
ArtCAM 2D

User Guide

By Delcam plc



Issue: 1.0 Released: 24/10/01

Disclaimer

Delcam plc has no control over the use made of the software described in this manual and cannot accept responsibility for any loss or damage howsoever caused as a result of using the software. Users are advised that all the results from the software should be checked by a competent person, in accordance with good quality control procedures.













Information contained in this manual is subject to change without notice and does not represent a commitment by Delcam plc. The software described in this manual is furnished under licence agreement and may be used or copied in accordance with the terms of such licence. No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, for any purpose without the express permission of Delcam plc.







Copyright © 2001 Delcam plc. All rights reserved.

Delcam plc
Talbot Way
Small Heath Business Park
Birmingham B10 OHJ
England

Tel: (UK) 0121-766-5544
(Int) +44 (0) 121-766-5544

Contents

Overview	1
ArtCAM 2D Overview	1
Information about ArtCAM 2D	2
Comparing Vector and Bitmap Data	2
Vector Data	3
Bitmap Data	4
ArtCAM 2D Layout	5
ArtCAM 2D Layout	5
Adjusting the Window View	8
2D View Manipulation	9
 3D View	9
 Zoom In	10
 Zoom Out Tool	10
 Zoom Previous	11
 Window Fit	11
 Zoom Object(s)	11
Scrolling the 2D View	11
2D View Options	12
Using Rulers	12
Using the Snap Grid	13
Using Guidelines	17
Snapping to Objects	20
3D View Manipulation	21
 2D View	21
 Twiddle Tool	22
 Pan View	22
 Zoom	22
 Zoom Out	23
 Scale To Fit	23

	Isometric View	23
	View Along X	23
	View Along Y	23
	View Along Z.....	23
	Origin.....	23
	Objects To Draw	24

Tutorial – Aston Martin DB5 27

Overview	27
Aston Martin DB5	27
Preparing the Model	28
Creating a Frame for the Sign.....	29
Importing the Vector Artwork	34
Creating the Vector Text	36
Wrapping the Vector Text	37
Creating an Offset Vector	38
Machining the Vectors.....	41
Marking the Drill Holes with Circles.....	52
Creating the Drill Holes.....	54
Saving the Toolpaths	58

Tutorial – 3D Bevelled Carving 63

Overview	63
Bevelled Letter B.....	63
Preparing the Model	64
Creating the Vector Text	65
Machining the Vector Text.....	66
Saving the Toolpaths	72

Tutorial – Bridging 77

Overview	77
Bridged Letter B.....	77
Preparing the Model	77
Creating the Vector Text	78
Machining the Vector Text.....	80
Adding the Bridges.....	84
Editing the Bridges	86
Saving the Toolpath.....	92

Tutorial – Engraving 95

Overview	95
Engraved Text	95
Preparing the Model	96
Defining the Outer-Edge of the Engraved Area	97
Creating the Vector Text	98
Machining the Model	99
Saving the Toolpaths	105

Tutorial – ArtTrace 109

Overview	109
Converting a Bitmap to Vector Objects	109
Preparing the Model	110
Opening the Bitmap File in ArtTrace.....	111
Reducing the Colours in the Bitmap Image.....	112
Linking the Colours	113
Creating the Vector Objects.....	114
Exporting the Vector Objects to ArtCAM 2D.....	116

Tutorial – Nesting Vectors 121

Overview	121
Nesting Vectors	121
Preparing the Model	122
Defining the Material Shape	123
Creating the Vector Text	125
Nesting the Vector Text.....	126
Machining the Nested Vector Text	128
Saving the Toolpath.....	131

Working with Models 133

Getting Started.....	133
Creating a Model	133
Opening an Existing Model	135
Opening the Last Model	136
Closing a Model	136
Shutting Down ArtCAM 2D	137
Managing a Model.....	138
Creating a New Model.....	139
Opening a Model	139
Saving a Model.....	140

Editing the Model Dimensions	141
Importing Vector Files.....	142
Exporting Vector Files.....	143
Correcting an Action	144
Mirroring a Model	144
Rotating a Model	145

Working with Vectors 147

Drawing using Vectors	147
Vector Editing Tools	147
Creating a Polyline	148
Completing Polyline Creation.....	149
Closing a Polyline to Create a Polygon.....	150
Amending a Polyline	151
Selecting Vectors.....	151
Moving Vectors	153
Editing Vector Spans	154
Editing Vector Nodes	162
Creating Simple Closed Shapes	167
Creating a Rectangle.....	168
Creating a Circle.....	172
Creating an Ellipse	176
Creating a Polygon	180
Creating a Star.....	184
Editing Vector Objects	188
Copying and Pasting Vector Objects	189
Offsetting Vector Objects	193
Smoothing Vector Objects.....	195
Locking and Unlocking Vector Objects.....	198
Fitting Arcs to Vector Objects	200
Pasting Vectors Along a Curve	202
Working with Vector Text.....	204
Creating Vector Text	204
Selecting Vector Text	206
Editing Vector Text	207
Formatting Vector Text	210
Wrapping Text round a Curve	214
Measuring Vector Objects	219
Transforming Vector Objects	220
Scaling Vectors.....	222
Moving Vectors	224
Rotating Vectors.....	225

Shearing Vectors	226
Manipulating Vector Objects	228
Mirroring Vectors	228
Aligning Vectors	232
Centring Vectors	234
Nesting Vectors	236
Merging Vectors	240
Joining Vectors	244
Closing Vectors	246
Grouping Vector Objects	248
Resizing a Grouped Vector Object	251
Viewing the Properties of a Vector Object	253
Reversing a Vector Object's Direction of Geometry	254
Ungrouped Vectors	254
Grouped Vectors	256

Machining Models 259

Machining a Model	259
Using Toolpath Strategies	261
Profiling	262
2D Area Clearance	270
V-Bit or Centreline Carving	275
3D Bevelled Carving	278
Engraving	284
Centreline Engraved Feature	290
Inlay Wizard	293
Drill Holes	322
Adding Bridging	327
Editing Bridging	328
Setting the Profile Machining Order	331
Adjusting the Machining Parameters	333
Adjusting Machining Parameters When Creating a Toolpath	334
Adjusting Machining Parameters in a Created Toolpath ..	335
Simulating Toolpaths	337
Viewing a Toolpath	338
Hiding a Toolpath	342
Editing a Toolpath	344
Saving a Toolpath	345
Deleting Toolpaths	348
Deleting a Toolpath	348
Deleting a Toolpath Group	350

Using a Toolpath Summary	351
Using the Tool Groups Database	355
Adding a Tool.....	356
Editing a Tool.....	357
Deleting a Tool.....	361
Adding a Tool Group.....	361

ArtTrace 363

Using ArtTrace	363
Importing a Bitmap Image	363
Setting the Image Size and Origin	364
Working with Colours	366
Selecting the Primary and Secondary Colours	367
Reducing Colours	367
Colour Merging	368
Colour Linking	369
Edge Marking.....	370
Colour Thinning	371
Colour Thickening.....	372
Adding Colours	374
Editing a Bitmap Image	375
Using the Paint Brush.....	376
Flood Filling.....	378
Converting a Bitmap into Vectors.....	379
Editing the Vector Objects.....	381
Exporting Vectors to ArtCAM 2D	382

ArtSpool 385

Using ArtSpool.....	385
Setting Up ArtSpool	385
Selecting the Communication Settings.....	386
Selecting the Spool Directory	388
Sending Toolpath Files	389
Deleting Toolpath Files	391

Index 393

Overview

ArtCAM 2D Overview

ArtCAM 2D is a powerful 2.5D machining solution for professional CNC engravers and router users. Designs can be created using ArtCAM 2D's comprehensive vector drawing tools or imported from other graphics packages as *.eps, *.dxf or *.ai files. Bitmap images and scans (*.bmp, *.tif, *.jpg and *.gif) can also be imported, vectorized and edited.

ArtCAM 2D handles complex designs with ease and provides flexible machining strategies that are fast, accurate and, most importantly, very reliable. Integrated Nesting automatically positions multiple objects inside a user-definable block of material, ensuring minimal material wastage when the objects are manufactured. Realistic 3D toolpath simulation can be used to verify all toolpaths, and visualise the end product, before sending them to the CNC machine.



Information about ArtCAM 2D

You can find information about the features in ArtCAM 2D from the following sources:

1. The ArtCAM 2D Assistant (In-line Help).
2. The ArtCAM 2D User Guide (this manual).
3. The On-line Help pages.

ArtCAM 2D User Guide

This manual provides you with instructions on how to create and manipulate a 2D model, and then machine it. Further information can be found in the On-line Help pages.

This User Guide is divided into the following parts:

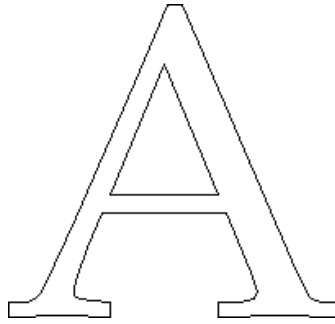
- Overview
- ArtCAM 2D Layout
- Tutorials
- Working With Models
- Working With Vectors
- Machining Models
- ArtTrace
- ArtSpool

Comparing Vector and Bitmap Data

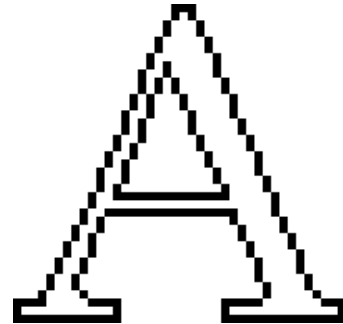
Vectors and bitmaps are two different methods of reproducing particular types of images. Although ArtCAM 2D uses vector objects to generate 2D models, the ArtTrace tool available within the application allows you to convert a bitmap image to a vector object.

For details, see “Using ArtTrace” in the ArtTrace chapter.

Vector Data



Bitmap Data



Vector Data

Vector data is defined mathematically by a drawing language. Objects are geometrical, being made up of a number of points mapped on a grid connected by lines or curves. In being geometrical objects, vectors are extremely flexible and can be manipulated with both ease and accuracy.

The amount of data required to display all of the attributes of a vector object is very little, so graphics made up of vector objects can have very small file sizes. As the objects become more complex, the sizes increase.

You may also infer from the images above that vector data is ideal for producing smooth features. The vector letter not only has greater definition than the bitmap, the geometry of the vector object can also be used to drive an assigned machining tool directly, which, in turn, produces a far superior finish.

ArtCAM 2D can read files containing vector data saved in the following formats:

- Drawing Interchange files, including PowerSHAPE and AutoCAD 2D (**.dxf**)
- PostScript format (**.eps**)
- Adobe Illustrator image (**.ai**)
- Windows Metafile (**.wmf**)
- DUCT picture (**.pic**)

Bitmap Data

Bitmap data is made up of a set of binary values specifying the colour of individual pixels (picture elements) that make up an image. Bitmap data is characterised by resolution and bit depth.

Resolution relates to the detail in an image and is expressed in dots per inch (**.dpi**) or pixels per inch (**.ppi**). The higher the resolution (i.e. the more dots used to describe the image), the more detail possible.

Bit depth has to do with the number of colours the image can display. Bits are the building blocks of binary data. A black and white image is 1 bit, meaning it can be off or on, black or white. As bit depth increases, more colours are available.

Unlike vector data, bitmap data is large. For example, a simple object like the letter in the previous image is 32,838 bytes as vector data in ArtCAM 2D. When rasterized (changed to a bitmap), the file size changes to 40,078 bytes in ArtCAM 2D. For small compositions the increase in file size may not matter greatly, but for larger compositions the difference in file size seriously impacts machining times.

ArtCAM 2D can read bitmap files generated by other drawing and desktop publishing packages or those scanned from paper based artwork saved in any of the following formats:

- Windows Bitmap (**.bmp**)
- TIFF image (**.tif**)
- PCX image (**.pcx**)
- CompuServe image (**.gif**)
- JPEG image (**.jpg**)

ArtCAM 2D Layout

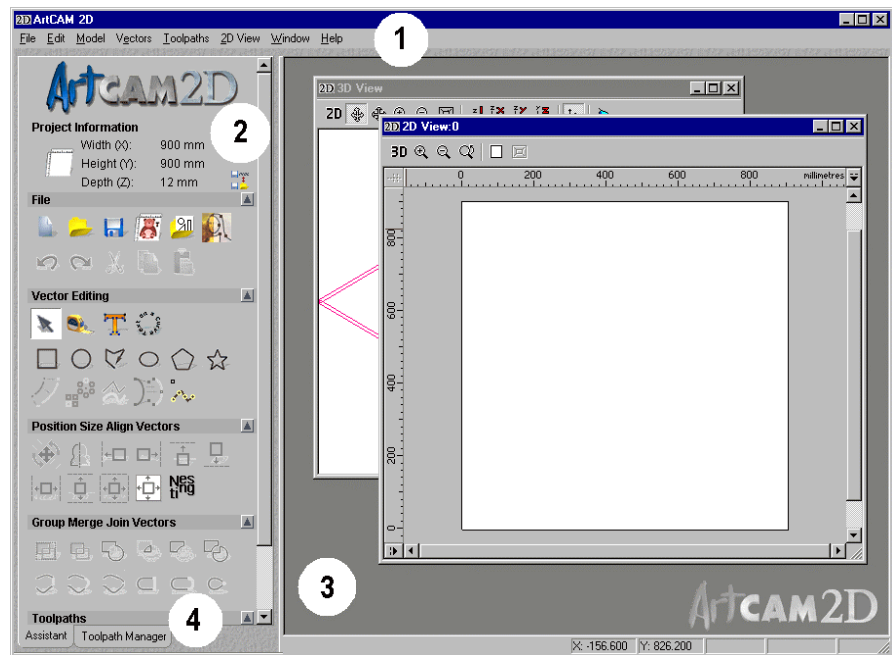
ArtCAM 2D Layout

The ArtCAM 2D screen layout has been designed to let you work effectively and efficiently.

The hub of ArtCAM 2D is the innovative **Assistant** window. When you have an open model, the **Assistant**'s Home page displays a collection of tools to help you create, edit and machine a 2D design. These tools appear in the form of buttons.

Grouped in a logical arrangement, you are able to navigate to the button that you require quickly. To find out more about a button, click on it to display a page in the **Assistant** window showing In-line Help. The In-line Help informs you of exactly where, when and how to use the button, thus reducing the learning curve.

The screen layout is divided into four regions:



1. **Main menu bar** – Click on a menu item to display a drop-down menu that contains a range of sub-menus and commands relating to the features in ArtCAM 2D. If an item in a menu is greyed-out, then it does not apply to the currently active **2D View**.
2. **Assistant Window** – On starting ArtCAM 2D, the **Assistant's Getting Started** page is displayed. This page contains three icons. These allow you to create a new model or work on an existing model. When a model has been created or opened, the **Assistant's Home** page is displayed.




The **Assistant's Home** page contains buttons for each of the features in ArtCAM 2D, as well as a summary of your model dimensions. For almost every button you click on, a corresponding interactive In-line Help page is automatically displayed in its place.

These buttons are divided into five areas:

- **File** – You can use these buttons to manage your model files, as well as vector and bitmap files that you want to use as part of a model.


- **Vector Editing** – You can use these buttons to create vector objects in the form of shapes or text, as well as measure and manipulate the vector objects you create as part of your model.
- **Position Size Align Vectors** – You can use these buttons to transform, mirror, align, centre and nest the vector objects you create as part of your model.
- **Group Merge Join Vectors** – You can use these buttons to group, merge and join the vector objects you create as part of your model.
- **Toolpaths** – You can use these buttons to create a toolpath for the model you want to machine, drill holes, create bridging, manage the machining order, produce a toolpath summary, and manage a database for the tools you want to use when machining.


You can change the appearance of the **Assistant's** Home page in the following ways:


- Click on the **Toggle Display** icon  to reveal or hide text labels naming each of the buttons on the **Assistant's** Home page.
- Click on the appropriate arrow to hide  or reveal  options and reference material in any given area of the **Assistant's** Home page.


You can also change the appearance of each page displayed in the **Assistant** window when you click on any of the buttons on the **Assistant's** Home page:

- Click on **Hide Help** to hide all In-line Help shown on the page.


You can also click on the  icon in the top-right corner of the page to hide In-line Help shown.

- Click on  to display In-line Help on the page.

You can also click on the  icon in the top-right corner of the page to display the In-line Help.

- Click on the  icon in the top-right corner of the page to return to the **Assistant's** Home page.

You can play a video tutorial on how you can use the page that is currently displayed in the **Assistant** window if you:

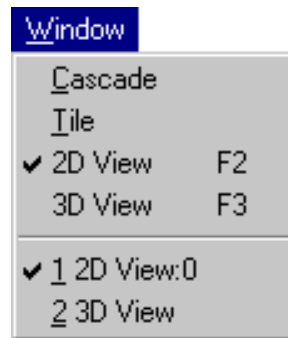
- Click on the video icon  on the In-line page.

3. **Design Windows** - This is the central area of the screen. ArtCAM 2D uses two types of view. The **2D View** window displays the two-dimensional model that you create, while the **3D View** window displays a three-dimensional representation of the machined 2D model and any calculated toolpaths.
4. **Toolpath Manager** – This tab displays the **Toolpath Manager** page in the **Assistant** window. You can use this page to simulate toolpaths, save toolpaths and edit the machining parameters relating to a tool.

Adjusting the Window View

You can adjust the appearance of the **2D View** and **3D View** windows in ArtCAM 2D:


1. Click on the **Window** option in the Main menu bar to display the **Window** menu:



2. Click on the option that you want to use to adjust the view of the design windows:


- **Cascade** – Click on this option to display both the **2D View** and **3D View** windows overlapping one another.
- **Tile** – Click on this option to display both the **2D View** and **3D View** windows beside one another.
- **2D View** - Click on this option to display the **2D View** window only.



Note: You can also display the **2D View** window by pressing the **F2** key  on your keyboard.

- **3D View** - Click on this option to display the **3D View** window only.



Note: You can also display the **3D View** window by pressing the **F3** key  on your keyboard.

2D View Manipulation


You can change the **2D View** of a model using the tools above the window:



3D 3D View


Click on the **3D View** button  to display the **3D View** window.






Note: You can also move from the **2D View** to the **3D View** window by pressing the **F3** key  on your keyboard.

Zoom In


You can use the **Zoom In** button  in two ways on an open model. You can:

- Enlarge the area directly beneath the  cursor by 50%.
- Zoom in on a defined area of the model.



To enlarge an area directly beneath the  cursor by 50%:

1. Click on the **Zoom In** button , then move the magnifying cursor  over the area of the model that you want to zoom in on.
2. Click the right mouse button.



Note: You can also magnify the area directly beneath the cursor by 50% if you hold down the **Ctrl** key  on your keyboard and right-click.


To zoom in on a defined area of the model:

1. Click on the **Zoom In** button  and move the magnifying cursor  over the area of the model that you want to zoom in on.
2. Click and drag the mouse to create a bounding box around the area of the model that you are interested in.
3. Release the left mouse button to view the area defined by the bounding box you have drawn.

Zoom Out Tool

Each click on the **Zoom Out** button  reduces the size of the image by 50%.



Note: You can also reduce the area directly beneath the cursor by 50% if you hold down the **Shift** key  on your keyboard and right-click.




Zoom Previous

Click on the **Previous Zoom** button  to restore the previous zoom setting.




Window Fit

Click on the **Window Fit** button  to automatically adjust the zooming to make the entire **2D View** window visible.



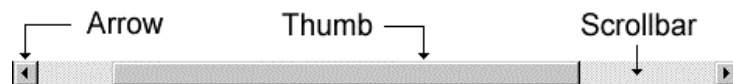
Zoom Object(s)

Click on the **Zoom Object(s)** button  to focus in on a selected vector object within an open model.

For details, see “Selecting Vectors” in the Working with Vectors chapter.

Scrolling the 2D View

If you cannot see all of an open model in the **2D View** window, often as a result of zooming in, ArtCAM 2D automatically displays scrollbars along the vertical and horizontal axes:



These scrollbars can be used to view a particular area of an open model currently outside of the **2D View** window.

You can adjust the area of the open model that is visible if you:

- Click on the arrow at either end of the scrollbar.

- Drag the thumb in the scrollbar to the appropriate position.
- Click directly in the scrollbar on either side of the thumb to page back and forth.

2D View Options

When drawing vector objects in ArtCAM 2D, there are three invaluable features available to help you create a vector object according to an exact set of measurements. These are:

- Rulers.
- The Snap Grid.
- Horizontal and vertical guidelines.

These features assist you in positioning vector objects, making it easier to consistently align and size them.

You can also turn on snapping to make the positioning of a vector object relative to another more accurate.

Using Rulers

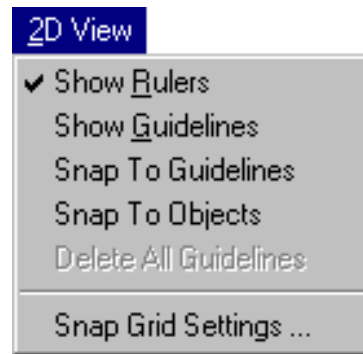
You can use the rulers adjacent to the X and Y-axis of the **2D View** window to make measurements. The rulers are shown by default.

The ruler along the X-axis also shows the units of measurement (millimetres or inches) selected for the model that is shown in the **2D View** window.

For details, see “Creating a Model” in the Working with Models chapter.

To turn the rulers off:

1. Click on **2D View** in the Main menu bar to display the **2D View** options:



2. Click on the **Show Rulers** option to turn it off.

The rulers along the X and Y-axis of the **2D View** window are hidden.

To turn the rulers on:

1. Click on **2D View** in the Main menu bar to display the **2D View** options:



2. Click on the **Show Rulers** option to turn it on.

Rulers appear adjacent to the X and Y-axis of the **2D View** window.

Using the Snap Grid

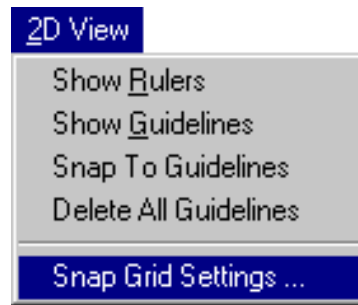
The snap grid is made up of a network of fixed points that govern the placement of vector objects, making it easier to consistently size and align them.

You can use the **Snap Grid Settings** dialog box to adjust the spacing of gridlines, to activate or deactivate the grid, or to force vector objects to automatically align themselves to the snap grid.

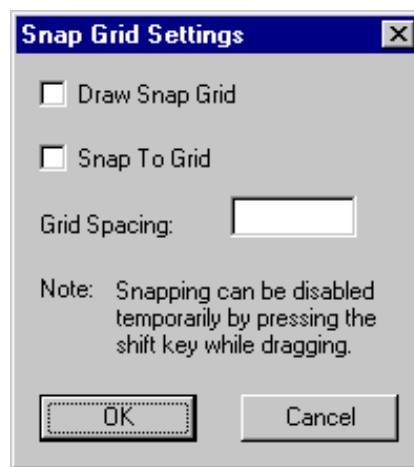
Displaying the Snap Grid



To display the snap grid in an active **2D View** window:

1. Click on **2D View** in the Main menu bar, and then on the **Snap Grid Settings** option:



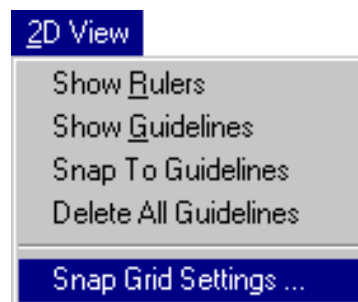
The **Snap Grid Settings** dialog box is opened:



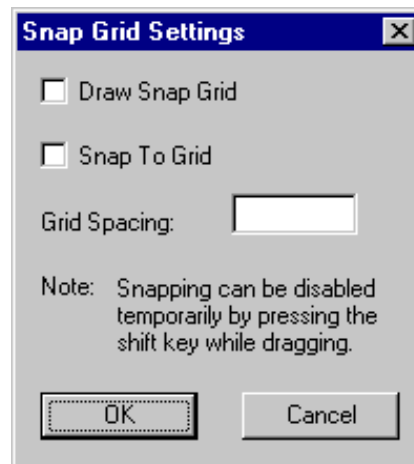
2. Click on the **Draw Snap Grid** option to turn it on .
3. Click on the **OK** button  to close the **Snap Grid Settings** dialog box and draw the snap grid.

To hide the snap grid in an active **2D View** window:

1. Click on **2D View** in the Main menu bar, and then on the **Snap Grid Settings** option:



The **Snap Grid Settings** dialog box is displayed:



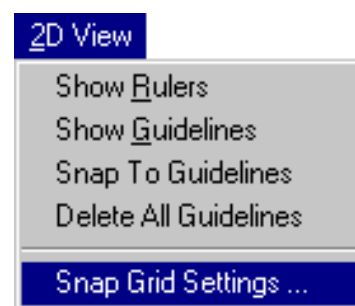
2. Click on the **Draw Snap Grid** option to turn it off ☐.
3. Click on the **OK** button  to close the **Snap Grid Settings** dialog box and hide the snap grid.

Setting the Grid Spacing

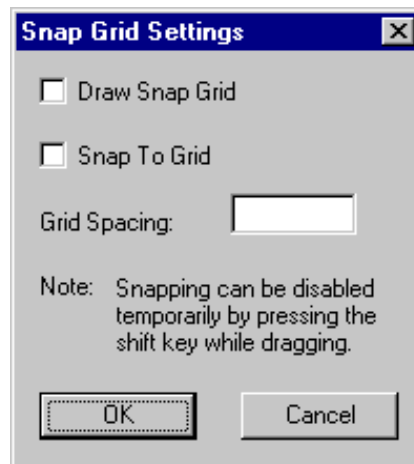
You can set the spacing between grid points using the units of measurement that you had selected in the **Setup Job Dimensions** dialog box (millimetres or inches) when creating the model. For details, see “Creating a Model” in the Working With Models chapter.


To set the grid spacing:

1. Click on **2D View** in the Main menu bar, and then on the **Snap Grid Settings** option:



The **Snap Grid Settings** dialog box is displayed:

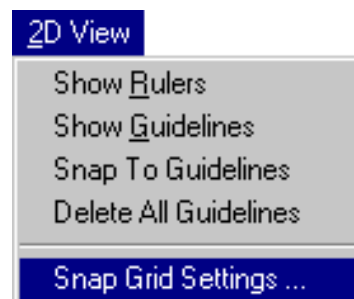


2. Type a value in the **Grid Spacing** box.
3. Click on the **OK** button  to close the **Snap Grid Settings** dialog box and set the grid spacing.

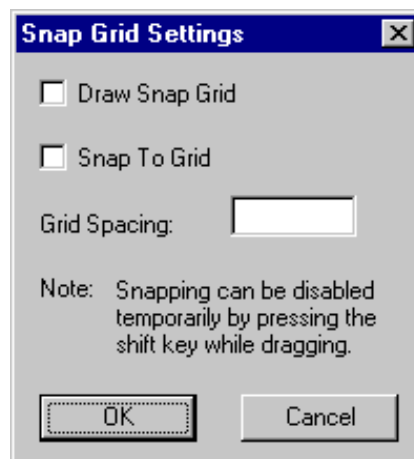
Snapping to the Grid



To make each cursor click during the creation or editing of a vector object snap to the nearest point on the grid:

1. Click on **2D View** in the Main menu bar, and then on the **Snap Grid Settings** option:




The **Snap Grid Settings** dialog box is displayed:



2. Click on the **Snap To Grid** option to turn it on .
3. Click on the **OK** button  to close the **Snap Grid Settings** dialog box and activate grid snapping.



Note: To temporarily disable the snapping behaviour, press and hold the **Shift** key  on your keyboard.

Using Guidelines

While a **Snap Grid** is made up of a network of fixed points, a guideline is a solid line parallel to either the horizontal or vertical axis that can be moved to any point in the **2D View** window.


To begin creating guidelines, you must first turn on the rulers adjacent to the X and Y-axis. For details, see “Using Rulers” on page 12.

To create a horizontal guideline:

1. Click and hold down the left mouse button on the top ruler to display a guideline in the **2D View** window.
2. Drag the guideline to the required position.

To create a vertical guideline:

1. Click and hold down the left mouse button on the left-hand ruler to display a guideline in the **2D View** window.
2. Drag the guideline to the required position.

Guidelines can be repositioned at any time by placing the mouse cursor over them. On doing so, the cursor changes to a double-headed arrow . At this point, click and drag the guideline into the desired position.

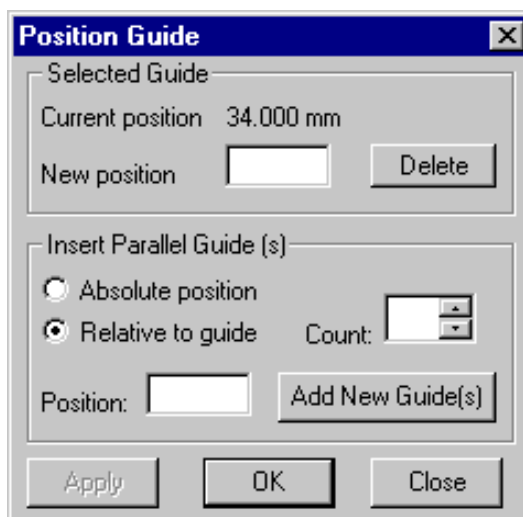


Warning: You must have the both the **Show Rulers** and the **Show Guidelines** options turned on to see guidelines in the **2D View** window.

Defining a Guideline's Position

You can define the position of a guideline using the **Position Guide** dialog box. This is a more accurate method than clicking and dragging a guideline into position.

To display the **Position Guide** dialog box, move the mouse cursor over a guideline and click the right mouse button:




The **Selected Guide** area of the **Position Guide** dialog box allows you to:

- Reposition a guideline.
- Delete a guideline.

Guidelines are positioned according to the units of measurement that you had selected in the **Setup Job Dimensions** dialog box (millimetres or inches) when creating the model. For details, see “Creating a Model” in the Working With Models chapter.

To reposition a guideline:

1. Type a value for the position of the guideline in the **New Position** box.
2. Click on the **Apply** button .




To delete a guideline:

1. Click on the **Delete** button .


The **Insert Parallel Guide(s)** area of the **Position Guide** dialog box allows you to:

- Create a guideline at an absolute position.
- Create any number of guidelines at a position relative to the selected guideline.

To insert a parallel guideline at an absolute position:

1. Click on the **Absolute position** radio button .
2. Type the co-ordinate for the position of the new guideline in the **Position** box.
3. Click on the **Add New Guide(s)** button  to draw the guideline.
4. Click on the **OK** button  to close the **Position Guide** dialog box.


To insert any number of parallel guidelines at a relative position:

1. Click on the **Relative to guide** radio button .
2. Type the number of guidelines that you want to create in the **Count** box.
3. Type the distance that you want to put between each of these parallel guidelines in the **Position** box.



You can set the relative position for the new guidelines using a positive or negative value.

For example, if you want to create a new guideline to the right of an existing vertical guideline, or above an existing horizontal guideline, you must type a positive value in the **Position** box e.g. 10.0.

If you want to create a new guideline to the left of an existing vertical guideline, or below an existing horizontal guideline, you must type a negative value in the **Position** box e.g. -10.0.

4. Click on the **Add New Guide(s)** button  to draw the guidelines.



Tip: If you want to carry out more than one action in the **Position Guide** dialog box, instead of clicking the **OK** button , click on the **Apply** button . This applies the change and keeps the dialog box open.

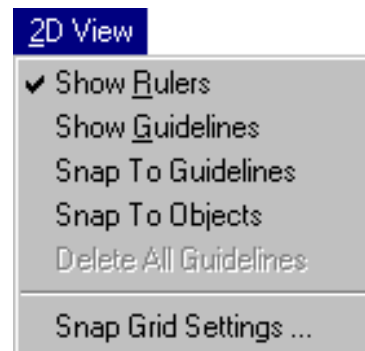
Snapping to Objects

You can make a point (node) in a vector object snap:

- To a point (node) in another vector object.
- About the centre of a linear or arc span within another vector object.
- About the centre another vector object, as defined by the area of the bounding box that surrounds the vector object when selected.

To make a point (node) in a vector object snap to a point (node), the centre of either a linear or an arc span, or about the centre of another vector object:

1. Click on **2D View** in the Main menu to display the **2D View** options:





2. Click on the **Snap To Objects** option to turn it on:




3. Click and drag the vector object that you want to move.

If you click within a cursor length of a point (node), the cursor snaps to the point (node).

When the selected vector object moves over a point (node), about the centre of a linear or arc span, or about the centre of another vector object (as defined by the area of the bounding box that surrounds the vector object when selected) the cursor changes from  to .

4. Release the mouse button to position the vector object.



Note: To temporarily disable the snapping behaviour, press and hold the **Shift** key  on your keyboard.

3D View Manipulation

Once you have completed creating and simulating a specific toolpath in relation to your finished model, a three-dimensional representation of the machined model is automatically generated in a **3D View** window.


You can change the view of a model using the tools above the **3D View** window:




2D View

Click on the **2D View** button  to display the **2D View** window.



Note: You can also move from the **3D View** to the **2D View** window by pressing the **F2** key  on your keyboard.


Twiddle Tool

The **Twiddle Tool** button  allows you to rotate the 3D image around a central point.

Click on the **Twiddle Tool** button , then click and drag the 3D image to the required viewing angle.


Pan View

The **Pan View** button  allows you to move the 3D image within the **3D View** window.



Click on the **Pan View** button , then click and drag the 3D image to the required viewing position.

Zoom



There are two ways that you can zoom in on an open model. You can:

- Enlarge the area beneath the  cursor by 50%.
- Zoom in on a defined area of the model.


To enlarge the area beneath the  cursor:

1. Click on the **Zoom** button , then move the magnifying cursor  over the area of the model that you want to zoom in on.
2. Click the right mouse button.

To zoom in on a defined area of a model:

1. Click on the **Zoom** button , then move the magnifying cursor  over the area of the model that you want to zoom in on.
2. Click and drag the mouse to create a bounding box around the area of the model that you are interested in.
3. Release the left mouse button to view the area defined by the bounding box.


Zoom Out

Click on the **Zoom Out** button  to reduce the size of the image by 50%.

Scale To Fit

The **Scale To Fit** button  resizes the model so that it fits in the **3D View** window.


Isometric View

The **Isometric View** button  displays the model in the standard isometric view. The viewing angle is shown by the XYZ representation on the button.


View Along X

The **View Along X** button  displays the model from the X-axis.


View Along Y


The **View Along Y** button  displays the model from the Y-axis.

View Along Z


The **View Along Z** button  displays the model from the Z-axis.

Origin


The **Origin** button  shows the X, Y and Z positions in the co-ordinate system used for the open model.

Click on the **Origin** button  to display the origin in the **3D View** window.

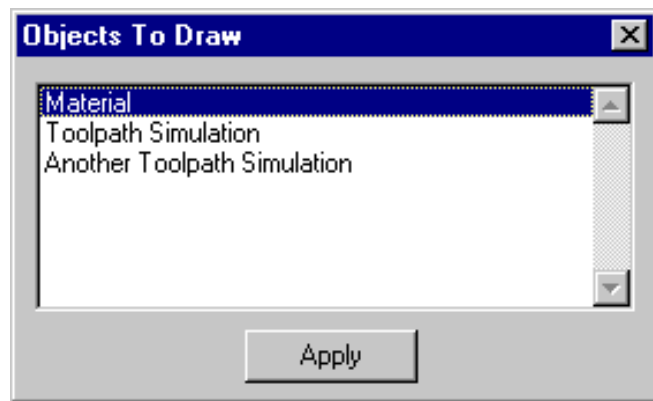
The X-axis is red, the Y-axis is green and the Z-axis is blue.

If the origin is displayed in the **3D View** window, you can also click on the **Origin** button  to hide the origin.

Objects To Draw

Click on the **Objects To Draw** button  to display the **Objects To Draw** list box.

The **Objects To Draw** list box lists the block of material, all of your calculated toolpaths and all of your toolpath simulations:

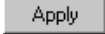



All items in the **Objects To Draw** list box are highlighted in blue and are shown in the **3D View** window by default.

You can hide any of the objects displayed in the **3D View**:

1. Click on the **Objects To Draw** button  to display the **Objects To Draw** list box.
2. Click on the object in the list box you want to hide.

The selected object is highlighted in blue.



3. Click on the **Apply** button  to hide the object in the **3D View** window.
4. Click on the  in the top right corner of the **Objects To Draw** list box to close it.

To show any of the hidden objects in the **3D View**:

1. Click on the **Objects To Draw** button  to display the **Objects To Draw** list box.

2. Click on the object in the list box you want to show.

The selected object is highlighted in blue.

3. Click on the **Apply** button  to show the object in the **3D View** window.
4. Click on the  in the top-right corner of the **Objects To Draw** list box to close it.

Tutorial – Aston Martin DB5

Overview

The following tutorial demonstrates how to create an *Aston Martin DB5* sign from imported vector artwork, using the vector drawing and toolpath tools available in ArtCAM 2D.

The design is courtesy of Holmes & Cottrell Graphic Technologies. Visit their website www.vectorart.com for high quality designs.

Aston Martin DB5

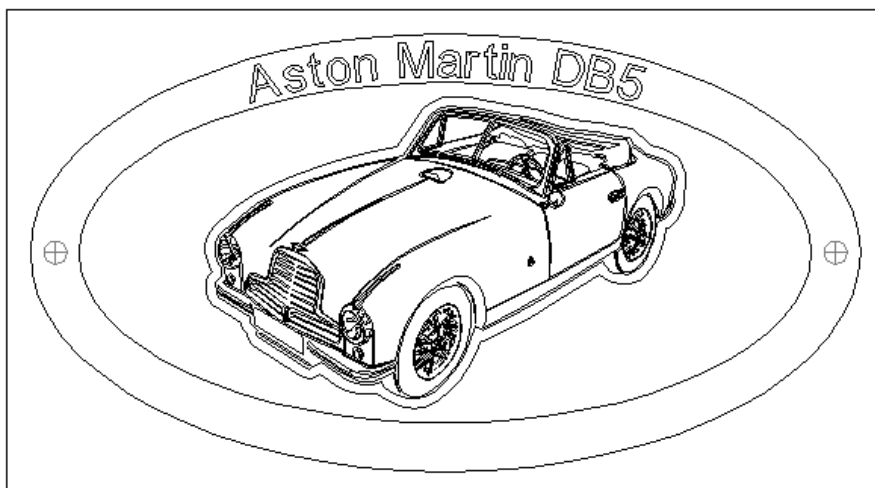
The ten stages that you will cover during the course of this tutorial are:

- Preparing the model.
- Creating a frame for the sign.
- Importing the vector artwork.
- Creating the vector text.
- Wrapping the vector text.
- Creating an offset vector.
- Machining the vectors.
- Marking the drill holes with circles.

- Creating the drill holes.
- Saving the toolpaths.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating the *Aston Martin DB5* sign.

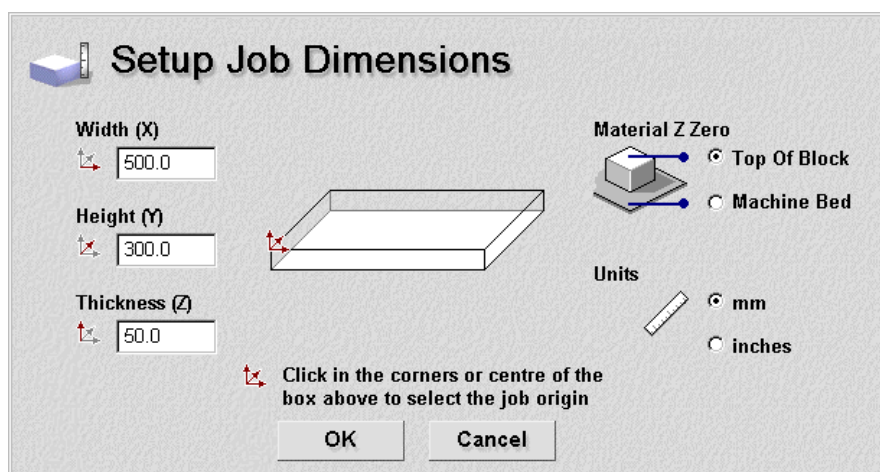
At the end of this tutorial, you will have produced the three-dimensional *Aston Martin DB5* sign shown in the following image:




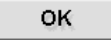


Preparing the Model

First, you will set up the dimensions of the block of material needed for this particular job:

1. Click on the **Create New Model**  button located in the **Getting Started** menu options in the **ArtCAM 2D Assistant** to display the **Setup Job Dimensions** dialog box:



2. Click on the **Units** option  that you want to use (millimetres or inches).
3. Type 500 mm (20") in the **Width (X)** box, 300 mm (12") in the **Height (Y)** box and 50 mm (2") in the **Thickness (Z)** box.
4. Make sure that the **Material Z Zero** option  is set to **Top of Block**.
5. Make sure that the **Job Origin**  is positioned on the front-left corner of the box, as illustrated in Step 1.
6. Click on the **OK** button  to close the **Setup Job Dimensions** dialog box.

A **2D View** window automatically fills the previously empty design window area.




This window represents the block of material viewed down the Z-axis.

Creating a Frame for the Sign

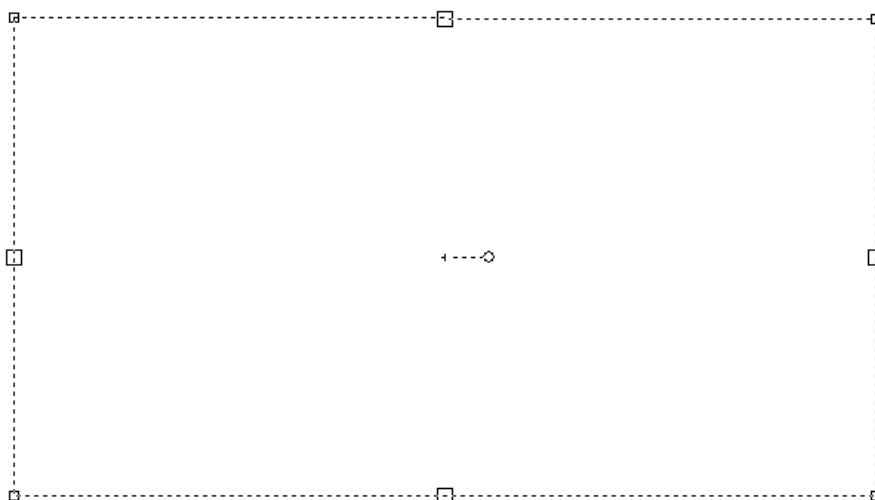
Next, you will create the vector objects that represent the frame of the sign in your model.

Creating the Outer Rectangle


First, you will draw the outer rectangle of the sign's frame:

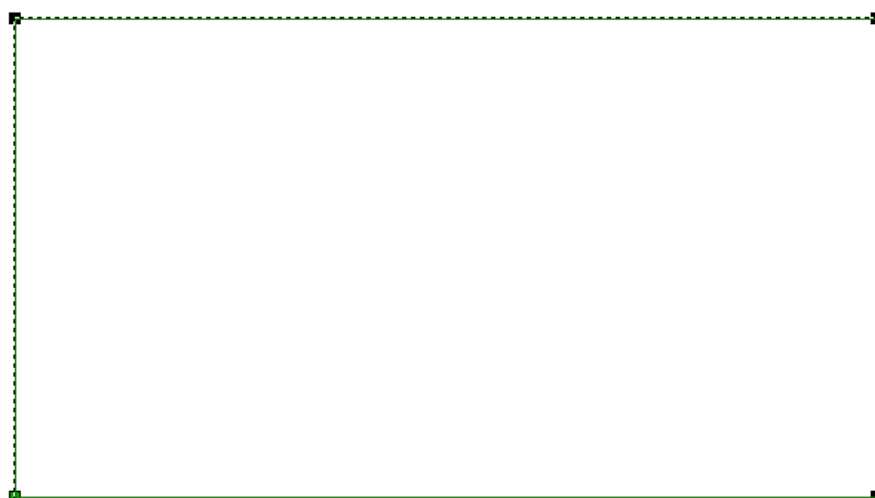
1. Click on the **Create Rectangle** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Rectangle Creation** page.
2. Make sure that the **Rectangle** option is selected .
If not, click on the **Rectangle** radio button to select it.
3. Type 250 mm (10") in the **Height** box and 450 mm (18") in the **Width** box.
4. Click on the **Preview** button  at the bottom of the **Rectangle Creation** page to


produce a preview image of the following rectangle:




The preview image appears centred about the origin of the model, which is in the bottom left corner.

5. Click on the **Create** button  at the bottom of the **Rectangle Creation** page to create the rectangle in your model:



6. Click on the **Close** button  at the bottom of the **Rectangle Creation** page to return to the **Assistant's** Home page.
7. Make sure that the rectangle is selected.


The rectangle should be green and surrounded by a bounding box. If not, click on the rectangle to select it.

- Click on the **Centre In Page** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to place the rectangle in the centre of your model.

This rectangle represents the total area of the sign that you are creating in your model.


Creating the Outer Ellipse

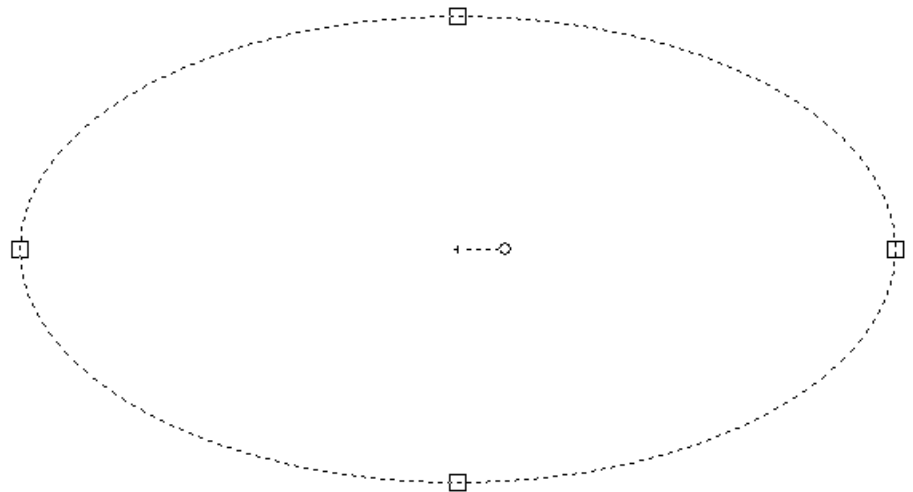
Second, you will draw the outer ellipse of the sign's frame:

- Click on the **Create Ellipse** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Ellipse Creation** page in the **Assistant** window.


- Type 225 mm (9") in the **Height** box and 425 mm (17") in the **Width** box.

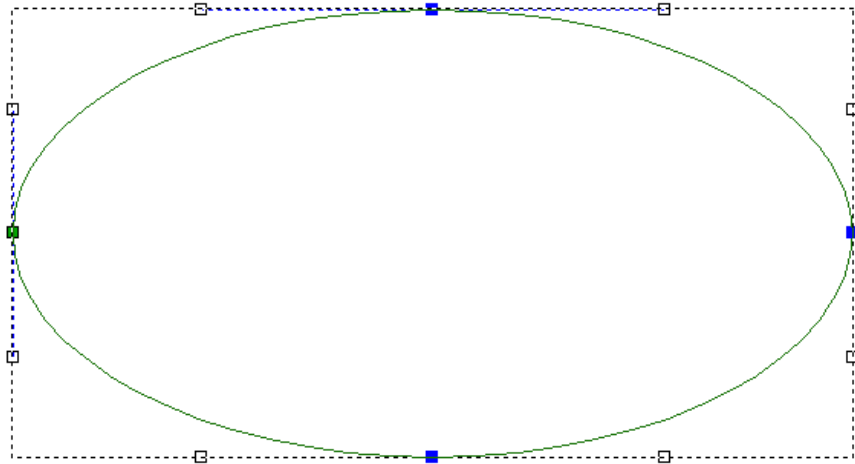
Make sure that the value in the **Angle** box remains at the default setting of 0.

- Click on the **Preview** button  at the bottom of the **Ellipse Creation** page to produce the following preview image of the ellipse:





The preview image appears centred about the origin of the model.

- Click on the **Create** button  at the bottom of the **Ellipse Creation** page to create the ellipse in your model:





The ellipse is green.

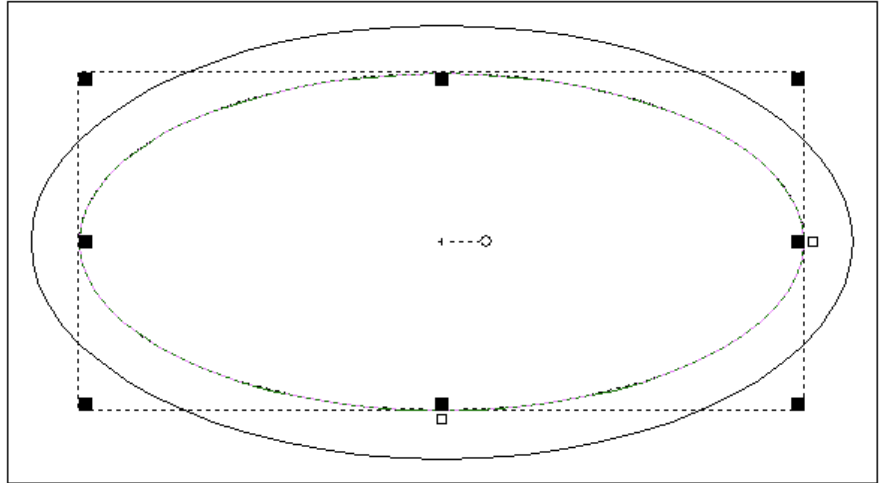
5. Click on the **Close** button  at the bottom of the **Ellipse Creation** page to return to the **Assistant's** Home page.
6. Make sure that the ellipse is selected.
7. Click on the **Centre In Page** button  to place the ellipse in the centre of your model.


Creating the Inner Ellipse

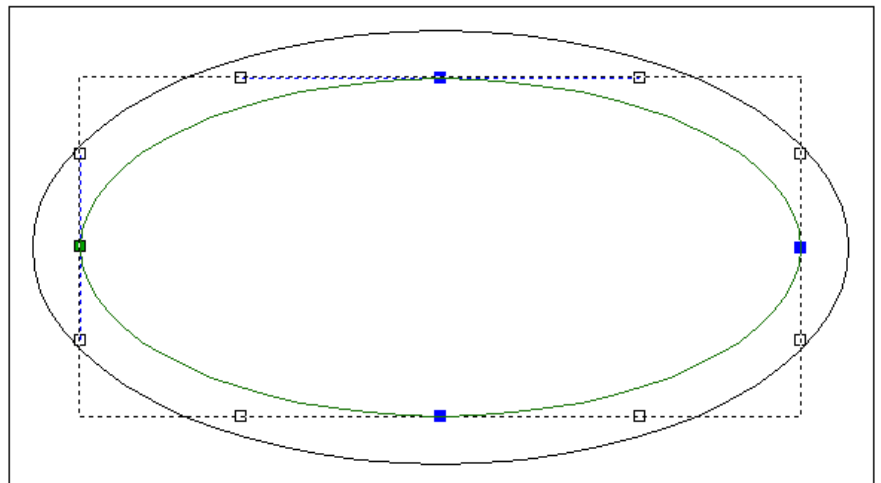
Now you will draw an inner ellipse to complete the sign's framework:

1. Click on the ellipse you have just created to select it.
2. Click on the **Copy** button  in the **File** area of the **Assistant's** Home page to create a duplicate of the selected ellipse and place it on the clipboard.
3. Click on the **Paste** button  in the **File** area of the **Assistant's** Home page to place an identical ellipse in your model, overlapping the original.
4. Click on the **Transform Vector(s)** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to display the **Transform Vector(s)** page.
5. Click on the **Link Width and Height** option to turn it off ☐.

6. Type 375 mm (15") in the **Size's New Width** box.
7. Type 175 mm (7") in the **Size's New Height** box.
8. Click on the **Apply** button  at the bottom of the **Transform Vector(s)** page to create a preview image of a second, scaled ellipse:




9. Click on the **Close** button  at the bottom of the **Transform Vector(s)** page to create the second, scaled ellipse in your model and return to the **Assistant's** Home page:

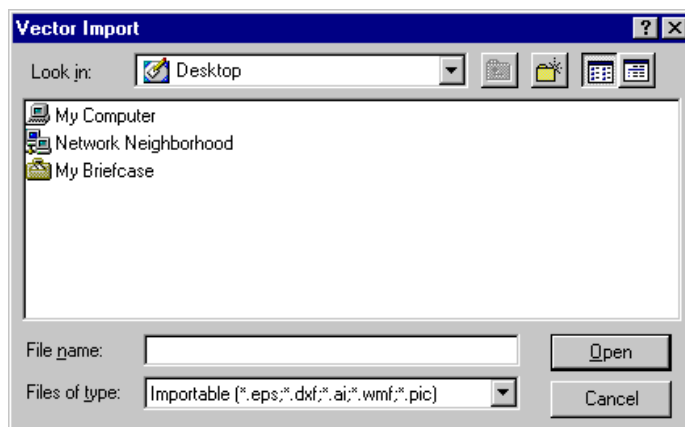


All three of the vector objects that you have drawn, as illustrated above, complete the frame for the *Aston Martin DB5* sign.

Importing the Vector Artwork

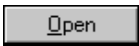
The next stage is to import the Aston Martin vector artwork:

1. Click on the **Import DXF, EPS or AI Files** button  in the **File** area of the **Assistant's** Home page to display the **Vector Import** dialog box:

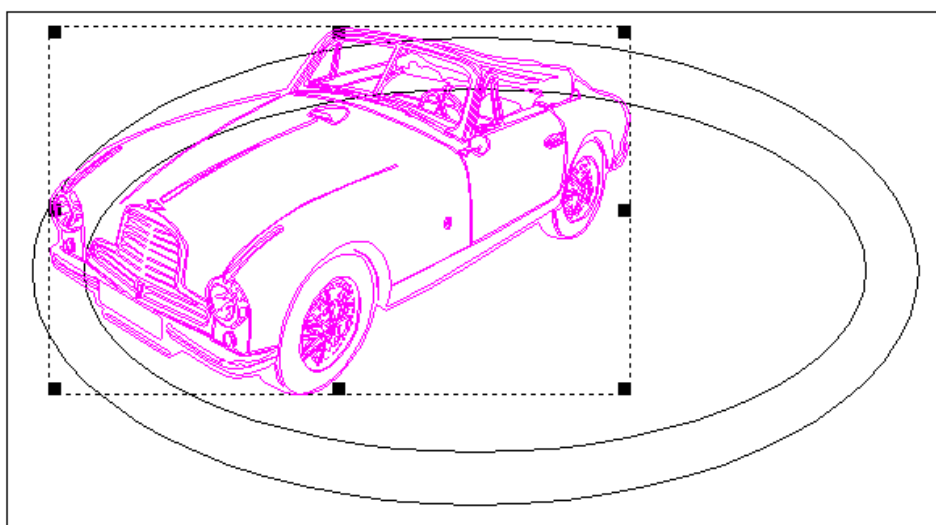


2. Click on the **Look In** list box and select ArtCAM 2D V1.0\Examples.
3. Click on the .eps file named *AstonCar* to select it.

The file name appears in the **File name** box.


4. Click on the **Open** button  to import the vector artwork.

The Aston Martin is magenta, showing that it is a grouped set of vector objects:





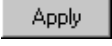
5. Make sure that the grouped vector objects that make up the Aston Martin are selected.

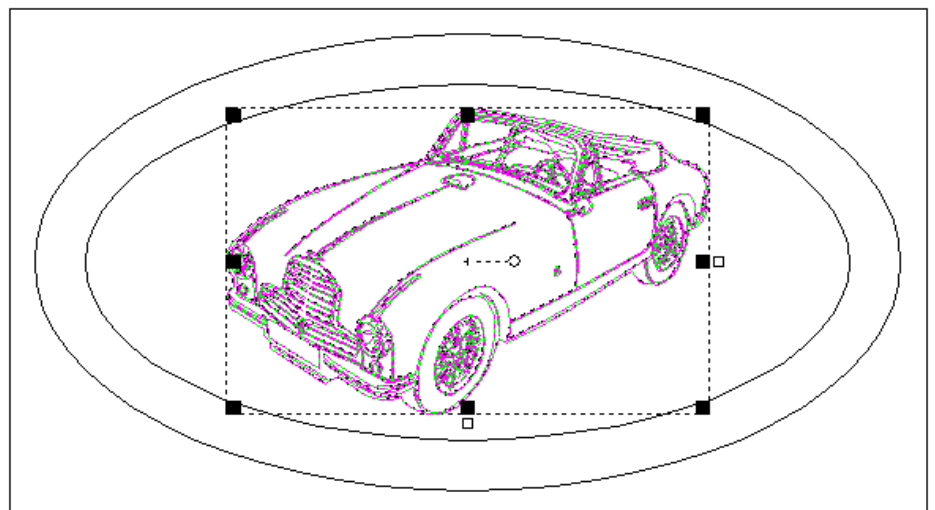
The grouped vector objects that make up the Aston Martin should be magenta and surrounded by a bounding box. If not, click anywhere on the grouped vector objects that make up the Aston Martin to select it.

6. Click on the **Centre In Page** button  to place the grouped vector objects that make up the Aston Martin in the centre of your model.


The grouped vector objects that make up the Aston Martin overlap the inner ellipse in the sign.

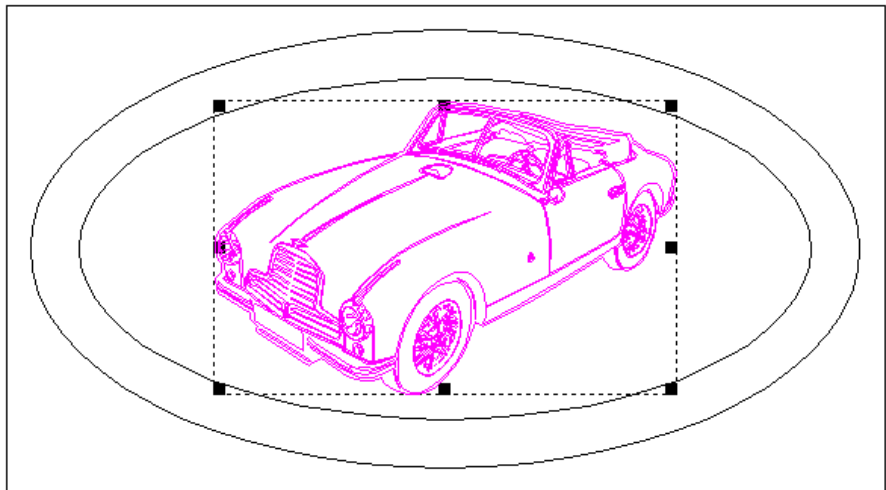
You will now reduce its size in order to fit it within the inner ellipse.

7. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page.
8. Make sure that the **Link Width and Height** option is turned on .
9. Type *150 mm (5.91")* in the **Size's New Height** box.
10. Click on the **Apply** button  at the bottom of the **Transform Vector(s)** page to create a preview image of the resized group of vector objects that make up the Aston Martin:




A value of 236.235 mm (9.3112") automatically appears in the **Size's New Width** box. This is because the **Link Width and Height** option is on ☒.


11. Click on the **Close** button  at the bottom of the **Transform Vector(s)** page to create the resized group of vector objects that make up the Aston Martin in your model and return to the **Assistant's** Home page:

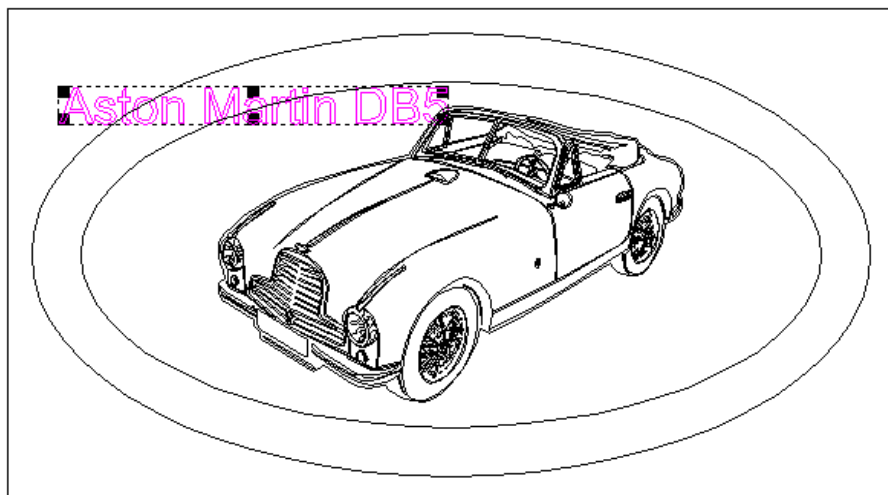


Creating the Vector Text

The next stage is to create the vector text for the writing on the sign:


1. Click on the **Create Vector Text** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text Tool** page.
2. Click on the **Font** list box, and then click on **Arial** to select it.
3. Click on the **Size** list box, and then click on the appropriate unit of measurement option (millimetres or inches).
4. Type 28 mm (1.1") in the **Size** box.
5. Click anywhere in your model (the white area in the **2D View** window), then type *Aston Martin DB5*.

6. Click the **Done** button  on the **Text Tool** page to create the vector text and return to the **Assistant's** Home page:





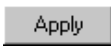
Wrapping the Vector Text

Next, you will wrap the vector text around the inner ellipse that you had previously created:

1. Click on the inner ellipse in your model to select it.
2. Hold the **Shift** key  on your keyboard, and then click on the vector text to select it.

Both the inner ellipse and the vector text are magenta, showing that both are selected.

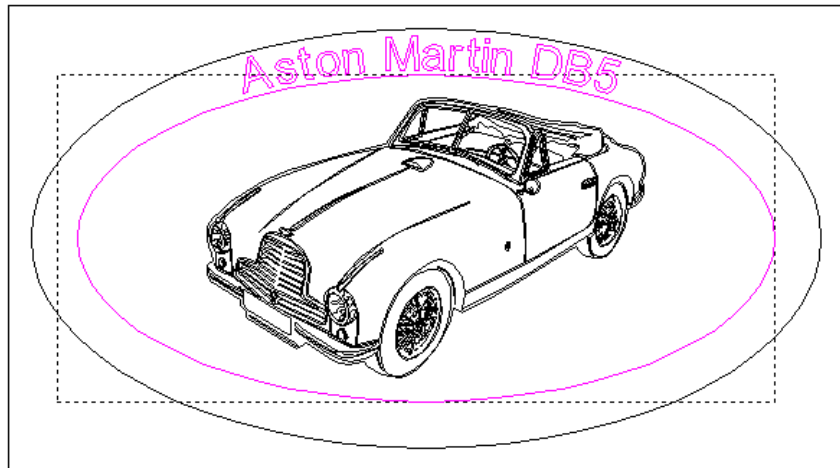
3. Click on the **Wrap Text Round A Curve** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text On A Curve** page.
4. Click on the **Specify** radio button  to select it.


This option allows you to position the block of vector text about the inner ellipse, according to the positive or negative value you type in the **Specify** box.
5. Type 3 mm (0.12") in the **Specify** box.
6. Click on the **Apply** button .

7. Click on the **Text on Other Side** option to turn it on .

This option reverses the direction of the inner ellipse, and resets the vector text off the inner ellipse.


8. Click and drag the vector text approximately into the centre of the model, as shown below:



9. Click on the **OK** button  at the bottom of the **Text On A Curve** page to return to the **Assistant's** Home page.

Creating an Offset Vector

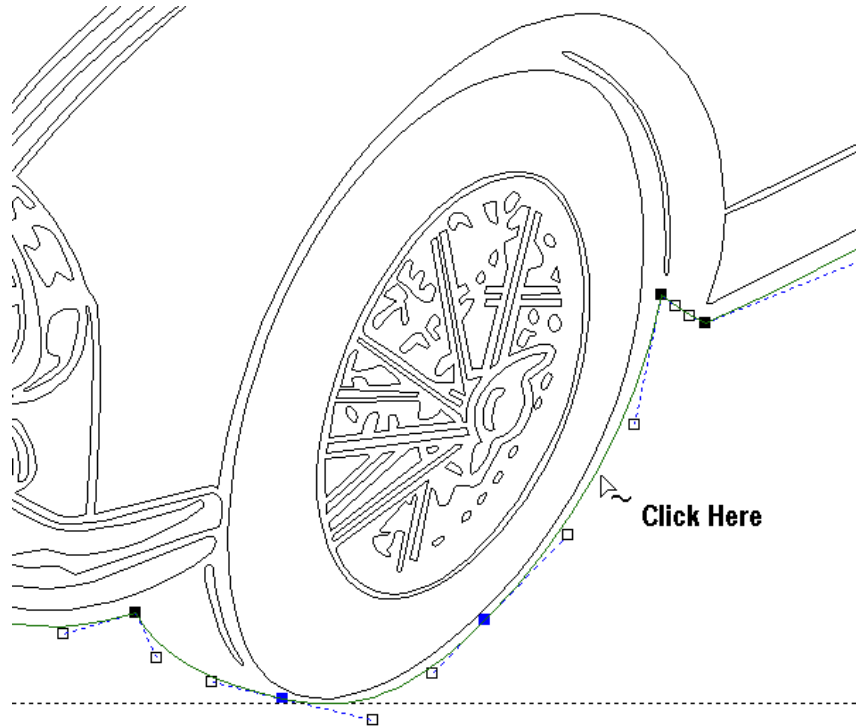
Next you will create a vector object, offset from the outline of the imported Aston Martin vector artwork. This will be referred to as the “offset vector”:


1. Click on the group of vector objects that make up the Aston Martin to select it.
2. Click on the **Ungroup** button  in the **Group Merge Join** area of the **Assistant's** Home page to ungroup the vector objects that make up the Aston Martin.

In ungrouping, the group of vector objects that makes up the Aston Martin is divided into a number of separate vector objects.

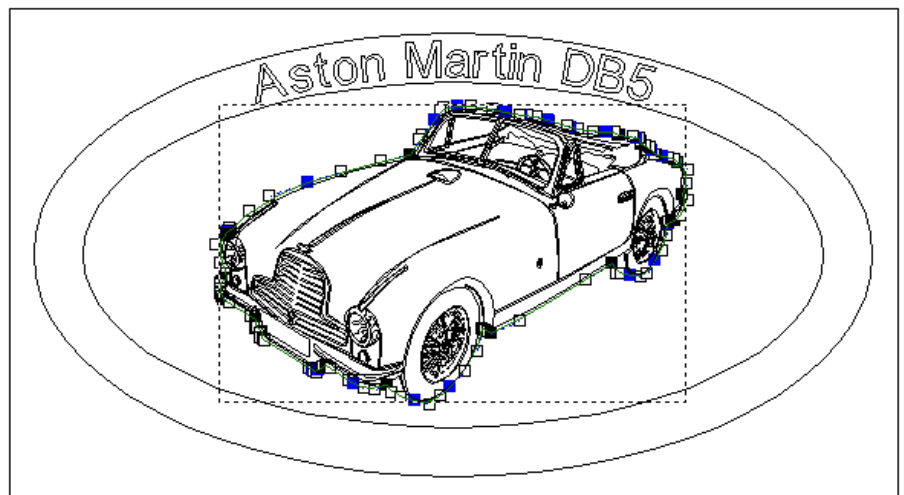
3. Click on the **Zoom In** button  in the **2D View** toolbar.

4. Click and drag to form a bounding box around the front wheel of the Aston Martin car, then release the mouse button to zoom in on it.
5. Click on the outer vector object of the Aston Martin car to select it:







6. Click on the **Window Fit** button  in the **2D View** toolbar to view the whole of the model.

You can clearly see the spans, points (nodes) and adjoining control points that make up the selected outer vector:



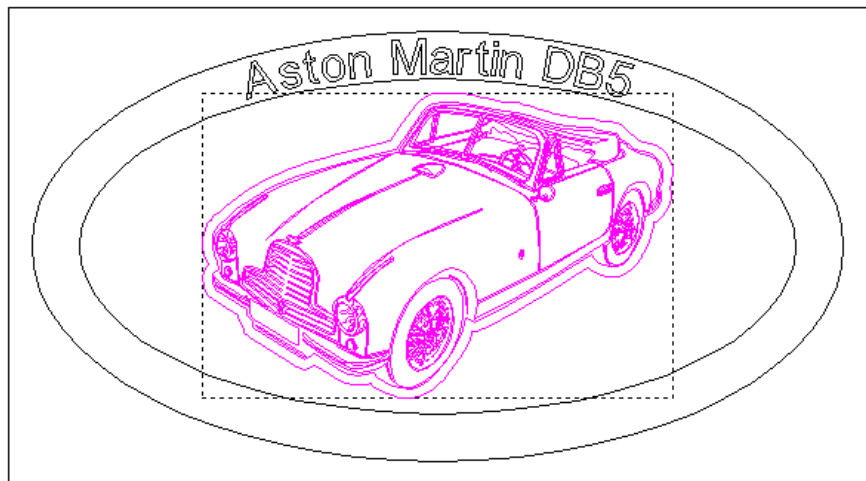
The offset vector you will now create acts as a boundary for the area clearance tool you will use to machine this area of the sign.

7. Click on the **Offset Vector(s)** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Offset Vector** page.
8. Type 5 mm (0.20") in the **Offset Distance** box.
9. Make sure that the **Outwards** option is selected  for the **Offset Direction**.
10. Click on the **Offset** button  to create the offset vector.
11. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to regroup the vector objects that make up the Aston Martin car so that they can be machined in the same way.

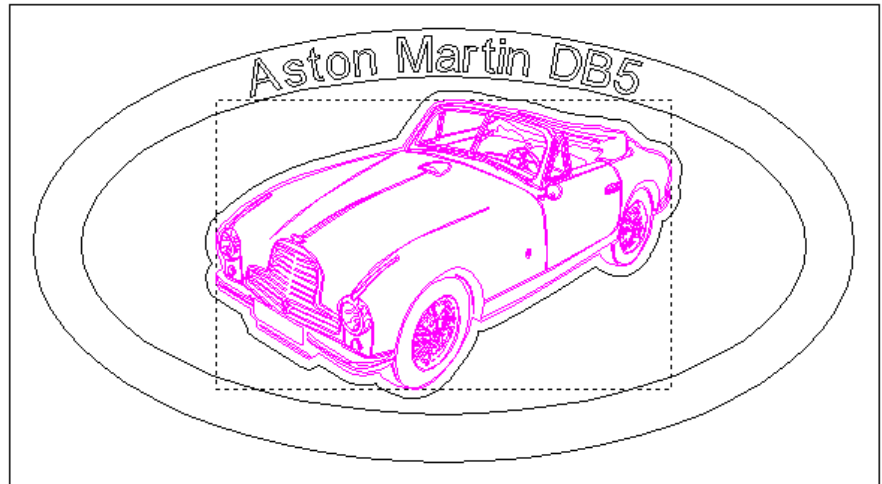
12. Click and drag around the vector objects that make up the Aston Martin car and the offset vector to select them all.


The vector objects that make up the Aston Martin and the offset vector turn magenta:



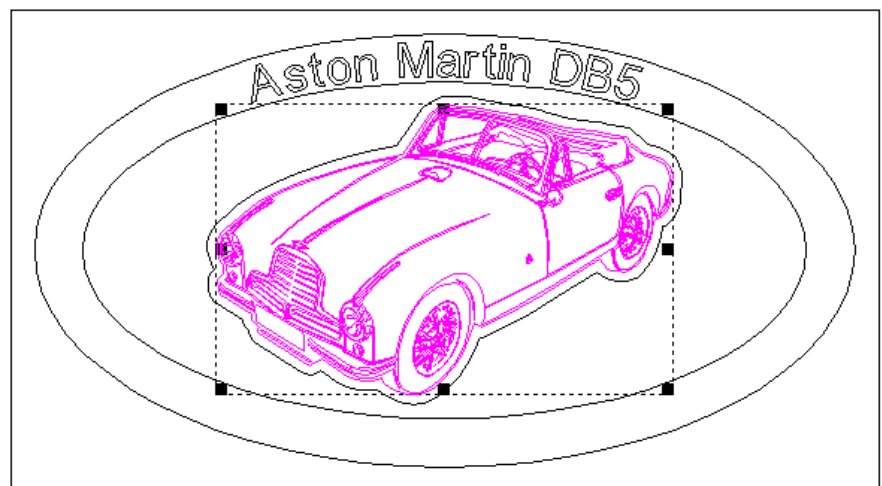
13. Hold the **Shift** key  on your keyboard, and then click on the offset vector to deselect it.

The offset vector is now black, whilst the vector objects that make up the Aston Martin remain as magenta:



14. Click on the **Group** button  in the **Group Merge Join** area of the **Assistant's** Home page to group the vector objects that make up the Aston Martin.

The grouped vector objects that make up the Aston Martin are magenta, surrounded by a bounding box with resizing handles:




Machining the Vectors

Now that you have positioned and resized the Aston Martin car, you will create the toolpaths that will be used to machine your model, and thus create your sign.




Clearing the Unwanted Material

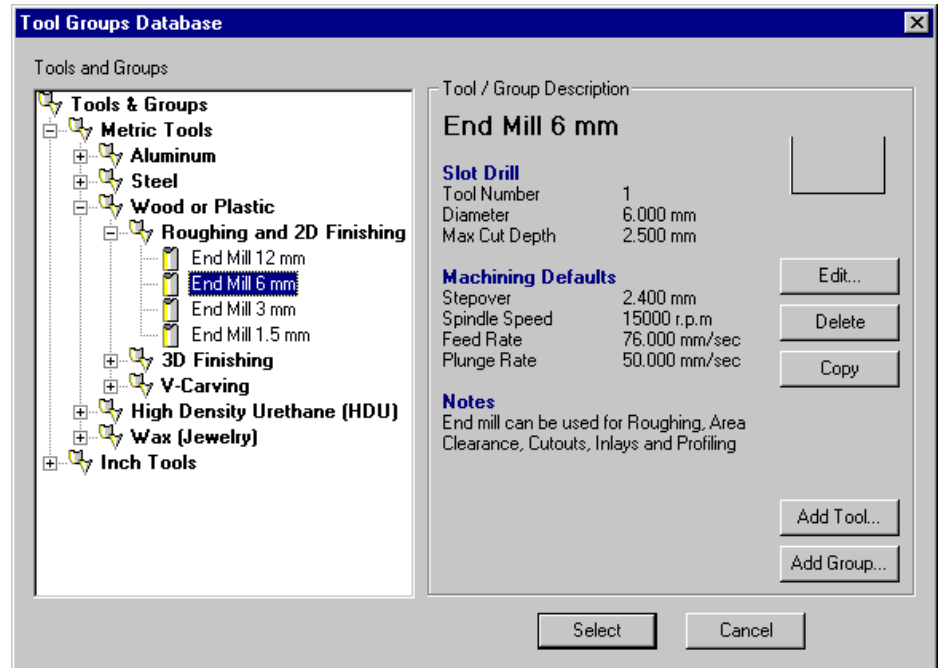
First, you will create an area clearance toolpath that will remove the unwanted material in your model:




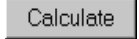
1. Click on the rectangle to select it.
2. Hold the **Shift** key  on your keyboard, and then click on each of the ellipses and the offset vector in turn to select them:



All of the selected vector objects turn magenta.



3. Click on the **Area Clearance** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **2D Area Clearance** page.
4. Type *10 mm (0.39")* in the **Finish Depth** box.
5. Type *0.02 mm (0.001")* in the **Tolerance** box.
6. Click on the  arrow in the **Safe Z** area of the page to display the **Safe Z** box.
7. Type *3 mm (0.12")* in the **Safe Z** box.
8. Click on the **Add** button  beneath the **Tool List** window to display the **Tool Groups Database**:



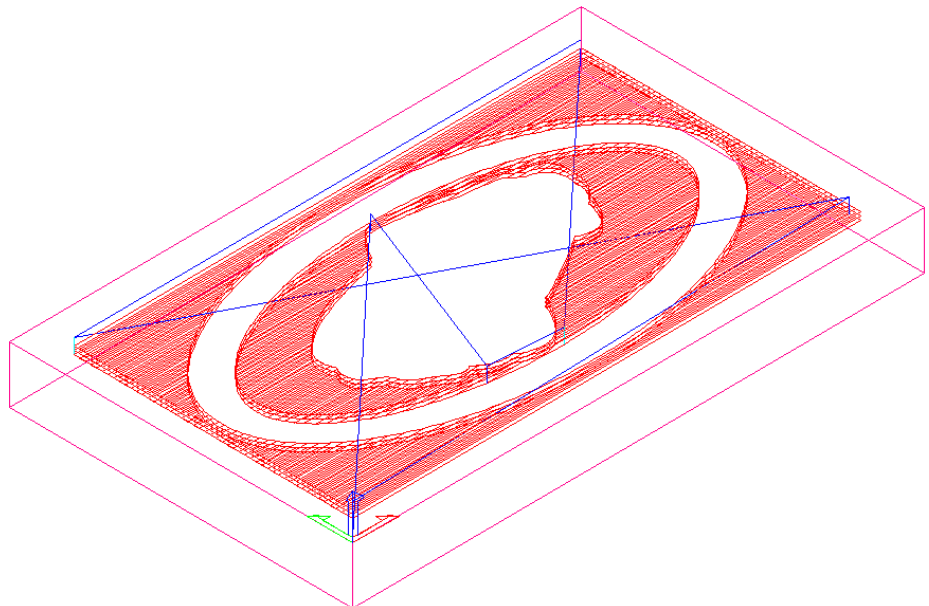
9. Click on the **End Mill 6mm** (End Mill ¼ Inch) tool in the **Wood or Plastic\Roughing and 2D Finishing** tool group to select it.
10. Click on the **Select** button  to close the **Tool Groups Database** and add the tool to the **Tool List** on the **2D Area Clearance** page.
11. Type 5 mm (0.20") in the **Stepover** box located in the **Tool Settings** area of the page.
12. Make sure that the **Raster** option is selected  in the **Tool Clearance Strategy** area of the **2D Area Clearance** page.
13. Make sure that the **Create 2D Preview** option is checked on .
14. Click on the **Calculate** button  to create the Area Clearance toolpath.

The Area Clearance toolpath appears in the **2D View** window as follows:



15. Click on the **Close** button  to return to the **Assistant's** Home page.
16. Click on the **3D View** button  in the **2D View** toolbar to display a three-dimensional representation of the Area Clearance toolpath in the **3D View** window.

An isometric view of the Area Clearance toolpath appears in the **3D View** window as follows:



17. Click on the **Toolpath Manager** tab .

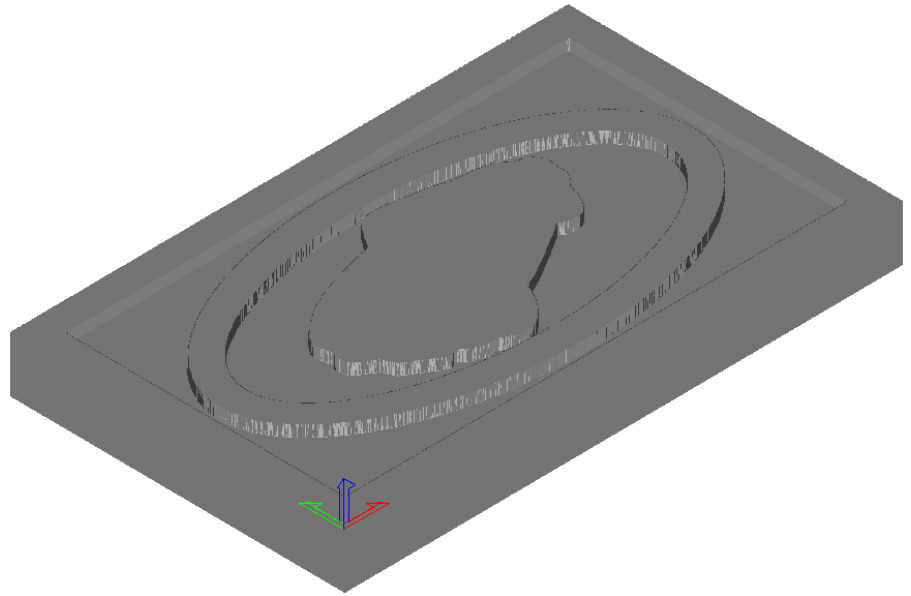
The **Toolpath Manager** allows you to edit, simulate and save the toolpaths that you have created.

18. Click on the **Simulate Toolpath(s)** button



in the **Toolpath Simulation** area of the **Toolpath Manager** to simulate the Area Clearance toolpath you have created.

An isometric view of the simulated Area Clearance toolpath appears in the **3D View** window as follows:



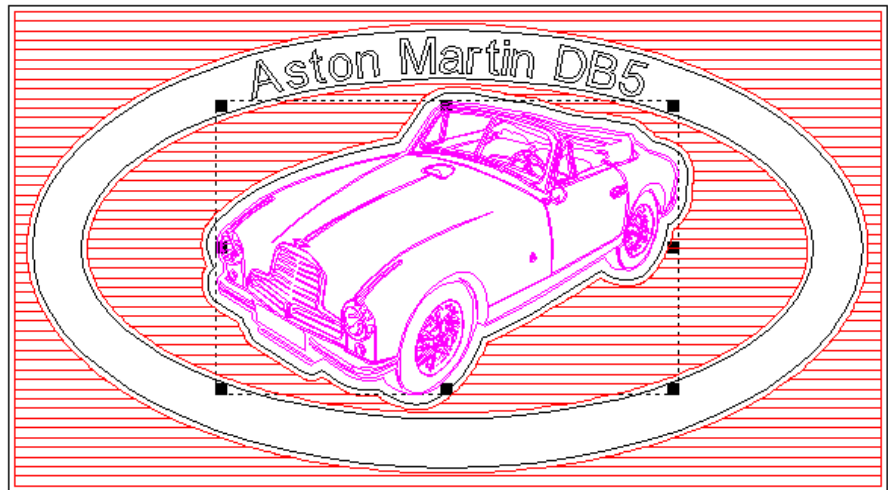
19. Click on the **2D View** button **2D** in the **3D View** toolbar to display the **2D View** window.




Carving the Aston Martin

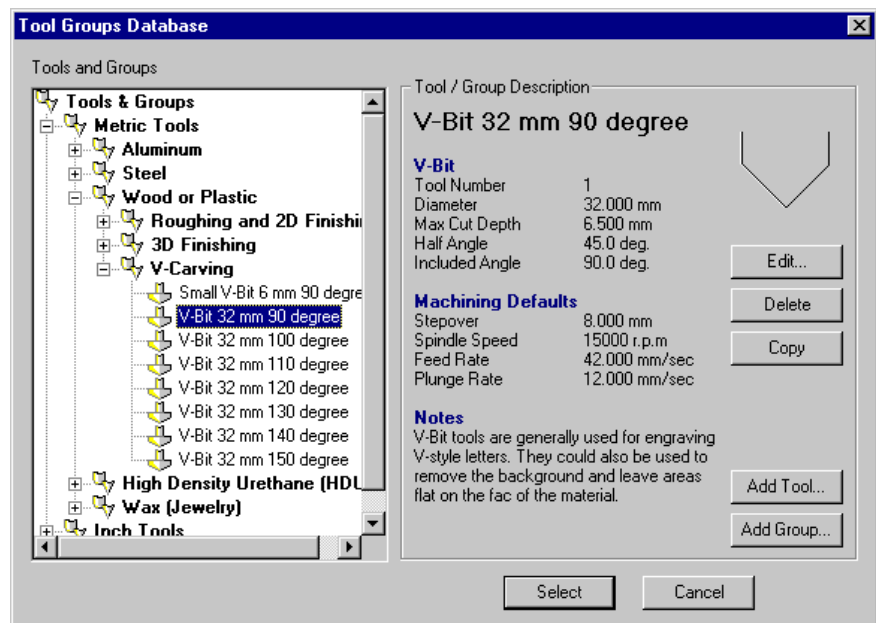
Second, you will create a V-Bit Carving toolpath that will carve the Aston Martin vector object in your model:

1. In the **2D View** window, click on the Aston Martin vector object to select it.



The Aston Martin vector object is magenta:



2. Click on the **Centreline Carving** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **V-Bit Carving** page.
3. Type *0.02 mm (0.001")* in the **Tolerance** box.
4. Click on the  arrow in the **Safe Z** area of the page to display the **Safe Z** box.
5. Type *3 mm (0.12")* in the **Safe Z** box.
6. Click on the **Select** button  in the **Carving Tool** area of the page to display the **Tool Groups Database**:



7. Click on the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool in the **Wood or PlasticV-Carving** tool group to select it.

8. Click on the **Select** button  to close the **Tool Groups Database** and display the selected tool in the **Carving Tool** area of the **V-Bit Carving** page.
9. Click on the  arrow to display the machining parameters of the selected tool.
10. Click on the **Tool Number** list box, and then click on the number **2** option.

This number should correspond with the position of the tool in your CNC machine's tool changer.

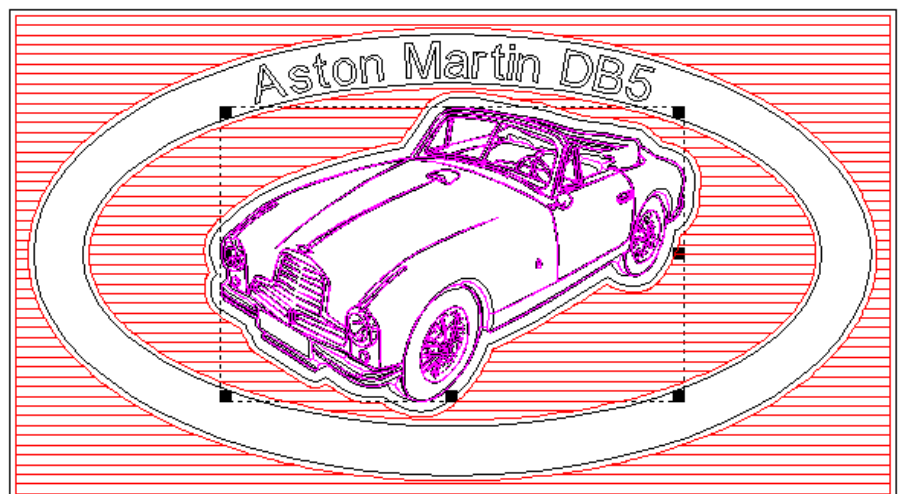
11. Click on the **Calculate** button  to create the V-Bit Carving toolpath.



The Aston Martin vector object is colour-filled in cyan during the centreline calculation process.

The progress bar appears beneath the **2D View** window. This indicates the progress ArtCAM 2D is making in calculating the centreline:



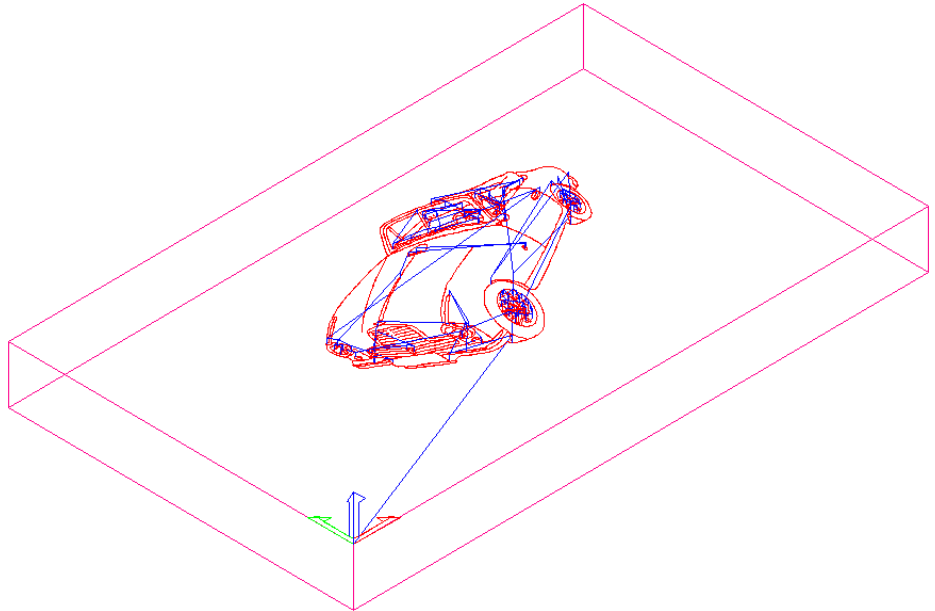
The V-Bit Carving toolpath appears in the **2D View** window as follows:



12. Click on the **Close** button  to return to the **Assistant's** Home page.
13. Click on the **3D View** button  in the **2D View** toolbar to display a three-dimensional

representation of the V-Bit Carving toolpath in the **3D View** window.

An isometric view of the V-Bit Carving toolpath appears in the **3D View** window as follows:



14. Click on the **Toolpath Manager** tab

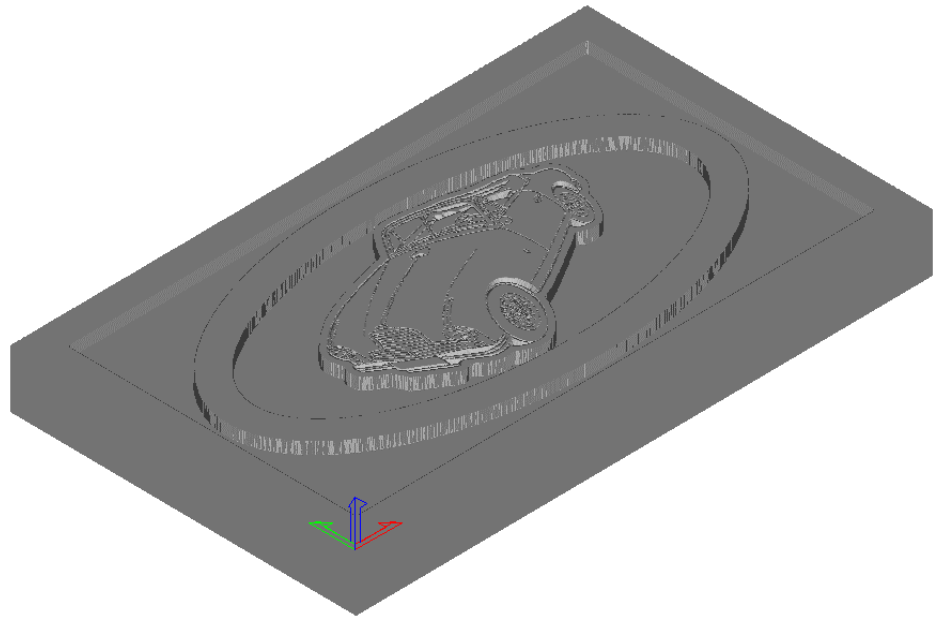



15. Click on the **Simulate Toolpath(s)** button



in the **Toolpath Simulation** area of the **Toolpath Manager** to simulate the V-Bit Carving toolpath you have created.

An isometric view of the simulated V-Bit Carving toolpath appears in the **3D View** window as follows:

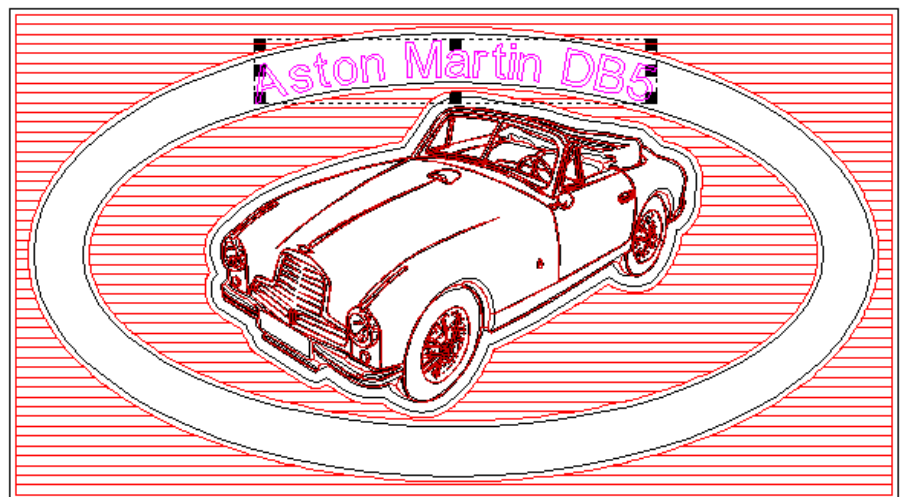




16. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.

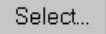
Carving the Text

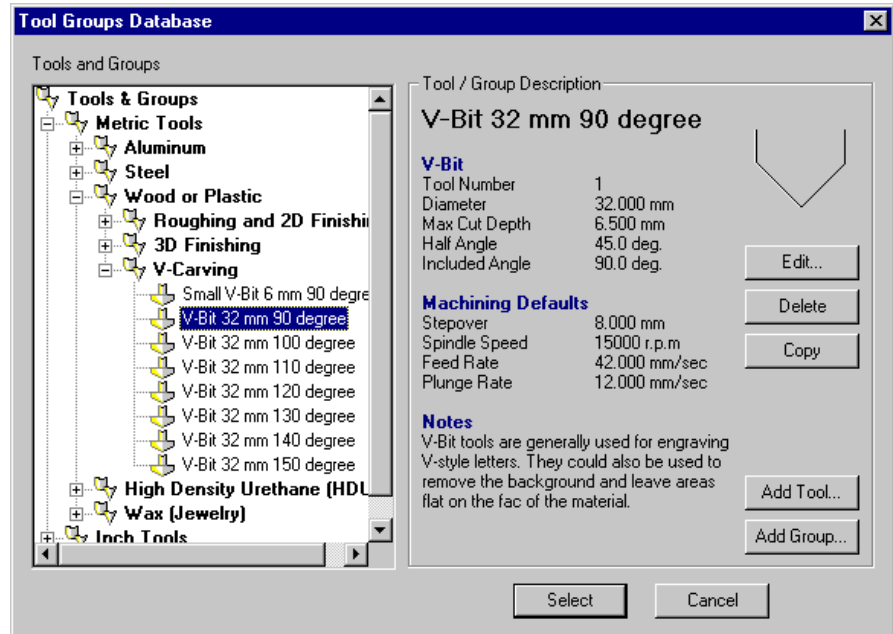
Next, you will create a V-Bit Carving toolpath that will carve the *Aston Martin DB5* vector text in your model:



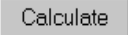
1. In the **2D View** window, click on the *Aston Martin DB5* vector text to select it:



2. Click on the **Centreline Carving** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **V-Bit Carving** page.
3. Type 0.02 mm (0.001") in the **Tolerance** box.
4. Click on the  arrow in the **Safe Z** area of the page to display the **Safe Z** box.

5. Type 3 mm (0.12") in the **Safe Z** box.
6. Click on the **Select** button  in the **Carving Tool** area of the page to display the **Tool Groups Database**:



7. Click on the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool in the **Wood or PlasticV-Carving** tool group to select it.
8. Click on the **Select** button  to close the **Tool Groups Database** and display the selected tool in the **Carving Tool** area of the **V-Bit Carving** page.
9. Click on the  arrow to display the machining parameters of the selected tool.
10. Click on the **Tool Number** list box, and then click on the number **2** option.
11. Click on the **Calculate** button  to create the V-Bit Carving toolpath.



The *Aston Martin DB5* vector text is colour-filled in cyan during the centreline calculation process.

The progress bar appears beneath the **2D View** window. This indicates the progress ArtCAM 2D is making in calculating the centreline:

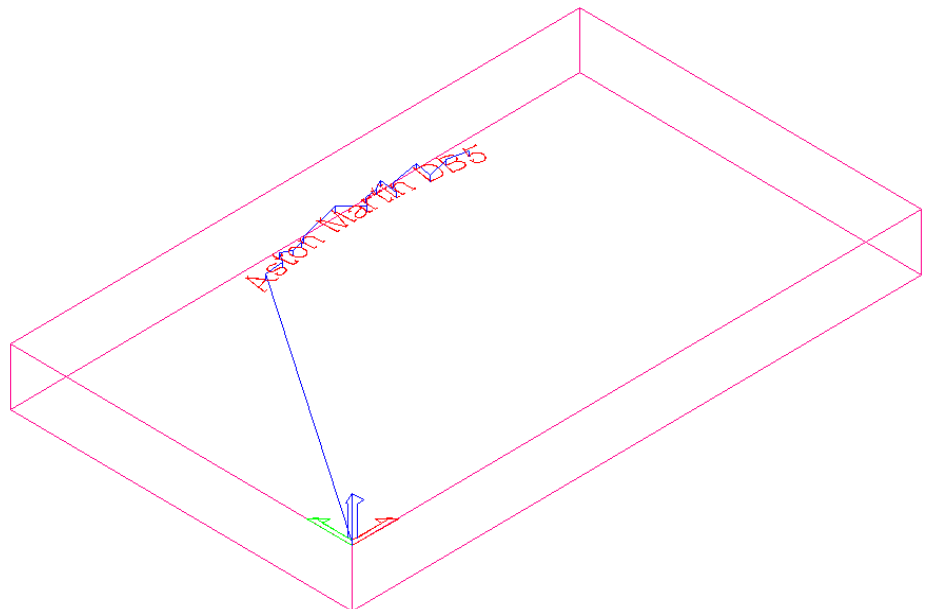


The V-Bit Carving toolpath appears in the **2D View** window as follows:

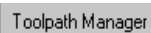


12. Click on the **Close** button  to return to the **Assistant's** Home page.
13. Click on the **3D View** button  in the **2D View** toolbar to display a three-dimensional representation of the V-Bit Carving toolpath in the **3D View** window.

An isometric view of the V-Bit Carving toolpath appears in the **3D View** window as follows:



14. Click on the **Toolpath Manager** tab

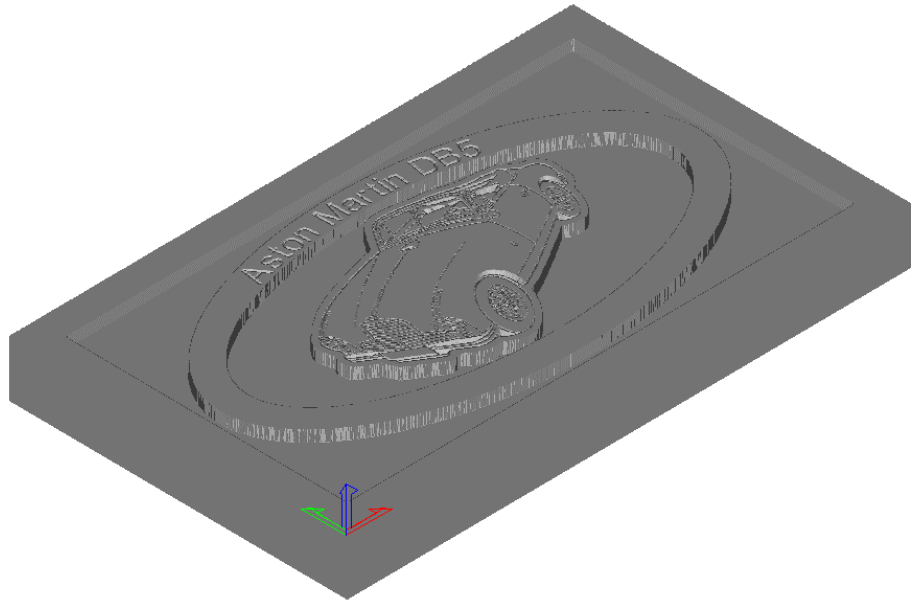



15. Click on the **Simulate Toolpath(s)** button



in the **Toolpath Simulation** area of the **Toolpath Manager** to simulate the V-Bit Carving toolpath you have created.



An isometric view of the simulated V-Bit Carving toolpath appears in the **3D View** window as follows:



16. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.

Marking the Drill Holes with Circles

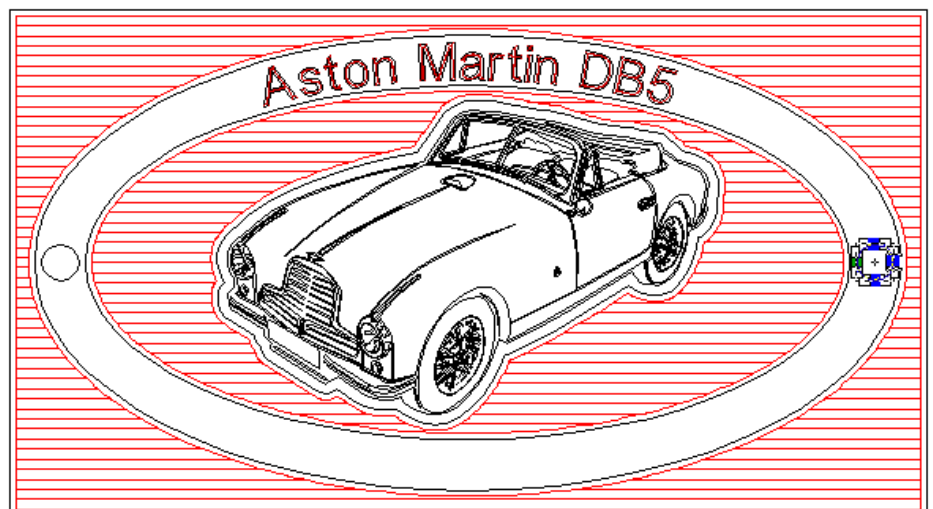
Now you will mark the position of the drill holes that you want to machine using circles:

1. Click on the **Assistant** tab  to display the **Assistant's** Home page.
2. Click on the **Create Circles** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Circle Creation** page.
3. Type *50 mm (2")* in the **Circle Centre's X** box.
4. Type *150 mm (6")* in the **Circle Centre's Y** box.


5. Type 9 mm (0.35") in the **Circle Radius** box.
6. Click on the **Create** button to create a circle between the middle of the inner and outer ellipse on the left side of the model:



7. Type 450 mm (18") in the **Circle Centre's X** box.
8. Type 150 mm (6") in the **Circle Centre's Y** box.
9. Type 9 mm (0.35") in the **Circle Radius** box.
10. Click on the **Create** button to create a circle between the middle of the inner and outer ellipse on the right side of the model:



11. Click on the **Close** button to return to the **Assistant's** Home page.




12. Hold the **Shift** key  on your keyboard, and then click on both of the circles that you have created to select them.

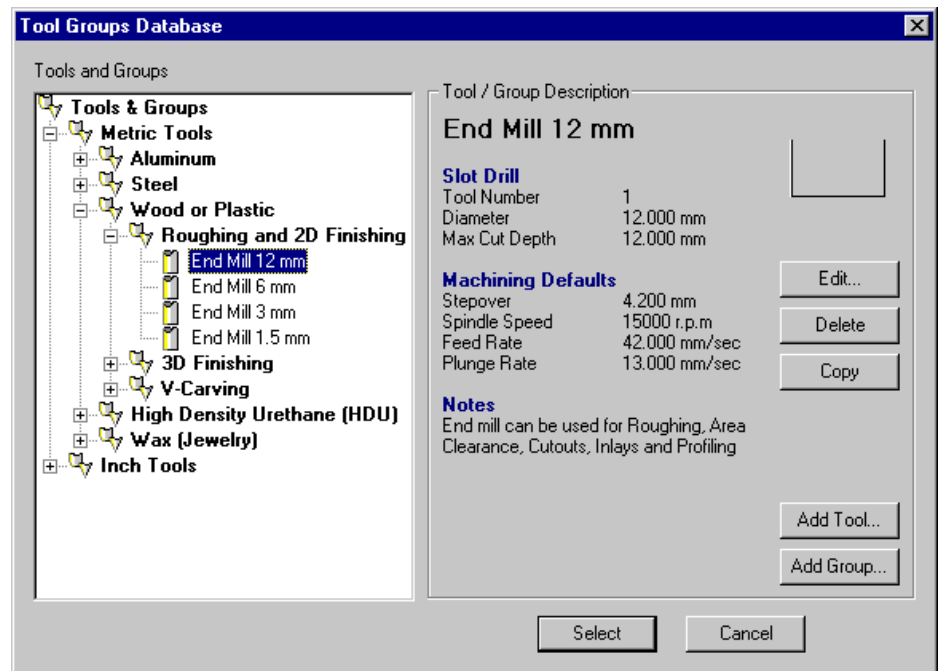
The circles turn magenta and are surrounded by a bounding box:

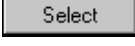



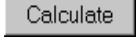


Creating the Drill Holes

In this next stage, you will create drill holes inside the selected circles:


1. Click on the **Drill Holes** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Drilling** page.
2. Type 50 mm (2") in the **Finish Depth** box.
3. Click on the  arrow in the **Safe Z** area of the page to display the **Safe Z** box.
4. Type 3 mm (0.12") in the **Safe Z** box.
5. Click on the **Select** button  in the **Tool** area of the page to display the **Tool Groups Database**:



6. Click on the **End Mill 12 mm** (End Mill ½ Inch) tool in the **Wood or Plastic\Roughing and 2D Finishing** tool group to select it.
7. Click on the **Select** button  to close the **Tool Groups Database** and display the selected tool in the **Tool** area of the **Drilling** page.
8. Click on the  arrow to display the machining parameters of the selected tool.
9. Click on the **Tool Number** list box, and then click on the number **3** option.
10. Click on the **Circular Vectors** radio button  in the **Drill Centre of...** area of the page to select it.
This option is used because you have selected circles to define the position of the drill holes.
11. Make sure that the **Create 2D Preview** option is checked on .
12. Click on the **Calculate** button  to create the Drilling toolpath.


The Drilling toolpath appears in the **2D View** window, shown as a cross in the centre of both circles:



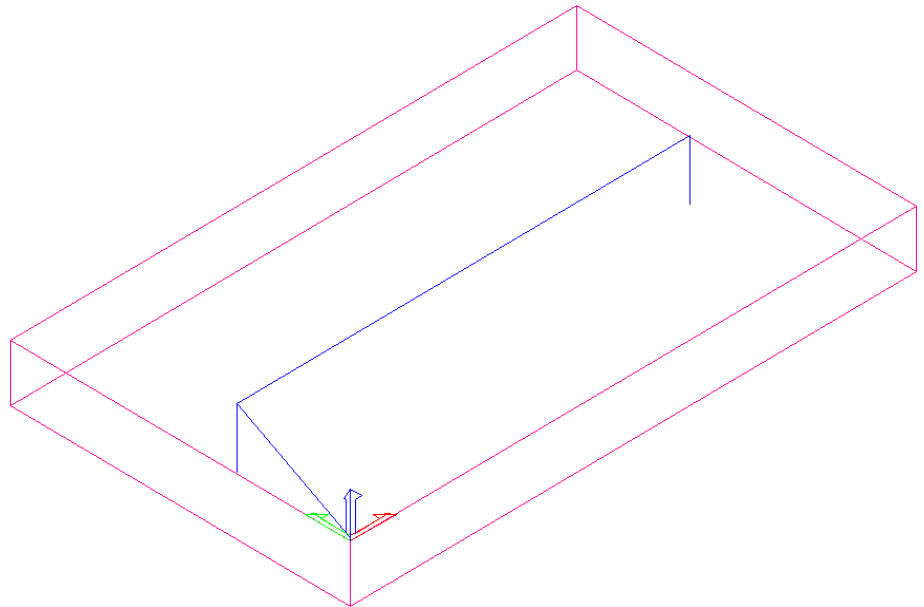
13. Click on the **Close** button  to return to the **Assistant's** Home page.

14. Press the **Delete** key  on your keyboard to delete the two circles, leaving just the drill holes:



15. Click on the **3D View** button  in the **2D View** toolbar to display a three-dimensional representation of the Drilling toolpath in the **3D View** window.

An isometric view of the Drilling toolpath appears in the **3D View** window as follows:



16. Click on the **Toolpath Manager** tab

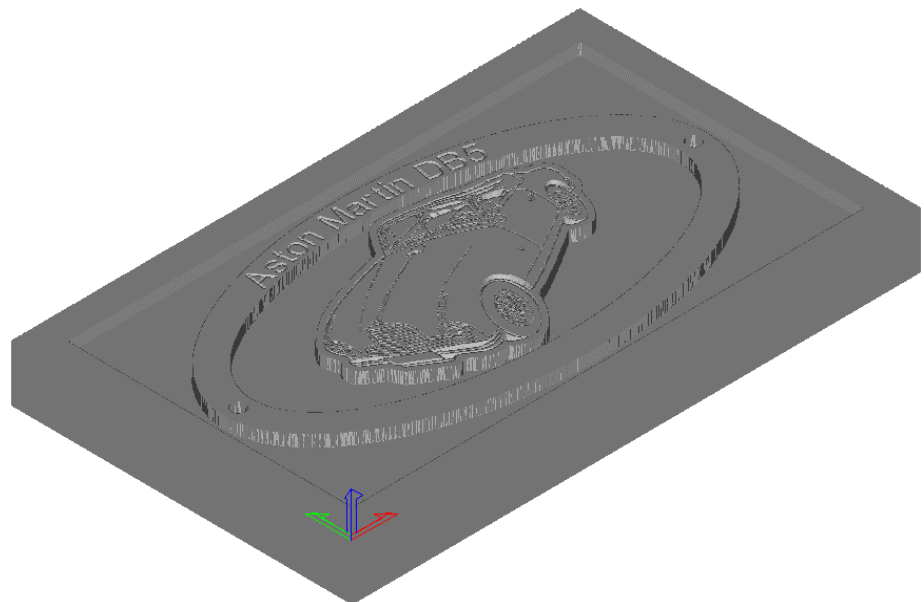
 Toolpath Manager .

17. Click on the **Simulate Toolpath(s)** button



in the **Toolpath Simulation** area to simulate the Drilling toolpath you have created.

An isometric view of the simulated Drilling toolpath appears in the **3D View** window as follows:



Saving the Toolpaths

You are now ready to save the toolpaths that you have created to machine the *Aston Martin DB5* sign:

1. Click on the **Toolpath Manager** tab

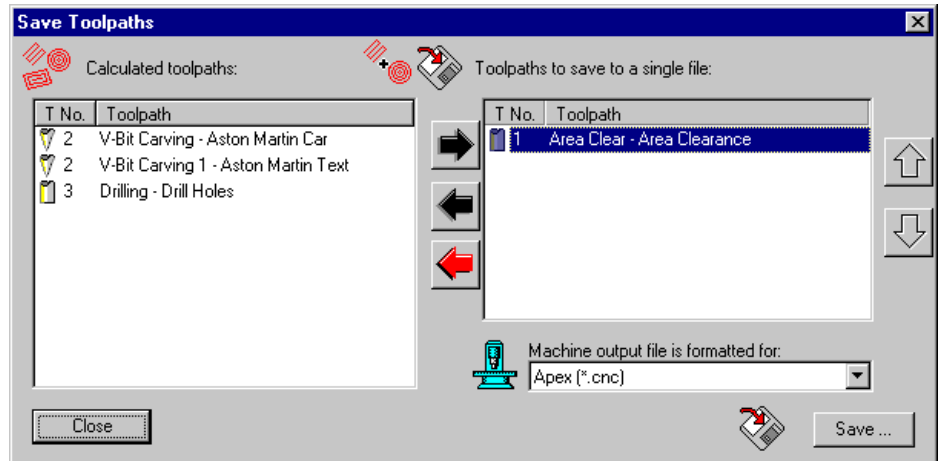


2. Click on the **Area Clear** toolpath to select it.

The toolpath name is highlighted in blue:


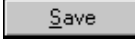





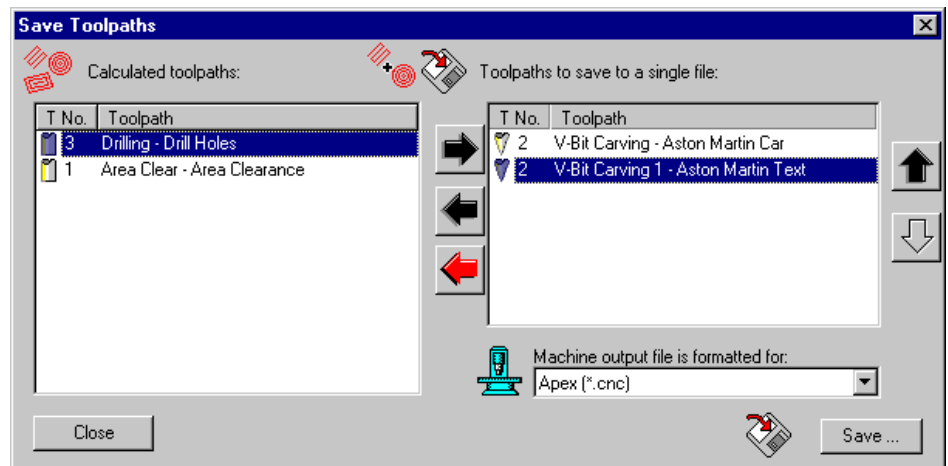
3. Click on the **Save Toolpaths** button  in the **Toolpath Operations** area to display the **Save Toolpaths** dialog box:







You will save the toolpaths as separate files, grouping together those that use the same tool.

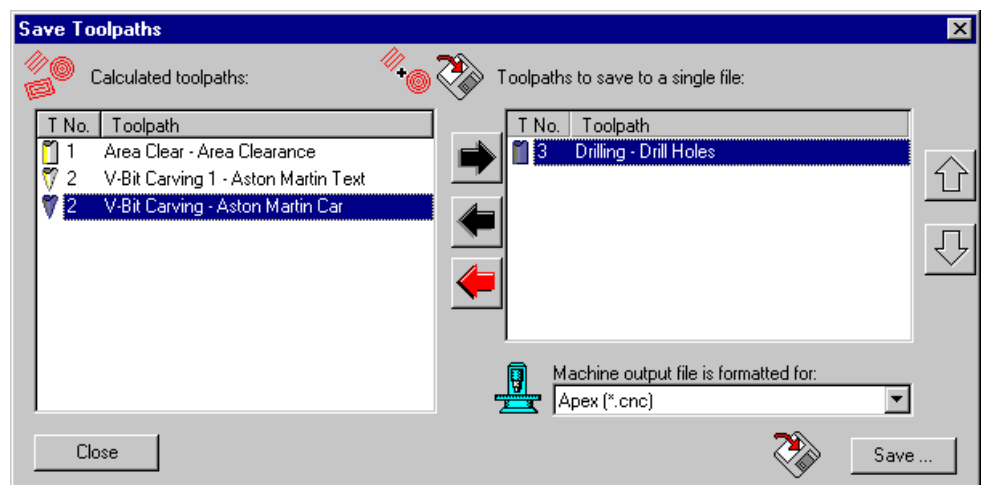
Both of the **V-Bit Carving** toolpaths have the same tool number because the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool is used in each of them.




4. Click on the **Machine output file is formatted for** list box and select the format compatible with your machine.
5. Click on the **Save...** button  to open the **Save As...** dialog box.
6. Type *Area Clearance* in the **File Name** box.
7. Click on the **Save** button  to save the toolpath to the selected directory.
8. Click on the  button to send the **Area Clear** toolpath to the **Calculated Toolpaths** window in the **Save Toolpaths** dialog box.
9. Hold the **Shift** key  on your keyboard, and then click on both of the **V-Bit Carving** toolpaths in the **Calculated Toolpaths** window to select them.
10. Click on the  arrow to send both of the selected toolpaths to the **Toolpaths to save to a single file** window:



Both of the **V-Bit Carving** toolpaths are saved as a single file because the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool is used in each of them.

11. Click on the **Save...** button  to open the **Save As...** dialog box.
12. Type *V-Bit Carving* in the **File Name** box.
13. Click on the **Save** button  to save the toolpath.
14. Click on the  button to send both the **V-Bit Carving** and the **V-Bit Carving 1** toolpath to the **Calculated Toolpaths** window.
15. Click on the **Drilling** toolpath to select it.
16. Click on the  button to send the selected toolpath to the **Toolpaths to save to a single file** window:



17. Click on the **Save...** button  to open the **Save As...** dialog box.
18. Type *Drilling* in the **File Name** box.
19. Click on the **Save** button  to save the toolpath.
20. Click on the **Close** button  to close the **Save Toolpaths** dialog box.

You can now send these toolpath files to your CNC machine tool to create the *Aston Martin DB5* sign.

Tutorial – 3D Bevelled Carving

Overview

The following tutorial demonstrates how to create bevelled (angle-edged) lettering using the vector text and toolpath tools available in ArtCAM 2D.

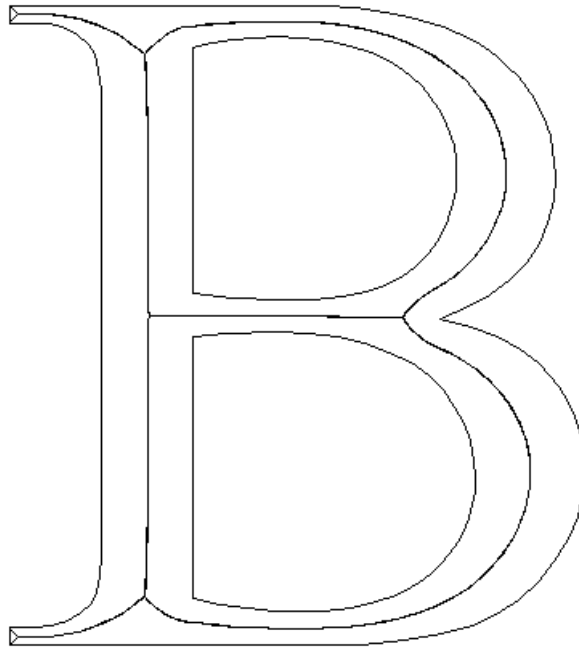
Bevelled Letter B

The four stages that you will cover during the course of this tutorial are:

- Preparing the model.
- Creating the vector text.
- Machining the vector text.
- Saving the toolpaths.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating a bevelled letter *B*.

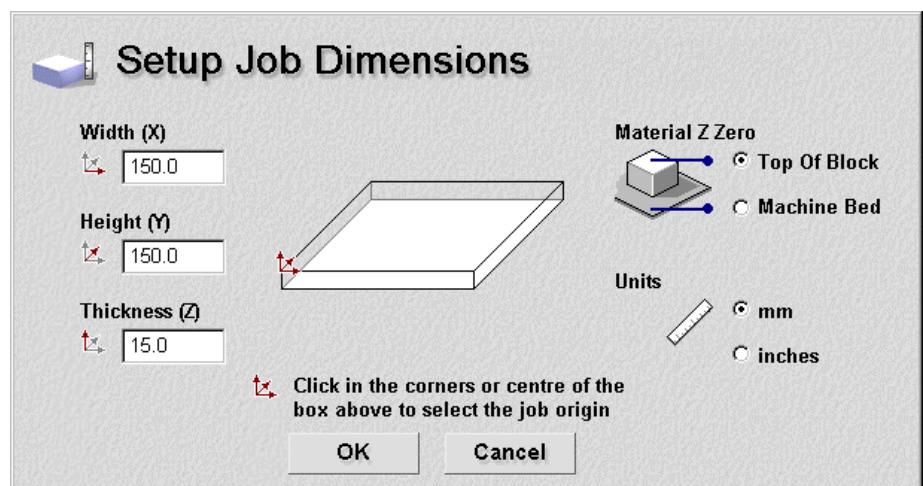
At the end of this tutorial, you will have produced a model of a bevelled letter *B* that looks like this:







Preparing the Model

First, you will set up the dimensions of the block of material that you will be working with for this particular job:

1. Click on the **Create New Model**  button located in the **Getting Started** menu options in the **ArtCAM 2D Assistant** to display the **Setup Job Dimensions** dialog box:







2. Click on the **Units** option  that you want to use (millimetres or inches).
3. Type *150 mm (6")* in the **Width (X)** box, *150 mm (6")* in the **Height (Y)** box and *15 mm (0.6")* in the **Thickness (Z)** box.

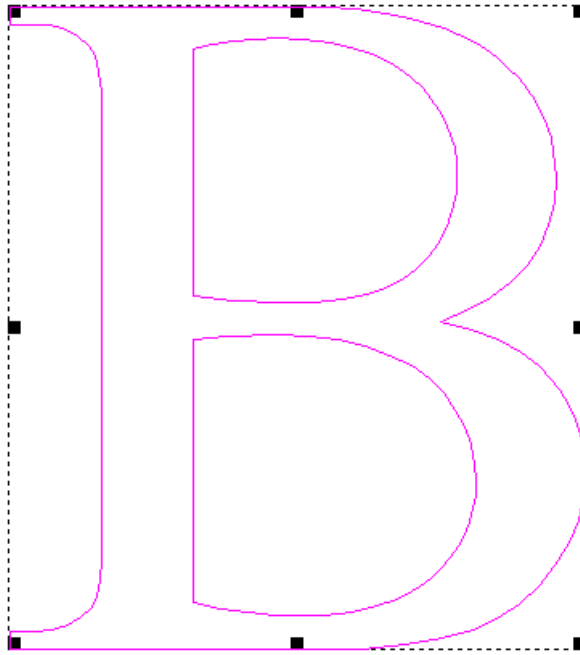
4. Make sure that the **Material Z Zero** option  is set to **Top of Block**.
5. Make sure that the **Job Origin**  is positioned on the front-left corner of the box.
6. Click on the **OK** button  to close the **Setup Job Dimensions** dialog box.

A **2D View** window automatically fills the previously empty design window area.

Creating the Vector Text




Now you will create the vector text you will use to produce the bevelled letter *B*:

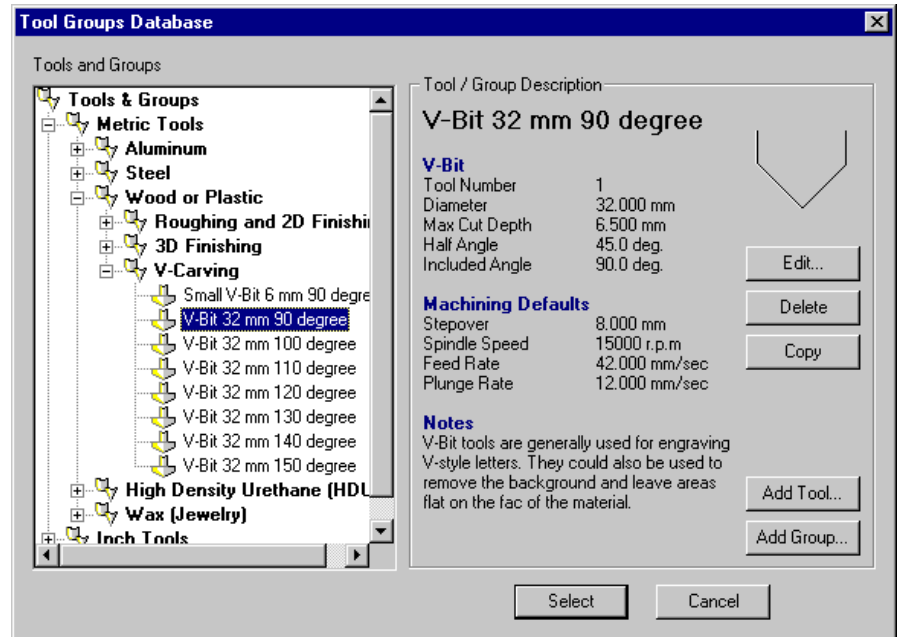
1. Click on the **Create Vector Text** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text Tool** page.
2. Click on the **Font** list box, and then click on **Times New Roman** to select it.
3. Click on the **Size** list box, and then click on the appropriate unit of measurement option (millimetres or inches).
4. Type 200 mm (8") in the **Size** box.
5. Click anywhere in the **2D View** window. Hold the **Shift** key  on your keyboard and then type *B*.
6. Click the **Done** button  on the **Text Tool** page to create the vector text and return to the **Assistant's** Home page.
7. Make sure that the *B* vector text is selected.
The *B* vector text should be magenta and surrounded by a bounding box. If not, click on the *B* vector text to select it.
8. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to place the *B* vector text in the centre of your model.

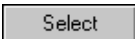
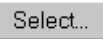


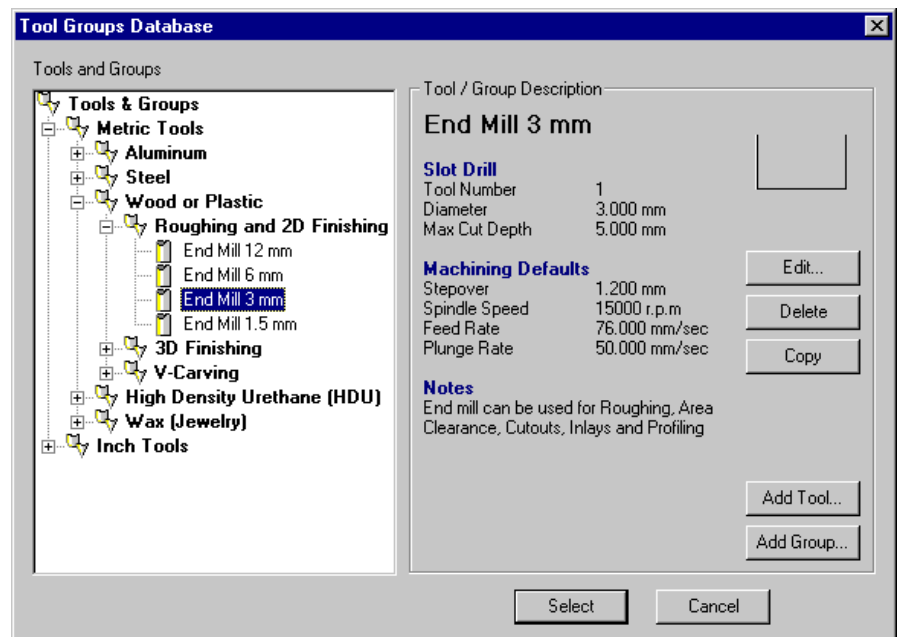
Machining the Vector Text

You are now ready to create the toolpath that will be used to machine your *B* vector text, and thus create your bevelled letter:


1. Click on the **Create a V-Bit Bevelled Carving** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **3D Bevel Carving** page.
2. Type 3 mm (0.15") in the **Wall Height** box.
3. Type 15 mm (0.6") in the **Finish Depth** box.
4. Type 0.02 mm (0.001") in the **Tolerance** box.
5. Click on the  arrow in the **Safe Z** area of the page to display the **Safe Z** box.
6. Type 3 mm (0.12") in the **Safe Z** box.
7. Click on the **Select** button  in the **Carving Tool** area of the page to display the **Tool Groups Database**:




8. Click on the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool in the **Wood or Plastic\V-Carving** tool group to select it.
9. Click on the **Select** button  to close the **Tool Groups Database** and display the selected tool in the **Carving Tool** area of the **3D Bevel Carving** page.
10. Click on the **Select** button  in the **Profiling Tool** area of the page to display the **Tool Groups Database**:



11. Click on the **End Mill 3 mm** (End Mill 1/8 Inch) tool in the **Wood or Plastic\Roughing and 2D Finishing** tool group to select it.

12. Click on the **Select** button  to close the **Tool Groups Database** and display the selected tool in the **Profiling Tool** area of the **3D Bevel Carving** page.

13. Click on the  arrow to display the machining parameters of the selected tool.

14. Click on the **Tool Number** list box, and then click on the number **2** option.

This number should correspond with the position of the tool in your CNC machine's tool changer.

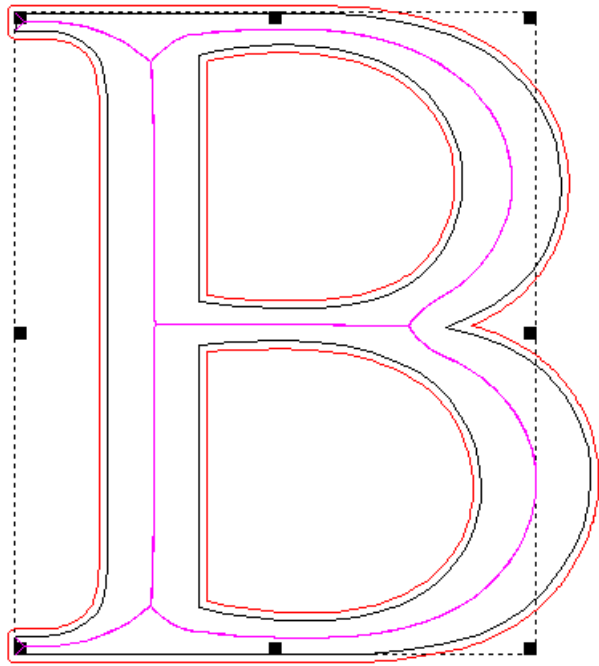
15. Click on the **Calculate** button  to create the Bevelled Carving toolpath



The *B* vector text is colour-filled in cyan during the centreline calculation process.

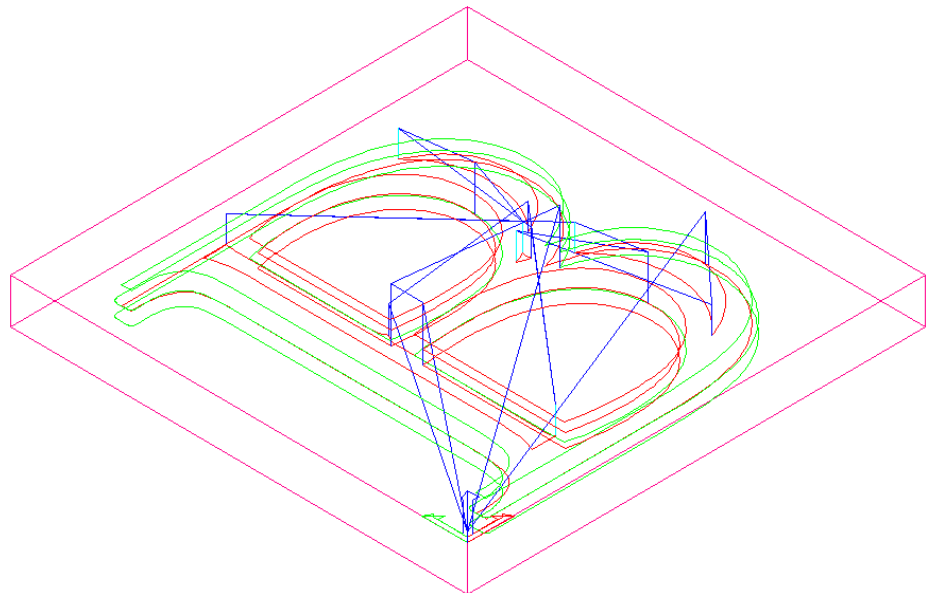
The progress bar appears beneath the **2D View** window. This indicates the progress ArtCAM 2D is making in calculating the centreline:



The Bevelled Carving toolpath appears in the **2D View** window as follows:



16. Click on the **Close** button  to return to the **Assistant's** Home page.
17. Click on the **3D View** button  in the **2D View** toolbar to display an isometric view of the Bevelled Carving toolpath in the **3D View** window:




18. Click on the **Toolpath Manager** tab .

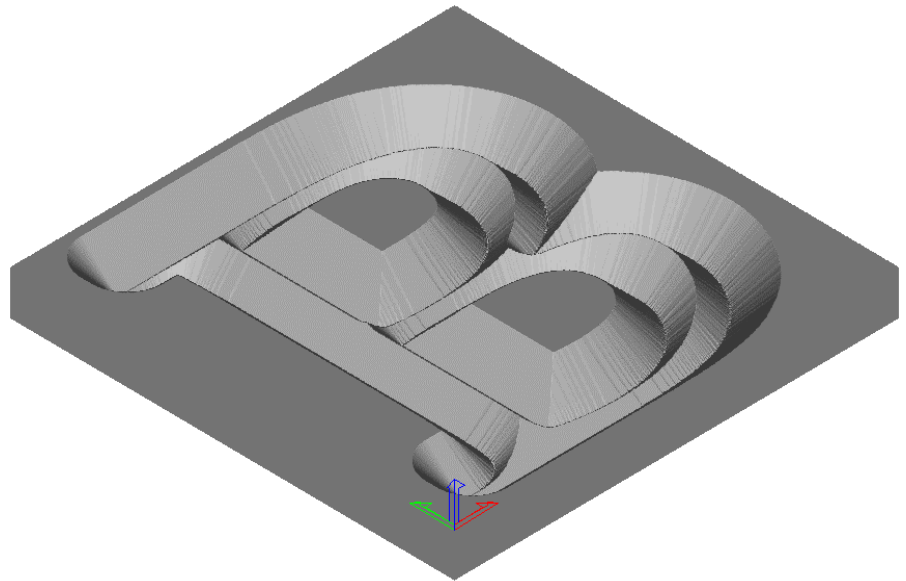
The **Toolpath Manager** allows you to edit, simulate and save the toolpaths that you have created.

19. Click on the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) toolpath under the **Bevelled Carving** heading, so that only this toolpath name is highlighted in blue:




20. Click on the **Simulate Toolpath(s)** button  in the **Toolpath Simulation** area of the **Toolpath Manager** to simulate the Carving part of the Bevelled Carving toolpath you have created.

An isometric view of the simulated Carving part of the Bevelled Carving toolpath appears in the **3D View** window as follows:

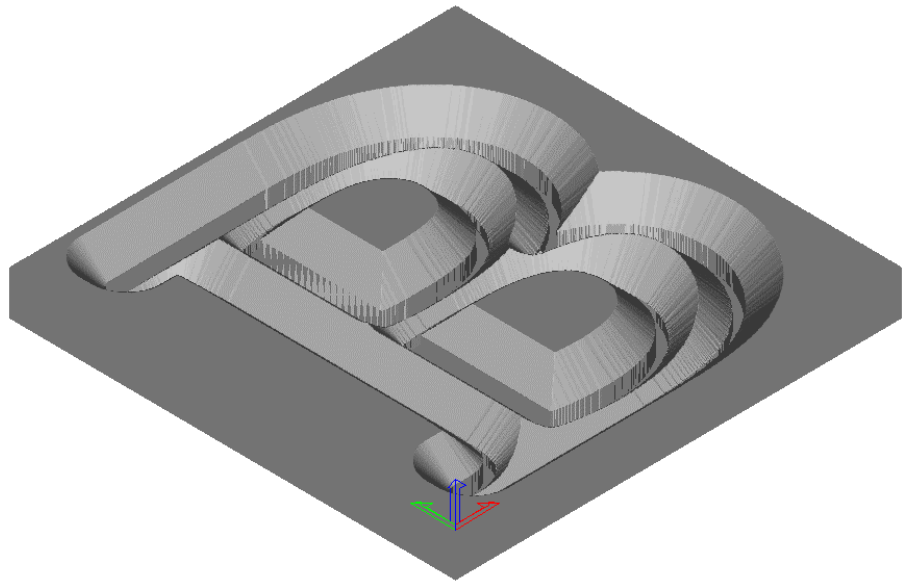


21. Click on the **End Mill 3 mm** (End Mill 1/8 Inch) toolpath under the **Bevelled Carving** heading on the **Toolpath Manager** to select it:



22. Click on the **Simulate Toolpath(s)** button  in the **Toolpath Simulation** area of the **Toolpath Manager** to simulate the Profiling part of the Bevelled Carving toolpath you have created.

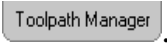
An isometric view of the simulated Carving part of the Bevelled Carving toolpath appears in the **3D View** window as follows:

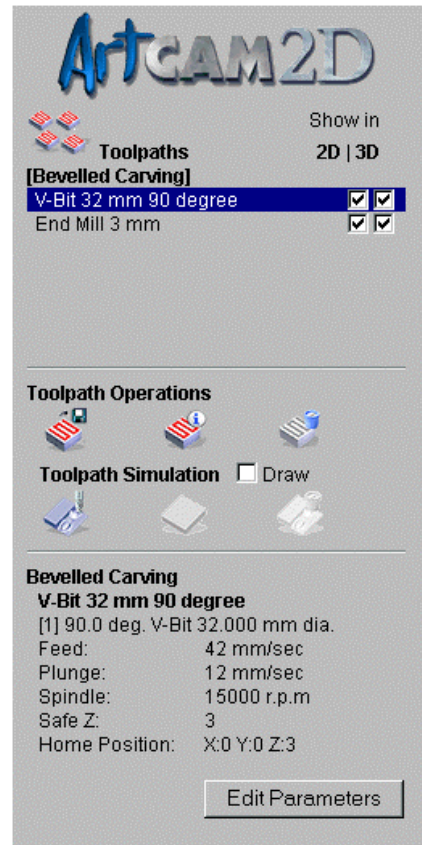


This isometric view now represents a simulation of the complete Bevelled Carving toolpath.

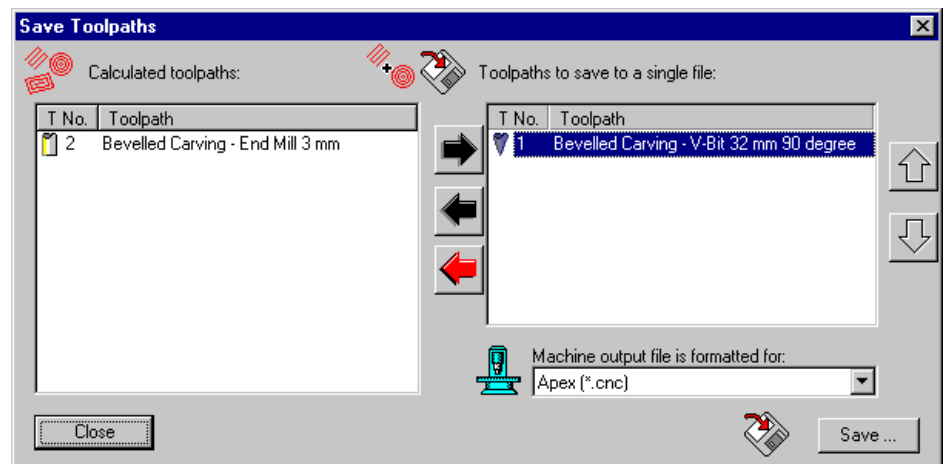
Saving the Toolpaths


Finally, you will save the toolpaths that you have created to machine the bevelled letter *B*:


1. Click on the **Toolpath Manager** tab
.
2. Click on the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) toolpath under the **Bevelled Carving** heading to select it:




3. Click on the **Save Toolpaths** button  in the **Toolpath Operations** area to display the **Save Toolpaths** dialog box:

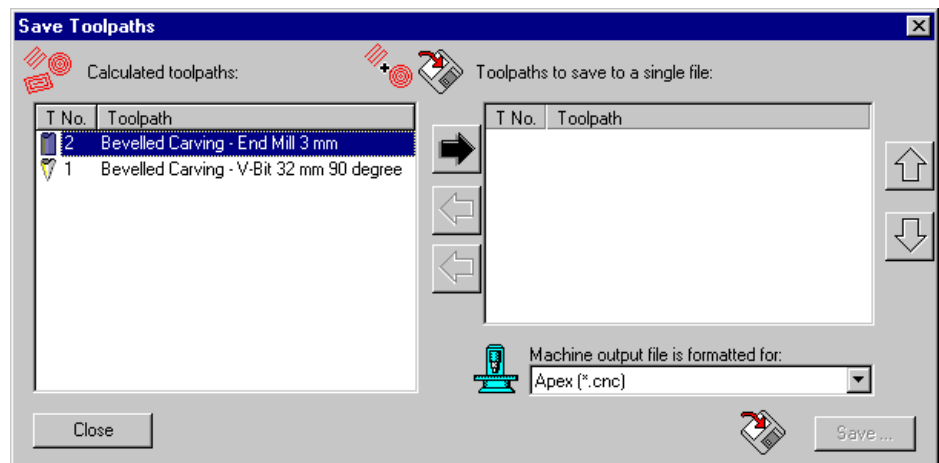


4. Click on the **Machine output file is formatted for** list box and select the format compatible with your machine.
5. Click on the **Save...** button  to open the **Save As...** dialog box.
6. Type *Bevelled Carving 1* in the **File Name** box.

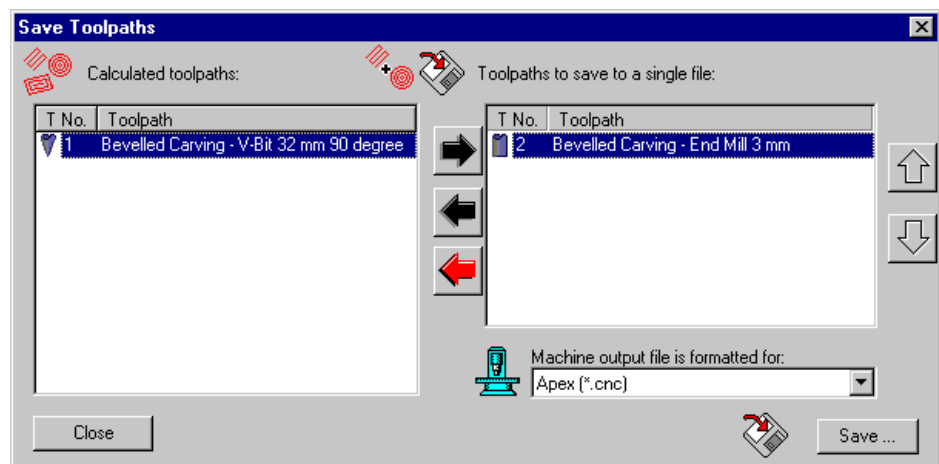
7. Click on the **Save** button  to save the toolpath to the selected directory.



You have now saved the Carving part of the Bevelled Carving toolpath.

8. Click on the  button to send the **Bevelled Carving – V-Bit 32 mm 90 degree** (Bevelled Carving – V-Bit 1.25 Inch 90 degree) toolpath to the **Calculated Toolpaths** window in the **Save Toolpaths** dialog box.
9. Click on the **Bevelled Carving – End Mill 3 mm** (Bevelled Carving – End Mill 1/8 Inch) toolpath in the **Calculated Toolpaths** window to select it:

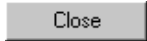


10. Click on the  arrow to send the **Bevelled Carving – End Mill 3 mm** (Bevelled Carving – End Mill 1/8 Inch) toolpath to the **Toolpaths to save to a single file** window:



11. Click on the **Save...** button  to open the **Save As...** dialog box.
12. Type *Bevelled Carving 2* in the **File Name** box.
13. Click on the **Save** button  to save the toolpath.

You have now saved the Profiling part of the Bevelled Carving toolpath.

14. Click on the **Close** button  to close the **Save Toolpaths** dialog box.

You can now send these toolpath files to your CNC machine tool to create the bevelled letter *B*.

Tutorial – Bridging

Overview

The following tutorial demonstrates how to add bridges, also referred to as tabs, to a Profile toolpath. Bridges are used to hold a part in place during machining.

Bridged Letter B

The six stages that you will cover during the course of this tutorial are:

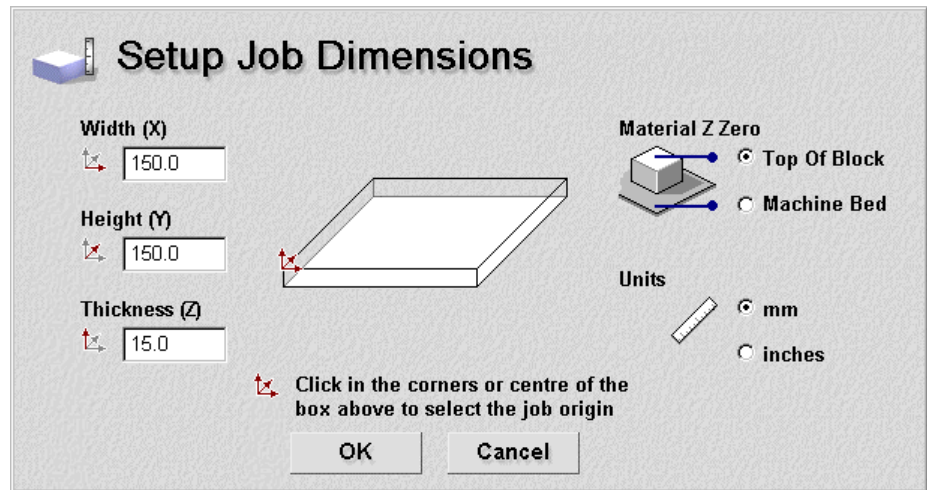
- Preparing the model.
- Creating the vector text.
- Creating the toolpath.
- Adding the bridges.
- Editing the bridges.
- Saving the toolpath.





The tutorial will lead you through each of these stages, guiding you through the complete process of creating a profiled letter *B* with bridging.

Preparing the Model

First, you will set up the dimensions of the block of material that you will be working with for this particular job:

1. Click on the **Create New Model**  button located in the **Getting Started** menu options in the **ArtCAM 2D Assistant** to display the **Setup Job Dimensions** dialog box:







2. Click on the **Units** option  that you want to use (millimetres or inches).
3. Type *150 mm (6")* in the **Width (X)** box, *150 mm (6")* in the **Height (Y)** box and *15 mm (0.6")* in the **Thickness (Z)** box.
4. Make sure that the **Material Z Zero** option  is set to **Top of Block**.
5. Make sure that the **Job Origin**  is positioned on the front-left corner of the box, as shown above.
6. Click on the **OK** button  to close the **Setup Job Dimensions** dialog box.

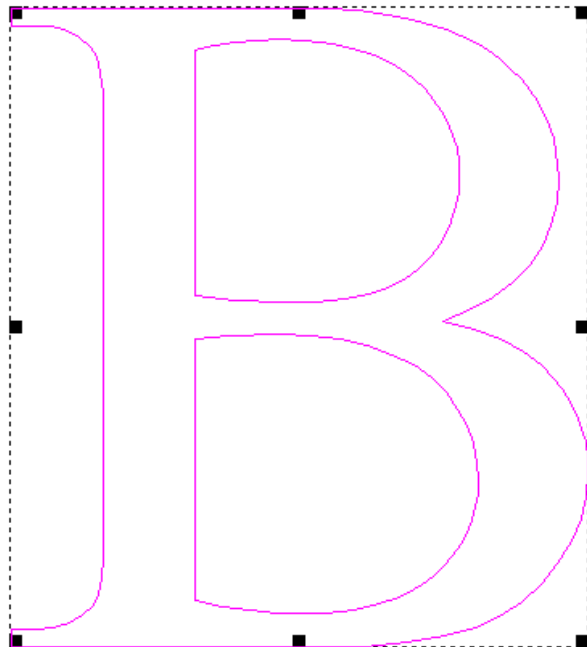
A **2D View** window automatically fills the previously empty design window area.

Creating the Vector Text

The next stage is to create the vector text to which you will be adding bridging:





1. Click on the **Create Vector Text** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text Tool** page.

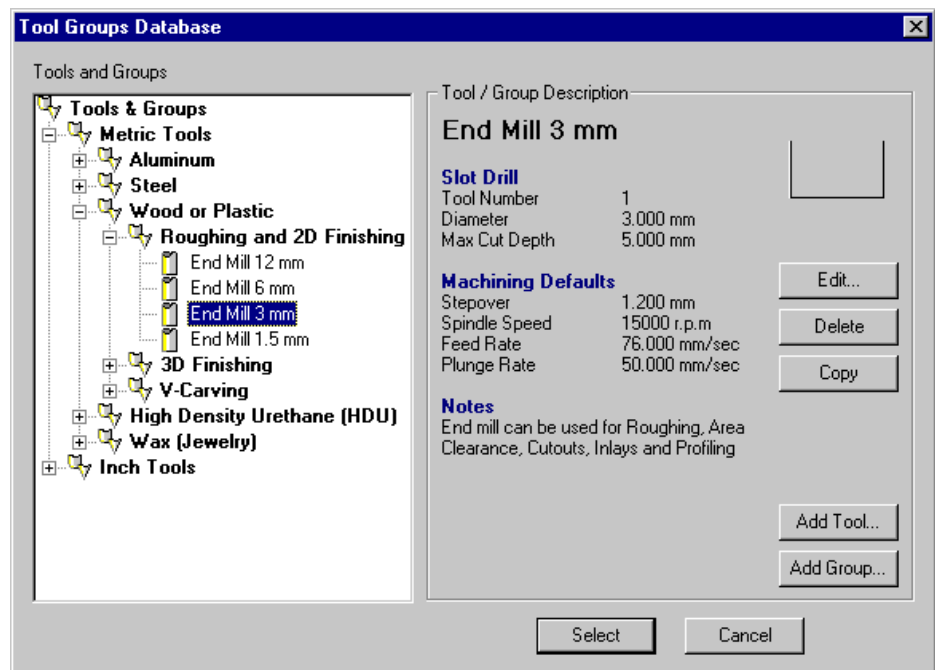
2. Click on the **Font** list box, and then click on **Times New Roman** to select it.
3. Click on the **Size** list box, and then click on the appropriate unit of measurement option (millimetres or inches).
4. Type 200 mm (8") in the **Size** box.
5. Click anywhere in the **2D View** window. Hold the **Shift** key  on your keyboard and then type *B*.
6. Click the **Done** button  on the **Text Tool** page to create the vector text and return to the **Assistant's** Home page.
7. Make sure that the *B* vector text is selected.
The *B* vector text should be magenta and surrounded by a bounding box. If not, click on the *B* vector text to select it.
8. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to place the *B* vector text in the centre of your model:

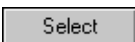


Machining the Vector Text


In this next stage, you will create the toolpath that will be used to machine your *B* vector text:

1. Click on the **Profiling** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Profiling** page.
2. Make sure that the **Outside** radio button  is selected.
3. Make sure that the **Finish Depth** is set to 15 mm (0.6").
4. Type 0.02 mm (0.001") in the **Tolerance** box.
5. Click on the  arrow in the **Safe Z** area of the page to display the **Safe Z** box.
6. Type 3 mm (0.12") in the **Safe Z** box.
7. Click on the **Select** button  in the **Profiling Tool** area of the page to display the **Tool Groups Database**:

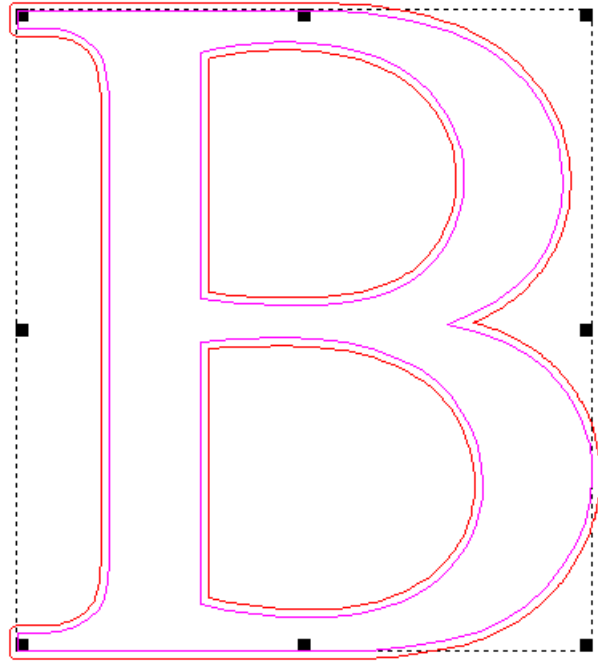




8. Click on the **End Mill 3 mm** (End Mill 1/8 Inch) tool in the **Wood or Plastic\Roughing and 2D Finishing** tool group to select it.
9. Click on the **Select** button  to close the **Tool Groups Database** and display the

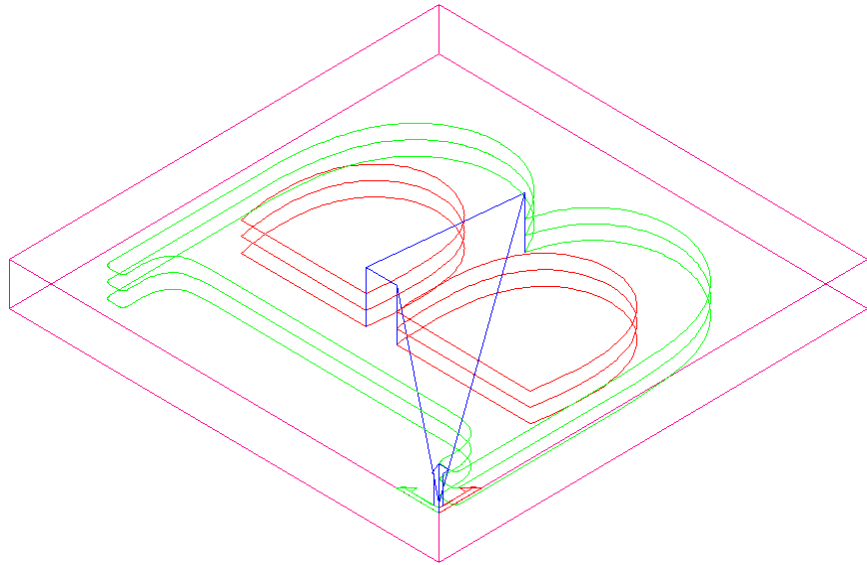
selected tool in the **Profiling Tool** area of the **Profiling** page.

10. Click on the **Calculate** button  to create the Profile toolpath.

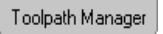
The Profile toolpath appears in the **2D View** window as follows:



11. Click on the **Close** button  to return to the **Assistant's** Home page.
12. Click on the **3D View** button  in the **2D View** toolbar to display an isometric view of the Profile toolpath in the **3D View** window:



13. Click on the **Toolpath Manager** tab

 .

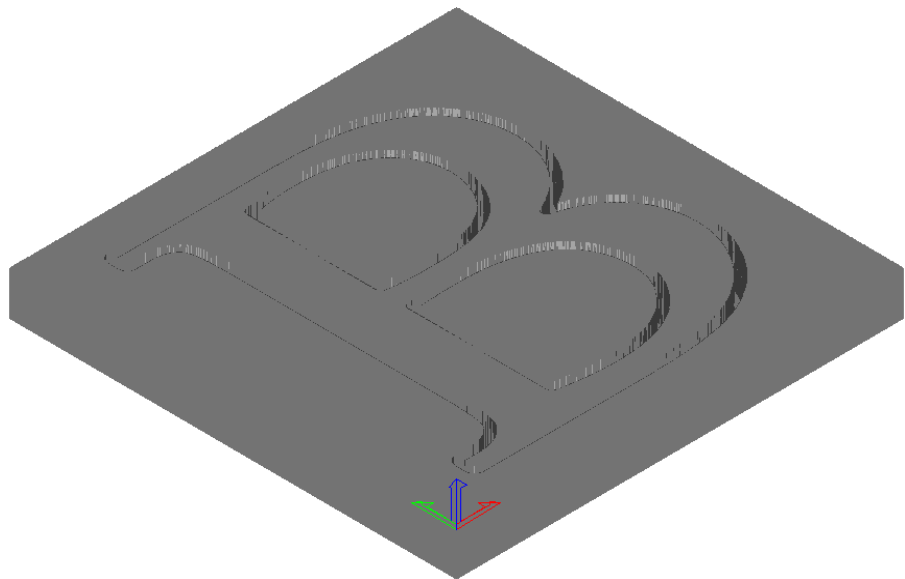
The **Toolpath Manager** allows you to edit, simulate and save the toolpaths that you have created.

14. Click on the **Simulate Toolpath(s)** button

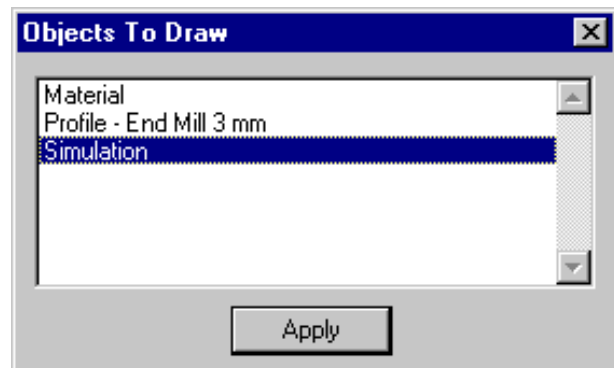


in the **Toolpath Simulation** area to simulate the Profile toolpath you have created.

An isometric view of the simulated Profile toolpath appears in the **3D View** window as follows:

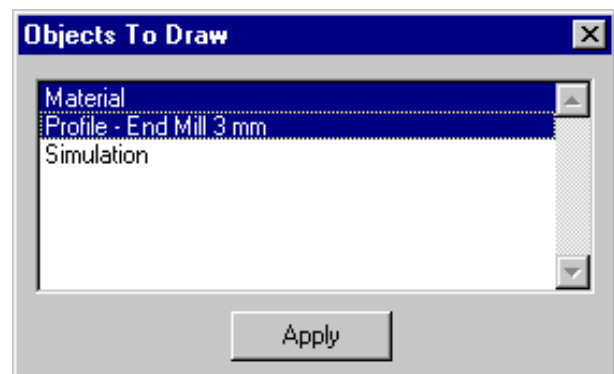


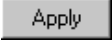
15. Click on the **Objects To Draw** button  in the **3D View** toolbar to open the **Objects To Draw** list box:

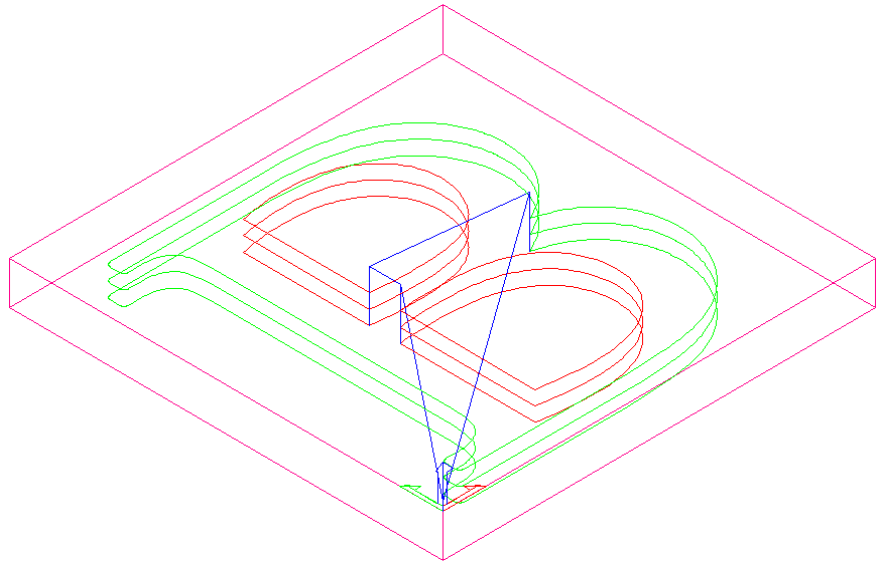


The **Objects To Draw** list box allows you to control what objects are seen and hidden in the **3D View** window.

16. Click on the **Simulation** option to deselect it, so that it is no longer highlighted in blue.
17. Click on the **Material** option, followed by the **Profile – End Mill 3mm** (Profile – End Mill 1/8 Inch) option to select them (so that they are highlighted in blue):



18. Click on the **Apply** button  to display the following isometric view of the Profile toolpath in the **3D View** window:



You can now see how the 3mm End Mill (1/8 Inch End Mill) tool is used to machine the *B* vector text before any bridging is added.

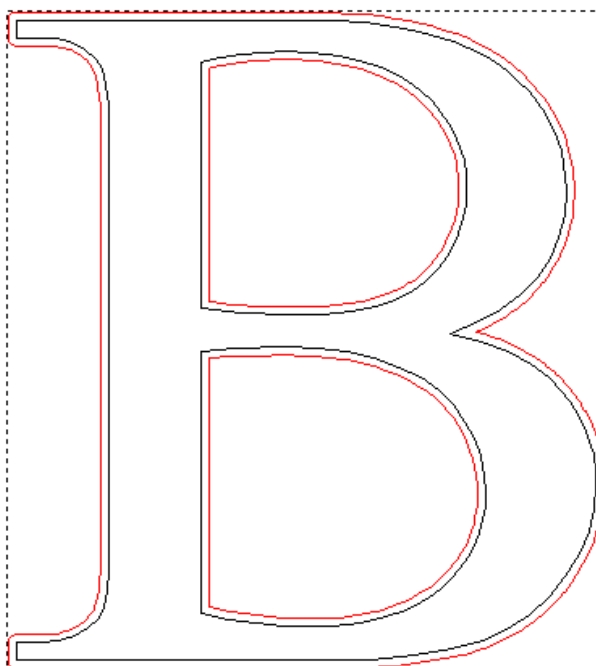
19. Click on the **Objects To Draw** button  to close the **Objects To Draw** list box.
20. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.





Adding the Bridges

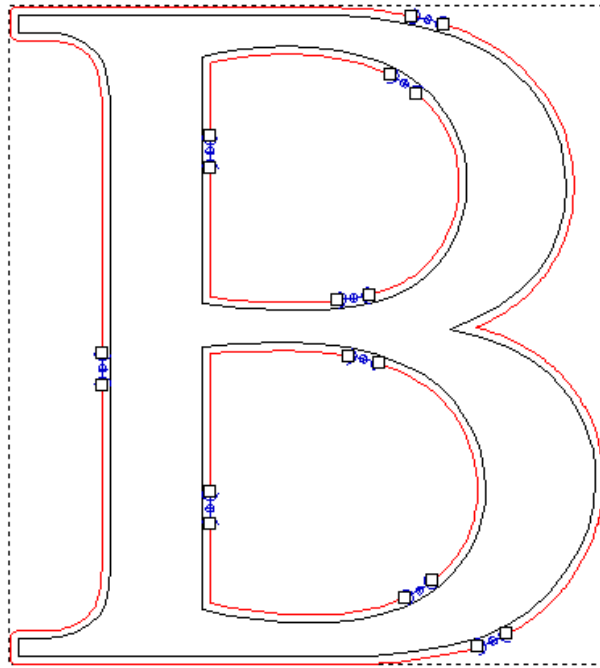
You can now add the bridges to the Profile toolpath that you have created:

1. Click on the dark red Profile toolpath to select it.

A bounding box surrounds the Profile toolpath:




2. Click on the **Assistant** tab  to return to the **Assistant's** Home page.
3. Click on the **Create Bridges** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Bridging** page.
4. Make sure that the value in the **Bridge Length** box is 3 mm (0.125").
5. Make sure that the value in the **Bridge Thickness** box is 1 mm (0.05").
6. Make sure that the **Constant Number** option is selected  in the **Add Bridges To Profiles** area of the page.
7. Type 3 in the **Number** box. This will add three bridges to each part of the Profile toolpath.
8. Click on the **Create Bridges** button  to add the bridging to the Profile toolpath as follows:



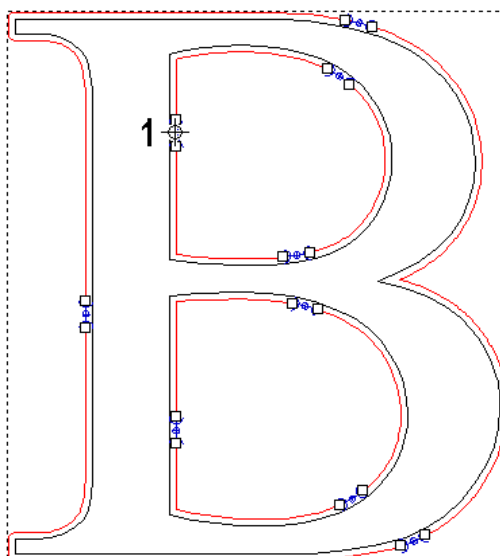
Editing the Bridges

Now you will edit the bridges you have just added to the Profile toolpath.

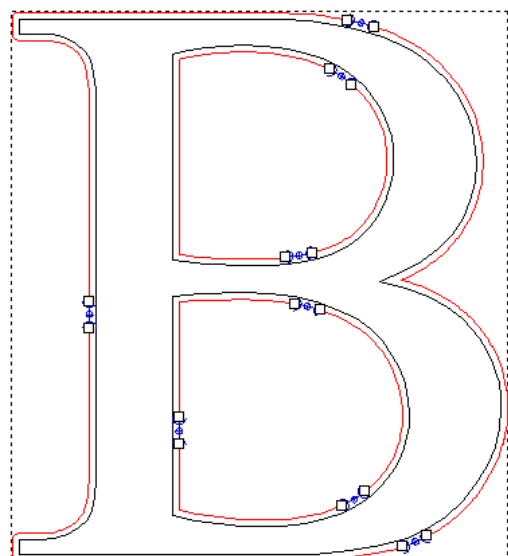
It is important to position the bridges on the Profile toolpath in places to make it easier to snap the letter from the block of material and file down the bridged areas after it has been machined:



1. Move the  cursor over the first bridge as shown below, then double-click on it to delete it:

Before...

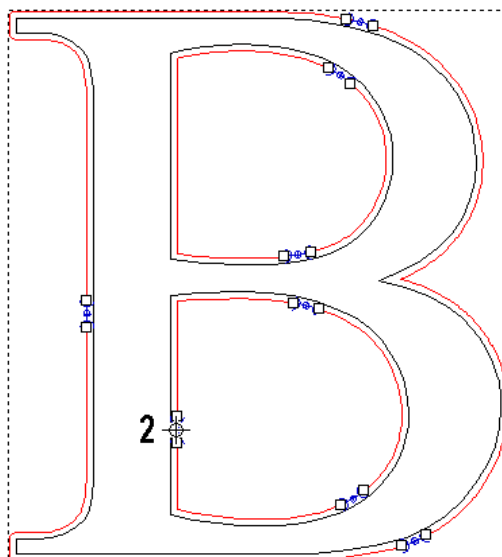


After...

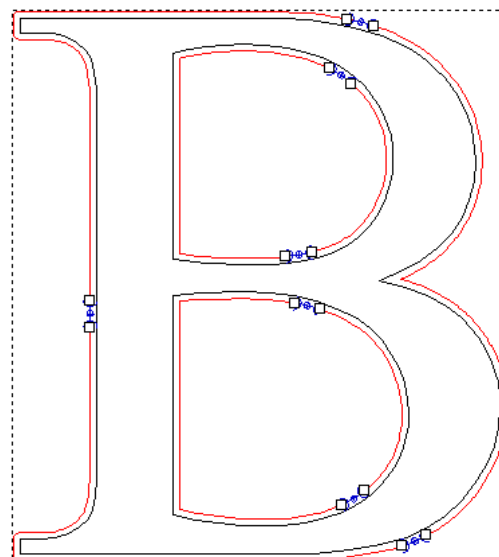


2. Move the  cursor over the second bridge as shown below, then press the **D** key  on your keyboard to delete it:

Before...



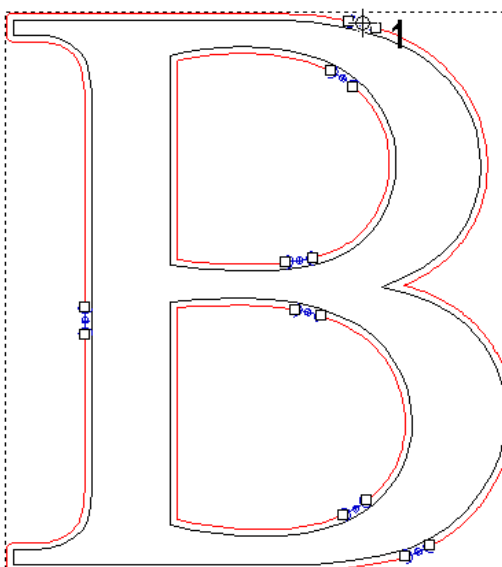
After...



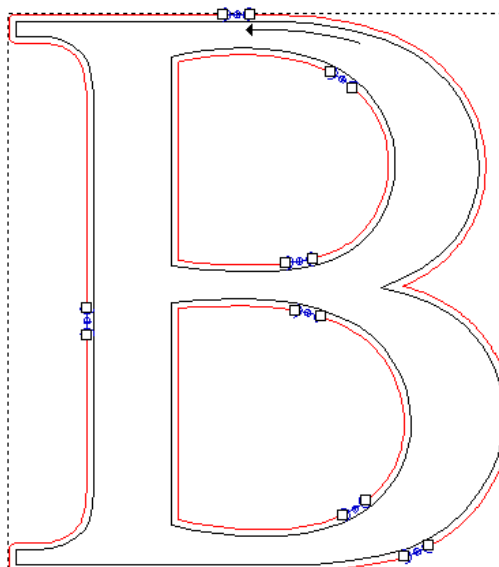
There are now seven bridges remaining on the Profile toolpath.

3. Click and drag the first bridge into the position shown below:

Before...

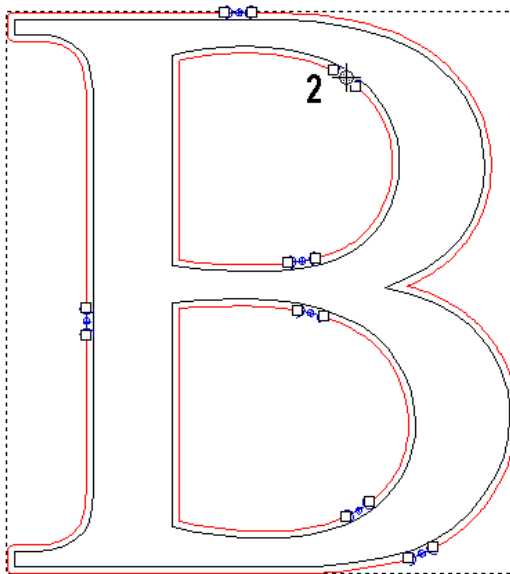


After...

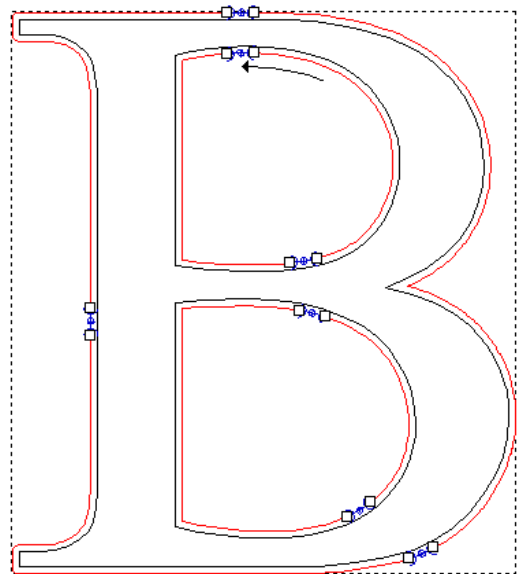


- Click and drag the second bridge into the position shown below:

Before...

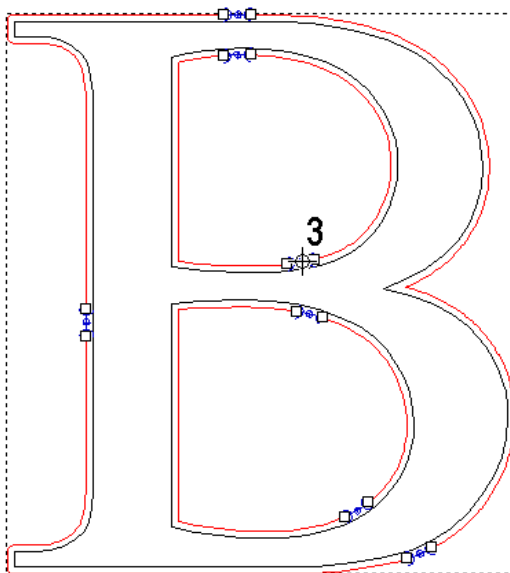


After...

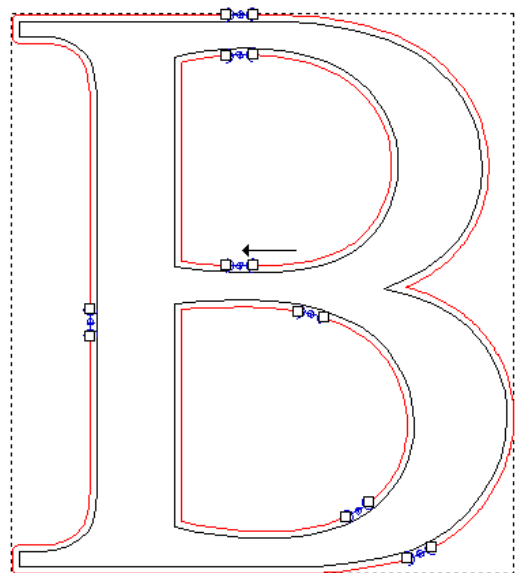


- Click and drag the third bridge into the position shown below:

Before...

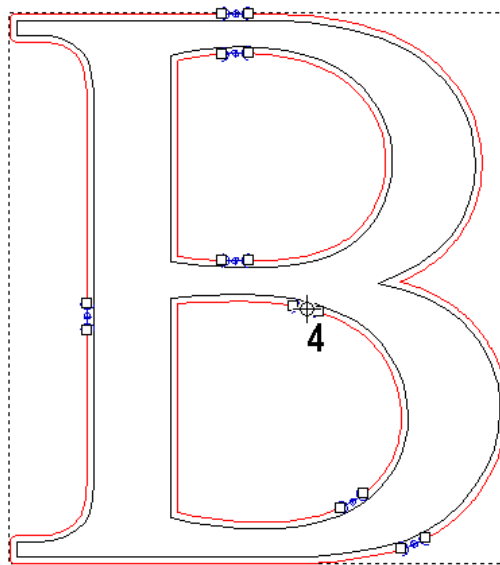


After...

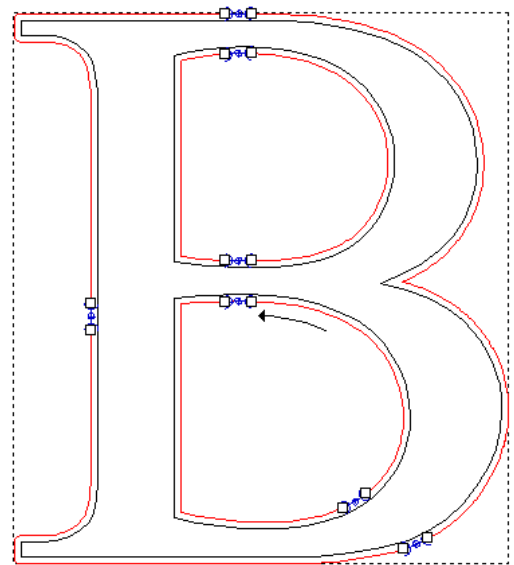


- Click and drag the fourth bridge into the position shown below:

Before...

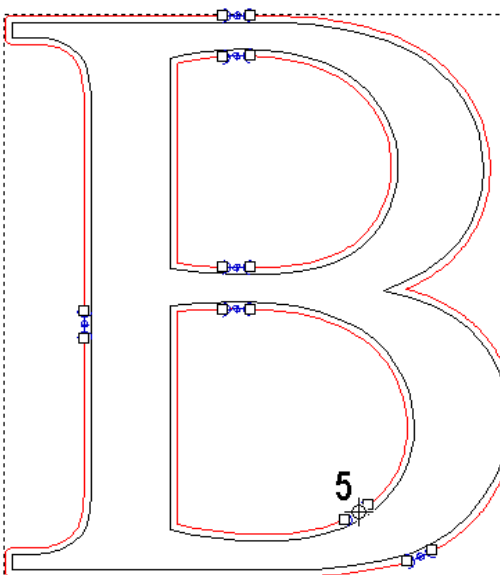


After...

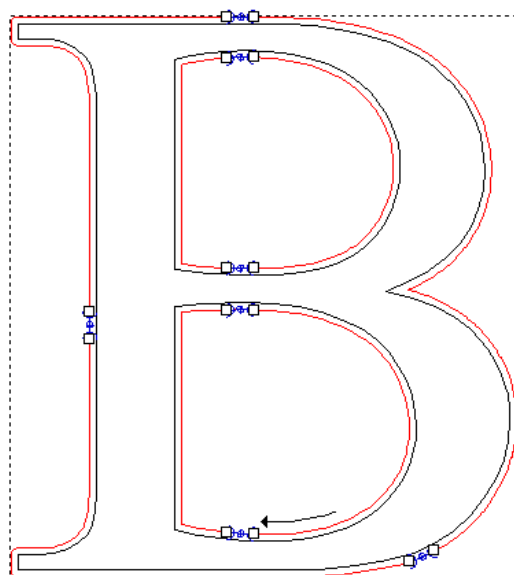


7. Click and drag the fifth bridge into the position shown below:

Before...

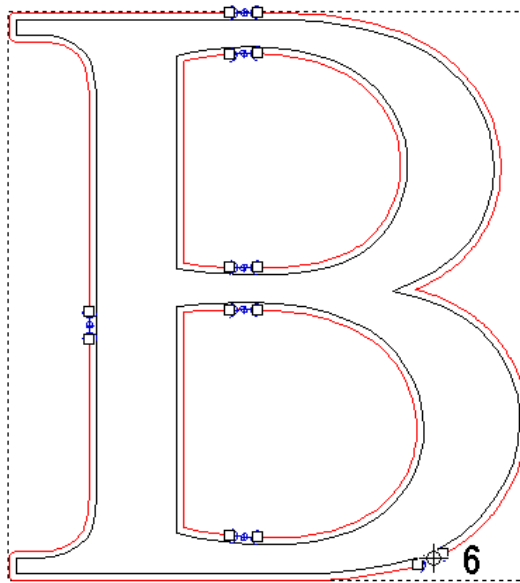


After...

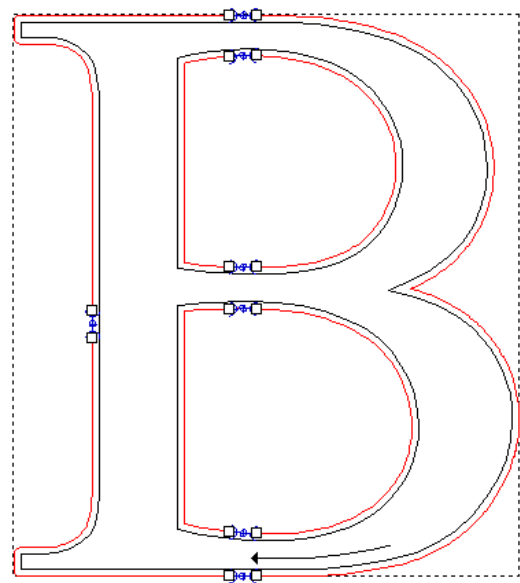


8. Click and drag the sixth bridge into the position shown below:

Before...

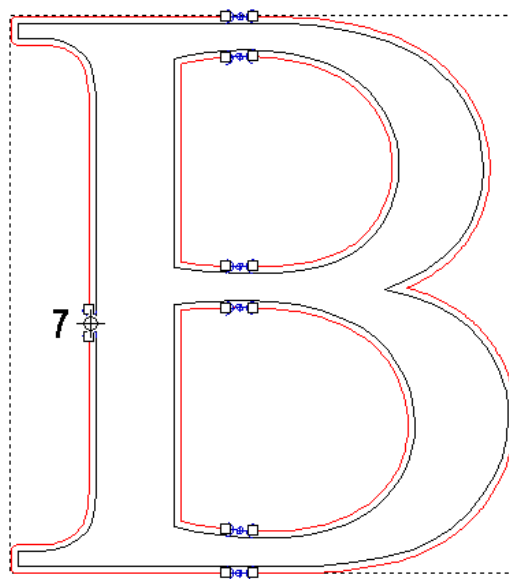


After...

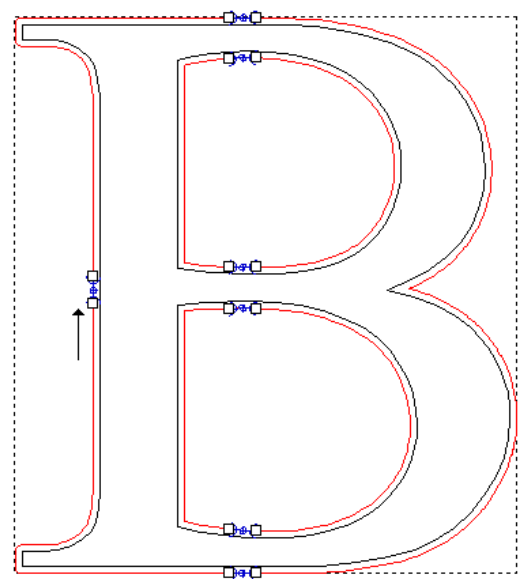




9. Click and drag the seventh bridge into the position shown below:

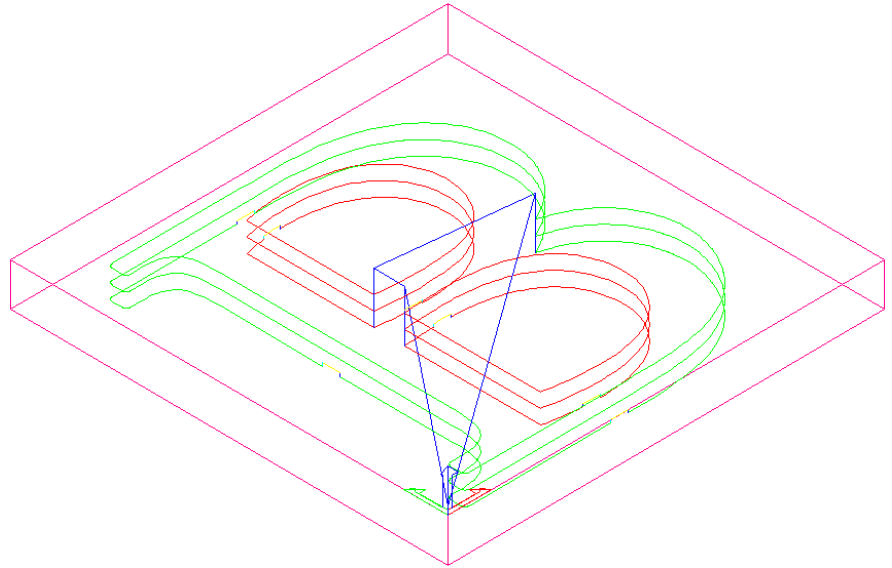
Before...




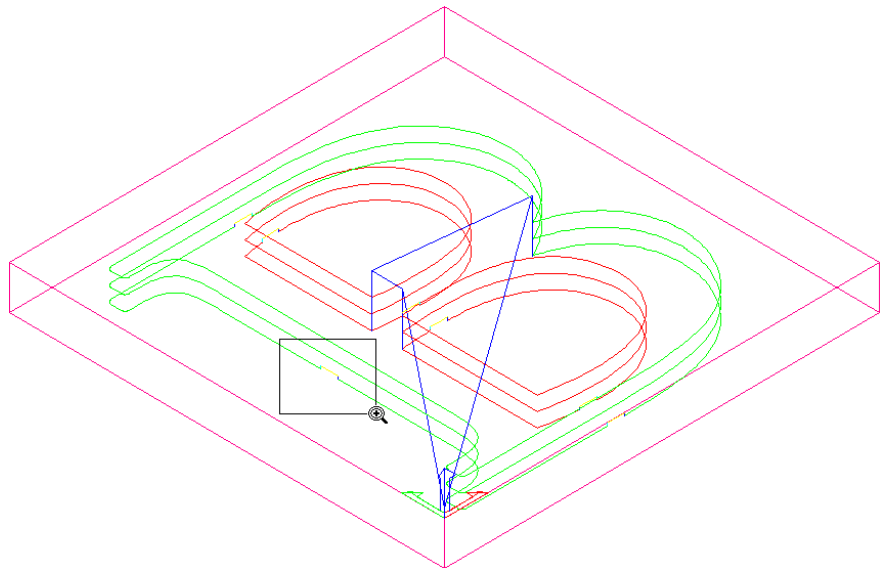
After...



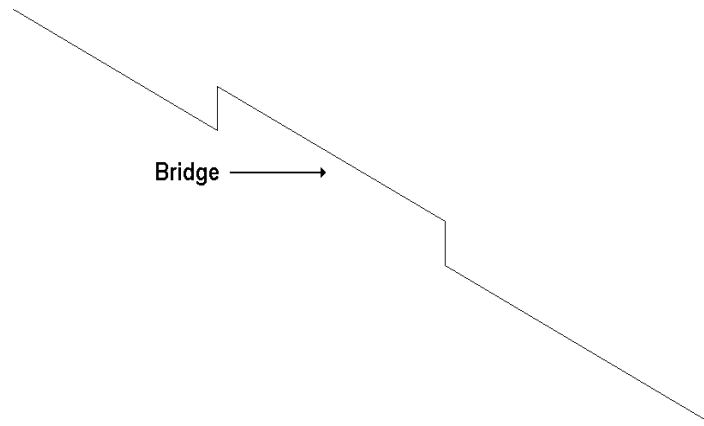
10. Click on the **Close** button  to return to the **Assistant's** Home page.
11. Click on the **3D View** button  in the **2D View** toolbar to display a three-dimensional representation of the Profile toolpath with bridging in the **3D View** window:



12. Click on the **Zoom** button  in the **3D View** toolbar.
13. Click and drag in the **3D View** window to create a bounding box as shown below:



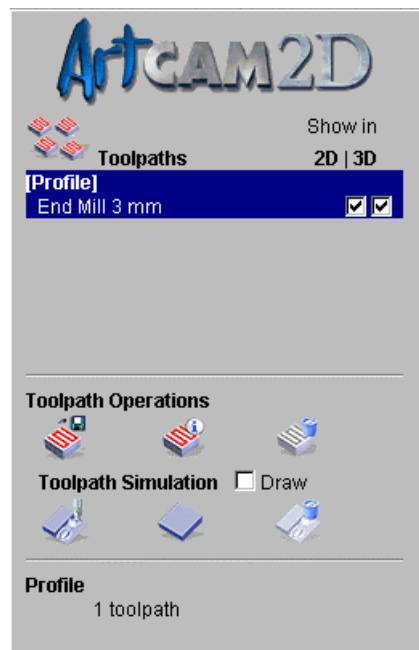
You can now see a bridge on the Profile toolpath clearly:



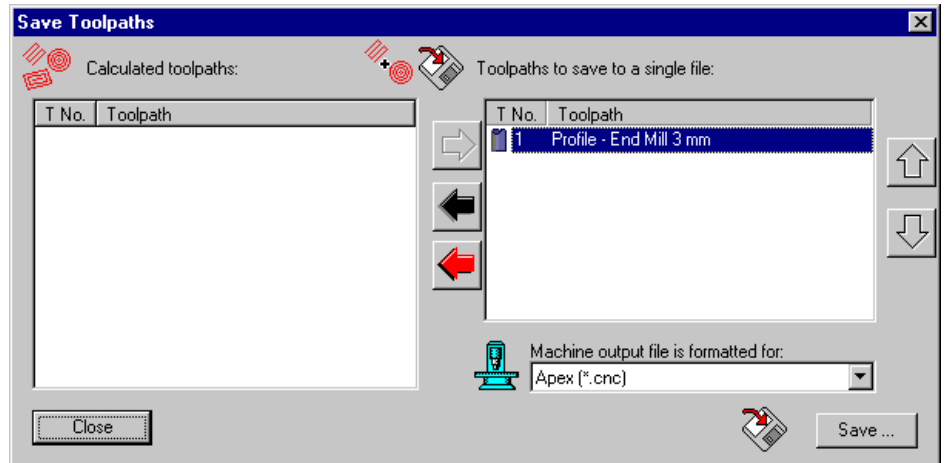
Saving the Toolpath




The final stage is to save the Profile toolpath with the bridging. This file can then be sent to your CNC machine tool to cut out the letter:

1. In the **Toolpath Manager**, make sure that the **Profile** toolpath in the **Toolpaths** area is selected (highlighted in blue):



2. Click on the **Save Toolpaths** button  in the **Toolpath Operations** area to display the **Save Toolpaths** dialog box:



3. Click on the **Machine output file is formatted for** list box and select the format compatible with your machine.
4. Click on the **Save...** button  to open the **Save As...** dialog box.
5. Type *ProfileWithBridges* in the **File Name** box.
6. Click on the **Save** button  to save the toolpath in the selected directory.
7. Click on the **Close** button  to close the **Save Toolpaths** dialog box.

You can now send this toolpath file to your CNC machine tool to create the bridged letter *B*.

Tutorial – Engraving

Overview

The following tutorial demonstrates how to create engraved text using the vector editing and toolpath tools available in ArtCAM 2D.

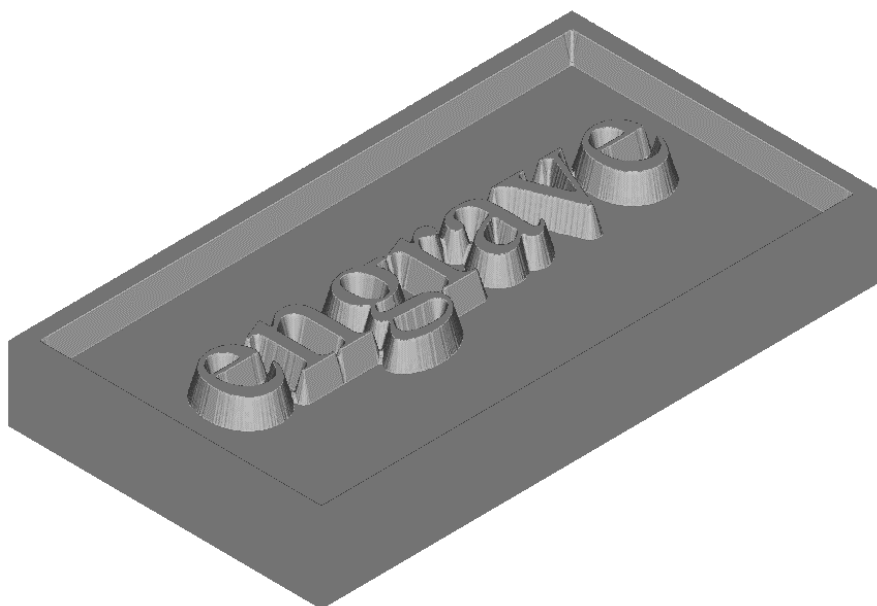
Engraved Text

The five stages that you will cover during the course of this tutorial are:

- Preparing the model.
- Creating the outer-edge of the engraved area.
- Creating the vector text.
- Machining the model.
- Saving the toolpaths.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating the engraved text.

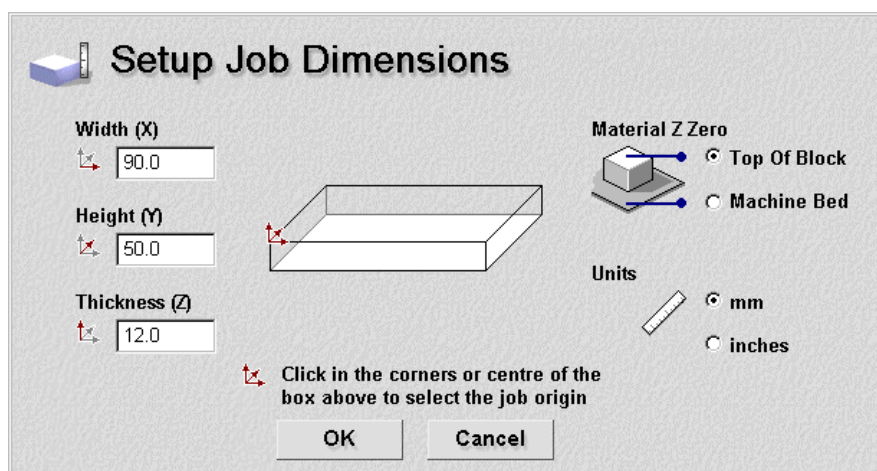
At the end of this tutorial, you will have produced a model of the engraved text that looks like this:







Preparing the Model

First, you will set up the dimensions of the block of material that you will be working with for this particular job:

1. Click on the **Create New Model**  button located in the **Getting Started** menu options in the **ArtCAM 2D Assistant** to display the **Setup Job Dimensions** dialog box:






2. Click on the **Units** option  that you want to use (millimetres or inches).
3. Type 90 mm (3.5") in the **Width (X)** box, 50 mm (2.0") in the **Height (Y)** box and 12 mm (0.5") in the **Thickness (Z)** box.


4. Make sure that the **Material Z Zero** option  is set to **Top of Block**.
5. Make sure that the **Job Origin**  is positioned on the front-left corner of the box, as illustrated in Step 1.
6. Click on the **OK** button  to close the **Setup Job Dimensions** dialog box.

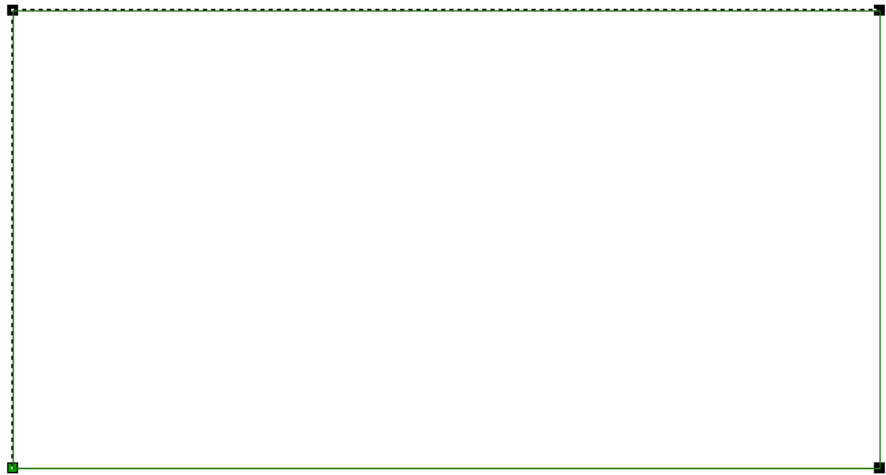
A **2D View** window automatically fills the previously empty design window area.



Defining the Outer-Edge of the Engraved Area

In this next stage you will create a rectangle that represents the outer-edge of the area to be engraved:

1. Click on the **Create Rectangle** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Rectangle Creation** page.
2. Make sure that the **Rectangle** option is selected .
3. Type **45 mm (1.8")** in the **Height** box and **85 mm (3.3")** in the **Width** box.
4. Click on the **Preview** button  at the bottom of the **Rectangle Creation** page to produce a preview image of the rectangle.


The preview image appears centred about the origin of the model, which is in the bottom left corner.
5. Click on the **Create** button  at the bottom of the **Rectangle Creation** page to create the rectangle in your model:




6. Click on the **Close** button  at the bottom of the **Rectangle Creation** page to return to the **Assistant's** Home page.
7. Make sure that the rectangle is selected.
The rectangle should be green and surrounded by a bounding box. If not, click on the rectangle to select it.
8. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to place the rectangle in the centre of your model.
This rectangle represents the outer-edge of the area to be engraved.


Creating the Vector Text

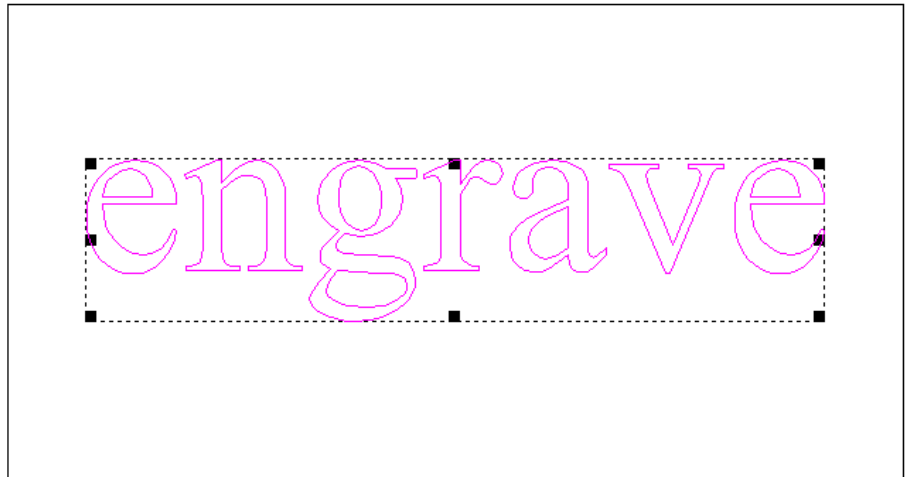
The next stage is to create the vector text that you will engrave:

1. Click on the **Create Vector Text** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text Tool** page.
2. Click on the **Font** list box, and then click on **Times New Roman** to select it.
3. Click on the **Size** list box, and then click on the appropriate unit of measurement option (millimetres or inches).
4. Type 25 mm (1") in the **Size** box.

5. Click anywhere in your model, then type *engrave*.
6. Click the **Done** button  on the **Text Tool** page to create the vector text and return to the **Assistant's** Home page.
7. Make sure that the *engrave* vector text is selected.


The *engrave* vector text should be magenta and surrounded by a bounding box. If not, click on the vector text to select it.

8. Click on the **Centre In Page** button  to place the vector text in the centre of your model:






Machining the Model

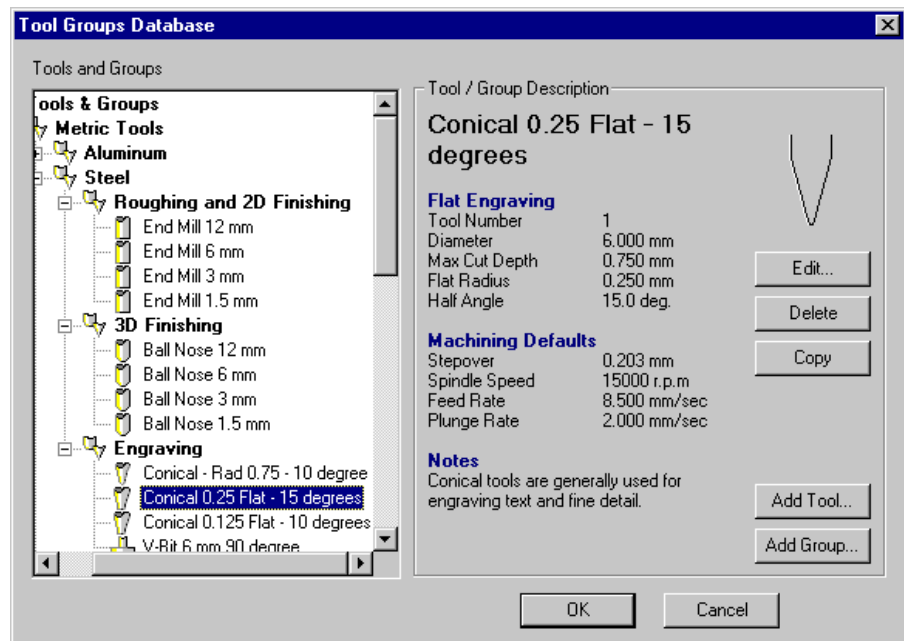
Next, you will create two toolpaths to engrave the design. A 3 mm End Mill (1/8 Inch End Mill) tool will be used to rough the part and a Conical 0.25 mm Flat – 15 degrees (Conical 0.01 Inch Flat – 15 degrees) tool will be used to finish engrave it:

1. Click on the rectangle to select it.
2. Hold the **Shift** key  on your keyboard, then click on the *engrave* vector text to select it.



Both the vector text and the rectangle are magenta:


engrave

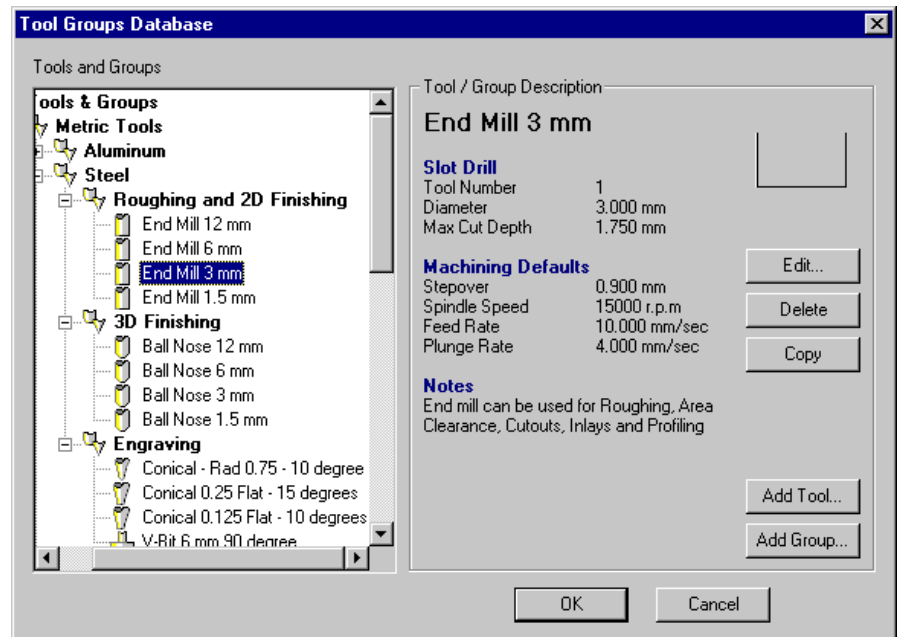
3. Click on the **Engraving** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Engraving** page.
4. Type 4 mm (0.15") in the **Finish Depth** box and 0.02 mm (0.001") in the **Tolerance** box.
5. Click on the  arrow in the **Safe Z** area of the page to display the **Safe Z** box.
6. Type 3 mm (0.12") in the **Safe Z** box.
7. Click on the **Select** button  in the **Engraving Tool** area of the page to display the **Tool Groups Database**:





8. Click on the **Conical 0.25 Flat – 15 degrees** (Conical 0.01 Flat – 15 degrees) tool in the **Steel\Engraving** tool group to select it.

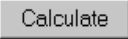
9. Click on the **Select** button  to close the **Tool Groups Database** and display the selected tool in the **Engraving Tool** area of the **Engraving** page.
10. Click on the  arrow to display the machining parameters of the selected tool.
11. Click on the **Tool Number** list box, and then click on the number **2** option.

This number should correspond with the position of the tool in your CNC machine's tool changer.
12. Click on the **Select** button  in the **Roughing Tool** area of the page to display the **Tool Groups Database**:

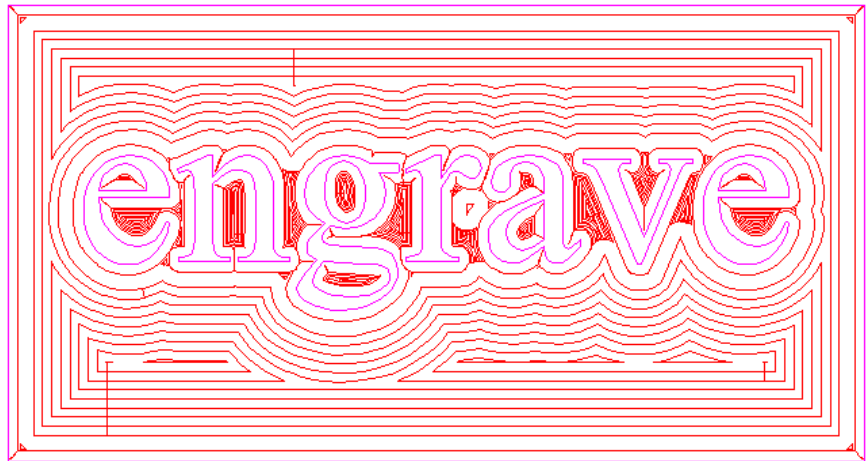



13. Click on the **End Mill 3mm** (End Mill 1/8 Inch) tool in the **Steel\Roughing and 2D Finishing** tool group to select it.
14. Click on the **Select** button  to close the **Tool Groups Database** and display the selected tool in the **Roughing Tool** area of the **Engraving** page.
15. Make sure that the **Offset for engraving tool** option is turned on .


This option automatically offsets the roughing tool in order to leave sufficient material for the angled-edge of the Conical engraving tool to form the side of the engraved feature.

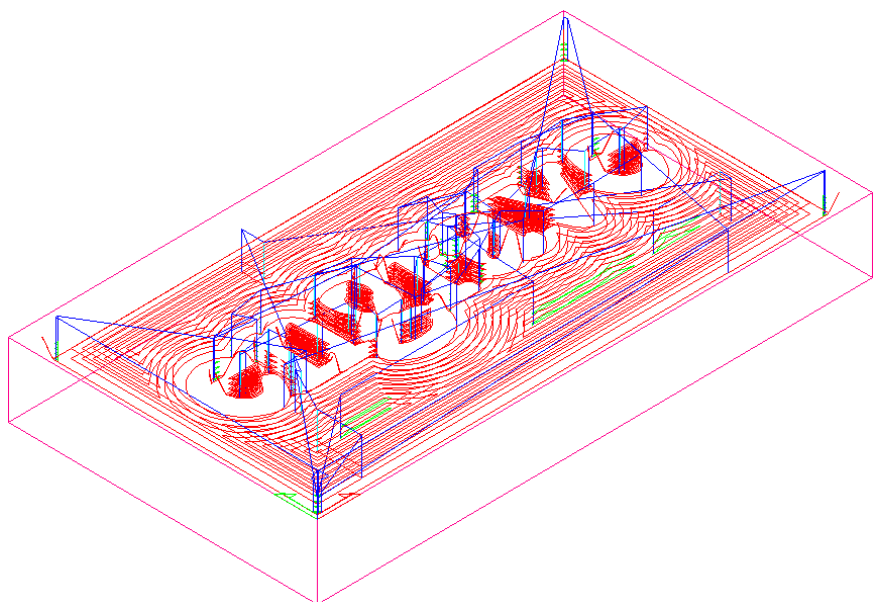
16. Click on the **Calculate** button  to create the Engraving toolpath.

The Engraving toolpath appears in the **2D View** window as follows:

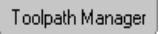


17. Click on the **Close** button  to return to the **Assistant's** Home page.

18. Click on the **3D View** button  in the **2D View** toolbar to display an isometric view of the Engraving toolpath in the **3D View** window:

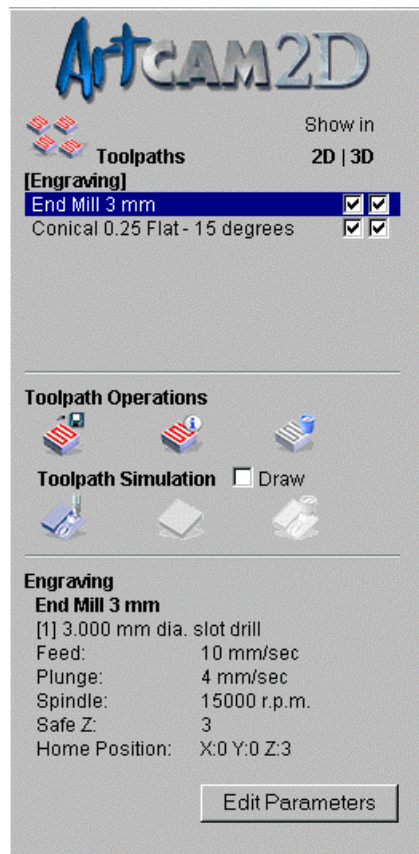


19. Click on the **Toolpath Manager** tab

.

The **Toolpath Manager** allows you to edit, simulate and save the toolpaths that you have created.

20. Click on the **End Mill 3mm** (End Mill 1/8 Inch) toolpath under the **Engraving** heading on the **Toolpath Manager** to select only this part of the **Engraving** toolpath:

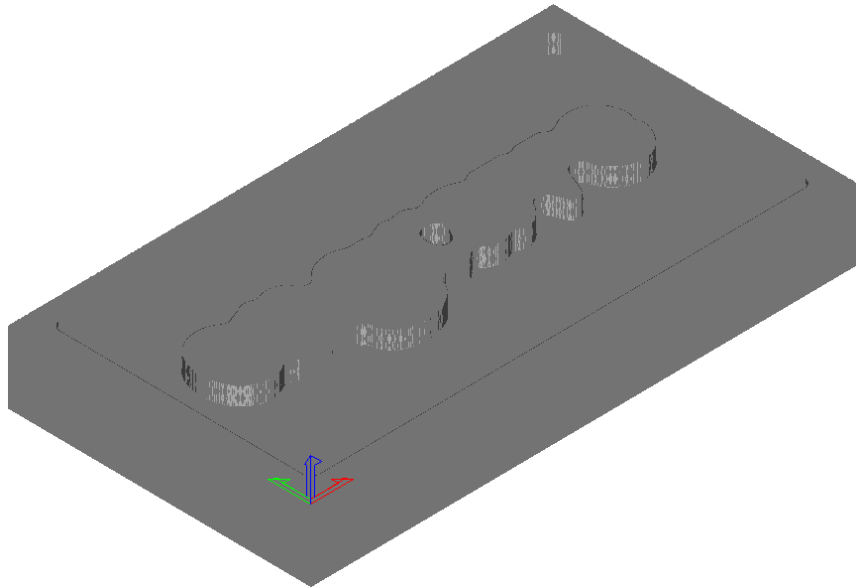


21. Click on the **Simulate Toolpath(s)** button

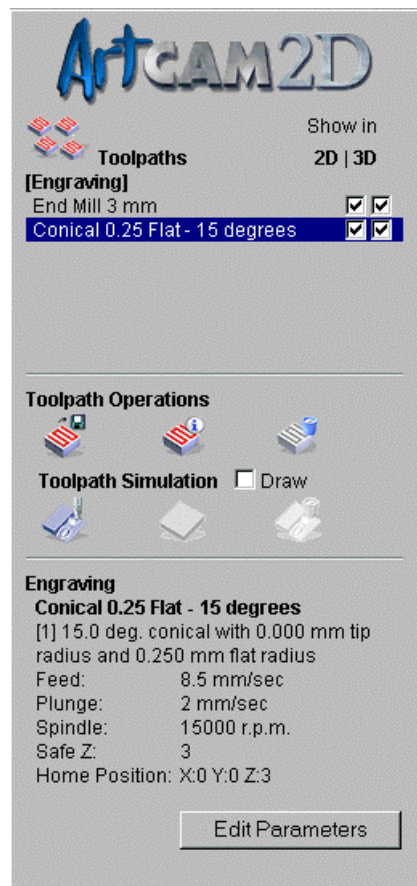



in the **Toolpath Simulation** area to simulate the Roughing part of the Engraving toolpath you have created.

An isometric view of the simulated Roughing part of the Engraving toolpath appears in the **3D View** window as follows:



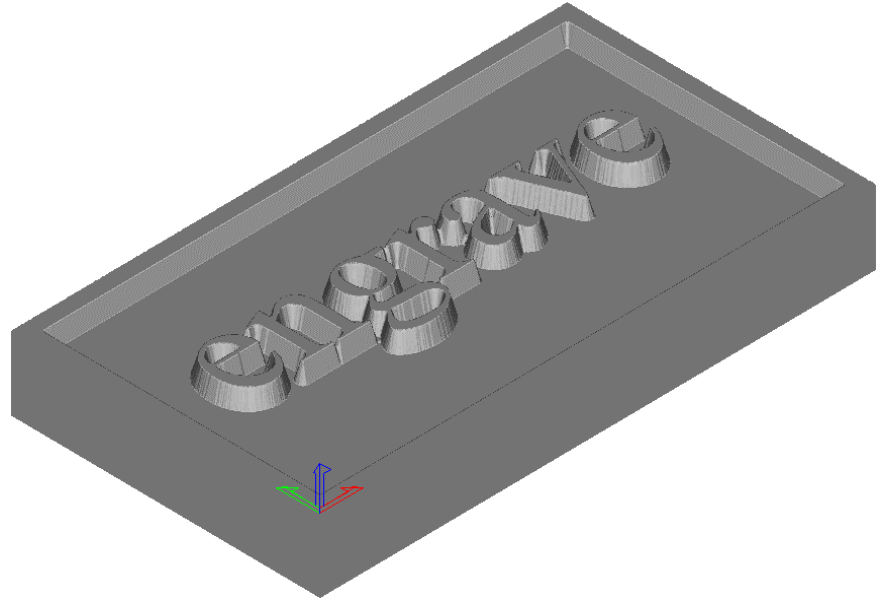
22. Click on the **Conical 0.25 Flat – 15 degrees** (Conical 0.01 Flat – 15 degrees) toolpath under the **Engraving** heading on the **Toolpath Manager** to select it:



23. Click on the **Simulate Toolpath(s)** button  in the **Toolpath Simulation** area of the

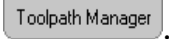
Toolpath Manager to simulate the Engraving part of the Engraving toolpath you have created.

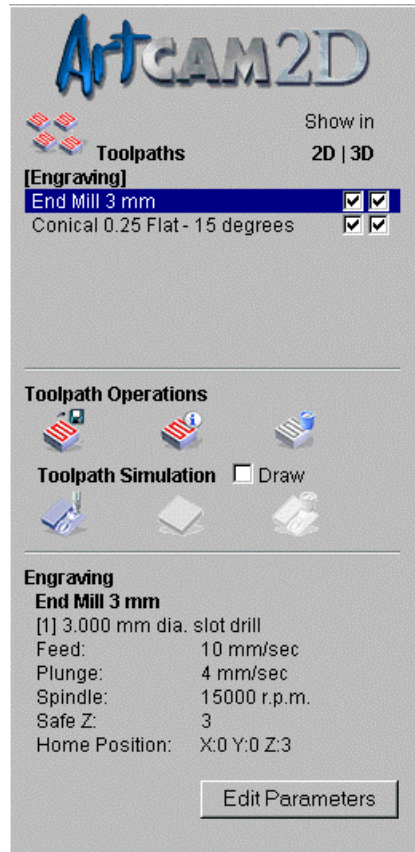
An isometric view of the simulated Engraving part of the Engraving toolpath appears in the **3D View** window as follows:



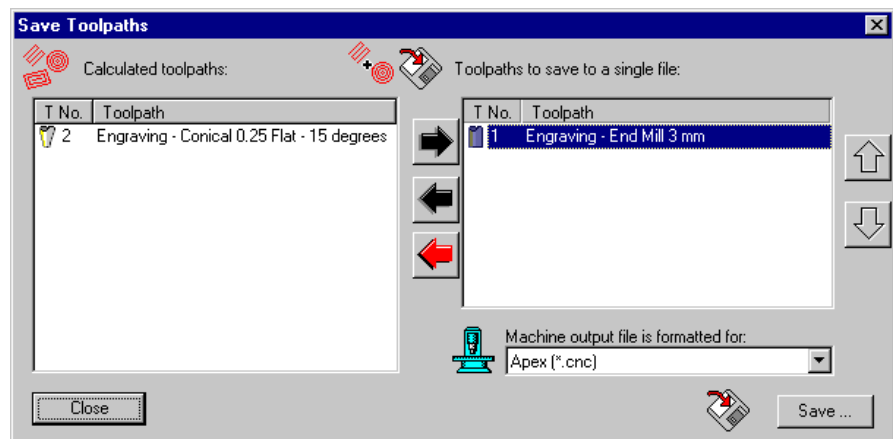
Saving the Toolpaths


You are now ready to save the toolpaths that you have created. These files can then be sent to your CNC machine tool to machine the engraving:


1. Click on the **Toolpath Manager** tab
.
2. Click on the **End Mill 3mm** (End Mill 1/8 Inch) toolpath under the **Engraving** heading on the **Toolpath Manager** to select it:




- Click on the **Save Toolpaths** button  in the **Toolpath Operations** area to display the **Save Toolpaths** dialog box:

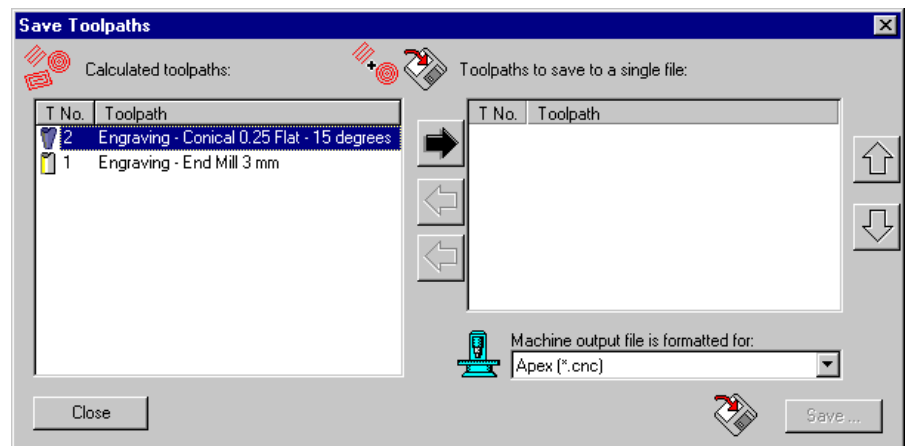



- Click on the **Machine output file is formatted for** list box and select the format compatible with your machine.
- Click on the **Save...** button  to open the **Save As...** dialog box.
- Type *Engraving 1* in the **File Name** box.

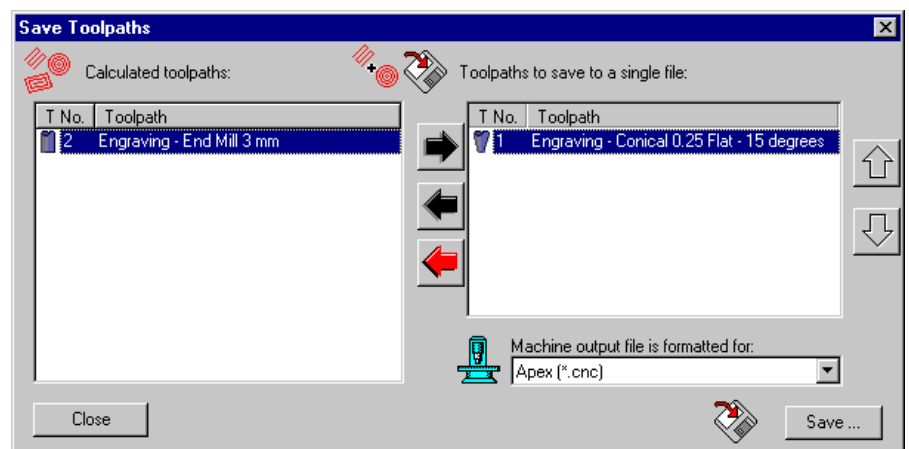
7. Click on the **Save** button  to save the toolpath to the selected directory.


You have now saved the Roughing part of the Engraving toolpath.

8. Click on the  button to send the **Engraving - End Mill 3mm** (Engraving - End Mill 1/8 Inch) toolpath to the **Calculated Toolpaths** window in the **Save Toolpaths** dialog box.
9. Click on the **Engraving – Conical 0.25 Flat – 15 degrees** (Engraving - Conical 0.01 Flat – 15 degrees) toolpath in the **Calculated Toolpaths** window to select it:



10. Click on the  arrow to send the **Engraving – Conical 0.25 Flat – 15 degrees** (Engraving - Conical 0.01 Flat – 15 degrees) toolpath to the **Toolpaths to save to a single file** window:




11. Click on the **Save...** button  to open the **Save As...** dialog box.

12. Type *Engraving 2* in the **File Name** box.

13. Click on the **Save** button  to save the toolpath to the selected directory.

You have now saved the Engraving part of the Engraving toolpath.

14. Click on the **Close** button  to close the **Save Toolpaths** dialog box.

You can now send these toolpath files to your CNC machine tool to create the engraving.

Tutorial – ArtTrace

Overview

The following tutorial demonstrates how to create vector objects from a bitmap file using ArtTrace. The vector objects are created around a specified colour in the bitmap image. These can then be exported to ArtCAM 2D.

For further information, see “Using ArtTrace” in the ArtTrace chapter.

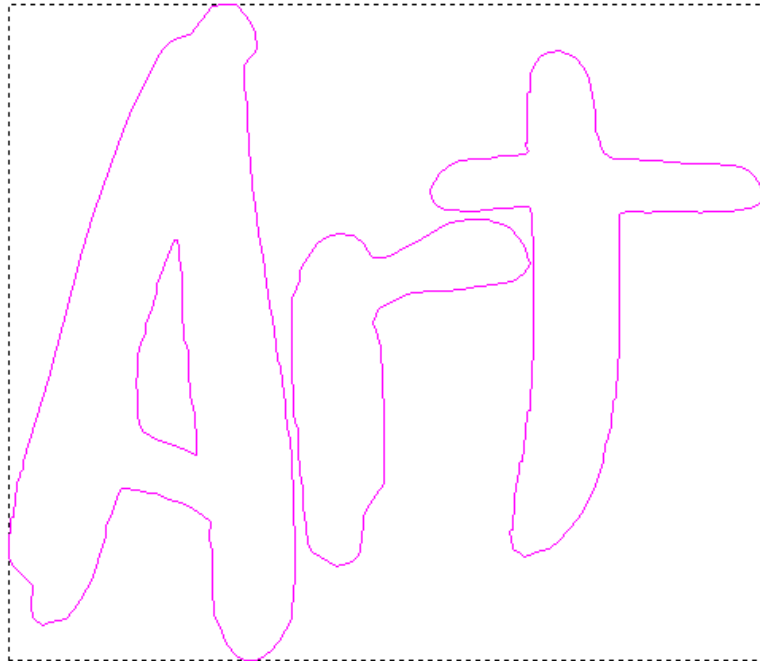
Converting a Bitmap to Vector Objects

The six stages that you will cover during the course of this tutorial are:

- Preparing the model.
- Opening the Bitmap file in ArtTrace.
- Reducing the colours in the Bitmap image.
- Linking colours in the Bitmap image.
- Creating the vector object.
- Exporting the vector object to ArtCAM 2D.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating vector objects from a bitmap file, and then exporting them to ArtCAM 2D.

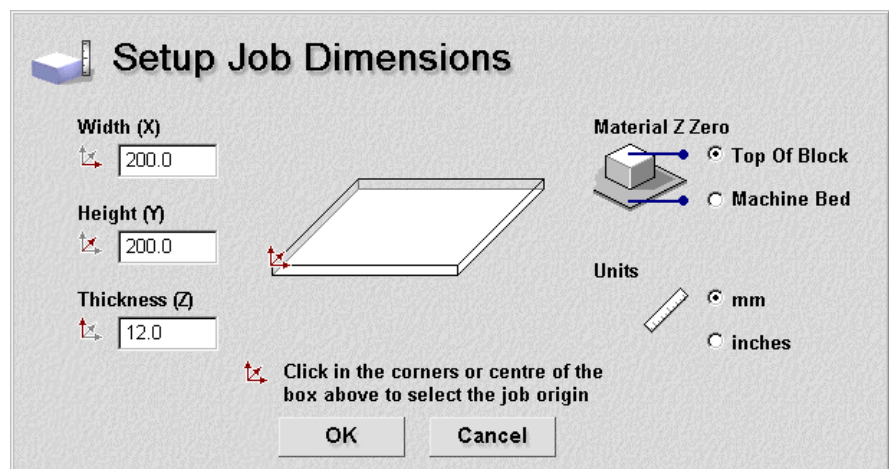
At the end of this tutorial, you will see a vector object in the **2D View** window of ArtCAM 2D that resembles the following image:







Preparing the Model

First, you will set up the dimensions of the block of material that you will be working with for this particular job:

1. Click on the **Create New Model**  button located in the **Getting Started** menu options in the **ArtCAM 2D Assistant** to display the **Setup Job Dimensions** dialog box:



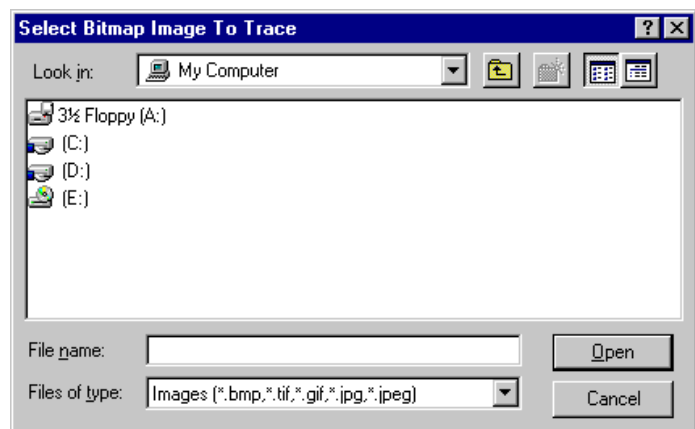
2. Click on the **Units** option  that you want to use (millimetres or inches).

3. Type *200 mm (8")* in the **Width (X)** box, *200 mm (8")* in the **Height (Y)** box and *12 mm (0.5")* in the **Thickness (Z)** box.
4. Make sure that the **Material Z Zero** option  is set to **Top of Block**.
5. Make sure that the **Job Origin**  is positioned on the front-left corner of the box, as shown above.
6. Click on the **OK** button  to close the **Setup Job Dimensions** dialog box.
A **2D View** window automatically fills the previously empty design window area.

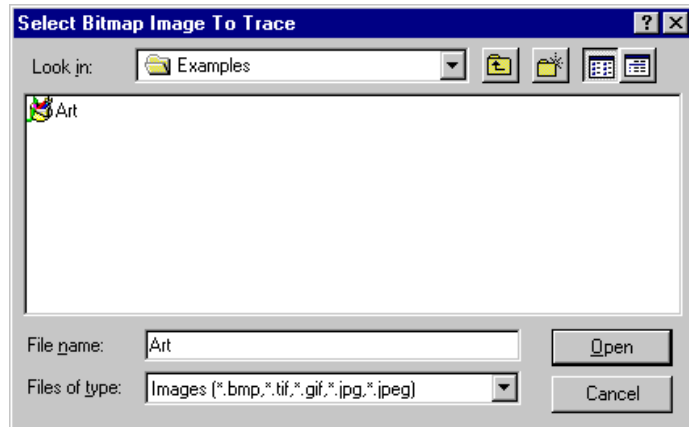
Opening the Bitmap File in ArtTrace


In this next stage you will open the Bitmap file to be vectorized in ArtTrace:

1. Click on the **Trace Bitmap** button  in the **File** area of the **Assistant's** Home page to open the **Select Bitmap Image To Trace** dialog box:



2. Click on the **Look In** list box and select **ArtCAM 2D V1.0\Examples**, which can be found in the same directory as the ArtCAM 2D files:




3. Click on the .bmp file named *Art* to select it.
The file name appears in the **File Name** box.
4. Click on the **Open** button  to start ArtTrace and import the bitmap image:




In this tutorial you will create vector objects around each of the letters in the bitmap image.

Reducing the Colours in the Bitmap Image

You are now ready to reduce the number of colours in the bitmap image. This will accelerate the vectorization process:

1. Click on the **Reduce Colours** button  to open the **Reduce Number of Colours In Image** dialog box:



2. Type 5 in the **New Maximum Number of Colours For Image** box.
3. Click on the **OK** button  to reduce the number of colours in the bitmap image.

ArtTrace takes colours of a similar shade and produces a new average of them.

There are now only five colours in the Colour Palette beneath the **2D View** window:



Linking the Colours

ArtTrace creates vector objects around the outline of areas in the Primary Colour. You can link other colours to the Primary Colour so that vector objects are created around the outline of areas in these colours too.

You can now select white as the Primary Colour and link brown to it. ArtTrace can then create vector objects around the outline of all areas in white and brown:

1. Click on the third colour from the left (white) in the Colour Palette to select it as the Primary Colour, using the left mouse button.

The Colour Palette appears as follows:



2. Double right-click on the fourth colour from the left (brown) in the Colour Palette to link it to the Primary Colour.


Pixels in the bitmap image that are of the colour you have linked to the Primary Colour are now displayed as the Primary Colour in the **2D View** window.

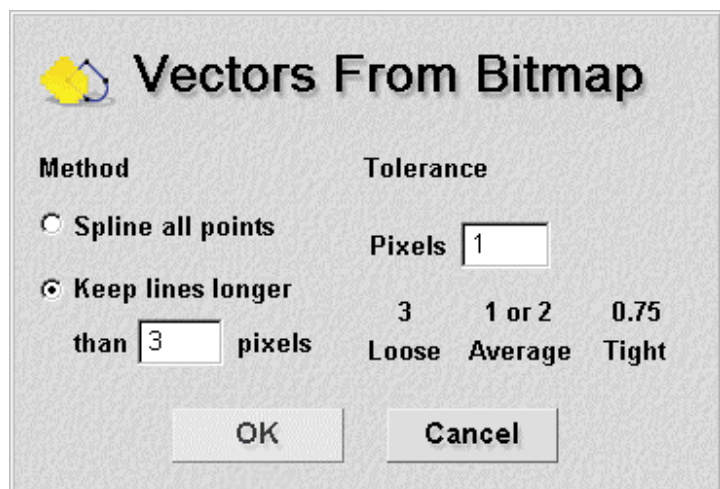
The Colour Palette now appears as follows:





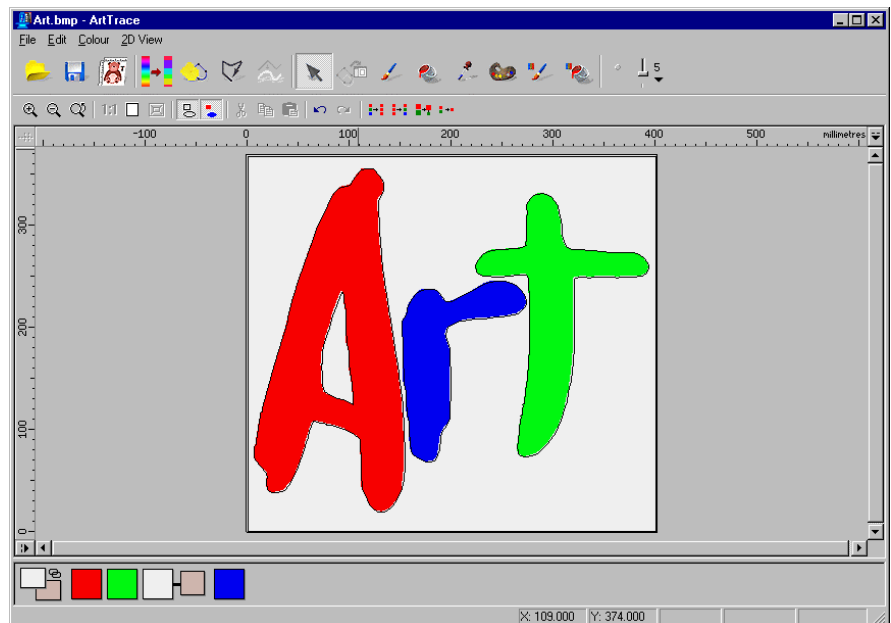
Creating the Vector Objects

Next, you will create the vector objects around the Primary and linked colours in the bitmap image:

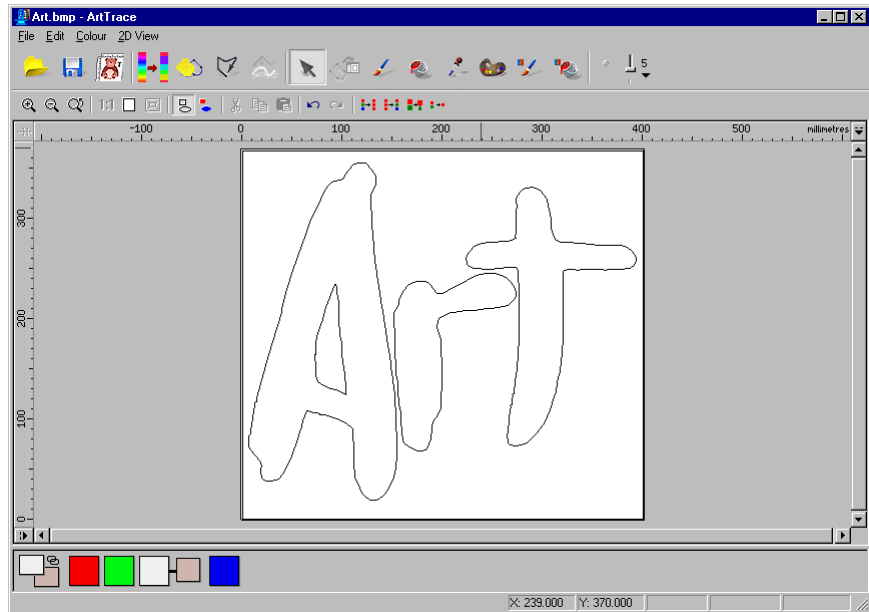
1. Click on the **Bitmap to Vector** button  in the **Main** toolbar to open the **Vectors From Bitmap** dialog box:



2. Make sure that the **Keep lines longer than** **pixels** radio button is selected  in the **Method** area.
3. In the **Method** area, type 3 in the box.
Selecting a small value means that the vector objects will closely follow the outline of the Primary Colour.
4. Type 1 in the **Pixels** box in the **Tolerance** area.
5. Click on the **OK** button  to close the **Vectors From Bitmap** dialog box and create vector objects around all areas in the Primary Colour within the bitmap image:



6. Click on the **Bitmap On/Off** button  to hide the bitmap image:

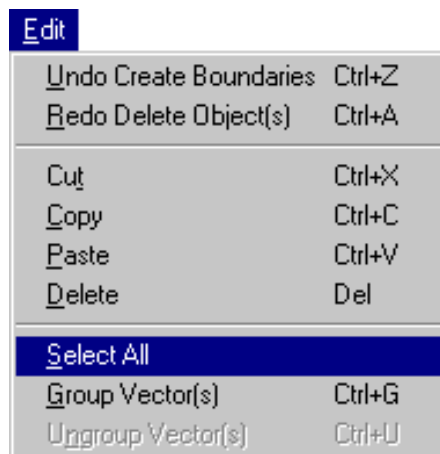


You can clearly see the vector object in the **2D View** window.

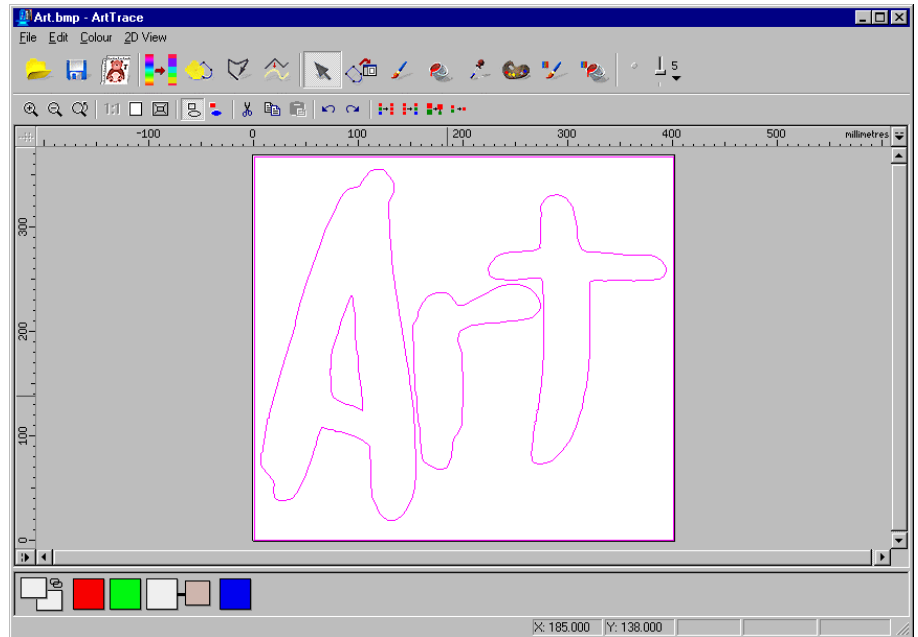
Exporting the Vector Objects to ArtCAM 2D


You can now export the vector objects created in ArtTrace by copying them to the ArtCAM 2D clipboard, then switching to ArtCAM 2D to paste them into the open model:

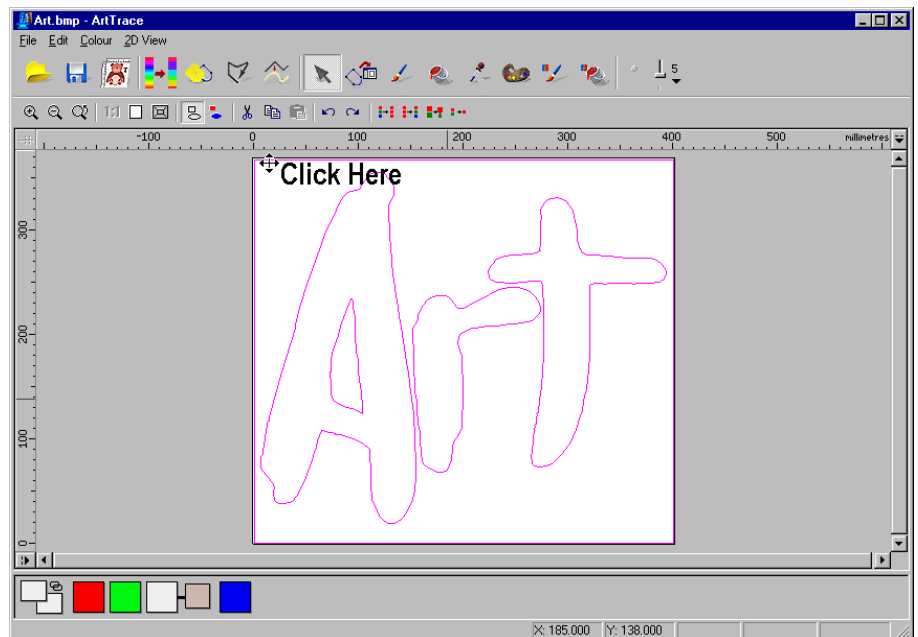
1. From the Main menu bar, click on the **Edit** option and then on **Select All**:







All of the vector objects turn magenta:


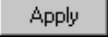




2. Hold the **Shift** key  on your keyboard and click on the rectangular vector object around the edge of the image to deselect it:



3. Click on the **Copy** button  to copy the vector object to the ArtCAM 2D clipboard.
4. Click on **File > Exit** to shut ArtTrace down.
5. In ArtCAM 2D, click anywhere in the **2D View** window. This makes it the active window.

6. Click on the **Paste** button  in the **File** area of the **Assistant's** Home page to paste the vector object into your model.
7. Click on the **Transform Vectors** button  in the **Position Size Align** area of the **Assistant's** Home page to open the **Transform Vector(s)** page.
8. Make sure that the **Link Width and Height** option is turned on .
9. Type *190 mm (7.5")* in the **Size's** **New Width** box.

A value of *165.112 mm (6.5176")* automatically appears in the **Size's** **New Height** box. This is because the **Link Width and Height** option is on .
10. Click on the **Apply** button  to reduce the size of the vector object.
11. Click on the **Close** button  to return to the **Assistant's** Home page.
12. Click on the **Centre In Page** button  in the **Position Size Align** area of the **Assistant's** Home page to position the vector object in the centre of your model:



You can now use these vector objects in the same way as if they had been created in ArtCAM 2D or imported in the usual way from a vector image file.

Tutorial – Nesting Vectors

Overview

The following tutorial demonstrates how the Nesting tool in ArtCAM 2D repositions vector objects in order to minimise material wastage when you are machining.

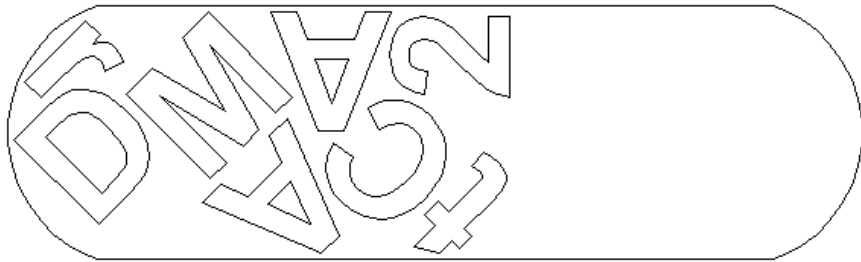
Nesting Vectors

The six stages that you will cover during the course of this tutorial are:

- Preparing the model.
- Defining the material shape.
- Creating the vector text.
- Nesting the vector text.
- Machining the nested vector text.
- Saving the toolpath.

The tutorial will lead you through each of these stages, guiding you through the complete process of nesting.

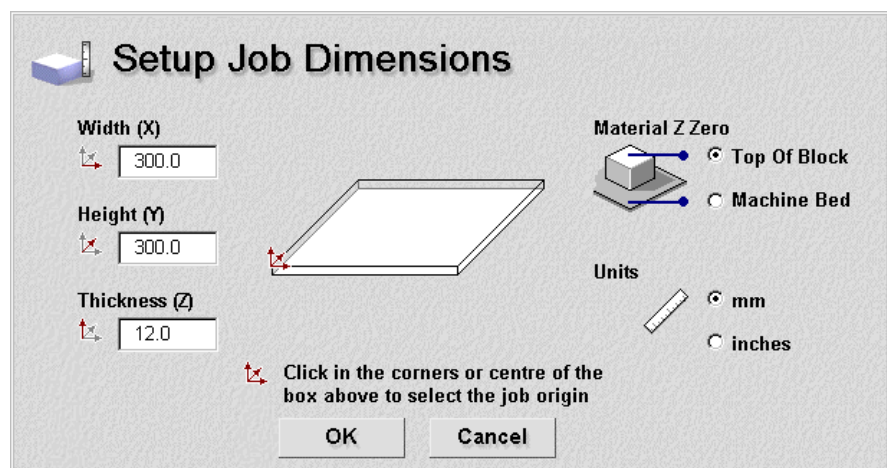
At the end of this tutorial you will have nested text within an area of material, and created the toolpath with which to machine it. The nested text appears as follows:







Preparing the Model

First, you will set up the dimensions of the block of material that you will be working with for this particular job:

1. Click on the **Create New Model**  button located in the **Getting Started** menu options in the **ArtCAM 2D Assistant** to display the **Setup Job Dimensions** dialog box:




2. Click on the **Units** option  that you want to use (millimetres or inches).
3. Type 300 mm (12") in both the **Width (X)** and **Height (Y)** boxes, and 12 mm (0.5") in the **Thickness (Z)** box.
4. Make sure that the **Material Z Zero** option  is set to **Top of Block**.
5. Make sure that the **Job Origin**  is positioned on the front-left corner of the box, as illustrated in Step 1.
6. Click on the **OK** button .

The **2D View** window automatically fills the previously empty design window area.

Defining the Material Shape

In this next stage, you will create the vector object in which you will nest the vector text:


1. Click on the **Create Rectangle** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Rectangle Creation** page.

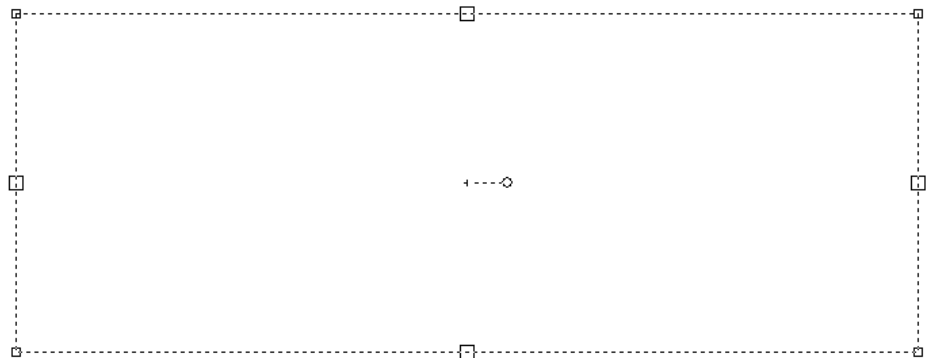
2. Make sure that the **Rectangle** option is selected .

If not, click on the **Rectangle** radio button to select it.


3. Type 75 mm (3") in the **Height** box.

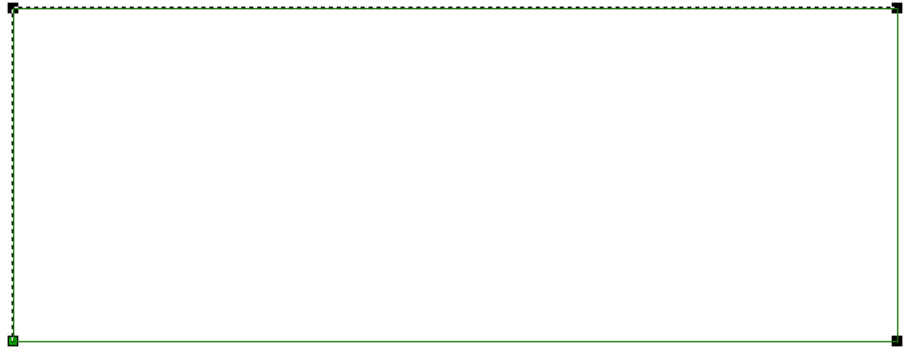
4. Type 200 mm (8") in the **Width** box.

5. Click on the **Preview** button  at the bottom of the **Rectangle Creation** page to produce the following preview image of the rectangle:




The preview image appears centred about the origin of the model, which is in the bottom left corner.

6. Click on the **Create** button  at the bottom of the **Rectangle Creation** page to create the rectangle in your model.




The rectangle is green.

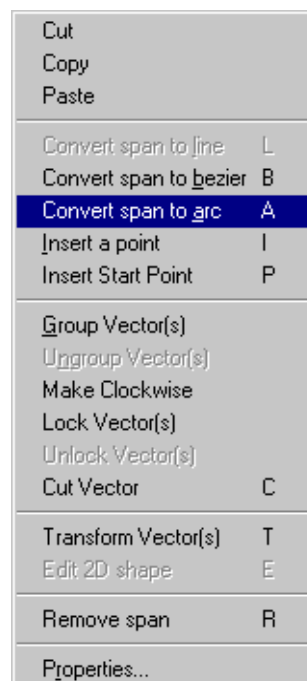
7. Click on the **Close** button  at the bottom of the **Rectangle Creation** page to return to the **Assistant's** Home page.

8. Make sure that the rectangle is selected.

The rectangle should be green and surrounded by a bounding box. If not, click on the rectangle to select it.


9. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to place the rectangle in the centre of your model.

10. Move the cursor over the right span of the rectangle, right-click to display the **Vector Editing** menu, then click on the **Convert span to arc** option:

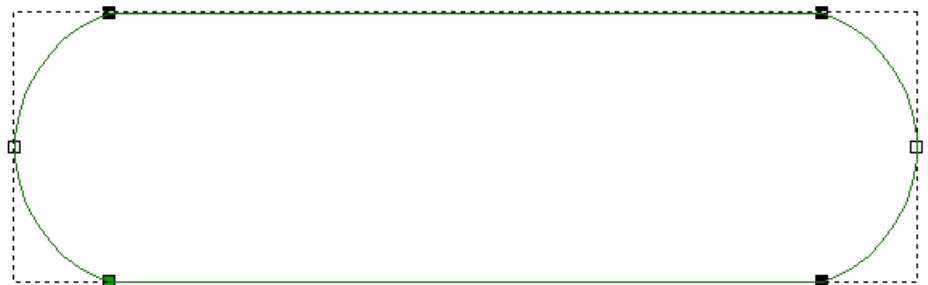


The rectangle now appears as follows:



11. Move the cursor over the left span of the rectangle, then press the **A** key  on your keyboard to convert the span to an arc.

The rectangle now appears as follows:






The rectangle will now be referred to as a vector object.

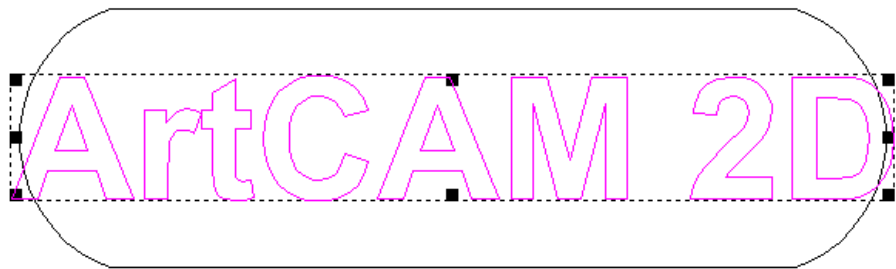
This vector object represents the total area of the material you have available in which to machine a block of vector text.

Creating the Vector Text

Now that you have created the vector object, you will create the vector text that you will be nesting within it:

1. Click on the **Create Vector Text** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text Tool** page.
2. Click on the **Font** list box, and then click on **Arial** to select it.
3. Click on the **Size** list box, and then click on the appropriate unit of measurement option (millimetres or inches).
4. Type 55 mm (2.15") in the **Size** box.

5. Click on the **Bold** button  to type in bold.
6. Click anywhere in the **2D View** window, then type *ArtCAM 2D*.
7. Click the **Done** button  on the **Text Tool** page to create the vector text and return to the **Assistant's** Home page:



Nesting the Vector Text

You are now ready to nest the *ArtCAM 2D* vector text within the vector object that you created to represent the material:


1. Click on the vector object in your model to select it.

The vector object changes from black to green.

2. Hold the **Shift** key  on your keyboard, and then click on the vector text to select it.

Both the vector object and the *ArtCAM 2D* vector text are magenta:



3. Click on the **Nesting** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to display **Nest Vectors** page.
4. Type 3 mm (0.125") in the **Tool Diameter (D)** box.

5. Click on the **Allow Part Rotation** option to turn it on ☒.
6. Type 45 ° in the **Step Angle (A)** box.
7. Make sure that the **Bottom Left** option is selected in the **Nest From** list box.
8. Type 0.02 mm (0.001") in the **Curve Tolerance** box.
9. Click on the **Create Leftover Material Vector** option to turn it on ☒.

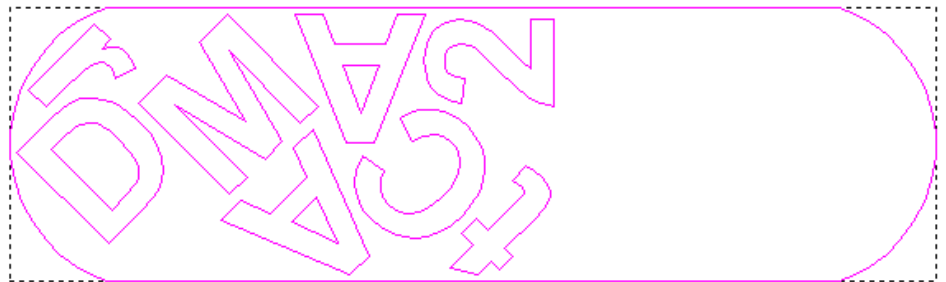
This option creates a vector object that represents the area of material after the vector text has been machined.


10. Click on the **Nest** button .

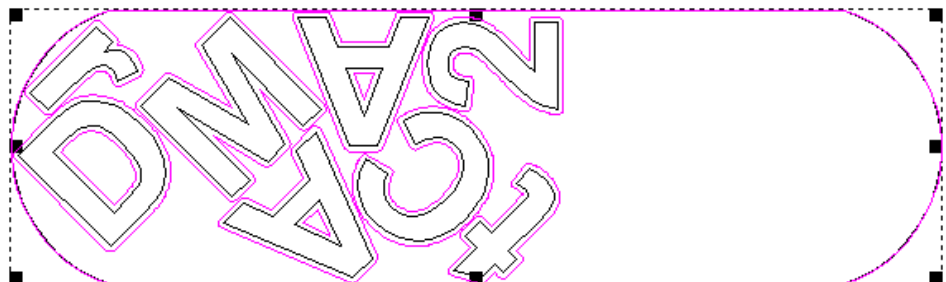
The progress bar appears beneath the **2D View** window. This indicated the progress ArtCAM 2D is making in calculating the position of the nested vector text:



The nested vector text appears in the **2D View** window as follows:



11. Click on the **Close** button  to return to the **Assistant's** Home page.
12. Click on the vector object representing the total area of the material to select it:



You can see that the area of the material that surrounds the nested vector text is now a vector object in which you can nest other vector objects into again.

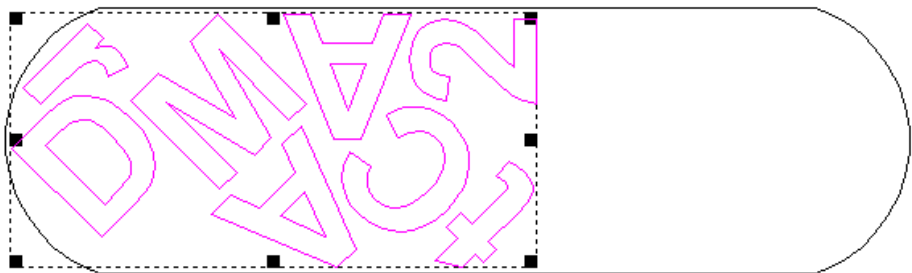
You could save this vector object for the next time you use this area of material in a job.





Machining the Nested Vector Text

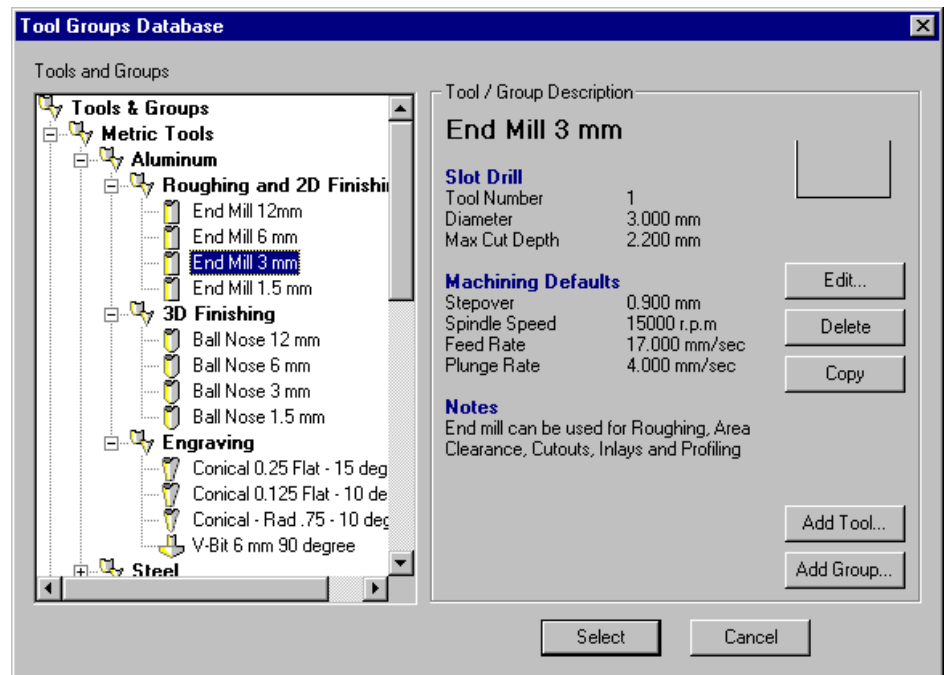
Now that the *ArtCAM 2D* vector text has been nested, you are ready to create the toolpath that will be used to machine it:

1. Click anywhere in the **2D View** window to deselect the vector objects.
2. Click on the nested vector text to select it.


The vector text is magenta:

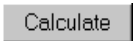


3. Click on the **Profiling** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Profiling** page.
4. Make sure that the **Outside** radio button  is selected.
5. Make sure that the **Finish Depth** is set to 12 mm (0.5").
6. Type 0.02 mm (0.001") in the **Tolerance** box.
7. Click on the  arrow in the **Safe Z** area of the page to display the **Safe Z** box.
8. Type 3 mm (0.12") in the **Safe Z** box.
9. Click on the **Select** button  in the **Profiling Tool** area of the page to display the **Tool Groups Database**:

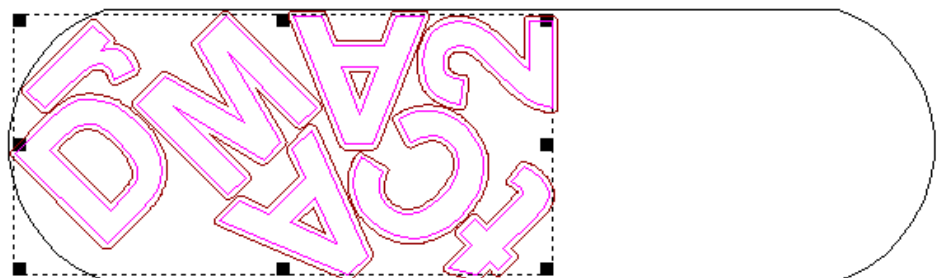


10. Click on the **End Mill 3mm** (End Mill 1/8 Inch) tool in the **Aluminum\Roughing and 2D Finishing** tool group to select it.

11. Click on the **Select** button  to close the **Tool Groups Database** and display the selected tool in the **Profiling Tool** area of the **Profiling** page.



12. Click on the **Calculate** button  to create the Profile toolpath.

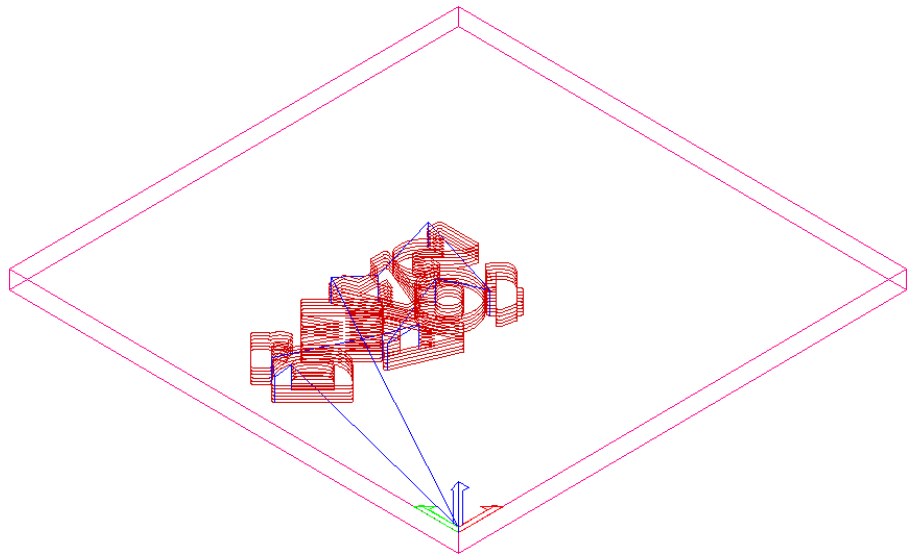
The Profile toolpath appears in the **2D View** window as follows:



You can see by looking at the toolpath that ArtCAM 2D has nested the individual characters in this way to leave a sufficient offset for the 3mm End Mill (1/8 Inch End Mill) tool to profile each of them without causing gouging.


A 3mm End Mill (1/8 Inch End Mill) tool must be used to machine the nested vector text for each character to be cut from the area of material successfully.

13. Click on the **Close** button  to return to the **Assistant's** Home page.
14. Click on the **3D View** button  in the **2D View** toolbar to display an isometric view of the Profile toolpath in the **3D View** window:

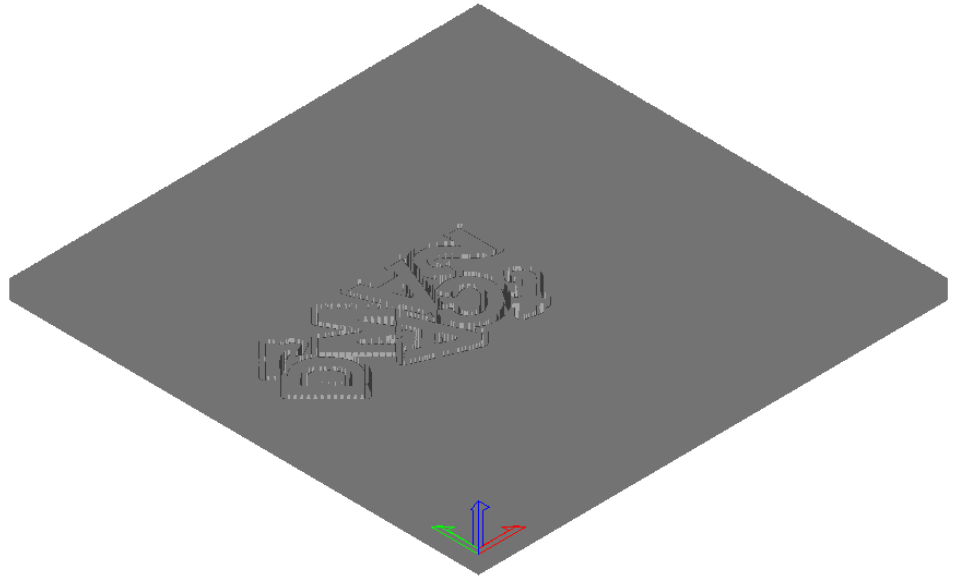


15. Click on the **Toolpath Manager** tab .

The **Toolpath Manager** allows you to edit, simulate and save the toolpaths that you have created.

16. Click on the **Simulate Toolpath(s)** button  in the **Toolpath Simulation** area to simulate the Profile toolpath you have created.

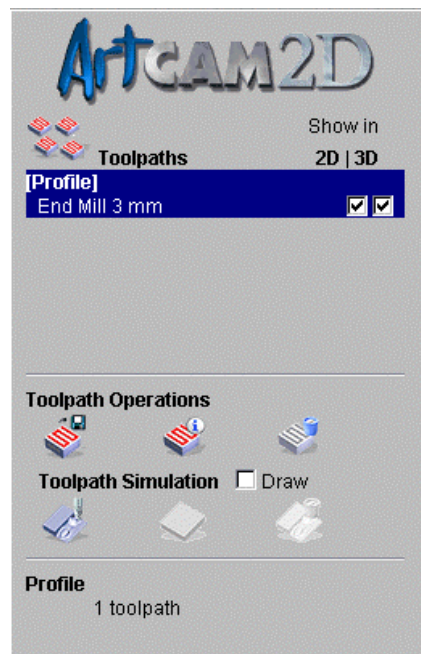
An isometric view of the simulated Profile toolpath appears in the **3D View** window as follows:



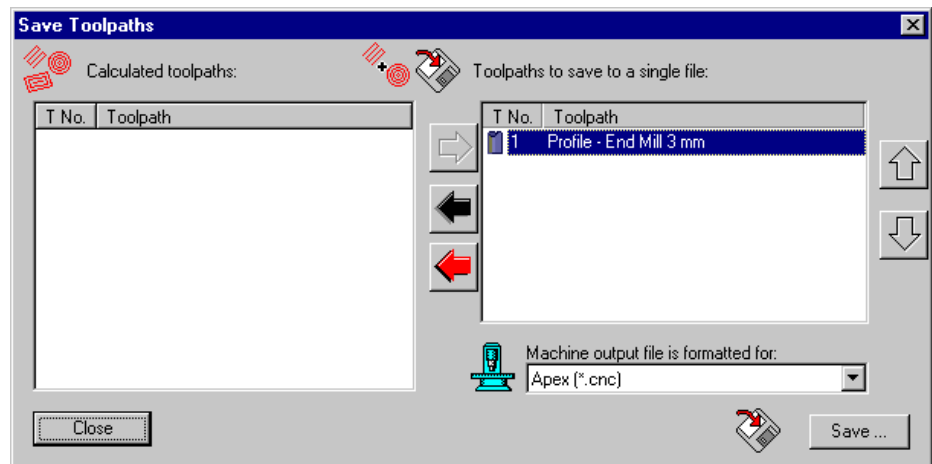
Saving the Toolpath

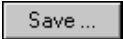

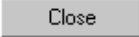
Finally, you will save the Profile toolpath used to machine the nested vector text:

1. In the **Toolpath Manager**, make sure that the **Profile** toolpath in the **Toolpaths** area is selected (highlighted in blue):



2. Click on the **Save Toolpaths** button  in the **Toolpath Operations** area to display the **Save Toolpaths** dialog box:



3. Click on the **Machine output file is formatted for** list box and select the format compatible with your machine.
4. Click on the **Save...** button  to open the **Save As...** dialog box.
5. Type *ProfileNesting* in the **File Name** box.
6. Click on the **Save** button  to save the toolpath to the selected directory.
7. Click on the **Close** button  to close the **Save Toolpaths** dialog box.

Working with Models

Getting Started

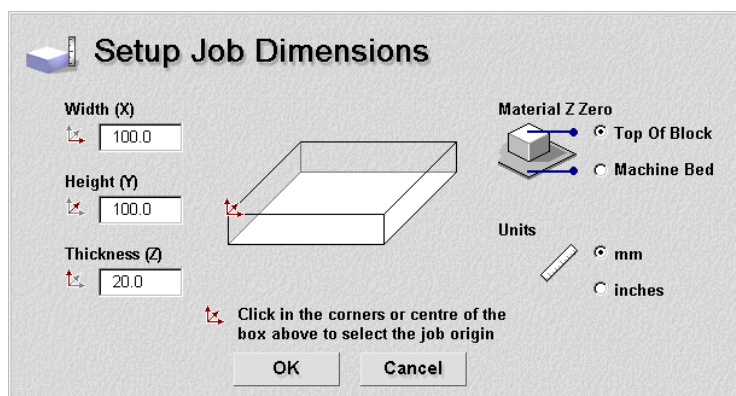
When you start ArtCAM 2D, there are three icons on the **Assistant's Getting Started** page. These three icons are commands that enable you to:


- **Create a New Model** – Define the dimensions of a block of material that you want to produce a 2D model from.
- **Open an Existing Model** – Open a previously defined block of material that you have either machined or made some progress toward creating a 2D model from.
- **Open the Last Model** – Return to the previous 2D model that you had opened in ArtCAM 2D.


Creating a Model


To create a model:


1. Click on the **Create New Model** icon  on the **Assistant's Getting Started** page to display the **Setup Job Dimensions** dialog box:



2. Type in the **Width (X)**, **Height (Y)** and **Thickness (Z)** values according to the physical size of the model you want to create.
3. Click on one of the **Material Z Zero** radio buttons  to define the Z-axis zero level, or the position of the cutter relative to the surface of the block of material to be machined:

- Click on the **Top Of Block** radio button  if you want to position the cutter on the material surface.


The **Job Origin** icon  appears on the top-front-left corner of the box.

- Click on the **Machine Bed** radio button  if you want to position the cutter on the bed of the machine.

The **Job Origin** icon  appears on the bottom-front-left corner of the box.


4. Click on the centre or any of the four corners of the box to define the X-axis zero and Y-axis zero origin.

The **Job Origin** icon  appears in the position you have clicked on.

5. Make sure that the **Units** option is set according to those you are working in, either millimetres or inches.
6. Click on the **OK** button  to display a **2D View** window.

This window is the area in which you draw or import the vector objects that make up your model.

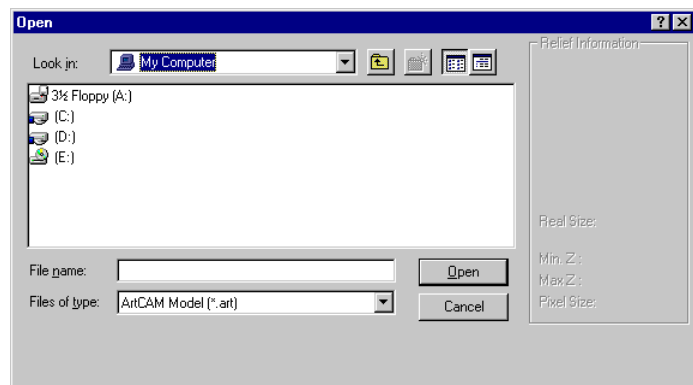


Note: If you want to create a new model when the ArtCAM 2D application has already been started, click on the **New Model** button  in the **File** area of the **Assistant's** Home page.

Opening an Existing Model

If you have already created a model and want to review or modify it's content:

1. Click on the **Open Existing Model** icon  on the **Assistant's** **Getting Started** page to display the **Open** dialog box:



2. Click on the **Look In** list box in the **Open** dialog box and find the file that you want to open.
3. Once you have found the file, click on the file name listed in the main window of the **Open** dialog box.




Note: You are only able to select ArtCAM Model files (*.art). You can confirm this by clicking on the **Files of Type** list box.

The name of the file you have selected appears in the **File Name** box.

4. Click on the **Open** button  to open the model.



Note: If you want to open an existing ArtCAM Model file when ArtCAM 2D has already been started, click on the **Open** button  in the **File** area of the **Assistant's** Home page.

Opening the Last Model

If you want to open the model that you were working on last:

1. Click on the **Open Last Model** icon  on the **Assistant's** **Getting Started** page.

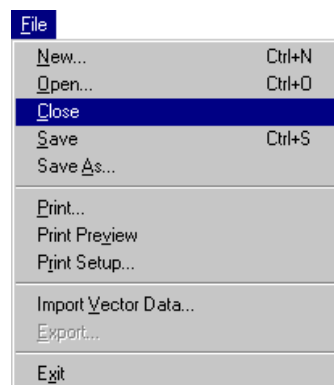


Tip: You can also open previously saved models by clicking on the **File** menu in the Main menu bar, and then clicking on the appropriate file name listed above the **Exit** option. Up to five models can be listed.

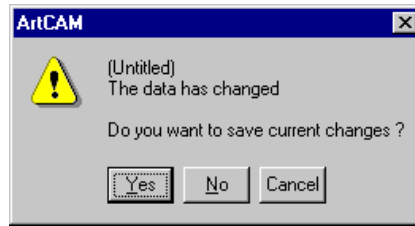
Closing a Model

To close the ArtCAM 2D model that you are currently working on:


1. Click on **File** in the Main menu bar, then select the **Close** option:



If you click on the **Close** option before saving a new model, or any changes that you may have made to an open model, the following message box appears:



If you want to save the model:

1. Click on the **Yes** button  to open the **Save As...** dialog box.
2. Follow Steps 2 to 5 of “Saving a Model” on page 140.

If you do not want to save the model you are working on:

1. Click on the **No** button  to close the message box.

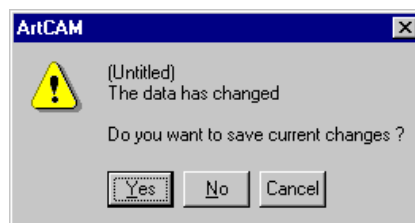
Shutting Down ArtCAM 2D

To shut down ArtCAM 2D:

1. Click on **File** in the Main menu bar, and then on the **Exit** option:



If you click on the **Exit** option before saving a new model, or any changes that you may have made to an open model, the following message box appears:




If you want to save the model:

1. Click on the **Yes** button  to open the **Save As...** dialog box.

2. Follow Steps 2 to 5 of “Saving a Model” on page 140.

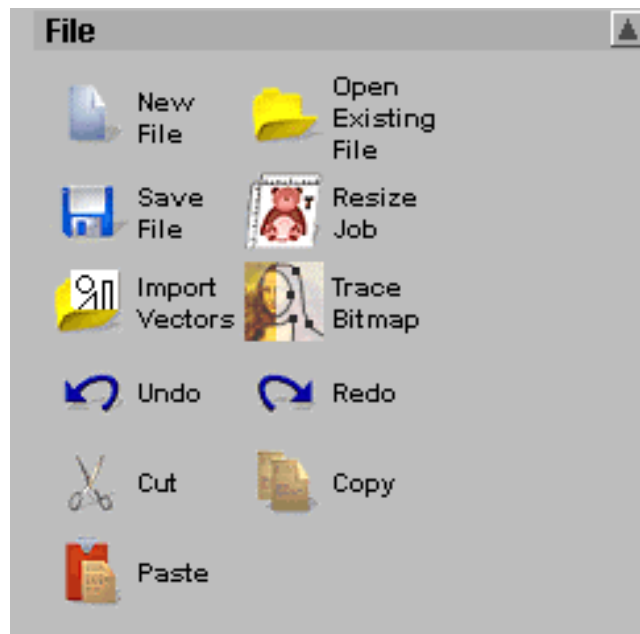
If you do not want to save the model you are working on:

1. Click on the **No** button  to close the message box.

Managing a Model

When you have created or opened a model in ArtCAM 2D, the **Assistant**'s Home page is automatically displayed.

There is a group of tools in the **File** area of the **Assistant**'s Home page to help you manage a model:



With the tools within the **File** area of the **Assistant**'s Home page you can:

- Create a new model.
- Open a saved model.
- Save an open model.
- Edit the dimensions of an open model.
- Import vector files created in other applications.
- Convert a bitmap image into a vector object.
- Correct a mistake that you have made.

Creating a New Model

You can only create a new model when a model has already been created or opened in ArtCAM 2D.


To create a new model:

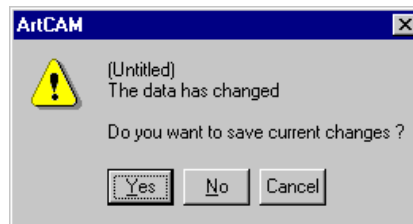
1. Click on the **New Model** button  to open the **Setup Job Dimensions** dialog box.




Note: You can also open the **Setup Job Dimensions** dialog box by clicking on **File** in the Main menu bar, and then selecting the **New...** option.

2. Follow Steps 2 to 6 of “Creating a Model” on page 133.


If you click on the **New Model** button while working on an unsaved model and then the **OK** button  in the **Setup Job Dimensions** dialog box, the following message box appears:



If you want to save the model:

1. Click on the **Yes** button  to open the **Save As...** dialog box.
2. Follow Steps 2 to 5 of “Saving a Model” on page 140.

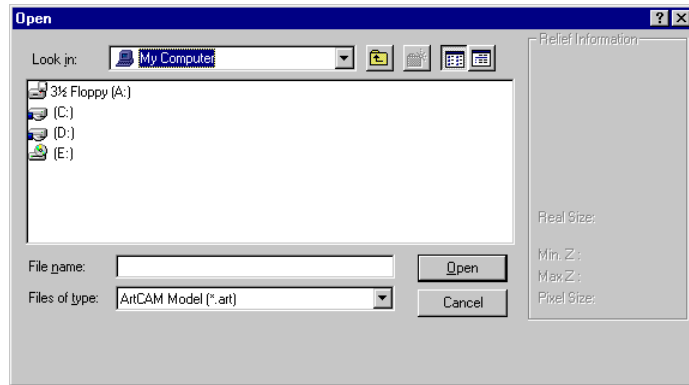
If you do not want to save the model you are working on:

1. Click on the **No** button  to close the message box.

Opening a Model

To open a model that you have previously saved (*.art):


1. Click on the **Open** button  to display the **Open** dialog box:

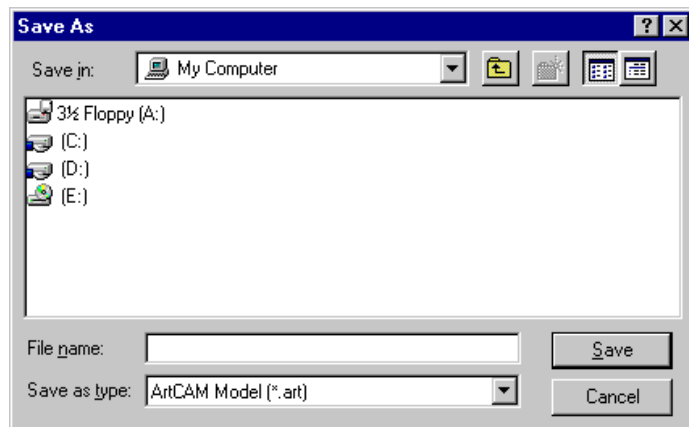



2. Follow Steps 2 to 4 of “Opening an Existing Model” on page 135.

Saving a Model

To save the model you have created:

1. Click on the **Save** button  to display the **Save As...** dialog box:



2. Click on the **Save In** list box and select the directory you want to save the model in.
3. Type the file name you want to use for the model in the **File name** box.
4. Click on the **Save as type** list box, and then click on the file type you want to save the model as.
5. Click on the **Save** button .

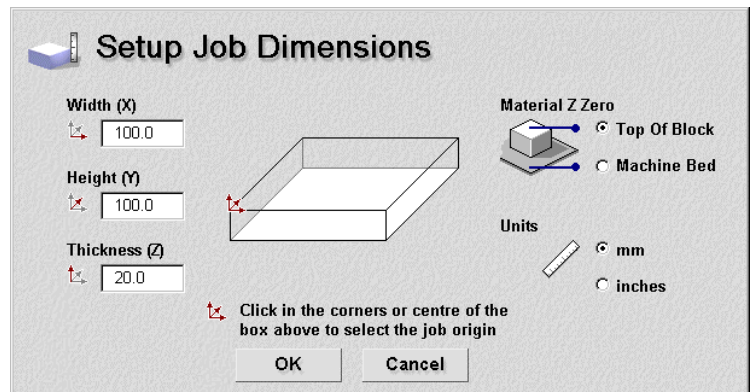


Note: You can also open the **Save As...** dialog box if you click on **File** in the Main menu bar, and then on the **Save As...** option.

Editing the Model Dimensions

To edit the dimensions that you had originally defined for a model when creating it, you must:

1. Click on the **Set Model Size** button  to display the **Setup Job Dimensions** dialog box:



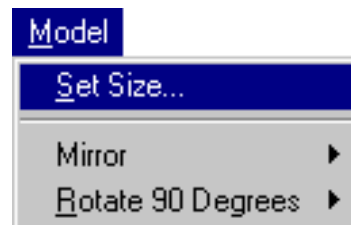
2. Follow Steps 2 to 6 of “Creating a Model” on page 133.

By adjusting the current settings in the **Setup Job Dimensions** dialog box, you can change:

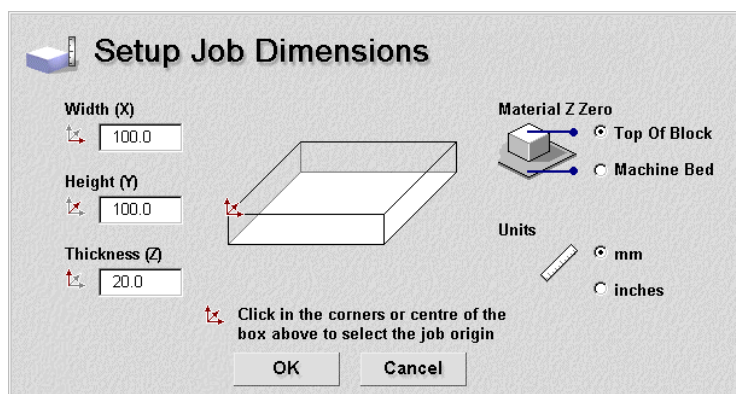
- The height, width and/or thickness of the block of material.
- The job origin.
- The material Z zero level.
- The units of measurement you are using.

You can also edit the dimensions that you had originally defined for a model if you:

1. Click on the **Model** option in the Main menu bar to display the **Model** menu:



2. Click on the **Set Size...** option to display the **Setup Job Dimensions** dialog box:




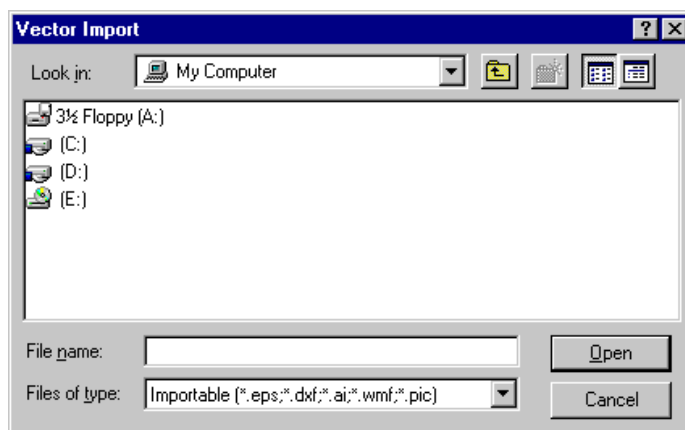
3. Follow Steps 2 to 6 of “Creating a New Model” on page 139.

Importing Vector Files

In ArtCAM 2D, you can use vector data created in other drawing packages as part of your model.


If you want to import vector data saved as files of type ***.dxf**, ***.eps**, ***.ai**, ***.wmf** or ***.pic** into an open model:

1. Click on the **Import EPS, DXF or AI Files** button  in the **File** area of the **Assistant's** Home page to display the **Vector Import** dialog box:



2. Click on the **Look In** list box and find the file that you want to import.
3. Once you have found the file, click on the file name listed in the main window of the **Vector Import** dialog box.

The file name you have clicked on appears in the **File Name** box.

- Click on the **Open** button  to import the file into the open model.

The imported vector object is magenta.



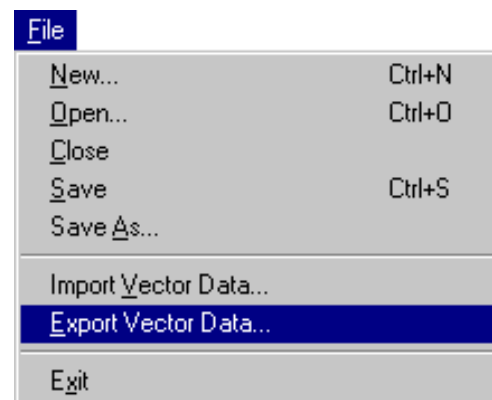
Note: You can also open the **Vector Data** dialog box by clicking on **File** in the Main menu bar, and then selecting the **Import Vector Data...** option.

Exporting Vector Files

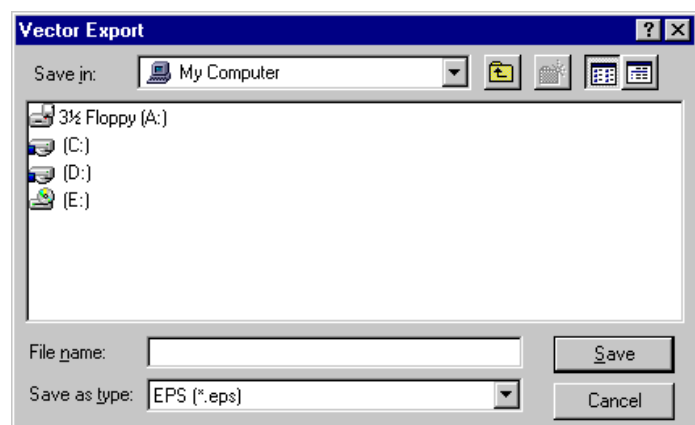
You can export a vector object as data. This data can then be used in other drawing packages supporting *.eps, *.dxf and *.pic file formats.


To export a vector object as data:

- Select the vector object that you want to export.
For details, see “Selecting Vectors” in the Working with Vectors chapter.
- Click on the **File** option in the Main menu bar to display the **File** menu:





- Click on the **Export Vector Data** option to open the **Vector Export** dialog box:



4. Click on the **Save In** list box and select the directory you want to save the vector object in.
5. Type the file name you want to use for the vector object in the **File name** box.
6. Click on the **Save as type** list box, and then click on the file type you want to save the vector object as.
7. Click on the **Save** button .

Correcting an Action

There are two buttons you can use to correct your mistakes when working in ArtCAM 2D:

- Click the **Undo** button  to cancel your last action.
- Click the **Redo** button  to repeat the last action that you had made before clicking on the **Undo** button.



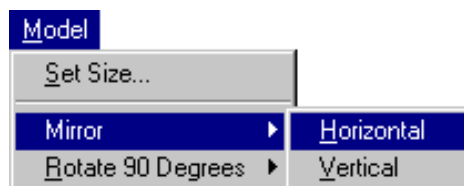
Note: You can either **Undo** or **Redo** an action by clicking on **File** in the Main menu bar, and then selecting the relative option listed. For example, *Undo Draw Ellipse*.

Mirroring a Model

You can mirror an open model both vertically and horizontally.

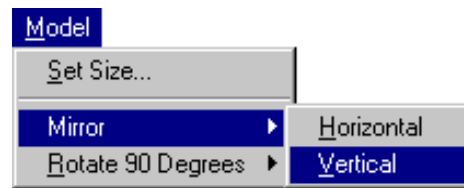
To mirror a model horizontally:

1. Click on the **Model** option in the Main menu to display the **Model** menu, then click on **Mirror > Horizontal**:



To mirror a model vertically:

1. Click on the **Model** option in the Main menu to display the **Model** menu, then click on **Mirror > Vertical**:

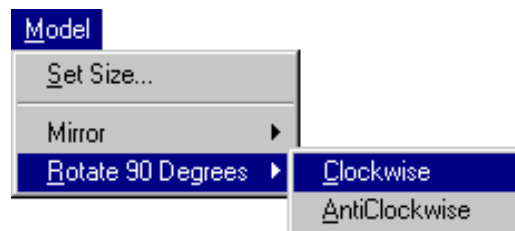


Rotating a Model

You can rotate an open model both clockwise and anti-clockwise.

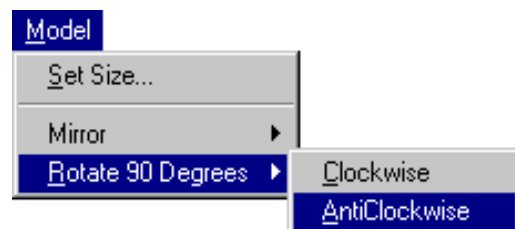
To rotate a model clockwise:

1. Click on the **Model** option in the Main menu to display the **Model** menu, then click on **Rotate 90 Degrees > Clockwise** to turn the model through 90° in a clockwise direction:



To rotate a model anti-clockwise:

1. Click on the **Model** option in the Main menu to display the **Model** menu, then click on **Rotate 90 Degrees > AntiClockwise** to turn the model through 90° in an anti-clockwise direction:



Working with Vectors

Drawing using Vectors

In ArtCAM 2D, it is not only possible to import vector artwork from other applications or convert a bitmap image into vector objects. For details, see “Importing Vector Files” in the Working With Models chapter and “Converting a Bitmap into Vectors” in the ArtTrace chapter.

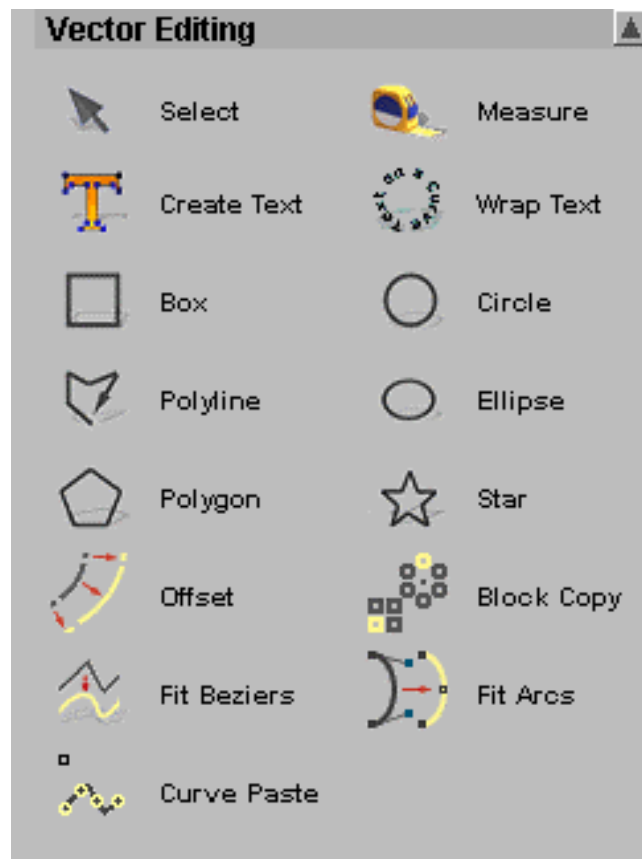
Once you have created or opened a model file, you can use the drawing tools in the **Vector Editing** area of the **Assistant**’s Home page to create your own vector objects that can then be used to machine a 2D model.

Vector Editing Tools


A vector object, or object-oriented graphic, is made up of a sequence of commands or mathematical statements that places lines and shapes in a given two-dimensional or three-dimensional space. Vector objects are fully scalable without loss of resolution, and file sizes are independent of resolution.

In ArtCAM 2D, you can create vector objects in the form of simple shapes including a square, rectangle, circle, ellipse, polygon and star. With a polyline, you can also create your own shape of vector object. Finally, you can create vector objects in the form of text in any selected font.

The suite of **Vector Editing** tools is found on the **Assistant**’s Home page:




Creating a Polyline

You can use the **Create Polyline** button  to create a polyline, which is one or more linear spans joined together by points (nodes).

You are able to manipulate the polyline that you have drawn in order to form new vector objects.

To create a polyline:

1. Click on the **Create Polyline** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Polyline Creation** page.




Note: Clicking on **Hide Help** clears the page of all reference material relating to a specific button. However, it is recommended that you **Show Help** until you are familiar with each of the ArtCAM 2D commands.

2. Click once in the **2D View** window to create the start point (node) of the polyline.

3. Drag the mouse. A dotted line appears indicating where the polyline is to be drawn.
4. Click at the position where you want to create another point (node) in the polyline.





Tip: Press and hold the **Ctrl** key  on your keyboard during each click of the mouse to constrain the angle of the linear span drawn between points (nodes) to 15° increments.

A linear span is drawn connecting the two points (nodes).

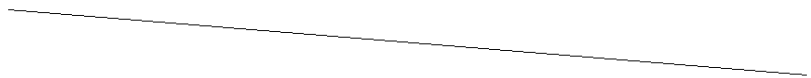
Repeat Steps 3 and 4 if you want to create further points (nodes) in the polyline connected by linear spans.

5. Right-click to end the polyline and return to the **Assistant's** Home page.

You can also end the polyline if you:

- Press the **Esc** key  on your keyboard.
- Click the **Close** button  on the **Polyline Creation** page in the **Assistant** window.

For example, if you click in the right of the **2D View** window, drag downwards and left, and then right-click, you can create a polyline that looks something like this:






Completing Polyline Creation

To complete the polyline you are drawing, but remain in polyline creation mode:

- Press the **Space Bar**  on your keyboard.

To finish creating a polyline and return to the **Assistant's** Home page, leaving it as an open vector object, you can either:

- Right-click on your mouse.
- Press the **Esc** key  on your keyboard.
- Press the **Enter** key  on your keyboard.
- Click on the **Close** button  at the bottom of the **Polyline Creation** page.

The polyline is black, indicating that an open vector object has been created.

Closing a Polyline to Create a Polygon

If you are in **Polyline Creation** mode, you can finish creating a polyline and automatically join its start and last points (nodes) to form a polygon if you:

1. Press the **Tab** key  on your keyboard.

If you have already created a polyline, you can join its start and last points (nodes) to form a polygon if you:


1. Select the polyline that you have created.

The polyline is black.

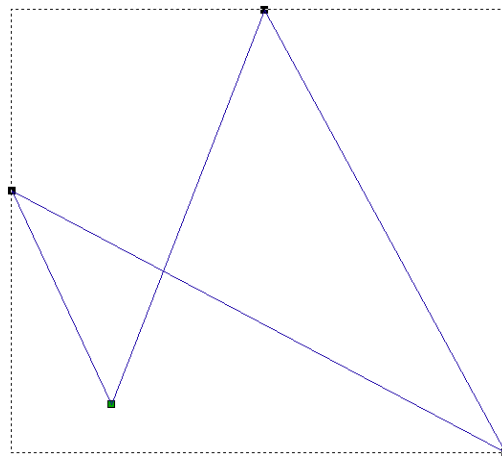
For details, see “Selecting Vectors” on page 151.

2. Click on the start point (node) and drag it to meet the last point (node) in the polyline.

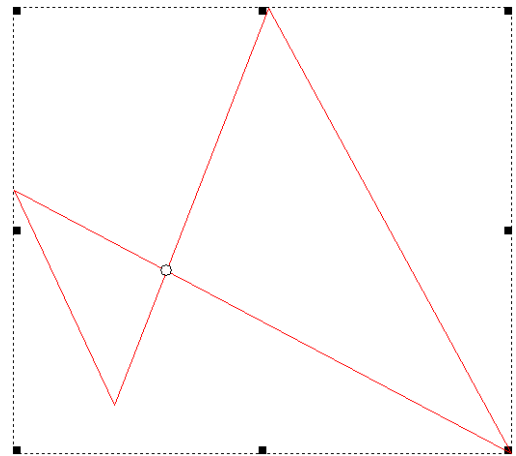
In both instances, the selected polyline changes from black to blue, indicating that a closed vector object has been created.

However, if you create a polygon from a polyline in which two spans overlap another and then group it, the polyline turns red with white circular shapes  marking the positions where the spans overlap when you select it:

Before...



After...



For further information, see “Grouping Vector Objects” on page 248.

Amending a Polyline


A polyline is made up of spans and points. A point, also referred to as a node, is a mathematically defined point connected by a linear, arc or bezier curve span. The position of the points and the nature of the spans can be altered after the polyline is created. For example, a linear span can be changed to an arc or a bezier curve span.

You can change the appearance of a polyline using both the **Node Editing** and **Span Editing** menu options. The **Span Editing** menu is displayed when you right-click on any span within a polyline. The **Node Editing** menu is displayed when you right-click on any point (node) within a polyline.

Selecting Vectors

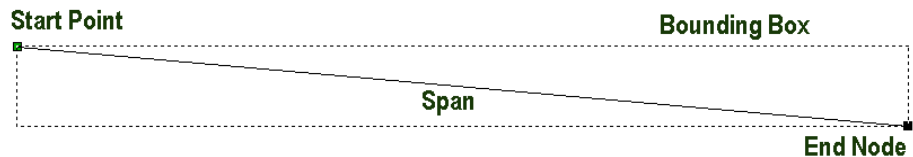
You can select any number of vector objects in an open model.

To select a single vector object:



1. Click on the **Select Vectors** button  in the **Vector Editing** area of the **Assistant's** Home page.

2. Click on the vector object to select it.

For example, if you click on a span within a polyline, a bounding box appears around the polyline indicating that it has been selected:



To select more than one vector object:

1. Click on the **Select Vectors** button  in the **Vector Editing** area of the **Assistant's** Home page.
2. Hold the **Shift** key  on your keyboard, and then click on each vector object that you want to select.




Note: You can also click and drag around any number of vector objects to select them. A bounding box surrounds all selected vector objects.

An ungrouped, open vector object is black when selected.

An ungrouped, closed vector object is blue when selected, unless the vector object's direction of geometry is anti-clockwise, and then it is green.

For details, see “Reversing a Vector Object's Direction of Geometry” on page 254.

A grouped, open vector object is blue when selected, unless two spans overlap another within it, then it is red with white circular shapes  marking the positions where the spans overlap.


A grouped, closed vector object is magenta when selected.

If you click and drag around a vector object that you want to select and it has one or more copies overlapping it, the vector object turns red.

For details, see “Copying and Pasting Vector Objects” on page 189 and “Grouping Vector Objects” on page 248.

A bounding box surrounds all vector objects you select.



Tip: To deselect a vector object you have selected by mistake, hold the **Shift** key  on your keyboard and click.

Moving Vectors


You can move part or the whole of any selected vector object to another area of an open model.

To move a point (node):

1. Select a vector object.

For details, see “Selecting Vectors” on page 151.

2. Move the cursor over any of the points (nodes) in the vector object.

The cursor now changes to , the **Node Editing** cursor.

3. Click and drag on the point (node), and then release the mouse button to reposition it.


The vector object is redrawn to link the newly positioned points (nodes).

To move a vector object to another position in the **2D View** window:

1. Select a vector object.

For details, see “Selecting Vectors” on page 151.

2. Move the cursor over a span in the vector object.

The cursor now changes to , the **Span Editing** cursor.

3. Click and drag on the whole vector object, then release the mouse button to reposition it.

Editing Vector Spans

Spans within a vector object can be linear, arc or bezier curve. You can change the appearance of a span using the **Span Editing** options, displayed when you right-click on a selected vector object.

The **Span Editing** options allow you to:

- Convert a span to a line.
- Convert a span to a bezier curve.
- Convert a span to an arc.
- Insert a point (node) into a span.
- Delete a span.

Converting a Span to a Bezier Curve


Converting a span to a bezier curve allows you to alter the appearance of a linear or an arc span within a vector object.

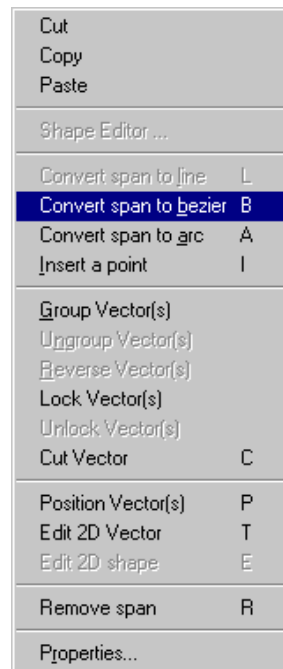
Converting a span to a bezier curve places two control points on the span, both of which can be dragged to add or reduce the curvature within the span.

To convert a span into a bezier curve:

1. Select a vector object.

For details, see “Selecting Vectors” on page 151.


2. Position the cursor over the middle of a linear or an arc span. Right-click when the **Span Editing** cursor  appears to display the **Span Editing** menu:



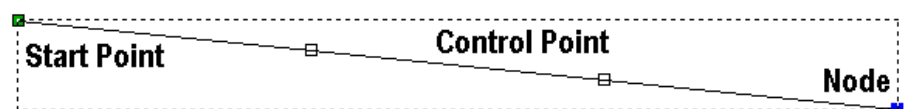
Note: Depending on the option that you select from the **Span Editing** menu, it either affects the vector currently selected, or the span below the mouse cursor prior to a right-click.

3. Click on the **Convert span to bezier** option to convert the span into a bezier curve.



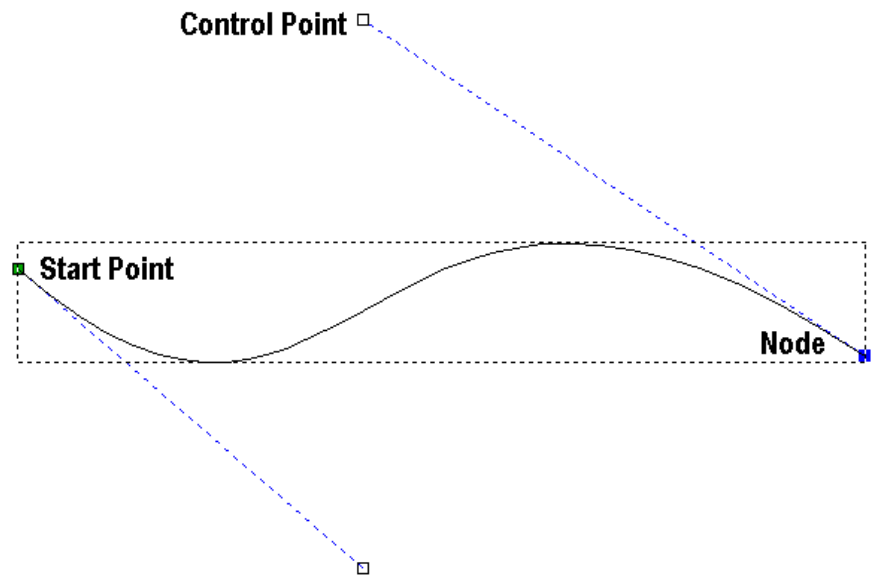
Note: Moving the cursor over the span and pressing the **B** key  on your keyboard also converts it to a bezier curve.

For example, your span may look something like that shown below:



Although this span may not look like a curve now, the two control points in it indicate that it is a bezier curve span.

In our example, by dragging the control points as shown below, a bezier curve span with a smooth curvature is produced:



Inserting a Point


You can insert a point (node) in any span, whether it is a line, bezier curve or an arc. Inserting a point divides a span into two new spans of the same type as the original.

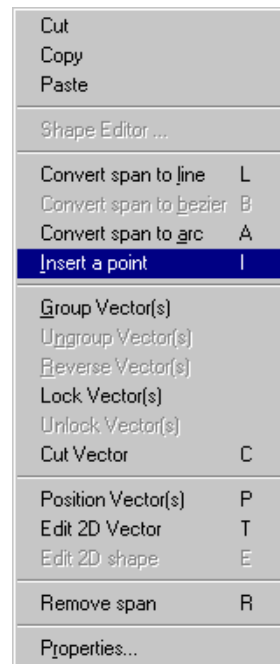
By inserting a point (node) you add greater flexibility in changing the shape of a span, and, therefore, the whole vector object.

To insert a point (node) in a span:

1. Select a vector object.

For details, see “Selecting Vectors” on page 151.

2. Position the cursor over the middle of a span. Right-click when the **Span Editing** cursor  appears to display the **Span Editing** menu:

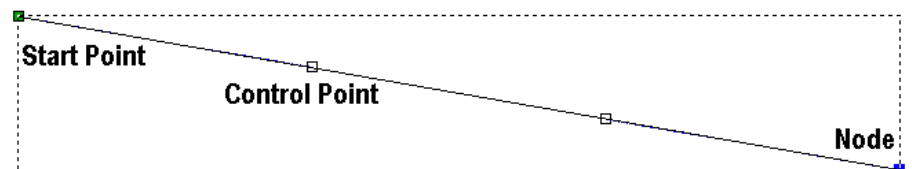


- Click on the **Insert a point** option to produce a new point (node) in the span, dividing it into two separate spans.

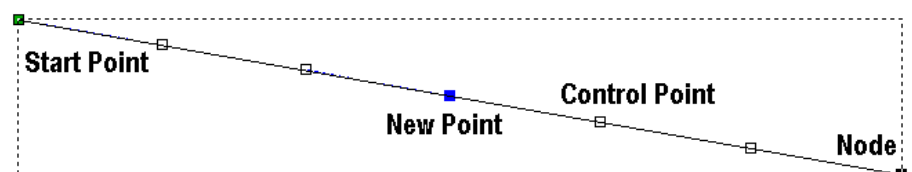
For example, a point (node) has been inserted into the bezier curve span illustrated below.


You can see that doing so has created a second span and its adjoining control points:

Before...



After...



Note: Moving the cursor over the span and pressing the **I** key  on your keyboard also executes this action.



Tip: Adding points (nodes) to a vector object can be a time consuming process. Alternatively, you can use the **Create Polyline** tool to create more complicated shapes from the beginning. With the tool selected, each corresponding movement and click of the mouse creates a new point and adjoins it to the last with a linear span.


Converting a Span to a Line

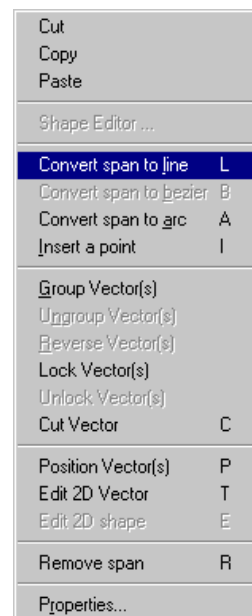
Converting a span to a line allows you to alter the appearance of an arc or a bezier curve span within a vector object.

To convert a span to a line:

1. Select a vector object.

For details, see “Selecting Vectors” on page 151.

2. Position the cursor over the middle of a span.
Right-click when the **Span Editing** cursor  appears to display the **Span Editing** menu:

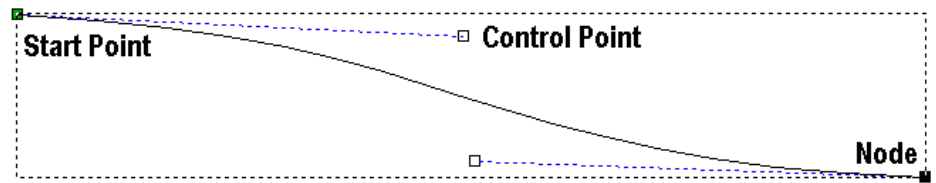


3. Click on the **Convert span to a line** option to convert the arc or the bezier curve span into a linear span.

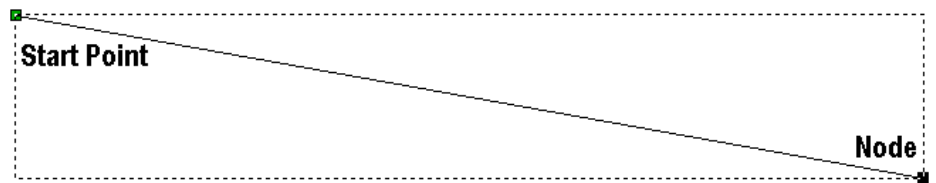
For example, if you were to convert a bezier curve span to a linear span you would see that


its adjoining control points have been removed along with any curvature, as shown below:

Before...



After...



Note: Moving the cursor over the span and pressing the **L** key  on your keyboard also executes this action.

Converting a Span to an Arc


Converting a span to an arc allows you to alter the appearance of a linear or bezier curve span within a vector object.

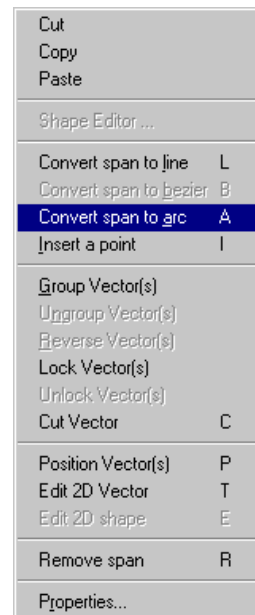
Converting a span to an arc places one control point in the middle of the span. This can be dragged to add or reduce the degree of curvature in the arc.

To convert a span into an arc:

1. Select a vector object.

For details, see “Selecting Vectors” on page 151.

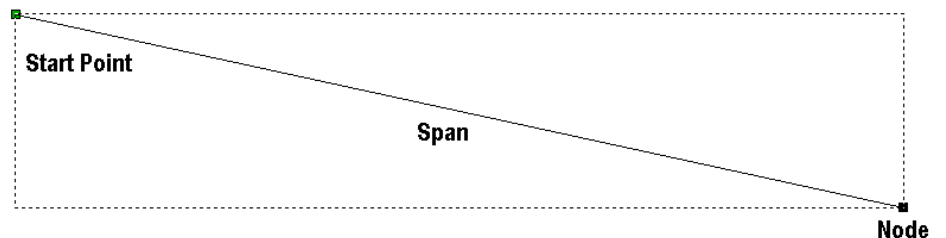
2. Position the cursor over the middle of a span. Right-click when the **Span Editing** cursor  appears to display the **Span Editing** menu:



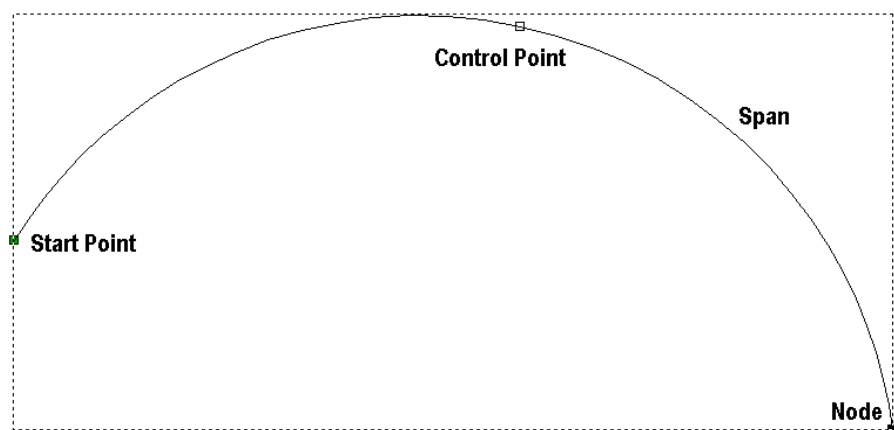
- Click on the **Convert span to an arc** option to convert the linear or bezier curve span into an arc span.

For example, if you were to convert a linear span to an arc span you would see that one control point is now positioned in the centre of the arc, as shown below:


Before...



After...





Note: Moving the cursor over the span and pressing the **A** key  on your keyboard also executes this action.


Removing a Span

You can delete a linear, bezier curve or an arc span within any selected vector object in the same way.

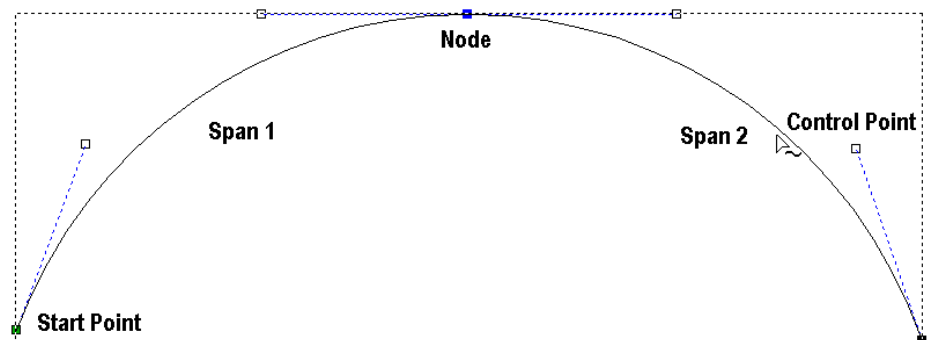
To remove a span:

1. Select a vector object.

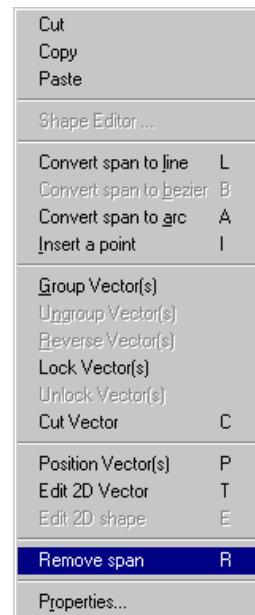
For details, see “Selecting Vectors” on page 151.


2. Position the cursor over the middle of a span. Right-click when the **Span Editing** cursor  appears to display the **Span Editing** menu.

For example, a vector object with two spans appears as follows:

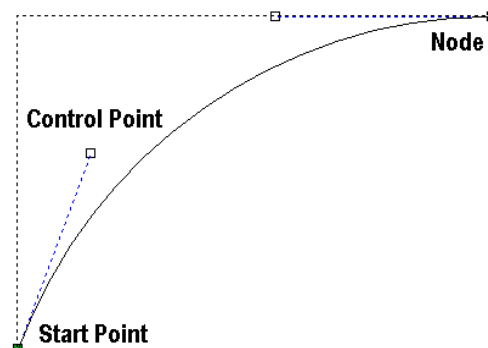


3. Click on the **Remove Span** option to delete the selected span:



Note: Moving the cursor over the span and pressing the **R** key  on your keyboard also removes it.

In our example, if you select and remove Span 2 of the vector object, the following vector object remains:



Editing Vector Nodes

You can change the structure and appearance of a vector object using the **Node Editing** options.

The **Node Editing** menu is displayed when you right-click on any point (node) within a selected vector object.

The **Node Editing** options allow you to:

- Smooth a point (node).
- Delete a point (node).
- Change the position of the start point.

Smoothing Points

You can smooth any point (node) in a vector object other than the start or last point (node) in an ungrouped, open vector object. This is because there must be a span on either side of a point (node) for the smoothing process to take place, and there is not in these instances.

An ungrouped, open vector object is black when selected.


An ungrouped, closed vector object is blue, unless the vector object's direction of geometry is anti-clockwise, and then it is green when selected.

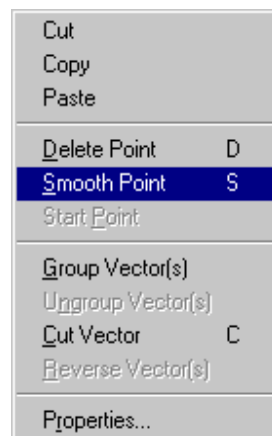
In smoothing, the span on either side of the point (node) is converted to a bezier curve span. Therefore, control points are automatically adjoined to the point (node), allowing you to control the degree of curvature in the whole vector object.

To smooth a point:

1. Select a vector object that you want to smooth.


For details, see “Selecting Vectors” on page 151.

2. Move the cursor over a point (node) in order that it changes to the **Node Editing** cursor , then right-click to open the **Node Editing** menu:



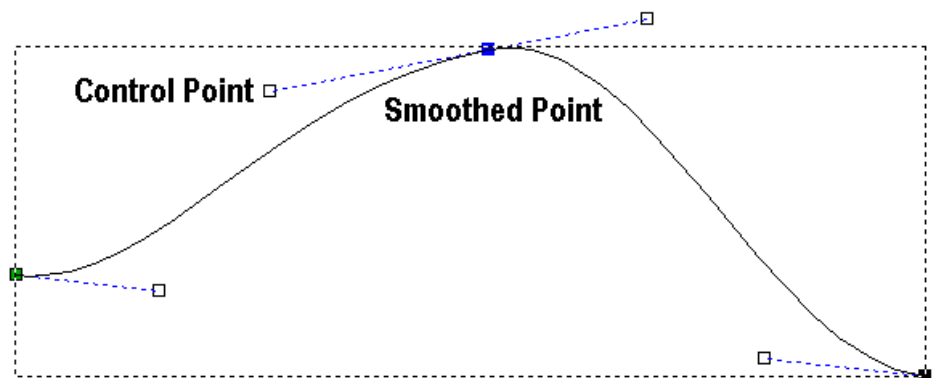
3. Click on the **Smooth Point** option to smooth the selected point (node):



Note: Moving the cursor over the point (node) and pressing the **S** key  on your keyboard also smooths it.


The point (node) is blue when the **Smooth Point** option is selected.

For example, the point (node) in the middle of the vector object shown below has been smoothed:



If you move one of the control points adjoined to the smoothed point (node), the other automatically moves with it. This simultaneous movement preserves the smoothness of the junction between the two bezier curve spans.

If you want to remove the smoothing option from a smoothed point:

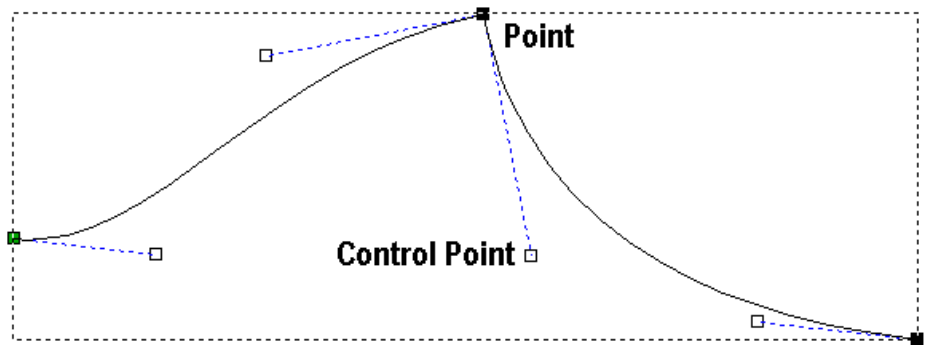
1. Select a vector object that is smoothed.
For details, see “Selecting Vectors” on page 151.
2. Move the cursor over a smoothed point (node) in order that it changes to the **Node Editing** cursor , then right-click to open the **Node Editing** menu.
3. Click on the **Smooth Point** option to deselect it.

The point (node) turns black when the **Smooth Point** option is deselected.

Although the span on either side of the point (node) remains as a bezier curve span,

deselecting the **Smooth Point** option causes the control point on either side of the point (node) to affect its adjoining bezier curve span only, rather than the whole vector object.

In our example, you can see that moving one control point no longer automatically moves the other:



Deleting Points


You can delete any of the points (nodes) within a vector object.

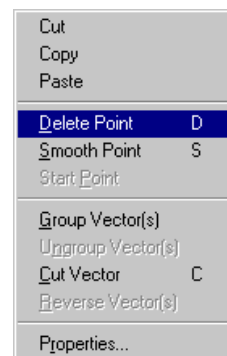
Deleting a point does not change the type of span on either side of the point (node), but it does reduce your ability to manipulate the shape of the whole vector object.

To delete a point (node) in a vector object:

1. Select a vector object.


For details, see “Selecting Vectors” on page 151.

2. Move the cursor over a point (node) in order that it changes to the **Node Editing** cursor , then right-click to open the **Node Editing** menu:



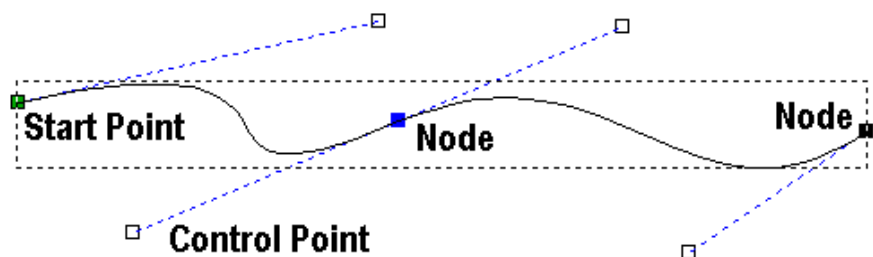
3. Click on the **Delete Point** option to delete the point (node) from the vector object.



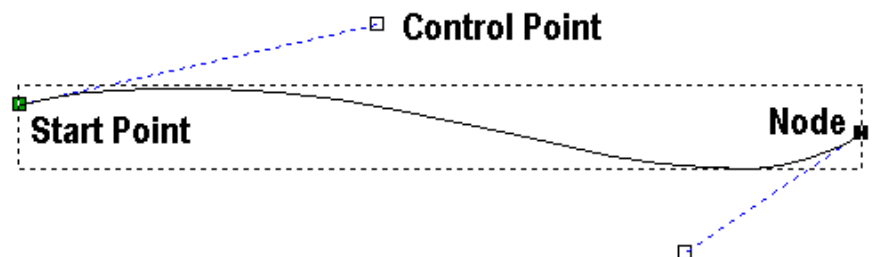
Note: Moving the cursor over the point (node) and pressing the **D** key  on your keyboard also deletes it.

For example, you can see that in deleting the middle point (node) in the vector object shown below, the number of control points is reduced and its shape is changed considerably:

Before...



After...



Changing the Start Point

The start point (node) in a vector object determines the point at which a tool enters the block of material when you are machining your 2D model.


You can change the position of the start point (node) in any vector object.

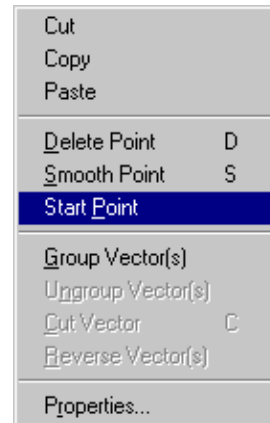
The green point (node) within a vector object indicates the current position of the start point.

To change the position of the start point (node):

1. Select a vector object.

For details, see “Selecting Vectors” on page 151.


2. Move the cursor over a point (node) in order that it changes to the **Node Editing** cursor , then right-click to open the **Node Editing** menu:



3. Click on the **Start Point** option to change the selected node to the start point.




Note: Moving the cursor over the point (node) and

pressing the **P** key  on your keyboard also changes it to the start point.

The point (node) changes from black to green.

Creating Simple Closed Shapes

In addition to the **Create Polyline** button , as detailed in “Creating a Polyline” on page 148, there are a further five buttons in the **Vector Editing** area of the **Assistant**’s Home page that allow you to create specific shapes of vector object.

You can create:

- Rectangles or Squares.
For details, see “Creating a Rectangle” on page 168.
- Circles.
For details, see “Creating a Circle” on page 172.
- Ellipses.

For details, see “Creating an Ellipse” on page 176.

- Polygons.

For details, see “Creating a Polygon” on page 180.



- Stars.

For details, see “Creating a Star” on page 184.

Creating a Rectangle

You can create either an exact or an approximate square or rectangular shaped vector object.

To create an exact square or rectangle:

1. Click on the **Create Rectangle** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Rectangle Creation** page.
2. Click on the **Square** or **Rectangle** radio button  to select the type of shape you want to create.
3. Type the height you want for the shape in the **Height** box.
4. Type the width you want for the shape in the **Width** box.
5. If you want filleted (rounded) corners, type the radius you want to apply to all four corners in the **Corner Radii** box.



If you do not want filleted (rounded) corners, leave the default value of 0 in the **Corner Radii** box.

6. Define the centre point of your shape:
 - Type values in the **Centre Point's X** and **Y** boxes.
 - Move the \oplus cursor to the point in the model you are interested in and click.

The X and Y co-ordinates of the point you click on appear in the **Centre Point's X** and **Y** boxes.

7. If you want your shape to be drawn at a specific angle, type a value in the **Angle** box:
 - Type a positive value in the **Angle** box to rotate the shape clockwise.
 - Type a negative value in the **Angle** box to rotate the shape anti-clockwise.


If you do not want your shape to be drawn at a specific angle, leave the default value of 0 in the **Angle** box.

8. Click on the **Preview** button  to draw a preview image of the shape you are creating in the **2D View** window.
9. If you want to draw your shape and remain in **Rectangle Creation** mode:
 - Click on the **Create** button .



If you want to draw your shape and return to the **Assistant's** Home page:

- Click the right mouse button.

To create an approximate sized square or rectangle:

1. Move the **+** cursor to the point in the model where you want to draw the shape.
2. Click and drag to form the shape you want to create.
3. Release the mouse button to draw a preview image of the shape you are creating in the **2D View** window.
4. If you want to draw your shape and remain in **Rectangle Creation** mode:
 - Click on the **Create** button .

If you want to draw your shape and return to the **Assistant's** Home page:

- Click the **Create** button  and then the **Close** button  on the **Rectangle Creation** page.
- Click the right mouse button.

Editing a Square or Rectangle

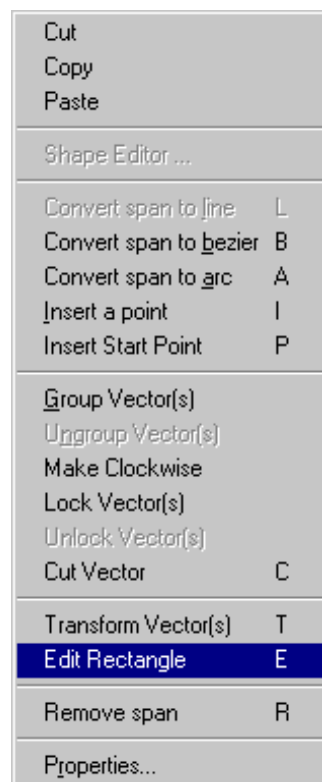
You can edit the size, position, corners and/or angle of a square or rectangular shaped vector object.

To begin editing a square or rectangle:

1. Select the square or rectangle you want to edit in the open model.

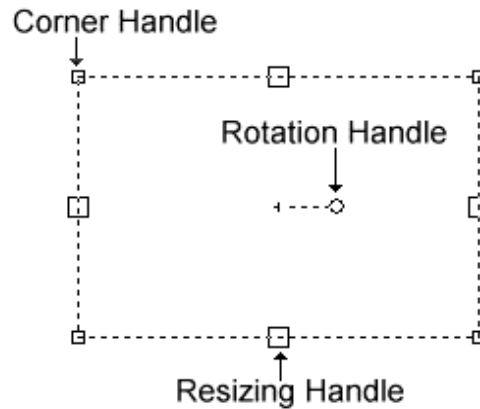
For details, see “Selecting Vectors” on page 151.


2. Right-click on the selected shape to display the **Vector Editing** menu:



3. Click on the **Edit Rectangle** option to display the **Rectangle Editing** page in the **Assistant** window.

The selected shape now appears as a preview image with resizing handles attached to it, and a rotation handle about its centre point:



Note: You can display the **Rectangle Editing** page in the **Assistant** window by selecting a square or rectangle, and pressing the **E** key  on your keyboard.

You can now change the size, position, corners and/or angle of the selected square or rectangle using the **Rectangle Editing** page in the **Assistant** window, or by manipulating the handles on the shape itself.

To edit the selected square or rectangle using the **Rectangle Editing** page in the **Assistant** window:

- Type a new value in the appropriate box for each attribute of the shape that you want to adjust.


For example, typing a new value in the **Height** box immediately increases or decreases the height of the selected square or rectangle.

You can edit the selected square or rectangle using the shape itself:

- Click and drag any of the resizing handles to adjust the size of the shape.

The new height and width of the shape appears in the **Height** and **Width** boxes on the **Rectangle Editing** page.



Tip: To create an exact square, hold down the **Shift** key  on your keyboard and drag the resizing handles on your rectangle to the required size.

- Click and drag any of the corner handles to add filleting to all four corners of the shape.

The new radius of the filleted corners of the shape appears in the **Corner Radii** box on the **Rectangle Editing** page.

- Click and drag the rotation handle to adjust the angle of the shape.



Drag the rotation handle clockwise to produce a positive value in the **Angle** box on the **Rectangle Editing** page.

Drag the rotation handle anti-clockwise to produce a negative value in the **Angle** box on the **Rectangle Editing** page.

- Move the $+$ cursor over the centre point of the shape until it changes to the \leftrightarrow cursor, then click and drag to adjust its position.

The new centre point of the shape appears in the **Centre Point's X** and **Y** boxes on the **Rectangle Editing** page.


To confirm the new shape shown in the **2D View** window and return to the **Assistant's** Home page:

- Click on the **Apply** button  and then the **Close** button  on the **Rectangle Editing** page.
- Click the right mouse button.

Creating a Circle



You can create a circular shaped vector object.

To create an exact circle:

1. Click on the **Create Circle** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Circle Creation** page.
2. Define the centre point of your circle:
 - Type values in the **Circle Centre's X** and **Y** boxes.

- Move the $+$ cursor to the point in the model you are interested in and click.


The X and Y co-ordinates of the point you click on appear in the **Circle Centre's X** and **Y** boxes.

3. Type a value in the **Circle Radius** box.
4. Click on the **Preview** button  to draw a preview image of the circle you are creating in the **2D View** window.
5. If you want to draw your circle and remain in **Circle Creation** mode:
 - Click on the **Create** button .



If you want to draw your circle and return to the **Assistant's** Home page:

- Click the right mouse button.

To create an approximate sized circle:

1. Move the $+$ cursor to the point in the model where you want to draw the circle.
2. Click and drag to create the size of circle you want.
3. Release the mouse button to draw a preview image of the circle you are creating in the **2D View** window.
4. If you want to draw your circle and remain in **Circle Creation** mode:
 - Click on the **Create** button .

If you want to draw your circle and return to the **Assistant's** Home page:

- Click the **Create** button  and then the **Close** button  on the **Circle Creation** page.
- Click the right mouse button.

Editing a Circle

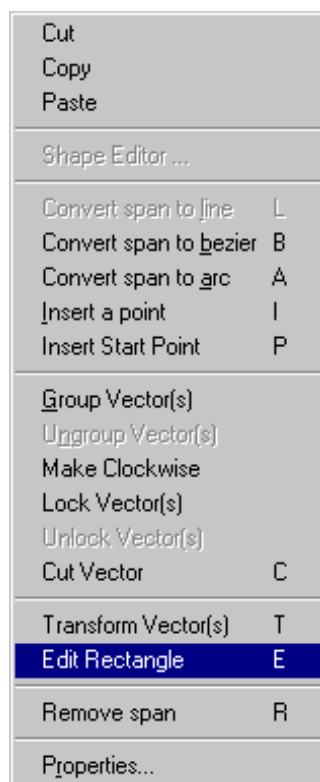
You can edit the radius and position of a circular shaped vector object.

To edit a circle:

1. Select the circle you want to edit in the open model.

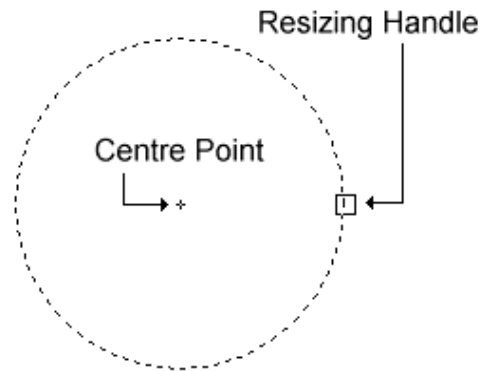
For details, see “Selecting Vectors” on page 151.


2. Right-click on the circle to display the **Vector Editing** menu:



3. Click on the **Edit Circle** option to display the **Circle Editing** page in the **Assistant** window.

The selected circle now appears as a preview image with a resizing handle positioned on its circumference:



Note: You can display the **Circle Editing** page in the **Assistant** window by selecting a circle, and pressing the **E** key  on your keyboard.

You can now change the size and position of the selected circle using the **Circle Editing** page in the **Assistant** window, or by manipulating the resizing handle and the centre point on the shape itself.

To edit the selected circle using the **Circle Editing** page in the **Assistant** window:

- Type a new value in the appropriate box for either of the shape's attributes that you want to adjust.

For example, typing a new value in the **Radius** box immediately increases or decreases the size of the selected circle.

You can edit the selected circle using the shape itself:

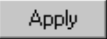

- Click and drag the resizing handle positioned on the circumference of the circle to adjust its radius.

The new radius of the circle appears in the **Radius** box on the **Circle Editing** page.

- Move the $+$ cursor over the centre point of the circle until it changes to the \leftrightarrow cursor, then click and drag to adjust its position.

The new centre point of the circle appears in the **Centre Point's X** and **Y** boxes on the **Circle Editing** page.


To confirm the new circle shown in the **2D View** window and return to the **Assistant's** Home page:

- Click on the **Apply** button  and then the **Close** button  on the **Circle Editing** page.
- Click the right mouse button.

Creating an Ellipse

You can create an elliptical shaped vector object.



To create an exact ellipse:

1. Click on the **Create Ellipse** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Ellipse Creation** page.
2. Define the centre point of your ellipse. To do so:
 - Type appropriate values in the **Start Point's X** and **Y** boxes.
 - Move the **+** cursor to the point in the model you are interested in and click.

The X and Y co-ordinates of the point you click on appear in the **Start Point's X** and **Y** boxes.

3. Type the height you want for the ellipse in the **Ellipse Height** box.
4. Type the width you want for the ellipse in the **Ellipse Width** box.
5. If you want your ellipse to be drawn at a specific angle, type a value in the **Angle** box.
 - Type a positive value in the **Angle** box to rotate the ellipse clockwise.
 - Type a negative value in the **Angle** box to rotate the ellipse anti-clockwise.


If you do not want your ellipse to be drawn at a specific angle, leave the default value of 0 in the **Angle** box.

6. Click on the **Preview** button  to draw a preview image of the circle you are creating in the **2D View** window.
7. If you want to draw your ellipse and remain in **Ellipse Creation** mode:
 - Click on the **Create** button .



If you want to draw your ellipse and return to the **Assistant's** Home page:

- Click the right mouse button.

To create an approximate sized ellipse:

1. Move the $+$ cursor to the point in the model where you want to draw the ellipse.
2. Click and drag to create the size of ellipse you want.
3. Release the mouse button to draw a preview image of the ellipse you are creating in the **2D View** window.
4. If you want to draw your ellipse and remain in **Ellipse Creation** mode:
 - Click on the **Create** button .

If you want to draw your ellipse and return to the **Assistant's** Home page:

- Click the **Create** button  and then the **Close** button  on the **Ellipse Creation** page.
- Click the right mouse button.

Editing an Ellipse

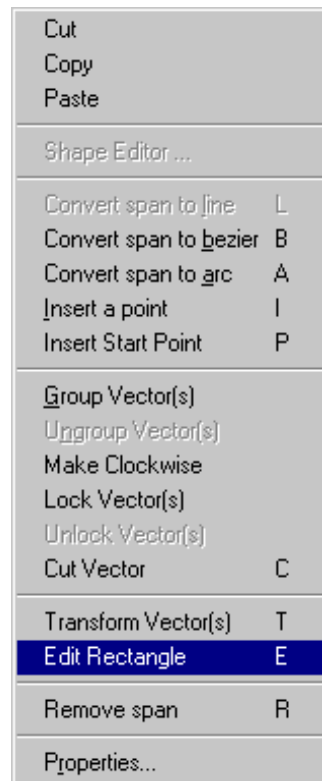
You can edit the size, position and/or angle of an elliptical shaped vector object.

To edit an ellipse:

1. Select the ellipse you want to edit in the open model.

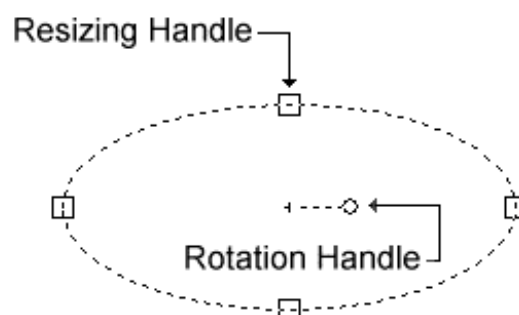
For details, see “Selecting Vectors” on page 151.


2. Right-click on the selected ellipse to display the **Vector Editing** menu:



3. Click on the **Edit Ellipse** option to display the **Ellipse Editing** page in the **Assistant** window.

The selected ellipse now appears as a preview image with resizing handles attached to it, and a rotation handle about its centre point:



Note: You can display the **Ellipse Editing** page in the **Assistant** window by selecting an ellipse, and pressing the **E** key  on your keyboard.

You can now change the size, position and/or angle of the selected ellipse using the **Ellipse Editing** page in the **Assistant** window, or by manipulating the handles on the ellipse itself.

To edit the selected ellipse using the **Ellipse Editing** page in the **Assistant** window:

- Type a new value in the appropriate box for each attribute of the ellipse that you want to adjust.

For example, typing a new value in the **Height** box immediately increases or decreases the height of the ellipse.

You can edit the selected ellipse using the shape itself:

- Click and drag any of the resizing handles to adjust the size of the ellipse.

The new height and width of the ellipse appears in the **Height** and **Width** boxes on the **Ellipse Editing** page.

- Click and drag the rotation handle to adjust the angle of the ellipse.

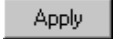

Drag the rotation handle clockwise to produce a positive value in the **Angle** box on the **Ellipse Editing** page.

Drag the rotation handle anti-clockwise to produce a negative value in the **Angle** box on the **Ellipse Editing** page.

- Move the **+** cursor over the centre point of the ellipse until it changes to the **↕** cursor, then click and drag to adjust its position.

The new centre point of the ellipse appears in the **Start Point's X** and **Y** boxes on the **Ellipse Editing** page.

To confirm the new ellipse shown in the **2D View** window and return to the **Assistant's** Home page:


- Click on the **Apply** button  and then the **Close** button  on the **Ellipse Editing** page.

- Click the right mouse button.

Creating a Polygon

You can create a vast range of polygonal shaped vector objects.

To create an exact polygon:

1. Click on the **Create Polygons** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Polygon Creation** page.
2. Type the number of sides you want in the polygon in the **Settings' No. of Sides** box.





Warning: A polygon must have a minimum number of three sides. Typing a value of 3 in the **Settings' No. of Sides** box produces a triangle.

3. If you want your polygon to be drawn at a specific angle, type a value in the **Settings' Angle** box.

- Type a positive value in the **Angle** box to rotate the polygon clockwise.
- Type a negative value in the **Angle** box to rotate the polygon anti-clockwise.

If you do not want your polygon to be drawn at a specific angle, leave the default value of 0 in the **Settings' Angle** box.


4. Define the centre point of your polygon. To do so:
 - Type values in the **Polygon Centre's X** and **Y** boxes.
 - Move the **+** cursor to the point in the model you are interested in and click.
The X and Y co-ordinates of the point you click on appear in the **Polygon Centre's X** and **Y** boxes.
5. Type a value in the **Geometry's Radius** box.

6. Click on the **Preview** button  to draw a preview image of the polygon you are creating in the **2D View** window.
7. If you want to draw your polygon and remain in **Polygon Creation** mode:
 - Click on the **Create** button .



If you want to draw your polygon and return to the **Assistant's** Home page:

- Click the right mouse button.

To create an approximate sized polygon:

1. Move the $+$ cursor to the point in the model where you want to draw the polygon.
2. Click and drag to create the size of polygon you want.
3. Release the mouse button to draw a preview image of the polygon you are creating in the **2D View** window.
4. If you want to draw your polygon and remain in **Polygon Creation** mode:
 - Click on the **Create** button .

If you want to draw your polygon and return to the **Assistant's** Home page:

- Click the **Create** button  and then the **Close** button  on the **Polygon Creation** page.
- Click the right mouse button.

Editing a Polygon

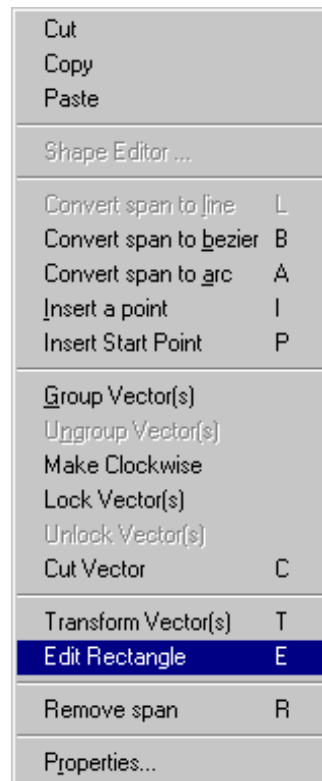
You can edit the size, position, sides and/or angle of a polygonal shaped vector object.

To edit a polygon:

1. Select the polygon you want to edit in the open model.

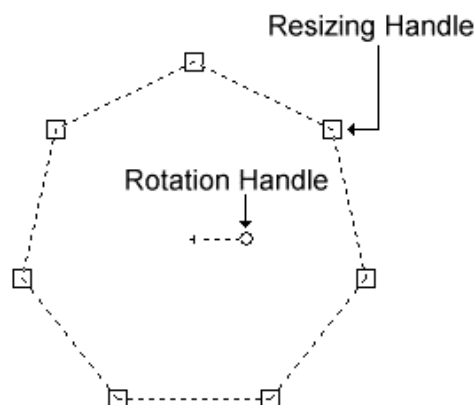
For details, see “Selecting Vectors” on page 151.

2. Right-click on the polygon to display the **Vector Editing** menu:




3. Click on the **Edit Polygon** option to display the **Polygon Editing** page in the **Assistant** window.

The polygon now appears as a preview image with resizing handles attached to it, and a rotation handle about its centre point:





Note: You can display the **Polygon Editing** page in the **Assistant** window by selecting a polygon, and pressing the **E** key  on your keyboard.

You can now change the size, position, sides and/or the angle of the selected polygon using the **Polygon Editing** page in the **Assistant** window, or by manipulating the handles on the polygon itself.

To edit the selected polygon using the **Polygon Editing** page in the **Assistant** window:

- Type a new value in the appropriate box for each attribute of the polygon that you want to adjust.

For example, typing a new value in the **No. of Sides** box immediately increases or decreases the number of sides in the selected polygon.

You can edit the selected polygon using the shape itself:

- Click and drag any of the resizing handles to adjust the size of the polygon.

The new size of the polygon appears in the **Geometry's Radius** box on the **Polygon Editing** page.

- Click and drag the rotation handle to adjust the angle of the polygon.



Drag the rotation handle clockwise to produce a positive value in the **Settings' Angle** box on the **Polygon Editing** page.

Drag the rotation handle anti-clockwise to produce a negative value in the **Settings' Angle** box on the **Polygon Editing** page.

- Move the $+$ cursor over the centre point of the polygon until it changes to the \leftrightarrow cursor, then click and drag to adjust its position.

The new centre point of the polygon appears in the **Polygon Centre's X** and **Y** boxes on the **Polygon Editing** page.


To confirm the new polygon shown in the **2D View** window and return to the **Assistant's** Home page:

- Click on the **Apply** button  and then the **Close** button  on the **Polygon Editing** page.
- Click the right mouse button.

Creating a Star

You can create a star shaped vector object.

To create an exact star:

1. Click on the **Create Star** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Star Creation** page.
2. Type the number of sides you want in the polygon in the **Settings' No. of Points** box.



Warning: A star must have a minimum number of three points.

3. If you want your star to be drawn at a specific angle, type a value in the **Settings' Angle** box.

- Type a positive value in the **Angle** box to rotate the star clockwise.
- Type a negative value in the **Angle** box to rotate the star anti-clockwise.

If you do not want your star to be drawn at a specific angle, leave the default value of 0 in the **Settings' Angle** box.

4. Define the centre point of your star. To do so:
 - Type values in the **Star Centre's X** and **Y** boxes.
 - Move the **+** cursor to the point in the model you are interested in and click.


The X and Y co-ordinates of the point you click on appear in the **Star Centre's X** and **Y** boxes.

5. Type a value in the **Geometry's Radius of first Points** box.

This sets the radius of a polygon, upon which the outer points (nodes) in the star lie.

6. Type a value in the **Geometry's Radius of second Points** box.

This sets the radius of a polygon, upon which the inner points (nodes) in the star lie.

7. Click on the **Preview** button  to draw a preview image of the star you are creating in the **2D View** window.

8. If you want to draw your star and remain in **Star Creation** mode:

- Click on the **Create** button .

If you want to draw your star and return to the **Assistant's** Home page:



- Click the right mouse button.

To create an approximate sized star:

1. Move the $+$ cursor to the point in the model where you want to draw the star.
2. Click and drag to create a polygon, upon which the outer points (nodes) in the star lie.
3. Click and drag to create a polygon, upon which the inner points (nodes) in the star lie.
4. Release the mouse button to draw a preview image of the star you are creating in the **2D View** window.
5. If you want to draw your star and remain in **Star Creation** mode:

- Click on the **Create** button .

If you want to draw your star and return to the **Assistant's** Home page:

- Click the **Create** button  and then the **Close** button  on the **Star Creation** page.
- Click the right mouse button.

Editing a Star

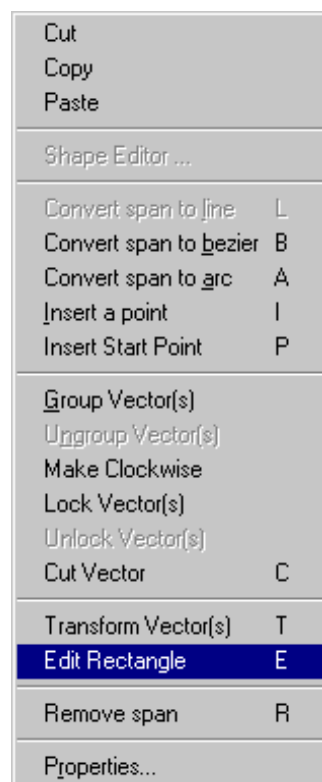
You can edit the size, position, sides and/or angle of a star shaped vector object.

To edit a star:

1. Select the star you want to edit in the open model.

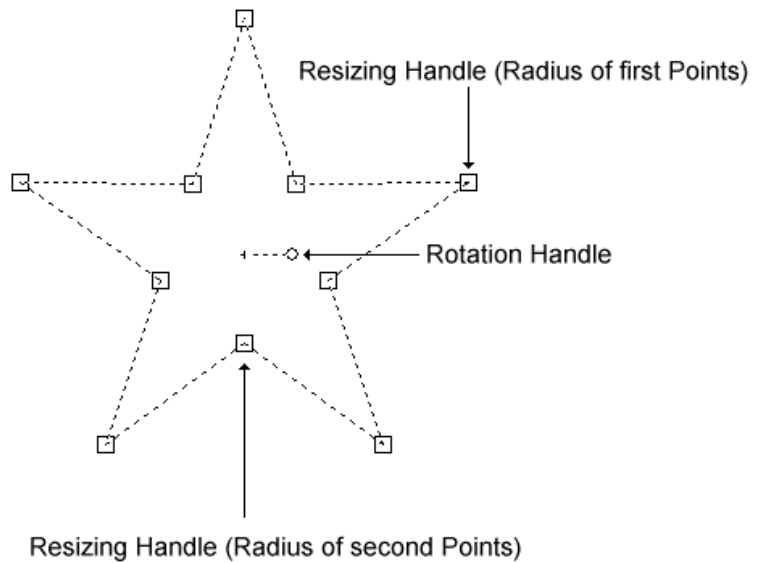
For details, see “Selecting Vectors” on page 151.


2. Right-click on the star to display the **Vector Editing** menu:



3. Click on the **Edit Star** option to display the **Star Editing** page in the **Assistant** window.

The star now appears as a preview image with resizing handles attached to it, and a rotation handle about its centre point:



Note: You can display the **Star Editing** page in the **Assistant** window by selecting a star, and pressing the **E** key  on your keyboard.

You can now change the size, position, sides and/or the angle of the selected star using the **Star Editing** page in the **Assistant** window, or by manipulating the handles on the star itself.

To edit the selected star using the **Star Editing** page in the **Assistant** window:

- Type a new value in the appropriate box for each attribute of the star that you want to adjust.
For example, typing a new value in the **No. of Sides** box immediately increases or decreases the number of sides in the selected star.

You can edit the selected star using the shape itself:

- Click and drag any of the inner or outer resizing handles to adjust the size and shape of the star.

The new size of the star appears in the **Geometry's Radius of first Points** and/or **Radius of second Points** boxes on the **Star Editing** page.

- Click and drag the rotation handle to adjust the angle of the star.



Drag the rotation handle clockwise to produce a positive value in the **Settings' Angle** box on the **Star Editing** page.

Drag the rotation handle anti-clockwise to produce a negative value in the **Settings' Angle** box on the **Star Editing** page.

- Move the $+$ cursor over the centre point of the star until it changes to the \leftrightarrow cursor, then click and drag to adjust its position.

The new centre point of the star appears in the **Star Centre's X** and **Y** boxes on the **Star Editing** page.

To confirm the new star shown in the **2D View** window and return to the **Assistant's** Home page:

- Click on the **Apply** button  and then the **Close** button  on the **Star Editing** page.
- Click the right mouse button.


Editing Vector Objects

You can edit any of the standard shapes of vector object in a model: square, rectangle, circle, ellipse, polygon and star.

You cannot edit any of the vector objects that you have:

- Created with the **Polyline Creation** tool.
For details, see “Creating a Polyline” on page 148.
- Imported directly into ArtCAM 2D.
For details, see “Importing Vector Files” in the Working With Models chapter.
- Created from a bitmap image using the **ArtTrace** tool.
For details, see “Converting a Bitmap into Vectors” in the ArtTrace chapter.

To edit any of the standard shapes of vector object, select the vector object, then either:


- Press the **E** key  on your keyboard.
- Right-click and select the **Edit** command relevant to the particular shape of vector object e.g. **Edit Ellipse**.

ArtCAM 2D displays the **Editing** page which is relevant to the selected shape of vector object e.g. **Ellipse Editing**.

You are then able to change the properties relating to the selected shape of vector object by modifying the appropriate values. For example, **Height**.

Copying and Pasting Vector Objects

There are three buttons in the **File** area of the **Assistant's** Home page that you can use to copy, paste and cut vector objects in an open model.



You can also create multiple copies of a vector object in two regular patterns using the **Block Copy / Rotate** button  in the **Vector Editing** area of the **Assistant's** Home page:


- Block copy.
- Rotate copy.

To copy, paste or cut a vector object:

1. Select the vector object(s) that you want to copy, paste or cut.


For details, see “Selecting Vectors” on page 151.

2. In the **File** area of the **Assistant's** Home page, click on the appropriate button:
 - If you want to remove the selected vector object and place it on the clipboard, click on the **Cut** button .
 - If you want to create a duplicate of the selected vector object and place it on the clipboard, click on the **Copy** button .

- If you want to place an identical vector object in the model, overlapping the original, click on the **Paste** button .



Note: If you click and drag around a vector object that you want to select and it has one or more copies overlapping it, the vector object turns red.

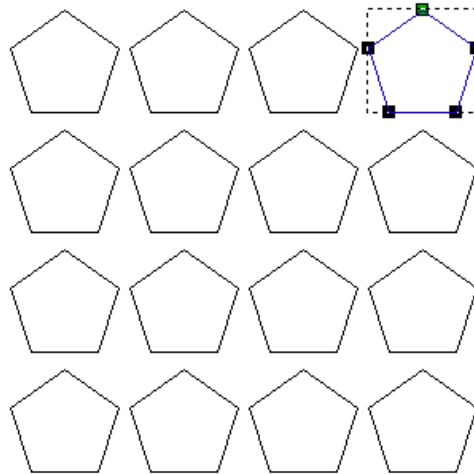
To move a pasted copy, move the cursor over the selected vector object until it changes to a , then click and drag into position.





Note: You can also cut, copy or paste a selected vector object by clicking on **Edit** in the Main menu bar, and then selecting the appropriate option.

Block Copy

You can produce several copies of a selected vector object in a grid format:



To make copies of a selected vector object in this way:

1. Select a vector object in the open model.
For details, see “Selecting Vectors” on page 151.
2. Click on the **Block Copy / Rotate** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Block and Rotate Copy** page.
3. Click on the **Block Copy** option to select it .



4. Type the distance you want to set between each copy along the X-axis in the **X Offset** box.

The values you type in Steps 4 and 5 set the distance between the bottom left corner of each subsequent copy of the vector object you produce.

You can set the distance you want between each copy using a positive or negative value.

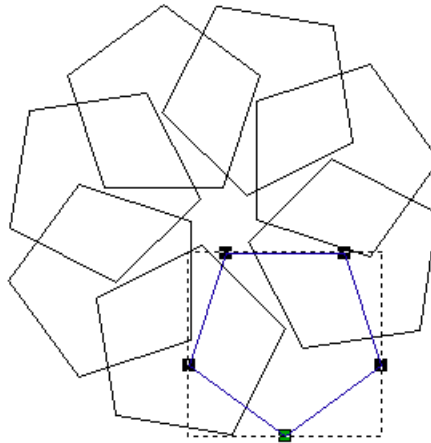
For example, if you want to create a block of copies to the right and above a selected vector object, type a positive value in the **X Offset** box e.g. 90.0.

If you want to create a block of copies to the left and below a selected vector object, type a positive value in the **X Offset** box e.g. -90.0.






5. Type the distance you want to set between each copy along the Y-axis in the **Y Offset** box.
6. Type a value in the **Number of Rows** box.
7. Type a value in the **Number of Columns** box.
8. Click on the **Apply** button  to create the block of copies in the model.
9. Click on the **Close** button  to return to the **Assistant's** Home page.

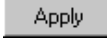

Rotate Copy

You can produce several copies of a selected vector object in a circular pattern using a user-defined rotation centre:



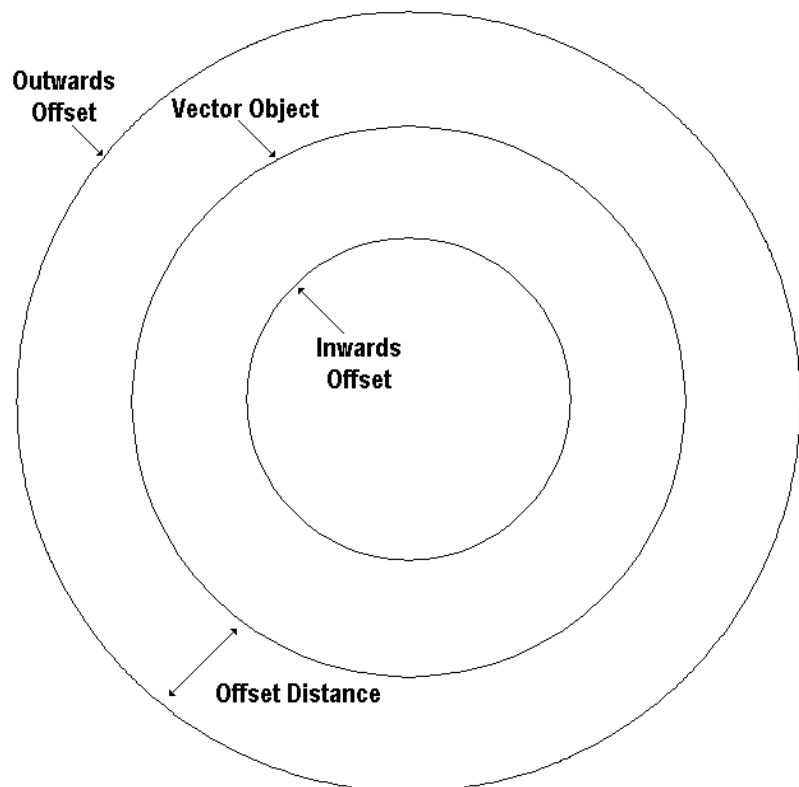
To make copies of a selected vector object in this way:

1. Select a vector object in the open model.
For details, see “Selecting Vectors” on page 151.
2. Click on the **Block Copy / Rotate** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Block and Rotate Copy** page.
3. Click on the **Rotate Copy** option to select it .
4. Define the point around which you want to rotate the selected vector object:
 - Type a value in both the **Rotation Centre X** and **Rotation Centre Y** boxes.
 - Click on the **Pick Centre with Mouse** option to select it , then move the  cursor over the point in the model you want to use as the origin for the rotation and click.
5. Click on the appropriate **Angle** radio button :
 - **Incremental** - To rotate each copy of the selected vector object by the specified angle in relation to its predecessor.
 - **Total** - To rotate each copy of the selected vector object by the specified angle.
6. Type an angle of rotation in the **degrees** box:
 - Type a positive value in the **degrees** box to rotate the vector object clockwise.


- Type a negative value in the **degrees** box to rotate the vector object anti-clockwise.
7. Type the number of copies you want to make in the **Number of Objects** box.
 8. Click on the **Apply** button  to create the circular pattern of copies in the model.
 9. Click on the **Close** button  to return to the **Assistant's** Home page.

Offsetting Vector Objects

You can create an offset vector from any of the vector objects already drawn in a model:



To create an offset vector from a vector object:



1. Select the vector object from which you want to create an offset vector.
For details, see “Selecting Vectors” on page 151.
2. Click on the **Offset Vector(s)** button  in the **Vector Editing** area of the **Assistant's**

Home page to display the **Offset Vector(s)** page.

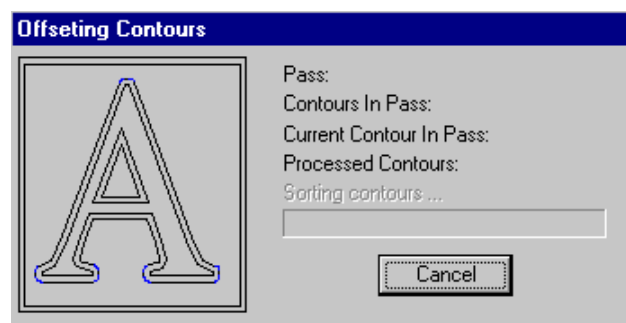
3. Type a value in the **Offset Distance** box to determine the distance between the selected vector object and the offset vector.

This value is defined according to the units of measurement you had originally selected in the **Setup Job Dimensions** dialog box (millimetres or inches).

For details, see “Creating a Model” in the Working With Models chapter.

4. Click on the appropriate **Offset Direction** radio button  to set the position of the offset vector:
 - Select **Inwards** if you want the offset vector drawn within the selected vector object.
 - Select **Outwards** if you want the offset vector drawn outside of the selected vector object.
5. Click on the **Offset** button  to draw the offset vector in the model.

The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the position of the offset vector:



Note: You may not see the **Offsetting Contours** dialog box if you are creating an offset vector from a simple shape of vector object. For example, a circle.

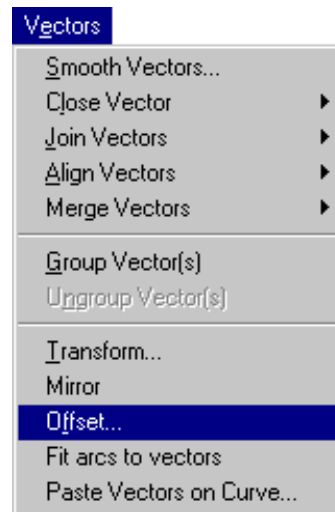
6. Click on the **Close** button  to return to the **Assistant's** Home page.

You can also display the **Offset Vector(s)** page in the **Assistant** window if you:

1. Select the vector object from which you want to create an offset vector.

For details, see “Selecting Vectors” on page 151.

2. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then on the **Offset...** option:

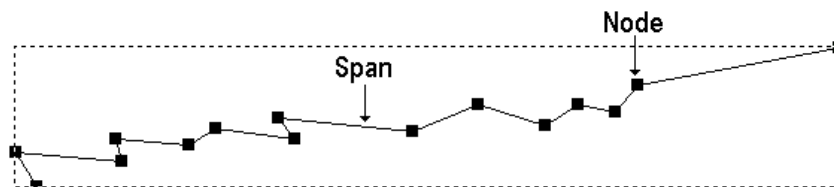


Smoothing Vector Objects

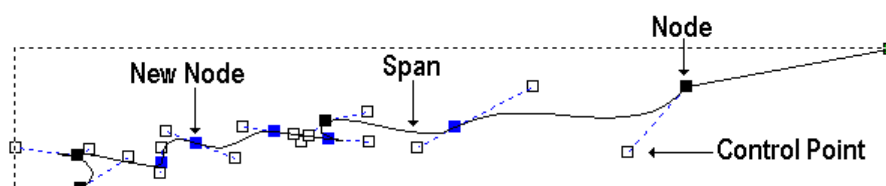
You can smooth an ungrouped vector object by converting each of its linear and/or arc spans to bezier curve spans.

For example, a polyline made up entirely of linear spans changes considerably when smoothed:

Before...



After...




Smoothing automatically replaces all of the linear and arc spans within a selected vector object with bezier curve spans.

For details, see “Editing Vector Spans” on page 154.


To smooth a vector object:

1. Select the vector object that you want to smooth.

For details, see “Selecting Vectors” on page 151.

2. Click on the **Smooth Vectors** button  in the **Vector Editing** area of the **Assistant’s** Home page to open the **Smooth Vectors** page in the **Assistant** window.

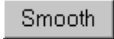

The number of spans (lines, bezier curves and arcs), points (nodes) and control points that make up the selected vector object is automatically displayed in the **Selected Vectors Information** area of the **Smooth Vectors** page.

3. Type a value in the **Tolerance** box to specify how closely you want the bezier curve spans to follow the points (nodes) in the selected vector object(s).
4. Click on the radio button  you want to use:
 - Select **Ignore Straight Spans** to fit bezier curve spans between all points (nodes) in the selected vector object(s).
 - Select **Preserve Straight Spans** to fit bezier curve spans between all points (nodes) in the selected vector object(s),

except where linear spans are of the length you type in the **Keep lines longer than** box.

This value is defined according to the units of measurement you had selected in the **Setup Job Dimensions** dialog box (millimetres or inches) when creating the model.

For details, see “Creating a Model” in the Working With Models chapter.

5. Click on the **Smooth** button  to smooth the selected vector object(s).
6. Click on the **Close** button  to return to the **Assistant's** Home page.

New points (nodes) and control points appear on the smoothed vector object(s). These can be used to manipulate the shape of the vector object(s) further.

For details, see “Editing Vector Spans” on page 154 and “Editing Vector Nodes” on page 162.

You can also display the **Smooth Vectors** page in the **Assistant** window if you:

1. Select the vector object that you want to smooth.
For details, see “Selecting Vectors” on page 151.
2. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then on the **Smooth Vectors...** option:



Restoring the Original Shape of a Smoothed Vector

You can restore the original shape of a smoothed vector object.

To restore the original shape of a smoothed vector object:

- Click on the **Edit** option in the Main menu to display the **Edit** menu, then click on the **Undo Spline Vectors** option:



- Press the **Ctrl**  and **Z**  keys simultaneously on your keyboard.

Locking and Unlocking Vector Objects

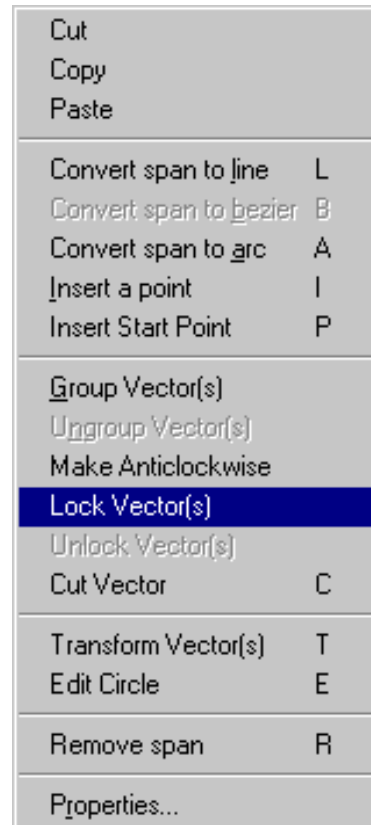
You can prevent a vector object from being moved to a different position in a model by locking it.

To do so:

1. Select the vector object that you want to lock into position.

For details, see “Selecting Vectors” on page 151.

2. Right-click to open the **Vector Editing** menu, then select the **Lock Vector(s)** option:



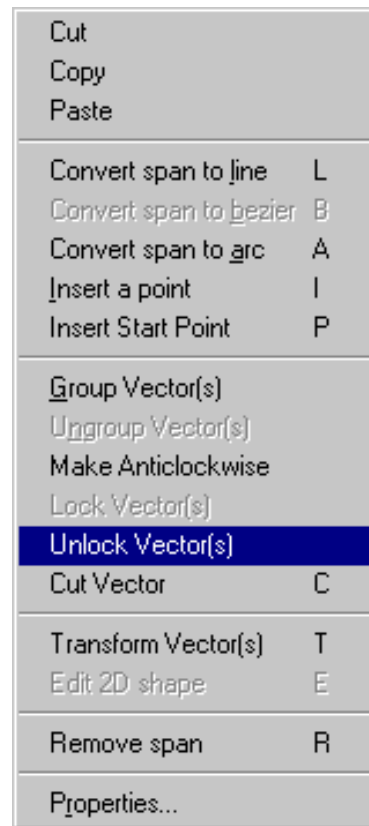
The selected vector object turns grey.

If you want to move any vector object that has previously been locked into position:

1. Select the locked vector object that you want to move.

For details, see “Selecting Vectors” on page 151.

2. Right-click to open the **Vector Editing** menu, then select the **Unlock Vector(s)** option:



The selected vector object turns black if it is an open vector object, blue if it is a closed vector object with a clockwise direction of geometry, or green if it is a closed vector object with an anti-clockwise direction of geometry.

Fitting Arcs to Vector Objects


You can automatically replace all of a selected vector object's bezier curve spans with a series of arc spans whilst maintaining its original shape.

For details, see “Editing Vector Spans” on page 154.

To do so:

1. Select the vector object(s) that you want to fit arc spans to.


For details, see “Selecting Vectors” on page 151.

2. Click on the **Arc Fit Vectors** button  in the **Vector Editing** area of the **Assistant's** Home page to open the **Fit Arcs To Vectors** page in the **Assistant** window.

The number of spans (linear, bezier curve and arc) points (nodes) and control points in the selected vector object is automatically displayed in the **Selected Vectors Information** area of the **Fit Arcs To Vectors** page.



Note: The points (nodes) and control points in a selected vector object are grouped together under **Points** in the **Selected Vectors Information** area of the page.

3. Type a value in the **Tolerance** box specifying how closely you want the arc spans to follow the original shape of the bezier curve spans in the selected vector object(s).
4. Click on the **Fit Arcs** button  to convert all bezier curve spans in the selected vector object(s) to a series of arc spans.

The new number of spans (linear, bezier curve and arc), points (nodes) and control points in the selected vector object(s) is automatically displayed in the **Selected Vectors Information** area of the **Fit Arcs To Vectors** page.



Note: If a bezier curve span in the selected vector object has no curvature, it is automatically converted to a linear span.

5. Click on the **Close** button  to return to the **Assistant's** Home page

New points (nodes) and control points appear on the selected vector object(s). These can be used to manipulate the shape of the vector object(s) further.

For details, see “Editing Vector Spans” on page 154 and “Editing Vector Nodes” on page 162.

You can also display the **Fit Arcs To Vectors** page in the **Assistant** window if you:

1. Select the vector object(s) that you want to fit arcs to.

For details, see “Selecting Vectors” on page 151.





2. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then on the **Fit arcs to vectors** option:





Pasting Vectors Along a Curve

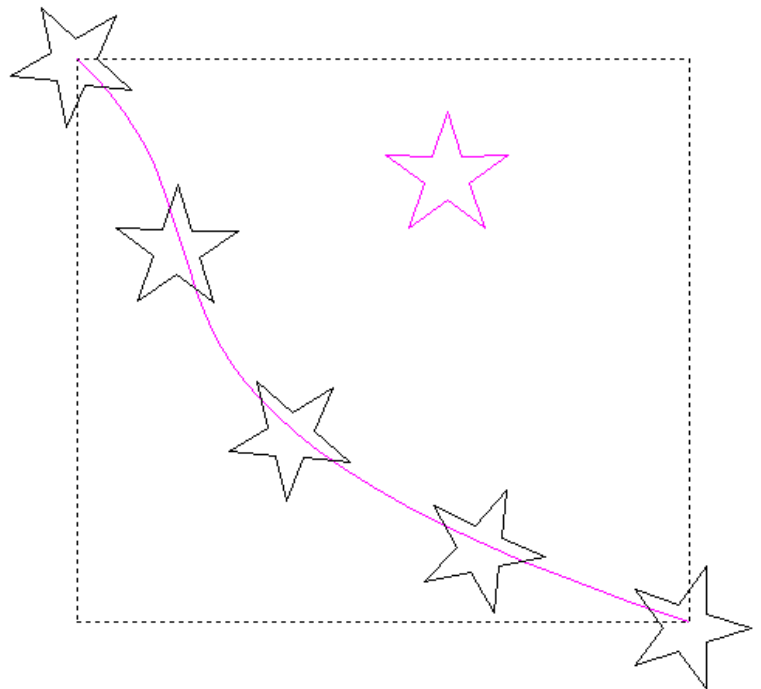
You can paste copies of a selected vector object along another curved vector object within a model.

To do so:

1. Hold the **Shift** key  on your keyboard, and then click on the vector object that you want to copy and paste, followed by the curved vector object that you want to paste these copies along.
The selected vector objects turn magenta.
2. Click on the **Paste Along A Curve** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Paste Along A Curve** page.
3. Select the pasting method that you want to use:
 - Click on the **Specify Number** radio button , then type a value in the **Number of Copies** box.
 - Click on the **Specify Distance** radio button , then type a value in the **Distance Between Copies** box.


4. If you want to make the spacing between the copies even, click on the **Make Spacing Even** option to turn it on .
5. Click on the **Paste** button  to produce the copies along the selected curved vector object.

For example, the following image shows five copies of a star shaped vector object pasted evenly along a curved vector object:



6. Click on the **Close** button  to return to the **Assistant's** Home page.



You can also display the **Paste Along A Curve** page in the **Assistant** window if you:

1. Hold the **Shift** key  on your keyboard, and then click on the vector object that you want to copy and paste, followed by the curved vector object that you want to paste these copies along.
For details, see “Selecting Vectors” on page 151.
2. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then on the **Paste Vectors on Curve...** option:



Working with Vector Text


You can create and manipulate vector text automatically with two simple tools in the **Vector Editing** area of the **Assistant's** Home page. These are:

- The **Create Vector Text** button .
- The **Wrap Text round a Curve** button .

Creating Vector Text

You can create vector text within your model with ease. Creating vector text in ArtCAM 2D is similar to typing text in most word processing packages.

To create vector text:

1. Click on the **Create Vector Text** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text Tool** page.
2. Select the font that you want to type in from the **Font** list box.

The **Font** list box displays all the fonts that are available; both installed TrueType fonts as well as resident printer fonts.

A preview of the selected font appears in the **Sample** area of the **Text Tool** page.

3. Select the appropriate language script option for your computer from the **Script** list box. For example, Western.


The **Script** list box displays the available language scripts for the font you have selected.


4. Type an appropriate size for the vector text in the **Size** box.

You can select the unit of measurement that you want to use from the list box to the right.

5. Type the angle at which you want the vector text to be written in the **Angle** box.



6. Type the amount of space you want between each character in the **Spacing** box.

7. Move the  cursor over to the **2D View** window and click where you want to create the vector text in your model.

A text box appears in the **2D View** window and the mouse cursor changes to a cross .




8. Type the vector text you want to create.

It is useful to remember the following keystrokes when typing in vector text:

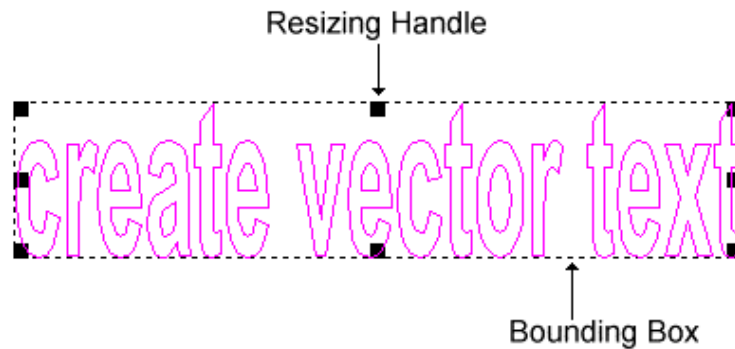
- Press the **Enter** key  on your keyboard to start a new line of vector text.
- Press the **Backspace** key  on your keyboard to delete vector text.

9. Make sure that the vector text is formatted in the way that you want.

For details, see “Formatting Vector Text” on page 210.

10. Click on the **Done** button  or press both the **Ctrl**  and **Enter**  keys on your keyboard at the same time to create the vector text in your model and return to the **Assistant's** Home page.

The vector text is magenta, indicating that the closed vector objects that make up the text are grouped. A bounding box with resizing handles also surrounds it:




You can scale a block of vector text if you move the cursor over any of the resizing handles adjoined to the bounding box, then click and drag in the appropriate direction.

You can move a block of vector text if you move the cursor over it, then click and drag it into the appropriate position.

Selecting Vector Text

You can select vector text both during and after you have created it.

You can select vector text when the **Text Tool** page is displayed in the **Assistant** window if you:

- Click and drag over the character or block of vector text that you want to select.
- Hold the **Shift** key  on your keyboard, and then use the arrow keys to control your selection.

The selected vector text is white and is highlighted in black:








Note: If you select a block of vector text containing more than one style of font and/or formatting, the relevant list box appears as blank.

When you have created the vector text, you can select it using the method described in “Selecting Vectors” on page 151.


Editing Vector Text

Text editing refers to making changes in vector text, such as adding and deleting, or copying and pasting individual characters or blocks of vector text.

You can cut, copy and paste a character or block of vector text both during and after its creation using the editing buttons in the **Settings** area of the **Text Tool** page:

- Click on the **Cut** button  to remove the selected vector text and place it on the clipboard.
- Click on the **Copy** button  to create a duplicate of the selected vector text and place it on the clipboard.
- Click on the **Paste** button  to place an identical copy of the copied vector text, overlapping the original.




Note: If you copy a block of vector text that contains multiple fonts, when you use the **Paste** button  the block is written in the currently selected font only.

You can cut, copy and/or paste a block of vector text after it has been created using the editing buttons in the **Vector Editing** area of the **Assistant**'s Home page.

For details, see “Copying and Pasting Vector Objects” on page 189.

You can add or delete characters during their creation using your keyboard:

- Use the character keys on your keyboard to add characters to a block of vector text.
- Press the **Backspace** key  on your keyboard to delete vector text.

You can delete a selected block of vector text after it has been created if you:

- Press the **Delete** key  on your keyboard.

Editing in Text Creation Mode

Text creation mode refers to when the **Text Tool** page is displayed in the **Assistant** window.

To edit a character or block of vector text during text creation mode:

1. Select the vector text that you want to edit.
For details, see “Selecting Vector Text” on page 206.
2. Click on the appropriate editing button in the **Settings** area of the **Text Tool** page, or use the appropriate keys on your keyboard.
For details, see “Editing Vector Text” on page 207.

Editing Created Vector Text


Vector text is created when you close the **Text Tool** page and return to the **Assistant**’s Home page.

For details, see “Creating Vector Text” on page 204.

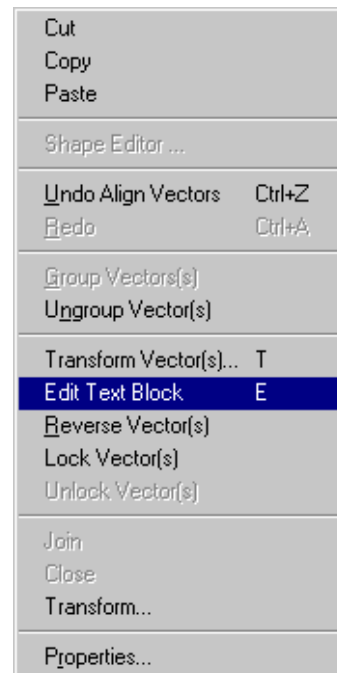
To edit a character or block of vector text after you have created it:

1. Select the block of vector text that you want to edit.
For details, see “Selecting Vectors” on page 151.




Note: You can now use the **Delete** key  on your keyboard if you want to delete the selected block of vector text.

2. Right-click on the block of vector text to display the **Text Editing** menu:



3. Click on the **Edit Text Block** option to display the **Text Tool** page in the **Assistant** window.



Note: You can display the **Text Tool** page in the **Assistant** window by selecting a block of vector text, and pressing the **E** key  on your keyboard.

4. Select the vector text that you want to edit.

For details, see “Selecting Vector Text” on page 206.



Note: A selected block of vector text that has been transformed, e.g. sheared, appears as a default block whilst the **Text Tool** page is displayed. After closing the page, the transform is restored and is also applied to the changes you have made to the block of vector text.

5. Click on the appropriate editing button in the **Settings** area of the **Text Tool** page or press the appropriate keys on your keyboard.

For details, see “Editing Vector Text” on page 207.






6. Click on the **Done** button  to return to the **Assistant's** Home page.



Formatting Vector Text

Text formatting refers to setting up the way a character or block of vector text looks by using commands to set the fonts, bold or italic type, indents and alignments.

You can format a character or block of vector text both during and after its creation using the formatting buttons in the **Settings** area of the **Text Tool** page and the boxes on the page:

You can use the formatting buttons as follows:

- Click on the **Bold** button  to make the vector text bold.
If you have selected vector text that is already bold, click on the **Bold** button to remove the bold formatting.
- Click on the **Italic** button  to make the vector text italic.
If you have selected vector text that is already italic, click on the **Italic** button to remove the italic formatting.
- Click on the **Align Left** button  to align the selected vector text to the left of the text box with a ragged right edge.
This button only affects a block of vector text containing more than one line of text.
- Click on the **Align Right** button  to align the selected vector text to the right of the text box with a ragged left edge.
This button only affects a block of vector text containing more than one line of text.
- Click on the **Centred** button  to place the selected vector text in the centre of the text box.
This button only affects a block of vector text containing more than one line of text.

- Click on the **Decrease Indent** button  to indent the selected vector text to the left by one character width of the font in use.
- Click on the **Increase Indent** button  to indent the selected vector text to the right by one character width of the font in use.

To change the font you are using:

- Click on the **Font** list box, and then click on the font that you want to use.

To change the size of the font you are using:

- Type the appropriate value in the **Size** box.
You can also change the unit of measurement that you want to use by clicking on the appropriate option from the list box to the right.

To change the script you are using:

- Click on the **Script** list box, and then click on the script that you want to use.

To adjust the angle of a character or block of vector text:

- Type the angle you want to position the vector text at in the **Angle** box.

For example, setting the angle at 45° places each character in a block of vector text as follows:



To adjust the amount of white space on either side of a character in a block of vector text:

- Type the distance you want to place between each character in the **Character** box.

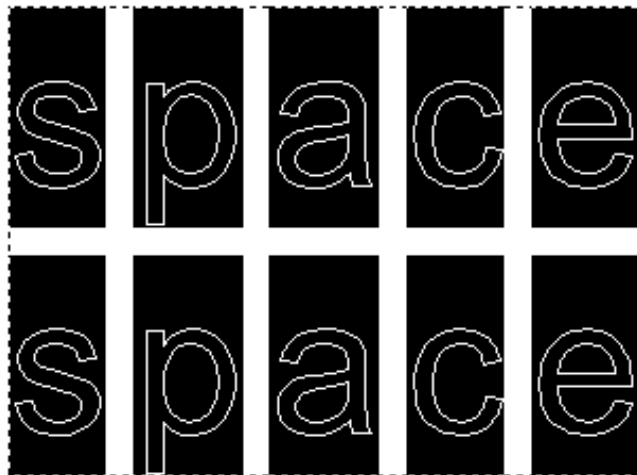
For example, setting the **Character** kerning to 10 mm separates each character in a block of vector text as follows:



To adjust amount of white space on either side of a line in a block of vector text:

- Type the distance you want to place between each line in the **Line** box.

For example, setting the **Line** kerning to 10 mm separates each line in a block of vector text as follows:



Formatting in Text Creation Mode

Text creation mode refers to when the **Text Tool** page is displayed in the **Assistant** window.

When you are in text creation mode you can format vector text before and after you type using your keyboard.

To format a character before you type it:

1. Click on the appropriate formatting button in the **Settings** area of the **Text Tool** page or type a value in the relevant box, and then type.

To format a character or block of vector text after you have typed it:

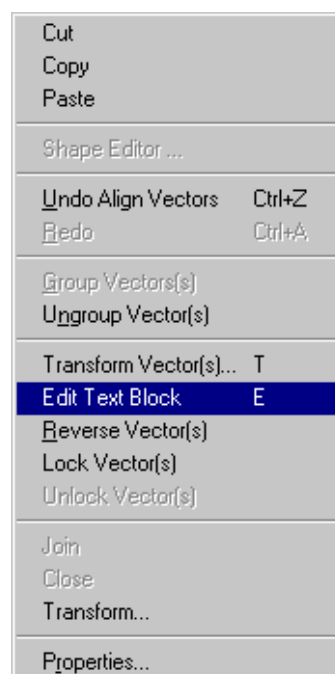
1. Select the vector text that you want to format.
For details, see “Selecting Vector Text” on page 206.
2. Click on the appropriate formatting button in the **Settings** area of the **Text Tool** page or type a value in the relevant box, and then type.

Formatting Created Vector Text

Vector text is created when you close the **Text Tool** page and return to the **Assistant**’s Home page.


To format a character or block of vector text after you have created it:

1. Select the block of vector text that you want to format.
For details, see “Selecting Vectors” on page 151.
2. Right-click on the block of vector text to display the **Text Editing** menu:



3. Click on the **Edit Text Block** option to display the **Text Tool** page in the **Assistant** window.




Note: You can display the **Text Tool** page in the **Assistant** window by selecting a block of vector text, and pressing the **E** key  on your keyboard.

4. Select the character or block of vector text that you want to format.

For details, see “Selecting Vector Text” on page 206.



Note: A selected block of vector text that has been transformed, e.g. sheared, appears as a default block whilst the **Text Tool** page is displayed. After closing the page, the transform is restored and is also applied to the changes you have made to the block of vector text.

5. Click on the appropriate formatting button in the **Settings** area of the **Text Tool** page or adjust the settings in the relevant box.
6. Click on the **Done** button  to return to the **Assistant**'s Home page.

Wrapping Text round a Curve

ArtCAM 2D allows you to place vector text on or around any open or closed curved vector object automatically, providing for improved kerning (the amount of white space on either side of a character).

Before you can wrap a block of vector text around a curve, you must create both a curved vector shape and some vector text.


To wrap vector text around a curved vector object in a model:

1. Click on the curved vector object around which you want to wrap a block of vector text.

For details, see “Selecting Vectors” on page 151.

2. Hold the **Shift** key  on your keyboard and then click on the block of vector text.

Both the curved vector object and block of vector text turn magenta, surrounded by a bounding box.

3. Click on the **Wrap Text Round a Curve** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text on a Curve** page.

You can now position the active block of vector text as follows:


- Move the cursor over the block of vector text, then click and drag it along the curved vector object.
- Use the **Text Settings** on the **Text on a Curve** page.


For details, see “Using the Text Settings” on page 215.

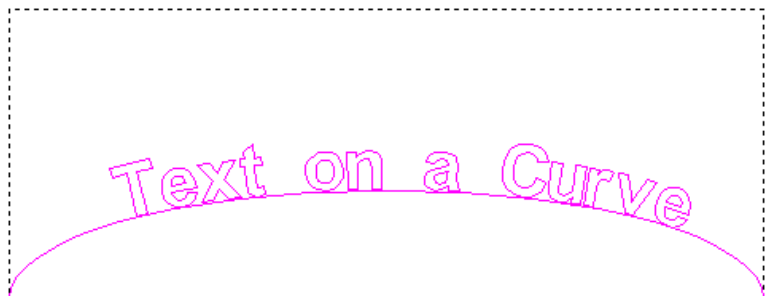
Using the Text Settings


You can select the text position, alignment and spacing using the options in the **Text Settings** area of the **Text on a Curve** page.

Text Position


You can position a block of vector text on a curved vector object in a number of ways using the six **Text Position** radio buttons  on the **Text on a Curve** page:

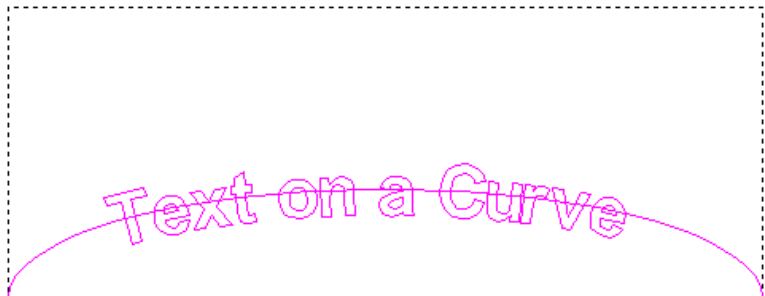
- **Above Line** - Click on this radio button  to position the block of vector text above the curved vector object:




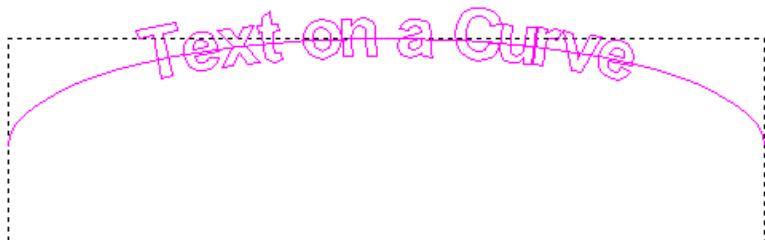
- **Base Line** - Click on this radio button  to position the block of vector text directly on the curved vector object:




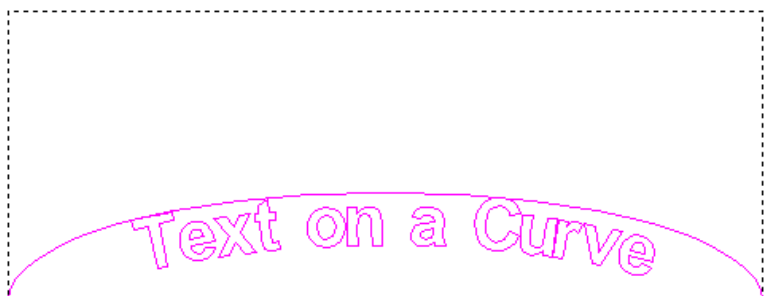
- **Centre On Ascent** - Click on this radio button  to position the block of vector text about the ascending part of the characters in the block:




- **Centre On Strikeout** - Click on this radio button  to position the block of vector text so that the curved vector object is used as a line, or strikeout, which runs through the middle of the vector text:



- **Below Line** - Click on this radio button  to position the block of vector text below the curved vector object:



- **Specify** - Click on this radio button  to position the block of vector text about the

curved vector object, according to the positive or negative value you type in the box.

Click on the **Apply** button  to view the specified position.

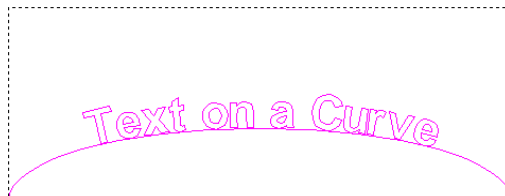
For example, typing a value of -50 mm in the box produces the following result:



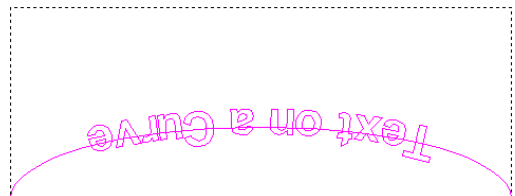
You can also reverse the direction of the curved vector object if you turn on the **Text on other side** option .

If you turn this option on, the block of vector text is written as shown in the example below:


Text on other side Off...




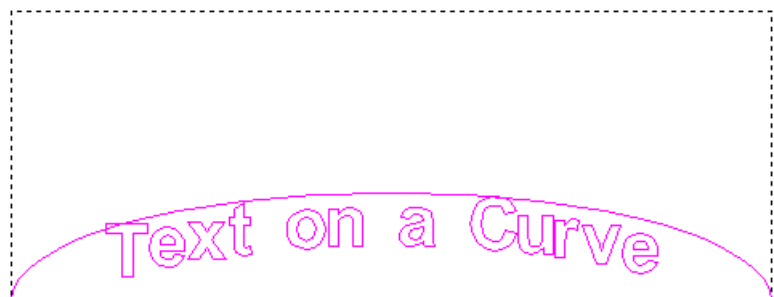
Text on other side On...




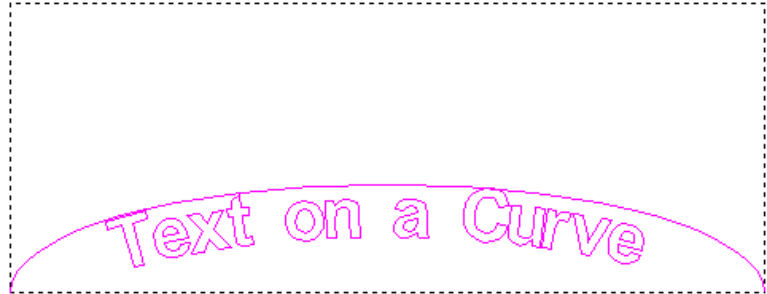
Text Alignment

You can align a block of vector text on a curved vector object using either of the **Text Alignment** radio buttons  on the **Text on a Curve** page:

- **Vertical** - Click on this radio button  to align all letters in the block of vector text vertical to the curved vector object:

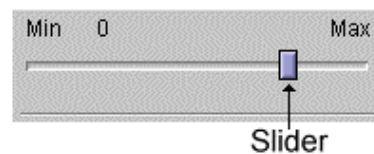


- **Align To Curve** - The default setting, click on this radio button  to align all letters in the block of vector text perpendicular to the curved vector object:



Text Spacing

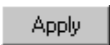
You can change the distance between characters within a block of vector text by using the **Text Spacing** slider:



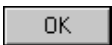
- Move the cursor over the slider, then click and drag to either increase or reduce the spacing.

Drag to the right if you want to increase the spacing. Drag to the left if you want to reduce it.

To preview your spacing adjustments:



- Click on the **Apply** button  at the bottom of the page.

When you are satisfied with the spacing between the individual characters in the block of vector text:


- Click on the **OK** button  at the bottom of the page.


Editing Style

You can adjust the position of individual characters or specific words in a block of vector text in different ways by selecting from the range of **Editing Style** options:


- **Whole Sentence** - Click on the radio button , move the cursor over the block of vector text, then click and drag the entire sentence into the desired position on the curved vector object.
- **Single Words** - Click on the radio button , move the cursor over a specific word in the block of vector text, then click and drag the word into the desired position on the curved vector object.



Note: Instead of selecting **Single Words** from the **Editing Style** menu, you can press and hold the **Ctrl** key  on your keyboard, and then click and drag a specific word into place on the curved vector object.


- **Single Letters** - Click on the radio button , move the cursor over a specific character in the block of vector text, then click and drag the character into the desired position on the curved vector object.



Note: Instead of selecting **Single Letters** from the **Editing Style** menu, you can press and hold the **Alt** key  on your keyboard, and then click and drag a specific character into place on the curved vector object.

Measuring Vector Objects


You can calculate the size, position and angle of any vector object in an open model as follows:

1. Click on the **Measure Tool** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Measure** page.
2. Click on the point in the model that you want to measure from.
This point is known as the **Anchor Point**.
3. Drag the mouse to the point you want to measure to and click.

Both the **Distance** and **Angle** between the current and anchor points are calculated and displayed on the **Measure** page.

ArtCAM 2D calculates the measurement details in real time. This means that you can view the calculated values on the **Measure** page as you are dragging the cursor into position.

By default, the cursor snaps to points (nodes) in vector objects. This is indicated by the $+$ cursor changing to a \oplus cursor when over points (nodes).

To disable snapping, press the **Shift** key  whilst dragging the cursor into position.

Transforming Vector Objects

ArtCAM 2D provides a number of options that allow you to transform a selected vector object in different ways.

You can:

- Change the size of a vector object by scaling it.
Move a vector object to a specific position.
- Rotate a vector object.
- Shear a vector object.

All of these transform options are available when the **Transform Vector(s)** page is displayed in the **Assistant** window.


To display the **Transform Vector(s)** page in the **Assistant** window:

1. Select the vector object that you want to transform.

For details, see “Selecting Vectors” on page 151.

2. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page in the **Assistant** window.



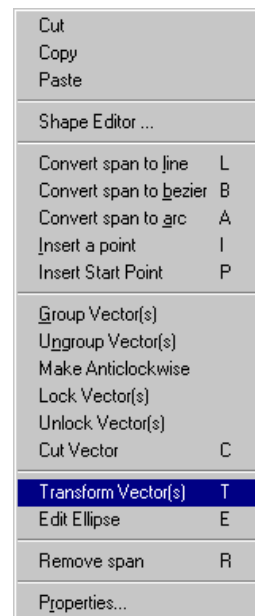
Note: You can also click on a vector object and press the **T** key  on your keyboard to display the **Transform Vector(s)** page in the **Assistant** window.

Alternatively, you can display the **Transform Vector(s)** page in the **Assistant** window if you:

1. Select the vector object that you want to transform.

For details, see “Selecting Vectors” on page 151.

2. Right-click on the vector object to display the **Vector Editing** menu:



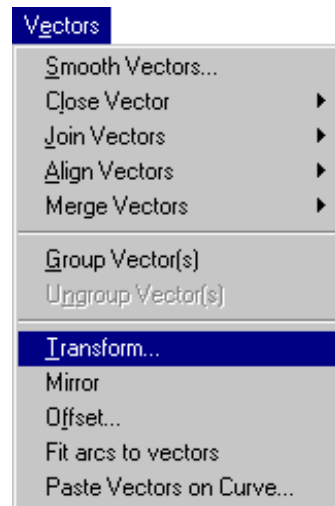
3. Click on the **Transform Vectors** option.

Finally, you can also display the **Transform Vector(s)** page in the **Assistant** window if you:

1. Select the vector object that you want to transform.

For details, see “Selecting Vectors” on page 151.

2. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then click on the **Transform...** option:



The **Transform Vector(s)** page is divided into four areas:

- **Size** - This option allows you to change the size of the selected vector object.
For details, see “Scaling Vectors” on page 222.
- **Position and Origin** - This option allows you to move a selected vector object to a specific point in a model.
For details, see “Moving Vectors” on page 224.
- **Rotate** - This option enables you to spin a selected vector object around the model’s X and Y-axes.
For details, see “Rotating Vectors” on page 225.
- **Shear** - This option enables you to shear a selected vector object.
For details, see “Shearing Vectors” on page 226.

Scaling Vectors

You can change the size of a vector object in two ways using the **Size** area of the **Transform Vector(s)** page:

- Using specific measurements.
- Using the slider.

To change the size of a vector object using specific measurements:

1. Select the vector object that you want to change the size of.

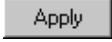

For details, see “Selecting Vectors” on page 151.

2. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page in the **Assistant** window.

The values displayed beneath the slider in the **Size** area of the **Transform Vector(s)** page indicate the current height and width of the selected vector object.

3. Type a value in the **New Width** box.
4. Type a value in the **New Height** box.


A preview image of the new size of the selected vector object appears in the **2D View** window.

5. Click on the **Apply** button  at the bottom of the page to resize the selected vector object.
6. Click on the **OK** button  to return to the **Assistant's** Home page.


To change the size of a vector object using the slider:

1. Select the vector object that you want to change the size of.

For details, see “Selecting Vectors” on page 151.

2. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page in the **Assistant** window.

The values shown beneath the slider show the current height and width of the selected vector object.



3. Click on the **Link Width and Height** option  to preserve the ratio between the width and height of the selected vector object.
4. Click and drag the slider in the appropriate direction.

- Drag to the right if you want to increase the size of the selected vector object.
- Drag to the left if you want to reduce the size of the selected vector object.



Note: If you drag the slider without turning the **Link Width and Height** option on ☐, only the value in the **New Width** box changes.

A preview image of the new size of the selected vector object appears in the **2D View** window.

5. Click on the **Apply** button  at the bottom of the page to confirm the new size of the selected vector object.
6. Click on the **OK** button  to return to the **Assistant's** Home page.

Moving Vectors

You can change the position of a vector object relative to a defined origin using the **Position and Origin** area of the **Transform Vector(s)** page:


To adjust the position of a vector object:

1. Select the vector object that you want to change the position of.


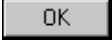
For details, see “Selecting Vectors” on page 151.

2. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page in the **Assistant** window.

The values in the **X** and **Y** boxes show the current position of the selected vector object.

3. Click on the appropriate radio button  to define the origin about which you want to move the selected vector object.

The co-ordinates of the origin you select appear in the **X** and **Y** boxes.




4. Type the co-ordinate you want to move the X-origin of the selected vector object to in the **X** box.
5. Type the co-ordinate you want to move the Y-origin of the selected vector object to in the **Y** box.
6. Click on the **Apply** button  at the bottom of the page to reposition the selected vector object.
7. Click on the **OK** button  to return to the **Assistant's** Home page.

Rotating Vectors

You can rotate a vector object in two ways using the **Rotate** area of the **Transform Vector(s)** page:

- Using a specific angle.
- Using the slider.

To rotate a vector object using a specific angle:

1. Select the vector object that you want to rotate.
For details, see “Selecting Vectors” on page 151.
2. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page in the **Assistant** window.
3. Type the angle by which you want to rotate the selected vector object in the **Rotate** box:
 - A positive value rotates the selected vector object clockwise.
 - A negative value rotates the selected vector object anti-clockwise.
4. Click on the **Apply** button  to confirm the new angle of the selected vector object.
5. Click on the **OK** button  to return to the **Assistant's** Home page.



To rotate a vector object using the slider:

1. Select the vector object that you want to rotate.
For details, see “Selecting Vectors” on page 151.

2. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page in the **Assistant** window.

3. Click and drag the slider in the appropriate direction:
 - Drag to the right if you want to rotate the selected vector object clockwise.
 - Drag to the left if you want to rotate the selected vector object anti-clockwise.

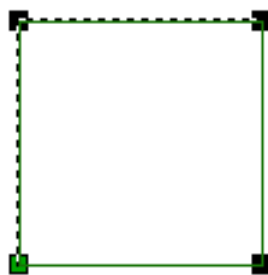
A preview image appears in the **2D View** window representing the new angle of the selected vector object.

4. Click on the **Apply** button  at the bottom of the page to confirm the new angle of the selected vector object.
5. Click on the **OK** button  to return to the **Assistant's** Home page.

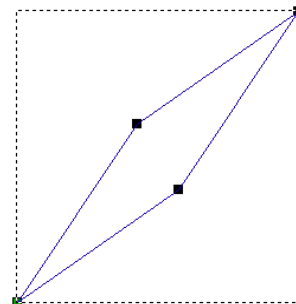
Shearing Vectors

Shearing can be visualised by thinking of an image superimposed onto a flexible rubber sheet. If you hold the sides of the sheet and move them up and down in opposite directions, the image undergoes a spatial stretching known as shearing:

Before...




After Shearing in the X-axis...



You can shear a vector object in two ways using the **Rotate** area of the **Transform Vector(s)** page:

- Using specific angles.
- Using the sliders.

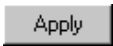

To shear a vector object using specific angles:

1. Select the vector object that you want to shear.
For details, see “Selecting Vectors” on page 151.
2. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page in the **Assistant** window.
3. Type the angle by which you want to shear the selected vector object vertically in the **Shear X** box.


A preview image appears in the **2D View** window representing the new shape of the selected vector object.


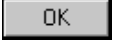
4. Type the angle by which you want to shear the selected vector object horizontally in the **Shear Y** box.

A preview image appears in the **2D View** window representing the new shape of the selected vector object.

5. Click on the **Apply** button  to confirm the new shape of the selected vector object.
6. Click on the **OK** button  to return to the **Assistant's** Home page.

To shear a vector object using the sliders:

1. Select the vector object that you want to shear.
For details, see “Selecting Vectors” on page 151.
2. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page in the **Assistant** window.

3. Click and drag the **Shear X** slider in the appropriate direction to shear the vector object vertically.
4. Click and drag the **Shear Y** slider in the appropriate direction to shear the vector object horizontally.
5. Click on the **Apply** button  at the bottom of the page to confirm the new shape of the selected vector object.
6. Click on the **OK** button  to return to the **Assistant's** Home page.

Manipulating Vector Objects



There is a range of tools in both the **Position Size Align Vectors** and **Group Merge Join Vectors** areas of the **Assistant's** Home page designed to assist you in manipulating vector objects.

Mirroring Vectors

You can reverse the direction of a vector object from its original position using the mirroring button in the **Position Size Align Vectors** area of the **Assistant's** Home page.

To mirror a selection of vector objects:

1. Select the vector object(s) that you want to mirror.

For details, see “Selecting Vectors” on page 151.
2. Click on the **Mirror Vectors** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to display the **Mirror Vectors** page.
3. Click on the **Copy the Original Vectors** option  if you want to produce the mirrored vector object(s) and retain the original position of the selected vector object(s).



Note: If you hold the **Ctrl** key before you click on a **Mirror Types** option, you also produce a mirrored vector object and retain the original position of the selected vector object.

4. Click on an appropriate option listed in the **Mirror Types** area of the **Mirror Vectors** page to mirror the selected vector(s).

You can select from six mirroring options listed in the **Mirror Types** area of the **Mirror Vectors** page.

For details, see “Using the Mirroring Options” on page 230.

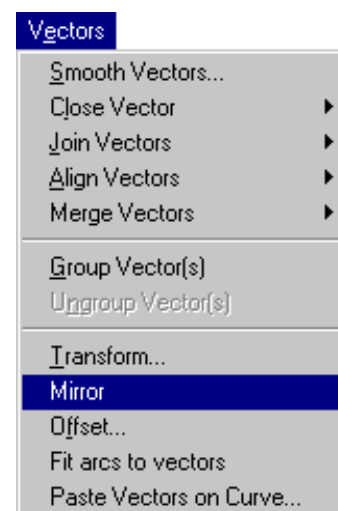
5. Click on the **Close** button  to return to the **Assistant**’s Home page.

You can also display the **Mirror Vectors** page in the **Assistant** window if you:

1. Select the vector object(s) that you want to mirror.

For details, see “Selecting Vectors” on page 151.

2. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then on the **Mirror** option:



Using the Mirroring Options

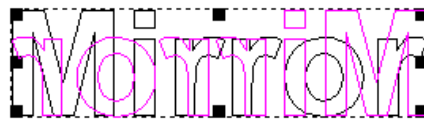
You can use three options in the **Mirror Types** area of the **Mirror Vectors** page to mirror a vector object in the **Horizontal** plane.

These are:

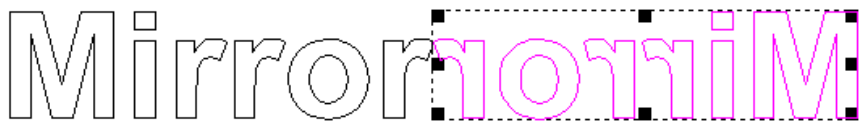
- **Left** - This option mirrors the selected vector objects in the horizontal plane about a point on the left edge of the selected vector objects:



- **Centre** - This option mirrors the selected vector objects in the horizontal plane about a point in the centre of the selected vector objects:



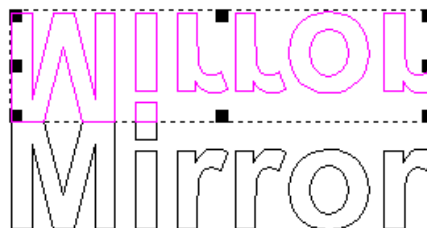
- **Right** - This option mirrors all your selected vector objects in the horizontal plane about a point on the right edge of the selected vector objects:



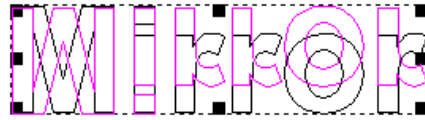
You can use three options in the **Mirror Types** area of the **Mirror Vectors** page to mirror a vector object in the **Vertical** plane.

These are:

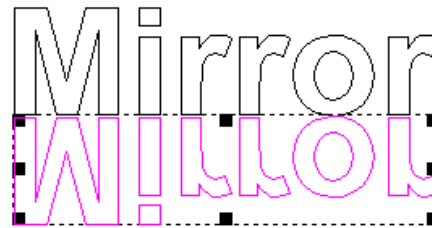
- **Top** - This option mirrors all your selected vector objects in the horizontal plane about a point on the top edge of the selected vector objects:



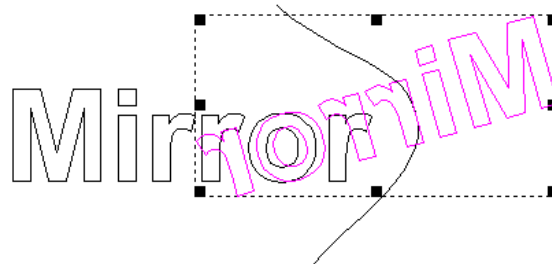
- **Centre** - This option mirrors the selected vector objects in the vertical plane about a point in the centre of the selected vector objects:



- **Bottom** - This option mirrors the selected vector objects in the horizontal plane about a point on the bottom edge of the selected vector objects:





You can also mirror a selected vector object about an open vector object, such as a polyline, using the **About Line** option on the **Mirror Vectors** page:




To mirror a vector object about a polyline:

1. Select the polyline about which you want to mirror a vector object.

For details, see “Selecting Vectors” on page 151.

2. Hold the **Shift** key  on your keyboard, and then click on the vector object(s) that you want to mirror.
3. Click on the **Mirror Vectors** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Mirror Vectors** page.
4. Click on the **About Line** option on the **Mirror Vectors** page.

5. Click on the **Close** button  to return to the **Assistant's** Home page.

Aligning Vectors

You can position two or more vector objects relative to one another in different ways using the align buttons in the **Position Size Align Vectors** area of the **Assistant's** Home page.

When you select the vector objects that you want to position relative to one another, it is important to remember that all of the vector objects you select are to be aligned to the vector object selected last. This is referred to as the base vector object.




To align two or more vector objects:


1. Select two or more vector objects that you want to position relative to one another.

For details, see “Selecting Vectors” on page 151.

A bounding box surrounds all of the selected vector objects.

2. Click on the appropriate align button in the **Position Size Align Vectors** area of the **Assistant's** Home page to align all of the selected vector objects relative to the base vector object:

- Click on the **Align Left** button  to align the left edge of all other vector objects that you have selected to the left edge of the base vector object.
- Click on the **Align Right** button  to align the right edge of all other vector objects that you have selected to the right edge of the base vector object.
- Click on the **Align Top** button  to align the top edge of all other vector objects that you have selected to the top edge of the base vector object.

- Click on the **Align Bottom** button  to align the bottom edge of all other vector objects that you have selected to the bottom edge of the base vector object.

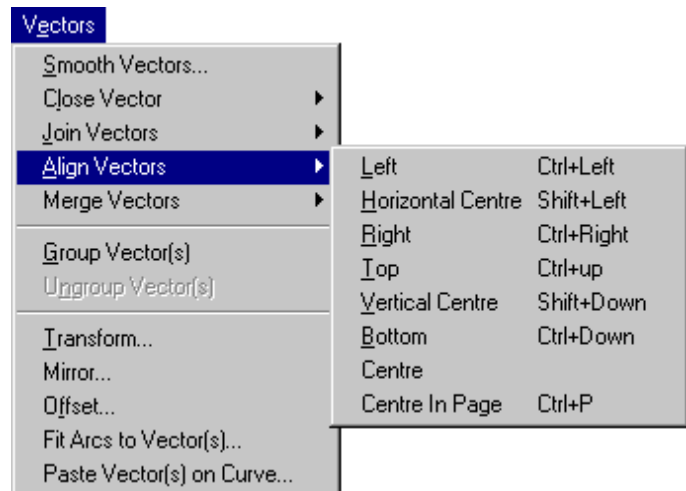
You can also use the **Align Vectors** options in the **Vectors** menu within the Main menu bar to achieve the same results as the align buttons in the **Position Size Align** area of the **Assistant's** Home page:

1. Select two or more vector objects that you want to position relative to one another.

For details, see “Selecting Vectors” on page 151.

A bounding box surrounds all of the selected vector objects.

2. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then move the cursor over the **Align Vectors** option to display the **Align Vectors** menu:



3. Click on the option you want to use to align all of the selected vector objects relative to the base vector object:
 - Click on the **Left** option to align the left edge of all other vector objects that you have selected to the left edge of the base vector object.
 - Click on the **Right** option to align the right edge of all other vector objects that you have

selected to the right edge of the base vector object.

- Click on the **Top** option to align the top edge of all other vector objects that you have selected to the top edge of the base vector object.
- Click on the **Bottom** option to align the bottom edge of all other vector objects that you have selected to the bottom edge of the base vector object.

Centring Vectors

You can centre one or more vector objects inside of another in different ways using the centring buttons in the **Position Size Align Vectors** area of the **Assistant's** Home page.

When selecting the vector objects that you want to centre inside of another, it is important to remember that all of the vector objects you select are to be centred inside of the vector object selected last. This is referred to as the base vector object.



To centre one or more vector objects inside of another:

1. Select two or more vector objects that you want to position relative to one another.


For details, see “Selecting Vectors” on page 151.

A bounding box surrounds all of the selected vector objects.


2. Click the appropriate button in the **Position Size Align Vectors** area of the **Assistant's** Home page to centre all of the selected vector objects inside of the base vector object:

- Click the **Centre Vertically** button  to align the centre of all other vector objects that you have selected to the centre in the X-axis of the base vector object.
- Click the **Centre Horizontally** button  to align the centre of all other vector objects

that you have selected to the centre in the Y-axis of the base vector object.

- Click the **Centre Vector** button  to align the centre of all other vector objects that you have selected to the centre of the base vector object.

There is one additional centring button in the **Position Size Align** area of the **Assistant's** Home page, although it does not, unlike the other centring buttons, affect one vector object relative to another:

- Click the **Centre In Page** button  to align the centre of the vector objects that you have selected to the centre of the model.

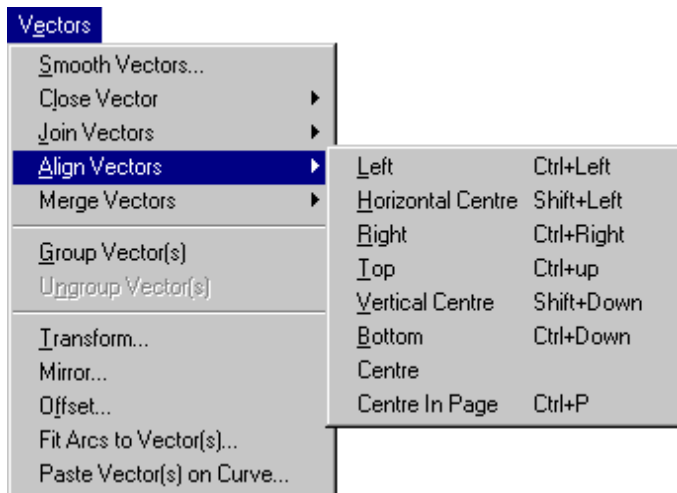
You can also use the **Align Vectors** options in the **Vectors** menu within the Main menu bar to achieve the same results as using the centring buttons in the **Position Size Align** area of the **Assistant's** Home page:

1. Select two or more vector objects that you want to position relative to one another.

For details, see “Selecting Vectors” on page 151.

A bounding box surrounds all of the selected vector objects.

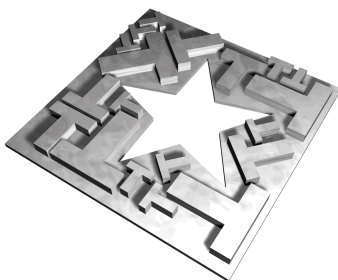
2. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then move the cursor over the **Align Vectors** option to display the **Align Vectors** menu:



3. Click on the option you want to use to align all of the selected vector objects relative to the base vector object:


- Click on the **Horizontal Centre** option to align the centre of all other vector objects that you have selected to the centre in the X-axis of the base vector object.
- Click on the **Vertical Centre** option to align the centre of all other vector objects that you have selected to the centre in the Y-axis of the base vector object.
- Click on the **Centre** option to align the centre of all other vector objects that you have selected to the centre of the base vector object.
- Click on the **Centre In Page** option to align the centre of all the vector objects that you have selected to the centre of the model.

Nesting Vectors



If you have an area of material that cannot contain a block of vector text as it is normally written, or a group of vector objects, you need not treat it as waste material.

Rather than creating the space to fit the vector text or vector objects in the conventional sense, you can manipulate them so as to fit it into space already available.

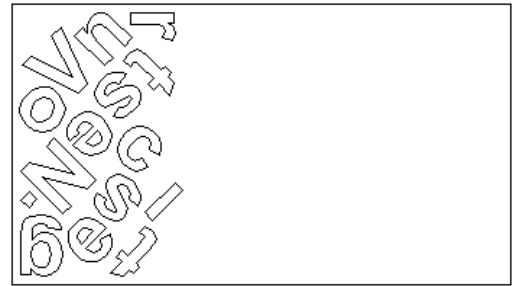
You can be as economical as possible with your material by using the **Nest Selected Vectors Within Area** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page.

For example, consider the vector text *Nesting Vectors* before and after the nesting process:

Before...



After...



You must first define the area in which you want to nest vector objects.

You can use a tool from the **Vector Editing** area of the **Assistant's** Home page to define the area of material.

For example, if you have an odd shape of material in which you want to nest vector text, use the **Create Polyline** tool to follow the outline of the area of material available. For details, see “Creating a Polyline” on page 148.


For information on using any of the other creation tools in the **Vector Editing** area of the **Assistant's** Home page, see “Creating Simple Closed Shapes” on page 167.

The vector object used to define the area of material must be a closed vector object. For details, see “Selecting Vectors” on page 151.



To nest vector objects:

1. Select the vector object in which you want to nest the other vector objects.

For details, see “Selecting Vectors” on page 151.

2. Hold the **Shift** key  on your keyboard, then click on the vector objects you want to nest within the vector object selected in Step 1.

The selected vector objects turn magenta.

3. Click on the **Nest Selected Vectors Within Area** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page.
4. Type the diameter of the cutting tool you are using to machine the nested vector objects in the **Tool Diameter (D)** box.
5. Type the value of the amount of extra material that you want to surround each of the nested vector objects in the **Toolpath Clearance (C)** box.
6. If you want to allow vector objects to be rotated, click on the **Allow Part Rotation** option to turn it on .



This and the remaining options allow ArtCAM 2D flexibility when fitting the vector objects into the available space.

If you have turned the **Allow Part Rotation** option on .

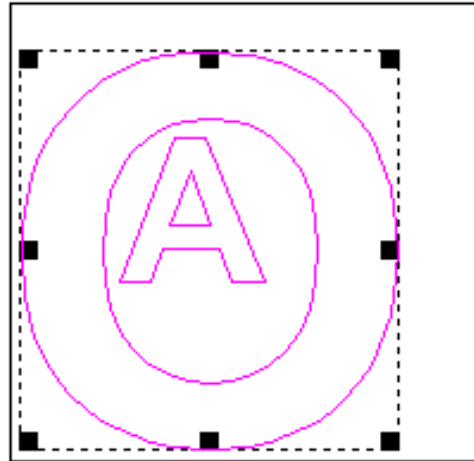
- Type a value in the **Step Angle (A)** box.

The **Step Angle (A)** is the increment by which the vector objects are rotated during the nesting process.


For example, if the **Step Angle (A)** is 90°, ArtCAM 2D attempts to nest the vector objects, rotating them by 0°, 90°, 180° and 270°.

7. If you want to allow vector objects to be mirrored during the nesting process, click on the **Allow Mirrored Parts** option to turn it on .
8. If you want to allow vector objects to be nested within other vector objects that have a central cavity, click on the **Allow Parts In Parts** option to turn it on .

In the example below, the letter *A* is nested within the central cavity of the letter *O*:



Warning: Avoid using the **Allow Parts In Parts** option unless absolutely necessary as this makes for complex and prolonged machining.


9. Click on the **Nest From** list box, then click on one of the following options:
 - **Bottom Left** – To nest the vector objects about the bottom-left corner of the defined area.
 - **Bottom Right** – To nest the vector objects about the bottom-right corner of the defined area.
 - **Top Left** – To nest the vector objects about the top-left corner of the defined area.
 - **Top Right** – To nest the vector objects about the top-right corner of the defined area.
10. Type a value in the **Curve Tolerance** box to specify how closely you want the cutter to follow the shape of the vector objects to be nested.
11. If you want to create a vector object in the shape of the leftover material after machining the nested vector objects, click on the **Create Leftover Material Vector** option to turn it on ☒.
12. Click on the **Nest** button  to begin the nesting process.

The **Nesting** progress bar appears beneath the **2D View** window indicating the progress ArtCAM 2D is making in calculating the final position of the nested vector objects:



The nesting calculation time depends on the **Part Rotation** options you have selected: the fewer the options you have turned on, the faster the nesting process.

You can click on the **Cancel** button  at any time to stop the **Nesting** process.

13. Click on the **Close** button  to return to the **Assistant's** Home page.

Merging Vectors

You can merge two or more shapes of vector objects in order to create a new shape of vector object using the merging buttons in the **Group Merge Join Vectors** area of the **Assistant's** Home page.




Warning: You can only merge two or more vector objects if they are ungrouped and overlapping.

To merge two or more ungrouped vector objects:

1. Select the first vector object that you want to merge.

For details, see “Selecting Vectors” on page 151.

2. Hold the **Shift** key  on your keyboard, and then click on each additional vector object that you want to merge with the first.





Warning: Unless the vector objects that you want to merge are ungrouped and overlap, they cannot be merged.

The vector objects selected for merging turn magenta.

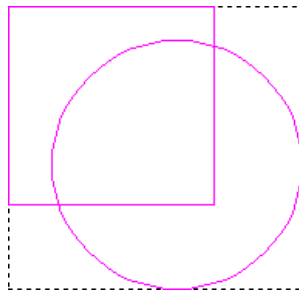
3. Click on an appropriate merging button in the **Group Merge Join Vectors** area of the **Assistant's** Home page:



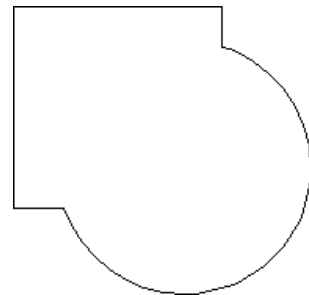
Warning: The **Weld Vectors** button  is the only merging button in the **Group Merge Join Vectors** area of the **Assistant's** Home page that you can use to merge more than two overlapping vector objects.


- Click on the **Weld Vectors** button  to take two or more vector objects and create a new vector object that is the outline of them when fused together:

Before...

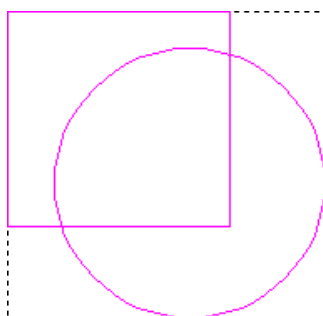


After...

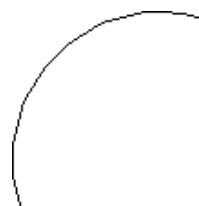



- Click on the **Intersect Vectors** button  to take two vector objects and create a new vector object that is the shape of the area where they overlap:

Before...



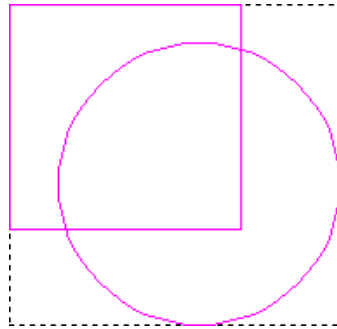
After...



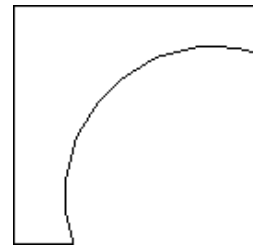
- Click on the **Subtract Vectors** button  to produce a vector object that is the shape of the area remaining when the vector object


selected second is subtracted from that which was selected first:

Before...

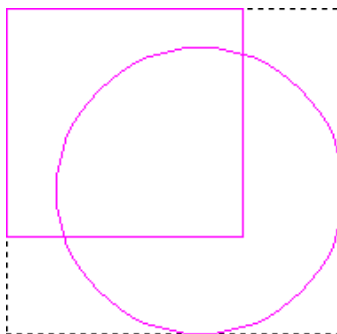


After...

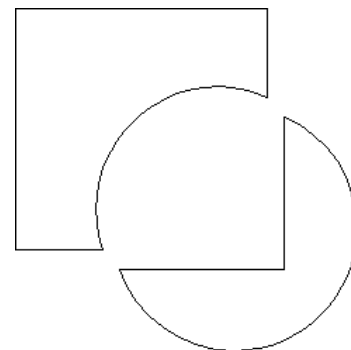


- Click on the **Trim Vectors** button  to combine two selected vector objects in such a way that all that remains are the areas of the vector objects which are not overlapping:

Before...



After...




You can also use the **Merge Vectors** options in the **Vectors** menu within the Main menu bar to achieve the same results as the merging buttons in the **Position Size Align** area of the **Assistant's** Home page:

1. Select the first vector object that you want to merge.

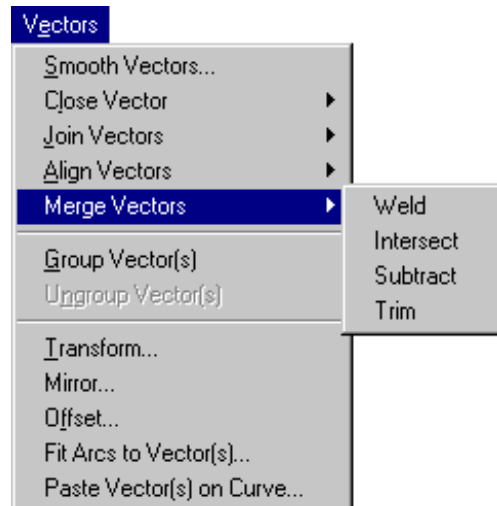
For details, see “Selecting Vectors” on page 151.

Warning: Unless the vector objects overlap, they cannot be merged.

2. Hold the **Shift** key  on your keyboard, and then click on each additional vector object that you want to merge with the first.

The vector objects selected for merging turn magenta.

3. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then move the cursor over the **Merge Vectors** option to display the **Merge Vectors** menu:



4. Click on the option you want to use to merge the selected vector objects:



Warning: The **Weld** option in the **Merge Vectors** menu is the only option you can use to merge more than two overlapping vector objects.

- Click on the **Weld** option to take two or more vector objects and create a new vector object that is the outline of them when fused together.
- Click on the **Intersect** option to take two vector objects and create a new vector object that is the shape of the area where they overlap.
- Click on the **Subtract** option to produce a vector object that is the shape of the area remaining when the vector object selected second is subtracted from that which was selected first.
- Click on the **Trim** option to combine two selected vector objects in such a way that all

that remains are the areas of the vector objects which are not overlapping.

Joining Vectors


Note: The vector objects must be open and ungrouped.

You can join two vector objects to create one of three types of new shape using the joining buttons in the **Group Merge Join Vectors** area of the **Assistant's** Home page.

To join two vector objects:


1. Select the first vector object that you want to join with another.

For details, see “Selecting Vectors” on page 151.

2. Hold the **Shift** key  on your keyboard, and then click on the vector object that you want to join with the first.

Both vector objects selected for joining turn magenta.

3. Click on the appropriate joining button in the **Group Merge Join Vectors** area of the **Assistant's** Home page:


- Click on the **Join Vectors With A Line** button  to link the first and last points (nodes) of the two vector objects with a linear span:

Before...

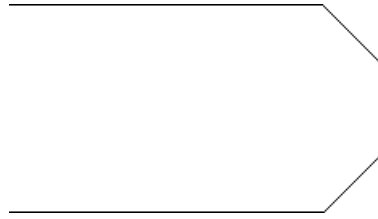


After...

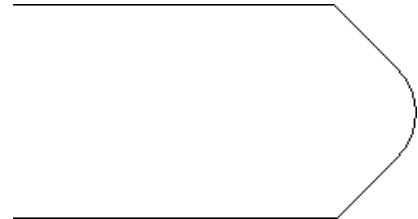



- Click on the **Join Vectors With A Curve** button  to link the first and last points (nodes) of the two vector objects with a bezier curve span:

Before...

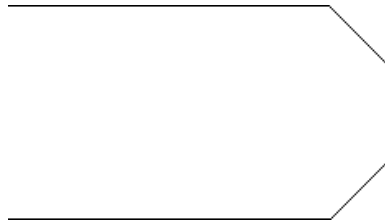


After...

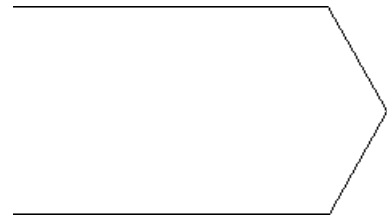


- Click on the **Join Vectors By Moving Ends** button  to link the first and last points (nodes) of the two vector objects by moving each point (node) to a central position:

Before...




After...



You can also use the **Join Vectors** options in the **Vectors** menu within the Main menu bar to achieve the same results as the joining buttons in the **Position Size Align** area of the **Assistant's** Home page:

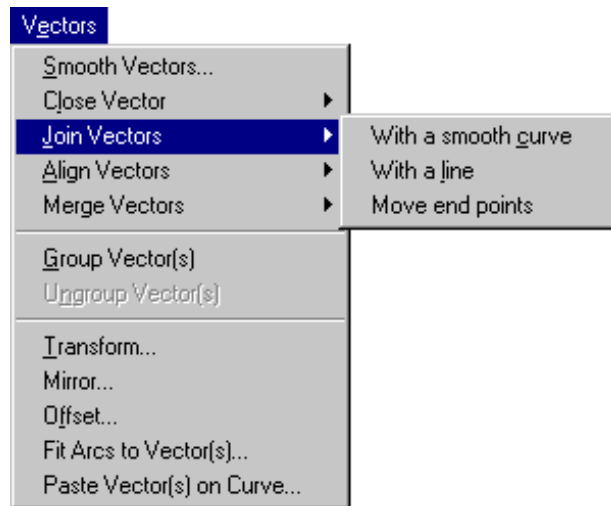
1. Select the first vector object that you want to join with another.

For details, see “Selecting Vectors” on page 151.

2. Hold the **Shift** key  on your keyboard, and then click on the vector object that you want to join with the first.

The vector objects selected for merging turn magenta.

3. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then move the cursor over the **Join Vectors** option to display the **Join Vectors** menu:



4. Click on the option you want to use to join the selected vector objects:
 - Click on the **With a smooth curve** option to link the first and last points (nodes) of the two vector objects with a bezier curve span.
 - Click on the **With a line** option to link the first and last points (nodes) of the two vector objects with a linear span.
 - Click on the **Move end Points** option to link the first and last points (nodes) of the two vector objects by moving each point (node) to a central position.


Closing Vectors

Note: The vector objects must be ungrouped.

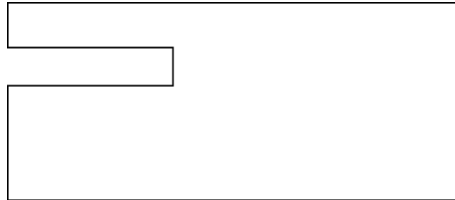
You can close an open vector object to create one of three types of closed vector object using the closing buttons in the **Group Merge Join Vectors** area of the **Assistant's** Home page.

To close an open vector object:

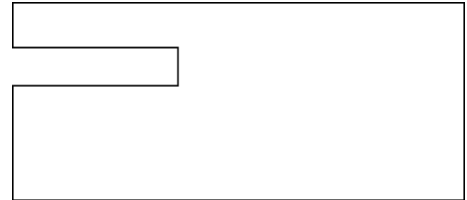
1. Select the open vector object that you want to close.
The selected vector object is black.
2. Click on one of the three closing buttons in the **Group Merge Join Vectors** area of the **Assistant's** Home page:


- Click on the **Close Vector With A Line** button  to join the first and last point (node) of an open vector object with a linear span, as shown below:

Before...

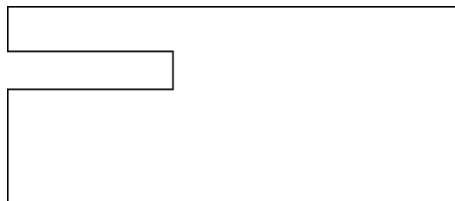


After...

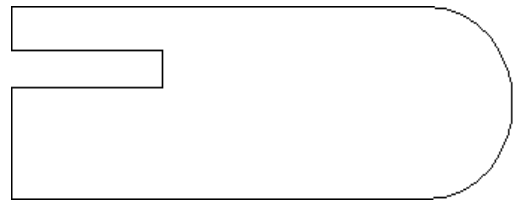



- Click on the **Close Vector With A Curve** button  to join the first and last point (node) of an open vector object with a bezier curve span, as shown below:

Before...

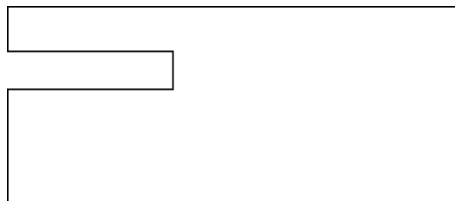


After...

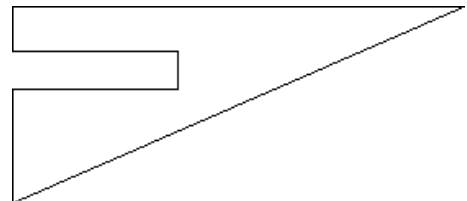


- Click on the **Close Vector – Move End Points** button  to join the last point (node) of an open vector object to the first, as indicated below:

Before



After...

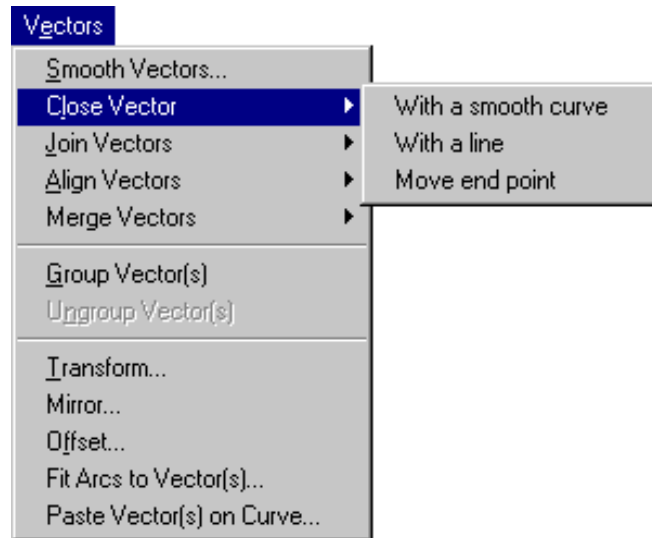


You can also use the **Close Vectors** options in the **Vectors** menu within the Main menu bar to achieve the same results as the closing buttons in the **Position Size Align** area of the **Assistant's** Home page:

1. Select the vector object that you want to close.

For details, see “Selecting Vectors” on page 151.

2. Click on the **Vectors** option in the Main menu bar to display the **Vectors** menu, then move the cursor over the **Close Vectors** option to display the **Close Vectors** menu:



3. Click on the option you want to use to close the selected vector object:
 - Click on the **With a smooth curve** option to join the first and last points (nodes) an open vector object with a bezier curve span.
 - Click on the **With a line** option to join the first and last points (nodes) of an open vector object with a linear span.
 - Click on the **Move end Point** option to join the last point (node) of an open vector object to the first.

Grouping Vector Objects

Grouping combines all of the individual spans, points (nodes) and adjoining control points that make up a vector object as a single entity.

You can group an individual vector object or a selection of them. This process allows you to simultaneously machine or engrave each of the vector objects that you define as a group in the same way.

For details, see “Selecting Vectors” on page 151.

Grouping allows you to machine or engrave an open vector object along with an individual or group of closed vector objects when using certain toolpaths. These toolpaths are **Centreline Engraved Feature**, **Engraving** and **Drill Holes**.

For details, see “Using Toolpath Strategies” in the Machining Models chapter.




Note: An ungrouped, open vector object is black when selected. An ungrouped, closed vector object is green or blue when selected.

To group an open vector object:

1. Select the vector object that you want to group.

For details, see “Selecting Vectors” on page 151.

The selected vector object is black.

2. Click on the **Group** button  in the **Group Merge Join Vectors** area of the **Assistant's** Home page.


The vector object turns blue.

To group a closed vector object:


1. Select the vector object that you want to group.

The selected vector object is green or blue.

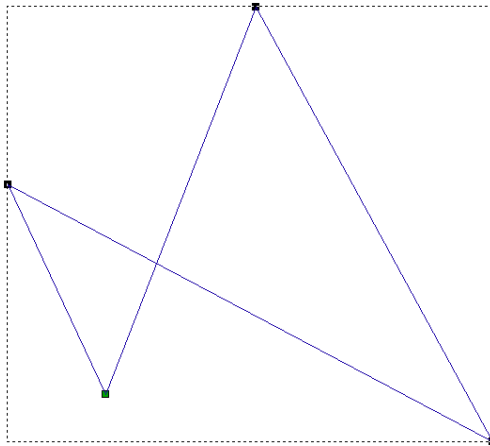
For details, see “Selecting Vectors” on page 151.

2. Click on the **Group** button  in the **Group Merge Join Vectors** area of the **Assistant's** Home page.

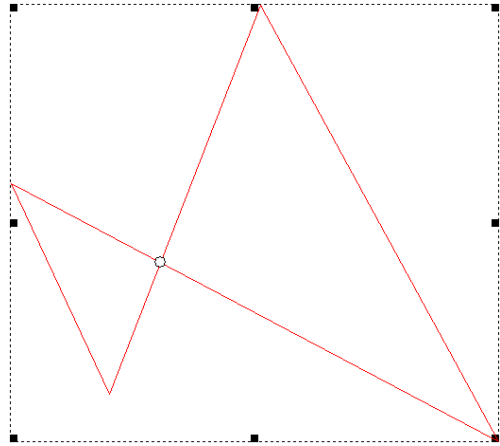
The vector object turns magenta.

If you create a polygon from a polyline in which a span overlaps another and then group it, the polygon turns red with white circular shapes  marking the places where the spans overlap:

Before...



After...

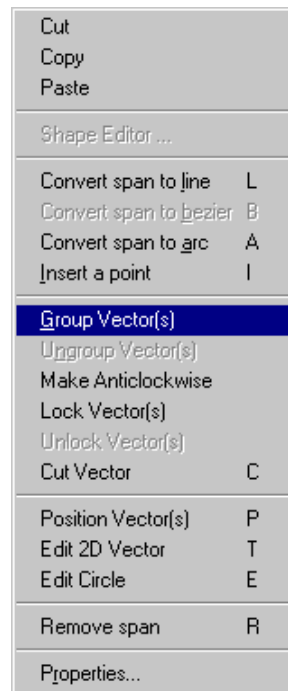


For details, see “Closing a Polyline to Create a Polygon” on page 150.

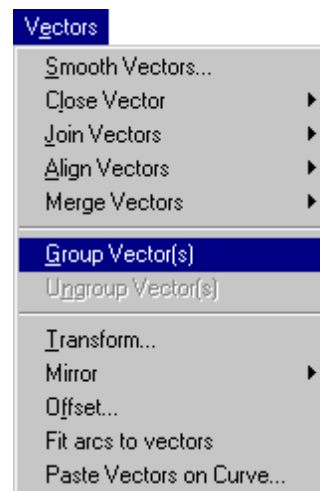
If you select a combination of open and closed vector objects with the intention of grouping them, all of them turn magenta. However, when they have been grouped, the closed vector objects remain magenta while the open vector objects turn blue.


You can also use either of these other methods to group vector objects:

- Select the vector object(s) you want to group, then select **Group Vector(s)** from the **Vector Editing** menu:



- Select the vector object(s) you want to group, click on the **Vectors** menu in the Main menu bar and then select **Group Vector(s)**:



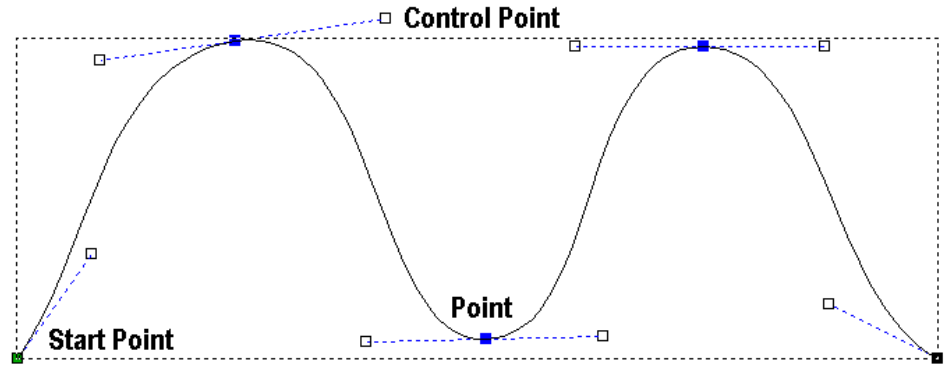
Note: Click on the **Ungroup** button  in the **Group Merge Join Vectors** area of the **Assistant's** Home page to ungroup any selected vector object(s).

Resizing a Grouped Vector Object

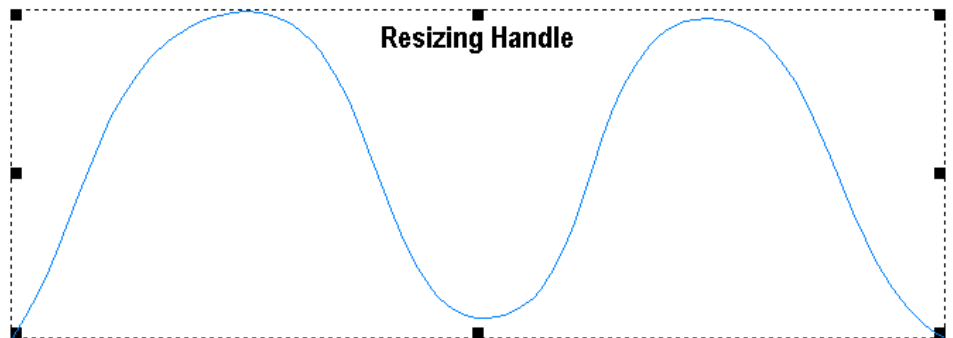
Whether you have grouped either an open or closed vector object, a bounding box with resizing handles replaces points (nodes) and control points in the vector object.

For example, you can see how by grouping the polyline illustrated below, the points (nodes) and control points are replaced by resizing handles:

Before...



After...



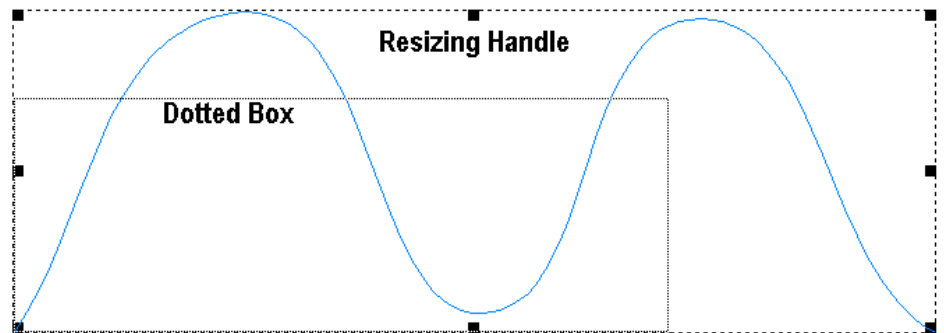
These resizing handles allow you to stretch the shape of the vector object. To do so:

- Click and drag any of the resizing handles.

A dotted box within the bounding box indicates the new size of the vector object.

On moving the cursor over each resizing handle, it changes to a double-headed arrow indicating the direction in which the shape can be stretched (↔, ↗ or ↕).

In our example, by clicking and dragging the top-right corner resizing handle inwards, the polyline can be reduced to the size represented by the dotted box within the bounding box:



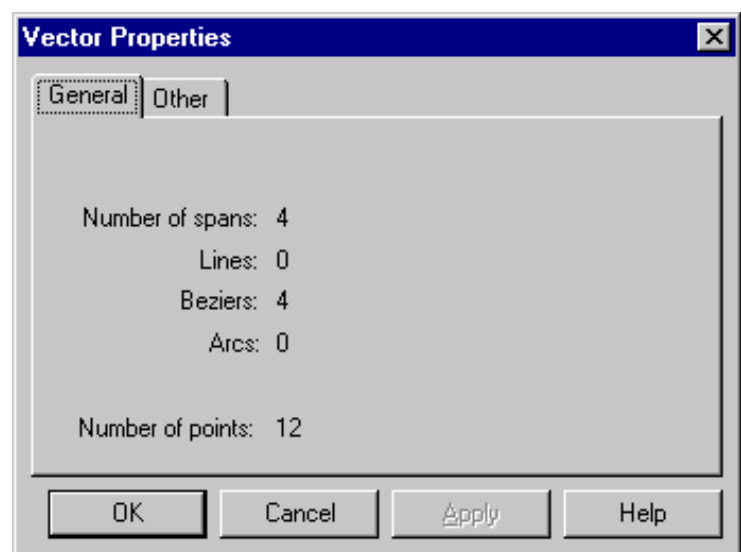
Viewing the Properties of a Vector Object

You can find out the number of points (nodes), linear, bezier curve or arc spans within any ungrouped vector object using the **Vector Properties** dialog box.

To view the properties of an ungrouped vector object:

1. Select an ungrouped vector object.
For details, see “Selecting Vectors” on page 151.
2. Right-click to display the **Vector Editing** menu.
3. Click on the **Properties...** option to display the **Vector Properties** dialog box.

The **General** page of the **Vector Properties** dialog box is displayed by default:



The **Number of Spans** area of the **General** page shows the total number of spans in the selected vector object. It also shows the number of linear, bezier curve and arc spans that make up the total number of spans.

For details, see “Editing Vector Spans” on page 154.

The **Number of points** area of the **General** page shows the number of points (nodes) and control points in the selected vector object. The number of points (nodes) and control points are not counted separately.

For details, see “Editing Vector Nodes” on page 162.

4. Click on the **OK** button  to close the **Vector Properties** dialog box.

Reversing a Vector Object's Direction of Geometry

You can reverse the current direction of geometry in any closed vector object.

Ungrouped Vectors

If an ungrouped vector object is green when selected, the direction of geometry is anti-clockwise.

If an ungrouped vector object is blue when selected, the direction of geometry is clockwise.

To reverse the direction of geometry in an ungrouped, closed vector object:

1. Select an ungrouped, closed vector object.

For details, see “Selecting Vectors” on page 151.

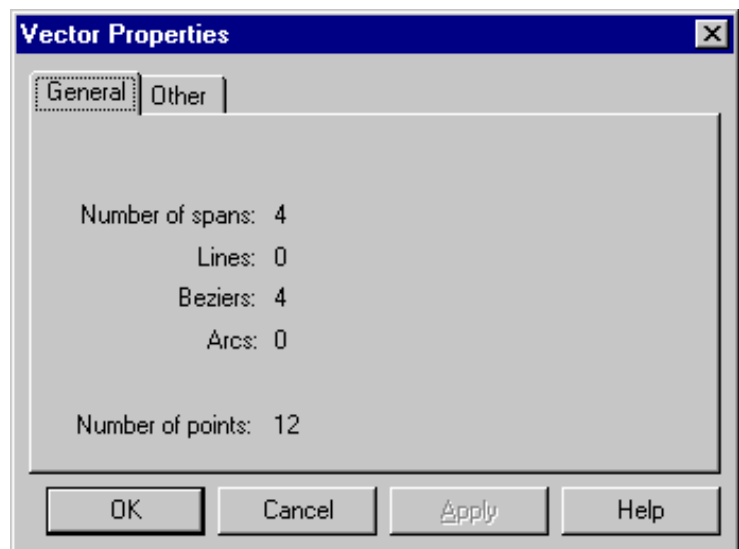
The vector object is green or blue.

2. Right-click to display the **Vector Editing** menu.
3. Click on the direction change option available:

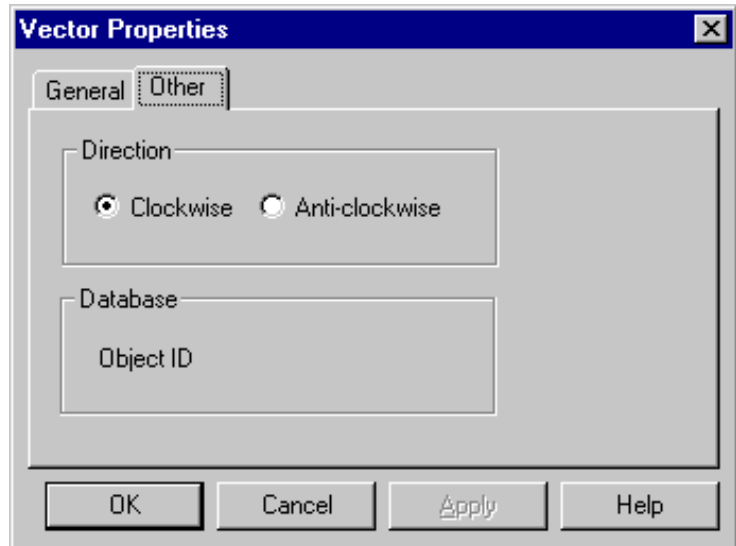
- **Make Clockwise** – To change the direction of geometry to clockwise.
The vector object turns blue.
- **Make Anti-Clockwise** – To change the direction of geometry to anti-clockwise.
The vector object turns green.

You can also reverse the direction of geometry in an ungrouped, closed vector object if you:

1. Select an ungrouped, closed vector object.
For details, see “Selecting Vectors” on page 151.
The vector object is green or blue.
2. Right-click to display the **Vector Editing** menu.
3. Click on the **Properties** option to display the **Vector Properties** dialog box:

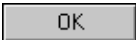


4. Click on the **Other** tab **Other** to display the **Other** page:



5. Click on the appropriate **Direction** radio button :

- **Clockwise** – To set the direction of geometry as clockwise.
- **Anti-clockwise** – To set the direction of geometry as anti-clockwise.

6. Click on the **OK** button  to set the direction of geometry in the selected vector object and close the **Vector Properties** dialog box.

Grouped Vectors

You can reverse the direction of geometry in a grouped, closed vector object that you have created.

To reverse the direction of geometry in a grouped, closed vector object:

1. Select a grouped, closed vector object.
For details, see “Selecting Vectors” on page 151.
The selected vector object is magenta.
2. Right-click to display the **Vector Editing** menu.
3. Click on the **Reverse Vector(s)** option to reverse the direction of geometry.

When you reverse the direction of geometry in a grouped, closed vector object, the vector object does not change colour.

You can confirm the direction of geometry in a grouped, closed vector object by ungrouping it after you click on the **Reverse Vector(s)** option, and then regrouping it again.

For details, see “Grouping Vector Objects” on page 248.

Machining Models

Machining a Model



Warning: It is assumed that you already know how to operate your machine tool, and that you are able to select the appropriate tools and the necessary cutting conditions for the job you are doing. If you are not confident about any aspect of operating your machine tool, consult a member of staff or your machine tool supplier.

In order to machine the model that you have created, it is necessary to create a toolpath file. This file is made up of a sequence of commands, which tells a CNC machine tool the path a cutter is required to follow, in order to produce your model.

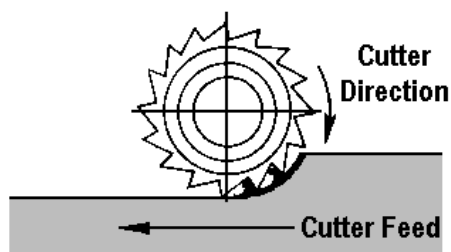
You can create a toolpath strategy to machine either the whole model, or selected vector objects that make up the model. ArtCAM 2D provides a database containing a broad selection of pre-defined tools that you can use when creating your toolpath strategy. You can edit the machining parameters of these tools and add new tools to the database if necessary.

You can control the cut direction of the tool used for machining by selecting either Conventional or Climb Milling in almost all of the toolpath strategies available in ArtCAM 2D.

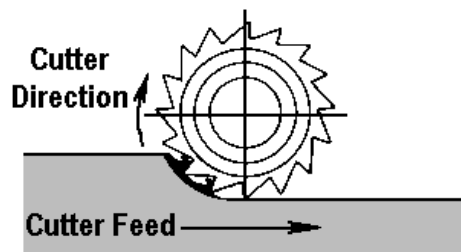
In Conventional Milling, the tooth of the tool meets the block of material at the bottom of the cut. The teeth of the tool slide along until sufficient pressure builds up to break through the material surface. This sliding action,

under pressure, tends to abrade the edge of the tool, which results in dulling. Also, the cutting action has a tendency to lift the block of material, fixture and table from their positions. A typical application is in cutting alloys with surface scale.

Climb Milling...



Conventional Milling...



In Climb Milling, the tooth of the tool meets the block of material at the top of the cut, at the thickest part of the chip. This provides instant engagement of the tool with the block, providing a chip of definite thickness at the start of the cut. Climb Milling does not cause the abrasive action caused by Conventional Milling. It also permits the gradual removal of the tool from the block, so that dwell marks are largely eliminated. Climb Milling often provides a better finish, permits greater tool feed rates and prolongs the life of a tool. A typical application is in finishing cuts on aluminium.

ArtCAM 2D allows you to create multiple toolpaths, each of them relating to a selected area of your model. This enables for a number of roughing passes to be made, removing excess material prior to the finishing passes.

If your CNC machine has a tool changer, you are able to generate separate toolpath files for each tool that you want to use, or group all of the toolpaths relative to a series of cutters into one machine-specific file.

If your CNC machine does not have a tool changer, you must generate separate toolpath files for each tool that you want to use.

Using Toolpath Strategies

ArtCAM 2D provides a number of toolpath strategies that you can use to machine your model. These are available using the **Toolpaths** area of the **Assistant's** Home page.

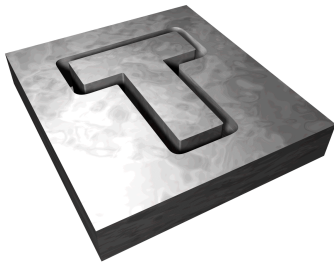
You can use the following toolpath strategies:


- Profiling.
- 2D Area Clearance.
- V-Bit Carving Along a Centreline.
- 3D Bevelled Carving.
- Engraving.
- Drilling Holes.
- Machining Along a Vector.
- Inlay Machining.

You can also find buttons that assist you in managing and modifying the toolpaths that you create:

- Toolpath Summary.
- Tool Groups Database.
- Add Bridging.
- Setting the Machining Order.

Profiling






The **Profiling** button  in the **Toolpaths** area of the **Assistant's** Home page allows you to create a toolpath that machines either inside or outside the boundary of a selected vector object.

Using the **Profiling** page, you can:

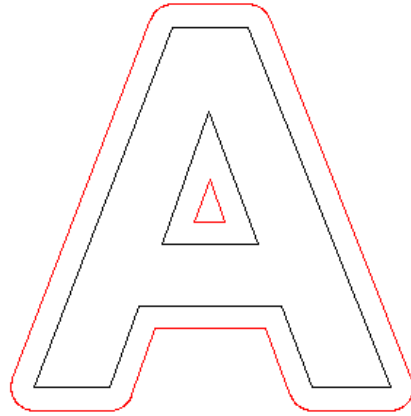
- Control where your tool cuts into and retracts from the block of material by adding lead in and lead out moves.
- Control how your tool cuts into and retracts from the block of material by adding ramping moves.
- Control the cutting direction of the tool.
- Control whether the vector object is cut or snapped out from the block of material by defining the thickness of the final machine pass and/or adding bridging.

A Profile toolpath strategy is ideal for cutting out letters and shapes from a block of material.

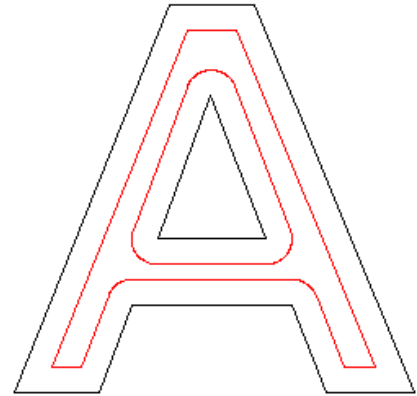
To profile a vector object:

1. Select the vector object that you want to profile.
For details, see “Selecting Vectors” in the Working with Vectors chapter.
2. Click on the **Profiling** button  in the **Toolpaths** area of the **Assistant's** Home page.
3. In the **Profile Side** area of the page:
 - Click on the **Outside** radio button  to instruct the tool to profile outside of the selected vector object.
 - Click on the **Inside** radio button  to instruct the tool to profile inside of the selected vector object.

Profile Side – Outside...



Profile Side – Inside...



4. Type the absolute Z value of the material surface in the **Start Depth** box.
5. Type the absolute Z zero value for the bottom of the cut in the **Finish Depth** box.




Note: If you are cutting the vector object out of the block of material, the **Finish Depth** value is equal to the **Thickness (Z)** value entered in the **Setup Job Dimensions** dialog box. For details, see “Creating a Model” in the Working with Models chapter.

6. If you want to add or remove extra material around the vector object, you can type a value in the **Allowance** box.


The value you enter sets the distance between the boundary of the selected vector object and the profiling tool. Type a positive value to add material or a negative value to remove it.


7. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.
8. If you want to leave a thin 'web' of material around the selected vector object, click on the **Final Pass Thickness** option ☒ and type a value in the adjacent box.

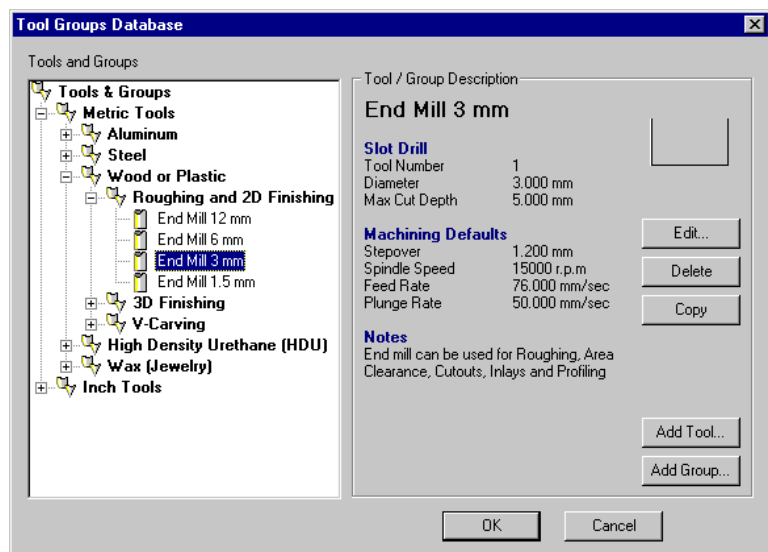
If turned on ☒, the vector object is held more securely in position during machining. You can gently snap it from the block of material afterwards.


9. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
10. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.




Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Profiling** page.



11. Click on the **Select** button  in the **Profiling Tool** area of the page to open the **Tool Groups Database**:



12. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Profiling Tool** area.
13. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Profiling Tool** area.


For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

14. The cutting direction defaults to **Climb Mill**. If you want to change this, click on the  arrow in the **Cut Direction** area of the **Profiling** page, then click on one of the **Cut Direction** radio buttons :



- **Climb Mill** - Climb Milling rotates the cutter in the same direction as the feed motion.
- **Conventional** – Conventional Milling rotates the cutter in the opposite direction to the feed motion.

For more details, see “Machining a Model” on page 259.

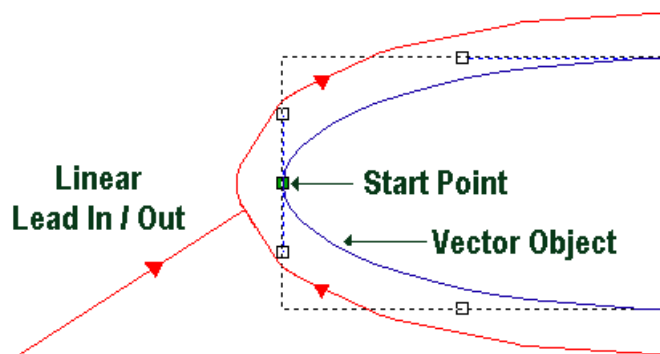
15. If you want to add lead-in and lead-out moves to the Profile toolpath, click on the **Add Lead In/Out Moves** option to turn it on .



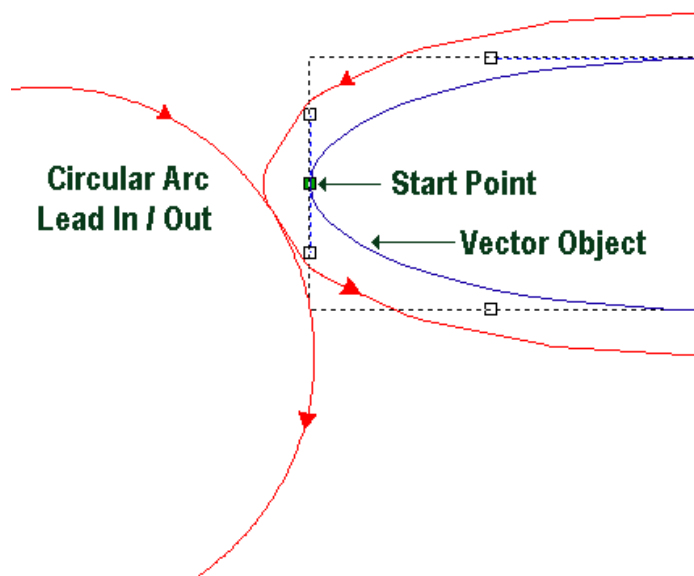
Warning: Although adding lead-in and lead-out moves reduces abrasion on the cutting tool and dwell marks on the material surface, doing so cannot guarantee gouge-free results when machining all shapes of vector object.

- If you do not want to add a lead-out move, click on the **Do not Lead Out** option .
- Type the distance from the Profile toolpath that you want the tool to cut into and retract from the block of material in the **Distance (D)** box.
- Select how you want the tool to move using the **Add Lead In/Out Moves** radio buttons :

Linear – Click on the **Linear** option to instruct the tool to lead into and out of the block of material in a straight-line motion:



Circular Arc – Click on the **Circular Arc** option to instruct the tool to lead into and out of the block of material in an arc motion:



If you select the **Circular Arc** option, type in the radius of the arc you want to use in the **Radius (R)** box.

- Set the **Automatic Positioning** as follows:

Turn **Automatic Positioning** on ☒, to position lead-in and lead-out moves at the optimum point in the vector object. This is usually within its longest linear span.

Turn **Automatic Positioning** off ☐ to position lead-in and lead-out moves at the Start Point of the vector object. If you

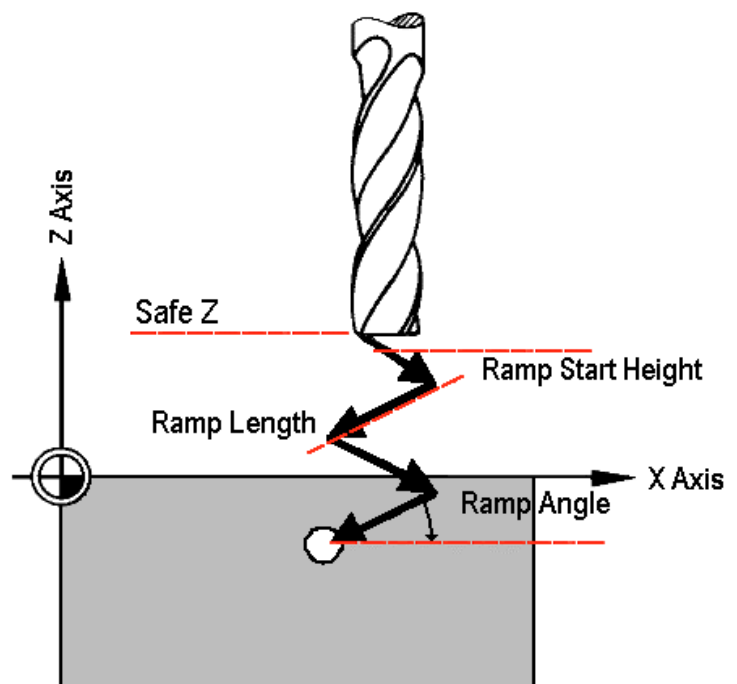
change the Start Point, this changes the position of lead-in and lead-out moves.

For details on changing the Start Point, see “Changing the Start Point” in the Working with Vectors chapter.

16. If you want to add ramping moves to the Profile toolpath, click on the **Add Ramping Moves** option to turn it on ☒.




Tip: Feeding the cutter into the material surface in a straight plunge motion at full feed rate often causes pivoting around the loaded tooth in the direction of rotation. This, in turn, causes deflection. It is this deflection that causes gouging and, consequently, tool damage. **Add Ramping Moves**, also known as Zig-Zag Plunge moves, to allow the cutting tool to enter the block of material gradually, ensuring minimum tool damage and the likelihood of gouge-free machining.



- Type the maximum angle of descent for each zig and zag movement of the cutting tool in the **Max Ramp Angle (A)** box.


- Type the maximum distance that you want the cutting tool to zig-zag across the material surface in the **Max Ramp Length (L)** box.
- Type the minimum distance that you want the tool to zig-zag across the material surface in the **Min Ramp Length (Lmin)** box.
- If you want to define the height at which the ramping moves start, click on the **Ramp Start Height (S)** option to turn it on ☒, then type a value in the box beneath it.

If you do not define the **Ramp Start Height (S)** here, the **Safe Z** level, as defined in Step 9, is used.

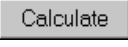
17. Click on the  arrow in the **Material** area of the **Profiling** page to view details of the block of material used for this model.

The difference between the **Z Top** and **Z bottom** values is equal to the thickness of the block. The **Origin** shows the material Z zero position.

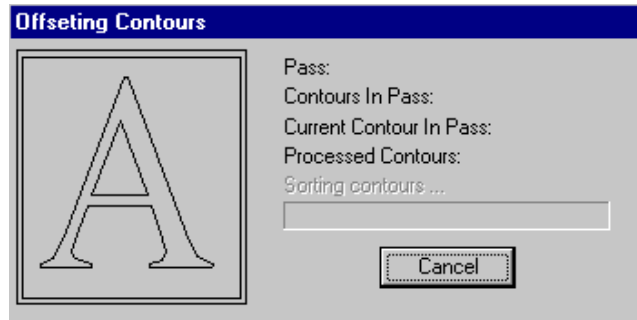
18. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

For more details on how to use this, see “Creating a Model” in the Working with Models chapter.


19. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.
20. Type a name for the toolpath in the **Name** box.
21. Click on the **Calculate** button .

The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the toolpath:



A dark red line represents the machining passes used to Profile the selected vector object in the model. It is drawn either inside or outside of its boundary, according to the **Profile Side** that you had selected in Step 3.

It is not drawn if you turned the **Create 2D Preview** option off ☐ in Step 19.

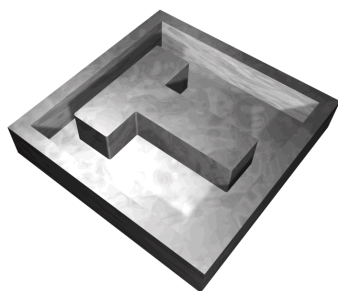
22. Click on the **Close** button  to return to the **Assistant's** Home page.


If you want to add bridging to the Profile toolpath, see "Adding Bridging" on page 327.

If you want to set the machining order of the Profile toolpath, see "Setting the Profile Machining Order" on page 331.

You are now ready to simulate the toolpath you have created. For details, see "Simulating Toolpaths" on page 337.

2D Area Clearance



The **2D Area Clearance** button  in the **Toolpaths** area of the **Assistant's** Home page allows you to create a toolpath that clears an area of material based on the boundary of the vector object you have selected.

Using the **2D Area Clearance** page, you can:


- Select multiple tools to perform *rest machining*, where ArtCAM 2D automatically selects the biggest tool first, and then the smaller tools in order of size to machine the areas that larger predecessors cannot fit into.
- Select a different tool clearance strategy for each of the tools you want to use.

Depending on what strategy you select, you can control the angle, or where and in what direction the tool cuts into the block of material.

To clear an area of material:


1. Select the vector object around which you want to clear an area.

For details, see “Selecting Vectors” in the Working with Vectors chapter.


2. Click on the **2D Area Clearance** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **2D Area Clearance** page.
3. Type the absolute Z value of the material surface that you want to clear in the **Start Depth** box.
4. Type the absolute Z zero value of the bottom of the area you want to clear in the **Finish Depth** box.
5. If you want to add or remove extra material around the vector object, you can type a value in the **Allowance** box.


The value you enter sets the distance between the boundary of the selected vector object and

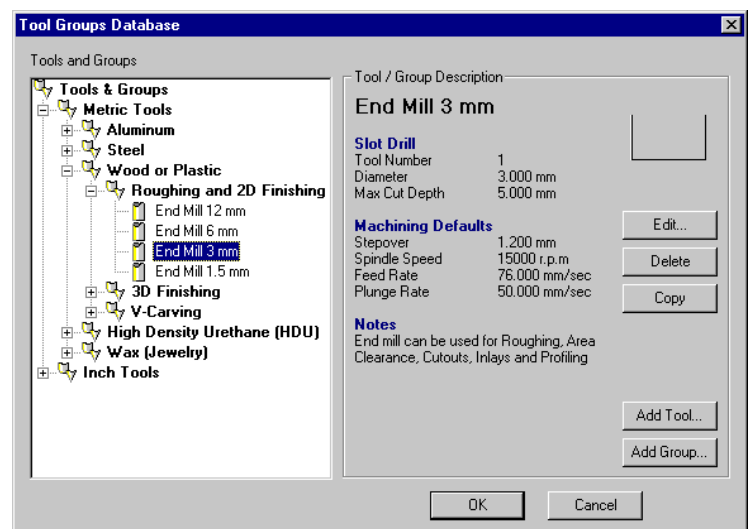
the profiling tool. Type a positive value to add material or a negative value to remove it.

6. If you are using more than one tool, type an allowance for the smallest tool to use when clearing around the selected vector object in the **Final Tool Allowance** box
7. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.
8. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
9. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.




Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **2D Area Clearance** page.

10. Click on the **Add** button  in the **Tools List** area to open the **Tool Groups Database**:




11. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Tools List** area.


The machining parameters of the selected tool are automatically displayed in the **Tool Settings** area.

If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Tool Settings** area.


For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

12. If you want to use more than one tool:

- Click on the **Add** button  in the **Tools List** area.
- Repeat steps 10 and 11 until all of the tools that you want to use are listed in the **Tools List** window.

13. Click on the tool in the **Tools List** window that you want to select a tool clearance strategy for.

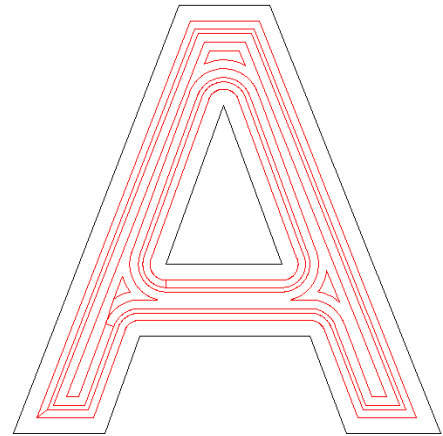
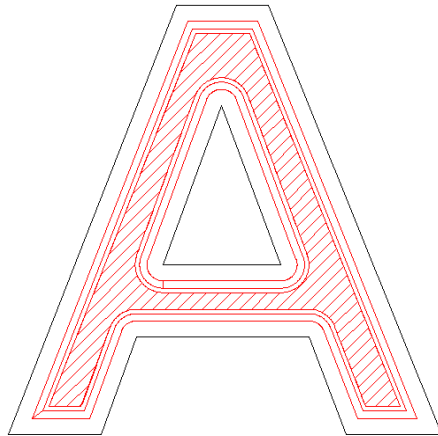
14. Select how you want the tool to clear the area about the selected vector object using the **Tool Clearance Strategy** radio buttons .

- **Raster** - This strategy machines in passes back and forth along a specified angle.
- **Offset** - This strategy machines in repeated passes, each time moving inwards by the selected tool's **Stepover** value.

You can see the stepover value of the selected tool when the machining parameters are displayed in the **Tool Settings** area of the **2D Area Clearance** page.

Raster Tool Clearance at 45°...

Offset Tool Clearance at Climb...



15. If you have selected **Raster**:

- Type the angle you want the tool to move at in the **Raster Angle** box.


If you have selected **Offset**:

- Click on one of the **Cut Direction** radio buttons :

Climb Mill - Climb Milling rotates the cutter in the same direction as the feed motion.


Conventional - Conventional Milling rotates the cutter in the opposite direction to the feed motion.


For more details, see “Machining a Model” on page 259.

- Click on one of the **Start Point** radio buttons :


Outside - Select this option if you want the tool to cut into the material at the vector object's boundary, then machine inwards.

Inside - Select this option if you want the tool to cut into the material at the vector object's centre, then machine outwards.

16. If you want the selected tool to cut to a different depth than the other tools in the **Tools List** window, click on the **Independent Finish Depth** option to turn it on .


If you have turned this option on , type the absolute Z zero value of the bottom of the area you want to clear in the **Finish Depth** box below.

17. Repeat steps 13 to 16 for all of the other tools in the **Tools List** window.

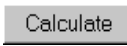
18. Click on the  arrow in the **Material** area of the **Profiling** page to view details of the block of material used for this model.

The distance between the **Z Top** and **Z bottom** values is equal to the thickness of the block.
The **Origin** shows the material Z zero position.

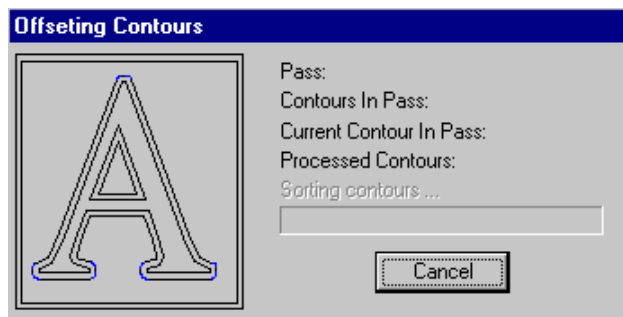
19. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

For more details on how to use this, see “Creating a Model” in the Working with Models chapter.


20. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.
21. Type a name for the toolpath in the **Name** box.
22. Click on the **Calculate** button .

The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the toolpath:



The machining passes used to clear the area about the selected vector object are represented


by a sequence of dark red lines drawn either inside or outside of its boundary, according to the **Tool Clearance Strategy** that you had selected in Step 14.

23. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.

V-Bit or Centreline Carving





The **Centreline Carving** button  in the **Toolpaths** area of the **Assistant's** Home page allows you to create a toolpath that replicates a hand carved look for the vector object or text that you have selected.

The **V-Bit Carving** page allows you to control the depth of the centreline carved into the block of material.

To begin centreline carving your vector object or text:


1. Select the vector object or text that you want to centreline carve.


For details, see “Selecting Vectors” in the Working with Vectors chapter.

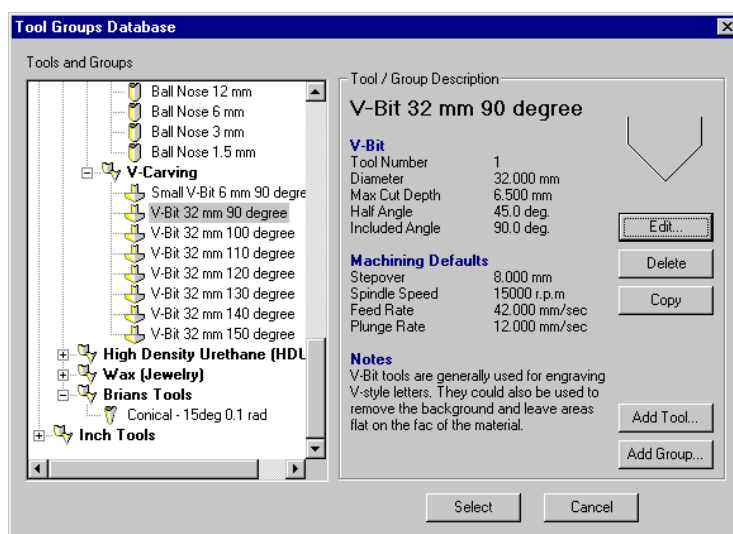
2. Click on the **Centreline Carving** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **V-Bit Carving** page.
3. Type the absolute Z value of the material surface that you are carving into in the **Start Depth** box.
4. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.
5. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's** X, Y and Z boxes.


- Type a value in the **Safe Z** box.
6. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.




Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **2D Area Clearance** page.


7. Click on the **Select** button  in the **Carving Tool** area of the page to open the **Tool Groups Database**:



8. Double-click on the V-Bit, Conical or Ball Nose tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Carving Tool** area.
9. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Carving Tool** area.

For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

10. Click on the **Centreline** button  to set the width of the path to be engraved.




Note: If you choose a tool with a smaller diameter than the maximum width of the path, ArtCAM 2D makes multiple passes to clear the specified width of the path.

The selected vector object or text is colour-filled in cyan during the centreline calculation process.


The **Centreline** progress bar positioned beneath the **2D View** window indicates the progress ArtCAM 2D is making in calculating the centreline:




You can stop the **Centreline** command at any time by clicking on the **Cancel** button  to the right of the progress bar.

The selected centreline within the vector object or text is shown in magenta.

When you deselect the vector object or text, the centreline turns dark red.


11. If you want to limit the depth at which the selected tool cuts into the block of material:
 - Click on the **Limit tool maximum depth** option in the **Carving Tool** area of the page to turn it on .
 - Type the **Max Depth** value shown in the **Carving Tool** area of the page in the **Maximum Depth** box.

12. Click on the  arrow in the **Material** area of the **Profiling** page to view details of the block of material used for this model.

The distance between the **Z Top** and **Z bottom** values is equal to the thickness of the block.

The **Origin** shows the material Z zero position.

13. Make sure that the thickness of the block and the origin displayed is correct.

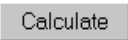
If you want to change these settings, click on the  button in the **Material** area of the

page to display the **Setup Job Dimensions** dialog box.


For more details on how to use this, see “Creating a Model” in the Working with Models chapter.

14. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.

The **Create 2D Preview** option is turned on ☒ by default.

15. Type a name for the toolpath in the **Name** box.
16. Click on the **Calculate** button .


The machining passes used to centreline carve the selected vector object are represented by a sequence of dark red lines drawn inside its boundary.

17. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.

3D Bevelled Carving



The **Create a V-Bit Bevelled Carving** button  in the **Toolpaths** area of the **Assistant's** Home page allows you to create a toolpath that replicates a bevelled (angled edge) look for the vector text or object that you have selected.


Using the **Bevel Carving** page, you can:

- Control the height of the angled edge in the bevel carving.
- Control the cutting direction of the tool.

To begin bevelling your vector text or object you must:


1. Select the vector object that you want to create a bevelled carving out of.

For details, see “Selecting Vectors” in the Working with Vectors chapter.


2. Click on the **Create a V-Bit Bevelled Carving** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **3D Bevel Carving** page.
3. Type the absolute Z value of the material surface that you want to cut the profile into in the **Start Depth** box.
4. Type the height of the wall in the block of material, the profiled area situated below the bevelled area, in the **Wall Height** box.
5. Type the absolute Z zero value of the bottom of the cut in the **Finish Depth** box.




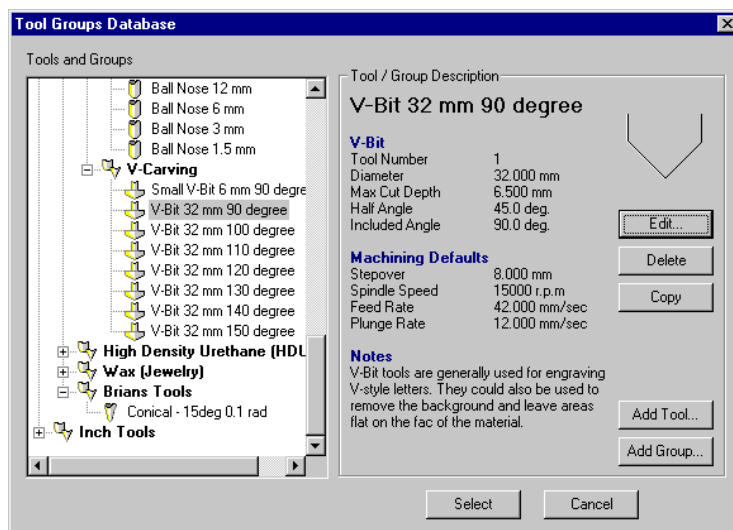
Note: If you are cutting the vector object out of the block of material, the **Finish Depth** value is equal to the **Thickness (Z)** value entered in the **Setup Job Dimensions** dialog box. For details, see “Creating a Model” in the Working with Models chapter.

6. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.
7. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
8. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.




Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **3D Bevel Carving** page.


9. Click on the **Select** button  in the **Carving Tool** area of the page to open the **Tool Groups Database**:




10. Double-click on the V-Bit tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Carving Tool** area.

11. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Carving Tool** area.

For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

12. Click on the **Centreline** button  to set the width of the path to be carved.




Note: If you choose a tool with a smaller diameter than the maximum width of the path, ArtCAM 2D makes multiple passes to clear the specified width of the path.

The selected vector text in the **2D View** window is colour-filled in cyan during the centreline calculation process.

The **Centreline** progress bar positioned beneath the **2D View** window indicates the


progress ArtCAM 2D is making in calculating the centreline:

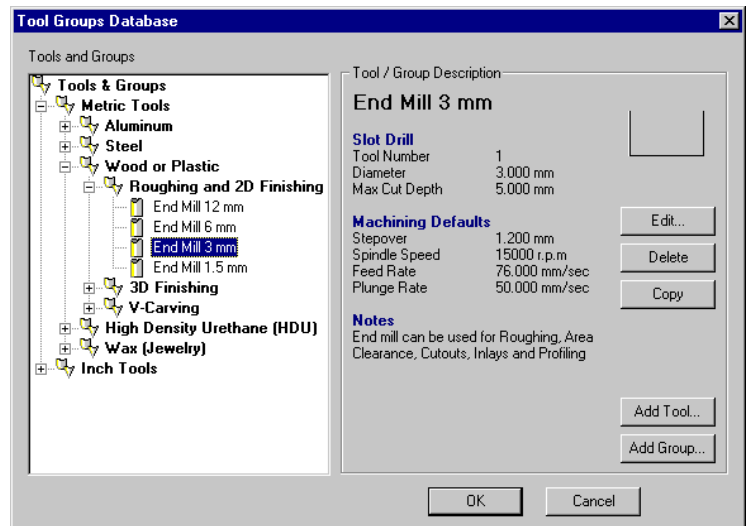



You can stop the **Centreline** command at any time by clicking on the **Cancel** button  to the right of the progress bar.

The selected centreline within the vector object or text is shown in magenta.


When you deselect the vector object or text, the centreline turns dark red.



13. Click on the **Select** button  in the **Profiling Tool** area of the page to open the **Tool Groups Database**:



14. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Profiling Tool** area.
15. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Profiling Tool** area.


For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

16. To set the cut direction, click on the  arrow in the **Cut Direction** area of the **3D Bevel Carving** page, then click on one of the **Cut Direction** radio buttons :


- **Climb Mill** - Climb Milling rotates the cutter in the same direction as the feed motion.
- **Conventional** – Conventional Milling rotates the cutter in the opposite direction to the feed motion.

For more details, see “Machining a Model” on page 259.


17. Click on the  arrow in the **Material** area of the **3D Bevel Carving** page to view details of the block of material used for this model.

The difference between the **Z Top** and **Z bottom** values is equal to the thickness of the block. The **Origin** shows the material Z zero position.

18. Make sure that the thickness of the block and the origin displayed is correct.


If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

For more details on how to use this, see “Creating a Model” in the Working with Models chapter.

19. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off .

20. Type a name for the toolpath in the **Name** box.

21. Click on the **Calculate** button .




22. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.

Help with creating a 3D Bevelled Carving


You can display information on how to create a 3D Bevelled Carving toolpath if you click on **Show Help** at the top of the **3D Bevel Carving** page.

However, if you would like more information on creating a 3D Bevelled Carving toolpath:

1. Click on the **More Help** button  at the bottom of the **3D Bevel Carving** page to display the **Bevelled Carving Help** window.
2. Click on one of the **Step 1** radio buttons  to display its corresponding **Step 2** in the window:
 - **I want to cut the bevelled carving out of the material** – Select this option if you want to remove the bevelled carving from the block of material.
 - **The bevelled carving sits within a bigger job** – Select this option if you do not want to remove the bevelled carving from the block of material.
3. Click on the **Close Window** button  to close the **Bevelled Carving Help** window.

Engraving



The **Engraving** button  in the **Toolpaths** area of the **Assistant's** Home page allows you to create a toolpath that engraves the vector text or object that you have selected.


Using the **Engraving** page, you can:

- Select both engraving and roughing tools.
- Control the areas that the engraving tool sharpens and profiles.
- Control the cut direction of the engraving tool.

To engrave a vector object:

1. Select the vector object that you want to engrave.

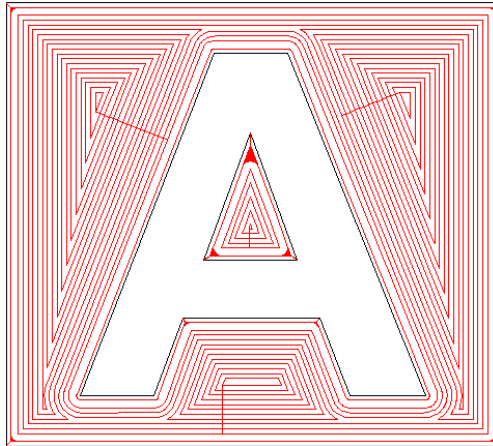
For details, see “Selecting Vectors” in the Working with Vectors chapter.

2. Click on the **Engraving** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Engraving** page.
3. Type the absolute Z value of the material surface that you want to engrave into in the **Start Depth** box.
4. Type the absolute Z zero value of the bottom of the cut in the **Finish Depth** box.
5. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.
6. If you are engraving one vector object inside of another, and do not require the engraving tool to sharpen the corners or machine the boundary of the outer vector object, click on the **Outer vectors are boundary** option to turn it on ☒.

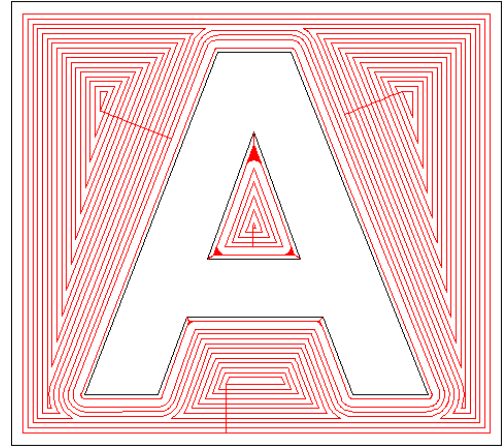
In the example below, you can see that the engraving tool machines along the boundary and sharpens the corners of the outer

rectangular vector object when the **Outer vectors are boundary** option is off ☐:


*Outer Vectors are boundary
OFF...*



*Outer Vectors are boundary
ON...*





7. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:

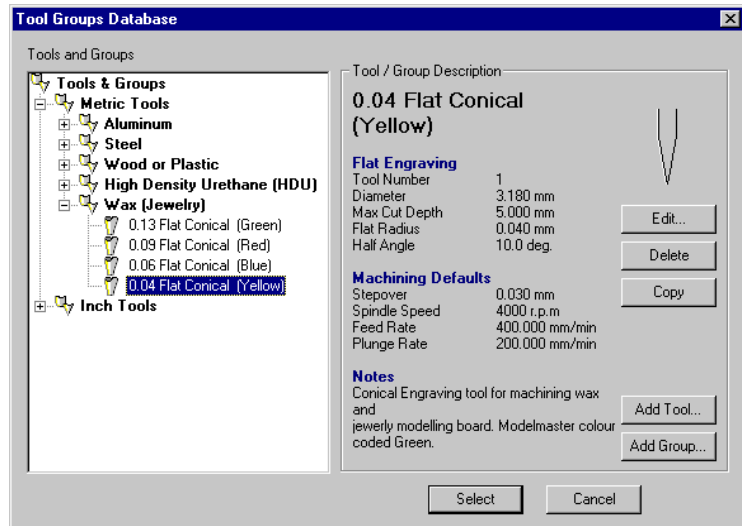
- Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
- Type a value in the **Safe Z** box.

8. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.




Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Engraving** page.


9. Click on the **Select** button  in the **Engraving Tool** area of the page to display the **Tool Groups Database**:



10. Double-click on the Conical tool you want to use. This closes the **Tool Groups Database**, and displays the selected tool's details in the **Engraving Tool** area.

11. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Engraving Tool** area.

For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

12. If you want to add or remove extra material around the vector object, you can type a value in the **Allowance** box.

The value you enter sets the distance between the boundary of the selected vector object and the engraving tool. Type a positive value to add material or a negative value to remove it.

13. To set the cut direction, click on one of the **Cut Direction** radio buttons  in the **Engraving Tool** area of the **Engraving** page:

- **Climb Mill** - Climb Milling rotates the cutter in the same direction as the feed motion.

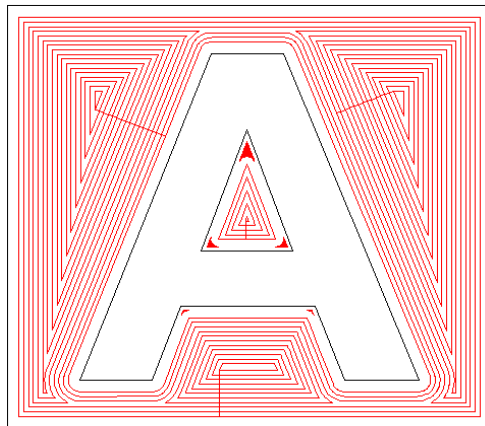
- **Conventional** – Conventional Milling rotates the cutter in the opposite direction to the feed motion.

For more details, see “Machining a Model” on page 259.

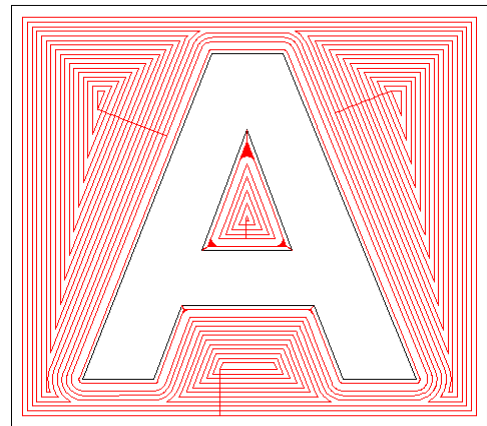
14. If you want the engraving tool to sharpen the corners of the machined vector object, click on the **Do Corner Sharpening** option to turn it on ☒.

In the example below, you can see that the engraving tool profiles the vector text A to sharpen its corners when the **Do Corner Sharpening** option is turned on ☒.

Do Corner Sharpening OFF...



Do Corner Sharpening ON...

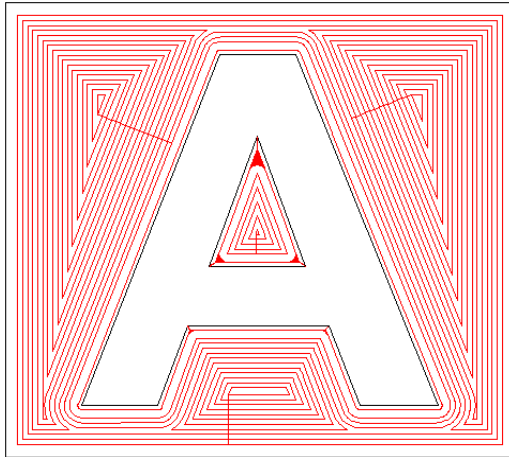


The engraving tool is also lifted in the Z direction to minimise the curvature in the corners of the vector text A.

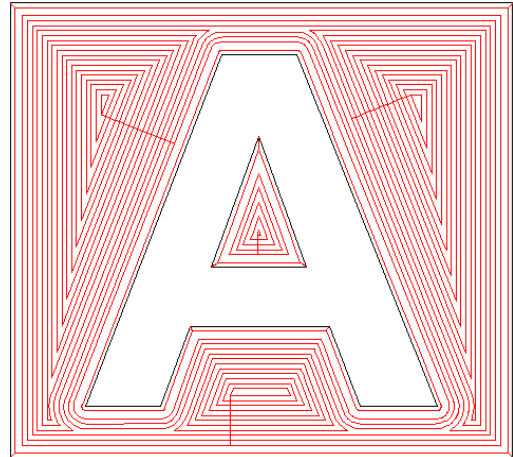
15. If you want the engraving tool to make a single profile pass around the vector object, click on the **Profile Only** option to turn it on ☒.

In the example below, you can see that the number of machining passes is reduced, particularly in the central cavity of the vector text A, when the **Profile Only** option is turned on ☒.

Profile Only OFF...



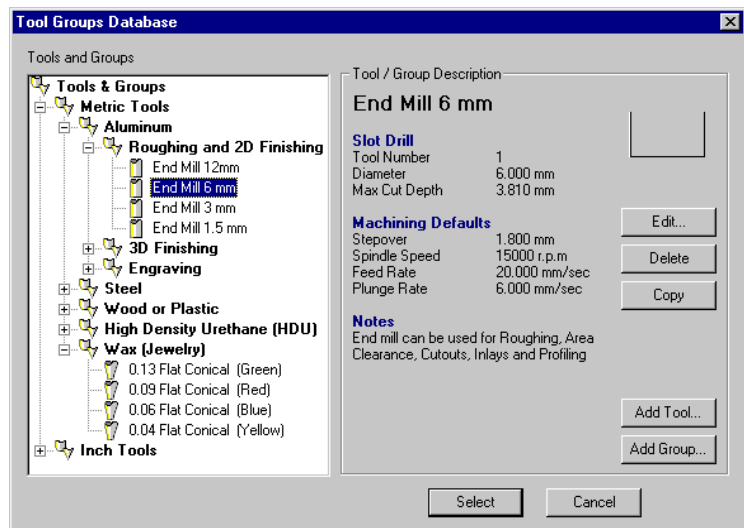
Profile Only ON...




16. If you want the engraving tool to cut to at a different depth than the roughing tool, click on the **Independent Finish Depth** option to turn it on ☒.

If you have turned this option on ☒, type the absolute Z zero value of the bottom of the area you want to engrave with the engraving tool in the **Finish Depth** box below.


17. Click on the **Select** button in the **Roughing Tool** area of the page to display the **Tool Groups Database**:



18. Double-click on the tool you want to use. This closes the **Tool Groups Database**, and displays the selected tool's details in the **Roughing Tool** area.


19. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Roughing Tool** area.


For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

20. If you want to add or remove extra material around the vector object, you can type a value in the **Allowance** box.


The value you enter sets the distance between the boundary of the selected vector object and the roughing tool. Type a positive value to add material or a negative value to remove it.

21. If you want to automatically offset the roughing tool in order to leave sufficient material for the angled-edge of the Conical engraving tool to form the side of the engraved feature, click on the **Offset for engraving tool** option to turn it on .

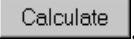

22. Click on the  arrow in the **Material** area of the **Engraving** page to view details of the block of material used for this model.

The difference between the **Z Top** and **Z bottom** values is equal to the thickness of the block. The **Origin** shows the material Z zero position.

23. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.


For more details on how to use this, see “Creating a Model” in the Working with Models chapter.

24. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.
25. Type a name for the toolpath in the **Name** box.
26. Click on the **Calculate** button .
27. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.

Centreline Engraved Feature





The **Machine Vectors** button  in the **Toolpaths** area of the **Assistant's** Home page allows you to create a centreline engraved (female) feature.

The boundary of a selected vector object represents the centreline of the cutting tool. The engraved feature has no diameter other than that of the tip of the cutting tool.


This toolpath is mainly used to produce simple, engraved text or to provide sharp profiling for detailed edges.

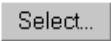
1. Select the vector object that you want to engrave about the outline.

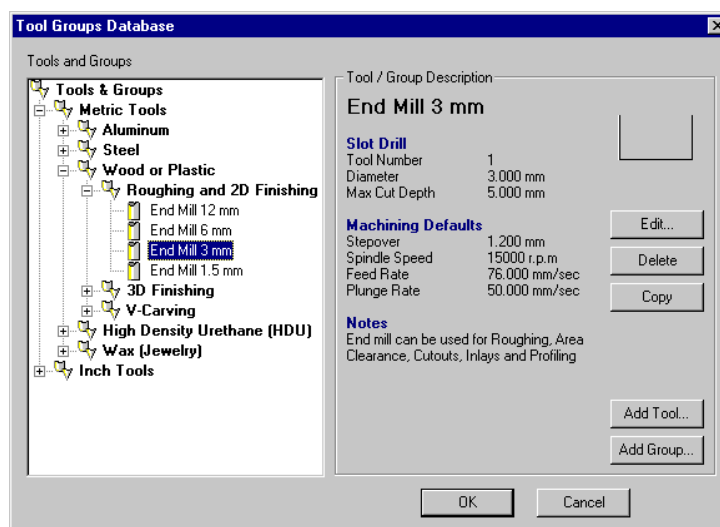
For details, see “Selecting Vectors” in the Working with Vectors chapter.
2. Click on the **Machine Vectors** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Machine Vectors** page.
3. Type the absolute Z value of the material surface that you want to cut the outline into in the **Start Depth** box.
4. Type the absolute Z zero value of the bottom of the cut in the **Finish Depth** box
5. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.


6. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
7. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.




Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Machine Vectors** page.


8. Click on the **Select** button  in the **Profiling Tool** area of the page to open the **Tool Groups Database**:



9. Double-click on the tool you want to use. This closes the **Tool Groups Database**, and displays the selected tool's details in the **Profiling Tool** area.
10. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Profiling Tool** area.

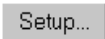
For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

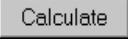
11. Click on the  arrow in the **Material** area of the **Machine Vectors** page to view details of the block of material used for this model.

The difference between the **Z Top** and **Z bottom** values is equal to the thickness of the block. The **Origin** shows the material Z zero position.

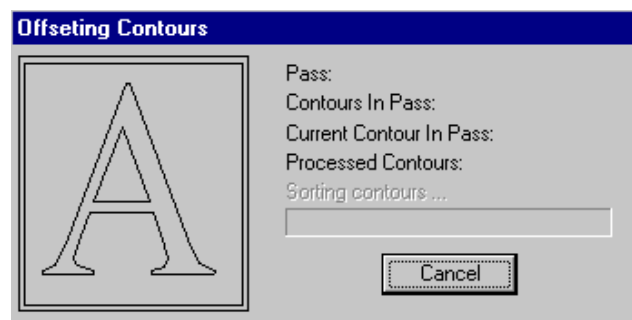
12. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

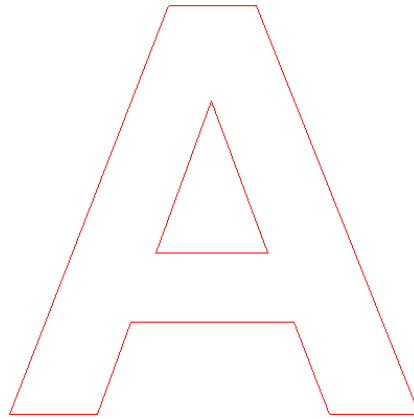
For more details on how to use this, see “Creating a Model” in the Working with Models chapter.


13. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.
14. Type a name for the toolpath in the **Name** box.
15. Click on the **Calculate** button .

The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the toolpath:



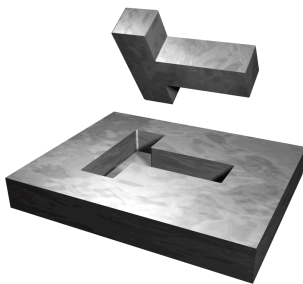
The passes used to machine the stepped insert are represented by a sequence of dark red lines drawn on the boundary of the selected vector object(s):




16. Click on the **Close** button  to return to the **Assistant's** Home page.


You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.

Inlay Wizard



The **Inlay Wizard** button  in the **Toolpaths** area of the **Assistant's** Home page allows you to create a toolpath that can produce one of many different kinds of inlays and inserts. Essentially, you can use this strategy to machine interlocking male and female parts.

To produce a particular style of interlocking male and female parts:

1. Select the vector object that you want to create an inlay or insert out of.
For details, see “Selecting Vectors” in the Working with Vectors chapter.
2. Click on the **Inlay Wizard** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Inlay Wizard** page.
3. Select the **Inlay Type** that you want to create:
 - **Pocket.** For details, see “Creating a Pocket” on page 294.
 - **Hole.** For details, see “Creating a Hole” on page 300.

- **Stepped Pocket.** For details, see “Creating a Stepped Pocket” on page 304.
- **Stepped Hole.** For details, see “Creating a Stepped Hole” on page 310.
- **Straight Insert.** For details, see “Creating a Straight Insert” on page 314.
- **Stepped Insert.** For details, see “Creating a Stepped Insert” on page 318.

Creating a Pocket


This **Female Inlay** option displays the **Female Inlay Pocket** page in the **Assistant** window. This allows you to create a pocket, which is a hole in the material that has a bottom and does not go right through the block. You can then create a male straight insert to fit into the pocket.

Using the **Female Inlay Pocket** page, you can:

- Select both roughing and finishing tools.
- Select a tool clearance strategy for the roughing tool you want to use.


Depending on the strategy you select, you can control the angle, where and in what direction the tool cuts into the block of material.

To create a pocket:


1. Click on the **Pocket** option  in the **Inlay Types** area of the **Inlay Wizard** page to display the **Female Inlay Pocket** page in the **Assistant** window.
2. Type the absolute Z value of the material surface in which you are creating the pocket in the **Start Depth** box.
3. Type the absolute Z zero value of the bottom of the pocket you are creating in the **Finish Depth** box.
4. If you want to enlarge or reduce the pocket around the selected vector object, you can type a value in the **Allowance** box.

The value you enter sets the distance between the boundary of the selected vector object and the finishing tool. Type a positive value to enlarge the pocket or a negative value to reduce it.

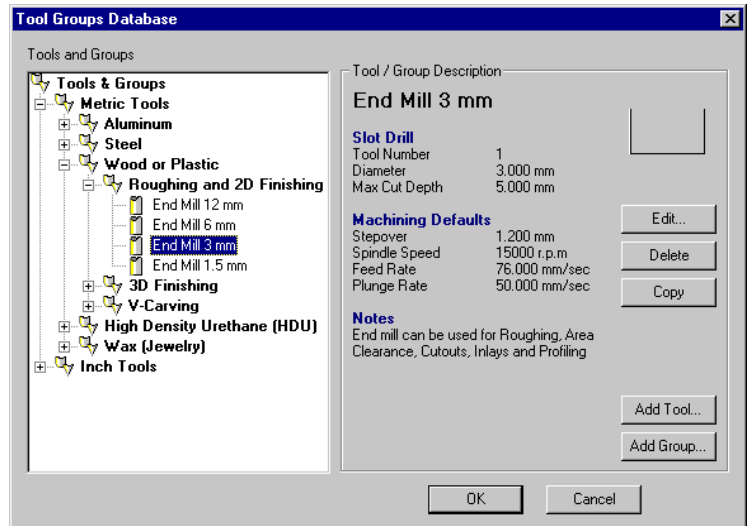
Make sure that there is a sufficient allowance for the corresponding male straight insert to fit into the pocket.

5. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the selected vector object.
6. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
7. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.



Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Female Inlay** page.


8. Click on the **Select** button  in the **Finishing Tool** area of the page to open the **Tool Groups Database**:




9. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Finishing Tool** area.



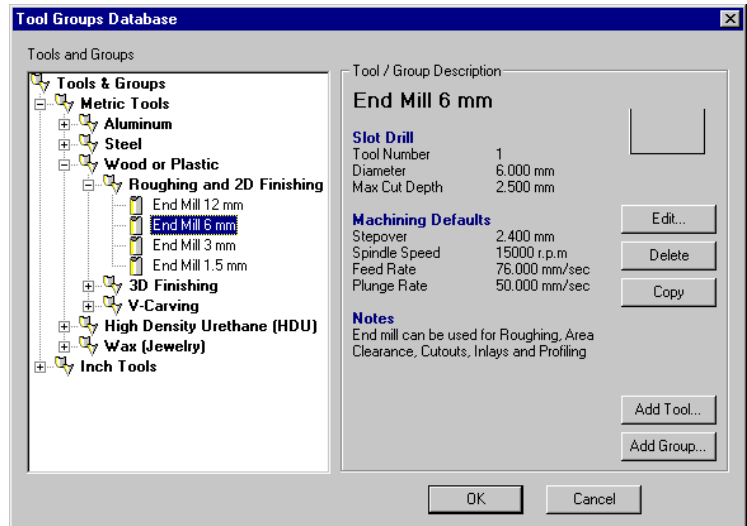
Important: The selected **Finishing Tool** must be the same size as the tool used to machine the male straight insert to be fitted into this pocket.

10. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Finishing Tool** area.


For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.


11. Click on the **Select** button  in the **Roughing Tool** area of the page to open the **Tool Groups Database**:



12. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Roughing Tool** area.

13. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Roughing Tool** area.


For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

14. If you want to enlarge or reduce the pocket around the selected vector object, you can type a value in the **Allowance** box in the **Roughing Tool** area of the page.

The value you enter sets the distance between the boundary of the selected vector object and the roughing tool. Type a positive value to enlarge the pocket or a negative value to reduce it.

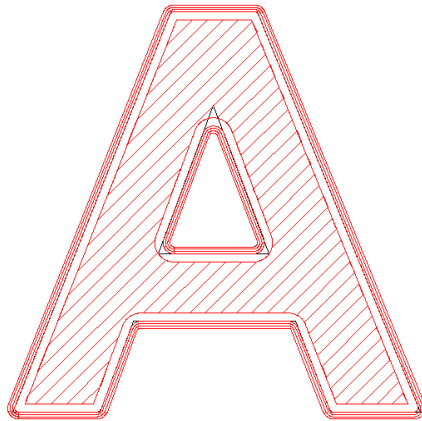
Make sure that there is a sufficient allowance for the corresponding male straight insert to fit into the pocket.

15. Select how you want the roughing tool to clear the pocket using the **Strategy** radio buttons :

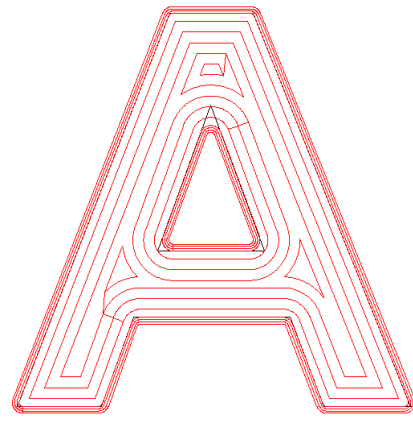
- **Raster** - This strategy machines in passes back and forth along a specified angle.
- **Offset** - This strategy machines in repeated passes, each time moving inwards by the **Stepover** value of the tool you use.

You can see the stepover value of the selected tool when the machining parameters are displayed in the **Roughing Tool** area.


Raster Strategy at 45°...



Offset Strategy at Climb...



If you have selected **Raster**:

- Type the angle you want the tool to move at in the **Angle** box.
- Click on one of the **Profile Pass** radio buttons :

None – Select this option if you want the roughing tool to machine the first offset pass, then move inwards to clear the remaining area. The tool does not profile the selected vector object.

First – Select this option if you want the roughing tool to profile the selected vector object first, and then move inwards to clear the remaining area.

Last – Select this option if you want the roughing tool to machine the innermost offset pass first, move outwards to clear the remaining area, then finally profile the selected vector object.


If you have selected **Offset**:

- Click on one of the **Cut Direction** radio buttons :

Climb - Climb Milling rotates the cutter in the same direction as the feed motion.


Conv. - Conventional Milling rotates the cutter in the opposite direction to the feed motion.

For more details, see “Machining a Model” on page 259.

- Click on one of the **Start Point** radio buttons :

Outside - Select this option if you want the tool to cut into the material at the boundary of the selected vector object, then machine inwards.


Inside - Select this option if you want the tool to cut into the material at the centre of the selected vector object, then machine outwards.

16. Click on the  arrow in the **Material** area to view details of the block of material used for this model.

The distance between the **Z Top** and **Z bottom** values is equal to the thickness of the block.

The **Origin** shows the material Z zero position.

17. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

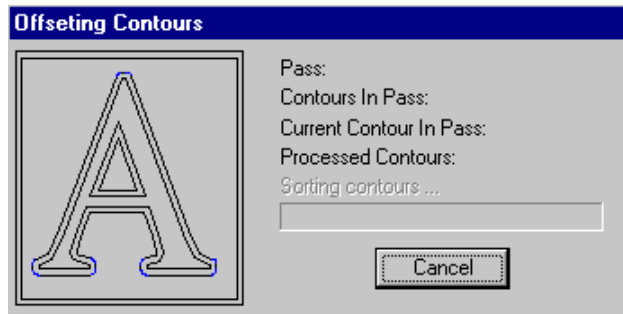
For more details on how to use this, see “Creating a Model” in the Working with Models chapter.

18. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.


19. Type a name for the toolpath in the **Name** box.

20. Click on the **Calculate** button .

The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the toolpath:



The passes used to machine the pocket are represented by a sequence of dark red lines drawn about the boundary and inside of the selected vector object, according to the **Strategy** that you had selected in Step 15.

21. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.


Creating a Hole

This **Female Inlay** option displays the **Female Inlay** page in the **Assistant** window. This allows you to create a hole in the block of material. You can then create a male straight insert to fit into the hole.

Using the **Female Inlay** page, you can:

- Select a tool to cut the hole in the block of material.
- Control the cutting direction of the tool.


To create a hole:

1. Click on the **Hole** option  in the **Inlay Types** area of the **Inlay Wizard** page to display the **Female Inlay** page in the **Assistant** window.


2. Type the absolute Z value of the material surface in which you are creating the hole in the **Start Depth** box.
3. Type the absolute Z zero value of the bottom of the hole you are creating in the **Finish Depth** box.
4. If you want to enlarge or reduce the hole around the selected vector object, you can type a value in the **Allowance** box.

The value you enter sets the distance between the boundary of the selected vector object and the profiling tool. Type a positive value to enlarge the hole or a negative value to reduce it.

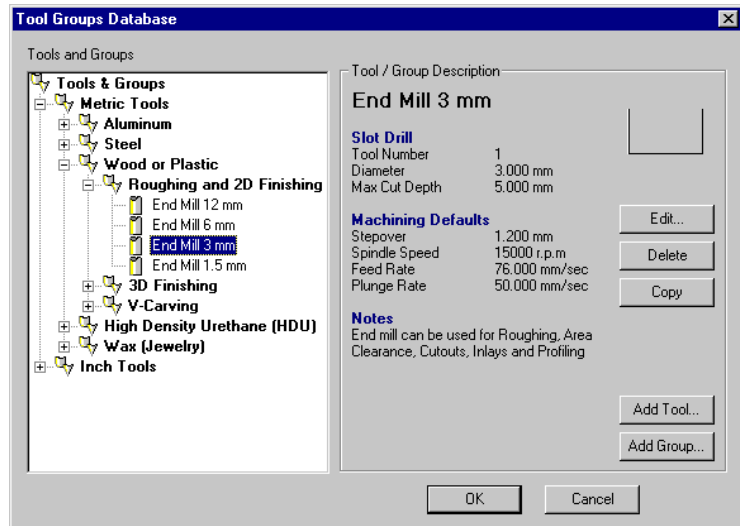
Make sure that there is a sufficient allowance for the corresponding male straight insert to fit into the hole.

5. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.
6. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
7. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.




Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Female Inlay** page.


8. Click on the **Select** button  in the **Tool** area of the page to display the **Tool Groups Database**:





9. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Tool** area.

10. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Tool** area.


For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

11. To set the cut direction, click on the  arrow in the **Cut Direction** area of the **Female Inlay** page, then click on one of the **Cut Direction** radio buttons :

- **Climb Mill** - Climb Milling rotates the cutter in the same direction as the feed motion.
- **Conventional** - Conventional Milling rotates the cutter in the opposite direction to the feed motion.

For more details, see “Machining a Model” on page 259.

12. Click on the  arrow in the **Material** area of the **Female Inlay** page to view details of the block of material used for this model.

The distance between the **Z Top** and **Z bottom** values is equal to the thickness of the block.

The **Origin** shows the material Z zero position.

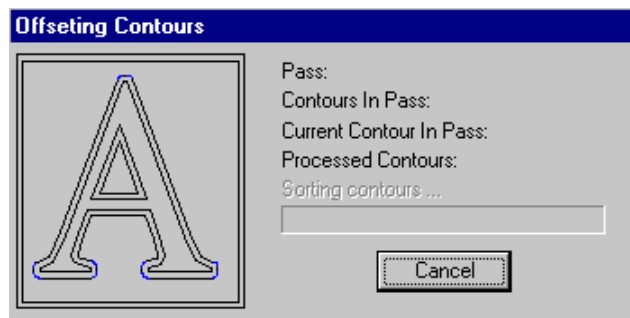
13. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the **Setup...** button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

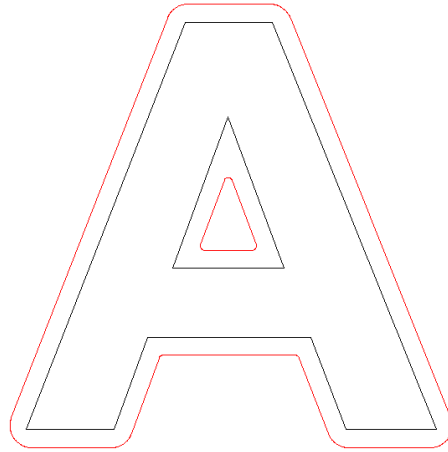
For more details on how to use this, see “Creating a Model” in the Working with Models chapter.


14. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.
15. Type a name for the toolpath in the **Name** box.
16. Click on the **Calculate** button **Calculate**.

The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the toolpath:



The passes used to machine the hole are represented by a sequence of dark red lines drawn about the boundary of the selected vector object:



17. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.

Creating a Stepped Pocket


This **Female Inlay** option displays the **Female Stepped Pocket Inlay** page in the **Assistant** window. This allows you to create a stepped pocket, which is a stepped hole in the material that has a bottom and does not go right through the block. You can then create a male straight insert to fit into the stepped pocket.

Using the **Female Stepped Pocket Inlay** page, you can:

- Control the depth and width of the pocket shoulder.
- Select both roughing and finishing tools.
- Select a tool clearance strategy for the roughing tool you want to use.

Depending on what strategy you select, you can control the angle, where and in what direction the tool cuts into the block of material.

To create a stepped pocket:

1. Click on the **Stepped Pocket** option  in the **Inlay Types** area of the **Inlay Wizard** page to display the **Female Stepped Pocket Inlay** page in the **Assistant** window.

2. Type the absolute Z value of the material surface in which you want to create the stepped pocket in the **Start Depth** box.
3. Type the absolute Z zero value of the bottom of the stepped pocket you want to create the **Finish Depth** box.
4. If you want to enlarge or reduce the stepped pocket around the selected vector object, you can type a value in the **Allowance** box.


The value you enter sets the distance between the boundary of the selected vector object and the finishing tool. Type a positive value to enlarge the stepped pocket or a negative value to reduce it.

Make sure that there is a sufficient allowance for the corresponding male straight insert to fit into the hole.

5. If you want to enlarge or reduce the stepped pocket around the selected vector object, you can type a value in the **Allowance** box.


The value you enter sets the distance between the boundary of the selected vector object and the finishing tool. Type a positive value to enlarge the stepped pocket or a negative value to reduce it.


Make sure that there is a sufficient allowance for the corresponding male stepped insert to fit into the stepped pocket.

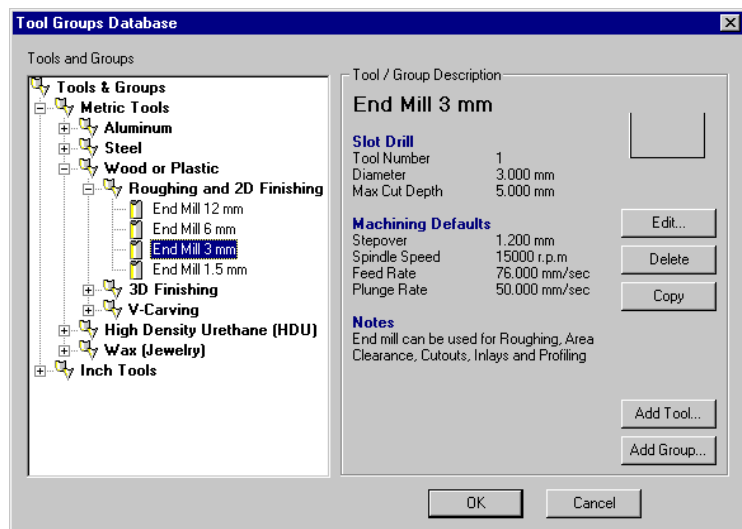
6. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the selected vector object.
7. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.

8. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.



Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Female Stepped Pocket Inlay** page.


9. Type the relative depth of the shoulder from the **Start Depth** in the **Depth (d)** box, in the **Shoulder Dimensions** area of the page.
10. Type the width of the shoulder in the **Width (s)** box.
11. Click on the **Select** button  in the **Finishing Tool** area of the page to open the **Tool Groups Database**:




12. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Finishing Tool** area.



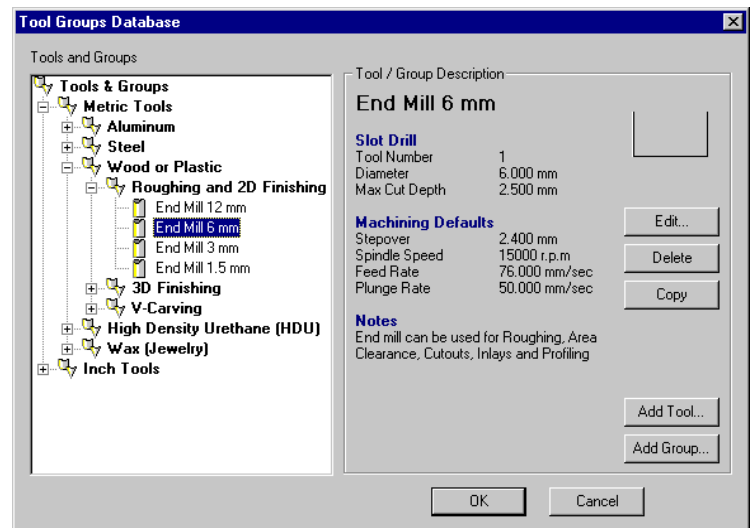
Note: The selected **Finishing Tool** must be the same size as the tool used to machine the male stepped insert which you want to fit into this stepped pocket.


13. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Finishing Tool** area.

For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.


When you have finished, click on the  arrow to hide the machining parameters.

- Click on the **Select** button  in the **Roughing Tool** area of the page to open the **Tool Groups Database**:



- Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool’s details in the **Roughing Tool** area.
- If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Roughing Tool** area.

For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.


When you have finished, click on the  arrow to hide the machining parameters.

- If you want to enlarge or reduce the stepped pocket around the selected vector object, you can type a value in the **Allowance** box in the **Roughing Tool** area of the page.

The value you enter sets the distance between the boundary of the selected vector object and the roughing tool. Type a positive value to

enlarge the stepped pocket or a negative value to reduce it.

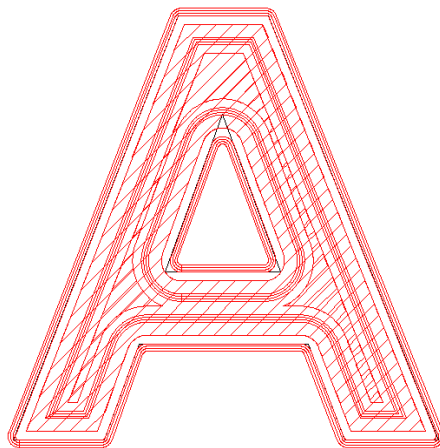
Make sure that there is a sufficient allowance for the corresponding male straight insert to fit into the stepped pocket.

18. Select how you want the roughing tool to clear the stepped pocket using the **Strategy** radio buttons :

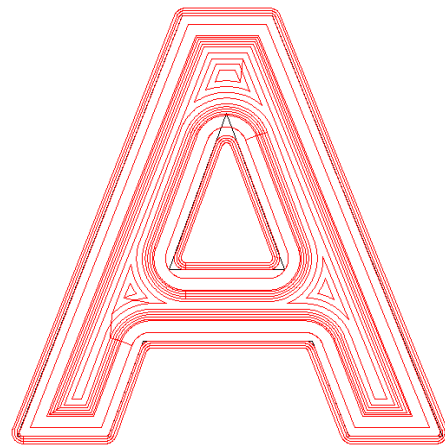
- **Raster** - This strategy machines in passes back and forth along a specified angle.
- **Offset** - This strategy machines in repeated passes, each time moving inwards by the **Stepover** value of the tool you use.

You can see the stepover value of the selected tool when the machining parameters are displayed in the **Roughing Tool** area of the **Female Stepped Pocket Inlay** page.


Raster Strategy at 45°...



Offset Strategy...



If you have selected **Raster**:

- Type the angle you want the tool to move at in the **Angle** box.
- Click on one of the **Profile Pass** radio buttons :

None – Select this option if you want the roughing tool to machine the first offset pass, then move inwards to clear the remaining area. The tool does not profile the selected vector object.

First – Select this option if you want the roughing tool to profile the selected vector object first, and then move inwards to clear the remaining area.

Last – Select this option if you want the roughing tool to machine the innermost offset pass first, move outwards to clear the remaining area, then finally profile the selected vector object.


If you have selected **Offset**:

- Click on one of the **Cut Direction** radio buttons :

Climb - Climb Milling rotates the cutter in the same direction as the feed motion.


Conv. - Conventional Milling rotates the cutter in the opposite direction to the feed motion.

For more details, see “Machining a Model” on page 259.

- Click on one of the **Start Point** radio buttons :

Outside - Select this option if you want the tool to cut into the material at the boundary of the selected vector object, then machine inwards.

Inside - Select this option if you want the tool to cut into the material at the centre of the selected vector object, then machine outwards.

19. Click on the  arrow in the **Material** area of the **Female Stepped Pocket Inlay** page to view details of the block of material used for this model.

The distance between the **Z Top** and **Z bottom** values is equal to the thickness of the block.

The **Origin** shows the material Z zero position.

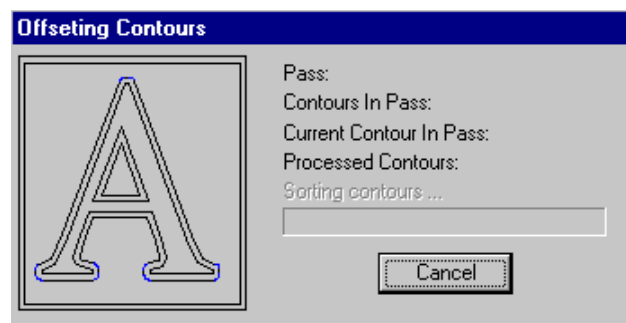
20. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the **Setup...** button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

For more details on how to use this, see “Creating a Model” in the Working with Models chapter.

21. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.
22. Type a name for the toolpath in the **Name** box.
23. Click on the **Calculate** button **Calculate**.

The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the toolpath:



The passes used to machine the stepped pocket are represented by a sequence of dark red lines drawn about the boundary and inside of the selected vector object, according to the **Strategy** that you had selected in Step 18.

24. Click on the **Close** button **Close** to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.

Creating a Stepped Hole


This **Female Inlay** option displays the **Female Stepped Hole Inlay** page in the **Assistant** window. This allows you to create a stepped hole in the block of

material. You can then create a male stepped insert to fit into the stepped hole.

Using the **Female Stepped Hole Inlay** page, you can:

- Control the depth and width of the hole shoulder.
- Select a tool to cut the hole in the block of material.
- Control the cutting direction of the tool.


To create a stepped hole:

1. Click on the **Stepped Hole** option  in the **Inlay Types** area of the **Inlay Wizard** page to display the **Female Stepped Hole Inlay** page in the **Assistant** window.
2. Type the absolute Z value of the material surface in which you are creating the hole in the **Start Depth** box.
3. Type the absolute Z zero value of the bottom of the hole you are creating in the **Finish Depth** box.
4. If you want to enlarge or reduce the stepped hole around the selected vector object, you can type a value in the **Allowance** box.


The value you enter sets the distance between the boundary of the selected vector object and the tool. Type a positive value to enlarge the stepped hole or a negative value to reduce it.


Make sure that there is a sufficient allowance for the corresponding male stepped insert to fit into the stepped hole.

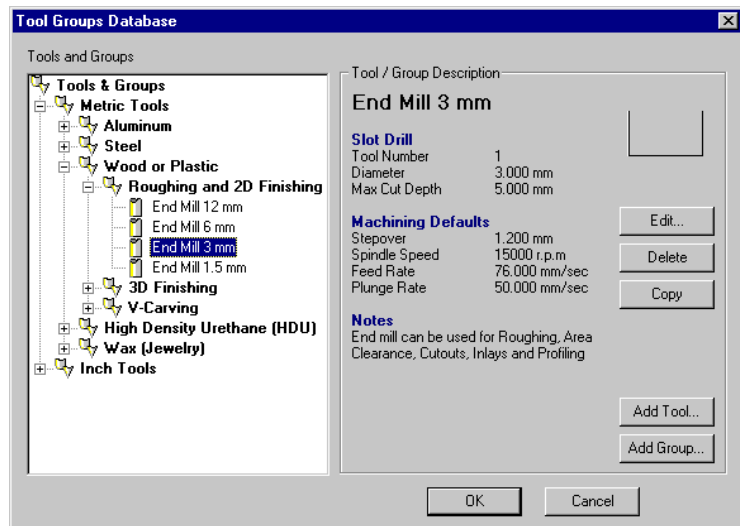
5. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.
6. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:


- Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
7. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.




Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Female Stepped Hole Inlay** page.



8. Type the relative depth of the shoulder from the **Start Depth** in the **Depth (d)** box, in the **Shoulder Dimensions** area of the page.
9. Type the width of the shoulder in the **Width (s)** box.
10. Click on the **Select** button  in the **Tool** area of the page to display the **Tool Groups Database**:



11. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Tool** area.
12. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Tool** area.


For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

13. To set the cut direction, click on the  arrow in the **Cut Direction** area of the **Female Stepped Hole Inlay** page, then click on one of the **Cut Direction** radio buttons :

- **Climb Mill** - Climb Milling rotates the cutter in the same direction as the feed motion.
- **Conventional** - Conventional Milling rotates the cutter in the opposite direction to the feed motion.


For more details, see “Machining a Model” on page 259.

14. Click on the  arrow in the **Material** area of the **Female Stepped Hole Inlay** page to view details of the block of material used for this model.

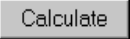
The distance between the **Z Top** and **Z bottom** values is equal to the thickness of the block.

The **Origin** shows the material Z zero position.

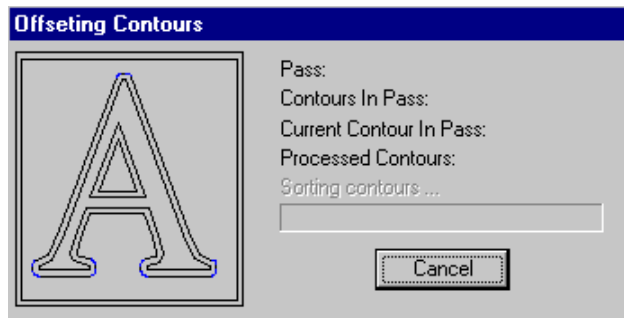
15. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

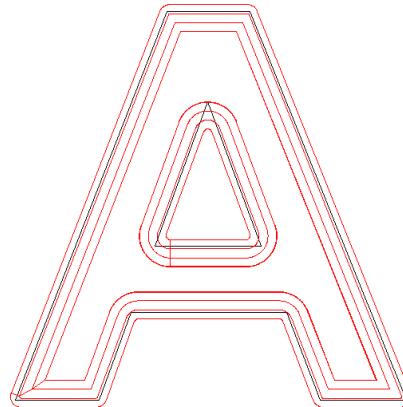
For more details on how to use this, see “Creating a Model” in the Working with Models chapter.


16. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.
17. Type a name for the toolpath in the **Name** box.
18. Click on the **Calculate** button .

The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the toolpath:



The passes used to machine the stepped hole are represented by a sequence of dark red lines drawn about the boundary of the selected vector object:



19. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.

Creating a Straight Insert


This **Male Inlay** option displays the **Male Insert** page in the **Assistant** window. This allows you to create a male straight insert from the block of material. You can then create a female hole or pocket to fit the male straight insert into.

Using the **Male Insert** page, you can:

- Select a tool to cut the straight insert out of the block.


- Control the cutting direction of the tool.

To create a straight insert:


1. Click on the **Straight** option  in the **Inlay Types** area of the **Inlay Wizard** page to display the **Male Insert** page in the **Assistant** window.
2. Type the absolute Z value of the material surface in which you are creating the straight insert in the **Start Depth** box.
3. Type the absolute Z zero value of the bottom of the straight insert you are creating in the **Finish Depth** box.
4. If you want to enlarge or reduce the straight insert around the selected vector object, you can type a value in the **Allowance** box.

The value you enter sets the distance between the boundary of the selected vector object and the tool. Type a positive value to enlarge the straight insert or a negative value to reduce it.

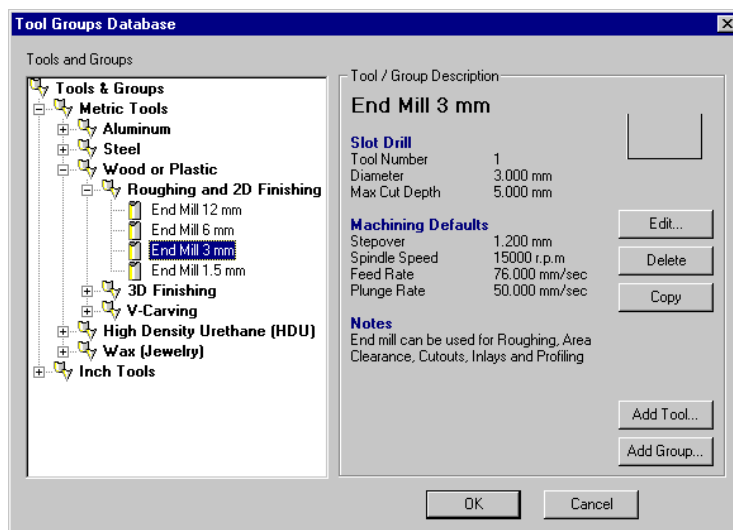
Make sure that there is a sufficient allowance for the corresponding female hole or pocket.

5. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.
6. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
7. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.



Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Male Insert** page.


8. Click on the **Select** button  in the **Tool** area of the page to display the **Tool Groups Database**:




9. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Tool** area.





Note: The selected **Tool** must be the same size as that used to machine the female hole or pocket which you want to fit this straight insert into.

10. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Tool** area.

For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.


When you have finished, click on the  arrow to hide the machining parameters.

11. To set the cut direction, click on the  arrow in the **Cut Direction** area of the **Male Insert** page, then click on one of the **Cut Direction** radio buttons :

- **Climb Mill** - Climb Milling rotates the cutter in the same direction as the feed motion.

- **Conventional** - Conventional Milling rotates the cutter in the opposite direction to the feed motion.


For more details, see “Machining a Model” on page 259.

12. Click on the  arrow in the **Material** area of the **Male Insert** page to view details of the block of material used for this model.

The distance between the **Z Top** and **Z bottom** values is equal to the thickness of the block.

The **Origin** shows the material Z zero position.

13. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

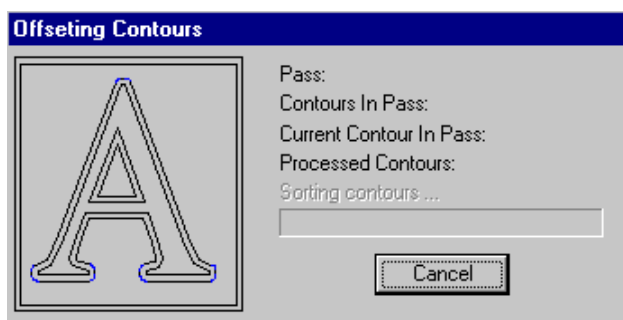
For more details on how to use this, see “Creating a Model” in the Working with Models chapter.

14. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.

15. Type a name for the toolpath in the **Name** box.

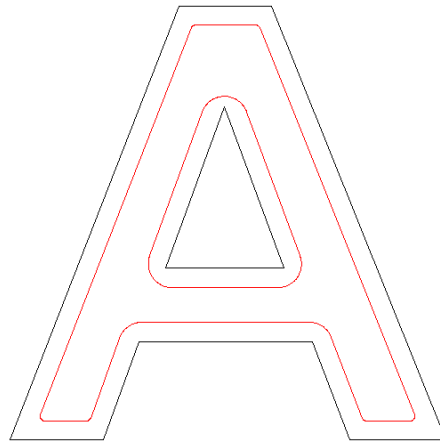
16. Click on the **Calculate** button .


The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the toolpath:



The passes used to machine the straight insert are represented by a sequence of dark red lines

drawn about the boundary of the selected vector object:



17. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.


Creating a Stepped Insert

This **Male Inlay** option displays the **Male Stepped Insert** page in the **Assistant** window. This allows you to create a male stepped insert from the block of material. You can then create a female stepped hole or stepped pocket to fit the male stepped insert into.

Using the **Male Stepped Insert** page, you can:

- Select a tool to cut the stepped insert out of the block.
- Control the depth and width of the insert shoulder.
- Control the cutting direction of the tool.


To create a stepped insert:

1. Click on the **Stepped** option  in the **Inlay Types** area of the **Inlay Wizard** page to display the **Male Stepped Insert** page in the **Assistant** window.
2. Type the absolute Z value of the material surface in which you are creating the stepped insert in the **Start Depth** box.


3. Type the absolute Z zero value of the bottom of the stepped insert you are creating in the **Finish Depth** box.
4. If you want to enlarge or reduce the stepped insert around the selected vector object, you can type a value in the **Allowance** box.


The value you enter sets the distance between the boundary of the selected vector object and the tool. Type a positive value to enlarge the stepped insert or a negative value to reduce it.

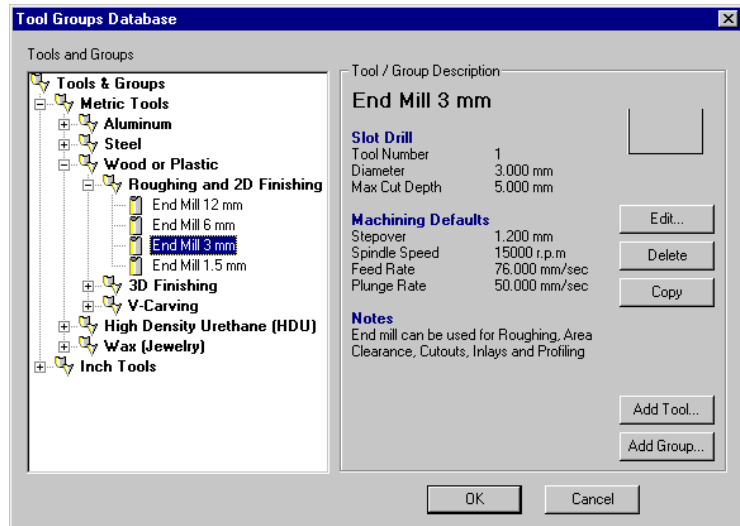
Make sure that there is a sufficient allowance for the corresponding female stepped hole or stepped pocket.

5. Type a value in the **Tolerance** box to specify how closely you want the cutter to follow the shape of the vector object.
6. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
7. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.



Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Male Stepped Insert** page.


8. Type the relative depth of the shoulder from the **Start Depth** in the **Depth (d)** box, in the **Shoulder Dimensions** area of the page.
9. Type the width of the shoulder in the **Width (s)** box.
10. Click on the **Select** button  in the **Tool** area of the page to display the **Tool Groups Database**:




11. Double-click on the tool you want to use. This closes the **Tool Groups Database** and displays the selected tool's details in the **Tool** area.





Note: The selected **Tool** must be the same size as that used to machine the female stepped hole or stepped pocket which you want to fit this stepped insert into.

12. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Tool** area.


For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.

When you have finished, click on the  arrow to hide the machining parameters.

13. To set the cut direction, click on the  arrow in the **Cut Direction** area of the **Male Stepped Insert** page, then click on one of the **Cut Direction** radio buttons :

- **Climb Mill** - Climb Milling rotates the cutter in the same direction as the feed motion.
- **Conventional** - Conventional Milling rotates the cutter in the opposite direction to the feed motion.


For more details, see “Machining a Model” on page 259.

14. Click on the  arrow in the **Material** area of the **Male Stepped Insert** page to view details of the block of material used for this model.

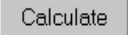
The distance between the **Z Top** and **Z bottom** values is equal to the thickness of the block.

The **Origin** shows the material Z zero position.

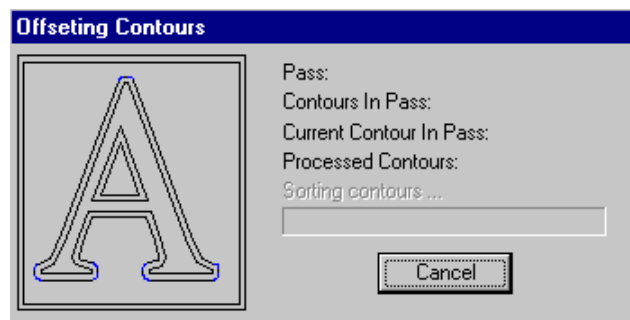
15. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

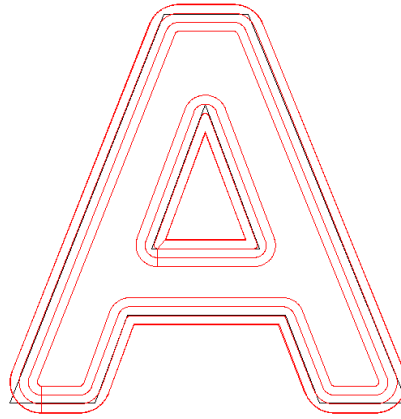
For more details on how to use this, see “Creating a Model” in the Working with Models chapter.


16. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.
17. Type a name for the toolpath in the **Name** box.
18. Click on the **Calculate** button .

The **Offsetting Contours** dialog box is displayed while ArtCAM 2D calculates the toolpath:



The passes used to machine the stepped insert are represented by a sequence of dark red lines drawn about the boundary of the selected vector object:




19. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created. For details, see “Simulating Toolpaths” on page 337.

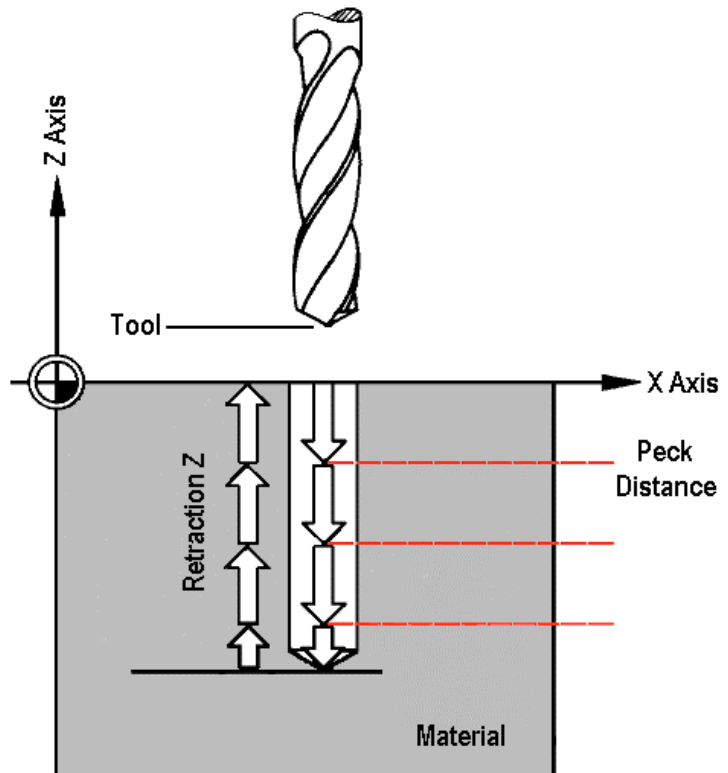
Drill Holes

When creating a sign, it is often necessary to drill holes in the block of material so that it can be hung.

The **Draw Drill Holes** button  in the **Toolpaths** area of the **Assistant's** Home page allows you to create drill holes.

The hole size is determined by the diameter of the cutting tool that is used to drill it.

When drilling holes you can use peck drilling to reduce chip packing in the hole. The tool drills a short distance into the block of material, then withdraws. The deeper the hole, the more frequent the drill must be retracted (or pecked) to be effective:




The selected tool is retracted from the block of material to the **Retraction Z** level when it reaches the level displayed in the **Max.Depth** box in the **Tool** area of the page. The **Max.Depth** is also referred to as the Peck Distance. The tool then continues to cut deeper into the block of material until the **Finish Depth** is reached or the **Max.Depth** is reached again. In the latter instance, the tool retracts from the block of material to the **Retraction Z** level again. This cycle continues until the **Finish Depth** is finally reached.

To create drill holes in your model:


1. Select vector objects through which you want to create drill holes.

For details, see “Selecting Vectors” in the Working with Vectors chapter.

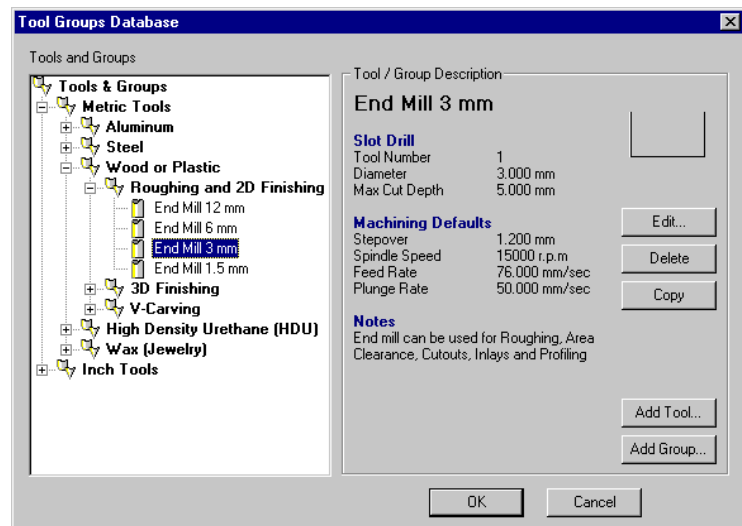
2. Click on the **Draw Drill Holes** button  to display the **Drilling** page in the **Assistant** window.

3. Type the absolute Z value of the material surface in the **Start Depth** box. This is where the drilling starts.
4. Type the absolute Z zero value of the bottom of each drill hole in the **Finish Depth** box.
5. If you want to change the height at which the cutting tool makes rapid moves between toolpath segments:
 - Click on the  arrow to display the **Safe Z** box and the **Home Position's X, Y and Z** boxes.
 - Type a value in the **Safe Z** box.
6. If you want to define the **Home Position** for the machining tool, type values in the **Home Position's X, Y and Z** boxes.




Note: Click on the  arrow to hide the **Safe Z** box and the **Home Position's X, Y and Z** boxes on the **Engraving** page.


7. Click on the **Select** button in the **Tool** area of the page to open the **Tool Groups Database**:



8. Double-click on the tool you want to use to close the **Tool Groups Database**, and display the selected tool's details in the **Tool** area.



9. If you want to amend the machining parameters for the selected tool, click on the  arrow in the **Engraving Tool** area.

For further information, see “Adjusting Machining Parameters When Creating a Toolpath” on page 334.


When you have finished, click on the  arrow to hide the machining parameters.



Note: The diameter of the selected tool is equal to the diameter of the drill holes.


10. To set where the holes are drilled in your model, click on one of the **Drill Centre of...** radio buttons :
- **Circular Vectors** – Select this option if you have selected circles or ellipses to define the position of the drill holes.
 - **All Vectors** – Select this option if you have selected vector objects that are not circular. ArtCAM 2D then drills holes at the centre of all selected vector objects, irrespective of their shape. The holes are drilled at the centre of the bounding box that surrounds the selected vector object.
 - **All Vector Nodes** – Select this option to drill holes at each node (point) in the selected vector object. For example, holes would be drilled in a square at each corner, assuming that there are no intermediate points on any of its four sides.
- For details on nodes (points), see “Inserting a Point” and “Editing Vector Nodes” in the Working with Vectors chapter.
11. If you want to drill the holes using the peck drilling method:
- Click on the **Peck Drilling** option to turn it on  and display the **Retraction Z** box.
 - Type a value in the **Retraction Z** box.

If you do not, make sure that the **Peck Drilling** option is turned off ☐.

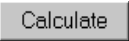

12. Click on the  arrow in the **Material** area of the **Engraving** page to view details of the block of material used for this model.

The difference between the **Z Top** and **Z bottom** values is equal to the thickness of the block. The **Origin** shows the material Z zero position.

13. Make sure that the thickness of the block and the origin displayed is correct.

If you want to change these settings, click on the  button in the **Material** area of the page to display the **Setup Job Dimensions** dialog box.

For more details on how to use this, see “Creating a Model” in the Working with Models chapter.

14. If you do not want to preview the toolpath in the **2D View** window, click on the **Create 2D Preview** option to turn it off ☐.
15. Type a name for the toolpath in the **Name** box.
16. Click on the **Calculate** button .
17. Click on the **Close** button  to return to the **Assistant's** Home page.

You are now ready to simulate the toolpath you have created for the drill holes. For details, see “Simulating Toolpaths” on page 337.

Adding Bridging




Bridging is a precautionary measure to prevent a profiled vector object from shifting in the block of material as it is machined.

The tool used to profile vector objects lifts slightly in the Z direction about the position of each bridge, leaving small tabs that hold the vector object in position during machining. The machined vector object can then be gently snapped out from the block of material.

You can add bridges to any existing Profile toolpath you have created. To do so:


1. Click on a Profile toolpath to select it.

The selected Profile toolpath is dark red and surrounded by a bounding box.

2. Click on the **Create Bridges** button  in the **Toolpaths** area to display the **Bridging** page in the **Assistant** window.



Note: If you open this page without a Profile toolpath selected, there are no input boxes shown on the **Bridging** page. Click on a Profile toolpath to display the input boxes.

3. Type a value in the **Bridge Length** box to set the length of each bridge.
4. Type a value in the **Bridge Thickness** box to set the thickness of each bridge in the Z direction.
5. To set how the bridges are added to the Profile toolpath, click on one of the **Add Bridges To Profiles** radio buttons :
 - **Constant Number** – Select this option to place a specific number of evenly spaced bridges on each Profile pass.

If you select this option, type the number of bridges you want in the **Number** box.

- **Constant Spacing** – Select this option to place bridges at a specific distance apart from each other on each Profile pass.

If you select this option, type the distance you want between bridges, about the centre of each bridge, in the **Distance** box.

Now type the minimum number of bridges that you want on each Profile pass, irrespective of the distance you have set between them, in the **Min. Number** box.


6. Click on the **Create Bridges** button

Create Bridges

to add the bridging.

Each bridge is blue with a control point at each end.

Any existing bridges on the Profile toolpath are deleted and replaced according to the options you have selected.

7. Click on the **Close** button  to return to the **Assistant's** Home page.

Editing Bridging

You can edit the bridging that you have added to a Profiling toolpath in several ways. You can:




- Insert new bridges.
- Delete an individual or all existing bridges.
- Change the length of individual or all existing bridges.
- Move bridges into a new position on the Profile toolpath.

Inserting a Bridge

You can add an individual bridge to any place in the Profile toolpath. To do so:

1. Click on the Profile toolpath to select it.


The selected Profile toolpath is dark red and surrounded by a bounding box.


2. Click on the **Create Bridges** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Bridging** page in the **Assistant** window.
3. Move the  cursor over the point in the Profiling toolpath where you want to insert the centre point of the new bridge.
4. Press the **I** key  on your keyboard to insert the new bridge.

The new bridge is the same length and thickness as the other bridges on the Profile toolpath.

Deleting Bridges


You can delete any or all of the bridges added to a Profiling toolpath. To do so:

1. Click on the Profile toolpath to select it.
The selected Profile toolpath is dark red and surrounded by a bounding box.
2. Click on the **Create Bridges** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Bridging** page in the **Assistant** window.

3. Move the  cursor over the bridge that you want to remove.

The cursor changes to a .

4. Delete the bridge by using either of these methods:



- Press the **D** key  on your keyboard.
You must have clicked at least once in the **2D View** window before you can use this method.
- Double-click on the bridge itself.

If you want to delete all bridging that has previously been added to the Profile toolpath:

1. Click on the **Delete All Bridges** button  on the **Bridging** page.

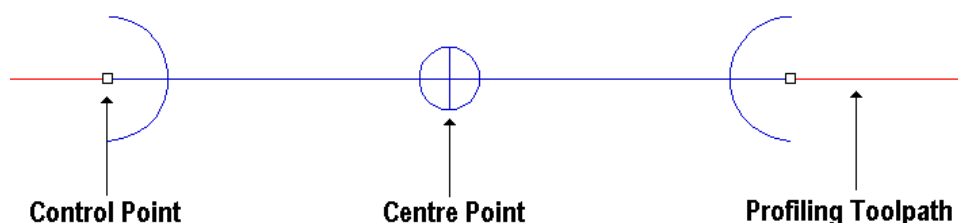
Changing the Length of a Bridge

You can change the length of an individual bridge added to a Profile toolpath. To do so:

1. Click on the Profile toolpath to select it.
The selected Profile toolpath is dark red and surrounded by a bounding box.
2. Click on the **Create Bridges** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Bridging** page in the **Assistant** window.
3. Zoom in on the bridge that you want to extend or reduce, then click on its centre point  to select it.

For details, see “Zoom In” in the ArtCAM 2D Layout chapter.


The bridge is blue with a control point at each end of it.



4. Click and drag either of the control points to set the length of the bridge.

The new length of the bridge appears in the **Bridge Length** box on the **Bridging** page.

If you want all bridges in the Profile toolpath to share the new length that you have set:




1. Click on the **Update All Bridges** button  on the **Bridging** page.

Moving a Bridge

You can change the position of an individual bridge on a Profile toolpath. To do so:

1. Click on the Profile toolpath to select it.

The selected Profile toolpath is dark red and surrounded by a bounding box.

2. Click on the **Create Bridges** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Bridging** page in the **Assistant** window.
3. Zoom in on the bridge that you want to move, then click on its centre point  to select it.
For details, see “Zoom In” in the ArtCAM 2D Layout chapter.
The bridge is blue with a control point at each end of it.
4. Click and drag on the centre point  to move the bridge along the Profile toolpath to the position you want.

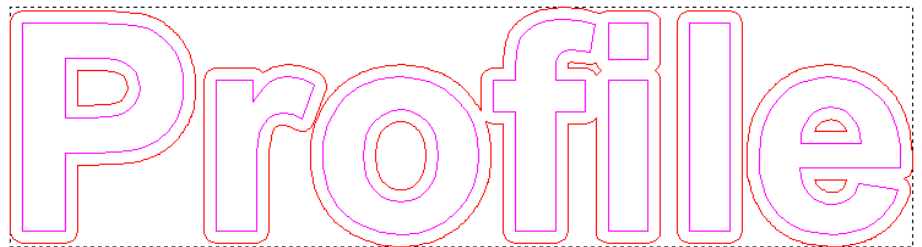
Setting the Profile Machining Order


When machining a Profile toolpath that is made up of several segments, you can set the order in which each of these segments is machined.

1. Click on the Profile toolpath to select it.

The Profile toolpath is red, surrounded by a bounding box.

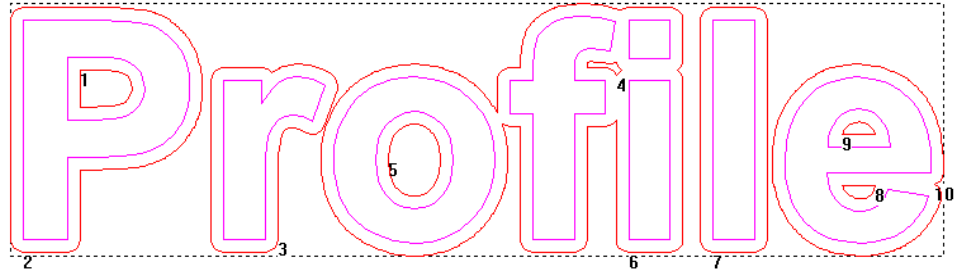
For example, selecting the Profile toolpath around the *Profile* vector text appears as follows:



2. Click on the **Set Profile Machining Order** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Toolpath Ordering** page.

Each of the segments within the selected Profile toolpath is numbered.

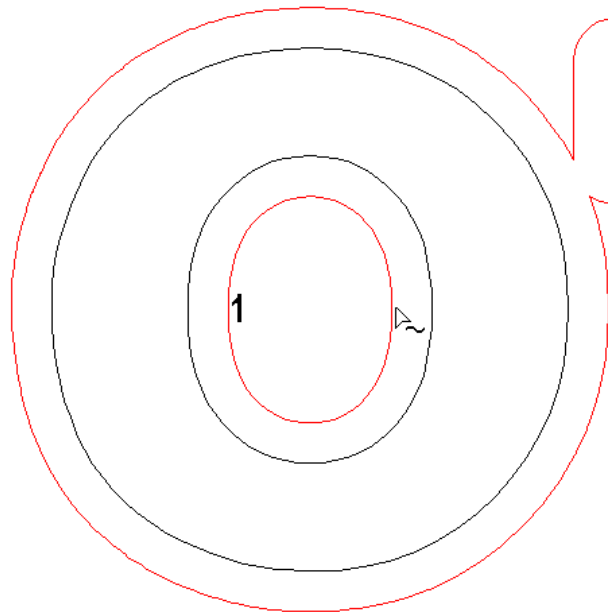
In our example, the *Profile* vector text appears as follows:



3. Click on each of the segments in the Profile toolpath in turn to set the order in which they are machined.

The position of each selected segment in the overall machining order is displayed in the **Segment Position** box as you click on it.


In our example, if we click on the profile pass inside of the central cavity of the letter *o* in the *Profile* vector text first, it is numbered as 1:



4. Click on the **Close** button  to return to the **Assistant's** Home page.



Resetting the Machining Order

You can correct any mistakes you make when selecting the order in which you want to machine the segments:

1. Click on the **Reset Count** button .
2. Click on the segment that you want to set as the first to be machined.
3. Continue to click on each segment in the order you want to machine them until each segment in the Profile toolpath is numbered accordingly.

Manipulating the Machining Order

You can manipulate the order in which the segments are machined in a selected Profile toolpath by using the options in the **Segment Ordering** area of the **Toolpath Ordering** page:

- Click on the **Order segments from start** radio button  to machine the numbered segments in sequential order.
- Click on the **Order segments from end** radio button  to machine the numbered segments in reverse order.

Adjusting the Machining Parameters

You can adjust the machining parameters for CNC machine tools in ArtCAM 2D as follows:

- When creating a toolpath strategy, in the toolpath strategy's page. For example, the **Profiling** page.
- After creating a toolpath strategy, using the **Toolpath Manager**.

Note: This method should only be used before selecting a toolpath.

You can also change the tool's default machining parameters stored in the **Tool Groups Database**. For details, see "Editing a Tool" on page 357.

Adjusting Machining Parameters When Creating a Toolpath

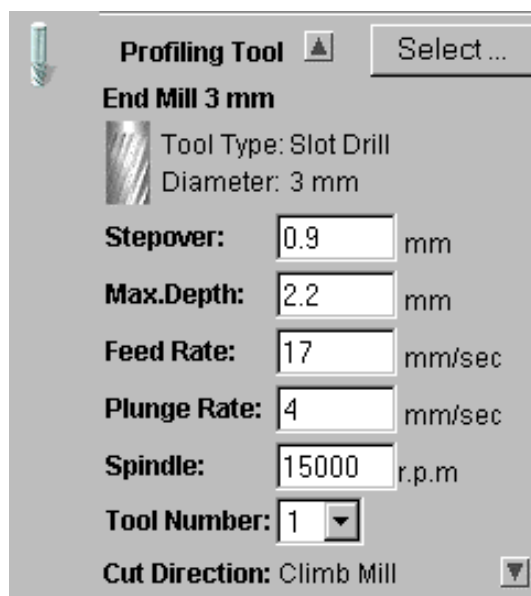
You can change the machining parameters of the CNC machine tool used to machine a model, when creating a toolpath strategy.

To change the machining parameters of a CNC machine tool:

1. With the toolpath strategy page displayed in the **Assistant** window, display the machining parameters of the selected tool.

To do this, click on the  arrow in the tool area of the page.

For example, if you have selected a 3mm End Mill tool for a Profile toolpath, the tool area of the **Profiling** page looks like this:



2. You can type new values in the appropriate boxes:
 - If you want to change the stepover value of the selected tool, type a value in the **Stepover** box.

The **Stepover** value defines the distance between adjacent machining passes.

- If you want to change the maximum cutting depth of the selected tool, type a value in the **Max.Depth** box.

This value generates multiple machining passes.

- If you want to change the feed rate of the selected tool, type a value in the **Feed Rate** box.

The **Feed Rate** value defines the rate at which the tool moves in relation to the block of material.

- If you want to change the plunge rate of the selected tool, type a value in the **Plunge Rate** box.

The **Plunge Rate** value defines the rate at which the tool moves in the Z direction and plunges into the block of material.

- If you want to change the rotational speed of the spindle, type a value in the **Spindle** box.

The spindle is the part of the machine tool that rotates during operation. On a mill it holds the tool in position. On a lathe it holds the block of material.

- If you want to give the selected tool a number, click on the **Tool Number** list box and then on the number you want to give to the tool.

This number should correspond with the position of the tool in the CNC machine's tool changer.

Adjusting Machining Parameters in a Created Toolpath

When you have created a toolpath strategy, you can adjust the machining parameters, except for the **Max. Depth** and the **Stepover**.


In addition, you can amend toolpath parameters such as the **Home Position** and the **Safe Z** level.

You can adjust many of the machining parameters and the toolpath parameters using the **Toolpath Manager**:

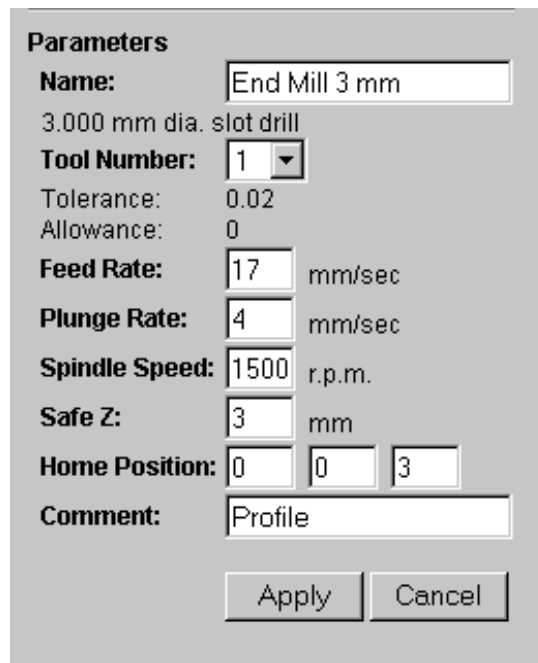
1. Click on the **Toolpath Manager** tab
 to display the **Toolpath Manager**.

2. Click on the tool in the **Toolpaths** area that you want to change the machining parameters for.

The tool is highlighted in blue.

3. Click on the **Edit Parameters** button
 to display the machining parameters for the selected tool.

For example, if you selected an **End Mill 3mm** tool when creating a Profile toolpath, the **Parameters** area looks like this:



The image shows a 'Parameters' dialog box for an 'End Mill 3 mm' tool. The tool is described as '3.000 mm dia. slot drill'. The parameters are as follows:

Parameter	Value	Unit
Name	End Mill 3 mm	
Tool Number	1	
Tolerance	0.02	
Allowance	0	
Feed Rate	17	mm/sec
Plunge Rate	4	mm/sec
Spindle Speed	1500	r.p.m.
Safe Z	3	mm
Home Position	0, 0, 3	
Comment	Profile	

Buttons: Apply, Cancel

4. You can change the machining parameters in this area as described in “Adjusting Machining Parameters When Creating a Toolpath” on page 334. In addition, you can amend:
 - The tool’s name.
 - The height at which the cutting tool makes rapid moves between toolpath segments, or **Safe Z** level.
 - The **Home Position** of the tool.

- The comment about the toolpath.
5. Click on the **Apply** button .

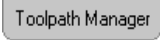
Simulating Toolpaths

Once you have created a toolpath, you can then simulate it in order to visualise the machining passes.

A toolpath simulation is a more informative display of the toolpath than that offered by the sequence of dark red lines displayed in the **2D View** window.

You can simulate an individual toolpath or toolpath group. A toolpath group is a toolpath that requires the use of more than one machining tool. For example, a Bevelled Carving toolpath uses both a Carving tool and a Profiling tool.


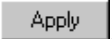


To simulate a toolpath:

1. Click on the **Toolpath Manager** tab  to view a list of the toolpaths set up.
2. Click on the toolpath in the **Toolpaths** area to select it.

The selected toolpath is highlighted in blue.

3. Make sure that the machining parameters of the tool listed in the **Parameters** area are correct.

If not:

- Click on the **Edit Parameters** button  to display all parameter boxes.
 - Type the correct machining parameters in the appropriate boxes.
 - Click on the **Apply** button .
4. Make sure that the **Draw** option in the **Toolpath Simulation** area of the **Toolpath Manager** is turned on .
 5. Click on the **Simulate Toolpath(s)** button  in the **Toolpath Simulation** area of the **Toolpath Manager** to produce a

representation of the toolpath and the machined vector object(s) in the **3D View** window.



Note: If you want to change the **3D View**, see “3D View Manipulation” in the ArtCAM 2D Layout chapter.



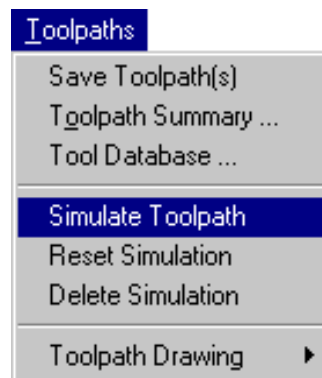
Tip: You can also simulate a toolpath by clicking on the toolpath to select it, then selecting **Simulate Toolpath** from the menu displayed when you right click.

You can simulate a toolpath group if you:

1. Click on any part of the toolpath group that you want to simulate.

A bounding box surrounds the selected toolpath.

2. Click on the **Toolpaths** option in the Main menu bar to display the **Toolpaths** menu.
3. Click on the **Simulate Toolpath** option to produce a representation of the toolpath group and the machined vector object(s) in the **3D View** window.



Tip: You can also simulate a toolpath group by clicking on any part of the toolpath group to select it, then selecting **Simulate Toolpath Group** from the menu displayed when you right click.

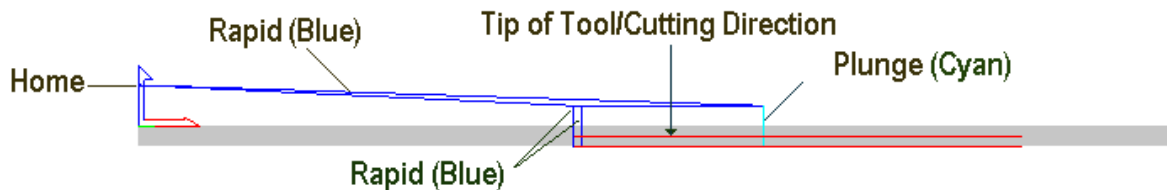
Viewing a Toolpath

You can view a toolpath you have created in both the **2D View** and **3D View** windows. A toolpath is displayed as

a sequence of dark red lines in the **2D View** window, and a series of multi-coloured lines in the **3D View** window.

The colour in which a toolpath is displayed within the **3D View** window shows the movement the selected tool will make when machining the vector object.

The following example shows a toolpath simulation as seen along the Y-axis:



Rapid and Plunge Moves

The selected tool leaves the **Home** position, moves to the **Safe Z** level, then above and across the material surface until it reaches the point of entry. This movement is known as a **Rapid** move, and a blue line marks this.

The tool cuts into the material surface at its **Plunge** rate. A cyan line marks plunge moves.

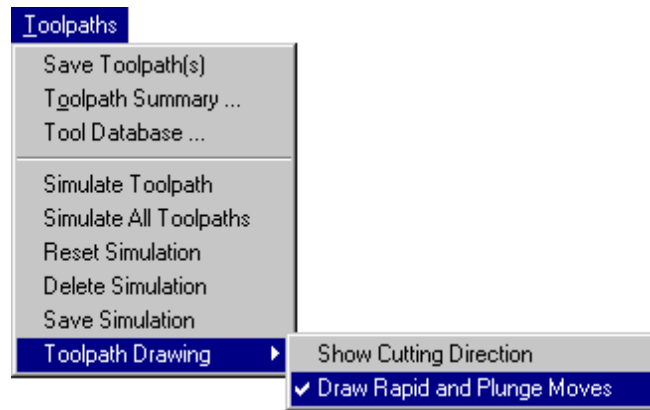
Once the cutting is complete, the tool retracts from the block of material to the **Safe Z** level and then moves above and across the material surface until it reaches the **Home** position. This is another **Rapid** move marked by a blue line.

Rapid and **Plunge** moves are drawn in a toolpath simulation by default.

If a toolpath simulation contains several **Rapid** and **Plunge** moves, the lines representing the movement of the selected tool in the **3D View** window can become obscured. For this reason, you may want to hide them from view.

You can hide the **Rapid** and **Plunge** moves as follows:

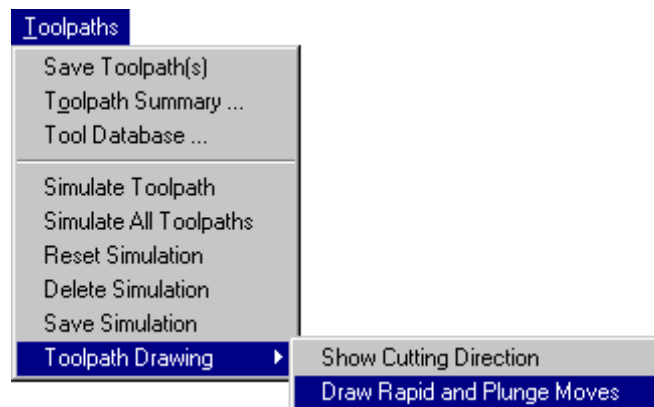
1. From the Main menu bar, select **Toolpaths > Toolpath Drawing > Draw Rapid and Plunge Moves** to turn off this option:



The **Rapid** and **Plunge** moves are no longer visible in the **3D View** window.

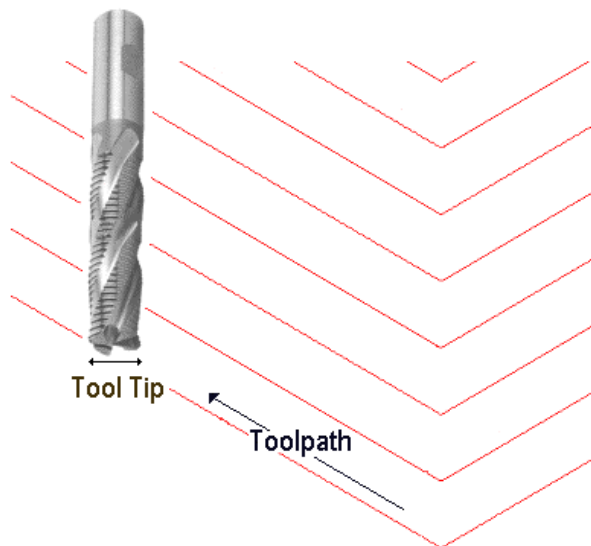
To show the **Rapid** and **Plunge** moves again:

1. From the Main menu bar, select **Toolpaths > Toolpath Drawing > Draw Rapid and Plunge Moves** to turn on this option:



Cutting Direction

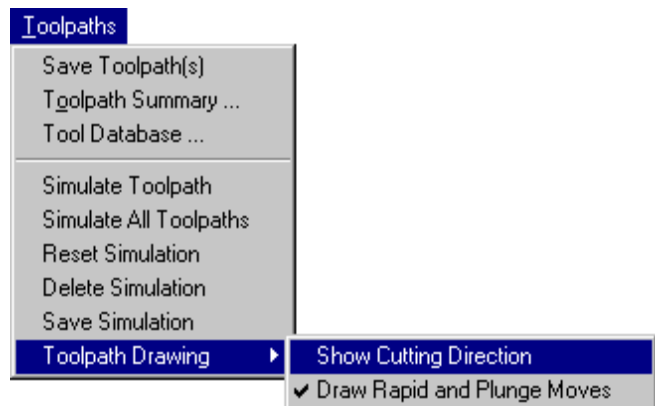
A machining strategy is displayed as a sequence of lines:



All dark red lines in a toolpath simulation indicate the position of the tip of the selected tool as it cuts away at the block of material. A dark red line does not indicate the cutting direction of a tool.

The cutting direction is hidden in a toolpath simulation by default. To view the cutting direction within a toolpath simulation:

1. From the Main menu bar, select **Toolpaths > Toolpath Drawing > Show Cutting Direction** to turn on this option:



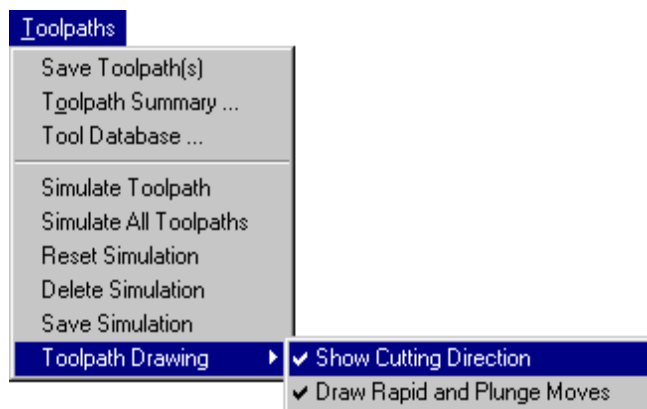
All dark red lines within the toolpath simulation turn green or dark blue, showing the cutting direction.

A dark blue line indicates a clockwise cutting direction.

A green line indicates an anti-clockwise cutting direction.

To hide the cutting direction again:

1. From the Main menu bar, select **Toolpaths > Toolpath Drawing > Show Cutting Direction** to turn off this option:



All green or dark blue lines within the toolpath simulation turn dark red.

Hiding a Toolpath

You can hide most toolpaths shown in either the **2D View** or **3D View** window.

You cannot hide the following toolpaths in the **2D View** window:

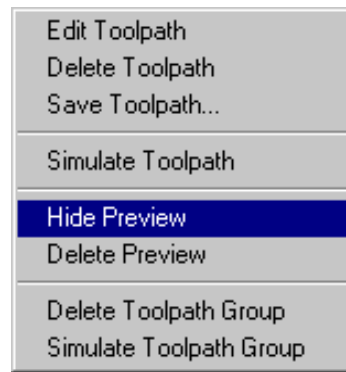
- V-Bit Carving along A Centreline.
- 3D Bevelled Carving – Centreline.
- Drilling.

To hide a toolpath shown in the **2D View** window:

1. Click on the toolpath that you want to hide to select it.

A bounding box surrounds the selected toolpath.

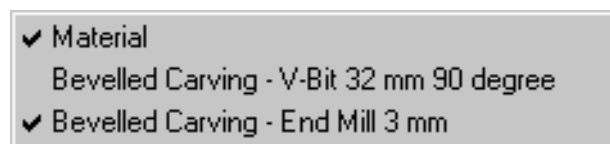
2. Right-click to display the **Toolpaths** menu, then select the **Hide Preview** option:



You can hide a toolpath shown in the **3D View** window if you:

1. Double right-click on the **3D View** window to display a list of toolpath viewing options.


For example, the list of toolpath viewing options for a Bevelled Carving toolpath would look something like this:



2. Click on the toolpath that you want to hide.

The toolpath that you want to hide is no longer checked on.




Note: You can hide any of the toolpaths shown in the **3D View** window using the **Objects To Draw** button  in the **3D View** toolbar. For details, see “Objects To Draw” in the ArtCAM 2D Layout chapter.

Restoring a Hidden Toolpath


You can restore a toolpath that has been hidden in either the **2D View** or **3D View** window.

To restore a toolpath hidden in the **2D View** window:

1. Click on the **Toolpath Manager** tab  to display the **Toolpath Manager**.
2. Make sure that the **2D View** window is open.

If the **3D View** button  is in the toolbar above the design window, the **2D View** is open.

If not, click on the **2D View** button  to open it.

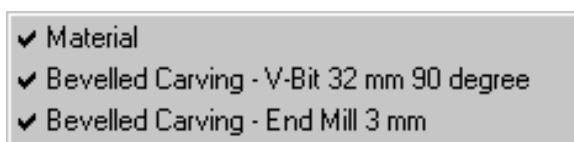
3. Click on the **Show In 2D** box next to the relevant toolpath to turn it on .

The toolpath appears in the **2D View** window in dark red.

To restore a toolpath hidden in the **3D View** window:

1. Double right-click on the **3D View** window to display a list of toolpath viewing options.


For example, the list of toolpath viewing options for a Bevelled Carving toolpath would look something like this:



2. Click on the toolpath that you want to restore.

The toolpath that you want to restore is now turned on.



Note: You can restore any of the toolpaths hidden in the **3D View** window using the **Objects To Draw** button  in the **3D View** toolbar. For details, see “Objects To Draw” in the ArtCAM 2D Layout chapter.

Editing a Toolpath

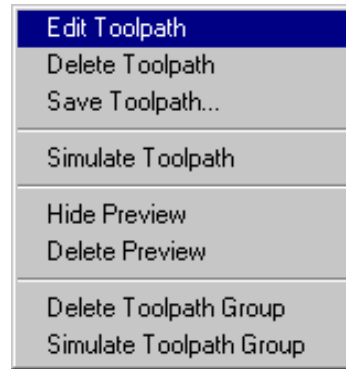
You can change the settings in any toolpath that you have created.

To edit the settings in a toolpath:

1. Click on the toolpath that you want to edit.

The selected toolpath is dark red and surrounded by a bounding box.


2. Right-click to display the **Toolpath** menu:




3. Click on the **Edit Toolpath** option to display the toolpath's details in the **Assistant** window.

For example, if you select a Profile toolpath and then the **Edit Toolpath** option from the **Toolpath** menu, the **Profiling** page is displayed in the **Assistant** window.

You can also edit toolpath settings using the **Toolpath Manager**:

1. Click on the **Toolpath Manager** tab to display the **Toolpath Manager** .
2. Click on the toolpath that you want to edit in the **Toolpaths** area.

The selected toolpath is highlighted in blue.

3. Click on the **Edit Toolpath** button  in the **Toolpath Operations** area to display the page for the toolpath in the **Assistant** window.

For example, if you select a Profile toolpath and then the **Edit Toolpath** option from the **Toolpath** menu, the **Profiling** page is displayed in the **Assistant** window.



Note: You can also edit toolpath settings by double-clicking on the toolpath shown in the **2D View** window or double-clicking on the toolpath name in the **Toolpaths** area of the **Toolpath Manager**.

Saving a Toolpath

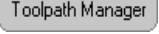
When you have created a toolpath, it can be saved in two formats:

- If you want to use the toolpath in a different ArtCAM 2D model, you can save them as a

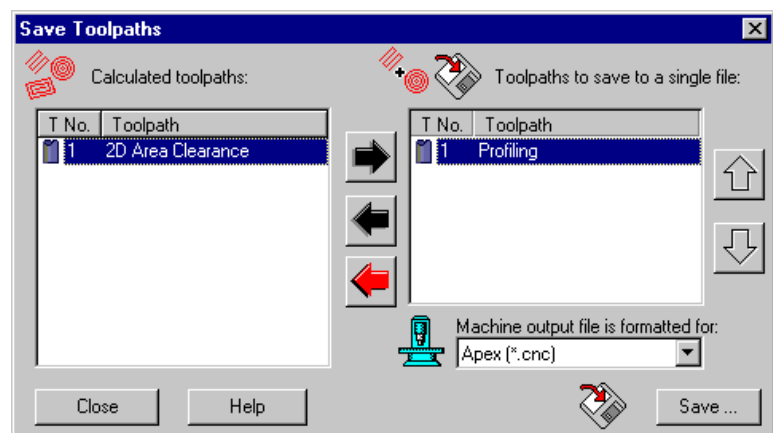
model file (*.art). For details, see “Saving a Model” in the Working with Models chapter.

- If you want to export the toolpath data to a CNC machine tool, follow the steps below.


To save the toolpath data as a machine-specific file:


1. Click on the **Toolpath Manager** tab
 to display the **Toolpath Manager**.



2. Click on the **Save Toolpaths** button  in the **Toolpath Operations** area to open the **Save Toolpaths** dialog box:






3. Click on the toolpaths in the **Calculated toolpaths** window that you want to save as one machine-specific toolpath file.

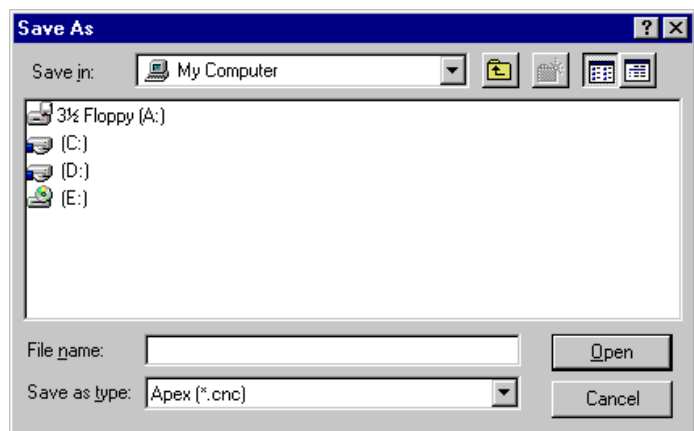
To select more than one toolpath, hold the **Shift** key  on your keyboard as you click on each of the toolpaths.



4. Click on the right button  to transfer your selected toolpaths to the **Toolpaths to save to a single file** window.
5. Make sure that the toolpaths are in the correct order.

You can change the order of the toolpaths by clicking on the up  and down  buttons in the right of the dialog box. Each click, up or down, moves the selected toolpath one position in the list.

If you want to alter the selection, you can click on the black left button  to transfer files back to the **Calculated toolpaths** window or click on the red left button  to transfer all files back to the **Calculated toolpaths** window.

6. Click on the **Machine output file is formatted for** list box, then click on the relevant machine format to select it.
7. Click on the **Save** button  to open the **Save As** dialog box:



8. Click on the **Save In** list box and select the directory you want to save the machine-specific toolpath file in.
9. Type the file name that you have chosen to use for the machine-specific toolpath in the **File name** box.
10. Click on the **Save as type** list box, then click on the file type you want to save your machine-specific toolpath as.
11. Click on the **Save** button  to close the **Save As** dialog box.
12. Click on the **Close** button  in the **Save Toolpaths** dialog box.



Tip: You can also save a selected toolpath in the **2D View** window. First, select the toolpath. Right-click to display the **Toolpaths** menu, then select **Save Toolpaths** to display the **Save Toolpaths** dialog box. Finally, follow steps 3 to 11 in this section.



Note: You can also save a toolpath from either the **2D View** or the **3D View** in the same way. From the Main menu bar, select **Toolpaths**, then **Save Toolpaths** to display the **Save Toolpaths** dialog box. Finally, follow steps 3 to 11 in this section.

Deleting Toolpaths

You can delete a toolpath or toolpath group that you have created.

A toolpath group is a toolpath that requires the use of more than one machining tool. For example, a Bevelled Carving toolpath uses both a Carving tool and a Profiling tool.

Deleting a Toolpath

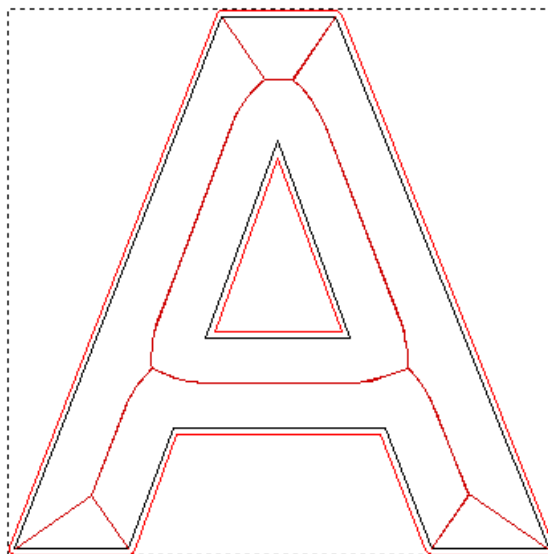
There are three ways to delete a toolpath.

To delete a toolpath from the **2D View** window:

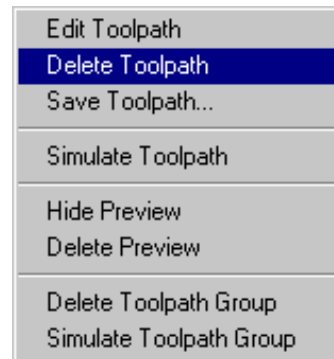
1. Click on the toolpath that you want to delete to select it.

A bounding box surrounds the toolpath.

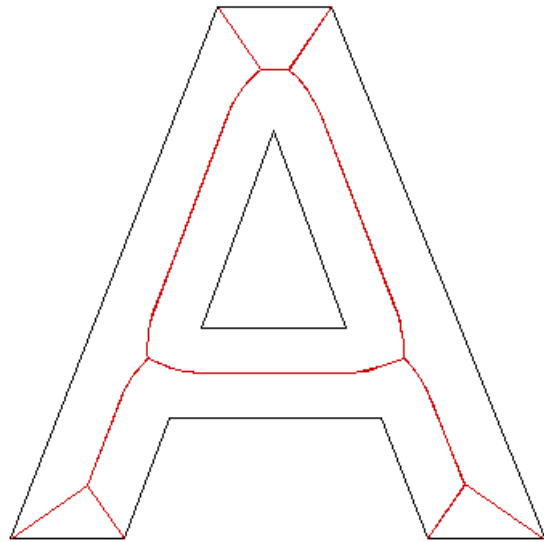
For example, if you want to delete the Profiling part of a Bevelled Carving toolpath it would appear something like this when selected:





2. Right-click to display the **Toolpaths** menu, then click on the **Delete Toolpath** option:



In our example, you can see that the Profile part of a Bevelled Carving toolpath is now deleted:




Tip: You can also delete a toolpath from the **2D View** window if you click on the toolpath to select it, press the

Delete key  on your keyboard, then click on the **Yes** button  in the message box displayed.



Note: You can also delete a toolpath using the **Toolpath Manager** by clicking on the toolpath in the **Toolpaths** area to select it and then on the **Delete**

Toolpath button  in the **Toolpath Operations** area.

Deleting a Toolpath Group

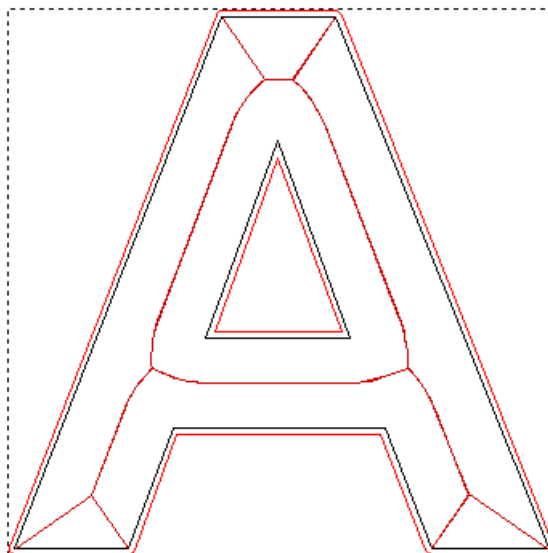
A toolpath group is a toolpath that requires the use of more than one machining tool. For example, a Bevelled Carving toolpath uses a both Carving tool and a Profiling tool.

To delete a toolpath group with the **2D View** window open:

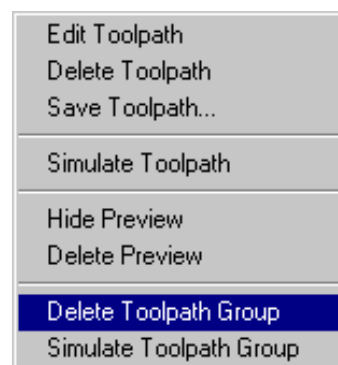
1. Click on a toolpath that is part of a toolpath group to select it.

A bounding box surrounds the toolpath.

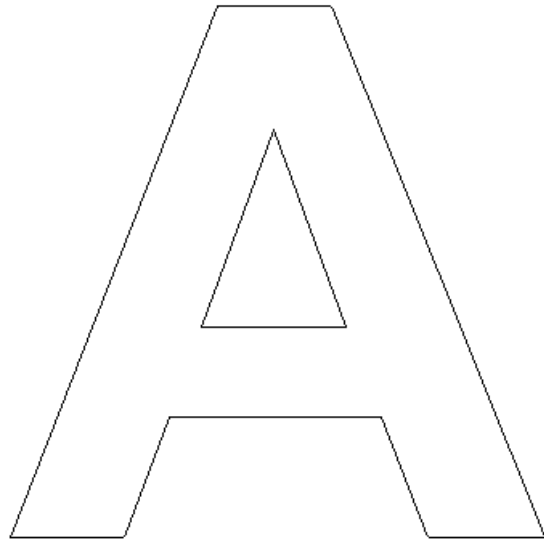
For example, if you want to delete a Bevelled Carving toolpath, and select the Profiling part of the toolpath, the toolpath looks like this when selected:




2. Right-click to display the **Toolpaths** menu, then click on the **Delete Toolpath Group** option:





In our example, you can see that both the Profiling and Carving parts of the Bevelled Carving toolpath group are now deleted:




Tip: You can also delete a toolpath group from the **2D**

View window if you hold the **Shift** key  on your keyboard and click on the toolpaths, press the **Delete**

key  on your keyboard, then click on the **Yes** button  in the message box displayed.



Note: You can also delete a toolpath using the **Toolpath Manager** by clicking on the toolpath group in the **Toolpaths** area to select it, for example Bevelled Carving, and then on the **Delete Toolpath** button  in the **Toolpath Operations** area.

Using a Toolpath Summary

You can review, print or save details of all of the toolpaths that you have created in order to machine a model.

The **Toolpath Summary Information** box displays the following details:

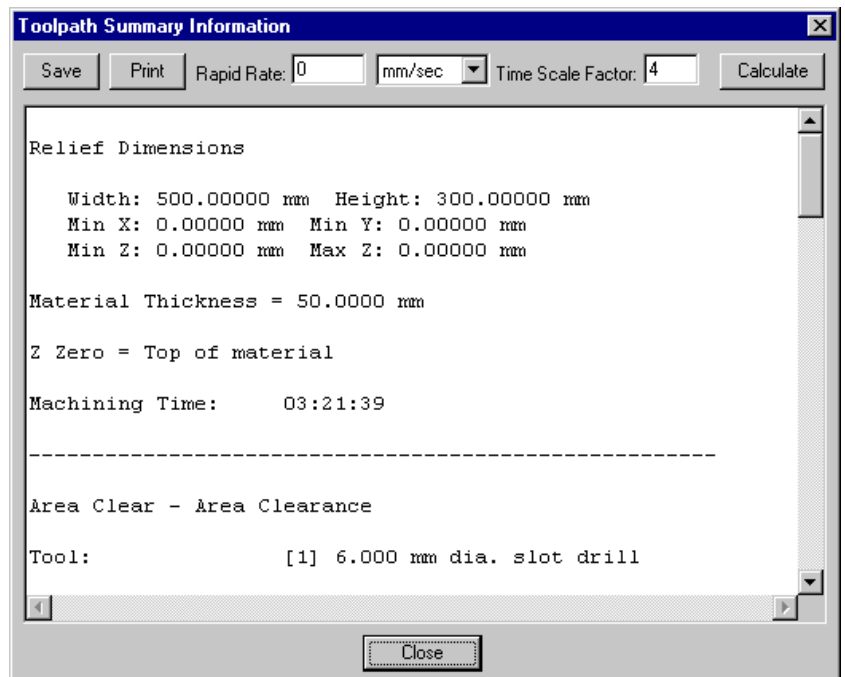
- Job dimensions used.
- Toolpaths used.

- Machining parameters of all tools used.

A total machining cycle time is also calculated based on the Feed Rates of the various tools that you had selected when creating a toolpath.

To display the **Toolpath Summary Information** box for the open model:

1. Click on the **Toolpath Summary** button  in the **Toolpaths** area of the **Assistant's** Home page:



You can use the scrollbar at the right of the **Toolpath Summary Information** box to view all of the toolpath information.




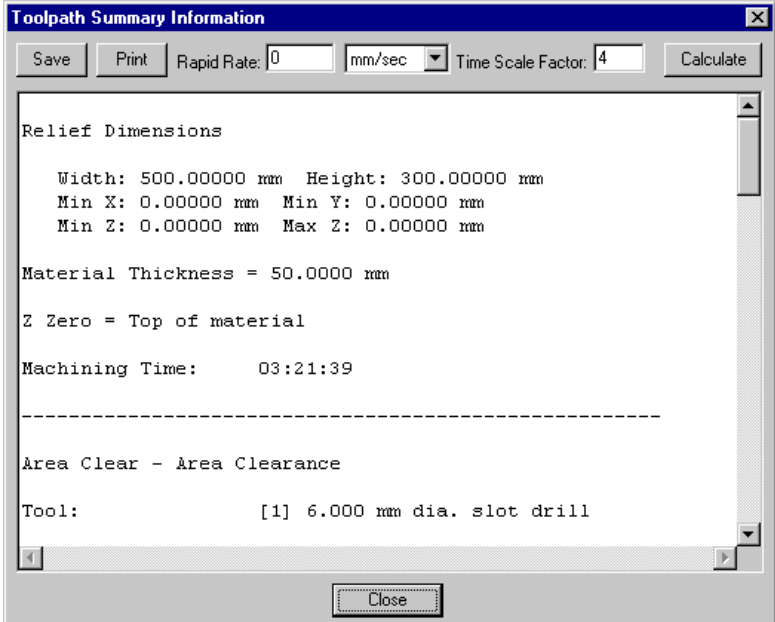
Tip: You can also display the **Toolpath Summary Information** box by selecting **Toolpaths > Toolpath Summary** from the Main menu bar.

Calculating the Estimated Machining Time

You can amend the machining parameters to estimate the actual machining time for a job.

To calculate the estimated machining time of a toolpath:

1. Click on the **Toolpath Summary** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Toolpath Summary Information** box:



Toolpath Summary Information

Save Print Rapid Rate: 0 mm/sec Time Scale Factor: 4 Calculate

Relief Dimensions

Width: 500.00000 mm Height: 300.00000 mm
Min X: 0.00000 mm Min Y: 0.00000 mm
Min Z: 0.00000 mm Max Z: 0.00000 mm

Material Thickness = 50.0000 mm

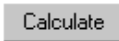
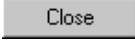
Z Zero = Top of material

Machining Time: 03:21:39

Area Clear - Area Clearance


Tool: [1] 6.000 mm dia. slot drill

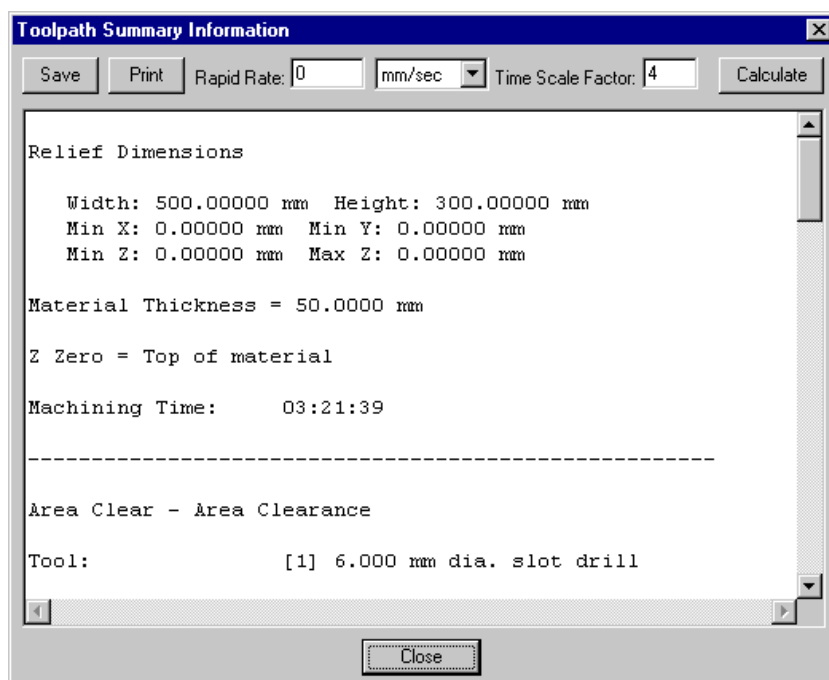
Close



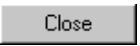
2. Type a value in the **Rapid Rate** box.
You should confirm the maximum Rapid Rate of your CNC machine by consulting the manufacturer's manual.
If the manual contains no reference to the maximum Rapid Rate, use the maximum Feed Rate value.
3. Click on the list box and select the appropriate unit of speed.
4. Type a value in the **Time Scale Factor** box.
The default time scale factor is 4. You should experiment with finding the appropriate value for your machining.
5. Click on the **Calculate** button .
The new estimated machining time is displayed in the **Machining Time** area of the page.
6. Click on the **Close** button  to close the **Toolpath Summary Information** box.

Printing a Toolpath Summary

To print a toolpath summary:


1. Click on the **Toolpath Summary** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Toolpath Summary Information** box:

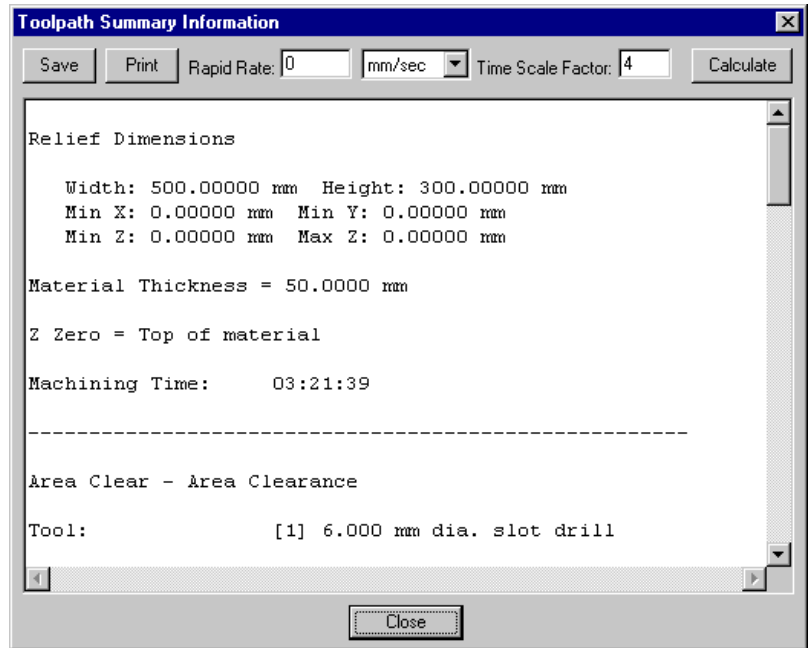




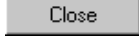
2. Click on the **Print** button  to display the **Print** dialog box.
3. Click on the **Name** list box and click on the appropriate printer to select it.
4. Click on the **OK** button  to print the toolpath summary at the selected printer.
5. Click on the **Close** button  to close the **Toolpath Summary Information** box.

Saving a Toolpath Summary

To save a toolpath summary:

1. Click on the **Toolpath Summary** button  in the **Toolpaths** area of the **Assistant's** Home page to display the **Toolpath Summary Information** box.



2. Click on the **Save** button  to display the **Save Toolpath Summary** dialog box.
 3. Click on the **Save In** list box and select the directory where you want to save the toolpath summary.
 4. Type the file name you want to use for the toolpath summary in the **File name** box.
 5. Click on the **Save** button .
- The file is saved as a text file (*.txt).
6. Click on the **Close** button  to close the **Toolpath Summary Information** box.

Using the Tool Groups Database

When creating a toolpath in ArtCAM 2D, it is necessary to select a tool with which to machine your 2D model. A broad range of predefined tools can be selected from the **Tool Groups Database**.

The **Tool Groups Database** allows you to:

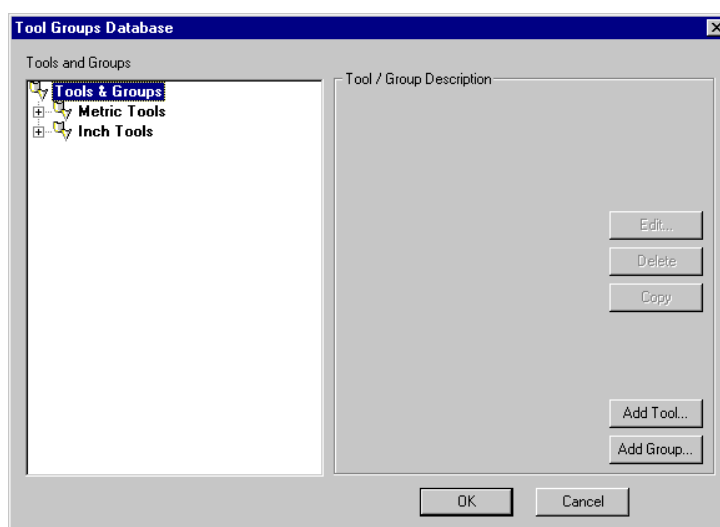
- Select a tool to machine a toolpath with.
For details, see “Using Toolpath Strategies” on page 261.
- Define and add your own tools.

- Edit the default machining parameters of any selected tool.
- Group tools together, as you prefer.

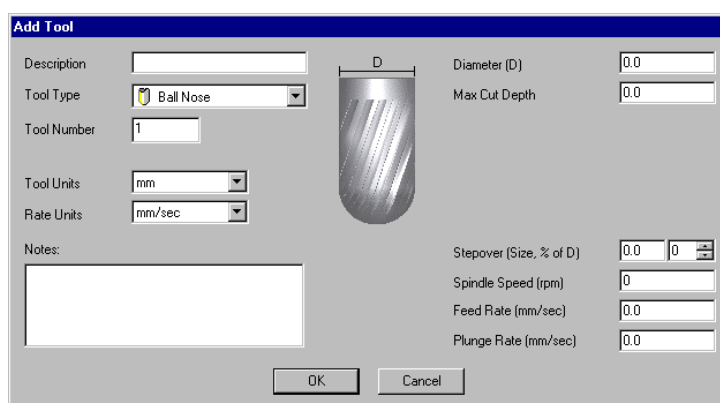
Adding a Tool

To define and add a new tool to the **Tool Groups Database**:

1. Click on the **Tool Database** button  in the **Toolpaths** area of the **Assistant's** Home page to open the **Tool Groups Database**:




2. Click on the **Add Tool** button  to open the **Add Tool** dialog box:



3. Type a name for the tool in the **Description** box.
4. Click on the **Tool Type** list box, and then click to select one of the tool types listed.

An image representing the selected **Tool Type** appears in the middle of the dialog box.

Boxes to type in the necessary machining parameters of the tool appear in the right side of the dialog box.

5. Click on the **Tool Units** list box, and then click to select the appropriate unit of measurement.
6. Click on the **Rate Units** list box, and then click to select the appropriate unit of speed.
7. Type any relevant information concerning the practical use of the tool you are adding to the **Tool Groups Database** in the **Notes** box.
8. Type a value in all of the boxes relating to the machining parameters of the tool, such as **Diameter**, **Stepover** and **Flute Length**.
9. Click on the **OK** button  to add the tool to the **Tool Groups Database**.

The tool you have added appears in the **Tools and Groups** window, and its details appear in the **Tool / Group Description** area of the **Tool Groups Database**.

10. Click on the tool in the **Tools and Groups** window and drag it into the appropriate group in the **Tool Groups Database**.



Note: For details on how to set up your own group, see “Adding a Tool Group” on page 361.

11. Click on the **OK** button  to close the **Tool Groups Database**.



Editing a Tool

You can edit the geometry and the default machining parameters of any tool selected from the **Tool Groups Database**:

- **Description** – If you want to change the name of the selected tool, type it in this box.

- **Tool Number** – If you want to change the number of the selected tool to correspond with its position on a tool changer, type it in this box.
- **Tool Units** – If you want to change the unit of measurement for the selected tool, click on the **Tool Units** list box and then on the unit of measurement you want to use.
- **Rate Units** – If you want to change the unit of speed for the selected tool, click on the **Rate Units** list box and then on the unit of speed you want to use.
- **Notes** – If you want to make any notes about the selected tool, type them in this box.
- **Diameter** – If you want to change the diameter of the selected tool, type it in this box.
- **Max Cut Depth** – If you want to change the maximum cut depth of the selected tool, type it in this box.
- **Stepover** – If you want to change the distance between adjacent machining passes made by the selected tool, type it in this box.

You can also adjust the stepover of the selected tool using the **% of** box and buttons:

- Each click on  increases the stepover of the selected tool by 1% of the value shown in the **Diameter** box.
- Each click on  decreases the stepover of the selected tool by 1% of the value shown in the **Diameter** box.
- Type a value in the **% of** box to define the **Stepover** as a percentage of the tool **Diameter**.
- **Spindle Speed** – If you want to change the rotational speed of the spindle, type it in this box.
- **Feed Rate** – If you want to change the rate at which the tool moves in relation to the block of material, type it in this box.

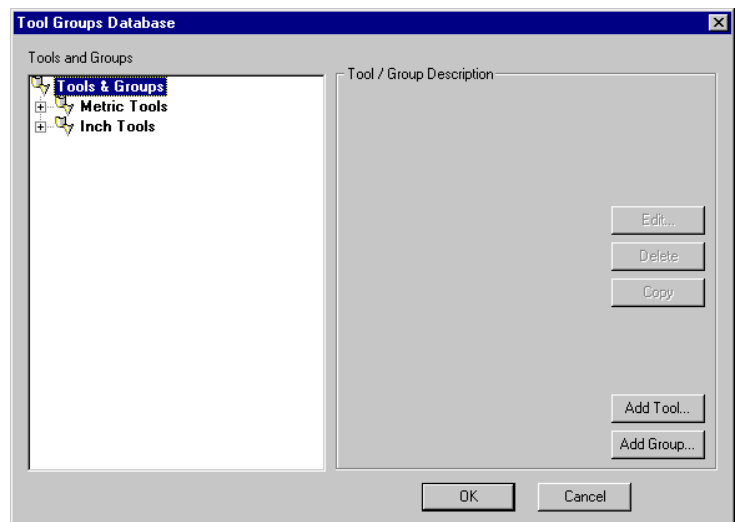
- **Plunge Rate** – If you want to change the rate at which the tool moves in the Z direction and plunges into the block of material, type it in this box.

Editing the geometry of certain types of tools in the **Tool Groups Database** requires more data than with other tools. The additional information required includes:

- **Included Angle** – To change the angle of a V-Bit tool, type it in this box.
- **Half Angle** – To change the angle of a Conical tool, type it in this box.
- **Flat Radius** – To change the radius of a flat Conical tool, type it in this box.
- **Tip Radius** – To change the radius of a rounded Conical tool


To edit the machining parameters or the geometry of a tool in the **Tool Groups Database**:

1. Click on the **Tool Database** button  in the **Toolpaths** area of the **Assistant's** Home page to open the **Tool Groups Database**:



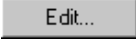
2. Click on the tool in the **Tools and Groups** window that you want to edit.

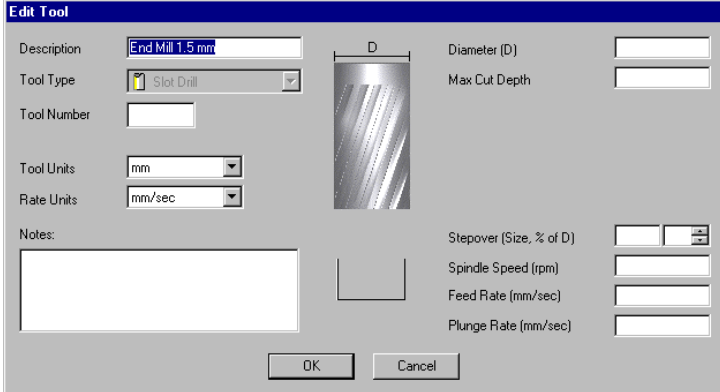



Note: Before editing the machining parameters of a selected tool, you may want to make a copy of it. To do so, click on the tool in the **Tools and Groups** window, and then clicking on the **Copy** button . A copy of the tool appears directly beneath the original in the **Tools and Groups** window.

The selected tool is highlighted in blue.

The machining parameters of the selected tool appear in the **Tool / Group Description** area of the dialog box.

- Click on the **Edit** button  to open the **Edit Tool** dialog box:



- Type a new value in the appropriate box, or click on the appropriate list box option, to change the geometry and/or machining parameters of the selected tool.
- Click on the **OK** button  to save these new values and to return to the **Tool Groups Database**.

The tool you have edited appears in the **Tools and Groups** window, and the information that you had typed in the **Edit Tool** dialog box appears in the **Tool / Group Description** area of the **Tool Groups Database**.

- Click on the **OK** button  to close the **Tool Groups Database**.

Deleting a Tool

You can delete any tool listed in the **Tool Groups Database**:

1. Click on the tool that you want to delete in the **Tools and Groups** window.

The selected tool is highlighted in blue.

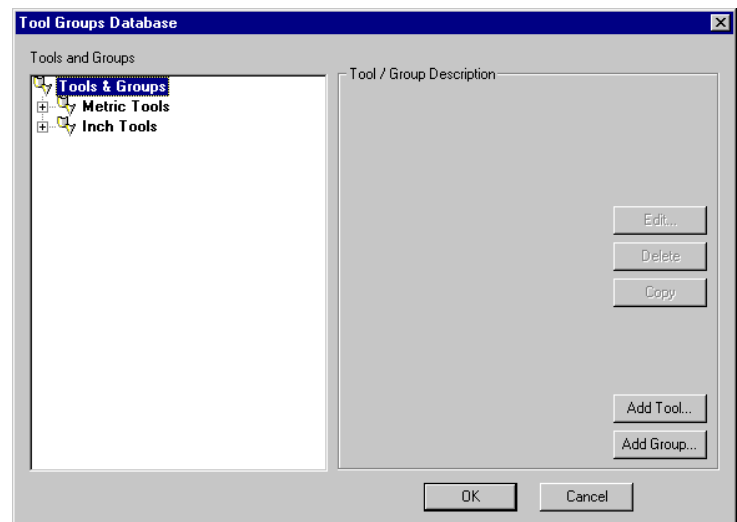
2. Click on the **Delete** button .

Adding a Tool Group

Within the **Tool Groups Database**, tools are organised into various groups for ease of reference. When you define and add a selection of tools to the **Tool Groups Database**, you may want to create a new group for them.

To create a new tool group:

1. Click on the **Tool Database** button  in the **Toolpaths** area of the **Assistant's** Home page to open the **Tool Groups Database**:



2. Click on the **Add Group** button .

A folder named **New Group** appears in the **Tools and Groups** window:



3. Click on the **New Group** folder, and type the name for the tool group you want to add to the database.

You can now click and drag any tools listed in the **Tools and Groups** window into the tool group folder that you have created.

4. Click on the **OK** button  to close the **Tool Groups Database**.

ArtTrace

Using ArtTrace

ArtTrace is an application tool that allows you to convert bitmap images into vector objects that you can use in ArtCAM 2D. ArtTrace works especially well with bitmap images that contain only a few colours. You can also use ArtTrace to edit bitmap images.

The features within ArtTrace fall into the following categories:

- Importing a bitmap image.
- Setting the size and origin for the bitmap image.
- Working with the colours within the bitmap image.
- Editing the bitmap image.
- Converting the bitmap image into vector objects.
- Exporting the vector objects to ArtCAM 2D.

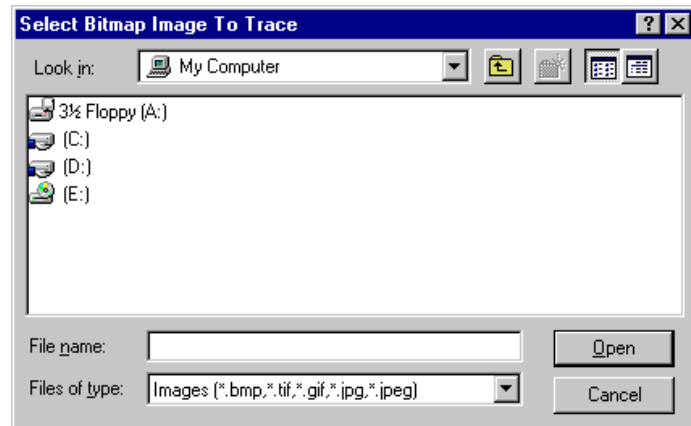
Importing a Bitmap Image

You can import the following types of image files as bitmaps into ArtTrace: *.bmp, *.tif, *.gif, *.jpg and *.jpeg.

To start ArtTrace and import a bitmap image:

1. Click on the **Trace Bitmap** button  in the **File** area of the **Assistant's** Home page to

open the **Select Bitmap Image To Trace** dialog box:



2. Click on the **Look In** list box and find the image file that you want to edit.
3. Once you have found the image file, click on the file name listed in the main window of the **Select Bitmap Image To Trace** dialog box.

The file name you have clicked on appears in the **File Name** box.

4. Click on the **Open** button to start ArtTrace and import the image file.

The **Loading image** box appears while the image file you have selected is loading into ArtTrace:



Setting the Image Size and Origin

You can change the size of a bitmap image imported into ArtTrace. In resizing the bitmap image, you also set the size of the vector objects that can be created from it.

There are three ways to set the size of a bitmap image imported into ArtTrace, all of which are done via the **Set Model Size** dialog box.

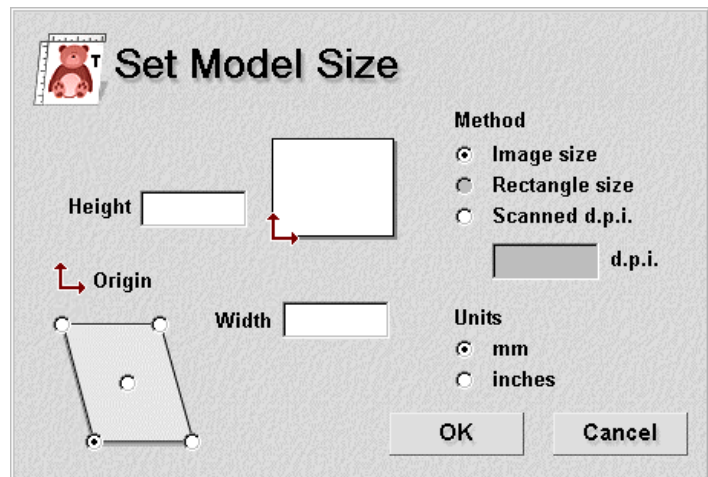



Note: Changing the size of the image does not alter the resolution of the original bitmap you imported into ArtTrace. The image retains the same number of pixels as the original.

You can also set the origin of an imported bitmap image to any one of five pre-set positions in ArtTrace. Each of these positions determines where the vector objects you create from the bitmap image are positioned in the model when you export them to ArtCAM 2D.

To set the image size and origin:

1. Click on the **Set Model Size** button  to open the **Set Model Size** dialog box:



2. Click on the appropriate **Method** radio button .

- **Image Size** - This option sets the size of the whole image using the values in the **Height** and **Width** boxes.


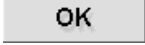
You need only type a value in one of the boxes for ArtTrace to calculate the value in the other and maintain the height/width ratio of the image.

- **Rectangle Size** – This option sets the size of the bitmap image to the size of the bounding box that surrounds all selected vector objects in the **2D View**.

This option is greyed-out if a vector object is not selected.



Note: You can only use the **Rectangle Size** option when you have converted an imported bitmap image into vector objects. For details, see “Converting a Bitmap into Vectors” on page 379.

- **Scanned d.p.i.** - This option sets the size of a pixel in the image. Type the number of dots per inch that you want ArtTrace to use in the **d.p.i.** box to calculate the size of the image.
3. Click on the centre or any of the four corners of the **Origin** box to define the X-axis zero and Y-axis zero origin.
The **Origin** icon  appears in the position you have clicked on.
 4. Make sure that the **Units** option is set according to those you are working in, either millimetres or inches.
 5. Click on the **OK** button  to close the **Set Model Size** dialog box and set your image size and origin.

Working with Colours

When you have imported a bitmap image, all of the colours within the bitmap image are displayed in the Colour Palette below the **2D View** window.

ArtTrace allows you to manipulate the colours within an imported bitmap image. You can:

- Select the Primary and Secondary colours from the Colour Palette.
- Reduce the number of colours in an imported bitmap image.
- Link colours within the bitmap image.
- Merge colours within the bitmap image.
- Mark the edge of the bitmap image.
- Thicken colours within the bitmap image.

- Thin colours within the bitmap image.
- Add colours to the Colour Palette.

Selecting the Primary and Secondary Colours

The Primary Colour defines the shape of the vector objects you can create from an imported bitmap image. ArtTrace creates vector objects around the outline of all areas in the Primary Colour and around those colours linked to it.

The Primary Colour also controls the colour of the Paint tool in ArtTrace. You can use the Secondary Colour only when painting and editing a bitmap image.

You can select the Primary and Secondary colours from the Colour Palette:



To select the Primary Colour:

1. Left-click on the colour in the Colour Palette you want to use.

To select the Secondary Colour:

1. Right-click on the colour in the Colour Palette you want to use.


Reducing Colours

You can reduce the number of colours in an imported bitmap image. ArtTrace takes colours of a similar shade and produces an averaged colour. This averaged colour is displayed in the Colour Palette in place of the original colours.



Note: Colour reduction should be done as an iterative process so that the number of colours can be minimised whilst preserving the detail in the original bitmap image.


To reduce the number of colours in an imported bitmap image:

1. Click on the **Reduce Colours** button  to open the **Reduce Number Of Colours In Image** dialog box.




2. Type a value in the **New Maximum Number Of Colours For Image** box.

The default value is one less than the value in the greyed-out **Current Number Of Colours In Image** box.

3. Click on the **OK** button  to close the **Reduce Number Of Colours In Image** dialog box and reduce the number of colours in the bitmap image to that specified in Step 2.



Warning: Reducing the number of colours in a bitmap image resets all colour links and attributes. If you want to keep any new or linked colours you have created, do not click on the **OK** button .

Colour Merging

You can merge all the pixels in the Secondary Colour in a bitmap image with the Primary Colour. The Secondary Colour is then removed from the Colour Palette.

To do so:

1. Left-click on the colour within the Colour Palette you want to select as the Primary Colour.
2. Right-click on the colour within the Colour Palette you want to select as the Secondary Colour.



3. Click on the **Merge Colours** button  to merge the current Secondary Colour with current the Primary Colour.

The Secondary Colour is removed from the Colour Palette altogether.

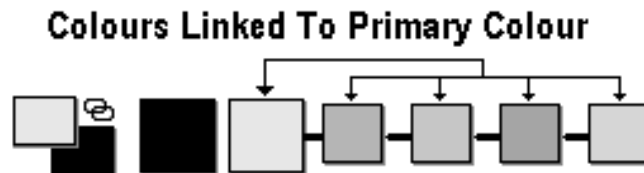
Colour Linking

You can both link and unlink colours within the ArtTrace Colour Palette.

There are three ways you can link a colour in the Colour Palette with the current Primary Colour:


- Click on the **Link/Unlink** button  to link the Secondary Colour to the Primary Colour.
- Click on the **Link/Unlink** icon  in the Colour Palette to link the Secondary Colour to the Primary Colour.
- Double right-click on the colour you want to link to the Primary Colour.

You can see that colours are linked to the Primary Colour when they appear in the Colour Palette as follows:




When colours are linked to the Primary Colour, they are displayed in the Primary Colour in the image.

Linking All Colours

By clicking on the **Link All Colours** button , you can simultaneously link all colours currently in the Colour Palette, other than the Secondary Colour, to the Primary Colour.



Tip: Depending on how many colours there are you want to link, it may be quicker to use the **Link All Colours** method of linking and then use the **Link/Unlink** button  to unlink the individual colours that you do not want.

Unlinking All Colours

By clicking on the **Unlink All Colours** button , you can unlink all colours currently linked in the Colour Palette.

Edge Marking

You can paint a line around the edge of a bitmap image. Marking the outline of a bitmap image in this way means that its shape is clearly defined when it is converted into vector objects.

To mark the edges:

1. Click on the colour in the Colour Palette around which you want to paint a line.

This colour is now set as the Primary Colour.

2. Right-click on the colour in the Colour Palette that you want to use for painting the outline.

This colour is now set as the Secondary Colour.

3. Click on the **Colour** option from the Main Menu toolbar:



4. Click on the **Mark Edge** option from the **Colour** menu.

A line is painted in the Secondary Colour around all regions in the bitmap image made up of the Primary Colour.

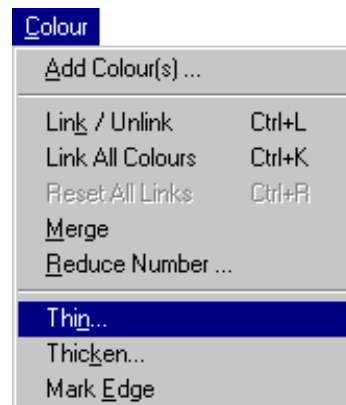
Colour Thinning

Thinning reduces the width of a colour band, replacing the inner area with the Secondary Colour. If you select the full thinning process, this reduces the area to a single pixel band around the original area's edge.

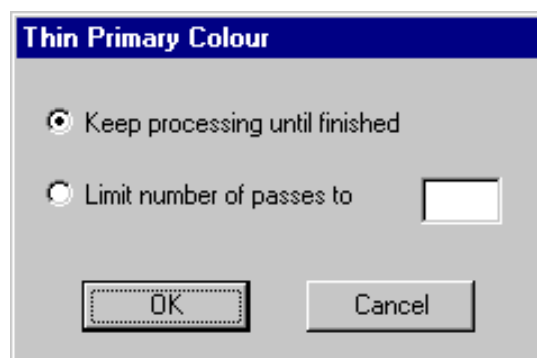
Rather than manually changing an area of colour pixel by pixel, you can automatically thin areas in the Primary Colour.


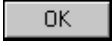
To thin areas in the Primary Colour:

1. Left-click on the colour within the Colour Palette you want to select as the Primary Colour.
2. Click on the **Colour** option from the Main Menu toolbar:

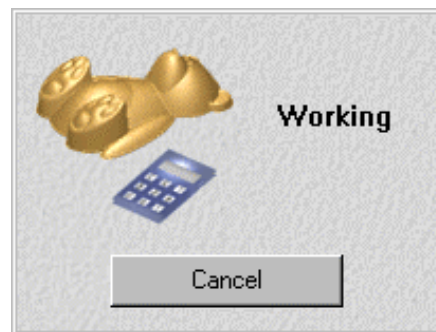


3. Click on the **Thin...** option from the **Colour** menu to open the **Thin Primary Colour** dialog box:



4. Click on the appropriate radio button  to select the method of thinning:
 - **Keep processing until finished** - This option continues to thin all regions in the Primary Colour until they are reduced to a width of one pixel.
 - **Limit number of passes to** - This option sets a limit on the number of thinning passes according to the value you type in the box. Each pass converts one edge pixel in the Primary Colour to the Secondary Colour.
5. Click on the **OK** button  to close the **Thin Primary Colour** dialog box and to thin all regions in the Primary Colour.

The **Working** box is displayed while ArtTrace completes the colour thinning process:



The region of removed pixels is marked in the current Secondary Colour. If you do not need to mark this region, ensure that the Secondary Colour is the same as the background colour in the bitmap image before colour thinning.

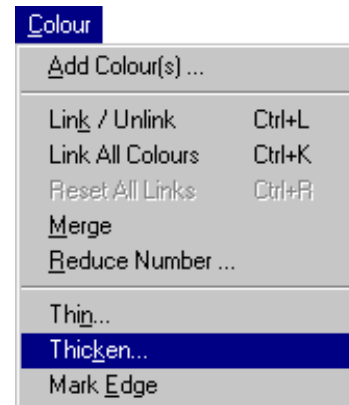
Colour Thickening

Thickening increases the width of a colour band, replacing the inner area with the Secondary Colour.

Rather than manually changing an area of colour pixel by pixel, you can automatically thicken areas in the Primary Colour.

To thicken areas in the Primary Colour:

1. Left-click on the colour within the Colour Palette you want to select as the Primary Colour.
2. Right-click on the colour within the Colour Palette you want to select as the Secondary Colour.
3. Click on the **Colour** option from the Main Menu toolbar:




4. Click on the **Thicken...** option from the **Colour** menu to open the **Thicken Colour** dialog box:



5. Type a value in the **Brush Diameter** box.



Warning: The brush diameter should be an odd number. Even numbers are automatically rounded up to an odd number.

6. Click on the **OK** button  to close the **Thicken Colour** dialog box and to apply a round brush of the diameter specified in Step 4 in the current Secondary Colour to each pixel in the current Primary Colour.

The **Working** box is displayed while ArtTrace completes the colour thickening process:



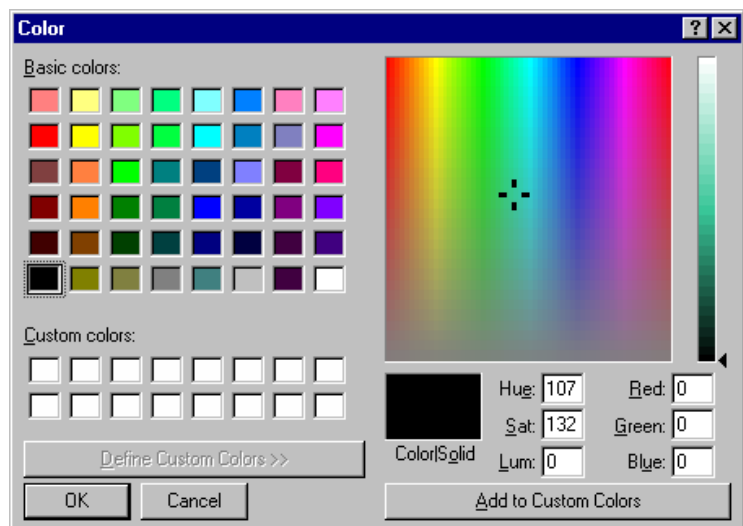
The original pixels in the bitmap image remain in the Primary Colour, while the thickened regions appear in the Secondary Colour. If you do not need this distinction, ensure that both the Primary and Secondary Colours are identical before colour thickening.

Adding Colours

You can increase the range of colours within the Colour Palette in ArtTrace. You can add Basic Colours and/or create your own Custom Colours for you to paint in.

To add to the ArtTrace Colour Palette:

1. Click on the **Add Colour** button  to open the **Color** dialog box:




2. Select a colour that you want to add to the Colour palette:


To select a Basic colour:

- Click on a colour in the **Basic colors** chart.

To select a Custom colour:

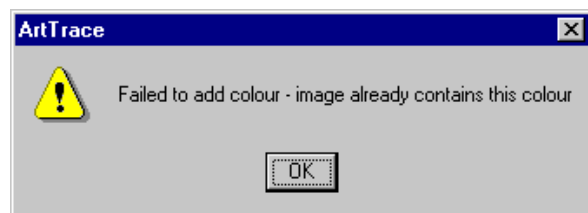
- Click on an approximate colour in the Colour Matrix, then click and drag the slider  at the right of the dialog box to adjust the colour's attributes.
- Type values in the **Hue**, **Sat** (Saturation) and **Lum** (Luminosity) or the **Red**, **Green** and **Blue** boxes to specify the colour.

The colour appears in the **Color|Solid** area of the **Color** dialog box.

3. Click on the **Add To Custom Colors** button  to add the colour you have defined to the Custom Colours palette.

4. Click on the **OK** button  to close the **Color** dialog box.

If you try to add a colour that is already in the Colour Palette is already contained there, the following message box appears:



If so, click on the **OK** button  to close the message box and repeat Steps 1 to 4, to add a different colour.

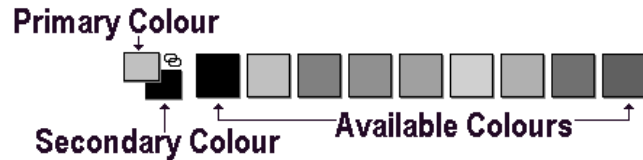
The Basic and/or Custom Colours that you have selected appear in the ArtTrace Colour Palette.

Editing a Bitmap Image

You can use ArtTrace to amend an imported bitmap image using the painting tools and the Colour Palette. The painting tools in ArtTrace are a brush and a flood-fill tool.

Using the Paint Brush

The paint brush allows you to paint in the Primary and Secondary Colours, as shown on the left of the Colour Palette below the **2D View** window:

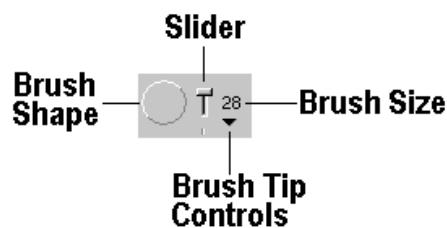


You can use the paint brush in ArtTrace to modify any bitmap image imported into ArtTrace:

1. Click on the **Paint** button  to enter Paint mode.
2. Set the brush size and shape, as described in “Setting the Brush Size and Shape” on page 376.
3. Move the  cursor over the area of the bitmap image you want to edit, then click and drag to paint in the Primary Colour.
If you want to paint in the Secondary Colour, hold the **Shift** key  on your keyboard, then click and drag.
4. Click on the **Select Vectors** button  to exit from Paint mode.

Setting the Brush Size and Shape

You can change the size and shape of the brush used for painting at any time with the **Brush Size** tool displayed on the right of ArtTrace’s main toolbar:

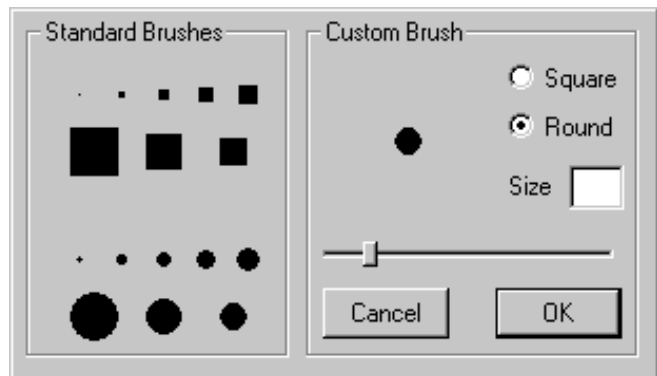


You can change between a square and a circle brush tip simply by clicking on the Brush Shape, as shown above.

You can increase the number of pixels that make up the Brush Size by clicking and dragging the slider upwards, or decrease them by clicking and dragging the slider downwards.

Alternatively, you can use the Brush Tip controls to set the brush properties:

1. Click on the . arrow of the **Brush Size** tool to open the Brush Tip controls:




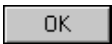
2. Select or create an appropriate brush.

If you want to select a Standard brush:

- Click on the appropriate square or circle icon.

If you want to create a Custom brush:

- Click on the appropriate radio button  to select the shape of the brush.
- Type an appropriate number of pixels in the **Size** box, or drag the slider to set the size of the brush.

3. Click on the **OK** button  to set the size and shape of the brush and close the Brush Tip controls.

You are now ready to paint with your new brush.

Selective Painting


You can use the **Paint Selective** tool to paint with your brush in the current Primary Colour in all areas of a bitmap image, other than those which are made up of the current Secondary Colour.

To do so:

1. Click on the **Paint Selective** button .

2. Left-click on the colour within the Colour Palette you want to select as the Primary Colour.

3. Right-click on the colour within the Colour Palette you want to select as the Secondary Colour.

4. Move the  cursor over the area you want to paint over, then click and drag.

All areas of the bitmap image that are of the Secondary Colour are replaced with the Primary Colour.

Flood Filling

You can replace areas of any selected colour with the current Primary Colour, using the **Flood Fill** tool.

To do so:

1. Click on the **Pick Colour** button .

2. Move the dropper  over the colour you want to select as the Primary Colour and click.

3. Click on the **Flood Fill** button , then move the roller  over the colour you want to flood fill with the Primary Colour and click.


The block of colour you click is replaced with the Primary Colour.

Selective Flood Filling

You can flood fill all areas differently coloured with the current Primary Colour, other than those areas made up of the current Secondary Colour, using the **Flood Fill Selective** tool.

To do so:

1. Click on the **Flood Fill Selective** button .

2. Left-click on the colour within the Colour Palette you want to select as the Primary Colour.
3. Right-click on the colour within the Colour Palette you want to select as the Secondary Colour.
4. Move the roller  over the bitmap image and click to flood fill it with the Primary Colour.

The only colours that remain in the bitmap image are the Primary and Secondary Colours.



Note: If colours are surrounded by the Secondary Colour they are not filled in the Primary Colour. You must flood fill these areas separately.

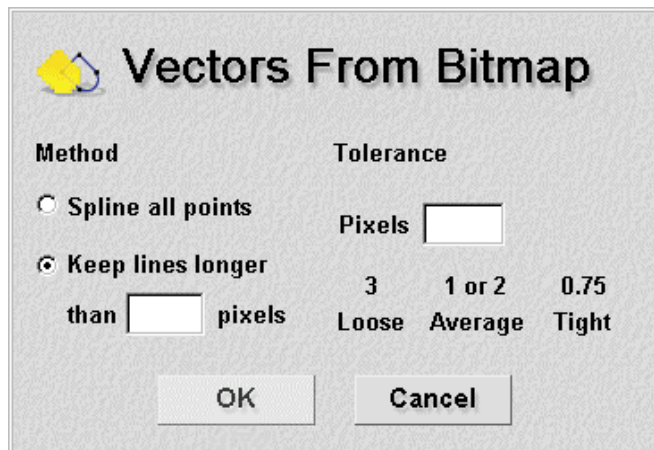
Converting a Bitmap into Vectors

You can use ArtTrace to convert any imported bitmap image into vector objects. ArtTrace creates vector objects around the outline of all areas in the Primary Colour, together with those colours that are linked to the Primary Colour. For further details about colour linking, see “Colour Linking” on page 369.

When converting a bitmap image into vector objects, the vector objects follow the pixellated outline of the bitmap. You can smooth the outline of the vector objects by replacing the linear spans within them with bezier curves. For details, see “Smoothing Vector Objects” in the Working with Vectors chapter.

To convert a bitmap image into vector objects:

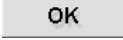
1. Click on the **Bitmap to Vector** button  to display the **Vectors From Bitmap** dialog box:



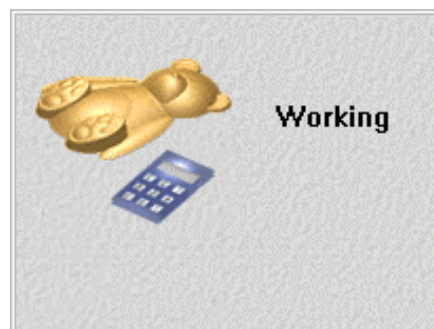
2. Click on the **Method** radio button  you want to use:


- **Spline all points** - This option fits bezier curve spans between all points (nodes) in the vector objects.
- **Keep lines longer than [] pixels** - This option fits bezier curve spans between all points (nodes), except where the number of consecutive pixels you type in the box form a straight line.

3. Type a value in the **Pixels** box to set the **Tolerance**. This sets how closely the bezier curve spans follow the points (nodes) in the vector objects.

4. Click on the **OK** button  to close the **Vectors From Bitmap** dialog box and produce the vector objects in the **2D View** window.

The **Working** box appears while ArtTrace converts the bitmap image into vector objects:



5. Click on the **Bitmap On/Off** button  to hide the original bitmap image, allowing you to see the new vector objects clearly.

Editing the Vector Objects

You can use two simple tools to edit the shape of the vector objects before exporting them to ArtCAM 2D:

- **Smooth Vectors**
- **Create Polyline**

Smooth Vectors

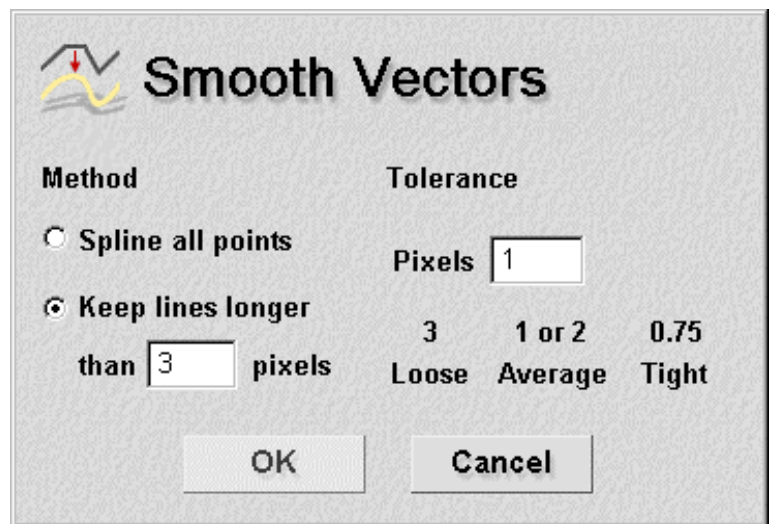
You can smooth vector objects by converting each of their linear and/or arc spans to bezier curve spans.


To smooth the vector objects:



1. Click and drag to form a bounding box around the vector objects you want to smooth.

The selected vector objects turn magenta.


2. Click on the **Smooth Vectors** button  to open the **Smooth Vectors** dialog box:




3. Click on the **Method** radio button  you want to use:
 - **Spline all points** - This option fits bezier curve spans between all points (nodes) in the vector objects.

- **Keep lines longer than  pixels -**
This option fits bezier curve spans between all points (nodes), except where the number of consecutive pixels you type in the box form a straight line.
4. Type a value in the **Pixels** box to set the **Tolerance**. This sets how closely the bezier curve spans follow the points (nodes) in the vector objects.
 5. Click on the **OK** button  to close the **Smooth Vectors** dialog box and smooth the vector objects in the **2D View** window.

Create Polyline

You can use the **Create Polyline** button  to create a polyline, which is a vector object of one or more linear spans joined together by points (nodes). This tool allows you to draw vector objects in ArtTrace, and edit the vector objects that are created by converting a bitmap image.

For further information on using the **Create Polyline** button , see “Drawing using Vectors” in the Working with Vectors chapter.

Exporting Vectors to ArtCAM 2D



When you have created vector objects from an imported image in ArtTrace, you can use one of two methods to transfer vector objects to an open model in ArtCAM 2D:

- Copy and Paste.
- Export and Import as a data file.

To copy and paste the vector objects:

1. Click and drag to create a bounding box around the vector objects you want to use in ArtCAM 2D.

The vector objects are surrounded by a bounding box and turn magenta.

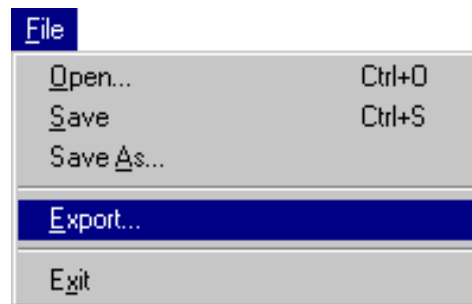
2. Click on the **Copy** button  to copy the new vector objects to the ArtCAM 2D clipboard.
3. In ArtCAM 2D, click anywhere in the **2D View** window.
4. Click on the **Paste** button  in the **File** area of the **Assistant's** Home page to paste the new vector objects in the model.

To export the vector objects as data, and then import them in ArtCAM 2D:

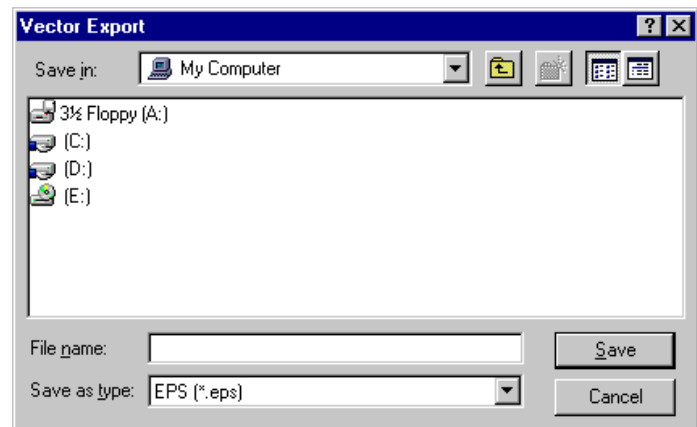
1. Click and drag to create a bounding box around the vector object you want to use in ArtCAM 2D.

The vector object is surrounded by a bounding box and turns magenta.



2. Click on the **File** option in the Main menu bar to display the **File** menu.

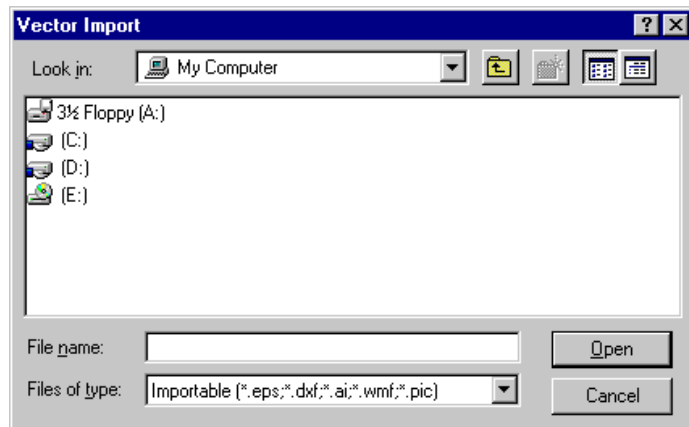


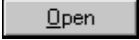
3. Click on the **Export...** option to display the **Vector Export** dialog box.



4. Click on the **Save In** list box and select the directory you want to save the vector object in.

5. Type the file name you want to use for the vector object in the **File name** box.
6. Click on the **Save** button .
7. In ArtCAM 2D, click anywhere in the **2D View** window.
8. Click on the **Import EPS, DXF or AI Files** button  in the **File** area of the **Assistant's** Home page to display the **Vector Import** dialog box.



9. Click on the **Look In** list box and select the directory you had saved the vector data (*.eps) in.
10. Click on the file name listed in the main window of the **Vector Import** dialog box.
11. Click on the **Open** button  to import the vector data into the model.

The imported vector object is magenta and positioned in the model according to the **Origin** selected in the **Set Model Size** dialog box. For details, see “Setting the Image Size and Origin” on page 364.

You can change the position of the vector objects in ArtCAM 2D if required. For details, see “Moving Vectors” in the Working with Vectors chapter.

ArtSpool

Using ArtSpool

ArtSpool is an application tool you can use to send toolpath data to your CNC machine tool through a serial cable.

For details about saving toolpaths which can then be transferred to your CNC machine tool using ArtSpool, see “Saving a Toolpath” in the Machining Models chapter.

ArtSpool runs as a background task in Windows 95, 98, 2000 or NT4+. This means that instead of your computer being inaccessible for hours at a time processing and sending data to your CNC machine tool, you can continue to use it while ArtSpool handles your machining jobs.



Warning: ArtSpool is an unsupported application tool supplied free of charge. Delcam plc cannot guarantee that it will be suitable for sending toolpath files to your CNC control system. Please contact your CNC machine tool and software resellers if you experience difficulties.

Setting Up ArtSpool

Before you can send toolpath data to your CNC machine tool, it is necessary to configure ArtSpool. You must set up:

- The communication settings that ArtSpool uses to send data to the CNC machine tool.

- A spool directory where toolpath data is stored, ready to be transferred.

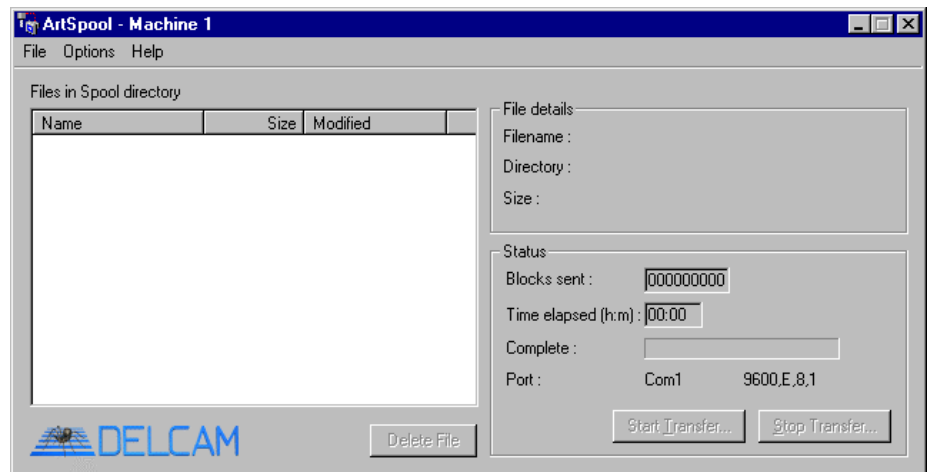
Selecting the Communication Settings

You must configure ArtSpool to communicate with your CNC machine tool before you can use it to send toolpath data.



Warning: When you configure ArtSpool, it is important that you consult your CNC machine manual or suppliers to ensure the correct communications settings are used.

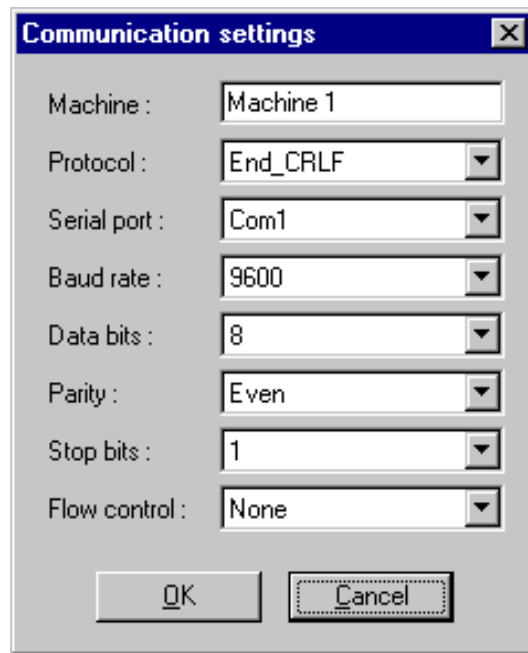
1. Click on **Start > Programs > ArtCAM 2D > ArtSpool** to start ArtSpool:



2. Click on **Options** in the Main menu bar:




3. Click on **Configure Communications** to open the **Communications Settings** dialog box:



4. Select the correct settings for your CNC machine:

- Type the name of your CNC machine in the **Machine** box.
- Select the protocol used by your CNC machine in the **Protocol** list box.
- Select the serial port to which your CNC machine is connected in the **Serial Port** list box.
- Select the Baud rate of your CNC machine in the **Baud Rate** list box.
- Select the number of bits for your CNC machine in the **Data Bits** list box.
- Select the parity bit for your CNC machine in the **Parity** list box.
- Select the number of stop bits for your CNC machine in the **Stop Bits** list box.
- Select how you want to control the flow of data from the spool directory in the **Flow Control** list box.

Select **Hardware [RTS/CTS]** to use your CNC machine tool and **Software [XOn XOff]** to use ArtSpool.

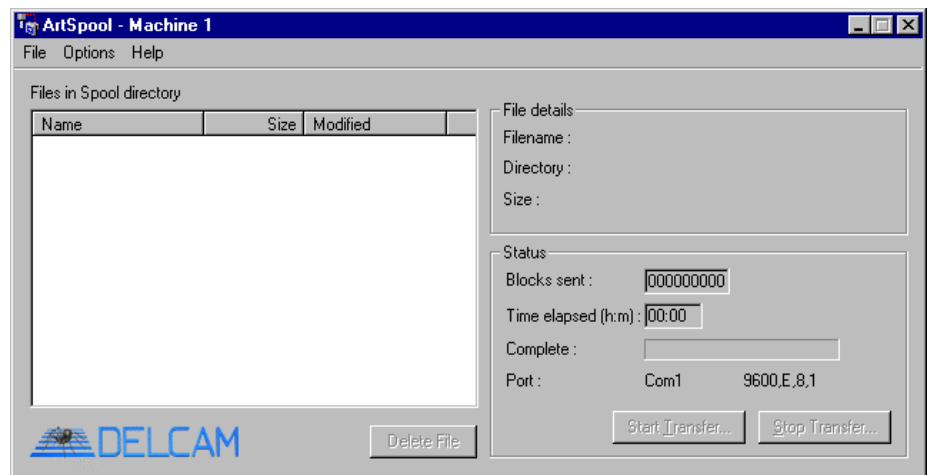
5. Click on the **OK** button  to save your settings and close the **Communications Settings** dialog box.

Selecting the Spool Directory

Before you can use ArtSpool to send toolpath data to your CNC machine tool, you must select the folder to which you want to spool your toolpath files. This is where the toolpath data is stored, before being sent to your CNC machine tool.

To select the **Spool Directory**:

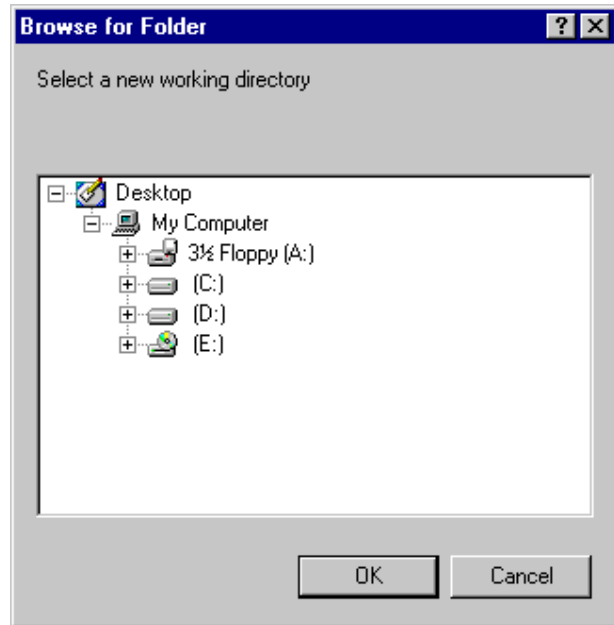
1. Click on **Start > Programs > ArtCAM 2D > ArtSpool** to start ArtSpool:




2. Click on **Options** in the Main menu bar:



3. Click on **Select Spool Directory** to open the **Browse for Folder** dialog box:



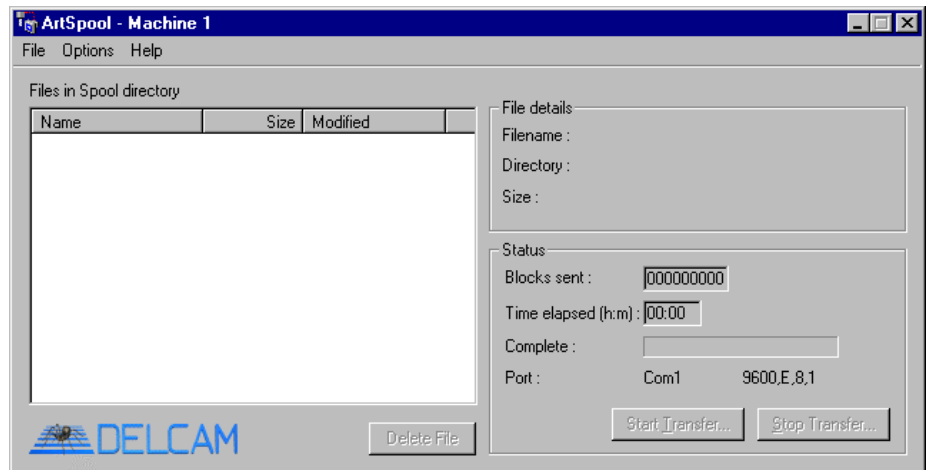
4. Click on the folder to which you want to spool your toolpath files.
5. Click on the **OK** button  to select the spool directory and close the **Browse for Folder** dialog box.

Sending Toolpath Files

When you have selected a spool directory and set your communication settings you can send toolpath files to your CNC machine tool, using ArtSpool.

To send a toolpath file to your CNC machine tool:

1. Click on **Start > Programs > ArtCAM 2D > ArtSpool** to start ArtSpool:



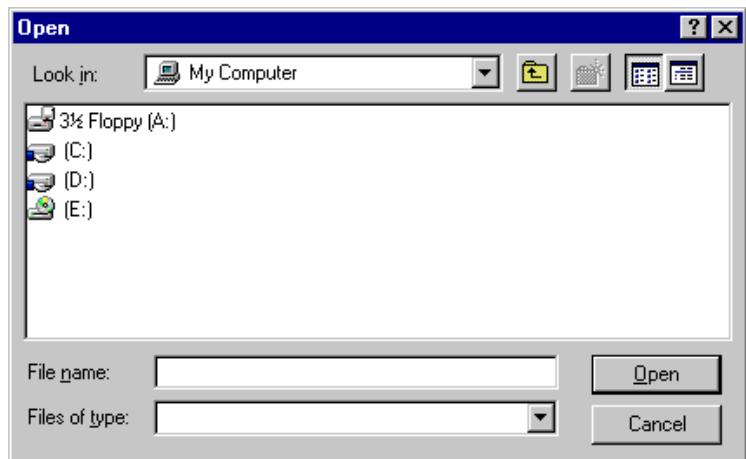
2. If you want to send a toolpath file from the Spool Directory to your CNC machine:

- Click on the file in the **Files in Spool directory** window to select it.

The name, size and location of the toolpath file appear in the **File Details** area of ArtSpool.


If you want to send a toolpath file to your CNC machine from another directory:

- In the Main menu bar, click on **File > Select Other File** to open the **Open** dialog box:



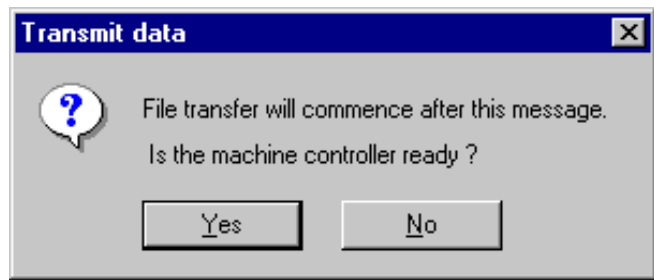
- Click on the toolpath file that you want to send to your CNC machine tool.

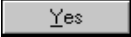
The name of the selected toolpath file appears in the **File name** box.

- Click on the **Open** button  to close the **Open** dialog box and load the toolpath file into ArtSpool.

The name, size and location of the toolpath file appear in the **File Details** area of ArtSpool.

3. Click on the **Start Transfer** button  to open the **Transmit Data** message box:



4. Click on the **Yes** button  to send the selected toolpath file to your CNC machine tool.

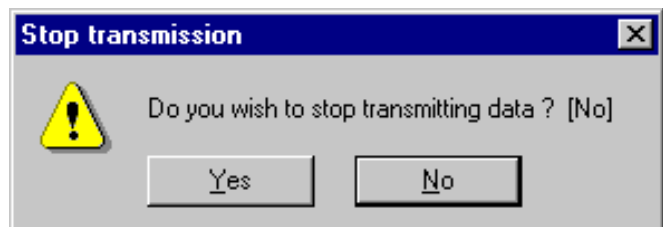
It takes a few minutes to transmit the data, during which a progress bar is shown in the **Status** area:



When the toolpath data has been sent to your CNC machine tool, *TX complete* is displayed on the ArtSpool title bar.

If you want to stop the transmission of toolpath data to your CNC machine:

1. Click on the **Stop Transfer** button  to open the **Stop Transmission** message box:



2. Click on the **Yes** button .

Deleting Toolpath Files

You can delete any of the files contained in the **Spool Directory** using ArtSpool. You should only delete a toolpath file from the **Spool Directory** after it has been sent to your CNC machine tool and you no longer require it for machining a model.

To delete a file from the **Spool Directory**:

1. Click on the file in the **Files in Spool directory** window to select it.

2. Click on the **Delete File** button .

Index

2

2D Area Clearance 270

2D View

- guidelines 17
- rulers 12
- scrolling 11
- snap grid 13
- toolbar 9

3

3D Bevelled Carving 278

3D View

- isometric view 23
- objects to draw 24
- origin 23
- pan view 22
- scale to fit 23
- toolbar 21
- twiddle tool 22
- view along X 23
- view along Y 23
- view along Z 23
- zoom 22
- zoom out 23

A

Adding

- bridging 327

colours to the ArtTrace colour
palette 374

points to a vector object 156

tool groups to the database 361

tools to the database 356

Adjusting Machining Parameters 334,
335

Aligning

- vector text 210
- vectors 232

Arcs

- converting span to an arc 159
- fitting to vector objects 200

ArtCAM 2D

2D View window 9

Assistant 5, 6

compatible bitmap files 4

compatible vector files 3, 142, 143

correcting an action 144

exporting vector files 143

finding out about 2

importing vector files 142

Main menu bar 6

overview 1

screen layout 5

shutting down 137

ArtSpool

communication settings 386

deleting toolpath files 391

selecting the spool directory 388

sending toolpath files 389

setting up 385

using 385

ArtTrace

adding colours to the Colour Palette
374

colour thickening 372

converting a bitmap into vectors 379

editing vector objects 381

exporting vector objects to ArtCAM
2D 382

flood filling 378

importing a bitmap image 363

- linking colours 369
- marking the edge of a bitmap 370
- merging colours 368
- paint brush 376
- reducing colours in a bitmap 367
- selecting the Primary colour 367
- selecting the Secondary colour 367
- selective flood filling 378
- selective painting 377
- setting paint brush shape 376
- setting paint brush size 376
- setting the origin in a bitmap image 364
- setting the size of a bitmap image 364
- smoothing vector objects 381
- thinning colours 371
- using 363

Assistant

- File area 6, 138
- Group Merge Join area 7
- Home page 6
- overview 6
- Position Size Align area 7
- Toolpaths area 7
- Vector Editing area 7, 147, 167

B

Bevelled Carving 278

Bitmaps

- compared to vectors 2
- converting into vectors 379
- definition 4
- files compatible with ArtCAM 2D 4
- files compatible with ArtTrace 363
- marking the edge 370
- reducing the number of colours 367
- setting the origin 364
- setting the size 364

Bridges

- adding to a Profile toolpath 327
- changing the length 330

- deleting 329
- editing 328
- inserting 328
- moving 330

C

Calculating the Machining Time 352

Centreline Carving 275

Centreline Engraving 290

Centring vectors 234

Changing

- start point 166
- the length of a bridge 330

Circle

- creating 172
- editing 173

Climb Milling 260

Closing vectors 246

Colour

- adding to the Colour Palette 374
- marking the edge 370
- merging colours 368
- primary colour 367
- reducing the number of colours 367
- secondary colour 367
- thickening 372
- thinning 371

Colour Linking

- creating colour links 369
- linking all colours 369
- linking colours 369
- unlinking all colours 370

Communication Settings 386

Conventional Milling 259

Converting

- bitmap into vectors 379
- span to a bezier curve 154
- span to a line 158
- span to an arc 159

Copy 189

- block 190
- rotate 191

- vector objects to clipboard in
 ArtTrace 382
- Correcting an action 144
- Creating
 - circle 172
 - drill holes 322
 - ellipse 176
 - hole 300
 - offset vector 193
 - pocket 294
 - polygon 180
 - rectangle 168
 - star 184
 - stepped hole 310
 - stepped insert 318
 - stepped pocket 304
 - straight insert 314
 - vector text 204
- Cut direction 259
- Cutting Direction 340

D

- Deleting
 - bridges 329
 - points 165
 - spans 161
- Drill Holes 322

E

- Editing
 - bitmaps 375
 - bridges 328
 - circle 173
 - created vector text 208
 - ellipse 177
 - model dimensions 141
 - polygon 181
 - polyline 151, 188
 - rectangle 170
 - square 170
 - star 186

- Toolpaths 344
- tools in the database 357
- Vector Editing tools 147
- vector nodes 162
- vector objects 188
- vector objects in ArtTrace 381
- vector spans 154
- vector text in text creation mode 208
- Ellipse
 - creating 176
 - editing 177
- Engraving 284
- Exporting
 - vector files from ArtCAM 2D 143
 - vector objects from ArtTrace 382

F

- Fitting arcs to vector objects 200
- Flood Fill 378
- Flood Fill Selective 378
- Formatting created vector text 213
- Formatting vector text 210
- Formatting vector text in creation
 mode 212

G

- Grouped vectors 256
- Grouping vectors 248
- Guidelines
 - 2D View 17
 - inserting a parallel guide 18
 - positioning 18

H

- Hiding a Toolpath 342
- Hole 300

I

- Importing
 - bitmap files 363

- vector files 142
- Information about ArtCAM 2D 2
- Inlay Wizard 293
 - hole 300
 - pocket 294
 - stepped hole 310
 - stepped insert 318
 - stepped pocket 304
 - straight insert 314
- Inserting bridges 328

J

- Joining vectors 244

L

- Linking All Colours 369
- Linking Colours 369
- Locking vectors into position 198

M

- Machining a model 259
- Machining Order 331
 - manipulating 333
 - resetting 332
- Machining Parameters
 - adjusting in a created toolpath 335
 - adjusting when creating toolpath 334
- Manipulating the Machining Order 333
- Measuring vectors 219
- Merging vectors 240
- Mirror
 - model 144
 - vectors 228, 230
- Mirroring vectors 228
- Models
 - closing 136
 - creating 133
 - creating new 139
 - editing dimensions 141
 - exporting vector files 143

- importing vector files 142
- machining 259
- mirroring 144
- opening 139
- opening existing 135
- opening the last model 136
- rotating 145
- saving 140
- Moving
 - bridges 330
 - vectors 224

N

- Nesting vectors 237
- Node editing 162

O

- Objects to Draw 24
- Offsetting vectors 193
- Origin 23
- Overview
 - ArtCAM 2D 1
 - Assistant 6

P

- Paint Brush
 - selective painting 377
 - setting the shape 376
 - setting the size 376
 - using 376
- Pan View 22
- Paste
 - vector 190
 - vector objects along a curve 202
- Peck Drilling 322
- Plunge moves 339
- Pocket 294
- Point
 - changing the start point 166
 - deleting 165
 - inserting 156

- smoothing 163
- Polygon
 - creating 180
 - creating from a polyline 150
 - editing 181
- Polyline
 - closing to create a polygon 150
 - completing 149
 - creating 148
 - editing 151, 188
- Primary Colour 367
- Printing a Toolpath Summary 354
- Profiling 262
- Properties of a vector 253

R

- Rapid moves 339
- Rectangle
 - creating 168
 - editing 170
- Redo 144
- Resetting the Machining Order 332
- Resizing grouped vectors 251
- Resizing vectors 222
- Restoring a Hidden Toolpath 343
- Restoring the original shape of a
 - smoothed vector 198
- Reversing direction of geometry 254
- Rotate
 - copy 191
 - model 145
 - vectors 225
- Rotating vectors 225
- Rulers
 - 2D View 12
- Scaling vectors 222
- Secondary colour 367
- Selecting vector text 206
- Selecting vectors 151
- Selective Painting 377
- Setup Job Dimensions 133
- Shearing vectors 226
- Shutting down 137
- Simulating a Toolpath 337
- Simulating a Toolpath Group 338
- Smooth
 - point 163
 - vector objects 195, 382
 - vector objects in ArtTrace 381
- Smoothing vector objects 195, 381
- Snap Grid
 - displaying 13
 - hiding 14
 - snapping 16
 - snapping to objects 20
 - spacing 15
- Span
 - converting to a bezier curve 154
 - converting to a line 158
 - converting to an arc 159
 - deleting 161
 - editing 154
 - inserting a point 156
- Spool Directory 388
- Square
 - creating 168
 - editing 170
- Star
 - creating 184
 - editing 186
- Start Point
 - changing 166
- Stepped Hole 310
- Stepped Insert 318
- Stepped Pocket 304
- Straight Insert 314

S

- Saving
 - model 140
 - toolpath 345
 - toolpath summary 354

T

- Thickening Colours 372
- Thinning Colours 371
- Tool Groups Database 355
 - adding a tool group 361
 - adding tools 356
 - deleting a tool 361
 - editing a tool 357
- Toolpath Manager 8
- Toolpath Summary 351
 - calculating machining time 352
 - printing 354
 - saving 354
- Toolpaths
 - 2D area clearance 270
 - adding bridging 327
 - bevelled carving 278
 - centreline carving 275
 - centreline engraving 290
 - cut direction 259
 - cutting direction 340
 - deleting a group 350
 - deleting in ArtCAM 2D 348
 - deleting in ArtSpool 391
 - drill holes 322
 - editing 344
 - engraving 284
 - hiding 342
 - inlay wizard 293
 - machining parameters 333
 - profiling 262
 - rapid and plunge moves 339
 - restoring hidden 343
 - saving 345
 - sending files from ArtSpool 389
 - setting the Profile machining order 331
 - simulating 337
 - summary 351
 - tool groups database 355
 - Toolpath Manager 8
 - viewing 338

- Toolpaths
 - buttons 7
- Trace Bitmap 363
- Transforming vectors 220
- Twiddle Tool 22

U

- Undo 144
- Ungrouped vectors 254
- Unlinking Colours 370
- Unlocking vectors 199

V

- V-bit Carving 275
- Vectors
 - aligning 232
 - block copy 190
 - centring 234
 - closed 152
 - closing 246
 - compared to bitmaps 2
 - copying 189
 - creating text 204
 - definition 3, 147
 - editing 154, 188
 - editing text 207, 208
 - editing tools 147
 - exporting from ArtCAM 2D 143
 - exporting from ArtTrace 382
 - files compatible with ArtCAM 2D 3, 142, 143
 - fitting arcs 200
 - formatting text 210, 212, 213
 - grouped 152, 256
 - grouping 248
 - importing into ArtCAM 2D 142
 - joining 244
 - locking 198
 - measuring 219
 - merging 240
 - mirroring 228, 230

- moving 153, 224
- nesting 237
- offsetting 193
- open 152
- overlapping 152
- pasting 189
- pasting along a curve 202
- resizing 222
- resizing grouped 251
- reversing direction of geometry 254
- rotate copy 191
- rotating 225
- scaling 222
- selecting 151, 152
- selecting multiple 152
- selecting text 206
- shearing 226
- smoothing 195
- smoothing in ArtTrace 381
- transforming 220
- ungrouped 152, 254
- unlocking 198
- viewing the properties 253
- wrapping text round a curve 214
- Viewing a Toolpath 338

- Zoom Out
 - 2D View 10
 - 3D view 23
- Zoom Previous 11

W

- Window
 - 2D view 9
 - 3D view 9
 - cascade 9
 - tile 9
 - zoom in 10
- Window Fit 11
- Wrapping text round a curve 214

Z

- Zoom In
 - 2D view 10
 - 3D view 22
- Zoom Objects 11

