ENROUTE

USER GUIDE

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Creating an SAi Cloud account

SAicloud.com is the platform through which EnRoute software and licenses are distributed. Users create an account in SAicloud.com and activate their software to that account. Multiple licenses can be activated to the same account.

If your company has multiple licenses, choose a general business email address to create the saicloud account with. The chosen email address will be the user name of the account and all communication regarding password resets will be sent to it.

When you purchased a Version License, you received an Activation Code.

- Browse to http://saicloud.com
- Paste the activation code in the corresponding field and click **Activate** to continue.
- If you **already have an saicloud account**, you can **log in** using the email address and password you previously created.
- If this is your **first time** activating an sai product, select "**I am new to the SAi Cloud**"
- **Enter the email address** you want to use for your saicloud account. This will be your username.
- When you click **Create Account**, an email will be sent to you containing a link to confirm your activation.

  Be sure to check spam or junk folders if the email did not arrive.
- Either **click the link** or copy and paste it into a browser.

  Your email address will already be entered and cannot be changed at this time.
- **Choose a password** with at least 6 characters and retype it to confirm
- Enter in further details and click **Create Account**
- Read through the Terms and Conditions and **Accept.**
- Click **Activate Now** to confirm and link the license to the account.

You have now created an saicloud account and activated your software on that account. Having an saicloud account means you can log back in at any time to download software again, get updates and manage your licenses.

Downloading the software

When you activate your software, or when you log into saicloud.com at a later time and select your software, the following detail page will be displayed:

- Hit the **Download Now** button.

  A small tool with the name SAi_software_download.exe will be downloaded.
- Choose to **Run** or Open this tool when the download is finished.

  This will launch the Installation Tool , which will start downloading all the necessary installation files
- Once the tool has finished downloading and extracting files, the installation can begin.
- Click **Yes** and **choose the language** for your installation.
- Follow the instructions of the Installation Wizard.

Installing the software

At the end of the download of your software, Installer will be launched automatically.

To install the software, you must have **Administrator** privileges. To use the software, you must have Administrator or Power User privileges. See your Windows user guide for more information.

- Select your language
- Click **Next** in the Welcome to the InstallShield Wizard screen.
- Select **I Accept** the Terms of the License Agreement and click **Next**.
- Click **Next** to accept the default Destination Location folder.
- Click **Next** to accept the default Select Features.
- Click **Next** to create a Program Folder to hold the program icons.

The Setup Status window appears, and the software installation process begins. When the installation completes, License Manager will launch.

- Enter your product **Activation Code** and click **Next.**
- Click **Next** when the Licensing Successful message appears.
- Click **Finish** in the InstallShield Wizard window. (This last window may be hidden behind other open windows.)

After the software has finished downloading, a folder with the name SAi_Installer is created on your desktop. If you interrupted the installation at any point, or if you need to reinstall, you can double click autorun.exe from within this folder to launch installer again.

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Recommended System Requirements

Supported Operating Systems	Windows 10
	Windows 8.1
RAM	8 GB
Installation Space	1 GB
Working Disk Space	4 GB
Other	Broadband Internet connection
	Available port for output device if it is connected to the same computer.

Software License Types

EnRoute is available in two different license types.

Subscription Licenses

Users with subscription licenses pay a monthly fee for the usage of the software. As long as the subscription is active, all upgrades and new features are available to the subscription user at no additional cost.

Version Licenses

Users with Version Licenses paid a one-time fee for a particular version of the software. Upgrades and new features are available only at an additional upgrade cost.

The EnRoute Workspace

The workspace within EnRoute has several built in features to assist with designs.

Rulers

Rulers can be added to the **Top**, **Right**, and **Front** views. Rulers provide an easy way to add guidelines to a drawing, click on the ruler and drag into the workspace to create a new guideline.

Hiding and Displaying Rulers

Rulers can be hidden or displayed by navigating to the **View > Rulers** menu. Click on a view name to add or remove rulers from the view.

Toolbars

EnRoute tools are activated by selecting the corresponding tool icon from the toolbar ribbon at the top of the display. Hover over each icon to preview the name of each tool.

All tools can also be found in the menu (File, Edit, View, etc.) at the top of the screen.

Hiding and Displaying Toolbars

Toolbars can be hidden by navigating to **Setup > Toolbars**. In the drop down menu, all toolbars with a check mark will be visible in the ribbon. Click on a toolbar to hide or display it in the ribbon.

Toolbar Drop Down Menus

Tools with similar functions can be grouped together under the same tool icon and accessed by a drop down menu. A drop down menu can be opened by selecting the drop down arrow to the right of a tool icon. The last used tool from a tool grouping will be shown as the top level icon in the tool ribbon.

Layers

Layers provide a method to separate drawing elements so unused information can be hidden when it is not being used. Objects in different layers can be displayed in different colors to distinguish different parts of the design.

Layers Toolbar

Enable the Layers toolbar in **Setup > Toolbars > Layers**. The layers toolbar provides a selection box to choose a specific layer to display.

The **Activate all Layers**  button makes all layers visible.

Layers Dialogue

Each layer has several options: **On**, **Off**, **Lock**, and **Move Lock**. A check box indicates the option is enabled for the selected layer.

On	All objects in the layer are displayed and selectable
Off	None of the objects in the layer are visible and none can be selected
Lock	All Objects in the layer are displayed but cannot be selected. Drawing tools will still snap to locked geometry.
Move Lock	All Objects in the layer are displayed and can be selected, but cannot be moved.

Layer Operations

Select the Current Layer	Check the **Current** box for that layer.
Add a New Layer	Click **New**. The new layer is added to the bottom of the list and is selected as the current layer.
Delete Layers	Select layer and Click **Delete**. All objects within the layer will also be deleted.
Remove Empty Layers	Click on **Remove Empty** button.
Rename a Layer	Edit the text in the name column for that layer.
Change the Color of a Layer	Click on the color displayed next to the layer to open the color selection dialogue. Select a new color and click OK.
Moving Layers	Select the layer and click Move Up or Move Down. Layers can also be moved by clicking and dragging the row header at the left edge of the list.
Hide or Display Layers	In the On and Off Column, check On to display a layer, check Off to hide a layer. The current layer cannot be hidden.
Lock a Layer	Check the **Lock** option. Clear the check to unlock the layer.
Save Changes and Exit	Click **OK**.
Cancel Changes	Click **Cancel** to discard any changes.

Change Layer

1. Select the objects to change layers
2. Activate the Change Layer command
3. Click on the new layer in the dialogue window. The current layer and new layer will both be displayed
4. Click **OK**

Zoom

The workspace view can be changed by zooming in to view detail, or zooming out to see the entire composition. Zooming does not affect the dimensions of the design, only the view of the design information.

Zooming with the Mouse

Hold **Ctrl** and right click and drag left to zoom out, drag right to zoom in. The mouse wheel can also be used to zoom, scroll backwards to zoom out and forwards to zoom in. The mouse wheel zoom is centered on the cursor location which makes it ideal for zooming in on specific points.

Zoom Commands

Zoom Window		Click and drag to define an area to magnify
Zoom In		Zoom in towards the center of the window
Zoom Out		Zoom out and enlarge the view of the design
Zoom to Plate		Display the extents of the plate
Zoom Previous		Return to previous zoom level
Zoom to Extents of Selection		Zoom in on the currently selected objects. If all four views are active, all views will zoom to the extents of the selection
Zoom to Extents of All Objects		Zoom out to display all objects including the plate. If all four views are active, all views will zoom to the extent of the objects

Guidelines

Guidelines are design aids displayed as dashed lines in the workspace. Guidelines allow for precise placement of points within the drawing. When Snap to Guideline is enabled, contours moved near a guideline will automatically be positioned along the guideline, or at the intersection of two guidelines.

Create Guideline

The easiest way to create a guideline is to click on the horizontal or vertical ruler and drag a guideline into the workspace. A new guideline can also be created by using the **Edit Guideline Dialogue**.

Edit Guidelines Dialogue

Open the guideline dialogue by opening **View > Edit Guideline**, or by right clicking on an existing guideline and selecting **Edit Guideline**. The guideline dialogue provides parameters to define the X, Y, and Z coordinates and the angle of a guideline. When multiple guidelines are active in the workspace, the Next button will move through the guidelines. The active guideline will change from red to blue, and the parameters will display in the dialogue.

New	Create a new guideline at the specified position
Delete	Delete the selected guideline
Move	Move the guideline to the specified coordinates
Rotate	Rotate the guideline by the specified angle
Lock Guides	Prevent all guidelines from being moved
Hide Guides	Hide all guidelines

Snaps

Snaps allow specific geometric features to be selected while using drawing and editing tools. Most drawing tools will automatically move the cursor to drawing elements that meet the active snap criteria.

Snap	Icon	Description	Cursor
Snap to Grid		Snaps to the nearest grid point, as defined in **Setup > Preferences > Grid**	
Snap to Guideline		Snap cursor to guideline. Contour boundaries will also snap to guidelines when dragged	
Snap to Intersection		Snap to the intersection of two line segments	
Snap to Endpoint		Snap to the endpoints of arc, curve, and line segments	
Snap to Contour		Snap to the nearest point along a contour	
Snap to Arc Center		Snap to the center of an arc segment when the cursor is placed near the arc	
Snap to Midpoint		Snap to the midpoint of a segment	
Snap to Per-pendicular Point		When constructing line segments, after defining the first point in the segment, the second endpoint will snap to a point on a contour so that the line segment will be per-pendicular to the contour.	
Snap to Tangent Point		When constructing line segments, the second endpoint will snap to a point on an arc so that the new line seg-ment will be tangent to the arc	

Snap	Icon	Description	Cursor
Snap to Tangents Between Two Circles		When in a construction tool, the snap identifies the tangent point to the nearest arc segment as well as corresponding tangent point on an adjacent arc segment	
Snap to Show Intersecting Contours		Toggles the display of intersecting or overlapping contour segments. This Snap is most useful in identifying potential toolpath creation issues before generating toolpaths.	

Views

The main display area shows a view of the workspace. The display can be adjusted to show a **Top**, **Right**, **Front**, or **Perspective** view of the workspace, or all four views at the same time. **Top** view is the default view and is where most design work will take place.

The name of each view is shown in the upper left hand corner of the view window. Double click the view name to open the four panel view window and double click the view name again to maximize the single view.

Top view and perspective view can be toggled between pressing the **F12** key

Redraw

Redraw is used to refresh the screen and clear any remnants left over from manipulating drawing elements. Press **Ctrl + R** to redraw, or select **Redraw** from the **View** menu.

Snapshot

Save an image of the active view.

1. Activate the snapshot command
2. Select a location to save the image
3. Click Save

Preferences

The behavior of EnRoute can be adjusted through user preferences. To open the preferences menu, select **Setup > Preferences**.

General

Merge Contours

Define the behavior for merging open contours when importing from other drawing programs.

Import	Merge contours on import
Paste	Merge contours when pasted
Tolerance	Maximum separation between contour endpoints that will still be merged

Auto Cleanup

Control if short segments are automatically deleted when imported or pasted.

Import	Delete short segments when contours are imported
Paste	Delete short segments when contours are pasted from the clipboard
Tolerance	Maximum segment length to be deleted

Undo Operations Limit

Controls the number of operations that can be undone by the Undo command.

Unlimited	All operations since the last save can be undone
Limited	Only the specified number of actions can be undone

Save

Specify an auto save time interval

Auto Save	Enables automatic saving functionality
Time Interval	The time interval between automatic saves

Toolpath

Scaling of toolpath groups	Allow toolpath groups to be scaled when checked. When a toolpath group is scaled the toolpaths will automatically be recalculated using the original strategy parameters. If unchecked, toolpath groups cannot be resized.
Clip toolpaths to plate	Output toolpaths will not extend beyond plate boundaries when checked

Horizontal cutting	Allow toolpaths to be rotated out of the horizontal X-Y plane when checked. This option is only applicable if using a machine that is capable of cutting toolpaths not in the X-Y plane.
Show Lift Options	Lift Options
Enable Tool Compensation	Enable the tool compensation option in the cut parameters dialog.

Misc

Bump Increment	The distance a selected object is moved when the arrow key is pressed by default. Pressing **Shift + Arrow Key** will vary the bump increment based on the zoom level so when zoomed in close, objects move smaller increments.
Click Increment	The amount that values change when adjustment arrows are clicked in dialogue boxes.
Snap Threshold	The distance in pixels at which the snaps take effect and the cursor automatically moves to the snapped geometry

Initialization

Maximize Application	Automatically maximize the software on start up
Maximize Document	Automatically maximize new documents when opened
Display 4 Views	Display the 4 view mode by default
Prompt for Plate	Open the define plate dialogue when creating a new design
Small Part Size Threshold	Used by EnRoute to select small parts when **output small parts** first is selected
Solutions Path	Defines the path of any 3rd party applications

Display

Display preferences define the colors for each of the drawing elements and set the rendering options.

Color Selection

- Double click the color you want to change
- Select the desired color from the pop up window
- Click OK to save the changes

Display Settings

Show Layer Colors	Show colors assigned to individual layers
Update Buttons	When checked, toolbar buttons will automatically disable when the function is not available. This option should typically be enabled
Real-time Rendered Panning	Allow real time relief rendering while panning and rotating. If this causes computer performance issues, it can be disabled in an EnRoute preferences file. Contact EnRoute support for assistance

Rendering Options

Define what level of rendering to use in the perspective view.

OpenGL Level 3	Highest level graphics rendering, the default setting
OpenGL Level 2	Default option in EnRoute 4
OpenGL Level 1	This option has been proven to work well on computers without dedicated graphics cards
Windows Graphics	Decreased performance to allow rendering on computers that cannot support OpenGL rendering

Units

Allows the drawing units for **length**, **time**, and **speed** to be selected.

If the units are changed while a drawing is open, the size of any existing objects will be converted to the new units and remain the same size.

Toolpath units are not automatically converted in open drawings. It is recommended to close a drawing containing toolpaths, change units, and reopen the drawing to ensure the toolpath units are converted correctly.

Grid

Define the grid size used in the drawing window. There are two levels of grid, **Major** and **Minor**. Each level has the same set of parameters.

Show Grid	When checked, the grid is displayed in the workspace
Interval	Distance between grid lines
Style	Style of the grid lines
Size	Size of the grid lines in pixels
Color	Color of the gridlines

View Setup

Standard Items

Plate	Display the plate when checked
Contours	Display contours when checked. Contours are the main type of drawing element, this option is usually left enabled
Contour loops	Display contour loop indicators when checked. The indicators will display before generating toolpaths. EnRoute will automatically remove loops when generating toolpaths by altering the contour.
Open Contour direction	Display arrows on open contours indicating their direction
Popup menu on right click	Open a popup menu on a right click in the workspace when checked

Toolpath Items

Toolpaths	Display toolpaths
Direction	Display direction arrows on toolpaths
Entry/Exit	Display the Entry and Exit positions for each toolpath
Bridges	Display the location of toolpath bridges
Start Point	Display a small circle with an X inside to indicate the toolpath starting point

Toolpath Width

Determine how toolpaths are displayed

Lines	Displays toolpaths as lines with directional arrows.
By Tool	Displays toolpaths with the diameter of the tool used to create the toolpath.

Toggle between the two modes using the **F9** key.

Depth

Controls how toolpaths are displayed based on depth

All Depths	All toolpath depths are displayed
Surface	Toolpaths at the surface are displayed
Final	The last (bottom) toolpath is displayed
[Specific Depth]	One of the specific depths assigned to the passes is displayed

Tools

Control which toolpaths are displayed based on the associated tool. Options are displayed based on the tools used in the drawing.

All Tools	Toolpaths for all tool types are displayed
[Specific Type]	Only toolpaths which use the selected tool are shown

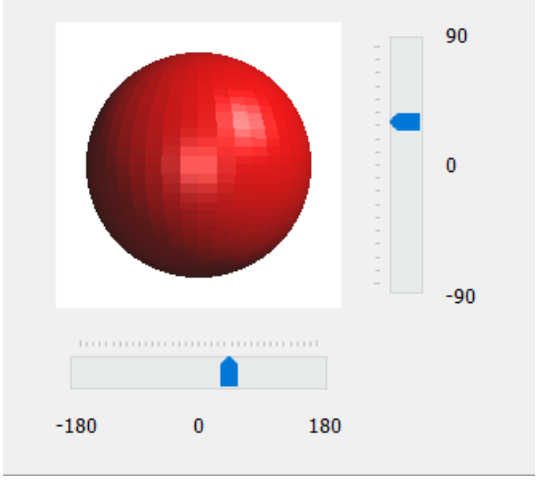
Relief

Toolpath Tolerance

Define how closely toolpaths follow a relief surface. A smaller tolerance will more closely follow the relief surface, but it will also create more segments in the toolpath and increase the output file size.

Relief Lighting

Adjust the lighting position of rendered reliefs.



Start Point

Adjust where start points are automatically located for routing offset toolpaths

Long Edge	Locate the start point at the start of the longest edge of the contour. If **Edge Midpoint** is checked, the start point will be placed at the midpoint of the longest segment.
Direction	Define a direction used to locate the starting point. The direction is defined in degrees relative to the drawing origin.
Magnetic	Enter a specific point and the start points will automatically be placed as close to the defined point as possible.
Longest Segment	Locate the start point at the start of the longest segment of the contour. If **Segment Midpoint** is checked, the start point will be placed at the midpoint of the longest segment.

Dimension

Define the display parameters for all dimension tools.

	Text height in the dimension tool
	Define the separation distance between dimension extension lines and the contour surface
	Define the height of the arrow
	Define the width of the arrow
	Set the number of decimal places when measuring a line segment

	Set the number of decimal places when measuring an angle
	Sets the position of text above the arrow line
	Sets the position of text in the middle of the arrow line
	Sets the position of text below the arrow line

Order

Define the default ordering process when generating toolpaths. The interface matches the ordering parameters used in **Output**, **2D simulate**, **Ortho Simulate**, and **Rendering**. The order preferences can be updated from any of these tools.

Priority Order	Sort toolpaths based on priority. Priority order can be adjusted by clicking and dragging the row headers. Reference the machine output section for more detail.
Tool Order	Add tools from the tool library and click and drag them into the preferred cut order.
Strategy Order	Arrange EnRoutestrategy types into a preferred cut order.
Object Order	Select the default object ordering method.
Small Parts First	When checked, parts with surface areas below the defined threshold will be put at the top of the object order list, regardless of other object ordering methods.
Maintain Grouping	Grouped objects will be treated as single objects for object ordering.
Add Tool	Add a tool to the tool order list.
Delete Tool	Remove a tool from the tool order list.
Clear Tools	Clear all tools from the tool order list.
Reset Active	Resets currently active parameters to the default values.
Reset Parameters	Resets all ordering parameters to the default values.

Create A Drawing

All EnRoute designs start with creating a new drawing. Select the new file button from the file toolbar or from the main menu, **File > New**.

Drawing Files

All EnRoute designs begin with creating a new file or loading an existing design.

Create New Drawing

Creates a blank drawing in the EnRoute workspace.

If another drawing is open when a new drawing is created, the new drawing becomes active and the existing drawing is minimized. All open drawings can be switched between using the **Window** menu.

Open an Existing Drawing

A file dialog is opened to select EnRoute files. When a file is selected, a preview of the EnRoute workspace is shown on the right side of the dialog.

Save Drawing

If saving a file for the first time, or Save As was selected, the save dialogue box is displayed to enter a name and location for the file.

Import Design

1. Activate the Import command
2. Select the file format and file location to import
3. Click **Open**

See Preferences for import options

Bitmaps must be converted to contours before generating toolpaths, see Vectorize Bitmaps

Export Design

1. From the File menu, select Export to open the export dialogue
2. Select a file format and file location
3. Set a file name
4. Click **Save**

Print

1. Activate the Print command
2. Select a print option

Design	Print all contours in the current design
Selection	Print only the selected contours
Window	Print only what is displayed on screen
Plate	Print only the plate

3. Click **OK**

Plate Definition

The plate in EnRoute is a useful drawing aid that is commonly used to define the size of the material that will be cut. When a new drawing is created, the plate definition dialog will be opened by default to define the plate size. This behavior can be disabled in the Initialization Preferences.

Parameters

Width	Plate dimension along the X axis
Height	Plate dimension along the Y axis
Thickness	Plate dimension along the Z axis
X/Y Origin	The position of the lower left corner of the plate
X/Y Margin	If entered, a second dashed rectangle will be generated within the plate with the specified margins. Typically used for masking out clamp locations.
Surface Option	Choose to set the plate surface at the top of the material or bottom of the material (top of the table).

Wrap Plate	EnRoute supports output for rotary access CNC machines. Enabling Wrap plate will automatically set the plate size in the X or Y direction so it is compatible with the design being wrapped. The wrapped dimension of the plate is the circumference of the wrapped surface, which corresponds to the thickness of the material, which for a wrapped surface is the radius of the material.
Material	Select the type of material being used. Materials are defined in the material library.
Save	Save the current plate parameters as a template. The template can be loaded when defining another plate from the template box.
Delete	Delete the currently selected template.
Fit Design	Automatically adjust the height and width of the plate to fit the current design.
Fit Selection	Automatically adjust the height and width of the plate to fit the currently selected contours.

Create Plate from Contour

Define a plate with any shape. Select any closed contour and activate the Create Plate from Contour command.

This tool is useful when used with the remnant contour created by the nesting tool, automatically defining the next plate as the remnant sheet from the last cut.

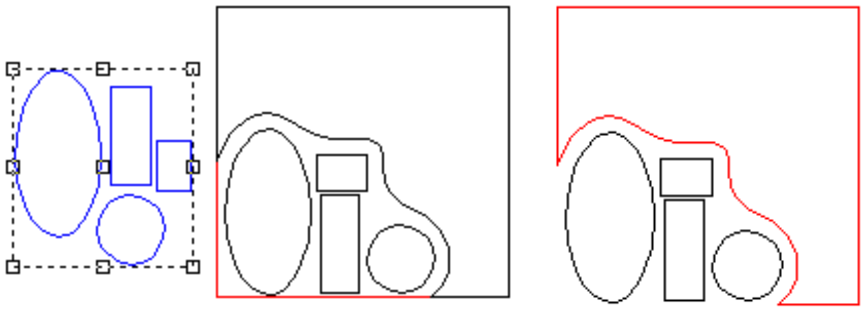
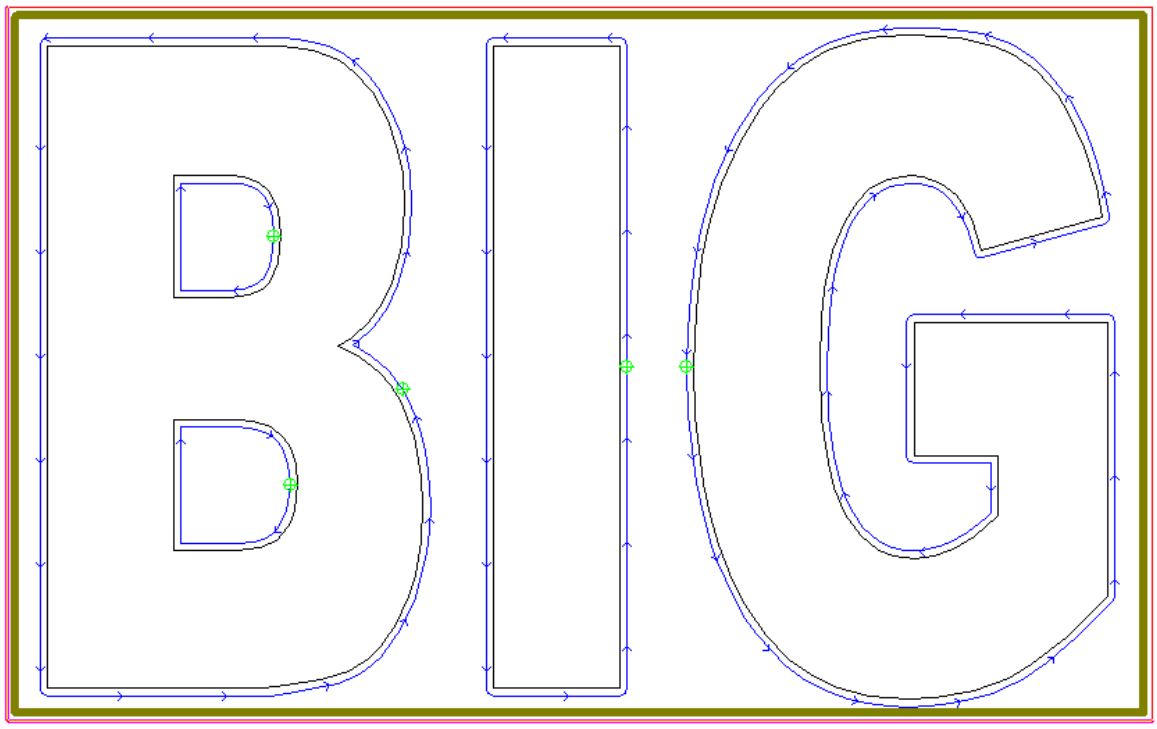


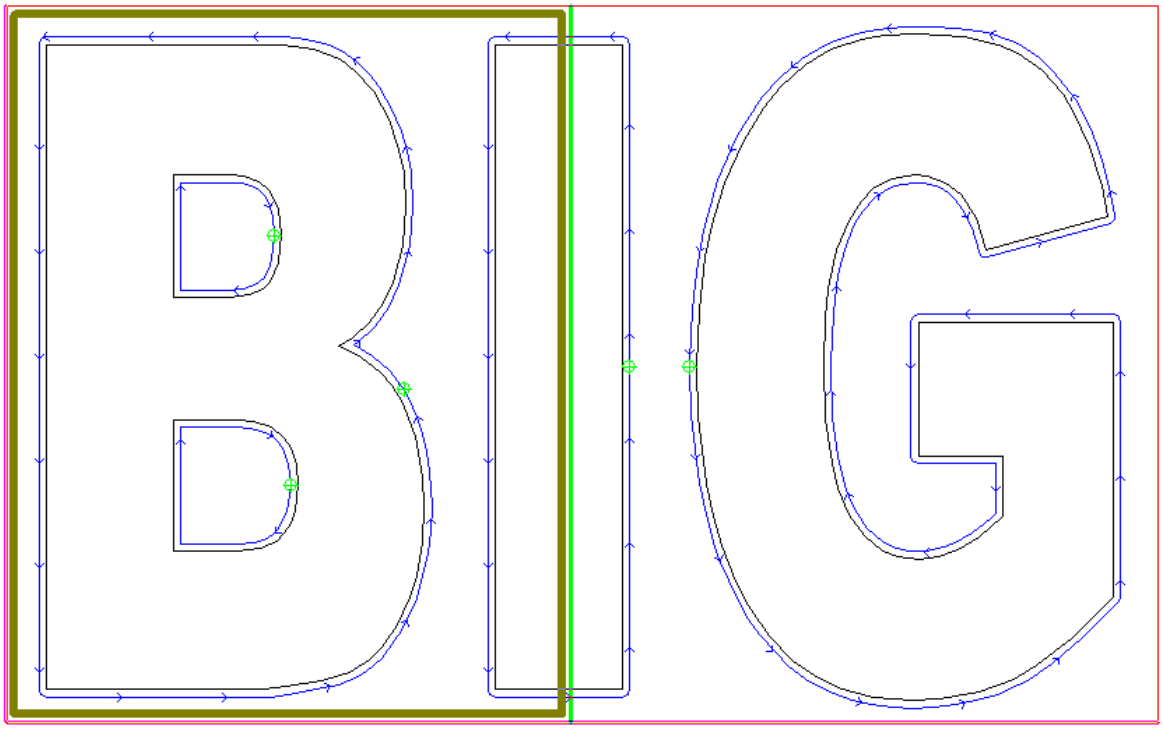
Plate Panels

Define an area within a panel to generate output for toolpaths. This tool is most useful for breaking up large designs that can be cut in smaller pieces.

1.  Define a basic plate, it should be the size of the design to cut.
2.  Activate the plate panels command, a wide yellow border will appear within the plate boundary.

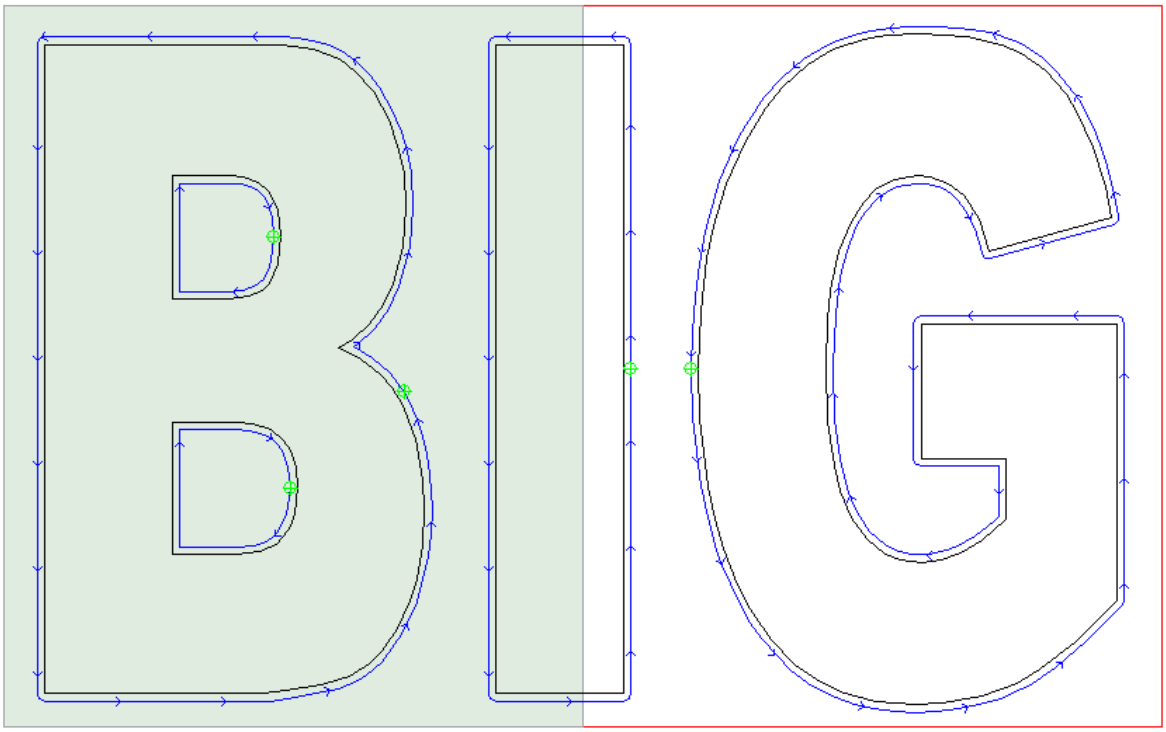


3. Click outside the plate border and drag to the location within the panel to create the plate. Hit **Enter** to apply.



Use the **F2** button to open a precision dialogue window to precisely place the panel border. Click **OK** to apply.

4. The shaded area is the active area to generate toolpaths, any toolpaths that cross the boundary will be cut off when output.



5. To switch active panels, activate the plate panels command and click on a different panel. Press **Enter**, or open the **F2** menu and click **OK** to apply the change.

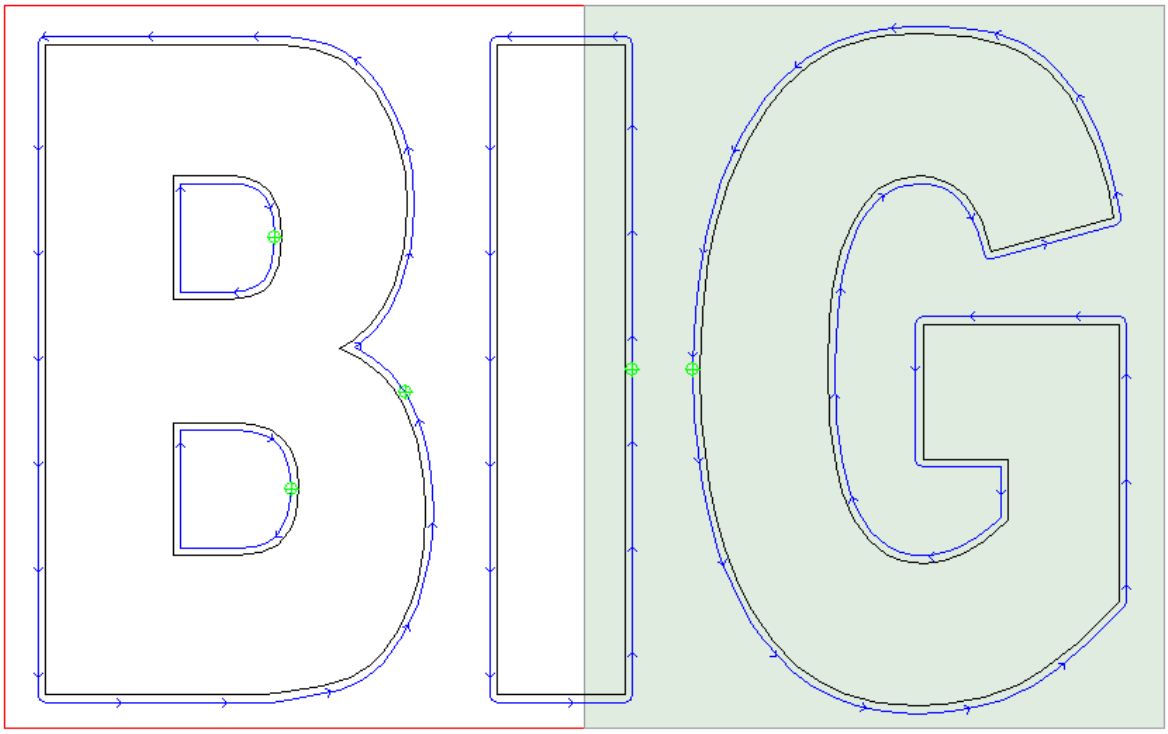


Plate Templates

Templates can be used to save plate settings that can be used across multiple designs.

Create Template

1. Enter parameters in the Plate Definition dialogue
2. Enter a template name in the Template box
3. Click Save to add the template to the library

Using a Template

1. Open the Plate Definition dialogue
2. Click on the Template drop down box
3. Select the template from the list to load the saved parameters

Creating Contours

Draw new contours that will become the basis for a new design.

Line

Draws a straight line segment connecting two points

1. Activate the draw line command
2. Click at the desired starting point

> You can also enter each starting and ending point's coordinates into the Precision Input Center. Enter each point's coordinates into the X, Y and Z fields and click OK.

3. Move the cursor to the end point and then click again

> Hold the **SHIFT** key down while drawing to snap the current line segment to horizontal or vertical only.

4. The end point of the first segment becomes the start point of the next line segment, repeat the process to create several line segments
5. Right click once to cancel the next segment, right click again to exit the draw line command

Polyarc

Create a series of lines and arcs to form a new contour.

Create segments one at a time using the drawing modes to modify each segment individually.

1. Activate the Polyarc command to automatically open the precision toolbar
2. Select line or arc mode in the precision toolbar
3. Select creation mode based on the desired drawing mode

> Creation Mode options will only be available when available based on the arc or line creation mode. Arc creation modes cannot be used when drawing a line.

> This tool can only be used in the top view. Arcs are limited in EnRoute to the X-Y plane.

Creation Modes

Line	Toggles line segment creation mode

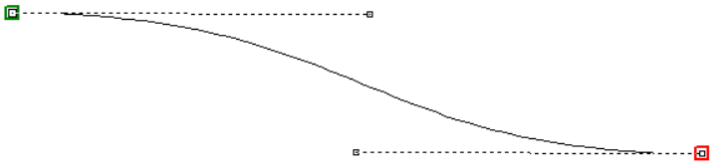
Arc	Toggles arc segment creation mode
Position	Define the X Y coordinates for the next point in the segment
Direction	Define the angle for a line being created. Define the angle of the tangent line for an arc being created.

Only available in arc mode:

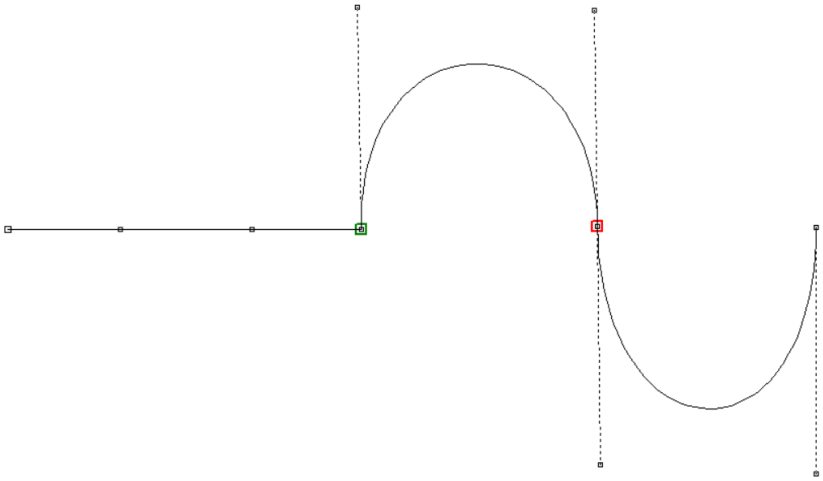
Arc Center	Define the arc center
Radius	Define the arc radius
Sweep Angle	Define the arc sweep angle

Bezier Curve

Bezier curves provide a way of drawing complex curved segments. Each section of a Bezier curve is defined by four points, two end points, and two handle points which define the shape of the curve.



The Bezier tool will draw multiple segments linked together. Each segment can either be drawn as a Bezier segment or a straight line.



All of the segments in a contour created with the Bezier tool are Bezier segments, even if they are drawn as straight line segments. In the case of a straight line segment, the handles for that segment are located at the end points of the segment.

Drawing a Line Segment

1. Activate the Bezier command
2. Click at the desired starting point
3. Click at the desired end point to complete the line segment. The end point becomes the start of a new line segment

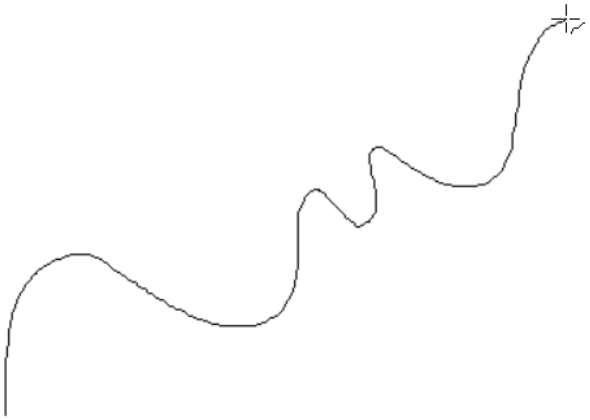
Drawing a Bezier Segment

1. Activate the Bezier command
2. Click at the desired starting point and drag the mouse to create a Bezier handle and create a curve
3. Click the mouse again to end the curve. Drag the mouse to begin another Bezier segment, release to start a line segment

Bezier curves cannot be created with the Precision input center, the curves must be created with a mouse or other pointing device

Sketch

Create contours by drawing freehand



1. Activate the Sketch command
2. Click and hold the left mouse button to begin drawing
3. Move the mouse to create the contour shape
4. Release the left mouse button to end the contour, EnRoute will construct the drawn contour from line and curve segments
5. Right click to exit the tool

Rectangle

Create rectangles by drawing or defining parameters

Drawing a Rectangle by Corners

1. Activate the rectangle command
2. In the precision toolbar, select **Draw from Corner to Corner**
3. Click the left mouse button to define the first corner
4. Move the mouse button and left click again to define the second corner and complete the rectangle

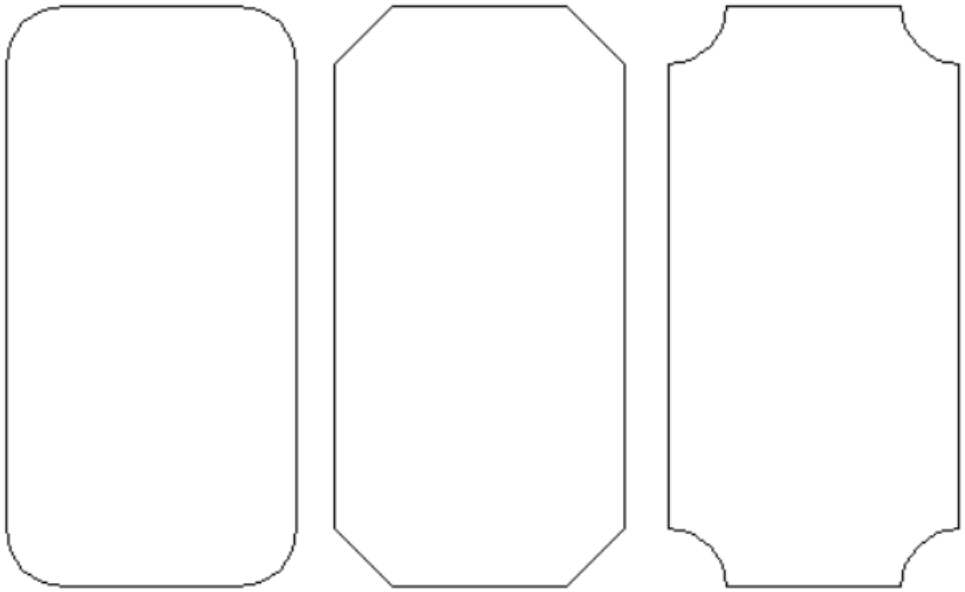
   Hold the **SHIFT** key to only draw squares

5. Repeat steps 3 and 4 to create more rectangles
6. Right click to exit the tool

Draw Rectangle by Dimensions

1. Activate the rectangle command
2. In the precision toolbar, select **Draw by Dimensions**
3. Enter the Height and Width values into the precision toolbar to define the rectangle size
4. Click the reference grid button to select the corner, side, or center point that will be used to position the rectangle
5. Left click in the workspace or click apply to create a rectangle
6. Repeat to create more rectangles or right click to exit the tool

Radius Corners, Chamfer Corners, or Inverse Radius Corners



1. When drawing a rectangle, select a corner effect in the precision toolbar
2. Define the size of the effect to be applied

> The selected corner option will only be created if the height and width of the rectangle are large enough to allow the size of the effect defined

3. Newly drawn rectangles will have corner effect applied

Circle

Draw a circle by defining different parameters.

Drawing a Circle by Center and Radius

1. Activate the circle command
2. In the precision toolbar, select **By Center and Radius**
3. Define the radius value in the precision toolbar
4. Left click to place the circle in the workspace. A more accurate position can be defined by entering coordinates in the precision toolbar
5. Left click to create more circles with the same radius or right click to exit the circle tool

Drawing a Circle by Center and Point

1. Activate the circle command
2. In the precision toolbar, select **Circle by Center and Point**
3. Left click to place the center point of the circle

> Snaps are a good way to locate the center of circles

4. Move the mouse away from the center point and left click again to define a point on the circle
5. Repeat steps 3 and 4 to create more circles, or right click to exit the circle tool

Drawing a Circle by Three Points

1. Activate the circle command
2. In the precision toolbar, select **By Three Points**
3. Left click to define the first point on the circle, then again to define the second.
4. Click a final time to define the third point, and the circle will be create that contacts all 3 points
5. Repeat steps 3 and 4 to create more circles, or right click to exit the circle tool

Drawing a Circle by Corners

1. Activate the circle command
2. In the precision toolbar, select **Circle By Corners**
3. Left click to place the first corner
4. Move the mouse and left click to define the other corner and create the circle
5. Repeat steps 3 and 4 to create more circles, or right click to exit the circle tool

> All Circles can be drawn by entering relevant information into the precision toolbar, or by drawing in the work-space

Arc

Three methods to create arcs

Drawing an Arc by Center, Start and Finish

1. Activate the Arc Command
2. In the precision toolbar, select **Arc by Center, Start and Finish**
3. Left click to define the arc center
4. Move the mouse and left click again to define the start point
5. Click again to define the arc end point
6. Right click to exit the arc tool

Drawing an Arc by Center, Radius and Angle

1. Activate the Arc Command
2. In the precision toolbar, select **Arc by Center, Radius and Angle**
3. Define the arc radius and sweep angle in the precision toolbar
4. Define the arc center in the precision toolbar and click APPLY to create the arc
5. Repeat to create more arcs, or right click to exit the tool

Drawing an Arc by Three Points

1. Activate the Arc Command
2. In the precision toolbar, select **Arc by Three Points**
3. Left click to define the arc start point
4. Click again to define the end point
5. Click a final time to define a point along the arc
6. Repeat steps 3-5 to create more arcs, or right click to exit the tool

Ellipse

Three methods to create an ellipse in the workspace

Drawing an Ellipse by Height and Width

1. Activate the ellipse command
2. From the precision toolbar select **Draw by Height and Width**
3. Define Height and Width parameters in the precision toolbar
4. Define the center point position in the precision toolbar and select **APPLY** to create the arc
5. Left click in the workspace to create more ellipses with the same parameters
6. Right click to exit the arc tool

Drawing an Ellipse by Major and Minor Axis

1. Activate the ellipse command
2. From the precision toolbar select **Ellipse by Major and Minor Axis**
3. Left click to place the center of the ellipse
4. Move the mouse to define the angle of the first axis
5. Left click to define the width of the ellipse along the first axis
6. Repeat steps 4 and 5 for the second axis to complete the ellipse
7. To create more ellipses with the same dimensions, switch to **Draw by Height and Width**and left click to create another ellipse

Drawing an Ellipse by Corners

1. Activate the ellipse command
2. From the precision toolbar select **Draw from Corner to Corner**
3. Left click to place the first corner
4. Move the mouse and left click again to define the opposite corner
5. Repeat to create more ellipses or right click to exit the tool

Polygon

Create multiple sided closed contours such as pentagons and stars.

Parameters

	Create concave polygons
	Create convex polygons

	Contour creation mode
	Mesh creation mode
Points	The number of external points to create in the polygon
Standard	Select a standard star pattern to create
Radius (Outer)	The radius for all exterior points along the contour
Radius (Inner)	The radius for all interior points along the contour
Center	Define the coordinates for the polygon center
Height	Define the mesh height
Return Height	Define a vertical offset between the mesh and the drawing plane

1. Activate the **Polygon** command
2. Define the desired parameters in the dialogue window
3. Left click in the workspace to create a polygon or click **Apply**

Text

Create text in the workspace and modify parameters such as size, font, and spacing. The left side of the precision toolbar will allow the font to be selected and display a preview of the selected font.

Parameters

	Defines the **height** of created text objects. The height parameter is a multiplier that adjusts the character height relative to the default width defined by the selected font. As the parameter is adjusted the cursor will change height to preview the new text height.
	Defines the **slant** of text characters. Positive values will cause the letter to lean towards the right, negative values will lean the letter to the left.
	Defines the **width** of the text characters. The width parameter is a multiplier that adjusts the character width relative to the default width defined by the selected font.
	Define the **spacing** between characters. Positive values increase the spacing, negative values decrease the spacing
	Adjust the location of the selected text up or down. Positive values move text up, negative values move text down.

	Select the preferred text alignment. Left, Center, or Right justified.
	Toggle which side of a line or curve the text is created on.

Create Text

1. Activate the **Add Text** Command
2. Left click in the workspace to place the cursor. To create text on an arc or curve, left click the contour at the starting point for the text.
3. Select the text style, a preview will be shown to the right of the font selection.
4. Type text to create it in the workspace.
5. Select the **Close** button to exit.

Edit Existing Text

1. All of the text creation tools can be used to edit text, start by activate the **Add Text** command .
2. Left click on the text to be edited. The cursor will snap into place in line with the selected text.
3. Click and drag across characters in the text to select them. A box will appear around each character indicating it has been selected.
4. Modify the text parameters in the toolbar to change the selected text.
5. Select the **Close** button to exit.

Edit Text Character Spacing

1. Select the text to be edited.
2. Activate the Edit Existing Text command .
3. Click on the text to be edited.
4. Colored points will appear to edit the text with.

5. The **Green Point** changes the starting point of the line, the **Blue Point** adjusts individual letter spacing, and the **Red Point** equally adjusts the spacing of all letters.

Convert Text to Curves

Text objects must be converted to curves before toolpaths can be generated.

Any toolpath command will automatically convert text to curves, or you can use this tool to convert text to curves.

1. Select the text objects to be converted.
2. Activate the convert text to curves command and the text will be converted immediately.
3. The text display colors will change from the text object display color to the standard contour display colors.

Text Object

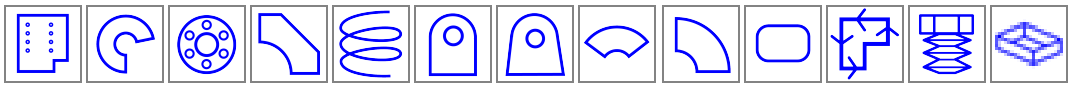
Text Converted to Curves

Dimensions

Display measurements of lines and angles.

	Measure the distance between two points
	Measure the angle between two contours
	Measure the radius of a contour
	Measure the diameter of a contour
	Draw a leader arrow in the workspace

Geometry Creation Wizards



Wizards in EnRoute provide a method to automatically create common objects rather than drawing them. Wizard parameters can be saved to make recreating the same objects is easy.

Icon	Wizard Name	Description
	Boxster	Configure and generate standard cabinet shapes using a set of parameters to control the geometry
	Cone	Generate flat geometry that can be formed into a cone
	Flange	Parametrically create flanges
	Gusset	Create gusset geometry
	Helix	Define the path of a helix and the position within the workspace
	Lift Lug	Generate 2 different shapes of lift lugs
	Part Round	Easily create partial round geometry
	Quarter Round	Define the dimensions of a standard quarter round geometry
	Radius Rectangle	Create rectangles with rounded corners
	Thread Pitch	Generate a thread pitch path by specifying standard thread dimensions
	GCode	Import geometry from GCode files

Icon	Wizard Name	Description
	Simple Box	A box generator wizard that builds contours to create a box from a provided set of parameters

Vectorize Bitmaps

Bitmap artwork must be converted to vectors before it can be used to generate toolpaths. This tool traces bitmaps and converts it to vectors. There are 3 modes for vectorizing bitmap images, **Standard**, **Centerline**, and **Color** Vectorize.

For the best results, clean up bitmaps before vectorizing by removing speckling and unwanted detail. For standard vectorizing, the best results are achieved with black and white or gray scale images.

Common Parameters

The common parameters apply to the **Standard** and **Centerline** vectorizer.

Bezier	Favor the creation of bezier segments when approximating the bitmap
Enhanced Corners	Create a contour with distinct corners where possible
Enhanced Curves	Favor the creation of arc segments when approximating the bitmap
Auto Cleanup	Automatically simplify the created contours by reducing the number of segments
Tolerance	Specify the smallest feature on the bitmap to keep when cleaning up the created contours. A smaller tolerance will maintain more detail with a more complex contour, a larger tolerance will create a contour that is easier to edit by removing some of the detail.

Standard Vectorizer

The standard vectorizer will create contours from a bitmap image by tracing the boundaries between the primary 2 colors in the image. This vectorizer mode works best with black and white and gray scale images.

Centerline Vectorizer

Pure Centerline	When enabled, the vectorizer will only create the centerline trace
Outline Thick Areas	When enabled, the vectorizer will outline areas of the bitmap wider than the specified value
Min Segment Length	The minimum contour segment length to create
Min Centerline Section	The minimum length of a centerline section to vectorize
Automatic Width	Automatically recognize thick areas to outline
Line Width	Define the minimum width to begin outlining the bitmap

The centerline vectorizer will trace a single line down the middle of a bitmap section. The centerline vectorizer will also outline areas of the bitmap that are thicker than a specified width.

Only black and white images can be vectorized using the centerline tool.

Color Vectorizer

Max Colors	The maximum number of colors the vectorizer will recognize and convert to contours. A lower value will create simpler contours, and a larger value will create more complex contours.

The color vectorizer will create contours that represent distinct colors in the bitmap being vectorized. For simpler bitmaps that have a limited number of colors, setting the maximum colors value close to or slightly below the number of colors in the bitmap will yield the best results. For more complex images getting the desired result will likely require vectorizing the image a few times and adjusting the Max Colors value to get the desired contours.

Arranging Contours

Adjust how contours are positioned within the workspace.

Selecting Contours

Select a contour by clicking anywhere along the edge. Multiple contours can be selected by any of the following methods:

- Hold the **Shift** key and click each contour
- Click and drag a selection box around the contours

> Dragging from the top of the workspace down will select all contours fully enclosed by the selection box. Dragging from the bottom up will select any contours the selection box touches.

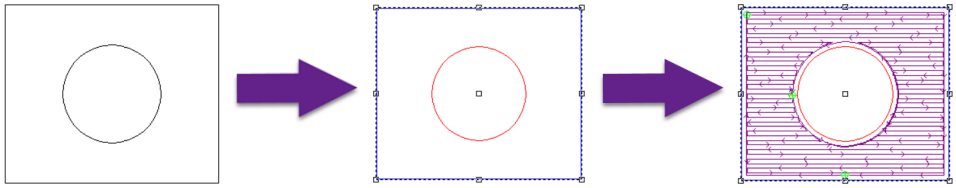
- Select **Edit > Select All** from the menu to select all contours in the design

Automatic Sorting

When multiple contours are selected, EnRoute automatically identifies and color codes each contour as open curves, containers, or holes. By default, all closed contours are classified as containers. If a closed contour is completely contained within another closed contour, the inside contour becomes a hole within the outer container and forms an inner edge to the bounding container.

By default, selected contours will display blue for containers, red for holes, and purple for open curves.

The images below illustrate the selection of 2 contours, the outer contour classified as a container and the inner contour classified as a hole, and the result when a hatch fill is applied.



Cut, Copy, and Paste

Contours can be manipulated using the cut, copied, and paste commands to move between drawings and layers.

Cut and Paste

1. Select the contour and choose **Edit > Cut** from the menu, or press **Ctrl + X**.
2. Select where to place the contour.
3. Choose **Edit > Paste** from the menu or press **Ctrl + V**.

Copy and Paste

1. Select the contour and choose **Edit > Copy** from the menu, or press **Ctrl + C**.
2. Select where to place the contour.
3. Choose **Edit > Paste** from the menu or press **Ctrl + V**.

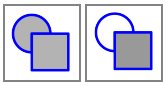
When pasting into the same design, the copy will be placed in the same position as the original

To create a copy in the same design, press the **Ctrl** key and click the center control box of the contour and drag a new copy to a new location.

Pasting from Other Programs

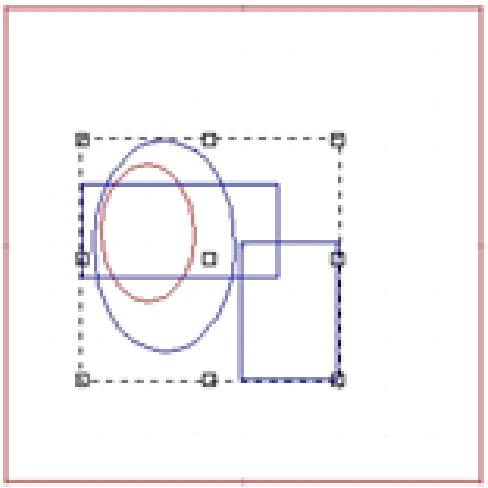
See General Preferences for contour merge settings when pasting from other programs.

Grouping Contours

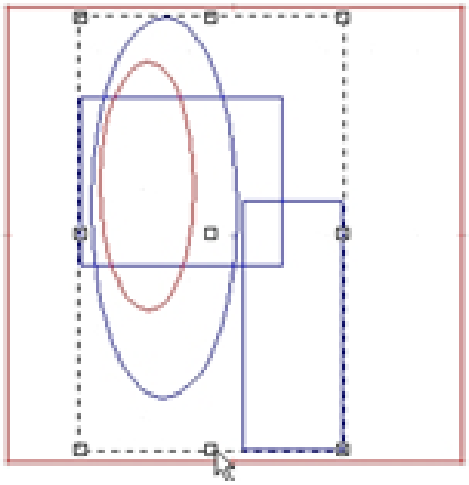


Contours can be grouped together so that all contained contours can be manipulated as a single contour.

1. Select a number of contours
2. Click the Group icon  or press **Ctrl + G** to group them together
    a. Selecting any one of the contours in the group will select the entire group.



b. When the group is re sized or moved within the workspace, it is treated as a single contour.



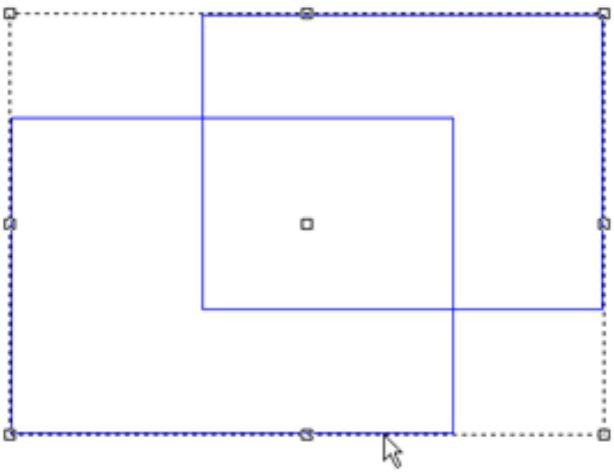
3. To separate the group, select the Ungroup Icon  or press **Ctrl + U**

Interactive Adjustment

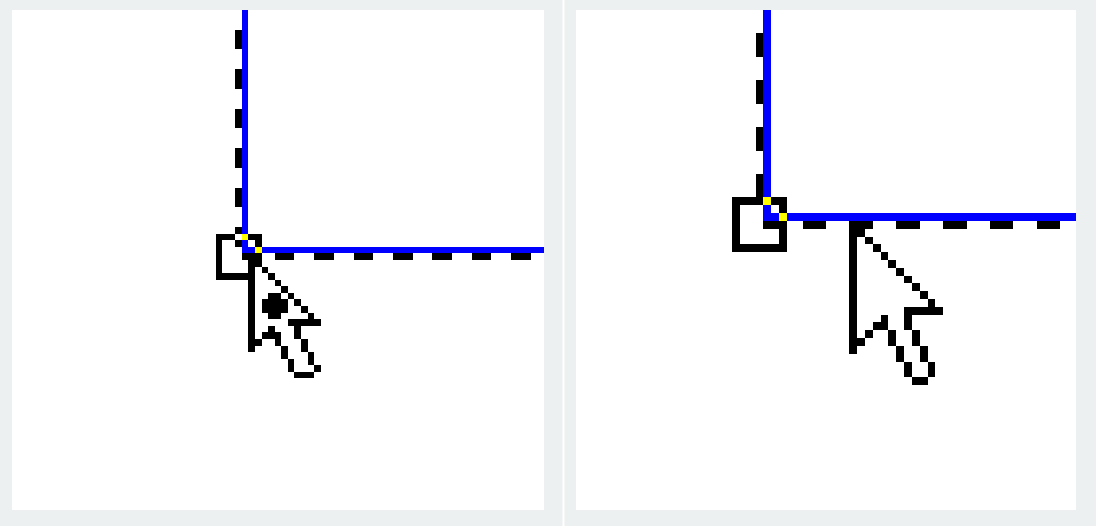
Several tools are provided to accurately position and size objects in EnRoute.

With the Mouse

Objects in the workspace can be moved interactively using the mouse. To move a selection, click on any of the contours in the selection and then drag to the new location. It is important to click on the contour to maintain the selection, as shown in the image below.



Contours can be moved using the nine selection handles around the selection box. The center handle will always move the selection when clicked and dragged around the workspace. Clicking on any of the other handles will scale the size of the selection, but if the cursor is placed near the selection handle and dragged, the selection will snap to the handle for accurate placement. The images below illustrate the cursor placement.



Scale Contour	Move Contour

Note that the center of the cursor changes to a black dot when in scaling contours, and is white when moving contours.

Contours can be scaled interactively by clicking any of the selection handles around the perimeter of the selection box and dragging. Hold the **SHIFT** key while dragging to scale the selection proportionally.

Precise Adjustment

The **Precision Input Center** can be activated by pressing the **F2 key** and provides an interface to precisely adjust objects. There are 3 tabs in the precision input center: Scale, Rotate, and Move.

Scaling the selection can be accomplished in the **Scale Tab** by entering the dimensions or a scaling factor. Check the **Proportional** option to scale the selection proportionally.

To rotate a selection from the **Rotate Tab**, the axis of rotation must be defined. To rotate in the **Top** view, the contour will rotate about the Z axis in the X-Y plane. By default the center of rotation is the center of the selection, but that can be changed by entering new coordinates for the rotation center. Enter the desired rotation angle and click **OK** to complete the rotation.

Move a contour through the **Move Tab** by defining the corner of the selection to define the position for, and then entering the coordinates for that location. Click **OK** to move the selection.

The include toolpaths option specifies if toolpaths are moved and sized along with the contours.

Move, Scale, and Rotate Tools

There are also tools to Move, Scale, and Rotate objects that can be activated from the toolbar.

- Move
- Scale
- Rotate

Move

Move selected objects through one of 3 modes.

Right Click at any point when using the Move tool to back up one step in the Move dialogue. For example when interactively selecting the starting point, right click to reset the start point and reselect with the mouse.

Move Absolute

Define a starting and ending point for the move. Starting and ending points can be defined by entering the coordinates or by clicking in the workspace. With snaps enabled, shapes can be accurately positioned interactively using the mouse.

Start	Coordinate of the starting position of the selection
End	Coordinate of the ending position of the selection

Move Relative

Define a starting point and the amount to move in each direction.

Origin	Coordinate of the starting position of the selection
Move	The amount to move the selection in each direction

Move Corner

Move a corner of the selection to a specific coordinate.

End	Coordinate of the ending position of the selection
Corner Selector	Choose which corner to move to the end point

The **Copy** option can be checked for any move mode to create a copy of the selection and move it to the specified location

Scale

Scale a selection in 3, 2, or 1 dimensions interactively or by specifying the final dimensions.

Three Dimensions

Scale the selection in all 3 dimensions, regardless of the active view.

Two Dimensions

Only the 2 visible dimensions will be scaled. In the Top view only the X and Y dimensions will be scaled. This is useful when scaling reliefs to keep the thickness constant.

One Dimension

Distort the selection by scaling along a single axis by clicking and dragging interactively. Click to define the starting and ending point of a line to define the direction to scale the selection. Move the mouse along the axis to distort the selection and click again to apply the changes.

Parameters

Size	Scale the selection by entering the XYZ sizes
Factor	Scale the selection by applying a scaling factor
Include Toolpaths	Scale any toolpaths in the selection
Proportional	If checked, the scaling operation will be applied proportionally
Copy	Create a copy of the selection when scaled. The original will remain in the same position
Corner Selector	Select which point remains stationary when scaling the selection

Rotate

Rotate selected objects about a selected point by defining the angle of rotation.

Right Click at any point when using the Rotate tool to back up one step in the Rotate dialogue when rotating interactively

Parameters

Center	Specify the coordinates for the center of rotation
Axis	Define which axis the selection will be rotated about. To rotate objects in the Top view, objects will rotate about the Z axis.

Angle	The angle of rotation
Copy	If checked, a copy of the selection will be created and rotated
Corner Selector	Select the rotation center when using the **Angle** parameter

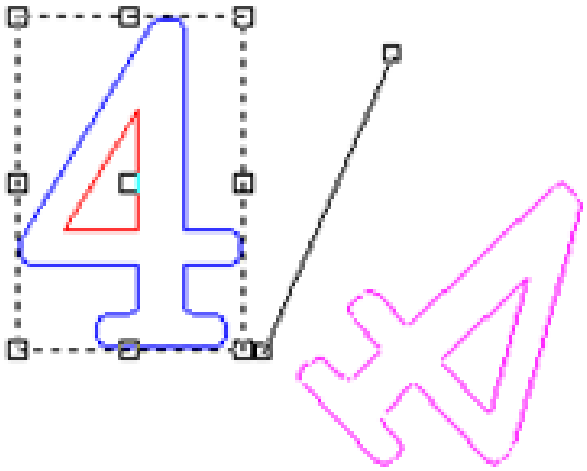
Hold Shift when rotating interactively with the mouse to snap the rotation angle to fixed increments

Mirror

Reverse the selected contour so that it becomes its mirror image. A copy of the original can be created by checking the copy option.

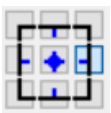
Mirror Interactively

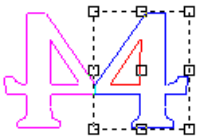
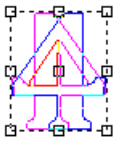
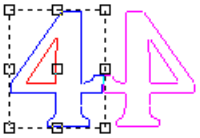
Click to place the start point of the mirror axis, and then click again to place the end point. The start and end point can also be defined by entering the coordinates. A preview will display while working.



Mirror Vertically

Mirror the selected contour about the vertical axis. Click the selection grid button to select the point the contour will be mirrored about.

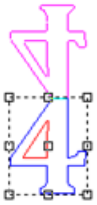
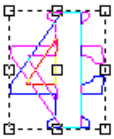


Mirror Horizontally

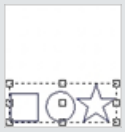
Mirror the selected contour about the horizontal axis. Click the selection grid button to select the point the contour will be mirrored about.

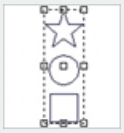
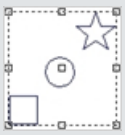
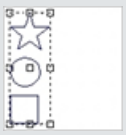
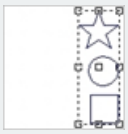



Align Contours

Align one or more EnRoute objects relative to each other

Align to Centers			
Align to Bottom			
Align to Top			
Align to Center Vertically			

Align to Center Horizontally			
Alight Left			
Align Right			

Nest

Arrange parts on the plate to maximize material utilization. There are 2 different nesting dialogues that can be accessed from the **Nest** tool: the **Shape Nester**, and the **Block Nester**.

Common Nesting Parameters

Quantity	The number of copies of the selected parts to create and nest. An individual quantity can be applied to each part by selecting each part and changing the quantity before clicking apply.
Priority Order	The priority for each object to be nested used to determine the nesting order.
Gap	Minimum distance between each contour being nested.
Margin	Minimum distance between the edge of the plate and the contours being nested.
Multiple Sheets	When checked, additional layers will be created to allow for the nesting of all objects. After nesting objects, all layers will be turned on, click the layer arrows to cycle through nested layers.
Create Remnant	When checked, create a contour that represents the remnant of the material used to cut the objects. The remnant can be created and a new plate can be created. See Create Plate from Contour
Create Summary	A summary report will be generated when checked. The report can be accessed by using the View Summary tool  .

Shape Nester Dialogue

Shape Nester Types

Standard

The base nester that has been the standard since EnRoute version 4.

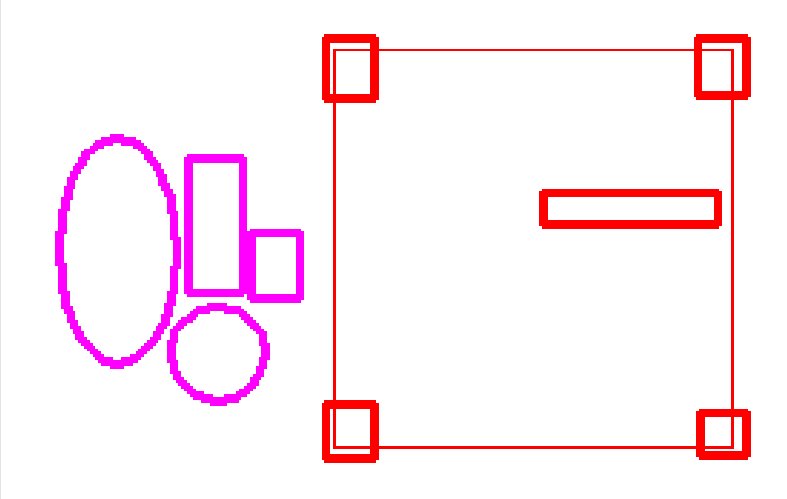
New

The New nester is capable of recognizing contours within plate boundaries as obstructions and will nest around them providing a simple way to avoid clamps or a section of the material with defects.

Legacy

The original nester in early versions of EnRoute.

Shape Nester Parameters

Nest Originals	When checked, the original objects will be nested. When additional quantities are defined, the originals will be highlighted when nested.
Step Angle	Specify the angle in degrees objects are allowed to rotate by when nesting
Use Holes	When checked, smaller contours will be nested inside the holes of larger contours
Obstruct (New Nester Only)	When checked, contours within the boundaries of the plate will be recognized as obstructions. Contours will be nested around obstructions. Obstructions must be selected with the contours to be nested before activating the Nest tool. Obstruction contours will be displayed in red. 
Reference Grid	Click the position of the plate to nest the contours in. The **New** nester allows multiple locations to be selected.

Block Nester Dialogue

Designed to nest squares and rectangles efficiently and provide tools to align contours for optimized cutting.

Block Nester Parameters

Allow Rotate	When checked, selected contours can be rotated when nested.

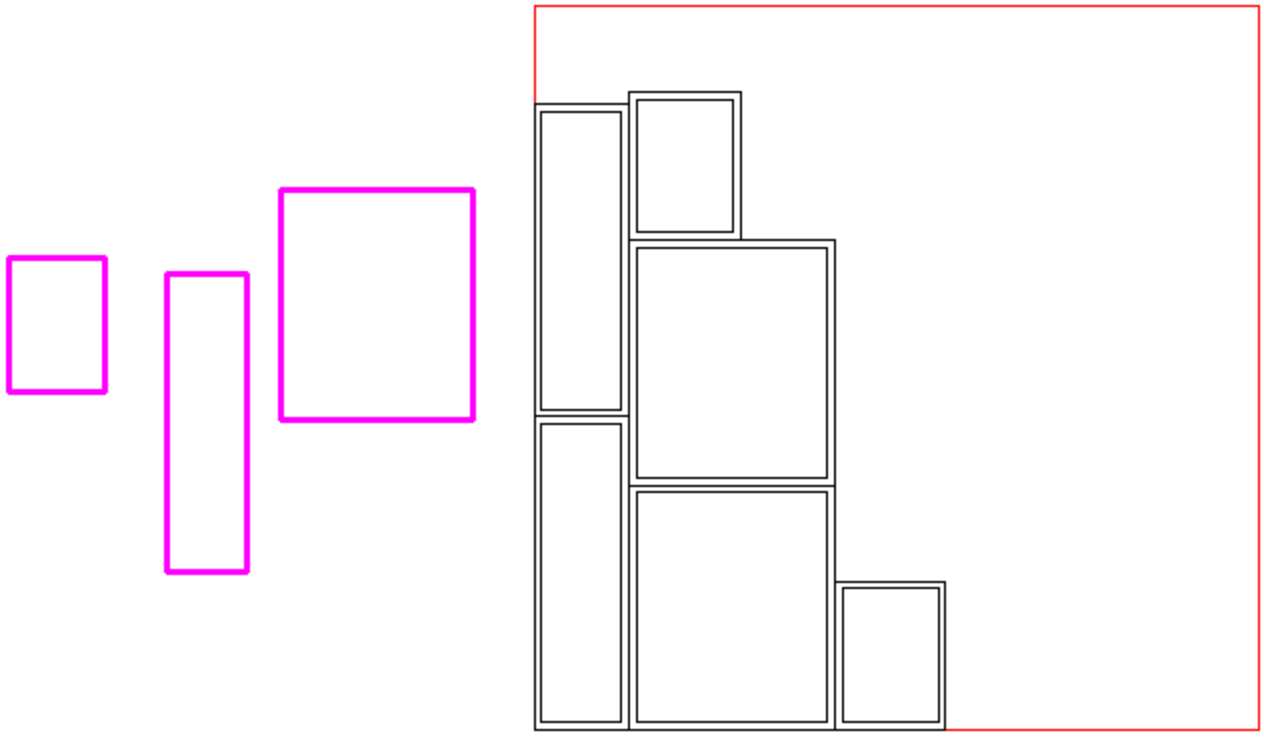
Create Common Line	When checked, the block nester will generate a common line contour that can be used to generate toolpaths. The common line contour prevents double cutting rectangular parts. See the example below.

Common Line Example

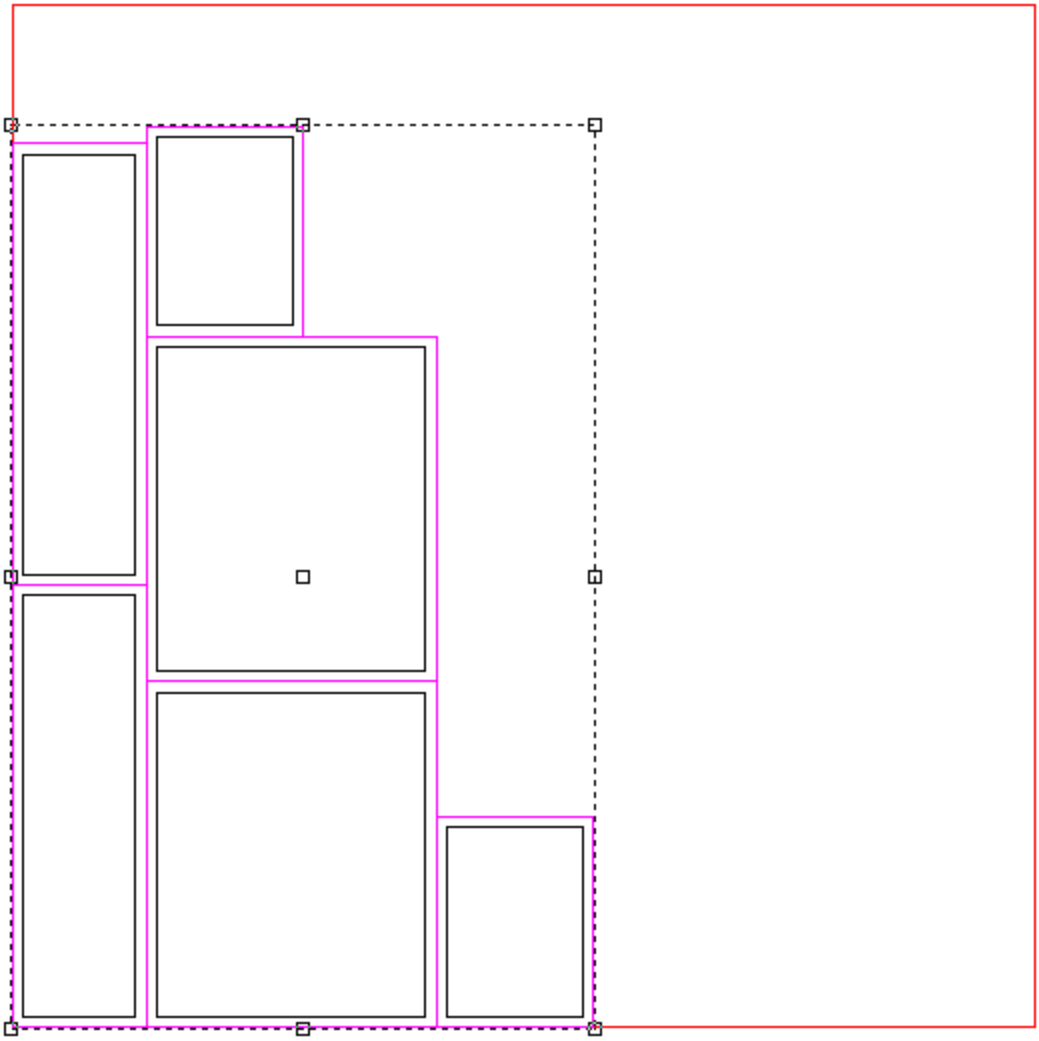
Using the block nester, the parts pictured below were nested and the common line was created using the following parameters:

Quantity	2
Gap	0.25"
Margin	0.25"
Create Common Line	Checked

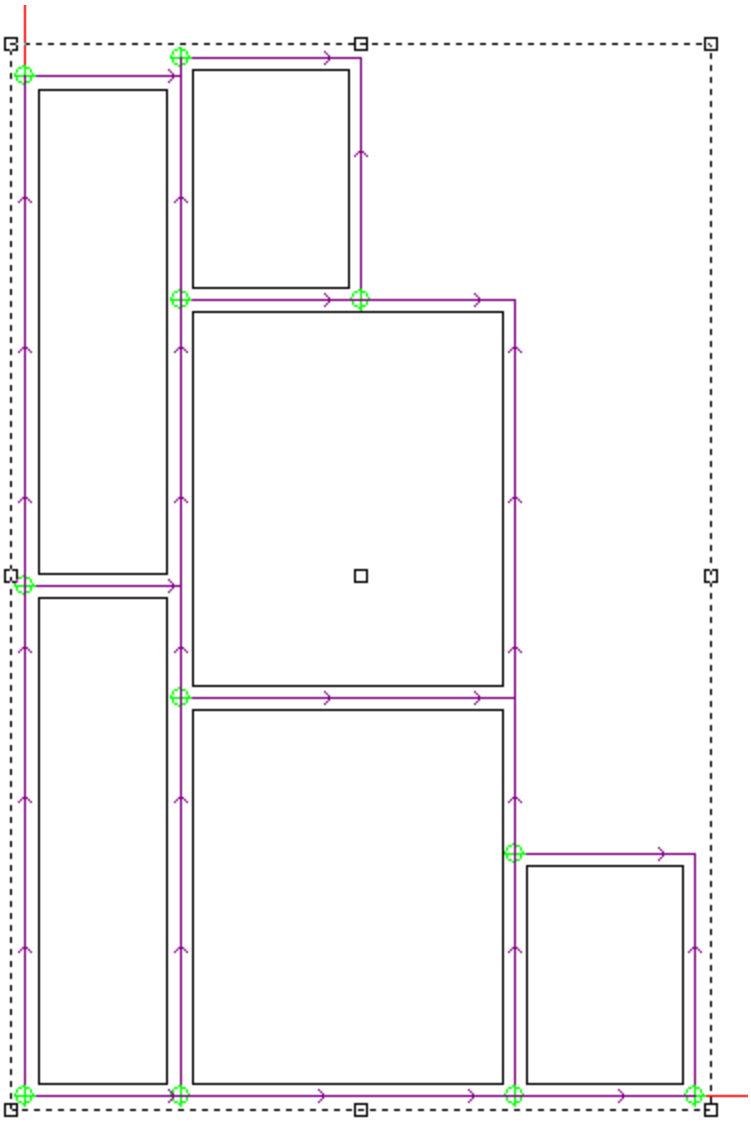
The gap is set to 0.25" because a 1/4" tool will be used to cut the parts



To cut the parts, a toolpath must be generated from the common line contour. Select the common line contour.



Activate the Open Contour Offset tool  . Select a 1/4" end mill tool, and from the strategy parameters section, select the follow **Middle** of contour option. Click **OK** to apply the toolpaths.



By assigning the gap distance the same with as the tool, both sides of adjacent parts can be cut at the same time.

Dynamic Nest

Click and drag parts onto the plate to nest them. The parts will automatically rotate to fit within the constraints of the other objects within the plate and the plate boundaries.

Parameters

Rotation Steps	The maximum number of rotations EnRoute is allowed to attempt before placing an object
Nest Resolution	Increase the display resolution of the nested object. Increased resolution will decrease the display speed

Part Offset	The minimum distance between each nested contour
Plate Margin	The minimum distance between the plate edge and nested contours

Editing Contours

Manipulate contours into new shapes or fine tune the placement of points and segments.

Edit Points

Edit Points Video

Manipulate the points, lines, and curves within contours. After activating the **Edit Points** tool, select a contour to edits the points and segments.

Click and drag points to change the starting and ending points of segments. Click and drag the segment to change the path of the segment.

Clicking and dragging a line segment will automatically convert it to an arc.

Cursor

Hover over a segment to preview if it is a line, arc, or curve.

Line	Arc	Curve
		

Convert Segments

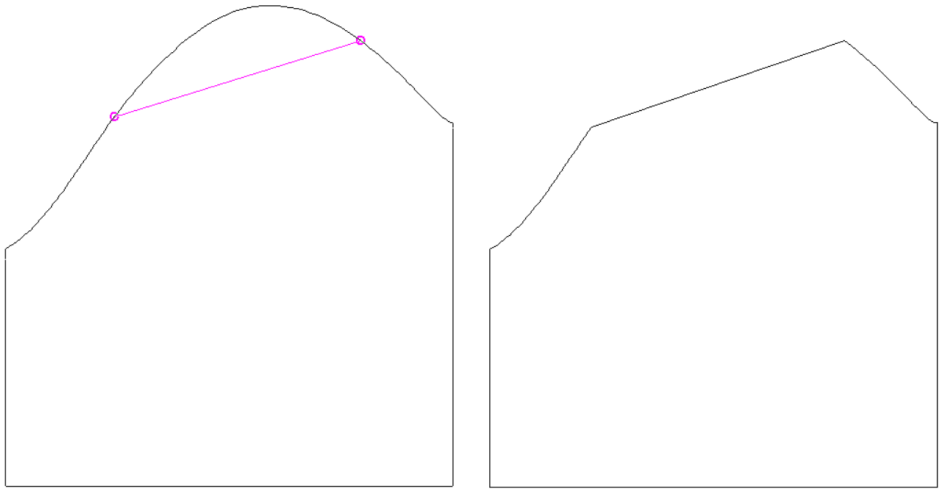
Right click on a segment to open a menu with commands specific to that segment.

Convert to Line	Convert segment to a line
Convert to Arc	Convert segment to an arc
Convert to Curve	Convert segment to a curve

Click and drag to select multiple segments at once. Once selected, the segments can be moved or converted together.

Linearize

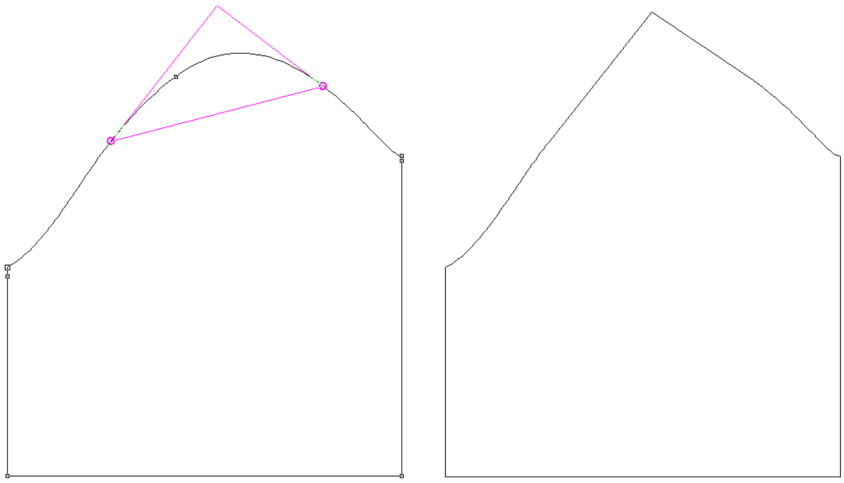
Convert a section of a contour to a line by defining a starting and an ending point.



1. Activate the **Linearize** command
2. Click to place the first point on the contour
3. Click to place the second point on the contour
4. A preview of the line will be shown in pink, drag the start and end points to adjust placement
5. Press **Enter** to accept the change

Insert Corner

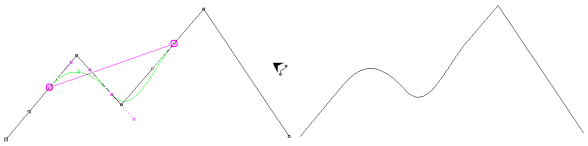
Select 2 points on a contour to extend tangent lines from to form a corner.



1. Activate the **Corner** command
2. Click to select the first point
3. Click to select the second point
4. A preview of the corner will be shown in pink. Drag the two points to adjust how the corner position.
5. Press **Enter** to accept the change.

Curve Fit

Replace a section of a contour between 2 points by fitting a curve to the contour path.



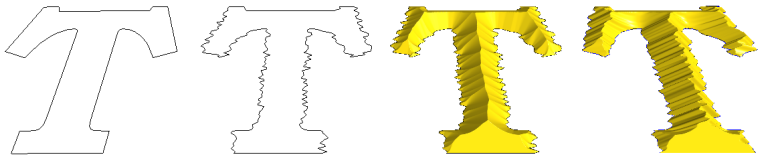
1. Activate the **Curve Fit** command.
2. Click to place the first point
3. Click to place the second point
4. A pink preview of the new segment will appear. Drag the two points to change the contour section that will be approximated.
5. Press **Enter** to accept the change

Noise Distortion

Distort contours by introducing a random noise pattern. Control the size of the distortion through input parameters.

The images below show a set of contours before and after introducing noise distortion

The distort tool can modify contours or reliefs. Distorting a relief creates a different effect than creating a relief from a distorted contour as illustrated below.



The far left contour is the original, and the right contour has been distorted. The left relief was created by applying a beveled relief to the distorted contour. The right relief was created by applying a beveled relief to the base contour and then adding noise distortion.

Another example shows how the original relief on the left can be modified with a subtle texture to create a unique surface.

Method 1

Define parameters that control the size and position of the noise.

Wavelength	Define the length along the contour over which the noise is applied along the contour. Longer values spread the distortion over longer distances.
Jitter	Define the strength of the distortion. Small values cause subtle distortions, larger values exaggerate the distortion.
Horizontal Amplitude	The distance the contour is distorted in the horizontal (X-Y) plane

Vertical Amplitude	The distance the contour is distorted in the Z axis. To keep contours flat vertically, set this value to 0.

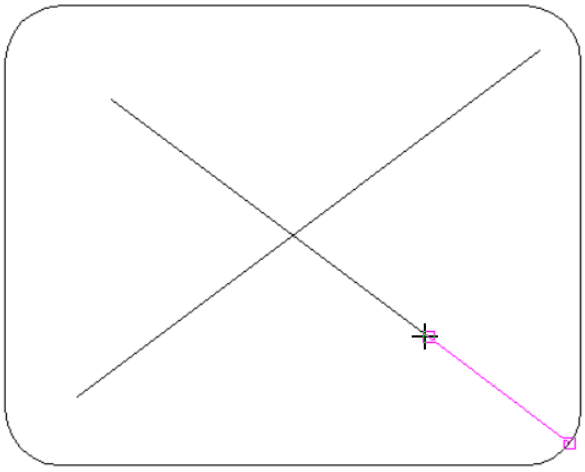
Method 2

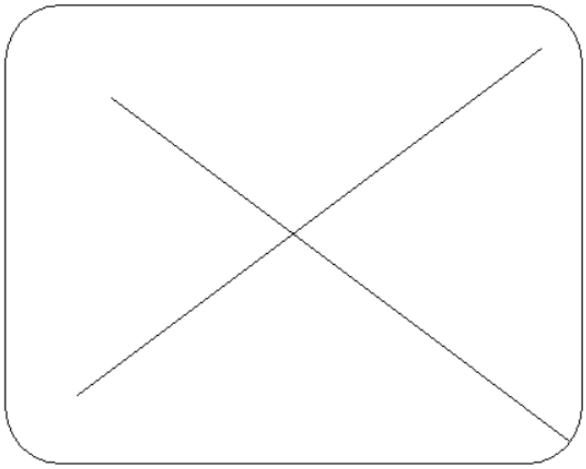
Method 2 provides more parameters than Method 1 and allows the noise to be controlled in each direction individually. There are two parameters, Size and Power, and there are two instances of each parameter. The contour is distorted in two passes, and each set of parameters controls one of the distortion passes.

Size	Define the size of the distortion in the X, Y, and Z direction. Distortion can be limited in any direction by setting the value to 0
Power	Define the strength of the distortion in each direction. Small values create subtle distortions, larger values create more exaggerated distortions.

Extend

Automatically extend an open contour to the next intersection point.



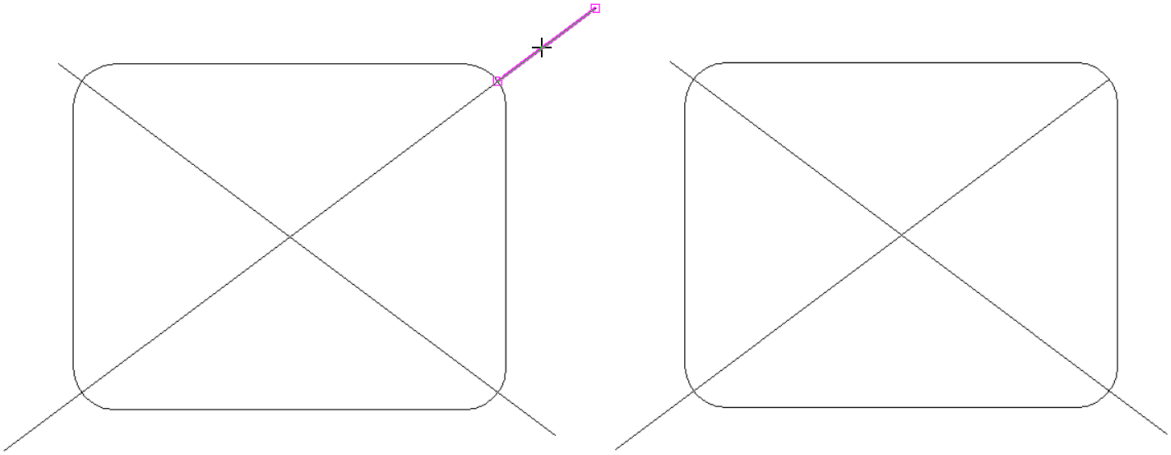


1. Activate the Extend command
2. Hover over the end of an open contour, a pink preview of the extension will be shown
3. Left click to apply the change

To interactively extend an open contour, hold **Shift** and hover over the open end of the contour to extend. Move the mouse to the new end point and click again to extend the contour.

Trim

Trim open contours that extend beyond intersection points with other contours.

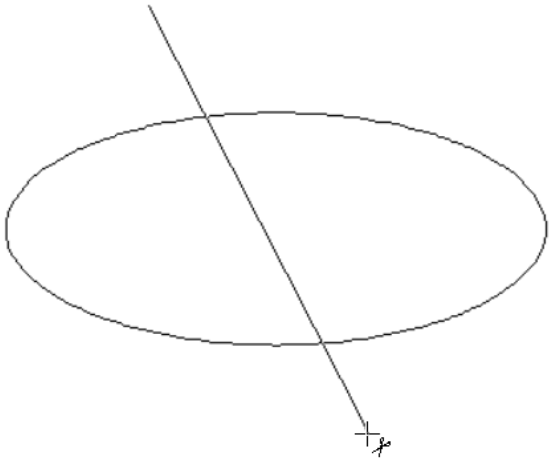


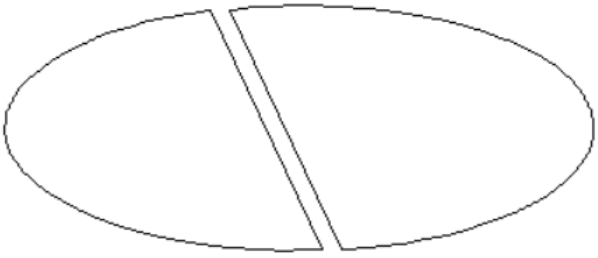
1. Activate the Trim command
2. Hover over the segment to trim, a pink preview will show the trimmed segment
3. Click to trim the contour

Contours can be trimmed interactively by holding Shift and hovering over the open end of the contour. Move the mouse along the contour and click to trim the contour.

Cut By Line

Cut closed contours into multiple closed contours.





1. Left click to define the cut line starting point
2. Left click again to define the second point of the cut line
3. Any contours that crossed the cut path are divided into separate contours along the cut line

Cut by Line affects contours differently when used on multiple selected contours. When groups of contours are selected, they are automatically grouped into containers and holes. The grouping is respected by the Cut by Line tool. The following images illustrate this concept. When 2 contours are cut without selecting them, 4 contours are created. When the contours are selected before cutting, the hole is respected and 2 contours are created.

Weld Contours

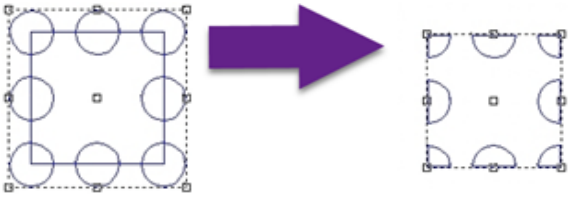
Combine multiple overlapping contours through different weld operations.

Weld Joined

Overlapping areas are merged together to form a contour that is the union of all of the parts.

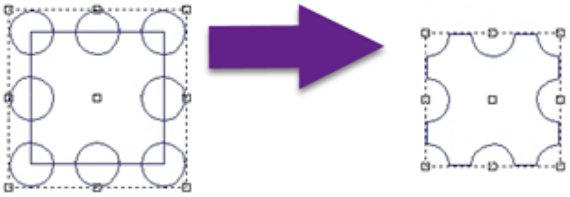
Weld Common

Only the overlapping sections between contours are merged into a single contour.



Weld Subtract

The volume of a number of contours is removed from the first contour selected. The resulting contour is the first contour minus any area that overlapped with other contours.

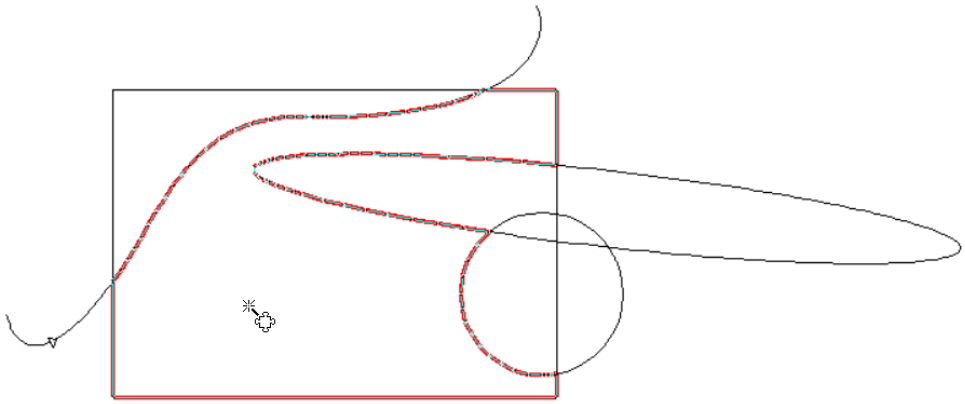


Weld Jigsaw

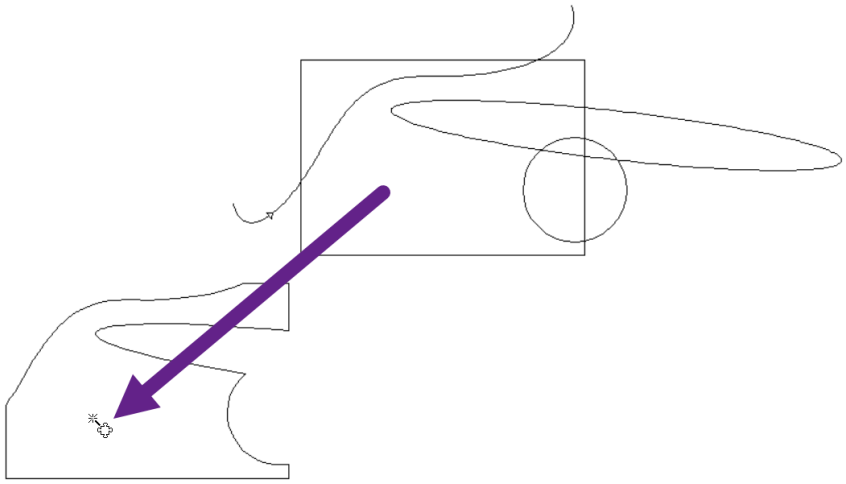
Create contours based on the intersections of contours in the design.

The Jigsaw tool works with both open and closed contours which can be helpful when constructing closed contours for toolpathing.

Move the cursor over the design and possible contours will be highlighted automatically.



When the desired shape is highlighted, click and drag to create the new contour. Release to place the contour in the design.



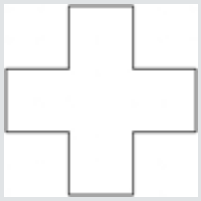
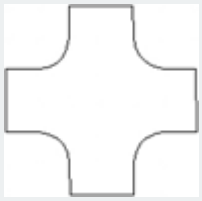
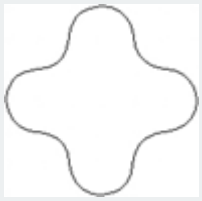
The Jigsaw tool works in the XY plane and can apply to contours at different Z heights. All contours are projected to the XY plane and the resulting contours are created within the XY plane at a Z height of 0.

Fillet

Insert an arc in the selected corners of one or more contours.

Parameters

Single Fillet	Select a specific corner to fillet

Multiple Fillet 	Choose which corners to fillet within a contour **Inside Corners**  **Outside Corners**  **All Corners** 
Chamfer	Apply a chamfer to corners instead of a fillet
Radius	The radius size for the fillet or chamfer
Keep Original	When checked, the original contour will not be modified and the fillet will be created as an open contour over the original contour

Single Fillet

1. Activate the **Fillet** command
2. Click to define a point on either side of the corner to fillet
3. A preview of the fillet will appear in pink, drag the starting and ending point to adjust the fillet
4. Click **Apply** to create the fillet

Multiple Fillet

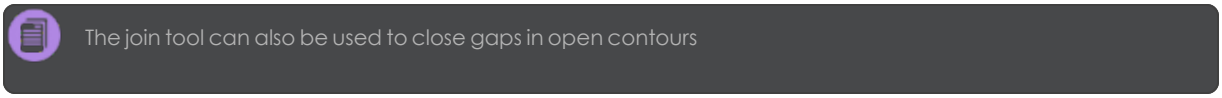
1. Activate the **Fillet** command
2. Select the contour to fillet and the Multiple Corners option.
3. The fillets will be previewed in pink
4. Click **Apply** to create the fillets

Where fillets overlap they will automatically be created tangent to each other

Join

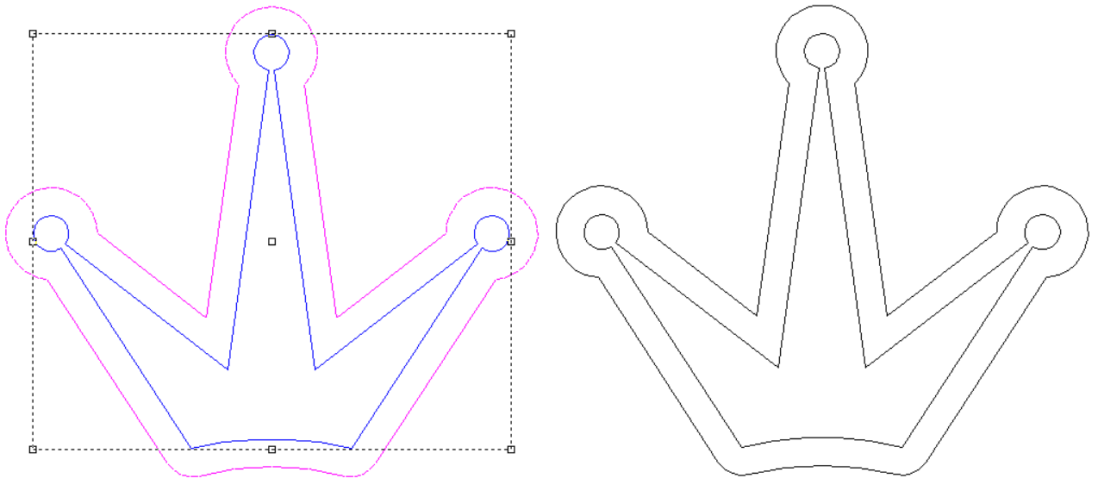
Join open contours together.

1. Activate the Join command
2. Click on the first contour end to join
3. Hover over the second contour end to join, a red preview will be shown of the new segment
4. Click again to join the contours into a single contour



Offset

Create a new contour offset from a selected contour.

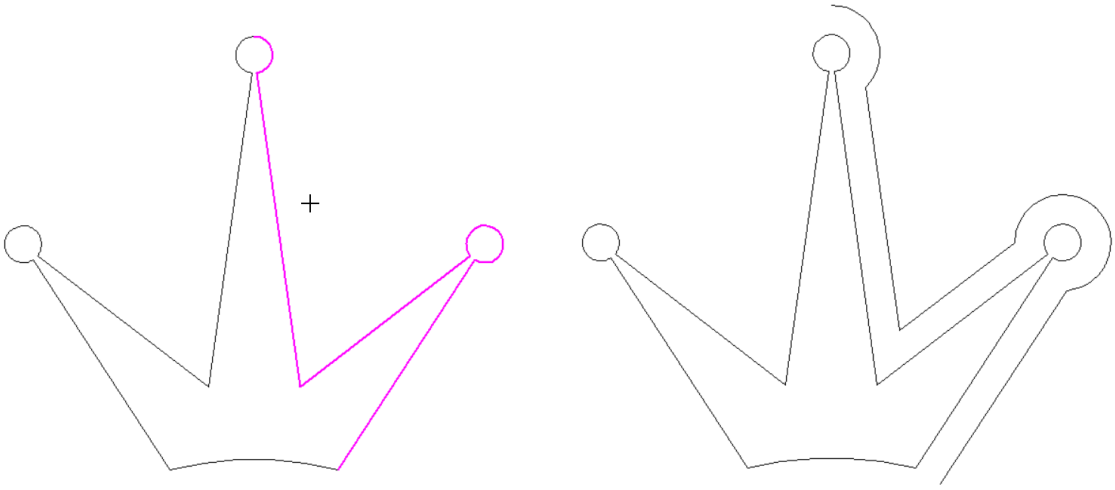


Parameters

Number	How many offset contours to create
Amount	The distance between each offset
Outline	Offset to the outside of the contour
Inline	Offset to the inside of the contour
Rounded	Create offsets with rounded corners
Square	Create offsets with square corners

Partial Offset

Create an offset from a section of a selected contour.



1. Select a segment of a contour to offset, hold the Shift key to select multiple segments
2. Specify the offset amount, and if the offset should have square or rounded corners
3. Click to create the offset. Clicking outside of the contour will create an exterior offset, clicking to the inside creates an interior offset

Merge Open Contours

Join open contour ends within a definable tolerance.

This feature is useful when importing drawings from other software packages that don't emphasize creating closed contours. Quickly join together separate contours into closed contours that can be used to generate toolpaths

1. Select the open contours to merge
2. Activate the **Merge Open Contours** command
3. Define the merge tolerance (the maximum distance between endpoints that will still be merged)
4. Click **OK** to merge contours

Explode Contours

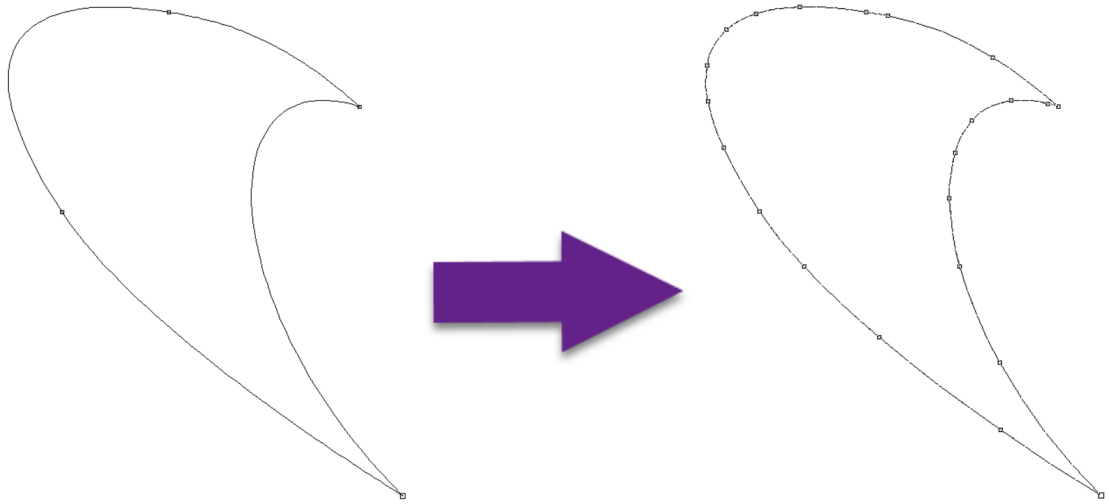
Separate a closed contour into individual segments.

1. Select the contour to separate into individual segments
2. Activate the Explode Contours command to create individual segments

Convert Curves to Arcs

Transform curve and line segments within a selected contour into arcs.

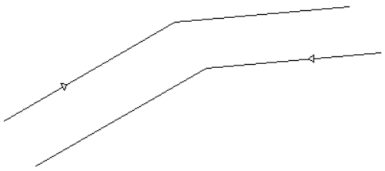
One curve may require many arcs to be converted properly, which can increase the number of segments significantly.



1. Select the contours to convert
2. Activate the Convert to Arcs command to convert the segments to arcs

Reverse Open Contours

Reverse the direction of open contours. The direction is indicated by the arrow on the contour.



The direction arrow display can be toggled in the View Setup Preferences under **Open Contour Direction**.

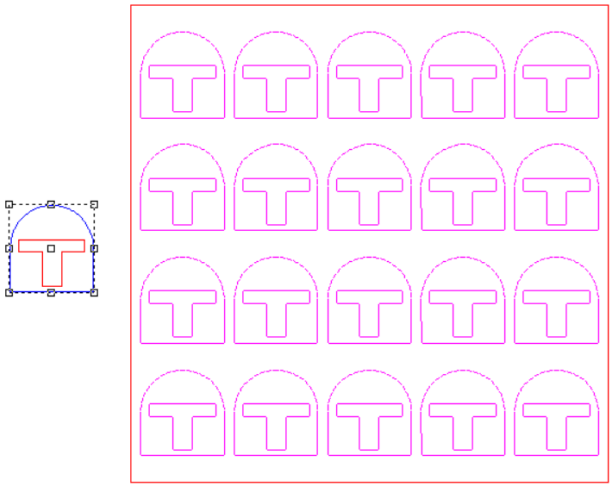
1. Select the open contour
2. Activate the **Reverse Open Contour** command to reverse the direction

Multiple Copy

Create multiple copies of a selected contour. Specify the number of copies and the orientation and pattern of the copies.

Array Copy

Create copies ordered into a specified number of rows and columns with a defined spacing.



Parameters

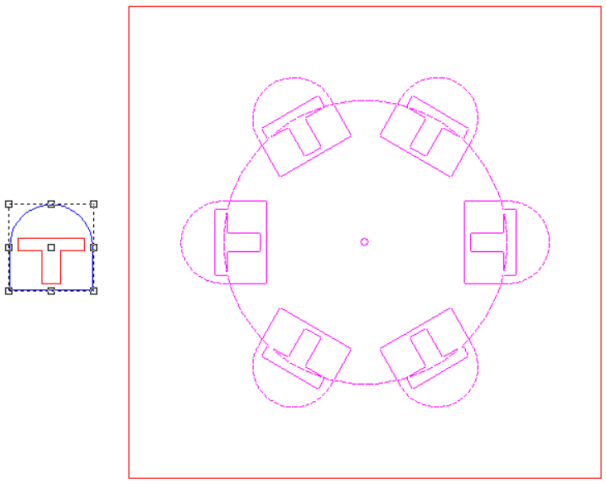
As parameters are changed, a preview of the copies will be displayed in the workspace in pink.

Fill Plate	Automatically fill the plate with as many copies that fit when checked. All other parameters will be calculated automatically.	
Rows	Number of rows of copies to create	
Columns	Number of columns of copies to create	
Horizontal Spacing		Define the horizontal spacing between each part
		Define the horizontal spacing between the left edge of each part
Vertical Spacing		Define the vertical spacing between each part
		Define the vertical spacing between the top edge of each part

Click **Apply** to create the copies.

Arc Copy

Create copies spaced along an arc.



Parameters

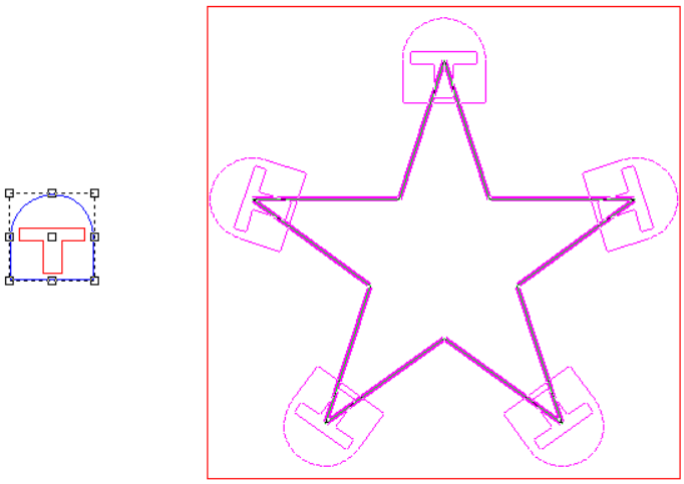
As parameters are changed, a preview of the copies will be displayed in the workspace in pink.

Align	Rotate the copies along the path of the arc
Number	Number of copies to create
Radius	Radius of the arc
Start Angle	Angle in degrees for the starting point of the arc
Swept Angle	Defines the distance the arc covers from the start angle to the end. Angles greater than 360 degrees will loop around
Center	Specify the coordinates for the arc center
Panel Selector	Select the corner, side, or center point to position the contours along the curve with

Click **Apply** to create the copies.

Path Copy

Create copies along another contour.



Parameters

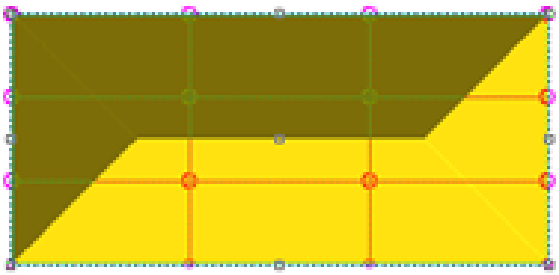
Align	Rotate the copies along the path of the contour
Number	Number of copies to create when **Hold Number** is enabled
Spacing	Spacing of copies along the contour when **Hold Spacing** is selected
Offset %	Offset the first copy from the starting point by a percentage of the spacing
Hold Number	Specify a number of copies to be equally spaced along the contour
Hold Spacing	Create copies along the contour at a specified spacing
All Corners	Create copies at all corners of the selected contour
Inside Corners	Create copies only at the inside corners of the selected contour
Outside Contours	Create copies only at the outside corners of the selected contour
Panel Selector	Select the corner, side, or center point to position the contours along the curve with

Click **Apply** to create the copies.

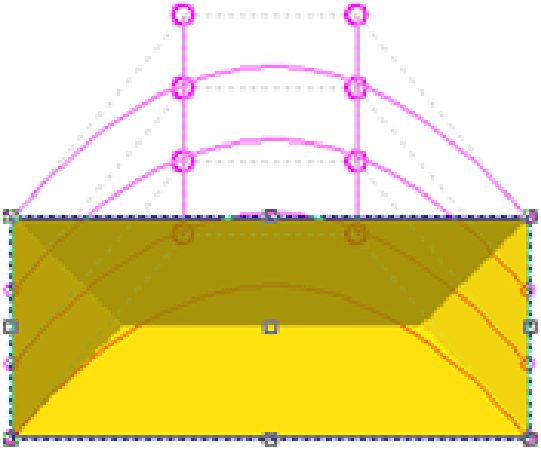
Patch Distort

Distort selected objects using a grid of control points by moving the control points together or separately.

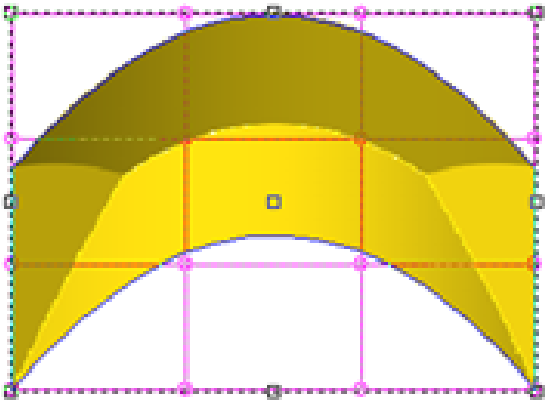
1. Select a contour or relief and activate the patch distort command
2. A grid will appear over the object.



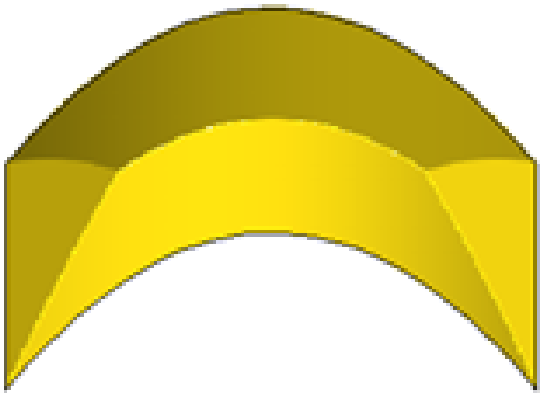
3. Click one or more selection points and drag to a new location



4. Click **Enter** to apply the change



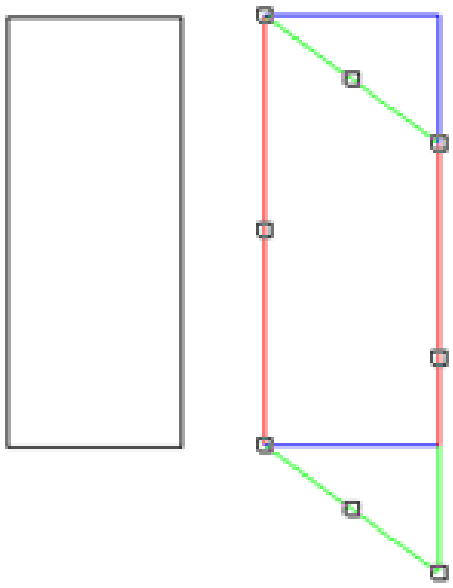
5. Right click to exit the tool



Taper Distort

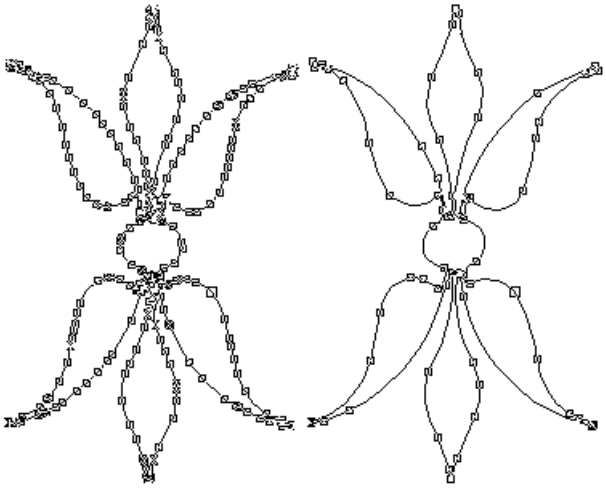
Distort an object by dragging the edges.

1. Select a contour
2. Activate the **Taper Distort** command
3. Click on a selection handle and drag to the desired position
4. Press Enter to accept the change
5. Right click to exit the tool



Clean Up Contours

Automatically simplify contours by reducing the segment count while maintaining the geometry shape. Reducing segment count simplifies toolpath generation and reduces the chance for toolpath errors.



1. Select the contour to cleanup
2. Activate the **Cleanup** command
3. Set the tolerance for the smallest features to keep

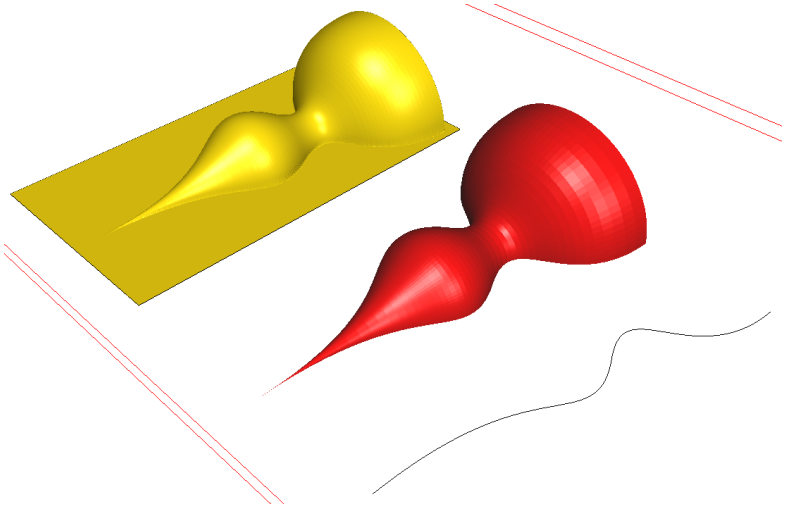
> Higher tolerances will clean up the contour more, but will also change the appearance of the contour more

4. Click **OK**

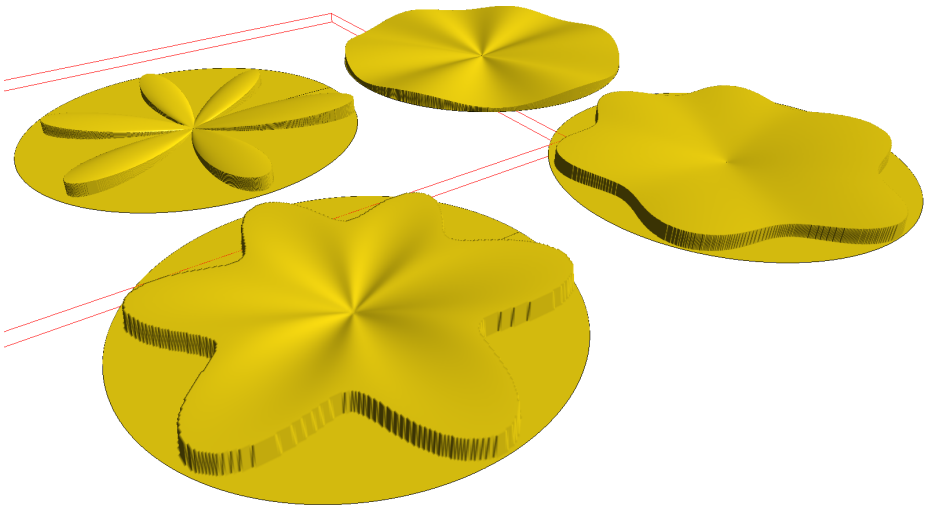
Relief Tools

Reliefs are the basis of all 3D designs within EnRoute. EnRoute provides several tools to create relief surfaces and mesh objects.

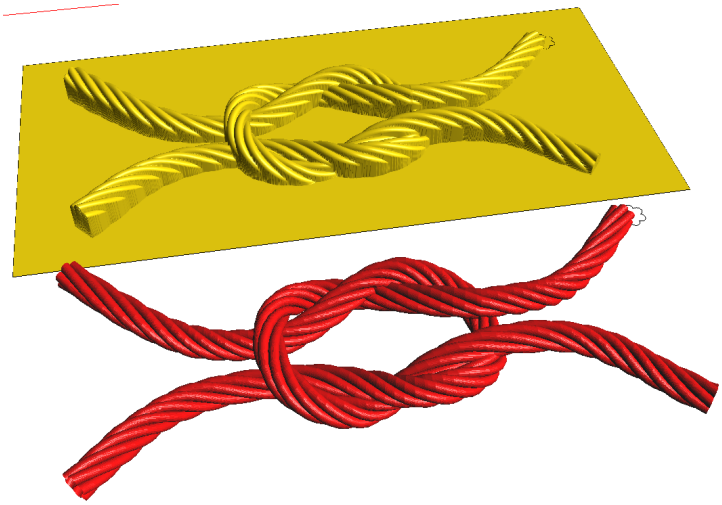
Revolve



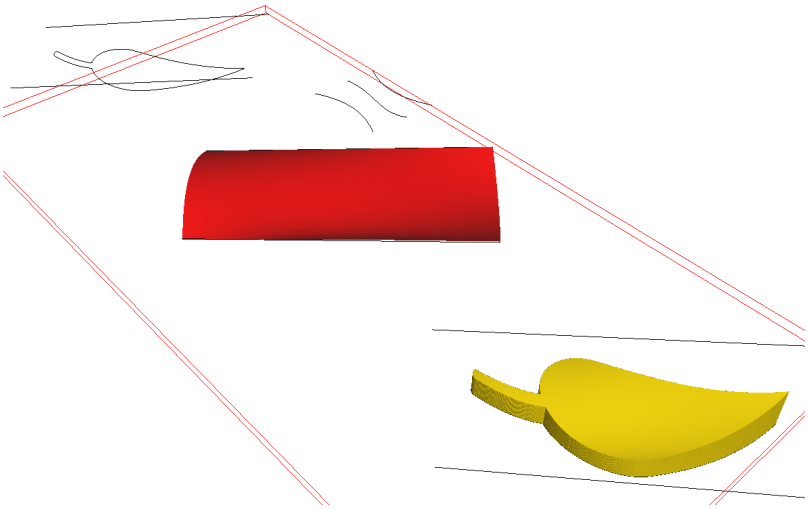
Spin



Extrude



Sweep Two Rails



Relief Dialogue

Many surface creation tools use a common dialogue window to define the relief.

Application Method

Define the relief creation mode and how it will interact with existing reliefs.

Relief Options

Define how the height of the relief will be determined.

Relief Parameters

Additional parameters for adjusting the final height and shape of the relief.

Relief Shape

Specify the relief shape.

Mesh Parameters

Mesh objects are constructed of triangles, or facets, that make up the surface. The number of facets to create the mesh object with must be specified by defining the **Stacks** and **Slices**.

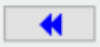
Stacks	Number of sections along the revolution axis that the mesh surface is divided into
Slices	Number if sections between the start and end angle per **Stack**

Stacks - The number of sections along the revolution axis that the mesh surface is divided into

Slices - The number of sections between the start and end angle per **Stack**.

Wizard Prompts

When the command is activated, the wizard will provide prompts for each step to complete. The wizard also provides buttons to complete steps or cancel the tool.

	**Start**	Return to Start
	**Back**	Go back one step
	**Next**	Go to the next step
	**Execute**	Execute the function
	**Cancel**	Cancel the function

Application Method

Define how the tool will modify the relief surface.

Add

Create a raised relief. To modify an existing relief, select the base contour along with the modifying contours.

The image shows an elliptical base relief with text relief applied using the add option.

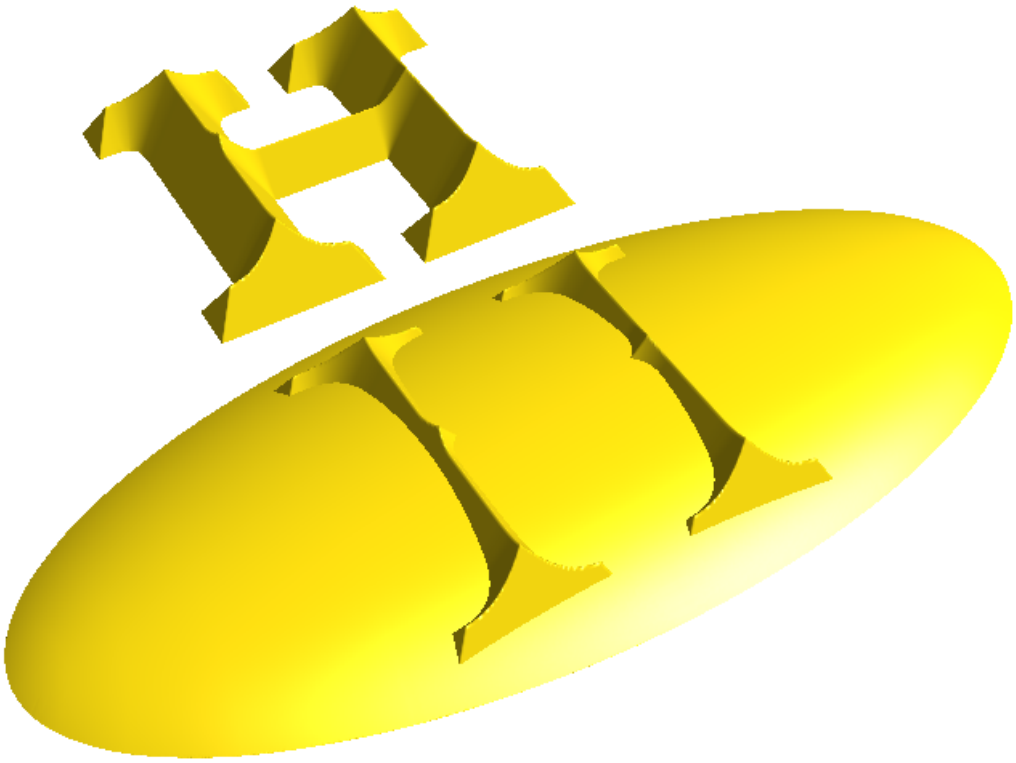
Subtract

Create a recessed relief. To modify an existing relief, select the base contour along with the modifying contours.

The image above shows the text contours used to modify the base elliptical relief, and the resulting relief when combined.

Merge Highest

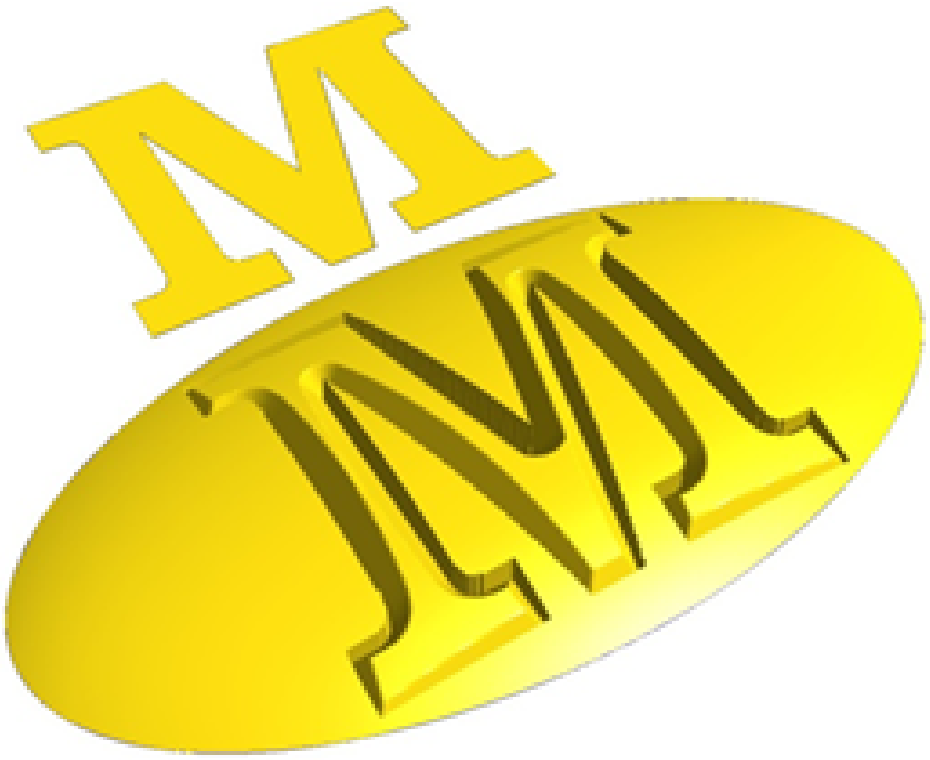
The **Merge Highest** application method is most effective when modifying existing contours. When applied to a new relief, the resulting relief will be the same as the **Add** application method. When used to modify a relief, the existing relief is only modified where the modifying relief is higher than the existing relief.



The letter on top shows a new relief created by the **Merge Highest** application method. The bottom relief shows the resulting relief when the same contour is used to modify an elliptical base relief.

Merge Lowest

The merge lowest option modifies an existing relief by merging the relief, only where the new relief is lower than the existing relief.



The top relief in the image above shows a new relief created with the merge lowest option. A flat surface is the lowest surface over the entire area, so the resulting relief is flat. The bottom relief is the result of using the top contour to modify an elliptical relief. Only the sections where the new relief surface is below the elliptical relief surface have been merged.

Replace

When used to modify an existing relief, the applied profile takes the place of the existing relief wherever they overlap. When used to create a new relief, the result is the same as the **Add** application method.

The top relief in the image is a new relief created with the **Replace** application method. The bottom relief shows the resulting relief when the same contour is used to modify an elliptical relief.

Mesh

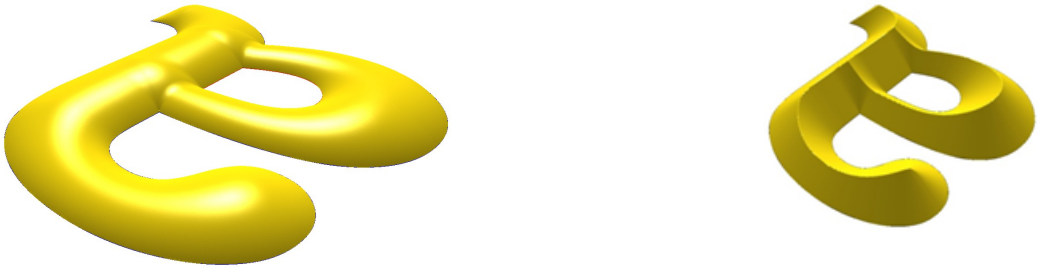
Some relief tools provide the option to create a mesh object instead of a relief surface. The mesh option will appear as the right most application method and activate a set of mesh definition parameters to define the mesh facet size.

Relief Options

Modify how relief shapes are created.

Normal

The default option. The height of the relief is defined by the width of the base contour and the specified relief angle. As the contour surface becomes wider, the height of the created relief increases. Similarly, as the contour surface narrows, the height of the relief decreases.

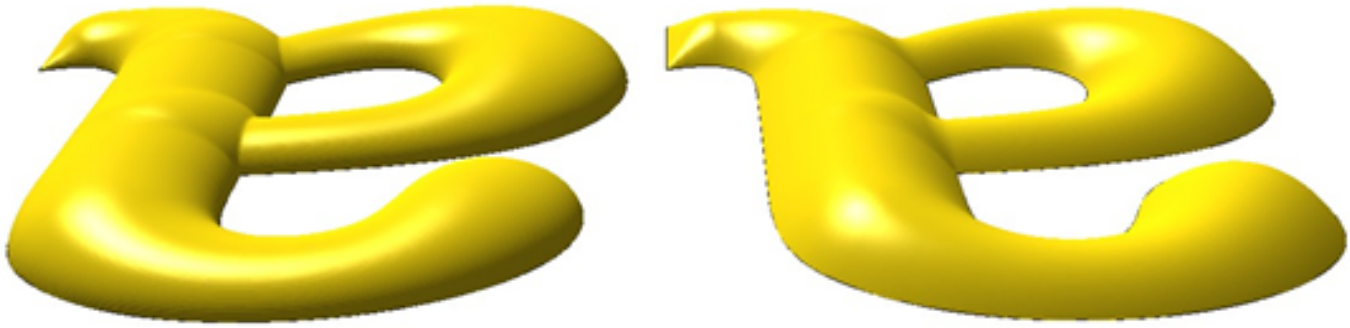


Constant Height

Create a relief that has a constant specified height. The resulting relief has cleaner lines, most notably where relief parts merge together.

Scale to Height

Create a relief with the features of a Normal relief, and then scale it to a specified height. The tool can be used to subtly alter the relief shape by changing the relief angle. Increasing the angle will create a relief that looks more inflated, while decreasing the angel will create a flatter relief. In the images below the height of each relief is the same, but the left relief was created with a relief angle of 85 degrees, and the right relief used an angle of 15 degrees.



Limit to Height

Create a normal relief and cut off any relief surface above a specified height. Useful for creating reliefs that have a rounded or beveled base with a flat top.

Relief Parameters

Height

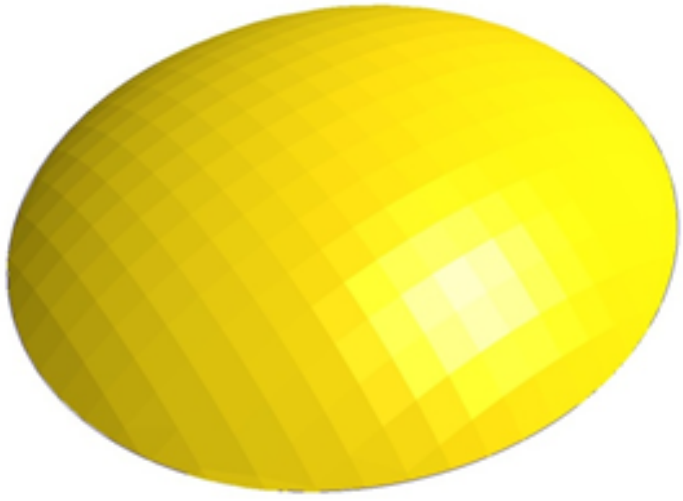
Define the height of created relief. This option is active for **Constant Height**, **Scale to Height**, and **Limit to Height** relief options, and is automatically disabled when not applicable.

When the Normal option is selected, the relief height is defined by the angle parameter and height is not needed.

Resolution

Define the resolution of a new relief in dots per inch (dpi).

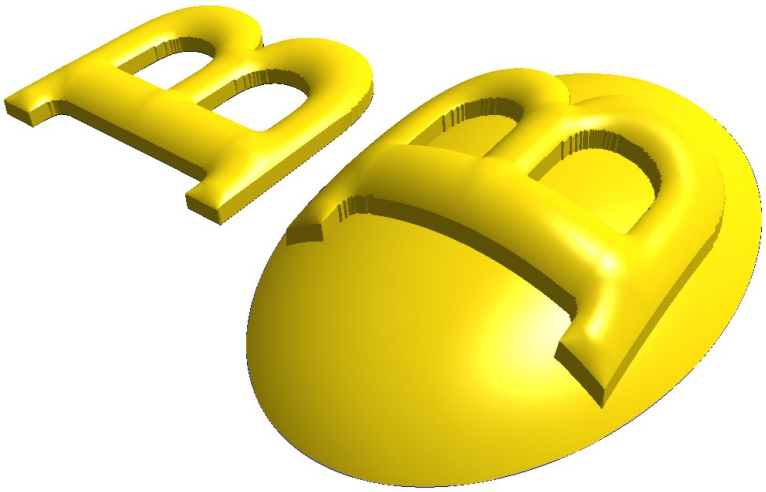
Resolution units are in dots per inch regardless of the drawing units. If EnRoute is configured to use millimeters, this parameter is still defined in dots per inch



Relief size and resolution is directly related to the amount of memory required. A relief with a resolution of 200 dpi will require 4x as much memory as the same relief with a resolution of 100 dpi. To maximize performance, a relief should be defined with the lowest resolution to accommodate the level of detail.

Base

Define a vertical offset to raise the relief surface.



The image shows two applications of the same relief with a base dimension. The top relief was created with vertical sides with the height of the base dimension. The bottom relief shows an elliptical relief modified with the same relief with a base dimension.

Angle

Define **Round** and **Beveled** reliefs when the **Normal** relief option is selected. For beveled reliefs, the angle defines the angle of the bevel. For rounded reliefs, the angle defines the angle of a line tangent to the round surface. An angle of 90 degrees will create a relief with a semi circular cross section.

In the image above, reliefs to the left were created with small angles, and the reliefs to the right were created with larger angles.

Relief Shape

There are 3 basic shapes to create reliefs with.

Round

Create a rounded surface using the selected contour as the boundaries.

Beveled

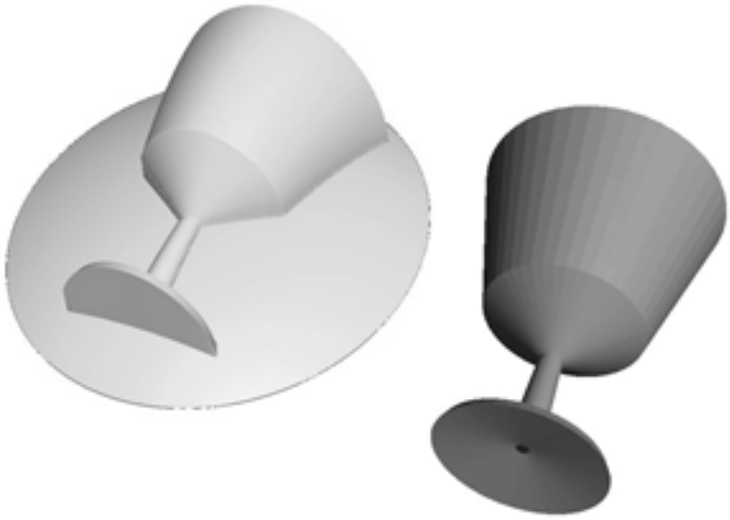
Create a relief with beveled edges that meet in the center of the base contour.

Flat

Create a flat relief following the contour outline.

Revolve

Use one or more contours to revolve around an axis to either modify a relief, or to create a new mesh object.



In the image above, the left object is a relief modified by revolving a contour and the right object is a mesh created by revolving the same contour.

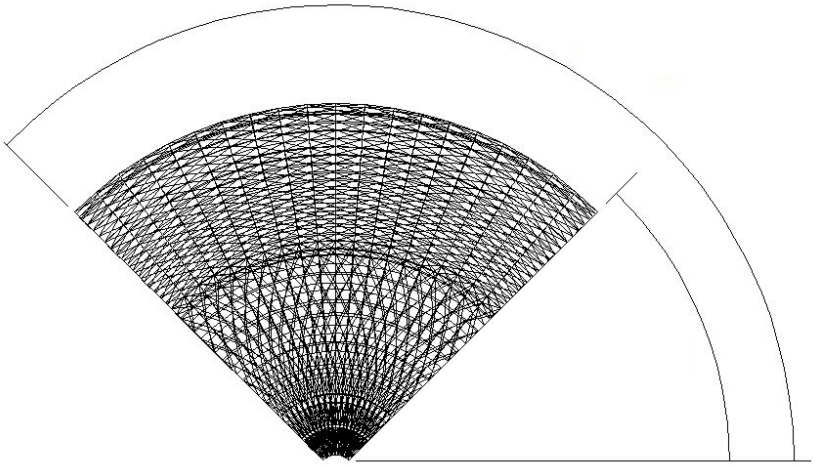
Parameters

When the **Revolve** command is activated, the Relief Dialogue will activate with additional parameters to define the revolve action.

Revolution Angles

Define the **Start Angle** and **End Angle** for the resulting relief or mesh. A complete revolution is 360 degrees and would have a **Start Angle** of 0 and an **End Angle** of 360.

A half revolution would use a **Start Angle** of 0 and an **End Angle** of 180.



The image shows a mesh object created with a **Start Angle** of 45 degrees and an **End Angle** of 135 degrees.

Spin

Create a relief surface or mesh by spinning a contour around a selected axis.

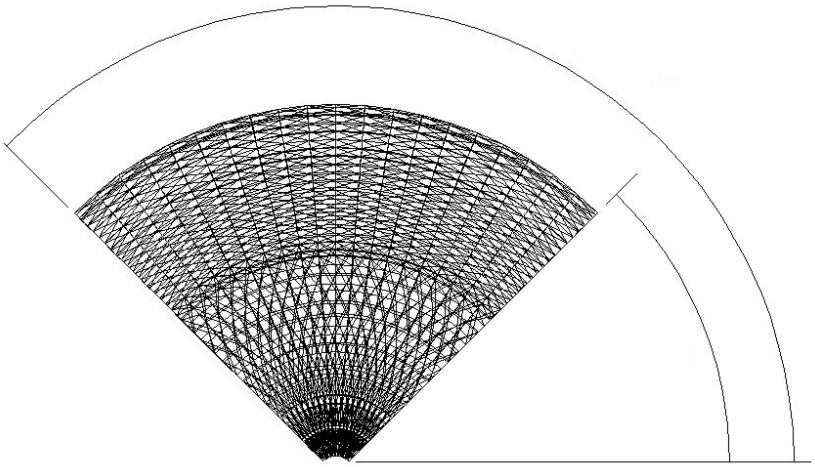
Parameters

When the spin command is activated, the Relief Dialogue will activate with additional spin parameters.

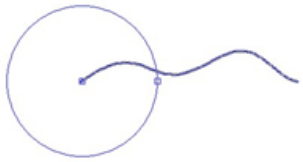
Spin Angles

Define the **Start Angle** and **End Angle** for the resulting relief or mesh. A complete revolution is 360 degrees and would have a **Start Angle** of 0 and an **End Angle** of 360.

A half revolution would use a **Start Angle** of 0 and an **End Angle** of 180.



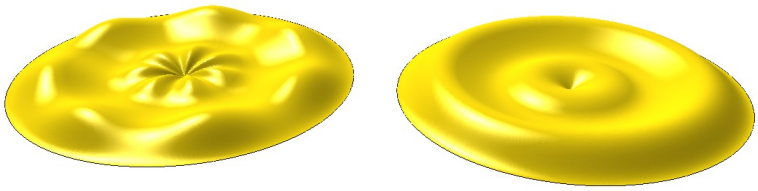
The image shows a mesh object created with a **Start Angle** of 45 degrees and an **End Angle** of 135 degrees.



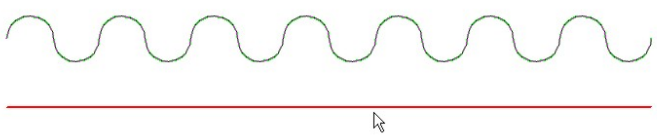
The **Start Angle** and **End Angle** can also be changed interactively by clicking and dragging the circle used to define the center of the spin as shown in the above image.

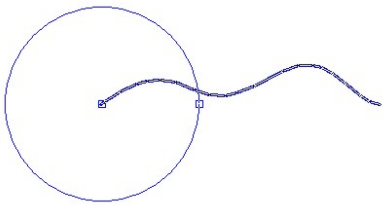
Height Control Curve

Define a contour used to vary the height of the relief as it is spun. This is an optional step in the spin wizard that allows for more complex surfaces to be created. The relief on the left was created with a **Height Control Curve**. The relief on the right was created using the same profile without the **Height Control Curve**.



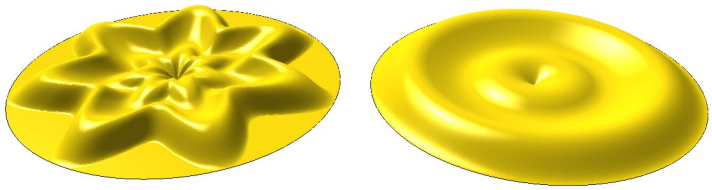
Below are the contours used to create the surface above. The **Height Control Curve** is the top curve in green. The straight line shown below it is the influence line, which is automatically drawn after the **Height Control Curve** is selected. Click and drag the influence line to control how much influence the **Height Control Curve** will have on the spun surface. Dragging the influence line away from the **Height Control Curve** will decrease the effect it has on the spun surface.





Width Control Curve

The optional **Width Control Curve** modifies the spun surface the same way as the **Height Control Curve**, except it modifies the width of the spun surface instead of the height. The relief on the left was created using a Width Control Curve and the relief on the right was created without it.



The optional Height and Width control curves can be used separately or together to create surfaces. The surfaces pictured below were all created with the same profile, but with different options applied.

Both Height and Width Control

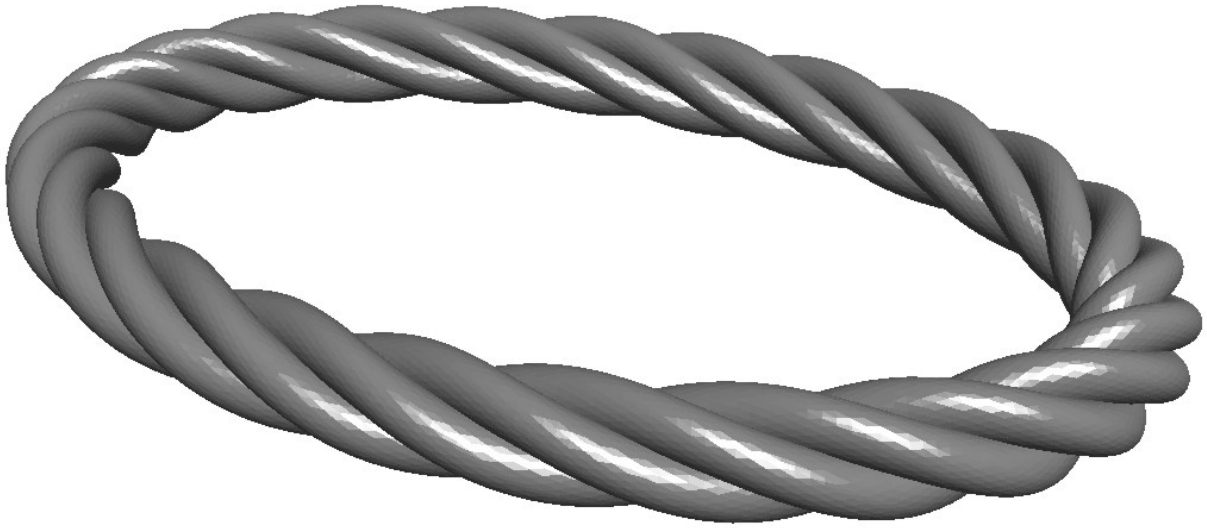
Only Width Control

Only Height Control

Only the Profile

Extrude

Extrude one or more profiles along a path to create a mesh or modify a relief. The extrude tool also allows the size of the profiles to change as they are extruded, and the ability to rotate the profiles while extruding.



Parameters

When the **Extrude** command is activated, the Relief Dialogue will activate with additional extrude parameters.

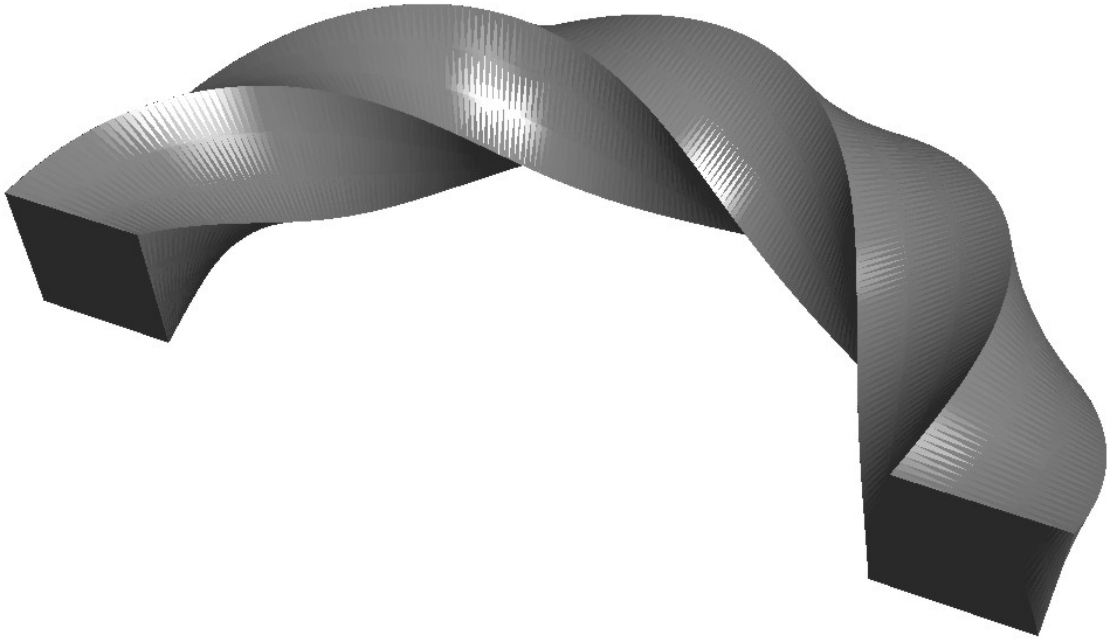
Scale and Rotate

Scale defines the proportion the profile size is to be changed by along the length of the contour. A **Scale** factor of 1.0 will apply no scaling and the profile will be constant along the contour. A **Scale** factor of 0.5 will reduce the cross section by half from the start to the end of the contour.

The image below shows a mesh created by extruding a circular cross section along an arc with a **Scale** factor of 0.25

The **Rotations** parameter defines the number of times the profile will be rotated along the extrusion contour. A value of 1.0 will cause the profile to be rotated 360 degrees over the length of the extrusion.

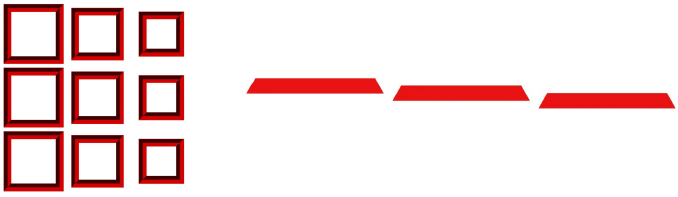
The image below shows a mesh created by rotating a square cross section one time along the extrusion length.



Profile Placement

The profile placement buttons position the extruded profile relative to the path. Each button indicates where the profile will be located as it is extruded.

The images below show examples of meshes created with the same profile and path, but using each of the profile placement button.

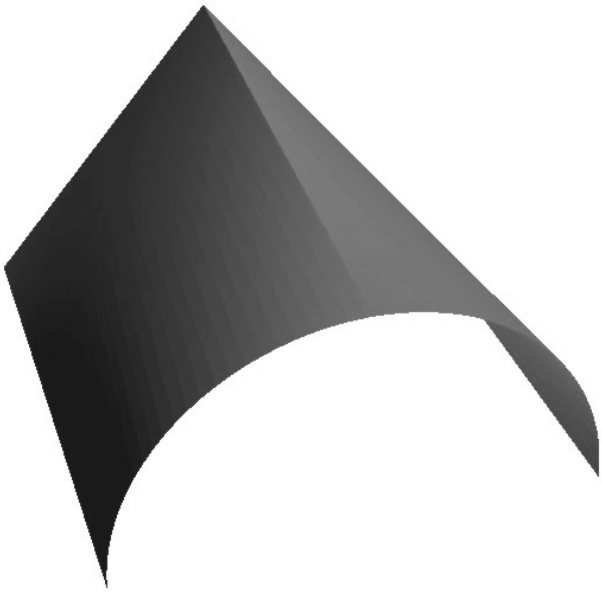


Top View Right View

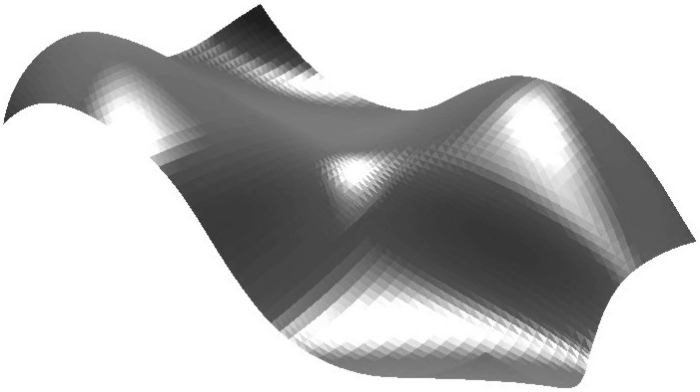
Sweep Two Rails

Use profile contours to either modify an existing relief or create a new mesh surface. Two open contours are specified as rails for the left and right edges of section contours to follow as they are used to create an extruded surface.

The image below demonstrates a surface created by sweeping a semi-circle and an angled contour along two straight rails.



This image demonstrates a more complex surface created by using curved rails and curved cross sections.



Activating the **Sweep Two Rails** command will open the sweep two rails dialogue. The provided parameters will change depending on whether creating a mesh, or using a relief modification application method.Parameters

Parameters

When the **Sweep Two Rails** command is activated the Relief Dialogue will activate and the wizard prompts will guide the creation of a swept surface.

Modifying Reliefs

After creating reliefs, they can be modified through a number of EnRoute tools to create a finished design.

Standard Modification

All of the basic object operations in EnRoute can be applied to relief objects. **Cut**, **Copy** and **Paste** functions can be used to duplicate or move relief objects to different locations within the workspace. Reliefs can be removed from the work-space by using the **Delete** function.

Cut, **Copy**, and **Paste** functions can all be accessed through the **Edit** menu, or through their keyboard shortcut. **Delete** is also available in the **Edit** menu, or by pressing the **Delete** key.

Function	Shortcut
Cut	ctrl + X
Copy	ctrl + C
Paste	ctrl + V

Clear Relief

Clearing a relief deletes the relief surface, but retains the perimeter contour that defined the relief. This tool is used most frequently to delete a relief so that it can be recreated with different parameters.

To clear a relief, select the relief object, and then activate the **Clear Relief** command.

Rotate and Move Relief

Reliefs can be moved and rotated like any other object in EnRoute using the **Move** or **Rotate** functions.

Move

Rotate

Merge Reliefs

Merge one or more reliefs with a base relief and preserve the copies of the merged reliefs.

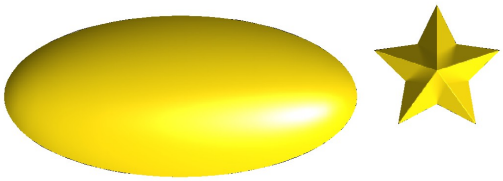
Dialogue

When the Merge Relief command is activated a dialogue window will appear with a standard set of parameters for the application method and wizard prompts.

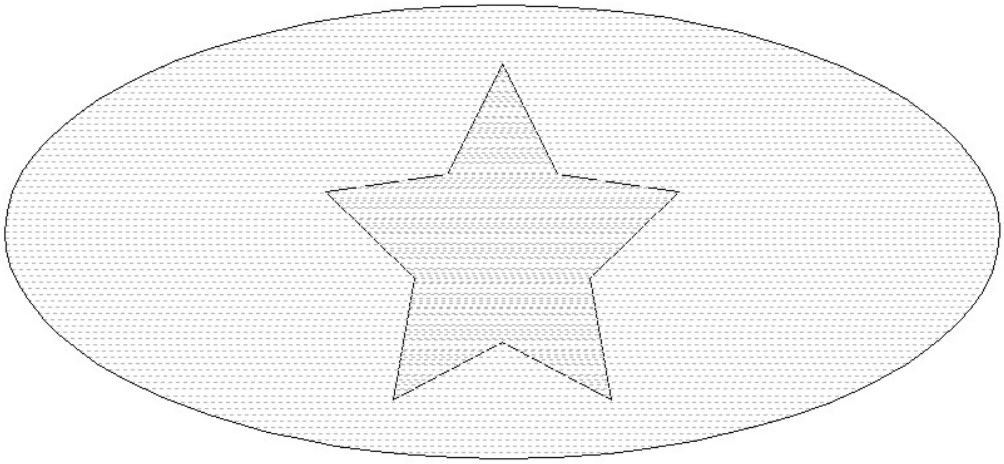
Common Tool Parameters

Below is an example of a star relief merged into an elliptical base relief.

1. Create Reliefs

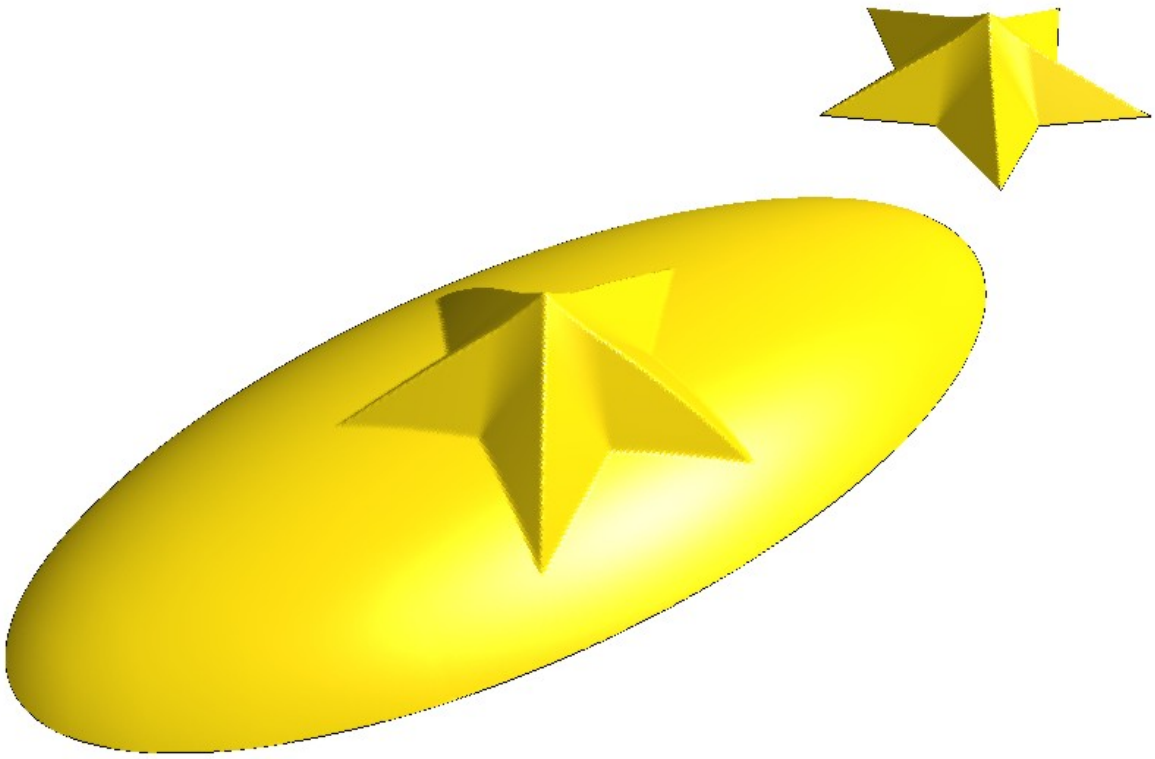


2. Position reliefs for merging



3. Activate the **Merge Reliefs** command
4. Select the base relief to modify and advance the wizard step
5. Select all reliefs to be merged into the base relief
6. Select the **Application Method** for merging the reliefs, this example uses **Add to Relief**

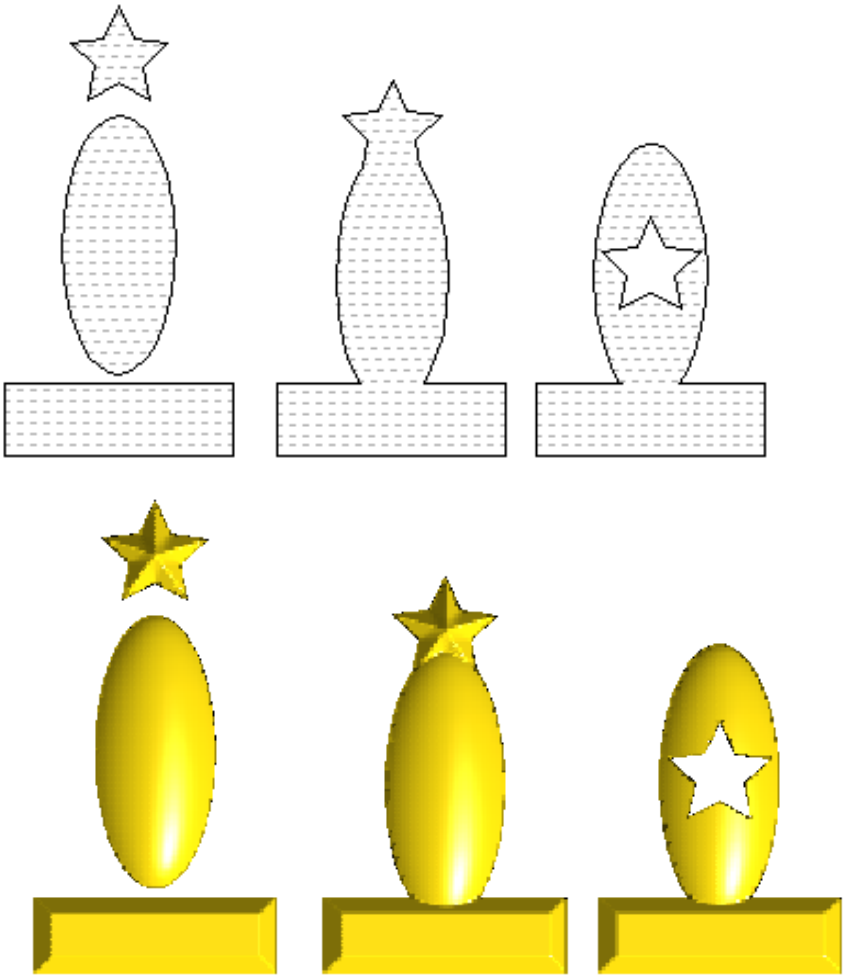
7. Execute **Merge Reliefs** through the wizard command



Combine Reliefs

Combine multiple reliefs into a single surface.

If the reliefs overlap, they will be combined into a single surface. If one relief is entirely enclosed within another, it will create a hole in the relief.



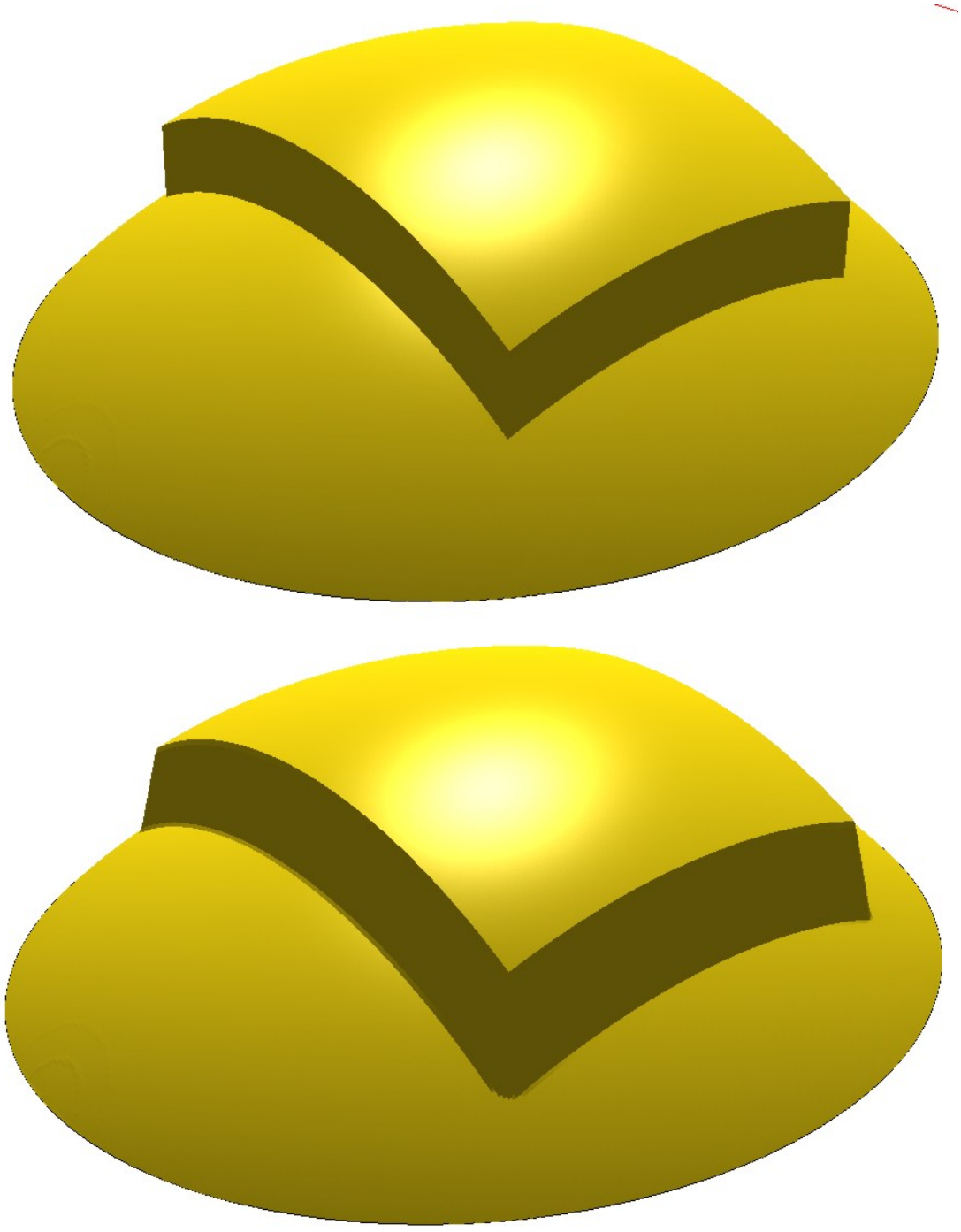
Invert Relief

Invert the relief surface relative to the perimeter contour.

Apply Draft Angle

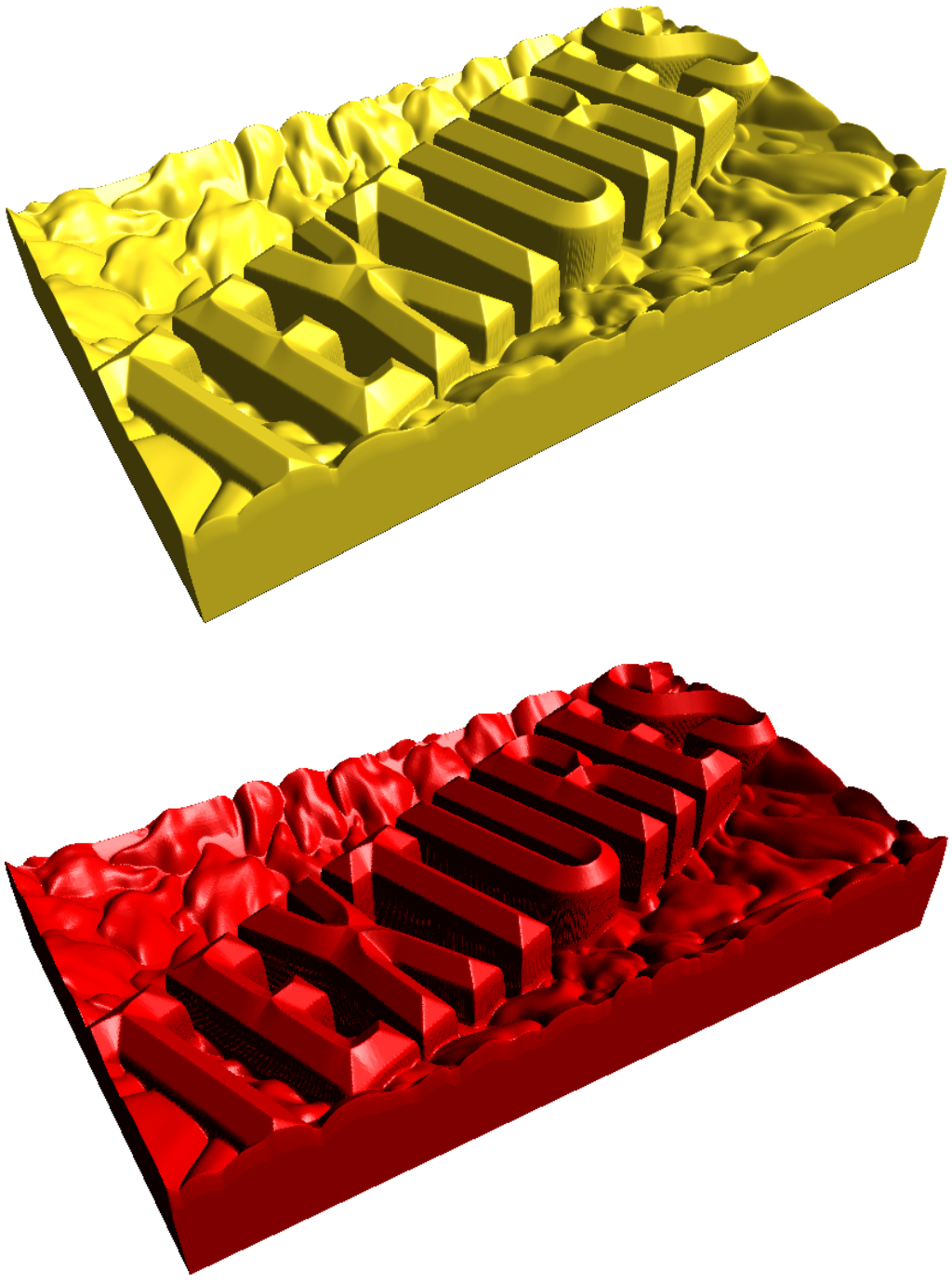
Apply a draft angle to vertical relief surfaces. Parameters for **Draft Angle** and **Height Threshold** define how draft angles are created. **Height Threshold** refers to the starting height of the draft angle.

Below is an example of a relief surface before and after a draft angle is applied to the vertical surfaces.

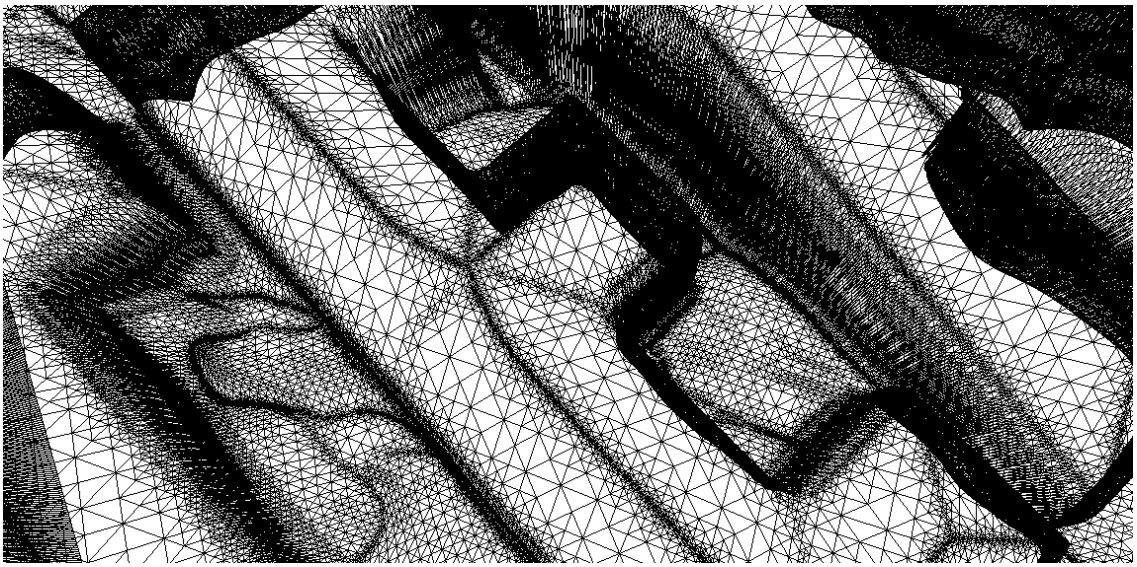


Create Mesh from Relief

Create a mesh from an existing relief surface. A **Mesh Tolerance** parameter defines the minimum dimension to be captured by the mesh. The mesh is created in the same position as the original relief.



On the left is a relief created in EnRoute and on the right is the mesh created from the relief.



The mesh facet size is varied depending on the size of detail in the relief.

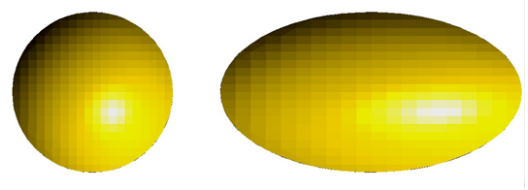
Offset Relief Surface

Modify a relief surface by applying an offset to the existing surface by an **Offset Amount**. Below is an example of a relief surface before and after an offset was applied.

Scaling Reliefs

Reliefs can be scaled similar to other EnRoute objects by clicking and dragging one of the corner selection boxes or by using the **Scale** tool.

When scaling reliefs it is important to consider that the relief resolution is also scaled. If a relief is created with a resolution of 100 dpi and then scaled to be ten times larger, the relief now has a resolution of 10 dpi. The image below illustrates this concept. On the left is the original relief and on the right is the scaled relief which has decreased resolution along the scaled axis.



Fit Relief to Plate

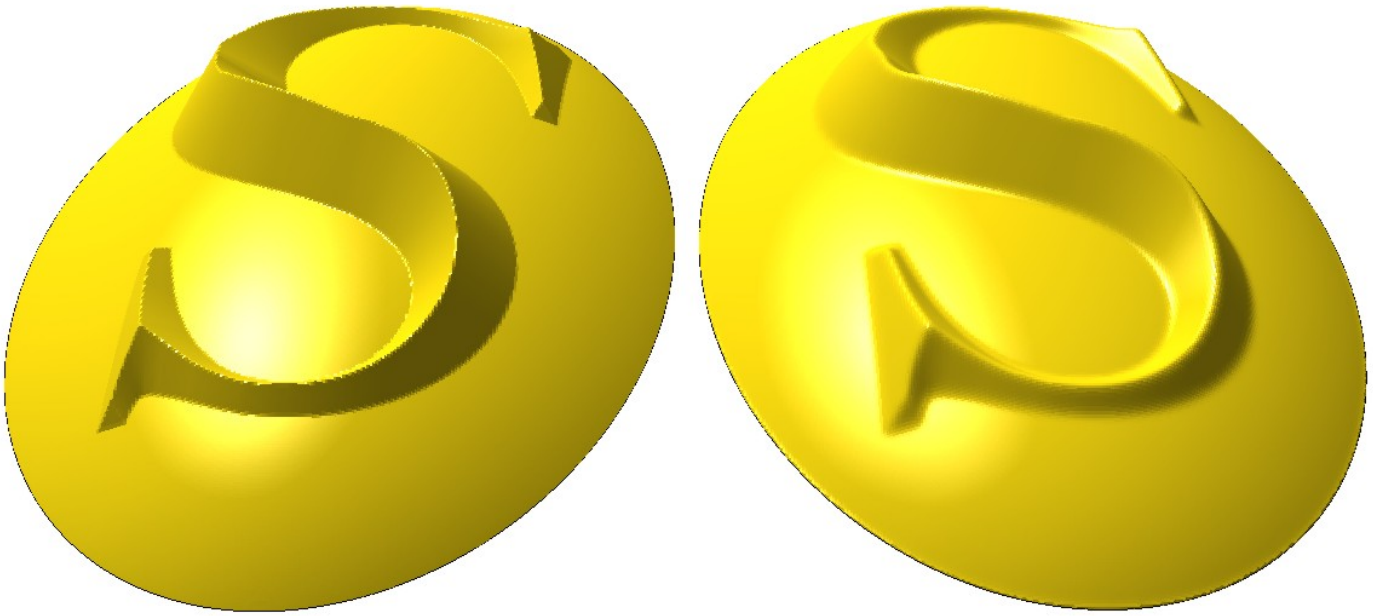
Automatically scale the relief in the Z dimension of the plate definition.

Smooth Reliefs

Apply a smoothing effect to a relief to reduce sharp edges. Inputs for **Smoothing Radius** and **Smoothing Power** adjust how much the selected relief is smoothed.

Smooth Relief can be applied multiple times to increase the smoothing effect.

Below is an example of a relief before and after smoothing.



Extract Relief Slices

Cut a relief into horizontal slices, allowing material to be stacked to create larger objects. If a final design height is 4 inches, the design relief can be cut into 3 horizontal slices so it can be cut from 1.5 inch material and assembled into the final design.

Most slices will have large flat areas that correspond to the top of the material and do not need to be machined. The **Extract Slices** tool can generate masking contours to exclude the flat top when generating toolpaths.

Extract Slice Parameters

Slice Thickness	Thickness of each slice, typically the thickness of material
Slice Count	Number of slices to create
Slice Bottom	Location of the bottom of the first slice. Most commonly the bottom of a relief, but it can be increased slightly to remove a flat relief background
Produce Mask	Generate masking contours for toolpath creation
Mask Offset	Offset masking contours from the slice edge. Provides room for the toolpaths to over cut the slice
Separate Layers	Separates slices into separate drawing layers when enabled
Apply	Creates slices with selected parameters
Close	Closes tool without slicing

Vertical Positioning

Vertical positioning of reliefs is very important when generating toolpaths. In addition to the **Move** function, several tools are provided for accurately positioning reliefs in the Z axis. The table below describes each of the vertical relief positioning tools.

Aligns each of the selected reliefs to the **Bottom** of the plate

Aligns selected reliefs to the **Bottom** of the plate without changing the relative position of the reliefs within the selection

Aligns each of the selected reliefs to the **Top** of the plate

Aligns selected reliefs to the **Top** of the plate without changing the relative position of the reliefs within the selection

Aligns each of the selected reliefs to the **Middle** of the plate

Aligns selected reliefs to the **Middle** of the plate without changing the relative position of the reliefs within the selection

Aligns contours for selected reliefs to the top of the plate. This is the default location.

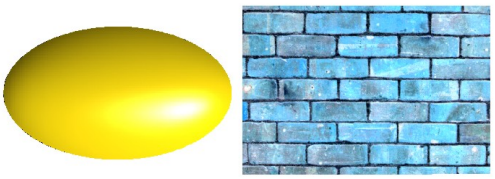
Using Bitmaps

Bitmaps can be used to modify relief surfaces. EnRoute utilizes the gray scale shading of a bitmap to modify the height of a relief. Bitmaps can be an efficient way to apply texture to a design.

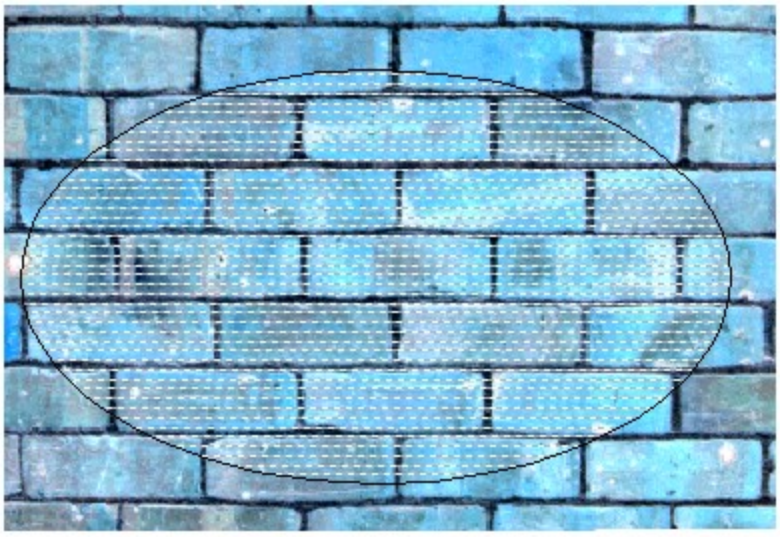
Apply Bitmap to Relief

Modify a relief surface using a bitmap by using the bitmap gray scale to vary the relief height. The Height parameter controls the maximum height of the applied bitmap, and the Application Method is the same as the Common Tool Parameters.

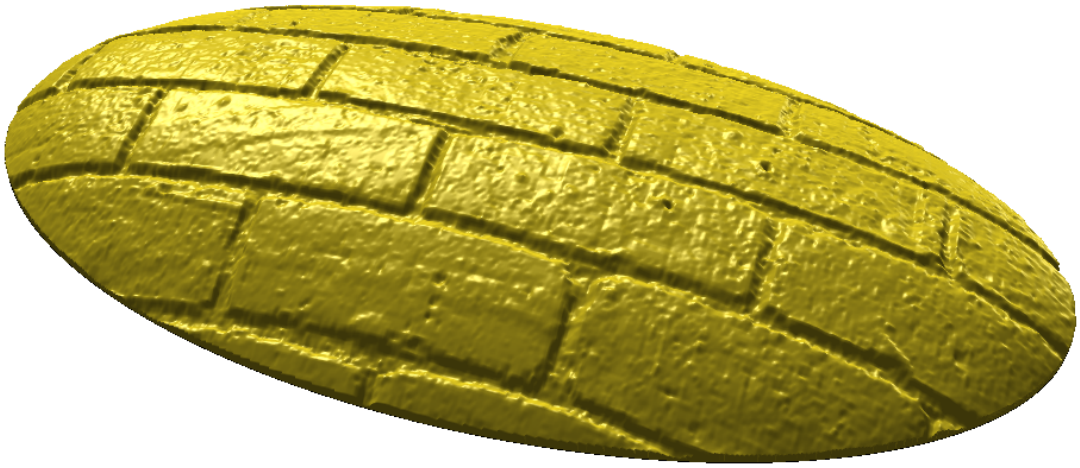
1. Import the bitmap into the workspace containing the relief surface



2. Position the bitmap on top of the relief



3. Activate the **Apply Bitmap** command
4. Set the Height and Application Method parameters in the dialogue window
5. Click Apply to create the final relief



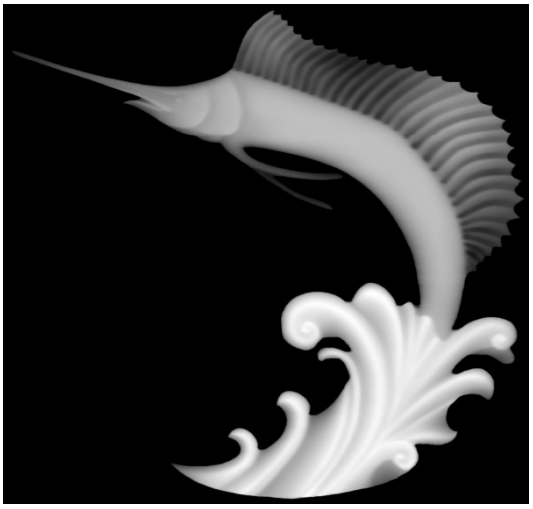
Using a Mask

Any contour that is not part of the relief boundary will act as a mask when applying a bitmap to a relief surface. Before activating the Apply Bitmap command, select the relief, bitmap, and masking contours to automatically incorporate a mask. The masking contour will limit the application of the bitmap to within the masking contours.

3D Bitmap Effects

Realistic 3D effects can be created using bitmaps, if the bitmaps are made for the purpose of importing into EnRoute. The gray scale values of the bitmap are used to add to the relief surface up to the specified **Height** parameter with white colors applying the full **Height** value, black colors applying zero height, and shades of gray applying intermediate heights.

Below is an example of a gray scale drawing created for the purpose of modifying a relief.



When applied to a relief, notice that the white areas of the waves create the tallest sections of the relief, and the black background has no effect.

The same effect can be applied to a photograph. It is important to note that the gray scale information in a photo may not communicate realistic 3D dimensions and not all photos will yield the desired effect when applied to a relief. Below is an example of a relief surface created from a photo.

Textures

EnRoute contains a variety of texture tools to quickly and easily apply unique texture to reliefs.

Parametric Textures

- Continuous three dimensional textures that can be scaled to fit any size relief
- Customizable and shareable to other instances of EnRoute
- Multiple textures can be layered for unique effects
- Automatically match the relief resolution

Symmetric Textures

- Continuous three dimensional textures similar to parametric textures
- Symmetric textures are optimized to by symmetrical across a defined panel size

Rapid Texture

- Utilizes the size and shape of the cutting tool as a design parameter
- Generates textures that can be quickly machined

Rapid Picture

- A specialty use of Rapid Texture that uses an image to control texture dimensions

Parametric Textures

Built in textures that can be applied to any relief.

Texture Dialogue

After activating one of the Parametric Texture tools a dialogue window will appear.

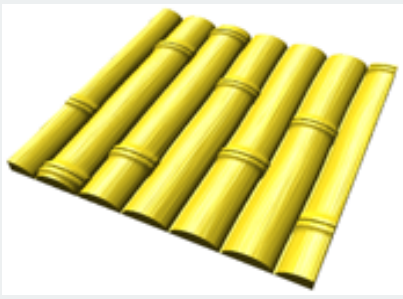
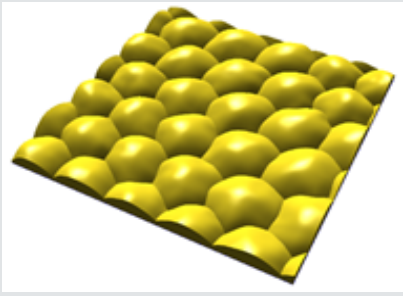
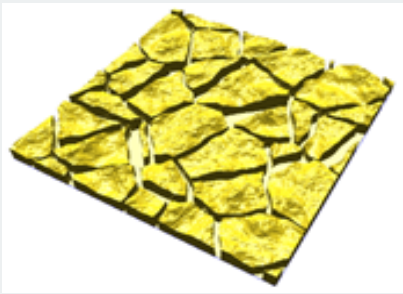
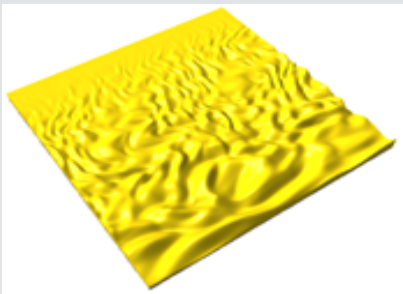
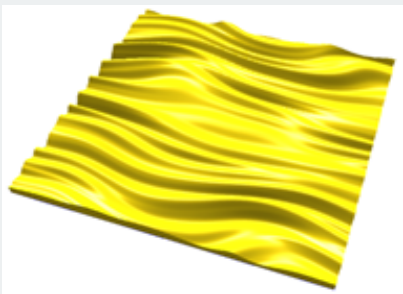
Each texture has an information button  to provide detailed information on texture specific parameters.

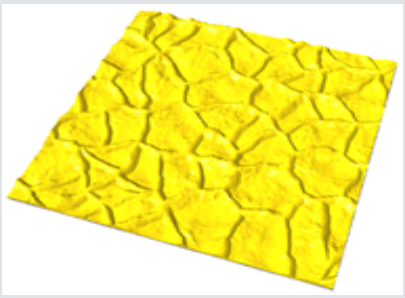
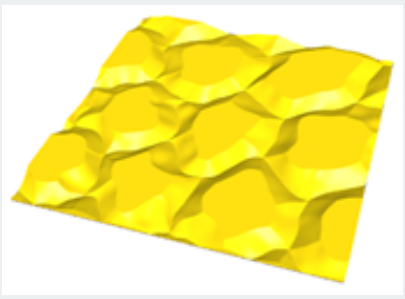
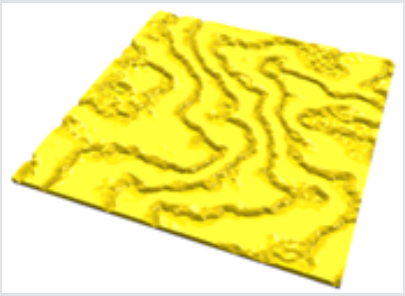
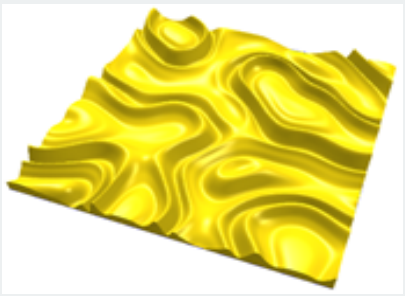
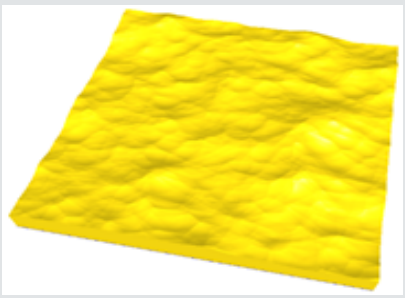
Every texture tool has an **Application Method** and **Height** parameter that works the same way as in the Common Tool Parameters.

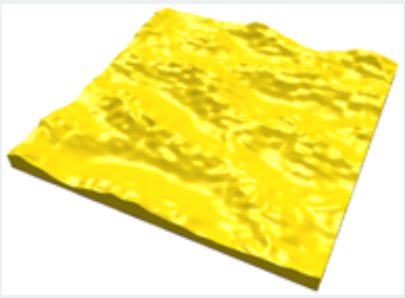
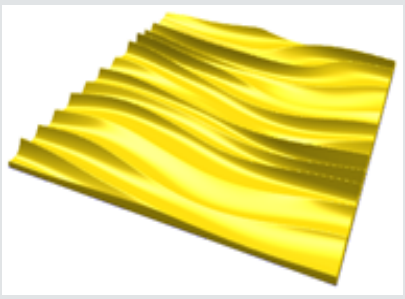
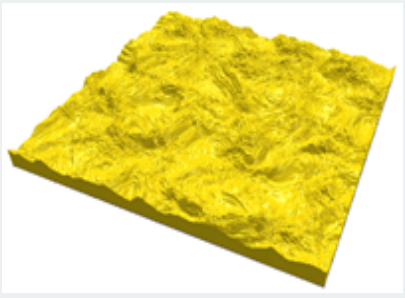
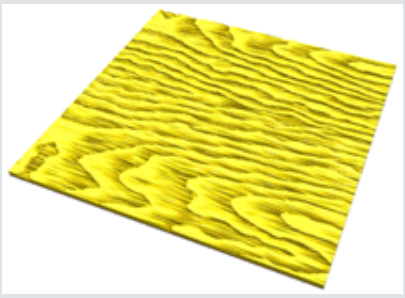
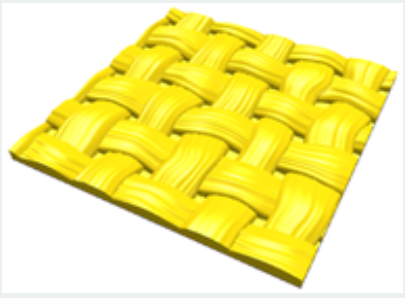
Templates

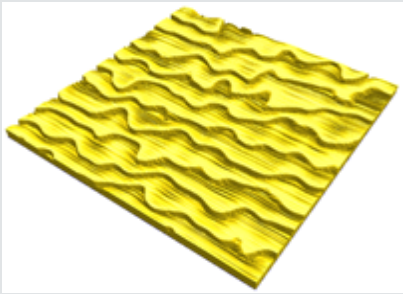
Custom texture parameters can be saved as a template for easy reuse. In the template section of the dialogue window, click the save button and enter a Name into the message box to save the current parameters to a template. Templates can then be loaded from the same texture tool to reload the same parameters.

Texture Types

Bamboo	
Dots	
Flagstone	
Flame	
Flow	

Hammered	
Hexes	
Marble	
Mudpot	
MultiCell	

MultiFract	
Phase	
Terrain	
Veneer	
Weave	

Wood	

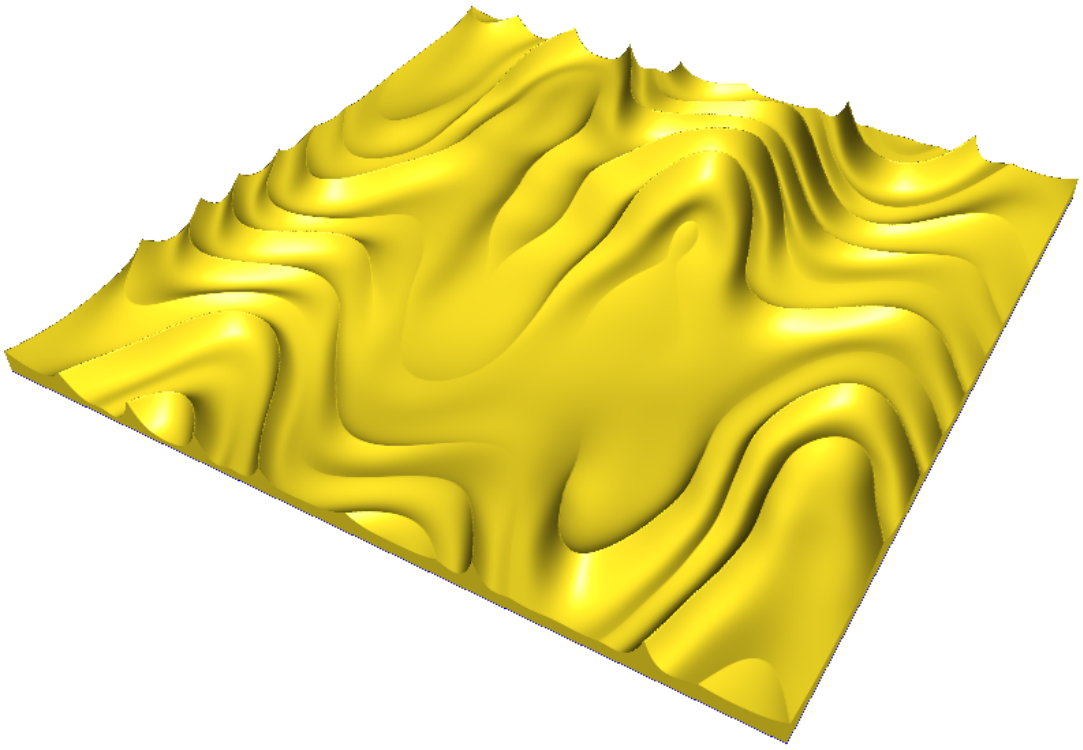
Symmetric Textures

Create textured surfaces that are symmetric within a specified panel. Symmetric textures are defined very similar to Parametric Textures except for the **Density Parameters** and **Panel Definition**.

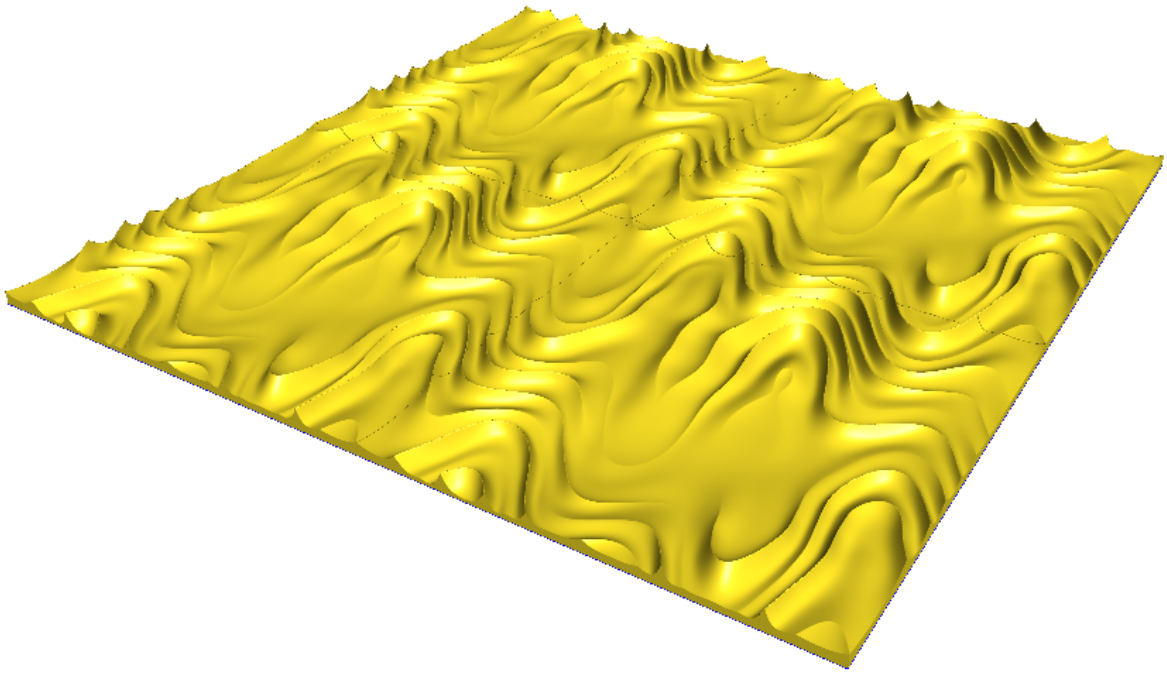
Density Parameters

Each symmetric texture has a set of **Density Parameters** to control how many times the texture is replicated within the panel, defined by the **Panel Definition** parameters. For the **Basic** texture, the density parameters are named **Waves X** and **Waves Y**, and they control the number waves in each dimension.

Below is an example of the Phase 2 texture



Below is the result of applying the same Phase 2 texture with an X density of 2 and a Y density of 2. The resulting piece is symmetric top to bottom and side to side allowing multiple panels to be cut with the same design that can be assembled on a larger scale.



Rapid Texture

Create a textured surface utilizing the cutting tool dimensions as the primary influence on the final shape. The resulting design has several interesting characteristics:

- Number of toolpaths required to cut the final part are greatly reduced, decreasing production time
- No tooling marks to remove, reducing surface preparation post production before a finish is applied
- 3D surfaces can still be incorporated into Rapid Texture designs

Seed Contour

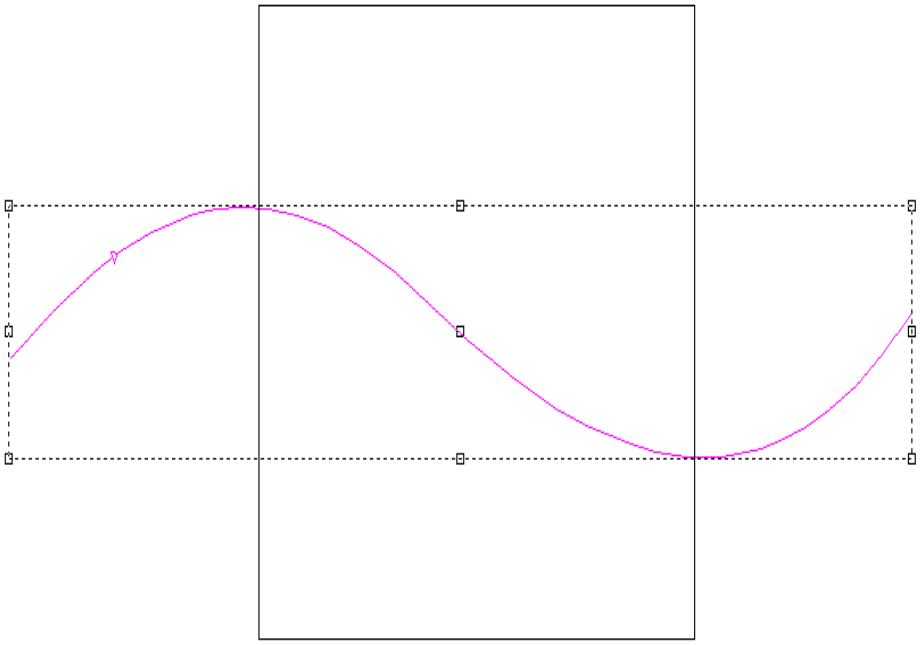
Rapid Texture is generated by creating offset contours and then distorting them. To create the offsets, a seed contour is required as a starting point. One or many seed contours can be used to generate **Rapid Texture**, and the seed contours can be open or closed contours. The seed contour must extend beyond the panel boundary to fully cover the panel.

It is not required to select a seed contour to generate rapid texture. If no seed contour is selected, a horizontal line along the X axis of the panel boundary will be used as an automatic seed contour.

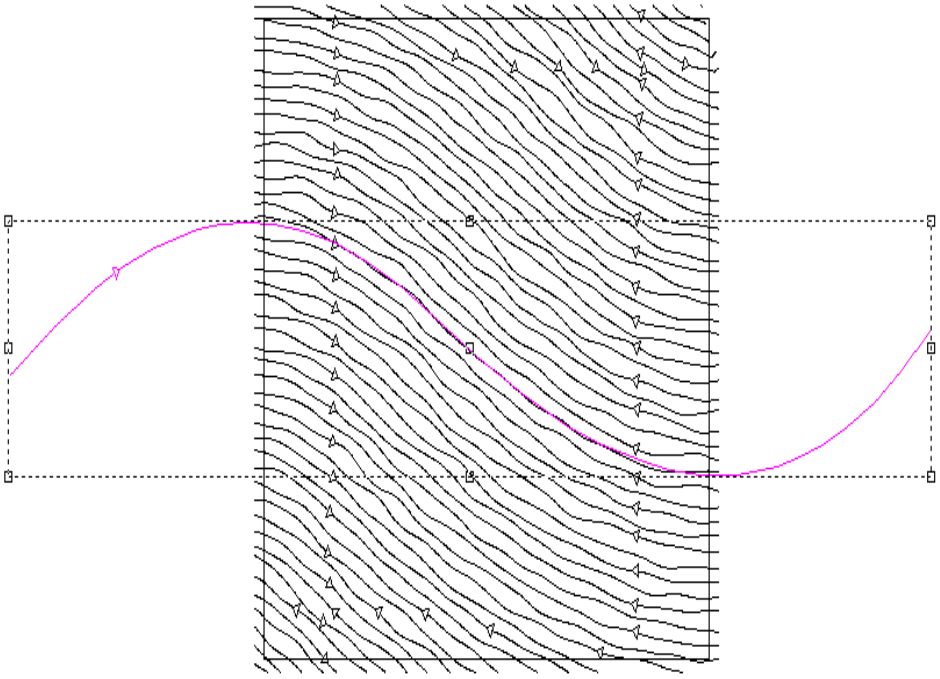
Panel Definition

The panel size can be set through the Panels tab in the Rapid Texture dialogue window. A closed contour can also be used to set the rapid texture boundary.

Below is an example of a typical open Seed Contour and a square closed contour defining the panel boundary.



The resulting rapid texture is pictured below



Rapid Texture Dialogue

After activating the Rapid Texture command, a dialogue window will appear with parameters to define the output.

Panels Tab

Template	Save parameters to a template for future use
Position	Defines the X and Y coordinates lower of the panel lower left corner
Size	Size of the panels to create
Rows	Number of panels in the X axis
Columns	Number of panels in the Y axis
Overlap	The amount the contours will overlap the panel edge. Typically 1/2 the tool width to ensure the texture extends to the edges correctly

Displacement Tab

Wavelength	Define the minimum distance between crests in the texture pattern in all axis
Offset	The offset between each of the offset contours. Tool size is important to consider when setting this parameter
Horizontal Amplitude	Height of the noise curve in the X and Y plane relative to the offset contour
Vertical Amplitude	Height of the noise curve in the Z axis relative to the offset contour
Noise Displacement	Distort the offset contours in a non-uniform pattern.

Wave Displacement	Distort the offset contours using the **Wavelength** and **Amplitude** settings
Randomize	When **Noise Displacement** is enabled, randomize the noise distortion so that no 2 contours match
Symmetric	Generate panels with symmetric edges in the X and Y Axis allowing multiple panels to line up to create a larger texture. Default horizontal **Seed Contour** is recommended. Requires **Noise Displacement** and **Randomize** to be **Enabled**. **Overlap** must be defined for continuity between panels.

Parameters Tab

Fade Left and Fade Right	Define a distance over which the Rapid Texture distortion on the offset contours fade out to each side of the seed contour. Once the fade out is reached, the offset contours will match the seed contour.
Resolution	The resolution of the noise pattern. 25 dpi by default.
Cleanup Tolerance	Define the minimum distance between points that define rapid texture contours. 0.01 inch to 0.001 inch is a standard range and yields smooth results. Larger values will reduce the smoothness of the generated curves.

Rapid Picture

Generate **Rapid Texture** using an image to define contour parameters.

Photo Selection

Color photos yield better results than black and white photos. Black and white images are more uniform and result in more uniform contours. In this example a black and white photo was used and the original image is shown on the left. Several edits were made to the photo to increase the contrast between light and dark areas to improve the **Rapid Picture** results.

Example

1.  Define the plate dimensions. This example uses a 15" x 15" panel of 0.5" thick material
2.  **Import** the image into the workspace
3.  **Scale** the image to the panel size. For this example the photo size is 13" x 13" to allow for a 1" border

4. Move the image to the center of the panel

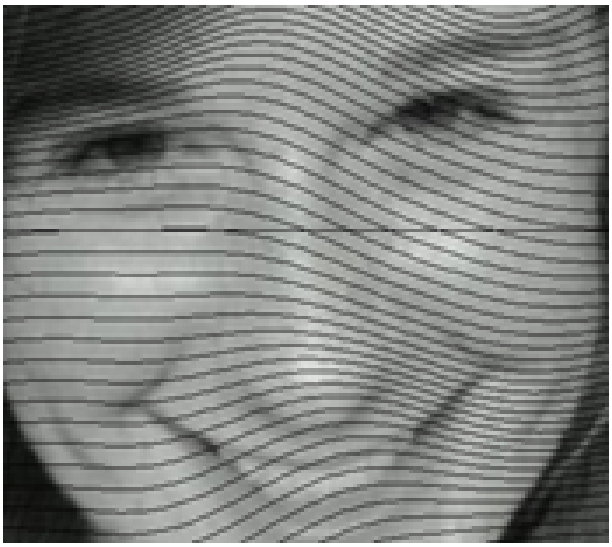
> With image selected the Hold down **Alt** + **Ctrl** and press the **5 Key** on the number pad to automatically snap the selection to the plate center.

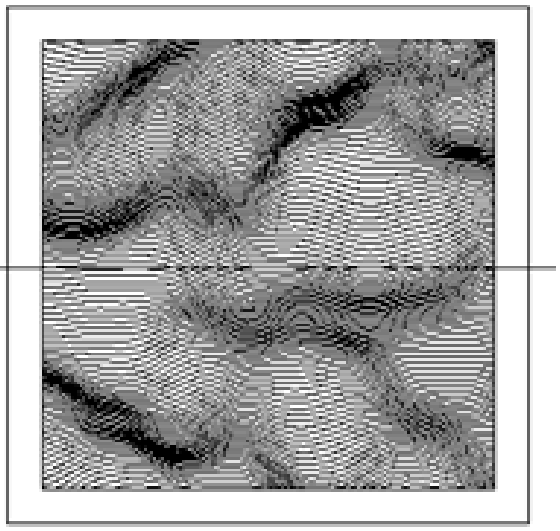
5.  Use the **Rectangle** tool to create a contour at the plate boundary

> Enable **Snap to Grid** to easily create a **Rectangle by Corners** that defines the plate boundaries. Note the default grid size is 1 inch intervals.

6. Draw a **Seed Contour** for Rapid Texture generation

7. Select the **Seed Contour** and activate the **Rapid Texture** command 
8. Left Click on the image to open the tool selection dialogue. Select the tool that will be used to cut the toolpaths. This example uses a 0.02 engrave tool. Click **Accept**
9. Define the **Whitespace Gap** which controls the minimum separation between contours in dark areas of the photo. Click **OK**
10. An information box will appear with the selected parameters, click **OK**
11. Define the **Rapid Texture** parameters
12. Parameters for the example pictured
13. **Position**: X = 1, Y = 1
14. **Size** = 13" x 13" (Image Dimensions)
15. **Wavelength** = 3.5
16. **Horizontal Amplitude** = 1.5
17. **Vertical Amplitude** = 0.01
18. **Offset** = 0.15
19. **Noise Displacement** Enabled
20. Click **Apply** to create contours.





21. Select one of the contours, all of the generated contours are grouped at this point. Activate the **Engrave** command 

22. Set the Engrave parameters.
    a. For this example the following parameters were used
        i. **Tool** = 0.02" Engrave
        ii. **Depth** = 0.01"
        iii. **Follow Contours** = Checked
        iv. **Feed Rate** = 60 inches per minute
23. Click OK to generate Toolpaths.  Group the toolpaths together while they are selected
24. Apply a routing offset to the panel contour
    a. Example parameters
        i. **Tool** = 1/4" End Mill
        ii. **Depth** = 0.5"
        iii. **External** = Checked
25. Apply an Engrave toolpath to the panel contour to add a beveled edge to the design
    a. Example parameters
        i. **Tool** = 90 Conic
        ii. **Depth** = 0.2"
        iii. **3D Engrave Toolpath** = Checked
        iv. **Internal** = Checked
26. Use the Simulate 3D  tool to create a rendered view of the toolpaths

27. The project is now ready to cut

Chamfer

Chamfer tools modify reliefs by applying profiles around the perimeters of contours. Chamfer tools can only be used to modify reliefs and cannot create mesh objects.

The relief in the image below is an example of a relief created by the **Chamfer Centerline** tool by applying a simple profile to a set of contours to modify an elliptical relief.

Common Chamfer Tool Parameters

Chamfer tools use a set of common parameters to modify the created relief or mesh.

Application Method

All of the relief modification application methods  are the same as in the relief creation tool.

Application Methods

To modify a relief surface, it is necessary to select the relief before activating the selected tool

Relief Parameters

- **Base** - Defines a base height to be added to the extruded surface when applied to the relief

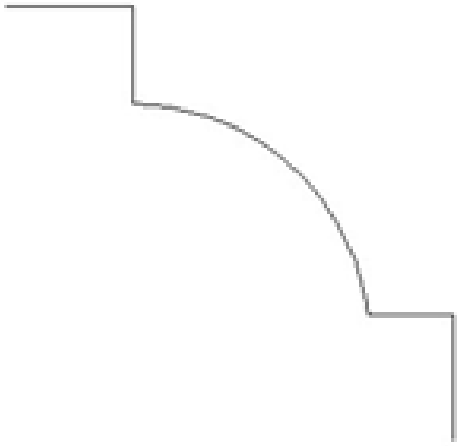
Wizard Prompts

When the command is activated, the wizard will provide prompts for each step to complete. The wizard also provides buttons to complete steps or cancel the tool.

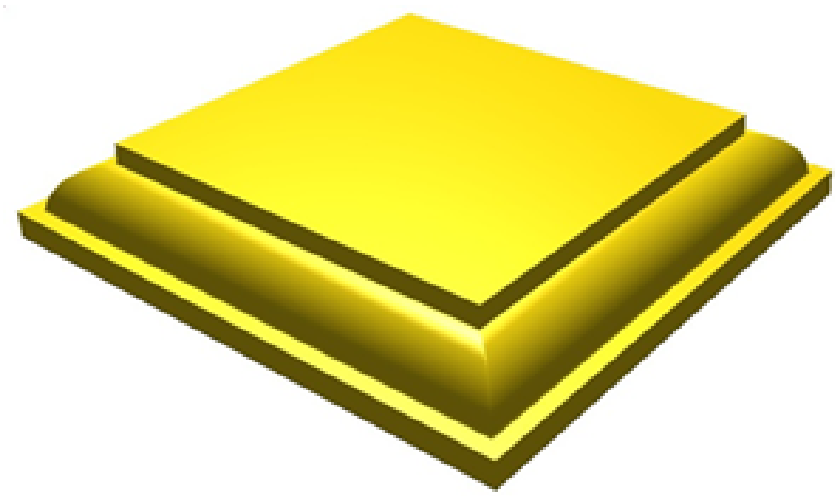
	Start	Return to Start
	Back	Go back one step
	Next	Go to the next step
	Execute	Execute the function
	Cancel	Cancel the function

Standard Chamfer

The Standard Chamfer creates a shaped perimeter around an existing relief using a profile. An analogy for this method is using a router and a shaper tool to around a block of material. Below is an example profile used to create a chamfered edge.



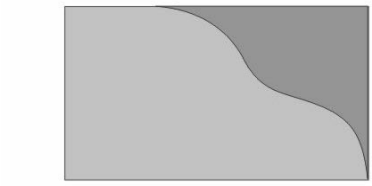
The Standard Chamfer tool modifies the existing relief first by creating a relief the height of the selected profile, and then by removing the material around the perimeter of the relief to match the selected profile. Below is an example of a relief created using a Standard Chamfer on a flat relief with zero height, using the sample profile above.



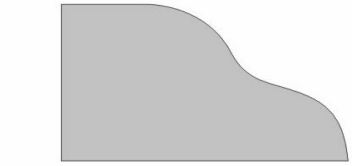
The relief has sharp corners similar to a result a router with shaper tool would create

The graphic below illustrates how the Standard Chamfer tool creates the final relief.

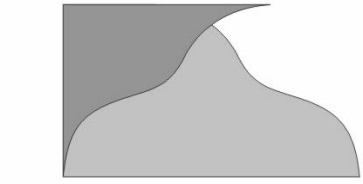
The height of the profile is added to the relief.



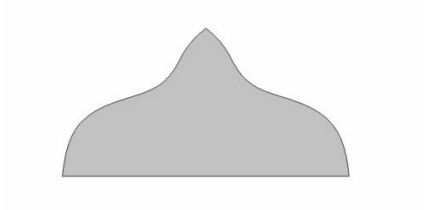
The profile is passed around one side of the relief.



Relief shape after the first pass.

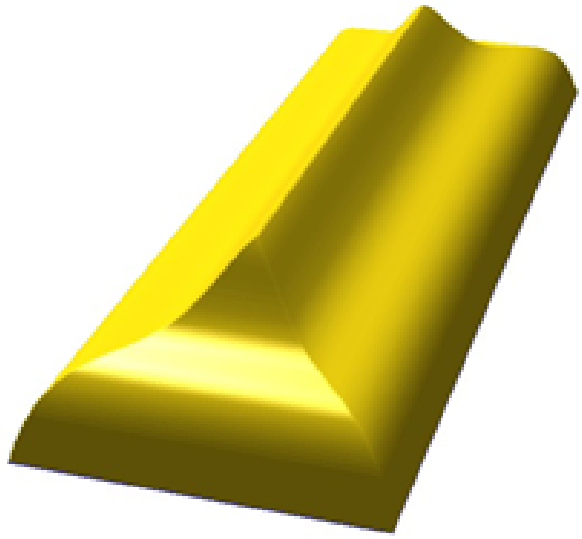


The profile is passed around the other side. Note that when the relief width is less than twice the profile width, the relief will be truncated where the profiles overlap.



Final relief shape.

Below is the resulting relief in EnRoute.



Standard Chamfer Dialogue

When the Standard Chamfer command is activated, the tool dialogue will appear. A set of standard parameters are available to control the relief shape.

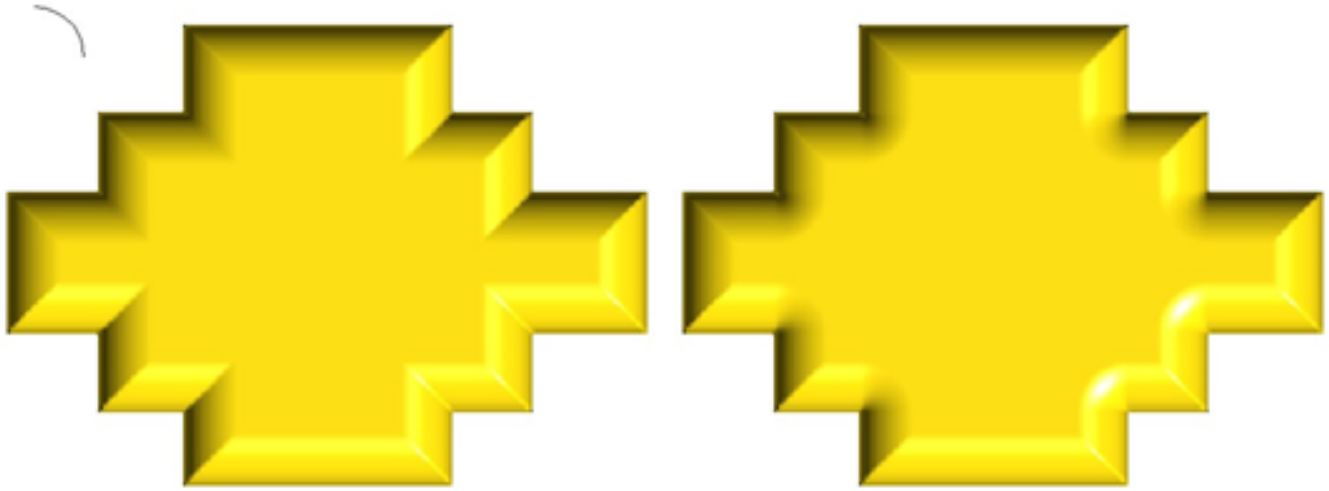
Not all common tool parameters are used by the standard chamfer and some will not be visible in the dialogue.

Common Tool Parameters

Miter and Centerline

Define how the chamfer is applied in the corners. Either **Miter** or **Centerline** can be applied at one time to a relief, or they can be disabled. The effects of each option are best explained with examples. The image below illustrates the effect of the **Miter** option in corners.

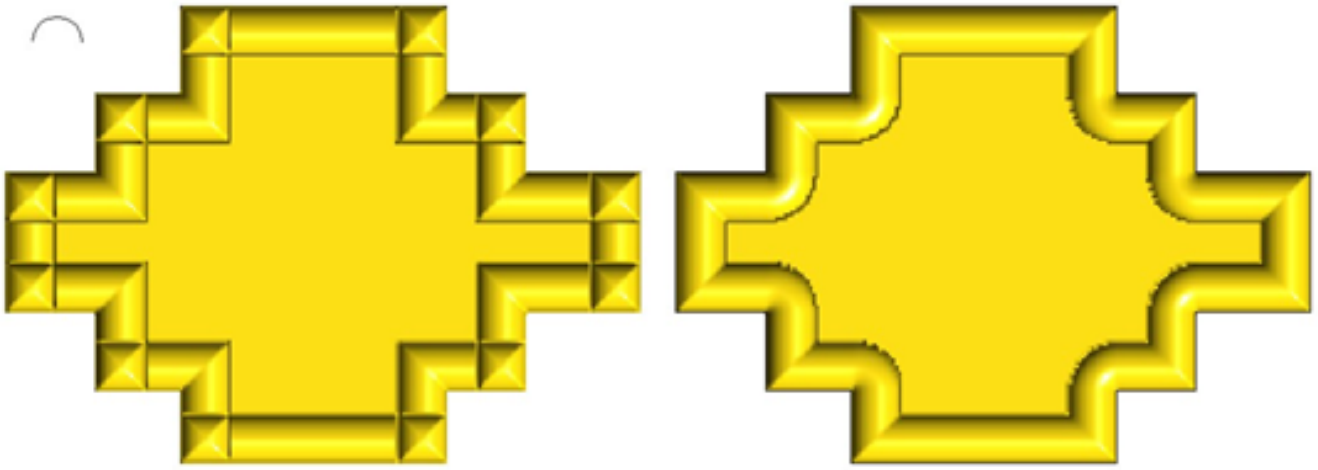
It is standard convention to place the high side of the contour to the left when applying a Standard Chamfer



With Miter

Without Miter

If the desired profile does not follow the standard convention of placing the high side on the left, the **Centerline** option will prevent the **Standard Chamfer** tool from cutting through the profile. As the profile is passed around the perimeter, it will overlap itself at several points and truncate the relief. If this is not the desired effect, the **Centerline** option prevents the **Standard Chamfer**tool from truncating in the corners of the relief. The image below illustrates the effect of the **Centerline** option.



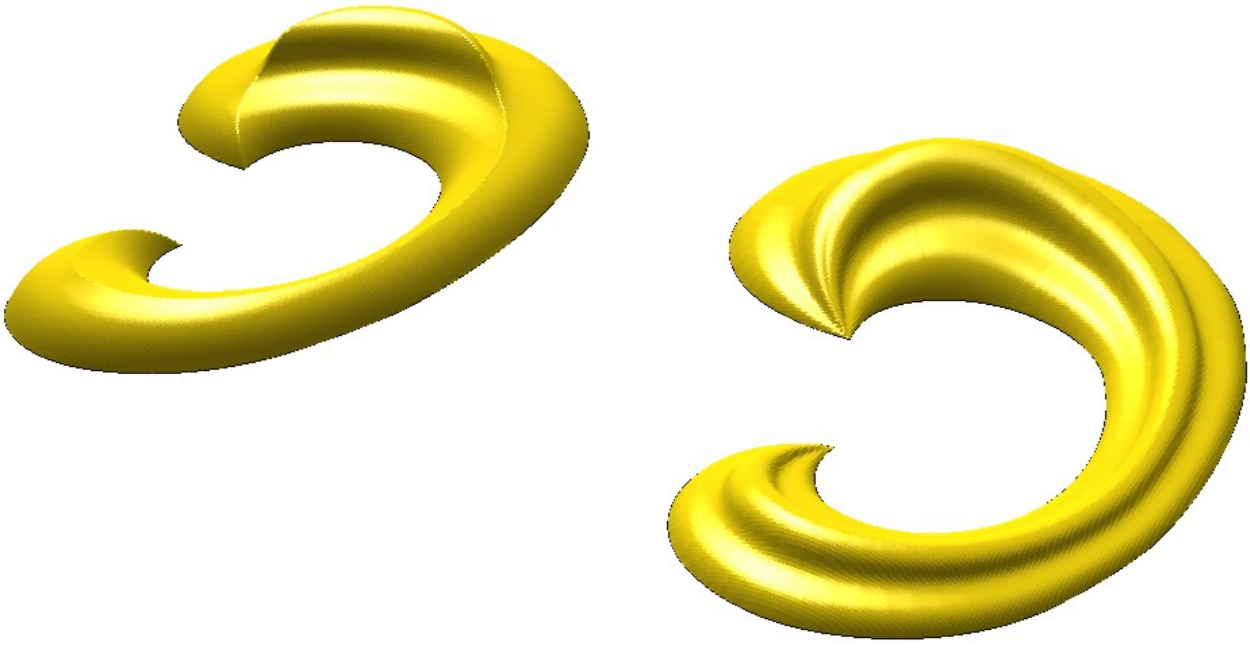
Miter Option

Centerline Option

Chamfer Centerline

Apply a chamfer to a relief using a profile that is scaled and extended to the contour center line to create a symmetric surface. More natural looking surfaces can be created using the **Chamfer Centerline** tool than the **Standard Centerline** tool. Below is an example of a relief created with the **Chamfer Centerline** tool.

For comparison, the left relief was created using the **Standard Chamfer** tool and the right relief was created with **Chamfer Centerline**. Note the smooth edges created by **Chamfer Centerline**.



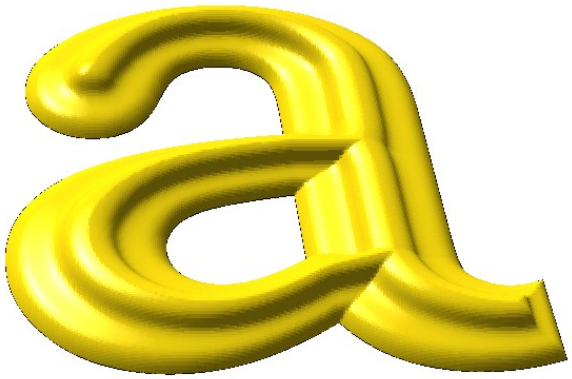
Chamfer Centerline Dialogue

When the Standard Chamfer command is activated, the tool dialogue will appear. A set of standard parameters are available to control the relief shape.

Common Tool Parameters

The **Constant Height** relief option works well with the **Chamfer Centerline** tool and creates smoother surfaces. The image below illustrates the difference between the **Normal** and **Constant Height** relief options when applied to the same relief.

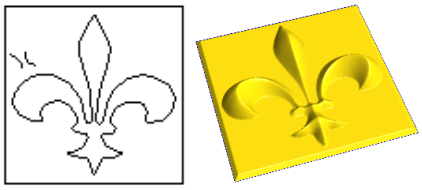
Normal



Constant Height

Chamfer Carve

Create a chamfered surface with a non symmetrical surface by specifying a different profile for the inside and outside surfaces. The example images below show the contours for the relief shape, inner and outer profiles, and the resulting relief when applied to a relief. The resulting relief has outer surfaces that are convex and inner surfaces that are concave due to the specified profiles.



Baroque Chamfer Dialogue

When the Baroque Chamfer command is activated, the tool dialogue will appear. A set of standard parameters are available to control the relief shape.

Common Tool Parameters

3D Meshes

Meshes are a common 3D design format across many software design packages. EnRouteis capable of producing 3D meshes and utilizing existing meshes as part of the relief design process.

Most EnRoute relief tools provide the ability to create meshes that can be positioned, rotated, and scaled before being incorporated into a relief design.

Creating 3D Meshes in EnRoute

Several EnRoute tools can create mesh objects. The tools below can all create mesh objects.

Revolve

Spin

Extrude

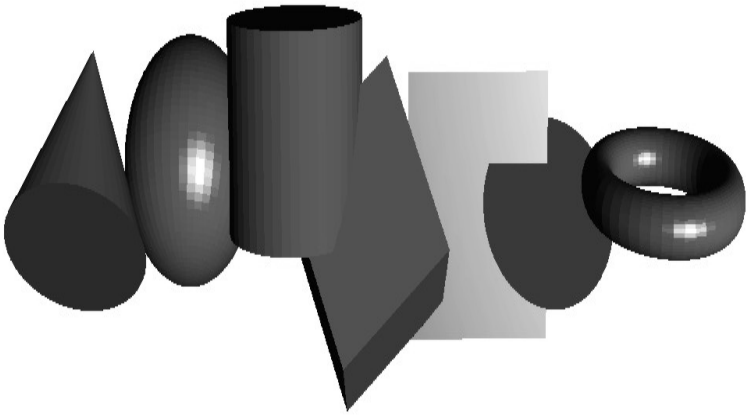
Sweep Two Rails

A set of common controls is used for each of the tools to control the mesh creation.

Common Tool Parameters

Primitives

Create basic 3D shapes automatically. These elements can be used to create more complex shapes or be used directly.



Primitives Dialogue

When the primitives command is activated, a dialogue window will appear. The first option allows the type of primitive to be selceted.

The remaining parameters adjust the dimensions and surfaces of the primitive.

X, Y, Z	Coordinates for the location of the center of the primitive
Slices	Number of sections either around the circumference of the object or along one axis
Stacks	Number of sections along one axis, typically the z-axis, of the object
Radius	Half the diameter of a circular dimension of the object
Height	Z dimension of the object
Size	The dimension along one axis of the object, such as 'X Size'
Sweep Angle	For the Torus object, this is the number of degrees of the sweep of the object around the 'outer' radius
Close top or Close Bottom	Define if Cylinders, Cones and Boxes should have surfaces that cover their tops and bottoms

Using 3D Meshes from Other Applications

EnRouteis capable of importing meshes in a few different formats.

• **DXF** – **D**ata e**X**change **F**ormat is the format created by AutoDesk® as a standard method for bringing data into and out of AutoCAD®. It has become a standard method for exchanging data between many software packages. EnRoute imports both 2D and 3D data using this format.

• **3DS** – This is the format used by 3D Studio®. EnRoute imports 3D files saved using this format.

• **STL** – **ST**ereo **L**ithography is a standard method created for sharing 3D mesh surface data. EnRoute imports STL mesh objects.

• **OBJ** – Alias Wavefront mesh format

Applying Meshes to a Relief

Modify relief surfaces with mesh objects.

Before using the tool, a mesh and a relief must be selected.

Apply Mesh Dialogue

After activating the apply mesh command, the dialogue window will open. Several parameters influence how the mesh is integrated into the relief.

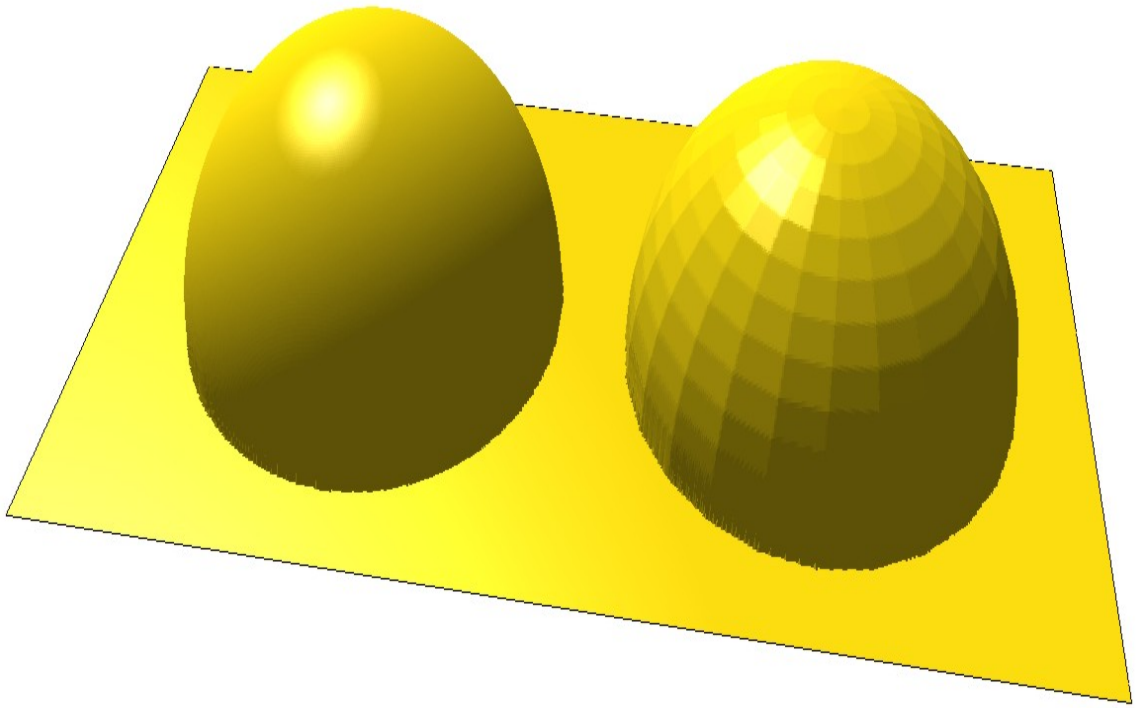
Faceted 

Meshes are composed of facets, triangular sections that define the surfaces. Meshes can be applied to reliefs without modifying the mesh facets and will be visible in the final relief surface.

Smooth 

Smooth out the mesh facets so that they are not visible in the resulting surface.

The images below illustrate the differences between the smooth and faceted options when applying meshes to reliefs.

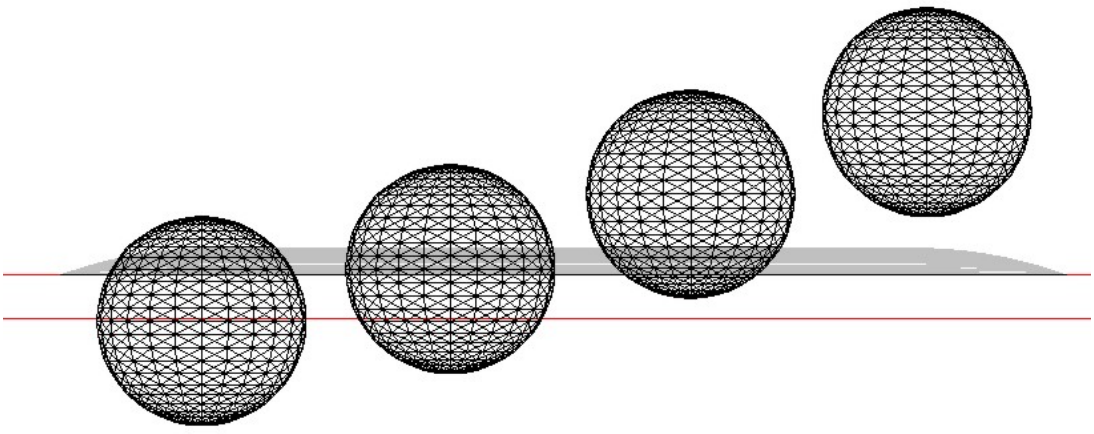


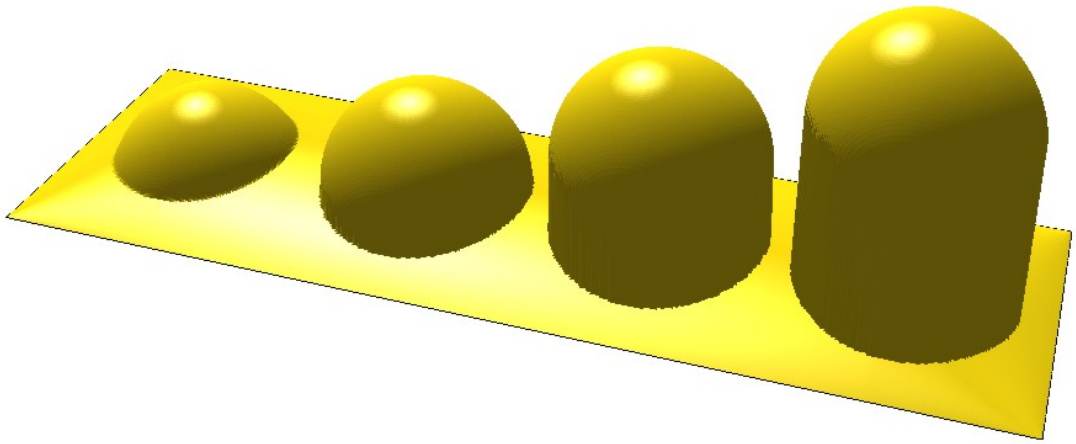
The **Application Methods** for applying mesh to relief are the same as the common tool parameters used by EnRoute relief tools.

Common Tool Parameters

Vertical Positioning

Z axis positioning is important when applying a mesh to a relief. The vertical location of the mesh controls how much the relief is modified. The images below demonstrate how the position of a sphere mesh with respect to a relief surface changes the resulting relief.

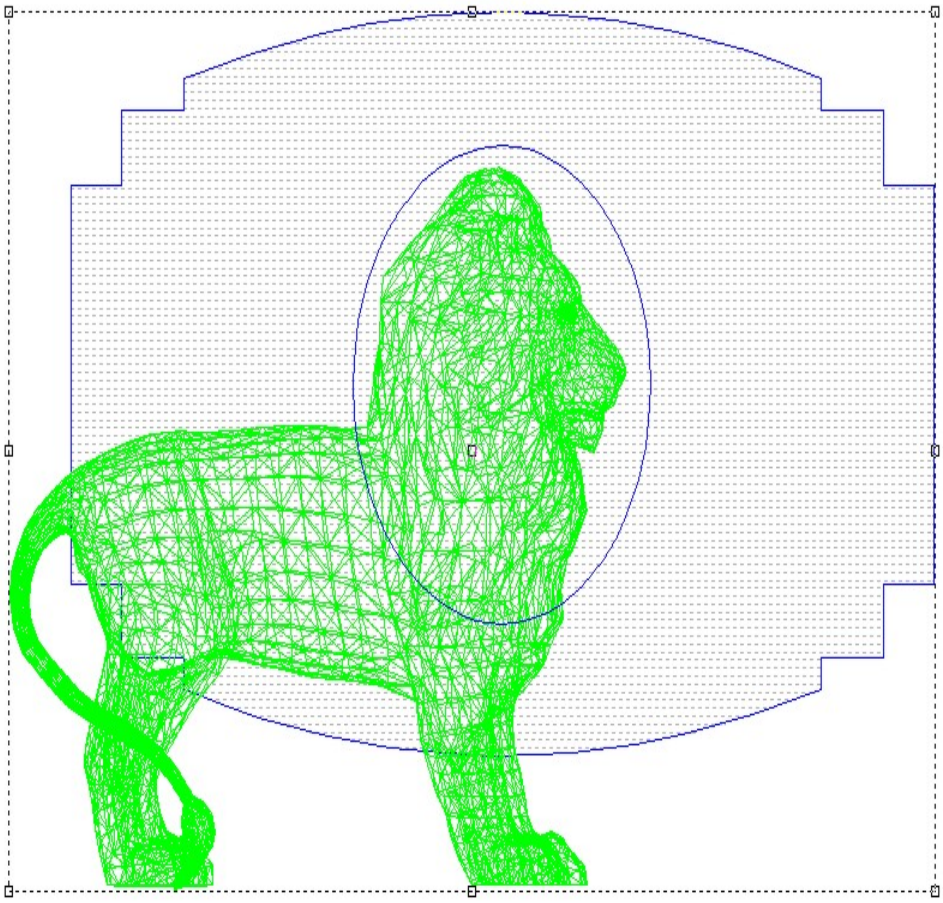




Using a Mask

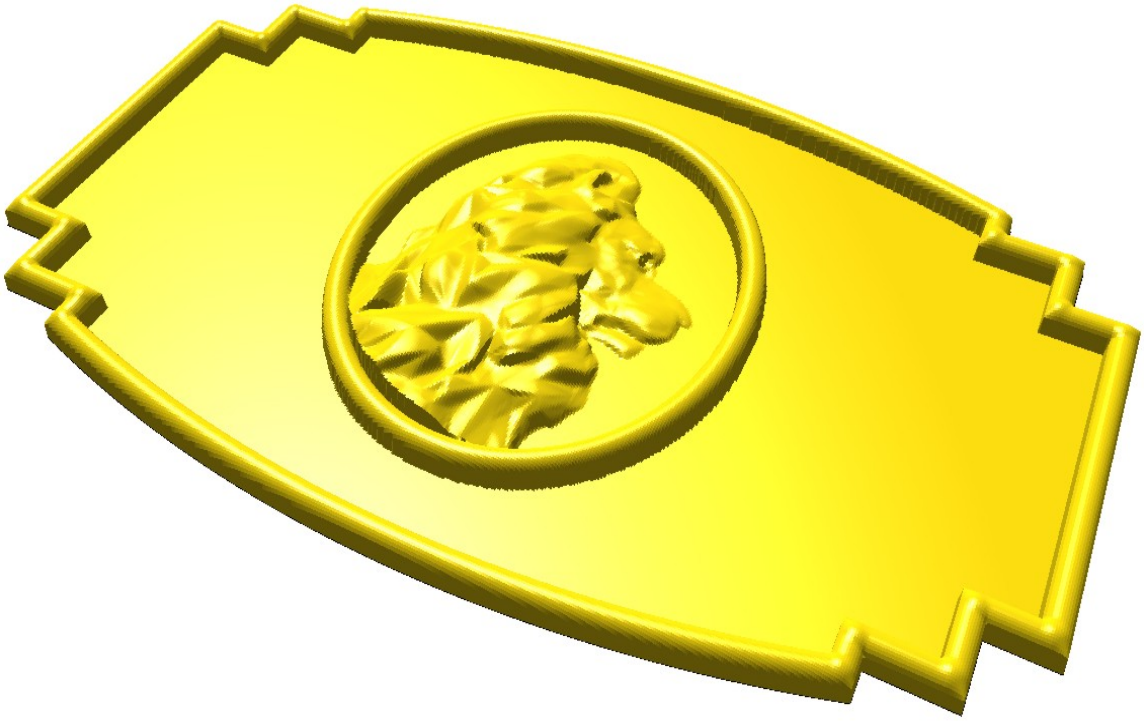
Utilize a closed contour to mask off a section of a mesh to be applied to a relief and ignore the remainder of the mesh.

The following image shows a base relief, a large 3D mesh of a lion, and a ellipse acting as a mask. All three must be selected before activating the **Apply to Relief** command to successfully use the mask.



When the Apply to Relief command is executed, only the masked portion of the lion is added to the relief.

The completed design with added borders show how including a portion of a mesh using a mask can be a useful tool.



Slicing Meshes

Create slices of a mesh object along the X, Y, and Z axis.

Slice Meshes Dialogue

Select a mesh object and activate the Slice Mesh command to open the dialogue window. Several options are provided to control how the mesh will be sliced.

Z	Create slices along the Z axis, horizontal slices top to bottom
X	Create slices along the X axis, vertical slices created in the front view
Y	Create slices along the Y axis, vertical slices created in the right view
Thickness	Slice Thickness, typically the thickness of material used
Number	Number of slices, automatically calculated by thickness and object dimensions
Offset	The distance from the bottom of the plate to the first slice. Typically 0.0, but can be used to adjust slice location to fit the model better
Layout	Creates separate geometry of the slices when enabled
Label	Labels slice geometry when enabled
Model	Creates a model to simulate the assembled piece when enabled

Toolpaths

Overview

Part of any design process is creating toolpaths used to machine the final piece. There are several key topics for creating toolpaths.

Contours

Toolpaths are derived from the contours in a design. Contours can define toolpath boundaries in the case of a fill pattern, or toolpaths can trace the inside, outside, or the path of a contour.

All toolpaths are generated exclusively of line and arc segments. Bezier segments will be temporarily converted to lines and arcs for toolpath generation

Toolpath Groups

Toolpaths are automatically grouped with the contour they are derived from, creating a toolpath group. Any subsequent toolpaths generated from the same contour are added to the same toolpath group.

Contours can only belong to a single toolpath group. If there is a need to generate a toolpath using a group of contours, and generate another toolpath from a contour within the same group, a copy of the contour will have to be created for the individual toolpath.

When duplicate contours are used, it is best to keep the individual contour in a separate layer to avoid confusion

Strategy

Toolpath strategy determines what kind of toolpath will be generated (**Fill**, **Engraving**, **Slot**, etc). Each strategy has a complete set of parameters to define the final shape of the toolpath. Because the strategy determines the shape of the final toolpath, EnRoute always refers to the toolpath by the chosen strategy, not the toolpath.

Plan

The plan is all of the strategies within any toolpath group.

Cuts

Each toolpath strategy is made up of one or more cuts. For instance, a fill can contain a Rough cut, a Fine cut, and a Clean cut. Each cut uses a different tool and different parameters.

Templates

At each step in the toolpath creation process it is possible to save a set of parameters to be used as a template to automate the process.

Cut Template - Saves parameters associated with individual cuts

Strategy Template - Saves strategy parameters and any parameters associated with cuts within the strategy

Plan Template - Saves all associated strategy parameters for a toolpath group and all cut parameters within all associated cuts

Templates can be applied to new contours and recreate all the work for the original toolpath.

Strategy Dialogue

All toolpath strategies in EnRoute use the strategy dialog to define the type of cuts to be performed, which tools to use, and the relevant parameters for each type of toolpath strategy.

Cut Definition

The top window in the strategy dialog is the cut list and is used to select the tool for each cut and define the cut parameters.

Toolpath strategies can have multiple cuts per strategy, a common example is a fill toolpath strategy that has a fill cut, a clean cut, and a fine cut, each with a different tool and set of cut parameters.

To add cuts, select a tool from the **Tools** list and click the **Add Tool** button, or double click the tool. The Cut Type will automatically be set based on the type of toolpath strategy being created and the number of cuts defined.

To remove a cut from the cut list, select the tool and click to the **Delete Tool** button, or click the **Clear** button to remove all cuts from the cut list.

Depth

The fourth column of the cut list defines the depth of each cut. Cut depths can be defined by either typing a value or by using the spin edit buttons. Adjusting the depth of one cut will automatically adjust the depth of any other cuts in the cut list to the same depth.

Cuts must have a depth greater than 0, otherwise the strategy cannot be created

Cut Parameters

The **Edit** column in the cut list is for defining Cut Parameters, and clicking the cell for a cut will open the cut parameters dialog.

Strategy Parameters

At the bottom of the strategy dialog is the strategy parameters window. Strategy parameters are different for each type of toolpath strategy and details of the strategy parameters of each toolpath type can be found on their knowledge base pages.

Strategy Templates

Toolpath strategies require many settings to be defined to work correctly, and it can be time consuming to redefine the parameters each time a new toolpath is applied. Every toolpath strategy in EnRoute can be saved as a strategy template that can then be reloaded and applied later without having to reset every parameter.

To save the current strategy as a template, in the toolpath dialogue select the **Save As** button. Type a name for the template and click **OK**.

To load a settings template, select the **Strategy** list at the top of the dialogue window and select the template name.

Cut Parameters

Fine tune each cut within a strategy using the following parameters. To edit cut parameters, select the ellipses in the edit column of the strategy dialogue.

Current Tool

Displays the currently selected tool. Select a new tool from the list to change the tool used.

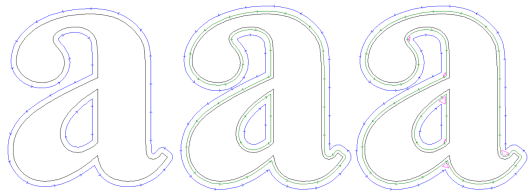
Cut Type

Define how the cut will be generated relative to the geometry. There are 3 options, **Rough**, **Clean**, and **Fine**. The cut options are automatically determined by EnRoute based on the strategy type and cut order.

The first cut is always defined as a **Rough** cut and the second cut is automatically defined as a **Clean** cut. This setup allows the Rough cut to remove material around the part and the Clean cut to finish the final cutout.

A **Fine** cut can also be added which is intended to fit into corners and tight areas the **Rough** and **Clean** tool cannot reach.

Below is an example of the same part with 3 different strategies. The first only uses a **Rough** cut. The second uses a **Rough** and **Clean** cut. The third part has a **Rough**, **Clean**, and **Fine** cut applied.



Depths

Surface Depth	The distance from the top of the plate to the top of the design. Default is 0.0
Final Depth	The depth of the cut measured from the surface depth. When surface depth is 0, Final Depth is the distance from the material surface.

Passes

Number	Number of passes that will be created. The minimum number of passes is automatically calculated by the **Max Per Pass** value and the **Final Depth**. **Number** cannot be set below the minimum value.
Max Per Pass	Maximum depth of each pass. The default is automatically calculated from tool dimensions, but can be decreased to control the depth per pass.
Actual Per Pass	Calculated from the **Number** of passes and the **Final Cut Depth**. If a **Final Pass** is used, the **Final Pass Depth** is removed from the **Actual Per Pass** value.
Final Pass	Define a final pass with a different depth than the other passes. **Number** of passes must be greater than 1.
Final Pass Depth	Depth of the **Final Pass**

Width

Width of Cut	Define an offset from the part surface a clean or rough cut will follow to leave material for a clean cut to remove on a second pass. A cut width of 0.0 will generate a **Rough** and **Clean** cut that trace the same surface of the part. A cut width greater than 0.0 will offset the **Rough** cut by the width, leaving additional material to be removed by the **Clean** cut.
Number of Steps	The number of passes required for a specified cut width. Automatically calculated based on the **Max Step** value and the **Width of Cut**.
Max Step	Maximum width of material that can be removed in one step.
Actual Step	Calculated based on the **Number of Steps** and Width of Cut parameters.
Shoulder	Create a step around the perimeter of the design.

Feeds and Speeds

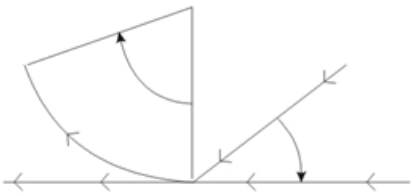
Feed Rate	Speed the tool will move through the material when cutting
Final Pass Rate	If the Final Pass option is enabled, specify the speed for the final pass
Plunge Rate	Speed the tool will move down into the material
Dwell	A time delay that will cause the tool to pause between plunging into the material and feeding into the material
Spindle Speed	Speed of the spindle during cutting

Direction

Conventional	The tool will turn in the direction of travel. For a standard exterior cut along a contour, the tool will move in a counter clockwise direction.
Climb	The tool will turn against the direction of travel. For a standard exterior cut along a contour, the tool will move in a clockwise direction.

Toolpath Entry and Exit Parameters

Define how the tool should move away from the finished edge when moving in and out of cut.



Arc	Define an arc path for the tool to follow by specifying a **Radius** and **Angle** of the arc path to follow. The **3D Arc** option can be enabled and a **Lift** defined to create a 3D entry/exit path.
Line	Define a straight line path for the tool to follow by specifying the **Length** and **Angle** away from the finished surface. The **3D Line** option can be enabled and a **Lift** defined to create a 3D entry/exit path.
Combination	Create a combination arc and line entry/exit path by specifying **Radius**, **Angle**, and **Length**. The tool will follow a straight line to approach the finished surface and then arc into cut, or reverse for an exit path.

Lift Options

Lift Options

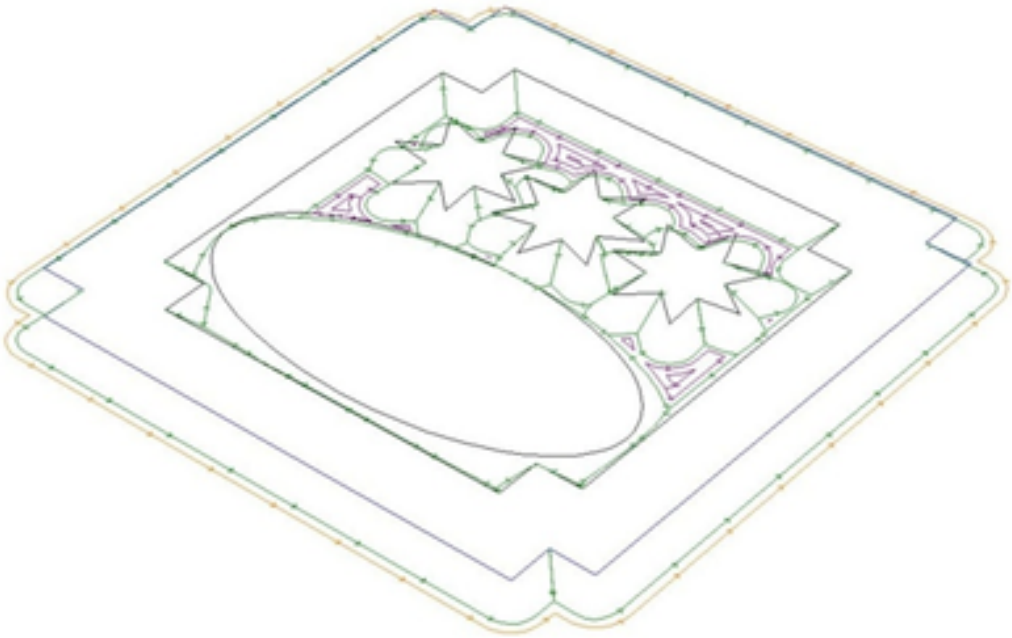
For Routing Offset and Engrave type strategies, the lift type between each pass can be specified.

3D Toolpaths

Create a 3D cut. A 3D toolpath must be created with a conic, tapered, or engraving tool. A 3D toolpath uses the beveled shape of the tool to create a beveled edge on the finished piece. The tool will also move into the corners as far as the tip dimension of the tool will allow.

EnRoute automatically monitors the type of cut and type of tool and will only allow 3D toolpaths to be enabled when appropriate.

The following image is an example of a piece cut with 3D toolpaths.

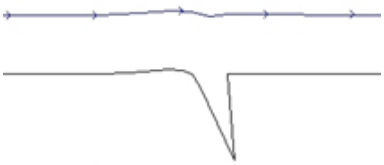


Routing Offset Toolpaths

Create a toolpath that runs either inside or outside of a closed contour. The toolpath is offset from the contour by the tool radius to the edge of the cut surface will align with the contour perimeter.

Routing Offset toolpaths can only be applied to closed contours

If a cutting tool cannot follow the contour shape into a tight corner or curve, the toolpath will follow the closest smooth curve possible.



Activating the Routing Offset tool will open the strategy dialogue. Use the Strategy Dialogue to add and remove cuts. Set the Cut Parameters for each cut to define how the Routing Offset will be generated.

Steps

1. Select the contour for the toolpath to follow
2. Activate the Routing Offset command 
3. In the Routing Offset dialogue, select the desired tool from the **Tools** list and select **Add Tool**

   The Sort by list sorts the **Tools** list by parameter or tool type

   The first tool in the list is always defined as the **Rough** tool, and is typically the main cutting tool. Additional tools serve as the **Clean** or **Fine** tools
4. Define a **Depth** for the selected tool in the tool listing window
5. Add additional cuts using other tools as necessary
6. Set the Routing Offset Parameters

External (Male)	When checked, the toolpaths will follow the outside of the contour
Internal (Female)	When checked, the toolpaths will follow the inside of the contour
Weld Offsets	When checked, overlapping offsets will be welded together to form a single toolpath group. If unchecked, overlapping offsets will remain unchanged
Sharp Corners	Offset toolpaths from square corners are rounded by default, allowing for smoother machine operation without rounding the contour perimeter. When checked, this parameter forces toolpaths to be generated with square corners. It is generally not recommended to enable this paramter.
Inlay	If checked, the toolpath defines either the socket for an inlaid piece of a different material (if the toolpath is set to Internal), or the cut that will separate the inlay itself from the plate (if the toolpath is set to External). Because a round bit is being used to cut out both pieces, both the male and female toolpaths need to take into account the dimension of the tool. This changes the shape of the toolpath, particularly in corners. If this option is checked, the Inlay Gap parameter displays. This parameter indicates the size of the gap that will exist between the inlay and its socket.
Bridges	When checked, generated toolpaths will leave small tabs of material uncut to connect the design to the remaining material sheet. Additional parameters are activated to define the bridge shape when this option is checked.

7. Click **OK**

After toolpath generation, the contour will become part of the toolpath group

Bridges

Bridges are lifts in **Routing Offset** toolpaths that create tabs that maintain the connection between part being cut and the material it is being cut from. Bridges improve stability so the part does not move while being cut. The tabs are trimmed away after cutting the part.

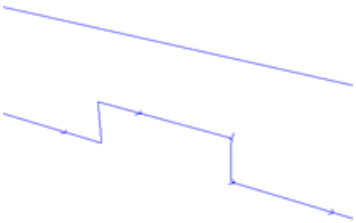
Bridge Parameters

Type	Define the shape of the bridge. Each shape has advantages for different materials, while smooth bridges allow for the smooth machine operation
Length	Length of each bridge. Longer bridges have increased strength, shorter bridges work well in stronger materials
Height	Height of each bridge tab. Another parameter to influence bridge strength
By Number	Define the number of bridges in an offset
By Length	Define the distance between each bridge
Manual	Define specific bridge locations along the offset.

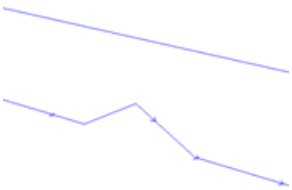
All bridge positions can be edited after generation

Bridge Shapes

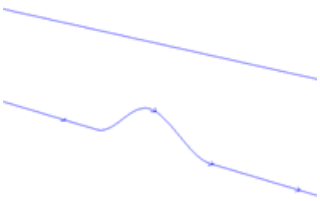
Lift

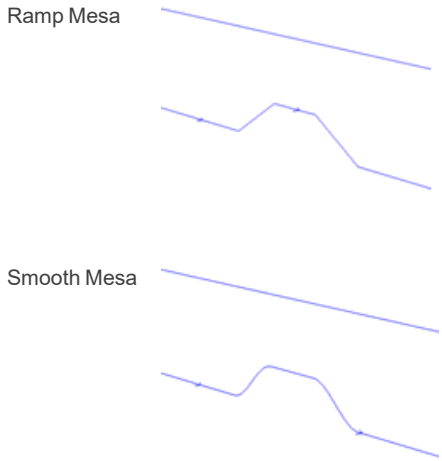


Ramp



Smooth





Open Contour Offset Toolpaths

Generate toolpaths similar to Routing Offset toolpaths, except for open contours.

Strategy

Activating the Open Contour Offset tool will open the strategy dialogue. Use the Strategy Dialogue to add and remove cuts and define strategy parameters.

Side

Define which side of the contour to place the toolpath. Left or Right of the contour is determined as if facing in the direction of the contour. Middle will follow the path of the contour.

Left

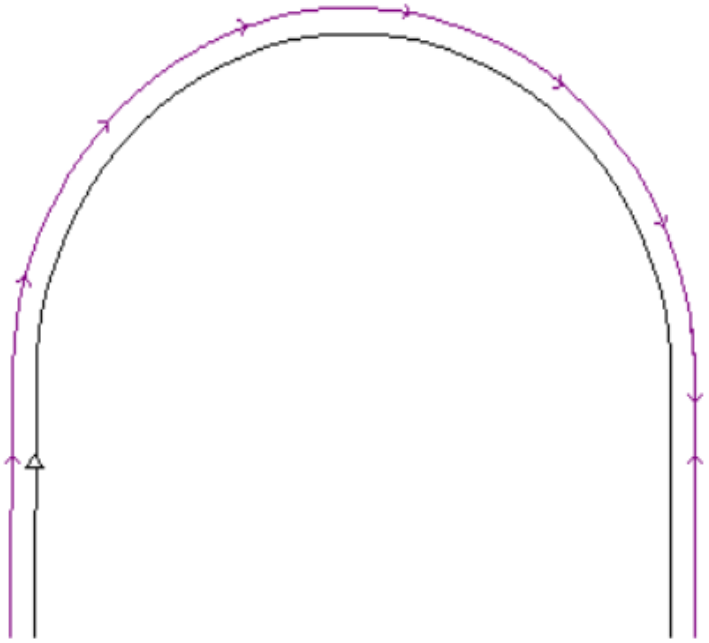
Right

Middle

With Relief

When open contour offset toolpaths cross design boundaries, it can be beneficial to have the tool enter the material at both ends. When a tool exits materials like wood, it can cause a blowout where the material breaks apart at the edge. The With Relief option allows a segment at the end of the toolpath to be defined where the tool will move in the opposite direction so that it enters the design rather than exits.

The image below displays a contour with the option enabled. Note that at the right end of the cut, the arrow is reversed.



Relief Length	The length of the toolpath at the end that the tool will move back in from the end
Relief Overlap	Distance to overlap the two cuts to ensure a clean cut
Cut End First	When selected, the Relief section of the toolpath will be cut first

Cut Parameters

The Cut Parameters are similar to the Routing Offset toolpaths with a few exceptions.

- 3D toolpaths cannot be created for open contours.
- The direction of the cut is defined by the direction of the contour.
- Open contours can be used to cut out wide areas by specifying the cut width.

Kerf Compensation Toolpaths

A simplified toolpath tool designed for CNC cutting devices other than routers. The tool behaves similar to the Routing Offset tool, but only the necessary 2D parameters are available. Kerf compensation also provides a parameter to enable and define toolpath loops in and out of external corners to maintain cutting head speed for water jet and plasma cutters.

Kerf Width	0.05, 0.10, and 0.15 are default, additional options can be added.
External (male)	Toolpaths will follow the outside of the contours
Internal (female)	Toolpaths will follow the inside of the contours

Feed Rate	The speed the tool will move in the material when cutting
Weld Offsets	When checked, overlapping offsets will weld together into a single toolpath group. If unchecked, overlapping offsets will remain separate
Loop Corners	Create toolpath loops on external corners. Loops prevent the tool from decelerating as it rounds the corner.
Sharp Corners	When checked, toolpath offsets form square corners
Direction - Conventional	Cut in a counter-clockwise direction for a standard exterior cut
Direction - Climb	Cut in a clockwise direction for a standard exterior cut

Entry and Exit Parameters

Define how the tool should move away from the finished edge when moving in and out of cut.

Arc	Define an arc path for the tool to follow by specifying a **Radius** and **Angle** of the arc path to follow. The **3D Arc** option can be enabled and a **Lift** defined to create a 3D entry/exit path.
Line	Define a straight line path for the tool to follow by specifying the **Length** and **Angle** away from the finished surface. The **3D Line** option can be enabled and a **Lift** defined to create a 3D entry/exit path.
Combination	Create a combination arc and line entry/exit path by specifying **Radius**, **Angle**, and **Length**. The tool will follow a straight line to approach the finished surface and then arc into cut, or reverse for an exit path.
Corner	Force the toolpath start point to coincide with a corner, and the entry and exit paths to align with the edges of the corner. If either the entry or exit type are set to **Corner**, both the entry and exit paths will be generated at the toolpath corner.

Engrave Toolpaths

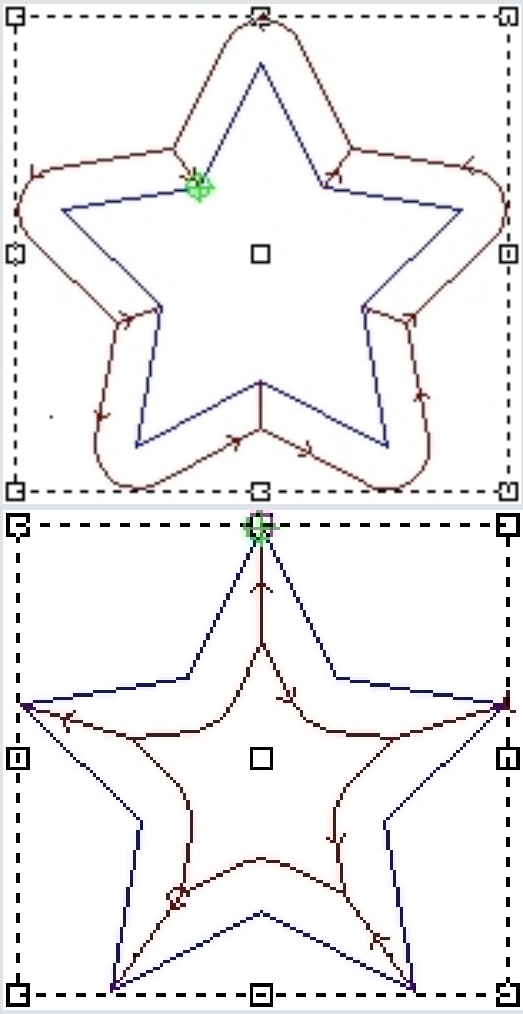
Create 2D or 3D engraving toolpaths. 2D toolpaths follow the selected contour exactly to add a beveled effect. 3D toolpaths use the shape of the engraving tool to more accurately cut out sharp corners.

Only tools capable of engraving including conic, engrave, and tapered tools can be used to generate engrave toolpaths.

Cut Parameters

Parameter for Depths, Passes, Feed and Speeds, and Direction match the other toolpath Cut Parameters.

3D Engrave Toolpath	When checked, the engrave will be created as a 3D toolpath. If unchecked, a 2D toolpath will be generated.

External or Internal	When **3D Engrave Toolpath** is checked, it must be specified if the toolpath should pass to the inside or outside of the contour.  3D engrave toolpaths require all selected objects to be combined into a single toolpath group. Existing toolpath groups included in the selection will be deleted when creating engrave toolpaths.

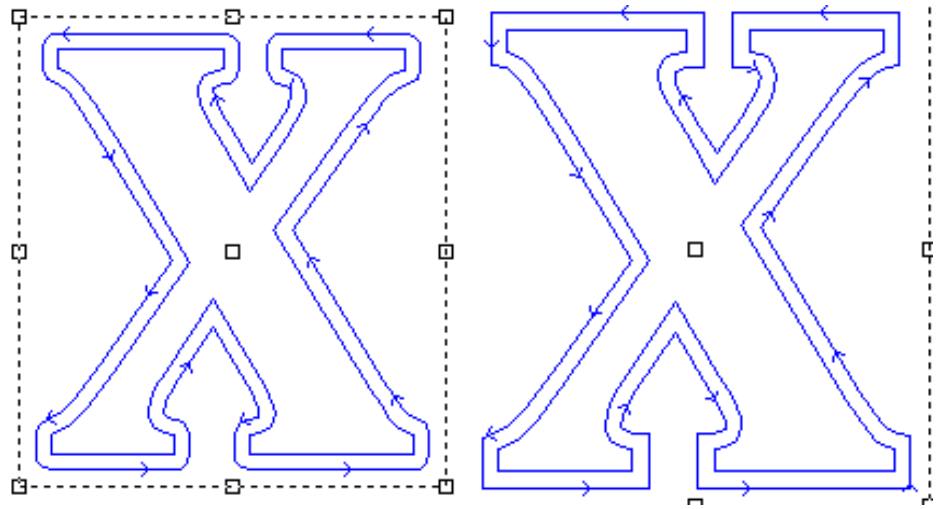
Strategy Parameters

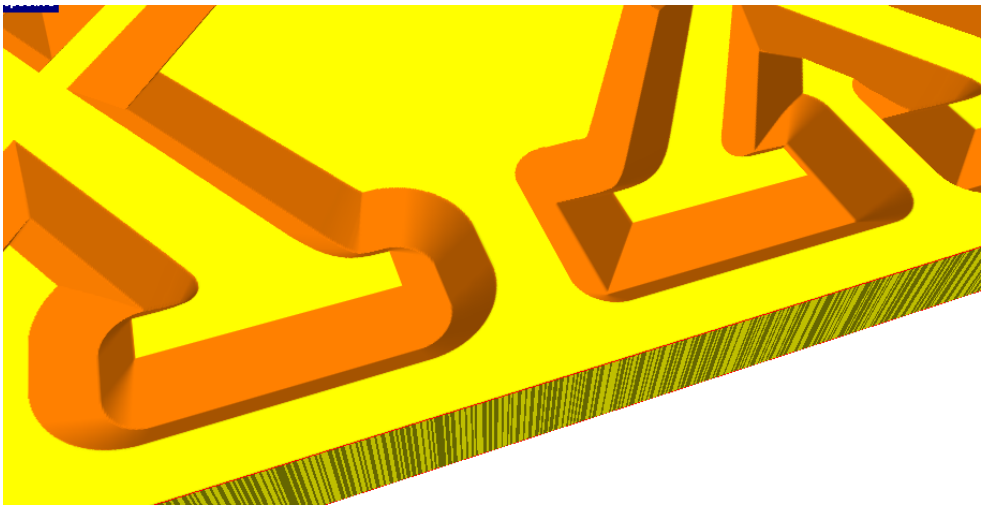
The first tool defined in the engrave strategy is always the engrave tool, and the second tool is defined as the rough tool. Toolpaths for the rough tool are only generated if required by the engrave cut.

A common configuration for deep engrave cuts is to define rough cut that uses an end mill tool to remove excess material.

Square Corners

For **External 3D Engrave** toolpaths, there is an additional option for square corners which will create squared toolpaths at corners in the contour and change the finished surface.





Hatch and Island Fill Toolpaths

Hatch Fill

Island Fill

Generate toolpaths for milling large areas.

Hatch vs Island Fill

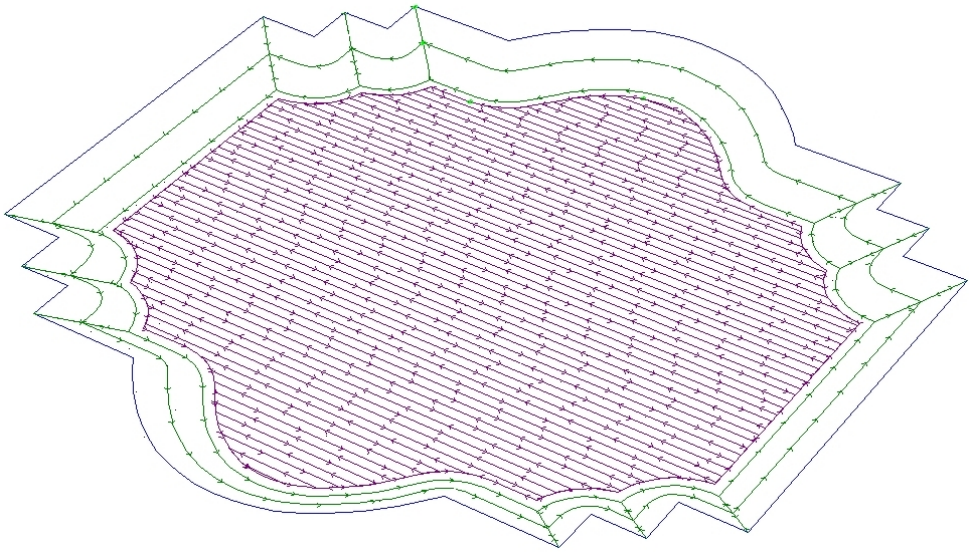
Efficiency and surface finish are the two most important considerations when choosing between hatch and island fills. Generally when cutting a large area the hatch fill will be the most efficient. If a design is made up of long, thin sections, the island fill will be the most efficient. Both methods leave a distinctive surface after milling and if the surface finish of the final design is important, it could drive which method to use.

Types of Cuts

There are three types of cuts that can be defined in a Hatch Fill strategy: Fill Cut, Fine Cut, and Clean Cut.

Fill Cut	Define the tool to perform the **Hatch Fill**.
Fine Cut -(optional)	A tool with a smaller diameter than the **Fill Cut** that fits into corners and thin areas too small for the Fill tool. The amount of overlap between the fine cut and adjacent toolpaths must be specified.
Clean Cut - (optional)	Define a tool that generates toolpaths offset from the contours to improve the finished edge of the design or to utilize a 3D engraving toolpath.

The image below illustrates a hatch fill strategy with a fill cut and 3D engrave clean cut.

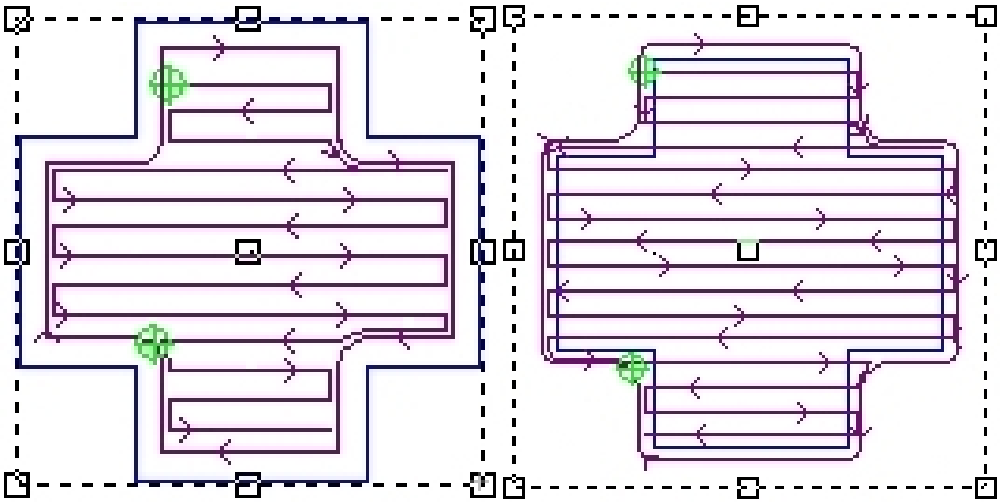


Strategy Parameters

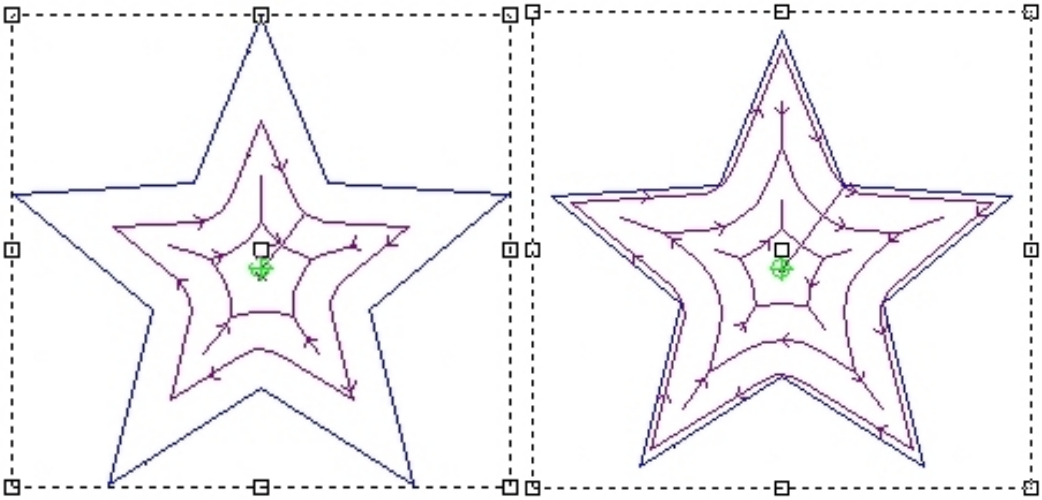
Inlay

Defines if the strategy will be used as the female part of an inlay project. The toolpath must compensate for the tool dimensions and account for an inlay gap, which is the spacing between the male and female portions of the inlay. The images on the left below show toolpaths without with out inlay and the images on the right have inlay applied and highlight how the toolpaths are modified in the corners.

Hatch



Island



Optimization

There are three different options for how the hatch fill cuts the contour.

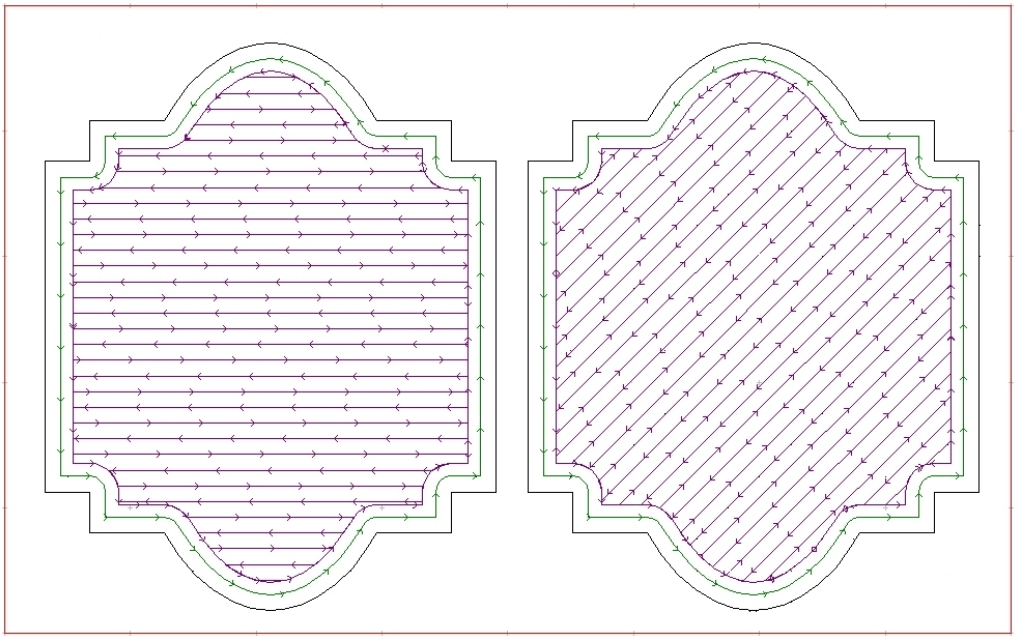
Standard	Minimize the number of tool lifts, do not allow the hatch toolpath to pass over any part of the hatch area more than once, and enforce a strict back-and-forth pattern across the cut area
Nose Cone	Generate hatch toolpaths for compatibility with a **Nose Cone** engraving tool. Maintain an edge of uncut material next to the nose cone to maintain a constant cut depth.
None	Cut the cleaning pass before the associated fill cut.

Hatch Fill Cut Parameters

Hatch Fill toolpaths use the common Cut Parameters . A couple of unique parameters to control the **Fill.**

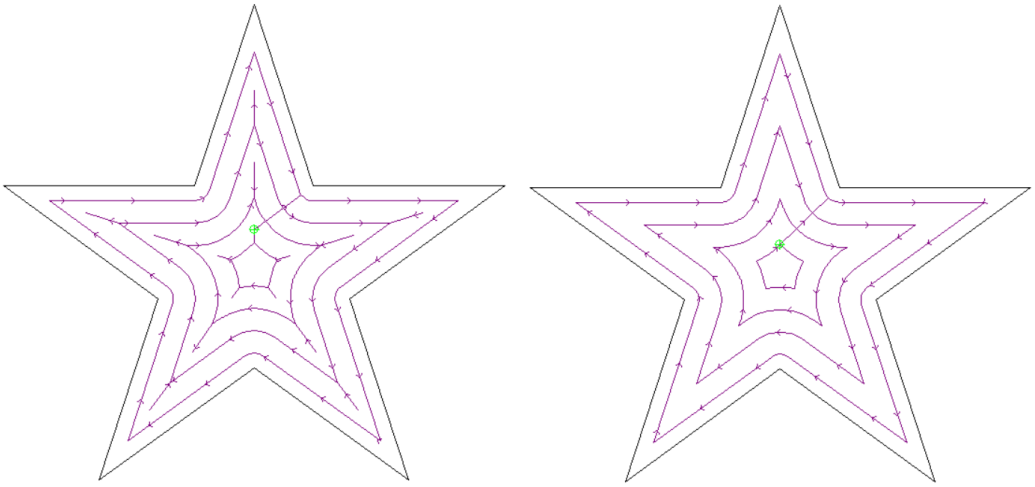
Overlap	Define the overlap percentage between adjacent toolpaths. Valid values range from 0-99 with a default of 50. A general rule of thumb is that softer materials require less overlap and harder materials require more overlap. This value can also be changed to achieve a desired surface effect.

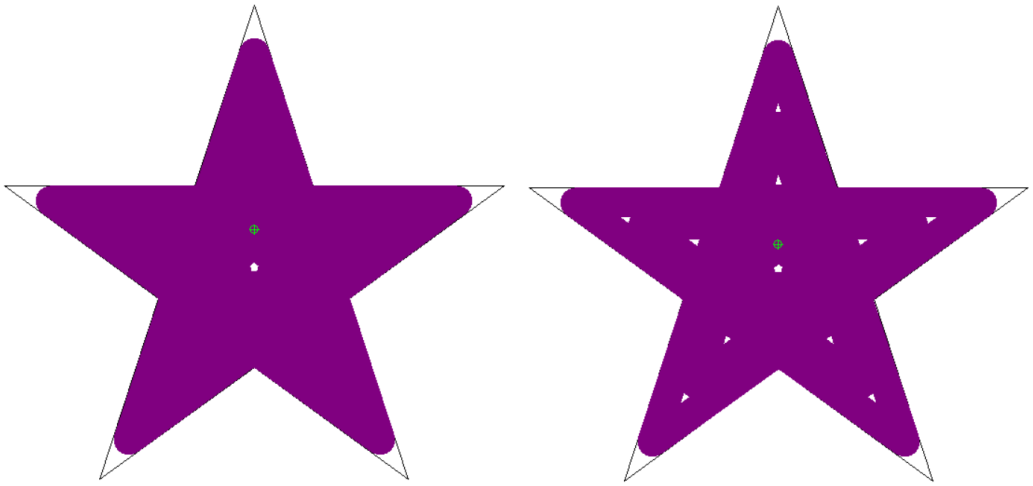
Hatch Angle	Define the angle with respect to horizontal that the toolpaths will be generated at. A hatch angle of 0 degrees will generate a horizontal fill pattern and 90 will generate a vertical fill.



Island Fill Cut Parameters

Island Fill toolpaths use the common Cut Parameters. A **Corner Tag** parameter defines if additional toolpaths will be generated in corners. Corner tags are important when the overlap is set to less than 50 percent to ensure the entire area is milled. The images below show a star contour on the left with corner tags, and on the right without.

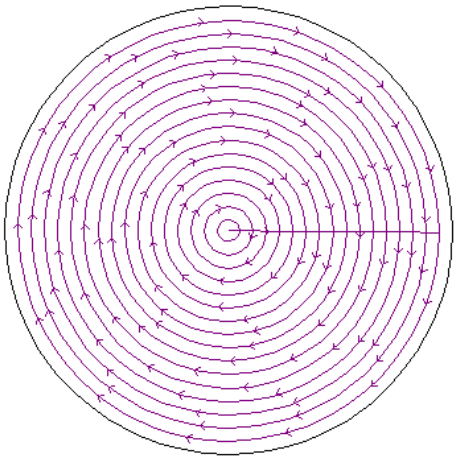


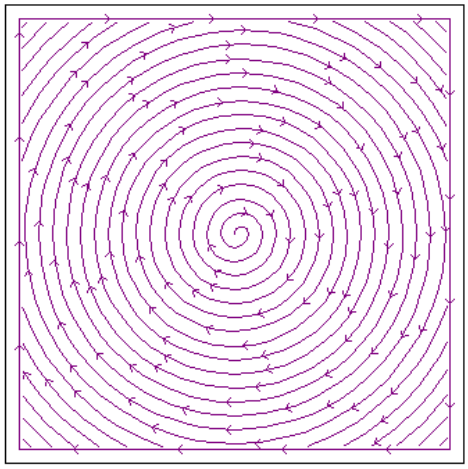


Spiral Fill Toolpaths

Create a toolpath that spirals out from the center of the contour. Spiral toolpaths are most efficient for round or near round design elements which allow the contour to be a single continuous spiral and eliminate the need for tool lifts. Objects that are not round require the tool to lift every time it encounters an edge creating more lifts than a normal **Island Fill** or **Hatch Fill**.

The images below illustrate a spiral fill toolpath for a circular contour and a square contour.





Pyramid Toolpaths

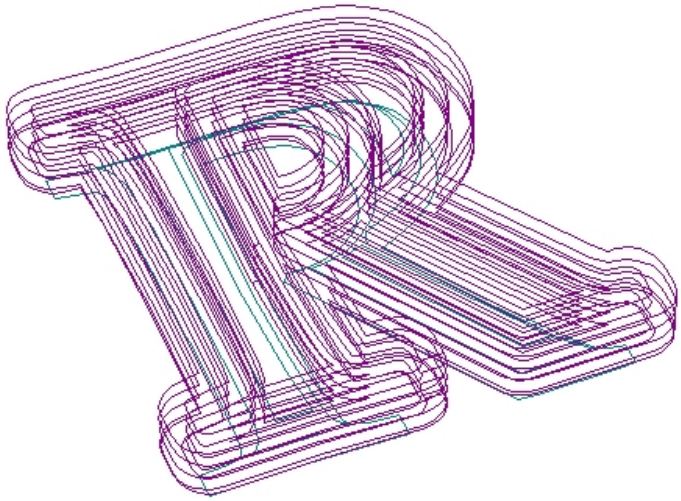
Generate toolpaths to create a beveled design using the tool dimensions and design to determine cut depth.

Only tools capable of engraving including conic, engrave, and tapered tools can be used to generate pyramid toolpaths.

Strategy Parameters

The first tool in the strategy is always defined as the Pyramid tool.

The second tool is defined as the Rough tool and is used to remove excess material, typically a medium sized end mill.



Return Height	The height of a vertical edge to be created below the beveled portion of the cut. **Move to bottom of plate** must be checked for **Return Height** to be cut correctly.
Move to bottom of plate	If checked, the bottom edge of the return height will be aligned with the bottom of the plate. If unchecked, the toolpaths will be placed so the top of the beveled surface will be at the surface of the material.

Cut Parameters

Pyramid toolpaths share many of the same Cut Parameters as other toolpaths. The key difference is that the depths of the cuts are automatically defined based on strategy parameters. The Surface Depth for the cuts can be overridden, but is not recommended.

By default, EnRoute utilizes 90 percent of the tools cutting depth for the Pyramid cut. This is likely appropriate for soft materials, but for denser material like wood, it will likely be necessary to decrease the pass depths by increasing the number of passes.

Drag Knife

Create a toolpath for a knife to cut the selected contours.

1. Select the contours to apply toolpaths to.
2. Activate the **Drag Knife** tool
3. Select a **Depth**, and define the **Strategy Parameters** and **Cut Parameters**
4. Click **OK**.

Strategy Parameters

Lift Corner	Lift the knife in corners of the contour being cut
Lift	The amount to lift the knife by in corners
Align	
Radius Corner	Cut corners in the selected contour with a radius
Radius	The size of the radius to apply to corners in the contour
Loop Corners - Outside Corners Only	Loop the knife around external corners
Loop Standoff	The size of the loop the knife follows at external corners

Cut Parameters

Drag Knife Toolpaths use a subset of the common toolpath Cut Parameters.

Editing Toolpaths

After toolpaths are created, the toolpaths retain all of the information about how they were generated. Toolpaths can be edited at any time to change the cut and strategy parameters.

To edit a toolpath:

1. Select a toolpath
2. From the **Toolpath** menu select **Edit Toolpaths**, or right click the toolpath and select **Edit Toolpaths** from the pop up menu.
3. If the toolpath group contains more than one strategy, the strategy to edit must be selected from a dialogue box. Click OK to open the selected strategy.
4. The toolpath dialogue will open. make the desired changes and click OK.

3D Toolpaths

Most of the same strategies used on other toolpaths can be applied to 3D designs, including Routing Offset, Engrave, and Hatch and Island Fills. 3D toolpaths require a few additional parameters to define how the relief influences the

toolpaths.

Strategy Parameters

The parameters required for 3D toolpaths are automatically enabled when one or more reliefs are selected when activating a strategy. When checked, the **Apply to Relief** parameter displays the four additional parameters that define how toolpaths are applied to a relief.

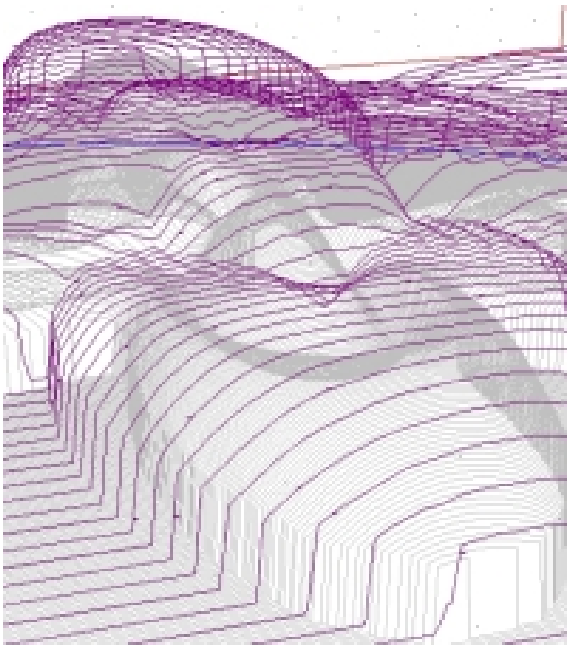
Apply to Surface	Toolpaths will follow the relief surface and the depth of cut will be adjusted to follow the relief. If no relief is selected, the depth is defined by the cut parameters depth. The cut depth defines the maximum depth of the toolpaths.
Carve into Surface	Toolpaths follow the relief while using the cut depth to define how deep to cut into the relief. Enabling this parameter enables two more.
	Project — Calculates the toolpaths as if they were projected onto the relief. (Most common)
	Float — Calculates the toolpaths so they will not cut into the relief surface. This option can cause distortion of the toolpaths and should only be used in special circumstances when the toolpaths should not cut into the relief surface
Apply Overcut (Fills Only)	Compensate for the dimensions of ball end mills by allowing toolpaths to extend beyond the part boundaries. Without this option, the design would leave the radius of the ball nose uncut around the edges.
	A good rule of thumb is to set overcut to a little less than 1/2 the tool diameter on the finish pass

Cut Parameters

Offset from Surface

Set how close the toolpaths will follow the surface of the relief. Typically defined for rough cuts to ensure the roughing pass does not damage the finished surface. Offset is determined by the type of material, type of tool, and how fast the roughing pass should run.

The image below shows toolpaths with a 0.20 offset.



Step Rough

Available for Hatch and Island Fills. Create optional toolpaths to rough out the relief surface before creating the finish toolpaths.

This method is more efficient than standard 3D rouging passes because it creates 2D toolpaths at multiple pass depths to remove as much material as possible at that depth. The 2D toolpaths can typically be defined using higher feed rates than 3D toolpaths.

An important consideration when applying a step rough is that the ball end mill used for the final pass must be capable of cutting the steps that remain after the step rough. The height of each step is the difference between the depths of each pass in the step rough.

Key 3D Toolpath Concepts

Three axis routers create 3D objects by making incremental cuts with a ball end mill to remove material from the finished surface. The size of the tool, the amount of overlap, and how much detail is required are all constraints. The relationship is the smaller the tool, the larger the overlap, and the finer the detail, the **longer** the design will take to cut.

In general the finish cut should be run as a single pass because it takes the longest time to run. The rough strategy clears material out of the way for the final cut and goes a long way to getting the job done. It is important to use the EnRoute visualization tools to ensure the job will cut correctly because the depth of cut can vary greatly across large 3D surfaces. It is easy to get into trouble using a small tool to make a deep cut, but EnRoute provides tools to avoid these situations.

Overlap

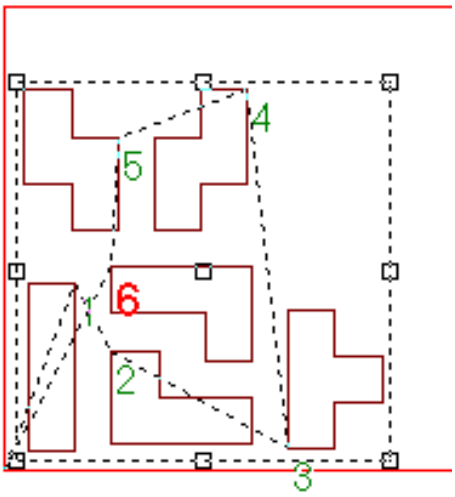
It is important to select the proper overlap percentage when milling a 3D surface to achieve the desired surface finish. Milling 3D relief surfaces requires the use of a ball end mill to cut smooth surfaces. The spherical surface of the tool creates small grooves in the finished surface which vary in size depending on the amount of overlap. As overlap increases, the tool marks are reduced while increasing the cut time. The goal is to balance cut time and cut quality.

The best way to determine overlap is to cut a test relief using the same material as the job to estimate cut time, the surface quality, and the amount of finishing work.

Typical overlap values range from 80% on larger reliefs with larger tooling marks, to 95% for small reliefs with a smooth finish.

Toolpath Ordering

Review and edit the order assigned to toolpath groups. The toolpath order influences the order in which cuts will be made.



Ordering Toolpath Groups Manually

1. In the **Order Toolpath** dialogue, use the horizontal **blue arrow** buttons to select toolpaths. The selected toolpath is indicated by a bold red number.
2. Use the vertical **green arrow** buttons to change the cut number of the selected toolpath.
3. Click OK when finished.

Pressing the arrow keys on the keyboard produces the same result as clicking on the blue and green arrows.

Order Manually using the Mouse

1. Select the **Manual** option in the **Order Toolpath** dialogue.
2. Click each toolpath in the desired order
3. Click OK when finished

Order Toolpath Groups Using Sorting Methods

Select the sorting method from the Current Sort Method list.

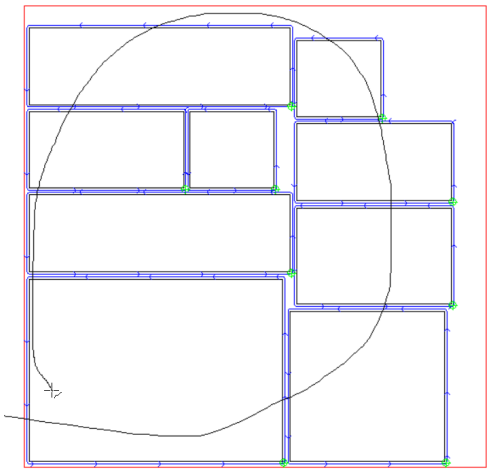
Shortest	Produce the shortest overall set of toolpaths and movements
Rows	Order toolpaths in rows starting at the bottom of the plate and numbering left to right
Columns	Order toolpaths in columns starting at the left of the plate and numbering top to bottom
Inside Out	Sort toolpaths by position from the center of the plate to the edges
Outside In	Sort toolpaths by position from the edges of the plate to the center

Order by Line

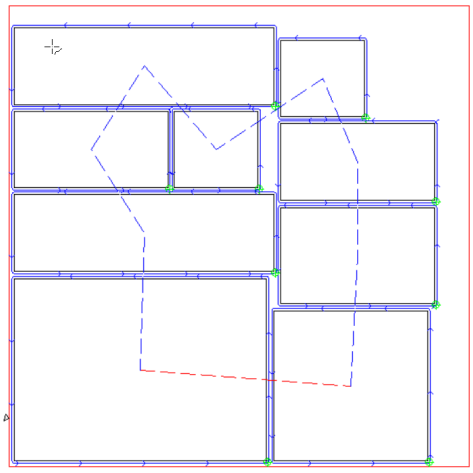
Define the toolpath cut order by drawing a path between the toolpaths using the mouse.

After the toolpaths have been arranged on the plate, activate the **Order by Line** tool. The cursor will change to a cross to indicate the tool is active.

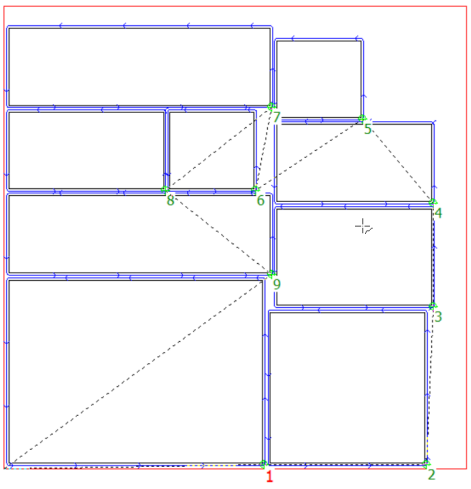
1. Click and drag in the plate to define the tool movement.



2. Release the mouse to see the path that was defined.



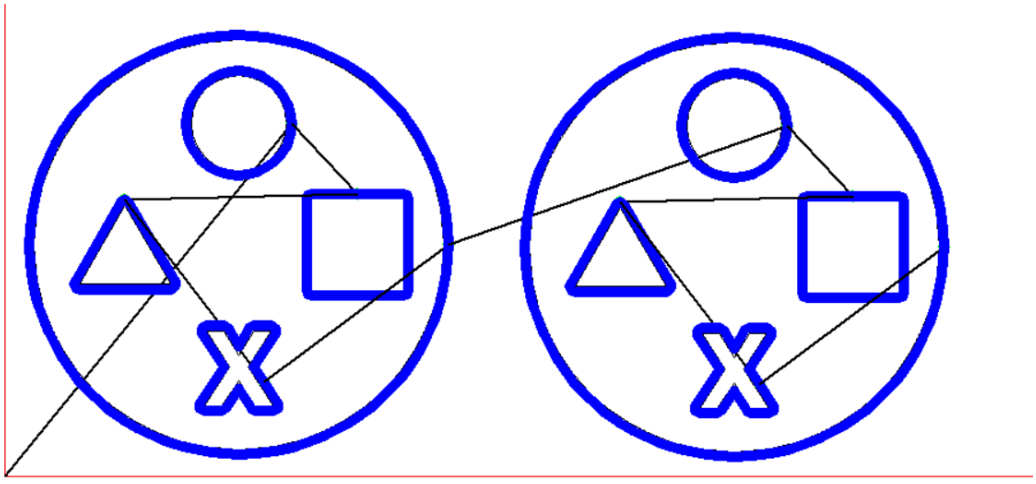
3. Press Enter to accept the cut order. The view will change to show the new order and it can be reviewed using the simulation tools.



4. Right click to exit the tool.

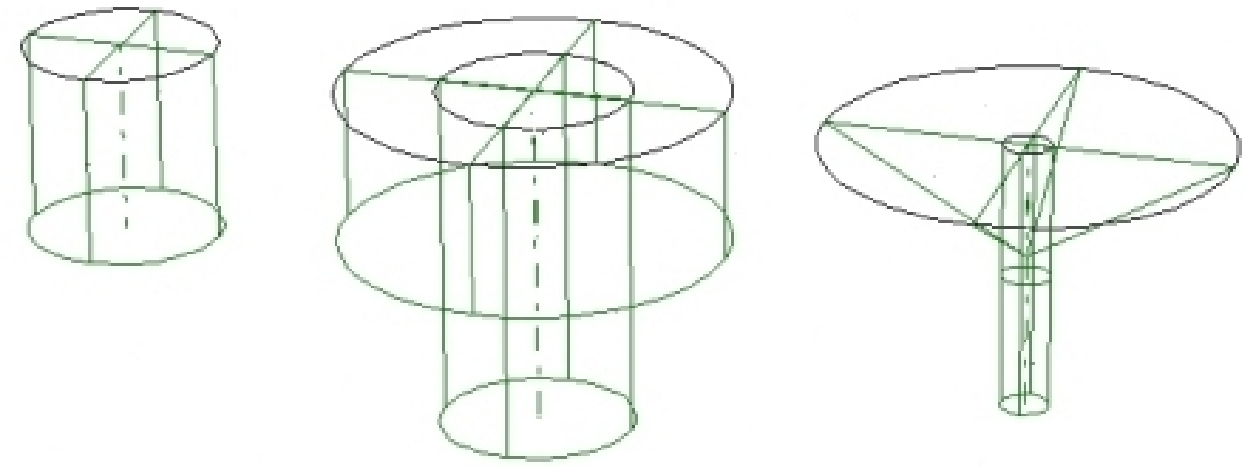
Group Order

Ordered objects within a group will maintain the original ordering when copied.



1. Select the objects in the order to be cut, then Group them together.
2. When the group is copied, the order of the group is also copied.

Drill Tools



Drill points are similar to toolpaths but can be interpreted differently by many CNC machines. EnRoute creates drill points differently than toolpaths so that the machine driver can determine how much information to send to the machine.

Drill points are all created with the same cut parameters in EnRoute. There are six tools that create drill points in different arrangements.

Drill Strategy Templates

Similar to toolpaths, drill strategies can be saved as templates and reloaded later. Within the drill strategy dialogue, type a name into the **Strategy** box and click the **Save As** button to save the current strategy as a template. The template can be reloaded by selecting the template name from the **Strategy** drop down box.

Drill Points

Create a single Drill Point at a specified location.

Parameters

X and Y Coordinate	X and Y location for the drill point
By Graphic	When checked, the Drill Point will be located with the mouse

Drill Circle

Create a circular pattern of drill points centered about a specified location.

Parameters

Circle Diameter	Diameter of the circle the drill points will be generated around. Must be greater than zero.
Angle	Rotate the drill points about the center by the specified angle. An Angle of 0 will place the first circle to the right of center.
Number of Holes	Number of holes to generate, must be 1 or greater.
X and Y Coordinate	X and Y location for the center of the circle
By Graphic	When checked, the circle center will be located with the mouse

Drill Array

Create a matrix of Drill Points with a set number of rows and columns and a defined spacing.

Parameters

Columns	Number of vertical drill columns	
Rows	Number of horizontal drill rows	
Spacing	**Width by Overall Width**	Specify the overall width of the array, the drill points will be evenly spaced horizontally within the overall width
	Width by Horizontal Spacing	Specify the amount of horizontal space between each column of drill points
	Height by Overall Width	Specify the overall height of the array, the drill points will be evenly spaced vertically within the overall height
	Height by Vertical Spacing	Specify the amount of vertical space between each row of drill points
X and Y Coordinate	X and Y location for the bottom left hole in the array	
By Graphic	When checked, the array will be located with the mouse	

Drill Centers

Create a drill point in the center of all selected contours. Contours can be filtered so that only circles of a specified diameter are used.

Drill Centers can only be used with closed contours

Parameters

All Contours	Holes will be drilled in the center of all contours
Circles Only	Holes will only be drilled in the center circles within the selected contours

All Circles	Holes will be generated in the center of all circles
By Diameter	Holes will only be generated in the centers of circles within the **Tolerance** of the **Check Diameter** value

Drill Contours

Create drill points along selected contours.

Parameters

Spacing Type	**Hold Number**	A number of drill points will be generated along the contour as specified by the **Number of Holes** parameter
	Hold Spacing	Drill points will be spaced along the contour at even intervals defined by the **Spacing** parameter
	Corners	Create Drill points at all corners in the contour
	Inside Corners	Create Drill points at all inside corners in the contour
	Outside Corners	Create Drill points at all outside corners in the contour

Circles and Ellipses have no corners and will not have drill points generated for any of the corner spacing types

Number of Holes	The number of holes used by the **Hold Number** spacing type
Spacing	The spacing between drill points used by **Hold Spacing** type

Drill Corners

Create drill points at the corners of the plate, and optional drill points between the corners.

Drill Corners is only available if a plate has been defined

Parameters

Inset X	The horizontal inset from the corners of the plate
Inset Y	The vertical inset from the corners of the plate
Add Copies X	Create additional drill points spaced evenly between the corner drills along the horizontal axis
Add Copies Y	Create additional drill points spaced evenly between the corner drills along the horizontal axis

Drill Cut Parameters

Drill cut parameters for Depths, Passes, Feeds and Speeds are the same as the toolpath Cut Parameters. There are a couple additional parameters that are unique to drill points.

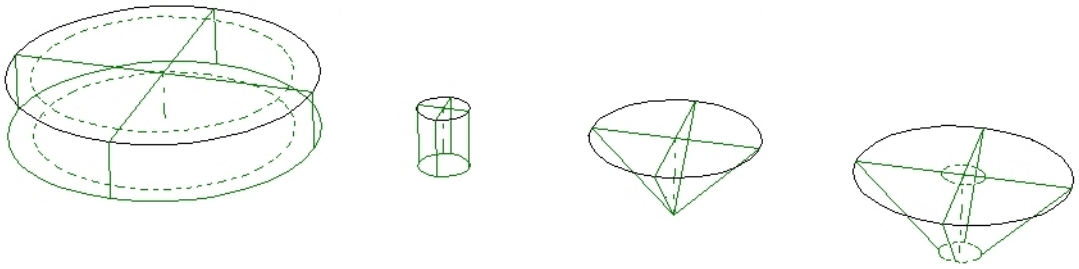
Diameter by tool vs. Exact diameter

If **Diameter by tool**is selected the drill point will only be a point and the size of the hole will be based on the diameter of the tool at the given depth.

If **Exact Diameter** is selected, a diameter larger than the tool diameter can be specified and the drill point will be generated as a circle. The circle will be sized to create a hole with the selected diameter using the tool dimensions at the given depth.

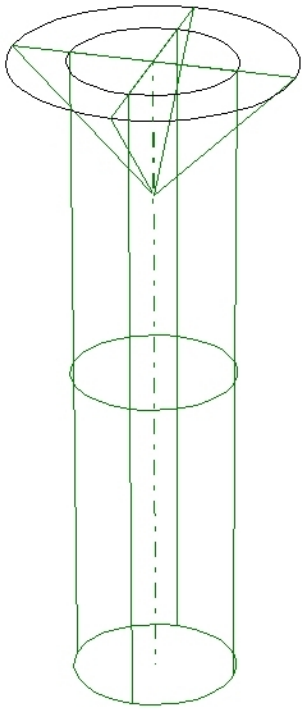
When using **Exact diameter**, EnRoute accounts for the shape of the tool when determining the drill path. For example, a drill point generated with a conic tool where the drill depth is less than the conic bevel height, the real diameter of the tool at the drill depth will be used to generate the drill path.

The image below illustrates drills defined with both **Diameter by tool** and **Exact diameter**.



Countersink

The **Countersink** option is available when using an engraving capable tool (conic, engraving, tapered) and **Diameter by tool** is selected. **Countersink** allows the specification of the outer diameter of the countersink hole and then automatically calculates the depth of cut based on the tool dimensions.



Slot Toolpaths

Define a cut along a line, creating a slot the width of the tool diameter. Slots can include multiple tools and depths.

Parameters

Start X and Y Coordinates	X and Y coordinates of the starting point of the slot
End X and Y Coordinates	X and Y coordinates of the end point of the slot
By Graphic	When checked, the start and end coordinates of the slot will be selected by the mouse
Back and Forth	When checked, the tool will move from the start to the end point, and return to the start point before lifting from the material

Automatic Toolpaths

Overview

Automatic Toolpaths (ATP) in EnRoute allow parts contained in external DXF files to be processed for output. EnRoute's Automatic Toolpath capabilities provide an efficient way to process large numbers of parts as part of a Nested-Based Manufacturing (NBM) process.

Design Application Support

Several design applications are supported by EnRoute and new application support is added based on requests from users, manufacturers, and customers.

The images in the ATP section must often show a specific design application as the active application. For simplicity, KCD was chosen as the active application in the examples. This is not intended to provide a specific recommendation or to exclude any other supported applications. References to the active application are marked as **<active application>** or **<KCD>** and should be interpreted as any design application can be used in these references.

The ATP Process

DXF files supported by EnRoute separate each machining operation onto a different layer. The geometry within all layers represents a single part and all of the machining information. To process the part, the toolpath strategies in EnRoute must be mapped to the correct DXF layer in the ATP.

EnRoute uses the strategy mappings to apply toolpaths to each piece of the part geometry. Parts are imported one at a time and toolpaths are created for each layer of geometry. They are then separated into different material types and thicknesses, and then nested onto sheets using the selected nesting parameters. Machining output files are created based on ordering and output preferences. Finally, labels are created if they have been specified, and summary printouts are created if they have been requested.

One of the key efficiencies of this process is that all of the layer mappings and processing parameters are stored in an ATP configuration file that can automatically be loaded when the ATP is activated. When a job is created using most popular design applications, it includes a List File that provides information about the parts and their corresponding geometry files. This list file is used to load the parts into the ATP, and then to subsequently process the parts.

When the ATP has been fully configured, processing a job becomes as easy as opening the ATP, loading the appropriate list file, and clicking the Process Parts button.

ATP Dialog

All of the ATP functions are accessed through the ATP dialog. The dialog window tabs represent the main ATP steps and are arranged left to right from the start of processing to configuring output files.

Start - This tab allows selection of the design application or other source for part information. It also provides for loading and saving ATP configuration files.

Parts - This tab provides for loading parts using either job list files or loading individual DXF files.

Map - The Map tab is for selecting saves Strategies that will be applied to part layers.

Material - Different materials and importantly, their thicknesses, are defined in this tab.

Processing - Parameters for nesting, double-sided processing, and labels are defined in this tab.

Output - Finally, this tab provides ordering, output options, and file naming options for output files.

Start

Load an ATP parameters file and select the active application and part source to create output for.

Parameters

Active Application	Choose the active supported design application. This only needs to be set once, EnRoute will remember the selected application and won't be necessary reset it unless changing applications.	
Part Source	**Application List File**	Process files from the active application
	Select Import Files	Select the DXF files that contain the part information
	Active Drawing	Process the parts in the currently active EnRoute design
Load ATP File	Load a saved ATP parameters file	
Save ATP File	Save changes to the currently loaded parameters file. If no parameter file is loaded, the Save As dialogue will open	
Save ATP File As	Save the current settings as a new ATP parameters file	
Clear ATP	Clear the loaded ATP settings and reset all fields to the default values	

Selecting Parts

Parts can be loaded 3 different ways into the ATP dialogue. If using a specific design application, it can be selected from the **Design Application** drop down menu. With a design application specified, the parts to process will be loaded from a list file in the Parts tab of the ATP dialogue. The list file is a list of all of the DXF files to be processed, along with additional information such as material, quantity, and rotation for each part.

If not using a list file from a supported design application, parts can be imported individually using the **Selected Import Files** option and then by selecting each file in the Parts tab. The ATP can also be used to toolpath parts from the current EnRoute workspace by selecting the **Active Drawing** option.

Loading an ATP File

ATP files can be used to save ATP settings to automatically configure future jobs. Layer mappings, strategies, nesting, and output options can all be saved to an ATP file so processing a new job can be as simple as loading an ATP file and generating output.

Parts

Select the files to be processed either individually, or by loading a **List File**. Part output files from supported applications include a **List File** that contains all of the information for the job including DXF file names, size, material, quantity, and rotation. Each DXF file is automatically verified and the information is displayed in the table in the parts tab.

Part Parameters

Use	Process the part when checked
Part Name	Part name definition, not editable
Width	Part width
Length	Part Length
Thickness	Nominal part thickness
Material Type	Part material, not editable
Quantity	Part Quantity, editable
Allow Rotate	Allow the part to be rotated when nested, usually checked

Loading List Files

If a **Design Application** is selected in the Start tab, a list file input dialogue will be visible in the Parts tab. Select **Add List File** to open a dialogue window to select the list file location. The dialogue will automatically filter the view to display only list files in the correct format for the selected design application. Multiple list files can be added at once and all can be removed using the **Clear** button. When a list file is used, the part name, size, and material will be displayed. Once loaded, the parts dialogue provides additional parameters that can be edited for enabling part output, quantity, and allowing the part to rotate.

If using selecting the parts individually, files can be added using the **Add Files** button, which will opens a dialogue window to select DXF files. Files can be removed from the list using **Delete Files** to remove selected files, or Clear to remove all parts from the list.

Map

Each machining operation is separated into a different layer in the part XML files. Synchronize toolpath generation with the XML files by mapping each layer to the correct toolpath strategy. This is the core step for defining automatic toolpaths.

For example, a layer could be named CUTOUT, and it would contain the part perimeter. In the layer tab, a routing offset would be associated with the CUTOUT layer. All parts loaded into the ATP with a CUTOUT layer would have a routing offset applied to geometry in the CUTOUT layer.

Layers can either be added one at a time, or they can be automatically imported from the loaded files using the **Use Parts** button. The next step is to map toolpath strategies to each layer from the saved strategy templates which can be created from each toolpath strategy through the Strategy Dialogue.

Actions

Add Layer	Add a new layer mapping
Remove Layer	Remove the selected layer mapping
Clear Layers	Remove all layer mappings
Use Active	Populate the layers from the active EnRoute drawing
Use Parts	Populate the layers from the parts loaded in the Parts tab

Layer Parameters

Map Layer Name	Layer name that corresponds to a machining operation layer in the part
Strategy	Toolpath strategy assigned to the layer
Small Part Strategy (Optional)	Toolpath strategy assigned to the layer to be used when cutting small parts
TP - Toolpath	Create toolpaths for this layer, usually checked.
NT - Nest Together	Include this layer with the part defined by the DXF when nesting. When processing files from supported applications, this option should always be checked.
OP - Output	Include this layer with the part in the toolpath output. Usually checked. If unchecked, the geometry information for that layer will not be included in the output.
FL - Flip	The geometry on the selected layer is for the flip side of the material when utilizing 2 sided processing.

Design Depth and Use Depth

When **Use Depth** is checked, the depth of the geometry in the part file will be used to generate toolpaths. If **Use Depth** is unchecked, the toolpaths for the layer geometry will be generated at the strategy depth.

Design Depth specifies the nominal depth the selected strategy was designed for. If the strategy was created to cut 0.75" thick material, **Design Depth** should be set to 0.75 and similarly, if the strategy was created to cut 0.5" material, **Design Depth** should be set to 0.5.

If a strategy is designed to cut a material that is 0.75" thick but the strategy depth is set to 0.77" to allow for 0.02" extra cut depth to cut through the entire material, **Design Depth** would still be set to 0.75. If the same strategy is applied to a part with thickness 0.25", the **Design Depth** is set to 0.75", and **Use Depth** is checked, the toolpaths will be output to a depth of 0.27". The strategy depth was designed for nominally 0.75" material but with 0.02" additional depth to create a complete cut. When the same strategy is applied to 0.25" thick material, the ATP interprets that because the strategy depth was designed with 0.02" additional depth, the same additional depth should be applied to the 0.25" material.

Using the **Design Depth** and **Use Depth** parameters allows for creating fewer strategies that can be applied to different depths of geometry. Otherwise, leaving **Design Depth** set to 0.0 and **Use Depth** checked will generate toolpaths at the geometry depth specified in the part file.

Default Strategy

The default strategy applied to layers without a strategy assigned.

Sheet Trim Strategy

The strategy used to trim the sheet edges when processing 2 sided cuts.

Material

Define the material types the parts will be cut from. Multiple types of material can be defined at once.

Default Material

A default material is always defined as the first material. Any new materials will be created with the same dimensions as the default material. The default material size is saved to the ATP file and will update when a new ATP file is loaded.

Actions

Add	Add a new material definition
Remove	Remove the selected material definition
Reset	Reset the material parameters to the original settings

Parameters

Material	Material Name
Width	X dimension of the material
Height	Y dimension of the material
Thickness	Default material thickness. Output for an active design application will automatically adjust the thickness based on part thickness. If no design application is selected, this value will be used.

Processing

Specify specific processing parameters for part nesting, double sided parts, and labels.

Nest Options

Parts are grouped together for nesting based on the associated material type for each part. The nesting options define how the parts are placed within each sheet of material.

Nest Method	Select the EnRoute nester to use to nest the parts
Angle Steps	The angle increment to rotate parts by when nesting. Larger values increase the number of nesting options, but also increase nesting time
Gap*	Minimum distance between nested parts
Margin*	Minimum distance between nested parts and the edge of the material
Use Holes	Nest parts inside the holes of other parts when checked
Nest Position	Select the nesting position on the plate

* Overall part dimensions when nesting include any external toolpaths allowing nesting spacing parameters to be very small or even 0.0 to maximize material usage.

Double Sided Machining

Flip Direction	The direction the material will be rotated when processing 2 sided geometry
Horizontal Trim Amount	The thickness of material trimmed off the horizontal edge of the material to create an accurate registration surface for flipping the material
Vertical Trim Amount	The thickness of material trimmed off the vertical edge of the material to create an accurate registration surface for flipping the material
Horizontal Edge	Select the top or bottom horizontal edge to trim
Vertical Edge	Select the left or right vertical edge to trim

Label

Label Design	Select a label design created by the ***Label Designer*** application in EnRoute
Label Format	Select a label format
Labels on Flip Side	Labels will be generated for the flip side output when double sided parts are processed

Output

Define how the toolpaths should be ordered when output, how the output files should be created, and the output location.

Parameters

Create Output	Generate output for the loaded parts
Create printout of parts	Create an image of each nested sheet with part names labeled and the name of the corresponding output file
Create label output	Create labels for each part based on the label design and format specified in the **Processing** tab.
Process as single parts	Generate a separate output file for each part
Create output sub directory	Create a sub directory within the specified output folder with the date and time in the name
Surface at (Top/Bottom)	Select if the material surface for this job is set at the top or bottom. This can be overridden for a specific machine driver by the **Surface at Top of Plate** and **Surface Override** parameters in the Driver Selection dialog.
Output Path	Open a dialogue to select the output path for all generated files
Output file name prefix	Specify a prefix to append to all generated file names
Printer	Select a printer to send the labels to

Output Results

After processing a job, an Output Results dialog will appear. The dialog will show the files that were created, the length of cut in material, and the time to cut the job.

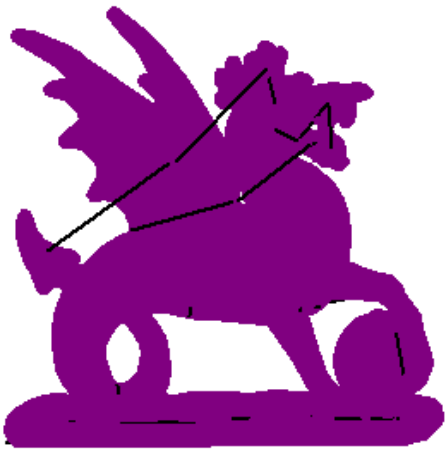
Ordering

ATP output uses the common toolpath Ordering Dialogue to define the cut order. The ordering options apply the same way to parts loaded in the ATP dialogue.

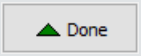
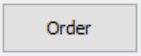
Preview Output

Simulate 2D

Preview the toolpath output in they will be sent to the machine. This provides a way to review the output before cutting to make sure toolpaths are ordered correctly.



Controls

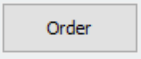
	**Rewind**	Rewind the simulation to the beginning
	**Draw Next Segment**	Advance the simulation until the next segment is drawn
	**Play**	Start the simulation and allow it to play to the end
	**Next Lift**	Advance the simulation to the next tool lift
	**Next Tool**	Advance the simulation to the next tool change
	**Done**	End the simulation and close the 2D simulation dialogue
	**Order**	Display the Toolpath Ordering dialogue. Changes can be ma in the **Priority Ordering**, **Tool**, **Strategy**, and **Sort** Method from the 2D Simulation tool and reviewed. Click to **Update Order** button to apply changes

Use the Up and Down arrow keys to speed up and slow down the simulation

Simulate Orthographic

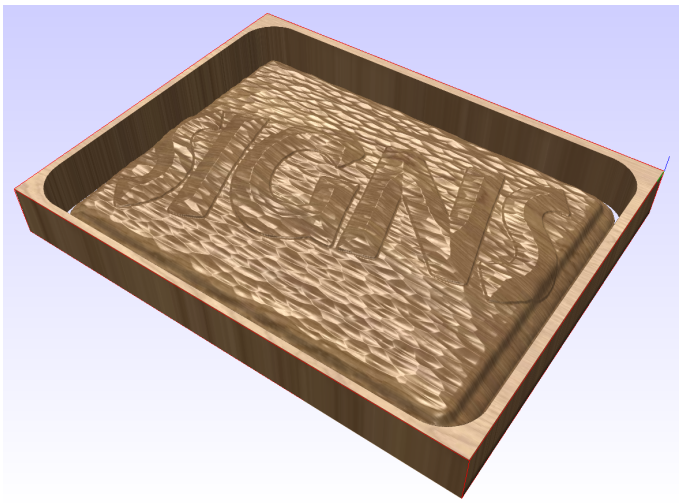
Display and animated orthographic view of the path each tool will take in the defined order. This provides a way to review toolpaths and toolpath order before cutting

Controls

	**Rewind**	Rewind the simulation to the beginning
	**Draw Next Segment**	Advance the simulation until the next segment is drawn
	**Pause**	Pause the simulation
	**Next Lift**	Advance the simulation to the next tool lift
	**Next Tool**	Advance the simulation to the next tool change
	**Done**	End the simulation and close the 2D simulation dialogue
	**Order**	Display the Toolpath Ordering dialogue. Changes can be ma in the **Priority Ordering**, **Tool**, **Strategy**, and **Sort** Method from the 2D Simulation tool and reviewed. Click to **Update Order** button to apply changes

Simulate 3D

Simulate a rendered view of the design output. All tool shapes are accurately rendered allowing both 2D and 3D toolpaths to be rendered.

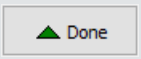
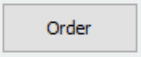


Simulation Options

Resolution	The display resolution of the rendered image. Higher resolution will create more pixels in the image and a clearer picture, but will take longer to display
Material Color	The color of the rendered relief. Click on the color panel to select a new color
Material Texture	Select a bitmap texture to apply to the simulation. If no option is selected, the material color will be used to render the simulation
Cut Color	**Use Tool Color**: The colors assigned to each tool type will be used to render cuts **Use Selected Color**: The selected color is shown to the right. Click the color panel to select a new color **Use Material Color**: The material color will be used to render cuts
Use selected contours as mask	When checked, any selected contours will be used as a mask for the area to simulate
Save simulation as relief	The simulation will be saved as a relief and placed in the plate
Simulation Tolerance	How closely the simulation will display the relief toolpaths

Controls

	**Rewind**	Rewind the simulation to the beginning

	**Draw Next Segment**	Advance the simulation until the next segment is drawn
	**Pause**	Pause the simulation
	**Next Lift**	Advance the simulation to the next tool lift
	**Next Tool**	Advance the simulation to the next tool change
	**Done**	End the simulation and close the 2D simulation dialogue
	**Simulation Options**	Open the simulation options dialogue
	**Render**	Toggle the rendered view
	**Order**	Display the Toolpath Ordering dialogue. Changes can be ma in the **Priority Ordering**, **Tool**, **Strategy**, and **Sort** Method from the 2D Simulation tool and reviewed. Click to **Update Order** button to apply changes

Output to Machine

Generating Output

Use the toolpaths created for a design to generate an output file or send data directly to a machine for manufacturing.

There are 3 steps to generating Output:

1. Select the Machine Driver
2. Determine Cut Order
3. Select Output Parameters

When all 3 steps have been completed, click **To File** to open a **Save As** window to save the output to a machine file.

Cut Statistics

Generate a report for the currently active job that estimates the total time to complete the job, based on the total distance covered, and machine specific parameters.

Cut Statistic Preferences

Before generating a report, the cut statistics estimator needs to be configured in Preferences, under the **Cut Statistics** tab.

Cut Time Estimator	Select which estimation method to use. Standard takes into account acceleration and deceleration. Simplified and Legacy only estimate straight line speed along the contours.
Cut Factor	A scaling factor to calibrate the estimation to match real world values.
Tool Change Interval	The required time to change tools
Maximum Speed	Maximum machine movement speed

Acceleration Angles

The acceleration and deceleration angles approximate how quickly the machine changes speed and are only valid when using the **Standard** estimator. 45 degrees is the default value and represents a steady change in speed. Larger angles will estimate that the machine changes speed more rapidly, and smaller angles will estimate that the machine changes speed more slowly. This can be calibrated to match estimation times to real world machine times.

Cut Statistics Report

After defining the cut statistics preferences, reports can be generated to estimate job time. With toolpaths created in the active workspace, activate the **Cut Statistics** tool to generate a report. The report has 3 main sections:

General

General information for the active job.

Line Count	Number of straight line segments

Arc Count	Number of arc segments
Feed Count	Number of movements in material
Rapid Count	Number of movements above the material
Total Moves	Total number of machine movements to job completion
Tool Changes	Number of tool changes
Tool Lifts	Number of Tool Lifts
Factor	The scaling factor applied to the estimate

Distances

Estimates for the distance the machine will travel to complete the job.

Feed Distance	Movement distance in material
Rapid Distance	Movement distance above the material
Total Distance	Total distance covered for this job

Times

Estimates for time to complete the job.

Feed Time	The time spent in the material
Rapid Time	The time spent above the material
Tool Change Time	Time spent changing tools, defined in preferences
Total Time	Total estimated time to job completion

Configure Machine Drivers

Select and configure **Machine Drivers** for a specific machine.

Machine Drivers are also referred to as **Post Processors**. The driver or post processor interprets the output from EnRoute and translates it into a format that can be recognized by a specific machine.

In the Machine Drivers dialogue, select the driver to configure from the **Current Driver** list. The **Current Driver** list shows drivers that have been marked as active; if the driver for a specific machine is not shown open the **Active Drivers** dialogue and add it to the list of active drivers.

Parameters

Driver Description			
	Name	Name of the driver file	
	Model	Model of the driver	
	Description	A brief description of the driver, such as the model of the machine or the type of driver	
Driver Parameters			
	Width		Machine width (typically the X axis dimension)
	Height		Machine height (typically the Y axis dimension)
	Z Lift		The maximum Z axis dimension
	Surface Override		Override the surface at Top/Bottom setting in the plate definition and ATP and use the parameter value in the driver
	Surface at Top of Plate		Sets the surface at top of plate when checked, and bottom of plate when unchecked, when the **Surface Override** parameter is enabled
	Primary Axis		The machine primary axis, for use with the **Rotate for Driver Primary Axis** in the AutoTP Preferences. When enabled, parts processed by the ATP will automatically be rotated to align with the primary axis.

Driver Speeds	Values in this category are limited by the machine capabilities so that it is not possible to define a speed that the machine is not capable of. These values are set by the manufacturer and it is not recommended to change them. The units in this category are defined by the manufacturer based on the units used by the controllers. It is not recommended to change the units. **Spindle Speed** — Default spindle speed to use if no spindle speed is specified **Feed** — Default feed rates the machine moves in the X and Y axis if not specified in toolpath output. **Above the Material** refers to speeds moving between toolpaths and **Within the Material** refers to speeds when cutting material. **Plunge** — Default Z axis speed moving in and out of cut. **Dwell** — A minimum dwell time after entering the material to allow the tool to clear chips before beginning a cut.
Driver Units	These are units set by the manufacturer that are expected by the machine controller. As described above, it is not recommended to change these units. The default units can be restored at any time by selecting the **Use Defaults** button.
Communication Parameters	These parameters are used to communicate with the machine when sending output directly and are defined by the manufacturer. Many machines are not designed to receive information directly from the software. Check with the manufacturer to find out what communication parameters should be used if appropriate. Do Not Change These Values unless you know for sure the changes are correct. If specified incorrectly, speeds and distances will not be communicated correctly to the machine

After a driver is configured it is typically not required to edit the configuration again, except to change tools loaded in a tool changer if the machine has one.

Configuring a Tool Changer

Specify if the selected machine has a tool changer and select the specific tools present.

Parameters

Auto Tool Changer	Enables auto tool changer for the specific machine
Number of Tools	Number of tools in the tool changer
Edit Tools	Edit the specific tools loaded at each position in the tool changer **Add Tool** — Add a new tool in the selected position **Remove Tool** — Remove a tool from the selected position **Empty Turret** — Clear all tool selections

- Use the drop down list for each position to select the type of tool loaded in that position
- Click OK to accept the tool changer configuration
- The **Print TC** button will print out a copy of the current tool changer configuration for use when setting up a machine

Configuring a Drill Bank

Configure an available boring head as a drill bank. The configuration must match the machine configuration and drill arrangement to function correctly. EnRoute also supports horizontal drills.

Check the **Has drill bank** parameter and click the **Click to Edit** button to open the drill bank configuration dialogue.

1. Set the **Number** of drill tools that are present on the machine
2. For Each Drill Tool:
   a. Select the type of Drill Tool that is loaded into that position from the pull down list

      Tools must be added to the **Tool Library** before they can be added to the drill bank

   b. Define the X, Y and Z location of the tool
   c. Define the tool direction. Drills commonly point down in the -Z direction, but they can be configured to point in other cardinal directions to match a machine configuration.

      If Horizontal bores are used, it is very important that the machine driver is properly configured. Please contact EnRoute Technical Support before implementing horizontal bores.

      This location information is used to create the final output and it is very important it is correct. It may be necessary to get the location from the manufacturer.
3. Click **OK** to accept the drill bank configuration

After defining a drill bank, it can be disabled at any time by disabling the **Has drill bank** parameter. The drill bank configuration parameters will be retained and reloaded the next time the drill bank is enabled.

It is important to verify the selected driver is capable of supporting a drill bank. Not all drivers can support the correct output commands. If unsure, check with the manufacturer or contact EnRoute Technical Support.

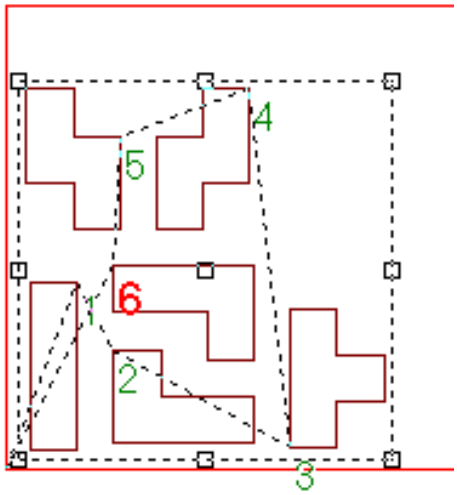
Output Parameters

Which Toolpaths?	Select One:	
	All	All toolpaths will be output
	Selected	Only the current selection will be output
Depth	Select One:	
	All	Toolpaths at all depths will be output
	[Specific Depth]	Only cut passes at the specified depth will be output
Orientation	Output the toolpaths rotated by **0**, **90**, **180**, or **270** degrees	

Copies	Not Supported, leave at 1
Hold Output	When sending the output to the Output Control Center, hold the output in a queue so they con be sent to the machine when ready.

Toolpath Ordering

Review and edit the order assigned to toolpath groups. The toolpath order influences the order in which cuts will be made.



Ordering Toolpath Groups Manually

1. In the **Order Toolpath** dialogue, use the horizontal **blue arrow** buttons to select toolpaths. The selected toolpath is indicated by a bold red number.
2. Use the vertical **green arrow** buttons to change the cut number of the selected toolpath.
3. Click OK when finished.

Pressing the arrow keys on the keyboard produces the same result as clicking on the blue and green arrows.

Order Manually using the Mouse

1. Select the **Manual** option in the **Order Toolpath** dialogue.
2. Click each toolpath in the desired order
3. Click OK when finished

Order Toolpath Groups Using Sorting Methods

Select the sorting method from the Current Sort Method list.

Shortest	Produce the shortest overall set of toolpaths and movements
Rows	Order toolpaths in rows starting at the bottom of the plate and numbering left to right
Columns	Order toolpaths in columns starting at the left of the plate and numbering top to bottom

Inside Out	Sort toolpaths by position from the center of the plate to the edges
Outside In	Sort toolpaths by position from the edges of the plate to the center

Cut Order

The order in which cuts are made determines the time to output a finished piece.

The default ordering options will create a high-quality finished piece and it is not necessary to edit the ordering. The ordering parameters only need to be changed to fine tune the process.

Priority

Set the priority levels of the major parameters relative to each other.

Priority Options

Tool	Type of cutting tool used to make the cut
Object	The object that the cut forms a part of. In this context an object a piece that will be cut from the plate
Strategy	The strategy the cut belongs to
Pass	The cutting pass the cut belongs to
Layer	The layer the cut belongs to

The order listed above is the default priority order, which is designed to minimize tool changes. If the output uses 2 tools, all of the toolpaths associated with the first tool would be cut first, followed by all of the toolpaths with the second tool.

Entries in the Priority Order list can be changed by dragging them up or down the list by clicking on the row header column on the left edge.

Cutting Each Object Completely Before Continuing

A common change to the priority order list is to cut out each object completely before moving on to the next object. Moving **Object** to the top of the order will prioritize each object above the individual tools used to cut out the object. This will increase the number of tool changes, but that could be a valid tradeoff if it is more important to keep completed parts moving through a shop.

Click Default Order to reset the Priority Order to the default

Tool Order

The **Tools** list displays all tools used in the design ranked from highest to lowest priority. Highest priority tools are used first down to the lowest priority tool. A 1/4" end mill used to cut out pieces from the plate should be prioritized lowest so that all other cuts can be made to a design before separating it from the plate.

Entries in the Tool Priority list can be changed by dragging them up or down the list by clicking on the row header column on the left edge.

Clear the **Use** check box to the right of a tool to prevent any cuts using that tool from being output.

Strategy Order

The **Strategies** list displays the different strategies within the design in priority order. Higher priority strategies are cut first and lower priority strategies are cut later.

Entries in the Strategy Order list can be changed by dragging them up or down the list by clicking on the row header column on the left edge.

Clear the **Use** check box to the right of a strategy to disable it from generating output. For example, if the same contours are used to generate male and female **Routing Offset** toolpaths for an inlay job, each strategy will need to be sent to the machine at a different time. Mark one strategy as unused to generate output files for the other strategy.

Object Order

Choose how objects are prioritized. Object order uses the same dialogue as Toolpath Ordering.

Additional Ordering Options

Small Parts First	Cut out small parts first
Maintain Grouping	Treat grouped objects as a single reference in the cut order

Load and Save Ordering to Preferences

Ordering parameters can be saved to preferences and reloaded later by using the Load and Save Ordering to Preferences buttons in the ordering dialogue. When Load Ordering is selected, the ordering parameters saved to preferences will be loaded into the dialogue. When Save Ordering is selected, the parameters loaded in the dialogue will be saved to EnRoute preferences, overwriting any previously saved ordering parameters.

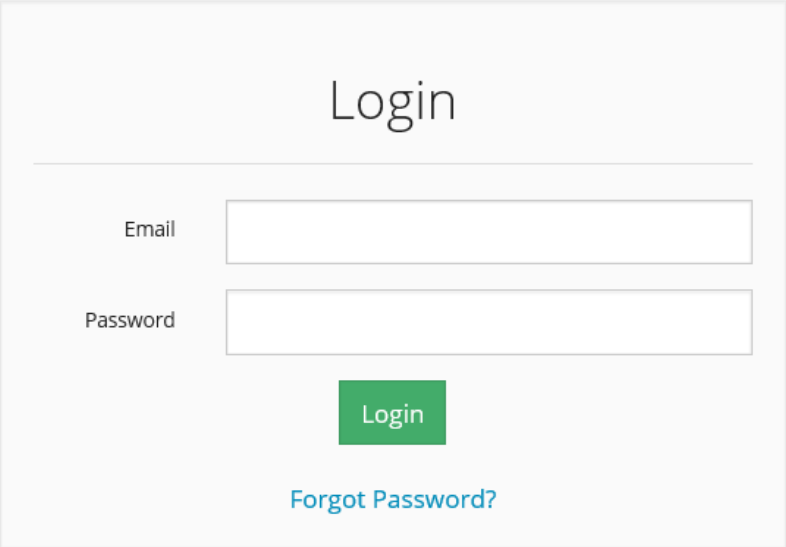
SAi Cloud

Accounts and Licenses

Manage your SAi cloud account and software licenses.

Logging into your SAi Cloud Account

Browse to http://saicloud.com



Enter in the email address and password you signed up with and click Login.

Change your email address

To change your email address, which is also your username, in the SAIcloud :

- Log in to http://saicloud.com
- Click Login Settings
- Under Login Settings, click the Change email link
- Type in a new email address
- Type in your current password
- Click Send

Change your password

To change your password :

- Log into your saicloud account and click Login Settings
- Scroll down to Set Password.
- Type in a new password

- Retype the new password
- Click Set Password

If you have forgotten your password

- Browse to http://saicloud.com
- Click the Forgot Password? link underneath the login section
- Enter in your email address and click reset password

You will receive an email with instructions to reset your password

Manage your subscription

If you have a EnRoute Subscription, you can manage your subscription from the SAi Cloud.

- Browse to http://saicloud.com
- Enter your user name (email address) and password
- In your list of software, click the Manage button next to the Subscription
- This will take you the overview of all your subscriptions with SAi

Depending on the type of subscription or its current state a number of actions are available :

Flexi	**Monthly Commitment**	Subscriptions with a monthly commitment are billed every month until you cancel them. Because your commitment is month to month, you can cancel at any time.	
		Cancel Subscription	Cancels the subscription. The status of the subscription will change to canceled and you will not be billed the next month.
		Update Payment Details	Use this if your credit card has changed.
		Annual contract	Converts your subscription into an annual contract. You will still be billed monthly but at the discounted price. You will not be able to cancel your subscription after converting to annual until the year is over.
		Invoice History	Access your invoices in PDF format
Flexi	**Annual Commitment**	Subscriptions with Annual Commitment are also billed every month. However, since you committed to pay for the subscription for the duration of 1 year you cannot cancel the subscription. You can switch off Auto renewal, which will make sure that the subscription will cancel at the end of the year.	
		Switch Auto Renewal Off	When auto renewal is switched off, the subscription will cancel at the end of the year you committed to.
		Update Payment Details	Use this if your credit card has changed.
		Invoice History	Access your invoices in PDF format
Flexi Design	**Monthly Commitment**	Subscriptions with a monthly commitment are billed every month until you cancel them. Because your commitment is month to month you can cancel at any time.	

		Cancel Subscription	Cancels the subscription. The status of the subscription will change to canceled and you will not be billed the next month.
		Update Payment Details	Use this if your credit card has changed.
		Annual contract	Converts your subscription into an annual contract. You will still be billed monthly but at the discounted price.
		Invoice History	Access your invoices in PDF format
		Upgrade to Flexi	Converts your license from a Flexi Design to a full Flexi license. The same commitment as your current license will apply. You will be billed the corresponding price for the Flexi license.
Flexi Design	**Annual Commitment**	Subscriptions with Annual Commitment are also billed every month. However, since you committed to pay for the subscription for the duration of 1 year you cannot cancel the subscription. You can switch off the Autorenewal, which will make sure that at the end of the year the subscription will cancel.	
		Switch Auto Renewal Off	When auto renewal is switched off, the subscription will cancel at the end of the year you committed to.
		Update Payment Details	Use this if your credit card has changed.
		Invoice History	Access your invoices in PDF format
		Upgrade to Flexi	Converts your license from a Flexi Design to a full Flexi license. The same commitment as your current license will apply. You will be billed the corresponding price for the Flexi license.

» If you have canceled a subscription and would like to restart, you can do so at any time by choosing the Restart Subscription option

Use the Manage Subscriptions page to cancel subscriptions. Do not cancel via email. The subscriptions platform is a fully automated system but it is not capable of reading emails!

Cloud Tools

Review the available cloud tools in EnRoute.

Artwork Approval

Facebook

Click the Facebook icon to visit SA International's public page on Facebook. Here you will find photos, training videos, news, and user questions and comments. Click the Like to follow SA International's activity link.

Files

The Files option gives you at-a-glance information about the files you have stored in your account on the SAi Cloud. Files are stored (archived) on the SAi Cloud server using the Archive to Cloud option found in the File Menu and on the Standard Toolbar. Jobs that were sent to approval will also be stored in your Cloud account.

To see what has been stored in your Cloud account, click the Files icon.

The archive opens in the Cloud Window on the right side of your SAi product screen. The Summary section presents an overview of your total file count, storage usage, and space availability. The Files section lists each of the files you currently have stored on the SAi Cloud. The files are listed in date order with the most recently archived file at the top of the list. Each entry in the Files list contains a thumbnail image of the file, its name, size (in kilobytes), and time of archival.

Note: A file having the same name as an existing archived file will not overwrite it. Instead, the new file will be stored as a more recent version of the existing one. This serves as a safeguard against inadvertent deletions and as a version control.

Additional options—Download and Delete This File—can be accessed by clicking anywhere on a file's information. Any comments associated with the file will appear in the Comments section. And clicking Back To List will return you to the Summary page.

The list contains all files that were sent to Cloud from all licenses that are linked to an account.

License

Clicking this icon will display more information about your current license.

If your license is a subscription, you will also see a Manage button which you can use to update payment details, pause or manage a subscription.

Reports

The Reports option keeps a running total of the number of jobs your company has worked on during the past week and month, and reports the total area for each period.

Under Recent Jobs, Reports displays a list of all the jobs you have worked on during the past thirty days.

To find more detailed information about a particular job, click on it.

Support

The Support option takes you to the SAi Software Support page, where you can access SA International's many support resources.

To get started:

- Move your mouse over your region.
- Point to your preferred language.
- Select the software product that you own.

Training

Clicking this icon will open a YouTube training video to help you get started with Flexi.

YouTube

Click the YouTube icon to view TheSAiChannel on You Tube. Here you will find a number of video tutorials, product reviews, tradeshow interviews, and more.

Click Subscribe to follow TheSAiChannel