TwinCAM
User Manual

INFO

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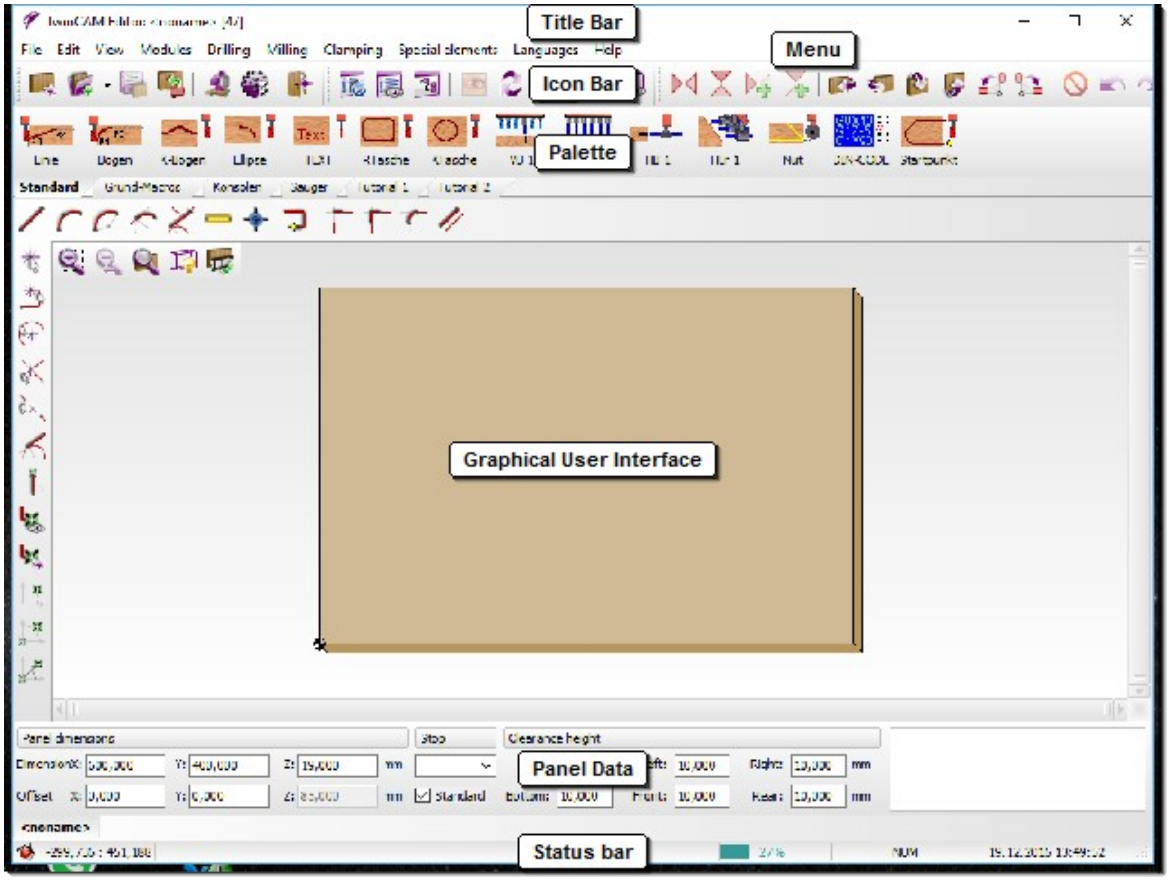
Chapter I

TwinCAM Editor

TwinCAM Editor

TwinCAM Editor is used to create and edit Workpiece descriptions.
This section of the handbook explains the Editor's construction and its principal components.



See also:

Title Bar
Menu
Icon Bar
Palette
Graphical User Interface
Panel Data
Status Bar

1.1 Title Bar

The Editor's Title Bar shows the File Version in square brackets as well as the file name of the file currently being edited.

1.2 Menu and Icon bars

The Menu Bar contains a conventional menu system giving access to all the programmes functions.

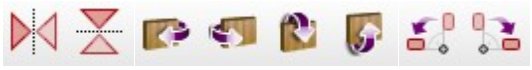
The Icon Bars provide access to a selection of programme functions. They are divided into the following categories:

- File

- View

- Edit

- Edit, Transformation



- Layer

- Domain

- Help

1.3 Palette

The Palette can be found in the upper area of the screen, immediately below the menu and Icon bars.

The Palette consists of a series of registers or "tabs". A number of symbols are available to the user on each of these tabs which link to a range of functions:

- Create Element
  These buttons generate TwinCAM basic elements. It is possible to have several buttons for the same basic element to take account of frequently used variations or default values.

- Insert File
  Using this button will insert a TwinCAMfile into the current panel. In this way it is possible to compile complex workpiece descriptions from a series of small groups of elements.

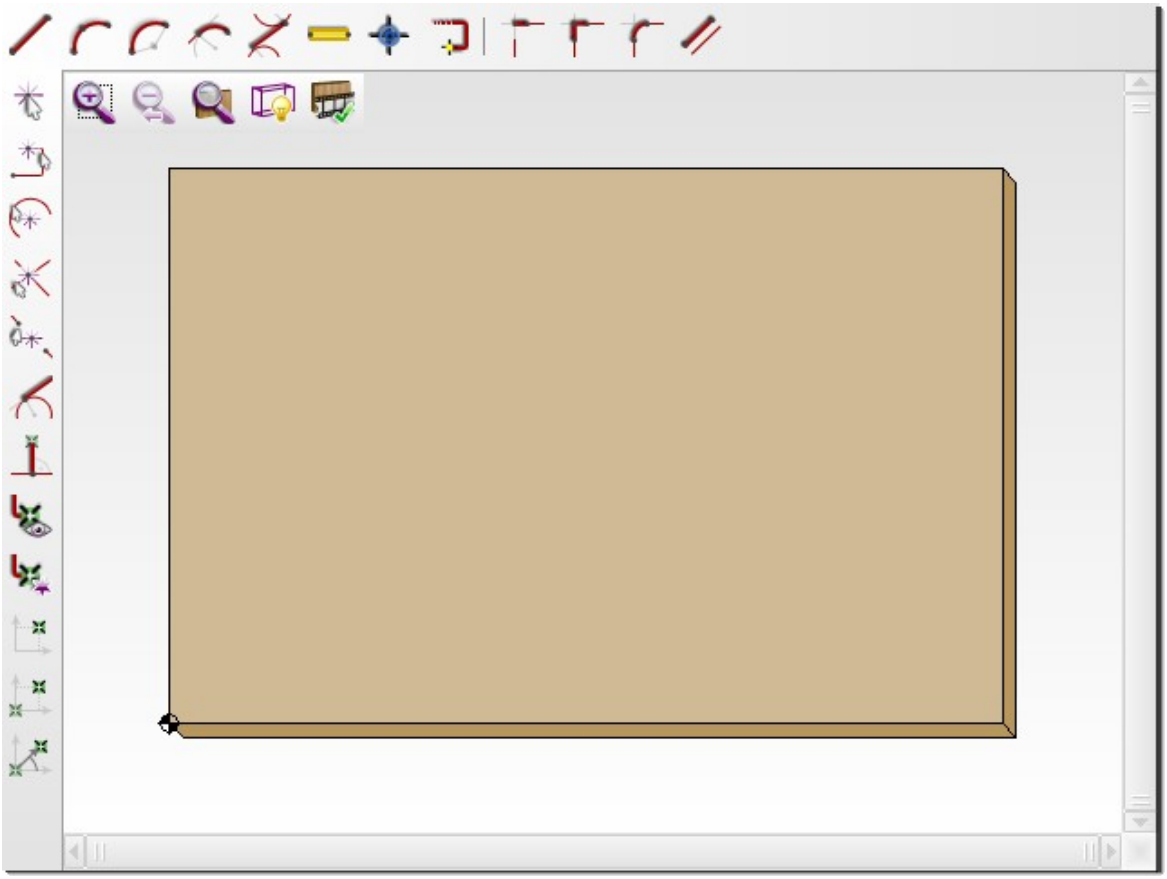
- Run Macro
  Finally, scripts may be concealed behind a button, introducing the user to the world of self-programmed or third party add-ons. The possibilities range from the creation of simple parametric elements to complex systems for the compilation of complicated workpieces.

The Palette is easily configured to meet individual needs and so may look very different from one user to the next. The tabs can be used to collect functions of any type together. Aside from global categories such as "*Standard*" for the basic elements or "*Rails*" for collecting machine dependent rail and suction pad configurations, tabs are frequently used to group similar workpiece descriptions together. For example, components for a particular furniture programme or drillings for commonly used fittings.

These user created palette tabs can be changed as needed. It is very useful to be able to save the contents of individual tabs and then add them to other palettes. naturally, the order of the tabs, as well as their names, can be amended as required and palettes that are no longer needed can be deleted.

1.4 Graphical Interface

The Graphical Interface takes up the largest part of the TwinCAM screen. This is used to display the panel currently being edited. As changes are made they are instantly updated and readily visible on screen.



Next to the Graphical Interface can be found on the upper and left hand borders CAD Functions In addition there are four Icons as well as the Scroll Bars to Zoom into or out of the drawing. The Context menu gives access to the most important programme functions.

See also:

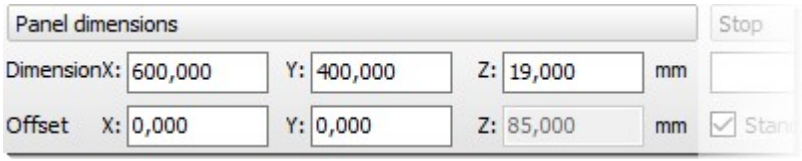
CAD Functions
Zooming
Scrolling
Context Menu

1.5 Base panel data

Current data for the basic panel are displayed at the foot of the screen. This field can be activated and deactivated from the Icon Bar.

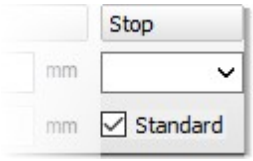
The window is divided into three areas:

1. Measurements:



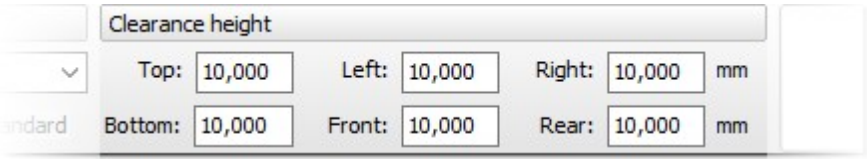
- The panel measurements are shown in X,Y and Z axes. The values entered here are available for use in Formulae and Functions for the variables DX,DY and DZ.
- The offset values allow an additional offset to be defined in addiion to the zero offset. This value too is available for use in Formulae and Functions in the OX/OY/OZ variables.
- The Z offset value is of particular importance. The zero offset does not normally take account of rails and suction pads. To enable correct programming of the Z value, the Z offset value must be entered here.So that this setting is as machine independent as possible, a standard Z offset for the most commonly used machine specific-suction pads can be entered in TwinCAM configuration. As long as the "*standard*" check box is activated, this value will be substituted by the machine specific standard value.

2. Panel Supports:



- Clicking on the arrow in the centre field displays the abbreviations for panel supports listed in the Machine Configuration. The panel support selected here is, however only valid for suction pad and rail positioning and simulations. The job list permits any panel description to be placed on any panel suppport. However, it must be noted, that the machine head has the range to carry out the work required.

3. Clearance height



This field records the safety margin or clearance height the machine head requires around the sides and above the top surface of the panel.

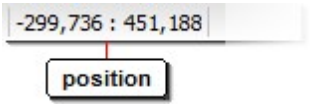
Warning:

This clearance height refers solely to the clearance required for the currently active tool and not for the machine head as a whole. This must be taken into account when entering the tool configuration.

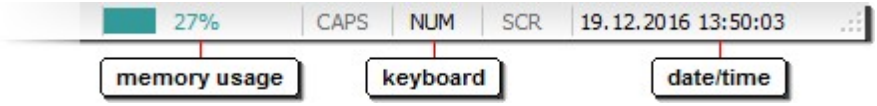
1.6 Status Bar

The status bar, at the foot of the screen consists of a number of areas.

The current cursor position within the graphical interface is displayed on the left of the bar. The units are whatever the configuration has been set to - either mm or inches. This is referenced from the panel zero point.



On the right hand side you will find some information to be aware of.



1.7 Reference

1.7.1 Menu and Icon bars

1.7.1.1 File

» ***New***

This command opens a new, blank panel for your use.

The current workpiece description will be closed. If unsaved changes have been made, you will be given the opportunity to save those changes or to cancel the new panel and continue working with the original workpiece. If you choose to save changes but there is, as yet, no file name for the workpiece, a dialogue box will open allowing a file name to be selected (s. "Save as..."). If the file already has a name, the changes will be saved under that name with no further dialogue.

The panel data for the new panel are taken from Default settings

See also:

Basic panel configuration

» ***Open...***

This command opens an existing panel description.

The current workpiece description will be closed. If unsaved changes have been made, you will be given the opportunity to save those changes or to cancel the new panel and continue working with the original workpiece. If you choose to save changes but there is, as yet, no file name for the workpiece, a dialogue box will open allowing a file name to be selected (s. "Save as..."). If the file already has a name, the changes will be saved under that name with no further dialogue.

File selection is carried out via a standard windows dialogue box. Aside from the usual items there is also a selection field for 'file type'. The default value is TwinCAM format (LDF). There are, however other File types that can be read. The right hand side of the dialogue box contains a pre-view window. This allows the user to make a visual check of the file before final selection.

When file selection has been confirmed by clicking on the "*Open*" button, the selected file will be opened in TwinCAM editor and displayed.

» *Save*

 With the aid of this command, changes to the current workpiece desciption are saved to the hard drive for future use.

If the workpiece description has not yet been named (the legend "<untitled>") will be visible on the title bar), this command has the same effect as "*Save as...*". Where the file already has a name, the changes are saved under the existing file name. Work on the workpiece description can then continue if desired. Any changes made after the last 'save' command will be lost when the programme is closed or if another panel is opened.

See also:

File - Save as...

» *Save as...*

 For a workpiece description to be saved permanently, it must be given a name. A new panel description is "untitled". on opening. This command can be used to name a new panel description, but also to change the name of an existing workpiece description.

A standard windows dialogue box will appear to enable the selection of a suitable file location and name. In addition to the normal fields, there is also one to permit the selection of a file type. The default for this field is "TwinCAM files (*.ldf)". However other File types may be selected. The current choice apart from LDF is between DXF and DXF(US).

Once a name and file location have been selected and confirmed using the "*Save*" button, the workpiece description will be saved under the appropriate name and location.

If the selected name is already in use, the user will be asked to confirm that the original file should be overwritten, if this is not done the alternative is to cancel the action.

See also:

File Formats

» *Insert...*

 This command serves to insert an existing panel description into the current one.

In so far as the elements within a panel description are parametrically defined, this procedure offers a simple and flexible means of creating new workpiece descriptions. Furniture parts can often be compiled from a series of common elements such as drilling rows, hinge mounts, back panel grooves etc.

This command works in a similar way to the "*Open...*" command with the exception that the selected panel description is inserted into the panel currently being edited.

See also:

File - Open...

» *Export...*

This command might be seen as a partner to the Insert command, as it allows selected elements from within a workpiece description to be saved independently. They can then be later inserted into other workpiece descriptions.

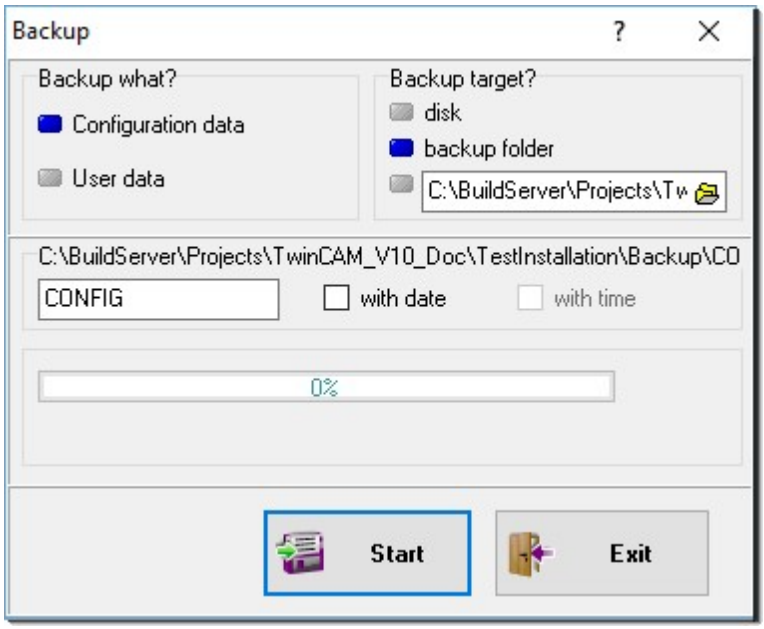
This command is only available when at least one element has been selected. A similar dialogue box to that for "*Save as...*" appears and is used in the same way.

See also:

File - Save as...

» *Backup*

This important command allows the user to backup all user data. So, for example, if the server needs to be changed, the full configuration can rapidly be re-established with all relevant data. This data is however, also of use to Support engineers to enable error messages to be interpreted from a picture of the current configuration.



On selecting this command a dialogue box appears. The following questions will be asked of you:...

1. ... What do you want to save?

   The alternatives are:

Configuration Data	This back-up encompasses TwinCAM default settings, the machine configuration and the tool configuration.
User Data	This back-up mode saves Palette data, variables, formulae and functions as well as all the tool descriptions, so long as they have been saved to the prescribed default directories.
Complete	This mode saves the whole contents of the TwinCAMdirectory. This may be a very large file.

2. ... Where should it be saved?

   Again there are three alternatives:

Floppy disk	The data will be saved to floppy disk. Depending on the amount of data, one or several disks may be required. **Warning:** It is not advisable to carry out a complete back-up on to floppy disks, as a very large number of disks may be required..
Back-up directory	The back-up data will be saved to the TwinCAM back-up directory. **Warning:** If the computer holding the data needs to be exchanged, you MUST take steps to load the data elsewhere first.
Other directory	The button to the right of this field opens a directory browser, so that you can select any available directory within the TwinCAM directory or elsewhere. For example, you could select a CD or network destination for the back-up data.

3. ... What should the back-up be called?

   TwinCAM will propose a default name for the back-up data. It makes sense to agree to the default name, particularly if the data is to be used by support engineers. In this way itcan easily be seen what type of data the directory holds. To prevent conflicts when data is regularly backed up, you have the option to include the date and/or time of the back-up in the file name. This is done by activating the appropriate radio button.

Once all the setting have been completed, click on the "*Start Back-up*" button. The progress of the back-up is indicated by a bar at the foot of the screen. Once complete, a message appears on the screen. Click to confirm that the back-up is complete.

NOTE:

- The data back-up function only saves data which is to be found in the appropriate location within the TwinCAM directory structure. If palette data or groups of elements are saved elsewhere, this data must be backed-up separately.

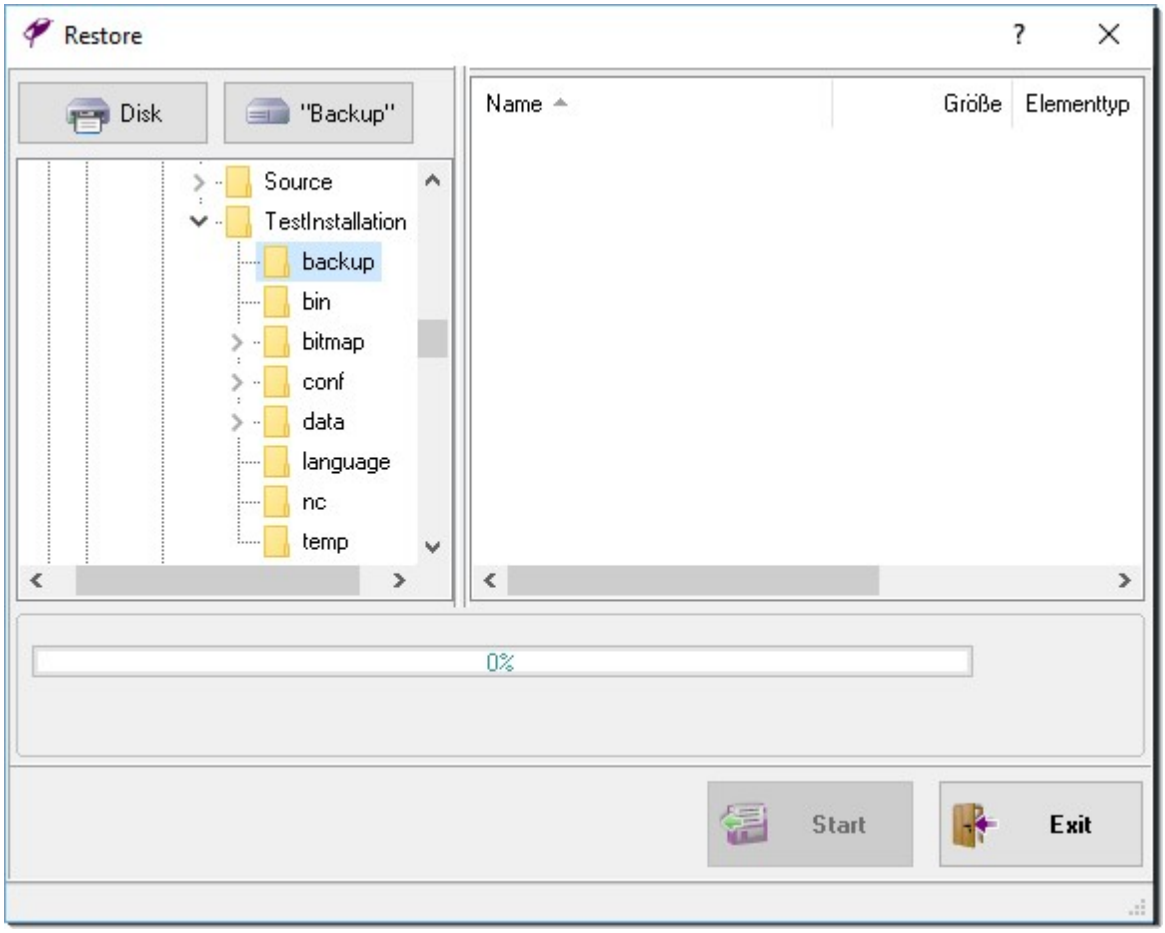
Data loss, for a wide range of reasons, is a fact of computer life. For this reason, data should be regularly backed-up. The data should then be kept in an appropriate location. TwinCAM's back-up directory is not an approriate location for this purpose. A hard drive failure would render both the original data and the back-up unuseable.

See also:

Restore

» *Restore*

The partner command to backup, this command restores previously backed-up data.



Use of this command is also supported by a dialogue box. The user is able to select the directory in which the backed-up data is to be found from the left hand side of the window. The buttons marked "Disk" and "Back-up" take the user direct to the appropriate directory.

The back-up files found in the selected directory can be seen in the right hand side of the window. Simply select a file and click on the "*Start*" button to begin the recovery process.

The data will now be recovered to their original location. As there will normally be files with the same names in these locations, over-writing the files needs to be confirmed. TwinCAM will ask for confirmation for every file unless confirmation is given by clicking the "*all*" button. In this case all subsequent files will be overwritten without further dialogue.

Warning:

Take care not to over-write new data with old recovered data by mistake.

See also:

Backup

» *Print*

The editor's print command allows the current drawing to be printed. If the NC Code Icon is displayed then this will also be printed.

A standard windows dialogue for the selection of a printer will be displayed. Confirming the settings by clicking on the "OK" button starts the print process.

» ***Recent files***

In a separate zone on the menu bar, you will find the four most recently used files listed. A click on one of the file names will immediately open the required file. If you have not yet saved the current panel description, you will, of course, be invited to do so by the appropriate dialogue box, before the new file is opened.

See also:

File - Open

» ***Exit***

 This command closes TwinCAM. If there are unsaved changes to the current workpiece description, the user will first be asked if these changes should be saved.

NOTE: Any changes not saved when the programme is exited will be lost.

1.7.1.2 Area

» ***Tools***

 Clicking on this icon opens the Machine Configuration.

See also:

Machine Configuration

» ***Settings***

 Selecting this command opens the TwinCAM default settings.

See also:

Configuration

1.7.1.3 Edit

» ***Delete***

 This button is only active if at least one element or group is selected. When active, all selected elements or groups may be deleted.

See also:

Undo
Redo

» ***Undo***

 This command allows the user to undo changes. TwinCAM maintains a list of changes so that if necessary, a number of changes can be undone. As soon as at least one change has been noted in the list the icon colour changes to denote that it is active.


No changes in list, "undo" function is not active.


At least one change can be undone.

See also:

Redo

» *Redo*


If the undo function has been used, these changes are in turn held in a list. This means that changes that have been undone can be re-instituted should their removal not prove desireable. As soon as at least one change is shown in the list, the icon colour changes and the function is available.


No changes in list, the "redo function" is not available.


At least one change can be redone.

See also:

Undo

» *Mirror*

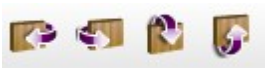

It is important to understand the distinction between mirroring a single element or group of elements, and mirroring the whole panel.

1. If *NO* elements are selected.
   The whole workpiece description is mirrored about the centre axis in X or Y.
2. If elements or groups are selected.
   Only the selected elements are mirrored. The axis is the centre axis of the surrounding group, normally the centre axis of the panel.

Tip:

It is possible to mirror elements other than about the centre axis of the panel. To do this, the elements must be part of a group whose Group Frame is different from the panel frame. Elements within such a group are mirrored about the group frame axis and not the panel axis. Elements which form part of a group may be selected by holding down the 'alt' button whilst clicking on the element.

» *Rotate*


The rotate function has a different effect dependant on whether or not elements or groups are selected.

1. *NO* elements selected.
   The whole panel will be rotated 90 degrees in the appropriate direction, from the standard view of the panel's upper surface, enabling work to be carried out on another surface.The orientation of the coordinate system remains the same.

2. Elements or groups are selected.
   The function moves the selected elements or groups in the indicated direction in 90 degree steps on to a new panel surface.

Note:

To make orientation more simple, the panel reference point always remains in the same place. If the user should nonetheless lose track of where he is following repeated rotate and turn operations, clicking on the bottom right hand corner of the screen where the two scroll bars meet will restore the standard 'helicopter' view of the panel's top surface.

Siehe auch:

Drehen

» ***Turn***

As with the rotate function, the turn function has a different effect dependant on whether or not elements and groups are selected.

1. *NO* elements are selected.
   The whole panel is turned by 90° in the direction of the arrow. The rotational axis is the mid point of the panel.
2. Elements or groups selected.
   The function turns the selected elements or groups by 90° in the direction of the arrow used. The axis is the mid point of the surrounding group, which is normally the mid point of the panel.

Tips:

- It is possible to turn elements other than about the centre axis of the panel. To do this, the elements must be part of a group whose frame is different from the panel frame. Elements within such a group are turned about the group frame axis and not the panel axis. Elements which form part of a group may be selected by holding down the 'alt' button whilst clicking on the element.

- Group commands include rotate. Using this command the goup can be rotated by any desired angle and not just in 90° steps. This should not be confused with the panel rotate command.

Note:

To make orientation more simple, the panel reference point always remains in the same place. If the user should nonetheless lose track of where he is following repeated rotate and turn operations, clicking on the bottom right hand corner of the screen where the two scroll bars meet will restore the standard 'helicopter' view of the panel's surface.

See also:

Rotate

1.7.1.4 View

» ***Refresh graphics***

Redraws the panel and its associated elements.

» *Generate*

 This icon activates and de-activates programme generation. As long as the icon is selected, each change to the workpiece description causes an immediate generation of NC code.

Notes:

- If there are a large number of elements, programme generation running in the background can adversely affect computer performance. It is therefore recommended that programme generation is de-activated whilst a panel is being edited.
- When programme generation is activated, each element is converted to NC code in turn. If an element cannot be converted for some reason, the element is highlighted in magenta. Holding the cursor over a highlighted element will cause an Error message to appear, which will provide information about the nature of the problem.

See also:

Tool selection error messages

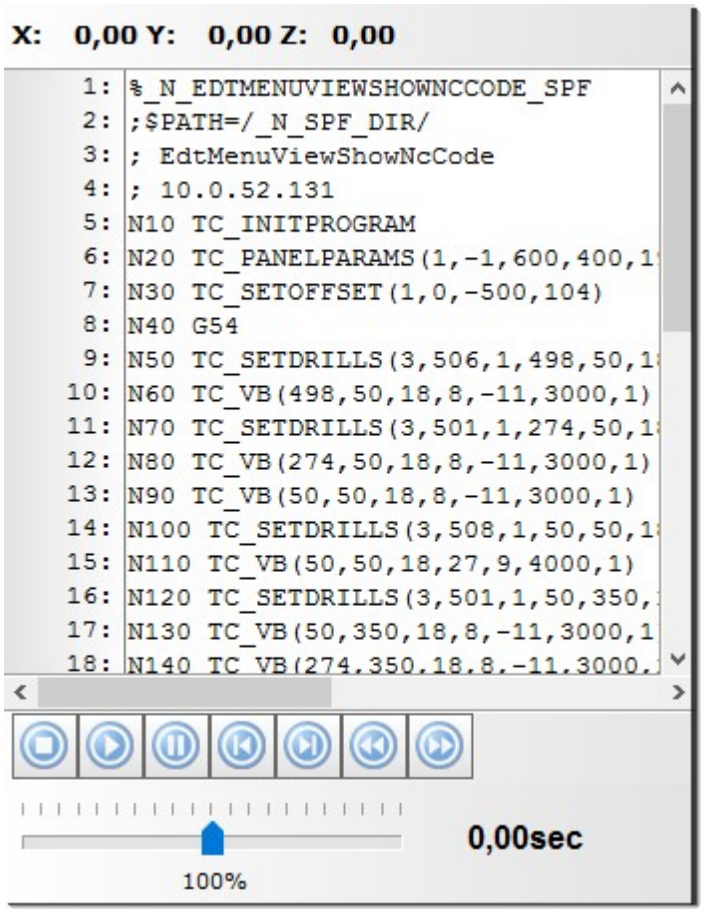
Programme Generation error messages

If TwinCAM automatic tool selection can not find a suitable tool, the machining for which the tool was sought will be omitted from programme generation. The relevant element will be shown in magenta in the Editor. If the cursor is moved over the marked element, an error message will appear. The meanings for the individual error messages are shown in the table below.

MinX **MinY** **MinZ**	The range of travel in X-,Y -or Z- is insufficient for the work to be carried out with an available tool.
MaxX **MaxY** **MaxZ**	The range of travel in X+,Y +or Z+ is insufficient for the work to be carried out with an available tool.
Type	The current tool list does not contain a tool of the type required.
Diameter	The current tool list does not contain a tool of the required diameter.
Direction	The current tool list contains no tool for the required cutting direction.
Rotation	The current tool list contains no appropriate tool with the required rotation (where clockwise or anticlockwise has been specified).
Length	The tool length is insufficient for the required cutting depth.

» *Display NC Code*

 Clicking this field activates/de-activates the NC Code display. When activated the display appears on the right-hand side of the TwinCAM window.



The upper part of the window shows the machine-specific NC code, the lower part contains the simulator controls.


This button starts the simulator. A schematic view of the machine aggregate is displayed in the graphical user interface; this display will then move as dictated by the NC code.


This button stops the simulator and returns it to the beginning of the programme. If the simulator is restarted, the programme will be re-run from the start.


This button pauses the simulation. clicking on it a second time re-starts the programme from the point where it was paused.

The actual time elapsed is dispayed to the right of the slider control. The run speed can be slowed down or speeded up by moving the slider left or right. The central position represents 'real' time.

Note:

The simulator interprets the available NC code. As a result the user should note the following:

- Changes to the NC code will immediately affect the simulation.
- In the case of strongly cycle orientated controllers such as the Siemens 810D/840D, the TwinCAM cycles are also called up and simulated. This leads to very realistic simulations, including tool change times and other similar actions.
- A simulation is just that, a simulation. Whilst TwinCAM is able to display a wide range of fthe controller's functions, it is not capable of 100% reality. This applies to the detail of machining features, the range of functions and the programme run time.

» *Display tree structure*

 It is sometimes difficult to select a particular element in TwinCAM, either because there are a large number of elements close together or because elements actually overlap each other. Also, elements which form part of a group may be difficult to select individually.

The tree structure is designed to combat this kind of problem. All the elements are displayed in a structured manner in groups. Any element, however tiny, can easily selected using the mouse. At the same time the selected element is highlighted in the graphical display to provide a check that the correct element has in fact been selected.

Each element in TwinCAM has a name which is displayed in the graphical user interface when the cursor is moved over it. Initially, this name will reflect TwinCAM's default, however the name can easily be changed. Simply click a second time on a selected element in the tree structure (take care not to double click on anelement as this will have unwanted side effects). The element can now be given any name the user chooses and can be saved. If, instead of a name a # is typed followed by a number, the default name will be retained but the element's priority will be changed. The name and priority can both be changed together, by typing the desired name followed by a space then a "#" and a number. Alternatively, the name and priority can both be edited in the element parameter dialogue. In this case there are two separate fields available.

Each element can be de-activated by means of the check box. This has the effect of preventing code being generated for this particular element; in turn, it is, of course, excluded from the NC code programme. Deactivated elements are displayed in grey in the graphical user interface.

In order to edit a selected element, right click on it either in the graphic or in the tree structure to open a Context menu. All the usual commands will then be available for use.

Notes:

- To select an element that is part of a group, click on it whilst holding down the ALT key. In the tree structure of course, you need only click on the desired element.
- To select several elements simultaneously, click on them in turn whilst holding down the CTRL key. This function is available both in the tree structure and in the graphical user interface.

See also:

Context menu - graphical user interface

» *Display panel data*

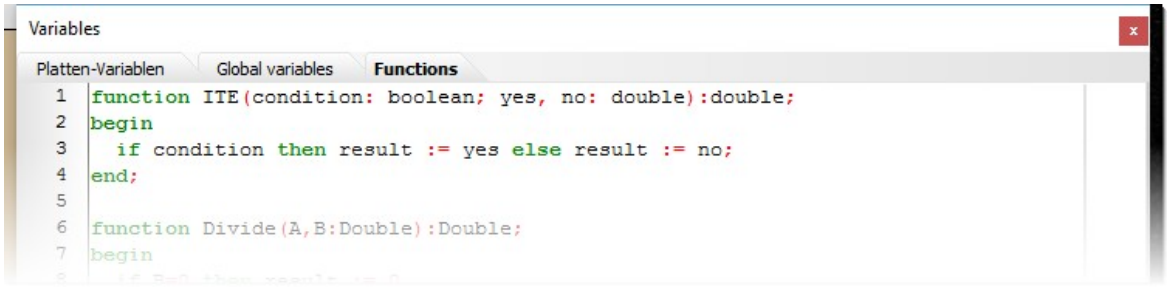
 This buton activates and de-activates the Basic panel data display.

See also:

Basic panel data

» *Variables and functions*

 A separate window to display variables and functions can be opened using this button.



The dialogue box has three tabs. The first two serve to define Variables the third to describe Functions.

See also:

Variables
Functions

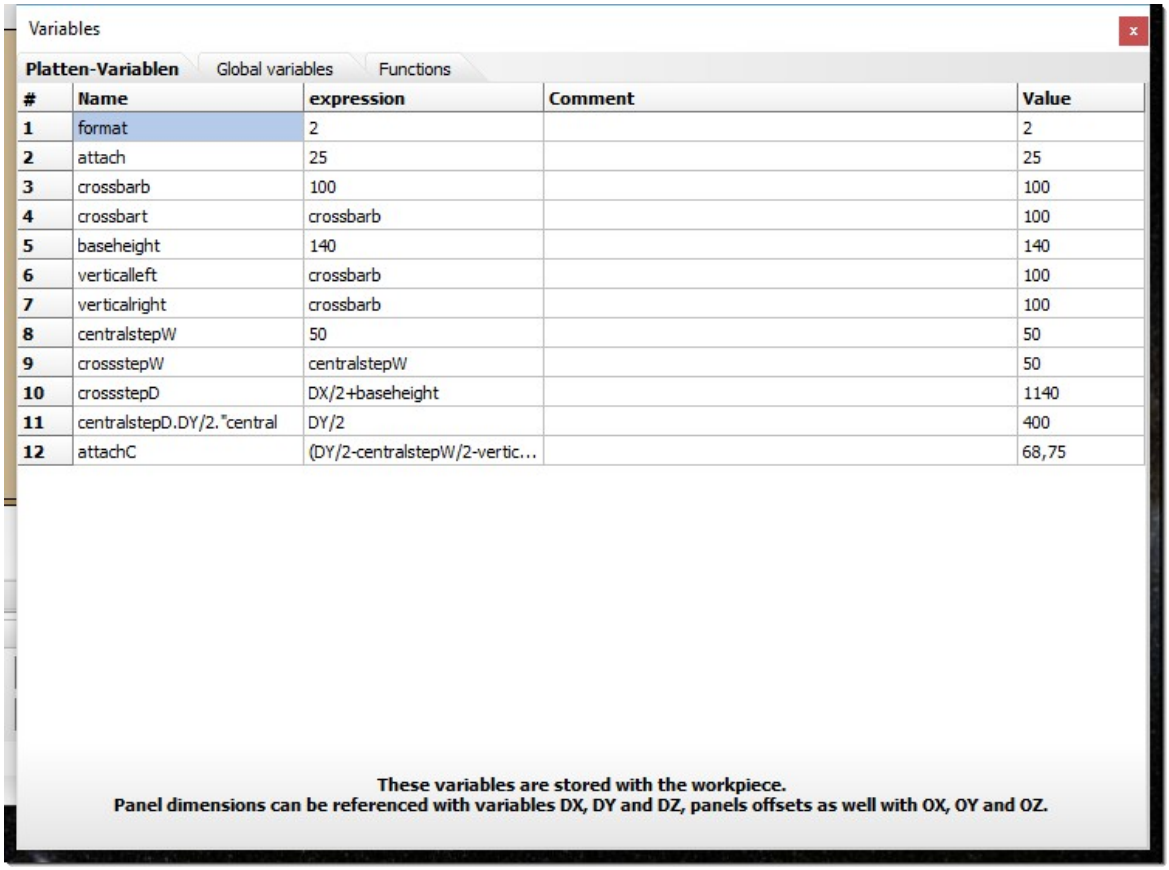
Variables

TwinCAM recognises three levels of variable:

1. Global variables.
   Global variables are valid for all panel descriptions within a TwinCAM installation. This might include machine dependent values for rails which will be the same for all panel descriptions.
2. Standard variables (local)
   These include the always available basic variables of DX, DY and DZ as well as OX, OY, and OZ. There is no separate tab TwinCAM for these variables.
3. Panel variables (local)
   These are variables that only apply to individual panels.

The two classes of local variables are saved together with the panel descriptions, whilst the global variables are part of the TwinCAM configuration.

Both local and global variables are administered using the dialogue shown here.



To *insert* a new variable, press CTRL and insert. An empty row will be inserted for the new variable. Only one "empty" row can be present at a time. If several variables need to be added, this must be done a row at a time with the data being entered before a new row is created. This can also be done by tabbing out of the last field in the row.

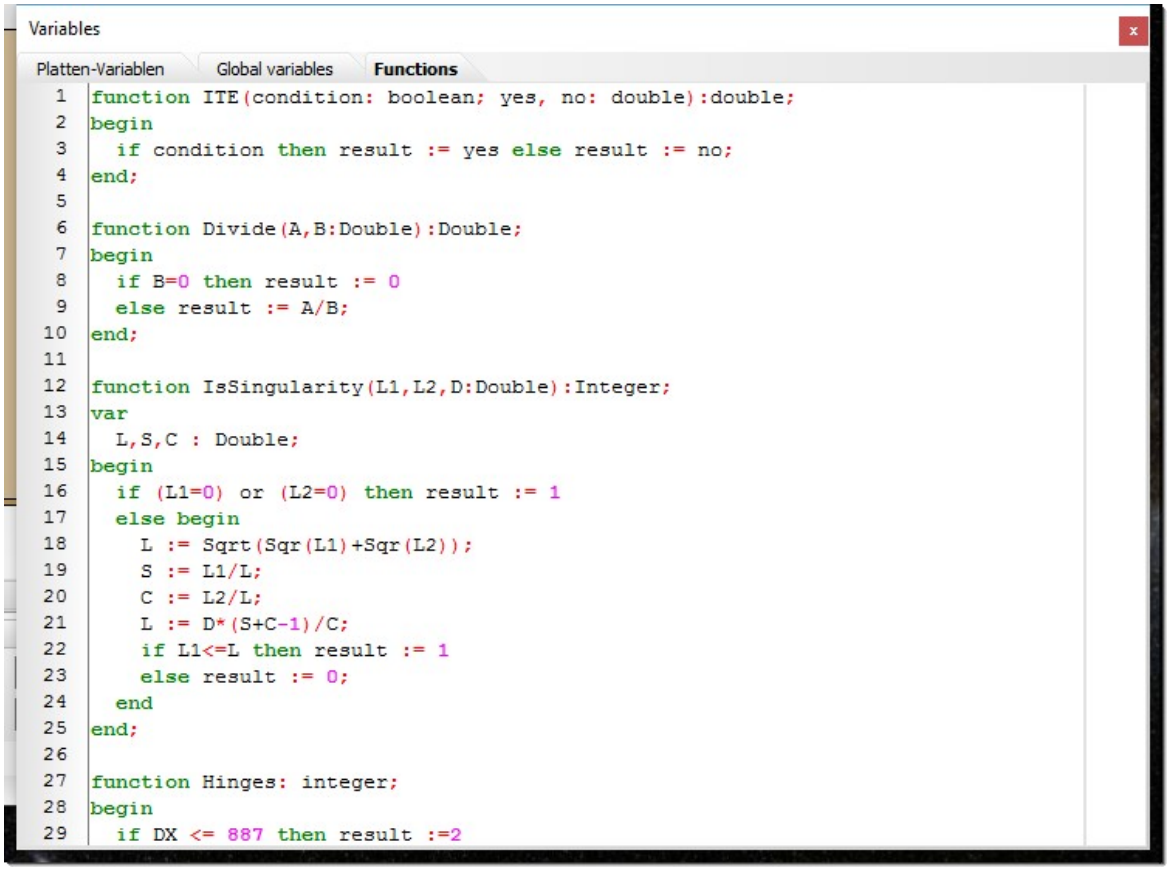
A variable can be *deleted* by pressing CTRL and delete. It will then be deleted with no further dialogue.

Note:

Variables which are used by elements are created automatically by TwinCAM. On the one hand this means that a new variable doesn't need to be created before it is used. On the other hand, a previously deleted variable may reappear if it is required by an element elsewhere in TwinCAM. Automatically created variables have a default value of 0.

Functions

This field is for the creation of user defined functions using the Pascal programming language. This may be used to write complex calculations, for example those involving differentiation, centrally and then use them subsequently in formulae.

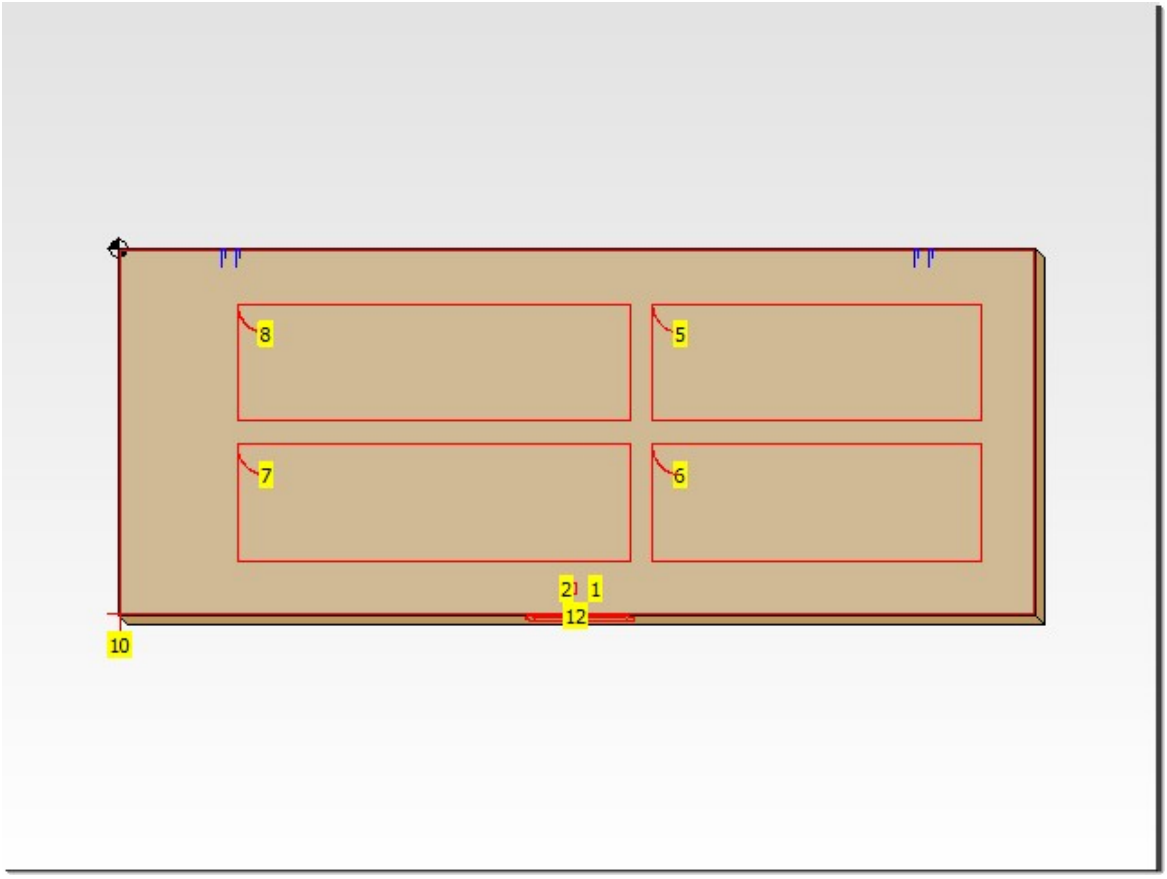


Note:

The conventions for functions are the same as those for scripting.

» *Display priorities*

This button may be used to display the Priorities of individual elements in the graphical user interface, so that they may be checked and/or amended.



When the priority display is activated, the relevant numbers are displayed in a yellow box at the start point of each element. If the element is selected, the box is displayed in red and the priority number can be changed by means of the + and - buttons.

Notes:

- Elements which have been created by mirroring have no priority of their own: they take the same priority as the element from which they were created.
- Priorities are only valid within their Layers. are machined in ascending numerical order of their layer names.

Tip:

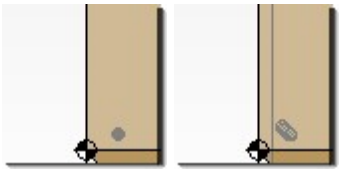
When work lists are used, the effective priority is the *sum* of the priorities of the constituent elements. In workpiece descriptions where work lists are used, the elements should not all be placed in one list together. The elements should be compiled, for example, in groups of ten.

See also:

Tree structure
Work lists

» *Transparent*

Transparent mode allows elements to be seen which would otherwise be concealed by the panel itself.



In the example shown above, activating transparent mode reveals the drilling on the underside of the panel.

1.7.1.5 Layer

» ***Add to layer***

 This icon adds the selected elements to the currently active Layer.

» ***Change layer***

This icon allows the user to change the currently active Layer. In addition, at the end of the list of available layers, there is a "new layer" function. Using this creates a new layer.

1.7.1.6 Drilling

This menu item makes all the drilled elements in TwinCAM available to the user. For detailed descriptions of the use of these elements please see the Elements chapter and the section on Drilling.

1.7.1.7 Milling

This menu item makes all the milled elements in TwinCAM available to the user. For detailed descriptions of the use of these elements please see the Elements chapter and the section on Milling, contours.

1.7.1.8 Clamping

This menu item makes all the elements in TwinCAM for securing panels available to the user. For detailed descriptions of the use of these elements please see the Elements chapter and the section on Panel supports.

1.7.1.9 Special elements

This menu item lists all the elements not covered in the other categories.

1.7.1.10 Languages

This menu item lists all the languages available this version of TwinCAM. The range of languages is constantly being updated. Clicking on the name of a language causes all the text in the user interface to be translated into the relevant language.

Tip:

It is recommended that you reboot TwinCAM after a change of language.

1.7.1.11 Help

» ***Contents***


This icon opens the TwinCAM online help file.

» ***Info about TwinCAM***


Here you will find information about your version of TwinCAM.

1.7.2 Palette

In the true sense of the word, there is no 'standard' for the palette. Machine manufacturers supply one or more palettes for purchasers to use. These are then, if not a 'standard' palette, at least a starting point for the user to extend and change according to need.

Nonetheless, every palette contains all TwinCAM's basic elements in one form or another. The symbols displayed for the various elements are specific to the manufacturer and therefore differ from one to another. The symbols shown in this manual are intended as examples rather than the definitive version.

Explanations of the basic elements can be found in the appropriate section of the manual.

The TwinCAM palette can be customised to the user's requirements in many ways. The means to do this are accessed via two context menus which are fully described in the following sections.

1. Tab set-up
2. Palette symbols

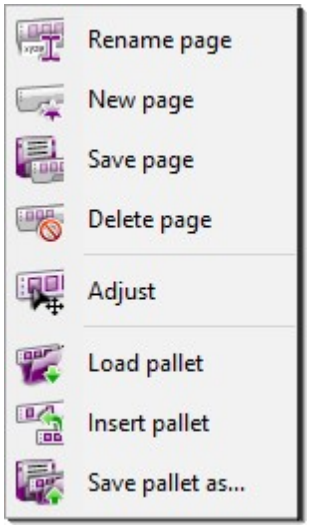
See also:

Elements

1.7.2.1 Tab set-up

A right click on an existing tab...

...opens a context menu giving access to the functions required to set up and customise the tabs.



The functions in detail:

-  Rename Tab
  This option allows the name of the currently selected tab to be edited. The name is displayed in the lower part of the palette.

-  New Tab
  A new register tab is added at the end of the list. To edit the order of the tabs, the customise mode must be activated.

-  Save Tab
  The current tab is saved to its own palette file. This file can then be inserted into another palette using the "insert palette" function - see below.

-  Delete Tab
  The current tab is deleted; deletion is only finalised after the user has confirmed via a dialogue that the tab should be deleted.

- Customise
  This command activates the customise mode. This allows the user to edit the order of symbols on the palette using drag and drop. Similarly, the order of the tabs on the palette bar can be edited by using drag and drop.

-  Load palette
  This opens a file selection dialogue where a different palette file can be selected. The current palette is then **exchanged** in its entirety for the newly selected one.

-  Insert palette
  This command also gives the user the opportunity to select from a list of existing palettes. In this case, however, the new palette is **added** to the current one. This enables the user to compile extensive palettes if required.

-  Save palette as...
  The currently displayed palette is saved under a new name and all subsequent changes are made to this new palette, whilst the previous one remains unchanged. When the programme is restarted the last loaded palette is reopened.

Tips:

- If wide ranging changes are to be made to a palette, the palette should first be saved under a new name. The previous version will then remain unchanged and can be loaded subsequently if required, using the "*load palette*" command.
- To create a completely new palette and still have TwinCAM's basic functions available, save the "standard" tab provided by the manufacturer using the "save tab" command, then reopen it using "load palette". This creates a new palette which just conatins the original tab. If further tabs are required from the standard palette, these can be saved using the "save tab" and then inserted into the new palette using "insert palette". As an alternative, the whole standard palette can be saved under a new name and the tabs and elements that are not required can be deleted.

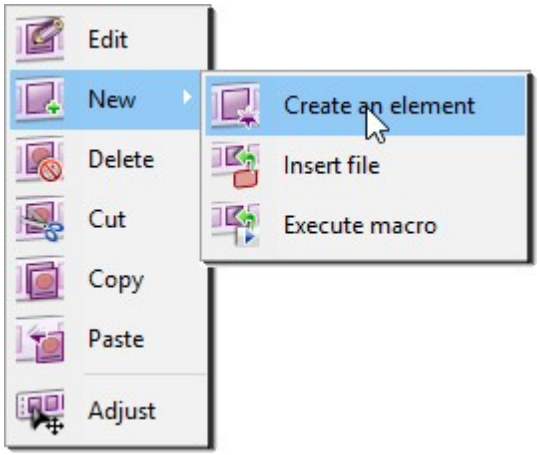
See also:

Symbol administration

1.7.2.2 Symbol administration

Right clicking on an existing symbol...

... opens the symbol administration context menu



In detail the functions are:

-  Edit
  Opens the settings dialogue for the selected symbol. The details can be viewed and amended. A change of type is not possible using this command; to do this a new symbol must be created.

-  New
  Creates a new symbol of the appropriate type. The settings dialogue also appears to enable the relevant details to be entered.

-  Delete
  The selected symbol is deleted after confirmation.

-  Cut
  The selected symbol is removed, but remains available to be "*pasted*" elsewhere (see below). Using this command, a symbol can be moved from one tab to another if required.

-  Copy
  The currently selected symbol is copied. The original remains unchanged, but is still available to be "*pasted*" onto another tab (see below).

-  Paste
  This command pastes a previously cut or copied (see above) symbol into a new location, which need not be on the same tab. This allows symbols to be easily moved between tabs or copied from one to another.

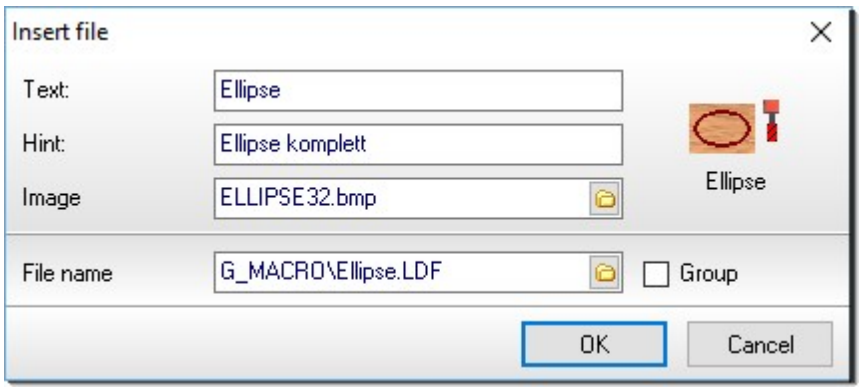
- Customise
  This command activates the customise mode which permits the user to customise the order of symbols on a tab or the order of tabs in a palette using drag and drop.

There are three different types of symbol, each of which has its own properties. Each type has its own dialogue which is accessed via the "new" and "edit" commands to enable the user to edit the settings:

1. Create element
2. Insert file
3. Execute macro

» *Button Properties*

All three types of symbol are represented by buttons with text and an image. These properties are therefore found in the settings dialogue for all three types of symbol.

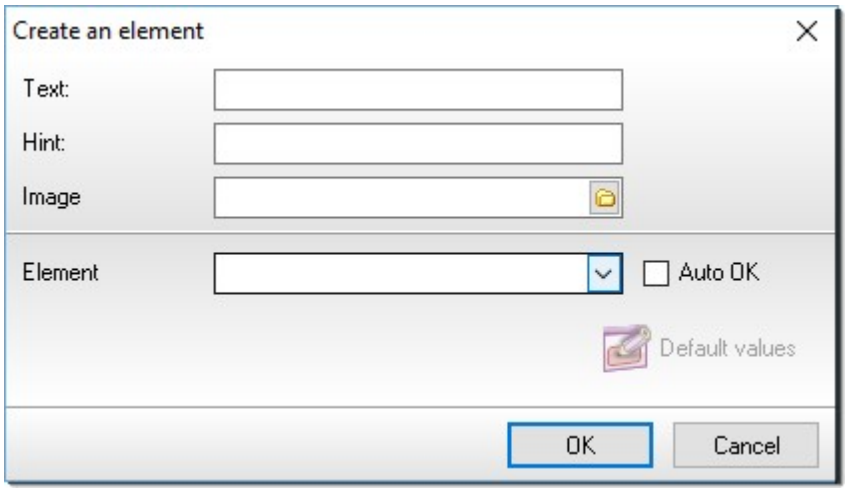


Parameters:

- Text
  Field for entering the text which appears below the symbol. This should be something brief rather than a lengthy explanation as the button size changes with the amount of text and all buttons are equally sized. If too much text is entered this can lead to the palette becoming unwieldy.
- Info Box
  This is another text entry field, in this case allowing unlimited space for a description. The text entered here appears in a box when the cursor is held over the symbol.
- Image
  This field is used to select the image file for the symbol. The image file format must be windows bitmap. The maximum permitted image size varies from manufacturer to manufacturer; if an image is too large for the permitted frame size it is displayed centered within the frame with the excess cropped. If there is an image of the same name in the "hot" subdirectory, TwinCAM will select this as a hot bitmap and display it when the cursor is held over the symbol.

» *Create element*

Symbols of this type insert a new basic element into the workpiece description. In order to do this the symbol contains a complete description of the element with all the required settings. By creating a number of symbols for the same basic element, variations can easily be introduced using a few mouse clicks.



The dialogue box has two tabs; the "*general*" tab contains the image settings and the button's function. The second, "*data*", page contains valid settings for the basic element. The second tab is equivalent to the settings described in Elements. The parameters for the first tab are described here.

Parameters:

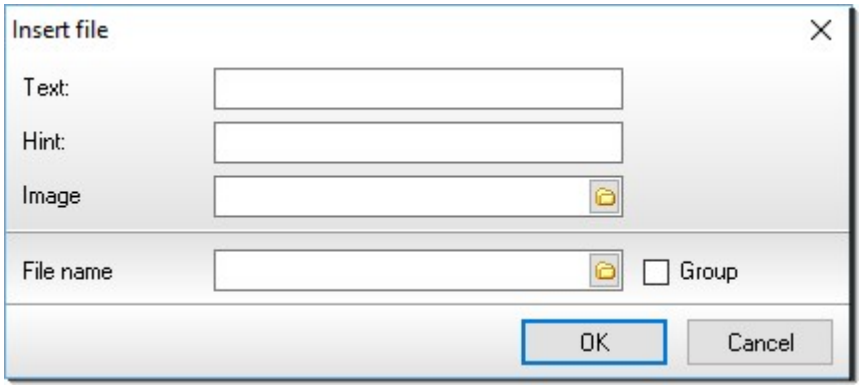
- Text
  Brief text displayed on the button (Details).
- Note
  A longer amount of text to be displayed when the cursor is held over a button. (Details).
- Image
  Image displayed on a button (Details).
- Element
  This list offers all the basic elements within TwinCAM. Selecting an element causes it to be inserted into the workpiece description.
- Auto OK
  If this switch is active, the element will be inserted into a workpiece description without any prior dialogue. If Auto OK is not activated a dialogue for the appropriate element will appear.

See also:

Elements

» *Insert file*

Using this symbol, a pre-prepared group can be inserted into a panel description. A group is, of course, simply a normal TwinCAM panel description, although this would usually consist of just a few elements. However parameterisation means that it can be integrated into a range of work piece descriptions without needing amendment.

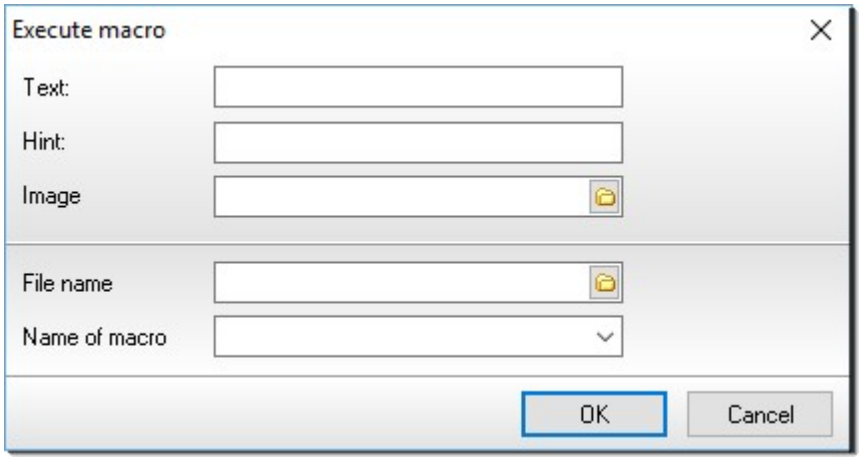


Parameters:

- Text
  Brief text displayed on the button (Details).
- Note
  A longer amount of text to be displayed when the cursor is held over a button. (Details).
- Image
  Image displayed on a button (Details).
- Dateiname
  The name of the file to be inserted is entered here. Clicking on the brackets [...] causes a dialogue to appear.
- Gruppieren
  Wird dieser Schalter aktiviert, so werden die Elemente in der Datei in einer umfassenden Gruppe zusammengefasst. Gruppierungen, die in der Datei bereits bestanden, bleiben davon unberührt. Diese Einstellung ist sinnvoll, wenn die hinzuzufügende Datei eine große Zahl von Elementen enthält, die ggf. schnell wieder zu entfernen sind. Andererseits bedeutet eine Gruppierung immer, dass der Zugriff auf einzelne Elemente durch die darüberliegende Gruppenstruktur erschwert wird.

» *Execute macro*

This function allows macros to be executed at the press of a button. This could be as extensive as a complete programme or a simple routine from a library of aids.



Parameters:

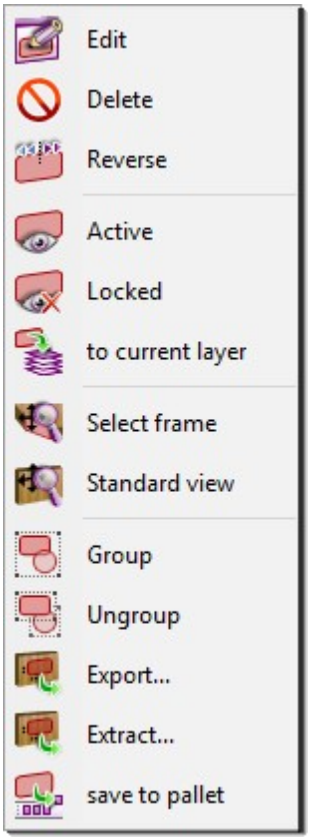
- Text
  Brief text displayed on the button (Details).
- Note
  A longer amount of text to be displayed when the cursor is held over a button. (Details).
- Image
  Image displayed on a button (Details).
- Dateiname
  Der Name der Datei, die das Skript enthält. Diese Angabe sollte mit Pfad angegeben werden. Der kleine Knopf am rechten Rand des Feldes ruft einen Suchdialog auf.
- Makroname
  If this field is left empty the whole file is viewed as a programme. Regardless of the scripting language used, there will always be a marked starting point or "main routine". This is run if there is no other routine indicated in this field, if there is, then that runs as described. Scripts which include formulae are an exception; these do not have a main routine, they are started by the user.

More information on the subject of scripts and macros can be found in the scripting manual.

1.7.3 Graphical Interface

1.7.3.1 Context Menu

The Graphical Interface's context menu provides access to functions used in editing elements or groups.



Functions:

-  Edit
  Opens the settings dialogue for the selected element. If several elements are selected, this item is not available.
-  Delete
  Deletes the selected element(s).
-  Reverse
  Exchanges the start and end points of the selected element. If more than one element is selected, this feature is not available.
-  Active
  Reactivates a selected blocked element.
-  Blocked
  Blocks the selected element. Blocked elements are ignored during programme generation.

-  Current Layer
  Adds the selected elements to the Current Layer.

-  Group
  Creates a new group and adds the selected elements to this group. If the group includes a contour, TwinCAM will add a Start Point to the group.

-  Ungroup
  Ungroups the selected group. The component elements remain as individual parts of the drawing.

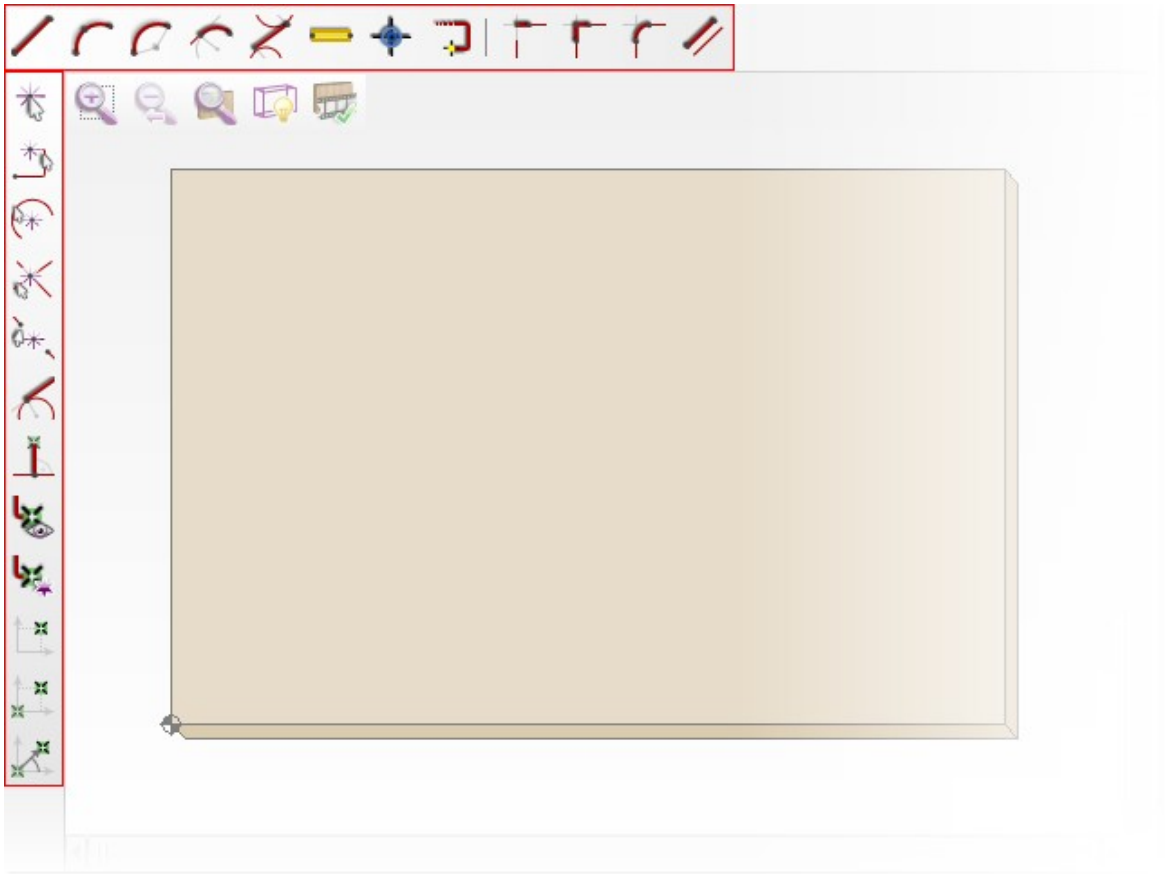
-  Export
  This permits the export of the selected elements as a separate panel description. This assists in modulising workpiece descriptions. For example all the required machining tasks for a particular fitting can be exported as a panel description and subsequently inserted into other workpieces as required.

-  Add to Palette
  Exporting can be made even simpler by adding the selected elements direct to a palette. If a single element is added, a button is created with the appropriate properties. If several single elements or a group are added to a palette together, a dialogue box will appear and a file name can then be selected. A button will then be created labelled "Insert File" linked to the newly created file.

1.7.3.2 CAD functions

TwinCAM offers a range of fundamental CAD functions. This means that it will only rarely be neccessary to turn to a specialised CAD programme, for example if very complex or freely constructed contours are required. For day to day tasks TwinCAM has a more than ample range of tools at your disposal.

The CAD functions are accessed via icons around the top left corner of the graphical interface.



The horizontal icons represent Basic Functions, whilst the vertical ones are Capture Functions.

See also:

Basic Functions
Capture Functions

1.7.3.3 Zooming

The following symbols and functions are available to customise your view of the work in progress:

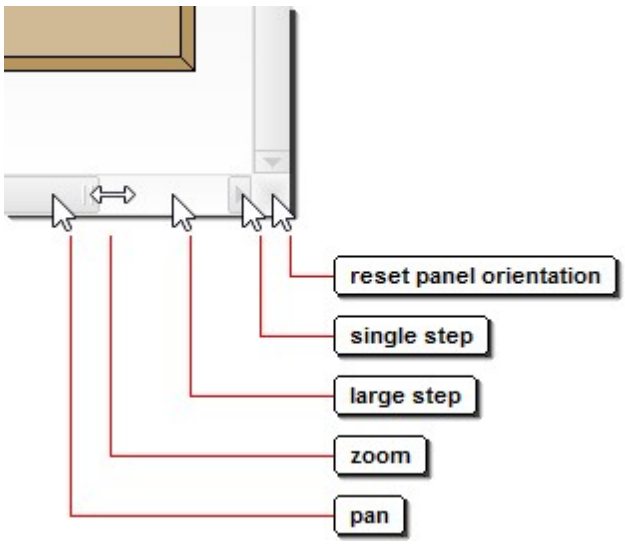
-  When this switch is activated, the view will be zoomed in to an area selected with the mouse. The function stays active until either de-activated by clicking on the icon again or by a right click anywhere on the graphical interface.

-  This button will zoom out step by step.

-  One click on this button restores the view of the whole panel.

1.7.3.4 Scrolling

Scrolling functionality in TwinCAM goes beyond that normally found in Windows. In addition to scrolling horizontally and vertically, the scroll bars can also be used for zooming.



1.7.4 CAD Functions

1.7.4.1 Basic Functions

The basic functions create or modify new objects.

Line

Arc (three points)

Arc (mid, start and end points)

Arc (tangential)

Tangent (two arcs)

Groove

Drilling

Start point

Trim

Trim 2 elements

Rounded corner

Parallel shift

With the exception of the two trim functions, a window appears on selection into which the relevant data can be entered. In most cases this will include a "Magic Point" Reference. This point reference will also be

used for the next point irrespective of whether this done via Direct mouse click or by means of some other Capture function These data must therefore be set *before* the relevant element is positioned. The details of each individual function will be described later.

Note:

It may not be neccessary to provide the full detailed data initially as the elements may, of course, be edited subsequently.

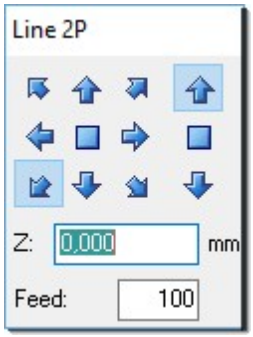
See also:

Capture functions

» *Line*


Two consecutive points joined by a line.

Detail data:



- Point reference
  Establishing the reference point as a Magic Point for the next. point.
- Depth (Z)
  As CAD functions always work in two dimensions, the depth for the next point can be entered here as additional information.
- Feed rate
  The newly created object will be allocated the feed rate set in the end point. Further information can be found in the "Elements" chapter under Feed rate.

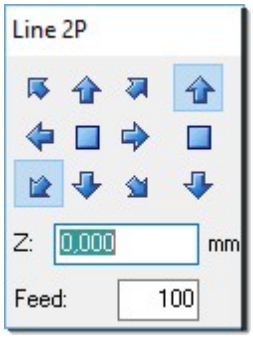
Tip:

If the CTRL key is pressed whilst the end point is set, the line will be extended in X or Y(rectangularly).

» *Arc (three points)*


The arc is defined via three points; in order, these are the start point, an arc point and the end point.

Detail data:



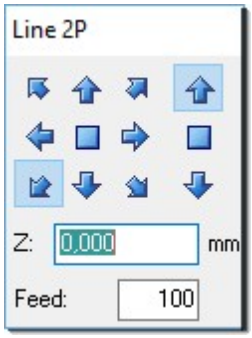
- Point reference
  Establishing the reference point as a Magic Point for the next. point.
- Depth (Z)
  As CAD functions always work in two dimensions, the depth for the next point can be entered here as additional information.
- Feed rate
  The newly created object will be allocated the feed rate set in the end point. Further information can be found in the "Elements" chapter under Feed rate.

» *Arc (mid start and end point)*


This function allows the construction of an arc by means of the mid point as well as the start and end points. The first defined point is the mid point of the arc. By moving the cursor away from the mid point

a circle is drawn. Marking the start point at the same time defines the radius of the arc. Finally, the end point is selected using the mouse. The direction of the arc follows the direction the mouse is moved. The arc can be made to run either clockwise or anti-clockwise from the start point.

Detail data:

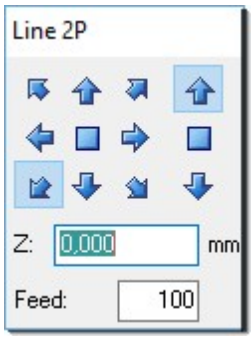


- Point reference
  Establishing the reference point as a Magic Point for the next. point.
- Depth (Z)
  As CAD functions always work in two dimensions, the depth for the next point can be entered here as additional information.
- Feed rate
  The newly created object will be allocated the feed rate set in the end point. Further information can be found in the "Elements" chapter under Feed rate.

» *Arc (tangential)*


This function creates an arc which is tangential to another element. As soon as this function is selected, the mouse is in end point capture mode. The end point of any element may now be marked. An arc will now be created starting from the end point of this element. Marking a further point will define the end point of the arc.

Detail data:

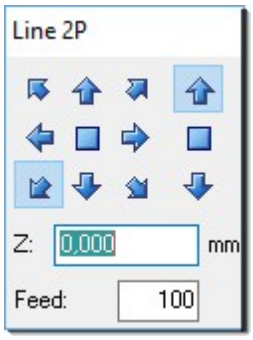


- Point reference
  Establishing the reference point as a Magic Point for the next. point.
- Depth (Z)
  As CAD functions always work in two dimensions, the depth for the next point can be entered here as additional information.
- Feed rate
  The newly created object will be allocated the feed rate set in the end point. Further information can be found in the "Elements" chapter under Feed rate.

» *Tangent (two arcs)*


This function allows the simple insertion of a line which is tangential to two arcs. As soon as the function is activated the mouse is put into object capture mode.This mode only allows arcs to be marked. When two arcs are selected one after the other, TwinCAM automatically creates a new line which links both arcs tangentially. Where there are a number of possible tangents, TwinCAM automatically selects the point on each arc nearest to where the mouse was clicked on the arc.

Detail data:

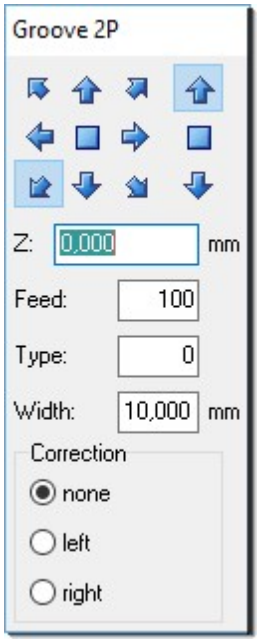


- Point reference
  Establishing the reference point as a Magic Point for the next. point.
- Depth (Z)
  As CAD functions always work in two dimensions, the depth for the next point can be entered here as additional information.
- Feed rate
  The newly created object will be allocated the feed rate set in the end point. Further information can be found in the "Elements" chapter under Feed rate.

» ***Groove***


By marking two points, this function constructs a groove along a line between them.

Detail data:



- Point reference
  Establishing the reference point as a Magic Point for the next. point.
- Depth (Z)
  As CAD functions always work in two dimensions, the depth for the next point can be entered here as additional information.
- Feed rate
  The newly created object will be allocated the feed rate set in the end point. Further information can be found in the "Elements" chapter under Feed rate.
- Type
  Unique reference used for Tool selection.
- Width
  Groove width.
- Correction
  Correction factor (left or right).

The properties accord to those of the element Groove.

Hint:

The qualities "type", "breadth" and "correction" will be already assigned to the groove when fixing the starting points. Whereas the feed will be fixed only at end.

Tip:

When pressing the Strg button at fixing the end, a groove running in x- or y- direction will be achieved.

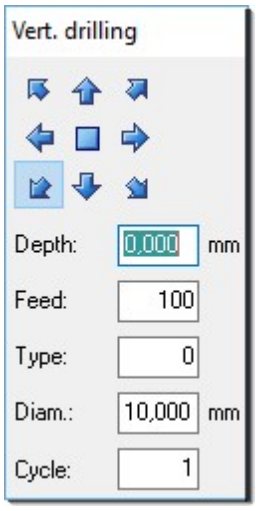
See also:

Groove

» *Drilling*

 This function is used to place drillings.

Detail data:



- Point reference
  Establishing the reference point as a Magic Point for the next. point.
- Tiefe
  Bohrtiefe.
- Feed rate
  The newly created object will be allocated the feed rate set in the end point. Further information can be found in the "Elements" chapter under Feed rate.
- Type
  Unique reference used for Tool selection.
- Diameter
  Tool diameter for tool selection.
- Cycle
  A variety of drilling cycles may be pre-set by the machine manufacturer. Entering a code in this field enables the user to access these cycles.

The properties shown here are identical to those for Drilling.

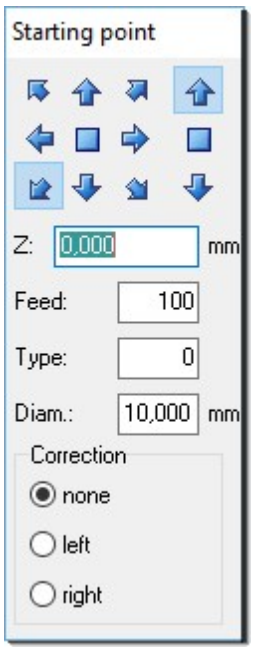
See also:

Drilling

» *Start point*

 This function allows an element's start point to be set. Once selected, this function sets the mouse to start point capture mode. The start point can then simply be placed at the beginning of a contour.

Detail data:



- Point reference
  Establishing the reference point as a Magic Point for the next. point.
- Depth (Z)
  As CAD functions always work in two dimensions, the depth for the next point can be entered here as additional information.
- Feed rate
  The newly created object will be allocated the feed rate set in the end point. Further information can be found in the "Elements" chapter under Feed rate.
- Type
  Unique reference used for Tool selection.
- Diameter
  Router diamter required for tool selection.
- Correction
  Router radius correction factor.

» *Trim*


With the aid of this function, one element can be trimmed to another. To do this the first selected element is either lengthened or shortened towards a second selected element so that it exactly meets their projected crossing point.

How it works:

1. Select the first element (the one to be trimmed).
   The first element should be selected at or near an end point. The element will be lengthened or shortened from this point.
2. Select the second element.
   The second element is selected as a whole.

First, a crossing point between the two elements is calculated. In doing this, the projected course of the second element is taken into consideration if it will not actually meet the first element. In the case of an arc, should this situation arise, the projected course will clearly be a circle. The point at which the first element is trimmed will always be the nearest possible crossing point of the two elements.

See also:

Trim 2 elements

» *Trim 2 elements*


This function trims two elements simultaneously, so that they then have a common start/end point. Both elements are lengthened or shortened towards the selected end point so that they meet exactly at their intersection.

The method of using this function is similar to that for the Trim function. The main difference is that the second element must also be selected at or near its end point, as this defines the direction in which the element is lengthened or shortened to meet the first element.

See also:

Trim

» *Rounded corner*


This function is in principle similar to Trim 2 elements, although it does not generate a common point between two elements. In this case a tangential link between the two elements is created using an arc of a given radius.

Detail data:

- Radius
  The radius of the tangential arc.

See also:

Trim 2 elements

» ***Parallel shift***


The selected element is shifted a given distance parallel to its current position. Take care not to click directly on the element, rather to one side, in the direction that it should be shifted.

Detail data:

- Distance
  The distance the element is to be shifted.

Notes:

- Only one element at a time can be shifted. If a complete contour needs to be moved, each element of it must be selected one at a time; no account is taken of grouping.
- The result of shifting every element of a contiguous contour may **NOT** be a new contiguous contour. Arcs may become a series of points if shifted and thus cease to exist. Lines that previously had common start and end points may subsequently either cross or not meet at all. In this case the elements will need to be trimmed as required.

See also:

Trim
Trim 2 elements
Rounded corner

1.7.4.2 Capture functions

Capture functions serve to capture point co-ordinates. In contrast to the creation of normal elements, the coordinates are not created by explicit data entries but by making use of existing element features. The individual capture methods available are listed below.

Direct mouse click (D)

End point (E)

Centre (C)

Intersection (X)

Mid point between two points (M)

Tangent on an arc (T)

Plumb point (L)

Current point (Y)

Define new current point (N)

Absolute co-ordinates (A)

Relative co-ordinates (R)

Relative Polar co-ordinates (P)

Tips:

- Apart from clicking on the icon, these capture functions can be accessed by pressing the key shown in brackets after the name of the function.
- The capture functions can be nested so that, for example, the M function can be called up and the two points between wich the mid point is to be found, can be established using other functions such as centre or end point.
- In order to connect the next element to the previous one, the start point can be easily defined using the current point (Y) function. The most recently defined point will always be the one taken.
- The edges of the panel can also be edited using capture functions such as rounded corners, trim parallel shift and so on. As an example, by selecting the side of a panel, the mid point of the side can easily be established.

» *Direct mouse click (D)*

 The cursor position's co-ordinates are captured.

» *End point (E)*

 On selecting an existing element, the co-ordinates of the end point nearest the mouse click are captured.

» ***Zentrum (C)***


This function also requires an element to be selected. The co-ordinates of the centre of the element are captured.

» ***Centre (C)***


This capture function requires two elements to be selected. The co-ordinates captured are those of the actual or projected intersection of the two elements. Where neccessary, the elements are extended to meet, in the case of an arc this will be extended to form a full circle.

» ***Mid point between two points (M)***


Two points must be set for this function, the capture function may then be utilised to establish a point mid way between the two points previously set.

» ***Tangent on an arc (T)***


The purpose of this function is, from a start point, to set a tangent point on an arc. The start point must, however be set first, e.g. the beginning or end of a line. Once the function has been activated, selecting an arc will cause a tangent point to be linked to the start point by a tangent.

» ***Perpendicular point (L)***


Similarly to the capture of a tangent point, a start point must first be established before the function is active. Clicking on an element will create a vertical line from the element to the start point.

» ***Current point (Y)***

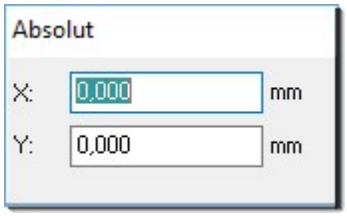

Each point is saved in turn as a new current point. This function enables the user to call up the current point, for example to use it as the start point for a new element or for nested capture functons. In particular, the end point of one element can become the start point of a new element, without having to go through the steps need to establish the co-ordinates of that point. The current point can also be used to create relative co-ordinates as well as for tangent or plumb points.

» ***Define new current point (N)***


This function allows the creation of a new start point for nested capture functions (in combination, for example, with relative co-ordinates). It also enables the user to construct 'assistance points' without having to create a supporting network of lines.

» ***Absolute coordinates (A)***

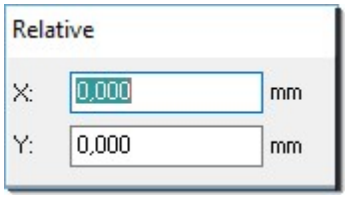

This function can be called up so that known, established, co-ordinates can be entered in to the window shown below.



The co-ordinates are entered by use of the keyboard.

» ***Relative coordinates (R)***

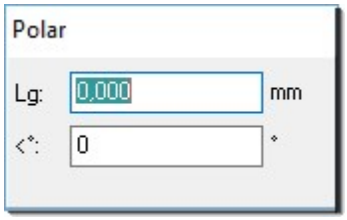
 In this case, a new point can be determined by reference to its position relative to the current point. Input here also requires the use of a new window, as shown below.



Data entry is again by means of the keyboard. The values entered are added to the coordinates of the current point to establish the position of the new point.

» ***Relative Polar coordinates (P)***

 Finally, the position of the next point can be determined relative to the co-ordinates of the current point by using polar co-ordinates (distance and angle). In the case the window for that entry looks slightly different.



The position of the next point is determined by its distance from the current point and the directional vector angle.

Chapter II

Elements

Elements

A Workpiece description in TwinCAM consists of a number of elements.

Each element comprises two different types of data:

- Geometric data
  "Where is the work to be carried out?"
- Technological Data
  "How and with which tool should the work be carried out?"

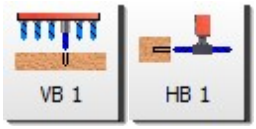
The basic elements available in TwinCAM can be categorised as shown below:

Milling - contours

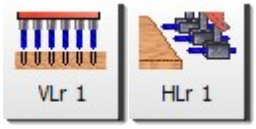
Milling - pockets and cut-outs

Milling - Text

Drillings - single



Drilled rows



Sawing

Miscellaneous elements

Panel supports

- Rails

- Suction pads
- Round suction pads
- Rectangular suction pads

Notes:

- References to technological data are not machine dependent. The assignment of a real tool to a particular machine is carried out using type numbers that are independent of the machine T numbers. This is explained more fully in the Tool selection section.
- Contour elements are an exception in so far as lines arcs and ellipses only carry geometric data apart from the feed rate. The remaining technological data is conferred by adding a start point.
- Panel supports are only independent of the machine to a limited extent. A support can only be brought into use if it is actually available on the machine in question.

See also:

Tool selection

2.1 General

There are various methods of adding a new element to a workpiece description.

1. Selection from the menu
   There is an entry for each of the basic TwinCAM elements in the menus. Selecting an item from the menu will cause the relevant item to be inserted into the workpiece description and the data entry dialogue for that element will be opened.
2. Selection from the Palette
   The Palette consists of a number of different tabs. The "Standard" tab holds the icons for the basic elements. In the same way as menu selection, clicking on the icon inserts the relevant element and opens its data entry dialogue box.
   Apart from the "Standard" tab there are other tabs with icons which can represent a wide variety of functions. The user can define icons to represent basic functions with particular default settings, a group of basic elements that together define a more complicated contour, or even scripts.The Palette is user defined and so will have a very different appearance and function from one user to another.
3. Insert Group
   The "Insert Group" command is available both via the menu and pallete selection methods. This allows pre-prepared panel descriptions to be inserted into the current workpiece.

Each basic element that is available for use in TwinCAM has its own data entry dialogue box. After selecting an element, its dialogue box will appear on the right hand side of the screen, whilst the panel appears in the graphical interface to the left. The newly inserted element appears as determined by its current settings in white. The effects of changes to the settings are immediately clearly visible.

If the settings for an existing element need to be edited this can be done either by double clicking on the element, or by simply selecting the element and then selecting the "*edit*" function from the Context menu.

This chapter explains each of these dialogues in detail. Some matters recur in most or even all of the dialogues. These concepts will be explained first and then ignored in the detail descriptions for the individual dialogues.

2.1.1 Parameterisation

Parameterisation is a key function in TwinCAM. In order to be equal to the demands of practical rather than theoretical use, TwinCAM offers a range of tools to assist with tasks of varying complexity. A fundamental aim has been to provide simple tools to carry out simple tasks and only provide complicated tools for the most complex work.

To make clear exactly what is meant by parameterisation, we will first explain the difference a *non*-parameterised work piece description makes. In this case all machining is carried out with reference to a single anchor point, usually the bottom left corner of the panel's upper surface. Standard CAD programmes would work in this way , for example. Files imported from these sorts of programme (DXF files for instance) are the most common non-parameterised programmes. If the panel dimnsions are changed for any reason, the machining will remain in the same absolute positions as they were before.

Things are very different with a parameterised workpiece description, though. Using a variety of different tools it is possible to define elements in such a way that however the panel dimensions are changed, the machining is moved to a new relative postion that is appropriate.

Examples:

- Horizontal drillings into the side of an un-parameterised panel, might end up in the middle of the material or even outside its margins altogether if the panel dimensions are changed.
- A parameterised panel description ensures that even after a change of dimension, the drillings are carried out in the correct position on the right side of the panel.
- Parametrically defined drilled rows are lengthened or shortened to suit changed panel dimensions.

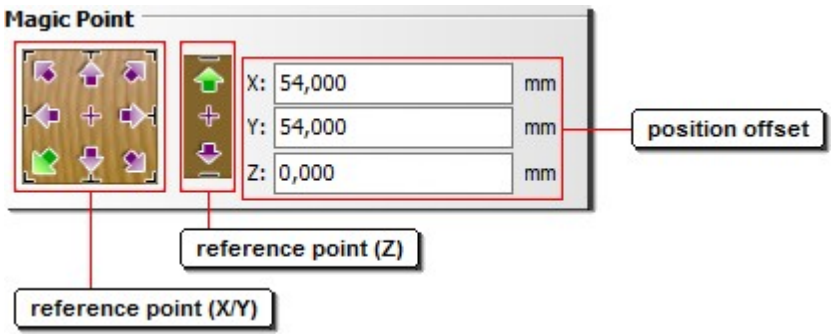
TwinCAM provides three different levels of complexity of parameterisation:

1. Magic Points
2. Variables Formulae and Functions
3. Scripts

2.1.1.1 Magic Points

Using this simple parameterisation method, machining can be referenced to any one of nine different points. Instead of just the lower left corner, elements can be referenced to any corner, the midpoint of any side or the centre of the panel. This method can solve quite a number of parametrisation problems whilst still being simple to learn and use.

Establishing the reference point is carried out using a dialogue box, which is identical or similar to the one shown for almost all elements.



The "*Reference point (X / Y)*" area allows the user to select a corner, the mid point of an edge or the centre of the panel as a reference point. The "*Reference point (z)*" area allows the user to choose the top or bottom surface or the centre of the panel.

A **left** mouse click switches the desired reference point on without changing the values in the offset values box. This will change the element's absolute position on the panel. If, on the other hand, the reference point is selected using a **right** mouse click , the position offset values are automatically recalculated so that the element remains in the same position on the panel. this method is particularly useful to parameterise nonparametric panel descriptions, for example those imported from a DXF file.

Warning: Using the right click method deletes any formulae or variables that have been entered as offset positions and replaces them with an equivalent value.

The position offset entry is always oriented into the panel. Thus measurements that are reference to the underside of the panel must be given positive values.

Positive X and Y values that are referenced to the centre follow the standard co-ordinate system i.e. to the left or rear. Centrally referenced Z values are oriented to the top for positive values and to the bottom for negative values.

Tip:

A **double mouse click** on the dialogue box title ("*Position*"in the illustration above) will reveal the reference and offset value for the endpoint of the last saved element.

Note:

Magic Points always relate to a group frame; they can however relate to a panel as the panel is itself a Group.

2.1.1.2 Variables, Formulae and Functions

Anywhere that a numerical value can be entered, TwinCAM will accept variables formulae and functions. A different panel can easily be created by amending certain variable values. Basic mathematical operators as well as, for example, trigonometric fuctions can be used to describe mathematical relationships. Clearly a knowledge of maths to a greater or lesser extent is neccessary here. Recurrent formulae and relationships in which decisions or loops have to be run through can be formulated as user created functions. A basic knowledge of programming will be needed for this.

Furthermore TwinCAM puts an internal calculator at your disposal to calculate constant numbers direct without formula - please give key combination <Strg>-<Enter>.

Note:

The conventions for variables and formulae as well as the range of useable functions are all linked to the the Pascal programming language. Detailed information on permitted variable names and pre-defined functions may be found in standard texts on the subject. For more information on scripting please see the appropriate TwinCAM handbook.

See also:

Variables
Formulae
Functions
Variable and function editors
Calculator

» *Variables*

If, instead of numerical value, a variable name is entered, the current valid value for that variable will be taken. If a variable name is used that has not previously been saved, it will automatically be added to the list with a value of 0. It follows that there is no defined separate process for saving variables.

For TwinCAM to be able to differentiate between a numerical value and a variable name, the latter must always start with a letter. There are a number of names that cannot be used as variable names because

they already have a meaning. For example "*Sin*" stands for the Sine function. A full list of these words and their pre-defined meanings can be found in the scripting handbook.

The current values for variables can be viewed and edited in the Variables editor.

Important:

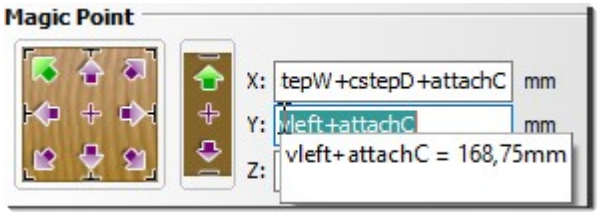
TwinCAM has six pre-defined variables:

- DX Panel dimensions in X
- DY Panel dimensions in Y
- DZ Panel dimensions in Z
- OX Offset in X
- OY Offset in Y
- OZ Offset in Z

The values for these variables are always those entered by the user in the appropriate dialogue box for Panel data.

» *Formulae*

Variables can be combined with basic mathematical operators (addition, subtraction, multiplication and division) to form formulae. In addition, pre- or user-defined functions can also be used.



Tip:

In order to establish the current result of a formula, place the cursor over the appropriate field. An information box will appear showing the result of the calculation.

» *Funktions*

Aside from a wide range of pre-defined functions, the user's own functions are available for use in formulae. These are functions which are created in the Function editor using the Pascal programming language.

» *Calculator*

If the <CTRL> and <Enter> keys are pressed with the cursor in a data entry field, a calculator will appear. It assumed that users will be familiar with this type of calculator. With the common keys for Copy (<CTRL>-C) and Paste (<CTRL>-V) the result from the calculator can be applied in TwinCAM.

2.1.1.3 Scripts

Scripts can describe an extensive programme of variations. They can provide the user with input masks for very complex pieces such as windows, stairs and doors with all their special features.Scripting is aimed principally at providers of third party software, although simple scripts can be written without extensive programming knowledge. To make full use of script's potential, however, substantial knowledge and experience of programming is essential.

Script programming is not covered in this document. For more information please see the appropriate handbook.

2.1.2 Cutting Rate

A nominal cutting rate for every tool is set in the Tool administration. The cutting rate for individual elements is set by being expressed as a percentage of the nominal rate.

Example:

Nominal cutting rate:	8 m/min
Element's cutting rate as a percentage:	60%
Actual programmed value:	4,8 m/min

Tip:

If all tools are given a nominal cutting rate of 10 m/min, then values for individual elements can be etered as "absolutes". In this case 4.8m/min equates to 48%.

Notes:

- If a cutting rate of 0% is entered, the nominal cutting rate from the tool administration will be used to carry out the work.
- Entering a cutting rate for one element of a contour only affects that one element and not the whole contour.

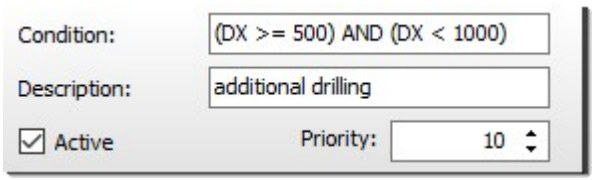
See also:

Tool Administration

2.1.3 Conditions

Every element can have a condition attached which decides whether or not the element is taken account of in the programme generation process. The default condition value is 1. That means that the element is taken account of during the generation process. If a value of 0 is entered, the element is not taken account of.

Ignored elements are displayed in grey.



As with all data input fields in TwinCAM, a numerical value can be replaced by a Variable, formula or function in order to set the value. The result of the formula may be either a numerical value (0 or 1 as described above) or true or false. Therefore, expressions may be used with logical operators.

Note:

Any numerical value other than 0 will cause the element to be included in the generation process.

See also:

Variables, Formulae and Functions
Examples

2.1.3.1 Example

- `(DX >= 500) AND (DX < 1000)`

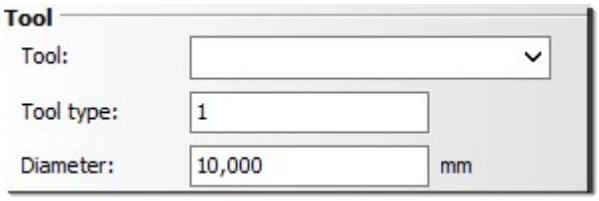
The machining is carried out so long as the panel dimension in X is equal to or greater than 500mm and also less than 1000mm.

2.1.4 Tool Selection

The process of selecting the most suitable tool for the work to be carried out is done largely automatically by TwinCAM. User input is limited to certain particular tool qualities.

The central tenet of the tool selection process in TwinCAM is the tool type number. Whilst DIN programming makes its tool selection by means of T-Numbers, TwinCAM uses type numbers. The difference between the two systems is quite clear; T-Numbers are not only dependent on the machine type but also on the current tool configuration of that particular machine.. One individual miller could have 4 as its T Number on Machine A whilst on machine B the same tool is referred to as 121 today and perhaps 124 tomorrow.

In contrast, tools in TwinCAM are labelled with a type number. A miller with the type number 10 could be located anywhere on machine A's toolchanger, whilst on Machine B the same tool with the same tool number may be located on a fixed drive without any change in tool description required.



Apart from the tool type, a diameter is required. The actual selection is then carried out using a combination of the tool type and diameter as described below.

1. **Drilling**
   The type and diameter of the drill must match the characteristics of the work to be carried out.
2. **Milling**
   Tool selection is carried out primarily on the basis of the tool type. If a diameter is given, then the tool with the appropriate type number AND the correct diameter is chosen. If 0 is entered as the tool type number, selection is carried out on the basis of the diameter. It should, however be noted that this could lead to confusion with profile millers.
3. **Sawing**
   Selection is carried out on the basis of the required tool type. If there is no suitable saw, the system will search for a suitable miller to carry out the work. The blade width is only of interest to the extent that a saw will not be selected if its width is greater than that of the groove to be machined. If the groove width is greater than the width of the blade, the groove will automtically be cut using several passes of the saw.

A precondition for automatic tool selection is that the Tool administration system is carried out in an orderly and consistent manner. The user has complete freedom in the way the type numbers are allocated. It is however to be recommended that the system used suits the widest range of uses. Most machines are supplied with some sort of typing or tagging system and it is sensible to use this as a basis as the range of tools is extended.

A Work list number may be used in place of a tool type number for milled work. The tools to be used are then selected for each step of the list using the tool type on the basis of the type number and diameter for each separate element.

Tip:

The tool type numbering system should be developed in such a way that each individual type of miller has a separate number to avoid confusion. Millers which are only differentiated by their direction of rotation may be given the same type number. TwinCAM will then be able to select a miller with the appropriate direction of rotation.

Drills on the other hand are simple to categorise. For example:

Blind hole drill Type 1
Pass through drill Type 2
Clearance drill Type 3
etc.

Note:

If TwinCAM is unable to find a tool that suits the job's requirements, the element is ignored in the programme generation process and shown in magenta in the editor. Holding the cursor over an element displayed in magenta will cause an Error message display window to appear with an explanation of why the work was not able to be carried out.

See also:

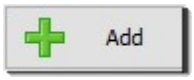
Tool administration
Work lists

2.1.5 Buttons

Confirms and saves entries.

Cancels entries.

Saves the current settings for this element as a default . This default will also be used for elements imported as DXF files, in so far as no default has been set in DXF.
This button is only visible for new elements.



Instead of amending the current element's data, a new element is inserted into the workpiece description using the amended data.
This button is only visible when existing elements are edited.

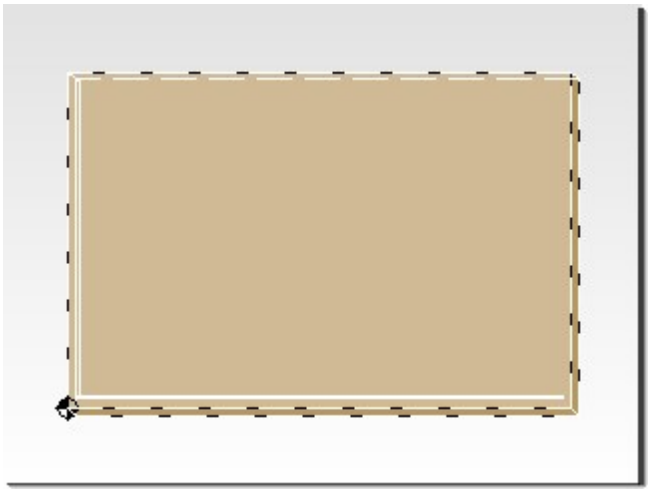
2.1.6 Groups

TwinCAM allows the user to link elements together as groups. A group will always be treated as a single entity. This is particularly important in the case of Context menu commands.

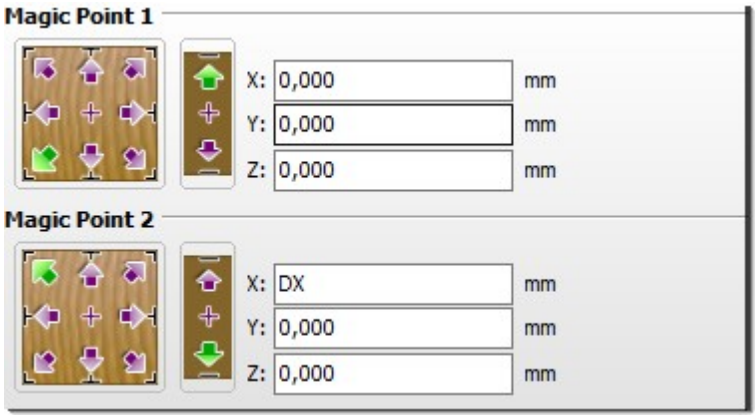
The method for creating a group is as follows:

1. Select the elements to be grouped.
   The first element is selected by a simple left mouse click. Subsequent elements are selected by holding down the CTRL key whilst selecting them with a left mouse click.
2. Select the "group" function from the Context menu.

The elements in a selected group are displayed in white. In addition a white dotted rectangle shows the group frame (see illustration below).



Groups have common properties for which there is a dialogue box. If a group is being edited, either the Set start point dialogue or the simple group dialogue shown below will appear.



There are two zones available for use:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Group frame (Point 1 / Point 2)
  With the aid of the parameters Point 1 and Point 2, two opposite corners of a cuboid can be described. All Magic Point references within the group will now be referenced to the group frame rather than the panel edges. In this way groups of elements can easily be copied or moved without having to do without Magic Point Parameterisation.
- Rotation
  A group can be rotated about itself. This is done by setting a pivot point and an angle of rotation. All elements in the group will be rotated about the given point by the stated angle.

Notes:

- If the group contains at least one contour element, a Start point is generated automatically.
- If a group is to be copied, the original group is selected and edited. The desired changes should be entered in the group dialogue box, in particular any changes to the group frame. Pressing the "*Insert*" button rather than "*OK*" will then add the new group to the panel description.

See also:

Start Point

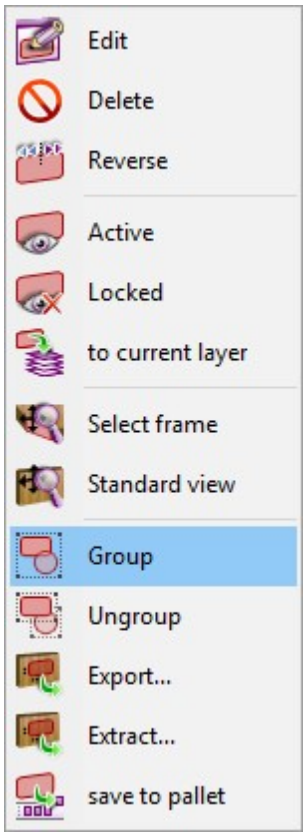
2.2 Milling

2.2.1 Contours

Contours consist of one or more geometric elements and a start point, which holds the technological data. If a selection includes a contour element (a line or an arc for example) TwinCAM automatically adds a start point..

The method of creating a contour is, then, as follows:

1. Create the individual contour elements.
2. Mark all the elements that are to belong to the contour.
   The first element is marked by simply left clicking on it, then hold down the CTRL key whilst clicking on the remaining elements.
3. Right click on the marked elements to open a context menu and then select "*group*" from the menu.



4. A double click on the newly created group will open a dialogue for the Start point.
   The required techological data can be entered here as well as the start point.

Note:

The grouping described in step three is not an absolute requirement as TwinCAM has an algorithm for automatic contouring.

Tip:

An alternative method is to select only the first element of a *continuous, smooth, non-cyclic* contour and to group. The start point is then placed automatically at the beginning of the contour, without having to select each element separately.

See also:

Automatic contouring
Start Point

2.2.1.1 Automatic contouring

The way in which TwinCAM calculates the the linked elements of a contour is quite complex. It is important to understand the underlying principles in order to be able to predict and control the way in which TwinCAM deals with contours.

There are three definitive propertiesof contours which are either present or not. TwinCAM selects its method of working depending on which combination is present.

- *Continuous*
  Contour elements may be described as *continuous* if the start and end points are in identical pairs, that is the end point of one is also the the start point of the next and so on.
- *Branched*
  A contour may be described as *branched* when more than one start point is co-located with the end of an element.
- *Cyclic*
  A contour is *cyclic* if a part of the contour is closed. In other words, when some or all of the elements are so linked that each element is linked to another in the same contour at both ends.

The simplest contour is one which is *continuous, not branched* and *not cyclic*. This type of contour has an obvious method of processing and can be calculated by TwinCAM completely automatically. The elements do not need to be grouped, the creation of a start point is sufficient.

If a contour is *not continuous*, at least one element from each segment must be in a common group with a start point. TwinCAM will, in this case, insert an implicit start point into each independent segment. This start point inherits the properties of the original start point. It should be noted that the user cannot influence which element will be taken as the start element and which end of th contour the start point will be linked to. As a consequence, it is not possible to predict how the contour will be machined; in turn of course, this will influence other factors such as whether the cutting i carried out clockwise or anticlockwise and which side correction is needed for the tool radius correction factor.

Similar considerations apply to the *branched* and *cyclic* contours. TwinCAM will calculate a route through the contour, but it is not possible to predict what that route will be. Elements which are not machined on the intitial run will be given implicit start points, as is the case with non continuous contours, and machined subsequently The same consequences regarding cutting direction and correction factors will apply here too.

To avoid ambiguities and unexpected consequences, *continuous, non branched* and *non cyclic* contour segments should be grouped and given a start point. It is sufficient for the automatic contouring algorithm if the first element is selected and given a start point by selecting group from the context menu.

Note:

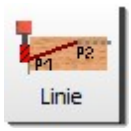
The "*group*" command will automatically link the start point to the beginning of the first selected element. If the contour has been mistakenly programmed against the flow of the work, the start point will be created at

the wrong end of the element, in the middle of the contour. This can be corrected by selecting the element whilst holding down the ALT key and then selecting "*reverse*" from the context menu.

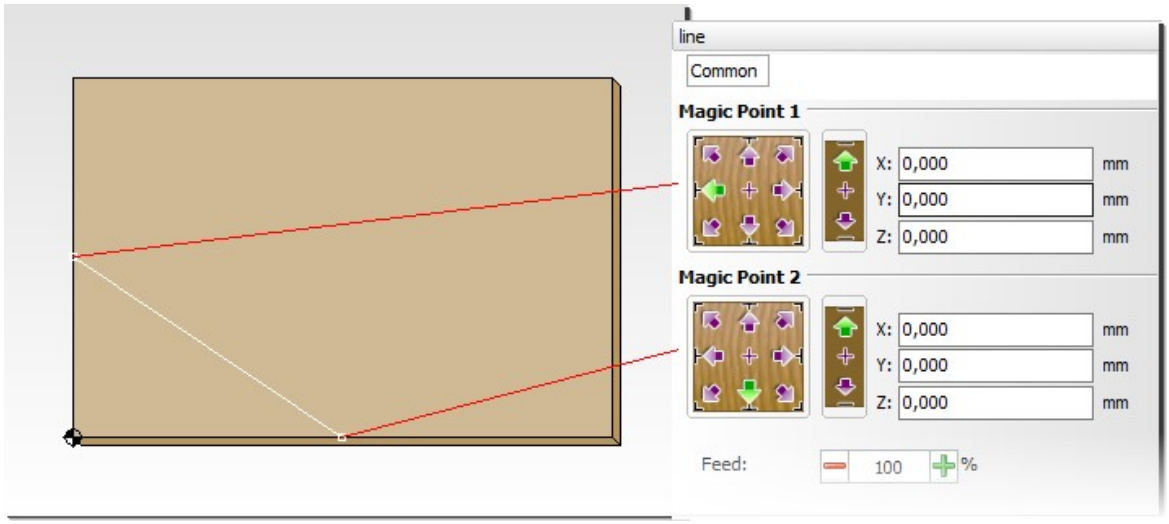
See also:

Start point

2.2.1.2 Line



This basic element consists of a milled line between two points.

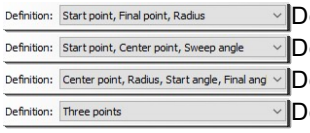


Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Point 1
  Defines a line's start point in the form of a Magic Point.
- Point 2
  Defines a line's end point in the form of a Magic Point.
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).

2.2.1.3 Arc

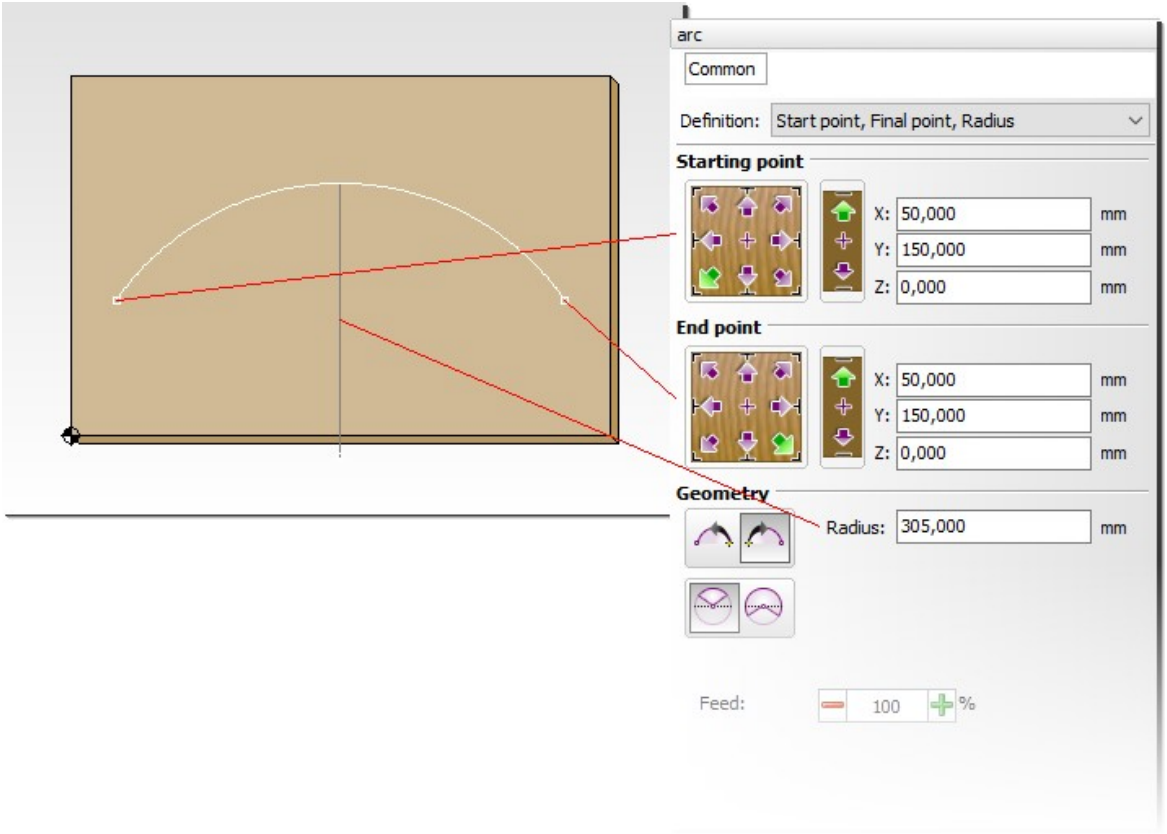
An arc can be defined geometrically in many ways. TwinCAM offers the user our definition methods. These are displayed as selection buttons at the head of the dialogue.



Defined by start point, end point and radius.
Defined by start point, mid point and opening angle.
Defined by mid point, radius and closing angle.
Defined by three points.

» ***Type 1 (Start point, end point and radius)***

In order to describe an arc of this type, the start point end point and radius are required.



Parameters:

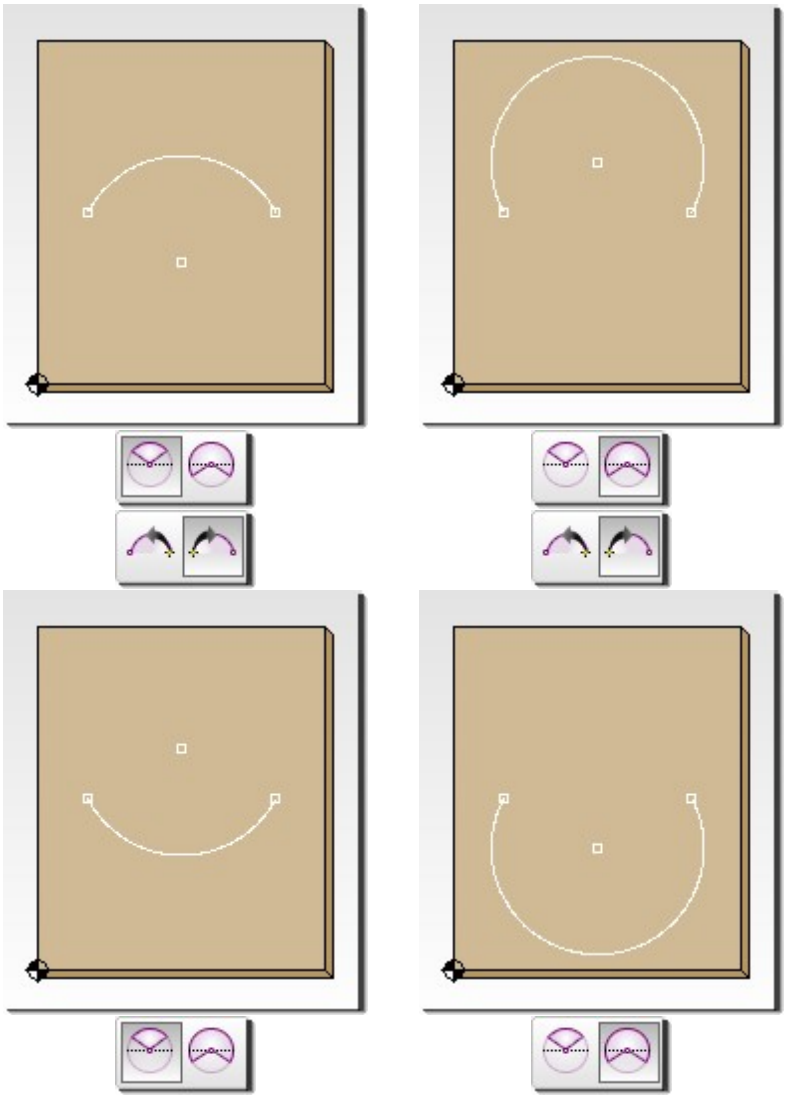
- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated

in this way cannot be reactivated using a condition. It must be reactivated directly by the user.

- Start Point
  Defines the start point of an arc in the form of a Magic Points.
- End point
  Defines the end point of an arc in the form of a Magic Points.
- Radius
  Radius of the arc; the mid point is calculated automatically.
- Depth
  Depth of a contour element. There is only one depth value for a contour and that is the depth at the *end* of the contour. The depth at the beginning of the contour is taken either from the depth of the previous element or the start point.
- Feed rate
  Feed rate for this section of contour (Detail).

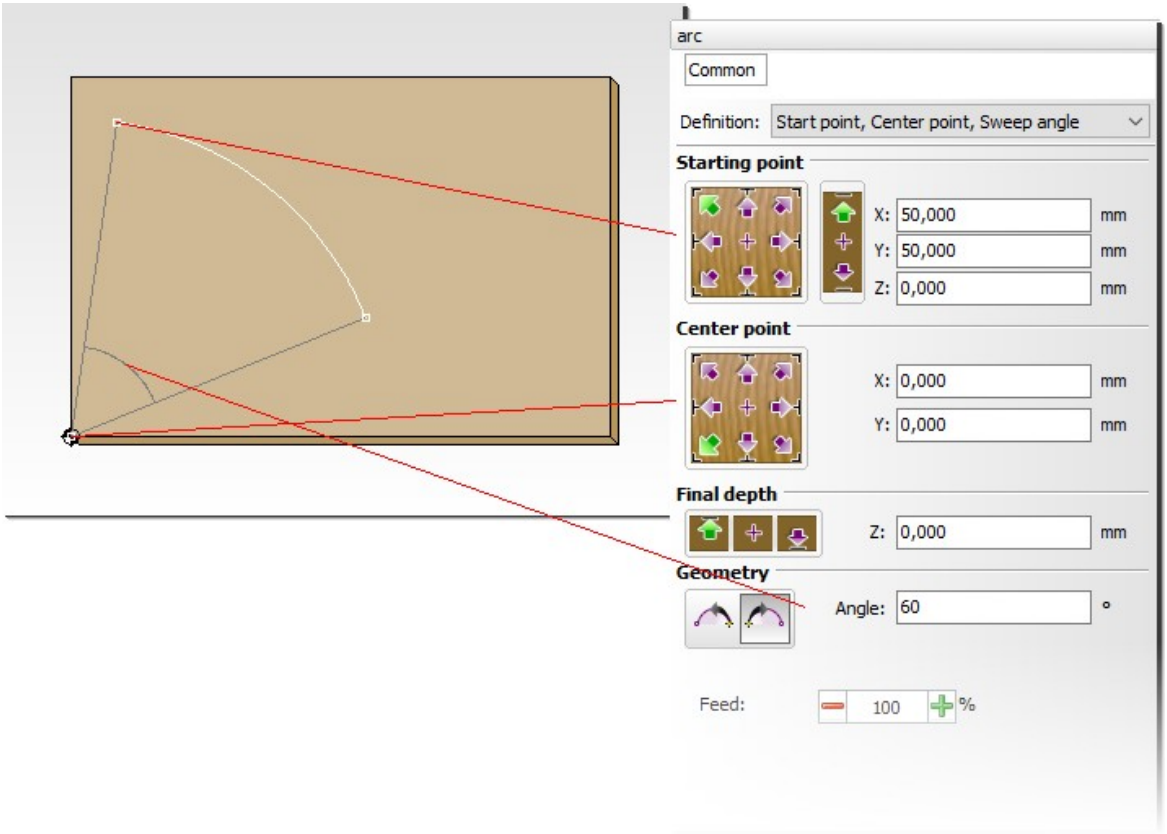
An arc which is described via the start point end point and radius is ambiguous. There are four possible interpretations which can be clarified by settings for the opening angle (> *180°*) and the direction.

- > 180°
  As long as the radius is larger than half the distance between the start point and the end point, the arc can be either "short" (opening angle is <= 180°) or "long" (opening angle is > 180°). If the radius is less than half the distance from start point to end point the result will be a half circle (opening angle = 180°).
- Direction
  The run of the arc from start point to end point is defined as clockwise "CW" or counterclockwise "CCW".



» *Type 2 (Start point, mid point and opening angle)*

If the co-ordinates of the start point and mid point are known, together with the opening angle, the arc can be defined using this method.



Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Start Point
  Defines the start point of an arc in the form of a Magic Points.
- Midpoint
  Defines the mid point of an arc in the form of a Magic Point .
- Opening angle
  Opening angle of the arc. The direction of the arc is defined by the "direction" parameter (CW or CCW). A plus or minus sign in front of the angle should not be used.

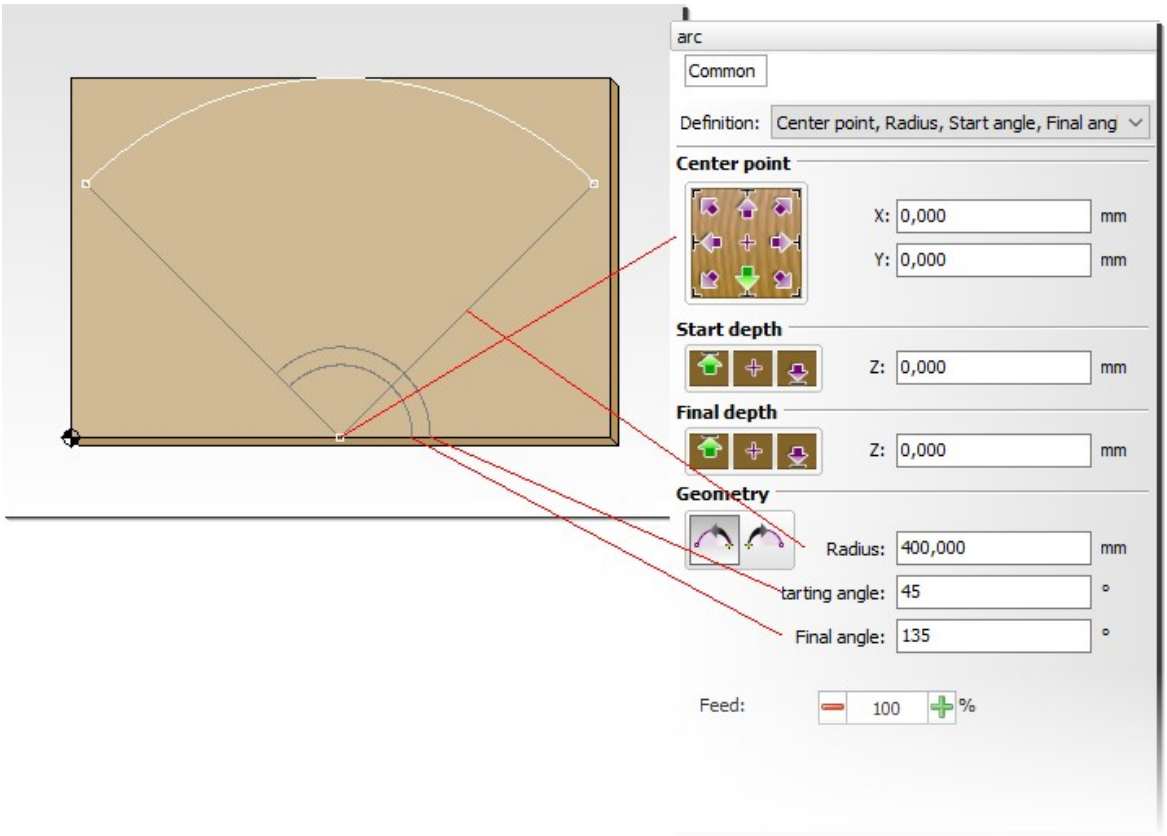
- Depth
  Depth of a contour element. There is only one depth value for a contour and that is the depth at the *end* of the contour. The depth at the beginning of the contour is taken either from the depth of the previous element or the start point.
- Feed rate
  Feed rate for this section of contour (Detail).
- Direction
  The run of the arc from start point to end point is defined as clockwise "CW" or counterclockwise "CCW".

Note:

If a full circle is to be defined, this method should be used with an opening angle of 360°. All the other definition methods are likey to cause unforeseen errors if used with a full circle.

» *Type 3 (Mid point, radius, start angle and end angle)*

Using this method, an arc can be constructed using the data for the mid-point, radius and start and end angles.



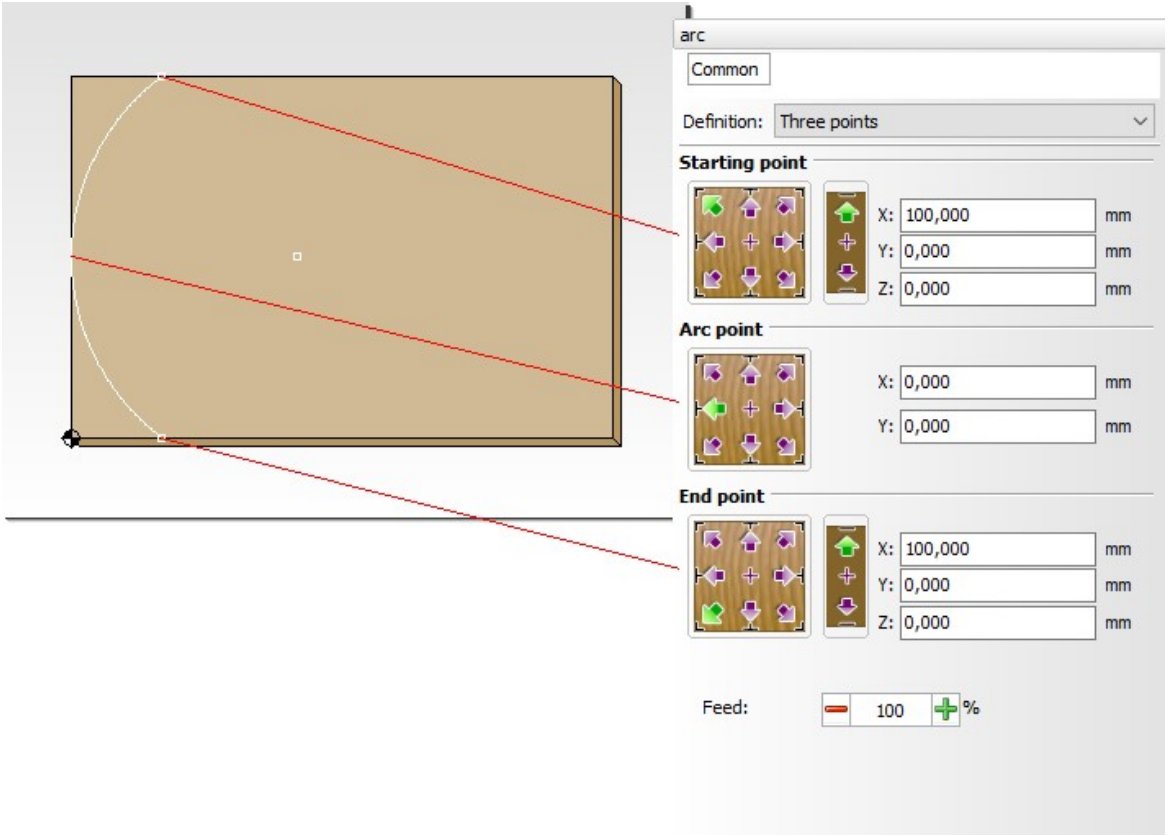
Parameter:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.

- Midpoint
  Defines the mid point of an arc in the form of a Magic Point .
- Starting angle
  The angle between the 0 degree line (parallell to the X axis) and start point of the arc though the mid point.
- End angle
  Angle between the 0 degree line and the arc end point, through the mid point.
- Radius
  Radius of the arc; the mid point is calculated automatically.
- Depth
  Depth of a contour element. There is only one depth value for a contour and that is the depth at the *end* of the contour. The depth at the beginning of the contour is taken either from the depth of the previous element or the start point.
- Feed rate
  Feed rate for this section of contour (Detail).
- Direction
  The run of the arc from start point to end point is defined as clockwise "CW" or counterclockwise "CCW".

» *Type 4 (Three points)*

This definition requires the data for the start point, the end point and any one other point to create an arc.



Parameters:

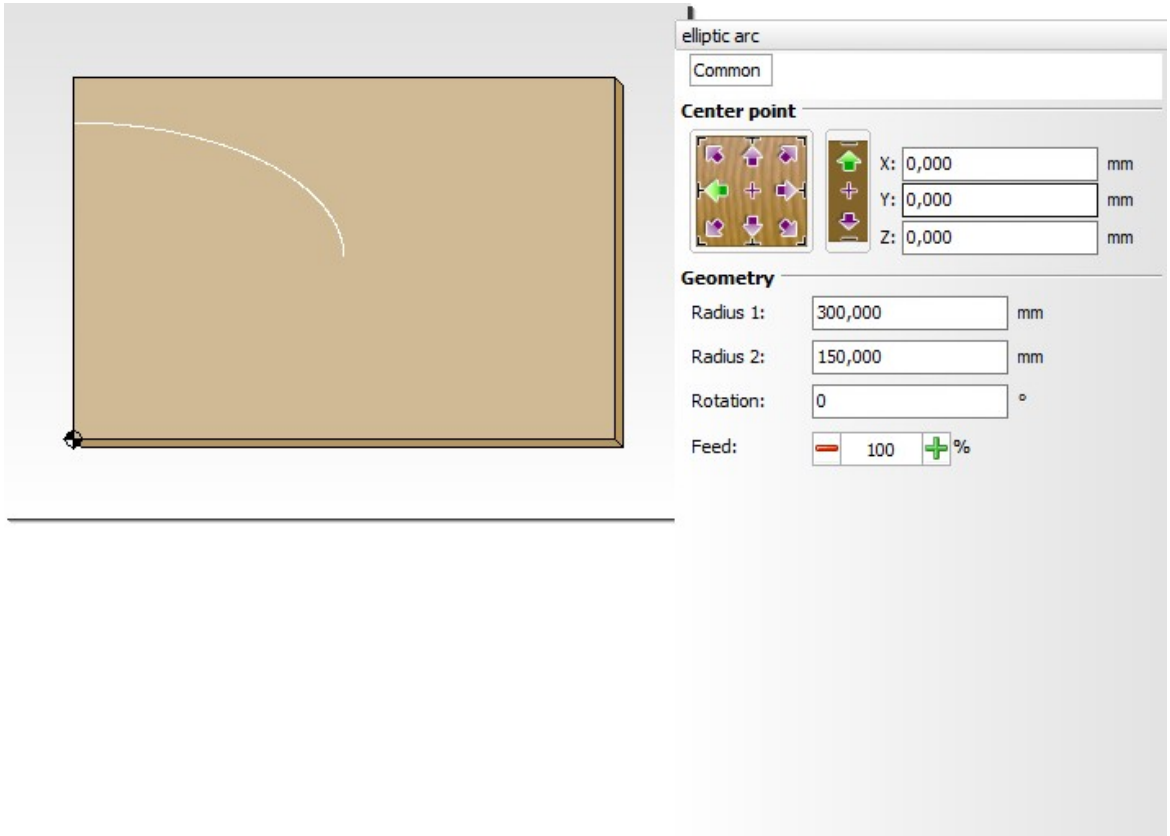
- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element.

The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.

- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Start Point
  Defines the start point of an arc in the form of a Magic Points.
- Arc point
  Defines the arc point in the form of a Magic Point. This may be any point along an arc, but must not be in a direct line between the start and end points. It does not neccessarily need to be in the middle as shown in the example above.
- End point
  Defines the end point of an arc in the form of a Magic Points.
- Depth
  Depth of a contour element. There is only one depth value for a contour and that is the depth at the *end* of the contour. The depth at the beginning of the contour is taken either from the depth of the previous element or the start point.
- Feed rate
  Feed rate for this section of contour (Detail).

2.2.1.4 Ellipse

This contour element is a quarter ellipse and is, mathematically speaking, an approximation. Programme generation renders the ellipse as arc segments.



Parameters:

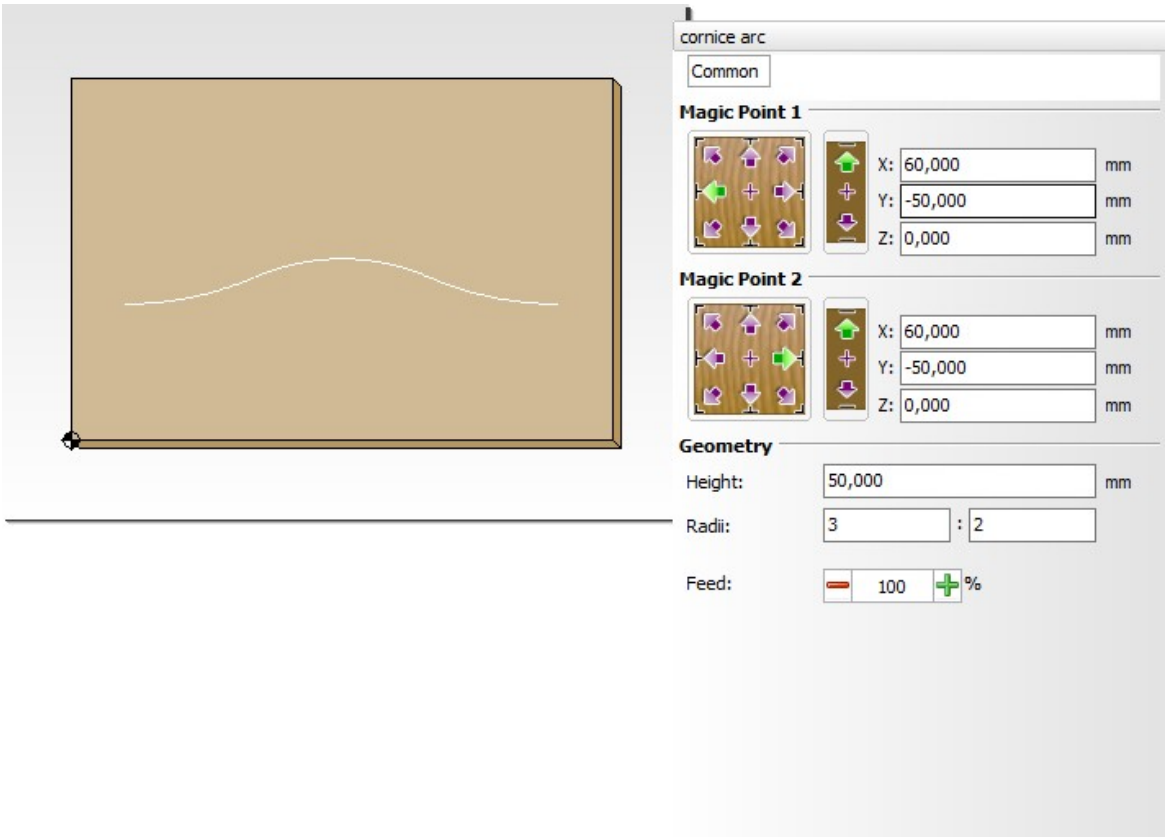
- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Position
  The mid point position of the ellipse in the form of a Magic Point.
- Radius 1 / 2
  Two radii, vertically above one another.
- Turn
  The base line of an ellipse may be turned by entering an angle. As a result the directions of the two radii will also be turned.
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).

Note:

The accuracy of the ellipse is defined in the "_SystemEllipsePrecision" global variable. This is done by entering the maximum permissible difference in millimeters from the mathematically correct path. If this variable has no given value, a standard logarithm is used, which resolves the ellipse as two tangentially linked arcs. This will generally be a fairly inaccurate approximation.

2.2.1.5 Cornice Arc

The Cornice Arc is a combination of three arcs. The radii of the two outer arcs are in a defined ratio to the inner arc.



Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Point 1
  Beginning point of a cornice arc as a Magic Point.
- Point 2
  End point of a cornice arc as a Magic Point.
- Height
  The height of the mid cornice arc above the base line, which is defined by the line from point one to point two.
- Radii
  The ratio between the radii of the two outer arcs and the radius of the centre arc.
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).

2.2.1.6 Start Point

A start point defines the beginning of a milled contour. Apart from the property of collecting a number of elements, it is also able to capture the technological details required for milled work.

General parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  The element's priority reference number. Further information can be found in the Editor chapter under display priorities or in the appendix under Layers und Priorities.

If a group is being edited, the below described dialogue will appear.

The dialogue is divided into four register tabs.

1. Position / Type
2. Approach and detach
3. Frame / Rotation

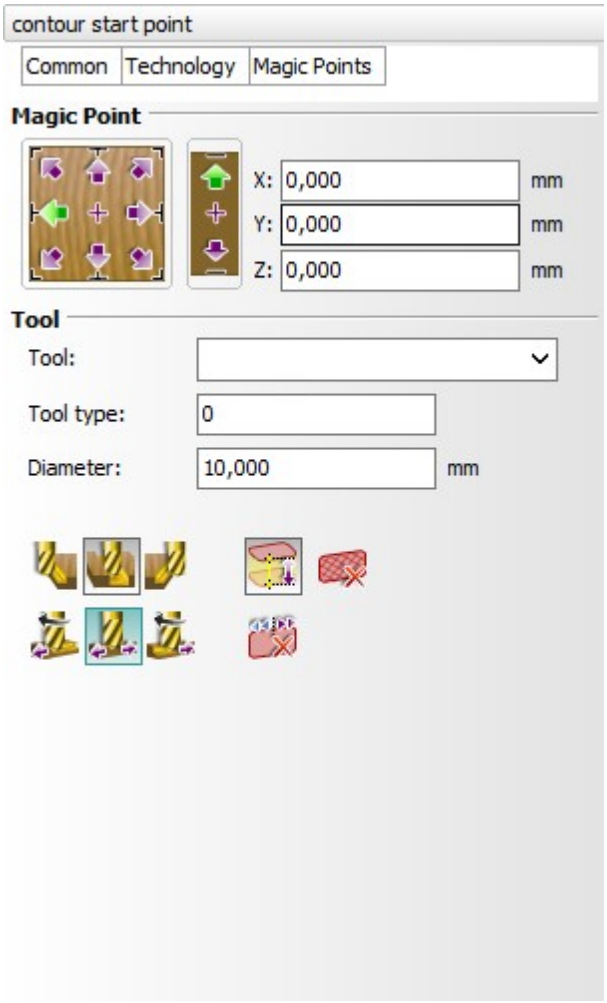
Note:

Frame and rotation equate to the settings for normal groups.

See also:

Groups
Contours
Automatic contouring

» ***Position / Type***



Parameters:

- Position
  To allot a start point to a contour, the start point must be located at the beginning of the contour; the Z value (approach depth) is immaterial. This point is a Magic Point.
- Router type / diameter
  Tool selection is carried out in the first instance by tool type. If a dimeter is also specified, then the tool of the correct type number with the specified diameter will be selected. If a tool type of 0 is entered, selection is based entirely on the tool diameter. This may lead to false selections particularly with profile routers (Details).
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).
- Correction
  Tool radius correction factor. The choices are "*None*", "*Left*" or "*Right*".
- Option
  Cutting direction. The possible choices are: cutting "*with*" the direction of cut or "*against*" the direction of cut. Entering "*None*" removes this limitation from tool selection.

  If the "*reversible*" switch is activated, TwinCAM will automatically reverse the direction of the contour if a tool with the correct direction of rotation cannot be found and there is one for the opposite direction.
- Z-Laser
  Laser projection. If this switch is activated, a laser projector output is generated for the contour. The outline of the overall dimensions of the panel and the contour are projected.

- Z-Override
  Although each contour has a setting for the depth in Z, activating this switch causes the individual element depths to be substituted by the startpoint Z value. Thus the whole contour has a common depth, which can be set in one location rather than several.
- Reversible
  Activating this switch marks the contour as reversible. See also *Option*.

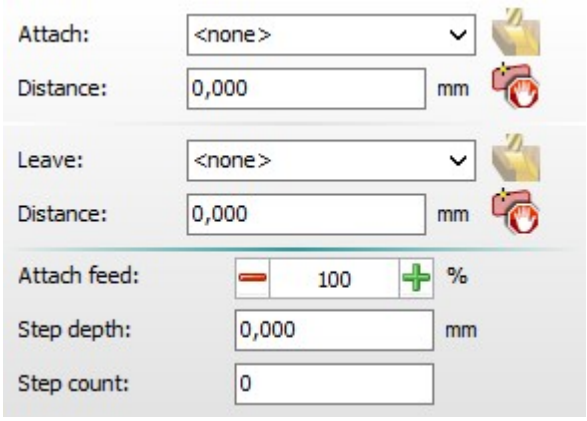
Tip:

If one or more contour elements are marked and grouped using the context menu, a start point is generated automatically and placed at the beginning of the first element. If the cutting direction of the first element is wrong, the start point will appear at the wrong end of the first element, within the contour. This can be corrected by selecting the element whilst holding down the ALT key and then selecting "*reverse*" from the context menu.

Note:

If the Z position is referenced to the lower surface of the panel and a Z offset of 0 is entered, the tool clearance height will be added to the cutting depth so that the machining is carried out from underneath the panel.

» *Approach and Detach*



Parameter:

- Approach and detach
  It is possible to select a separate strategy for the attach and leave paths. Dependent on the strategy selected, an attach or leave position is calculated taking account of any clearances set. Between the attach position and the start point or the end point and the leave position, movement is carried out as defined by the feed rate in the start point. The tool radius correction factor is already in place on arrival at the attach position and remains valid to the leave position. The following attach/leave paths are available:
  - None
  - Straight vertical *)
  - Straight Tangential
  - Quadrant *)
  - Semicircle *)

  *) These strategies require the entry of a correction factor so that TwinCAM can calculate the attach/leave direction.
- Abstand
  Dieser Wert gibt den Abstand zwischen An- bzw. Abfahrposition und Anfangs- bzw. Endpunkt der Kontur wieder. Grundsätzlich gilt: Der im Werkzeug konfigurierte Sicherheitsabstand zuzüglich des Werkzeugradius wird nie unterschritten, auch wenn der Wert in diesem Feld kleiner als dieses Minimum (oder 0) ist.

- fliegend
  Wird dieser Schalter aktiviert, so erfolgt die Zustellung in Z zwischen der Anfahrhöhe und der Konturtiefe kontinuierlich im Verlauf des An- bzw. Abfahrweges. Andernfalls wird die Zustellung an der An- bzw. Abfahrposition durchgeführt.
- Stop
  Dieser Schalter bewirkt einen programmierten Halt vor dem Anfahren bzw. nach dem Abfahren der Kontur.
- Zustellung Schritte
  Wird hier ein Wert größer 0 eingetragen, so erfolgt die Tiefenzustellung in der angegebenen Anzahl Schritte. Die Kontur wird entsprechend oft abgefahren.
- Zustellung Schritttiefe
  Wird hier eine Schritttiefe angegeben, so wird die Kontur in mehreren Schritten abgefahren, wobei in jedem Schritt eine Z-Zustellung von höchstens der angegebenen Schritttiefe erfolgt. Die Anzahl der Schritte ist in diesem Fall abhängig von der Konturtiefe und der Zustellungstiefe pro Schritt. Wurde bereits eine Vorgabe über die Anzahl der Schritte getroffen, so hat diese Vorrang gegenüber der Angabe der Schritttiefe.

» ***Group Frame***

- Group frame (Point 1 / Point 2)
  With the aid of the parameters Point 1 and Point 2, two opposite corners of a cuboid can be described. All Magic Point references within the group will now be referenced to the group frame rather than the panel edges. In this way groups of elements can easily be copied or moved without having to do without Magic Point Parameterisation.
- Rotation
  A group can be rotated about itself. This is done by setting a pivot point and an angle of rotation. All elements in the group will be rotated about the given point by the stated angle.

2.2.2 Pockets

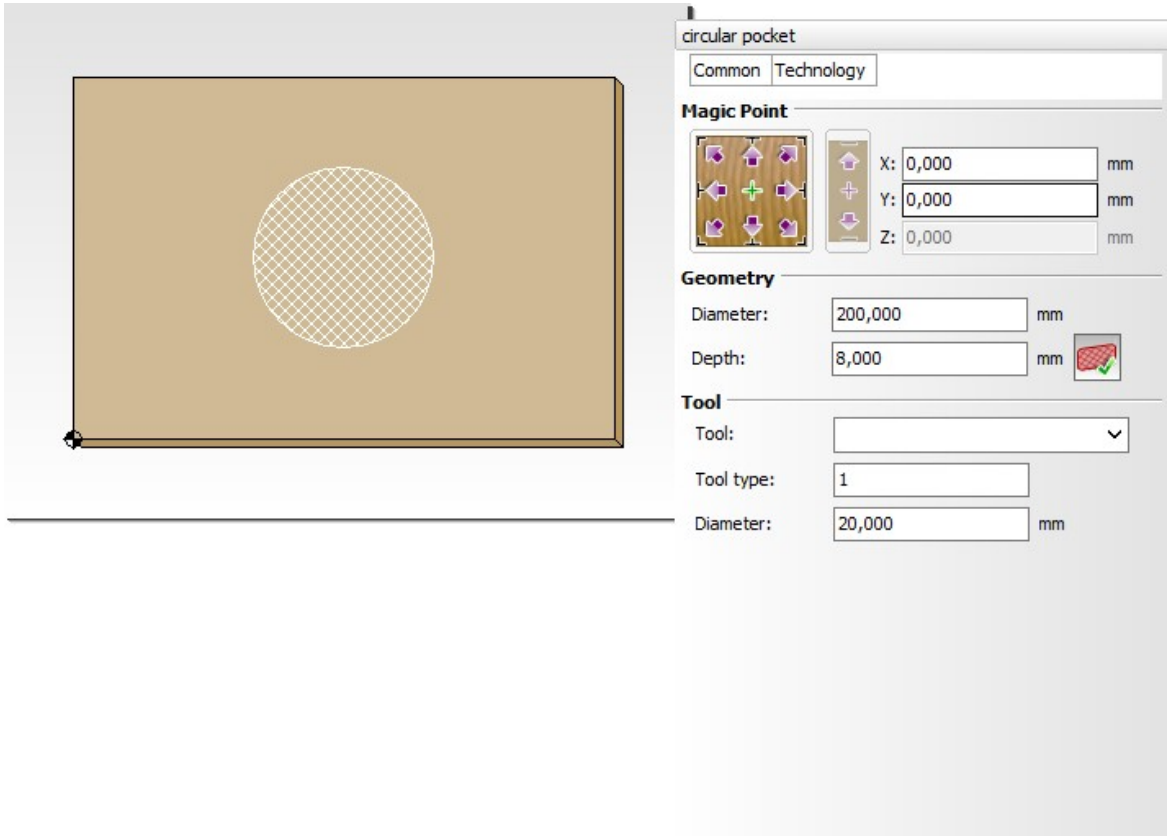
Pockets (and cut-outs) are created using the following elements. No start point is required as the technological data are entered with the positional and geometric data in the same dialogue.

Two types of pocket are available in TwinCAM:

1. Circular pockets
2. Rectangular pockets

2.2.2.1 Circular Pockets

This basic element can create either a pocket or a cut-out. In contrast to the milled elements already described, the pocket needs no start point as all the required technological data are entered in the initial dialogue. with the positional and geometric data.



Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  The element's priority reference number. Further information can be found in the Editor chapter under display priorities or in the appendix under Layers und Priorities.
- Position
  Defines the mid point of the pocket as a Magic Point.
- Diameter
  Diameter of a circular pocket.

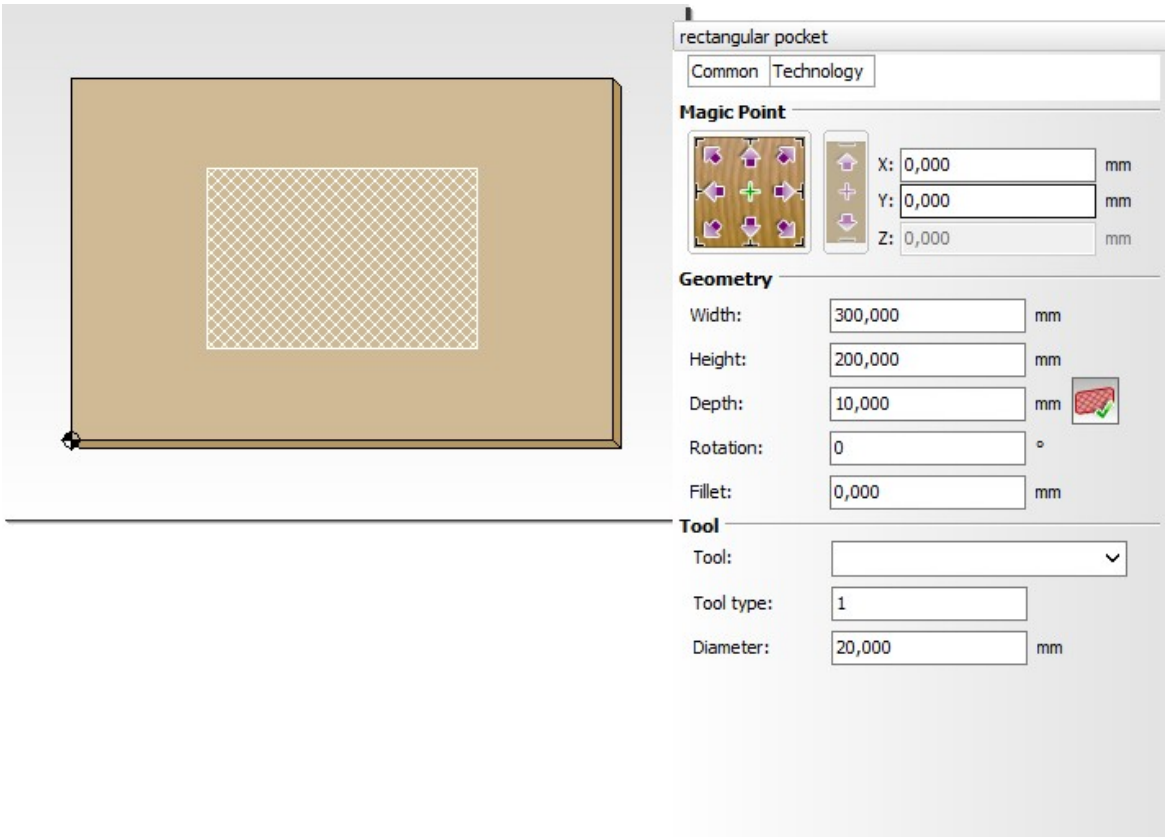
- Router type / diameter
  Tool selection is carried out in the first instance by tool type. If a dimeter is also specified, then the tool of the correct type number with the specified diameter will be selected. If a tool type of 0 is entered, selection is based entirely on the tool diameter. This may lead to false selections particularly with profile routers (Details).
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).
- Depth
  Depth of the pocket.
- Step depth
  It is often the case that a pocket or cutout cannot be cut in one process. If a step depth is entered, TwinCAM will program sufficient cycles so that the pocket is cut in stages without the step depth being exceeded.
- Pocket
  This switch defines whether a pocket or a cutout will result. A pocket is routed, whilst a cutout is cut as a solid piece. A pocket is shown as a hatched area on the drawing whilst a cutout is shown as a circle.
- Cutting direction
  The clearance cycle can be set to be carried out clockwise (CW) or Counter (anti) clockwise (CCW). By using this in conmbination with tool selection it is possible to define whether the work should be carried out with or against the direction of rotation.
- Steps
  As an alternative to setting the step depth, the number of steps can be set.

Tip:

If you want or need to create a circular cut-out without leaving a solid piece of debris, a pocket can be cut with the same or greater depth as the panel.

2.2.2.2 Rectangular Pockets

This element creates rectangular pockets and cut-outs. The majority of the details are as for circular pockets, including the fact that no start point is required as all the required data, including the technological data are entered in the same dilaogue.



Rectangular pocket parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  The element's priority reference number. Further information can be found in the Editor chapter under display priorities or in the appendix under Layers und Priorities.
- Position
  Defines the mid point of the pocket as a Magic Point.
- Width
  Width of the pocket.
- Height
  Height of the pocket.
- Router type / diameter
  Tool selection is carried out in the first instance by tool type. If a dimeter is also specified, then the tool of the correct type number with the specified diameter will be selected. If a tool type of 0 is entered, selection is based entirely on the tool diameter. This may lead to false selections particularly with profile routers (Details).
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).

- Depth
  Depth of the pocket.
- Step depth
  It is often the case that a pocket or cutout cannot be cut in one process. If a step depth is entered, TwinCAM will program sufficient cycles so that the pocket is cut in stages without the step depth being exceeded.
- Pocket
  This switch defines whether a pocket or a cutout will result. A pocket is routed, whilst a cutout is cut as a solid piece. A pocket is shown as a hatched area on the drawing whilst a cutout is shown as a circle.
- Winkel
  Drehung der Grundlinie im angegebenen Winkel um den Mittelpunkt.
- Rounding
  Radius of rounded corners.
- Cutting direction
  The clearance cycle can be set to be carried out clockwise (CW) or Counter (anti) clockwise (CCW). By using this in conmbination with tool selection it is possible to define whether the work should be carried out with or against the direction of rotation.
- Steps
  As an alternative to setting the step depth, the number of steps can be set.

Note:

The radius for rounded corners must be at least the radius of the tool to be used.If a large radius is required the cutting path will be adjusted accordingly.

Tip:

If a rectangular cut-out is required without producing a large piece of solid debris, cut a pocket with a depth at least as great as the depth of the material.

2.2.3 Text

With the aid of this element, text can be machined. Any Windows TrueType font can be selected and TwinCAM will generate an outline contour for the required text. The dialogue box for this element also contains the technological data as well as the geometric data, so no start point is required.

Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  The element's priority reference number. Further information can be found in the Editor chapter under display priorities or in the appendix under Layers und Priorities.
- Position
  Gibt die Position der Schrift als Magic Point an.
- Router type / diameter
  Tool selection is carried out in the first instance by tool type. If a dimeter is also specified, then the tool of the correct type number with the specified diameter will be selected. If a tool type of 0 is entered, selection is based entirely on the tool diameter. This may lead to false selections particularly with profile routers (Details).
- Height
  Height of the text, by which is meant the height of the text frame, not the height of the individual letters. This will vary with the font selected and includes the up- and downstrokes.
- Angle
  Rotation of the base line about the defined position.
- Text
  The text to be machined.

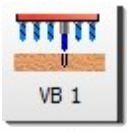
- Font
  Clicking on the font button, opens a selection dialogue. All the Windows fonts installed on your computer are available and all can be selected as bold or italic. The remaining settings have no effect on the appearance of the resulting work.
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).

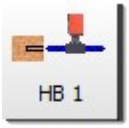
Note:

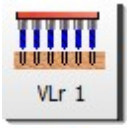
Whilst any Windows TrueType font can be converted into a milled contour by TwinCAM, some are less suitable than others. Some fonts may generate an unreasonable number of arc contours or may create fragile work. If a font is used which is not available on the system which is carrying out the machining, TwinCAM will default to "Arial".

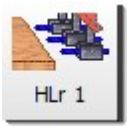
2.3 Drilling

The following section explains the basic elements that TwinCAM provides for the creation of drilled elements.

- Vertical drillings - single 

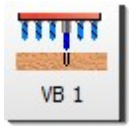
- Horizontal drillings - single 

- Vertical drilled row 

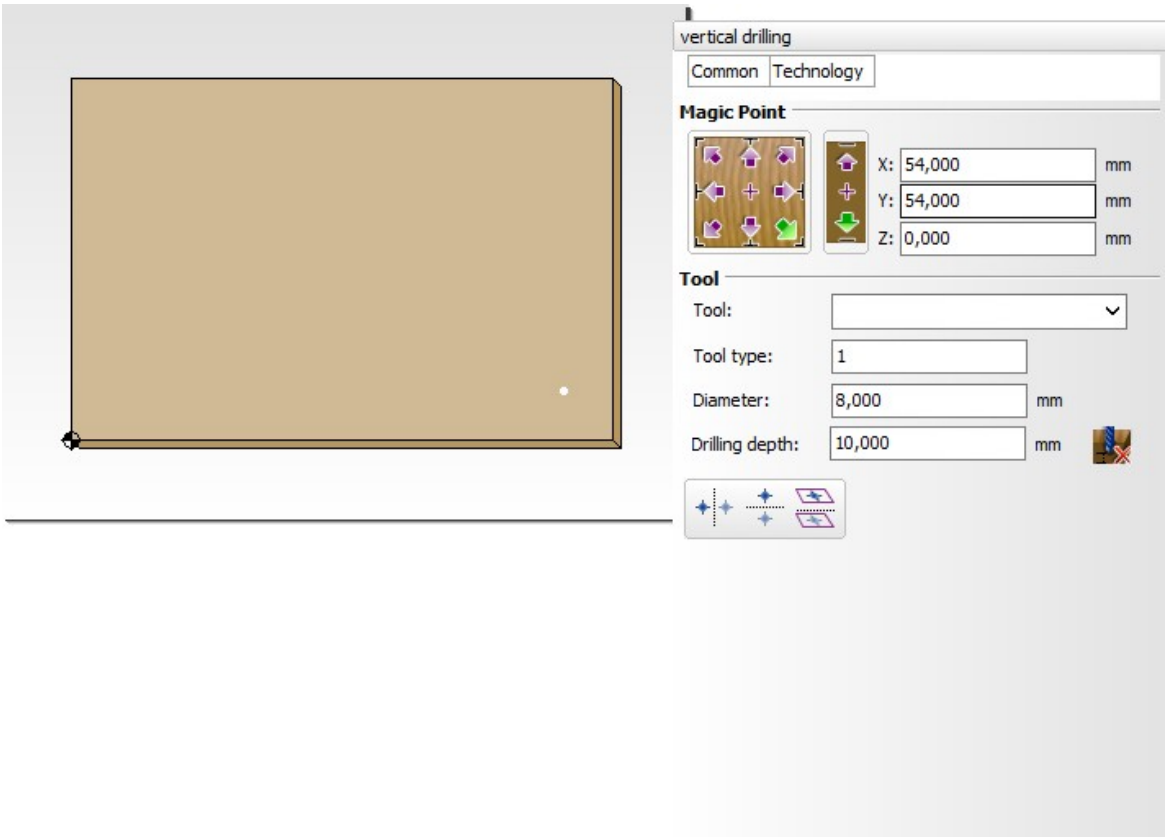
- Horizontal drilled row 

2.3.1 Single drillings

2.3.1.1 Vertical drillings



This element sets the position for a single vertical drilling. These are, by definition, carried out vertically from above.

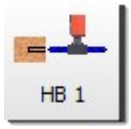


Parameters:

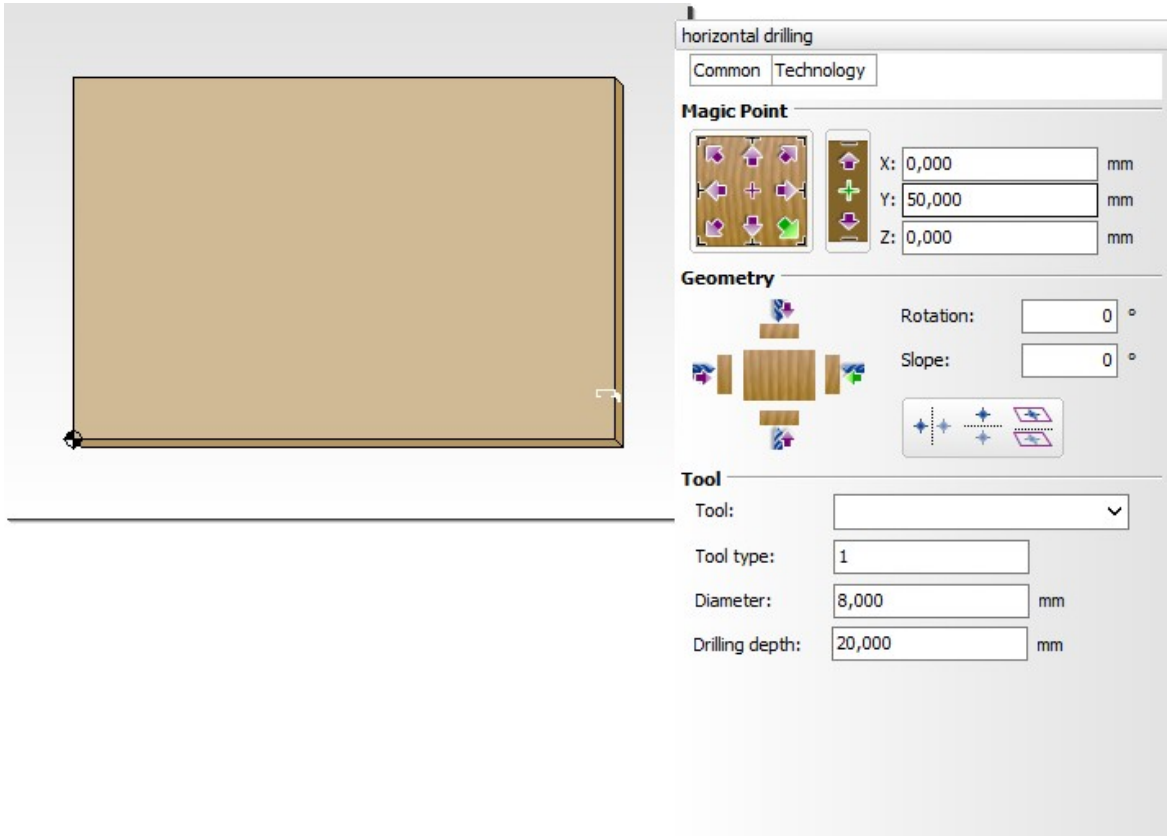
- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  The element's priority reference number. Further information can be found in the Editor chapter under display priorities or in the appendix under Layers und Priorities.
- Position
  The position indicates the start point for the drilling in the form of a Magic Points. The Z position in particular defines the location of the upper surface. The drilling depth is defined in "*drilldepth*". The machine can move to this point in high speed mode. Once this location has been reached, information about the cycle and feed rate is taken into account. Safety margins, as always in TwinCAM, are also taken account of.
- Drill depth
  Depth of the drilling.
- Type / Diameter
  Tool selection is carried out by type and/or diameter. Both type and diameter must match the requirements of the work to be carried out (Details).
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).

- Cycle
  Machine manufacturers can pre-set drilling cycles. by entering a code in this field the various cycles can be accessed.
- Drill through
  If this switch is activated TwinCAM will drill through the material irrespective of panel thickness or drill depth. Whilst doing so, TwinCAM will take account of the Z axis clearance required for the drill in question.
- Mirror
  This option allows individual drillings and drilled rows to be mirrored about the panel's mid axis.

2.3.1.2 Horizontal drillings



A horizontal drilling is always placed in one of the four vertical faces of the panel. It can, however, be tilted or angled to a limited extent.



Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.

- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  The element's priority reference number. Further information can be found in the Editor chapter under display priorities or in the appendix under Layers und Priorities.
- Position
  The position indicates the start point for the drilling in the form of a Magic Points. The Z position in particular defines the location of the upper surface. The drilling depth is defined in "*drilldepth*". The machine can move to this point in high speed mode. Once this location has been reached, information about the cycle and feed rate is taken into account. Safety margins, as always in TwinCAM, are also taken account of.
- Drill depth
  Depth of the drilling.
- Type / Diameter
  Tool selection is carried out by type and/or diameter. Both type and diameter must match the requirements of the work to be carried out (Details).
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).
- Cycle
  Machine manufacturers can pre-set drilling cycles. by entering a code in this field the various cycles can be accessed.
- Rotation
  The direction of drilling is rotated about the Z axis by the given number of degrees.
- Tilt
  A drilling can be tilted at an angle to the plane vertical to the direction of drilling. The tilt axis may also be turned by a given angle. The angle of tilt is entered here.
- Drill through
  If this switch is activated TwinCAM will drill through the material irrespective of panel thickness or drill depth. Whilst doing so, TwinCAM will take account of the Z axis clearance required for the drill in question.
- Mirror
  This option allows individual drillings and drilled rows to be mirrored about the panel's mid axis.
- Side
  These four buttons define the basic direction of the drilling. Tilt and turn are calculated in relation to the basic direction. The choices are: "*from right*", "*from front*", "*from left*" and "*from behind*".

2.3.2 Drilled Rows

In TwinCAM, drilled rows can also be described parametrically. This is valid not only for vertical rows but also for horizontal rows.

The drilled row dialogue is an exceptionally powerful one, to give the user the greatest possible degree of flexibility in programming. Unfortunately this also means that there is rather more to learn with this particular dialogue. The quickest way to learn your way around this feature is by simply trying it out. However, once you have learned how to use this feature you will find it capable of very complex work.

The basic concepts are explained in this section and apply to both horizontal and vertical rows.

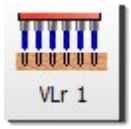
1. Setting the direction.
   Rows can run either in X or Y. Depending on which is chosen, some of the buttons in the dialogue change. It is therefore better to set the direction from the outset.
2. Setting a reference point within the row.
   The first or last drilling in a row may be chosen as a start point (see point 3) but the mid point of a row can also be selected. If the mid point is chosen, this may or may not coincide with the actual location of a drilling.

3. Entering the start point.
   The start point for a row aligned in X can be reference to the left or right panel margins or the mid point of the edges in the X axis In the case of a row aligned in Y, the start point can be referenced to the upper or lower margins or the mid point of the edges in the Y axis.
4. Setting the position of the row.
   This step sets the row's position in terms of its distance from a parallel panel margin. For a row aligned with the X axis, this may be the upper or lower panel edge or the mid X axis. For rows aligned to the Y axis, the distance is taken from either the left or right panel margin or the mid Y axis. Finally, for horizontal rows the distance is taken from the upper or lower surface or the mid Z axis.
5. Setting the length of the row.
   There are two ways of doing this:
   a) Entering a margin to the edge of the panel.
      If the mid point of the row was given as reference in step 1, then this margin applies from both ends of the row. In any other case the margin only applies to the end of the row furthest from the reference point.
   b) Entering a hole count.
      The given number of holes will be drilled, provided that the holes will fit completely on the panel. Drillings which due to changes in the panel dimensions would be either outside or on the edge of the panel are ignored. Of course, a Formula can be entered here to calculate the required number of drillings dynamically.
6. Other settings
   Apart from the general drilling parameters it is also possible to set the interval, or space between drillings in the row.

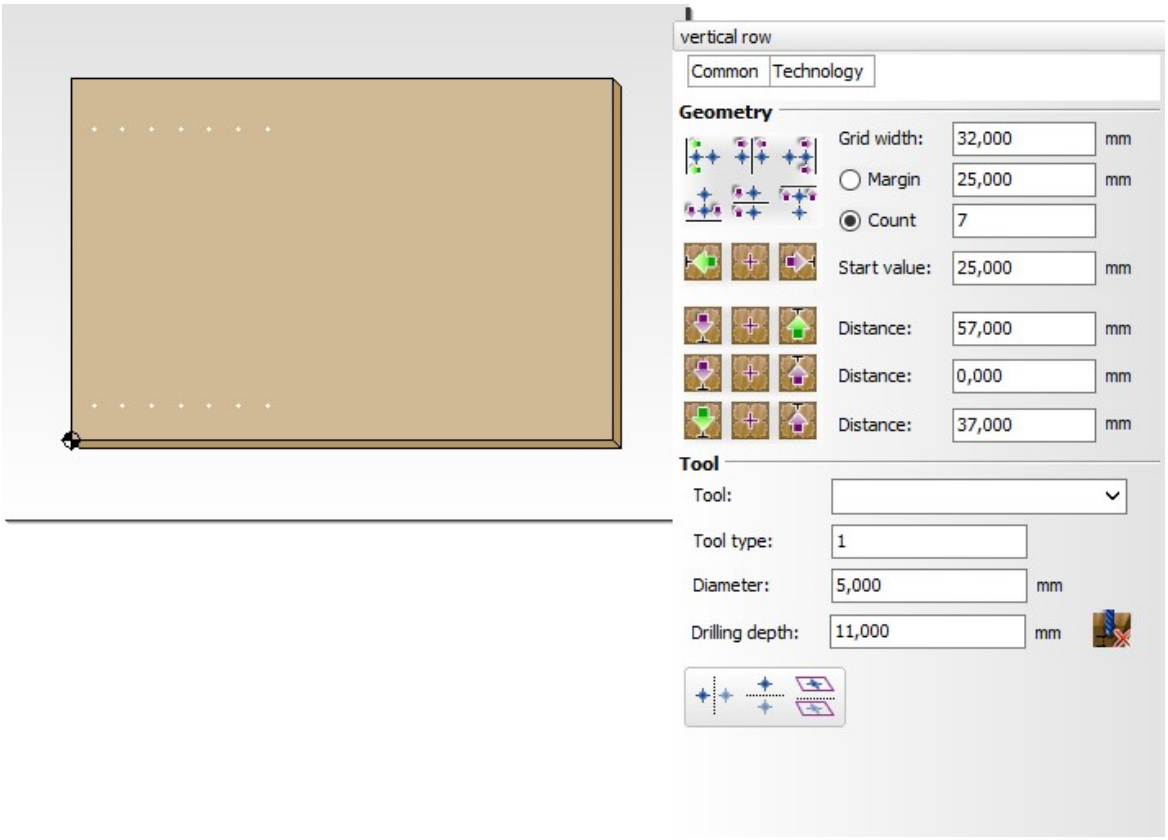
See also:

Vertical rows
Horizontal Rows

2.3.2.1 Vertical Rows



The basic vertical row element permits the programming of up to three rows in one step.



1. Setting the direction.
   Select one of the top row of buttons to make the row run in X; the lower row of buttons will set the row to run in Y. Changing these settings will also change the appearance of the buttons for steps 3 and 5. (see illustration).
2. Setting a reference point within the row.
   The same buttons set the reference point within the row. The first or last drilling or the mid point of the row can be chosen. The reference point is the point that is positioned in step 3.
3. Setting the start point.
   The point selected as a reference in step two will now be positioned. First a side of the panel must be selected as a reference. The start point will, as is usual with "*Magic Points*", be measured from this side. Rows aligned with the X axis can be reference to the left or right edges of the panel or the mid X axis. Rows aligned with the Y axis can be referenced to the upper or lower edges of the panel or the mid Y axis.
4. Setting the row's position.
   Up to three rows can be defined at the same time, using three sets of buttons and a data entry field. In the same way as the start point is set, first select a reference and then an offset from it. Clicking on a button for a second time deactivates the row.
5. Setting the length of the row.
   The length of the row is set either by entering a margin or a hole count as described in the general description of drilled rows.
6. General parameters:

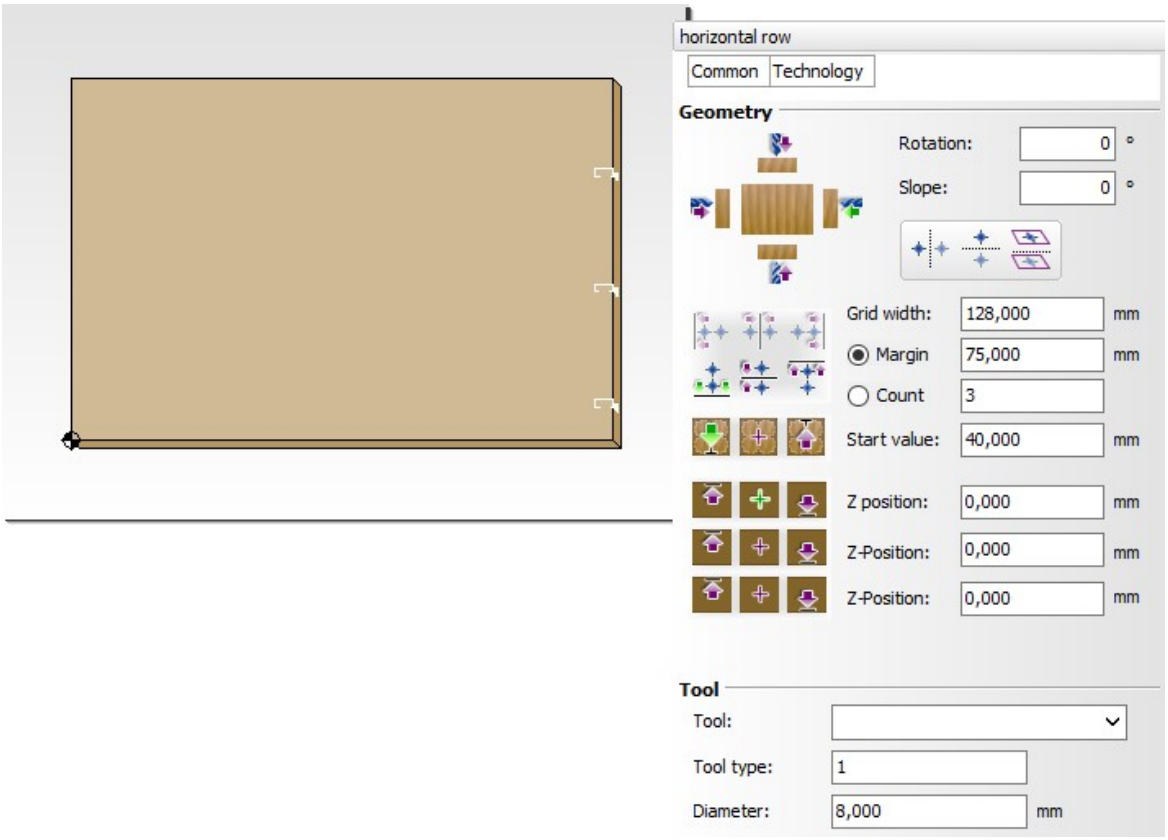
- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the

user does not provide one.

- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  The element's priority reference number. Further information can be found in the Editor chapter under display priorities or in the appendix under Layers und Priorities.
- Drill depth
  Depth of the drilling.
- Type / Diameter
  Tool selection is carried out by type and/or diameter. Both type and diameter must match the requirements of the work to be carried out (Details).
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).
- Cycle
  Machine manufacturers can pre-set drilling cycles. by entering a code in this field the various cycles can be accessed.
- Drill through
  If this switch is activated TwinCAM will drill through the material irrespective of panel thickness or drill depth. Whilst doing so, TwinCAM will take account of the Z axis clearance required for the drill in question.
- Mirror
  This option allows individual drillings and drilled rows to be mirrored about the panel's mid axis.

2.3.2.2 Horizontal rows

This element is used to create horizontal rows.



1. Setting the direction.
   Setting the side of the panel to which the row is reference sets its direction. Rows referenced to the left or right sides of the panel will be aligned to the Y axis whilst those referenced to the upper or lower sides will be aligned to the X axis.
   Changing the reference here will alter the appearance of the buttons in steps 2 and 3 (see illustration).
2. Setting a reference point within the row.
   A reference point within the row is set by using one of three buttons. The reference can be set as either the first or last holes in the row or the mid point of the row. This is the point, whose position is set in step 3.
3. Setting the start point.
   This sets the position for the reference point set in step 2. The first stage is to select an edge of the panel as a reference. As is usual with "*Magic Points*", the position will be measured from this reference. For rows aligned to the X axis, the left and right panel edges as well as the mid X axis can be used whilst for Y aligned rows the upper andlower edges or the mid Y axis may be used.
4. Setting the rows position.
   In the same way as the start point is set, so a horizontal row is positioned by first setting a reference (upper or lower edge of the panel or the centre line) and then setting a Z value.
5. Setting the length of the row.
   The row length is set either via a margin or a hole count as described in the general description of drilled rows.
6. General parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element.

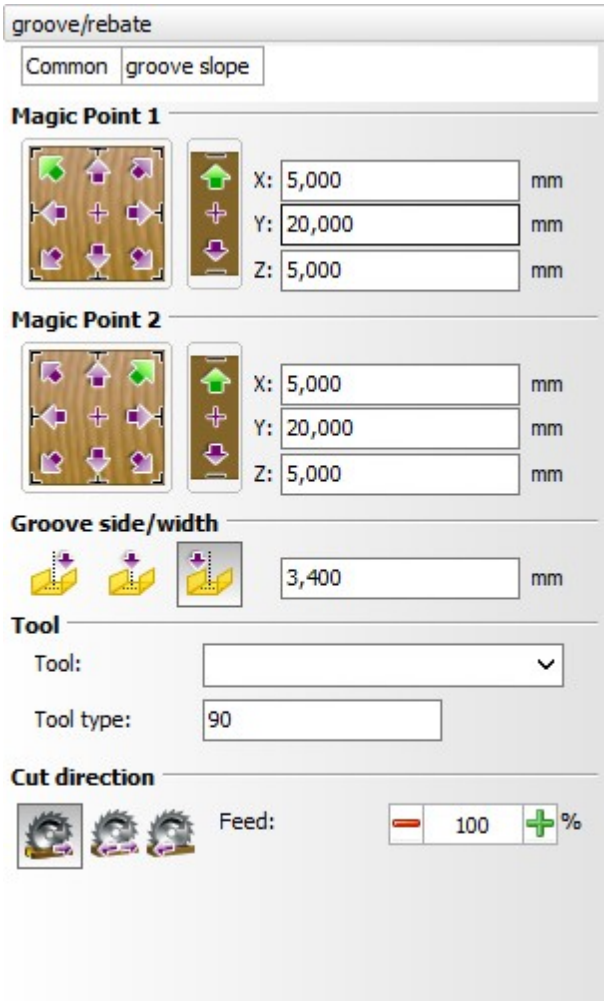
The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.

- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  The element's priority reference number. Further information can be found in the Editor chapter under display priorities or in the appendix under Layers und Priorities.
- Drill depth
  Depth of the drilling.
- Type / Diameter
  Tool selection is carried out by type and/or diameter. Both type and diameter must match the requirements of the work to be carried out (Details).
- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).
- Cycle
  Machine manufacturers can pre-set drilling cycles. by entering a code in this field the various cycles can be accessed.
- Mirror
  This option allows individual drillings and drilled rows to be mirrored about the panel's mid axis.
- Side
  These four buttons define the basic direction of the drilling. Tilt and turn are calculated in relation to the basic direction. The choices are: "*from right*", "*from front*", "*from left*" and "*from behind*".

2.4 Sawing

2.4.1 Groove

The dialogue shown below is used to define groove and saw cuts.



Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  The element's priority reference number. Further information can be found in the Editor chapter under display priorities or in the appendix under Layers und Priorities.
- Point 1
  A groove's start point is defined by a Magic Point.
- Point 2
  The groove's end point is defined by a Magic Point.
- Groove width / tool type
  Selection is carried out on the basis of tool type. If no suitable saw is found, a suitable router will be sought. Blade width is important to the extent that a groove will only be cut with a saw whose blade is narrower than the groove width. If required the groove will be cut in stages up to the required width (Detail).

- Feed rate
  Each tool has a set nominal feed rate defined in the tool administration. The feed rate for each element is set as a percentage of the tool's nominal feed rate (Details).
- Tilt
  
  Provided that a tiltable tool is available, a groove can also be tilted. The tilt is carried out along the line of cut at the angle entered here. The direction of tilt is set with the aid of the two buttons shown.
- Correction
  
  Saw blade correction factor.
- Cutting direction
  
  In a similar way to routed contours, a cutting direction can be entered for saw cuts. The cut will always be made with the saw rotating either with or against the direction of cut as the case may be. If the saw cannot be positioned so that the cut can be made as programmed, the cut will be made in the opposite direction to preserve the direction of rotation that is, the cut will be made from point 2 to point 1.

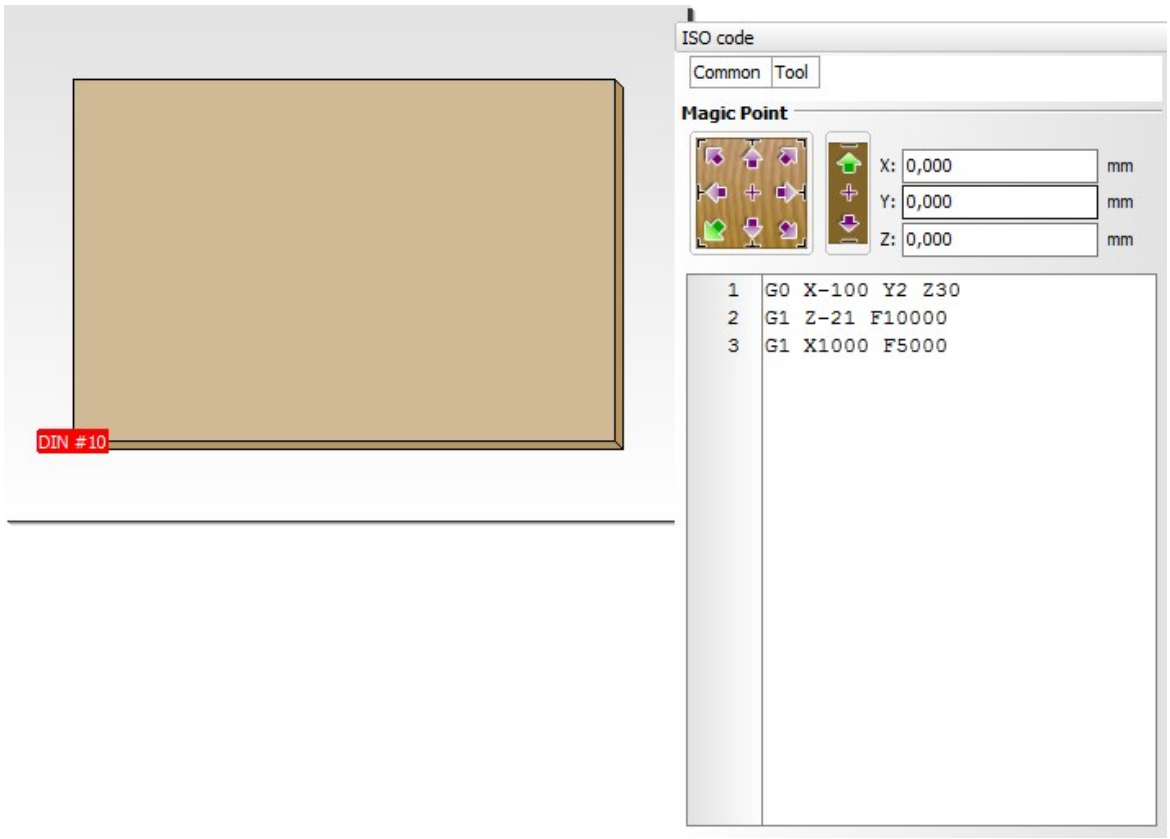
Note:

Where a groove extends to the edge of the panel, the approach will be calculated to start outside the confines of the panel. In any other case the approach will be calculated in such a way as to produce a clean contour.

2.5 Miscellaneous elements

2.5.1 ISO Code

This element allows the insertion of DIN code into a programme.



Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one. In addition, DIN code elements are displayed in the graphical user interface with a small information box showing this information.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Priority
  As with every other element, this one also has a Priority. This value can be used to dictate where the code will be inserted into the prgramme.
- Position
  Shows the position as a Magic Point. The position can be used in DIN code by using "*%X*", "*%Y*" and "*%Z*" as wild cards. These are then automattically replaced by the current valid offset co-ordiantes.
- Code
  Raw DIN code can be entered in this field.

Notes:

- The given code will be taken into account by the simulator as long as the syntax is compatible with the machine specific interpreter. The integrated interpreter will, however, never match the full functions of the machine's controller. Differences from the behaviour of an actual machine cannot be discounted.
- The code is adopted unchanged by the programme, with no syntax check being made. Equally, safety margins are not checked either. It is therefore the programmer's responsibility to ensure that the code is entered correctly.
- DIN-Code is by definition machine specific. This should be borne in mind before it is used. It will seldom be possible to use a DIN code panel description on a machine of a different manufacture. It is therefore worth checking first whether the task can be performed by TwinCAM without resorting to DIN Code.
- It is possible to insert and remove machine specific DIN code. See also Variables.

2.6 Panel Supports

The inclusion of panel supports in a workpiece description is optional. If the machine is not equipped with automatically positionable panel supports, the presence or otherwise of panel supports in the workpiece description will have no effect on programme generation. They will, however serve to assist the operator when setting up and feeding the machine.

Depending on the design of the machine, there may be any amount of assistance available to the user:

- Setup list with suction pad positions
- Laser pointers
- Laser projectors
- LCD and/or other display systems

The way in which TwinCAM panel support positions is highly dependent on the machine in question.

The following panel support systems can be accommodated by TwinCAM:

1. Smooth table
   - Round suction pads
   - Rectangular suction pads

2. Crossbeam table

- Rails
- Suction pads

Notes:

- The symbols and appearance of panel support systems within TwinCAM will also vary dependent on the type of machine in use. The illustrations within this manual should therefore be treated as representative, rather than exact replicas of the material seen with any particular machine.
- Generally, manufacturers deliver their machines complete with appropriate elements and groups for the TwinCAM palette, to make positioning panel supports easier.

2.6.1 Flat table suction pads

The simplest way to mark suction pads in a workpiece description is to postion them as desired in the drawing. If the machine is equipped with a smooth table, this can then easily been done in practice.

A suction pad element is simply added to the drawing and then moved to the desired position using drag&drop.

1. Select *[pannel support] then* > *[Round suction pads]* (or *[Rectangular suction pads]*).
2. The dialogue will permit the user to set the support geometry. This is, however, not required. Click on *OK* to close the dialogue.
3. The suction pad can now be placed as required by clicking on it, holding the mouse button down and dragging it to the desired location.

Alternatively, the usual methods for parametric positioning using "Magic Points" to position the suction pads.

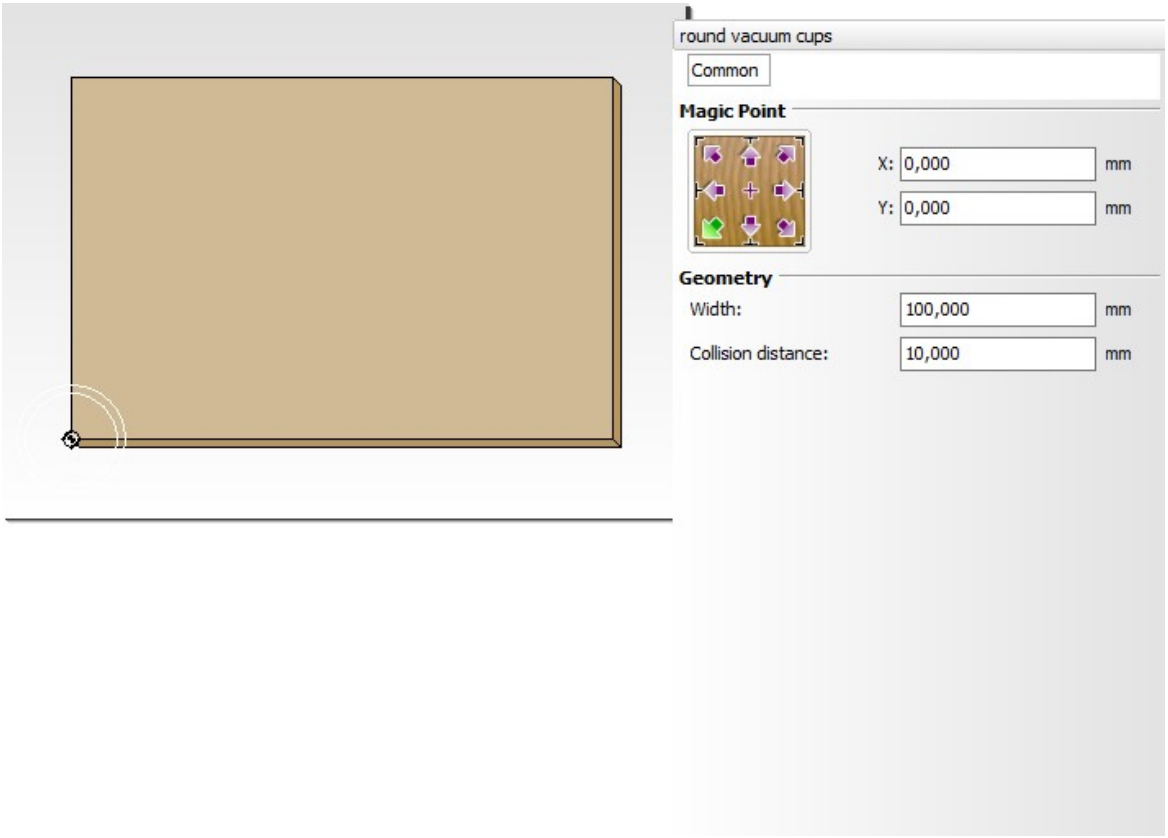
Important:

TwinCAM does not carry out any sort of check to ensure the suction pads do not impede any of the tools in use. It is the responsibility of the operator and/or programmer to ensure that suction pads are so placed that tools or drives do not collide with them.

Note:

It is recommended that the general measurements for suction pads are entered in the dialogue and saved using the *[default]* button. Any future suction pads inserted into drawings will then have the correct dimensions.

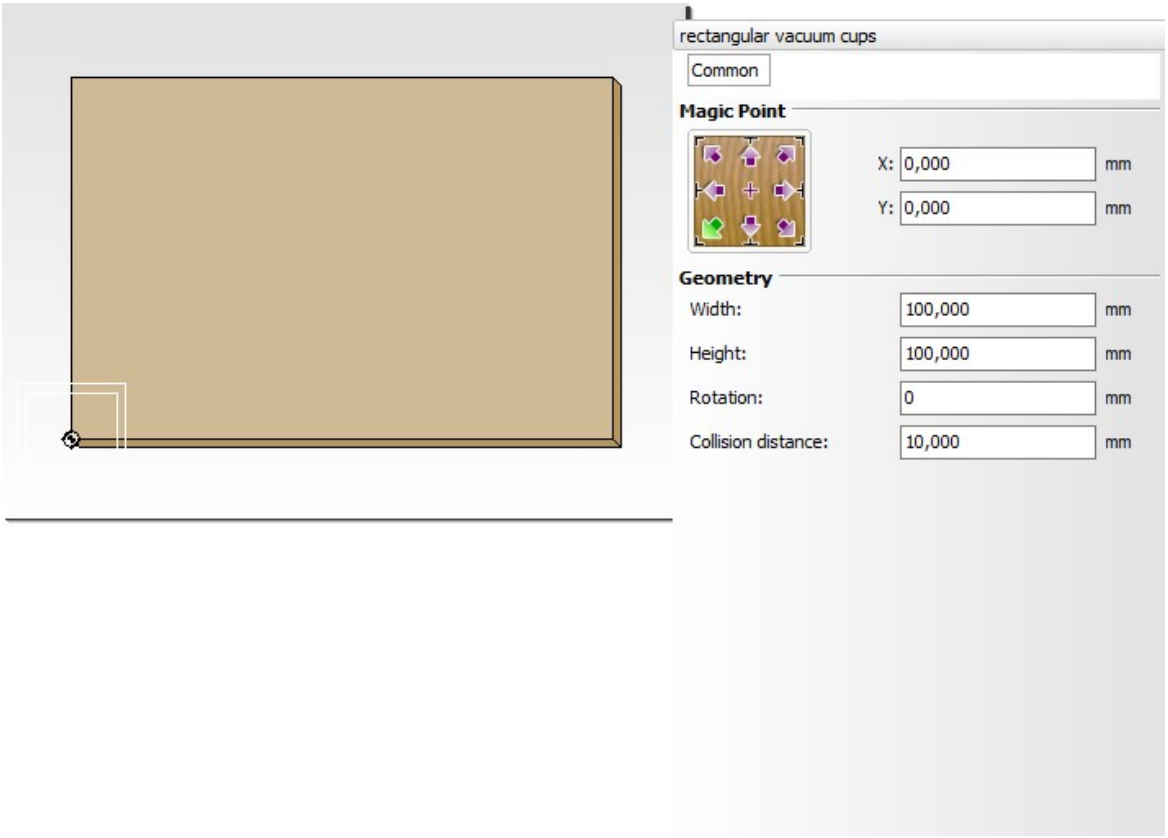
2.6.1.1 Round suction pads



Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Position
  Defines the position of a suction pad as a Magic Point.
- Diameter
  The suction pad's diamter.
- Clearance
  Clearance that must be maintained between suction pads.

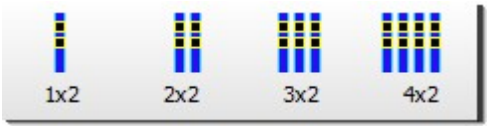
2.6.1.2 Rectangular suction pads



Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Position
  Defines the position of a suction pad as a Magic Point.
- Width
  Defines the width of the suction pad.
- Height
  Defines the height of a suction pad.
- Turn
  The angle of turn for a suction pad can be entered here.
- Clearance
  Clearance that must be maintained between suction pads.

2.6.2 Rails



TwinCAM does not have a standard icon for rails. This is because rails are in effect a type of group for suction pads. In addition, any one machine may have a whole array of different rails which will need to be configured differently depending on the positioning of the workpiece on the machine. The programmer does not need to rack his brains over this, as TwinCAM will carry this task out automatically.

Rails do not neccessarily need to be mentioned in the workpiece description. If the programmer ensures that suction pads are placed in identical positions, or with a sufficiently large interval in X, TwinCAM will calculate suction pad positions for the setup list automatically.

Rails do however make this task easier. They "collect" suction pad elements and place all suction pads with the same position on the X axis onto a single rail. In addition they allow the simple positioning of a number of suction pads on one rail.

Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).
- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.

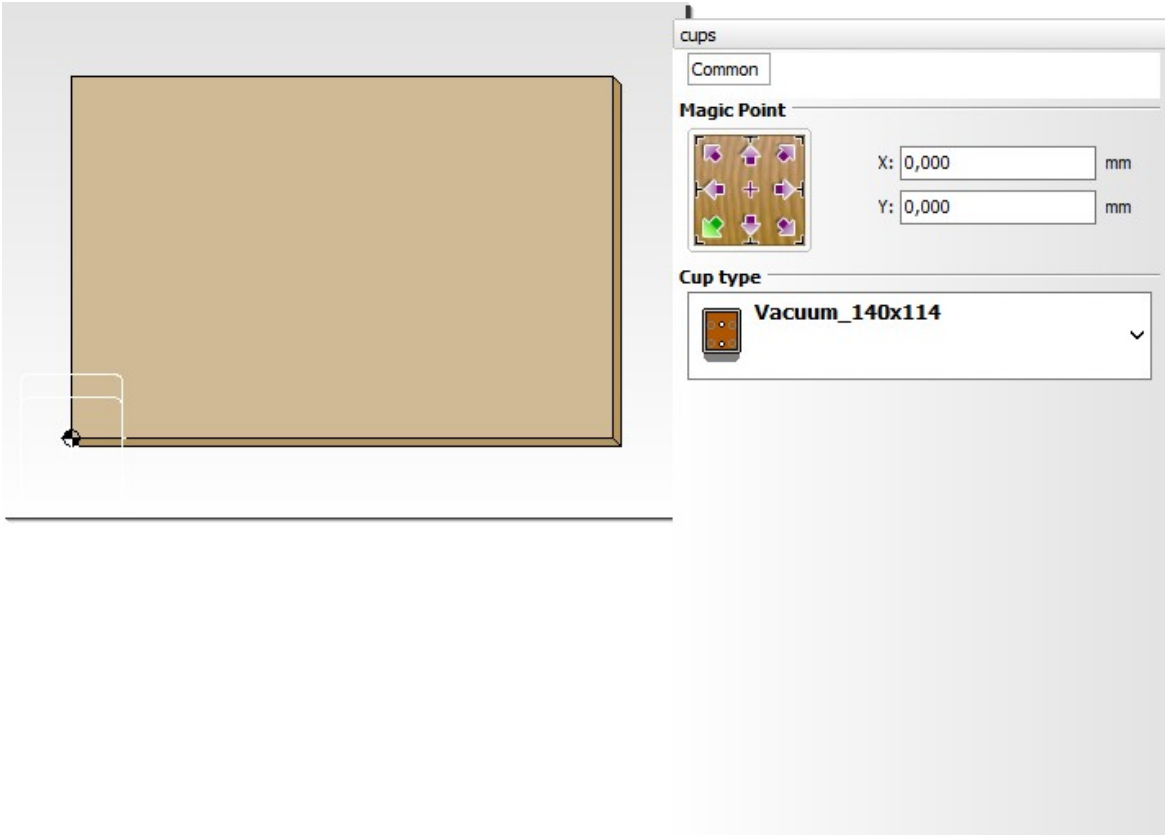
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Position
  As a console by virtue of its construction is fixed in the Y axis and can only be moved in the X axis, entries are only needed for the X position and a reference (left centre or right). Other data cannot be interpreted at this time.

Tip:

It is a good idea to save rail configurations that are repeatedly used, as in the illustration above. A combination of "*Magic Points*" and global variables allow these combinations to be created parametrically, so that they are independent of the actual panel measurements. Basic configurations of this kind are often part of the machine set up ex works.

2.6.3 Suction pads (rails)

Aside from simple round or rectangular suction pads, rails can be equipped with a range of different suction pads. To cope with this kind of variety, TwinCAM allows manufacturers to describe, and make available to the user, specific suction pad geometries. These are defined as silhouettes, each identified by a type number. This means that just one basic element - "*suction pads*" - can give access to the whole range of available panel supports.



Parameters:

- Condition
  Each element can have a condition applied which decides whether the element is included in

programme generation or not. As a default, all elements have a condition of 1, that is they are included in programme generation. If a condition value of 0 is entered or arrived at via a formula, the element will not be included. Elements that are not to be included are displayed in grey (Details).

- Info
  The element can be allocated a name which will be displayed when the cursor is held over the element. The same name will also be displayed in the tree structure. TwinCAM will allocate a default name if the user does not provide one.
- Active
  Activates or deactivates an element for programme generation. An element which has been deactivated in this way cannot be reactivated using a condition. It must be reactivated directly by the user.
- Type
  Creates a link between the external geometric description and the suction pad element.

Suction pads of this type, as with the simple ones, are selected from the menu and placed on the drawing, using click and drag they can be moved onto a previously inserted rail. Rails have a type of 'magnetic attraction' which draws the pads to them so long as they are reasonably close. Beyond a certain distance they can be removed from one rail and will then be attracted to the next.

Note:

Here too the manufacturer will usually provide icons for the available panel support systems so that they only need to be selected from the palette. This greatly simplifies the task of matching rails with suitable suction pads.

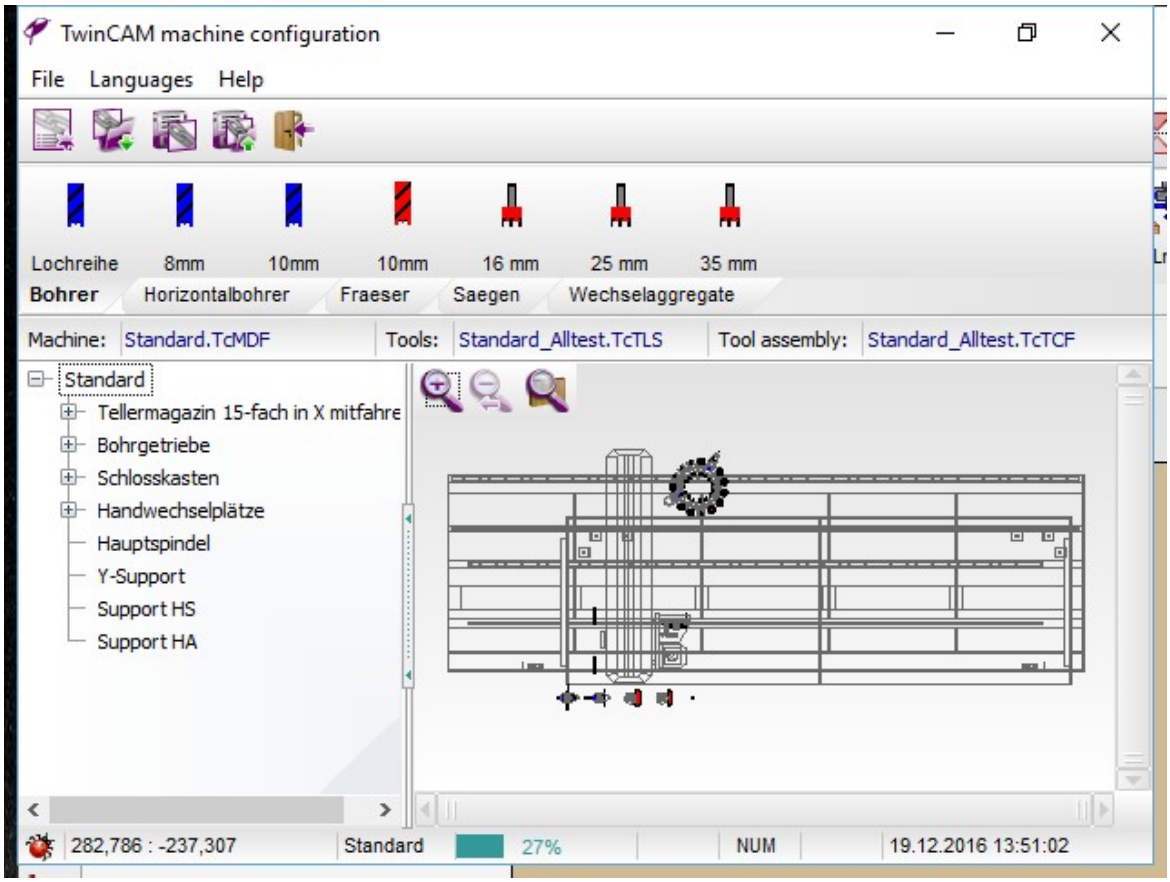
Chapter III

Machine configuration

Machine configuration

Machine and tool administration is an integral part of TwinCAM. To ensure that the interface between machine independent workpiece descriptions and machine dependent tool data is as trouble free as possible, TwinCAM needs a certain amount of information about the machine to be used and the tools it is equipped with. TwinCAM then passes the relevant data direct to the machine controller to save the operator having to enter data twice. This method of working brings with it a number of advantages:

- Provision of a transparent, easy to use interface for machine data administration.
- Consistency of data between TwinCAM and the machine itself.
- Easy to change between different configurations.



Machine configuration takes place in a window independent of TwinCAM's editor. Nonetheless, the window's composition shares some common features with the editor. In the upper part of the window, for example, there are menu icon and palette bars and a status bar at the bottom of the screen. The area in between is, like the editor, dominated by a graphics display area. To the left of the graphics area you will see a diagramatic depiction of the machine with its aggregates and tool mounts.

The functions of the sections are however, quite different; the most important difference being the method of editing. The machine configuration consists of three parts:

1. Machine
   The configuration editor only edits *one* currently selected machine at any time. A new machine configuration is created and selected in TwinCAM settings - machine register. Only then can the machine be edited. The initial machine configuration should be left to the manufacturer's technical staff. Detailed machine configuration information can be found in a separate handbook.

2. Tools
   The palette contains all tools that are available. This can be thought of as a kind of tool cupboard in which all the tools can be found, regardless of whether they are actually fitted to the machine or not. The tool file can be exchanged if required.
   WARNING: Exchanging tool files is not recommended. Each tool is individually coded. If a tool is copied from one tool file to another and subsequently only edited in one of the files, there will be two tools with the same identification, but different characteristics. This could lead to unforeseen consequences.
3. Tooling
   This is the assigning of tools from the tool cupboard to specific mounts on the machine and is the reality of editing the machine configuration. It is quite sensible to a have number of different tooling files for any one machine. By simply loading a new tooling file, all machine dependent tool data is passed to the controller and as soon as the physical tool change has taken place, the new configuration can be used.

The machine configuration then, consists of these three parts. Each part has its own configuration file. The TwinCAM configuration establishes the combination of these files for a given machine; the current data are displayed above the graphic area.

Note:

The various parts of the machine configuration are strongly interdependent. A tooling file is only valid for one machine. In addition the selected tools must all be contained in the tool palette.

All three parts can be edited in the machine configuration screen. For some areas particular permissions are required.

3.1 Tools / Multi purpose aggregates

Tools and aggregates are administered using a tool palette. Any number of tools can be categorised using descriptive registers or tabs, for example for drills, routers, saws and so on. How the categoristaion is carried out is up to the user, so each installation will have a different appearance.

Each symbol on the tool palette represents a tool or aggregate together with all its settings. Using drag and drop tools can be placed in a location. This is done by selecting the tool, holding the mouse button down and dragging the tool to the desired location. The cursor display indicates whether a tool may be fitted in a particular location. Releasing the mouse button releases the tool into the location.

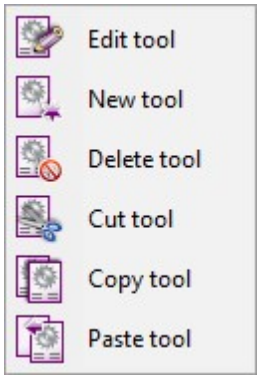
Important:

With the exception of *pattern drills*, all tools and aggregates are unique and have unique reference numbers. This means that logically they can only appear once on any given machine. If a tool is dragged from the palette to a location and is already shown in another location, the old location will be superceded by the new one. Pattern drills on the other hand are intended for creating drilled rows and several may be found on a machine.

3.1.1 Editing

To edit an existing tool or aggregate or to add new tools the tool list context menu is required. This appears when the right mouse button is clicked on the palette bar.

The menu contains the following commands:



- Edit Tool
  Calls up the edit dialogue for the selected tool. The appearance of the dialogue is dependent on the type of tool.
- New Tool
  Creates a new tool and calls up the relevent dialogue.
- Delete Tool
  The selected tool is deleted following confirmation of this command.
- Cut Copy or Insert Tool
  This function is used to move a tool from one register tab to another, by cutting it from one and then pasting it into another.

Note:

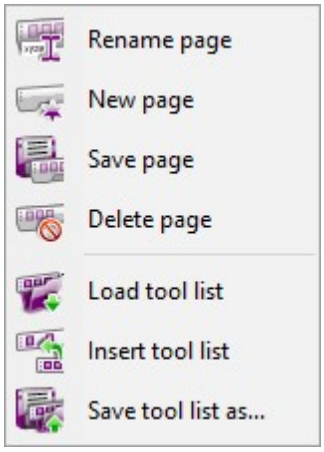
Copying a tool or aggregate creates an exact copy, which nonethless is given a separate identity. A copied tool can be used at the same time as the original.

3.1.2 Customising

Customising the tool palette is for the most part identical to the same task in the user palette.

First, right click on one of the register tabs...

... to open the context menu:



The context menu contains the following functions:

- Rename page
  This function allows the page name to be set in the lower part of the palette. The change affects only the currently selected page.
- New Page
  A new page is inserted immediaitely following the one currently open. The order of the pages can be altered by using 'drag and drop'. A moved page will be inserted behind the one it is dropped on, in relation to the direction it has been dragged. For example, if a page is dragged from left to right, the page will be inserted to the right of the page it is dropped on. If it is dragged from right to left, it will be inserted to the left of the page on which it is dropped.
- Save Page
  The tools on the active page are saved into a TwinCAM tool file. A tool file can be inserted into another palette using the "*Insert tool list*" command (see below).
- Delete Page
  Deletes the current active page *together with all its associated tools*. he user is asked for confirmation before this command is actioned.
- Load tool list
  Selecting this command opens a dialogue to select a file from. The user selects a tool palette from the list which then **replaces** the current one.
- Insert tool list
  This command also gives the user an opportunity to select an existing tool list file. In this case however, the selected file is **added** to the current one, making it possible to create extensive tool lists from a series of complete or part palettes.
- Save tool list
  The currently displayed tool list is saved under a new name. Any subsequent changes affect only the newly named file, not the one it was saved from. When TwinCAM is started, the most recently saved tool list is opened. The previous list remains unchanged under the previous name.

Tip:

If a lot of changes are to be made to a tool list it is recommended that you save the original list under a new name first. The original version is then available and can be reopened using the "*Load tool list*" command.

Note:

Tools are individually identifiable. The identification serves to differentiate between tools in tool lists and loaded on machines. Even when a list is saved under a new name, the identification of the tools within it remains unchanged. If changes are made to tools in separate lists, this can lead to unexpected effects It is therefore recommend to work with the same tool list at all times. The main purpose for saving and loading tool lists is the setting up of tool lists in the first place.

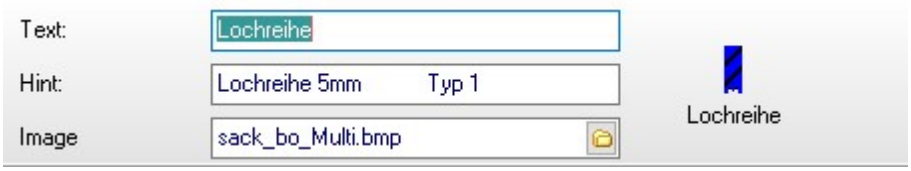
See also:

Symbol administration

3.1.3 Tool types

There are different dialogues for each of the different types of tools. The purpose of this is to make it as easy as possible to enter the relevant data for each type of tool.

The upper part of the dialogue is the same in each case.



The following values can be entered here:

- Text
  The text entered here is displayed below the symbol in the tool list. The chosen text should be as brief as possible.
- Info
  This text is displayed when the cursor is held over the symbol for a few moments. There is no restriction on the length of the text, so this can expand on the brief text displayed on the palette.
- Image
  The small button to the right of the field displays an open file dialogue which is used to select an image file to depict the tool required.
- Tool type
  A tool type must be set for each tool. This can only be set wothout restriction for a new tool. Once a tool has been allocated a tool type the changes that can be made to the tool type are limited, for example drill to pattern drill.

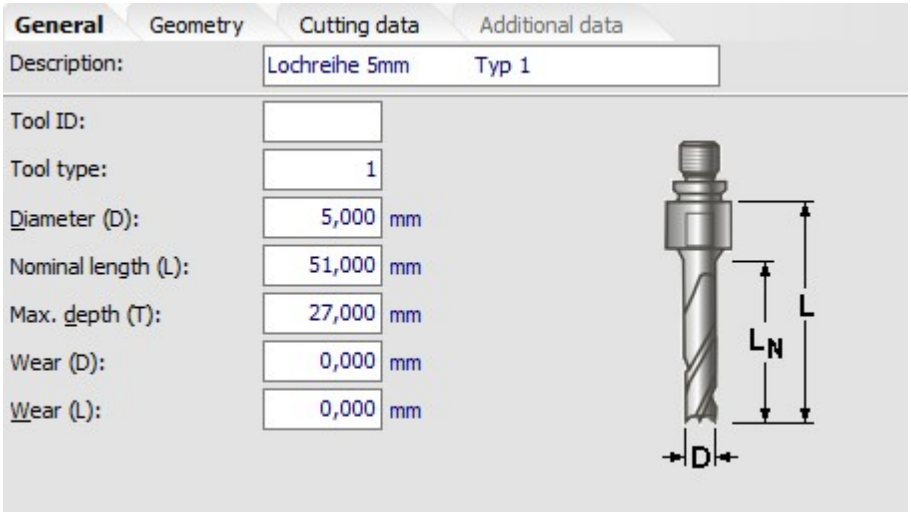
3.1.3.1 Drills / drills templates

Although this category describes simple drills, there is a distinction between drills and pattern drills. The latter have no individual unique reference in the sense that there will only ever be one of them on a machine because this is not the case. Pattern drills are used in multi drive spindles for , for example, drilled rows.

The Editor's settings dialogue is in three register tabs.

- General
- Geometry
- Cutting data

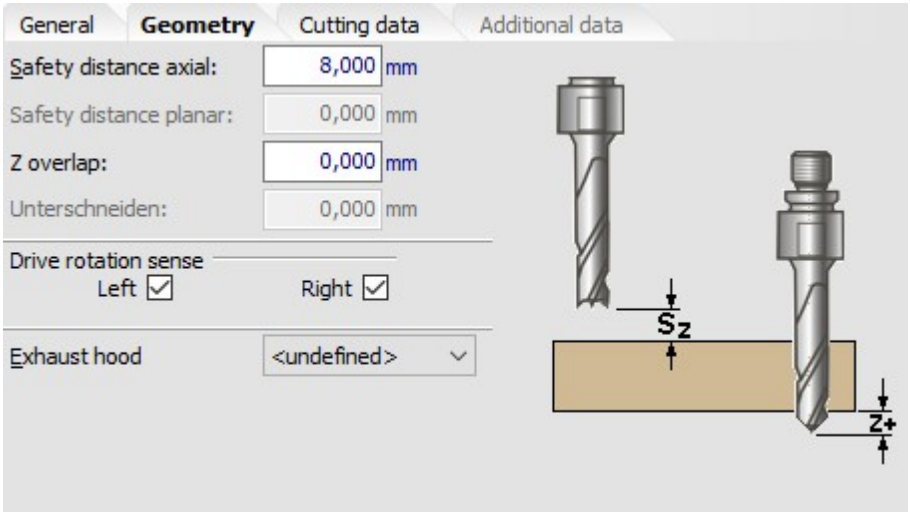
» ***General***



Parameters:

- Label:
  This text appears in the tree structure and the tooling list, wherever the tool is used.
- Tool type:
  The tool type assists TwinCAM's automatic tool selection. The designation here must match that in the work piece description.
- Diameter:
  Tool diameter
- Nominal length:
  The nominal length is used to calculate the tool length correction - the measured length of the tool from its reference point.
- max. depth:
  Maximum cutting depth (also known as useable length)
- Wear D:
  Diameter wear, variation from the nominal diameter.
- Wear L:
  Individual tools can vary from their nominal size in length as well as diameter due to either sharpening or simple wear and tear. The variations can be entered in these fields.

» *Geometry*



Parameters:

- Axial safety margin (Sz):
  This margin is the clearance height for the tool and is added to the standard clearance height for the panel. Note this margin is traversed in slow mode, whilst the standard clearance is traversed in fast mode. In other words, the approach to the panel over this last distance before contact with the panel is much slower.

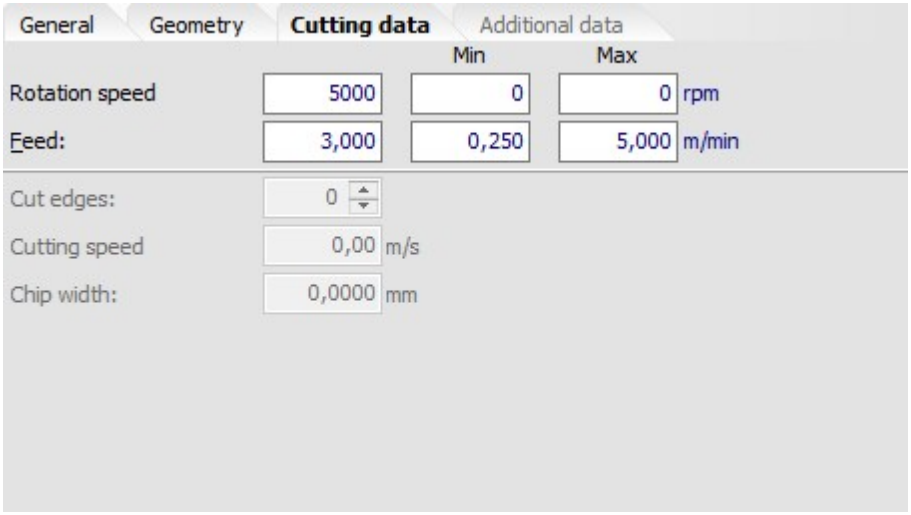
- Z-Excess (Z+):
  This in addition to the programmed end position and allows a clearance drill, which is pointed for example, to make a clean hole of uniform diameter.

- Drive rotation:
  These check boxes allow the user to set the direction of rotation the drill requires. This is checked by TwinCAM during the tooling process to ensure that the tool is not placed in an unsuitable location. It can be sensible not to specify a direction of rotation, especially for pattern drills, so that they can be used in any aggregate. In the final analysis, it is the operator's responsibility to ensure that an appropriate tool is loaded in the correct location for the job in hand.

- Exhaust hood
  Programming the exhaust hood ist dependent on its mechanical construction. Positioning differs from one machine to another and is carried out by te manufacturer. The following variations are possible:

<undefined>	Position is set elsewhere. If the position is not defined by the aggregate it may be defined by the tool and vice versa.
<dynamic>	The hood is positioned dynamically dependent on the length of the tool.
Position x:	The hood is positioned according to a range of pre-defined steps.

» *Cutting data*



Parameters:

- RPM:
  Nominal speed of the drill in RPM, with permissible minimum and maximum speeds for drives with fixed speeds.

- Cutting rate:
  Nominal cutting rate in meters per minute with permissible maximum and minimum speeds. The cutting rate can be entered in the start point dialogue as a percentage of the nominal.

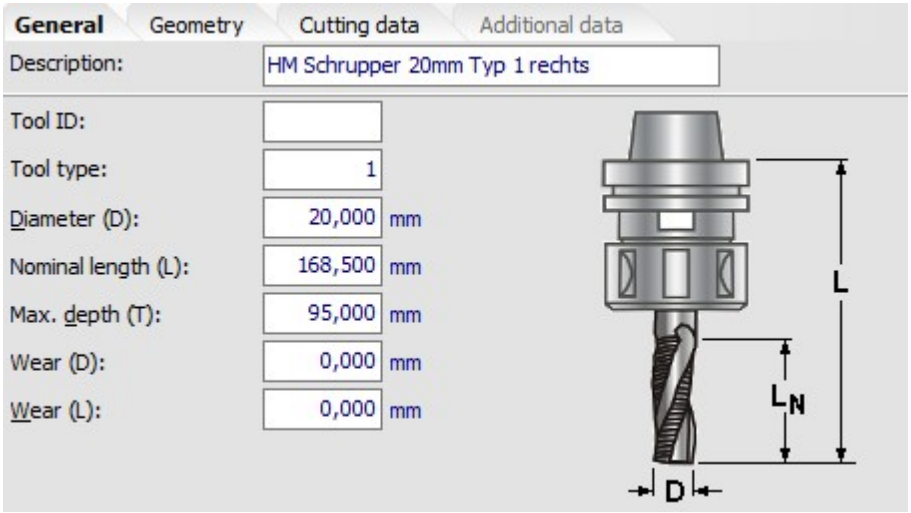
3.1.3.2 Millers / Routers

Routers can be used in number of different forms and areas. This area is used to set the basic data.

The Editor's settings dialogue is in three register tabs.

- General
- Geometry
- Cutting data

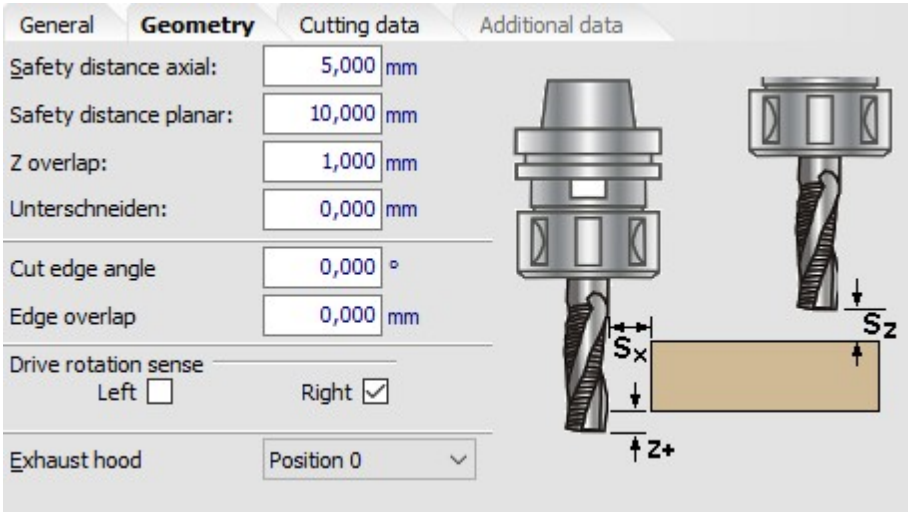
» *General*



Parameters:

- Label:
  This text appears in the tree structure and the tooling list, wherever the tool is used.
- Tool type:
  The tool type assists TwinCAM's automatic tool selection. The designation here must match that in the work piece description.
- Diameter:
  Tool diameter
- Nominal length:
  The nominal length is used to calculate the tool length correction - the measured length of the tool from its reference point. This may take one of three forms:
  1. From the tool location's zero point to the tool's calibration point (normally the tip).
  2. In the case of a single aggregate - from the aggregate's zero point to the tool's calibration point.
  3. In the case of an angled aggregate, from the output shaft's zero point to the tool's calibration point.
- max. depth:
  Maximum cutting depth (also known as useable length)
- Wear D:
  Diameter wear, variation from the nominal diameter.
- Wear L:
  Length wear, vatiation from the nominal length.

» *Geometry*



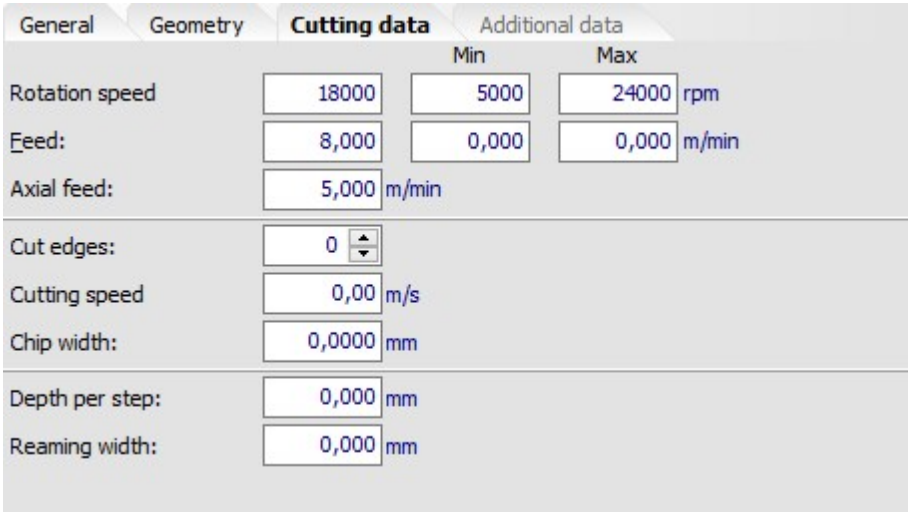
Parameters:

- Axial safety margin (Sz):
  This margin is the clearance height for the tool and is added to the standard clearance height for the panel. The standard clearance height is traversed in fast mode, whilst this safety margin is travelled at the defined cutting rate. The same additional margin is applied when the tool leaves the contour on completion of the work.
- Planar safety margin:
  An additional safety margin to the standard clearance to the side of the panel. This is also the distance of the tool from the contour start point, at cutting depth. Applies at both the beginning and end of the contour if an approach and leave have been programmed.

- Z Excess:
  Where the routing is to cut through the panel, (lower surface reference, Z value 0), this value is programmed in addition to the panel depth to ensure a clean cut.
- Blade angle:
  Angle of the blades on round point routers. This is used to obtain sharp corners in angled contours. The router is moved at an angle towards the surface of the panel and then back to cutting depth. This is activated by entering a value >0.
- Pointing correction:
  To obtain sharp corners on angled contours, the router is withdrawn to the panel surface. This correction factor is added so that the completed work is not marked when the tool returns. This correction factor is typed in here.
  Note: Routers for pointing must be defined with a diamter of 0.
- Direction of rotation:
  May be set to left or right, to suit the tool.
- Exhaust hood
  Programming the exhaust hood ist dependent on its mechanical construction. Positioning differs from one machine to another and is carried out by te manufacturer. The following variations are possible:

<undefined>	Position is set elsewhere. If the position is not defined by the aggregate it may be defined by the tool and vice versa.
<dynamic>	The hood is positioned dynamically dependent on the length of the tool.
Position x:	The hood is positioned according to a range of pre-defined steps.

» *Cutting data*



Parameters:

- RPM:
  Nominal speed of the tool in RPM, with permissible minimum and maximum values.

  If automatic Cutting data calculation is used, the nominal speed must be set to 0. TwinCAM calculates the optimum speed automatically whilst ensuring the permissible maxima and minima are not exceeded.

  This setting will only apply if the drive in which the tool is to be used has dynamic speed regulation.
- Feed rate:
  Nominal cutting rate of the router in m/min, with permissible minimum and maximum values.
- Axial cutting rate
  Cutting rate to be applied if the approach is vertical to the work surface and a flying approach is used.

- Blades:
  If automatic Cutting data calculation is used, the number of blades on a multi-bladed tool must be known.
- Cutting speed:
  An entry setting the tool's cutting speed for automatic Cutting data calculation.
- Tooth Feed rate:
  Feed rate per tooth in meters per minute for automatic Cutting data calculation.
- Feed depth:
  The maximum feed depth for the tool. If the work required is deeper than the feed depth for the tool, the work will be carried out in more than one pass.
- Clearance width
  Width of clearance when cutting pockets. An entry of 0 equates to ~72 % of the diameter.

See also:

Cutting data calculation, Start Point

3.1.3.3 Saw blades

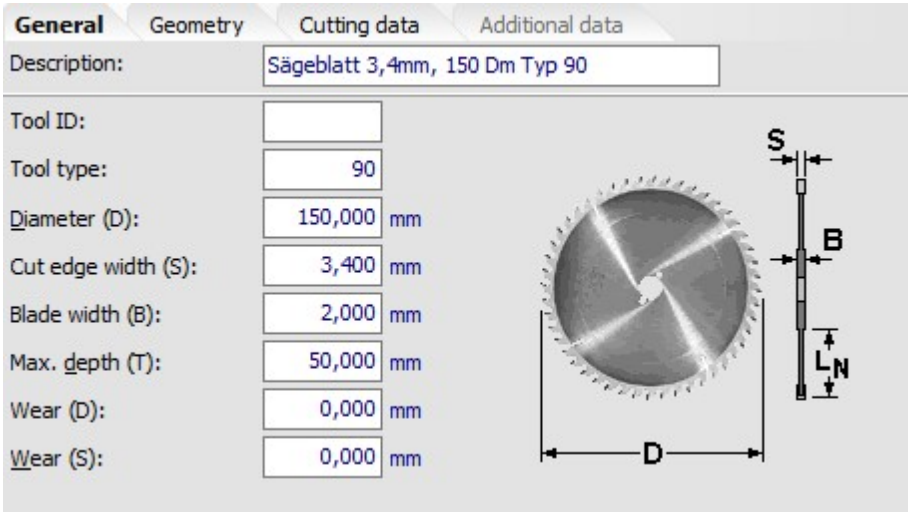
Saw blades comprise a separate tool category in TwinCAM.

The Editor's settings dialogue is in three register tabs.

- General
- Geometry
- Cutting data

» *General*

Defining a saw blade in either an angle drive or an individually controlled saw aggregate.

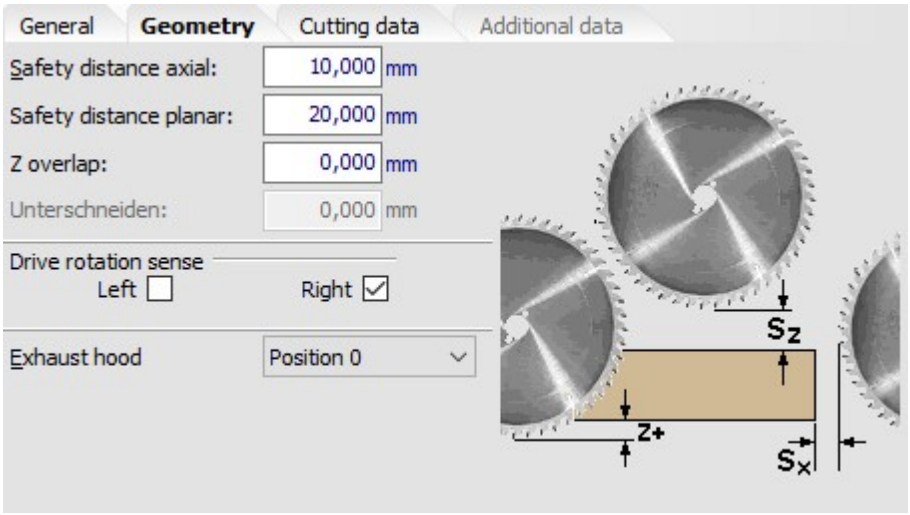


Parameters:

- Label:
  This text appears in the tree structure and the tooling list, wherever the tool is used.
- Tool type:
  The tool type assists TwinCAM's automatic tool selection. The designation here must match that in the work piece description.

- Diameter (D):
  Nominal diameter of the saw.
- Blade width (S):
  Width of the sawcut.
- Blade core (B):
  Width of the blade on the flange.
- max. Depth:
  Maximum cutting depth of the blade (also known as useable depth).
- Wear D:
  Diameter wear, variation from the nominal diameter.
- Wear S:
  Wear to the width of the blade, variation from the nominal width.

» ***Geometry***



Parameters:

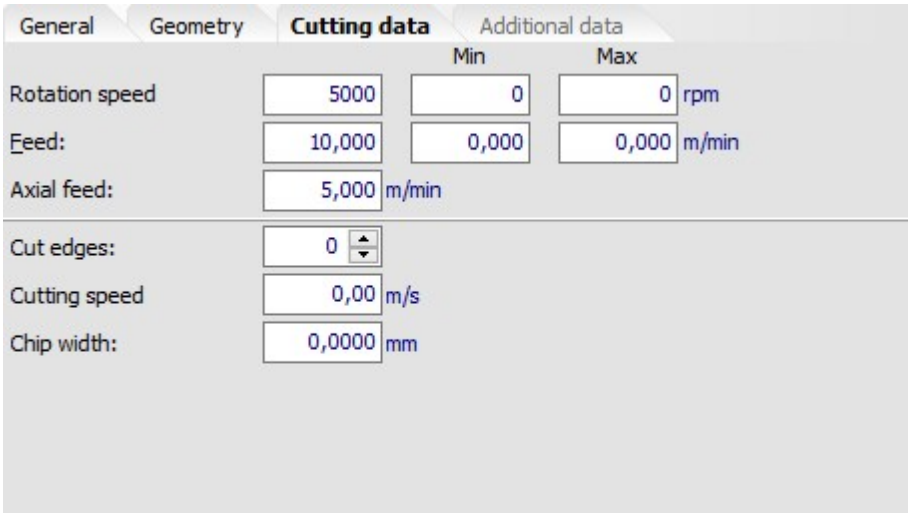
- Axial safety margin (Sz):
  This margin is the clearance height for the tool and is added to the standard clearance height for the panel. The saw moves in fast mode whilst at clearance height the approach is at feed rate. This margin is also used when the saw moves away after the work is complete.
- Planar safety margin:
  A safety margin to the side of the panel in addition to the standard margin to the side of the panel. This equates to the distance of the saw to the saw cut's programmed start point in the direction of cut at cutting depth. The safety margin takes effect at both the start and end of the cut, but only when the cut commences outside the panel margin. Where the Saw cut lies entirely within the panel boundary, the approach is carried out in such a way that the contour is cut cleanly.
- Z-Excess:
  Where the cut is to go through the panel (reference panel lower surface, Z value 0) the cut is programmed to be deeper by this value. The value entered here is added to the drawing value during programme generation.
- Direction of rotation:
  The choices available are left or right when viewing the blade towards the drive.
- Exhaust hood
  Programming the exhaust hood ist dependent on its mechanical construction. Positioning differs from one machine to another and is carried out by te manufacturer. The following variations are possible:

<undefined>	Position is set elsewhere. If the position is not defined by the aggregate it may be defined by the tool and vice versa.
<dynamic>	The hood is positioned dynamically dependent on the length of the tool.
Position x:	The hood is positioned according to a range of pre-defined steps.

See also:

Rebate

» ***Cutting data***



Parameters:

- RPM:
  Nominal speed in RPM with permissible maximum and minimum speeds.
- Feed rate:
  Nominal feed rate in meters/min with permissible maximum and minimum speeds.
- Blades:
  The number of blades on multi bladed tools must be known for automatic cutting data calculation.
- Cutting speed:
  The cutting speed of the tool in meters/min for automatic cutting data calculation.
- Tooth feed rate:
  Feed rate per tooth in meters/min for automatic cutting data calculation.

See also:

cutting data calculation, Start point

3.1.3.4 Horizontal aggregate (simple)

Angled drives are notable for the fact that output is not in the same plane as the spindle. Gear systems are provided to provide a take-off at an angle to the spindle. This will often be 90 degrees, although in some cases the angle can be regulated.

Aside from the simple angled drives described here, there are also multi drive aggregates which have several tool locations.

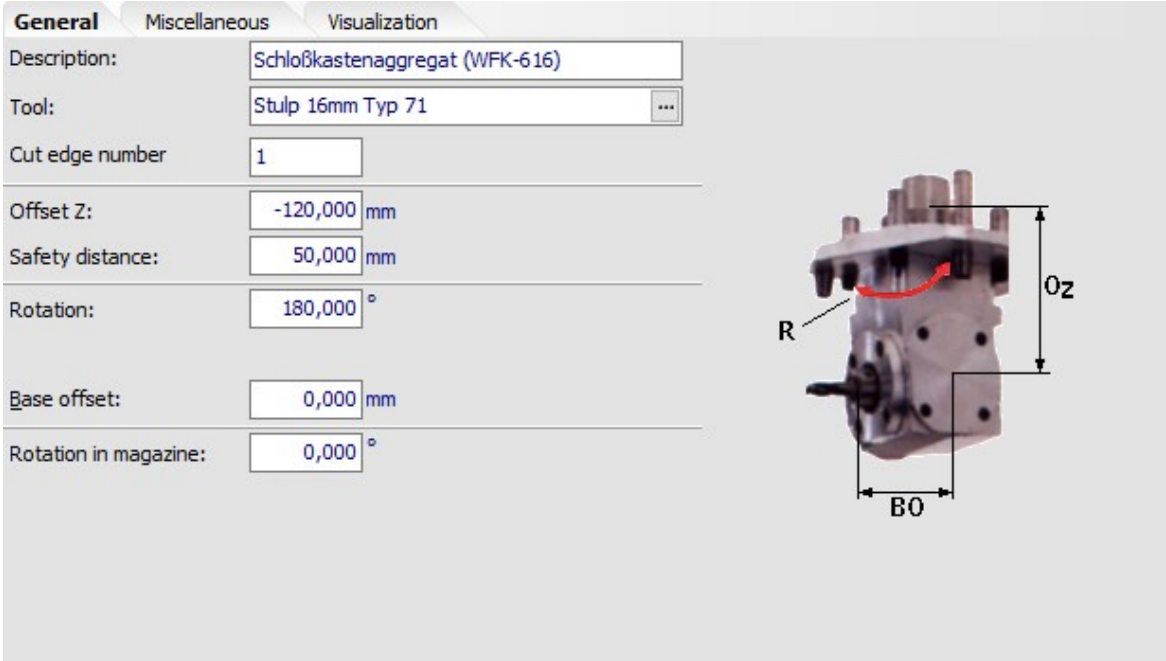
The settings editor consists of three register tabs:

- General
- Miscellaneous
- Display

See also:

Multi drive aggregates

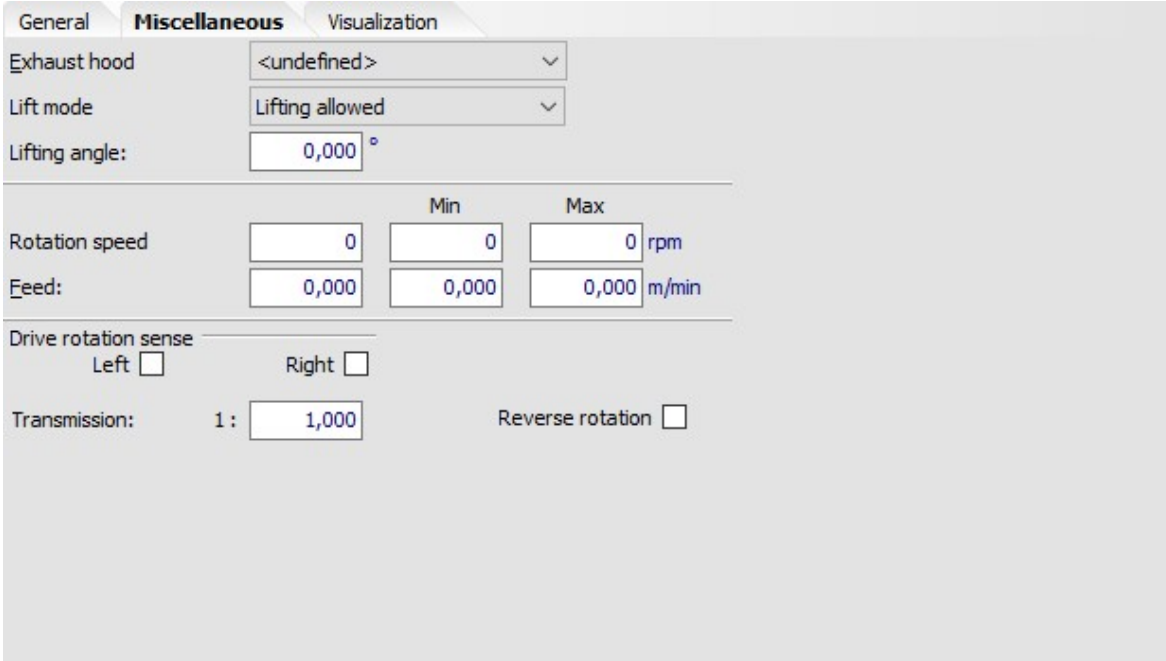
» ***General***



Parameters:

- Tool:
  Tool fitted to the angled drive.
- Offset Z:
  Distance between the tool location's zero point and the mid point of the angled drive output in the Z axis.
- Clearance height:
  A value in addition to the standard clearance height. Describes the distance from the calibrated Z offset point to the lower edge of the aggregate The programmed tool tip is positioned at the standard clearance height above the panel surface. To prevent contact between the tool and the workpiece, the tool is raised by this value following horizontal work.
- Rotation:
  Rotation of the display about the drawing's zero point. This makes it possible to align the drawing with the display if the drawing is not in the same plane as the machine .
- Angle of rotation:
  The aggregate's horizontal tilt. A positive tilt is upwards, whilst a negative tilt is downwards.
- Basis Offset:
  Distance from the mid axis of the tool location to the defined drive output. The tool is calibrated to the output point defined here.

» ***Miscellaneous***



Parameters:

- Exhaust hood
  Programming the exhaust hood ist dependent on its mechanical construction. Positioning differs from one machine to another and is carried out by te manufacturer. The following variations are possible:

<undefined>	Position is set elsewhere. If the position is not defined by the aggregate it may be defined by the tool and vice versa.
<dynamic>	The hood is positioned dynamically dependent on the length of the tool.
Position x:	The hood is positioned according to a range of pre-defined steps.

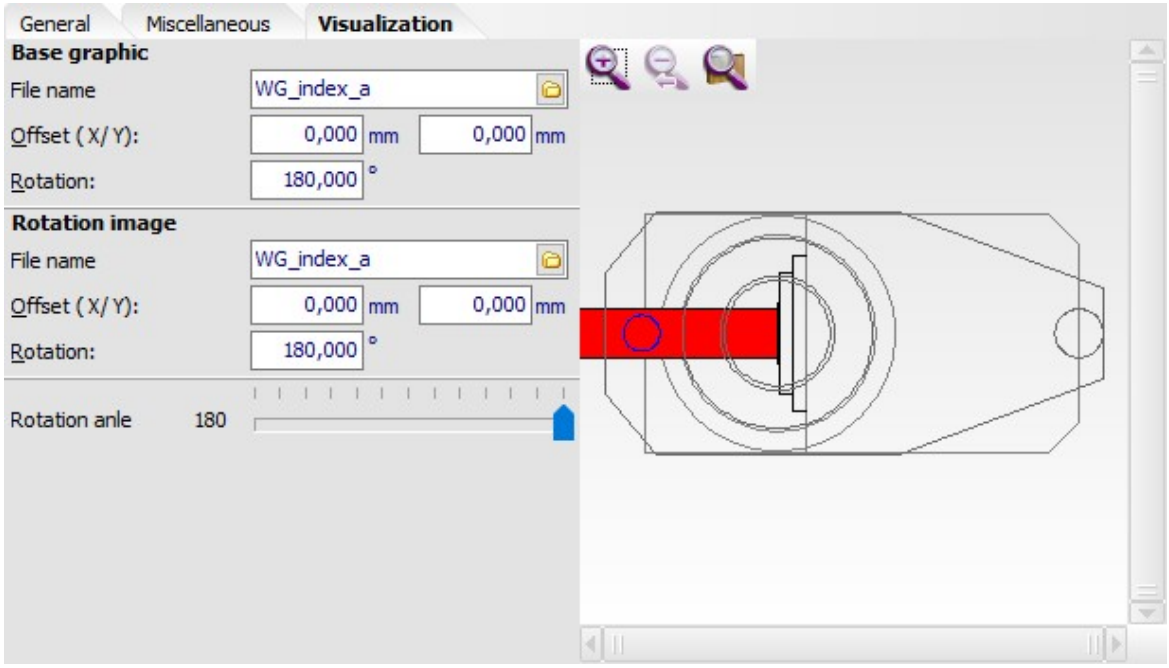
- Elevation mode/angle:

Raising not permitted	When the aggregate is in use, the main drive can not be withdrawn pneumatically. This could be because of the size of the aggregate or the tool currently fitted and in order not to collide with other parts of the machine. In this case the aggregate is unloaded before the main drive is withdrawn.
Raising permitted	When the aggregate is in use the main drive can be withdrawn pneumatically. In some cases it may be neccessary for the C axis to be at a specified angle to prevent collisions with other parts of the machine. The required angle is entered in the raise angle field.

- Elevation angle:
  Angle of the C axis to enable the main drive to be moved away.
- RPM:
  Nominal drive speed in RPM with maximum and minimum permitted input speeds.
- Feed rate:
  Nominal drive feed rate in meters per minute with maximum and minimum permitted speeds.
- Direction of rotation:
  Defines the input direction of rotation. Some drives will only accept one direction of rotation by virtue of there method of construction.

- Gearing:
  Gearing ratio between the input and output drive shafts. A ratio of 1:1.5 at an input speed of 6,000 RPM would result in an output speed of 9,000 RPM for example.
- Reversed:
  This field must be checked if the output drive rotates in the opposite direction to the input drive.

» *Display*



Basis display: (displays the fixed parts of the aggregate)

- File name:
  The DXF file that represents the aggregate in the simulation and tooling process.
- Offset X/Y:
  Display offset in relation to the actual position. It is however possible to position a DXF display exactly even if the drawing's zero point is not identical with that of the aggregate itself.
- Rotation:
  Rotation of the display about the drawing's zero point. This makes it possible to align the drawing with the display if the drawing is not in the same plane as the machine.

Rotation display: (displays the fixed parts of the aggregate)

- File name:
  The DXF file that represents the aggregate in the simulation and tooling process..
- Offset X/Y:
  Display offset in relation to the actual position. It is however possible to position a DXF display exactly even if the drawing's zero point is not identical with that of the aggregate itself.
- Rotation:
  Rotation of the display about the drawing's zero point. This makes it possible to align the drawing with the display if the drawing is not in the same plane as the machine.
- Angle of rotation:
  Allows the movement of the aggregate to be checked. This is only displayed in the display window and not saved. By right clicking on the scroll bar different positions can be selected.

Note:

Settings for the display only affect the way the aggregate is displayed in the programme, for exmple during simulation. Offsets and rotation have no influence over programme generation or how the machine will react in reality.

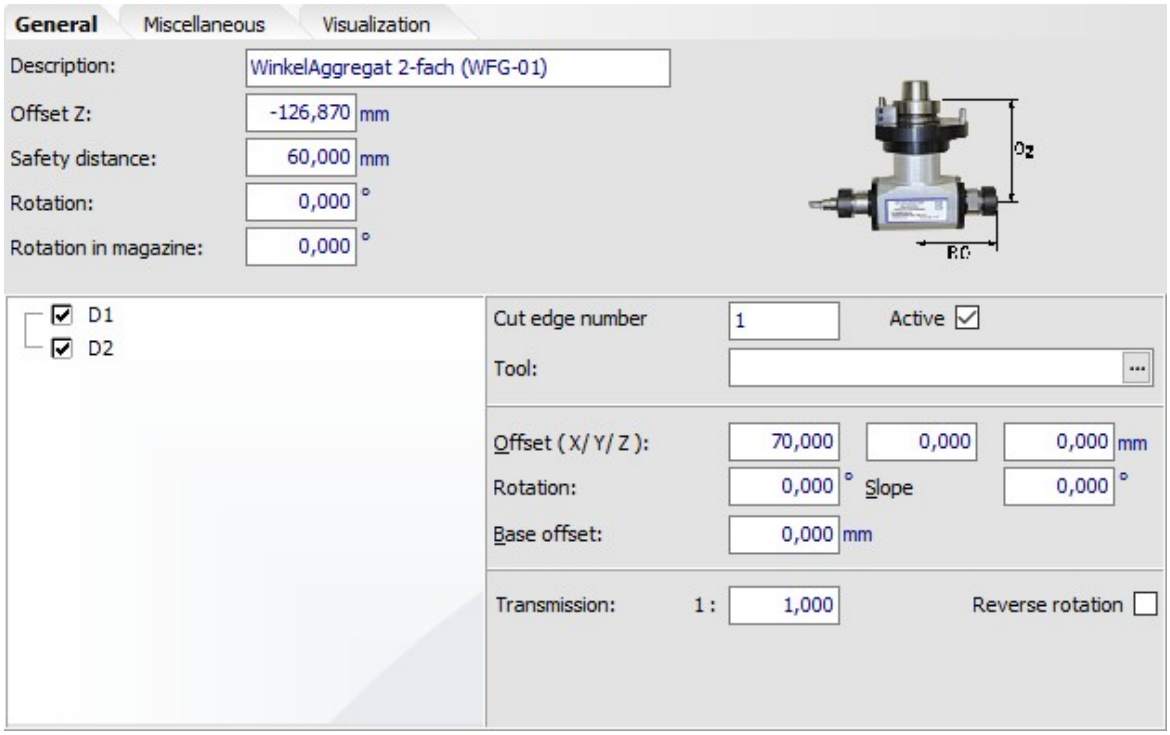
3.1.3.5 Horizontal aggregate (multiple)

Multiple aggregate drives are recognisable by the fact that they offer several output drives. Some properties need to defined separately for each drive, others may be valid for the entire aggregate. Information on the individual outputs is found on the "general" tab. The tab contains a list of the available outputs, with the data for the currently selected one displayed to the right of the list. The individual output drives may be configured by selecting an individual output drive and editing its properties.

The settings editor dialogue consists of three register tabs:

- General
- Miscellaneous
- Display

» *General*



General Parameters:

- Offset Z:
  Distance between the tool location's zero point and the mid point of the angled drive output in the Z axis.

- Clearance height:
  A value in addition to the standard clearance height. Describes the distance from the calibrated Z offset point to the lower edge of the aggregate The programmed tool tip is positioned at the standard clearance height above the panel surface. To prevent contact between the tool and the workpiece, the tool is raised by this value following horizontal work.

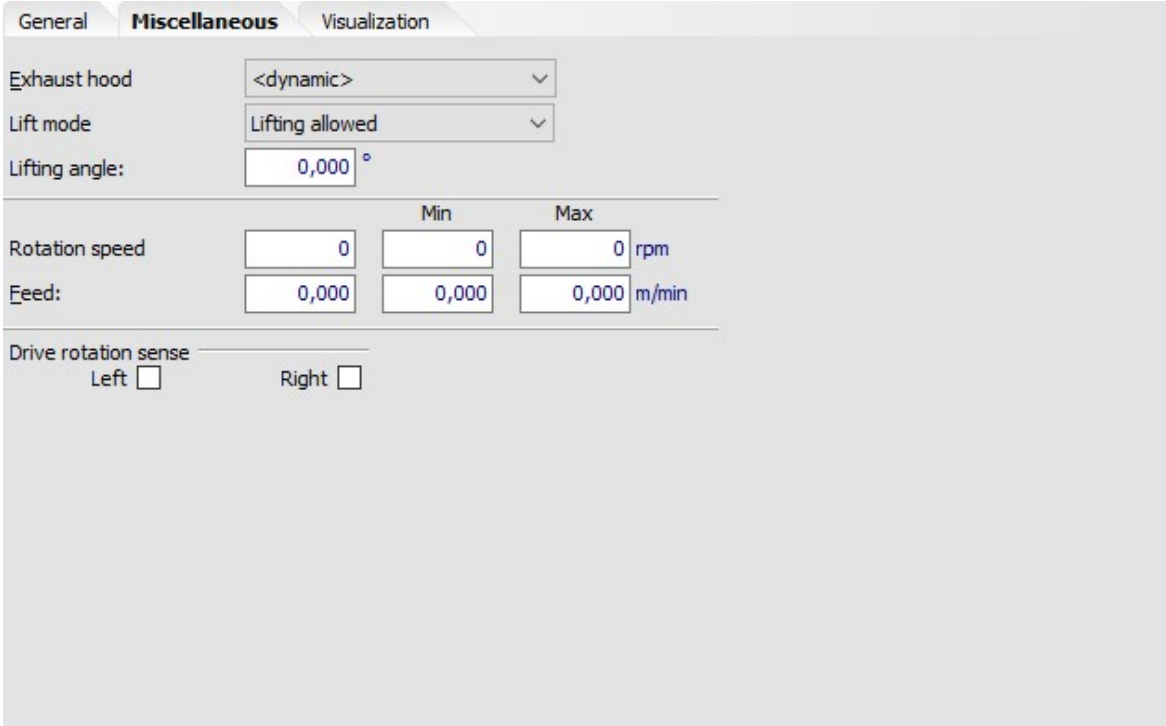
- Rotation:
  Output orientation in relation to mathematical zero. All angle data conforms to the convention that those in a clockwise direction from 0 are given as negative and anticlockwise as positive.

The following parameters are valid for individual output drives. To edit the settings for an individual output, first select the output from the list to th left of the screen. The settings can then be edited on the right of the screen.

Tool location Parameters:

- Tool locations:
  A listing of the available drives and the tools they are equipped with. The properties for individual drives can be edited in the field to the right of the screen. Additional drives can be added by right clicking and selecting 'insert drive' from the context menu.
- Blade number:
  Each output is allocated a serial number. This sets the correction factor defined in the tool data.
- Tool::
  The tool that the output drive is to be fitted with.
- Active:
  Sets whether an output drive is active or inactive. If the output is inactive, it will not be included in programme generation, regardless of whether it is equipeed with a tool or not.
- Offset (X/Y/Z):
  Distance form the tool location's mid axis to the defined output end stop. The tool is calibrated against the end stop defined here. The aggregate is viewed as if it were loccated at position C, 0 degrees.
- Rotation:
  Output orientation in relation to mathematical zero. All angle data conforms to the convention that those in a clockwise direction from 0 are given as negative and anticlockwise as positive.
- Tilt:
  The aggregate's horizontal tilt. A positive tilt is upwards, whilst a negative tilt is downwards.
- Basis Offset:
  Distance from the mid axis of the tool location to the defined drive output. The tool is calibrated to the output point defined here.
- Gearing:
  Gearing ratio between the input and output drive shafts. A ratio of 1:1.5 at an input speed of 6,000 RPM would result in an output speed of 9,000 RPM for example.
- Reversed:
  This field must be checked if the output drive rotates in the opposite direction to the input drive.

» *Miscellaneous*



Parameters:

- Exhaust hood
  Programming the exhaust hood ist dependent on its mechanical construction. Positioning differs from one machine to another and is carried out by te manufacturer. The following variations are possible:

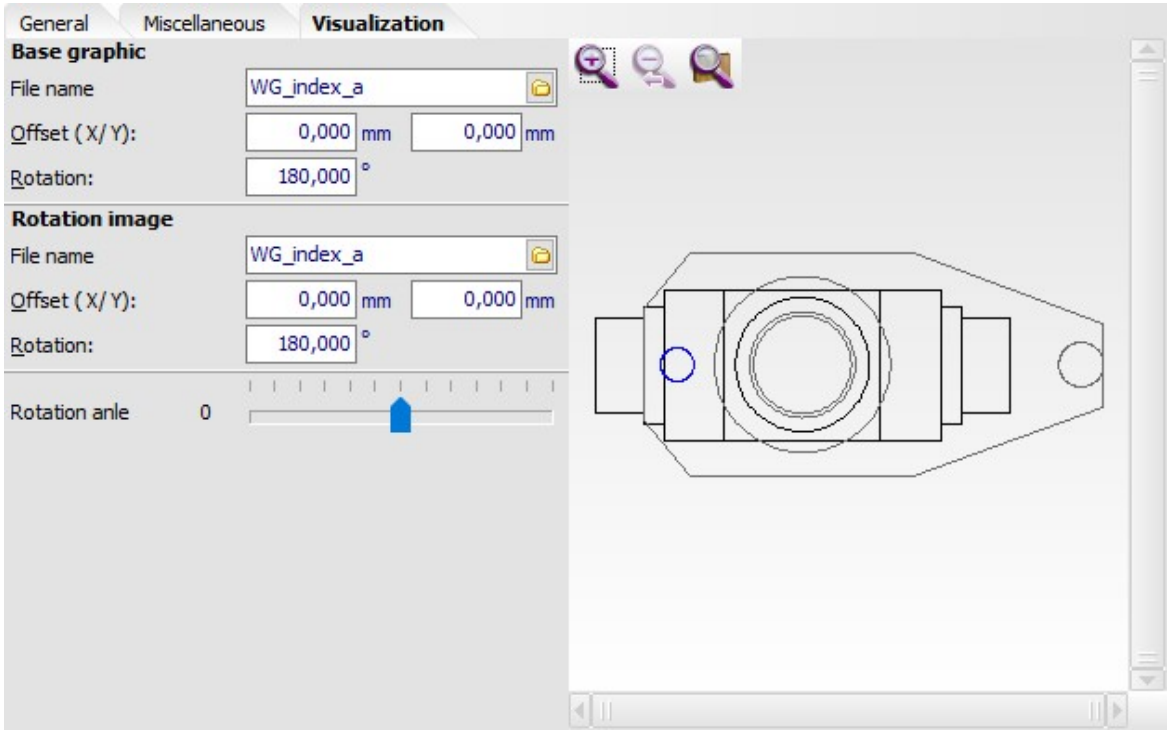
<undefined>	Position is set elsewhere. If the position is not defined by the aggregate it may be defined by the tool and vice versa.
<dynamic>	The hood is positioned dynamically dependent on the length of the tool.
Position x:	The hood is positioned according to a range of pre-defined steps.

- Elevation mode/angle:

Raising not permitted	When the aggregate is in use, the main drive can not be withdrawn pneumatically. This could be because of the size of the aggregate or the tool currently fitted and in order not to collide with other parts of the machine. In this case the aggregate is unloaded before the main drive is withdrawn.
Raising permitted	When the aggregate is in use the main drive can be withdrawn pneumatically. In some cases it may be neccessary for the C axis to be at a specified angle to prevent collisions with other parts of the machine. The required angle is entered in the raise angle field.

- Elevation angle:
  Angle of the C axis to enable the main drive to be moved away.
- RPM:
  Nominal drive speed in RPM with maximum and minimum permitted input speeds.
- Feed rate:
  Nominal drive feed rate in meters per minute with maximum and minimum permitted speeds.
- Direction of rotation:
  Defines the input direction of rotation. Some drives will only accept one direction of rotation by virtue of there method of construction.

» *Display*



Basis display: (displays the fixed parts of the aggregate)

- File name:
  The DXF file that represents the aggregate in the simulation and tooling process.
- Offset X/Y:
  Display offset in relation to the actual position. It is however possible to position a DXF display exactly even if the drawing's zero point is not identical with that of the aggregate itself.
- Rotation:
  Rotation of the display about the drawing's zero point. This makes it possible to align the drawing with the display if the drawing is not in the same plane as the machine.

Rotation display: (displays the fixed parts of the aggregate)

- File name:
  The DXF file that represents the aggregate in the simulation and tooling process..
- Offset X/Y:
  Display offset in relation to the actual position. It is however possible to position a DXF display exactly even if the drawing's zero point is not identical with that of the aggregate itself.
- Rotation:
  Rotation of the display about the drawing's zero point. This makes it possible to align the drawing with the display if the drawing is not in the same plane as the machine.
- Angle of rotation:
  Allows the movement of the aggregate to be checked. This is only displayed in the display window and not saved. By right clicking on the scroll bar different positions can be selected.

Note:

Settings for the display only affect the way the aggregate is displayed in the programme, for exmple during simulation. Offsets and rotation have no influence over programme generation or how the machine will react in reality.

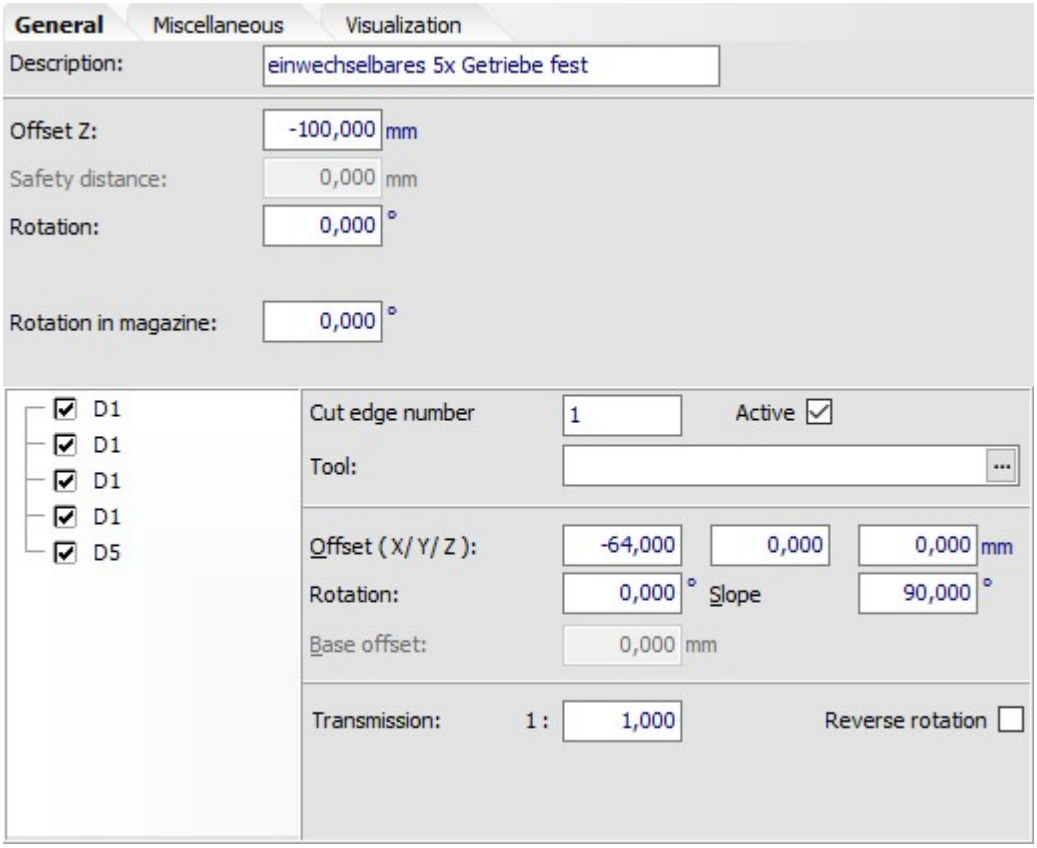
3.1.3.6 Multi drill aggregates

Similar to a multi angle drive, multi drill aggregates are also available. These drives can usually be used in the same in the same direction as the main drive, although use of the tilt mechanism may enable variations.

The settings editor dialogue consists of three register tabs:

- General
- Miscellaneous
- Display

» ***General***



General Parameters:

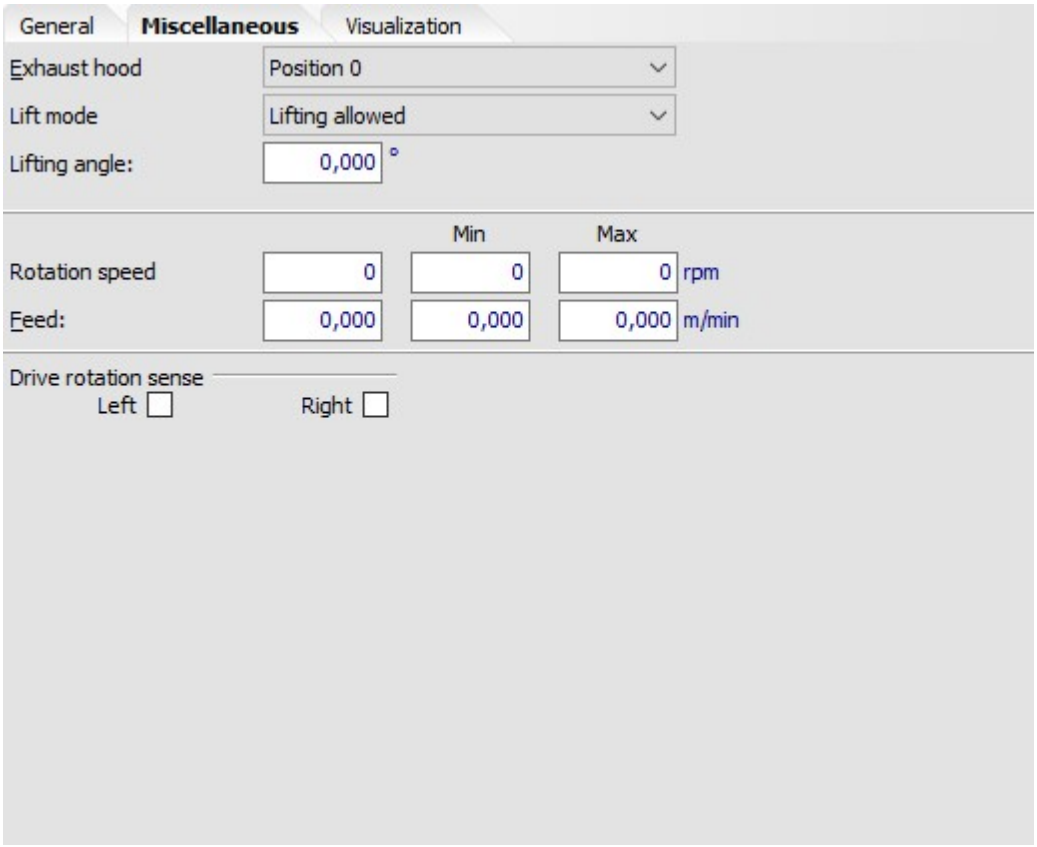
- Offset Z:
  Distance between the tool location's zero point and the mid point of the angled drive output in the Z axis. If the drive is tilted, the offset is quoted to the tilt axis. The offset for each individual spindle is then specified in the base offset data as this is oriented in line with the tilt.
- Clearance height:
  A value in addition to the standard clearance height. Describes the distance from the calibrated Z offset point to the lower edge of the aggregate The programmed tool tip is positioned at the standard clearance height above the panel surface. To prevent contact between the tool and the workpiece, the tool is raised by this value following horizontal work.
- Rotation:
  Output orientation in relation to mathematical zero. All angle data conforms to the convention that those in a clockwise direction from 0 are given as negative and anticlockwise as positive.
- Tilt:
  The aggregate's horizontal tilt. A positive tilt is upwards, whilst a negative tilt is downwards.

The following parameters are valid for individual output drives. To edit the settings for an individual output, first select the output from the list to the left of the screen. The settings can then be edited on the right of the screen.

Tool location Parameters:

- Tool locations:
  A listing of the available drives and the tools they are equipped with. The properties for individual drives can be edited in the field to the right of the screen. Additional drives can be added by right clicking and selecting 'insert drive' from the context menu.
- Blade number:
  Each output is allocated a serial number. This sets the correction factor defined in the tool data.
- Active:
  Sets whether an output drive is active or inactive. If the output is inactive, it will not be included in programme generation, regardless of whether it is equipeed with a tool or not.
- Offset X/Y:
  Distance from the tool mount's mid axis to the angle drive output's endstop. The mounted tool is calibrated against this endstop. The view is taken as if the angle drives is in position C, 0 degrees.
- Offset Z:
  Distance between the tool location's zero point and the angle drives's output in Z.
- Gearing:
  Gearing ratio between the input and output drive shafts. A ratio of 1:1.5 at an input speed of 6,000 RPM would result in an output speed of 9,000 RPM for example.
- Reversed::
  This field must be checked if the output drive rotates in the opposie direction to the input drive.

» *Miscellaneous*



Parameters:

- Exhaust hood
  Programming the exhaust hood ist dependent on its mechanical construction. Positioning differs from one machine to another and is carried out by te manufacturer. The following variations are possible:

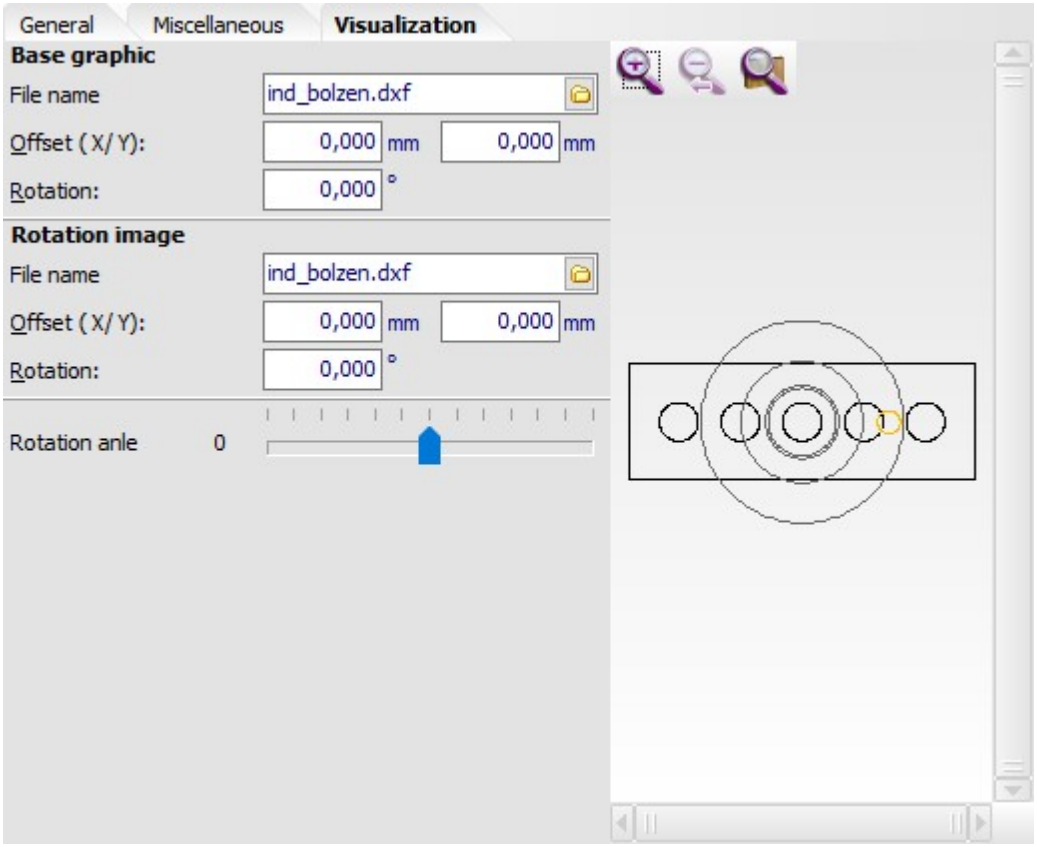
<undefined>	Position is set elsewhere. If the position is not defined by the aggregate it may be defined by the tool and vice versa.
<dynamic>	The hood is positioned dynamically dependent on the length of the tool.
Position x:	The hood is positioned according to a range of pre-defined steps.

- Elevation mode/angle:

Raising not permitted	When the aggregate is in use, the main drive can not be withdrawn pneumatically. This could be because of the size of the aggregate or the tool currently fitted and in order not to collide with other parts of the machine. In this case the aggregate is unloaded before the main drive is withdrawn.
Raising permitted	When the aggregate is in use the main drive can be withdrawn pneumatically. In some cases it may be neccessary for the C axis to be at a specified angle to prevent collisions with other parts of the machine. The required angle is entered in the raise angle field.

- Elevation angle:
  Angle of the C axis to enable the main drive to be moved away.
- RPM:
  Nominal drive speed in RPM with maximum and minimum permitted input speeds.
- Feed rate:
  Nominal drive feed rate in meters per minute with maximum and minimum permitted speeds.
- Direction of rotation:
  Defines the input direction of rotation. Some drives will only accept one direction of rotation by virtue of there method of construction.

» *Display*



Basis display: (displays the fixed parts of the aggregate)

- File name:
  The DXF file that represents the aggregate in the simulation and tooling process.
- Offset X/Y:
  Display offset in relation to the actual position. It is however possible to position a DXF display exactly even if the drawing's zero point is not identical with that of the aggregate itself.
- Rotation:
  Rotation of the display about the drawing's zero point. This makes it possible to align the drawing with the display if the drawing is not in the same plane as the machine.

Rotation display: (displays the fixed parts of the aggregate)

- File name:
  The DXF file that represents the aggregate in the simulation and tooling process..
- Offset X/Y:
  Display offset in relation to the actual position. It is however possible to position a DXF display exactly even if the drawing's zero point is not identical with that of the aggregate itself.
- Rotation:
  Rotation of the display about the drawing's zero point. This makes it possible to align the drawing with the display if the drawing is not in the same plane as the machine.
- Angle of rotation:
  Allows the movement of the aggregate to be checked. This is only displayed in the display window and not saved. By right clicking on the scroll bar different positions can be selected.

Note:

Settings for the display only affect the way the aggregate is displayed in the programme, for exmple during simulation. Offsets and rotation have no influence over programme generation or how the machine will react in reality.

3.1.3.7 Tool holder

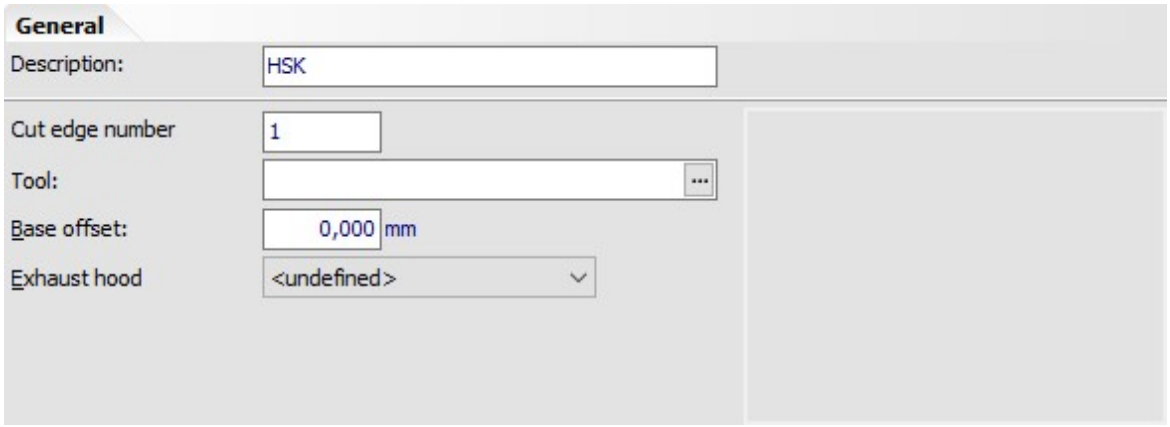
Tool locations allow the use of any tools in a multiple drive and thus also in a tool changer.

TwinCAM can make tool locations available for any tool, that is so that ordinary tools can be used in an auto change location.Under certain circumstances it can be an advantage to create tool locations with particular set properties.

The settings editor dialogue consists of just one register tab:

- General

» ***General***



Parameters:

- Blade number:
  Each output is allocated a serial number. This sets the correction factor defined in the tool data.
- Tool:
  Field to select a tool where the settings are already defined and calibrated. Thisdoes not include tools calibrated in a particular tool location.
- Basis Offset:
  Offset from the standard endstop offset to the endstop for this tool location. (for special mounts for example).
- Exhaust hood
  Programming the exhaust hood ist dependent on its mechanical construction. Positioning differs from one machine to another and is carried out by te manufacturer. The following variations are possible:

<undefined>	Position is set elsewhere. If the position is not defined by the aggregate it may be defined by the tool and vice versa.
<dynamic>	The hood is positioned dynamically dependent on the length of the tool.
Position x:	The hood is positioned according to a range of pre-defined steps.

3.1.4 Calculation of cutting data

TwinCAM can, if you wish, calculate the optimum rotation speed and feed rate automatically. For this certain tool details are required, namely:

- Number of blades
- Cutting speed
- Feed rate

If the nominal rotation speed is set to 0, TwinCAM will calculate the optimum rotation speed using the cutting speed and the tool diameter.

If the nominal feed rate is set to 0, TwinCAM calculates the optimum from the number of blades and the rotation speed. This is taken as 100% and can then be varied as described in Start point by entering a percentage.

The speed of rotation is calculated from the tool diameter and the given cutting speed. The optimum cutting speed can be obtained from the tool manufacturer.

Rotation = Cutting speed/tool diameter

Cutting rate = Feed rate x Number of teeth x RPM

See also:

Start Point

3.2 Tooling

In the real world, an operator takes the required tools out of their cabinet, and puts them in the magazine. There they are ready for the control system to access them when required.

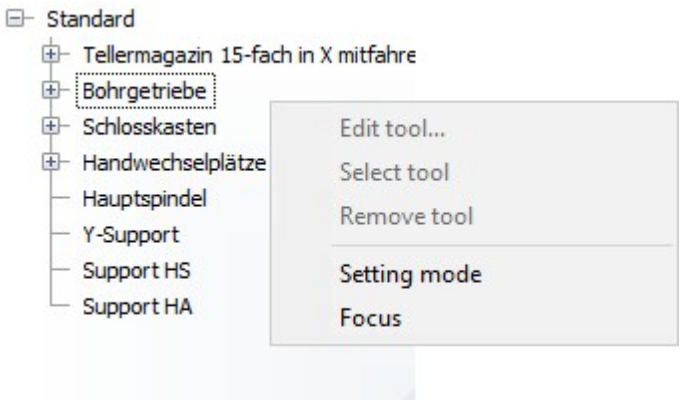
This process is matched by TwinCAM's method of work. All the tools found in the tool palette are entered on the tooling list and allocated places in the magazine. The tools are now ready for the work to be carried out. All the machine relevant tool data, e.g. tool length correction, is passed to the control system. There is no need for the data to be entered into the control system as well as the application.

See also:

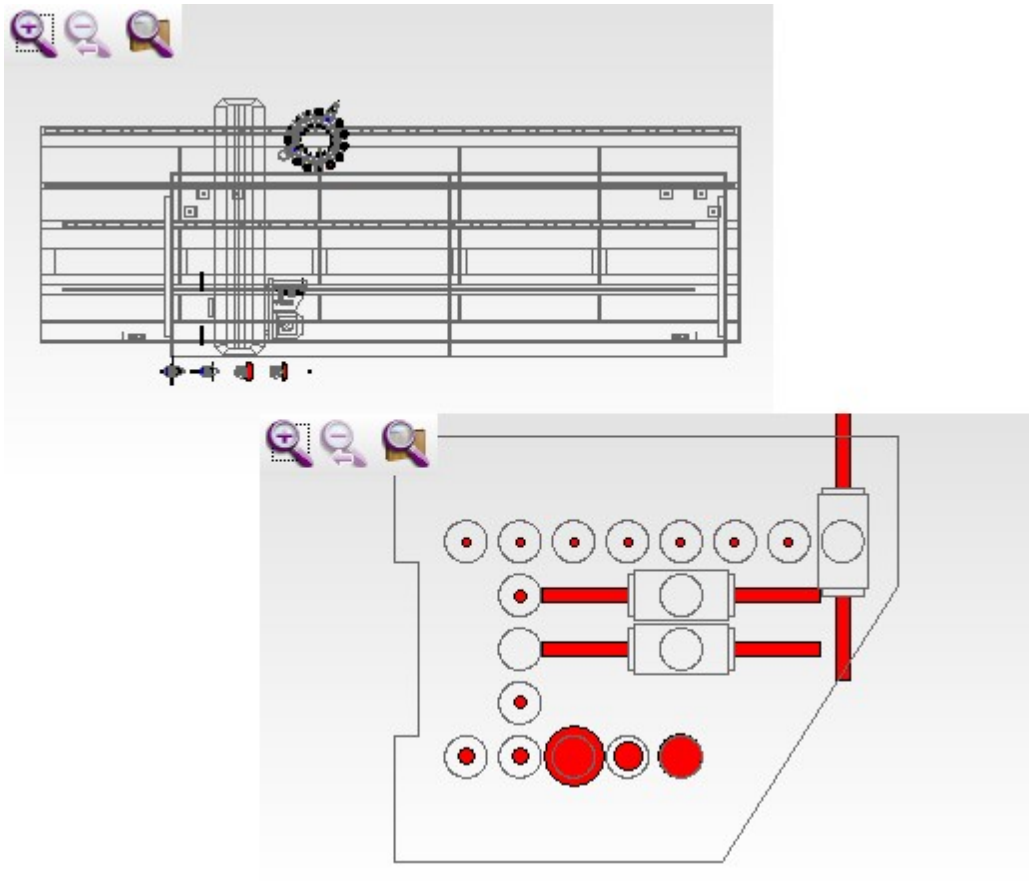
Focussed view
Loading the magazine
Cursor symbols
Zoom / Unzoom
Edit/Delete tooling
Tooling Administration

3.2.1 Focus aggregate

So that the user can carry out the tooling process more easily, TwinCAM has the facility of a 'focussed view'. What this means is that the aggregate which is to be tooled is shown at maximum size with all other aggregates, carriers and the machine bench itself removed from the display. This function is accessed by right clicking on the aggregate in the list and then selecting focussed view from the context menu.



With all distractions removed from the view, tooling can be carried out more easily and accurately.



To regain the view of the whole machine, the focussed view of the machine itself - the top entry on the list - is selected. If required another aggregate on the machine can be selected for a focussed view directly, to carry on the tooling process.

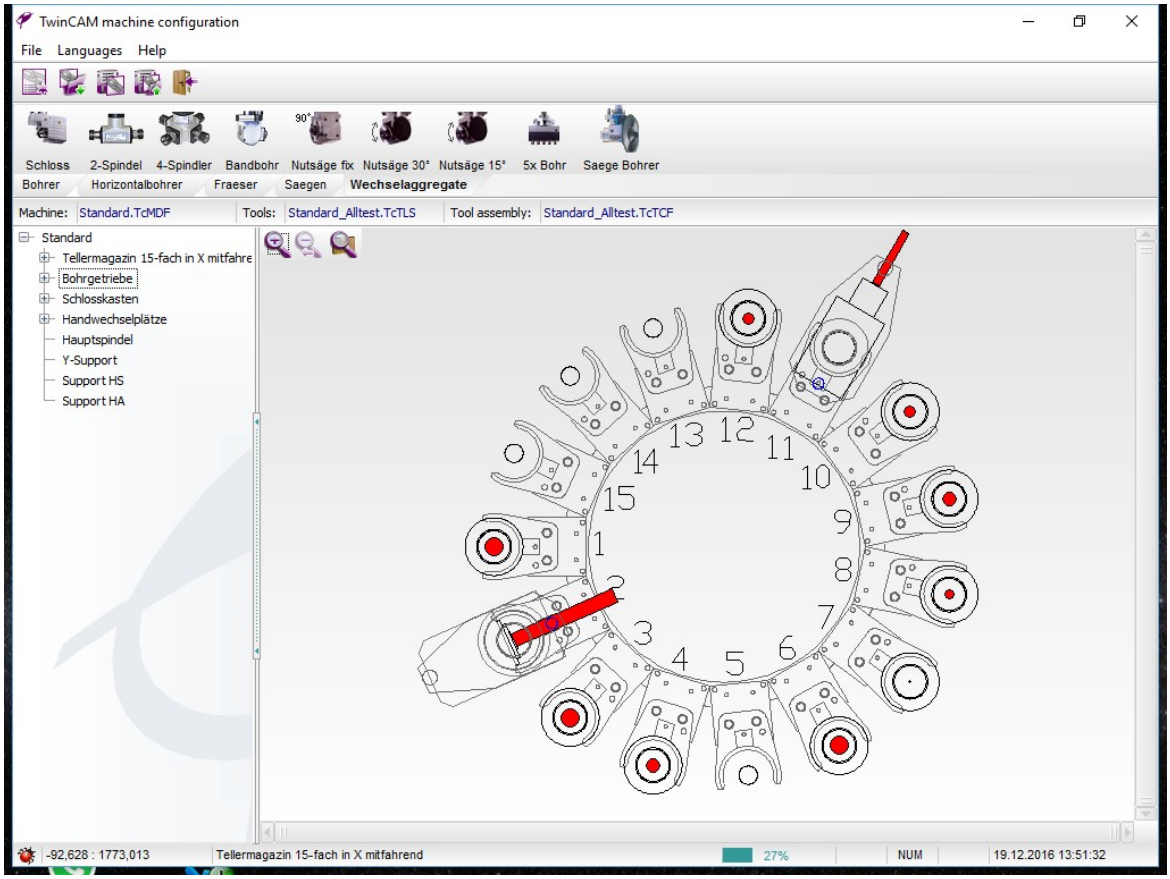
3.2.2 Loading the magazine

Tools can be loaded into the magazine using 'drag and drop' , that is by clicking on the symbol for the tool, holding the button down and dragging it to the required location.

Whilst the tool is being dragged, the display shows the tool symbol and a 'stop' sign. If the tool is moved to a location which cannot accept the tool, the *Stop sign* tays on view. This may be, for example, because the tool is a drill and the location is only suitable for routers.

When the tool has been dragged to a location that can accept it the 'stop' sign changes to an Arrow. If the mouse button is released, the tool is dropped into the location. A vertical tool is displayed as a red circle with diameter appropriate to the dimension of the tool itself. A horizontal tool is seen in side view, in a size appropriate to its length and diameter.

The tool editor can be opened by double clicking on the required tool or aggregate. Tools can be removed from a location either by selecting them and then pressing the delete button or simply dragging the tool away. The cursor changes to a picture of a Waste bin and when the mouse button is released the tool is removed.



Note:

Most tools are unique. That means that they can only be in use in one place at a time. If they are selected from the palette a second time and placed in a location, they are automatically removed from the first location. Pattern drills are a notable exception. As they are used in multiple drive spindles for drilled rows, they can be used in several drives at once.

See also:

Cursor symbols

3.2.3 Cursor symbols

The cursor symbols convey important messages during the tooling process.

If this symbol is displayed with the tool image, the tool cannot be placed in that location. When the aggregates are defined, the type of tool accepted in each location can be set. This prevents drills being loaded into a router location for example. In addition the drive's direction of rotation can be taken into account to prevent a clockwise rotating tool being placed in an anticlockwise roatating drive.

This symbol appears when the tool can be loaded into a location, taking account of its type and direction of rotation.

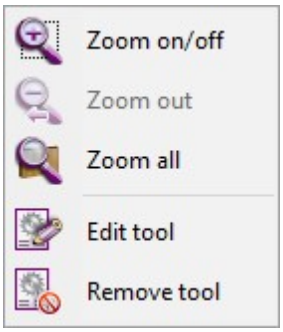
If a tool is dragged away from a location, this symbol appears, indicating that the the tool will be removed if the mouse button is released.

3.2.4 Zooming

Where tool locations are set very close together, it may be difficult to place tools accurately. TwinCAM provides a zoom function to enlarge the user's view of the tool locations. This is done by clicking on the zoom symbol at the top left corner of the display. The cursor will change into a cross symbol when it is moved over the graphic display area. By holding down the left mouse button and dragging a window across the area to be enlarged, the view zooms in to the selected area. To leave zoom mode, either click on the zoom symbol once again, or click anywhere in the display area with the right mouse button. To return to the normal view, click on the unzoom symbol, located next to the zoom symbol at the top left of the display.

3.2.5 Edit / delete tooling

To remove a tool from its location simply right click on it. This will open a context menu offering options to either edit the tool using the tool dialogue or to delete the tool.



A further method of deleting a tool is to click on the tool and then drag it away from its location. As soon as the waste bin symbol appears, the tool will be deleted when the mouse button is released.

This very simple process has other advantages: as far as the generator is concerned, an entry in the tooling list is only a link to the tool in the tool palette. If the tool's properties are changed, for example the radius changes because the tool has been sharpened, the changes take effect in the tooling list as well. As the tool palette supports an unlimited number of tooling lists, all lists are changed and not just the current one. If a tool is removed from the tool palette because it is no longer used at all by the company, it will automatically be removed from all the tooling lists it was present in.

3.2.6 Tooling administration

TwinCAM supports the creation and administration of an unlimited number of machine dependent tooling lists. Tooling lists can be organized by project using the *Save configuration* and *Load configuration*, icons or alternatively the *Open*, *Save* and *Save as* menu commands. If the *save* command is used, the file will be saved under its current name, which can be seen on the title bar. Selecting *save as* allows the file to be given a new name. The *Load* command opens a previously saved tooling list. To create a new tooling list, either click on the *New* icon or select the *New* command from the *File* menu.

3.3 Menu and Icon bars

3.3.1 File

3.3.1.1 New

 This command opens a new, empty tooling list in the editor.

The current tooling list will be closed. if there are any unsaved changes, you will be prompted to save the changes or cancel the new list, that is , to continue working with the current list. If the changes are to be saved, but the file has, as yet, no name, a dialogue will open to enable the selection of a suitable name and then save the file (see "save as"). If the file already has a name, the changes are saved under that name with no further prompt.

A new tooling list will then open.

3.3.1.2 Open...

 This command opens a previously saved tooling list.

The current tooling list will be closed. if there are any unsaved changes, you will be prompted to save the changes or cancel the new list, that is , to continue working with the current list. If the changes are to be saved, but the file has, as yet, no name, a dialogue will open to enable the selection of a suitable name and then save the file (see "save as..."). If the file already has a name, the changes are saved under that name with no further prompt.

A standard Windows dialogue will open to allow the selection of the desired file.

Once the file selection has been confirmed by clicking on the "*Open*" button, the selected tooling list is opened and displayed in the configuration editor and displayed.

3.3.1.3 Save

 Saves the current tooling list.

If this is a new, un-named, list, you will be prompted to name the file before it is saved.

3.3.1.4 Save as...

 Allows the user to save an existing file under a new name via a dialogue.

3.3.1.5 Exit

 This command exits the configuration editor. If there are unsaved changes to the current work, you will be prompted to save them.

Warning: Any unsaved changes will be lost when the programme is closed.

3.3.2 Languages

This menu lists all the languages offered by your TwinCAM installation. The list of languages available is subject to continuous improvement. Clicking on a language name will switch all text in the user interface to the selected language.

Tip:

It is recommended that you re-start the programme after a language change.

3.3.3 Help

3.3.3.1 Contents

 Opens TwinCAM on-line help.

3.3.3.2 Info about TwinCAM

 Clicking on this symbol provides information about your version of TwinCAM.

Chapter IV

Settings

Settings

TwinCAM permits a wide range of user defined settings. This dialogue leads the user though the individual configuration areas. The window is split into three areas.

- Colour settings
  Screen colour settings
- Basic Panel
  Default values for a new panel description
- File Paths
  Permits the allocation of default directories for different groups of files.
- Printer settings
  Settings for the printer
- Editor
  General settings
- Work lists
  Work list templates for complex machining
- Machines
  Machine configurations and the associated machine configuration files.
- DXF File Import / Export
  Colour settings for DXF files.

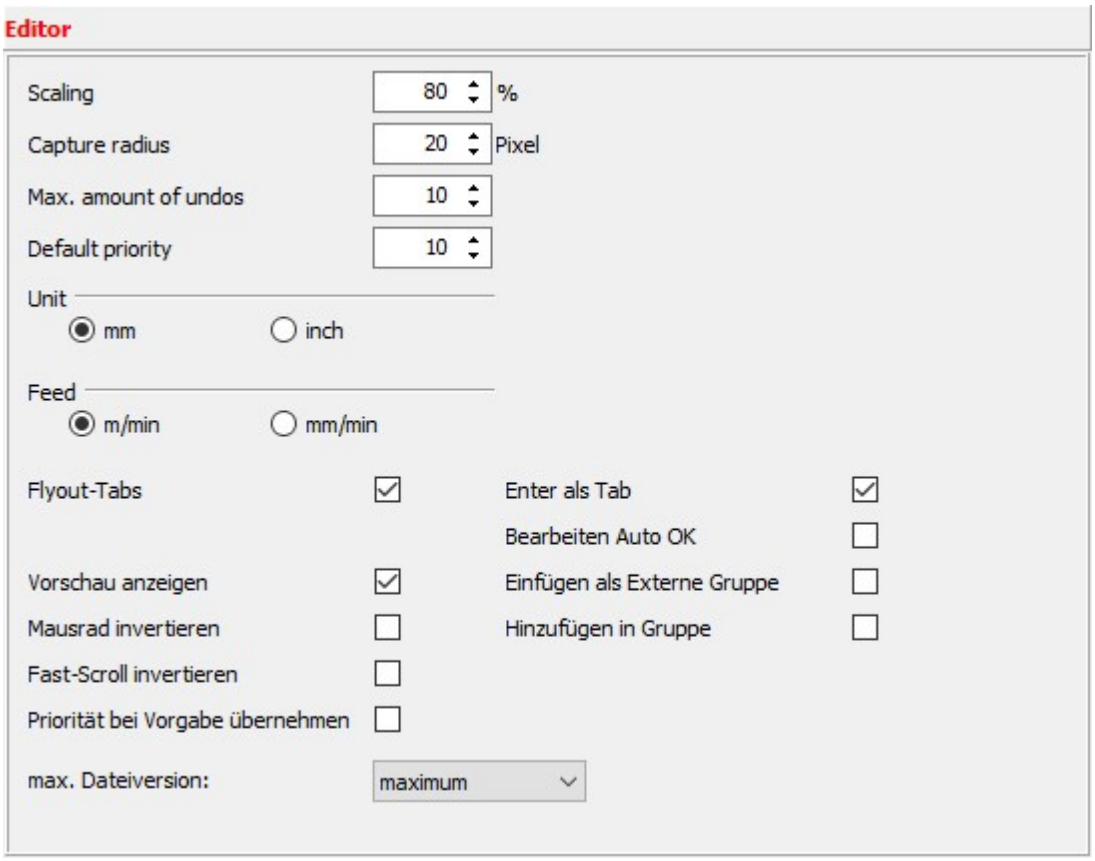
There are three buttons to be found in the lower area of the settings dialogue window:

Saves the current configuration and closes the settings dialogue window. This button is not active if it is not possible to save the configuration.
Closes the settings dialogue window without saving changes.

Saves the current configuraton without closing the settings dialogue window. If it is not possible to save the changes (OK button is inactive) the changes are only valid for the current session.

4.1 Working environment

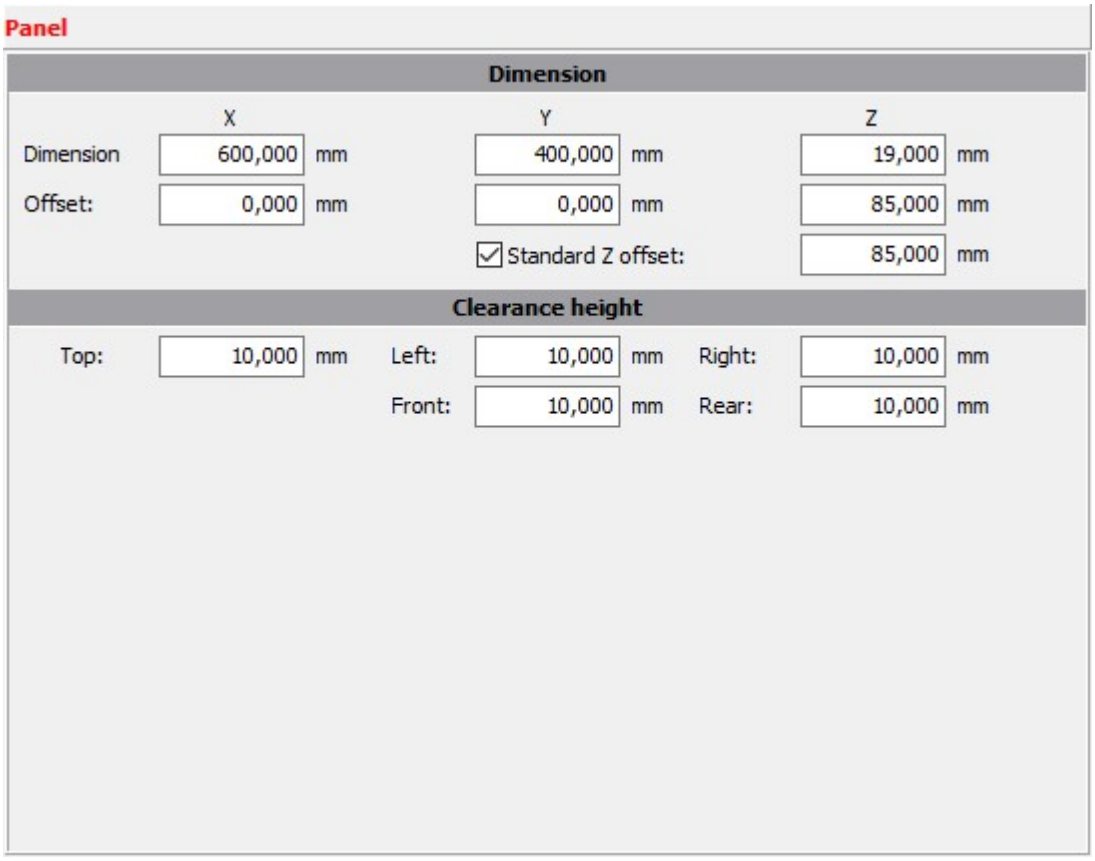
4.1.1 Editor



Parameters:

- Scaling
  This value defines the size of the workpiece in the editor window.
- Capture radius
  This defines the accuracy with which the cursor needs to be positioned to select an object on the graphical user interface. Any object within this radius of the cursor when it is clicked will be selected.
- max. number of Undos
  Saving a number of actions so that they can be undone if required uses a large amount of memory. This setting restricts the number of steps available to the undo function and therefore the amount of memory required for this function.
- Default priority
  Each new element is given this Priority code as a default.
- Unit of measurement
  This sets the unit of measurement selected by TwinCAM when the programme starts.

4.1.2 Basic Panel



This tab records the basic panel default settings. All entries may be edited separately for individual panels if needed; these are simply the default settings.

Parameters:

Measurements:

- Size
  The default size of a new base panel.
- Offset
  Offset values for a new base panel.
- Standard Z Offset
  Where suction pads are fitted, a Z offset needs to be entered to account for the height of the suction pads. So that a panel description remains independent of the machine type, a "standard Z offset" can be entered in the machine configuration. The panel description then only needs to contain a reference to the user standard Z offset. Whenever the NC programme is generated, the appropriate Z offset for the machine in question will be taken.

Park positions:

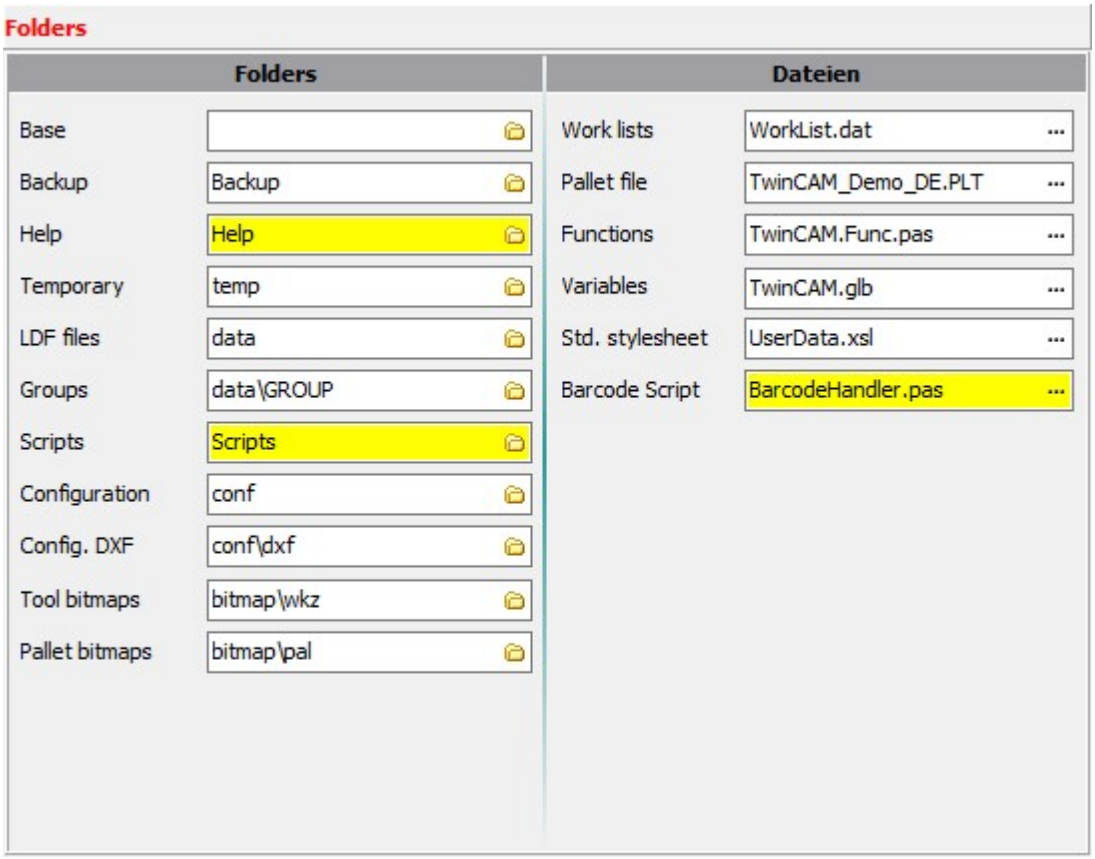
- Endstop
  Pre defined endstop value.

Clearance height:

- Safety margin above the workpiece for tools to move at speed.

4.1.3 File Paths

This dialogue sets TwinCAM's standard file paths. All the paths are defined in relation to the base path. If this field is left blank, the base path will be defined using TwinCAM's start file. This is the default setting for a standard installation.



Parameters:

Directories:

- Base directory:
  TwinCAM's base directory is the root of its internal directory structure. All other directories are normally defined in relation to this base directory and it is recommended that this is the case. Some TwinCAM functions, data backup for example rely on all TwinCAM directories being subsidiary to the base directory.
- Back up:
  Data back up places your files in this sub-directory if the back up directory is selected as a destination. The back up sub directory itself is never part of the back up procedureto ensure that old backup data is not re-saved.
- Help:
  This directory holds the TwinCAM help files.
- Temporary directory:
  Whilst TwinCAM is running, it uses this directory to store data that is only required in the short term. **WARNING:** Never save important data in this directory. TwinCAM deletes data from this directory as it needs to with no dialogue.
- LDF files:
  This is the default directory for all new panel descriptions.
- Groups:
  When insert group is selected, TwinCAM offers the contents of this directory as a default.
- Scripts:
  This directory is desgned to store your script files.

- Configuration::
  This directory holds all of TwinCAM's configuration data. This includes machine descriptions, tool and palette data.
- Config. DXF:
  TwinCAM's displays require drawings in DXF format which are stored in this directory.
- Programme Bitmaps:
  This is the default directory for TwinCAM bitmap images.
- Tool Bitmaps:
  This is the default directory for tool images.
- Palette Bitmaps:
  Bitmap images for tools and elements are stored in separate directories. This one is for the element images.

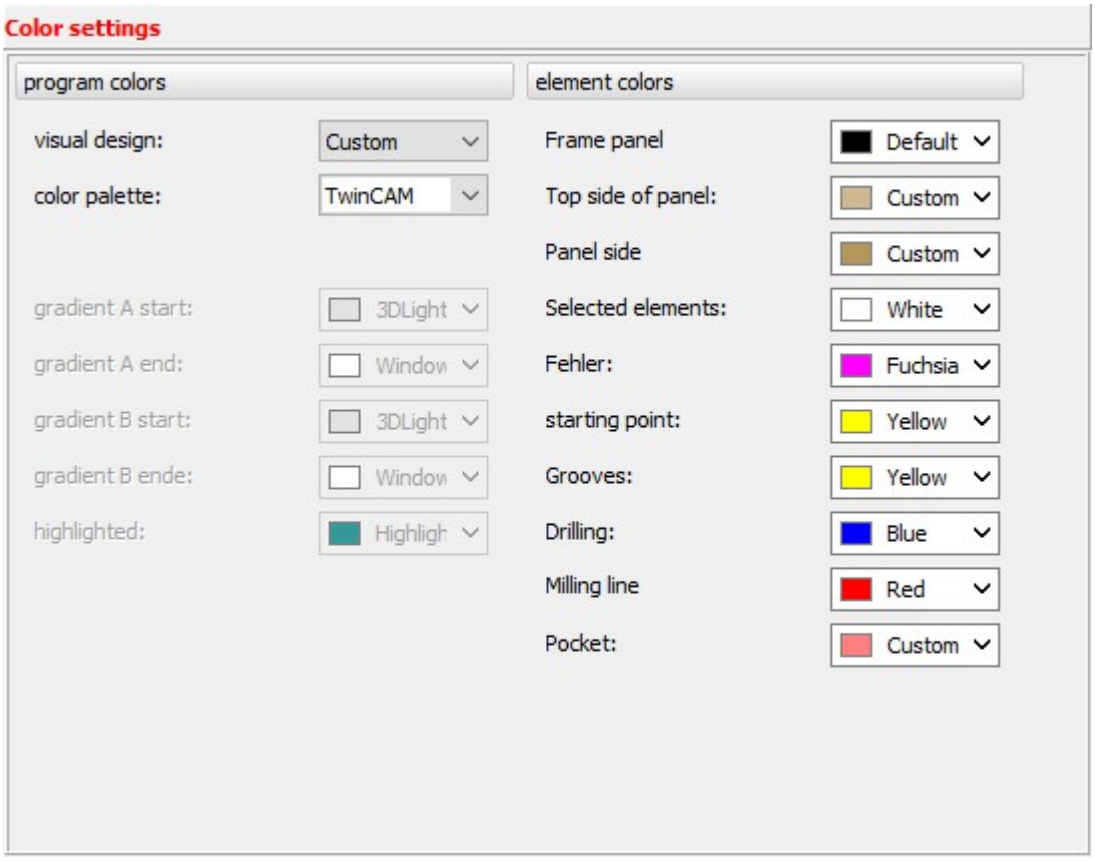
Files:

- Splash Screen:
  This is the directory for the splash screen seen when the programme starts and closes.
- Work lists:
  The file that you want the work list editor to work with is selected here.
  An extensive description of how to use work lists may be found in the Work lists chapter.
- Palette file:
  The palette file shows which palette is currently displayed in the editor.
- Functions:
  Any functions saved for use with TwinCAM are stored in this directory.
- Variables:
  TwinCAM's global variables are saved in tis directory.

Note:

The Tool Palette can also be defined. The field for this can be found in the Machine Configuration window.

4.1.4 Colour settings

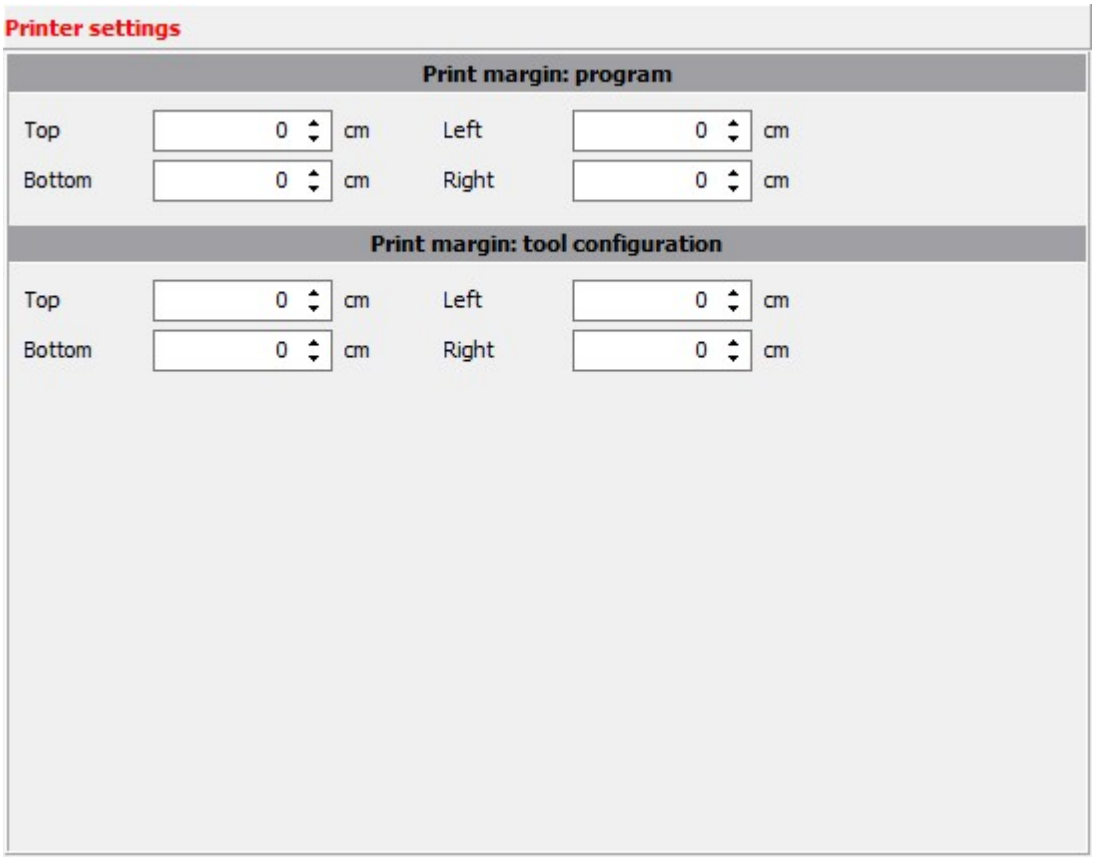


This register sets the colours to be used in the graphical user interface. The colours set here have no influence over the settings for drawing conventions. They may be set as the user wishes to differentiate elements.

See also:

DXF Import / Export
DXF file drawing conventions

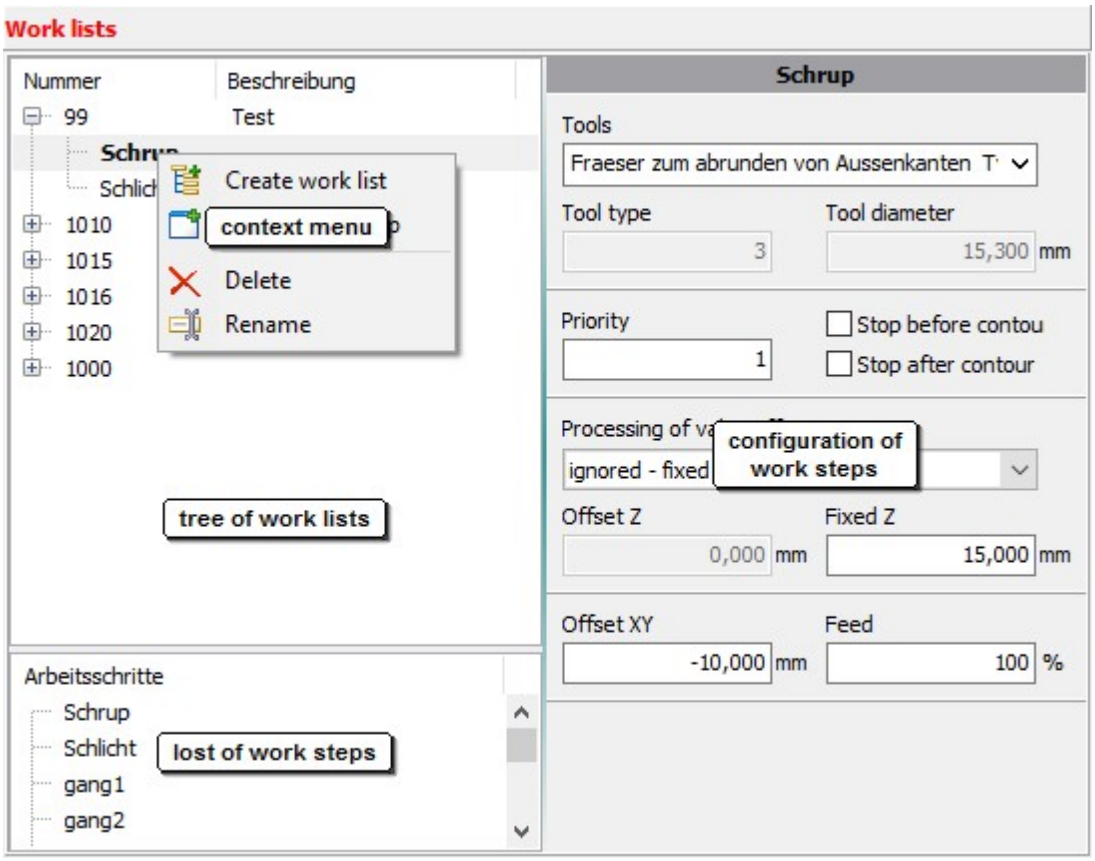
4.1.5 Printer settings



This tab allows the margin settings for programme listings and tool lists to be separately specified.

4.2 Work lists

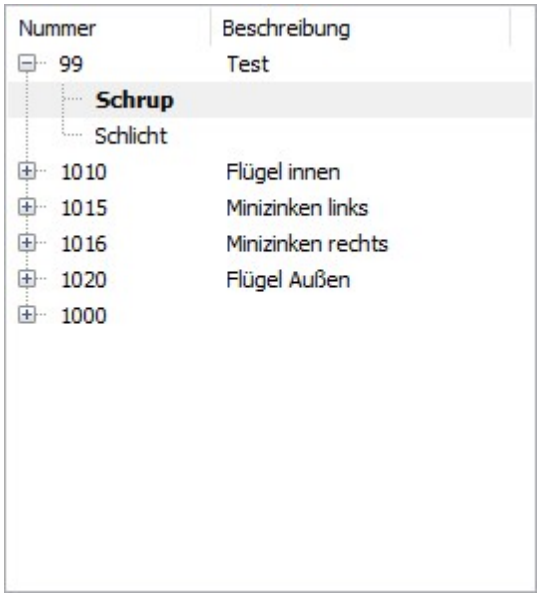
4.2.1 User Interface



Work lists for complicated processes can be prepared in this section. It can be found in the Settings dialogue under 'work lists'.

The use of worklists is of most advantage in window and door manufacture. Although the process consists of several stages using different routers, only one contour is shown. This is then worked through using a defined list of specific tools. To activate a work list, enter the work list number under router type in Start point.

4.2.2 Work Lists



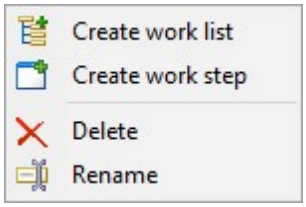
The tree structure shown above displays the available work lists with their processes. Each work list has a unique reference number and a description may also be displayed if desired. To avoid any confusion, the series of numbers used for work lists should be quite separate from that used for routing/milling tools. If a process is selected, its settings can be changed in the Configuration section.

4.2.3 Processes

This list displays all available processes. Settings for the process can be changed in the Configuration section if the process is selected.

4.2.4 Context menu

The context menu is displayed when you right click on a work list or process list.



Functions:

-  Creates a new work list.
  The name of the work list can be changed immediately if needed. To enter or edit a description click in the description column and press F2.

-  Creates a new process.
  Calling up the context menu from the work list tree:
  If a work list is selected, the new process is inserted at the end of the list. If a process is selected, the new process is added at the end of the list that the selected process forms part of. It is also entered in the list of processes and is therefore available for use in other work lists if need.
  Calling up the context menu from the process list:
  The new process is only inserted in the process list, but is available for use in any work list if required.

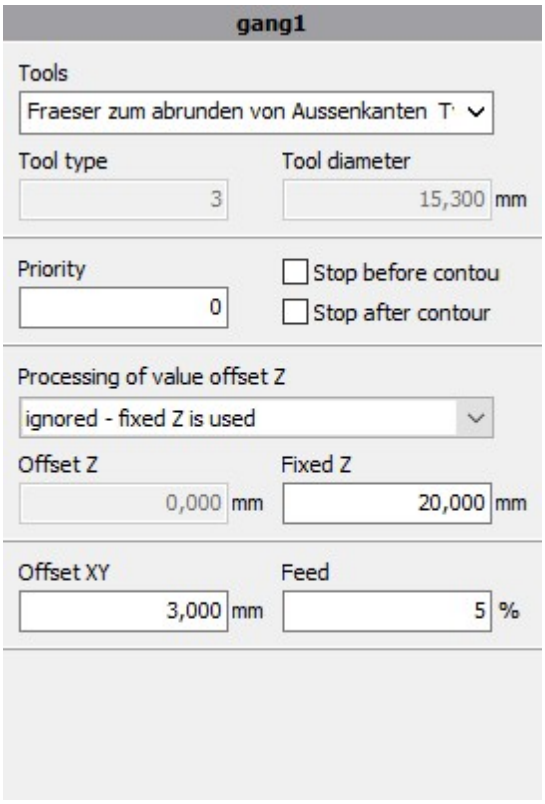
-  Deletes the selected work list or process list.
  If a process is deleted from the work list tree, it is removed from the work list. It does, however, remain in the process list. To delete a process completely, it must be deleted from the process list. If the process is included in several worklists, it will be removed from them without further dialogue.

-  Changes the name of the selected work or process list.
  Note the worklist number and/or the process name must be unique. The worklist name may only consist of numerical characters; a process name may consist of any combination of alphanumeric characters.

See also:

Editing work lists

4.2.5 Process configuration



This area can only be edited if a process is selected.

Description of possible settings:

- Tools:
  The user can select from a range of tools. When a tool is selected, the tool type and diameter are entered automatically and cannot be changed. To edit them select "<none>" from the tool list.

- Tool type/diameter
  Tool selection is carried out in the first instance using the tool type. If a diameter is also entered, then a tool of that diameter from a range with the same type number is selected. If 0 is entered as the type number, then the selection is made on the basis of the diameter alone. However, it must be borne in mind that this can lead to confusion, particularly with profile milling tools (Details). Editing these settings is only possible in the case of a tool that has not been previously defined.
- Priority:
  The sequence of processes 0 - X. The priority is added to the priority shown in the drawing.
- Stop before contour
  Programmed stop BEFORE the contour.
- Stop after contour
  Programmed stop AFTER the contour.
- Processing the Z Offset value:
  The method for evaluating the Z offset value is set here.
- Offset Z:
  This value is in addition to the Z value shown on the drawing.
- Fixed Z:
  This value is taken as the Z value for machining, the value shown in the drawing is ignored.
- Offset XY:
  XY values in addition to those shown on the drawing.
- Cutting rate:
  If 0 is shown, the drawing value is used.

4.2.6 Editing work lists

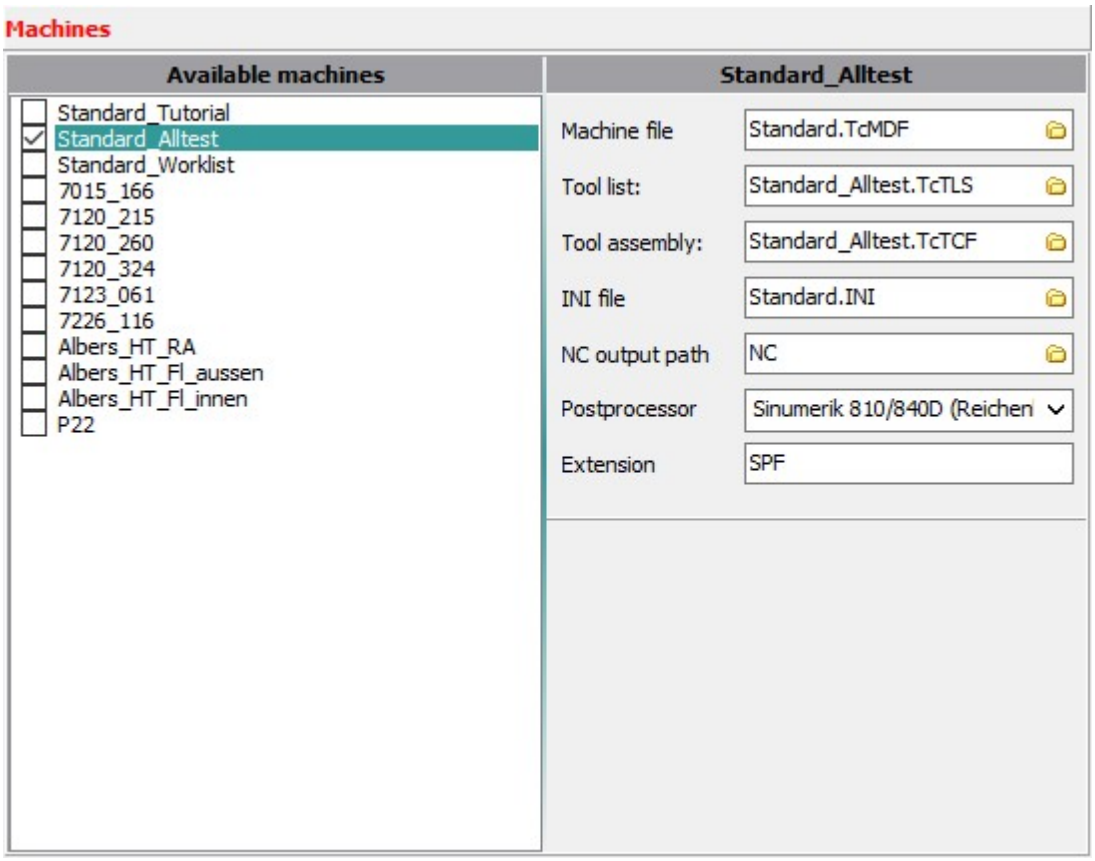
Work lists can be edited using drag and drop.

- **Adding a process to a work list**
  A process can be added to a work list by dragging it from the process list to the work list where it is needed.
- **Moving a process from list to another**
  In the same way, process can be dragged from one location to another within a work list or from one work list to another as you wish.

  Note that a process can be used in many work lists, but can only be used once in any one work list. It is not possible to add the same process more than once to the same work list.
- **Sorting work lists**
  Work lists can be sorted however you wish, using drag and drop. To move a work list to the end of the work list list, simply drag it to the last position in the list. The order of work lists within the list has no effect whatsoever.

4.3 Machine manager

4.3.1 Maschines



This tab brings together the machine's various components and allows the selection of a combination for the current TwinCAM session.

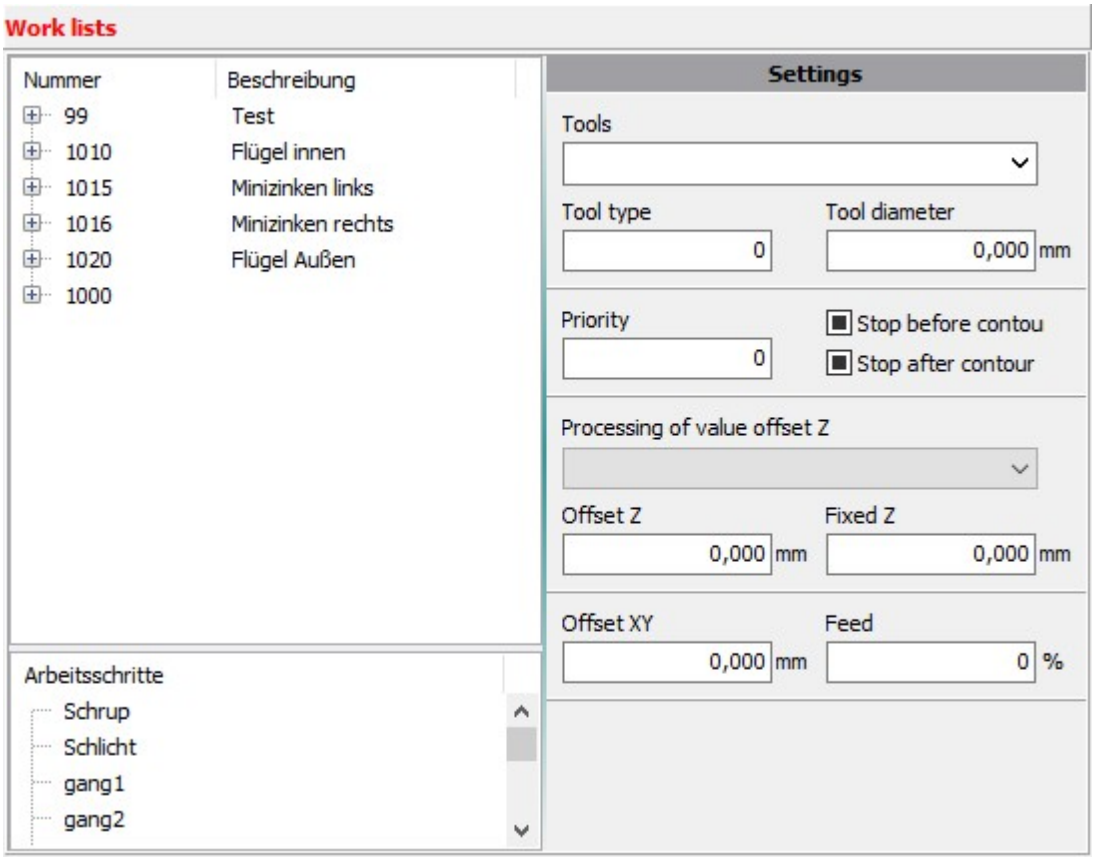
Parameters:

- Machine file
  File name for the machine configuration file.
- Tool list
  File name for a tool list. It is entirely possible (and usual) for one tool list to be used for a number of machines.
- Tooling list
  This file holds the assignment of tools from the tool list to the tool locations in the machine configuration.
- Ini File
  The Ini file contains various settings to enable communication with a machine.
- Post processor
  The appropriate post processor for the machine is selected from a list. This setting defines what the NC code looks like and whether the machine can process the code.
- NC output path
  This directory is used to store the NC code when generated.
- Extension
  NC programmes created by TwinCAM are given this file extension.

Note:

The file paths all relate to the Configuration directory.
Exception: NC - output path (relates to the base directory)

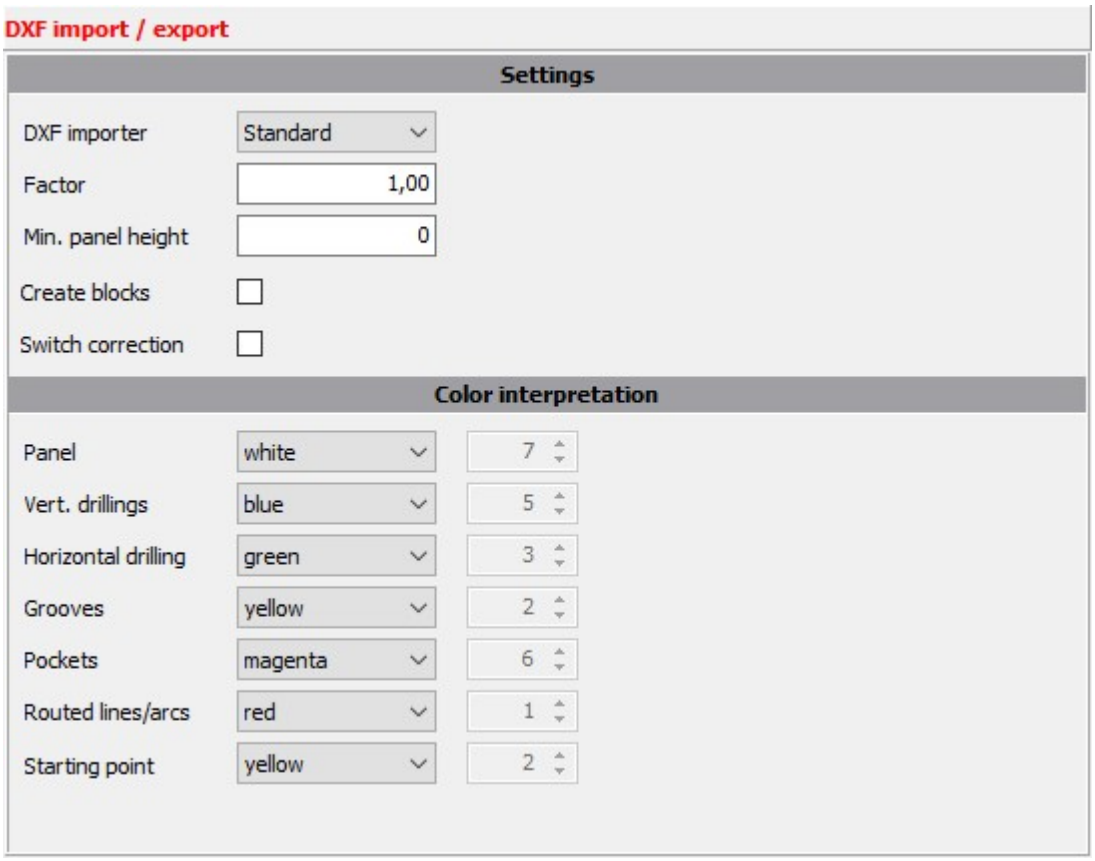
4.3.2 Work lists



The work list editor is a powerful tool which can make your work much easier. A detailed description of their purpose and function can be found under Work Lists.

4.4 Import / Export

4.4.1 DXF File Import / Export



This dialogue allows the setting of colours which are used to recognise various elements when DXF files are imported to or exported from TwinCAM. The numbers are AutoCAD colour numbers.

Einstellungen:

- DXF-Importer
  DXF importer selection. You may select either the standard or Holz-Her US importer.
- Factor
  Measurement calculation factor: 1 = drawing in mm, 25.4 = drawing in inches.
- Minimum panel thickness
  Automatically recognises mm and inches. If the panel thickness is less than the given value, TwinCAM automatically switches to inch measurement, otherwise the measurement is taken as mm. Inserting a value of 0 disables this feature.
- Creating blocks
  The creation of blocks when exporting data as a DXF file. Files so created may not always be read by all AutoCAD versions
  1= enabled, 0=disabled
- Reverse correction:
  If this field is not selected, layer 1 = left and layer 2=right. When selected, the interpretation of the tens position for DXF file import and export is reversed

Colour codes:

Meaning of the colours:

1	red
2	yellow
3	green
4	cyan
5	blue
6	magenta
7	white / black

See also:

DXF file drawing conventions

Chapter V

Anhang

Anhang

5.1 File formats

Format	Extension	Meaning
TwinCAM intern	LDF	The LDF format is TwinCAM"s own internal data format. This allows a wide range of flexibility between TwinCAM versions. LDF files are always upwards compatible, in other words any LDF file can be read by all newer versions of TwinCAM. They can also be read by older versions of TwinCAM provided that they support all the elements utilised within the file. The selection of a specific File version is therefore superfluous. LDF files also hold Licence information. This means that files created with a version of TwinCAM sold as an OEM bundle with a specific manufacturer's machine cannot be read by a TwinCAM version supplied as OEM by a different manufacturer. On the other hand a full version of TwinCAM can read files created by all manufacturer's OEM versions and files created by a full version of TwinCAM can be read by all manufacturer's OEM versions.
TwinCAM ISO	TWN	Files of this type solely contain DIN code. As such they are very machinespecific. In order that TwinCAM can read these files, they must start with the following data line. `;#PANEL Xnnn.n Ynnn.n Znnn.n` where `nnn.n` should be replaced with the X, Y and Z dimensions of the current panel. Files of this type will be displayed in TwinCAM editor as a basic panel with a DIN code element. Some other programmes will use this type of file to export information to TwinCAM if they utilise a machinespecific post processor unit.
AutoCAD DXF	DXF	The DXF format was created by AutoDesk (AutoCAD's developers) to enable the exchange of geometric data between CAD programmes. Almost all commonly available CAD programmes can read this format; the majority will also be able to write in this format. TwinCAM is able to import DXF files provided that certain conventions are adhered to - see DXF conventions. These consist of set formats for technical information, which would not normally be found in DXF files, so that it can be understood by TwinCAM. Workpiece descriptions can also be exported as DXF files and thus can be read by CAD programmes. The same conventions will apply.

5.2 DXF Conventions

5.2.1 DXF Import conventions

This section is intended for those TwinCAM users who prepare some or all of their production drawings using CAD programmes, e.g. AutoCAD. Information transfer is carried out using a DXF file, provided by AutoCAD as an interface. Other CAD systems generally also provide the option to produce a DXF output file, although an exact match between formats is not always guaranteed. Appropriate conversion progammes are available to purchase.

The minimum requirement for the import and export of DXF files is AutoCAD version 14 or higher.TwinCAM will import the following elements, provided that the conventions listed below are adhered to:

- Routed lines
- Routed arcs
- Start points

- Vertical drillings
- Horizontal drillings, straight and inclined
- Rebates, straight and inclined
- Circular and rectangular pockets

Note:

Important information and properties of elements will be explained here, which are required for an accurate interpretation of elements by TwinCAM.

Machining in a plane requires the transfer of a range of values to TwinCAM. This affects not only geometric data, but also technical information such as the nominal cutting rate or the tool correction factor.
To work successfully with TwinCAM, the following conventions must be adhered to:

- The colour of an *element*
  describes the work to be carried out (see below)
- The Layer name
  provides information about the tool type, the correction factor and the cutting rate during the machining procedure. It consists of a leading figure between 0 and 29 followed by TTx the two parts are separated by an underscore.

  For example: Layer 25_TT2:
  These entries have the following meaning:

  The tens position describes the tool's correction factor (left , right, nil). If the tool has no correction factor, there is no digit in the tens position. In this case "2" indicates a left correction. This interpretation is switchable (see below).
  The units position of the number indicates the cutting rate in ten percent blocks of the nominal cutting rate. In this case 50% of the nominal cutting rate is indicated.
  The TTx entry conveys the tool type to TwinCAM, in the example, type 2. The tool type value is enclosed in $ signs to ensure compatibility with AutoCAD14.

  False layer names are disregarded.
  The interpretation of the tens position for start points can be switched using "reverse correction" in Settings under DXF-Import / Export.

  The tool type entry in TTx need not be made. If left out, the tool type will be taken from TwinCAM's default settings for the element in question. The same applies to all other entries for TwinCAM elements. Any information which is not provided by the DXF conventions is taken from the default values of the appropriate element from the menu bar.
  Pockets and cut outs are an exception to this global definition. The variations are described under the individual element descriptions.
  It is recommended that the sequence of entries in the layer name are adhered to exactly as shown here. This is the format that exported data from TwinCAM is provided in variations from this format could lead to differring layer names between imported and exported files.

  The *Object height* refers to the machining depth in the case of a machined contour and the thickness of the material in the case of a panel. The object height must be negative if the contour is to be cut into the surface of the panel. The value Z=0 indicates the top surface of the panel.

  If an element is given a positive or negative Z value , this position is taken as the base value for the machining. In any other case, the panel upper surface is taken as the reference point. This position is in addition to the set safety margin.

The following always apply for drawn elements:

- *Basic panel*:
  White lines (rectangle, colour number 7) on layer 0 are interpreted as the basic panel. The smallest and largest X and Y valuesof all white lines are taken as the dimensions of the workpiece. All measurements are taken from the bottom left corner of the panel. Although the co-ordinate origin point 0,0,0 is ignored, the panel should have the bottom left corner aligned to it. A negative Object height indicates the depth of the panel.

- *Vertical Drilling*
  Vertical drillings are indicated by a blue circle (colour number 5). The diameter of the circle equals that of the drilling. The Object height of the circle equals the required drilled depth, whereby a negative value indicates the cutting direction. In the layer name, the units position represents the drilling rate whilst the TTx entry relates to the tool type. Any drillings which are not exactly vertical to the upper or lower surface of the panel are treated as horizontal drillings.

- *Horizontal drillings, rotated and inclined*
  Are also indicated by a blue circle (colour number 5). Here too, the the object height indicates the depth of the drilling. The direction of the drilling is indicated by the direction of the element's object height. The circle must be placed with its co-ordinates at the start point; the object height must have a negative value in the direction of the drilling. As previously, the layer name units position indicates the drilling rate, whilst the TTx entry relates to the tool type.

  Previous definition (no longer applicable): A green line from the outer edge of the panel with the negative object height measured from the upper surface of the panel. The layer name defined the drilling rate. There was no indication of the tool type, drill diameter, rotation or inclination.

- *Rebates, rotated and inclined*
  are described by yellow multi line rectangles (colour number 2), layer name and a negative object height. The width of the rectangle indicates the width of the rebate, the negative object height taken from the upper surface of the panel indicates the rebate depth. The units position of the layer name indicates the cutting rate and the tool type. The rebate's position is defined by the mid points of the vertical faces. To rotate or incline the rebate about the X/Z or Y/Z axis it must be rotated about the appropriate vertical face centre line. Rotating the rebate in the X/Y plane is achieved by rotating it about a freely defined point. Correction values are not given in this definition as both the centre line and width of the rebate are given.

  Previous definition (no longer applicable): Machining carried out by a rebate saw is defined by yellow lines (colour number 2). A negative object height indicates the depth of the rebate, the units position of the layer name indicates the cutting rate and the tens position the correction value (1 = right, 2 = left)

- *Circular and rectangular pockets/cutouts*
  are indicated by a magenta (colour number 6) circle or rectangle as the case may be. The Z position and the mid point define the position of the pocket, whilst the negative object height defines the depth. The pockets can only be placed on one of the six panel planes; inclined or rotated pockets are not possible at this time. The units position in the layer name indicates the cutting rate, the tens position the cutting direction (no entry or 1 = clockwise, 2 = anti clockwise). The tool type entry (TTx) follows, separated by an underscore. A 'C' for Cut separated again by an underscore defines the element as a cutout. If no C is present, the element is taken as a pocket by default. In the case of rectangular pockets and cutouts, an R in the layer name, again separated by an underscore, indicates rounded corners with their radius (e.g R20.5, radius = 20.5mm) If the relevant radius is a whole number, the decimal point and following zero can be omitted.

  EXAMPLE: 20_TT7_C_R20.5

- *Start points for milled/routed contours*
  are indicated by yellow (colour number 2) circles. The units position in the layer name indicates the feed rate, the tens position indicates the correction value for the whole contour followed by the tool type entry. The negative object height indicates the depth of the contour.

- *Red lines* and *arcs*
  (colour number 1) describe machining which is carried out by a miller/router. The object height indicates the depth of the contour. The layer name units position indicates the feed rate.

Note:

If you should need to use a different colour coding, you can alter the codes in TwinCAM Settings under DXF-Import / Export.

Warning:

Elements should be give a pure colour code although a "vonlayer" or "ByLayer" classification will also be evaluated. The line type should be entered as "continuous".

Importing Blocks

Elements which have been assembled as a block are imported into TwinCAM as a group. Each block will comprise a separate group. If a block contains a contour start point, this will be taken as the start point for all elements in the group.
The way groups are handled when exported as DXF files is to be found in the DXF export section.

Warning:

Circles cannot be imported into TwinCAM as a milled contour. As they are a closed figure, a circular contour has no start or end point that can be interpreted. To overcome this, a circle should divided into 2 semicircular contours.

Note:

- To record notes or measurements in a DXF drawing, use cyan (colour number 4). Any elements in this colour will be ignored when imported.

5.2.2 DXF Export conventions

It is possible that no drawing will be visible when loaded into AutoCAD. If this should be the case use the ZOOM/ALL command.
Note also the peculiarities in the layer definition of rectangular pockets and cutouts.

The conventions listed for the import of DXF files to TwinCAM are the same as those for the export of files from TwinCAM to DXF.
The minimum requirement for the import and export of DXF files is AutoCAD version 14 or higher.

Elements which have been grouped in TwinCAM can be exported as blocks. To do this, the DXF section in the TwinCAM.INI file must have 'useblocks' set to condition 1. (see DXF settings). This setting is only valid for DXF file export.
Drilled rows and mirrored drillings can be exported as blocks. However if a DXF block created on export to DXF from TwinCAM s re-imported to TwinCAM, a drilled row will be interpreted as a group of drillings and not a drilled row.

The following information and technical data which is defined in the export convention will be lost when exported as a DXF file:

- conditions, formulae and references (all elements are reference to the lower left corner of the panel)
- Information relating to suckers and rails
- Drilled rows and mirrored drillings are converted into individual drillings as blocks.
- Drilling cycles
- Information relating to drill through drillings
- Start up and park routes, cutting depth and step width for milled contours
- Correction values (new format only) and rebate cutting direction
- Cornice arcs are exported as three separate arcs
- Elipses are exported as a number of arc segments (the degree of accuracy can be set in glabal variables using SystemEllipsePrecision.

Note:

To export rebates in the previous format, as a line, the rebate must have a defined width of 0(zero). The correction value will be transfrerred with the layer name.

5.2.3 Examples

DXF-Object	Meaning
White rectangle	**Base panel**
Layer 0	
Object height = -19	Panel thickness = 19 mm

Blue circle on top surface	**Vertical drilling**
Diameter 8	Drilling diameter = 8 mm
Layer 4_TT1	Drilling speed = 40 % of nominal drilling rate, Tool type = 1
Object height = -12	Drilling depth = 12 mm
Blue circle on edge	**Horizontal drilling**
Z-Position = 8	Drilling located 8mm from top surface of panel
Diameter 8	Drilling diameter = 8 mm
Layer 7_TT5	Drilling speed = 70 % of nominal drilling rate, Tool type = 5
Object height = -12	Drilling depth = 12 mm

Red line or arc	**Milled contour**
Layer 0	Cutting rate = 100 % of the nominal cutting rate
Object height = -20	Contour depth (at the end of the element = 20 mm)
Yellow circle	**Start point of a milled contour (found at the end of a red line or arc)**
Diameter 16	Cutter diameter = 16 mm
Layer 24_TT12	*tens position:* correction value; 2=left / 1=right (set in TwinCAM.ini) *units position:* cutting rate = 40 % of the nominal cutting rate in the Z axis. Tool type = 12
Object height = -20	starting depth = 20 mm

Yellow circle	**Start point of a milled contour (found at the end of a red line or arc)**
Diameter 24	Cutter diameter = 24 mm
Layer 6 units position:	Cutting rate = 60 % of the nominal cutting rate in the Z axis
Object height = -24	starting depth = 14 mm If no tens position digit is present, the machining is carried out with no correction value. If no tool type is entered in the layer name, type 0 (zero) will be imported.
Yellow rectangle	**Rebate (new Definition)**
1200 x 7,2	Length 1200mm, width 7,2 mm
Layer 7_TT90	Cutting Rate = 70 % of nominal cutting rate, Tool type = 90
Object height = -6	Rebate depth = 6 mm

Yellow Line	**Saw Cut (= Rebate, previous definition)**
1200	Length 1200mm
Layer_17_TT90	*Tens position:* right correction factor *Units position:* Cutting Rate = 70 % of nominal cutting rate,

	Tool type = 90
Magenta Circle	**Circular Pocket or Cut-out**
Diameter = 120	Diameter = 120 mm
Layer 9_TT2_C	*Tens position* not present Default: Machining carried out in clockwise direction.
	Units position = 90 % of nominal cutting rate, Tool type = 2, C = Cut-out
Z-Position = 0	Circle's Z-location = 0, Panel top surface
Object height = -19	Cutting depth = 19 mm

Magenta Rectangle	**Rectangular Pocket or Cut-out**
300 x 200	Pocket/Cut-out dimensions, X=300 mm, Y=200 mm
Layer 25_TT_3_R20	*Tens position:* Machining carried out anti-clockwise (counterclockwise)
	Units position = 50 % of nominal cutting rate, Tool type = 3, Appendix R20 = 20 mm radius rounded corners
Z-Position = -5	Z-Position = -5 mm
Object height = -10	Pocket depth = 10 mm

5.3 Glossary

5.3.1 Layers and Priorities

In programming terms, TwinCAM follows a different philosophy to the majority of CAD/CAM programmes. Whilst in most cases the user has to compile a machining list to define the order in which work should be carried out, in TwinCAM this task is primarily carried out in the background. This method permits a greater degree of freedom in optimising the order of work.

On the other hand it is frequently neccessary to set down the order of certain interdependent tasks. TwinCAM provides the **Layers and Priorities** concept for these occasions. This concept works on the basis of a two stage process.

TwinCAM's standard method of work is for all the required machining elements to be collected in one layer. The various tasks in a layer are then sorted in priority code order. This does not mean that each task needs its own individual number; TwinCAM sorts tasks of equivalent priority code according to the required process or drilling optimisation. Should the user need for some reason to set down a specific order of work, this can be done simply by amending the appropriate priority code.

Layers are available in order to compile groups of elements in fixed machining order. Each element in a layer will be machined in order according to the method described above. The layers themselves are machined in sequence according to their code. It is, therefore, possible to define tasks of the same priority on different layers and still determine the order in which they are carried out.

Note:

Layers in TwinCAM are in no way equivalent to layers in AutoCAD despite the similarity of the names.

5.3.2 Workpiece descriptions

A workpiece description is the definition of a range of machining tasks to be carried out on a panel. A workpiece description has two notable features:

1. It is not machine dependent.
   All tasks are described independently of the machine and its current tool configuration. This makes it possible to use the same workpiece description to create programmes for a number of different machine types and tool configurations.
2. It is capable of parameterisation.
   All tasks may be parametrically described making it possible to create programmes for a broad range of variations from one workpiece description. Parameterisation can be carried out using a range of more or less complex techniques ranging from simple Magic Points over variables and formulae to fully programmed routines.

5.3.3 File Version

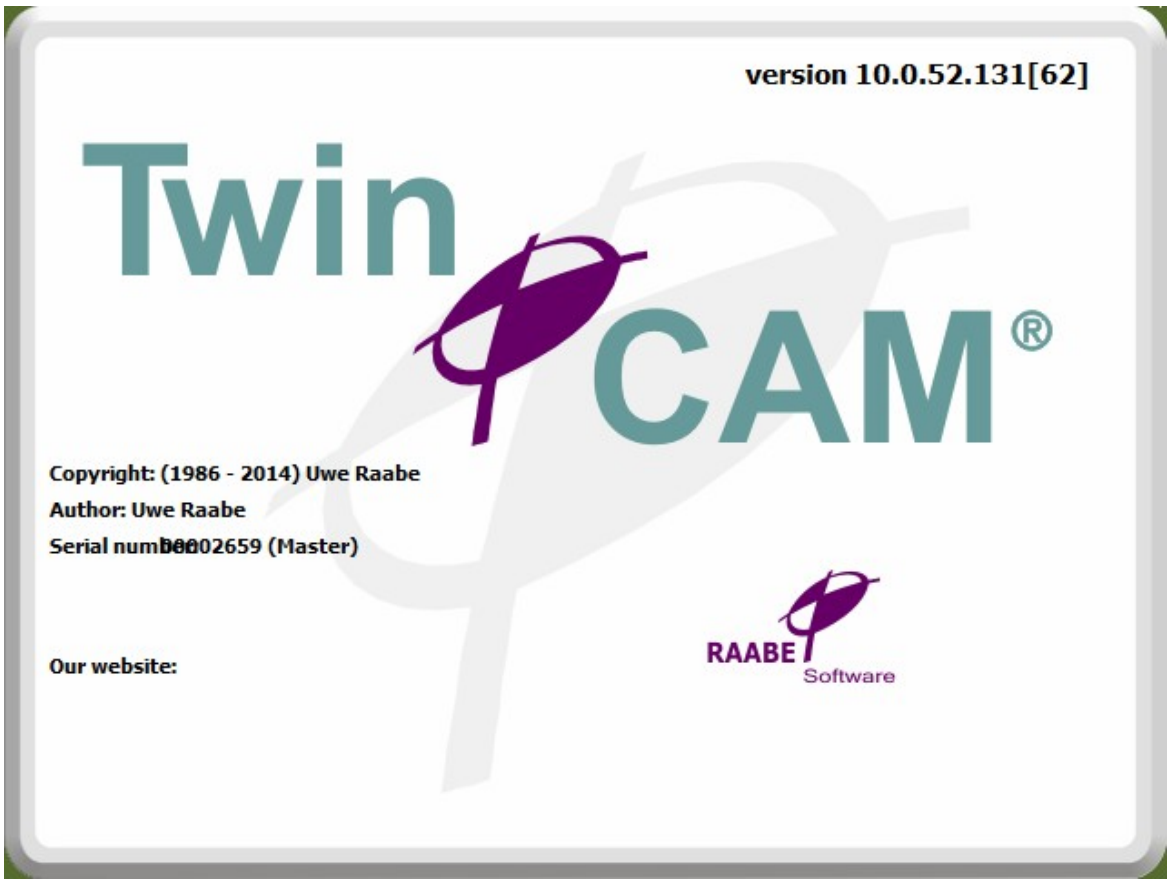
An LDF file's version shows which TwinCAM version is the minimum requirement to load a workpiece description. This will be dependent on the various elements employed within the workpiece description. If elements are used which are only available in a later release of the programme, the file version will be incremented. The same applies to new properties of previously used elements.

When saving files, TwinCAM automatically selects the lowest possible file version to enable compatibilty with the maximum number of older releases.

The file version for a file can be found on the title bar in square brackets following the file name.

Note:

The individual programme's release code, and thus the highest file version available to read and write files, may be found in the Information window (select *Help -> then TwinCAM information*).



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