

Installation assistance

For additional installation assistance, or to report any problems, contact the Global Technical Access Center (GTAC).

Website:

<http://support.industrysoftware.automation.siemens.com/gtac.shtml>

Phone:

United States and Canada: 800-955-0000 or 714-952-5444

Outside the United States and Canada: Contact your local support office.

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