DENFORD

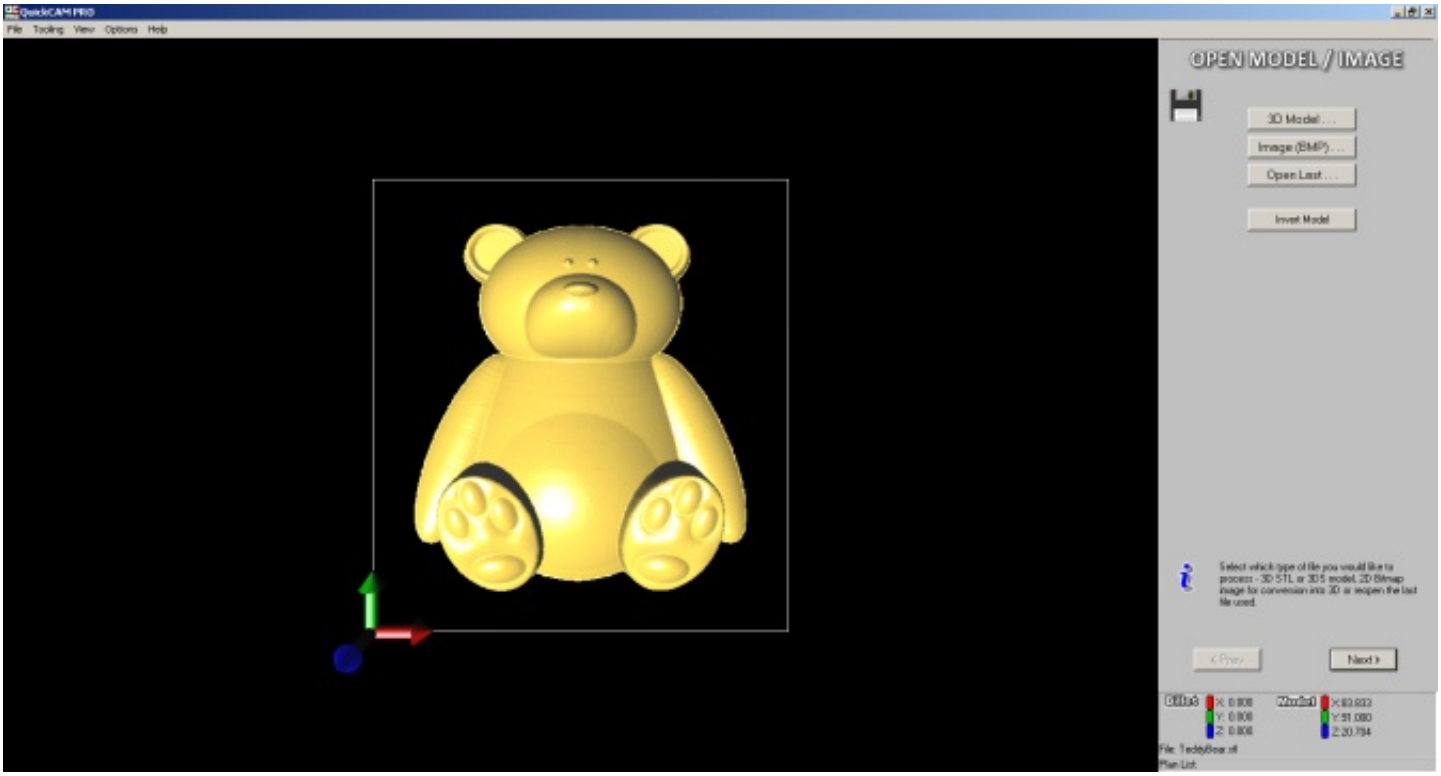
CAD/CAM Solutions & Projects for Education

QuickCAM Pro

Advanced Milling CAM Software

3D Model - Training Guide

QuickCAM Pro (V1.13)
VR Milling (V5.61)



IN SCHOOLS

LAND ROVER ABOVE & BEYOND

4 IN SCHOOLS technology challenge

eim ENGINEERING IN MOTION

JAGUAR Primary School Challenge

DENFORD

Denford Consumables

MATERIALS & CONSUMABLES

American Maple Wood Block

A creamy white hardwood with a close grain and fine, even texture.
Easy to work and finish, without the need for sanding.

Billet size: 160mm x 100mm x 20mm	Each	BI03509D
	Pack of 50	BI03509G

Round Pine Billets

Ideal for use with the Rotary Fixture attachments.

Billet size: 65mm Dia. x150mm Long	Pack of 10	BI03509J

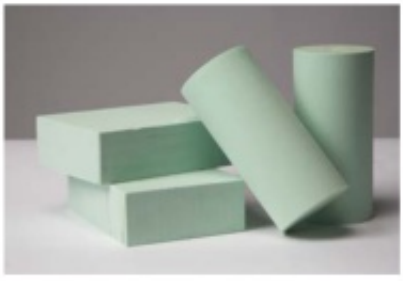
FOAM

These rigid, closed cell foam blocks are ideal for the rapid machining of parts on the full range of Denford Milling Machines and Routers.

High Density Foam

Ideal for most 3D prototyping applications. Offering plenty of surface detail, it is commonly used in moulds for vacuum forming and is also suitable for painting.

Billet size: 150mm x 110mm x 45mm	Each	BI03508
	Pack of 50	BI03508A



Billet size: 70mm Dia. x 150mm long	Each	BI03508DZ
	Pack of 15	BI03508E

Ideal for use with the Denford 4th axis programmable rotary fixture.

Contents

About QuickCAM Pro

QuickCAM Pro is an advanced, yet simple to use, wizard based CAM package, which is used to create cutter paths for machining 3D parts on a milling machine or router. Both STL files and image files can be imported into QuickCam Pro, and a comprehensive set of machining plans can be used individually or in combination to produce complex 3D surfaces and lithophanes.

Introduction

The aim of this training guide is to teach you how to navigate your way around QuickCAM Pro and instruct you how to operate this software to manufacture a part on your Denford Router or Mill from a 3D model.

This guide makes use of screen shots where possible and will use the following conventions:

Instructions will be in this format

Text to be typed will be in this format

Any software buttons to be pressed, a picture of the button will follow the instruction

This guide assumes that your software has already been installed and your machine has been commissioned.
If any of the features described in this guide are not operating as described please check that the version number you are using is the same as that shown on the front cover. Version is written on the title bar of the main software window.

Denford provide machine training and it is recommended that you undertake the training and use this guide as a revision guide after completion of the machine training.

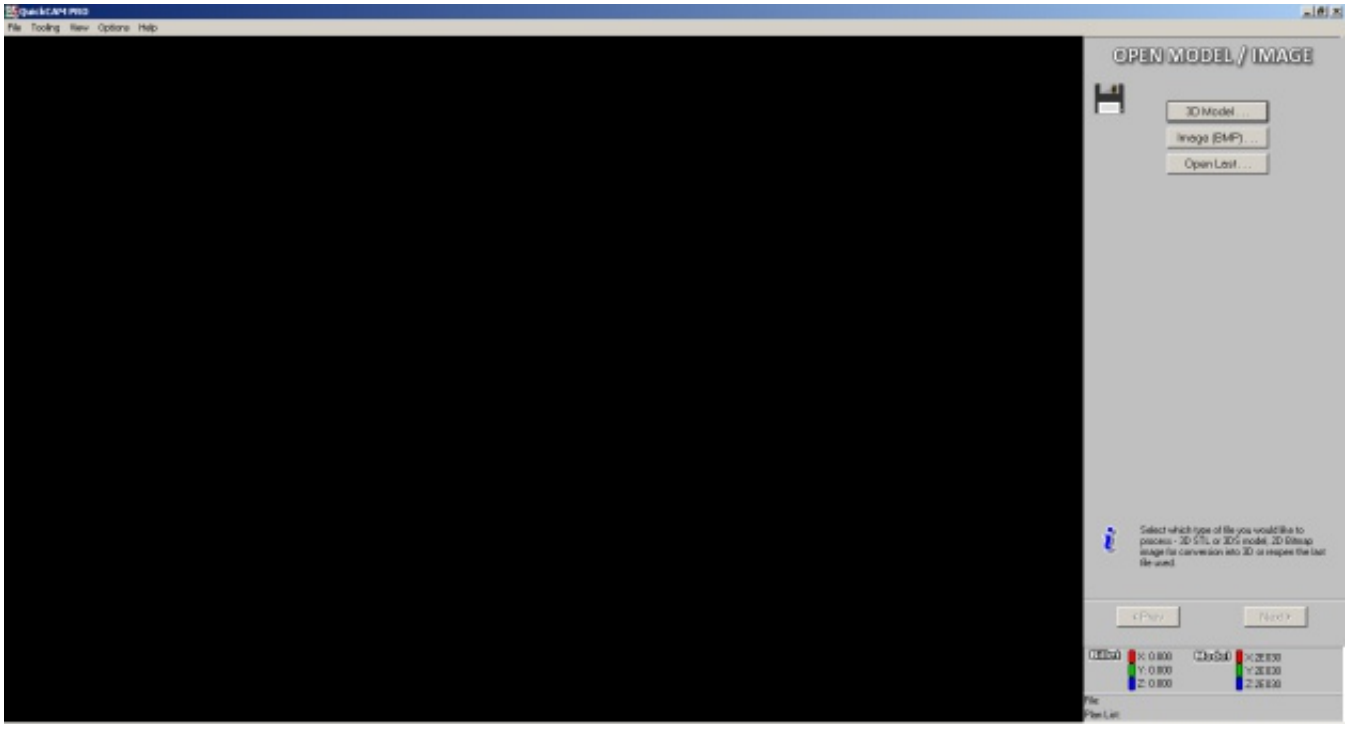
Launching QuickCAM Pro

Open the "Denford Applications" folder.
"Double click" on the QuickCAM Pro icon.

The screen shown on the right will be displayed and the software will take a minute or 2 to open.
You can force the software to open quicker by following the next instruction.

"Double click" on the area circled below.

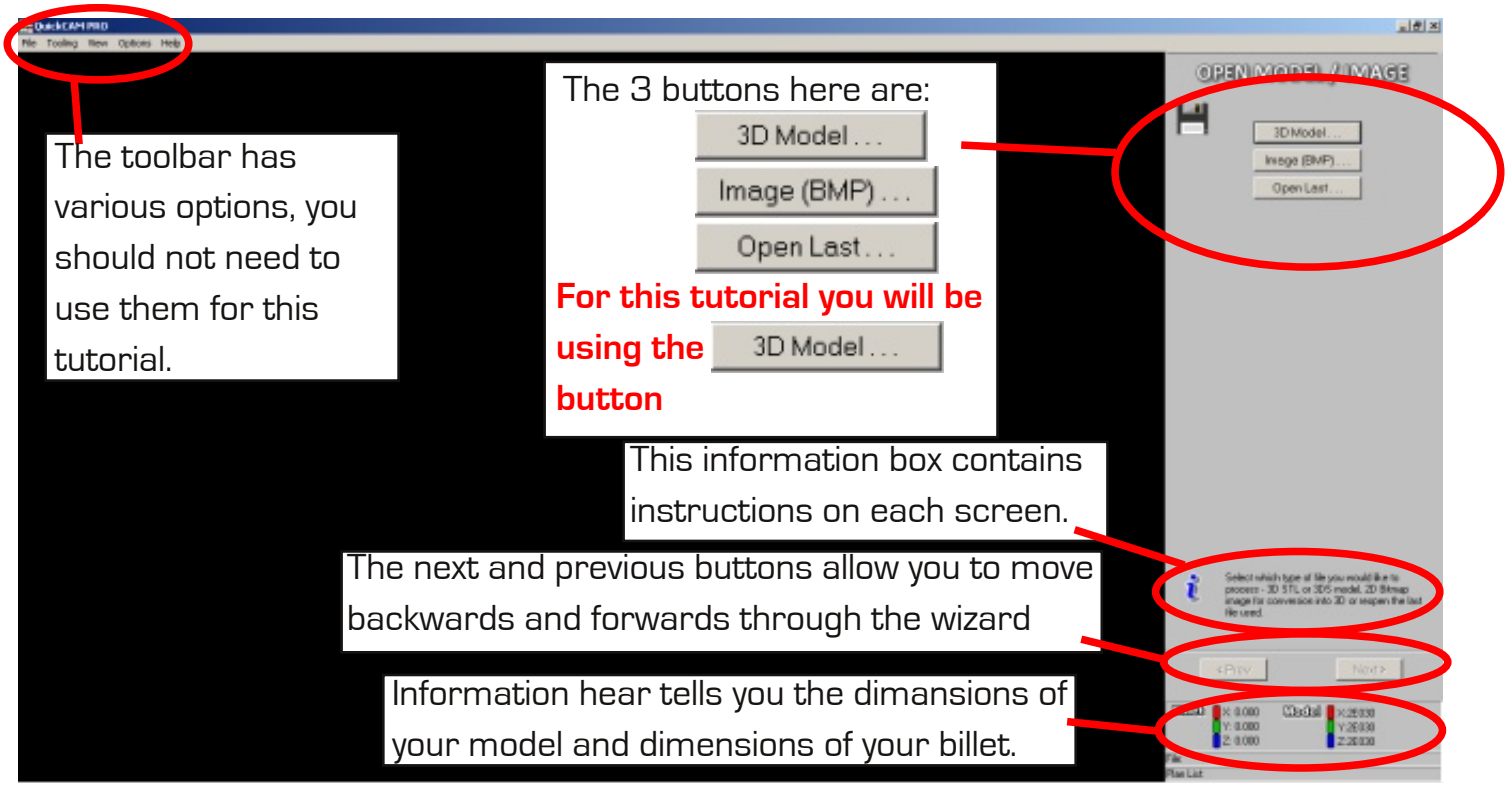
The software will open and you will be greeted with the screen below.



Navigating QuickCAM Pro

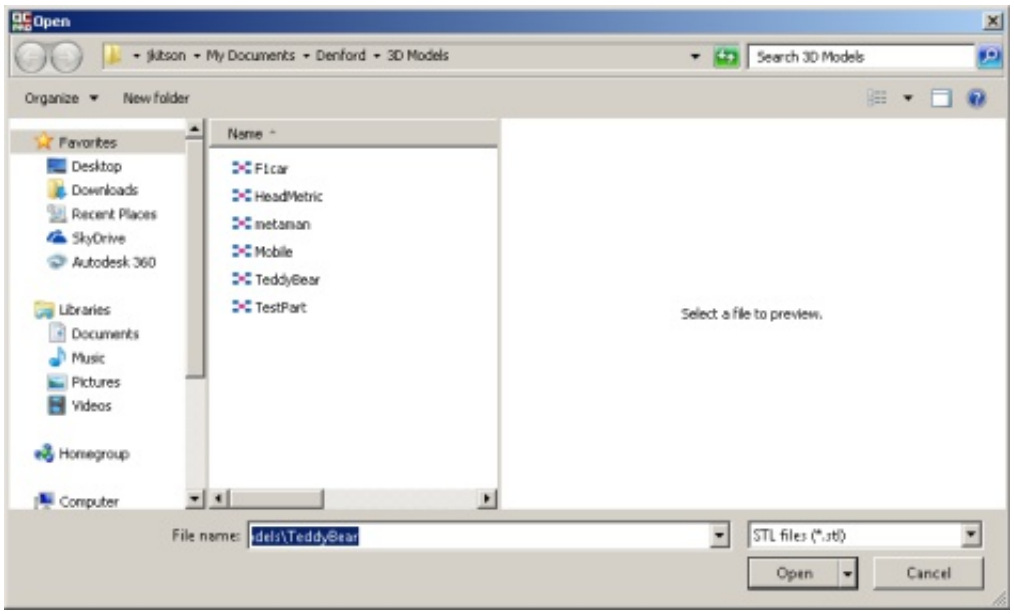
QuickCAM Pro is very easy to use, the main screen displays what is going on and the navigation panel on the right is how you select options and move around this wizard based program.

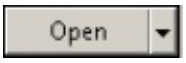
The left mouse button allows you to rotate the main display and the right mouse button allows you to zoom in and out.



Opening your Model

Select the 3D Model button 



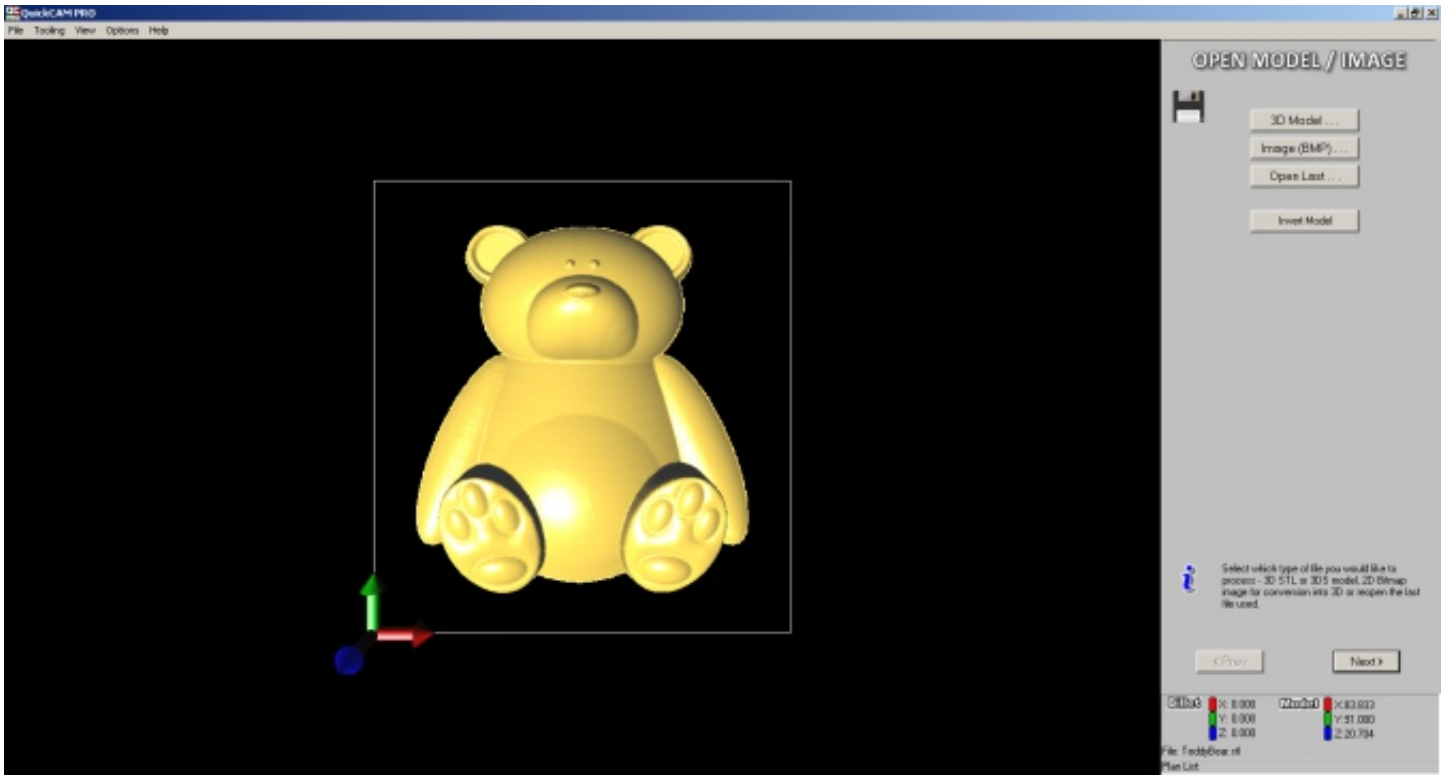
Select the .STL file you wish to machine and click the open button 

Your model will now be displayed in the main screen.

You can hold the left mouse button to rotate your model, holding the right mouse button zooms in and out.

A new button has appeared, this is the invert button 

You can use this to invert your model if wanting to make a mould.



Click the next button 

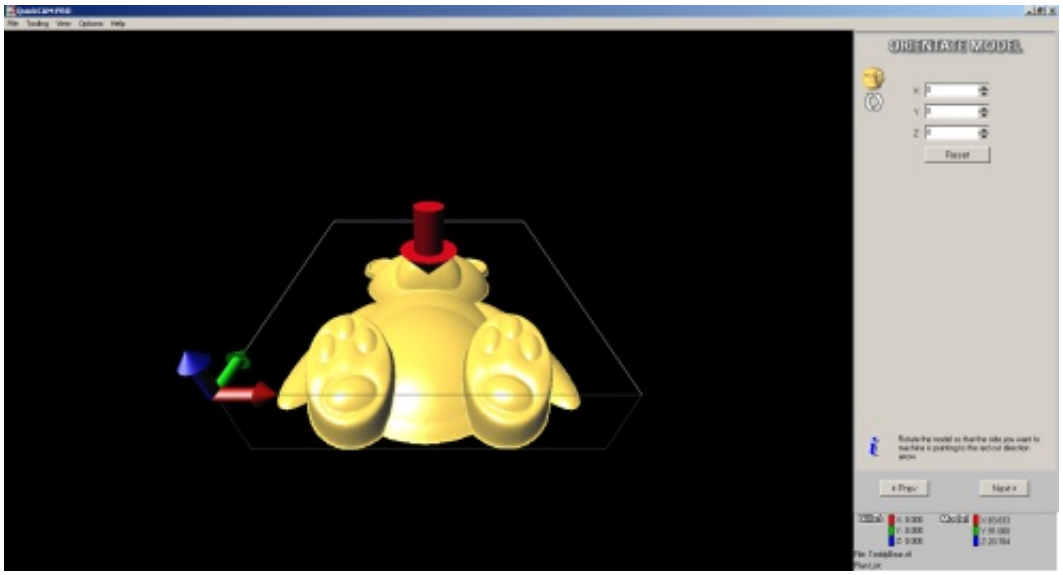
Orientate the Model

There are a number of ways to orientate the model, there is no right or wrong way as long as the billet in the machine is aligned the same way.

The large red arrow represents the direction that the cutting tool will come from.

The TeddyBear.stl model is not a full 3D model and has a flat underside, the original orientation is the one we will use for this tutorial so do not rotate in the X, Y or Z axis.

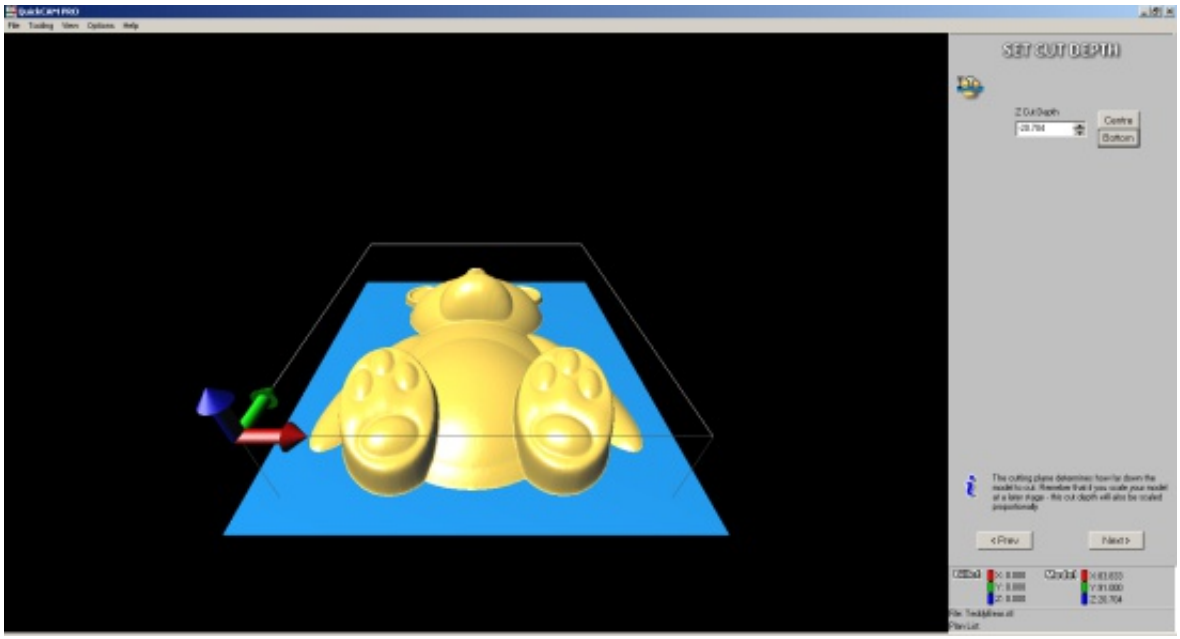
For other models you may want to rotate the model, you can either type an angle in the text editor next to each axis or you can click the direction arrows; the direction arrows move the model in 90 degree increments.



When your model is correctly orientated, click the Next button 

Set the Cut Depth

This screen allows you to set the cut depth



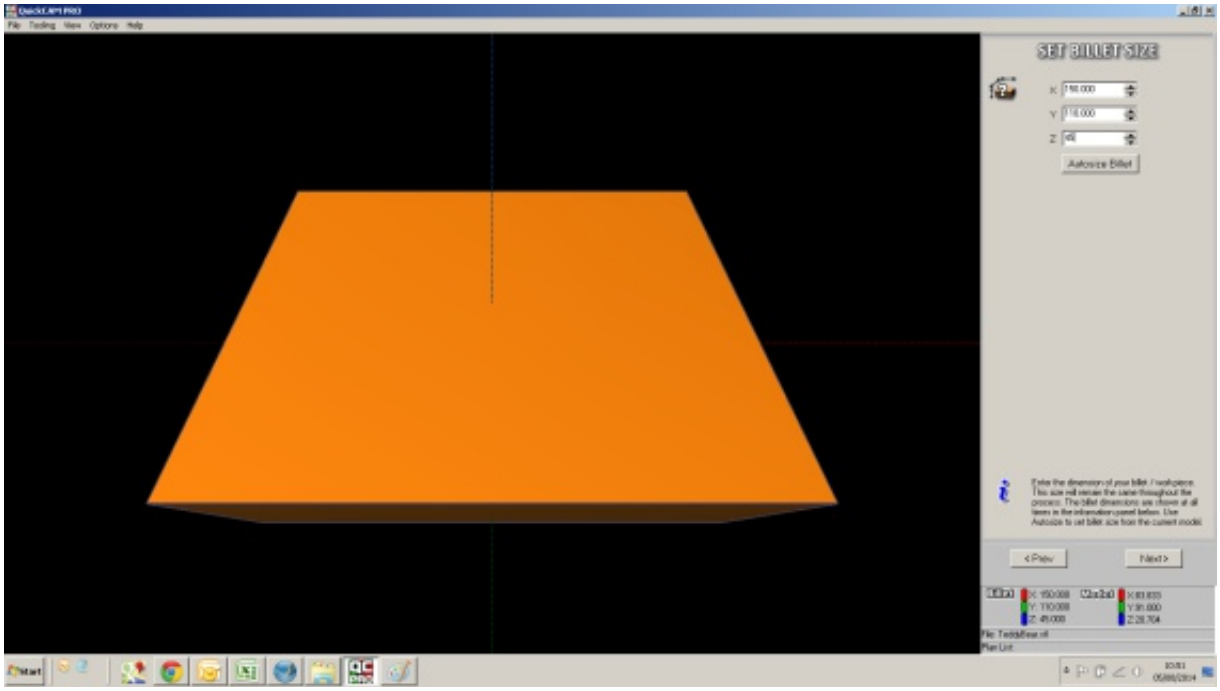
Adjusting the cut depth will set how deep the cut goes, it also slices the model at this depth so imagine that everything below the set depth has been deleted.

Click the Bottom button 

Click the Next button 

Set Billet Size

This screen is where we set the size of the billet.

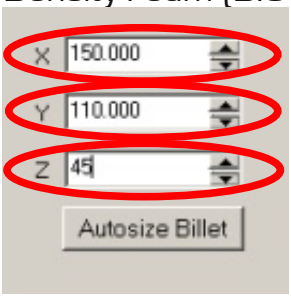


For this tutorial we are using the High Density Foam (BI03508A) billets.

Click in the X dialogue box and type *150*

Click in the Y dialogue box and type *110*

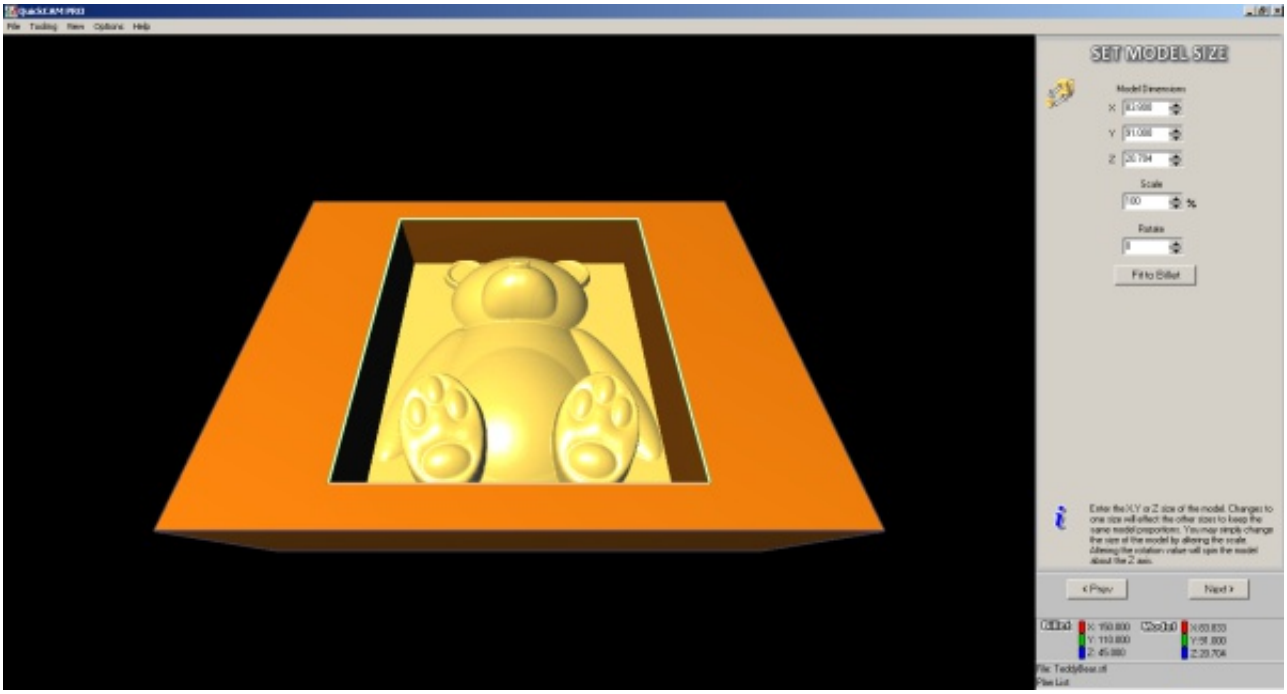
Click in the Z dialogue box and type *45*



Click the Next button 

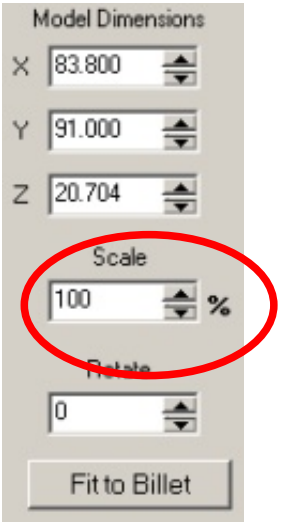
Set Model Size

This screen allows you to set the size of the model.



Having designed your model to a certain size you will most likely want to cut it out the same size.

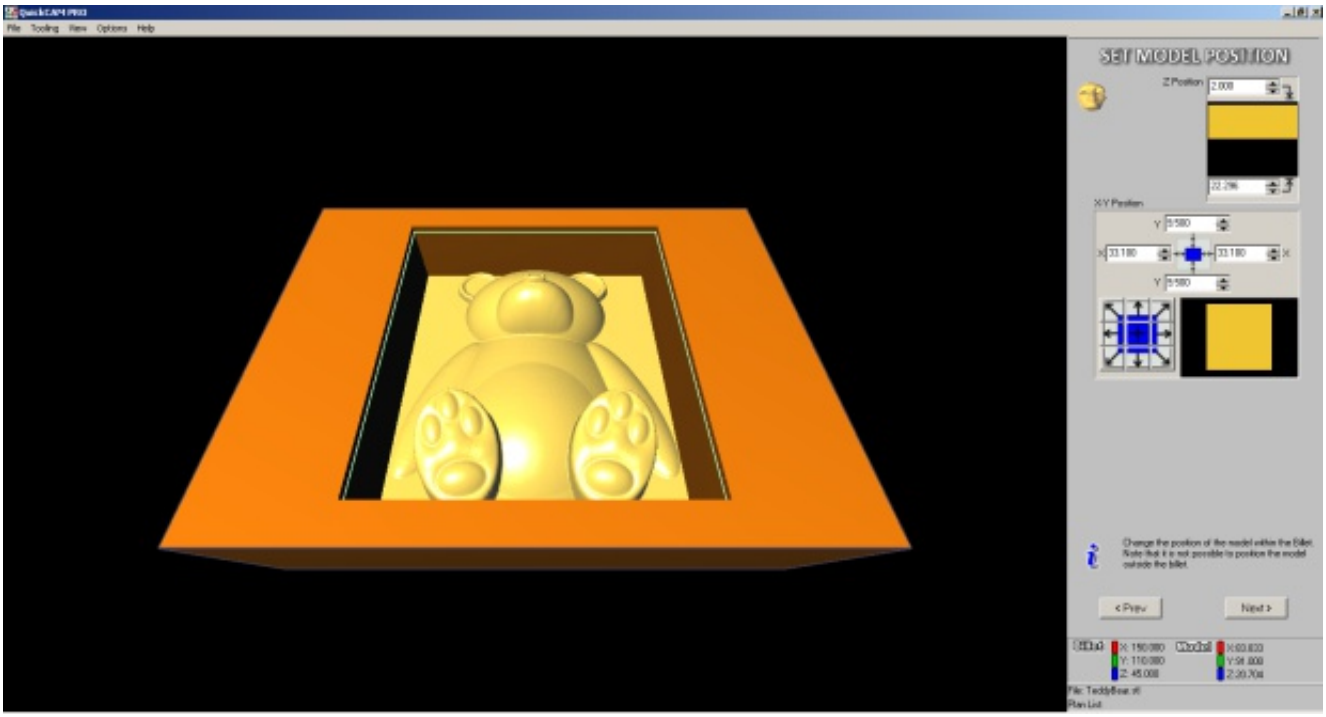
Check that the scale is set to 100%



Click the Next button 

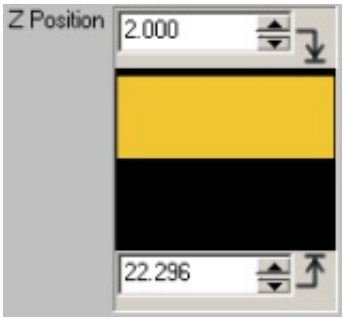
Set Model Position

This screen is where you set the position of your model within the billet.



It is very important to get this correct if you are going to be cutting the billet on multiple sides, as we will only be cutting the Teddy Bear from the top down it is not as critical.
The Z position should be thought of as raising or lowering the model within the billet, if the top surface of the billet is damaged having the model at the top would transfer this damage to the model.
We should lower the model a couple of mm.

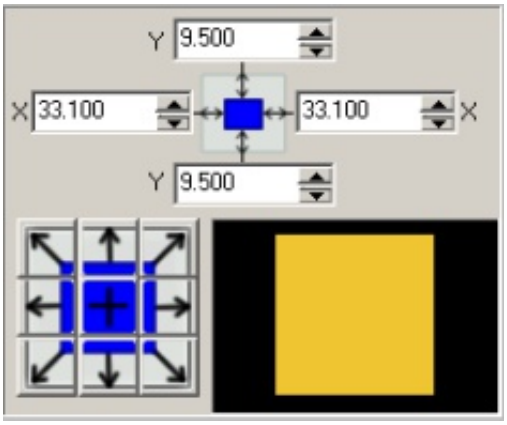
Set the top dialogue box to 2mm



The X position moves the model left or right, we will leave the model in the middle.
The Y position moves the model from front to back, we will leave the model in the middle.
The image below shows the navigation controls for the X and Y axis.
Selecting a direction arrow will move the model to the extreme of the billet in that direction.

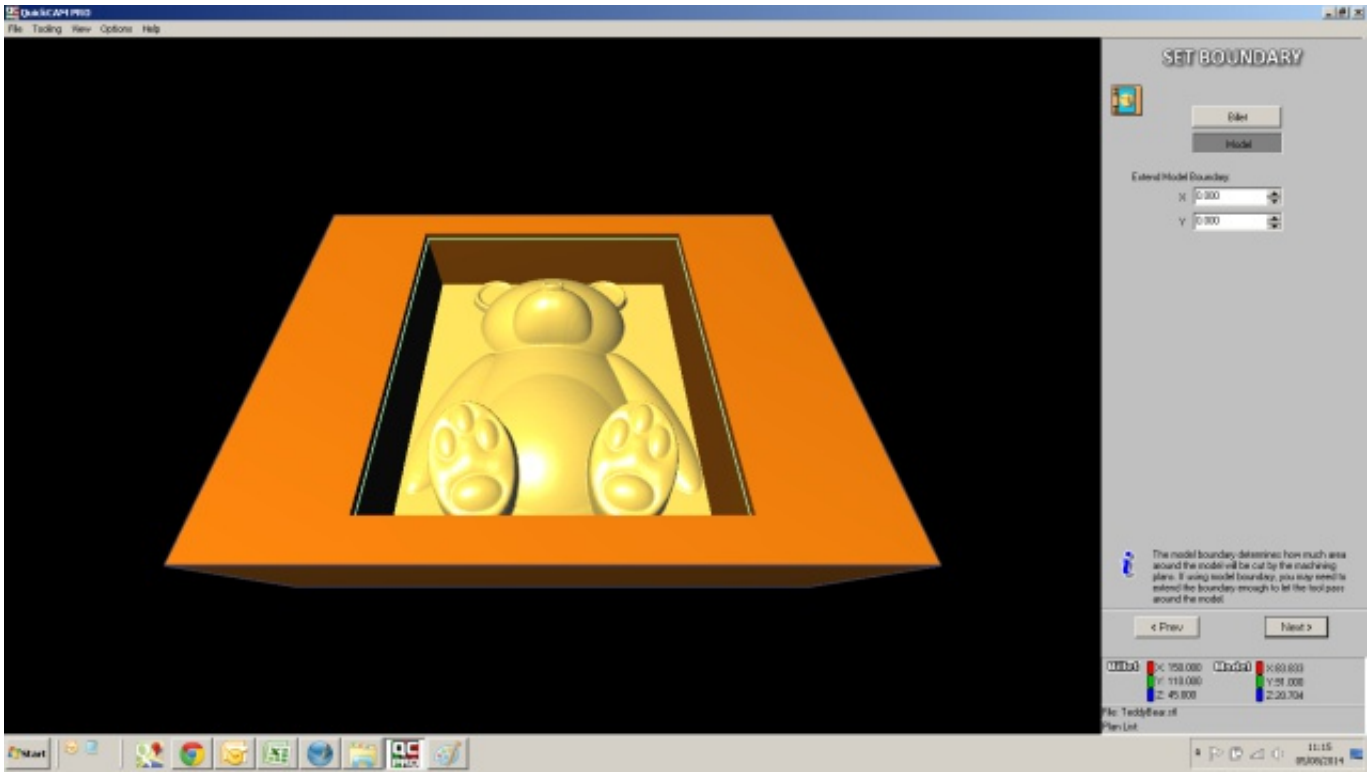
Click the Centre button 

Click the Next button 



Set Boundary

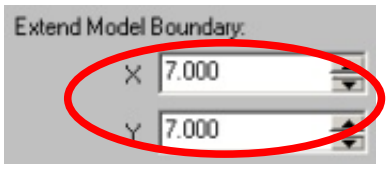
This screen is where you can set the boundary.



If the boundary is set to the Billet then all material will be removed, if the boundary is set to the model some detail around the edges of the model will be lost as the tool cannot fit. This is where the Extend Model Boundary option comes in useful.

Click the Model button

Extend the Model Boundary by 7mm (we will use a 1/4" cutter)



Click the Next button

Setup Tools

Manufacture of the High Density Foam is best done with the 1/4" (6.35mm) Long series Ball-nose cutter as it has a 40mm flute and will have about 50mm of length sticking out from the spindle nut. Using this cutter should prevent any clearance issues, the last thing you want to do is run the spindle nut into your model.

The screen below is where you set-up tools.

This screen takes the tooling information from VR Milling V5, as long as you have set the 1/4" Ball-nose in VR Milling V5 it should be showing here.

Click on the 1/4" (6.35mm) Ball-nose

The tool number should highlight in light blue

Click the next button Next >

Machining Plans

The screen below is where you create your machining plans having already instructed QuickCAM Pro on the size of your billet and the position and orientation of your model within it.

Click the Add button 

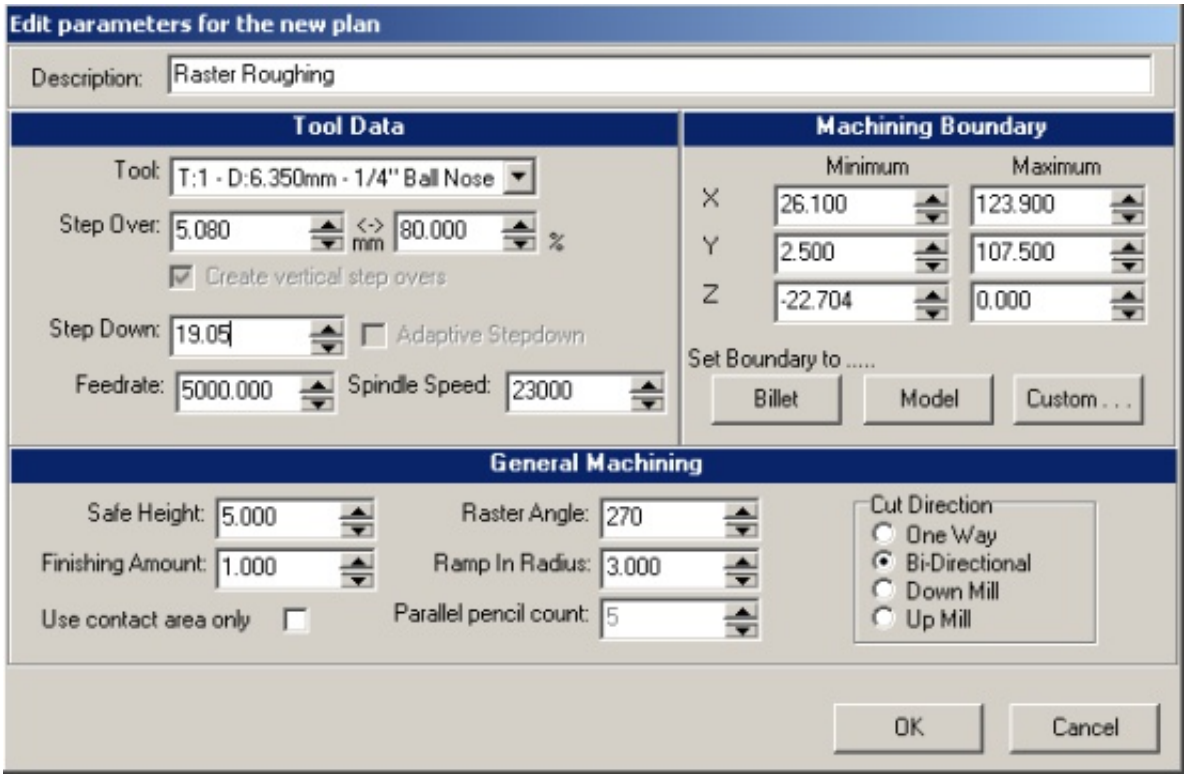
The window below will pop up.

Here you have a choice of 3 roughing plans, 6 finishing plans, and 3 fine finishing plans.
Right clicking each plan will launch a help file to describe how each plan works.
For this tutorial we will use a Raster Roughing, a Raster Finishing, and a Pencil Milling plan.

Raster Roughing

Click the Raster Roughing button

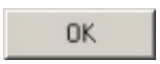
The window below will appear



Set the parameters below

Raster Roughing Parameters

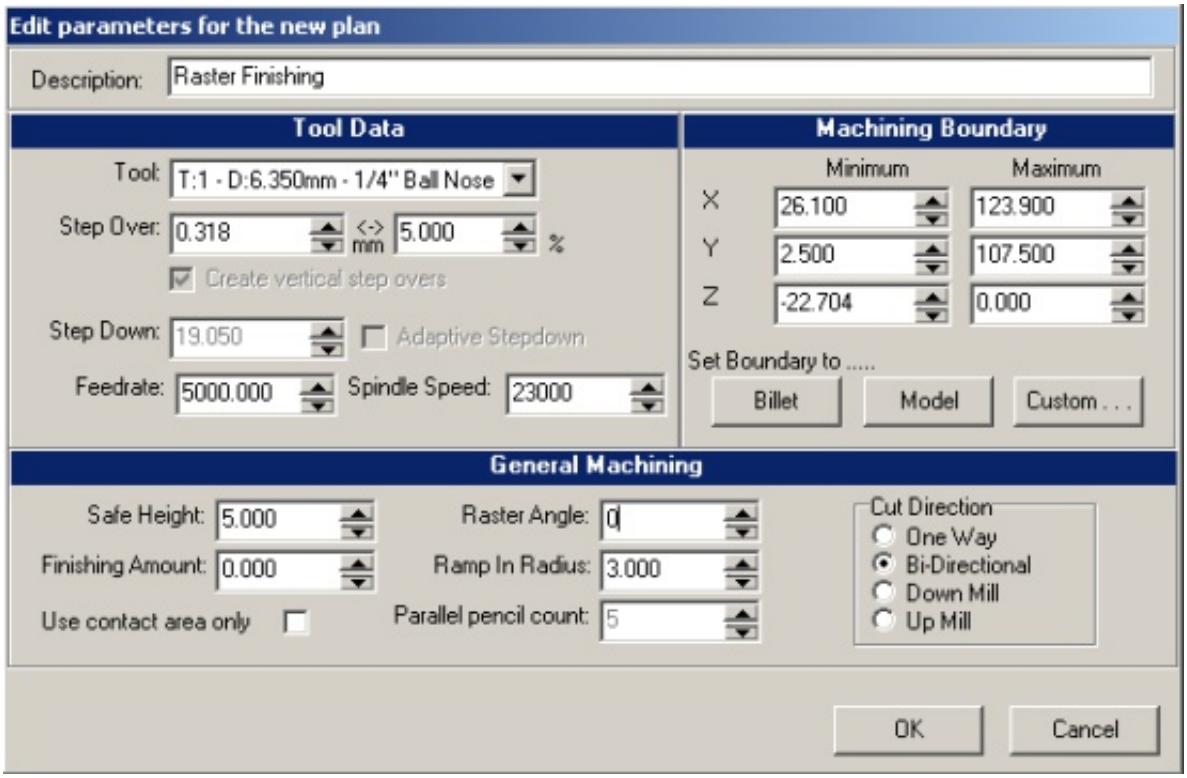
Tool Data		
Tool	**1/4" Ballnose**	This should already be selected
Step Over	**80%**	This is a percentage of the tool diameter, it wants to be high to remove material quickly
Step Down	**19.05mm**	Step down for foam is 300% of the tool diameter
Feedrate	**5000mm/s**	Feedrate for foam is 5000mm/s
Spindle Speed	**23000rpm**	Spindle speed for foam is 23000rpm
General Machining		
Safe Height	**5mm**	This is the height above the billet the cutter moves to when not cutting, 5mm should miss the fixture
Finishing Amount	**1mm**	To get a good finish some material needs to be left for the finishing plan, this will leave 1mm all over the model
Raster Angle	**0**	This is the direction that the tool will move in when rastering. 0= Right to left, starting at front. 180= Left to right, starting at back. 90= Back to front, starting on right. 270= front to back, starting on left.
Ramp in Radius	**3**	CNC tools are designed to cut sideways and not straight down, to get to the desired cutting height the tool moves down in a spiral motion and this is the radius of that spiral
Parallel pencil count	**N/A**	This option is for fine finishing only and will be greyed out here
Cut Direction	**Bi-Directional**	When rastering this will cut in both directions
Machining Boundary		
We have already set this earlier in the program, do not change anything here		

Click the OK button 

Raster Finishing

Click the Raster Finishing button

The window below will appear



Set the parameters below

Raster Finishing Parameters

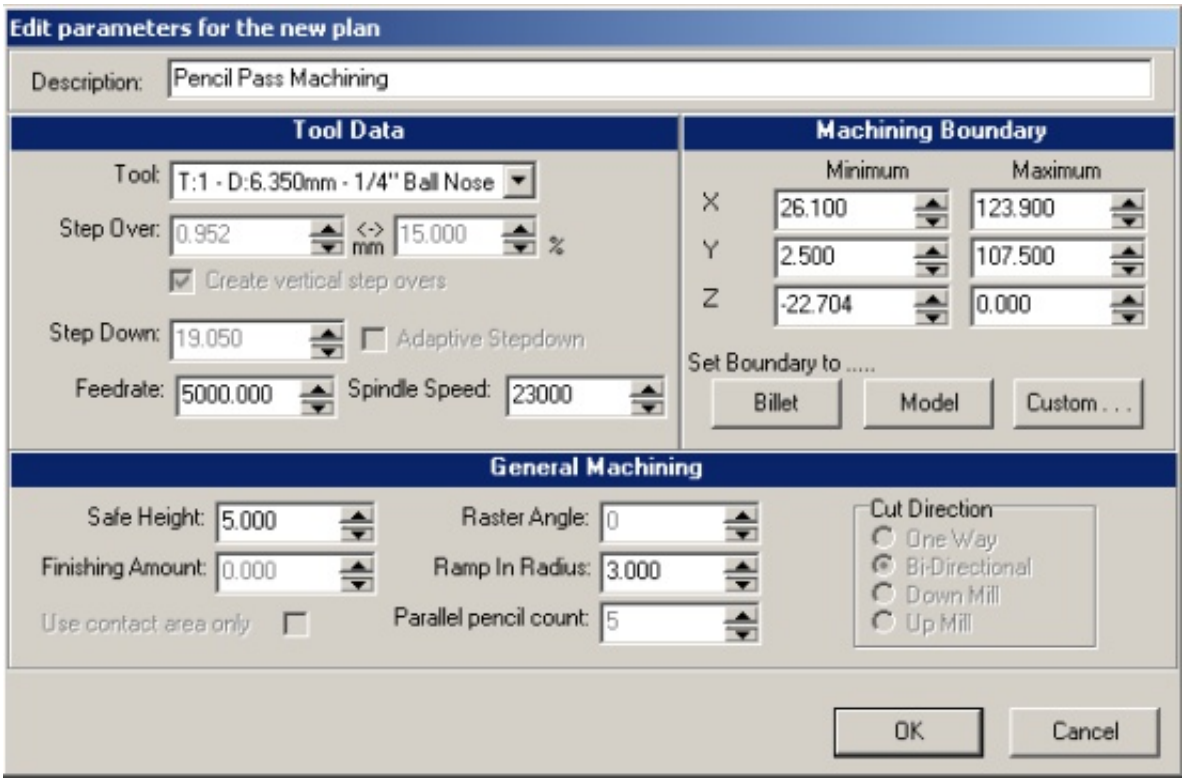
Tool Data		
Tool	**1/4" Ballnose**	This should already be selected
Step Over	**5%**	This is a percentage of the tool diameter, it wants to be low to give a good finish. Between 20% and 5% is recommended, this is a trade off between quality and time.
Step Down	**N/A**	This will be greyed out as it is a finishing plan
Feedrate	**5000mm/s**	Feedrate for Foam is 5000mm/s
Spindle Speed	**23000rpm**	Spindle speed for Foam is 23000rpm
General Machining		
Safe Height	**5mm**	This is the height above the billet the cutter moves to when not cutting. 5mm should miss the fixture
Finishing Amount	**0mm**	This is the finishing plan so set this to 0mm
Raster Angle	**0**	This is the direction that the tool will move in when rastering. 0= Right to left, starting at front. 180= Left to right, starting at back. 90= Back to front, starting on right. 270= front to back, starting on left.
Ramp in Radius	**3**	CNC tools are designed to cut sideways and not straight down, to get to the desired cutting height the tool moves down in a spiral motion and this is the radius of that spiral
Parallel pencil count	**N/A**	This option is for fine finishing only and will be greyed out here
Cut Direction	**Bi-Directional**	When rastering this will cut in both directions
Machining Boundary		
We have already set this earlier in the program, do not change anything here		

Click the OK button 

Pencil Milling

Click the Pencil Milling button

The window below will appear



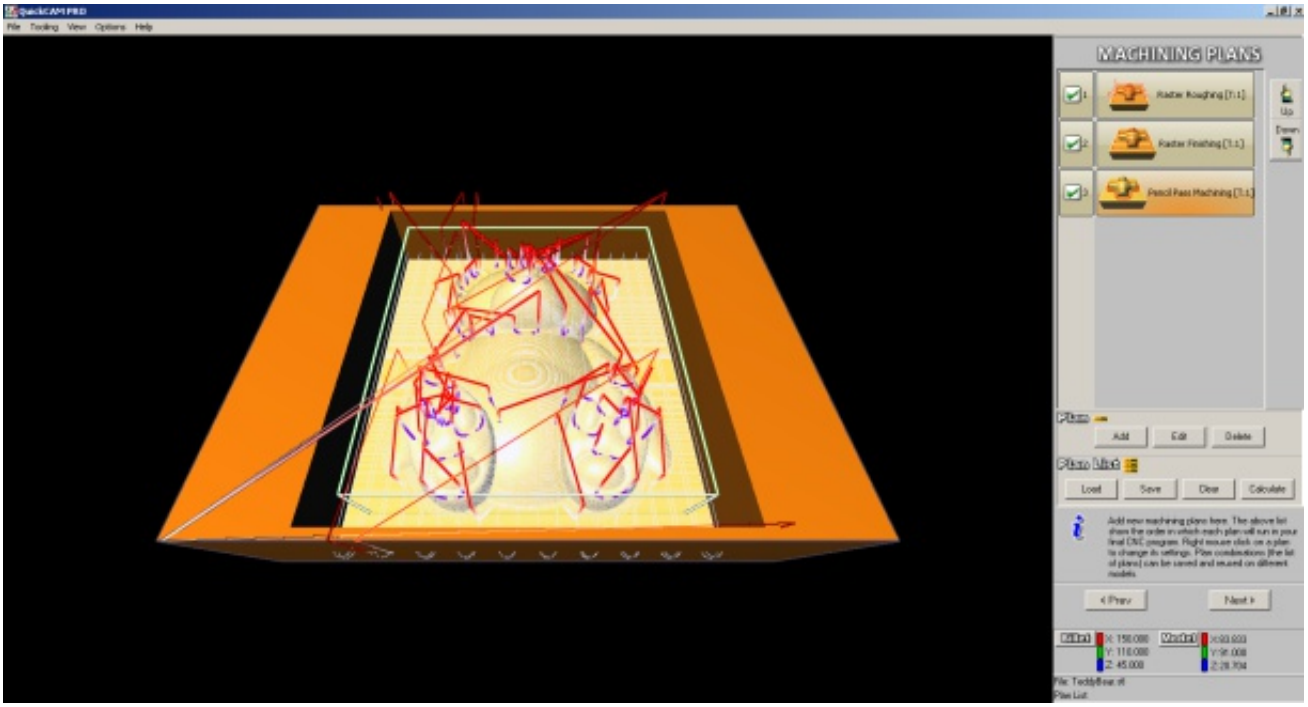
Set the parameters below

Pencil Milling Parameters

Tool Data		
Tool	**1/4" Ballnose**	This should already be selected
Step Over	**N/A**	This will be greyed out as it is a pencil milling plan
Step Down	**N/A**	This will be greyed out as it is a fine finishing plan
Feedrate	**5000mm/s**	Feedrate for Foam is 5000mm/s
Spindle Speed	**23000rpm**	Spindle speed for Foam is 23000rpm
General Machining		
Safe Height	**5mm**	This is the height above the billet the cutter moves to when not cutting. 5mm should miss the fixture
Finishing Amount	**N/A**	This will be greyed out as it is a fine finishing plan
Raster Angle	**N/A**	This will be greyed out as it is a fine finishing plan
Ramp in Radius	**3**	CNC tools are designed to cut sideways and not straight down, to get to the desired cutting height the tool moves down in a spiral motion and this is the radius of that spiral
Parallel pencil count	**N/A**	This option is for parallel pencil milling only and will be greyed out here
Cut Direction	**N/A**	This will be greyed out as it is a fine finishing plan
Machining Boundary		
We have already set this earlier in the program, do not change anything here		

Click the OK button 

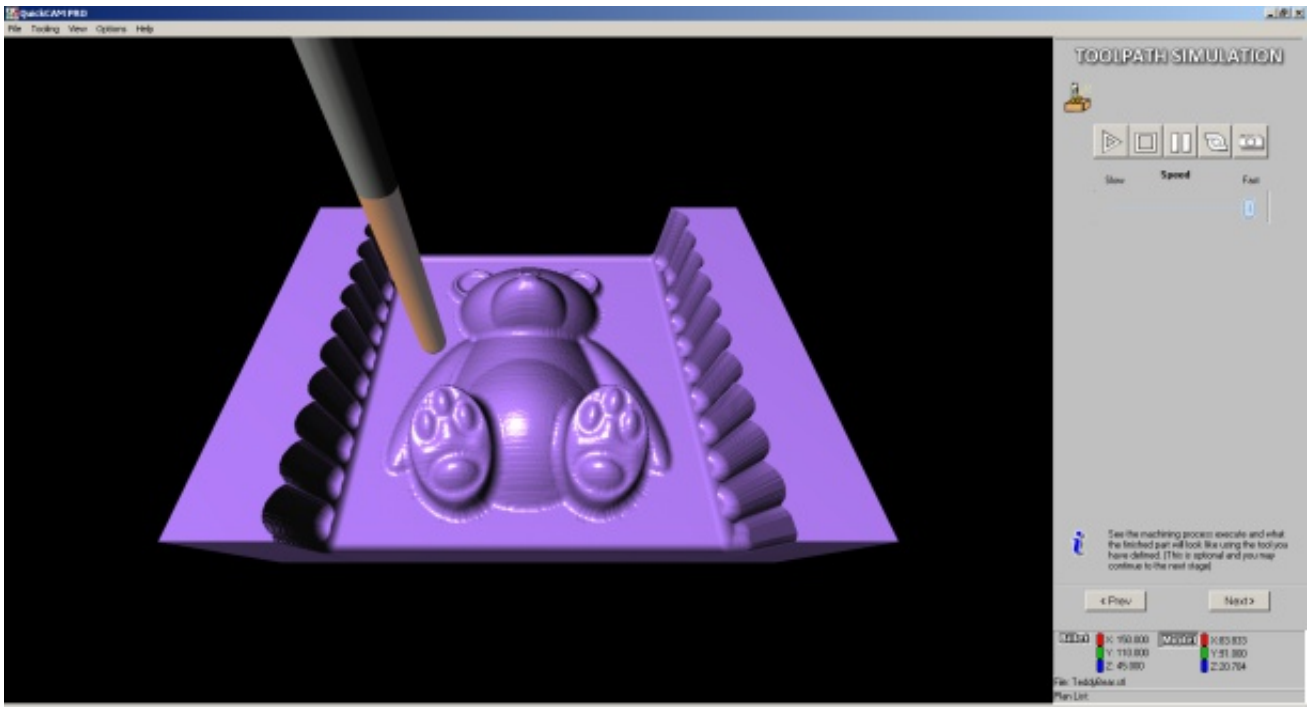
You should now have created 3 machining plans and your screen should look like the image below.



Click the Next button Next >

Toolpath Simulation

The Toolpath Simulation screen should appear and you can see a visual simulation of the toolpath.

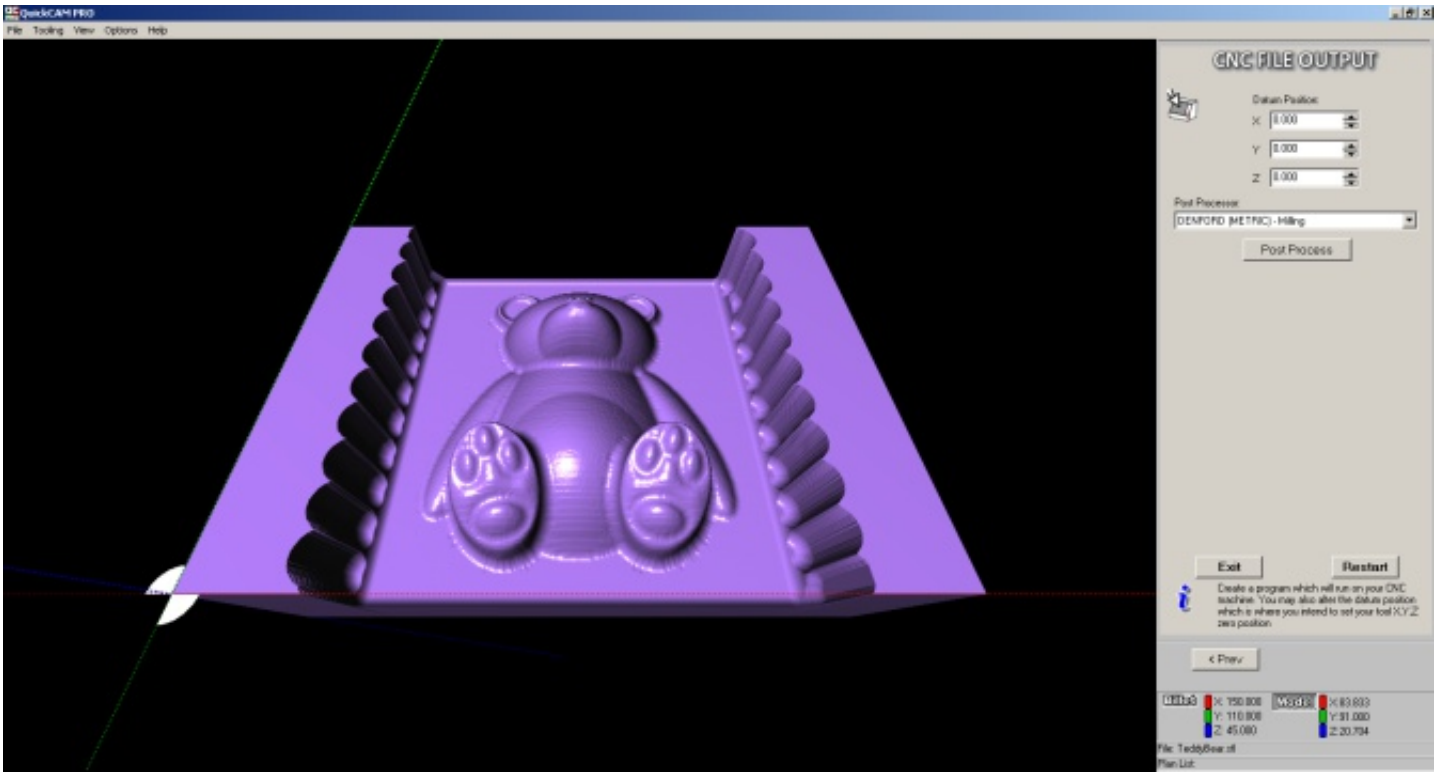


Click the Play button to run the simulation.

Click the Next button Next >

CNC File Output

The CNC Output screen is where the datum position is set and the post processor is chosen before creating the program.



Datum Position

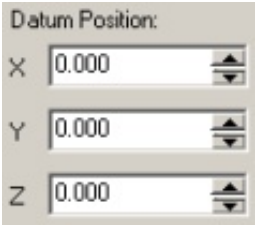
By default the datum position is set to X0, Y0, and Z0, this is the top surface of the billet in the bottom left corner.

You can change the datum position, which is something you may wish to do if you plan on machining the billet on more than one face.

Generally when planning to rotate the billet a fixture will be made for this and the datum position will be set on the axis of rotation.

For this tutorial we will use the default position.

Set Datum Position to X0, Y0, and Z0



Post Process

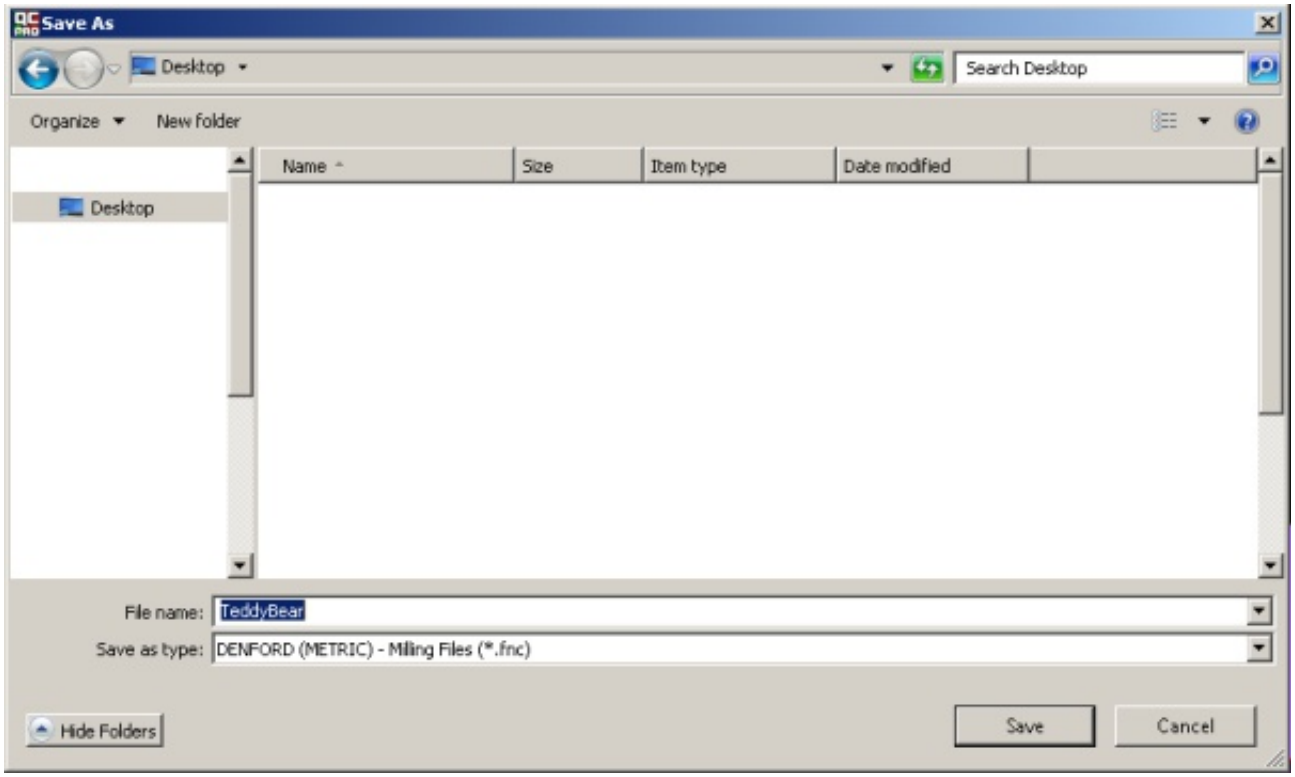
QuickCAM Pro has post processors for a number of different CNC machines, hitting the drop down button will display the full list.

For the current range of Denford CNC machines the post processor is called Denford (Metric) - Milling

Select Denford (Metric) - Milling

Click the Post Process button

The Save As window will appear.

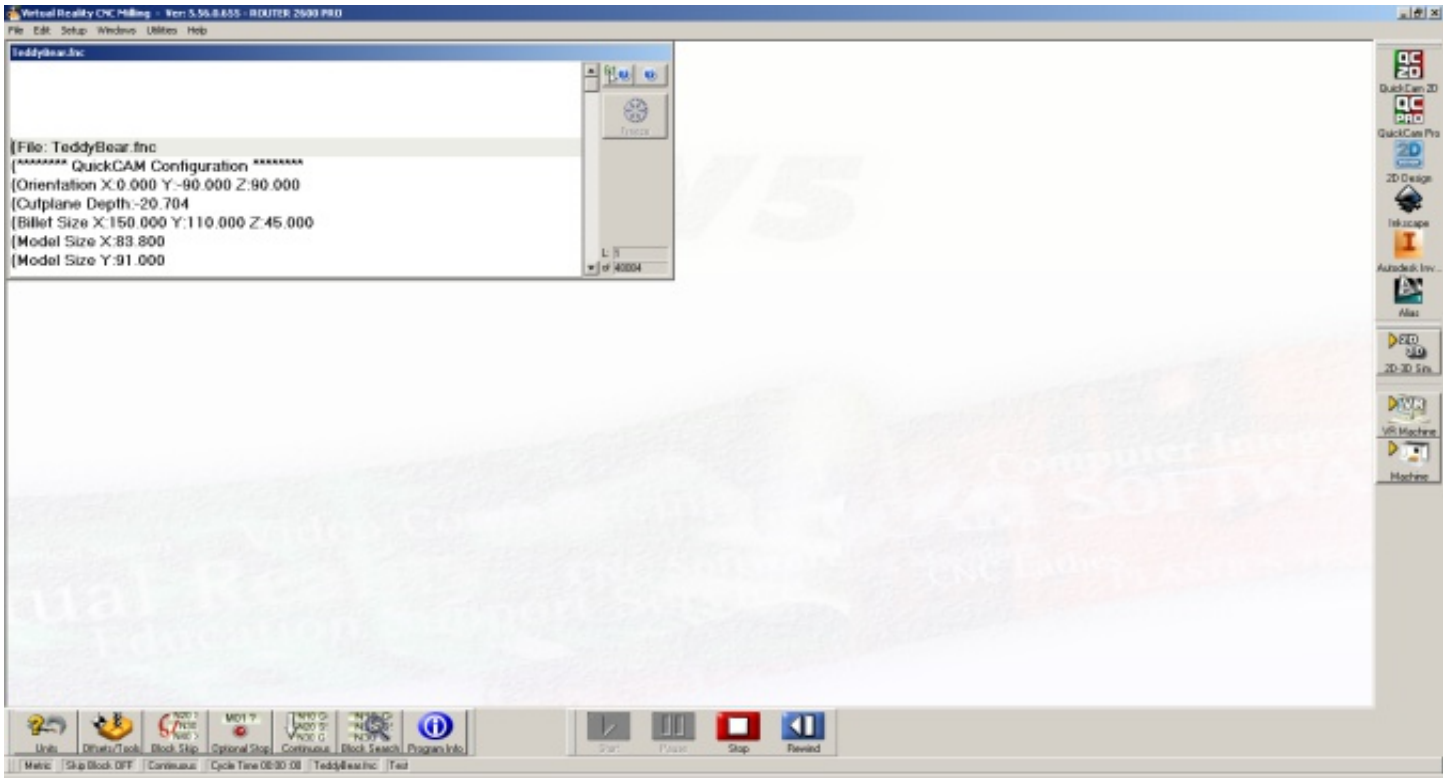


Enter a file name

Click the Save button

VR Milling V5

VR Milling V5 will now open and your saved program will be open in the Editor window.
You should now fix the billet onto the bed of the router and set the offsets.



Fixing the Billet

There are a number of ways in which you can fix the billet to the bed of the router, with foam the easiest is to use Heavy Duty Double Sided Tape (BI03502B) to hold it down.

Setting the Offset

Once the billet is fixed in the router the offset needs to be set as the router cannot see the billet.
The offset position is the same as the datum position, which you set in QuickCAM Pro.
For this tutorial it should be X0, Y0, and Z0

Set the offset

You are now ready to run the program and cut out the TeddyBear.

Model Foam

A low density and low cost foam product with easy machining properties which is particularly suitable for quick 3D realisation of design ideas.

Billet size: 160mm x 100mm x 50mm	Each	BI03508B
	pack of 50	BI03508Z

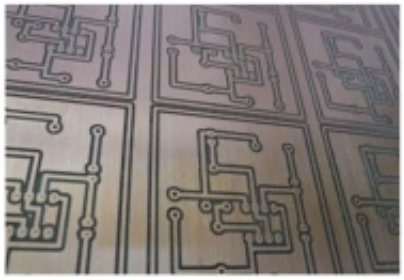
MODELLING BOARD

A high density (0.47gms per cubic metre) board ideal for high definition 3D work.

Modelling Board

For prototyping high quality models

Billet Size: 1500mm x 500mm x 50mm	Each	BI03508K



PCB BOARD

Ideal for use in conjunction with VR CNC Milling 5, PCB manufacturing feature.

Copper Coated Clad Pcb Board (Single Sided)

Size: 233.4mm x 160mm x 1.6mm	Each	4X40079

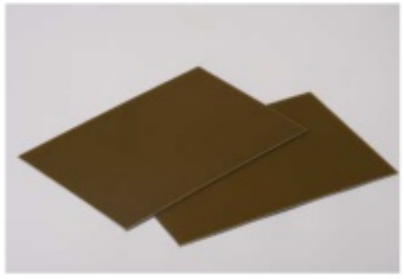


Photo Resist Coated PCB Board (Single Sided)

High quality dip coated positive working photoresist.
This high resolution photoresist contains a dye which gives a good contrast against the copper allowing boards to be easily inspected at the developing stage. Panels are protected by a specially designed light-proof blue film which allows them to be guillotined without the risk of fracturing the photoresist.

Size: 233.4mm x 160mm x1.6mm	Each	4X40080

Get in touch...
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denford.co.uk

denfordata.com/bb/

On-Line Technical Forum

TECHNICAL SUPPORT AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK

Denford's Technical Forum is a free of charge on-line technical support service that is available to Denford customers 24 hours a day, 7 days a week.

"The technical forum has provided a wealth of information and support for our 20-year-old Denford CNC machine, in fact just as good as the support we receive for our brand new CNC Router!"

Denford's On-Line Technical Forum is a free of charge service that can be accessed 24 hours a day, 7 days a week.

The On-Line Technical Forum is available to Denford customers, old and new, and it couldn't be easier to use. Just visit http://www.denfordata.com/bb/ and register on line.....it's that simple.

Denford's On-Line Technical Forum opens up the traditional communication channels that can restrict customer and technical support, due to availability of staff, teaching commitments or different time zones.

A multitude of topics relating to Denford machines and software (both new and old) are covered within the forum, which is simple to search, and easy to use.

Denford's Technical Team and Denford customers from around the world regularly log on to the forum to offer support and advice and, most importantly, post a solution for all to see.

As well as offering comprehensive technical support, Denford's On-Line Technical Forum enables customers to share ideas and projects with other users. Media such as teaching material, project work, PDF's, images, drawings and text documents are easily attached to messages for all users to view and comment on.

You can also read the latest Denford news before anyone else, and keep track of machine and software upgrades, some of which can be downloaded direct from the Technical Forum web site.

The On-Line Technical Forum has proved to be hugely popular with customers. One recent user posted a note to inform us that the Technical Forum has "provided a wealth of information and support for our 20-year-old Denford CNC machine, in fact just as good as the support we receive for our brand new CNC Router!"

Of course the traditional methods of phone and email are still available, but try out this new service by simply logging on to www.denfordata.com/bb/ and register.

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