

**SmartCAM Routing Automation** (October 2011)



The following routines have been developed by Prime Technologies Ltd to assist in the automation of CNC toolpath within SmartCAM.

The routines do not restrict the general usage of SmartCAM or limit its overall functionality.

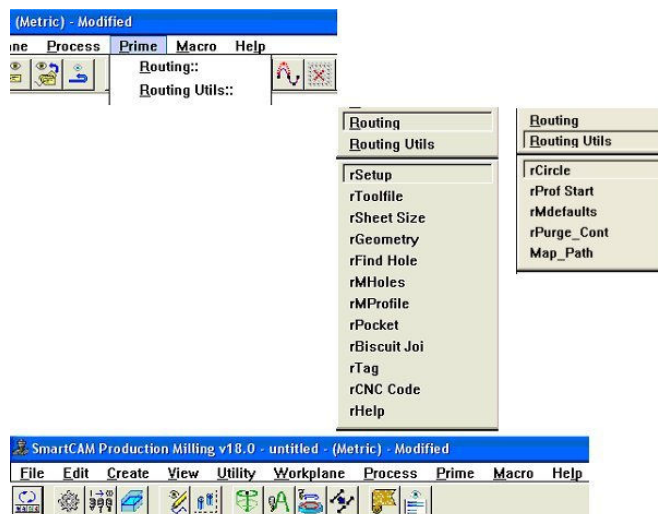
The software has been written using the SmartCAM Macro language and Visual CTK.

The routines are designed to work with the following products:

- a) SmartCAM Production Milling
- b) SmartCAM Advanced Production Milling
- c) SmartCAM Freeform Machining

These routines are subject to constant development and designed to work with the latest version of SmartCAM only. They are part of the SmartCAM Lib range of products and developed to provide productivity gain, many of the routines have been developed as a result of our end users requests.

After installation the routines will normally have the following appearance from the top and side menus within SmartCAM:



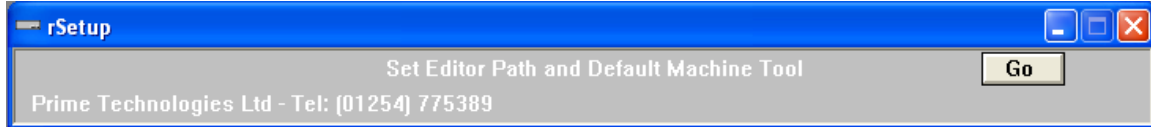
An alternative short cut ICON bar is illustrated available:

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**rSetup**

Used to set the following preferences:

- CNC editor and location path
- Default Machine / Control System



The following startup files allow user preferences to be changed:

C:\SmartCAM\_lib\Routing\user\_settings.ini  
C:\SmartCAM\_lib\Routing\router\_pack.ini

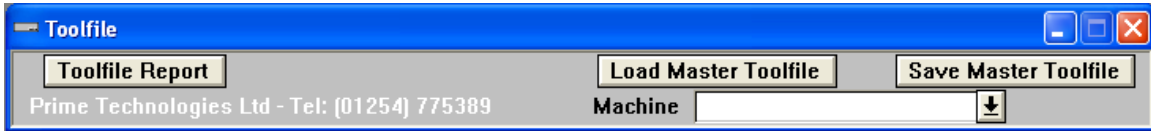
These files can be maintained by using the rMdefaults command documented below.

**rSetup is no longer required**

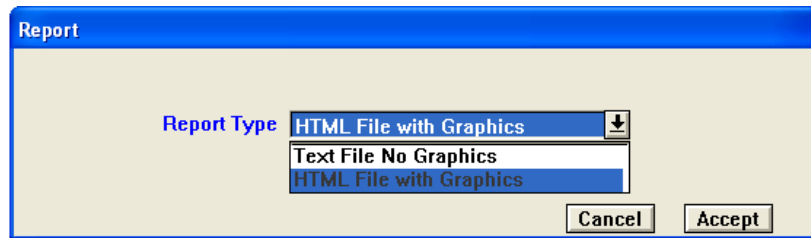
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**rToolfile**

Used to access the master toolfile for a specific machine / control system



**Toolfile Report** – Generates a file which contains a listing of all tools in the master toolfile. The file can be in text format or HTM which includes graphics.



*See sample reports on following pages*

**Load Master Toolfile** – Provides quick access to the master toolfile for a specified machine tool and loads the tools into SmartCAM.

**Save Master Toolfile** – Used to maintain the master toolfile by providing quick access to saving any changes made to the toolfile data.

**Machine** – A user selectable list of machine tool controls used to select the appropriate toolfile.

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rToolfile - continued

Sample text report:


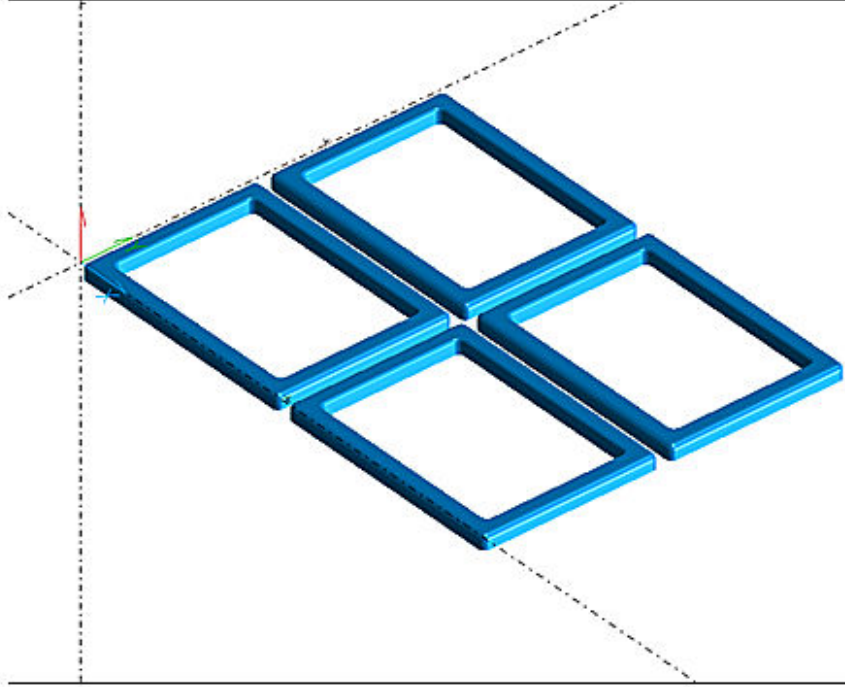
-----  
-----  
Wood Routing Tool Setup Report for:  
C:\SmartCAM\_lib\_source\Routing\Jobs\Frame.jof  
-----  
-----

- 1: 10mm dia Router Bit - Main Spindle 1  
Tool No=1 - 10.000 Dia. 2 Flute End Mill -  
Doff:1 Loff:1 Speed:2400 RPM Feed:3000.0 mm/min
  
- 2: 8mm dia router bit - Main Spindle 2  
Tool No=2 - 8.000 Dia. 2 Flute End Mill -  
Doff:2 Loff:2 Speed:2400 RPM Feed:3000.0 mm/min
  
- 3: 6mm dia Drill Bit - LH Drill  
Tool No=3 - 6.000 Dia. 2 Flute Twist Drill -  
Doff:3 Loff:3 Speed:5000 RPM Feed:75.0 mm/min
  
- 4: 7mm dia Drill Bit - RH Drill  
Tool No=4 - 7.000 Dia. 2 Flute Twist Drill -  
Doff:4 Loff:4 Speed:5000 RPM Feed:75.0 mm/min
  
- 5: Illegal Tool Number  
Tool No=5 - 10.000 Dia. 2 Flute End Mill -  
Doff:5 Loff:5 Speed:18000 RPM Feed:2000.0 mm/min
  
- 12: 12mm dia Router Bit - Heads 1 & 2  
Tool No=12 - 12.000 Dia. 2 Flute End Mill -  
Doff:12 Loff:12 Speed:2400 RPM Feed:3000.0 mm/min

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**rToolfile - continued**

Sample HTM report:

 <b>Prime Technologies Ltd HTML Router Report</b>							
Output File:	C:\SmartCAM_Lib\Routing\Reports\Output\ROUTER_REPORT.HTM			Print Date:	11/12/2010	Print Time:	4:8:43 PM
<b>Job Report</b>							
Process Model File:	C:\SmartCAM_Lib_source\Routing\Jobs\Frame.sst						
Job Operations File:	C:\SmartCAM_Lib_source\Routing\Jobs\Frame.jof						
Created By:	Prime Technologies Ltd						
Date Created:	07/04/08	Date Revised:	09/11/10	Revisions:	0		
Machine:							
Machine Type:	Milling	Units:	Metric				
CNC Runtime:	178.72	CNC Code Date:	09/11/10				
G-Code File:	C:\SmartCAM_Lib\Routing\Parts\Tools_User\Tools_Used.bt						
Part Description:	GBM Group						
Material Description:							
Notes:	#U10=12 #U16=0 #V10=1468.8384 #V11=1032.8711 #V12=18 #S0=SSS						
							
<b>Step Report</b>							
Step:	1	Step Desc:	10mm dia Router Bit - Main Spindle 1				
Tool No:	1	Tool Desc:	10.000 Dia. 2 Flute End Mill -				
Diff:	1	Loft:	1				
Speed:	2400 RPM	Feed:	3000.0000 mm/min	Plunge Feed:	1500.0000 mm/min		

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**rToolfile - continued**

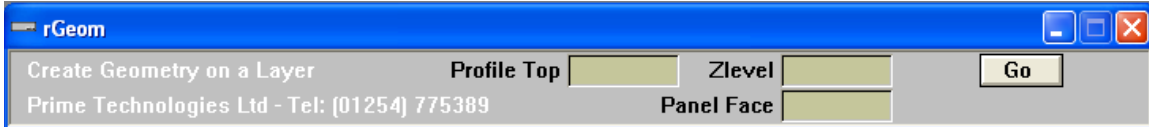
Sample HTM report:

Step:	2	Step Desc:	8mm dia router bit - Main Spindle 2		
Tool No:	2	Tool Desc:	8.000 Dia. 2 Flute End Mill -		
Doff:	2	Loff:	2		
Speed:	2400 RPM	Feed:	3000.0000 mm/min	Plunge Feed:	1500.0000 mm/min
Step:	3	Step Desc:	6mm dia Drill Bit - LH Drill		
Tool No:	3	Tool Desc:	6.000 Dia. 2 Flute Twist Drill -		
Doff:	3	Loff:	3		
Speed:	5000 RPM	Feed:	75.0000 mm/min	Dwell:	0.2000
Step:	4	Step Desc:	7mm dia Drill Bit - RH Drill		
Tool No:	4	Tool Desc:	7.000 Dia. 2 Flute Twist Drill -		
Doff:	4	Loff:	4		
Speed:	5000 RPM	Feed:	75.0000 mm/min	Dwell:	0.2000
Step:	5	Step Desc:	Illegal Tool Number		
Tool No:	5	Tool Desc:	10.000 Dia. 2 Flute End Mill -		
Doff:	5	Loff:	5		
Speed:	18000 RPM	Feed:	2000.0000 mm/min	Plunge Feed:	1000.0000 mm/min
Step:	12	Step Desc:	12mm dia Router Bit - Heads 1 & 2		
Tool No:	12	Tool Desc:	12.000 Dia. 2 Flute End Mill -		
Doff:	12	Loff:	12		
Speed:	2400 RPM	Feed:	3000.0000 mm/min	Plunge Feed:	1500.0000 mm/min
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**SmartCAM Routing Automation** (October 2011)

**rGeometry**

This routine controls the layer on which geometry will be created and the position of the top and bottom of a profile, the layer number will start at 500 and increment in steps of 1.



**Profile Top** – Designates the top of a profile as a Z level value.

**Zlevel** – Designates the bottom of a profile as a Z level value.

**Panel Face** – Options include, TOP; FRONT; BACK; LH\_SIDE; RH\_SIDE

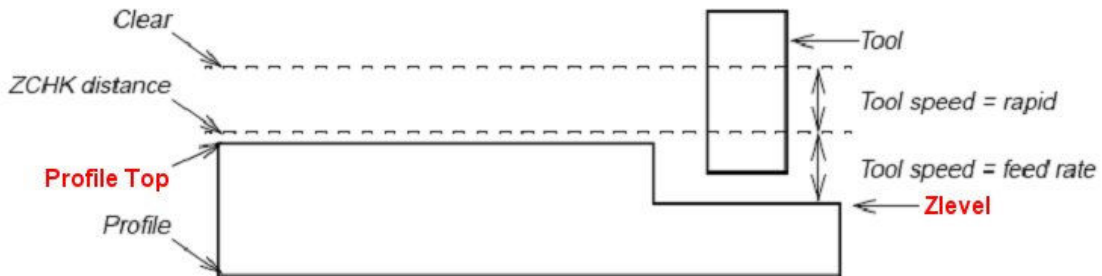


Illustration of Profile Top and Zlevel.

**Active group Data**

If data is grouped prior to using the **rGeometry** routine the user will be asked if the grouped geometry should be transferred to the new layer

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**rSheet Size**

Used to create a rectangle with thickness to represent the sheet stock on SmartCAM Layer 95, the geometry is packed into a container called “Sheet”.



**Sheet Size** – Specifies the “X” and “Y” values for the sheet stock, these are NOT signed values.

**Preset Sheets** – Used to access preset sheet size eg 8 x 4 feet otherwise set to user defined and specify sizes in Sheet Size fields X/Y.

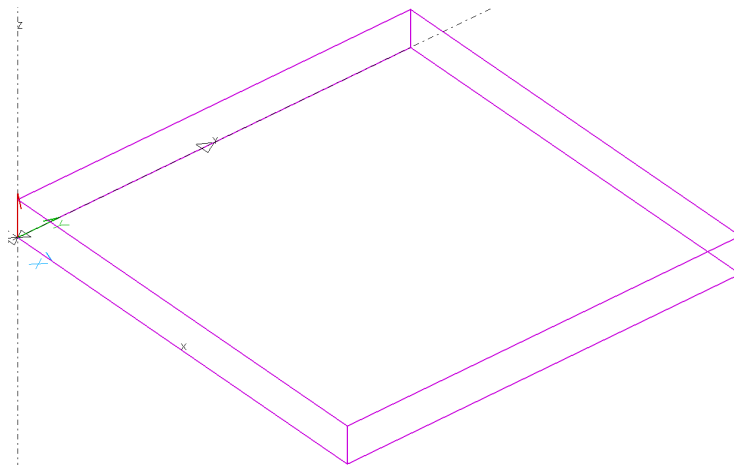
**Z datum** – Can be set to Bottom or Top of sheet and controls the “Z” zero position.

**Material Thickness** – Used to specify the thickness of the sheet stock, this is NOT a signed value.

**Location Stops** – Provides control of sheet location stops, options are:

- No Stops
- All Stops
- Left Stops
- Right Stops

**Get Details** – Used to obtain sheet details etc from a SmartCAM file which has not been created by the routing library.



Illustrates a sheet defined with datum at bottom.

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**rSheet Size** (continued)

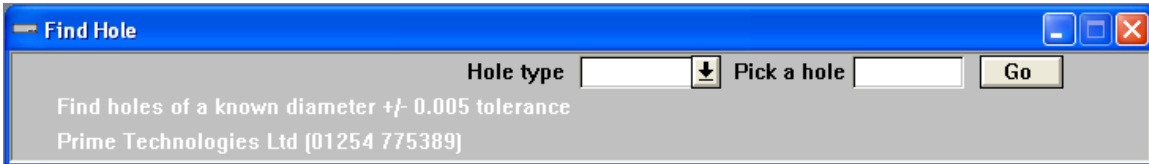
The rSheet\_Size routine will also check any existing geometry that may exist, none toolpath geometry will be changed to support a Profile Top and Zlevel equal to the sheet thickness and datum position. If the geometry already has a Profile Top then it will not be changed to match the sheet thickness and datum position it will remain as defined.

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**rFind Hole**

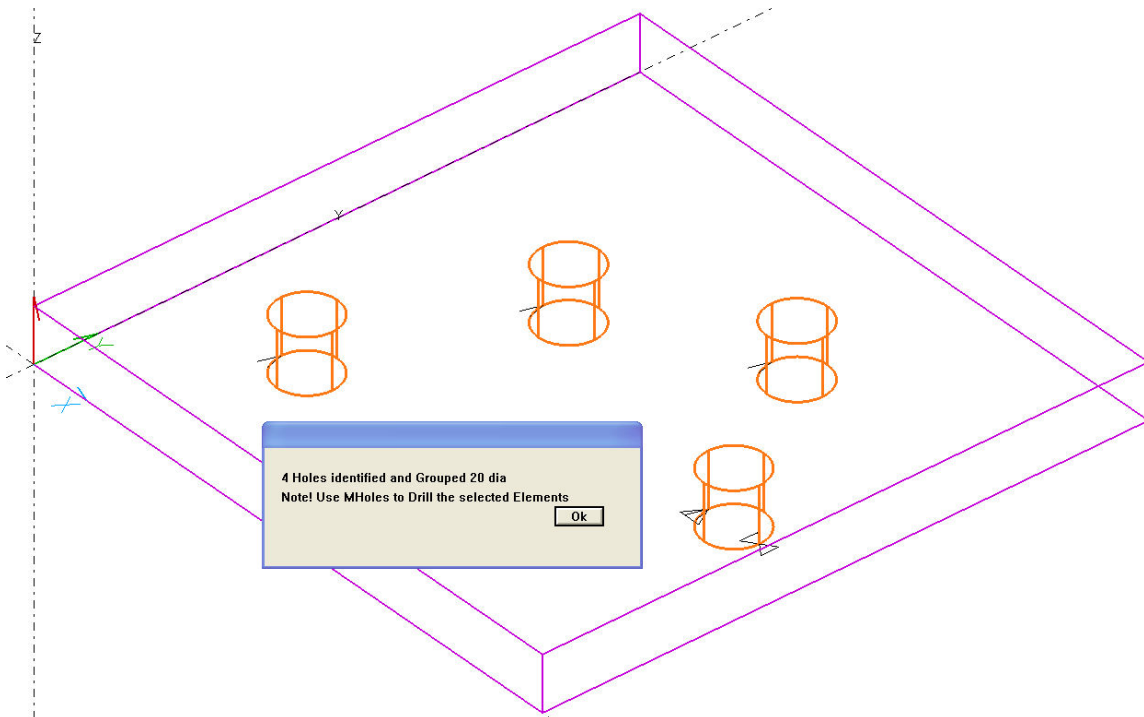
Used to Group or Select holes of a specific size for subsequent machining.

**Data types supported: arcs full or partial**



**Hole type** – Controls the selection of circular arcs which have been constructed as full circles or arcs. Options include: Full / Partial / Both.

**Pick a hole** – Used to supply the radius of a hole either by user input or picking from the graphic window. All holes within a radial tolerance of +/- 0.005 mm will be placed into a group for subsequent machining.



Predictive tool selection will be made on completion of geometry selection. A check for a suitable drill size will be made and if successful automatically selected for use in rMholes routine. Successful selection is based on tool type being a Drill and drill diameter being less than or equal to geometry diameter.

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**rMHoles**

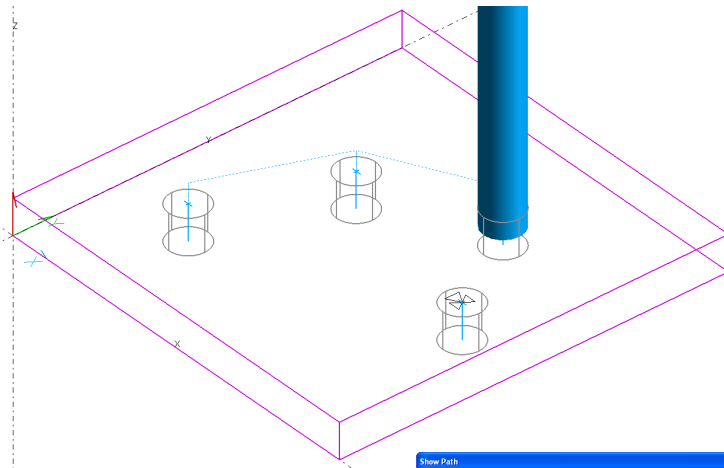
Used to machine Grouped or Selected holes using a Hole machining cycle.

**Data types supported: arcs and points**

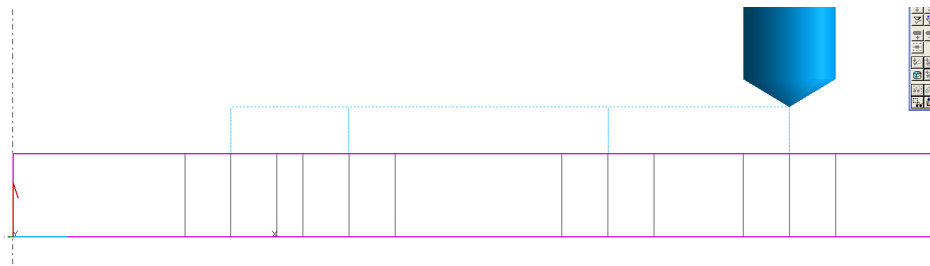


**Start Level** – Controls the starting level in ‘Z’ for drilling holes

**Select Drill** - Allows the user to select the SmartCAM Step / Tool to be used for machining the Grouped hole elements (see Find Hole).



**Hole Depth** – Tip depth of hole cycle from top of ‘Start Level’, this is NOT a signed value.

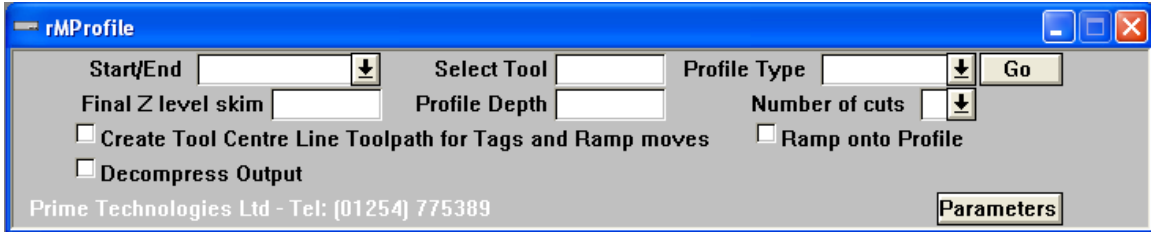


**Transfer Source Geometry to Completion Layer** – If ticked will change the grouped geometry to Layer 98 and HIDE the data after completing the drilling process, this will leave a clearer picture of un-machined data.

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**rMProfile**

This routine is used to control the machining of both open and closed profiles; multiple profile machining is supported from a single operation.



**Start/End** – Provides control for start and end position when machining closed profiles. When set to “Auto” the routine will normally start and end at the mid point of an element. When set to “As Profile” the start and end point will be the same as the existing element sequence in SmartCAM.

**Select Tool** – Allows the user to select the SmartCAM Step / Tool to be used for machining the profile.

**Profile Type** – Options include: “External / Internal / Slot”, the SmartCAM Step will be set to Left / Right / None on a profile depending on its direction to create External / Internal / Slot machining, NO CRC is output with Slot machining.

**Final Z level skim** – Specifies the skim cut thickness, if set to zero no skim cut will be applied to the profile machining.

**Profile Depth** – Determines the depth of cut on a profile, the profile top from the sheet will be used to determine the top level; this is NOT a signed value.

**Number of cuts** – This is a value between 1 and 6 and determines the number of equalized depth cuts.

**Create Tool Centre Line Toolpath for Tag** – This option MUST be selected if the profile requires Tag points (see Tag for associated information), NO CRC is output with Tool Centre Line machining.

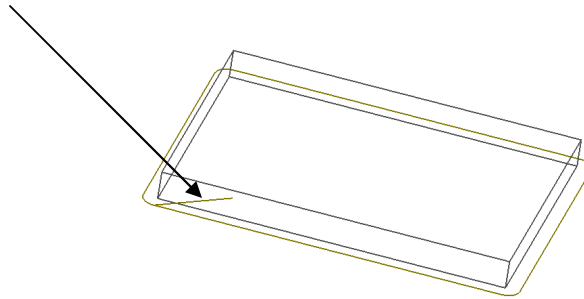
NB, When a profile is created the resulting elements will be packed into a container generally with the following naming convention:

EXP1; EXP2 etc	External Profile 1; 2
INP1; INP2 etc	Internal Profile 1; 2
SLOT1; SLOT2 etc	Slot Profile 1; 2

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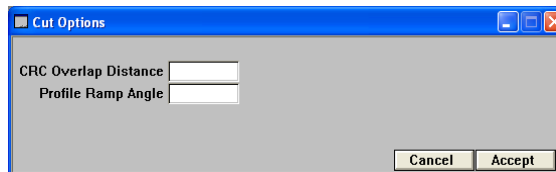
**rMProfile – continued**

**Ramp onto Profile** – When selected the resulting toolpath will have a controlled ramp movement from the material top down to the machining level, NO CRC is output with Ramp machining.



**Decompress Output** – Selecting this option will prevent profiles with cutter radius compensation (CRC) from being packed into a container. This is useful when the geometry is to be used for subsequent machining such as Miter joints.

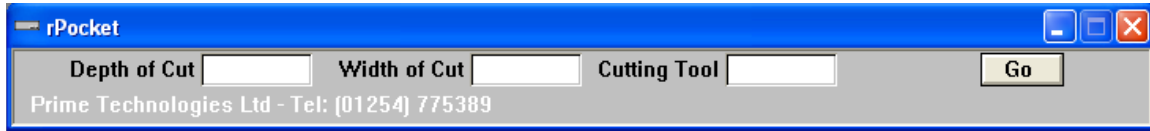
**Parameters** – The following dialog box will appear allowing input for the Ramp angle and Leadin/out overlap distance:



SmartCAM Routing Automation (October 2011)

rPocket

This routine is used to provide pocket machining on closed profiles; multiple profile machining is supported from a single operation.

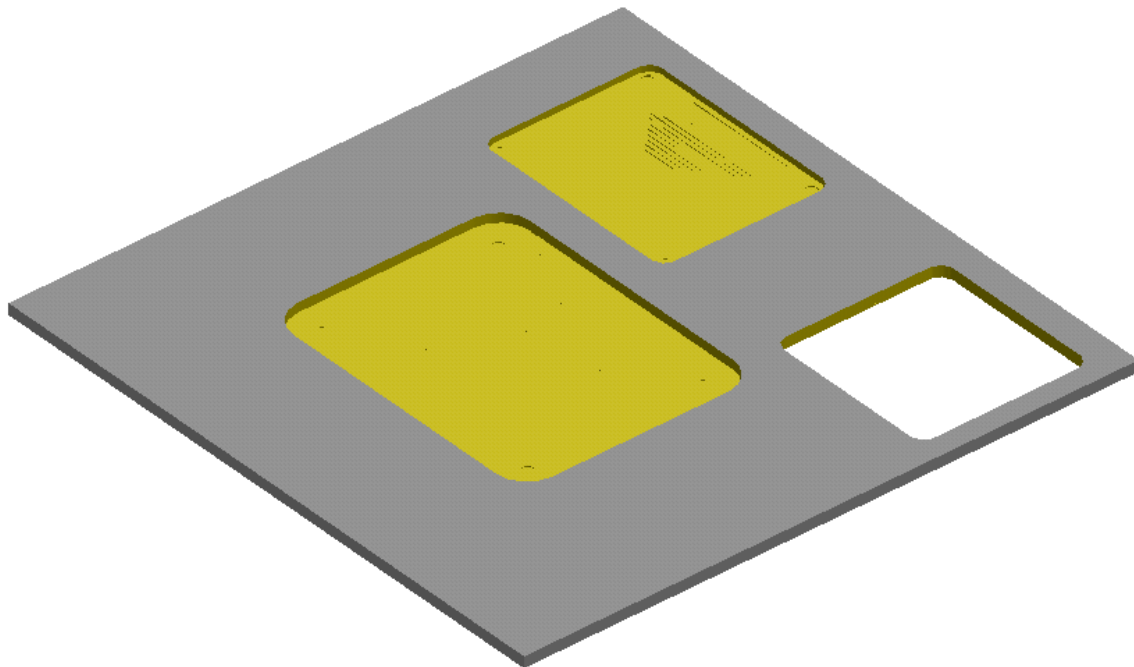


**Depth of Cut** – This is the maximum depth of cut for each pass of the pocket, the routine will equalize the depth of cut based on pocket depth and maximum cut depth.

**Width of Cut** – Normally about 60% of the tool diameter.

**Cutting Tool** – The SmartCAM STEP number to machine the pocket, normally selected from the STEP list window.

Note! rPocket expects the closed profile to have a suitable Profile Top and Zlevel.



Illustrating three pockets being machined with varying depths from a single command.

**SmartCAM Routing Automation** (October 2011)

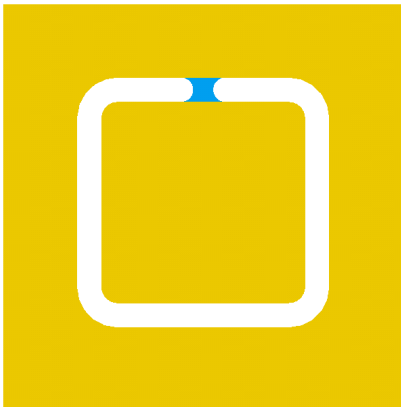
**rTag**

This routine is used to provide user control of tag points based on a **single** profile.

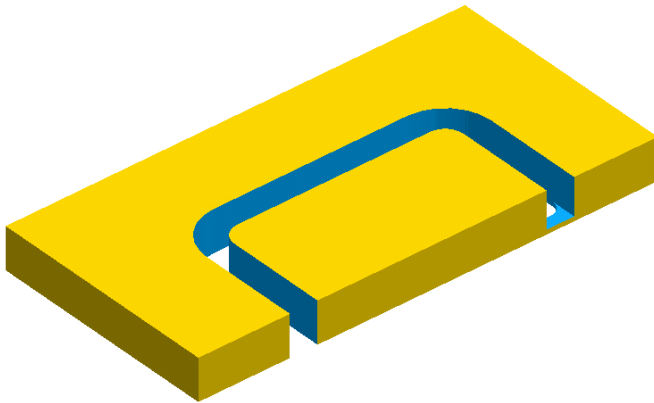


**Tag Position** – A tag can be positioned at the Start / Mid Point / End Point / Entire Profile / of a group of elements. If Entire Profile is used the profile must run sequentially.

**Minimum Tag Length** – User specified tag length, see below for illustration.



**Tag Thickness** – Amount of material between top and bottom of tag, the bottom of the tag will always be the bottom of the sheet, see below.



**Unpack** – If the selected profile / element have been packed into a container it must be unpacked before the “Tag” routine can be used. See “MProfile” for related information.

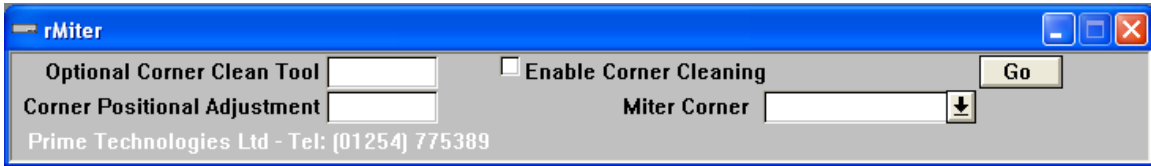
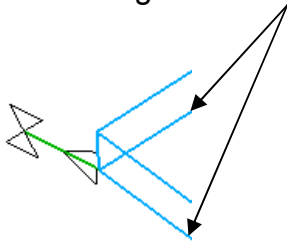
**SmartCAM Routing Automation** (October 2011)

**rMiter**

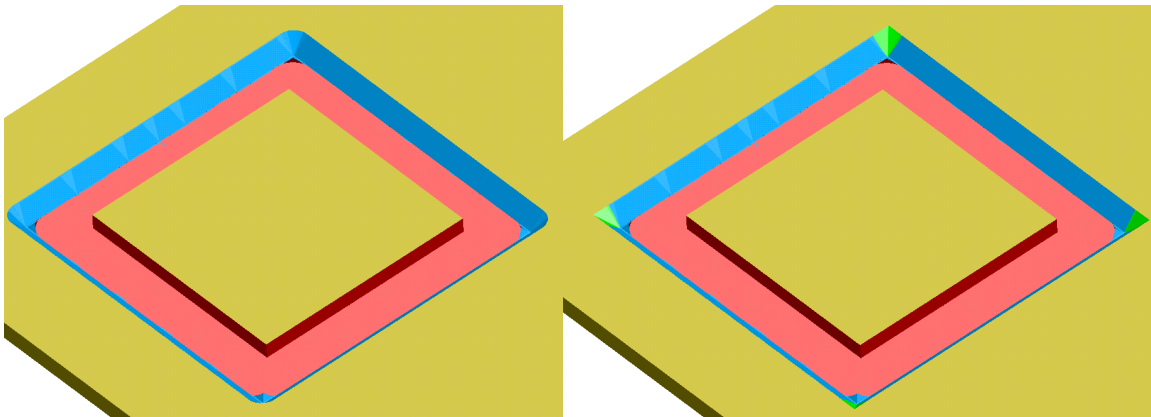
This routine will create a square corner or miter on a profile with angled sides.

The base geometry is as follows:

Two connecting base lines must be grouped and exist as toolpath.



The control panel requires a miter corner direction as viewed from part origin



Before Miter

After Miter

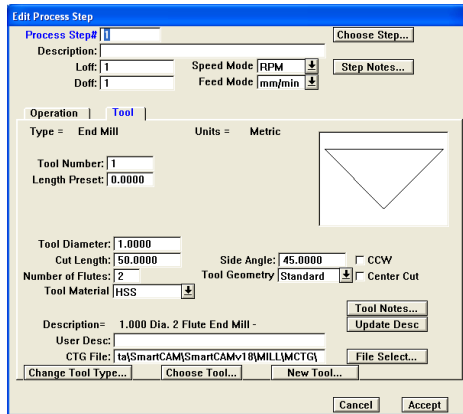
The two base lines which form the miter point must exist as machined profiles with a STEP property comprising an angled tool with a minimum base diameter, the same STEP is used to create the miter path. The tool angle is used to calculate the miter intersection.

See following example for a STEP definition with suitable properties:

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**rMitre – continued**

Illustrating a 45 degree form tool, note this is not a CTG tool, in general form tools of this type do not form an exact point at the tip hence the 1mm tool diameter in this example.

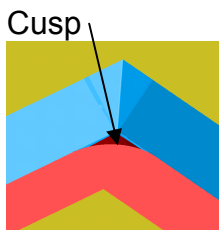


**Unpack** – If the selected base LINE elements have been packed into a container they must be unpacked before the “rMiter” routine can be used.

***Data types supported for input: lines parallel to the X/Y axis***

**Optional Corner Clean Tool** - After machining the miter intersection it is possible that a small cusp of material will remain in the corner, by selecting a small diameter router bit and enabling corner cleaning the excess material will be removed.

**Enable Corner Cleaning** – Switch on/off the corner cleaning option.

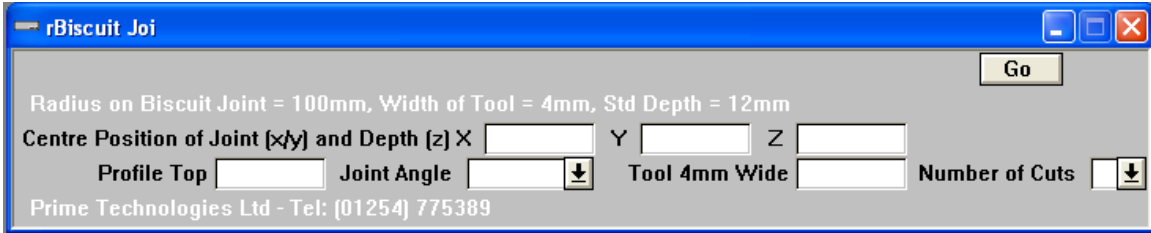


**Corner Positional Adjustment** – The side angles will be machined using cutter radius compensation (CRC) to provide geometrical adjustment, when the corner miter intersection is created no CRC will be active therefore a mismatch with the side angle profile geometry is possible. To correct this problem a signed value can be used in the Corner Positional Adjustment field.

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**rBiscuit Joint**

This routine automates the machining of a Biscuit joint slot.



**Centre Position of Joint (x/y) and Depth (z)** – Marks position of joint in x/y and its depth.

**Profile Top** – Z position for start of joint

**Joint Angle** – Either zero or 90 degrees

**Tool 4mm Wide** – Tool select option, note tool diameter must be 4mm wide

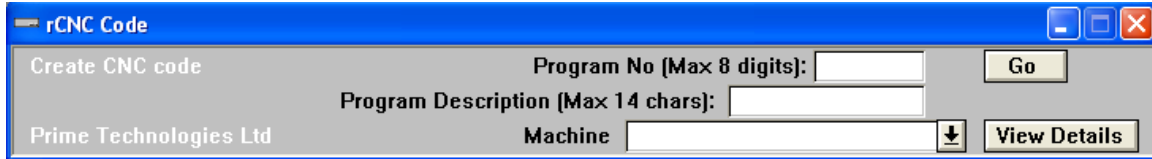
**Number of Cuts** – Number of passes from Profile Top to Z depth (Max 6 passes)



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**rCNC Code**

Used to create a CNC code file for a specified machine / control system.

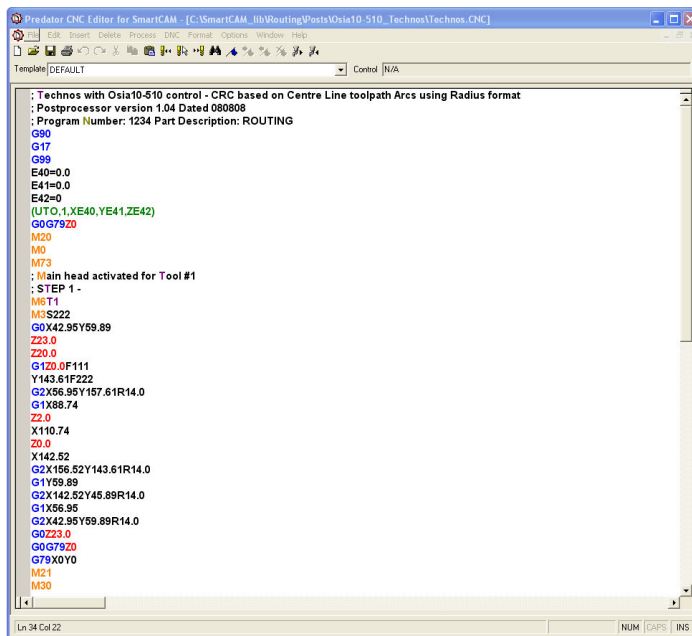


**Program No** – Up to eight alpha numeric characters can be used as the program number. Subject to machine tool control limitations this would normally be used in the CNC program file for identification.

**Program Description** - Up to fourteen alpha numeric characters can be used as the program description. Subject to machine tool control limitations this would normally be used in the CNC program file as a comment line.

**Machine** – A user selectable list of machine tool controls used to select the appropriate postprocessor for creating CNC code.

**View Details** – Provides details of the machine / control specification including work ranges and spindle configurations.



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**rHelp**

Used to provide a quick link from within SmartCAM to tutorial documents and video files



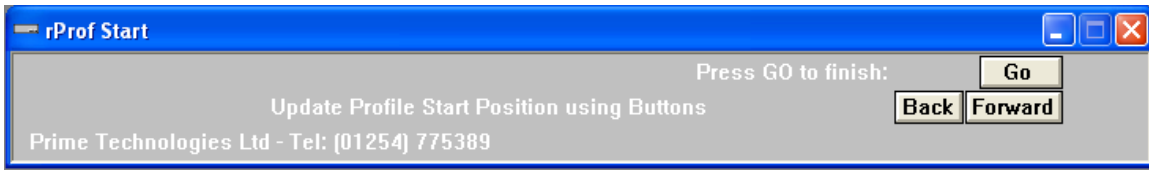
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**Router Utils**



This option includes a number of complementary commands when used in conjunction with the SmartCAM Router Pack.

**rProf Start**



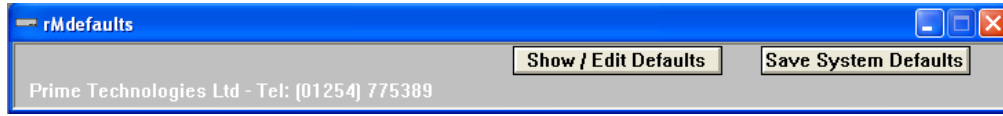
This command complements the standard SmartCAM Prof Start command and in many ways uses the same functionality. As with SmartCAM Prof Start command Geo Edit>Split is a companion command allowing users to split elements creating new options for profile start points. rProf\_Start is designed to work with GROUPED closed profiles only, the command will check the profile for the following conditions:

- 1) Profile is closed
- 2) Properties of profile
- 3) Existing Leadin / out geometry
- 4) Only works with a single profile at a time

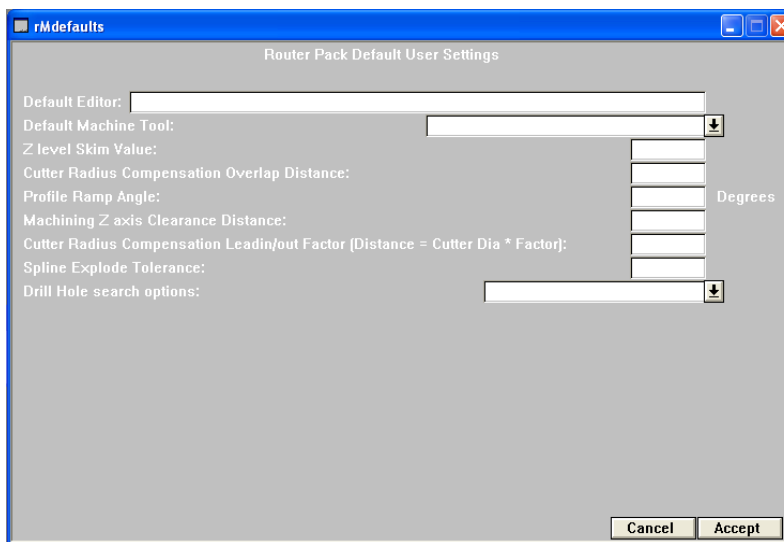
The new command will be seen to provide a high level of visual feedback clearly indicating the changed position of profile start points

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**rMdefaults**



This routine is designed to allow the user to easily view configurable manufacturing parameters and make changes during the machining process. An option also exists to update the system parameters to new preferred settings.



Manufacturing parameters can be changed allowing geometry to be machined with varying properties such as each profile having a different leadin/out distance.

**Default Editor** – Contains full path and application editor name, IMPORTANT the maximum number of characters supported by this field is 60, if your path length is greater than 60 chars then create a drive mapping to the source folder to reduce the number of characters. (see command 'rMap\_Path for more details)

**Default Machine Tool** – Quick and easy way to save the default machine tool

**Zlevel Skim** – This value is subtracted from the profile depth and used to leave a final skim cut when profiling.

**Cutter Radius Compensation Overlap** – When profiling a closed shape it is sometimes desirable to run past the start position thus minimizing potential dwell marks on the finish profile.

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rMdefaults continued

**Ramp Angle** – Available when profiling and the option to use tool centre line path has been selected, a three axis movement at the start of machining is created reducing Z plunge cutter burn.

**Clearance Distance** – When making a rapid move from one profile to the next the cutter must retract above the sheet, this value represents that distance.

**CRC factor** – When programming with CRC active an approach move on and off the profile is created, this is normally set to (Cutter Radius \* 1.5)

**Spline Explode Tolerance** – When spline geometry is encountered in the rMProfile routine the spline will be exploded into lines and arcs, the number of resulting elements is determined by this value.

**Drill Hole Search Option** – When using the rFind\_Hole routine a check on the toolfile will be made to find the closest tool which is equal or less the hole diameter. This option extends the search pattern to just drills or any tool.

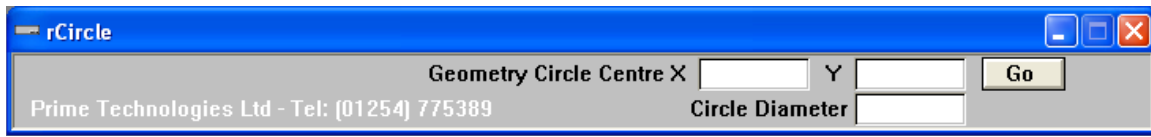
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**rPurge\_Cont**



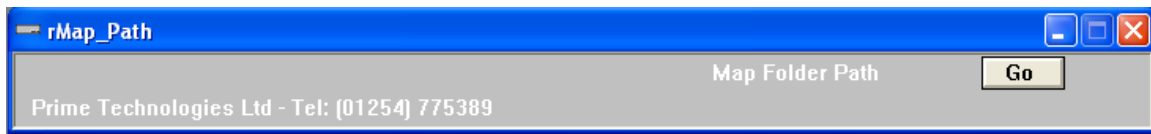
It is possible for the SmartCAM database to have empty CONTAINERS in its structure, rPurge\_Cont is designed to check the entire database and remove empty CONTAINERS, this command can be run at any time.

**rCircle**



When using the rCircle command geometry will be created on the active workplane providing the workplane is a valid plane. The panel allows the user to specify circles using a diameter rather than radius. The resulting geometry is ideally suited to creating hole cycles via rFind\_Hole and rMHole commands.

**rMap\_Path**



Depending on the operating system in use it may be necessary to shorten the editor path and command statement to less than 60 characters. rMap\_Path is designed to substitute a Drive letter for a path statement as follows:

C:\Program Files (x86)\Predator Software\Editor 9.0\PEditor.exe

Change to –

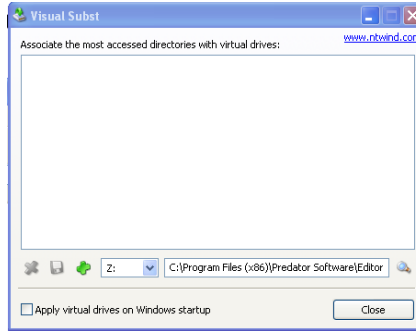
Z:\PEditor.exe

The following illustration shows how to map this path:

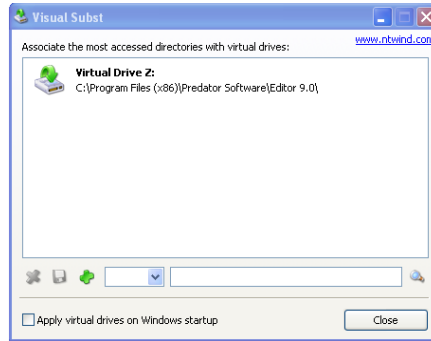
**SmartCAM Routing Automation** (October 2011)

**rMap Path (continued)**

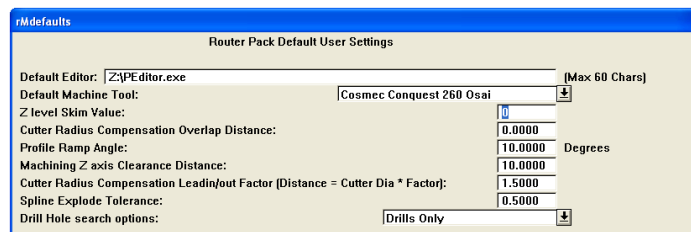
Press the control panel 'Go' button; set a Drive letter and a folder path; click on the green icon:



Click on the green icon and the folder mapping is complete.



Use this drive letter in the rMdefaults command as follows:



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**Group Attrib**



This command will automatically find any corner Miter geometry and place the geometry into an active group. This is useful for sequencing the machining of corner miter machining.

**SmartCAM Routing Automation** (October 2011)

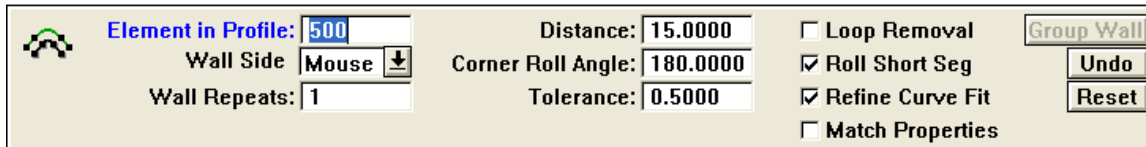
**Tips and Tricks**

**Spline geometry**

If the geometry contains SPLINES use the EXPLODE command in SmartCAM to convert them to ARCS. This will reduce the amount of CNC Code created to machine a spline curve. It is advisable to save your data prior to performing this action; this will allow you to re-load the spline geometry from its original restore point and try different explode tolerances.



IMPORTANT if a spline is to be WALL OFFSET controlled results can be obtained from the Wall Offset command by selecting the option 'Refine Curve Fit' and specifying an offset tolerance.



**Merged data**

If an existing SmartCAM model is MERGED into the working file planes can become duplicated with names like TOP1 and BACK1, by using the routine **rSetup** after the merge a check will be performed to remove duplicate and renamed workplanes.